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## TABLES OF <br> CALCULATED HOUR-ANGLES <br> and <br> ALTITUDE AZIMUTH TABLE <br> $30^{\circ} \mathrm{N}$. то $30^{\circ} \mathrm{S}$.

# COMBINED HORARY AND AZIMUTH TABLES 

By H. S. BLACKBURNE.

From JOHN COLES, Esq., formerly in the R.N.<br>Instructor in Practical Astronomy and Surveying to the Royal Geographical Society 6Th June 1897.

"As you and I have talked over the utility of your tables, you already know the high opinion I have of them; in proof thereof I endorse a cheque, and I trust they will receive the support they deserve. They are most excellent tables, and will be of great service to Navigators ; their arrangement is good, and simple, and that, I think, is about the best thing that can be said of any tables for the use of seafaring men."

From Lieut. VINCENT J. ENGLISH, R.N., Teacher of Navigation. Author of "Navigation for Yachtsmen." 7TH June 1897.<br>"Many thanks for the sheets of your new book. I am of opinion that they will be most useful to the overworked Ship Master, and they excel other short methods by their exceeding accuracy."

From A. C. JOHNSON, Esq., R.N.<br>Formerly Naval Instructor for H.M. Training Ship "Britannia." Author of several concise Azimuth Tables, and other Nautical Works. 7 TH JUNE 1897.

"I have no doubt that Captain Blackburne's Tables for finding the time would be very useful within the limits which they comprise, and that they are sufficiently accurate and safe. The facility they afford for obtaining the Azimuth simultaneously is certainly remarkable."

From Lieut. GEORGE WHITE, R.N., late Navigating Lieut., R.N. ilth June 1897.
"I have carefully examined the specimen copy of your Horary and Azimuth Tables, and have, as a test of their accuracy, worked several examples. I have therefore much pleasure in stating that I think them (especially the Azimuth Table) admirably adapted for their intended purpose. Having been for many years Navigating Officer in the Telegraph Service, I should have been very glad of such tables, especially when arriving on the intended grappling ground in the early morning, or late in the evening, as they would have so readily given the ship's position by double Altitudes of suitable stars."

## From Captain T. S. ANGUS, P. \& O. S.S. "Ballaarat." Now Nautical Inspector, P. \& O. S. N. Company, London. <br> $$
\text { 28Th July } 1897 .
$$

[^0]
# TABLES OF <br> CALCULATED HOUR-ANGLES AND <br> ALTITUDE AZIMUTH TABLE $30^{\circ} \mathrm{N}$. то $30^{\circ} \mathrm{S}$. <br> <br> EX-MERIDIAN TABLES <br> <br> EX-MERIDIAN TABLES $70^{\circ} \mathrm{N}$. то $70^{\circ} \mathrm{S}$. $70^{\circ} \mathrm{N}$. то $70^{\circ} \mathrm{S}$. <br> CALCULATED REDUCTIONS AND AZIMUTHS OF 30 BRIGHT STARS From 1 HOUR to 3 HOURS from MERIDIAN $64^{\circ} \mathrm{N}$. то $60^{\circ} \mathrm{S}$. 

By

## H. S. BLACKBURNE

## EXTRA MASTER (London)

PRINCIPAL EXAMINER OF MASTER AND MATES IN NEW ZEALAND, AND NAUTICAL ADVISER TO THE GOVERNMENT

SECOND EDITION

THOMAS AINSLEY, South Shields, England
JAMES BROWN \& SON, 52-58 Darnley Street, Glasgow, Scotland
J. D. POTTER, 145 Minories, London, E. i, England

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THIS BOOK IS DEDICATED TO

## Mr CHARLES WESTLAND

of glen muick, Canterbury, new zealand
AS A TOKEN OF GRATITUDE AND ADMIRATION FOR HIS VERY ABLE, GRATUITOUS, UNSELFISH, PAINSTAKING, AND LABORIOUS WORK IN HELPING THE WRITER WITH THE COMPILATION OF HIS PREVIOUSLY PUBLISHED EX-MERIDIAN TABLES, AND OF SEVERAL OF THE STAR REDUCTION TABLES IN THIS WORK

## EXPLANATIONS RE THE PUBLICATION OF THE CALCULATED HOUR-ANGLE TABLES

In view of the fact that other works have been published partly for the same purpose for which these Tables of Calculated Hour-Angles are intended, and especially considering the work which was published only a few years ago by Mr Percy Davis on very similar lines to these (except for Davis's omission to utilise the latitude variations for the azimuth), I feel that it is necessary for me to explain something about the reasons which have led me to publish these tables (which I began many years before Mr Davis thought of publishing his work), lest it should be thought that I was simply following Mr Davis, with some improvements and additions. I am glad to say that Mr Davis has generously mentioned in the Preface to his work that he knew of my MS. and previous efforts in this direction. I began the calculation of these tables about thirty-eight years ago, and worked at them every spare minute of my time for a few years, until (after tabulating about 80,000 calculations, including the variations) I was told about Lynn's famous "Horary" Tables, which were published in 1827 , but were even then out of print. This somewhat damped my ardour. I had discovered in the meantime that the latitude variations which had been calculated to three places of decimals gave the azimuth accurately to $\frac{1^{\prime}}{2}$ of arc. This discovery was due to Mr A. C. Johnson's little book, Latitude and Longitude in Cloudy Weather. In this work the latitude and sun's azimuth are used to find the correction of longitude due to $I^{\prime}$ of error in the latitude. I therefore rightly concluded that, inversely, the azimuth could be obtained if the latitude and longitude correction due to $I^{\prime}$ of error in the latitude were known ; finding how accurately this came out with my Hour-Angle Table, I tried a small skeleton table published by Adams of Southampton without any author's name, which was in general use in some of the mail-steamer lines under the title of $A$ and $B$ Tables for Correcting the Longitude for Error in Latitude.

I found, however, that this table was too inaccurately computed to give a true azimuth, so I determined to compute a table for every four minutes of time, which, with the aid of only half a dozen figures, would give the azimuth as accurately and quickly as by Burdwood's and Davis's tables, and which would include many azimuths that had been omitted in the large tables of inspection, and which I felt were much needed in double altitude work, especially in low latitudes, where no azimuths were given sometimes for two hours on each side of noon, and no azimuths at that time were given when the declination was over $23^{\circ}$. I accordingly then devoted all my spare time to this smaller work, $A$ and $B$ Tables for Time Azimuths., etc., which were published early in 1883, for latitudes from $60^{\circ} \mathrm{N}$. to $60^{\circ} \mathrm{S}$., and for any hourangle from the meridian. In the Preface to these tables I mentioned that I had begun the calculation of my Horary Tables seven years before. Three or four years after this I handed over the manuscript of my Horary Table work to Captain Martin, R.N., then Naval Instructor of Greenwich College, with full permission to give them to anyone who was willing to continue the
work and publish them on the same plan as I had begun them. He had them in his possession for a few years, but after giving up the sea I asked for them again, as no one seemed inclined to take them up, and Captain Martin returned them to me about eighteen years ago.

A year or two after this Mr Percy Davis, of the Nautical Almanac Office, and author of the famous Time Azimuth Tables, wrote to me of his intention to publish these tables, asking my advice, etc., about them, and I assisted him for a very short time in choosing suitable altitudes, and planning about the variations, etc., which I persuaded him to give for latitude, altitude, and declination. I was unable, however, to persuade him to follow my plan altogether in utilising the tables for azimuths as well. My disappointment that the tables were to be published with their utility so much curtailed led me-after having given Mr Davis full notice of my intention-to endeavour to publish them myself, at any rate for the latitudes of which I had already calculated so much, and which fortunately were of a different zone of latitude from that which Mr Davis was then contemplating publishing for trial. About two years after this I accepted an appointment, which I still hold, under the New Zealand Government, and found that I was not allowed then to publish on my own account, and the Government were not prepared to publish the work themselves. However, about four years ago I received permission from the Minister of Marine to publish the work on my own account, and have also been granted permission to publish with them some Ex-Meridian Tables and Calculated Star Reduction Tables, which, combined with the Hour-Angle Tables, make the work specially valuable for quickly fixing ship's position from two sun or star observations.

Mr Davis, however, was far in advance of me, and published his book several years ago, and his work now includes latitudes from $0^{\circ}$ to $50^{\circ}$.

I hope and confidently expect that the publication of these tables will not only not injure the sale of Mr Davis's work, but will actually increase it, as I prominently bring to the notice of navigators by several examples the value of the tables in connection with fixing the ship's position by combined altitudes of either sun or star observations, and the Altitude Azimuth Table may be used with the latitude variations from Davis's table, with amply sufficient accuracy for position-line purposes, though his variations would not give sufficient accuracy for azimuth purposes on account of their having been calculated for the mid-interval of latitude.

HAROLD S. BLACKBURNE.

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## PREFACE

The main purpose of these tables is to make as easy as possible the problem of finding the ship's position from combined altitudes of sun, moon, or stars, and especially to encourage the at present much neglected and apparently little valued practice of determining the ship's position from two or three stars at twilight, a few minutes before sunrise, and a few minutes after sunset. The writer, having made a regular practice of such observations for several years of his sea life, is fully alive to the great value of the problem, and considers it to be the most valuable problem in navigation, and has consequently for the last thirty and odd years deplored the neglect of the authorities to give it in the Board of Trade examination for masters and mates.

It ought to be the rule, instead of the rare exception, in all seagoing steamers to take such observations daily. In spite of the discouragement I have received from those whom I might most naturally have expected to help and encourage me, and the continued opposition of the authorities to the use of my tables and methods in the examination room, it will be seen that I have not yet given up my efforts to stir up and encourage shipmasters and officers to get out of the rut of relying wholly on their morning longitude and noon latitude position, and am still working to make easier and more popular the above-mentioned problems, and I have been much encouraged of late to find that my methods and tables are now being very generally used by the younger generation of officers, at any rate in the ships which trade regularly to New Zealand, and even by some of our coasting shipmasters.

My greatest incentive, however, to continued effort in this direction has been the knowledge that such observations tend greatly to the saving of lives and ships from destruction. In the course of my duties in the investigation of witnesses' evidence in wreck inquiry cases in New Zealand, I was struck by the fact that within three years no less than three ships were wrecked, and many lives lost, which would in all probability have been saved had the officers been in the habit of determining the ship's position by simultaneous observations of two stars at twilight ; but no Court of Inquiry could justly censure the master for neglect to take such observations when the determination of this problem is not provided for in the Board of Trade examination for either the mate or master. At about the same time I also received letters from two shipmasters gratefully acknowledging the value that my books had been to them, and telling me that the determination of their ship's position by stellar observations (after experiencing exceptionally strong currents) had been the means of saving their ships from great risk of stranding, one in the China Sea, and the other in the Bay of Bengal.

By the aid of the Calculated Star Reduction and Azimuth Tables in this work, a latitude and position-line can be obtained at any time when the stars are visible, almost as easily as by a meridian altitude of a star. Nothing, so far as the writer knows, has ever been published to so quickly, simply, and accurately solve the problem of finding the ship's position from two or three stellar observations out of the meridian, or for determining the latitude
and position-line from a single observation, which may often be used in conjunction with a sounding, or the bearing of some mountain peak or light, in determining the actual position of ships, as shown in example on page lii.

The below-Pole reductions and azimuths are of most value when only the azimuth or latitude and position-line are required, as the body is then changing very slowly, both in bearing and altitude; but owing to the small change of bearing, even up to two hours from the meridian, it is seldom that the position-lines resulting from bearings east and west of the meridian from two stars is sufficiently large to give a reliable " cut " for determining the position from two ex-meridian observations; but a good "cut" can always be made by combining a longitude by chronometer with one of these ex-meridian observations. The below-Pole reduction tables are also confined to extra tropical latitudes. The calculated reductions and bearings of stars from upper meridian, however, cover a much wider limit of latitude, and, owing to the much more rapid change of bearing when near the upper meridian, two stars can often be chosen from the Calculated Reduction and Azimuth Tables, where the position-lines cut one another at an angle of from $40^{\circ}$ to $50^{\circ}$, which is amply sufficient for a good determination of the ship's position. The reductions and azimuths of twenty-seven of the brightest stars have been tabulated for about one hour from upper meridian, and the reductions of a few of the high declination stars to two and three hours from the meridian. Another great advantage of these tables is that the approximate bearing of the bright stars, and their altitude for setting on the sextant, is determined very simply, so that there can be no mistake in the star, and no need of any star maps, which are, however, of little value when observing stars in twilight. It is my hope, therefore, that the publication of these tables will stimulate and encourage greatly the practice of determining the position of the ship from twilight observations of two or three stars; also of the more frequent determination of the ship's position from combined altitudes of the sun, after considerable change of bearing, or of the sun and moon, and not only in high latitudes but even in the tropics. If this work fulfils its aim in this direction, I shall be gratified by a knowledge that I have helped in some measure to save ships, and lives, from disaster.

Probably owing to the fact that all the "Sumner " problems in our Board of Trade examinations for masters and mates have for many years been set between the parallels of $46^{\circ}$ to $52^{\circ} \mathrm{N}$. and S. latitudes, an impression exists among many officers in the merchant service that a "Sumner" position is of no value in low latitudes. The lengthy and not very accurate way, especially in low latitudes, by which the candidate is obliged to work the problem in our examinations also tends to the neglect of officers practising the "Sumner" problem at sea. Also another great drawback is the difficulty about the chart : the coast charts are on too large a scale, and the ocean charts too small, and there are comparatively few yet who realise the fact that a plane chart (which does for any latitude) may be used with equal accuracy as a Mercator chart, as shown by examples in these pages. As my method of utilising the plane chart is not allowed in the examination room, none of the navigational guide-books mention it.

I feel certain, too, that the Altitude Azimuth Table in this work will be much appreciated by navigators, both for compass correction and for laying off position-lines in connection with observations for fixing the ship's position. Excellent as the many Time Azimuth Tables are, especially Burdwood's and Davis's-and nothing can be handier for compass adjusters when the time is correctly known,-yet I have so often seen mistakes made in obtaining the azimuth at sea through using an erroneous time, that I feel sure that a good Altitude Azimuth Table would be much more valued by the ordinary seagoing
officer than the Time Azimuth Tables, and it would certainly ensure greater accuracy. On the other hand, this Hour-Angle Table will make the Time Azimuth Tables of much more value, as the correct apparent time can be found by it at once by simple inspection. It was for this purpose that I first contemplated bringing out these Horary Tables, as many captains under whom I sailed, especially in earlier years, would not allow their officers to use the Time Azimuth Tables. Now, I believe they are almost universally used, and many men become careless about the time being correct, being content to take the time by the ship's clock, which is often several minutes in error, through the ship's change of longitude, or through the change of the clock to mean time before arrival at some by-port.

The following mentioned ladies and gentleman have assisted me in the compilation of these tables:-Miss Elsie Chapman, Miss Marie Moys, Miss Ida Richardson, and Mr C. B. Maltby, and I consider myself most fortunate in having secured the services of such faithful, conscientious, and accurate assistants.

Although I have had so much assistance in the compilation of the tables, I have personally overlooked every single observation, and can truthfully state that the utmost care has been taken to ensure the most minute accuracy. The hour-angles have been calculated to the nearest decimal of a second by six-figure logarithms, and each one checked by differences. The variations to every degree of latitude, etc., are the variations at the degree, not the midinterval as it is given in Davis's work; they have all been worked out to three places of decimals, and checked by differences, and with such accuracy that I have always found the latitude variation (with three places of decimals) give the azimuth to the nearest $\frac{1_{2}^{\prime}}{}{ }^{\prime}$ of azimuth. The Reduction Tables have been calculated with the same minute carefulness, and I am confident that not one per cent. of the tabulated reductions will be as much as $O^{\prime} \cdot \mathrm{I}$ in error. In addition to the Hour-Angle and Altitude Azimuth Tables and Star Reduction Tables, there is also a very comprehensive general Ex-Meridian Table, which, though occupying very few pages, yet comprises more extensive limits of use than most other Ex-Meridian Tables. This will be found very useful for facilitating the work of fixing the ship's position by combined altitudes of two sun ex-meridians, or with a chronometer and ex-meridian observation. A few other useful tables are also given. The Azimuth Table corresponding to the latitude variation is given from the equator to latitude $60^{\circ}$, so that it may be used also with Davis's Hour-Angle Table for aiding in quickly taking out the position-line for use with either a plane or Mercator chart, when outside the latitude limits of the Hour-Angle Table of this work, which are at present confined to latitudes from $30^{\circ} \mathrm{N}$. to $30^{\circ} \mathrm{S}$. This table is also used in conjunction with Table VIII., Ex-Meridian Table.

To minimise the need of interpolation as much as possible, the reductions to the meridian and azimuths of all the bright stars have been calculated for the actual declination of the stars for a few years ahead; but as the declination of most of the stars changes so slowly, there will be no appreciable change in the tabulated reductions and azimuths for the next forty or fifty years, and, the results being exhibited in this tabular form, the value of an error in either the latitude or time is seen at a glance.

In the Hour-Angle and Altitude Azimuth Table a glance at the table will show the best time for observing, viz.-when the lat. var. is o, the body being then on the prime vertical. Also, when the declination is greater than the latitude the lat. var. shows at a glance when the body is nearest to the prime vertical.

In closing, I have much pleasure in acknowledging the kind, gratuitous help voluntarily tendered to me by Mr Charles Westland, and in thanking
him for his disinterested labours in the calculation of several star reductions. I would also like to thank the Hon. Ministers of Marine for their permission to publish a few of the smaller tables previously published by. the New Zealand Marine Department in their Azimuth and Reduction Tables, also some of their previously published Star Reduction Tables now further extended by myself, and my assistants.

In the words of Raper, the nautical author whose work I have used and valued more than any book on navigation, I would solicit the indulgence of the reader to errors and to deficiencies. As he truly says, absolute correctness, especially in tables, is scarcely attainable, and in a work which contains much that has not appeared before, I cannot reasonably flatter myself that, notwithstanding every care and attention, some small inaccuracies may not be found, especially as in my case, owing to the long distance from my printer, and my desire to keep faith with those who bought copies of the work before publication, I have had to trust to a single correction of the proofs.

Should, however, any errors be discovered in the work, I shall be most grateful to anyone who will bring such to my notice.

HAROLD S. BLACKBURNE.

Wellington, New Zealand, June 1914.

## PREFACE TO SECOND EDITION

In this Second Edition of these tables over 35,000 new calculations have been made and added to the tabulations of the previous Edition, and some new examples are published with surprising results from ex-meridians with very high altitudes. The Ex-Meridian Table has been considerably enlarged, and the limits of its use increased both in latitude and bearing from the meridian. This is especially the case with high altitudes, when nearly all other Ex-Meridian Tables fail. I am indebted for the idea of the new table to a little book published about two years ago by Captain Cook of Bowden, Jamaica, in which he gives a small table of two half pages giving the reduction to I min., corresponding to a given latitude and azimuth.

I found that although only roughly computed by the traverse table, it often gave very good results, and would be independent of the latitude variation, and I saw that if it were expanded, and accurately computed by a true formula, accompanied by a table giving the limits within which it might be used with safety, it was likely to prove a very useful table; and the results with very high altitudes have far exceeded my expectations, and I have no doubt will surprise a good many.

A well-known and up-to-date author, in a recent publication, when advocating the claims of the "New Navigation," tells us that an ex-meridian at $22^{\circ}$ from the meridian is an impossible thing; but an example is given on p. xxxviii of this book, with a very high altitude, where the latitude and longitude are accurately determined from two ex-meridians, one of them being over $70^{\circ}$ from the meridian.

It is probable that a wrong impression will have been gathered with regard to the immense amount of labour which has been put into this work, on account of the remarks made by the reviewer of one of the principal Nautical Magazines about most of the tables having seen the light in earlier publications, and mention being made of Lynn's and Davis's Hour-Angle Tables having been previously published on the same lines. I may say that although Lynn's tables were very complete in the tabulation of hourangles from sunrise to the meridian, no variations were given for any of the elements, and consequently interpolation was very tedious. With regard to Davis's tables, the variations are only given to one place of decimal, and for the mid-interval, instead of being the variation at the degree of latitude, altitude, and declination; consequently, they could not be expected to give hardly one-tenth of the accuracy obtained by these tables. I, at first, computed several thousand of my own variations for the mid-interval, as it was so much easier to do this, but finding that results did not give the accuracy which I was aiming at, I recomputed them as now published. Neither Lynn's nor Davis's tables give the azimuth, whereas I understand from some of those who have used these tables that the Altitude Azimuth Table in this book is preferred even to the world-famous Red Book Time Azimuth Tables.

I can truthfully state that every tabulated hour-angle and variation in the book has been rigorously calculated, either by myself, or by computers paid by me. No one could contest this, as no other work tabulates the results to the same degree of fineness, viz., to $\frac{1}{10}$ of a second. I alone am responsible for every tabulated result in the book, all the calculations having been
made either by myself, or under my direct supervision and scrutiny, so that I can confidently guarantee the extreme accuracy of all the tabulations.

The Ex-Meridian Table is entirely new, though on the same principle (with an extension of limits) as the Ex-Meridian Table in my book of A B C Azimuth and Reduction Tables ; also, about 50,000 new calculations have been made, and tabulated in the Tables of Calculated Reductions and Azimuths of Bright Stars.

These are the main tables in the book; the other small supplementary tables which were previously published in one or two of my earlier works only comprise a few pages.

I have been disappointed to find that there is small probability of the immense labour and great expense entailed in the production of this work being rewarded by the satisfaction of knowing that the tables and methods advocated in the work will be at all generally used in my own lifetime, as the present authorities prohibit their use in the Board of Trade examinations for masters and mates, and the great majority of ship officers in the merchant service appear to be still ignorant of the value of a position-line in connection with an ex-meridian for position finding, or even in connection with a calculated altitude as taught in the so-called " New Navigation" (now forty years old), owing to the regrettable conservatism of the authorities in only allowing the "Sumner" to be worked from the calculation of four hour-angles, and plotted on the chart from two parallels of latitude, notwithstanding that this method has been frequently shown to give errors of a few miles in the resulting position, besides taking twice as long in the calculation.

Quite naturally the numerous guide-books which are used in preparation for our examinations only present the methods which candidates are expected to use in the examination room, and other improved methods are only taken up by the comparatively few who take a special interest in Navigation.

Such men are usually conversant with all the best and shortest methods; but to ensure the greater safety of navigation generally, it is essential to encourage in every way possible the man who is not fond of lengthy calculations, or who has little time at his disposal to frequently take azimuths, and determine the ship's position by the simplest accurate methods; but when a candidate is given a problem such as our double altitude problem, either by the sun, planet, or a star, and he is required to get a latitude only by the use of numerous logarithms, all rigorously corrected for seconds of arc, it is apt to leave an impression on his mind that the determination of even the latitude at some distance from the meridian is a very difficult, tedious, and uncertain business. As we in New Zealand are bound by the Board of Trade regulations in our examinations for foreign-going certificates, we are unfortunately debarred from making use of our tables for quick position finding by two stars at twilight, or by any of the simple methods of obtaining the azimuth, or position of ship by sun or stars, presented in this book.

Notwithstanding this discouragement, I am still continuing my labours for the sake of the few in my day who will profit by them, and in the assurance that at least some ships and lives will be saved by these efforts, and in the belief that in some future generation these methods, with the tables still further extended in their limits, will be generally adopted.

HAROLD S. BLACKBURNE.

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## EXPLANATION AND USE OF TABLES

## table l.--FOR FINDING HOUR-ANGLE AND AZIMUTH FROM ALTTTUDE

(pp. 2-245)
The arrangement of the arguments will be easily followed by attention to the following explanations, viz.:-

The latitude heads each page; the table begins at the equator, and comprises four pages to each latitude up to $30^{\circ}$ of latitude and declination of same name, then continues with latitude and declination of contrary names from $I^{\circ}$ to $30^{\circ}$, with another four pages to each latitude.

The declination immediately below the latitude runs horizontally through the four pages of latitude from $0^{\circ}$ to $23^{\circ}$.

The altitudes are arranged vertically on the left side of each page.
The hour-angle is given to the nearest decimal of a second for the full degrees of latitude, declination, and altitude.

The variation to $I^{\prime}$ of declination is given under the declination column on the righthand side of the hour-angle, and the variations to $I^{\prime}$ of latitude and altitude are given on the lower half of the page, L standing for latitude, and A for altitude. The variations to $\mathrm{I}^{\prime}$ of latitude, etc., are the variations at the degree in the same way as they are given in the Nautical Almanac. For instance, the variation at $8^{\circ}$ is found by dividing the difference between the hour-angles at $7^{\circ}$ and $9^{\circ}$ by $\mathbf{1 2 0}$, and the latitude and altitude variations are computed in the same way. It is important to bear this in mind, as the variations in Davis's Chronometer Tables have been calculated for the mid interval, and the apparent discrepancy between the variations as given in the two works might lead to some want of confidence in either work.

The latitude variation referred to Azimuth Table on pages $258-267$ gives the true azimuth, or bearing of the sun or other heavenly body, and on page 270 the position-line for a plane chart; or if the variation, considered as a difference of longitude, is converted into departure, it will give the true position-line for use on a Mercator chart.

In using the table, enter it with the latitude, declination, and altitude, each to the nearest degree, and take out the recorded hour-angle ; correct for the odd minutes of latitude, etc., by the previously mentioned variations. This may be effected either by simple multiplication or by reference to the Proportional Sexagesimal Table on pages $246-25$. The resulting hour-angle will seldom be more than $\frac{1}{2}$ second in error, and more often than not it will be within O.I s. of the truth.

Strict attention, however, must be paid to the signs which are given with each of the variations.

Formula used in the calculation of the table:-
Haversine H.A. $=\sec l . \operatorname{cosec} p \cdot \cos \mathrm{~S} \cdot \sin \mathrm{~S}-a$,

$$
\text { where } a=\text { alt., } l=\text { lat., } p=\mathrm{P} \text {. Dist., and } \mathrm{S}=\frac{a+l+p}{2}
$$

Examples of Finding the Time and Azimuth from Tables
Example i.-In latitude $30^{\circ} 12^{\prime}$ S., p.m. at ship, decl. $16^{\circ} 18^{\prime} \mathrm{S}$., and altitude $32^{\circ} 40^{\prime}$. Required the hour-angle and sun's bearing.

The nearest degrees are L. $30^{\circ}$, D. $16^{\circ}$, and A. $33^{\circ}$.

Variations. $\begin{gathered}\text { Minutes } \\ \text { (in excess }+, \\ \text { in defect }- \text { ). }\end{gathered}$


| S. | S. |
| ---: | :--- |
| D. $+2.0 \times+18=$ | $+36^{\circ} \circ$ |
| L. $+0.07 \times+12=$ | +0.8 |
| A. $-4^{\circ} 62 \times-20$ | $+\underline{92^{\circ} 4}$ M. S. S. |
| Cor. | $+129^{\circ} 2=29^{\circ} 2$ |

For the Azimuth.
s.
L. Var. $+{ }^{\circ} \circ 7$ gives (p. $25^{8}$ ) Azimuth S. $89^{\circ} \cdot{ }^{\circ} \mathrm{W}$.

Example 2.-In latitude $30^{\circ} 8^{\prime}$ N., P.m. at ship, decl. $14^{\circ} 48^{\prime}$ S., and altitude $20^{\circ} 12^{\circ}$. Required hour-angle and sun's bearing.

s.
L. Var. -2.84 gives (p. 258) Azimuth S. $58^{\circ} .4 \mathrm{~W}$.

These examples were taken at random with the highest latitude of the tables, and with latitude and decl. of same, and contrary names.

The resulting hour-angle from the tables will seldom be more than $\frac{1}{2}$ second in error, and if the tabulated variations are interpolated, results will seldom be more than 0.1 s . or 0.2 s . in error. Azimuths, if correctly interpolated, should never be more than $0^{\circ} \cdot 1$ in error, and the azimuth will generally be correctly given by the latitude variation to the nearest minute of arc, if Table V. is used in conjunction with the traverse table.

## TABLE II.-SEXAGESIMAL PROPORTIONAL TABLE (pp. 246-251)

This table may be used by those who prefer to look out results from a table instead of making the simple multiplication of the variations. It shows at a glance the error due to $0 \cdot 1 \mathrm{~s}$. for any number of minutes.

> Example.—Alt. vår. $4^{\cdot 1} 5 \mathrm{~s} . \times 24^{\prime}($ page 248$) 4 \cdot 10 \mathrm{~s}=98 \cdot 4 \mathrm{~s}$. $4 \cdot 20 \mathrm{~s} .=100 \cdot 8 \mathrm{~s} . \quad \therefore \quad 4 \cdot 15 \mathrm{~s} .=99.6 \mathrm{~s}$.
> -I S. $\quad 2.4 \mathrm{~s}$.

## TABLE II.-TABLE SHOWING THE ERROR IN TIME OR LONGITUDE PRODUCED BY AN ERROR OF $1^{\circ}$ IN THE ALTITUDE (pp. 252-257)

The arguments are latitude and azimuth, and with these elements the table shows at a glance the value of any single observation for determination of time when outside the limits of the hour-angle table. The table may also be usefully employed as an azimuth table, with altitude and time, following the rule for which the author is indebted to Mr H. B. Goodwin, R.N.

Formula used in the calculation of the table :-
Error in time $=$ sec. of lat. $\times \operatorname{cosec}$ of azim. $\times 4$.

## Rule for Finding the Azimuth

With H.A. as azim. and decl. as lat., go to Table III.
Take out co-efficient, call it M.
With alt. as lat. and M, take out azim. at top of page.
Example.-In lat. $44^{\circ} 15^{\prime}$ S., alt. of Canopus $14^{\circ} \cdot 6 .$, H.A. 2 h .57 m . Find the azimuth.

Lat. (dec.) $52^{\circ} \cdot 6 \mathrm{~S}$. , azim. (H.A.) $2 \mathrm{~h} .57 \mathrm{~m} .=44 \frac{1}{4}^{\circ}, \mathrm{M}=9.44$.
Lat. (alt.) 14.6 and M 9.44 gives azim. $26^{\circ}$.
Table III. will be found very useful in working out separately a set of observations, both with artificial horizon and at sea; or for working out another person's observations, taken within a few minutes of the same time. It also shows at sight the degree of dependence of any observation. And if at any time it is found that an erroneous altitude has been worked with, the longitude will readily be corrected by this table, a greater altitude giving a smaller hour-angle, or with A.m. sights a greater altitude making the longitude more to the eastward and a lesser altitude making the longitude more to the westward-vice versa with P.M. sights.

It will also be found useful when taking time azimuths by the sun or stars (when altitude is low) for readily obtaining the correct hour-angle, as in the following example :Lat. $20^{\circ} \mathrm{N} .$, * Arcturus bearing N. $71^{\circ} \mathrm{E}$. (true), altitude $5^{\circ}$. Table III. at lat. $20^{\circ}$ and azimuth $7 \mathrm{I}^{\circ}$ gives 4.5 m . of time to $\mathrm{I}^{\circ}$ change of alt. Table 26 (Raper), lat. $20^{\circ} \mathrm{N}$., decl. $20^{\circ} \mathrm{N}$., gives *'s hour-angle at rising or setting 6 h .30 m .

$$
\begin{aligned}
& 4.5 \mathrm{~m} . \times 5^{\circ}=-22 \frac{1}{2} \\
& * \text { 's H.A. at } 5^{\circ}=6 \quad 7
\end{aligned}
$$

The results of the table can be easily found by inspection from the traverse table. At the equator, when the sun or any other heavenly body is on the prime vertical, it moves at the rate of $I^{\circ}$ in 4 m ., or $I^{\prime}$ in 4 s . of time; and in any other latitude, when the sun is on the prime vertical, the ratio of its movement will be dep.: diff. long. Having, then, the rate of movement in any latitude on the prime vertical, the rate of movement on any other bearing may be found by the traverse table.

Example.-In latitude $30^{\circ}$, and $\odot$ 's bearing N. $63^{\circ}$ E., required the rate at which it moves. In latitude $30^{\circ}$, against 4 in D. lat. column, is 4.62 in dist. column; with $\odot$ 's bearing $63^{\circ}$, and 4.62 in dep. column, we have 5.18 in distance column $=5.18 \mathrm{~s}$. to $\mathrm{I}^{\prime}$ of altitude.

Further examples in the use of the table are given on page xlii.

## TABLE IV.-AZIMUTH TABLE (pp. 258-267)

Enter table with lat. var. to $\mathrm{I}^{\prime}$ at side, and latitudes on top of page running horizontally. Corresponding azimuth is given to nearest decimal of a degree, and the rule for naming the azimuth is clearly given at head of page.

Formula of calculation :-Cot azim. $=$ lat. var. $\times \cos$ lat. $\times 4$.
Example in Use of Table.-Lat. $20^{\circ}$ N., decl. $0^{\circ}$, alt. $50^{\circ}$, lat. var. -2.05 s. gives azim. (page 258) S. $64^{\circ} \cdot 25$.

## TABLE V.-AZIMUTH CORRESPONDING TO LATITUDE VARIATION IN DEPARTURE (pp. 268-269)

This table is given for cases where the azimuth is required to the nearest minute of arc.
Rule.-Consider the lat. var. as a d. long. and convert it into dep. by the traverse table. The azimuth corresponding to this factor may then be taken out to the nearest minute of arc.

Formula of calculation :-Cotan azim. $=$ lat. var. $\times 4$.
Example in Use of Table.-Lat. $20^{\circ}$ N., decl. $0^{\circ}$, lat. var. $-2.05 \mathrm{~s} .=$ dep. 1.926 s . gives azim. (page 268) S. $64^{\circ} 17 \frac{1_{2}^{\prime}}{}$.

## TABLE VI.-POSITION-LINES CORRESPONDING TO LATITUDE VARIATION FOR USE WITH THE PLANE SCALE CHART IN THE " SUMNER" PROBLEM (p. 270)

This table is given for the purpose of plotting a "Sumner" position on a plane chart. The position-lines corresponding to the lat. var. give the same result as to latitude and longitude on a plane chart as the true lines of position would give on a Mercator's chart. One chart, therefore, does for any latitude, or, with the aid of a small 6 -inch rule with a protractor and diagonal scale of inches marked on it, the chart may be dispensed with and the position plotted in the work book. To do this, set off the points of two longitudes on the parallel of the D.R. latitude at a distance from one another of, say, I in. to ro' of longitude. From these points lay down the "Sumner " lines, and from the point where they intersect draw a perpendicular to the parallel of D.R. lat. The longitude at the point struck by the perpendicular is the longitude required, and can be measured from either of the points of longitude. The same scale is used for the latitude as for the longitude.

It must be borne in mind that this table does not give the true geographical lines of position. If this is required for a Mercator chart, consider the lat. var. as a diff. long. and convert it into dep. by the traverse table. The position-line corresponding to this dep. will be the true geographical line of position.

Formula of calculation :-Tan position-line $=$ lat. var. $\times 4$.
Example.-a.m. at ship in lat. $30^{\circ} \mathrm{N}$., lat. var. was $+\cdot 75 \mathrm{~s} .=$ dep. $\cdot 650 \mathrm{~s}$., which gives true position-line $\mathrm{S} .9^{\circ} \cdot 2 \mathrm{E}$. and N. $9^{\circ} \cdot 2 \mathrm{~W}$.

## TABLE VII. AND VII.--LIMITS OF EX-MERIDIAN TABLE (pp. 272 and 292)

These tables show at a glance the hour-angles at which it is safe to use the Ex-Meridian Table so that with the correct time the reduction will not be in error more than $\frac{\frac{1}{2}^{\prime}}{}$. It must, however, be borne in mind that the resulting latitude is the latitude corresponding to the meridian of longitude used in the deduction of the time. The latitude variation will readily show the line of position which must be laid down, on the meridian of the D.R. longitude used in determining the time; or if the azimuth has been determined, Table IX. will show at a glance the error due to $1^{\prime}$ of longitude.

## TABLE VII.-AZIMUTH EX-MERIDIAN TABLE (pp. 278-291)

The factors under the heading of Azimuth abreast lat. are the reduction at 1 m . from the meridian to apply to an altitude to reduce it to the meridian altitude.

## Instructions concerning the Use of Table, and Rule for Application

Multiply the factor corresponding to the latitude and azimuth in Tables VIII. and VIII $a$., and abreast lat. var. in Table VIIIb., by the number of minutes and decimals in the hour-angle from the meridian, which gives the correction to apply to the observed altitude to reduce it to the meridian altitude. Add this correction to the observation taken near the upper meridian passage, and subtract the correction when observation is taken near the meridian below the Pole. This reduction will not be more than $\frac{1^{\prime}}{}{ }^{\prime}$ in error when the hour-angle is less than that shown in the preceding Tables VII. and VIIa.; the " "g", against the factor in the table signifies that the true reduction will be greater, and " 1 " less, than the tabular reduction.

The table gives the correct reduction at I min. from the meridian for any azimuth up to $60^{\circ}$ from the meridian, and has been rigorously calculated by seven-figure logarithms from the following formulæ :-

> Cot. $\mathrm{ZD}=$ Sin Azim. . Cot H.A. I min.
> Tan. Decl. $=$ Sin H.A. I min. . Cot Azim.

In Lat. $0^{\circ}$, Decl. $=M Z D$, and $Z D-M Z D=$ Reduction at Lat. $0^{\circ}$.
Then Cos Lat. $\times$ Redn $=$ Redn. for succeeding Latitudes.

## TABLES VIIa. AND VIIb.-EX-MERIDIAN TABLES (pp. 293-299)

Table VIII $a$. gives the reduction at I min . to three place of decimals corresponding to azimuths from $26^{\circ} 36^{\prime}$ to $74^{\circ}$, in lat. $o^{\circ}$.

The reduction for other latitudes may be quickly found by the Traverse Table. By taking the reduction at r min. in dist. column, the corresponding reduction for any latitude is found in D. lat. column : or cos. lat. $\times$ Redn. at i min. $=$ reduction for latitude required.

Table VIII $b$. is a continuation of Table VIII $a$., but must be used in conjunction with Table IV. (Azimuth Table), as shown in the following example.

Example.-Lat. $20^{\circ}$ azimuth $9^{\circ} \cdot 3$ gives lat. var. 26.00 sec., which gives Redn. at $1 \min =I^{\prime} \cdot 147$.

Pages 296 and 297 of Table VIIIb. have been recalculated with the formula above stated, but as there was no appreciable difference in the results when the azimuth was small between this formula and that employed in the first edition of the book, pages 298 and 299 have been retained. These two pages were calculated by the following formula :-Reduction for $\mathrm{r} \min .=\frac{30 \mathrm{~V}}{4+\mathrm{V}^{2}}$ where $\mathrm{V}=$ lat. var. in time, i.e. the error in time due to $I^{\prime}$ of error in lat. Table VIII. will be found the most convenient to use, but a reference to Tables VII. and VIIa. will indicate under different circumstances which table should be used to get the best results.

## table IX.-ERROR IN LATITUDE BY EX-MERIDIAN DUE TO 4 SECS. IN TIME, OR 1' OF LONGITUDE (pp. 300-301)

This table (pages $300-301$ ) shows at a glance the error which would result in the latitude from any single observation out of the meridian for every 4 secs. of time, or $\mathrm{I}^{\prime}$ of longitude. When two observations are taken the factors given in this table facilitate the problem of finding the ship's position from two ex-meridian observations, or one chronometer observation and an ex-meridian. See pages xxxiv, xlii, xlviii and xlix.

Formula used in the calculation of table :-Lat. error $=$ long. error $\times \tan$ azim. $\times \cos$ lat.

## table X.-The mean places of 108 of the brightest stars, in order OF RIGHT ASCENSION, FOR 1ST JANOARY 1914

On pages 302-303 the mean places of no8 of the brightest stars are given, in the order of their right ascension, for the Ist January 1914. In the column headed "Mag." the adopted unit of brightness is designated $\mathrm{I}^{\circ} \mathrm{o}$. The magnitudes of stars are determined to tenths of a magnitude with reference to this adopted unit. The magnitudes of the ten stars brighter than the unit are indicated by figures less than $1 \cdot 0$ : thus, the value 0.3 for Arcturus indicates that that star is seven-tenths of a magnitude brighter than the unit; the value -1.4 for Sirius that it is 2.4 magnitudes brighter than the unit. As the right ascensions and declinations of the stars do not change uniformly throughout the year, the correction for intermediate months cannot be made accurately by multiplying the annual change by a fraction of the year ; but the change is so small that for navigational purposes at sea the right ascensions and declinations here given may be used without appreciable
error for azimuths and latitudes, and even for longitude the error due to using these elements would seldom exceed a mile. When greater accuracy is required the navigator should use the Admiralty Nautical Almanac for the year, where the right ascensions and declinations of these and many other stars are given very minutely for every ten days throughout the year.

## TABLE XI.-APPROXIMATE APPARENT TIMES OF THE MERIDIAN PASSAGES OF THE PRINCIPAL FIXED STARS (pp. 304-306)

The times are given in this table for the ist of each month and the meridian of Greenwich. To find the time for any other day, subtract the portion of time corresponding to the day of the month in the day-correction table. Add 1 min . for every $90^{\circ}$ of east longitude, and subtract I min. for every $90^{\circ}$ of west longitude.

The time of the meridian passage of each star has been carefully calculated to the nearest second of time for the year 1910, and is given in the table to the nearest minute.

For the circumpolar stars which never set in higher latitudes than $50^{\circ} \mathrm{N}$. or S . the times of the meridian passages of the inferior as well as the superior transit have been given.

## Example and Caution in using this Table

Required the meridian passage of $* \beta$ Centauri on 3 1st October, in longitude $10^{\circ} \mathrm{W}$. н. M.

Mer. pass. of $* \beta$ Centauri on Ist Oct. is Cor. for 3ist day

Approx. time
2nd cor. required
Approx. mer. pass. $* \beta$ Centauri
$130 \mathrm{P} . \mathrm{m}$.
I 52

```
31 23 38=11 38 a.m. on Ist Nov.
        -4
    D.-
    31 23 34 or II 34 a.m. on Ist Nov.
```

The interval in this case is within 2 hours of 31 days instead of 30 days, therefore nearly 4 minutes more correction is required to be subtracted. The correction for longitude would be less than io seconds.

The table is calculated for the year rigro, but will be within 2 min . for many years, with the single exception of the $*$ Polaris, which has an annual and increasing change in R.A. of over 27 s ., and will therefore be about 5 min . later in passing the meridian in io years' time.

## TABLE XII.-ALPHABETICAL LIST OF 30 OF THE BRIGHTEST STARS WHOSE REDUCTION TO THE MERIDIAN AND AZIMUTH HAS BEEN CALCULATED AND TABULATED IN the following pages. also the order of these stars in r.a., giving the SIDEREAL time of star's meridian passage above and below the pole FOR THE CIRCUMPOLAR STARS (p. 307)

This table will be useful for reference in quickly determining which are the most suitable bright stars for latitude, longitude, azimuth, or position-finding from combined observations of two or three stars.

## TABLE XII.-REDUCTION TO THE MERIDIAN FOR * POLARIS, 1915

This table (page 308) has been calculated for star's declination in 1915, and shows at a glance the reduction to the meridian required for every 10 m . of hour-angle and every 10 m . of latitude from $10^{\circ} \mathrm{N}$. to $60^{\circ} \mathrm{N}$. latitude.

Examples in the use of the table are given at foot of page under the table.

## TABLE XIV.-STAR POLARIS AZIMUTH TABLE (p. 309)

The true bearing to the nearest decimal of a degree is given in this table for every 20 m . of hour-angle from $0^{\circ}$ to $60^{\circ} \mathrm{N}$. latitude. The declination of the star for the year 1915 was used in the calculation of the azimuth. The table is especially useful between $10^{\circ} \mathrm{N}$. and $30^{\circ} \mathrm{N}$., as for instance in the Red Sea. In a high latitude the altitude will be too high for compass correction work. It is therefore not given beyond $65^{\circ}$ of latitude.

## TABLE XV.-REDUCTION TO THE MERIDIAN AND AZIMUTH TABLES FROM 1 HOUR TO 3 HOURS FROM THE MERIDIAN ABOVE AND BELOW THE POLE OF 26 OF THE BRIGHTEST STARS (pp. 310-411)

These tables give at sight the reductions and azimuths of 29 of the brightest stars from about I hour to 3 hours from the meridian above and below the Pole. The reduction must be added to the altitude to reduce it to the meridian above the Pole, and subtracted from the altitude to reduce it to the meridian altitude at the inferior transit.

The azimuth will always be of the same name as the latitude at the inferior transit, and North or South at the superior transit according to whether the star's declination is North or South of the observer's latitude.

It is hoped that these tables will induce navigators to establish a habit of regular and systematic observation of stars for position-finding at twilight.

The reduction taken out at sight to the nearest couple of minutes, and applied to the calculated meridian altitude, would give the approximate altitude for setting on the sextant, and the bearing which is given on the same page will give the direction in which to look. There will be no need of star maps or celestial globes, as the altitude and bearing of the star will positively determine its identity.

The reductions which have been tabulated to the nearest tenth of a minute have been calculated to the nearest hundredth part of a minute. Most of them were calculated with Shortrede's seven-figure logarithm table, using the star's declination corrected to the nearest second of arc for the year 1920. The below-Pole reductions up to 1 h .15 m . from the meridian which were calculated at an earlier date, and first published in 1908, have been calculated for the year rgro. The difference would seldom amount to as much as $o^{\prime} \cdot 1$. The results have been carefully checked by differences of both time and latitudes, and can therefore be relied on for close accuracy.

The formula used in the calculations for the reduction tables is that deduced from dropping a perpendicular on the hour-circle from $Z$ at $N$ inside or outside the usual spherical triangle PZD, using the supplement of P. (H.A.) for below-Pole hour-angles.

Then PN $(\operatorname{arc} x)=\cos P \cdot \tan Z P$.
$\mathrm{ND}(\operatorname{arc} 2)=\mathrm{NP} \pm \mathrm{PD}$.
$\cos Z D=\cos P Z . \cos N D . \sec N P$.
Reduction $=Z \mathrm{D} \sim \mathrm{MZD}$.

## TABLE XVI.-ALTITUDE CORRECTIONS OF SUN AND STARS, AND ACCELERATION TABLE (pp. 412-413)

This table (the upper half for the sun, and the lower half for the stars) gives the lump correction to apply to their observed altitudes, involving for the sun dip, refraction, semidiameter, and parallax, and for the stars dip and refraction.

As the correction for very small altitudes changes rapidly, a supplementary table is given on page 413 for the correction of both sun and stars, at a height of 40 feet above sea-level, for altitudes between $3^{\circ}$ and $I x^{\circ}$, for every few minutes of altitude, and for other heights greater or less than 40 feet a second correction is given in same table.

Heights are given from 6 feet to 80 feet, so as to meet the need of navigators in every class of vessel, from the smallest to the largest. As standard authorities still slightly differ in their dip and refraction tables, a mean of the dip and refraction given in the three standard works (Raper, Inman, and Norie) has been used in the calculation of the table here given, and great care has been taken to ensure accuracy.

## TABLE XVIa.-ACCELERATION TABLE (p. 412)

This table is used for converting intervals of mean solar time into equivalent intervals of sidereal time. The seconds column which is given in most navigational tabular works has here been omitted for the sake of space, and because it is considered quite unnecessary in ordinary practical navigation. In practical navigation it becomes necessary in nearly all the problems where stars are used to convert mean solar time into sidereal time, as, for instance, in the time azimuth, longitude by chronometer, and the ex-meridian problems. In these problems the time is generally taken by a chronometer keeping mean solar time, and to compare this with the sidereal time found by the stellar observation it must be reduced to sidereal time.

Examples will be found among some of the worked-out problems following these explanations.

# GENERAL REMARKS, RULES, AND EXAMPLES 

## GENERAL REMARKS ON THE DOUBLE-ALTITUDE AND " SUMNER" PROBLEM

Many navigators undervalue Sumner's method in low latitudes: first, because of the small change of bearing between the usual times of taking the observations; and secondly, because with a high altitude the circle of altitude or line of position is not to the same extent a straight line on the chart. Those who do not think for themselves are further confirmed in the very common impression which one has so often heard expressed about the uselessness of attempting to get a "Sumner" position in low latitudes, owing to the practice of those who are responsible for setting the papers for the Board of Trade examinations for masters and mates in confining all their examples within the parallels of $46^{\circ}$ to $52^{\circ}$ of N . or S . latitudes, and compelling candidates to work the "Sumner" problem by the calculation of four hour-angles, plotting the position between two parallels of latitude instead of by the briefer, more accurate, and up-to-date method of working by positionlines taken from azimuth tables, and making the starting-point either from the meridian or parallel of latitude, according to whether the sun is nearest the meridian, or prime vertical. Naturally, all the navigational guide-books for candidates follow suit, and in consequence comparatively few officers in the merchant service know anything about utilising a position-line from an ex-meridian observation, or from the "intercept" of the altitude, as used in the Marcq St Hilaire method.

Some of the problems in this work have been purposely given in low latitudes and with very high altitudes, and it will be seen that a perfectly accurate result is obtained with an altitude as high as $89^{\circ}$ and $37^{\circ}$ from the meridian, when the same problem worked by the above-mentioned method would be as much as $9^{\prime}$ in error in the latitude. If observations are used intelligently, accurate "Sumner" positions may be obtained in any latitude, and no altitude need be considered too high-the only consideration is to make sure that the sun has changed sufficiently in bearing to make a good "cut" of not less than $40^{\circ}$, and, to ensure this, one of the observations should be made within half an hour of noon when in the tropics. In the winter months an hour from noon will sometimes give a sufficiently large angle to make a satisfactory "cut"; but when the observer is nearly under the sun, one of the observations should be taken within a few minutes of noon, and under such conditions a right-angle "cut" may sometimes be obtained within an interval of five to ten minutes, by A.m. and p.м. observations.

The writer has served a great deal of his sea time in low latitudes, and never found any difficulty in getting good reliable positions from double-altitude observations, although in those days, to the best of the writer's knowledge, there were no ex-meridian tables published which would give a reliable latitude when the sun was over $30^{\circ}$ from the meridian. He may, however, be wrong in this surmise, as, notwithstanding the fact that at least three or four such tables are now on the market, a very well-known and up-to-date author of nautical works, as lately as r9r3, considered that an altitude of a star which was only $22^{\circ}$ from the meridian was an impossible ex-meridian. On page xxxviii of this work an example is given where position of ship is accurately determined by these tables from two ex-meridians, one of them being over $70^{\circ}$ from the meridian, and the proof of the accuracy of the determination is verified by other methods.

In obtaining the latitude by the double-altitude or "Sumner" method, it is best if the observations are taken on the same side of the meridian for the same person to observe both; and generally the truest latitude will be found if both observations are taken on the same side of the meridian, as it is probable that if for any reason the altitude is observed too high, or too low, the same thing will occur in both observations. For the same reason the truest longitude will be found from observations taken on different sides of the meridian.

## REMARES ON THE POSITION-LINE AND "SUMNER" PROBLEM IN CONNECTION WITH EX-MERIDIANS

Although most navigators are now fully alive to the value of the position-line in connection with the longitude by chronometer, the value of the position-line in connection with the latitude by ex-meridian is seldom presented in works of navigation. It is generally supposed that an ex-meridian, if taken within a certain time from noon, will give a correct latitude, and that therefore the ship's line of position is anywhere on that parallel of latitude. This, however, is only the case when the ship time (which depends on the longitude) is nearly correct.

The further the object is in bearing away from the meridian, the greater will be the error due to an error in the time. (See Table IX., pp. 300-301.)

The time, however, might be uncertain to 4 or 5 minutes, and yet the ex-meridian observation may be of great value in connection with the position-line, either when near the land by combining this line of bearing with some sounding (see p. lii), or bearing of the land, or by combining it with another astronomical position-line, as in the "Sumner" problem. When the body which is used as an ex-meridian is within the limits of exmeridian tables, an accurate latitude for a particular meridian may be obtained with very few figures. For cases where the body is outside the usual ex-meridian limits the formula here given ( $\mathrm{pp} . \mathrm{xxv}$-xxvii) will give a correct latitude for any time from the meridian corresponding to the true hour-angle of the sun, or other heavenly body, and the latitude on an approximate D.R. longitude will give the starting point for the position-line, which these tables give, cutting this longitude meridian at that latitude.

It is very generally believed by navigators than an observation taken near the meridian is of no use in connection with the "Sumner" problem. To some extent this is true when the problem is worked by the usually taught methods and the D.R. latitude is much in error. I have endeavoured to show by the following examples how the ex-meridian problem may be combined with the chronometer observation in the "Sumner" problem; and, if this is done, it matters little how the sun or stars bear when the observations are taken, provided there is a suitable difference in bearing (say 3 points or more) between the two position-lines.

The ex-meridian and star reduction tables in this work enable the navigator to very readily obtain his position from two ex-meridians or by an ex-meridian and chronometer observation, which may be worked as a double altitude, or plotted on the chart, just as accurately and even more rapidly than it could be worked from two chronometer observations. Tables of still wider limits by Blackburne and Westland were published by the New Zealand Marine Department in 1908.

When observations are taken at the best possible time-shortly before sunrise and after sunset, when probably only three or four of the brightest stars are visible-we cannot expect always to get two stars sufficiently far from the meridian and prime vertical as is considered by some necessary (vide Wvinkles, gth ed., p. 514) for a satisfactory double altitude to be worked on the "Sumner" principle. However, if advantage is taken of the methods shown in the following examples it will be seen how little this matters. The only necessary condition of importance to ensure good results is that the stars should be sufficiently far apart in bearing to give a good cut; and if one observation be near the prime vertical, and the other one near the meridian, the writer would say so much the better, rather than that this should be looked upon as an objection.

By the following formula a true latitude may be calculated when the correct hourangle is known, and if an approximate longitude is used for finding the hour-angle, the latitude and position-line from this meridian is just as valuable as any position-line drawn from a given longitude on a D.R. parallel of latitude.

## FORMULE FOR CALCULATION OF LATTTUDE BY EX-MERIDIAN WHEN OUTSIDE THE LIMITS OF EX-MERIDIAN TABLES

Case No. I.-Object above the Pole. Angle at Z ( $=$ bearing of object) more than $90^{\circ}$ reckoned from observer's Pole.

In the spherical triangle ZPD , let $\mathrm{ZP}=c o$. lat., $\mathrm{ZD}=\mathrm{co}$. alt., and $\mathrm{PD}=\mathrm{P}$. Dist.
Given ZD, PD, and angle at P : to find $P Z=c o$. lat.
From D drop a perpendicular on the meridian at $M$, then in the right-angled spherical triangle PMD we have PD and angle at P to find $\mathrm{PM}=\operatorname{arc}(\mathrm{I})$.

Formula : $-\operatorname{Cos} \mathrm{P}=\tan \operatorname{arc}(\mathrm{I}) \cdot \cot \mathrm{PD} \quad \therefore \tan \operatorname{arc}(\mathrm{I})=\cos \mathrm{P} \cdot \tan \mathrm{PD}$.
Next find $Z M=\operatorname{arc}(2)$.

In the spherical triangle $\mathrm{PMD}, \cos \mathrm{PD}=\cos \operatorname{arc}(\mathrm{I}) . \quad \cos \mathrm{MD}$.

$$
\begin{gathered}
\therefore \quad \frac{\operatorname{Cos}(2)}{\operatorname{Cos}(1)}=\frac{\cos Z D}{\cos P D}+\therefore \cos (2)=\cos (1) \cdot \cos Z D \cdot \sec P D . \\
P Z \cos . \text { lat. }=\operatorname{arc}(1)-\operatorname{arc}(2) .
\end{gathered}
$$

Case No. 2.-Angle at $Z$ less than $90^{\circ}$. Same formula as in previous case, but $\mathrm{PZ}=\operatorname{arc}(\mathrm{I})+\operatorname{arc}(2)$.

CASE No. 3.-Object below the Pole. In the spherical triangle PMD, angle at $\mathbf{P}=$ supplement of hour-angle.

Then follow the same formula as in Case No. I.

$$
\mathrm{PZ} \text { (co. lat.) }=\operatorname{arc}(2)-\operatorname{arc}(1)
$$

By using the complements of PD and ZD and complement of PM for arc (I) when the object is above the Pole, or complement of ZM when object is below the Pole, the formula may be arranged as follows, and the rule as below applied :-

## Object above the Pole

Cot $\operatorname{arc}(\mathrm{I})=\cos$ H.A. . cot decl.
Cos arc (2) $=\operatorname{cosec}$ decl. . sin arc ( I ) . sin alt.
Name arc (1) same as decl.
Name arc (2) contrary to bearing of object-i.e. N. or S. of the prime vertical.
Add like and subtract unlike names. Sum or difference of arc (1) and arc (2) = latitude.

## Object below the Pole

Tan arc ( I ) $=$ cos. supplement of H.A. . cot decl.
Sin $\operatorname{arc}(2)=\operatorname{cosec}$. decl. . cos arc (1) . sin alt.
Name both arc (1) and arc (2) same as the decl.
Latitude = sum of arc (I), and arc (2) always named same as decl.
Note.-It is not advisable to use the formula here given when the declination of object is within $3^{\circ}$ or $4^{\circ} \mathrm{N}$. or S. decl. If it is then used, six-figure logarithms should be taken out and the corrections made for odd seconds of arc.

In the above-mentioned case it is recommended to calculate arc (2) after the azimuth has been calculated by the following formula as deduced from the spherical triangle MZD, viz.:-

Above-Pole Observation.-Tan arc (2) $=\cos$ Z. cot alt.
Below-Pole Observation.-Cot arc (2) $=\cos$ Z . cot alt.
As the azimuth is nearly always required to make use of an observation taken out of the meridian, this last-mentioned formula is preferred to the foregoing one, and is in the writer's opinion the best formula for an ex-meridian latitude that he knows of. For accuracy the azimuth should be calculated by the following formula :-
$\operatorname{Sin}$ azim. $=\sin$ H.A. . cos decl. . sec alt.

## CALCULATION OF EX-MERIDIAN LATITUDES. No. i Method

## Examples to Illustrate each Case

Case No. I.-H.A. 3 h. 00 m ., decl. $22^{\circ} 0^{\prime}$ S., alt. $22^{\circ} 2 I^{\prime} \cdot 8$ S.Elg. .


CASE No. 2.-H.A. 2 h .40 m. , decl. $50^{\circ} \mathrm{N}$. , alt. $54^{\circ} 2^{\prime} \cdot 6$ N.E ${ }^{\text {ty }}$.


CASE No. 3.-* Capella, H.A. 2 h. 6 m. from lower Pole, decl. $45^{\circ} 54^{\prime} \cdot 7$ N., alt. $7^{\circ} 2^{\prime}$ N.W. (Bee p.xlviii)


The accuracy of this method may easily be proved by reversing the process, and finding the hourangle from the latitude, declination, and altitude given.

Case No. 3 is especially useful, as with high declination stars the latitude will generally be fairly correct even when the time is in error a couple of minutes, and the body observed is an hour or more from the meridian below the Pole, as may be seen by a glance at the Reduction Tables of some of the high declination stars.

## FORMULE FOR CALCULATION OF EX-MERIDIAN LATITUDES WHEN AZIMUTH IS KNOWN. No. 2 Method

## Previous Examples Worked by this Alternate Method

Arc (I) is calculated as shown in the preceding examples, and from the foregoing figures it will be apparent that Arc (2) ZM may be found from the right-angled spherical triangle MZD by the following formula :-

$$
\begin{aligned}
& \text { Above-Pole Observations } \quad . \quad . \quad . \quad \begin{array}{l}
\operatorname{Tan} \operatorname{Arc}(2)=\operatorname{Cos} Z \\
\text { Below-Pole Observations }
\end{array} \quad . \quad . \quad \operatorname{Cot} \text { Alt. } \\
& \operatorname{Cot} \operatorname{Arc}(2)=\operatorname{Cos} Z
\end{aligned} \quad \operatorname{Cot} \text { Alt. }
$$

Note.-The Supt. of the hour-angle is used for the below-Pole observations, and for convenience of the rules and arrangement of the formula, Comp. of ZM is called $\operatorname{Arc}(2)$ in the deduced formula used.

CASE No. I.-H.A. $3 \mathrm{~h} .00 \mathrm{~m} .$, decl. $22^{\circ} 0^{\prime}$ S., alt. $22^{\circ} 2 \mathrm{I}^{\prime} \cdot 8$ S.Ely.

| H.A. | 3 h .00 m . | Cos | 9.84948 |  | Sin | 9.8495 | Azim. | $45^{\circ} 9^{\prime}$ | Cos | 9.84835 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Decl. | $22^{\circ} \mathrm{o}^{\prime} \mathrm{S}$. | Cot | 0.39359 |  | Cos | 9.9672 | Alt. | $22^{\circ} 2 \mathrm{I}^{\prime} \cdot 8$ | Cot | $0 \cdot 38571$ |
| Arc (1) |  | Cot | 0.24307 |  | Sec | $\bigcirc$ | Arc (2) | $59^{\circ} 44 \frac{\frac{1}{2}^{\prime}}{}$ | Tan | $0 \cdot 23406$ |
|  |  |  |  | Azim. $45^{\circ} 9^{\prime}$ | Sin | 9.8506 |  |  |  | , 3406 |

Arc (2) $59^{\circ} .44 \frac{\frac{1}{2}^{\prime}}{} \mathrm{N}$.
Lat.
$30^{\circ} \quad 0^{\prime} \mathrm{N}$.

Case No. 2.-H.A. 2 h .40 m ., decl. $50^{\circ} 0^{\prime}$ N., alt. $54^{\circ} 2^{\prime} \cdot 6$ N.Ety.

| H.A. Decl. | $\underset{50^{\circ}}{2 \mathrm{~h}}$. | Cos Cot | $\begin{aligned} & 9 \cdot 88425 \\ & 9.92382 \end{aligned}$ | - . . . . | $\begin{aligned} & \operatorname{Sin} \\ & \operatorname{Cos} \end{aligned}$ | $\begin{aligned} & 9 \cdot 808 \mathrm{r} \\ & 9 \cdot 808 \mathrm{r} \end{aligned}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Arc ( I ) | $57^{\circ} 16^{\prime} \mathrm{N}$. | Cot | $\underline{9.80807}$ | Alt. $54^{\circ} 2^{\prime} \cdot 6$ | Sec | 0.2312 | Cot | 9.86057 |
|  |  |  |  | Azim. $44^{\circ} 43 \frac{1}{\prime}^{\frac{1}{\prime}}$ | Sin | $\underline{9.8474}$ | Cos | 9.85156 |
| Arc (2) | $27^{\circ} 16^{\prime} \mathrm{S}$. |  |  |  |  | Arc (2) | Tan | $\underline{ } 9.71213$ |
| Lat. | $30^{\circ} \quad 0^{\prime} \mathrm{N}$. |  |  |  |  |  |  |  |

Case No. 3.-H.A. 2 h .6 m . from lower Pole, decl. $45^{\circ} 54^{\prime} \cdot 7$ N., alt: $7^{\circ} 2^{\prime}$ N.Wly.
H.A. Supt. 2 h. 6 m .

Decl. $45^{\circ} 54^{\prime} \cdot 7 \mathrm{~N}$.
Arc (I) $39^{\circ} 33^{\prime} \cdot 3 \mathrm{~N}$.
Cos 9.93077 . . . . . Sin 9.718 I

Cot 9.986 I 8 . . . . . Cos 9.8425
Tan $\xlongequal{9.91695}$ Alt. $7^{\circ} 2^{\prime} \quad \operatorname{Sec} 0.0033$. . Cot 0.90877

Arc (2) $7^{\circ} 33^{\prime} \cdot 2 \mathrm{~N}$.

Lat.
$47^{\circ} \quad 6^{\prime} \cdot 5 \mathrm{~N}$.
The foregoing formulæ for finding the latitude and azimuth when the body is far from the meridian is, in the writer's opinion, the very best known to him, and would be hard to beat.

Half of the logs are taken out at the same openings, and four figures of logs for the azimuth is amply sufficient.

## AN INTERESTING EXPERIENCE OF EXCESSIVE REFRACTION

A few years ago an old pupil of the writer, Captain W. H. Sweny, then commanding the P. \& O. s.s. Mooltan, had a remarkable experience of exceptional refraction on the evening before making Rottnest Light. He took observations of four different stars at about 6 p.m. on April inth, 19IO, and afterwards sent to the writer his own observations, asking him to work them out, and let him know what he made the resulting position, but without divulging what he made the result by his own calculations. This was done, and the observations were systematically worked on the plan mentioned at bottom of following page; and when Captain Sweny afterwards sent the results of his work, both observations were in agreement, and evidently not more than about $r^{\prime}$ in error in either latitude or longitude. The Captain also sent the worked-out observations of the other two officers, and from all these observations the writer was able to deduce fairly accurate separate positions, and it was evident from these observations that refraction was excessive all round the horizon, but greatest to the northward, where it was about $I I^{\prime} \cdot O$, and in other parts of the horizon averaging about $6 \frac{3^{\prime}}{}{ }^{\prime}$, the altitudes being smaller 'by these amounts than they should have been by allowing the usual tabular corrections. The height of eye when these observations were taken was 50 feet. If the captain had been satisfied with the ex-meridian observations of Procyon and Pollux, and the longitude of $\beta$ Centauri, he would have been $1 I^{\prime}$ or $12^{\prime}$ out in the latitude and $33^{\prime}$ out in the longitude. By using the observations intelligently he was practically correct in his position, and made Rottnest Light nearly ahead at 2 a.m. His position at the time was about $30^{\circ} 4^{\prime} \mathrm{S}$. and $113^{\circ} 47^{\prime} \mathrm{E}$.

The above-related experiences, though undoubtedly very exceptional, should tend to warn navigators not to trust too implicitly even in daylight to observations taken on one side only of the meridian or prime vertical ; for though such excessive refraction is very vave, and may not be experienced in the lifetime of a frequent observer, it is probable that such amounts as $2^{\prime}$ difference from the tabulated value of refraction are not uncommon.

## REMARKS ON P.M. OBSERVATIONS

Anyone who is in the habit of regularly taking p.m. sights must have noticed the large differences which sometimes occur between a.m. and p.m. observations, which is generally attributed to current, and some men have even been led to believe from this that p.m. sights are not of any value, as though the sun-or, rather, the earth-did not move as uniformly in the afternoon as in the forenoon. The principal difference between the results of the two observations is probably generally due to erroneous altitude, especially in rough weather, and sometimes, of course, to erroneous latitude, and the mean of the results from the two observations will generally be nearest the true position. It has often been noticed when there is a heavy sea on that p.m. sights place the longitude a long way to the eastward of the a.m. ones, owing probably to the sun being observed on the top of a wave, and consequently the altitude being too small, an error which in the morning would place the ship to the westward of the true position, but in the afternoon just as much to the eastward of it ; so that, supposing the ship to be in latitude $48^{\circ}$ and the sun to be $30^{\circ}$
from meridian at each observation, an error in the latitude of $2^{\prime}$ too little on both occasions would make a difference of $12^{\prime}$ of longitude, as may be seen from Table III., on page 256 . Suppose, then, that on the same occasion both observations have been worked with an error of $2^{\prime}$ south of the true latitude: this would make another difference of about $10 \frac{1^{\prime}}{}{ }^{\prime}$ of longitude, making the p.m. sights $22 \frac{1_{2}^{\prime}}{}{ }^{\prime}$ of longitude to eastward of the a.m. observation, and a slight easterly current in the interval between the two observations might easily make over $30^{\prime}$ difference. Generally, no doubt, one of these errors will in a measure counteract another, but exceptional occasions are almost sure to arise when they will all combine in the same direction.

## EFFECT OF ALTITUDE ERRORS

With a.m. sights too great an altitude will place a ship to eastward of true position, and vice versa with p.m. sights and too small an altitude. The amount of error in longitude or time due to $x^{\prime}$ error of altitude is shown in Table III., pages 252-257.

## THE UNRELIABILITY OF NOON POSITION FROM SUN OBSERVATIONS

The usually recorded noon position should never be relied on too implicitly, as it is generally liable to be a few minutes in error, and this may happen when three or four persons have taken observations and are all in agreement. The very agreement of so many observers would only give a false confidence, which is the more dangerous as there is no opportunity with the sun observation (except when near land) of checking it and thereby determining the error. Many well-known authorities, however, have recorded ${ }^{-}$ their experience of errors in the latitude from sun observations, due to excessive refraction, as amounting to from $7^{\prime}$ to 18 ' (see page 132 of Tables for Azimuths, etc., by Blackburne, and experience mentioned on previous page). Such refraction, however, is undoubtedly very exceptional : the greatest error in the noon latitude that the writer ever experienced was 7'-this was in the Malacca Straits; three observers on this occasion making the altitude practically the same, and at I p.m. the ship was abreast One Fathom Bank Lighthouse. It must be remembered also that the so-called noon longitude generally depends on an observation taken at about 8 a.m. or 9 a.m., and the calculation of the time from this observation is often made with an erroneous latitude, thereby giving a wrong result; and currents, or bad steering, etc., may again combine to still further throw the position out. In the winter months $x^{\prime}$ of error in the latitude used for the calculation of the time will often throw the longitude out as much as $2^{\prime}$. As the results of errors of both altitude and latitude are reversed with p.m. sights, it would be a good plan to adopt in recording the noon longitude to wait until p.m. sights had been taken for longitude, and then to take the mean of the a.m. and p.m. results, worked up to noon, as the true noon longitude.

As shown, however, in the lower part of this page, with the position obtained by simultaneous observations of three stars, errors resulting from uncertainty of refraction, etc., may be eliminated. The horizon shortly after sunset is generally very clearly defined, without any glare; and the latitude and longitude are obtained at the same instant of time. If shipowners made it compulsory for their officers to obtain the ship's position, whenever possible by stellar observations at twilight, it would, I believe, be the means of saving many ships from disaster, and the saving of not a few lives.

## THE SUPERIORITY OF STELLAR OVER SOLAR OBSERVATIONS

The two great advantages of stellar over solar observations are: ( 1 ) that by the stars the latitude and longitude can be obtained simultaneously, instead of having an interval of three or four hours between the observations, as is often the case when the sun is used; and (2) that uncertain errors in altitude resulting from personal equation, arc errors of sextant, or exceptional refraction may be practically eliminated by a proper choice of stars. If meridian altitudes can be obtained about the same time to the north and south of observer, it will be apparent to anyone that the errors would be eliminated by taking the mean result of the two observations for the true latitude; and in the same way the true longitude would be found by the mean result of observations taken nearly east and west of meridian. But it may happen that stars are not to be found north, south, east, and west of observer during the short time that the horizon is good for observation. The following is the plan that the writer used for several years with great success:-Take three stars, and of these choose two on the same side of the meridian northward and southward of the observer for a good latitude. If they both happen to be the same distance from the meridian, as in the example on page 114 of Blackburne's 1916 edition of Tables for Azimuth, etc., 10 ' of error in the altitude will make practically no difference in the resulting latitude as found by the "Sumner" or double-altitude problem. Then choose another star on the other side of the meridian, as near as possible the same distance from the meridian; cal-
culate the longitude with the latitude found from the previous observations, and the true longitude will be obtained by taking the mean between the eastern and western stars worked with the correct latitude.

On pages II4 and II5 of the work previously mentioned three stars were taken, and the altitude of each star was ro' in error (too great) ; but following the plan above mentioned, the calculation of ship's position was made, and did not differ more than $o^{\prime} \cdot \mathrm{I}$ in either the latitude or longitude from the correct position as determined from the correct altitudes of the same three stars.

## RULE FOR FINDING THE POSITION OF SHIP FROM TWO OBSERVATIONS BY AID OF these tables either with or without the use of chart

## From Two Chronometer Observations of the Sun

(1) Let two chronometer observations be taken at an interval in time during which the sun has changed at second observation not less than three points, and let the first be worked out with the D.R. latitude at the time of observation, or generally the nearest whole degree of latitude may be used.
(2) Let the D.R. latitude and longitude thus obtained be corrected for the run of the ship in the interval between the observations, and let the second observation be worked with the corrected latitude. Name these longitudes (I) and (2).
(3) With the hour-angle, latitude, and declination at each observation take out the lat. var. from the lower half of the page, and name the position-lines corresponding to this variation according to the instruction under the heading of Table No. VI. This variation divided by 4 gives the error in longitude due to $\mathrm{I}^{\prime}$ of error in latitude.

## When both Position-Lines go through the Same or Opposite Quadrants

(4) The difference between the two lat. vars. will give the difference in the resulting longitudes due to $I^{\prime}$ of error in the latitude. (See fig. 2 below.)

## When the Position-Lines go through Adjacent Quadrants

(5) The sum of the two vars. will give the difference in the resulting longitudes due to $I^{\prime}$ of error in the latitude. (See example on page xxxi and fig. I below.)

The three elements used in the calculation of time, or longitude, are altitude, latitude, and polar distance. Presuming that the altitude and polar distance are correct, the resulting difference in longitude between the two observations must be due to error in the latitude. The sum or difference of the two lat. vars. $\div 4$ gives the difference of longitude in the two observations due to $I^{\prime}$ of error in the latitude used in the calculation, and the amount of error in the latitude will therefore be found by a simple proportion sum (see page xxxi), from which it will be seen that the error or correction to be applied to the D.R. latitude will be found by dividing the difference between longitudes (I) and (2) by the sum or difference of the variation corrections. It must be applied to the latitude used in the last observation, and to the N . or S . according to whether the position-lines cut one another N. or S. of the D.R. latitude used in the calculation. The true longitude is then found by multiplying either of the $\frac{\text { lat. vars. }}{4}$ by the latitude error, and applying the correction according to the trend of the position-line.

To prevent the possibility of making a mistake in the application of the correction to the latitude, a short horizontal line representing the parallel of D.R. latitude may be drawn with a free hand in the work-book; on this line put down longitudes (I) and (2), and roughly draw the position-lines through each longitude, following the rule for naming the positionlines given on page 270, under the heading of Table VI., also bearing in mind that if the line runs in a north-easterly direction it is equally true that the line must also run in the opposite direction or south-westerly. No scale for longitude need be used, or protractor for laying down the bearings, but simply put longitude (I) or (2) to the right or left of the other, as they are to the east or west of one another, then draw the general trend of the position-lines through these two longitudes, thus :-


## For Stellar Observations

When finding the position of ship from stellar observations, it is best to observe the altitude of two stars which have a considerable difference in bearing from one another, and to take both observations within a few minutes of the same time. If the ship has not appreciably changed her position during the interval between the observations, both observations may be worked with the same latitude, and no correction for run need be applied to the first-observation latitude or longitude. Otherwise the same rules apply as for the observations by the sun.

When the ship has appreciably changed her position during the interval between the observations, rules Nos. I and 2 must be observed as in the sun observations.

## From Ex-Meridian and Chronometer Observation Combined, to Plot on Plane Chart

Let two observations be taken with a suitable difference in bearing between them, and let the one nearest the prime vertical be used for a longitude (working it with the D.R. latitude), and the other one for a latitude, using the time deduced from the longitude found by observation in the calculation for latitude; bring both results up to the same instant of time by applying the run in interval between the observations.

Take out the lat. var. for each observation, and with this enter Table VI., page 270, and take out the corresponding position-lines. We have then two latitudes and their corresponding position-lines starting from different points on the same meridian. Where these lines cut with one another on a plane chart will be the position of the ship.

For the ex-meridian observation, or if outside the limits of the Calculated Hour-Angle Table, the lat. var. must be found from Table IV. (Azimuth Table) from the approximate latitude and azimuth.

## From Two Ex-Meridian Observations on Different Sides of the Meridian

Let two observations be taken with a suitable difference in bearing between them, one east and the other west of the meridian, deducing the hour-angle by applying the equation of time and longitude by D.R. Bring both results up to the same instant of time by applying the run in interval between the observations. The latitude from either observation (if worked by a correct method) is the latitude where the circle of altitude of the body observed cuts the meridian used in deducing the time. If both latitudes agree when observations have a considerable difference in bearing between them, the longitude must be correct. If the latitudes do not agree, the true latitude and longitude may readily be found by plotting on the chart, or by the method explained below.

## Without the Aid of Chart

By aid of Table IX. giving the Error in Latitude by Ex-Meridian due to 4 sec . Error in Time, or I' of Longitude

By the aid of the above-named table the double-altitude problem may be worked from the meridian, on the same principle as two chronometer observations are worked from a parallel of latitude. If the azimuth is not over $85^{\circ}$ (the limit of the table), the problem may be worked from the meridian with either an ex-meridian and chronometer observation combined or from two ex-meridians.

When both observations are on same side of meridian, the difference between the two errors in latitude, due to $I^{\prime}$ of error in the longitude, taken from the table, will be the divisor for the two differences of latitude resulting from the two observations, and will give the correction for the longitude used.

When one observation is east and the other west of meridian, the error of longitude will be found by dividing the differences of latitude resulting from the two observations by the sum of the factors taken from the table. The error in latitude will then be found by multiplying the error in longitude by the correction taken from the table (in preference using the azimuth nearest to the meridian) and applying this to the ex-meridian latitude in the direction of the trend of the position-line, which is always at right angles to the bearing of object.

When the altitude is high and near the meridian the azimuth should be obtained by the time and altitude. This is most satisfactorily done by the rule of sines. (See examples on pages xxxii, xxxiv, xxxvi, etc.)

For examples from chronometer and ex-meridian observation see pages xxxii, xxxiv, xliv, xlvii.

For examples from two ex-meridian observations see pages xxxvi, xxxviii, xlii, xlviii, xlix, 1.

For examples from two longitude observations see pages xxxi, xlvi.
For examples by equal altitude and ex-meridian see pages xxxvii, li.

## EXAMPLES IN THE USE OF THE TABLES

POSITION FROM TWO A.M. LONGITUDE OBSERVATIONS OF THE SUN
1913.-On May 12th, a m. at ship, in approximate lat. $30^{\circ} \mathrm{N}$. and long. $20^{\circ} \mathrm{W}$., observed alt. of sun's L.L. was $9^{\circ} 25^{\prime}$ when a chronometer indicated M.T. Green. 19 h. 18 m .43 s .; and again a.m. at ship, observed alt. of sun's L.L. was $60^{\circ} 32^{\prime}$ when chronometer indicated 23 h .17 m .23 S . Course and distance run between observations, N. $36^{\circ}$, E. 40 m . ; height of eye, 30 ft . Required position of ship at and Observation, and Azimuth at time of ist Observation.
ist a.m. © Observation.


Course and distance run between observations N. $36^{\circ}$, E. $40 \mathrm{~m} .=32^{\prime} \cdot 4 \mathrm{~N} ., 23^{\prime} \cdot 5$ E. $=$ d. long. $27^{\circ} 2 \mathrm{E}$. gives lat. at and Observation $30^{\circ} 32^{\prime} \cdot 4 \mathrm{~N}$.


## For Stellar Observations

When finding the position of ship from stellar observations, it is best to observe the altitude of two stars which have a considerable difference in bearing from one another, and to take both observations within a few minutes of the same time. If the ship has not appreciably changed her position during the interval between the observations, both observations may be worked with the same latitude, and no correction for run need be applied to the first-observation latitude or longitude. Otherwise the same rules apply as for the observations by the sun.

When the ship has appreciably changed her position during the interval between the observations, rules Nos. r and 2 must be observed as in the sun observations.

## From Ex-Meridian and Chronometer Observation Combined, to Plot on Plane Chart

Let two observations be taken with a suitable difference in bearing between them, and let the one nearest the prime vertical be used for a longitude (working it with the D.R. latitude), and the other one for a latitude, using the time deduced from the longitude found by observation in the calculation for latitude; bring both results up to the same instant of time by applying the run in interval between the observations.

Take out the lat. var. for each observation, and with this enter Table VI., page 270, and take out the corresponding position-lines. We have then two latitudes and their corresponding position-lines starting from different points on the same meridian. Where these lines cut with one another on a plane chart will be the position of the ship.

For the ex-meridian observation, or if outside the limits of the Calculated Hour-Angle Table, the lat. var. must be found from Table IV. (Azimuth Table) from the approximate latitude and azimuth.

## From Two Ex-Meridian Observations on Different Sides of the Meridian

Let two observations be taken with a suitable difference in bearing between them, one east and the other west of the meridian, deducing the hour-angle by applying the equation of time and longitude by D.R. Bring both results up to the same instant of time by applying the run in interval between the observations. The latitude from either observation (if worked by a correct method) is the latitude where the circle of altitude of the body observed cuts the meridian used in deducing the time. If both latitudes agree when observations have a considerable difference in bearing between them, the longitude must be correct. If the latitudes do not agree, the true latitude and longitude may readily be found by plotting on the chart, or by the method explained below.

## Without the Aid of Chart

> By aid of Table IX. giving the Error in Latitude by Ex-Meridian due to 4 sec. Error in Time, or $\mathrm{I}^{\prime}$ of Longitude

By the aid of the above-named table the double-altitude problem may be worked from the meridian, on the same principle as two chronometer observations are worked from a parallel of latitude. If the azimuth is not over $85^{\circ}$ (the limit of the table), the problem may be worked from the meridian with either an ex-meridian and chronometer observation combined or from two ex-meridians.

When both observations are on same side of meridian, the difference between the two errors in latitude, due to $\mathrm{r}^{\prime}$ of error in the longitude, taken from the table, will be the divisor for the two differences of latitude resulting from the two observations, and will give the correction for the longitude used.

When one observation is east and the other west of meridian, the error of longitude will be found by dividing the differences of latitude resulting from the two observations by the sum of the factors taken from the table. The error in latitude will then be found by multiplying the error in longitude by the correction taken from the table (in preference using the azimuth nearest to the meridian) and applying this to the ex-meridian latitude in the direction of the trend of the position-line, which is always at right angles to the bearing of object.

When the altitude is high and near the meridian the azimuth should be obtained by the time and altitude. This is most satisfactorily done by the rule of sines. (See examples on pages xxxii, xxxiv, xxxvi, etc.)

For examples from chronometer and ex-meridian observation see pages xxxii, xxxiv, xliv, xlvii.

For examples from two ex-meridian observations see pages xxxvi, xxxviii, xlii, xlviii, xlix, 1 .

For examples from two longitude observations see pages xxxi, xlvi.
For examples by equal altitude and ex-meridian see pages xxxvii, li.

## EXAMPLES IN THE USE OF THE TABLES

## POSITION FROM TWO A.M. LONGITUDE OBSERVATIONS OF THE SUN

1913.-On May 12th, a m. at ship, in approximate lat. $30^{\circ} \mathrm{N}$. and long. $20^{\circ} \mathrm{W}$., observed alt. of sun's L. L. was $9^{\circ} 25^{\prime}$ when a chronometer indicated M.T. Green. 19 h .18 m .43 s. ; and again a.m. at ship, observed alt. of sun's L.L. was $60^{\circ} 32^{\prime}$ when chronometer indicated $23 \mathrm{~h} .17 \mathrm{~m}, 23 \mathrm{~s}$. Course and distance run between observations, N. $36^{\circ}$, E. 40 m. ; height of eye, 30 ft . Required position of ship at and Observation, and Azimuth at time of ist Observation.

IST A.M. © OBSERVATION.


Course and distance run between observations N. $36^{\circ}$, E. $40 \mathrm{~m} .=32^{\prime} \cdot 4 \mathrm{~N} ., 23^{\prime} \cdot 5$ E. $=$ d. long. $27^{\circ} 2 \mathrm{E}$. gives lat, at and Observation $30^{\circ} 32^{\prime} 4 \mathrm{~N}$.


## "SUMNER" PROBLEM AS GIVEN IN THE BOARD OF TRADE EXAMINATIONS FOR MASTERS and mates, WORKED BY the aid of davis's chronometer tables and BLACKBURNE'S EX-MERIDIAN TABLES

1898.-On June 20th, a.m., at ship, at sea, and uncertain of my ship's position: when a chronometer indicated M.T. Green. I9 d. 22 h .30 m . the true altitude of sun's centre was $52^{\circ} 9^{\prime}$; and again, a.m. on same day, when chronometer indicated 20 d .0 h .16 m . the true altitude of sun's centre was $65^{\circ} \mathrm{I} 8^{\prime}$, the ship having made 23 miles on a true N. $24^{\circ}$ E. course during the interval between the observations. Required the line of position and true bearing of the sun at time of rst Observation, and the position of the ship when 2nd Observation was taken, assuming latitudes $46^{\circ} \mathrm{N}$. and $47^{\circ} \mathrm{N}$.

Longitude by Davis's Chronometer Tables.


> Variations.

$\begin{aligned} & \text { H. M. } \\ & 230 \text { I }\end{aligned}$ $+15 \%$
-23118.7 E .
$1921284 \mathrm{I} \cdot 3$
$1922 \quad 28 \quad 43 \cdot 3$
$\begin{array}{rrrr}15 & 0 & 30 & \mathrm{~W} . \\ 13 & 36 & \mathrm{E} . \\ & \begin{array}{rrrr}1 & 46 & 54\end{array} & \mathrm{~W} .\end{array}$
o h. 59 m .7 .6 s .

2nd Observation © S.Ely.
D. H. M. S.
M.T. Green 20 o 16

Eq. T. $\quad$ I 1777
A.T. Green. 20 ○ $1442 \cdot 3$

Long. (1) $\quad-059 \quad 7.6 \mathrm{~W}$.
A.T.Ship
$\begin{array}{llll}19 & 23 & 15 & 34.7 \\ 24 & 0 & 0\end{array}$
H.A.

$$
044 \quad 25 \cdot 3
$$

For the Asimuth.

> | H.A. 44 m .25 s s. | $\operatorname{Sin} 9.285$ |  |
| :--- | :---: | :---: |
| Decl. | $23^{\circ} 27^{\prime}$ | $\operatorname{Cos} 9.962$ |
| Alt. | $65^{\circ} 18^{\prime}$ | $\operatorname{Sec} 0.379$ |
| Azim. | $25^{\circ} \quad \mathrm{I}^{\prime}$ | $\operatorname{Sin} 9.626$ |

gives Lat. Var. (p. 267).
12.4 s. gives Posn.-Line N. $72^{\circ} \cdot \mathrm{I}$ E.

Position by Chart, Lat. $46^{\circ} 30^{\prime} \cdot 5 \mathrm{~N}$., long. $14^{\circ} 40^{\prime} \cdot 5 \mathrm{~W}$.*
True Posn. by Spherics, $46^{\circ} 30^{\prime} 20^{\prime \prime} \mathrm{N}$., long. $14^{\circ} 4 \mathrm{I}^{\prime} \cdot 0 \mathrm{~W}$.

Lat. Var. 2.7 gives Posn.-Line for Plane Chart (p. 270) N. $34^{\circ} \mathrm{E}$.

$$
\begin{aligned}
& \text { Run N. } 24^{\circ} \text { E. } \quad \begin{array}{c}
\text { M. } \\
\text { 2 }
\end{array}=2^{\prime} \mathrm{I} \text { N. } 9^{\prime} \cdot 4 \mathrm{E} .=13^{\circ} 6 \text { d. long. } \\
& \text { Lat. ( } \mathrm{I} \text { ) } \\
& \text { Lat. D.R. } \\
& 46^{\circ} 2 I^{\prime} \text { N. at time of 2nd Obsn. }
\end{aligned}
$$

Lat. by Ex-Meridian Table No. 3. (Blackburne's and Westland's Tables.)


Reduced Specimen of Plane Sumner Chart published by the New Zealand Government Marine Department.


* Had the true lat. var. 2.5 s . been used, giving Posn.-Line N. $32^{\circ}$ E., the resulting position would have been exactly correct. Davis's vars. are calculated for the mid-interval, not as in these tables for the degree.


## "SUMNER" PROBLEM AS GIVEN IN THE BOARD OF TRADE EXAMINATIONS

1898.-On June 20th, a.m., at ship, at sea, and uncertain of my ship's position: when a chronometer indicated M.T. Green. 19 d .22 h .30 m . the true altitude of sun's centre was $52^{\circ} 9^{\prime}$; and again, a.m. on same day, when chronometer indicated 20 d .0 h .16 m . the true altitude of sun's centre was $65^{\circ} \mathrm{I} 8^{\prime}$, the ship having made 23 miles on a true N. $24^{\circ}$ E. course during the interval between the observations. Required the line of position and true bearing of the sun at time of ist Observation, and the position of the ship when 2nd Observation was taken, assuming latitudes $46^{\circ} \mathrm{N}$. and $47^{\circ} \mathrm{N}$.
ist Observation.

|  | D. | H. | M. | S. |
| :--- | ---: | ---: | :---: | :---: |
| M.T. Green. | I9 | 22 | 30 | 0 |
| Eq. of Time |  | - I 16.7 |  |  |
| A.T. Green. | I9 | 22 | 28 | 43.3 |

2nd Observation.

| D. | H. | M. | S. |
| ---: | ---: | :---: | :---: |
| 20 | O | I6 | 0 |
|  |  | -1 | 177.7 |
| 20 | 0 | 14 | 42.3 |

Decl. ${ }_{23}{ }^{\circ}{ }^{2} 7 \mathrm{~N}$.
$90 \quad 0$
P.D. $\overline{6633}$
Lat. 46 ón. Long. A. I $_{5}$ ó 3 I W.
, 470 ", $\quad$ B. 142054 W.

" D. 125752 W .

Run between Observations N. $24^{\circ}$ E. 23 miles was on line of first Position-Line.

| Line of position | N. $24 \frac{1}{2} \mathrm{E}$. | Position at $2 \mathrm{nd} \mathrm{Obsn}$. | Lat. ${ }^{\circ} 6{ }^{\text {2 }} 7$ N . | True Posn. Lat. |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sun's bearing | S. $65 \frac{1}{2} \mathrm{E}$. |  | Long. 1443 W . | Long. |  |  |  |



With the desire to show the superiority of the method advocated in these pages for accuracy and brevity over the method still employed in the Board of Trade examinations of masters and mates, for the "Sumner" problem, the above example is given and plotted on the chart by both methods. For the sake of better illustrating the possible error due to the old method, a wider range of latitude has been taken than is usually given in the examination papers, though, considering the high speed of some of the presentday steamers, the range is not excessive, as the run in interval itself might often amount to over $r^{\circ}$ of latitude. In the tropics, with a much smaller range of latitudes, the error resulting from considering the line of position of the higher altitude as a straight line will sometimes cause an error of half a dozen minutes or more in the latitude, as may be seen from the example on two following pages.

## xxxiv <br> EXAMPLES IN THE USE OF THE TABLES <br> POSITION FROM CHRONOMETER AND EX-MERIDIAN OBSERVATION OF SUN, 2ND ALTITUDE OVER $88^{\circ}$

1913.-6th August, in latitude somewhere between $18^{\circ} \mathrm{N}$. and $18^{\circ} 40^{\prime} \mathrm{N}$., and approximate longitude when first observation was taken $69^{\circ} 30^{\prime}$ E., between heavy rain squalls in the S.W. monsoon, the sun appeared for a few minutes at about 7 h .48 m . a.m.; and only showed himself for a short space a little after noon. G.M.T. at rst Observation 15 h .13 m .19 S ., when true altitude of $\Theta$ was $30^{\circ} 12^{\prime}$; and again at p.m. M.T.G. was 19 h. 26 m .4 S., when true altitude of $\theta$ was $88^{\circ} 10 \frac{1^{\prime} S^{\mathrm{d}} .}{}$ Run in interval N. $77^{\circ}$ E. 56 m . gives $12^{\prime} \cdot 6 \mathrm{~N} .54^{\prime} \cdot 6 \mathrm{E} .=57^{\prime} \cdot 4 \mathrm{E}$. d. long. Required the position of ship at time of and Observation.
ist Observation of © a.m.

A.T.G.
$515 \quad 730$


Decl. $18 \quad 54 \quad 40 \mathrm{~N}$.

## Tabular H.A.

| I8 óN. ${ }^{\circ} \mathrm{i}$ |  |
| :---: | :---: |
| 1654 | 41255 |
| Alt. 30 12 30 | Cor. -5 |


Cor. H.A.

$$
\begin{array}{rrr}
4 & \text { II } & 59.4 \mathrm{E.} \\
24 & 0 & 0.0 \\
\hline 19 & 48 & 0.6 \\
15 & 7 & 30 \cdot 0 \\
\hline
\end{array}
$$

A.T. at Ship
A.T. at Green.

Long. in Time
Long. at ist Obsn.
Run between Obsns.
Long. at Time of and Obsn.

$$
\frac{44030.6}{70^{\circ} 7^{\circ} \cdot 6 \mathrm{E} .} \begin{array}{r}
\text { Lat. } \\
57^{\circ} \cdot 4 \mathrm{E} .
\end{array}
$$

$$
\overline{7 \mathrm{I} \quad 5.0 \mathrm{E} .} \text { and Lat. } \overline{\underline{18 \quad 12.6} \mathrm{~N} .}
$$

Long. in Time 4 h .44 m .20 S .
A.T.G. $\quad 19 \quad 20 \quad 16$
H.A.

Decl. .
Alt.


For Azim. and Redn.
Sin 8.3025
Cos 9.9809
Sec 144969
Azim.
S. $37^{\circ} 5^{\prime} \mathrm{W}$.
$\operatorname{Sin} 9 \cdot 7803$

2nd Observation of © p.m.
M.T.G H. M. S.

Eq. of Time $\quad-548$
A.T.G. $\quad 192016$

## Variations.



Lat. Var. +0.70 s . gives Azimuth N. $80^{\circ} .6 \mathrm{E}$. (p. 258) and Posn.-Line for Plane Chart (p. 270) N. $10^{\circ} \mathrm{W}$.

Lat. Var. $5 \cdot 56$ s. gives Posn.-Line (p. 270)
N. $54 \cdot 2^{\circ}$ W. for Plane Chart.

Azim. $37^{\circ} \cdot 1$ gives from Table VIII. (Azimuth Ex-Meridian Table, p. 284) $4^{\prime} \cdot 78$ to $\mathrm{I} \mathrm{m} . \times 4^{\cdot 6 \mathrm{~m} . \text { gives Redn. } 22^{\prime} \cdot 0 .}$

## Table IX.


" (2) $1819.3 \mathrm{~N} . \quad$, S. 37 W . " $0 \cdot 74 \quad$, N. to W.
D. Lat. 6.7

Lat. Error 5.00

Lat. Error $5^{\prime} \cdot 0$ : D. Lat, $6^{\prime} \cdot 7^{:}:$Long. $I^{\prime} \cdot 0$ : Long. Cor. $I^{\prime} \cdot 3 \mathrm{~W}$. Long. Cor. $\mathrm{I}^{\prime} \cdot 3 \times 0^{\prime} \cdot 74$ gives Lat. Cor. $\mathrm{o}^{\prime} \cdot 97 \mathrm{~N}$.


Note.-The resulting latitude by spherical calculation only differs by $o^{\prime} \cdot 1$, and the proof of correctness of position is established by recalculating the longitude, using the latitude found at 2nd Observation, and the same resulting longitude is obtained. Now, many navigators would have considered that an altitude of over $88^{\circ}$, more than four minutes after noon, and $37^{\circ}$ from the meridian, was of no use for anything; it is outside the limits of such well-known and excellent Ex-Meridian Tables as Brent, Raper, or Davis, and most of the formulæ given in the navigational guide-books for the calculation of latitude by ex-meridian methods would give very erroneous results; the Sumner as taught through our examinations would be hopelessly out, giving over 9 ' of error in the latitude, and even the "New Navigation" method if worked as advocated by some authors would be $7 \frac{1^{\prime}}{}{ }^{\prime}$ in error in the latitude. Possibly this is such a case as Lieutenant Simpson Baikie had in mind when he wrote (p. 8 of his book of Tables for working Combined Altitudes): "The azimuth of an object is such that an ex-meridian altitude is impossible, and a chronometer sight worse than useless." Personally the writer knows of no such cases. No observation, if used intelligently, is without value.

# EXAMPLE ON PREVIOUS PAGE WORKED BY THE "OLD SUMNER METHOD" AND ALSO BY THE MARCQ ST HILAIRE SYSTEM 

"OLD SUMNER METHOD"<br>ist Observation.<br>2nd Observation.<br>

Resultant Position plotted on the Chart at 2nd Observation : Lat. $18^{\circ} \mathrm{II} \mathrm{I}^{\prime}$ N., Long. $7 \mathrm{I}^{\circ} 6^{\prime} \mathrm{E}$.

## MARCQ St HILAIRE SYSTEM

ist Observation.


Azimuth N. $80 \frac{1}{2}^{\circ} \mathrm{E}$.
Resultant Position plotted on the Chart : Lat. $182^{\circ} 8 \quad$ N., Long. 7 I 2. $2^{\prime} 5 \mathrm{E}$. True Position . . . . . Lat. 1820.3 N., Long. 713.7 E .


Note.-The St Hilaire system would have given the same accuracy as by the Improved Sumner Method if the problem were worked by the method shown by Brent in his ex-meridian book (combining chronometer observation and the St Hilaire method), and no chart is needed; or an accurate result would also be obtained if the first observation had been plotted on the chart before the second observation was taken, and the approximate longitude from this position-line had been used in obtaining the hour-angle and azimuth for second observation.

The plotting on the chart, in a somewhat extreme case, has been here given to clearly illustrate the possible errors which may arise from following the plan as given above, and advocated by some recent authors. Although one of these authors, in a little work which has attracted some attention in the Merchant Service, gives examples where the D.R.lat. is over 40 and 50 miles in error, he was wise enough when advocating the above plan never to give much error in the D.R. long., although it is undoubtedly a much more uncertain element than the latitude.

With the methods advocated in this work it is quite immaterial what the D.R. latitude is, as no difference would result if it were $2^{\circ}$ or more in error.

# POSITION FROM TWO EX-MERIDIAN OBSERVATIONS OF SUN WITH ALTITUDES ONLY $1^{\circ}$ FROM ZENITH 

1914.-12th May, in approximate lat. $19^{\circ} \mathrm{N}$. and long. $72^{\circ}$ E., making Bombay. From the following observations find the position of ship. Work the problem first from the two ex-meridian latitudes and position-lines, and confirm resulting position by other methods.
 Run in interval East $\mathrm{r}^{\prime} \cdot 0$ of Long. Long. D.R. ist Öbsn. $71^{\prime \prime} 59^{\prime}$ E." Long. (2) $72^{\circ} \mathrm{E}$.
a.m. © Observation.
P.M. © Observation.
H. M. S.


Gives (p. 286) Redn. at I m. $=5^{\prime} \cdot 86 \times 3 \mathrm{~m} .=$ 17'58.

Gives (p. 278) Redn. at $\mathrm{Im} .=2^{\prime \prime} \cdot 43 \times \mathrm{I} \cdot 4 \mathrm{~m} .=$ $3^{\prime} \cdot 4$.

| Redn. | ${ }^{\circ}+17.6$ |
| :---: | :---: |
| True Alt. © | $89 \quad 0.0 \mathrm{~S}$. |
| Mer. Alt. | $89 \mathrm{17.6} \mathrm{S}$. |
| M.Z.D. | - 42.4 N . |
| Decl. | 1756.3 N . |
| Lat. (I) | 1838.7 |

Position plotted on Chart.
Lat. $\quad{ }^{\circ} 8 \quad 47 \% 7 \mathrm{~N}$.
Long. 72 II. 8 E .
To find position on Chart.

| Redn. <br> True Alt. | +3: ${ }^{\prime}$ |  |
| :---: | :---: | :---: |
| Mer. Alt. |  |  |
| M.Z.D. |  | 56 |
| Lat. (2) |  | 52 |


(2) 1853 N. $\odot$, S. $99 \frac{1}{2}$ W. Z.D. $=60$

Take $60^{\prime}$ in the dividers, "and with"one leg" on the $\odot$ and the other'leg on latitudes ( 1 ) and (2), sweep two arcs from these latitudes. The intersection of these arcs gives the position of ship.

Note.-This method may be used with very high altitudes when the D.R. longitude is uncertain, and if the D.R. longitude is in error more than $6^{\prime}$ or $7^{\prime}$ it will give a more accurate result than by the ordinary method of position-lines at right angles to the bearing of object, but in such cases the longitude will seldom be in error more than $3^{\prime}$ or $4^{\prime}$, as the sun would be nearly on the prime vertical throughout the whole day, except within a quarter of an hour from noon. If the true bearing of the sun could be accurately observed at the same instant as the altitude, the position of ship would be determined by one altitude and azimuth.


# POSITION OF SHIP BY SHORT EQUAL ALTITUDE OF SUN AND EX-MERIDIAN LATITUDE 

1914.-May 12th, in approximate lat. $19^{\circ}$ N. and long. $72^{\circ}$ E. From the following observations find the position of ship by equal altitude method:-
 Run in interval I'o of long. East (true).


## POSITION OF SHIP FROM ABOVE OBSERVATIONS DETERMINED INDEPENDENTLY, FROM THE CHART

We are indebted for this method to the writer's old friend, Captain T. S. Angus, Nautical Inspector for the P. \& O. S. N. Company, one of the keenest and most enthusiastic navigators he ever met. It is as follows :-When the sun's decl. or that of any other heavenly body is within $\mathrm{I}^{\circ}$ or $\mathrm{I}_{\frac{1}{2}}{ }^{\circ}$ of the latitude of ship, observations may be taken as soon before noon as the Z.D. is small enough to be conveniently measured on the chart with a pair of dividers, and again shortly after noon. Plot the geographical position of the sun (lat. $=$ decl. long. $=$ A.T.G.) (applying the run to position of first observation to bring both observations to same instant of time), and from this position as centre sweep an arc with Z.D. as radius in a direction opposite to the rough bearing of object. This is a position-line. The intersection of the two position-lines is the position of the ship. With an altitude of $89^{\circ}$ a right-angle cut can be obtained in just under 6 minutes, and with an altitude of $89 \frac{1}{2}^{\circ}$ a right-angle cut may be obtained in less than 3 minutes.

The following figures give all that is necessary for plotting on the chart :-


The chartlet on previous page shows the G.A.T. longitudes on the parallel of the $\odot$ 's decl. corresponding with the positions drawn from the azimuths from the calculated latitudes on the mer. of $72^{\circ} \mathrm{E}$.

## POSITION FROM TWO EX-MERIDIAN OBSERVATIONS OF SUN WITH ALTITUDES LESS THAN $1_{2}^{\circ}$ FROM ZENITH

1917.-March 19th, in approximate position in lat. $0^{\circ}$ and long. $45^{\circ} \mathrm{W}$.

With the following observations find the position of ship at time of second observation :-

(A.M. at ship) M.T. Green. I9 32 | I |
| :---: | (P.M. at ship)

I9 3927 " " 8847.4 S.Wd. Run in interval between observations West. rì" miles.
A.M. Observation.

| M.T. Green. | 3 | $\begin{array}{rr}\text { M. } \\ 2 \\ 2 & 5 \mathrm{I}\end{array}$ | T. Alt. $\Theta$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Eq. of Time |  | 757 | Redn. |  | 54.2 |
| A.T. Green. | 2 | 5454 | Mer. Alt. |  | $35 \cdot 2$ |
| Long. $44^{\circ} 58 \frac{1}{\frac{1}{2}}$ W. | . | 5954 |  |  |  |
| A.T. Ship | 23 | 5500 | Mecl. |  | $\begin{array}{ll} 0 & 24.8 \mathrm{~N} . \\ 0 & 37 \circ \mathrm{~S} . \end{array}$ |
| H.A. ${ }^{\text {n }} 5^{\mathrm{m}}$; $\quad$ S | Sin | 8.3388 | Lat. |  | 12.2 S. |
| Alt. $88^{\circ} 4 \mathrm{I}^{\prime}$ S | Sec | 1.6387 |  |  |  |
| Az. S. $7 \mathrm{I}^{\circ} 43^{\prime} \mathrm{E}$. S | Sin | 9.9775 |  |  |  |

Gives (p. 293) Redn. at $1 \mathrm{~m} .=10.845 \mathrm{~s} . \times 5 \mathrm{~m} .=$
Redn. $54^{\prime} \cdot 2$.
P.M. Observation.


Gives Redn. at 1 m. $=2^{\prime} \cdot 38 \times 1 \frac{1}{2} \mathrm{~m} .=$ Redn. $3^{\prime} \cdot 6$.


$$
\begin{array}{llll}
\text { Posn. on chart } & 0^{\circ} & 21.0 & \mathrm{~N} . \\
& 44 & 38.7 \\
\hline
\end{array}
$$

| Mer. Alt. | $\overline{8851.0}$ |
| :--- | :--- |
| M.Z.D. I 9.0 N <br> Decl. 037.0 S. |  |

Lat.


On the meridian of $45^{\circ} \mathrm{W}$. lat. (1) is $0^{\circ} 12^{\prime} \cdot 2 \mathrm{~S}$. and $\odot^{\prime}$ 's bearing S. $72^{\circ} \mathrm{E}$. with Z.D. $79^{\prime}$.

$$
\text { " } \quad, \quad, \quad(2),, 032 \text { N. ", } \quad 3 . \quad \text { S. 18 W. } \quad, \quad 72 \cdot 6 .
$$

With one leg of the dividers on the $\odot$, in decl. $o^{\circ} 37^{\prime}$ S., and the Z.D. at time of each observation sweep two arcs from the latitudes found on the meridian of $45^{\circ} \mathrm{W}$. The intersection of the two arcs is the true position of ship.

Note.-This example, as an extreme case where both altitudes were near the zenith, and the D.R. position considerably in error, illustrates clearly the errors which would result from considering the positionlines as straight lines. A perfectly true position, however, is obtained by the method here shown. In such an extreme case, if it is inconvenient to adopt this method, a second calculation could very quickly be made by the use of the Ex-Meridian Table with a new hour-angle deduced from the approximate longitude obtained by the first calculation.

## DOUBLE PROOF OF CORRECTNESS OF POSITION AS DETERMINED BY THE METHOD AND CALCULATION OF PREVIOUS EXAMPLE

The following is a very good and simple -way of proving the accuracy of double altitude observations, viz. :-

With the resulting longitude deduce a new hour-angle, and recalculate the latitude by a true method from the observations. If both latitudes are the same as from previous determinations, it is a good guarantee of the correctness of position; or

With the resulting latitude recalculate the longitude from both observations. If they both agree with previous results we may rely with confidence on the correctness of the calculations, but of course this will not guarantee the correctness of position if a wrong altitude has been observed or a wrong declination used in the calculations.

## For Determination of Latitudes

A.M. Observation.


Gives Redn. at I $\mathrm{m} .=5^{\prime} .89 \times 3.58 \mathrm{~m} .=$ Redn . $2 I^{\prime} \cdot I$

| True Alt. $\Theta$ Redn. | $\begin{aligned} & 88^{\circ} 4 \mathrm{r}^{\mathrm{I} \cdot 0 \mathrm{~S}} . \\ & +2 \mathrm{I} \cdot \mathrm{I} \end{aligned}$ | True Alt. $\Theta$ Redn. | $\begin{gathered} 88^{\circ}{ }_{47}^{\prime} \cdot 4 \mathrm{~S} . \\ +14.7 \end{gathered}$ |
| :---: | :---: | :---: | :---: |
| Mer. Alt. | 89 2.I | Mer. Alt. | $892 \cdot \mathrm{I}$ |
| M.Z.D. | - 57.9 N . | M.Z.D. | - 57.9 N. |
| Decl. | - 37.0 N . | Decl. | - $37 \cdot 0 \mathrm{~N}$ |
| Latitude | $\underline{\underline{20.9}} \mathrm{~N}$. | Latitude | $\underline{\underline{20.9}} \mathrm{~N}$. |

Determination of Longitudes


Long. at time of 2nd Obsn. $44^{\circ} 38^{\circ} \cdot 6 \mathrm{~W}$.

Note.-The determination of latitude by the use of Table VIII. should only be made within the limits of time given in Tables VII. and VIIa., as it will not give a true result outside these limits.

## POSITION FROM TWO COMBINED ALTITUDES OF THE SUN DEDUCED BY TWO DIFFERENT METHODS

1917.-On May 2ISt, in approximate position $18^{\circ} 30^{\prime} \mathrm{W}$. and $72^{\circ} 0^{\prime} \mathrm{E}$. at time of second observation.

With the following observations find the position of ship at time of second observation. First by ex-meridian method, and then by two longitude observations.

A.M. Observation.

| M.T.G. | $\begin{array}{r} 185824 \\ +\quad 338 \end{array}$ |  |  |
| :---: | :---: | :---: | :---: |
| Eq. Time |  |  |  |
| A.T.G. | 1922 |  |  |
| Long. $7 \mathrm{I}^{\circ} 56 \frac{1}{\prime}{ }^{\prime} \mathrm{E}$. | +44746 |  |  |
| A.T. Ship | 234948 |  |  |
| H.A. | $\bigcirc 1012$ | Sin | $9 \cdot 6483$ |
| Decl. | $20^{\circ} 5^{\prime} \mathrm{N}$. | Cos | 9.9727 |
| Alt. | 871412 | Sec | 1-3169 |
| Azim. N. $60^{\circ} \cdot 5 \mathrm{E}$. |  | Sin | 9.9379 |

## Latitudes by Ex-Meridian.

| True Alt. $\Theta$ Redn. | $\begin{array}{ll} 87 \\ 814^{\prime} \\ +1 & 24 \end{array}$ | $\underset{\text { (Table VIII., p. } 291 \text { I }}{60^{\circ}}$ |
| :---: | :---: | :---: |
| Mer. Alt. | 8838.2 | Redn. at $\mathrm{Im} .88^{\prime} \cdot 23$ $\times 10.2 \mathrm{~m} .=83^{\circ} \cdot 05$ |
| M.Z.D. | $121.8 \mathrm{~S} .$ | or $I^{\circ} 24^{\prime}$. |
| Decl. | 2050 N. |  |
| Lat. | I8 43.2 N . |  |
| Run | 0.8 N . |  |
| Lat. at time of 2nd Obsn. | 844.0 N. | Posn.-Line S. 3 I $\frac{1}{2}^{\circ} \mathrm{E}$. |

Gives (p. 258) 2.44 s. Lat. Var., which gives (p.
270) Posn.-Line for Plane Chart S. $3 \mathrm{r}^{\circ} 4 \mathrm{E}$.
P.M. Observation.
M.T.G.

Eq. Time
A.T.G.

Long. $72^{\circ} \mathrm{E}$.
A.T. Sp .

Decl.
Alt.
Azim. N. $32^{\circ} 42^{\prime}$ W.

Gives (p. 259) Lat. Var. 6.60 s ., which gives (p. 270) Posn.-Line N. $59^{\circ}$ E.

True Alt. © $\quad 88^{\circ} \quad 7^{\prime} N . \quad$ Azim. $\quad 32^{\circ} \cdot 7$ gives Redn.
Mer. Alt.
M.Z.D.

Decl.
Lat. $\quad \underline{=} 30$ N. and Posn.-Line N. $59^{\circ}$ E.

Posn. on Chart, Lat. $\quad 18^{\circ} 33^{\prime} .8 \mathrm{~N}$. Long. $72 \quad 6 \cdot 2 \mathrm{E}$.

## POSITION FROM TWO CALCULATED LONGITUDES ON PARALLEL OF LAT. $18^{\circ} 30^{\prime}$ N.




POSITION REWORKED AND PROVED WHTH THE NEWLY FOUND LONGITUDE, $72^{\circ} 6 \frac{1}{2}$ E.


PREVIOUS CALCULATION PROVED BY DETERMINATION OF LONGITUDE WITH NEWLY FOUND LATTTUDE


NOTE.-The higher the altitude the greater will be the error in the resulting position due to considering the position-lines as straight lines when the D.R. position is much in error. The very small error in the resulting position of this example is due to the slight curvature in the short distance of $12{ }^{\prime}$.

## POSITION OF SHIP FROM TWO EX-MERIDIAN SUN OBSERVATIONS, USING THE EX-MERIDIAN TABLES

1913.-On December 22nd, in approximate lat. $13^{\circ} \mathrm{N}$. and long. $51^{\circ}$ E. Find ship's position from the following observations of the sun:-
(1) a.m. at ship M.T.G. by chron.
D. H. M. S.
(2) p.m.
$\begin{array}{llll}21 & 19 & 34 & 26 \\ 21 & 21 & 36 & 22\end{array}$
$\begin{array}{cccc}\text { Obsd. Alt. of Sun's L. L. } & 50 & 3 ́ & \text { S. } \\ \text { " } & \text { " } & 50 & 24 \\ \text { S. }\end{array}$

Run in interval between the observations N. $86^{\circ} \mathrm{W} .($ true $)$ distance $28 \mathrm{~m} .=2^{\prime} \circ \mathrm{N} .27^{\circ} 9 \mathrm{~W} .=\mathrm{d}$. long. $28^{\prime} \cdot 5 \mathrm{~W}$. gives long, at and Observation $50^{\circ} 3 x^{\prime} \cdot 5 \mathrm{E}$.; height of eye, 42 ft .

(p. 257) Lat. (decl.) $23 \frac{1}{2}^{\circ}$, Azim. (H.A.) $\mathrm{Ih} . \circ \mathrm{m},=\left(\mathrm{I} 5^{\circ}\right), \mathrm{M}=\mathrm{I} 6.85$.
(p. 256) Lat. (alt.) $50 \frac{35}{4}$ and M. 16.85 gives Azim. S. $22^{\circ}$ E.

Posn.-Line N. $68^{\circ}$ E.


| Lat. (I) Cor. | $\stackrel{1}{3}$ | $\begin{array}{r} 0.3 \mathrm{~N} . \\ 4.5 \mathrm{~N} . \end{array}$ | Long. (2) Cor. | 5 | $\begin{aligned} & \dot{3} \mathbf{I}^{\prime} 5 \mathrm{E} . \\ & \mathrm{II}^{\circ} \cdot 5 \mathrm{E} . \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. in | 13 | $4^{\circ 8} \mathrm{~N}$. | Long. in | 50 | $43^{\circ} \mathrm{O}$ E |

Note.-True Position by rigorous calculation (by spherics) $13^{\circ} 4^{\prime \prime} 9$ N., long. $50^{\circ} 44^{\prime \prime} \mathrm{I}$ E.
Greater accuracy would have been obtained by calculating the Azimuth to the nearest minute of arc at both observations by the rule of sines formula; the use of Table III. is here given by way of example.

## EXAMPLE OF FINDING THE ERROR OF CHRONOMETER BY OBSERVATIONS IN ARTIFICIAL HORIZON, SHOWING THE USE OF THE ALIITUDE VARIATIONS IN WORKING OUT SEVERAL OBSERVATIONS SEPARATELY.

1913.-On April 16 th, at about 7 h. rom. a.m. M.T. at place. Suppose the following observations to have been taken at Observation Spot, Suez Dock. Index Error of Sextant -0' $34^{\prime \prime}$, Lat. $29^{\circ} 56^{\prime \prime} 3^{\prime \prime} \mathrm{N}$. , Long. $32^{\circ} 33^{\prime} \mathrm{I} 2^{\prime \prime} \mathrm{E} .=2 \mathrm{~h}$. $10 \mathrm{~m} .12 \cdot 8 \mathrm{~s}$.

> Alt. Diff.


Middle Sight (No. 4).


| M.T.G. (No. 2) | $\begin{array}{lcc} \text { H. } & \text { M. } & \text { S. } \\ \text { I7 } & \text { O } & \text { I3. } \\ -24.6 \end{array}$ | M.T.G. (No. 4) | $\begin{array}{ccc}\text { H. } & \text { M. } & \text { S. } \\ \text { I7 } & \text { I } & 3.2\end{array}$ |  |  | H. M. s. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2.3IS. $\times 10{ }^{\text {g }}$ - $=$ |  | $2.3 \mathrm{IS}. \times \mathrm{IO}^{\prime \prime}{ }^{\prime}=$ |  | 1 +23 +23 | $2.3 \mathrm{IS} . \times 10 \frac{1}{2}=$ | 17 | $127 \cdot 1$ +24.2 |
| M.T.G. (No. I) | 165949.0 | M.T.G. (No. 5) | 17 | 127.1 | M.T.G. (No. 6) | 17 | $51 \cdot 3$ |
| Chron. | $165933 \cdot 0$ | Chron. | 17 | 1 Ir.o | Chron. | 17 | $135 \cdot 5$ |
| Chron. slow | O 16.0 | Chron. slow |  | $\bigcirc 16 \cdot \mathrm{I}$ | Chron. slow |  | 015.8 |

M.T.G. (No. 6)
$2 \cdot 3$ IS. XII ${ }^{\prime}$
M.T.G. (No. 7)

Chron.
Chron. slow
H. M. S.

I7 $151 \cdot 3$
$+27.0$
$\begin{array}{llll}17 & 2 & 18.3\end{array}$ It is evident that the last observation was in error, probably
owing to the altitude having been either read off or put down
incorrectly. It is therefore rejected, and a mean taken of the other six.
Observations with artificial horizon are not so much needed as they were twenty or thirty years ago, as of late years time signals giving G.M.T. have been established at most places of importance, and G.M.T. is also frequently given to steamers at sea from wireless stations. Still, it is well to be independent of such aids. In the first place, they are not always reliable, and, secondly, in these days of steam and rush a vessel sometimes arrives at and leaves a port again, as at Port Said, before the time when the signal is given; and there are still many places where such aids are not to Mean 16.03 be found. The writer, when second officer, used sometimes to check the chronometer by observations of stars in the quicksilver, in his middle watch at night, when tied up in the Suez Canal or at anchor in the Bitter Lakes. Results were very satisfactory, as proved by observations east and west of the meridian, which did not generally differ more than is. from one another.

He never found it possible to get such observations of the sun on board ship, as in the daytime so many people are moving about ; but in a large ship at anchor in smooth water observations in the quicksilver can often be taken at night, when all on board except the observer and time-taker are in bed, and everything is quiet.

Note.-Sets of sights at sea may be worked out separately in the same way.

## POSITION OF SHIP BY COMBINED OBSERVATIONS OF SUN AND PLANET VENUS． LONGITUDE AND EX－MERIDIAN OBSERVATIONS

1917．－December 29th P．M．at ship in approximate latitude $30^{\circ} \mathrm{S}$ ．the true altitude of sun＇s centre was $52^{\circ} 3^{\prime}$ when a chronometer（corrected）indicated M．T．G．I h． 51 m .58 s ．， and about the same time the true altitude of planet Venus（centre）was $74^{\circ} 43^{\prime} \mathrm{N}$ ．when chronometer．（corrected）indicated M．T．G．I h． $53 \mathrm{~m} . I_{5} \mathrm{~s}$ ．Run in interval N． $4 \mathrm{I}^{\circ} \mathrm{W}$ ． 0.3 m ．＝d．long． $\mathrm{o}^{\prime} 15^{\prime \prime} \mathrm{W}$ ．Required position of ship at time of second observation．
$\odot$ P．M．Observation for Longitude．


## Planet Venus．Ex－Meridian for Latitude．

|  | H．M．S． |  |  |
| :---: | :---: | :---: | :---: |
| M．T．Green． | 15315 | T．Alt．of＊ | 7443.0 N ． |
| S．T．G．Noon | 182928.7 | Redn． | ＋ 115 |
| Accl． | 18.6 |  |  |
| S．T．Gre |  | Mer．Alt． | 7454.5 |
| Long．E． |  | M．Z．D． |  |
|  |  | Decl． | $15 \quad 4.8 \mathrm{~S}$ ． |
| S．T．Ship | 212190 |  |  |
| ＊＇s R．A． | 213139 | Lat． | $30 \quad 10.3 \mathrm{~S}$ ． |
| ＊＇s H．A． | － 1030 E ． |  |  |


| $\left.\begin{array}{ll}\text { L．} & 30 \\ \text { D．} & 23 \\ \text { A } & 52\end{array}\right\}^{\text {a }}$ | Hour－angleCor． |  |  |
| :---: | :---: | :---: | :---: |
|  |  | ＋ | 9.5 |
|  | A．T．Ship | 24 | 3.7 |
|  | A．T．Green． | 14 | 56•0 |
|  | Long．in Time | － 5 | $7 \cdot 7$ |
|  | Longitude <br> Run |  | $\begin{aligned} & 55 \mathrm{E}, \\ & \mathrm{I} 5 \mathrm{~W} \end{aligned}$ |
| Longitude at time of 2nd Obsn． 143140 E ． |  |  |  |

For Azimuth and Reduction．

| H．A． | M．S． |  |  |
| :---: | :---: | :---: | :---: |
| Di． | 10 $5^{\circ}{ }^{\text {5 }}$ | Sos | $8 \cdot 6609$ |
| Alt． | 7443 | Sec | 9．9848 |
| Az． | N． 9 39⿺⿸⿻口一口八土 E． | Sin | 9.2248 |

Az． $9^{\circ} \cdot 7$（Table VIII．p．275）gives Red．at $\mathrm{Im} .=$ $\mathrm{I}^{\prime} \cdot 10 \times 10 \cdot 5 \mathrm{~m}=\mathrm{Red}$ ． $\mathrm{II} \cdot 55$ ．

Latitude by Spherical Calculation．

| $\begin{aligned} & \text { H.A. } \\ & \text { Di. } \end{aligned}$ | $\begin{gathered} \text { H. м. м. } \\ \text { o } 10,30 \\ 15^{\circ} 4^{\prime} 48^{\prime \prime} \end{gathered}$ | $\begin{aligned} & \mathrm{Cos} \\ & \mathrm{Cot} \end{aligned}$ | $\begin{aligned} & 9.999544 \\ & 0.569527 \end{aligned}$ | Cosec | 0.584747 |  | Position． |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Arc（ I ） | $15^{\circ} 5^{\prime} 42 \frac{12^{\prime \prime}}{} \mathrm{S}$ ． | Cot | 0.56907 I | Sin； | 9.415679 | Lat.Long. |  |
|  |  | Alt | $74^{\circ} 43^{\prime}$ | Sin | 9.984363 |  |  |
| Arc（2） | 15433 S ． |  |  | Cos | $\underline{9.984789}$ |  |  |
| Latitude | $301015 \frac{1}{2} \mathrm{~S}$ ． |  |  |  |  |  |  |

Note．－As the sun was on the prime vertical when the observation for longitude was taken， $10^{\prime}$ of error in the latitude worked with makes no difference in the longitude；the hour－angle deduced from the longitude for calculation of ex－meridian would be correct， and consequently the latitude by ex－meridian will also be correct without any further plotting on the chart，or further calculation．The hour－angle worked by direct spherics by logarithms gives exactly the same result as by the table to the decimal of a second．

# EXAMPLES IN THE USE OF THE TABLES <br> POSITION FROM COMBINED ALTITUDES OF SUN AND MOON 

1914.-April 30th, at about O h. 24 m . p.m., in approximate latitude $2^{\circ} \mathrm{N}$. and longitude $46^{\circ} \mathrm{E}$. Obsd. Alt. of $\odot$ 's L.L. was $76{ }^{\circ}$ \& "ON.W. when chronometer showed G.M.T. 2 II Iy 15 and Héight of eye, 40 ft . R"equired position of ship by plotting on 'Plane C’hart. ${ }^{2 I}$ I8 4 I


Gives (Table VIII., p. 280) Redn. at I m. $3^{\circ} \cdot 335 \times 24=$ Redn. $80^{\circ} \cdot 0=\mathrm{r}^{\circ} 20^{\prime}$.
Lat. Var. 8.54 s. gives Posn.-Line for Plane Chart N. $65^{\circ}$ E. (Table VI., p. 270).



L. Var. $2 \cdot 60 \mathrm{~s}$. gives Position-Line for Plane Chart N. $33^{\circ}$ W. (Table VI., p. 270).


## POSITION FROM COMBINED LONGITUDE OBSERVATIONS OF TWO STARS

1913.-On January 7 th, in approximate position lat. $30^{\circ} \mathrm{S}$. and long. $179^{\circ} \mathrm{E}$.

Soon after sunset, at about 7.15 p.m. A.T. Sp., the observed altitude of * Sirius was $30^{\circ} 19^{\prime} 30^{\prime \prime} \mathrm{E}$. of mer., when a chronometer indicated M.T.G. 6 d . 19 h .23 m .39 s., and after running on a true S. $10^{\circ}$ W. course $00^{\circ} 3 \mathrm{~m}$., observed altitude of ${ }^{*}$ Aldebaran was $34^{\circ} 57^{\prime} 10^{\prime \prime}$ E. of mer., when a chronometer indicated M.T.G. 6 d . 19 h .25 m .23 s .; height of eye, 35 ft . Required position of ship at 2nd Observation.

* Sirius to Eastrward.

|  | D. | H. | M. | S. |
| :--- | ---: | ---: | ---: | ---: |
| M.T.G. | 6 | I9 | 23 | 39 |
| M. ©'s R.A. |  | 19 | 5 | I |
|  |  |  | I4 | 28 |
| Sid. T. Green. |  | 40 |  |  |
|  |  |  |  |  |


| Sid. T. (G. noon) | $\begin{array}{ccc} \text { H. } & \text { M. } & \text { S. } \\ \text { I9 } & \text { I } & 49^{\prime} 9 \\ 3 & \text { II'I } \end{array}$ |  |  |
| :---: | :---: | :---: | :---: |
| Accl. |  |  |  |
| $\begin{aligned} & \text { M. } \odot \text { 's R.A. (I) } \\ & \text { Accl. } 2 \mathrm{~m} \text {. } \end{aligned}$ | 19 | 5 | $1 \%$ +0 |
| M. ©'s R.A. (2) | 19 | 5 | I'3 |

* Aldebaran ro N.E.

|  | H, | M. | S. |
| :---: | :---: | :---: | :---: |
| M.'T.G. | 19 | 25 | 23 |
| M. ©'s R.A. | 19 | 5 | 1*3 |
| Sid. T.G. | 14 | 30 | $24 * 3$ |



$$
\text { Run } \underset{0^{\prime} \cdot 3 \mathrm{~S} ., 0^{\prime} .05}{ } 10^{\circ} \mathrm{W} . \mathrm{W}^{\circ} \text {. gives }
$$



Long. by if Sirius to Eastward.
Variations.



A. $-4^{.62} \times+12^{\circ} 0=-\underline{55^{\prime}}$

Cor. +16.0

| Sid. T. at Sp. | 2 | 24 | 13.5 |  |
| :--- | ---: | ---: | ---: | :---: |
| Sid. T. Green. | -14 | 28 | $40^{\circ} 0$ |  |
| Long. in Time | -11 | 55 | $33^{\circ} 5$ |  |
|  |  |  |  |  |
| Long. (1) | 178 | 53 | 22 |  |

L. Var. $+\cdot{ }^{\text {S. }}$ 2 gives Posn.-Line for Plane Chart N. $3^{\circ}$ E. and S. $3^{\circ}$ W.

Long. by * Aldebaran to North-Eastward.
Variations.


# EXAMPLES IN THE USE OF THE TABLES xlvii POSITION BY STARS SIRIUS AND ALDEBARAN FROM CHRONOMETER AND EX-MERIDIAN OBSERVATIONS 

1913.-Shortly after sunset, at about 6 h .55 m . p.m. A.T. Sp., on January 27th, in approximate latitude $30^{\circ} \mathrm{S}$. and longitude $106^{\circ} \mathrm{E}$. Suppose a chronometer to indicate M.T.G. oh. 2 m .52 s . when true altitude of * Sirius was $44^{\circ} 4^{\prime}$ E. of meridian, and after running East (true) $0^{\circ} 7 \mathrm{~m}$. the chronometer indicated oh. 8 m .12 s . when the true altitude of * Aldebaran was $4 \mathrm{I}^{\circ} 22^{\prime}$ S.E. Required position of ship at time of and Observation.

* Sirius to Eastward.

| M.T.G. <br> M. ©'s R.A. | $\begin{array}{r} \text { H. M. S. } \\ 0 \quad 252 \\ +202438 \end{array}$ | $\begin{array}{ll} \text { True Alt. } & \stackrel{0}{44} \\ \text { Decl. } & { }^{16} 6 \\ 35^{8} \\ \hline \end{array}$ | Sid. T. (Green. noon) Accl. 3m. | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 20 & 24 \\ & 37.65 \\ & +47 \end{array}$ |
| :---: | :---: | :---: | :---: | :---: |
| Sid. T. G. | $202730$ | *'s R.A. ${ }^{6} \mathrm{~h} .41 \mathrm{~m} .200 \mathrm{~s}$. | M. ©'s R.A. Accl. $5 \frac{1}{3} \mathrm{~m}$. |  |
|  |  |  | M. ©'s R.A. (2nd Obs.) | $202439^{\circ}$ |

Run East $0 \cdot 7=$ d. long. 0.8 E.

## Variations.

|  |  | H. M. S. |  |
| :---: | :---: | :---: | :---: |
| L. 30 S . | Gives tabular H.A.Cor. | $3 \quad 928.3$ |  |
| D. 17 S . |  |  | +67 |
| A. 45 | $\begin{aligned} & \text { \%'s H.A. } \\ & \text { H's R.A. } \end{aligned}$ | $\begin{array}{lll} 3 & 9 & 35^{\circ} 0 \\ 6 & 41 & 20^{\circ} 0 \end{array}$ |  |
|  | Sid. T. at Sp. Sid. T. at Green. | $\begin{array}{r} 331450^{\circ} \\ 202730^{\circ} 0 \end{array}$ |  |
|  | Long. in Time | $7415{ }^{\circ}$ |  |
|  | Long. Run E. | $\begin{array}{rl} 106 & 35 \mathrm{E} . \\ & 45 \mathrm{E} . \end{array}$ |  |
|  | Long. at time of and | 106 | 430 E. 7 |

$$
\begin{array}{rcc}
\text { D. }+2.03 \times & -24^{\circ} \cdot 2= & \text { S. } \\
\text { A. } 13 \\
& -4.65 \times & -12 \circ= \\
& +55^{\circ} \circ 0 \\
& \text { Cor. } & +6.67
\end{array}
$$

s.
L. Var - 5 I gives Posn.-Line for Plane Chart (Table VI.) S. $74^{\circ} \mathrm{E}$.


Azimuth from Table (p. 316) N. $17 \frac{1}{2}^{\circ}$ E. gives (Table IV., p. 260) Lat. Var. $14^{\circ} 5 \mathrm{~s}$., which gives (Table VI.) Posn.-Line for Plane Chart S. $74^{\circ \frac{1}{2}} \mathrm{E}$.

To make certain that the right stars are observed, the approximate altitudes and bearing of both stars may be quickly calculated, or taken from the table almost at sight.

The final calculation of ship's position may be calculated readily without the aid of the Chart, as follows :-

Lat. (1) $\quad 3^{\circ} 00^{\circ} \mathrm{OS}$. Az. N. $83^{\circ} 7$ E. gives 7.82 to $\mathrm{I}^{\prime} \mathrm{O}$ of Long. Lat. (2) $3032^{\circ} 3 \mathrm{~S}$. Az. N. 17 $7^{\circ}$ E. gives 0.28 to $\mathrm{I}^{\circ} \mathrm{O}$ of Long. D. Lat. $\quad 32^{\circ} 3$

$$
\text { Lat. Error } \overline{7.54}
$$

| $\begin{aligned} & \text { Lat. Error } \\ & 7.54 \end{aligned}$ | $\begin{aligned} & \text { D. Lat. } \\ & 3^{2} \cdot 3 \end{aligned}$ | $\underset{I^{\prime} \cdot 0}{\text { Long. }}$ | Long. Cor 4.3 E . |
| :---: | :---: | :---: | :---: |

$4^{\prime} \cdot 3 \times 0^{\prime} \cdot 28$ gives Lat. Cor. $\mathrm{I}^{\prime} \cdot 2 \mathrm{~S}$.


# TO FIND APPROXIMATE ALTITUDES AND BEARINGS OF SUITABLE STARS FOR OBSERVATION TO QUICKLY OBTANN POSITION OF SHIP 

1913.-On July 9th, soon after sunset, at about 7 h .50 m. p.m. and 7 h .54 m ., in approximate latitude $47^{\circ} \mathrm{N}$. and longitude $7^{\circ} \mathrm{W}$., find what stars of first magnitude within the limits of the Reduction and Azimuth Tables would be suitable for quickly determining the ship's position, and the approximate altitudes and bearings of the stars. Height of eye, 40 ft .

First find the Sid. Time at ship=A.T. Sp. + A. ©'s R.A.


## POSITION FROM COMBINED ALTITUDES OF TWO EX-MERIDIAN STARS

1913.-On July 9 th, soon after sunset, at about 7 h .50 m . p.m., in approximate latitude $47^{\circ} \mathrm{N}$. and longitude $7^{\circ}$ W., the true altitude of $*$ Capella was $7^{\circ} 2^{\prime}$ N.W., when chronometer showed M.T.G. $8 \mathrm{~h} .23 \mathrm{~m} .37 \mathrm{~s} .$, and true altitude of $\#$ Arcturus was $60^{\circ} 25^{\prime}$ S.W., when chronometer showed M.T.G. 8 h .26 m .56 s . Run in interval N. $32^{\circ} \mathrm{E} .0 .7 \mathrm{~m}$. Required position of ship at time of 2nd Observation.



Gives from Reduction and Azim. Table (p. 346)
Redn. $4^{\circ} I^{\prime} \cdot 3$, Azim. N. 2 I $_{\frac{1}{2}}{ }^{\prime}$ W.; Posn.-Line S. $68 \frac{1_{2}}{}{ }^{\circ} \mathrm{W}$.

Run N. $32^{\circ}$ E. 0.7 m. $=0.6$ N $0^{\prime} .4 \mathrm{E}$. d. long. $0^{\prime} \cdot 5 \mathrm{E}$. * Arcturus to S.W.


Gives from Reduction and Azimuth Table (p. 325)
Redn. $2^{\circ} 16^{\prime} \cdot 8$ and Azim. S. $27 \frac{1}{2}^{\circ}$ W.; Posn.-Line N. $62 \frac{1_{2}}{}{ }^{\circ} \mathrm{W}$.
(Table IX. p. 301)
rst Obs. Lat. $4^{\circ} 77^{\prime} \cdot 0$ N. Azim. N. $21^{\circ} \cdot 5$ W.gives $0^{\circ} \cdot 27$ S. to W. 2nd ", " 4655.7 N. " S. 27.5 W. ", 0.35 N. to W.

Lat. $47^{\circ} 7^{\prime} \mathrm{N}$
Cor. ${ }_{5}$ S
 Cor.
Lat. 472 N. Long.
717.7 W .

Lat. Error. D. Lat. Long. Long. Cor. Lat. Cor. $0^{\prime} \cdot 62$ : $11 \cdot 3$ : : $\mathrm{I}^{\prime} \cdot 0$ : $18^{\prime} \cdot 2 \mathrm{~W} . \times 0^{\prime} \cdot 27=5^{\prime} \cdot 01 \mathrm{~S}$.

# EXAMPLES IN THE USE OF THE TABLES <br> <br> POSITION FROM COMBINED EX-MERDIAN OBSERVATIONS OF TWO STARS, <br> <br> POSITION FROM COMBINED EX-MERDIAN OBSERVATIONS OF TWO STARS, USING STAR REDUCTION tables 

 USING STAR REDUCTION tables}
xlix

19r3.-March Irth, shortly after sunset, at about 6 h . p.m., A.T. at ship, at approximate lat. $47^{\circ} \mathrm{N}$. and long. $6^{\circ} \mathrm{W}$. Suppose a chronometer to indicate M.T. Green. 6 h .35 m .47 s ., when the true altitude of * Aldebaran was $57^{\circ} 6^{\prime}$ to south-westward of mer.; and again, after running N. $28^{\circ} \mathrm{E}$. (true) for 1 mile the chronometer indicated M.T. Green. 6 h. 40 m .55 s., when the true altitude of * Sirius was $24^{\circ} 14^{\prime}$ southeastward of mer. Required the position of ship at time of and Observation.

> * Aldebaran to South-Westward.



* Sirius to South-Eastward.

| M.T. Green. Long. $5^{\circ} 59^{\prime} 3 \mathrm{~W}$. | $\begin{array}{rcc} \text { H. } & \text { M. } & \text { S. } \\ 6 & 40 & 55^{\circ} \\ -23 & 57^{\circ} 0 \end{array}$ | * s' Alt. Redn. |  |  |
| :---: | :---: | :---: | :---: | :---: |
| M.T. Sp. <br> M. ©'s R.A. | $\begin{array}{rrr} 6 & 16 & 58.0 \\ 23 & 15 & 15 \cdot 4 \end{array}$ | Mer. Alt. | $26 \quad 6.2$ | *'s bearing from Tables S. $18^{\circ}{ }^{3} \mathrm{E}$, |
| Sid. T. at Sp . *'s R.A. |    <br> 5 32 13.4 <br> 6 41 19.5 | M.Z. Dist. Decl. | $\begin{aligned} & 6353^{\circ} 8 \mathrm{~N} . \\ & 1635^{\circ} \mathrm{S} . \end{aligned}$ | Posn.-Line S. $72^{\circ} \mathrm{O} \mathrm{W}$. |
| *'s H.A. | I 96.0 E . | Approx. Lat. Cor. for $\mathbf{~} 8^{\prime}$ | $\begin{gathered} 47 \mathrm{r} 8.0 \mathrm{~N} . \\ +0.9 \end{gathered}$ |  |
|  |  | Lat, in | 47 18.9 N. |  |

(Table IX.)

| Alt. of $*$ Redn. from Table | $\begin{array}{cc} \circ & 6 \\ 57 & 60 \mathrm{~S} \\ +2 & 76 \end{array}$ |
| :---: | :---: |
| Mer. alt. | 5913.6 |
| M.Z. Dist. Decl. | $\begin{aligned} & 3046^{\circ} 4 \\ & 160^{\circ} \mathrm{N} . \\ & \mathrm{N} . \end{aligned}$ |
| Approx. Lat. Cor. for $6 \frac{1}{2}$ | $47{ }_{+0 \cdot 6}^{6 \cdot 6} \mathrm{~N}$ |
| $\begin{aligned} & \text { Lat. } \\ & \text { Run } \end{aligned}$ | $477_{0^{\circ} 2}^{2} \mathrm{~N} .$ |
| Lat. at time of and Obsn. | 47 8. I N. |



## POSITION OF SHIP FROM COMBINED EX-MERIDIAN OBSERVATIONS OF TWO STARS, USING STAR-REDUCTION AND AZIMUTH EX-MERIDIAN TABLES

1917.-On March 26th, soon after sunset, at about 6 h. 5 m . and 6 h .12 m . p.m., in approximate latitude $18^{\circ}$ S., and longitude D.R. $3^{\circ} 36^{\prime}$ W., the true altitude of $*$ Capella was $24^{\circ} 5^{\prime}$ N.W ${ }^{\text {d., }}$, when chronometer showed M.T.G. 6 h .24 m .18 s ., and after running N. $45^{\circ} \mathrm{W}$. $1 \frac{1}{2}$ miles the true altitude of $*$ Sirius was $87^{\circ} 10 \frac{1^{\prime}}{}{ }^{\prime}$ N.Ed. when chronometer showed $6 \mathrm{~h} .3 \mathrm{I} \mathrm{m} . \mathrm{r}_{7} \mathrm{~s}$. Required, the position of ship at and observation. Run N. $45^{\circ}$ W. $1 \cdot 5 \mathrm{~m} .=1 \cdot 0^{\prime}$ N. $\mathrm{I} \cdot \mathrm{I}^{\prime} \mathrm{W}$.


Nore.-The calculated reductions of stars are not given when altitude is over $65^{\circ}$. Table VIII. (Azimuth Ex-Meridian Table) is therefore used for Star Sirius.


The calculation from two longitudes, using latitude $17^{\circ} 4^{\prime} \mathrm{S}$. at time of second observation, gave longitudes $3^{\circ} 30^{\prime} 20^{\prime \prime} \mathrm{W}$. and $3^{\circ} 44^{\prime} 45^{\prime \prime} \mathrm{W}$., with resulting position $17^{\circ} 51^{\prime} \cdot 1$ S. and $3^{\circ} 43^{\prime} \cdot 3 \mathrm{~W}$.

The slight error (oly ${ }^{\prime}$ ) in latitude from the ex-meridian observation is due to neglect to interpolate in the reduction table for $*$ Capella for $10^{\prime}$ of error in the D.R. latitude, and the $0^{\prime} \cdot 3$ of error in the longitude is due to curvature in the position-line in $12 \frac{1_{2}^{\prime}}{}$ of arc, with a small Z.D.

## Latitude by ex-meridian and longitude by equal altitude of ${ }^{*}$ procyon. WORK ALSO PROVED BY DOUBLE ALTTTUDE METHOD OF CALCULATION

1917.-April 5 th, at 6 h .30 m . and 6 h .50 m. p.m. in lat. by D.R. $6^{\circ}$ 10 N. and long. $93^{\circ} 30^{\prime}$ E. Suppose observed alt. of $*$ Procyon to S.Ed. $87^{\circ} 28^{\prime}$ when a chronometer which was 5 m . Io s. fast on M.T. Green. showed o h. 22 m .34 S., and again after an interval of about 20 m . the same alt. of the $*$ Procyon was observed to S.Wa. when chronometer showed o h. $4^{2} \mathrm{~m}$. II s. Run in interval east 5 m . Height of eye 26 ft . Required position of ship at time of and observation.


## PROOF OF FOREGOING WORK BY DOUBLE ALTTTUDE METHOD



| Lat. worked with Cor. | $\begin{array}{r} \circ \\ 6 \\ \\ 5 \\ 5 \end{array}$ | Long. (x) Cor. | $93^{\circ} 43^{\prime} 33^{\prime \prime} \mathrm{E} .$ |
| :---: | :---: | :---: | :---: |
| Latitude in | 615 N . | Long. in | 934500 E . |

Note.-Longitude re-worked with lat. $6^{\circ} 14^{\prime} .8 \mathrm{~N}$. gives long. $93^{\circ} 45^{\prime} \mathrm{E}$. at 2nd observation.

## BELOW POLE EX-MERIDIAN AND POSITION-LINE

19ro.-On April rst, soon after sunset, at 6 h .42 m . p.m., observed altitude of $*$ a Cygni (Deneb) $8^{\circ} 4^{\prime} \mathrm{W}$. of meridian when a chronometer indicated mean time at Greenwich 7 h .34 m .13 s . Approximate latitude $52^{\circ} \mathrm{N}$. and longitude $12^{\circ} \mathrm{W}$. Required latitude of meridian and position-line from it.



The above example is given to draw special attention to the great value of the ex-meridian problem when near the meridian below the pole. The observation gives with a minimum amount of work (when within the limits of these tables) the latitude on a certain meridian, and the position-line from this meridian. The curvature of this position-line is seen at a glance from the Azimuth Table, which is given on the same page as the Reduction Table. In this example the change of azimuth only amounts to 0.7 of a degree in 4 m . of time, or $\mathrm{r}^{\circ}$ of longitude.

The position-line at Loop Head would be N. $78^{\circ} \mathrm{E}$.
This position-line crossed by a bearing of Tearaght Island light (if sighted) would give a good reliable position, provided the observation was good. A sounding in conjunction with this position-line would also give a fairly accurate position.

The latitude and position-line could also have been quickly found at the same time by $*$ Sirius, through the use of the Reduction and Azimuth Tables in this work, the position-line of which would have then been $\mathrm{S} .79^{\circ} \mathrm{E}$. The crossing of these two position-lines would give an excellent latitude, but the longitude would not be reliable, as the angle is small, and both observations are west of the meridian.

## HOUR-ANGLE AND ALTITUDE AZIMUTH TABLE $30^{\circ} \mathrm{N}$. то $30^{\circ} \mathrm{S}$.

## 2 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $0^{\circ}$ EQUATOR.

DECLINATION.

| True <br> Alt. | 0 |  | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $4^{\circ}$ | Decl. <br> Var. | $5{ }^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{cc} \text { H. M. } \\ 60 \end{array}$ |  |  | $\begin{array}{\|cc\|} \text { H. M. } & \text { S. } \\ 6 & 0 \\ 0 \end{array}$ |  | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { s. } \\ 6 & 0 \\ 0 \end{array}\right.$ |  | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 0.0 \end{array}\right.$ | $\stackrel{s}{.}$ | $\left.\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0 \end{array}\right.\right)$ |  | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 0.0 \end{array}\right\|$ |  |
| 10 | 520 | - | , | 51959.6 | - 01 | $\begin{array}{llll}5 & 19 & 58.5\end{array}$ | . 02 | 5 $51956 \cdot 7$ | . 04 | $\begin{array}{llll}5 & 19 & 54 \cdot 1\end{array}$ | .05 | $51950 \cdot 7$ | 06 |
| 12 | 512 | - | -00 | II 59.6 | - 01 | 5 II 58.2 | .03 | 5 II 56.0 | -04 | $\begin{array}{llllllllllllll}5 & \text { II }\end{array}$ | . 06 | 5 II 48.9 | 08 |
| 14 |  | - 0 | -00 | 359.5 | . 02 | $\begin{array}{llll}5 & 3 & 57.9\end{array}$ | .03 | 5 5 3 555.3 | -05 | 5 5 3 31.6 | -07 | $\begin{array}{llll}5 & 3 & 46 \cdot 9\end{array}$ | $\cdot 09$ |
| 16 | 456 |  | .oo | 5559.4 | . 02 | $455 \quad 57 \cdot 6$ | . 04 | $4 \quad 55 \quad 54 \cdot 6$ | . 06 | 455 50 | .08 | $45545 \cdot 0$ | - 10 |
| 18 | 4 4 4 40 |  | . 00 | 47 <br> 7993 <br> 59 <br> 59.2 |  | $\begin{array}{llll}4 & 47 & 57.3 \\ 4 & 39 & 57.0\end{array}$ |  | $\begin{array}{lllll}4 & 47 & 53 \cdot 9 \\ 4 & 39 & 53 \cdot 1\end{array}$ |  |  | - . 09 | $\begin{array}{llll}4 & 47 & 42 \cdot 9 \\ 4 & 39 & 40 \cdot 9\end{array}$ |  |
| 20 | 44 4 4 42 | - | -00 | $\begin{array}{lll}39 & 59 \cdot 2 \\ 31 & 59.1\end{array}$ | .02 | $\begin{array}{llll}4 & 39 & 57.0 \\ 4 & 31 & 56.6\end{array}$ | . 05 | (llllll4 <br> 39 <br> 4 <br> 4 | $\cdot 08$ |  | -10 | [139 $\begin{array}{lll}4 & 39 & 40 \cdot 9 \\ 4 & 31 & 38 \cdot 8 \\ 4 & 3 & 3\end{array}$ | 3 |
| 24 | 24 | - 0 | -00 | 2359.0 | 3 | $\begin{array}{llll}4 & 23 & 56 \cdot 3\end{array}$ | .06 | $\begin{array}{llll}4 & 23 & 51.6\end{array}$ | -10 | ${ }^{4} 23345{ }^{\circ}$ | -12 | 4 <br> 4 <br> 4 | I5 |
| 26 | 416 | $0 \cdot 0$ | -00 | 15 59.0 | . 03 | $41555 \cdot 9$ | -07 | $4 \quad 15$ 50.8 | -10 | $41543 \cdot 6$ | -14 | 41534.4 | 17 |
| 28 30 |  |  | -. 00 | 5958 | - . 04 | $\begin{array}{rrrr}4 & 7 & 55 \cdot 6 \\ 3 & 59 & 55.2\end{array}$ | -.07 |  |  |  |  |  |  |
| 32 |  | 0.0 | $\cdot \circ$ |  | $\cdot 04$ | $\begin{array}{llll}3 & 59 & 55 \cdot 2 \\ 3 & 51 & 54 \cdot 8\end{array}$ | .08 | $\left\lvert\, \begin{array}{lll}3 & 59 & 49 \cdot I \\ 3 & 51 & 48 \cdot 2\end{array}\right.$ | $\cdot 13$ | $\begin{array}{llll}3 & 59 & 40 \cdot 6 \\ 3 & 51 & 39 \cdot 0\end{array}$ | $\cdot 16$ | $\begin{array}{llll}3 & 59 & 29 \cdot 7 \\ 3 & 51 & 27 \cdot 1\end{array}$ | $\cdot 20$ |
| 32 33 | $\begin{array}{ll}3 & 52 \\ 3 & 48\end{array}$ | $\begin{aligned} & 0 \cdot 0 \\ & 0.0 \end{aligned}$ | $\cdot \circ$ | 3 51 $58 \cdot 7$ <br> 3 47 $58 \cdot 6$ | $\bullet 04$ | $\begin{array}{llll}3 & 51 & 54 \cdot 8 \\ 3 & 47 & 54 \cdot 6\end{array}$ | -09 | (1) $\begin{array}{lll}3 & 51 & 48 \cdot 2 \\ 3 & 47 & 47 \cdot 7 \\ 3 & 4 & 47 \cdot 3\end{array}$ | $\cdot 13$ | $\begin{array}{llll}3 & 51 & 39 \cdot 0 \\ 3 & 47 & 38 \cdot 2\end{array}$ | -17 | 3 51 $27 \cdot 1$ <br> 3 47 $25 \cdot 9$ <br>  4 29 | 22 |
| 34 | 44 | 0.0 | -00 | 4358.6 | -05 | 34354.3 | 9 | $34347 \cdot 3$ | - 14 | $\begin{array}{llllllllll}3 & 43 & 37 \cdot 3\end{array}$ | -19 | $34324 \cdot 6$ | 24 |
| 35 | 340 | $0 \cdot 0$ | o | 39 <br> 58.5 <br> 58.5 | -05 | $3954 \cdot 1$ | - - 10 | $\begin{array}{llll}3 & 39 & 46 \cdot 8 \\ 3 & 35 & 46 \cdot 3\end{array}$ | - 15 | 3 39 $36 \cdot 5$ <br> 3 35 $35 \cdot 6$ | -20 |  | . 25 |
| 36 | 36 | $0 \cdot 0$ | -00 | 3558.5 | -05 | 3553.9 | -10 |  | -15 | $3 \quad 3535 \cdot 6$ |  | $\begin{array}{llllllllll}3 & 35 & 21.8\end{array}$ | 25 .26 |
| 37 | 32 | $0 \cdot 0$ | -00 | 3158.4 | . 05 | $3153 \cdot 7$ | -10 | 3 31 $45 \cdot 8$ | 6 | $33134 \cdot 7$ | $\cdot 21$ | $33120 \cdot 4$ | 26 |
| 38 | 328 | $0 \cdot 0$ | $\bigcirc 0$ | $2758 \cdot 4$ | $\cdot 05$ |  | -II | 327 3 3 23 | - $\cdot 16$ | $\begin{array}{lllllllllllllllllll}3 & 27 & 33.7 \\ 3 & 23 & 32.8\end{array}$ | .22 .23 | $\begin{array}{lllll}3 & 27 & 18.9 \\ 3 & 23 & 17.4\end{array}$ |  |
| 39 | 324 | $0 \cdot 0$ | . 00 | 2358.3 | .06 | 32353.2 | -II | 32344 | -17 | 323 | $\cdot 23$ | 32317.4 |  |
| 40 | 20 | 0.0 | -00 | 1958.2 | . 06 | 31953.0 | 12 | 31944.2 | . 18 |  | $\cdot 23$ | 19 15.9 | $\cdot 30$ |
| 41 | 16 | 0.0 | -00 | 1558.2 | -6 | $\begin{array}{llllllllllllllllllll}3 & 15 & 52 \cdot 7\end{array}$ | -12 | $31543 \cdot 6$ | 18 | $\begin{array}{lllllllllllllll}3 & 15 & 30 \cdot 8 \\ 3 & 11 & 29\end{array}$ | 24 | 1514.3 | 3 I |
| 42 | 12 | $0 \cdot 0$ | -00 | II 58.I | 6 | 3 II $52 \cdot 4$ | -12 | 3 II 43.0 | 19 | 31129.7 | 5 | 3 II 12.6 | 32 |
| 43 | 38 | $0 \cdot 0$ | -00 | $58 \cdot 0$ | -06 | 752.2 | -13 | $\begin{array}{llll}3 & 7 & 42.4\end{array}$ | -20 | $\begin{array}{llll}3 & 7 & 28.6 \\ 3 & 3 & 27.5\end{array}$ | $\cdot 26$ $\cdot 27$ | $\begin{array}{llll}3 & 7 & 10.9\end{array}$ | $\cdot 33$ |
| 44 |  |  | -00 | 58 | -07 | $351 \cdot 9$ | $\cdot 14$ | $341 \cdot 7$ | . 20 | $\begin{array}{llll}3 & 3 & 27 \cdot 5\end{array}$ |  | $3 \quad 9$. | $\cdot 34$ |
| 45 |  |  | - 00 | 59 59 57.9 57.8 | -07 | $2{ }^{2} 595 \mathrm{SI} \cdot 6$ | - 14 | $25941 \cdot 0$ | - . 21 | $\begin{array}{llll}2 & 59 & 26 \cdot 4\end{array}$ | $-\quad .28$ | $\begin{array}{llll}2 & 59 & 7 \cdot 4 \\ 2 & 55 & 5 \cdot 4\end{array}$ |  |
| 46 | 56 | $0 \cdot 0$ | -00 | $25557 \cdot 8$ | -07 | $25551 \cdot 3$ | - 14 | $25540 \cdot 4$ | $\cdot 22$ | $255 \quad 25.2$ | 9 | $255 \quad 5$ | $\cdot 37$ |
| 47 | 252 | $0 \cdot 0$ | -00 | $25157 \cdot 7$ | -07 | $25151 \cdot 0$ | 15 | $25139 \cdot 8$ | $\cdot 23$ | $\begin{array}{llll}2 & 51 & 23.9\end{array}$ | -30 | $\begin{array}{lll}2 & 51 & 3.5\end{array}$ | -38 |
| 48 | 248 |  | -00 | $24757 \cdot 7$ | -08 | $\begin{array}{ll}2 & 47 \\ 20 & 50\end{array}$ | -16 | $24739^{\circ} \mathrm{O}$ | $\cdot 23$ | $\begin{array}{llllllll}2 & 47 & 22 \cdot 6\end{array}$ | $\cdot 31$ | 2 47 15 | -39 |
| 49 | 244 |  |  | 435 |  | $24350 \cdot 3$ |  | $2 \begin{array}{lllll}23 & 3 & 3\end{array}$ | -24 | 24321.3 | 32 | 24259.4 |  |
| 50 | 40 |  | -00 | $23957 \cdot 5$ | - . 08 | $3950 \cdot 0$ |  | $2 \begin{array}{llllllllll}29 & 37.5\end{array}$ |  | $\begin{array}{llllllll}29 & 39 & 19.9\end{array}$ | - 33 | $2{ }^{2} 3887.2$ | $\cdot 42$ |
| 51 | 36 | $0 \cdot 0$ | 00 | 3557.4 | $\bigcirc 9$ | $23549 \cdot 6$ | -17 | $\begin{array}{llllllllllllllll}2 & 35 & 36 \cdot 7 \\ 2 & 31 & 35 \cdot 8\end{array}$ | -26 | $23518 \cdot 5$ | 35 | 23454.9 | -44 |
| 52 | 32 | $0 \cdot 0$ | -00 | $23157 \cdot 3$ | -09 | $23149 \cdot 3$ | 18 | $\begin{array}{llll}2 & 31 & 35 \cdot 8 \\ 2 & 27 & 34 \cdot 0\end{array}$ | 27 | $\begin{array}{llll} 2 & 31 & 16 \cdot 9 \end{array}$ | $\cdot 36$ $\cdot 37$ | $\begin{array}{llll}2 & 30 & 52 \cdot 6 \\ 2 & 26 & 50 \cdot 1\end{array}$ |  |
| 53 54 | 228 | 0.0 0.0 | -00 | $22757 \cdot 2$ | 0 | $\begin{array}{llll}2 & 27 & 48 \cdot 9 \\ 2 & 23 & 48 \cdot 5\end{array}$ | 19 | 2 2 | -28 | $\begin{array}{lllll}2 & 27 & 15.3 \\ 2 & 23 & 13 & 3\end{array}$ |  | $\left\lvert\, \begin{array}{lll}2 & 26 & 50 \cdot 1 \\ 2 & 22 & 47 \cdot 4\end{array}\right.$ | $\cdot 47$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 0 | A. | L. $1^{\circ} \mathrm{A}$. |  |  | L. $2^{\circ} \mathrm{A}$. |  |  | L. $3^{\circ} \mathrm{A}$. |  |  | L. $4^{\circ} \mathrm{A}$. |  |  | L. $5^{\circ} \mathrm{A}$. |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | 5. | $\begin{array}{r} s . \\ -4 \cdot 00 \end{array}$ |  |  | $\begin{array}{r} \mathrm{s} . \\ -4 \cdot 00 \end{array}$ |  | $\stackrel{\text { S. }}{\text { - }}$ | S. |  | S. 21 | $\stackrel{\mathrm{s} .}{-4.01}$ |  | S. .28 | -4.01. |  | $\stackrel{\text { s. }}{ }$ | S. |
| 2 | $\bigcirc 00$ | 4.00 |  | -07 | 4.00 |  | -14 | 4.00 |  | $\cdot 21$ | 4.01 |  | -28 | $4 \cdot \mathrm{I}$ |  | $\cdot 35$ | 4.01 |
| 4 | -00 | 4.00 |  | -07 | 4.00 |  | -14 | $4 \cdot 00$ |  | -21 | 4.01 |  | -28 | 4.01 |  | -35 | $4 \cdot \mathrm{Or}$ |
| 6 | -00 | $4 \cdot 00$ |  | -07 | 4.00 |  | -14 | $4 \cdot 00$ |  | . 21 | 4.01 |  | -28 | 4.01 |  | -35 | $4 \cdot \mathrm{Or}$ |
| 8 | $\cdot 00$ | 4.00 |  | -07 | $4 \cdot 00$ |  | -14 | 4.00 |  | -2I | $4 \cdot \mathrm{or}$ |  | -28 | 4.01 |  | -35 | $4 \cdot 02$ |
| 10 | -00 | $4 \cdot 00$ | $+$ | -07 | 4.00 |  | . 14 | 4.00 |  | -21 | 4.01 |  | . 28 | 4.01 |  | $\cdot 35$ | 4.02 |
| 12 | -00 | $4 \cdot 00$ |  | -07 | $4 \cdot 00$ |  | -14 | 4.00 |  | -21 | $4 \cdot \mathrm{I}$ |  | -28 | $4 \cdot \mathrm{Or}$ |  | $\cdot 36$ | $4 \cdot 02$ |
| 14 | -00 | $4 \cdot 00$ |  | -07 | $4 \cdot 00$ |  | -14 | $4 \cdot 00$ |  | -21 | 4.01 |  | -29 | $4 . \mathrm{Or}$ |  | -36 | 4.02 |
| 16 | -00 | $4 \cdot 00$ |  | . 07 | $4 \cdot 00$ |  | -14 | $4 \cdot 00$ |  | $\cdot 22$ | 4.01 |  | -29 | 4 Or |  | $\cdot 36$ | $4 \cdot 02$ |
| 18 | -00 | 4.00 |  | .07 | 4.00 |  | -14 | 4.00 |  | $\cdot 22$ | $4 \cdot \mathrm{I}$ |  | - 29 | 4.01 |  | $\cdot 37$ | $4 \cdot 02$ |
| 20 | .00 | $4 \cdot 00$ |  | -07 | $4 \cdot 00$ |  | $\cdot 15$ | $4 \cdot 00$ |  | $\cdot 22$ | 4.01 |  | $\cdot 30$ | 4.01 |  | $\cdot 37$ | $4 \cdot 02$ |
| 22 | -00 | $4 \cdot 00$ |  | . 07 | $4 \cdot 00$ |  | -15 | 4.00 |  | $\cdot 23$ | 4.0 I |  | $\cdot 30$ | 4.01 |  | $\cdot 38$ | $4 \cdot 02$ |
| 24 | -00 | 4.00 |  | -07 | $4 \cdot 00$ |  | -15 | 4.00 |  | -23 | $4 \cdot \mathrm{I}$ |  | $\cdot 31$ | 4.01 |  | $\cdot 38$ | $4 \cdot 02$ |
| 26 | -00 | 4.00 |  | - 08 | 4.00 |  | -15 | 4.00 |  | . 23 | $4 \cdot \mathrm{OI}$ |  | $\cdot 31$ | 4.01 |  | -39 | $4 \cdot 02$ |
| 28 | -00 | 4.00 |  | -08 | 4.00 |  | -16 | 4.00 |  | - 24 | 4.01 |  | $\cdot 32$ | 4.01 |  | $\cdot 39$ | $4 \cdot 02$ |
| 30 | -00 | 4.00 | $+$ | . 08 | 4.00 |  | -16 | 4.00 |  | . 24 | 4.01 |  | $\cdot 32$ | 4.01 |  | $\cdot 40$ | $4 \cdot 02$ |
| 32 | -00 | $4 \cdot 00$ |  | -08 | $4 \cdot 00$ |  | -16 | 4.00 |  | -25 | 4.01 |  | $\cdot 33$ | 4.01 |  | -41 | $4 \cdot 02$ |
| 34 | -00 | 4.00 |  | -08 | 4.00 |  | $\cdot 17$ | 4.00 |  | . 25 | 4.01 |  | $-34$ | $4 . \mathrm{Or}$ |  | $\cdot 42$ | 4.02 |
| 36 | -00 | 4.00 |  | $\cdot 09$ | $4 \cdot 00$ |  | -17 | 4.00 |  | $\cdot 26$ | 4.01 |  | $\cdot 34$ | 4.01 |  | $\cdot 43$ | 4.02 |
| 38 | -00 | 4.00 |  | -09 | 4.00 |  | $\cdot 17$ | 4.00 |  | -26 | 4.01 |  | -35 | 4.02 |  | -44 | $4 \cdot 02$ |
| 40 | -00 | 4.00 | + | .09 | $4 \cdot 00$ | $+$ | -18 | 4.00 |  | $\cdot 27$ | 4.01 |  | $\cdot 36$ | 4.02 |  | $\cdot 46$ | 4.03 |
| 42 | $\bullet 00$ | 4.00 |  | $\cdot 09$ | 4.00 |  | -19 | 4.00 |  | $\cdot 28$ | $4 \cdot \mathrm{OI}$ |  | $\cdot 38$ | 4.02 |  | $\cdot 47$ | 4.03 |
| 44 | -00 | 4.00 |  | -10 | $4 \cdot 00$ |  | -19 | 4.00 |  | -29 | $4 \cdot 01$ |  | -39 | 4.02 |  | -49 | $4 \cdot 03$ |
| 46 | $\cdot 00$ | 4.00 |  | -10 | 4.00 |  | - 20 | $4 \cdot 00$ |  | $\cdot 30$ | $4 \cdot 01$ |  | -40 | 4.02 |  | $\cdot 51$ | $4 \cdot 03$ |
| 48 | -00 | 4.00 |  | -10 | 4.00 |  | -21 | 4.00 |  | $\cdot 31$ | 4.01 |  | $\cdot 42$ | 4.02 |  | $\cdot 53$ | 4.03 |
| 50 | -00 | 4.00 | + | . 10 | 4.00 |  | $\cdot 22$ | 4.01 |  | . 33 | 4.01 |  |  | 4.02 |  | -55 | 4.04 |
| 52 | $\cdot 00$ | 4.00 |  | -11 | 4.00 |  | $\cdot 23$ | 4.01 |  | $\cdot 34$ | $4 \cdot 01$ |  | $\cdot 46$ | $4 \cdot 03$ |  | - 57 | 4.04 |
| 54 | -00 | $4 \cdot 00$ |  | $\cdot 12$ | $4 \cdot 00$ |  | $\cdot 24$ | 4.01 |  | -36 | $4 \cdot 02$ |  | $\cdot 48$ | 4.03 |  | . 60 | 4.04 |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 3

 LATITUDE $0^{\circ}$ EQUATOR.
## DECLINATION.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| o | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 \\ \hline & 0 \\ 0.0 \end{array}\right.$ |  | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 0 & \text { o. } \end{array}\right.$ |  | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \mathrm{s.} \\ 6 & \mathrm{o} \\ 0.0 \end{array}\right.$ |  | $\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0 \\ 0.0 \end{array}$ |  | $\left\|\begin{array}{cc} \text { н. м. } & \text { s. } \\ 6 & \text { o } \\ \text { o.o } \end{array}\right\|$ |  | $\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & \circ \\ \hline \end{array}$ |  |
| 10 | $51946 \cdot 6$ | -90 | $\begin{array}{llllllllll}5 & 19 & 4\end{array}$ | -09 | $51936 \cdot 2$ | - 10 | $\begin{array}{llll}5 & 19 & 29.8\end{array}$ | - II | $\begin{array}{llll}5 & 19 & 22.6\end{array}$ | -13 | $\begin{array}{llllllllll}5 & 19 & 14.6\end{array}$ | 14 |
| 12 | 5 II 43.9 | -09 | 5 II $38 \cdot 0$ | 10 | 5 II 31.3 | - 12 | 5 II 23.5 | -14 | 5 II 14.9 | 5 | 5 II $5 \cdot 2$ | 17 |
| 14 | $\begin{array}{llll}5 & 3 & 4 \mathrm{I} \cdot \mathrm{I}\end{array}$ | $\cdot 10$ | $5 \quad 3 \quad 34 \cdot 2$ | -12 | $5 \quad 3 \quad 26 \cdot 3$ | -14 | $5 \begin{array}{llll}5 & 3 & 17.2\end{array}$ | - 16 | 5 3 $7 \cdot 1$ | -18 | $5 \quad 255 \cdot 8$ | $\cdot 20$ |
| 16 | $45538 \cdot 3$ | -12 | $45530 \cdot 4$ | -14 | 455 21.2 |  | $4 \begin{array}{lll}55 & 10 \cdot 8\end{array}$ |  | $4 \quad 54 \quad 59 \cdot 2$ | 20 | 454 46•r | 23 |
| 18 | $44735 \cdot 4$ | - 14 | $44726 \cdot 5$ | -16 | 447 16.I |  |  |  | $44651 \cdot 0$ |  | $44636 \cdot 3$ | 6 |
| 20 | 43932.4 | $\cdot 15$ | 43922.4 | -18 | 439 10•8 | -21 | $43857 \cdot 6$ | 3 | $43842 \cdot 7$ | - 26 | $43^{88} 26 \cdot 2$ | -29 |
| 22 | 43129.4 | -17 | 43118.3 | - 20 | $43 \mathrm{I} \quad 5.4$ | . 23 | $43050 \cdot 7$ | - 26 | 43034.2 | -29 | 43015.8 | 32 |
| 24 | $42326 \cdot 3$ | -19 | 423 14.0 | - 22 | 42259.8 | -25 | $42243 \cdot 6$ | -29 | $42225 \cdot 4$ | -32 | $422 \quad 5 \cdot 2$ | 35 |
| 26 | $415 \quad 23.0$ | -2I | $415 \quad 9.6$ | $\cdot 24$ | 41454.0 | . 28 | $41436 \cdot 3$ | $\cdot 31$ | 41416.4 | 35 | 41354.2 | 39 |
| 28 | 47 | $\cdot 22$ | 47 |  | $4 \quad 648.0$ | 30 | $\begin{array}{rrrrr}4 & 68 \cdot 7\end{array}$ |  | $\begin{array}{rrrr}4 & 6 & 7 \cdot 0\end{array}$ | - 38 | $\begin{array}{lrr}4 & 5 & 42 \cdot 8\end{array}$ |  |
| 30 | 35916.2 | 24 | $\begin{array}{lll}3 & 59 & 0 \cdot 3\end{array}$ | - 28 | 35841.9 | $\cdot 33$ | $\begin{array}{llll}3 & 58 & 20 \cdot 8\end{array}$ | $\cdot 37$ | $35757 \cdot 2$ | 41 | $35730 \cdot 9$ | $\cdot 46$ |
| 32 | 35112.6 | -26 | $35055 \cdot 4$ | -31 | $35035 \cdot 4$ | $\cdot 36$ | $35012 \cdot 6$ | -40 | $34947 \cdot 0$ | 45 | $34918 \cdot 6$ | 50 |
| 33 | $\begin{array}{llllllllllll}3 & 47 & 10.8\end{array}$ | $\cdot 27$ | $34652 \cdot 8$ | $\cdot 32$ | $34632 \cdot \mathrm{I}$ | $\cdot 37$ | $\begin{array}{lll}3 & 46 & 8.4\end{array}$ | $\cdot 42$ | $3454 \mathrm{I} \cdot 8$ | 47 | $\begin{array}{lllllllllll}3 & 45 & 12.2\end{array}$ | 52 |
| 34 | 343 | 28 | $34250 \cdot 2$ | -33 | $34228 \cdot 6$ |  | 3 42 4 <br> 1   | -43 | 341 | -49 | $\begin{array}{llll}3 & 41 & 5\end{array}$ | 54 |
| 35 | $\begin{array}{llll}3 & 39 & 6.9 \\ 3 & 35 & 4.9\end{array}$ | $\cdot 30$ | $\begin{array}{llllllllllll}3 & 38 \\ 3 & 47 \cdot 5\end{array}$ | -35 | $\begin{array}{llll}3 & 38 & 25 \cdot 1 \\ 3 & 34 & 15\end{array}$ | $\bullet 40$ | $\begin{array}{llll}3 & 37 & 59 \cdot 6\end{array}$ | $\cdot 45$ | $\begin{array}{llll}3 & 37 & 30 \cdot 9 \\ 3 & 33 & 25 \cdot 2\end{array}$ | . 50 | $\begin{array}{lllllllllllllll}3 & 36 & 58 \cdot 9\end{array}$ | . 56 |
| 36 | 335 | $\cdot 31$ | $33444 \cdot 8$ | - 36 |  | -4I | $33355 \%$ | $\cdot 47$ | 33325.2 | . 52 | 3 32 $52 \cdot \mathrm{I}$ | 58 |
| 37 | $3 \mathrm{3I}$ | $\cdot 32$ |  | $\cdot 37$ | $\begin{array}{lllll}3 & 30 & 17.9\end{array}$ | 43 | $\begin{array}{llllll}3 & 29 & 50 \cdot 3\end{array}$ | $\cdot 49$ |  | $\cdot 54$ | 3 28 45 | 60 |
| 38 | $\begin{array}{llll}3 & 27 & 0 \cdot 7 \\ 3 & 2 & 58\end{array}$ | 3 | 3 26 $39 \cdot 1$ <br>  I  | -39 |  | 45 | $32545 \cdot 5$ | $\cdot 50$ |  | -56 | $\begin{array}{lllll}3 & 24 & 37 \cdot 7\end{array}$ | 63 |
| 39 | $32258 \cdot 5$ | 34 | $32236 \cdot 1$ | 40 | $\begin{array}{llll}3 & 22 & 10 \cdot 2\end{array}$ | -46 | $32140 \cdot 6$ | $\cdot 52$ | $321 \quad 7 \cdot 3$ | $\cdot 58$ | $32030 \cdot 3$ | 5 |
| 40 |  | $\cdot 36$ |  | -42 | $\begin{array}{lll}3 & 18 & 6.2 \\ 3 & 14 & \end{array}$ | - 48 | $\begin{array}{lllll}3 & 17 & 35 \cdot 5 \\ 3 & 13 & 30.3\end{array}$ | $\cdot 54$ | $\begin{array}{llll}3 & 17 & 1.0\end{array}$ | -61 | $\begin{array}{llll}3 & 16 & 22.6\end{array}$ | . 67 |
| 41 | 31454.0 | $\cdot 37$ | $31430 \cdot 0$ | 43 | $\begin{array}{lllll}3 & 14 & 2 \cdot 1\end{array}$ | -50 | $31330 \cdot 3$ | - 56 | $\begin{array}{lllllllllllll}3 & 12 & 54.5\end{array}$ |  | 312214.6 | 70 |
| 42 | 3 10 51.7 | $\cdot 38$ | $\begin{array}{lll}3 & \text { 1о } 26 \cdot 7\end{array}$ | -45 | $\begin{array}{llll}3 & 9 & 57 \cdot 8\end{array}$ | 51 | $\begin{array}{llll}3 & 9 & 24 \cdot 9\end{array}$ | - 58 | $\begin{array}{llll}3 & 8 & 47.8\end{array}$ | -65 | $\begin{array}{llll}3 & 8 & 6 \cdot 4\end{array}$ | 72 |
| 43 | $\begin{array}{llll}3 & 6 & 49 \cdot 2\end{array}$ | -40 | $\begin{array}{llll}3 & 6 & 23.4\end{array}$ |  | $\begin{array}{llll}3 & 5 & 53.4 \\ 3 & 5 & \end{array}$ | 53 | $\begin{array}{llll}3 & 5 & 19 \cdot 3\end{array}$ | -60 | $\begin{array}{llll}3 & 4 & 40 \cdot 8 \\ 3 & \\ 0\end{array}$ | $\cdot 68$ | 3 3 $57 \cdot 9$ <br> 2 59  <br> 19.2   | 75 |
| 44 | $\begin{array}{llll}3 & 2 & 46 \cdot 7\end{array}$ | 41 | $\begin{array}{llll}3 & 2 & 19.9\end{array}$ |  | $\begin{array}{llll}3 & 1 & 48.9\end{array}$ | 55 | 3 I 13.5 |  | 3 o $33 \cdot 6$ | O | 25949.2 | 78 |
| 45 | $2{ }^{2} 5843 \cdot 9$ | $\cdot 43$ |  | $\cdot 50$ | $25744 \cdot 2$ | $\cdot 57$ | $\begin{array}{lll}2 & 57 & 7 \cdot 5\end{array}$ | - 65 | $25626 \cdot 2$ | - -73 | $25540 \cdot \mathrm{I}$ | .81 |
| 46 | $2544 \mathrm{I} \cdot 3$ | $\cdot 44$ | 2 54 12.6 <br> 2 50  | 52 | $\begin{array}{lllll}2 & 53 & 39 \cdot 3\end{array}$ | $\cdot 59$ | $\begin{array}{llll}2 & 53 & 1 \cdot 3\end{array}$ | $\cdot 67$ | $\begin{array}{lllllllllll}2 & 52 & 18.5\end{array}$ | $\cdot 75$ | $251130 \cdot 7$ | 84 |
| 47 | $25038 \cdot 5$ | $\cdot 46$ | $\begin{array}{lll}2 & 50 & 8.8\end{array}$ | 54 | $24934 \cdot 2$ | $\cdot 62$ | $24^{48} 54^{\circ} 9$ | $\cdot 70$ | $24810 \cdot 5$ |  | 24720.9 | . 87 |
| 48 | $24635 \cdot 7$ |  | $\begin{array}{lll}2 & 46 & 4.8\end{array}$ | 56 | 24529.0 | -64 | 244 48-I | 72 | $244 \begin{array}{ll}2 \cdot 1\end{array}$ | - | $24310 \cdot 7$ | 90 |
| 49 | $4232 \cdot 5$ | -49 | 42 | $\cdot 57$ | 24123.5 |  | $24041 \cdot \mathrm{I}$ | $\cdot 75$ | 23953.4 | $\cdot 84$ | $2390 \cdot 1$ | 93 |
| 50 | $\begin{array}{llll}2 & 38 & 29.4 \\ 2 & 34 & 26 \cdot 1\end{array}$ | . 51 | $\begin{array}{llll}2 & 37 & 56 \cdot 3 \\ 2 & 33 & 5\end{array}$ | - . 60 |  | - 69 | $\begin{array}{lllll}2 & 36 & 33 \cdot 9\end{array}$ |  | $\begin{array}{llllllllllll}2 & 35 & 44 \cdot 3 \\ 2 & 31 & \end{array}$ | - 87 | $\begin{array}{lllll}2 & 34 & 49.0 \\ 2\end{array}$ | -97 |
| 51 | $\begin{array}{llll}2 & 34 & 26 \cdot 1\end{array}$ | -53 | $\begin{array}{lllll}2 & 33 & 51 \cdot 7\end{array}$ | . 62 | $\begin{array}{llll}2 & 33 & 11.8 \\ 2 & 3 & 8\end{array}$ | $\cdot 71$ | $\begin{array}{llll}2 & 32 & 26 \cdot 3\end{array}$ | $\cdot 8 \mathrm{I}$ | 23134.9 | $\cdot 91$ | $2 \begin{array}{llll}2 & 30 & 37 \cdot 5\end{array}$ | I.01 |
| 52 | $\begin{array}{llll}2 & 30 & 22.6 \\ 2 & 26 & 18.9\end{array}$ | 55 | $\begin{array}{lll} 2 & 29 & 470 \\ 2 & 25 & 420 \end{array}$ |  | $\begin{array}{llll}2 & 29 & 5 \cdot 6 \\ 2 & 24 & 59 \cdot 1\end{array}$ | $\cdot 74$ | $\begin{array}{rrrr}2 & 28 & 18 \cdot 3 \\ 2 & 24 & 0 \cdot 0\end{array}$ |  | $\begin{array}{lllll}2 & 27 & 25 \cdot 0 \\ 2 & 23 & 14.5\end{array}$ | $\cdot 94$ | $\begin{array}{llll}2 & 26 & 25 \cdot 3 \\ 2 & 22 & 12 \cdot 6\end{array}$ | . 05 |
| 54 |  | 59 | $\begin{array}{llll}2 & 25 & 42 \cdot 0 \\ 2 & 21 & 36 \cdot 8\end{array}$ | 69 | $\begin{array}{llll}2 & 24 & 59 \cdot 1 \\ 2 & 20 & 52 \cdot 2\end{array}$ | - | $\begin{array}{llll}2 & 24 & 9 \cdot 9 \\ 2 & 20 & 1 \cdot 2\end{array}$ | go | [rrrer $\begin{array}{rrrr}2 & 23 & 14.5 \\ 2 & 19 & 3.6\end{array}$ | 1.02 | $22212 \cdot 6$ | 1.0 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | . | s. | + ${ }^{\text {s. }}$ |  |  | s. |  | s. | s. | s. |  | s. |
| 2 | + ${ }_{-42}$ | 4.02 | $\begin{array}{r}+\quad .49 \\ \hline\end{array}$ | 4.03 4.03 | + 5.56 | - 4.04 | +63 +63 | 4.05 | .780 | 4.06 | 78 .78 | 4.07 4.07 |
| 4 | 42 | 4.02 | -49 | 4.03 | . 56 | 4.04 | . 64 | 4.05 | 71 | 4.06 | .78 | 4.07 |
| ${ }_{8}^{6}$ | ${ }^{4} 42$ | 4.02 4.02 4. | . 59 | 4.03 4.03 | . 56 | 4.04 4.04 | $\begin{array}{r}.64 \\ .64 \\ \hline\end{array}$ | 4.05 4.05 | .71 | 4.06 | .788 | 4.08 4.08 |
| ıо | + ${ }^{43}$ | 4.02 | + 50 | $4 \cdot 03$ | + 57 | 4.04 | + 64 | 4.05 | + 72 | 4.06 | + 79 | 4.08 |
| 12 | $\cdot 43$ | 4.02 | - 50 | 4.03 | - 57 | 4.04 | . 65 | 4.05 | . 72 | 4.06 | . 79 | 4.08 |
| 14 | 43 | 4.02 | . 51 | 4.03 | . 58 | 4.04 | . 65 | 4.05 | .73 | 4.06 | .80 | 4.08 |
| $\xrightarrow{16}$ | 44 | 4.02 | . 51 | 4.03 | . 58 | 4.04 |  | 4.05 | .73 | 4.07 | .81 | 4.08 |
|  | -44 | 4.02 | 52 | $4 \cdot 03$ | 59 | 4.04 | 67 | 4.05 | 74 | 4.07 |  |  |
| 20 | + 45 | 4.02 | + 52 | 4.03 | + .60 | 4.04 | +.67 | 4.06 | + 75 | 4.07 | + 83 | 4.08 |
| 24 | -46 | ${ }_{4} \cdot 03$ | -54 | ${ }_{4} \cdot 04$ | . 62 | ${ }_{4}^{4.05}$ | . 69 | 4.06 4.06 | .77 | 4.07 4.07 | . 85 | 4.09 4.09 |
| 26 | -47 | $4 \cdot 03$ | $\cdot 55$ | 4.04 | . 63 | 4.05 | 71 | 4.06 | 79 | $4 \cdot 08$ | . 87 | 4.99 |
| 28 | 48 | 4.03 | $\cdot 56$ | 4.04 | . 64 | 4.05 | 72 | $4 \cdot 06$ | . 80 | $4 \cdot 08$ | . 88 | 4.10 |
| 30 | + 48 | 4.03 | + 57 | 4.04 | + 65 | 4.05 | + 73 | 4.07 | + 8.8 | 4.08 | + 90 | $4 \cdot 10$ |
| 32 | 49 | 4.03 | . 58 | 4.04 |  | 4.05 | 75 | 4.07 | . 84 | 4.09 | -92 | $4 \cdot 10$ |
| 34 36 3 | .51 | 4.03 4.03 | -69 | 4.04 <br> 4.05 | -68 | 4.406 | 77 | 4.07 | .86 | 4.09 | . 94 | 4.11 |
| 36 <br> 38 | . 52 | 4.03 4.04 4 | -61 | 4.05 4.05 | .78 | 4.06 4.06 | .79 .81 | 4.08 4.08 | -88 | 4.09 4.10 | .97 $\times .00$ | ${ }_{\substack{4 \cdot 11 \\ 4.12}}$ |
| 40 | + 55 | 4.04 | + 64 | 4.05 | + 74 | 4.07 | + 83 |  | +.93 | $4 \cdot \mathrm{II}$ | +1.03 | 4.13 |
| 42 | $\cdot 57$ | 4.04 | . 66 | 4.05 | . 76 | 4.07 | . 86 | $4 \cdot 09$ | +.96 | $4 \cdot \mathrm{II}$ | 1.06 | ${ }_{4} \cdot 14$ |
| 44 | . 59 | 4.04 | -69 | 4.06 | . 79 | 4.08 | -89 | $4 \cdot 10$ | .99 | $4 \cdot 12$ | I•Io | $4 \cdot 15$ |
| $4{ }_{48}^{46}$ | -61 | 4.04 <br> 4.05 | .71 | 4.06 4.07 | .82 | 4.08 4.09 | . 92 | 4.10 | I.03 | $4 \cdot 13$ | $\stackrel{1}{1.14}$ | $4 \cdot 16$ |
| 50 | +.66 |  |  |  |  |  |  |  |  |  |  |  |
| 52 | +69 | ${ }_{4} \cdot 06$ | + .87 | 4.08 | $\begin{array}{r}+.89 \\ \hline .93\end{array}$ | ${ }_{4}^{4 \cdot 10}$ | +1.00 +1.05 |  |  | 4.15 4.17 | 1.24 +1.30 | 4.19 <br> 4.2 I |
| 54 | $\cdot 72$ | 4.06 | . 85 | 4.09 | $\cdot 97$ | $4 \cdot 12$ | 1-10 | $4 \cdot 15$ | I. 24 | $4 \cdot 19$ | r. 37 | 4.23 |

4 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.
LATITUDE $0^{\circ}$ EQUATOR.
DECLINATION.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | ecl. <br> ar. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{aligned} & \text { H. M. } \\ & 6 \underset{0}{ } . \end{aligned}\right.$ | -00 | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 0 \\ \text { o.o } \end{array}$ | -oo | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { s. } \\ 6 & 0 \\ 0 \end{array}\right.$ | $\begin{aligned} & \text { s. } \\ & \hline 0 \text { lol } \end{aligned}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & \text { o } \\ 0.0 \end{array}\right.$ | -oo | $\begin{array}{cc} \text { H. м. } & \text { s. } \\ 6 & 0 \\ 0 & 0.0 \end{array}$ | s.oo | $\left\|\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0 \\ 0 \end{array}\right\|$ | . 00 |
| 10 | $\begin{array}{llll}5 & 19 & 5.8\end{array}$ | 15 | $\begin{array}{llll}5 & 18 & 56 \cdot 2\end{array}$ | -17 | $5 \mathrm{I} 8 \quad 45 \cdot 7$ | - 18 | 1834.4 | - 19 | $\begin{array}{llll}5 & 18 & 22 \cdot 2\end{array}$ | - 21 | 5 518 9.1 | - 22 |
| 12 | 5 ro 54.7 | I8 | 5 10 $43 \cdot 1$ | $\cdot 20$ | $1030 \cdot 5$ | - 22 | 10 I6. | -24 | 5 10 2.1 | 25 | $946 \cdot 3$ | 27 |
| 14 | $\begin{array}{llll}5 & 2 & 43 \cdot 4\end{array}$ | 22 | $\begin{array}{lll}5 & 2 & 29 \cdot 7\end{array}$ | -24 | 214.9 | -26 | 1 58.9 | $\cdot 28$ | 141.6 | -30 | $23 \cdot 1$ | $\cdot 32$ |
| 16 | 45431.8 | -25 | $4 \quad 54 \quad 16.2$ | $\cdot 27$ | 453 59•I | 29 | $5340 \cdot 7$ | $\cdot 32$ | $4 \begin{array}{lll}53 & 20 \cdot 8\end{array}$ | - 34 | $4 \begin{array}{llll}52 & 59 & 5\end{array}$ | $\cdot 37$ |
| 18 | 446 20.1 | - . 28 | $446 \quad 2 \cdot 3$ | $\cdot 31$ | $4543 \cdot 0$ | $\cdot 33$ | 4522 | $\cdot 36$ | 44459.5 | -39 | $44435 \cdot 4$ |  |
| 20 | $43^{8} 8$ - | $\cdot 32$ | $3748 \cdot 1$ | -34 | $3726 \cdot 5$ | $\cdot 37$ | 373.0 | 40 | $43637 \cdot 7$ | $\cdot 44$ | $43610 \cdot 6$ | 7 |
| 22 | 42955.6 | $\cdot 35$ | 42933.5 | $\cdot 38$ | $429 \quad 9 \cdot 5$ | 42 | $42843 \cdot 4$ | 45 | $1 \begin{array}{lll}4 & 28 & 15.4\end{array}$ | -48 | $42745 \cdot 2$ | - 52 |
| 24 | 42142.9 | -39 | 42118.5 | -42 | 20 52.0 | -46 | 2023.2 | $\cdot 50$ | $\begin{array}{llll}4 & 19 & 52.3\end{array}$ | 53 | $4 \begin{array}{llll}19 & 19.0\end{array}$ | 7 |
| 26 | $\begin{array}{llll}4 & \text { r3 } & 29 \cdot 8\end{array}$ | -43 | 443  | $\cdot 46$ | 1233.9 | $\cdot 50$ | 12 | 54 | 4 II 28.4 | $\cdot 59$ | 4 10 51-8 | 63 |
| 28 | $4516 \cdot 1$ | $\cdot 46$ | $446 \cdot 9$ | $\cdot 51$ | $415 \cdot 2$ | -55 | $340 \cdot 8$ | 60 | $3 \begin{array}{ll}3 & 3.6\end{array}$ | $\cdot 64$ | $\begin{array}{llll}4 & 2 & 23.7\end{array}$ | $\cdot 69$ |
| 30 | $57 \quad 2.0$ | 50 | $35630 \cdot 3$ | -55 | $35555 \cdot 7$ | 60 | $55 \quad 18.2$ | $\cdot 65$ | $35437 \cdot 8$ | 70 | 35354.4 | 75 |
| 31 |  | -53 | $35221 \cdot 6$ | -57 | $35145 \cdot 6$ | 62 | 3516.6 | $\cdot 67$ | $35024 \cdot 5$ | 73 | 34939.3 | .78 |
| 3 | 3 48 | -55 | $\begin{array}{llll}48 & 12.8\end{array}$ | -60 | $4735 \cdot 3$ | $\cdot 65$ | 34654.7 | $\cdot 70$ | $34610 \cdot 9$ | -76 | $\begin{array}{llllllllllllll}3 & 45 & 23 \cdot 8\end{array}$ |  |
| 33 | $34439 \cdot 6$ | $\cdot 57$ | $\begin{array}{llll}3 & 44 & 3\end{array}$ |  | 4324.8 |  | 4242.6 | -73 | 341570 | 79 | 34178 | . 85 |
| 34 | 4031 | - 59 | 33 39 54 | 65 | 3914.0 | $\cdot 70$ | $3830 \cdot x$ | - .76 | $33742 \cdot 7$ |  |  | . 88 |
| 35 | 36 23•7 | -6r | $33545 \cdot 1$ | $\cdot 67$ | $35 \quad 3.0$ | $\cdot 73$ | $3417 \cdot 3$ | $\cdot 79$ | $33328 \cdot 0$ |  | $\begin{array}{llll}3 & 32 & 34.9\end{array}$ | 92 |
| 36 | $3215 \cdot 5$ | -64 | 3 31 35.3 | $\cdot 70$ | 3051.6 | $\cdot 76$ | $\begin{array}{llll}3 & 30 & 4.2\end{array}$ |  | 32912.9 |  | $32817 \cdot$ | -95 |
| 37 | $\begin{array}{llll}3 & 28 & 7 \cdot 0\end{array}$ | . 66 | $32725 \cdot 3$ | $\cdot 72$ | $2639 \cdot 9$ | -79 | $2550 \cdot 7$ | 5 | $32457 \cdot 4$ | 2 | $\begin{array}{lll}3 & 24 & 0 \cdot 1\end{array}$ | 9 |
| 38 | 32358.3 | 69 | $\begin{array}{llll}3 & 23 & 15 \cdot 1\end{array}$ | $\cdot 75$ | $22 \quad 27.9$ |  | 21 | $\cdot 89$ | $32041 \cdot 5$ | 6 | 31942.0 | I.03 |
| 39 | 1949.4 | $\cdot 71$ | $3194 \cdot 5$ | 8 | 1815.6 | -. 85 | 1722.5 | - 92 | $31625 \cdot \mathrm{x}$ | -99 |  | . 07 |
| 40 | $\begin{array}{lllllllllll}3 & 15 & 40 \cdot 1\end{array}$ | $\cdot 74$ |  | .81 | $142 \cdot 8$ | . 88 | $13 \quad 7 \cdot 7$ | $\cdot 95$ | 3 12 $8 \cdot 1$ <br>  7 50 | r.03 | $\begin{array}{llll}3 & 11 & 3.9\end{array}$ | I-II |
| 4 I | $\begin{array}{lllllllllllll}3 & 11 & 30 \cdot 6\end{array}$ |  |  | $\cdot 84$ |  |  |  | 99 |  | 07 | $\begin{array}{llll}3 & 6 & 43.9\end{array}$ | I'15 |
| 42 | 3 7 $20 \cdot 8$ <br> 3   | $\cdot 80$ | 3 6 $30 \cdot 7$  <br>  2 18  | $\cdot 87$ | $5{ }^{3} 36 \cdot \mathrm{r}$ | -95 | $\begin{array}{lll} 3 & 4 & 36 \cdot 7 \end{array}$ | 1. | $\begin{array}{llll}3 & 3 & 32 \cdot 5\end{array}$ | $\xrightarrow{\text { I }}$-11 | 3 2 23.2 <br> 2 5  | I-20 |
| 43 | $\begin{array}{llll}3 & 3 & 10.7\end{array}$ | 3 | $\begin{array}{llll}3 & 2 & 18 \cdot 7\end{array}$ |  | $\text { I } 2 \text { : }$ |  | $020.4$ | $\underline{1.07}$ | $25913 \cdot 7$ |  | 258 | 1-24 |
| 44 | $2{ }^{2} 590 \cdot \mathrm{x}$ | - . 86 | $2 \begin{array}{lll}288 & 6.3\end{array}$ | '94 | $57 \quad 7.4$ | - 1.02 | $\begin{array}{llll}2 & 56 & 3.5\end{array}$ | - | 25454.2 | -120 | $25339 \cdot 5$ | 29 |
| 45 | $25449 \cdot 3$ | $\cdot 89$ | 25353.3 | -97 | $5252 \cdot 3$ |  | 25145.9 | 1.15 | 25034.0 | 1 | $2 \begin{array}{lll}29 & 16.4\end{array}$ | 4 |
| 46 | 25038.0 | -92 | $24940 \cdot 0$ | ror | 4836.6 | r. | 24727.7 | 1 | 24613.0 | I 29 | $244 \begin{array}{lll} & 52 \cdot 3\end{array}$ | 140 |
| 47 | $\begin{array}{llll}2 & 46 & 26 \cdot 2 \\ 2\end{array}$ | $\cdot 96$ | 245 26.0 | 05 | $44{ }^{20} 2 \cdot 2$ |  |  | I 24 |  |  | $24027 \cdot 2$ |  |
| 48 | $\begin{array}{llllllllll}2 & 42 & 13.9\end{array}$ | -99 | 24111.5 | 09 | 40 |  | $3^{8} \quad 48 \cdot 8$ | $I \cdot 29$ | $23728 \cdot 2$ |  | 236 1.0 | 1-51 |
| 49 | $\begin{array}{ll}38 & 1.2\end{array}$ | -r.03 | $2 \begin{array}{llll}36 & 56 \cdot 3\end{array}$ | - $1 \cdot 13$ | $3545 \cdot 4$ | -1. | 23428.1 | - I 34 | $\begin{array}{lll}33 & 4.3\end{array}$ | -r 4.45 | $\begin{array}{llll}2 & 31 & 33.6\end{array}$ | 57 |
| 50 | $3347 \cdot 8$ | 1.07 | 2 32 $40 \cdot 5$ <br> 2 28  | $1 \cdot 17$ | $3 \mathrm{I} \quad 26.8$ | I. 2 | 2 30 <br> 2 6.4 <br> 25 43.7 | 1.40 | $\begin{array}{llll}2 & 28 & 39.2 \\ 2 & 24 & 12.9\end{array}$ |  | 2 27 4.8 <br> 2 22 34.5 | 64 |
| 5 | $\begin{array}{llll}2 & 29 & 33 \cdot 9 \\ 2 & 25 & 19.3\end{array}$ | 11 | $\begin{array}{llr}2 & 28 & 23.9 \\ 2 & 24 & 6.5\end{array}$ | 27 | $\begin{array}{ccc}2 & 27 & 7 \cdot 3 \\ 2 & 22 & 46 \cdot 8\end{array}$ | I. 33 - 39 |  | $\begin{array}{r}1.45 \\ \\ \hline\end{array}$ | $\begin{array}{llll}2 & 24 & 12 \cdot 9 \\ 2 & 19 & 45 \cdot 3\end{array}$ |  | $\begin{array}{rrr\|} 2 & 22 & 34 \cdot 5 \\ 2 & 18 & 2 \cdot 7 \end{array}$ |  |
| 53 | $\begin{array}{ccc}2 & 25 & 19.3 \\ 1 & 21 & 3.9\end{array}$ | 12 | $\begin{array}{lllr}2 & 24 & 6 \cdot 5 \\ 2 & 19 & 48 \cdot 2\end{array}$ | 1.27 1.32 | $\begin{array}{llll}2 & 22 & 46.8 \\ 2 & 18 & 25.2\end{array}$ | I.39 I.45 | $\begin{array}{llll}2 & 21 & 19.8 \\ 2 & 16 & 54.6\end{array}$ | I.58 | $\begin{array}{lll}2 & 19 & 45 \cdot 3 \\ 2 & 15 & 16.1\end{array}$ | 1.64 <br> I 71 | $\begin{array}{ccc}2 & 18 & 2.7 \\ 2 & 13 & 29.0\end{array}$ | r <br> r |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. $+\quad .85$ | s. -4.09 | s. $+\quad .92$ | S. | $\begin{gathered} \mathrm{s} . \\ +\quad 99 \end{gathered}$ | S. | $\begin{gathered} \text { s. } \\ +\mathbf{x} \cdot 07 \end{gathered}$ | s. $-4 \cdot 14$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot \mathrm{Ij} \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot \mathrm{r} 6 \end{gathered}$ | S. +1.22 | $\stackrel{s}{4 \cdot 18}$ |
| 2 | .85 | 4.09 | . 92 | $4 \cdot 10$ | 1.00 | $4 \cdot 12$ | 1.07 | 4.14 | 1.15 | 4.16 | 1.22 | $4 \cdot 18$ |
| 4 | .85 | 4.09 | -92 | $4 \cdot 10$ | I.00 | $4 \cdot 12$ | r.07 | $4 \cdot 14$ | I. 15 | $4 \cdot 16$ | r 22 | 4.18 |
| 6 | . 85 | 4.09 | -93 | $4 \cdot 10$ | I 00 | $4 \cdot 12$ | 1.08 | $4 \cdot 14$ | 1.15 | $4 \cdot 16$ | 1.23 | $4 \cdot 18$ |
| 8 | . 86 | 4.09 | $\cdot 93$ | $4 \cdot 11$ | r-or | 4.12 | 1.08 | 4.14 | 1-16 | 4-16 | I. 23 | $4 \cdot 19$ |
| ro | +.86 | 4.09 | + 94 | $4 \cdot 11$ | +r.or | $4 \cdot 13$ | +r.09 | $4 \cdot 14$ | +r.16 | $4 \cdot 17$ | +1.24 | $4 \cdot 19$ |
| 12 | . 87 | 4.09 | -94 | $4 \cdot 11$ | 1.02 | 4-13 | 1-10 | 4.15 | $1 \cdot 17$ | $4 \cdot 17$ | 1.25 | $4 \cdot 19$ |
| 14 | -88 | 4.09 | -95 | $4 \cdot \mathrm{II}$ | r.03 | $4 \cdot 13$ | r•r | $4 \cdot 15$ | I•18 | $4 \cdot 17$ | 1.26 | $4 \cdot 19$ |
| r6 | $\cdot 88$ | $4 \cdot 10$ | -96 | $4 \cdot \mathrm{II}$ | I. 04 | $4 \cdot 13$ | 1.12 | $4 \cdot 15$ | 1.20 | $4 \cdot 17$ | 1.28 | $4 \cdot 20$ |
| 18 | -89 | $4 \cdot 10$ | -97 | $4 \cdot 12$ | 1.05 | $4 \cdot 14$ | I•3 | 4.16 | 1.2I | 4.18 | I. 29 | $4 \cdot 20$ |
| 20 | + 9 r | $4 \cdot 10$ | + 98 | $4 \cdot 12$ | +r.06 | $4 \cdot 14$ | +r.14 | $4 \cdot 16$ | +1.23 | $4 \cdot 18$ | + 1 . 31 | 4.21 |
| 22 | $\cdot 92$ | $4 \cdot 10$ | I.00 | $4 \cdot 12$ | 1.08 | $4 \cdot 14$ | I. 16 | $4 \cdot 16$ | $1 \cdot 24$ | 4.19 | r 33 | 4.21 |
| 24 | -93 | $4 \cdot 11$ | I.02 | $4 \cdot 13$ | I 10 | $4 \cdot 15$ | r.18 | $4 \cdot 17$ | I. 26 | $4 \cdot 19$ | 1.35 | 4.22 |
| 26 | -95 | $4 \cdot 11$ | 1.03 | $4 \cdot 13$ | $1 \cdot 12$ | $4 \cdot 15$ | 1.20 | $4 \cdot 18$ | 1.29 | 4.20 | $1 \cdot 37$ | $4 \cdot 23$ |
| 28 | -97 | $4 \cdot 11$ | r.05 | $4 \cdot 13$ | I. 14 | $4^{\cdot 16}$ | 1.22 | 4.18 | 1.3I | 4.21 | 1.40 | $4 \cdot 24$ |
| 30 | + 99 | $4 \cdot 12$ | +r.07 | $4 \cdot 14$ | +r.16 | $4 \cdot 16$ | +r.25 | 4•19 | +r.34 | 4.22 | +r.43 | $4 \cdot 25$ |
| 32 | 1.01 | $4 \cdot 13$ | r-ro | $4 \cdot 15$ | r.19 | $4 \cdot 17$ | r. 28 | $4 \cdot 20$ | 1.37 | $4 \cdot 23$ | r.47 | $4 \cdot 26$ |
| 34 | 1.04 | $4 \cdot 13$ | r'I3 | $4 \cdot 16$ | I 22 | $4 \cdot 18$ | I.31 | 4.21 | 1.45 | 4.24 | 1.51 | $4 \cdot 27$ |
| 36 | r.06 | $4 \cdot 14$ | 1.16 | $4 \cdot 16$ | r 25 | $4 \cdot 19$ | I. 35 | 4.22 | I.45 | 4.25 | 1.55 | $4 \cdot 29$ |
| 38 | r.09 | $4 \cdot 14$ | 1.19 | 4.17 | I. 29 | 4.20 | I 39 | 4.23 | 1.49 | $4 \cdot 27$ | 1.60 | $4 \cdot 3 \mathrm{I}$ |
| 40 | +r.13 | $4 \cdot 15$ | +r.23 | $4 \cdot 18$ | +1.33 | $4 \cdot 21$ | +1.44 | 4.25 | +r.54 | 4.29 | +r.65 | $4 \cdot 33$ |
| 42 | $1 \cdot 17$ | $4 \cdot 16$ | r 27 | $4 \cdot 19$ | $1 \cdot 38$ | $4 \cdot 23$ | I 49 | $4 \cdot 27$ | r 60 | 4.31 | $1 \cdot 71$ | 4.35 |
| 44 | 1.21 | $4 \cdot 18$ | r 32 | $4 \cdot 21$ | 1.43 | $4 \cdot 25$ | I.54 | $4 \cdot 29$ | r 66 | 4.33 | r•78 | 4.38 |
| 46 | I. 26 | $4 \cdot 19$ | I 37 | 4.23 | r 49 | $4 \cdot 27$ | I.61 | 4.31 | r.73 | 4.36 | 1.86 | 4.41 |
| 48 | 1.31 | $4 \cdot 21$ | 1.43 | $4 \cdot 25$ | I.55 | 4.29 | I.68 | $4 \cdot 34$ | r.81 | 4.39 | 1.94 | $4 \cdot 45$ |
| 50 | +r.37 | 4.23 | +1.49 | $4 \cdot 27$ | +1.63 | $4 \cdot 32$ | +r.76 | 4.37 | +1.90 | $4 \cdot 43$ | +2.04 | $4 \cdot 49$ |
| 52 | r.44 | 4.25 | r.57 | 4.30 | 1-71 | $4 \cdot 35$ | I.86 | 4.41 | 2.01 | 4.47 | $2 \cdot 16$ | $4 \cdot 55$ |

## LATITUDE $0^{\circ}$ EQUATOR.

DECLINATION.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 0 \cdot 0 \end{array}$ | $\begin{aligned} & \text { S. } \\ & .00 \end{aligned}$ | $\begin{array}{\|lll} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 0 \cdot 0 \end{array}$ | $\cdot \infty$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}$ |  | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}$ | $.00$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 0.0 \end{array}$ | -oo | $\begin{array}{\|ccc\|} \hline \text { H. M. } & \text { s. } \\ 6 & \text { o } & 0 \cdot 0 \end{array}$ | S. |
| 10 | 51785.1 | - 24 | $5 \quad 1740 \cdot 2$ | -26 | 517824.2 | -27 | $\begin{array}{llll}5 & 17 & 7 \cdot 3\end{array}$ | -29 | 5 I6 49.4 | -31 | $\begin{array}{llll}5 & 16 & 30 \cdot 3\end{array}$ | -33 |
| 12 | $\begin{array}{llll}5 & 9 & 29.4\end{array}$ | -29 | $5 \quad 9 \quad 11 \cdot 3$ | -31 | $5 \quad 8 \quad 52 \cdot \mathrm{I}$ | -33 | 5 5 8 $8131 \cdot 7$ | $\cdot 35$ | $5 \quad 8 \quad 10 \cdot 0$ | $\cdot 37$ | $\begin{array}{lcrl}5 & 7 & 47 \cdot 1\end{array}$ | 39 |
| 14 | 5 I $3 \cdot 3$ | -34 | $5 \quad 0 \quad 42 \cdot \mathrm{I}$ | $\cdot 3$ | $5 \quad 0 \quad 19.5$ | -39 | $45955 \cdot 5$ | $\bullet 41$ | 459 30•I | -44 | $4593 \cdot 1$ | 46 |
| 16 | $45236 \cdot 6$ | -39 | $4 \quad 5212 \cdot 3$ | -42 | $45146 \cdot 2$ | $\cdot 45$ | 45118.6 | -47 | $45049 \cdot 3$ | 0 | 45018 | 53 |
| 18 | 444 | $\cdot 45$ | 434 | 48 | 443 I | -51 | $44240 \cdot 9$ | $\cdot 54$ | $\begin{array}{llll}4 & 42 & 7 \cdot 6\end{array}$ | -57 | $44132 \cdot 3$ | . 60 |
| 20 | $43541 \cdot 5$ | - 50 | $43510 \cdot 5$ | -53 | $43437 \cdot 4$ | - 57 | $434 \begin{array}{ll}4 & 2 \cdot 2\end{array}$ | -60 | $\begin{array}{llll}4 & 33 & 24 \cdot 8\end{array}$ | -64 | $43245 \cdot 2$ | 68 |
| 22 | 42712.9 | $\cdot 56$ | $42638 \cdot 3$ | -59 | $426 \quad 1 \cdot 5$ | -63 | $425 \quad 22.4$ | -67 | $42440 \cdot$ | -71 | $42356 \cdot 7$ | 76 |
| 24 | 4 I8 $43 \cdot 3$ | -6I | $4 \begin{array}{lll}48 & 5 \cdot 1\end{array}$ | . 66 | 417824.5 | $\cdot 70$ | 4 I6 $41 \cdot 2$ | $\cdot 74$ | $415 \quad 55^{\circ} \mathrm{C}$ | $\cdot 79$ | $\begin{array}{llll}4 & 15 & 6 \cdot 5\end{array}$ |  |
| 26 | 4 IO 12.7 | -67 | $\begin{array}{llll}4 & 9 & 30 \cdot 8\end{array}$ | $\cdot 72$ | $4846 \cdot 1$ | $\cdot 77$ | $4 \begin{array}{lll}4 & 7 & 58.6\end{array}$ | 2 | $478 \cdot 1$ | 7 | $4 \quad 614.5$ | -92 |
| 28 | 4 I 40.9 | $\cdot 74$ | $4055^{\prime} \mathrm{I}$ | - 79 | 4 | -84 | $35914 \cdot 3$ | -89 | $35^{3} 8191$ | - 95 | $35720 \cdot 4$ | - I•OI |
| 30 | $\begin{array}{llll}3 & 53 & 7.8\end{array}$ | - 80 | 35218.0 | . 86 | $\begin{array}{llll}3 & 51 & 24.8\end{array}$ | -91 | $350028 \cdot 1$ | -97 | $314927 \cdot 9$ | 1.03 | $\begin{array}{llll}3 & 48 & 23.9\end{array}$ | 10 |
| 31 | $34^{3} 4850 \cdot 7$ | - | $34758 \cdot 7$ | -89 | $3 \begin{array}{lll}3 & 47 & 3 \cdot 3\end{array}$ | -95 | $\begin{array}{llll}3 & 46 & 4 \cdot 2\end{array}$ | - 01 | $345 \quad \mathrm{I} \cdot 4$ | I.08 |  | I•I5 |
| 32 | $34433 \cdot 2$ | . 87 | $3 \begin{array}{llll}3 & 43 & 39 & \text { I }\end{array}$ | -93 | $34241 \cdot 3$ | 99 | $\begin{array}{llll}3 & 41 & 39 \cdot 7\end{array}$ | I.06 | $34034 \cdot 1$ | 2 | $\begin{array}{llll}3 & 39 & 24 \cdot 6 \\ 3 & 34 & 53 \cdot 8\end{array}$ | -19 |
| 33 | 340 I5.2 | 1 | $\begin{array}{lllllll}3 & 39 & 18.9\end{array}$ | -97 |  | I.03 |  | I'IO | $\begin{array}{llll}3 & 36 & 6 \cdot 3\end{array}$ | 1-17 | $\begin{array}{lllllllllllllll}3 & 34 & 53\end{array}$ | I. 25 |
| 3 | $\begin{array}{llll}3 & 35 & 56 \cdot 8\end{array}$ | -94 | $\begin{array}{llll}3 & 34 & 58.2\end{array}$ | -I.OI | $\begin{array}{lllll}3 & 33 & 55 \cdot 6\end{array}$ | -I.08 | $\begin{array}{llll}3 & 32 & 48 \cdot 8\end{array}$ | -I'I5 | $33137 \cdot 7$ | - I. 22 | $3 \quad 30 \quad 22 \cdot 1$ | - I 30 |
| 35 | 33138.0 | -98 | $3 \quad 30 \quad 37 \cdot 0$ | I.05 | $3 \quad 29$ 31.8 | 1 | $\begin{array}{llll}3 & 28 & 22 \cdot 3\end{array}$ | I.19 | 32780 | $1 \cdot 27$ | $32549 \cdot 5$ | -35 |
| 36 |  | -02 | 32615. | I.09 | $\begin{array}{llll}3 & 25 & 7 \cdot 3\end{array}$ | I•I7 | $\begin{array}{llll}3 & 23 & 55 \cdot 0\end{array}$ | I. 24 | $322 \begin{array}{llll}3 & 27 \cdot 9\end{array}$ | I. 32 | $32116 \cdot 0$ | I.4I |
| 37 | $\begin{array}{llllllllllllllllll}3 & 22 & 58 \cdot 6\end{array}$ | I.06 | 32152.6 | I•I4 | $32042 \cdot 1$ | I. 21 | 3 I9 26.9 | 1.29 | $\begin{array}{llll}3 & 18 & 6 \cdot 7\end{array}$ | I. 38 | 3 I6 4I•3 | 47 |
| 38 | $\begin{array}{llllll}3 & 18 & 38 \cdot 0\end{array}$ | 1.10 | 3 I7 29.4 | 18 | 3 I6 I6.1 | I. 26 | 3 I4 57.9 | I-35 | $\begin{array}{lllll}3 & 13 & 34.4\end{array}$ | 1.44 | $312 \quad 5 \cdot 5$ | I.53 |
| 39 | 314156 | -I.I5 | 313 | -I.23 | 3 II 49*3 | -1.3I | 3 IO 27.9 | - I 40 | 3191 | - I. 49 | $37828 \cdot 5$ | - I. 59 |
| 40 | $\begin{array}{llll}3 & 9 & 54.8\end{array}$ | I.19 | $\begin{array}{llll}3 & 8 & 40 \cdot 8\end{array}$ | I. 28 | 3721.5 | I.36 | $\begin{array}{llll}3 & 5 & 56 \cdot 9\end{array}$ | I. 46 | $\begin{array}{llll}3 & 4 & 26 \cdot 5\end{array}$ | I. 55 | $\begin{array}{llll}3 & 2 & 50 \cdot 2\end{array}$ | I 66 |
| 41 | $\begin{array}{llll}3 & 5 & 32 \cdot 2\end{array}$ | I. 24 | $\begin{array}{llll}3 & 4 & I 5 \cdot 2\end{array}$ | I.33 | $\begin{array}{llll}3 & 2 & 52.8\end{array}$ | I. 42 | $\begin{array}{llll}3 & 1 & 24.8\end{array}$ | I. 52 | $25950 \cdot 7$ | I. 62 | $25810 \cdot 5$ | I•73 |
| 42 | $\begin{array}{llll}3 & 1 & 8 \cdot 7\end{array}$ | I. 29 | $25948 \cdot 7$ | I. 3 | $2 \begin{array}{lll}28 & 23 \cdot 1\end{array}$ | I. 48 | 25651.4 | I. 58 | 25513.6 | I. 69 | 253129.1 | \% |
| 43 | $25644 \cdot 4$ | I.34 | $255 \quad 2 \mathrm{I} \cdot 2$ | 44 | $25352 \cdot \mathrm{I}$ | I. 54 | 52 16.8 | I. 64 | 25034.9 | ェ・76 | $24846 \cdot 1$ | 1.87 |
| 44 | $25219 \cdot 1$ | - I. 39 | $25052 \cdot 7$ | - I 49 | $24920 \cdot 0$ | - I. 60 | $24740 \cdot 8$ | - I.71 | 24554.6 | - I .83 | 244103 | -r.95 |
| 45 | 24752.8 | I. 45 | $246 \quad 22 \cdot 9$ | I. 55 | $24446 \cdot 5$ | I 66 | 24313.2 | I.78 | 24112.6 | 1.91 | 23914.4 | $2 \cdot 04$ |
| 46 | 24325.4 | 1.50 | $24 \mathrm{5I} \cdot 9$ | I. 62 | 240 II•5 | I•73 | $\begin{array}{llll}2 & 38 & 23.9\end{array}$ | 1.86 | $\begin{array}{llll}2 & 36 & 28 \cdot 6\end{array}$ | 1.99 | $34 \quad 25 \cdot 3$ | $2 \cdot 13$ |
| 47 | 23856.8 | I. 56 |  | 68 | 23534.9 | I.8I | 23342.8 | I.94 | $23142 \cdot 6$ | 2.07 |  | 2 |
| 48 | $23426 \cdot 9$ | I. 63 | $23245 \cdot 6$ | I.75 | $23056 \cdot 7$ | 1.88 | 22859.7 | 2.02 | 22654.2 | $2 \cdot 17$ | $22439 \cdot 6$ | $2 \cdot 32$ |
| 49 | $22955 \cdot 6$ | - I•70 | 22810.0 | - I.83 | 22616.4 | - I.96 | 22414.4 | -2.11 | 222312 | -2.27 | $2 \begin{array}{llll}2 & 19 & 42.4\end{array}$ | $-2.43$ |
| 50 | $22522 \cdot 7$ | $1 \cdot 77$ | $22332 \cdot 7$ | 1.90 | $22134 \cdot 1$ | $2 \cdot 05$ | $21926 \cdot 5$ | 2.21 | $\begin{array}{llll}2 & 17 & 9.4\end{array}$ | $2 \cdot 37$ | 214479 | . 55 |
| 51 | $22048 \cdot 1$ | I. 84 | $218153 \cdot 3$ | I.99 | I6 $49 \cdot 4$ | $2 \cdot 14$ | 2 I4 $36 \cdot 0$ | 2.31 | 1212.4 | 2.49 | $937 \cdot 7$ | 2.68 |
| 52 | 2 I6 II. 6 | I.92 | 214 II•7 | $2 \cdot 08$ | $12 \quad 2 \cdot 2$ | $2 \cdot 24$ | $2 \quad 942 \cdot 5$ | 2.42 | $2 \begin{array}{llll}2 & 7 & 11.9\end{array}$ | 2.61 | 429.4 | $2 \cdot 81$ |
| 53 | 2 II 33.1 | $2 \cdot \mathrm{OI}$ | $927 \cdot 7$ | $2 \cdot 17$ | 712.1 | $2 \cdot 35$ | $2445 \cdot 6$ | $2 \cdot 5$ | $\begin{array}{lll}2 & 2 & 7\end{array}$ | $2 \cdot 74$ | 59 16.4 | $2 \cdot 97$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. 23 | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $+\mathrm{I} \cdot 30$ | S. | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 38 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4.23 \end{gathered}$ | S. +I .45 | S. -4.26 | S. $+\mathrm{I} \cdot 53$ | 5. -4.28 | $\begin{gathered} s . \\ +1 \cdot 6 I \end{gathered}$ | $\begin{gathered} s \\ -4 \cdot 3 I \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 70 \end{gathered}$ | $\begin{gathered} s . \\ -4.34 \end{gathered}$ |
| 2 | I-30 | $4 \cdot 21$ | I. 38 | 4.23 | 1.46 | 4.26 | 1.53 | $4 \cdot 28$ | I.61 | $4 \cdot 31$ | 1.70 | $4 \cdot 35$ |
| 4 | I-30 | 4.21 | I-38 | $4 \cdot 23$ | 1.46 | $4 \cdot 26$ | r. 54 | $4 \cdot 28$ | I. 62 | $4 \cdot 31$ | I•70 | $4 \cdot 35$ |
| 6 | I.3I | 4.21 | I-38 | $4 \cdot 23$ | 1.46 | $4 \cdot 26$ | $1 \cdot 54$ | $4 \cdot 29$ | I 62 | $4 \cdot 32$ | I•71 | $4 \cdot 35$ |
| 8 | I•3I | $4 \cdot 21$ | 1-39 | $4 \cdot 23$ | $1 \cdot 47$ | $4 \cdot 26$ | I-55 | 4-29 | I.63 | $4 \cdot 32$ | r.71 | $4 \cdot 35$ |
| IO | +I•32 | 4.21 | +1.40 | $4 \cdot 24$ | +1.48 | $4 \cdot 26$ | +1.56 | 4.29 | +I. 64 | $4 \cdot 32$ | +1.73 | $4 \cdot 36$ |
| 12 | 1-33 | $4 \cdot 21$ | I.4I | $4 \cdot 24$ | 1.49 | $4 \cdot 27$ | 1.57 | $4 \cdot 30$ | I. 66 | $4 \cdot 33$ | I•74 | $4 \cdot 36$ |
| 14 | I-34 | $4 \cdot 22$ | 1.42 | $4 \cdot 24$ | I.51 | $4 \cdot 27$ | I. 59 | $4 \cdot 30$ | I.67 | $4 \cdot 34$ | I.76 | $4 \cdot 37$ |
| 16 | 1-36 | $4 \cdot 22$ | 1.44 | $4 \cdot 25$ | I. 52 | $4 \cdot 28$ | I.6I | $4 \cdot 31$ | I. 69 | $4 \cdot 34$ | I.78 | $4 \cdot 38$ |
| 18 | 1-37 | $4 \cdot 23$ | 1.46 | $4 \cdot 26$ | I.54 | 4.29 | 1.63 | $4 \cdot 32$ | I•71 | $4 \cdot 35$ | I. 80 | $4 \cdot 39$ |
| 20 | +1.39 | $4 \cdot 23$ | +1.48 | $4 \cdot 26$ | +1.56 | 4-29 | +1.65 | $4 \cdot 33$ | +1.74 | $4 \cdot 36$ | +1.83 | 4.40 |
| 22 | I.4I | $4 \cdot 24$ | 1.50 | $4 \cdot 27$ | I 59 | $4 \cdot 30$ | 1.67 | $4 \cdot 34$ | I•77 | $4 \cdot 37$ | I.86 | $4 \cdot 4 \mathrm{I}$ |
| 24 | 1.44 | $4 \cdot 25$ | 1.52 | $4 \cdot 28$ | I.6I | $4 \cdot 31$ | 1.70 | $4 \cdot 35$ | I.80 | 4.39 | I.89 | $4 \cdot 42$ |
| 26 | $1 \cdot 46$ | $4 \cdot 26$ | 1.55 | $4 \cdot 29$ | I. 64 | $4 \cdot 32$ | 1.74 | $4 \cdot 36$ | I. 83 | $4.40^{\circ}$ | I.93 | 4.44 |
| 28 | 1.49 | $4 \cdot 27$ | I. 59 | $4 \cdot 30$ | I.68 | $4 \cdot 34$ | I.78 | $4 \cdot 37$ | 1.87 | 4.42 | 1.97 | 4.46 |
| 30 | +1.53 | $4 \cdot 28$ | +1.62 | 4.31 | +1.72 | $4 \cdot 35$ | +1.82 | $4 \cdot 39$ | $+1.92$ | $4 \cdot 44$ | $+2.02$ | $4 \cdot 48$ |
| 32 | I.56 | $4 \cdot 29$ | I. 66 | $4 \cdot 33$ | I.76 | $4 \cdot 37$ | I. 86 | 4.41 | I.97 | 4.46 | 2.07 | 4.50 |
| 34 | I. 60 | $4 \cdot 31$ | I.71 | $4 \cdot 35$ | I.81 | $4 \cdot 39$ | 1.92 | $4 \cdot 43$ | $2 \cdot 03$ | 4.48 | $2 \cdot 14$ | 4.53 |
| 36 | I. 65 | $4 \cdot 33$ | 1.76 | $4 \cdot 37$ | I. 87 | $4 \cdot 4 \mathrm{I}$ | 1.98 | $4 \cdot 46$ | 2.09 | $4 \cdot 51$ | $2 \cdot 20$ | 4.57 |
| 38 | 1.70 | $4 \cdot 35$ | I•8I | $4 \cdot 39$ | I.93 | $4 \cdot 44$ | $2 \cdot 04$ | $4 \cdot 49$ | $2 \cdot 16$ | $4 \cdot 55$ | $2 \cdot 28$ | 4.6 I |
| 40 | +1.76 | $4 \cdot 37$ | +1.88 | $4 \cdot 42$ | $+2.00$ | $4 \cdot 47$ | $+2 \cdot 12$ | $4 \cdot 52$ | $+2.24$ | 4.59 | +2.37 | $4 \cdot 65$ |
| 42 | 1.83 | $4 \cdot 40$ | 1.95 | $4 \cdot 45$ | 2.07 | $4 \cdot 50$ | $2 \cdot 20$ | $4 \cdot 57$ | $2 \cdot 34$ | $4 \cdot 63$ | 2.47 | $4 \cdot 70$ |
| 44 | 1.90 | 4.43 | 2.03 | 4.49 | 2.16 | $4 \cdot 55$ | $2 \cdot 30$ | $4 \cdot 61$ | 2.44 | 4.69 | 2.59 | $4 \cdot 76$ |
| 46 | 1.99 | $4 \cdot 47$ | $2 \cdot 12$ | $4 \cdot 53$ | $2 \cdot 26$ | $4 \cdot 60$ | 2.41 | $4 \cdot 67$ | $2 \cdot 56$ | 4.75 | 2.72 | $4 \cdot 84$ |
| 48 | $2 \cdot 08$ | $4 \cdot 5 \mathrm{I}$ | $2 \cdot 23$ | $4 \cdot 58$ | $2 \cdot 38$ | $4 \cdot 65$ | 2.54 | 4.74 | 2.70 | $4 \cdot 83$ | 2.88 | 4.93 |
| 50 | $+2 \cdot 19$ | $4 \cdot 56$ | $+2 \cdot 35$ | $4 \cdot 64$ | $+2.51$ | 4.72 | +2.69 | $4 \cdot 82$ | +2.86 | 4.92 | $+3.05$ | $5 \cdot 04$ |
| 52 | $2 \cdot 32$ | $4 \cdot 62$ | 2.49 | $4 \cdot 71$ | 2.67 | 4.81 | $2 \cdot 85$ | 4.92 | $3 \cdot 05$ | $5 \cdot 04$ | $3 \cdot 24$ | $5 \cdot 18$ |

## 6 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

 LATITUDE $1^{\circ}$.DECLINATION-SAME NAME AS-LATITUDE.


VARIATION 'TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{\circ}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4{ }^{\circ}$ | A. | L. 5 | ${ }^{\circ}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\circ$ <br>  <br> 2 <br> 2 <br> 4 <br> 8 <br> 8 | .00 | $\begin{aligned} & 4: 00 \\ & 4: 00 \\ & 4: 00 \\ & 4.0 \end{aligned}$ |  | $\begin{aligned} & 400 \\ & 4: 000 \\ & 4: 000 \\ & 4.00 \end{aligned}$ | + $\begin{array}{r}\text { + } 14 \\ \text {.13 } \\ \text {.13 } \\ \text {.13 } \\ \text {-13 }\end{array}$ | $\begin{aligned} & 4.00 \\ & 4: 00 \\ & 4.00 \\ & 4.00 \\ & 4.00 \end{aligned}$ | 21 .20 .20 .20 +20 |  | 27 27 27 27 |  |  |  |
| 10 | -or | 4.00 | +.06 | 4.00 | + 13 | 4.00 | + 20 | 4.0 | + 2 |  | + 34 | 4.02 |
|  | .02 | 4.00 | .06 | 4 | - ${ }_{\text {. } 13}$ | 4.00 | - 20 | $4 \cdot \mathrm{O}$ |  | 4.01 | . 34 | -02 |
| ${ }^{\text {r }}$ | ${ }^{02}$ |  |  |  |  |  |  |  |  | 4.0 | , | 4.02 |
|  |  |  | - 05 $+\quad .05$ |  |  |  |  |  |  |  |  |  |
| ${ }_{22}^{20}$ | . 2 | 4.00 | +.05 | 4.00 4.00 | + ${ }_{\text {I2 }}$ | + 4.00 | + 20 | ${ }_{4}^{4.01}$ | + ${ }^{27}$ |  |  | -02 |
| 24 26 | -3 | ${ }_{4}^{4.00}$ | .04 04 |  | -12 | ${ }_{4}^{4.00}$ | .20 |  | . 28 |  |  | . 02 |
| ${ }_{28}^{28}$ | -4 | 4.00 | -4 | 4.00 | ${ }^{12}$ | 4.00 | .20 | $4 \times$ or | ${ }^{28}$ | 4.01 | 35 | . 22 |
| 30 | -.04 | 4 | + -04 | 4.00 | + +12 | 4.0 | + 20 |  | + 2 |  | + 36 | ${ }^{\circ 2}$ |
|  | .05 | 4.00 | . 04 |  | ${ }_{12}$ | 4.00 | . 20 | ${ }_{4}$ | 29 |  |  | -02 |
| ${ }_{38}$ | .05 | 4.00 4.00 | - 0 | 4.00 | . 12 | 4.00 | .21 | 4.0 | $\begin{array}{r}29 \\ \\ \\ \\ \hline 0\end{array}$ | $4 \cdot 1$ | ${ }^{38}$ | 4.02 |
|  | - .06 | 4.00 | + 03 |  | + I 2 |  | + 21 |  |  |  |  |  |
| 42 |  |  | ${ }^{\circ} \mathrm{O} 3$ |  | . |  | . 22 | 4.0 |  | $4 \cdot 0$ |  | . 02 |
|  | :07 | 4:00 | -03 | 4.00 |  | 4 |  | 4, |  | 4. | . 43 |  |
| ${ }_{48}^{46}$ | . 08 | 4.00 | . 03 |  | ${ }^{1}$ | 4 | 24 |  | $\begin{array}{r}33 \\ \hline\end{array}$ |  | 45 | ${ }_{4}{ }^{4.22}$ |
| 50 |  | 4.00 | +.03 |  | + ${ }^{13}$ |  | + 24 |  | + 35 |  |  |  |
| 㐌2 |  | 4 | .02 |  |  | 4.400 | - ${ }_{-26}^{25}$ |  | ${ }_{\text {. }}^{38}$ |  |  | + ${ }_{4}^{4.03}$ |

## LATITUDE $1^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9{ }^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 0 & 25 \cdot 2 \end{array}\right.$ | +.07 | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 0 \end{array}\right.$ | + .07 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 0 & 33 \cdot 7 \end{array}\right.$ | $+.07$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 38 \cdot 0 \end{array}$ |  | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 0 & 42 \cdot 3 \end{array}$ | $+\mathrm{s} .{ }^{2}$ | $\left\|\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & 0 \\ 46 \cdot 6 \end{array}\right\|$ | 07 |
| 10 | 20 II•9 | . 00 | 520 I1.3 | - 01 | $5 \quad 201000$ | -.03 | 5208.0 | - 04 | 5 $20 \begin{array}{lll}5 & 5 \cdot 2\end{array}$ | -.05 | 5201.6 | .06 |
| 12 | 129.2 | . 02 | $12 \quad 7 \cdot 7$ | . 03 | $\begin{array}{lllll}5 & 12 & 5 \cdot 3\end{array}$ | -05 | $\begin{array}{lllll}5 & 12 & 1.9\end{array}$ | -06 | 5 II $57 \cdot 7$ | - 08 | 5 II 52.5 | -9 |
| 14 | $4 \quad 6 \cdot 6$ | . 03 | $4 \cdot 1$ | -05 | $\begin{array}{llll}5 & 4 & 0.5\end{array}$ | -07 | $355 \cdot 9$ | -08 | $350 \cdot 2$ | -ı0 | $43 \cdot 4$ | -12 |
| 16 | 456 | . 05 | $56 \quad 0.4$ | -07 | 45555.7 | -09 | $45549 \cdot 8$ | -11 | $45542 \cdot 6$ | -13 | $45534^{\circ}$ | -15 |
| 18 | $48 \quad 1 \cdot 2$ | -0 | $44756 \cdot 8$ | -0 | $44750 \cdot 9$ | -II | $44743 \cdot 6$ | -13 | $44734 \cdot 9$ | $\cdot 16$ | $44724 \cdot 7$ | 18 |
| 20 | 43958.5 | .08 | 3953.0 | . 10 | 43945.9 | -13 | $43937 \cdot 3$ | -16 | $43927 \cdot 1$ | $\cdot 18$ | $43915 \cdot 1$ | . 21 |
| 22 | $43155 \cdot 8$ | -09 | 43149.2 | - 12 | $43140 \cdot 9$ | -15 | 4313009 | -18 | 43119.1 | -2I | 431504 | -24 |
| 24 | $42353 \cdot 0$ | -II | $42345 \cdot 3$ | -14 | 42335.8 | -17 | 42324.3 | -21 | $4 \begin{array}{llll}4 & 23 & 10.9\end{array}$ | -24 | $42255 \cdot 4$ | 27 |
| 26 | 415 50.1 | - 13 | $41541 \cdot 4$ |  | $4 \quad 1530 \cdot 6$ | -20 |  | 23 | $\begin{array}{lll}4 & 15 & 2 \cdot 5\end{array}$ | -27 | $41445 \cdot 2$ | 31 |
| 28 | $747 \cdot 2$ | - | $737 \cdot 3$ | $\cdot 18$ | $4 \quad 7 \quad 25.2$ | $\cdot 22$ | $4 \quad 710 \cdot 7$ | . 26 |  | - 30 | $634 \times 7$ | - 34 |
| 30 | $35944 \cdot 2$ | $\cdot \mathrm{I} 6$ | $35933 \cdot 2$ | . 20 | $\begin{array}{llllllllllll}3 & 59 & 19.6\end{array}$ | $\cdot 24$ | 35959 | 29 | $\begin{array}{llll}3 & 58 & 45 \cdot 0 \\ 3 & \end{array}$ | $\cdot 33$ | $\begin{array}{lllllllllllll}3 & 58 & 23 \cdot 8\end{array}$ | 37 |
| 32 | $35141 \cdot 1$ | -18 | 35128.9 | $\cdot 22$ | 35114.0 | $\cdot 27$ | $35056 \cdot 3$ | $\cdot 32$ | $35035 \cdot 9$ | -36 | 35012.6 | $\cdot 41$ |
| 33 | 3 47 | -19 | $4726 \cdot 7$ | -24 | $\begin{array}{llllll}3 & 47 \\ \text { Ir }\end{array}$ | 28 | $34652 \cdot 5$ | -33 | $34631 \cdot I$ | -38 | 3466.8 | -43 |
| 34 | $34337 \cdot 9$ | $\cdot 20$ | 34324.4 | $\cdot 25$ | 343 | $\cdot 30$ | $34248 \cdot 7$ | -35 | $\begin{array}{llll}3 & 42 & 26.3\end{array}$ | -40 | $\begin{array}{llll}3 & 42 & 0.9\end{array}$ |  |
| 35 |  | $\cdot 21$ | $\begin{array}{llll}3 & 39 & 22 \cdot 1 \\ 3 & \text { 2 }\end{array}$ | $\cdot 26$ | $\begin{array}{llll}3 & 39 & 5.0 \\ 3 & 35 & \end{array}$ | $\cdot 31$ | $\begin{array}{lllllllll}3 & 38 \\ 3 & 44 \cdot 7\end{array}$ | - $\cdot 36$ | $\begin{array}{llll}3 & 38 & 21.4 \\ 3 & \\ 3\end{array}$ | - - 4 | $\begin{array}{llll}3 & 37 & 54.8 \\ 3 & 33 & 48.7\end{array}$ | 77 |
| 36 | $\begin{array}{lllll}3 & 35 & 34 \cdot 6\end{array}$ | 22 | $\begin{array}{llll}3 & 35 & 19 \cdot 8\end{array}$ | - 27 | $\begin{array}{llll}3 & 35 & 1.9 \\ 3 & 30\end{array}$ |  |  |  | $\begin{array}{llll}3 & 34 & 16.4 \\ 3 & \end{array}$ | 43 | $33348 \cdot 7$ | $\begin{array}{r} \\ \cdot 49 \\ \hline\end{array}$ |
| 3 | $\begin{array}{llllll}3 & 3 \mathrm{I} & 32 \cdot 9 \\ 3 & 27 & \\ \end{array}$ | $\cdot 23$ | $\begin{array}{llllll}3 & 31 & 17.4 \\ 3 & 27 & 15.0\end{array}$ | -28 | $\begin{array}{lllll}3 & 30 & 58.7 \\ 3 & 26 & 55.5\end{array}$ | $\cdot 34$ | $\begin{array}{lllll}3 & 30 & 36 \cdot 6\end{array}$ | -39 | $\begin{array}{cccc}3 & 30 & 11 \cdot 2 \\ 3 & 26 & 5 \cdot 9\end{array}$ | $\cdot 45$ | $\begin{array}{llll}3 & 29 & 42 \cdot 3\end{array}$ |  |
| 38 | $\left\lvert\, \begin{array}{llll}3 & 27 & 31 \cdot 2 \\ 3 & 23 & 29\end{array}\right.$ | $\cdot 24$ | $\begin{array}{llll}3 & 27 & 15 \cdot 0 \\ 3 & 23 & 12.5\end{array}$ | $\cdot 30$ | $\begin{array}{llll}3 & 26 & 55 \cdot 5\end{array}$ | $\cdot 35$ .37 | $\begin{array}{llll}3 & 26 & 32 \cdot 4 \\ 3 & 22 & 28 \cdot 1\end{array}$ | $\cdot 41$ | $\begin{array}{llll}3 & 26 & 5.9 \\ 3 & 22 & 0.5\end{array}$ | -47 | $\begin{array}{llll}3 & 25 & 35 \cdot 8 \\ 3 & 21 & 39\end{array}$ |  |
| 39 | $\begin{array}{llll}3 & 23 & 29.4\end{array}$ | - 25 | 2312.5 | $\cdot 31$ | 3225 | $\cdot 37$ | 322 | $\cdot 43$ | $\begin{array}{llll}3 & 22 & 0.5\end{array}$ | -49 | 32129.2 |  |
| 4 | 31929. | - 26 | $\begin{array}{lll}3 & 19 & 9.9\end{array}$ | $\cdot 32$ | $\begin{array}{llllll}3 & 18 & 48.7\end{array}$ | $\cdot 38$ |  | - 45 |  | - 51 | 3 I7 22.4 |  |
| 4 |  | $\cdot 27$ | $15 \quad 7 \cdot 3$ | 34 | $\begin{array}{llllllllll}3 & 14 & 45.2\end{array}$ |  | $314 \begin{array}{ll}19.2\end{array}$ | -4 | $31349 \cdot 3$ | 53 | 313150.4 |  |
| 42 | $\begin{array}{ccccc}3 & 11 & 23.8 \\ 3 & 7 & 7\end{array}$ | -29 | 3 lll | $\cdot 35$ |  | $\cdot 42$ |  | -48 | $\begin{array}{llll}3 & 9 & 43 \cdot 4\end{array}$ | 55 | $\begin{array}{lll}3 & 9 & 8 \cdot 1\end{array}$ |  |
| 43 | $\begin{array}{lllll}3 & 7 & 21.8 \\ 3 & 3 & \end{array}$ | $\cdot 30$ | $\begin{array}{llll}3 & 7 & 1 & 9\end{array}$ | -37 | 3 6 37.9 <br> 3 2  <br> 10   | 43 | $\begin{array}{lll}3 & 6 & 9 \cdot 7\end{array}$ | - 50 | 3 5 $37 \cdot 4$ <br> 3 5 3 | 57 | $\begin{array}{lr}5 & 0 \cdot 7 \\ 0 & 5\end{array}$ |  |
| 44 | $\begin{array}{llll}3 & 3 & 19\end{array}$ | $\cdot 31$ | $3 \quad 2 \quad 59 \cdot 1$ | -38 | $3 \quad 234 \cdot \mathrm{I}$ | ${ }^{-45}$ | $\begin{array}{llll}3 & 2 & 4.8\end{array}$ | -52 | 3 I 31-I |  | - 53.0 |  |
| 45 | $\begin{array}{llllllll}2 & 59 & 17.8 \\ 2 & 59 & 17.6\end{array}$ | $\stackrel{32}{ } \cdot 3$ | $\begin{array}{llll}2 & 58 \\ 2 & 56 \cdot 1 \\ 2 & 54 & 53 \cdot 1\end{array}$ | $\cdot 40$ | $\begin{array}{llll}2 & 58 & 30.2 \\ 2 & 54 & 26.1\end{array}$ | - $\cdot 47$ |  | -. 55 | 2 57 $24 \cdot 7$ <br> 2 5  | - . 62 | $2{ }^{2} 56645 \cdot 1$ | $\cdot 70$ |
| 4 |  | -34 | $25453 \cdot 1$ | $\cdot 41$ | $25426 \cdot 1$ | $\cdot 49$ | 25354.4 | - 57 | $25318 \cdot 0$ | 65 | $\begin{array}{lllll}2 & 52 & 36 \cdot 9\end{array}$ | 73 |
| 4 | $\begin{array}{llllll}2 & 51 & 13.4 \\ 2 & 47 & 11\end{array}$ | , | 2 50 <br> 2 $50 \cdot 0$ <br> 2 46 |  | $\begin{array}{llll}2 & 50 & 21.9 \\ 2 & 46 & 17.5\end{array}$ | . 51 | $24949 \cdot 0$ | . 59 | 249 II•2 | $\cdot 67$ | $2{ }^{2} 4828.4$ | -76 |
| 49 | $\begin{array}{llll}2 & 47 & 11 \\ 2 & 43 & 8\end{array}$ | $\cdot 38$ | $\begin{array}{llll}2 & 46 & 46 \cdot 8 \\ 2 & 42 & 43 \cdot 4\end{array}$ | 45 | $\begin{array}{llll}2 & 46 & 17.5 \\ 2 & 42 & 13.0\end{array}$ | 53 | $\begin{array}{lllll}2 & 45 & 43 \cdot 3 \\ 2 & 41 & 37 \cdot 5\end{array}$ |  | $\begin{array}{rrrr}2 & 45 & 4 \cdot 0 \\ 2 & 40 & 56 \cdot 6\end{array}$ | 70 73 | $\begin{array}{lll}2 & 44 & 19 \cdot 5 \\ 2 & 40 & 10 \cdot 4\end{array}$ |  |
| 5 | 239 | 40 | $3840 \cdot 0$ | $\cdot 48$ | $\begin{array}{llll}2 & 38 & 8 \cdot 3\end{array}$ |  | 23731.4 | - 66 | $23648 \cdot 9$ |  | 36 0•8 |  |
| 51 | 2 35 $3 \cdot 8$ <br> 2 31  | 41 | $\begin{array}{llll}2 & 34 & 36.4\end{array}$ | $\cdot 50$ | $\begin{array}{llll}2 & 34 & 3.5\end{array}$ | $\cdot 59$ | $23325 \cdot 0$ | $\cdot 69$ | $\begin{array}{lllll}2 & 32 & 40 \cdot 9\end{array}$ | 78 | $3150 \cdot 9$ | -88 |
| 52 | 2 31 1 <br>  26  | $\cdot 43$ | $\begin{array}{llll}2 & 30 & 32 \cdot 6 \\ 2 & 26 & \\ 2\end{array}$ | $\cdot 52$ | $\begin{array}{ll}2 & 29 \\ 2 & 58.4 \\ 2 & 53\end{array}$ | $\cdot 62$ |  | $\cdot 72$ | $\begin{array}{llll}2 & 28 & 32 \cdot 5 \\ 2 & 2 & 3\end{array}$ | $\begin{array}{r}\text {. } 82 \\ \\ \hline 85\end{array}$ | $2740 \cdot 5$ | . 92 |
| 53 | $\begin{array}{lllll}2 & 26 & 58 \cdot 4 \\ 2 & 22 & 55.5\end{array}$ | 45 | 226 | 54 | $22553 \cdot \mathrm{I}$ |  | 225 II.5 | $\cdot 74$ | 224 23.8 | .85 | 2329.6 | -96 |
| 5 | 2255 |  | 222 | $\cdot 57$ | 2147 |  | 21 | -78 | 2014.5 |  | 1918.2 | 1.0 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ}$ A. |  | L. 9 | A. | L. 10 | - A. | L. 11 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} \\ +\quad .42 \end{gathered}$ | S. -4.02 | $\begin{gathered} \mathrm{s} . \\ +\quad \cdot 49 \end{gathered}$ | S. | $\begin{gathered} \mathrm{s} \\ +\quad .56 \end{gathered}$ | $\begin{gathered} s . \\ -4.04 \end{gathered}$ | $\begin{aligned} & \text { s. } \\ & +\quad .63 \end{aligned}$ | $\begin{gathered} s . \\ -4.05 \end{gathered}$ | S. $+\quad .70$ | $\begin{gathered} s . \\ -4.06 \end{gathered}$ | S. $+\quad .78$ | S. $-4.07$ |
| 2 | $\begin{array}{r}+42 \\ \hline .42\end{array}$ | -4.02 4.02 | $+\quad 49$ 49 | -4.03 4.03 | +.56 +.56 | -4.04 4.04 | $\begin{array}{r}+.63 \\ \hline .63\end{array}$ | -4.05 4.05 | $\begin{array}{r}+.70 \\ \hline 70\end{array}$ | 4.06 4.06 | $+\quad .78$ $\cdot 77$ | 4.07 4.07 |
| 4 | -42 | 4.02 | $\cdot 49$ | 4.03 | -56 | 4.04 | -63 | 4.05 | $\cdot 70$ | $4 \cdot 06$ | $\cdot 77$ | 4.07 |
| 6 | -4I | 4.02 | -48 | 4.03 | - 56 | 4.04 | -63 | 4.05 | $\cdot 70$ | $4 \cdot 06$ | -77 | $4 \cdot 07$ |
| 8 | -41 | 4.02 | -48 | 4.03 | -56 | $4 \cdot 04$ | -63 | 4.05 | $\cdot 70$ | $4 \cdot 06$ | $\cdot 77$ | $4 \cdot 07$ |
| 10 | + 41 I | 4.02 | + 49 | 4.03 | +.56 | 4.04 | +.63 | $4 \cdot 05$ | + $\cdot 70$ | 4.06 | + $\cdot 78$ | 4.07 |
| 12 | -4I | 4.02 | -49 | $4 \cdot 03$ | - 56 | 4.04 | -63 | 4.05 | $\cdot 71$ | $4 \cdot 06$ | $\cdot 78$ | $4 \cdot 07$ |
| 14 | -4I | 4.02 | -49 | $4 \cdot 03$ | -56 | $4 \cdot 04$ | -63 | 4.05 | -71 | $4 \cdot 06$ | -78 | $4 \cdot 08$ |
| 16 | -42 | 4.02 | -49 | $4 \cdot 03$ | $\cdot 56$ | $4 \cdot 04$ | -64 | 4.05 | $\cdot 71$ | 4.06 | $\cdot 79$ | 4.08 |
| 18 | $\cdot 42$ | 4.02 | $\cdot 49$ | $4 \cdot 03$ | $\cdot 57$ | $4 \cdot 04$ | -64 | 4.05 | $\cdot 72$ | $4 \cdot 06$ | -79 | $4 \cdot 08$ |
| 20 | + 42 | 4.02 | + 50 | $4 \cdot 03$ | + 57 | $4 \cdot 04$ | +.65 | $4 \cdot 05$ | + $\cdot 72$ | 4.06 | $+.80$ | 4.08 |
| 22 | -42 | 4.02 | $\cdot 50$ | $4 \cdot 03$ | - 58 | 4.04 | . 65 | 4.05 | -73 | 407 | .81 | $4 \cdot 08$ |
| 24 | -43 | 4.02 | $\cdot 51$ | $4 \cdot 03$ | -58 | $4 \cdot 04$ | -66 | 4.05 | $\cdot 74$ | 4.07 | -82 | $4 \cdot 08$ |
| 26 | $\cdot 43$ | 4.02 | -51 | 4.03 | - 59 | $4 \cdot 04$ | $\cdot 67$ | 4.06 | $\cdot 75$ | 4.07 | . 83 | 4.09 |
| 28 | $\cdot 44$ | $4 \cdot 02$ | -52 | $4 \cdot 03$ | $\cdot 60$ | 4.04 | -68 | $4 \cdot 06$ | $\cdot 76$ | 4.07 | -84 | 4.09 |
| 30 | + $\cdot 44$ | 4.02 | +.53 | 4.03 | +.61 | 4.05 | $+.69$ | 4.06 | + 78 | $4 \cdot 07$ | + 86 | 4.09 |
| 32 | - 45 | 4.03 | $\cdot 53$ | $4 \cdot 04$ | - 62 | $4 \cdot 05$ | $\cdot 70$ | 4.06 | $\cdot 79$ | $4 \cdot 08$ | . 88 | 4.09 |
| 34 | $\cdot 46$ | 4.03 | - 55 | 4.04 | -63 | 4.05 | $\cdot 72$ | 4.06 | .81 | 4.08 | -89 | $4 \cdot 10$ |
| 36 | -47 | $4 \cdot 03$ | $\cdot 56$ | 4.04 | - 65 | 4.05 | -73 | 4.07 | -82 | 4.08 | -91 | $4 \cdot 10$ |
| 38 | -48 | 4.03 | $\cdot 57$ | $4 \cdot 04$ | -66 | 4.05 | $\cdot 75$ | 4.07 | $\cdot 84$ | 4.09 | $\cdot 94$ | $4 \cdot 11$ |
| 40 | + 49 | 4.03 | +.58 | $4 \cdot 04$ | +.68 | 4.06 | + 77 | 4.07 | +.87 | $4 \cdot 09$ | + .96 | 4-11 |
| 42 | -50 | 4.03 | -60 | $4 \cdot 05$ | $\cdot 70$ | $4 \cdot 06$ | $\cdot 79$ | 4.08 | $\cdot 89$ | $4 \cdot 10$ | $\cdot 99$ | $4 \cdot 12$ |
| 44 | -52 | 4.03 | . 62 | 4.05 | $\cdot 72$ | 4.06 | . 82 | 4.08 | $\cdot 92$ | 4-II | 1.03 | 4.13 |
| 46 | - 53 | 4.04 | -64 | 4.05 | $\cdot 74$ | 4.07 | -85 | $4 \cdot 09$ | $\cdot 95$ | $4 \cdot 11$ | I.06 | $4 \cdot 14$ |
| 48 | $\cdot 55$ | 4.04 | -66 | $4 \cdot 05$ | $\cdot 77$ | 4.07 | -88 | 4.10 | -99 | $4 \cdot 12$ | I. 10 | 4.15 |
| 50 | $+.57$ | 4.04 | +.68 | 4.06 | + 80 | 4.08 | + 91 | 4.ro | +1.03 | 4.13 | +I. 15 | 4.16 |
| 52 | - 60 | 4.04 | $\cdot 71$ | $4 \cdot 06$ | -83 | 4.09 | -95 | $4 \cdot 11$ | I. 08 | $4 \cdot 14$ | I-20 | $4 \cdot 18$ |
| 54 | $\cdot 62$ | 4.05 | $\cdot 75$ | $4 \cdot 07$ | . 87 | 4.09 | 1.00 | $4 \cdot 12$ | I•13 | $4 \cdot 16$ | I-26 | 4.19 |

8 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT.
LATITUDE $1^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl Var | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | H. M. | S. | H. M. S. | S. | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 59 \cdot 8 \end{array}$ | S. | H. M. S. | S. | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 8.8 \end{array}$ | S. | H. M. S. |  |
| 10 | $5 \begin{array}{llll}5 & 19 & 57 \cdot 3\end{array}$ | -08 | $\begin{array}{llll}5 & 19 & 52 \cdot 1\end{array}$ | -.09 | 5 I9 46.I | - . 10 | 51939.4 | 12 | 5 I9 3I•8 | 3 | 51923.4 | -I5 |
| 12 | 5 II $46 \cdot 4$ | - I I | 5 II 39.3 | -12 | 5 II 3I-2 | 14 | 5 II 22.2 | 6 | 5 II 12.1 | -18 | 5 II I 0 | -19 |
| 14 | $\begin{array}{llll}5 & 3 & 35 \cdot 5\end{array}$ | -14 | $\begin{array}{llll}5 & 3 & 26 \cdot 4\end{array}$ | 6 | $\begin{array}{llll}5 & 3 & 16 \cdot 2\end{array}$ | 18 | $\begin{array}{llll}5 & 3 & 4 \cdot 7\end{array}$ | -20 | $\begin{array}{llll}5 & 2 & 52 \cdot 2\end{array}$ | -22 | $\begin{array}{llll}5 & 2 & 38 \cdot 4\end{array}$ | 24 |
| 16 | $455 \quad 24.4$ | 17 | $45513 \cdot 3$ | -19 | $455 \quad 0 \cdot 9$ | 22 | 454 47•I | - 24 | $45432 \cdot 0$ | 26 | $4 \begin{array}{lll}44 & 15 \cdot 4\end{array}$ | -29 |
| 18 | 447 I3. | 20 | 447 | 23 | 4 | $\cdot 26$ | 446 29:2 | - 28 | 446 II*5 | -3I | 445 52.I | 34 |
| 20 | 439 1.7 | . 24 | $438 \quad 46 \cdot 5$ | $\cdot 27$ | $438129 \cdot 6$ | 30 | $4 \quad 3810 \cdot 9$ | $\cdot 32$ | $437 \quad 50 \cdot 5$ | -35 | $\begin{array}{llll}4 & 37 & 28 \cdot 3\end{array}$ | 38 |
| 22 | $43050 \cdot 0$ | -27 | $43032 \cdot 6$ | $\cdot 30$ | 43013.4 | -33 | $42952 \cdot 2$ | $\cdot 37$ | 42929.1 | 40 | 429309 | -44 |
| 24 | $42238 \cdot 0$ | $\cdot 31$ | $42218 \cdot 5$ | -34 | $42156 \cdot 9$ | $\cdot 38$ | $42133 \cdot 1$ | -4I | 4 2I 7-I | 45 | $42038 \cdot 9$ | 9 |
| 26 | $41425 \%$ | - 34 | $4 \begin{array}{lll}4 & 14 & 3 \cdot 9\end{array}$ | $\cdot 38$ | $4 \begin{array}{lllll}4 & 13 & 39 \cdot 8\end{array}$ | $\cdot 42$ | 44 I  | -46 | 4 I2 44.5 | -50 | 4 I2 I $13 \cdot 2$ | 54 |
| 28 | 4613. | $\cdot 38$ | $4 \quad 54$ | 42 | $\begin{array}{llll}4 & 5 & 22 \cdot 3\end{array}$ | - 46 | $\begin{array}{llll}4 & 4 & 53 \cdot 1\end{array}$ | -51 | $\begin{array}{llll}4 & 4 & 21.2\end{array}$ | - 55 | 4   <br>  3 $46 \cdot 6$ | 60 |
| 30 | 358 | $\cdot 42$ | 35733. | $\cdot 46$ | $\begin{array}{llll}3 & 57 & 4 \cdot 2\end{array}$ | . 51 | 356 | . 56 | $355 \quad 57 \cdot 0$ | -6I | 355190 | 66 |
| 31 | $\begin{array}{lllll}3 & 53 & 53.3\end{array}$ | -44 | $\begin{array}{llll}3 & 53 & 25 \cdot 5\end{array}$ | -49 | 352254.9 | - 53 | $35221 \cdot 2$ | -58 | 3 51 $44 \cdot 6$ | -64 | $3 \begin{array}{lll}3 & 51 & 4.8\end{array}$ | 69 |
| 32 | $34946 \cdot 5$ | $\cdot 46$ | $3 \quad 49$ I7•4 | -5I | $34845 \cdot 3$ | -56 |  | -6I | $3 \begin{array}{llllllll}3 & 47 & 31\end{array}$ | -66 | $\begin{array}{llllllllllllllllll}3 & 46 & 50 \cdot 3\end{array}$ | 72 |
| 33 | 34539.5 | $\cdot 4$ | 345 9•I | -53 | $34435 \cdot 6$ | $\cdot 58$ | $\begin{array}{lllllllllll}3 & 43 & 58\end{array}$ | -64 | $\begin{array}{lllll}3 & 43 & 18.9\end{array}$ | -69 | $\begin{array}{lllll}3 & 42 & 35 \cdot 5\end{array}$ | -75 |
| 3 | $\begin{array}{lllll}3 & 41 & 32 \cdot 3\end{array}$ | - 50 | 34150.6 | -55 | $34025 \cdot 6$ | - .6I | $339947 \cdot 3$ | - 67 | $\begin{array}{lll}3 & 39 & 5 \cdot 6\end{array}$ | - 72 |  | $\cdot 78$ |
| 3 | $\begin{array}{llll}3 & 37 & 25 \cdot 1\end{array}$ | -52 | $\begin{array}{lllll}3 & 36 & 51 \cdot 9\end{array}$ | - 58 | $\begin{array}{llll}3 & 36 & 15 \cdot 5\end{array}$ | - | $3 \begin{array}{llll}3 & 35 & 35 \cdot 5\end{array}$ | -69 | $33452 \cdot 0$ | -75 | $\begin{array}{llll}3 & 34 & 4 \cdot 8\end{array}$ | . 82 |
| 36 |  | -55 | $\begin{array}{lllll}3 & 32 & 43 \cdot 1\end{array}$ | -60 | $\begin{array}{llll}3 & 32 & 5 \cdot 1\end{array}$ | -66 | $3 \mathrm{3I} 23.4$ | $\cdot 72$ | $33^{30} 38 \cdot \mathrm{I}$ | 9 | $\begin{array}{lllllllll}3 & 29 & 48 \cdot 9\end{array}$ | 85 |
| 37 | 329 10.0 | -57 | $3{ }^{3} 8834^{\circ} \mathrm{O}$ | -63 | $3 \begin{array}{lllll}3 & 27 & 54.4\end{array}$ | -69 | 327 II•O | $\cdot 75$ |  | 2 | $\begin{array}{lllllllllllllll}3 & 25 & 32 \cdot 6\end{array}$ | 89 |
| 38 | $325 \quad 2 \cdot 1$ | -59 | $\begin{array}{lllll}3 & 24 & 24.7\end{array}$ | -65 | $\begin{array}{lllllllll}3 & 23 & 43\end{array}$ | $\cdot 72$ | $\begin{array}{llll}3 & 22 & 58 \cdot 3\end{array}$ | 9 | $\begin{array}{llll}3 & 22 & 9 \cdot 1\end{array}$ | 5 | $\begin{array}{llll}3 & 21 & 15.8\end{array}$ | 92 |
| 39 | $32054 \cdot 1$ | -62 | $32015 \cdot 1$ | -68 | 3 I9 32.2 | - •75 | $\begin{array}{llll}3 & 18 & 45: 2\end{array}$ | - $\cdot 82$ | 3 I7 54.0 | - $\cdot 89$ | 3 I6 $58 \cdot 6$ | -96 |
| 40 | 3 I6 45.9 | -64 | $\begin{array}{llll}3 & 16 & 5 \cdot 3\end{array}$ | $\cdot 71$ | 3 I5 20.7 | $\cdot 78$ |  |  | $\begin{array}{llll}3 & 13 & 38.5\end{array}$ | -92 | $\begin{array}{lllll}3 & 12 & 40 \cdot 8\end{array}$ | I. 00 |
| 41 |  | . 67 | 3 II 55.2 | $\cdot 7$ | 3 II 8.8 | -81 | $31017 \cdot 9$ | 8 | $\begin{array}{llll}3 & 9 & 22.5\end{array}$ | 96 | $\begin{array}{llll}3 & 8 & 22.5\end{array}$ | 4 |
| 42 | $\begin{array}{llll}3 & 8 & 28 \cdot 6\end{array}$ | -69 | $\begin{array}{llll}3 & 7 & 44 \cdot 8\end{array}$ | $\cdot 77$ | $\begin{array}{llll}3 & 6 & 56 \cdot 5\end{array}$ | 8 | $\begin{array}{llll}3 & 6 & 3.6\end{array}$ | '92 | $\begin{array}{lll}3 & 5 & 6 \cdot 0\end{array}$ | 0 | $\begin{array}{lll}3 & 4 & 3 \cdot 5\end{array}$ | 8 |
| 43 | $\begin{array}{llll}3 & 4 & 19.6\end{array}$ | $\cdot 72$ | $3 \quad 3 \quad 34^{\circ} \mathrm{O}$ | -80 | $\begin{array}{llll}3 & 2 & 43 \cdot 8\end{array}$ | -88 | $\begin{array}{lllll}3 & 1 & 48.9\end{array}$ | $\cdot 96$ | $3 \quad 0 \quad 48 \cdot 9$ | 1.04 | $2 \begin{array}{llll}59 & 43.9\end{array}$ | 1-13 |
| 4 | 3010 | 7 | $\begin{array}{llll}2 & 59 & 22.9\end{array}$ | -8 | $\begin{array}{llll}2 & 58 & 30 \cdot 7\end{array}$ | - 91 | 25733.6 | - 99 | $25631 \cdot 3$ | - I• | $25523 * 7$ | - I'17 |
| 45 | $256 \quad 0 \cdot 7$ | $\cdot 78$ | 25511.4 | -86 | $25417 \cdot 2$ | -95 | $25317 \cdot 8$ | I. 03 | 25213.0 | 3 | 251 | I 22 |
| 46 | 25 I 50.8 | .81 | $25059 \cdot 5$ | -90 | 250 | -98 | 249 I•3 | I | $24754{ }^{\circ}$ | 1.17 | $24640 \cdot 8$ | 1.27 |
| 47 |  | 88 | $2 \begin{array}{lllllll}2 & 46 & 47 \cdot 2\end{array}$ | -93 | $24548 \cdot 6$ | I.02 | $24444 \cdot 3$ | 12 | 243134.2 | 1.22 | $2 \begin{array}{llll}2 & 42 & 18 \cdot 1\end{array}$ | I. 32 |
| 48 | $2 \begin{array}{llll}2 & 43 & 29 \cdot 7\end{array}$ | -88 | $2 \begin{array}{llll}22 & 34.4\end{array}$ | -97 |  | I.06 | $24026 \cdot 6$ | I•16 | $2 \begin{array}{llll}2 & 39 & 13.7\end{array}$ | I. 27 | $2 \begin{array}{lllllllll} & 37 & 54.4\end{array}$ | I•37 |
| 49 | $\begin{array}{lllll}2 & 39 & 18.6\end{array}$ | -.91 | $23^{2} 8821.0$ | -I.OI | 23717.6 | -I•II | $2{ }^{2} 3688 \cdot 1$ | -1.2I | $2 \begin{array}{llll}2 & 34 & 52 \cdot 2\end{array}$ | - I•32 | 23329.7 | - I 43 |
| 50 | 235780 | -95 | $234 \begin{array}{llll} & 7 & 1\end{array}$ | $1 \cdot 05$ | 233 I. 2 | I• 5 | $23148 \cdot 8$ | 1.26 | 23029.8 | $1 \cdot 37$ | $22963 \cdot 8$ | I.49 |
| 51 | 23054.8 | -99 | 22952.6 | I.09 | $22844^{\circ} \mathrm{O}$ | . 20 | $2 \begin{array}{llllllllll}27 & 27\end{array}$ | 1-3I | $2 \begin{array}{lll}26 & 26 & 3\end{array}$ | I.43 | $22436 \cdot 8$ | 1.56 |
| 52 | $\begin{array}{llll}2 & 26 & 42 \cdot 2 \\ 2 & 22 & 28.9\end{array}$ | I.03 | $\begin{array}{llll}2 & 25 & 37 \cdot 4 \\ 2 & 25 & 21.5\end{array}$ | $1 \cdot 13$ | $\begin{array}{llll}2 & 24 & 26.0\end{array}$ | I 25 | $\begin{array}{llll}2 & 23 & 7 \cdot 5 \\ 2 & 7 & 75 \cdot 3\end{array}$ | 1.37 |  | 1.49 | $\begin{array}{lll}2 & 20 & 8 \cdot 3\end{array}$ | I. 62 |
| 53 | $22228 \cdot 9$ | 1.07 | $22121 \cdot 5$ | I.18 | $220 \quad 7 \cdot 0$ | I.30 | 2 I8 $45 \cdot 3$ | 1.43 | 2 I7 15.8 | I.56 | 2 I5 $38 \cdot 3$ | I. 69 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ}$ | ${ }^{\circ} \mathrm{A}$. | L. 1 | - A. | L. $14^{\circ}$ | - A. | L. $15^{\circ}$ | - A. | L. $16^{\circ}$ | A. | L. $17^{\circ}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .85 \end{aligned}$ | $\begin{gathered} s . \\ -4.09 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .92 \end{aligned}$ | $\begin{gathered} s . \\ -4^{\circ} I I \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 00 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 12 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 07 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot I 4 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 15 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 16 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 22 \end{gathered}$ | s. |
| 2 | $\begin{array}{r}\text { + } \\ +.85 \\ \hline .85\end{array}$ | -4.09 4.09 | ( $+\quad .92$ .92 | $-4 \cdot 11$ 4.11 | +1.00 .99 | -4.12 $4 \cdot 12$ | +1.07 1.07 | -4.14 4.14 | +1.15 I.14 | $-4 \cdot 16$ $4 \cdot 16$ | +1.22 I .22 | 4.18 4.18 |
| 4 | -85 | 4.09 | -92 | $4 \cdot 10$ | -99 | 4.12 | 1.07 | $4 \cdot 14$ | I. 14 | $4 \cdot 16$ | I. 22 | $4 \cdot 18$ |
| 6 | -85 | 4.09 | -92 | $4 \cdot 10$ | -99 | $4 \cdot 12$ | 1.07 | 4.14 | I. 15 | $4 \cdot 16$ | I 22 | 4.18 |
| 8 | $\cdot 85$ | 4.09 | -92 | 4.10 | 1.00 | $4 \cdot 12$ | 1.07 | $4 \cdot 14$ | I. 15 | 4-16 | $1 \cdot 22$ | 4.18 |
| 10 | +.85 | 4.09 | + 92 | 4•II | +1.00 | $4 \cdot 12$ | +1.07 | 4.14 | +I•15 | $4 \cdot 16$ | +1.23 | 4•18 |
| 12 | . 85 | 4.09 | .93 | 4.11 | I.OO | $4 \cdot 12$ | 1.08 | $4 \cdot 14$ | I-16 | $4 \cdot 16$ | 1.24 | $4 \cdot 19$ |
| 14 | -86 | 4.09 | -93 | 4.II | I.OI | $4 \cdot 12$ | I.09 | $4 \cdot 14$ | 1.17 | $4 \cdot 17$ | $1 \cdot 24$ | 4-19 |
| 16 | -86 | 4.09 | -94 | 4.II | 1.02 | $4 \cdot 13$ | I-IO | $4 \cdot 15$ | 1-17 | $4 \cdot 17$ | I 25 | 4-19 |
| 18 | . 87 | 4.09 | -95 | 4.II | I.03 | $4 \cdot 13$ | 1*10 | $4 \cdot 15$ | I•18 | 4-17 | 1.27 | $4 \cdot 19$ |
| 20 | +.88 | 4.10 | + 96 | 4•II | +I.04 | $4 \cdot 13$ | +1.12 | 4.15 | +1.20 | 4•7 | + I. 28 | $4 \cdot 20$ |
| 22 | -89 | 4.10 | -97 | $4 \cdot 12$ | I.05 | $4 \cdot 13$ | I-I3 | $4 \cdot 16$ | I-2I | $4 \cdot 18$ | $1 \cdot 30$ | $4 \cdot 20$ |
| 24 | -90 | 4.10 | -98 | $4 \cdot 12$ | I.06 | $4 \cdot 14$ | I-I5 | $4 \cdot 16$ | I. 23 | 4.18 | I 31 | $4 \cdot 21$ |
| 26 | '91 | $4 \cdot 10$ | I'00 | 4.12 | I.08 | $4 \cdot 14$ | I•16 | $4 \cdot 16$ | I 25 | 4•19 | I 34 | $4 \cdot 22$ |
| 28 | -93 | $4 \cdot 11$ | I $\cdot \mathrm{OI}$ | $4 \cdot 13$ | I-10 | $4 \cdot 15$ | I-I8 | $4 \cdot 17$ | 1.27 | $4 \cdot 20$ | I.36 | $4 \cdot 22$ |
| 30 | + 94 | 4.II | +1.03 | 4-13 | +1.12 | $4 \cdot 15$ | +1.2I | 4.18 | +1.30 | 4.20 | +1.39 | $4 \cdot 23$ |
| 32 | $\cdot 96$ | 4.II | 1.05 | $4 \cdot 14$ | I-14 | 4.16 | 1.23 | $4 \cdot 18$ | 1.32 | $4 \cdot 21$ | I 42 | $4 \cdot 24$ |
| 34 | . 98 | $4 \cdot 12$ | 1.07 | $4 \cdot 14$ | 1-17 | $4 \cdot 17$ | I. 26 | $4 \cdot 19$ | I.35 | $4 \cdot 22$ | 1.45 | 4.25 |
| 36 | 101 | 4*12 | I-IO | $4 \cdot 15$ | 1.20 | $4 \cdot 17$ | I. 29 | $4 \cdot 20$ | I 39 | $4 \cdot 23$ | I 49 | 4.27 |
| 38 | 1.03 | 4.13 | I.I3 | 4.16 | 1.23 | 4.18 | $1 \cdot 33$ | $4 \cdot 21$ | 1.43 | $4 \cdot 25$ | I.53 | $4 \cdot 28$ |
| 40 | +1.06 | 4•14 | +I.16 | 4.16 | +1.26 | 4.19 | +1.37 | 4.23 | +1.47 | $4 \cdot 26$ | +1.58 | $4 \cdot 30$ |
| 42 | $1 \cdot 09$ | 4•15 | I 20 | 4.17 | 1-30 | $4 \cdot 21$ | 1.41 | $4 \cdot 24$ | I. 52 | $4 \cdot 28$ | 1.63 | $4 \cdot 32$ |
| 44 | I.I3 | 4.16 | I. 24 | 4.19 | 1.35 | 4.22 | 1.46 | 4.26 | 1.58 | $4 \cdot 30$ | 1.69 | $4 \cdot 34$ |
| 46 | I.I7 | $4 \cdot 17$ | I. 28 | $4 \cdot 20$ | I. 40 | $4 \cdot 24$ | 1.52 | $4 \cdot 28$ | 1.64 | $4 \cdot 32$ | 1.76 | $4 \cdot 37$ |
| 48 | I. 22 | 4.18 | I•34 | 4.22 | 1.46 | $4 \cdot 26$ | 1.58 | $4 \cdot 30$ | 1-71 | $4 \cdot 35$ | I.84 | $4 \cdot 40$ |
| 50 | +1.27 | $4 \cdot 20$ | +1.39 | $4 \cdot 24$ | +1.52 | $4 \cdot 28$ | +1.65 | $4 \cdot 33$ | +1.79 | $4 \cdot 38$ | +I.93 | $4 \cdot 44$ |
| 52 | $1 \cdot 33$ | $4 \cdot 22$ | I 46 | $4 \cdot 26$ | 1.60 | $4 \cdot 31$ | $1 \cdot 74$ | $4 \cdot 36$ | 1.88 | 4.42 | 2.03 | $4 \cdot 49$ |

## LATITUDE $1^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ |  | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| o | $\left\lvert\, \begin{array}{ll} \text { H. M. M. } \\ 6 \\ \text { I } & \text { I } \end{array}\right.$ | + ${ }^{\text {S }}$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { I2. } \end{array}$ | + . 08 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I7.3 } \end{array}\right.$ | +.08 | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 62 \cdot \mathrm{I} \end{array}\right\|$ | . S . | $\left\|\begin{array}{lcc} \text { H. M. } \\ 6 & \text { I } & 37.0 \end{array}\right\|$ | $\begin{array}{r}\text { S. } \\ +\quad .08 \\ \hline\end{array}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 4 \mathrm{I} \cdot 9 \end{array}\right.$ |  |
| 10 | 51914.0 | - . 6 | $\begin{array}{llll}5 & 19 & 3.8\end{array}$ | -18 | $\begin{array}{lllll}5 & 18 & 52 \cdot 7\end{array}$ | - 19 | $5 \begin{array}{llll}5 & 18 & 40 \cdot 6\end{array}$ | $\cdot 21$ | 51818376 | - 22 |  |  |
| 12 | 5 10 $48 \cdot 8$ | -21 | 5 10 35.5 | $\cdot 23$ | 10 21.2 | - 25 | 5 10 $5 \cdot 7$ | $\cdot 27$ | $\begin{array}{llll}5 & 9 & 49 \cdot 0\end{array}$ | - 29 | $\begin{array}{llll}5 & 9 & 3 \mathrm{I} \cdot \mathrm{I}\end{array}$ | $\cdot 31$ |
| 14 | $\begin{array}{llll}5 & 2 & 23.3\end{array}$ | - 26 | $\begin{array}{llll}5 & 2 & 6 \cdot 9\end{array}$ | -28 | 5 I 49.3 | $\cdot 30$ | 5 I 30.2 | -33 | I 9.8 | $\cdot 35$ | - 48.0 | 38 |
| 16 | 4 533574 | 31 | $4 \begin{array}{llll}4 & 37 \cdot 9\end{array}$ | 34 | $5316 \cdot 9$ | $\cdot 36$ | 5254.3 | $\cdot 39$ | $5230 \cdot 1$ | 42 | $52 \quad 4.2$ | 44 |
| 18 | 44531 | - 36 | $4 \begin{array}{lll}4 & 45 & 8.4\end{array}$ | - 39 | 4443.9 | - $\cdot 42$ | 44 17•7 | 5 | $44349 \cdot 6$ | - 48 | 4319.6 |  |
| 20 | $\begin{array}{lllll}4 & 37 & 4 \cdot 2\end{array}$ | $\cdot 42$ | $\begin{array}{lllll}4 & 36 & 38 \cdot 2\end{array}$ | $\cdot 45$ | $43610 \cdot 2$ | - 48 | $3540 \cdot 2$ | - 52 | 4358.1 | $\cdot 55$ | 3433.9 | 9 |
| 22 | $42836 \cdot 7$ | -47 | $\begin{array}{lllll}4 & 28 & 7.3\end{array}$ | $\cdot 51$ | $42735 \cdot 7$ | $\cdot 54$ | 44 27 1.8 <br>  18  | - 58 | $42625 \cdot 7$ | . 62 | 25 47.I | 6 |
| 24 | $\begin{array}{llll}4 & 20 & 8.5\end{array}$ | 53 |  | - 57 | $4 \begin{array}{llll}4 & 19 & 0.2\end{array}$ | .61 | $\begin{array}{llll}4 & 18 & 22.4\end{array}$ | . 65 | 41742.0 | O | 1658.8 | -74 |
| 26 | 411139.3 | -59 | 4 II $2 \cdot 8$ | $\cdot 63$ | 4 10 23.6 | . 67 | $4 \quad 941 \cdot 6$ | $\cdot 72$ | $4856 \cdot 8$ | 77 | $8 \quad 9.0$ | . 82 |
| 28 30 | $\begin{array}{cccc}4 & 3 & 9 \cdot 3 \\ 3 & 54 & 38 \cdot 0\end{array}$ | . 65 | $\begin{array}{rrrr}4 & 2 & 29.0 \\ 3 & 53 & 53.8 \\ 3 & 4 & 3\end{array}$ | - 70 | $\begin{array}{rrrr}4 & 1 & 45 \cdot 7 \\ 3 & 53 & 6.4 \\ & & & \end{array}$ | - .74 | $\begin{array}{rrrr}4 \\ 3 & 0 & 59.5 \\ 52 & 15 \cdot 6\end{array}$ | -.80 | 4 0 $10 \cdot 0$ <br> 3 51 $2 I \cdot 4$ <br> 3 4  | -. 85 | $5917 \cdot 4$ | . 91 |
| 31 | $\begin{array}{lllll}3 & 50 & 21.9\end{array}$ | 74 | $\begin{array}{lllllllllllllll}3 & 49 & 35 \cdot 7\end{array}$ | . 80 | 348 46-I | . 85 | $34753 \cdot 0$ | $\cdot 91$ | $\begin{array}{lllll}3 & 46 & 56 \cdot 3\end{array}$ | 98 | 45 | 99 |
| 32 | $\begin{array}{llll}3 & 46 & 5 \cdot 5\end{array}$ | $\cdot 77$ | $\begin{array}{llllllllllll}3 & 45 & 17 \cdot 2\end{array}$ | . 83 | 34425.4 | $\cdot 89$ | $\begin{array}{lllllllllll}3 & 43 & 29 \cdot 9\end{array}$ | .96 | $34230 \cdot 6$ | 1.02 | $4127 \cdot 3$ |  |
| 33 | $\begin{array}{llll}3 & 41 & 48.7\end{array}$ |  | $34058 \cdot 3$ | -87 | 3404.2 | 93 | $\begin{array}{llll}3 & 39 & 6 \cdot 2\end{array}$ | I.00 | $\begin{array}{llll}3 & 38 & 4 \cdot 3\end{array}$ | 7 | $3658 \cdot 2$ | I-I4 |
| 34 | $\begin{array}{llll}3 & 37 & 31.5\end{array}$ | . 84 | $\begin{array}{lllll}3 & 36 & 38.9\end{array}$ | - 91 | $3542 \cdot 4$ | - 97 | $\begin{array}{lllll}3 & 34 & 41 \cdot 9\end{array}$ | - 1.04 | $3337 \cdot 3$ | -I•II | $3228 \cdot 3$ | -19 |
| 35 | 3 33 18.9 <br> 3 38  | . 88 | $\begin{array}{llll}3 & 32 & 19.0 \\ 3 & 27 & 5\end{array}$ | -95 | 3120.1 | 1.02 |  | $1 \cdot 09$ | $29 \quad 9 \cdot 6$ | $1 \cdot 16$ | $2757 \cdot 6$ | 24 |
| 36 |  | -92 | $\begin{array}{llllllllllllllllll}3 & 27 & 58.7\end{array}$ | 99 | $32657 \cdot 3$ | I.06 | $\begin{array}{llll}3 & 25 & 51.5\end{array}$ | $1 \cdot 13$ | $32441 \cdot 2$ | 1.21 | 23 26-1 |  |
| 37 | $\begin{array}{lllllllllll}3 & 24 & 37.3\end{array}$ | -96 | $\begin{array}{llll}3 & 23 & 37 \cdot 7\end{array}$ | O3 | $\begin{array}{llll}3 & 22 & 33 \cdot 7\end{array}$ | I•10 | $\begin{array}{llll}3 & 21 & 25.2\end{array}$ | I.18 | 32011.9 | 1.26 | I8 53.6 | 5 |
| 38 |  |  | $\begin{array}{lllll}3 & 19 & 16.2\end{array}$ | 7 | $\begin{array}{llll}3 & 18 & 9.5\end{array}$ | 1-15 | $31658 \cdot 1$ | $1 \cdot 23$ | $31541 \cdot 7$ | $\cdot 32$ | $1420 \cdot 1$ | O |
| 39 |  | - $\mathrm{I} \cdot 04$ | $\begin{array}{llll}3 & 14 & 54.0\end{array}$ | I•12 | 31344.6 | - 1.20 | $3 \begin{array}{lllllll}3 & 12 & 30.2\end{array}$ | - 1.28 | $1110 \cdot 6$ | -1.37 | $945 \cdot 6$ | -I.46 |
| I | $\begin{array}{lllll}3 & 11 & 38.4\end{array}$ | 1.08 | 3 10 31-1 | I•16 | $\begin{array}{llll}3 & 9 & 18.9\end{array}$ | 25 | $\begin{array}{lll}3 & 8 & 1.4\end{array}$ | I 34 | $\begin{array}{ll}6 & 38 \cdot 5\end{array}$ | I 43 | $\begin{array}{lll}5 & 9.8\end{array}$ | I.53 |
| 41 42 | $\begin{array}{llll}3 & 7 & 17.5 \\ 3 & 2 & 55.9\end{array}$ |  | 43.1 | 26 |  | I 1.35 | 3 3 $31 \cdot 6$ <br> 2 59 0.8 <br> 2 5  | $\begin{array}{r}1.39 \\ \\ \text { I } 45 \\ \hline\end{array}$ | $\begin{array}{rrr}2 & 5.2 \\ 57 & 30.8 \\ 52 & 5 .\end{array}$ | 1.49 I 59 | $\begin{array}{rrrrr}3 & 0 & 32 \cdot 8 \\ 2 & 55 & 54.5\end{array}$ | I. 59 I 66 r |
| 42 43 | $\begin{array}{rrrr}3 & 2 & 55 \cdot 9 \\ 2 & 58 & 33.7\end{array}$ | I. 17 I 22 | $\begin{array}{rrr}1 & 43 \cdot 1 \\ 57 & 17 \cdot 9\end{array}$ | I 26 $\mathrm{I} \cdot 31$ | $\begin{array}{cccc}3 & 0 & 24 \cdot 8 \\ 2 & 55 & 56 \cdot 3\end{array}$ | 35 | $\begin{array}{llll}2 & 59 & 0 \cdot 8 \\ 2 & 54 & 28.8\end{array}$ | 1.45 | $\begin{array}{lll}57 & 30 \cdot 8 \\ 52 & 55 \cdot 1\end{array}$ | . 55 | $\begin{array}{llll}2 & 55 & 54 \cdot 5 \\ 2 & 51 & 14.6\end{array}$ | 6 |
| 4 | $25410 \cdot 5$ | -1.27 | $25251 \cdot 6$ | -1.36 | $5126 \cdot 7$ | -1.47 | 4955.6 | - 1.57 | 48 17.8 | - 1.69 | $4633 \cdot 2$ | I.81 |
| 45 | 2 49 | $1 \cdot 32$ | $\begin{array}{lllll}2 & 48 & 24.4\end{array}$ | I. 42 | $4656 \cdot 0$ | 1.53 | 245 21.1 | I. 64 | $2 \begin{array}{lllll} & 43 & 39.1\end{array}$ | I.76 | 4149 | + 88 |
| 46 | $\begin{array}{llll}2 & 45 & 21.6\end{array}$ | 1.37 | $\begin{array}{llll}2 & 43 & 56 \cdot 1\end{array}$ | 1.48 | 4224.0 | I. 59 | $4045 \cdot 0$ | 1.71 | 3858.8 | I.83 | 374.8 | . 97 |
| 48 | $\begin{array}{llllll}2 & 40 & 55.6\end{array}$ | 仡 | $\begin{array}{llll}2 & 39 & 26.6\end{array}$ | I. 54 | $3750 \cdot 7$ | I. 66 | $367 \cdot 4$ | $1 \cdot 78$ | $3416 \cdot 5$ | I•92 | $2 \begin{array}{llll} & 3 & 17.5\end{array}$ | $2 \cdot 05$ |
| 48 | $\begin{array}{lllll}2 & 36 & 28.7\end{array}$ | 1.49 | $23455 \cdot 8$ | I.6I | $3315 \cdot 8$ | I•73 | 3128 | 1.86 | 29 32-3 | - | 2727.9 | $2 \cdot 15$ |
| 49 | $\begin{array}{llrr}2 & 32 & 0.3 \\ 2 & 27 & 30.6\end{array}$ | -1.55 | $\begin{array}{llll}2 & 30 & 23.6 \\ 2 & 25\end{array}$ | - 1.67 | $\begin{array}{lllll}2 & 28 & 39.3\end{array}$ | $-\mathrm{I} .8 \mathrm{I}$ |  | - 1.94 | 2445.9 | -2.09 | $2235 \cdot 7$ | 2.25 |
| 50 | $\begin{array}{lllll}2 & 27 & 30 \cdot 6 \\ 2 & 22 & 59.6\end{array}$ | $1 \cdot 62$ |  | $\begin{array}{r}1.75 \\ \mathrm{r} \\ \hline\end{array}$ | 2 24 $0 \cdot 9$ <br> 2 19  | I.89 | $\begin{array}{lll}2 & 22 & 3.5 \\ 2 & 17 & 17.8\end{array}$ | 2.03 | $1956 \cdot 9$ | $2 \cdot 19$ | 17 40.7 | $2 \cdot 36$ |
|  | $\begin{array}{llll}2 & 22 & 59 \cdot 6 \\ 2 & 18 & 26.9\end{array}$ |  |  | 81 | $\begin{array}{llll}2 & 19 & 20 \cdot 5 \\ 2 & 14 & 38 \cdot 0\end{array}$ | 1.97 2.06 | $\begin{array}{llll}2 & 17 & 17 \cdot 8 \\ 2 & 12 & 20.4 \\ 2\end{array}$ | 2.13 2.23 | $\begin{array}{rrr}15 & 5 \cdot 3 \\ 10 & 10.7\end{array}$ | 2.29 | 1242 | 47 |
| 53 | 1352 |  | 2 I1 57 | $2 \cdot 00$ | $\begin{array}{llll}2 & 9 & 52 \cdot 9\end{array}$ | 2 | $\begin{array}{llll} \\ 2 & 7 & 7 & 38.3\end{array}$ | 2.34 | 512.6 | 2.5 2.53 | $740 \cdot 9$ 235.2 | 73 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ}$ | ${ }^{\circ} \mathrm{A}$. | L. | ${ }^{\circ} \mathrm{A}$. | L. $20^{\circ}$ | $0^{\circ} \mathrm{A}$. | L. $21{ }^{\circ}$ | - A. | L. $22^{\circ}$ | A. | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | S. $+1 \cdot 30$ | $\begin{gathered} s . \\ -4 \cdot 2 I \end{gathered}$ | $\begin{gathered} s . \\ +\mathbf{I} \cdot 38 \end{gathered}$ | $\begin{gathered} \text { S. } \\ -4 \cdot 23 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 46 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 53 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -4 \cdot 28 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 62 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 3 \mathrm{I} \end{gathered}$ | S. $+\mathrm{I} \cdot 70$ | S. -4.34 |
| 2 | +1.30 | 4.21 4 | +1.38 $\mathbf{1} \cdot 38$ | -4.23 4.23 | +1.46 1.45 | -4.26 4.26 | +1.53 1.53 | -4.28 4.28 | +1.62 I. | 4.31 4.31 | +1.70 I. 1 | -4.34 4.34 |
| 4 | I. 30 | $4 \cdot 20$ | 1.37 | $4 \cdot 23$ | 1.45 | 4.26 | 1.53 | $4 \cdot 28$ | I. 61 | 4.31 | 1.70 | 4.34 4 |
| 6 | I.30 | $4 \cdot 20$ | I.38 | $4 \cdot 23$ | 1.46 | $4 \cdot 26$ | 1.54 | $4 \cdot 28$ | I. 62 | $4 \cdot 31$ | I-70 | $4 \cdot 34$ |
| 8 | 1.30 | $4 \cdot 21$ | I. 38 | $4 \cdot 23$ | I.46 | $4 \cdot 26$ | 1.54 | $4 \cdot 29$ | I. 62 | $4 \cdot 32$ | 1.70 | $4 \cdot 35$ |
| 10 | +1.31 | $4 \cdot 21$ | +1.39 | $4 \cdot 23$ | +1.47 | $4 \cdot 26$ | +1.55 | 4.29 | +1.63 | $4 \cdot 32$ | +I•71 | 4.35 |
| 12 | 1.31 | $4 \cdot 21$ | I.39 | $4 \cdot 24$ | I. 47 | $4 \cdot 26$ | I. 56 | $4 \cdot 29$ | I. 64 | $4 \cdot 32$ | I•72 | 4.35 |
| 14 | 1.32 | $4 \cdot 21$ | 1.40 | $4 \cdot 24$ | 1.49 | $4 \cdot 27$ | 1.57 | $4 \cdot 30$ | I. 65 | $4 \cdot 33$ | I•74 | $4 \cdot 36$ |
| 16 | 1-33 | $4 \cdot 22$ | I.4I | $4 \cdot 24$ | I.50 | $4 \cdot 27$ | 1.58 | $4 \cdot 30$ | I. 67 | $4 \cdot 33$ | I•75 | $4 \cdot 37$ |
| I8 | 1.35 | $4 \cdot 22$ | I.43 | $4 \cdot 25$ | I.5I | $4 \cdot 28$ | 1.60 | $4 \cdot 31$ | I. 68 | $4 \cdot 34$ | 1•77 | $4 \cdot 38$ |
| 20 | +1.36 | $4 \cdot 22$ | +1.45 | 4.25 | +1.53 | $4 \cdot 28$ | +1.62 | $4 \cdot 31$ | +1・クI | $4 \cdot 35$ | +1•79 | $4 \cdot 38$ |
| 22 | 1.38 | $4 \cdot 23$ | I. 47 | $4 \cdot 26$ | I 55 | $4 \cdot 29$ | 1. 64 | $4 \cdot 32$ | I•73 | $4 \cdot 36$ | I.82 | $4 \cdot 39$ |
| 24 | 1.40 | $4 \cdot 24$ | I. 49 | $4 \cdot 27$ | I. 58 | $4 \cdot 30$ | 1.67 | $4 \cdot 33$ | 1.76 | $4 \cdot 37$ | I. 85 | $4 \cdot 4 \mathrm{I}$ |
| 26 | 1.42 | $4 \cdot 24$ | I.5I | $4 \cdot 28$ | I.60 | $4 \cdot 31$ | 1.70 | $4 \cdot 34$ | I•79 | $4 \cdot 38$ | I. 88 | 4.42 |
| 28 | 1.45 | $4 \cdot 25$ | I.54 | $4 \cdot 29$ | I.63 | $4 \cdot 32$ | 1•73 | $4 \cdot 36$ | I.82 | $4 \cdot 40$ | I•92 | $4 \cdot 44$ |
| 30 | +1.48 | $4 \cdot 26$ | +1.57 | $4 \cdot 30$ | +1.67 | $4 \cdot 33$ | +1.77 | $4 \cdot 37$ | + $\mathrm{I} \cdot 86$ | 4.41 | + I.97 | $4 \cdot 45$ |
| 32 | 1.51 | $4 \cdot 27$ | I.6I | $4 \cdot 31$ | 1.71 | $4 \cdot 35$ | I.81 | $4 \cdot 39$ | I.91 | 4.43 | 2.01 | $4 \cdot 48$ |
| 34 | 1.55 | 4.29 | I. 65 | $4 \cdot 33$ | 1.75 | $4 \cdot 37$ | 1.85 | 4.41 | I.96 | $4 \cdot 45$ | 2.07 | $4 \cdot 50$ |
| 36 | 1.59 | $4 \cdot 30$ | I. 69 | $4 \cdot 34$ | I.80. | $4 \cdot 39$ | 1.91 | 4.43 | $2 \cdot 02$ | $4 \cdot 48$ | $2 \cdot 13$ | $4 \cdot 53$ |
| 38 | 1.64 | $4 \cdot 32$ | 1.74 | $4 \cdot 36$ | 1.85 | 4.41 | 1-97 | $4 \cdot 46$ | $2 \cdot 08$ | $4 \cdot 51$ | $2 \cdot 20$ | $4 \cdot 56$ |
| 40 | + $\mathrm{I} \cdot 69$ | $4 \cdot 34$ | +1.80 | $4 \cdot 39$ | +I.91 | 4.43 | $+2.03$ | 4.49 | +2.16 | $4 \cdot 54$ | +2.28 | $4 \cdot 61$ |
| 42 | 1.75 | $4 \cdot 36$ | I.86 | $4 \cdot 41$ | I.98 | $4 \cdot 46$ | $2 \cdot 11$ | $4 \cdot 52$ | $2 \cdot 24$ | $4 \cdot 58$ | 2.37 | $4 \cdot 65$ |
| 44 | 1.81 | 4.39 | $1 \cdot 94$ | $4 \cdot 44$ | 2.06 | $4 \cdot 50$ | $2 \cdot 20$ | 4.56 | $2 \cdot 33$ | 4.63 | $2 \cdot 48$ | $4 \cdot 71$ |
| 48 | 1.89 | $4 \cdot 42$ | $2 \cdot 02$ | $4 \cdot 48$ | 2.16 | $4 \cdot 54$ | $2 \cdot 30$ | $4 \cdot 61$ | $2 \cdot 44$ | 4.69 | $2 \cdot 60$ | $4 \cdot 77$ |
| 48 | $1 \cdot 97$ | $4 \cdot 46$ | 2.11 | 4.52 | $2 \cdot 26$ | $4 \cdot 59$ | $2 \cdot 4 \mathrm{I}$ | $4 \cdot 67$ | $2 \cdot 57$ | $4 \cdot 75$ | $2 \cdot 74$ | 4.85 |
| 50 | +2.07 | $4 \cdot 51$ | +2.22 | $4 \cdot 58$ | $+2 \cdot 38$ | $4 \cdot 66$ | +2.55 | $4 \cdot 74$ | +2.72 | $4 \cdot 84$ | +2.90 | $4 \cdot 94$ |
| 52 | 2.19 | $4 \cdot 56$ | $2 \cdot 35$ | $4 \cdot 64$ | $2 \cdot 52$ | 4.73 | $2 \cdot 70$ | 4.83 | 2.90 | $4 \cdot 94$ | $3 \cdot 10$ | $5 \cdot 06$ |

DECLINATION-SAME NAME AS-LATITUDE.


VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS—LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 50 \cdot 5 \end{array}\right.$ | $+$ | $\begin{array}{ccc} \text { H. M. } & \text { S } \\ 6 & \text { O } & 59 \end{array}$ | $+$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 7 \cdot 5 \end{array}\right.$ | S. $+\quad$ I | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & \text { I } 6 \cdot I \end{array}$ | + | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 24^{\circ} 7 \end{array}$ | $4$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 33 \cdot 3 \end{array}$ | $\stackrel{\text { S. }}{ }$ |
| 10 | $52036 \cdot 4$ | -07 | $52040 \cdot 2$ | -06 | $52043 \cdot 2$ | -04 | $52045 \cdot 5$ | -03 | $52047 \cdot 1$ | -02 | $52047 \cdot 9$ | +.OI |
| 12 | $\begin{array}{lllll}5 & 12 & 33.7\end{array}$ | -05 | $51236 \cdot 5$ | -04 | $51238 \cdot 5$ | -02 | $51239 \cdot 5$ | + -OI | 5123907 | -00 | $\begin{array}{lllll}5 & 12 & 38 \cdot 9\end{array}$ | . 02 |
| 14 | $\begin{array}{llll}5 & 4 & 3 \mathrm{I} \cdot \mathrm{O}\end{array}$ | -04 | $5 \quad 4 \quad 32 \cdot 9$ | -02 | $5 \quad 433 \cdot 7$ | + 00 | $\begin{array}{llll}5 & 4 & 33 \cdot 5\end{array}$ | -OI | $5 \quad 4 \quad 32 \cdot 3$ | -03 | $\begin{array}{llll}5 & 4 & 29 \cdot 9\end{array}$ | 05 |
| 16 | $\begin{array}{llll}4 & 56 & 28 \cdot 4\end{array}$ | -02 | $456 \quad 29 \cdot 3$ | . 00 | $456 \quad 29 \cdot 0$ | - OI | $4 \quad 56 \quad 27 \cdot 5$ | 3 | $4 \quad 5624 \cdot 8$ | -05 | $456 \quad 20 \cdot 9$ | -07 |
| 18 | $448 \quad 25 \cdot 7$ | + ${ }^{\circ} \mathrm{OI}$ | $44825 \cdot 7$ | - -OI | 4481243 | -03 | 448 21.5 | -06 | $4 \begin{array}{llll}4 & 48 & 17 \cdot 3\end{array}$ | - 08 | 448 II•7 | - - I0 |
| 20 | $44023 \cdot 1$ | 0 | $44022 \cdot 1$ | 3 | 44019.6 | -05 | 44015.4 | -08 | 440 | -II | $440 \quad 2 \cdot 5$ | 3 |
| 22 | $432 \quad 20 \cdot 4$ | - 02 | 432 I 8.5 | -05 | 43214.8 | -07 | $432 \quad 9 \cdot 3$ | -10 | $432 \quad 2 \cdot 2$ | -13 | 43153.2 | 6 |
| 24 | $42417 \cdot 8$ | -03 | 42414.8 | . 06 | $\begin{array}{lll}4 & 24 & 9 \cdot 9\end{array}$ | -10 | $\begin{array}{lll}4 & 24 & 3 \cdot 2\end{array}$ | -13 | 42354.4 | -16 | 42343.8 | 19 |
| 26 | 4 I6 I5.1 | . 05 | 4 I6 II•I | 8 | 4 I6 $5 \cdot 0$ | -12 | $415 \quad 56 \cdot 9$ | -15 | $41546 \cdot 6$ |  | 4 I5 $34 \cdot 2$ | 2 |
| 28 | $\begin{array}{llll}4 & 8 & 12.4\end{array}$ | - .06 | 4 | - 10 | $4880 \cdot 1$ |  | $4750 \cdot 5$ |  | $4738 \cdot 6$ | - $\cdot 22$ | $4 \begin{array}{llll}4 & 7 & 24.3\end{array}$ | - 26 |
| 30 | $409 \cdot 7$ | .08 | $4 \quad 3.6$ | -12 | $35955 \%$ | I6 | 35943.9 | 20 | $35930 \cdot 4$ | - 25 | $359514 \% 2$ | 29 |
| 32 | $\begin{array}{llll}3 & 52 & 6 \cdot 9\end{array}$ | -10 | 33 59  <br> 1   | -14 | 3 5I $49 \cdot 8$ | 9 | 35137 | -23 | 3 51 21.9 | $\cdot 28$ | 351 | 32 |
| 33 | $348 \quad 5 \cdot 5$ | -10 | $34757 \cdot 7$ | -15 | $34747 \cdot 2$ | -20 | 34733.8 | - 24 |  | -29 | $34^{3} 4658 \cdot 5$ | 34 |
| 34 | $\begin{array}{llll}3 & 44 & 4 \cdot 1\end{array}$ | -11 | $34355 \cdot 8$ | -16 | $34344 \cdot 5$ | -2I | 343 30.4 | -26 |  | -31 | $34253 \cdot 1$ | 36 |
| 35 | $340 \quad 2 \cdot 7$ | 12 |  | $\cdot 17$ | 339 4I•8 | $\cdot 22$ | $33926 \cdot 9$ | $\cdot 27$ | $\begin{array}{llll}3 & 39 & 8 \cdot 8\end{array}$ | -33 | $\begin{array}{llll}3 & 38 & 47 \cdot 6\end{array}$ | 8 |
| 3 | $\begin{array}{llll}3 & 36 & 1 \cdot 2\end{array}$ | 3 | $3 \begin{array}{lllll}35 & 51\end{array}$ | -18 | $3 \begin{array}{llll}35 & 39 & 1\end{array}$ | - 24 | $\begin{array}{lllll}3 & 35 & 23 \cdot 3\end{array}$ | -29 | $\begin{array}{llll}3 & 35 & 4 \cdot 3\end{array}$ | -34 | $\begin{array}{lllllllllllll}3 & 34 & 42 \cdot 0\end{array}$ | 40 |
| 37 | $\begin{array}{llll}3 & 31 & 59 \cdot 8\end{array}$ | -I4 | 3 3I 49.6 | 9 | 3 3I $36 \cdot 3$ | -25 | 3 31 19.6 | -30 | $3 \quad 30 \quad 59 \cdot 7$ | $\cdot 36$ | $33036 \cdot 3$ | 42 |
| 38 | $\begin{array}{llll}3 & 27 & 58 \cdot 3\end{array}$ | 15 |  | -21 |  | -26 |  | $\cdot 32$ | $\begin{array}{lllll}3 & 26 & 54.9\end{array}$ | $\cdot 38$ | $32630 \cdot 5$ | -44 |
| 39 | $\begin{array}{llll}3 & 23 & 56 \cdot 8\end{array}$ | 6 | $32345 \cdot 4$ | 2 | 323 30.5 | -28 | $32312 \cdot I$ | -33 | $32250 \cdot 1$ | -40 | 32224.5 | 6 |
| 40 | $\begin{array}{llll}3 & 19 & 55.3\end{array}$ | - -17 | $3 \begin{array}{lll}3 & 19 & 43.2\end{array}$ | $\cdot 23$ | 31927.5 | -29 | $\begin{array}{lll}3 & 19 & 8 \cdot 2\end{array}$ | -35 | 3 I8 $45 \cdot 2$ | -4 | $\begin{array}{llll}3 & 18 & 18.4\end{array}$ | -48 |
| 41 | 315153.7 |  | $31541 \cdot 0$ | -24 | 315154.5 | -30 | $3 \begin{array}{lll}3 & 15 & 4 \cdot 3\end{array}$ | $\cdot 37$ | $\begin{array}{lllllllllllllllll}3 & 14 & 40 \cdot 2\end{array}$ | 43 | $31412 \cdot 1$ | 50 |
| 42 | $31152 \cdot 1$ | -19 | 3 II $38 \cdot 7$ | $\cdot 25$ | 3 II $21 \cdot 5$ | - 32 | 3 II $0 \cdot 2$ | -39 | 3 10 $35 \cdot 0$ | -45 | 31050 | $\cdot 52$ |
| 43 | $\begin{array}{llll}3 & 7 & 50 \cdot 5 \\ 3 & 3 & 48.0\end{array}$ | -20 | $\begin{array}{llll}3 & 7 & 36 \cdot 4 \\ 3 & 3 & 34 \cdot 0\end{array}$ | $\cdot 27$ | $\begin{array}{llll}3 & 7 & 18 \cdot 3 \\ 3 & 3 & 15.1\end{array}$ | - 34 | $\begin{array}{llll}3 & 6 & 56 \cdot 1 \\ 3 & 2 & 5 I \cdot 8\end{array}$ | -40 | $\begin{array}{llll}3 & 6 & 29 \cdot 7\end{array}$ | -47 | $\begin{array}{llll}3 & 5 & 59.2 \\ 3 & 5 & 5.4\end{array}$ | $\cdot 54$ |
| 44 | $\begin{array}{llll}3 & 3 & 48 \cdot 9\end{array}$ | - 21 | 3334.0 | 8 | $\begin{array}{llll}3 & 3 & 15 \cdot 1\end{array}$ | -35 | $\begin{array}{llll}3 & 2 & 5 I \cdot 8\end{array}$ | -42 | $\begin{array}{llll}3 & 2 & 24.3\end{array}$ | -49 | 31582.4 | $\cdot 57$ |
| 45 | $25947 \cdot 2$ | - $\cdot 22$ | 2593 | $\cdot 29$ | 259 II:8 | -37 | $2 \begin{array}{lllll}2 & 58 & 47 \cdot 5\end{array}$ | -44 |  | - 52 | $25745 \cdot 4$ | -59 |
| 46 | 25545 | $\cdot 23$ | 255 | $\cdot 31$ | $25518 \cdot 3$ | $\cdot 38$ | $25443 \cdot 0$ | $\cdot 46$ | 254 13.0 | -54 | $253138 \cdot 2$ | 62 |
| 47 | $2515143 \cdot 7$ | $\cdot 25$ | $25126 \cdot 6$ | $\cdot 32$ | 25154.8 | -40 | $2 \begin{array}{llll}2 & 50 & 38.4\end{array}$ | $\cdot 48$ | $2507 \cdot 1$ | $\cdot 56$ | $24930 \cdot 8$ | 65 |
| 48 | $24742 \cdot 0$ | -26 | $24724^{\circ} \mathrm{O}$ | $\cdot 34$ | $2 \begin{array}{lll}2 & 47 & 1.2\end{array}$ | $\cdot 42$ | $24633 \cdot 6$ | -50 | $246 \quad 0.9$ | . 59 | $245 \quad 23 \cdot 2$ | -67 |
| 49 | 2434 | -27 | $2432 \mathrm{I} \cdot 3$ | $\cdot 35$ | $24257 \cdot 5$ | -44 | $242 \quad 28 \cdot 6$ | $\cdot 52$ | $24154 \cdot 6$ |  | 24115.2 | 70 |
| 50 | 23938.2 | - $\cdot$ | $23915 \cdot 5$ | -37 | $2 \begin{array}{llll}2 & 38 & 53 \cdot 7\end{array}$ |  | $\begin{array}{llll}2 & 38 & 23 \cdot 5\end{array}$ |  | $\begin{array}{lllll}2 & 37 & 48 \cdot 0\end{array}$ |  | 237 7.0 | $\cdot 73$ |
| 51 | $23536 \cdot 2$ | $\cdot 30$ | $23515 \cdot 7$ | -39 | $23449 \cdot 7$ | $\cdot 48$ |  | - 57 | $23341 \cdot 2$ | -66 | $\begin{array}{llll}2 & 32 & 58 \cdot 4\end{array}$ | $\cdot 76$ |
| 52 | 23134.2 | $\cdot 31$ | $23112 \cdot 76$ | -40 | $23045 \cdot 6$ | -50 | $23012 \cdot 8$ | -60 | $22934{ }^{\circ} \mathrm{I}$ I | -69 | $22849 \cdot 6$ | 9 |
| 53 | $\begin{array}{llll}2 & 27 & 32 \cdot 1\end{array}$ | $\cdot 33$ | $\begin{array}{llllllllllllllll}2 & 27 & 9 \cdot 6\end{array}$ | -42 | $2 \begin{array}{llllll}26 & 41 \cdot 3\end{array}$ | - 52 | $\begin{array}{llll}2 & 26 & 7 \cdot 0\end{array}$ |  | $225126 \cdot 8$ | $\cdot 72$ | $22440 \cdot 3$ | -86 |
| 54 | $1 \begin{aligned} & 2 \\ & 2\end{aligned} 23$ 29.9 | -34 | $23 \quad 6 \cdot 4$ | -44 | $22236 \cdot 8$ | -54 | 22 | $\cdot 65$ | 22119.1 | $\cdot 75$ | $22030 \cdot 6$ | -86 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ | - A. |  | L. 7 | A. | L. $8^{\circ}$ | A. |  | . 9 | A. | L. $10^{\circ}$ | A. | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. $+\quad .42$ | $\begin{gathered} s . \\ -4.02 \end{gathered}$ |  | S. $\cdot 49$ | $\begin{gathered} s \\ -4.03 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +\quad .56 \end{aligned}$ | $\begin{gathered} s \\ -4.04 \end{gathered}$ |  | S. .63 | $\begin{gathered} s . \\ -4.05 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\quad \cdot 7 I \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 06 \end{gathered}$ | S. $+\quad .78$ | $\begin{gathered} s . \\ -4.08 \end{gathered}$ |
| 2 | . 42 | 4.02 |  | $\cdot 49$ | 4.03 | . 56 | 4.04 |  | . 63 | 4.05 | +70 | 4.06 | + $\cdot 77$ | 4.08 |
| 4 | -41 | 4.02 |  | $\cdot 48$ | 4.03 | - 55 | 4.04 |  | . 62 | 4.05 | -70 | 4.06 | -77 | $4 \cdot 07$ |
| 6 | -4I | 4.02 |  | $\cdot 48$ | 4.03 | . 55 | 4.04 |  | -62 | 4.05 | -69 | 4.06 | $\cdot 77$ | 4.07 |
| 8 | $\cdot 40$ | $4 \cdot 02$ |  | -47 | 4.03 | - 55 | 4.04 |  | -62 | $4 \cdot 05$ | -69 | $4 \cdot 06$ | $\cdot 76$ | $4 \cdot 07$ |
| 10 | + 40 | 4.02 | $+$ | -47 | 4.03 | + 55 | 4.04 |  | $\cdot 62$ | $4 \cdot 05$ | +.69 | 4.06 | + .76 | 4.07 |
| 12 | -40 | 4.02 |  | $\cdot 47$ | 4.03 | -54 | 4.04 |  | -62 | 4.05 | . 69 | 4.06 | -76 | $4 \cdot 07$ |
| 14 | -40 | 4.02 |  | -47 | 4.03 | -54 | 4.04 |  | -62 | 4.05 | -69 | $4 \cdot 06$ | $\cdot 77$ | $4 \cdot 07$ |
| 16 | -40 | 4.02 |  | $\cdot 47$ | 4.03 | $\cdot 54$ | 4.04 |  | -62 | 4.05 | - 69 | $4 \cdot 06$ | $\cdot 77$ | $4 \cdot 07$ |
| I8 | $\cdot 40$ | 4.02 |  | $\cdot 47$ | 4.03 | $\cdot 54$ | $4 \cdot 04$ |  | -62 | $4 \cdot 05$ | $\cdot 70$ | $4 \cdot 06$ | $\cdot 77$ | 4.08 |
| 20 | + 40 | 4.02 | + | $\cdot 47$ | 4.03 | + 55 | $4 \cdot 04$ | $+$ | . 62 | $4 \cdot 05$ | + 70 | 4.06 | + 78 | 4.08 |
| 22 | -40 | 4.02 |  | $\cdot 47$ | 4.03 | - 55 | $4 \cdot 04$ |  | -63 | 4.05 | -70 | 4.06 | - 78 | 4.08 |
| 24 | -40 | 4.02 |  | -47 | 4.03 | -55 | $4 \cdot 04$ |  | -63 | 4.05 | -71 | $4 \cdot 06$ | $\cdot 79$ | 4.08 |
| 26 | -40 | 4.02 |  | -48 | 4.03 | $\cdot 56$ | 4.04 |  | -64 | 4.05 | $\cdot 72$ | 4.06 | -80 | 4.08 |
| 28 | -40 | 4.02 |  | -48 | 4.03 | $\cdot 56$ | $4 \cdot 04$ |  | -64 | 4.05 | $\cdot 72$ | 4.06 | -81 | 4.08 |
| 30 | + 40 | 4.02 | $+$ | -49 | 4.03 | + 57 | $4 \cdot 04$ |  | . 65 | $4 \cdot 05$ | $+\cdot 73$ | $4 \cdot 07$ | + 82 | 4.08 |
| 32 | -4 I | 4.02 |  | -49 | 4.03 | $\cdot 57$ | $4 \cdot 04$ |  | - 66 | $4 \cdot 06$ | $\cdot 74$ | 4.07 | . 83 | 4.09 |
| 34 | -4 1 | 4.02 |  | - 50 | 4.03 | $\cdot 58$ | $4 \cdot 04$ |  | -67 | $4 \cdot 06$ | $\cdot 76$ | 4.07 | -84 | $4 \cdot 09$ |
| 36 | -42 | 4.02 |  | -50 | 4.03 | $\cdot 59$ | 4.04 |  | -68 | 4.06 | -77 | 4.07 | - 86 | $4 \cdot 09$ |
| 38 | -42 | 4.02 |  | -51 | 4.03 | . 60 | $4 \cdot 05$ |  | . 69 | $4 \cdot 06$ | $\cdot 79$ | 4.08 | - 88 | 4.10 |
| 40 | + $\cdot 43$ | 4.02 | $+$ | $\cdot 52$ | 4.03 | + .62 | 4.05 | $+$ | $\cdot 71$ | $4 \cdot 06$ | +.8r | 4.08 | + 90 | 4.10 |
| 42 | -44 | 4.02 |  | $\cdot 53$ | 4.04 | . 63 | $4 \cdot 05$ |  | $\cdot 73$ | $4 \cdot 07$ | . 83 | $4 \cdot 08$ | $\cdot 93$ | 4.II |
| 44 | -45 | 4.03 |  | $\cdot 55$ | 4.04 | -65 | 4.05 |  | $\cdot 75$ | $4 \cdot 07$ | -85 | $4 \cdot 09$ | -95 | $4 \cdot 11$ |
| 46 | -46 | 4.03 |  | $\cdot 56$ | 4.04 | $\cdot 67$ | $4 \cdot 06$ |  | $\cdot 77$ | $4 \cdot 08$ | -88 | $4 \cdot 10$ | $\cdot 98$ | $4 \cdot 12$ |
| 48 | $\cdot 47$ | 4.03 |  | -58 | 4.04 | -69 | 4.06 |  | -80 | $4 \cdot 08$ | -91 | 4.10 | 1.02 | 4-13 |
| 50 | + 49 | 4.03 |  | -60 | 4.05 | +•71 | 4.06 |  | . 82 | 4.09 | + 9.94 | 4.II | +1.06 | 4.14 |
| 52 | $\cdot 50$ | 4.03 |  | -62 | 4.05 | $\cdot 74$ | $4 \cdot 07$ |  | -86 | 4.09 | $\cdot 98$ | $4 \cdot 12$ | I-10 | $4 \cdot 15$ |
| 54 | $\cdot 52$ | 4.04 |  | $\cdot 65$ | 4.05 | $\cdot 77$ | $4 \cdot 08$ |  | $\cdot 89$ | $4 \cdot 10$ | 1.02 | 4.13 | I-15 | $4 \cdot 17$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl Var | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 42 \cdot 1 \end{array}$ | S. $+\quad .15$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 50 \cdot 9 \end{array}$ | + ${ }^{\text {S. }}$ | $\begin{array}{\|ccc\|} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 59.8 \end{array}$ | $\begin{array}{r} \mathrm{S} . \\ +\quad 15 \end{array}$ | $\left\|\begin{array}{ccc} \text { H. } & \text { M. } & \text { S. } \\ 6 & 2 & 8 \cdot 7 \end{array}\right\|$ | $+\quad \begin{aligned} & \text { S. } \\ & + \end{aligned}$ | $\left\|\begin{array}{rrc} \text { H. M. } & \text { S. } \\ 6 & 2 & 17 \\ \hline \end{array}\right\|$ | $\begin{array}{r} \mathrm{S} \\ +\quad{ }^{-15} \end{array}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 2 & 26 \cdot 8 \end{array}$ | S. $\cdot 15$ |
| 10 | $52048 \cdot 0$ | -00 | $5 \quad 20 \quad 47 \cdot 3$ | -02 | $52045 \cdot 8$ | - 03 | $\begin{array}{llll}5 & 20 & 43 \cdot 6\end{array}$ | -. 04 | $5 \quad 2040 \cdot 6$ | -.06 |  | - 0.07 |
| 12 | $\begin{array}{llll}5 & 12 & 37 \cdot 2\end{array}$ | -03 | 5 I2 $34 \cdot 6$ |  | $51231 \cdot 1$ | -07 | $\begin{array}{llll}5 & 12 & 26 \cdot 6\end{array}$ | -08 | $51221 \cdot 1$ | -10 | 51214.7 | 11 |
| 14 | $\begin{array}{lll}5 & 4 & 26 \cdot 5\end{array}$ | - 07 | $5 \quad 4821.9$ | -08 | $\begin{array}{lll}5 & 4 & 16 \cdot 3\end{array}$ | -10 | $\begin{array}{llr}5 & 4 & 9 \cdot 5\end{array}$ | -12 | $\begin{array}{lll}5 & 4 & 1 \cdot 6\end{array}$ | -14 | $\begin{array}{llll}5 & 3 & 52 \cdot 5\end{array}$ | 16 |
| 16 | $45615 \cdot 7$ | - Io | 456 | ${ }^{1} 12$ | $\begin{array}{llll}4 & 56 & 1 * 4\end{array}$ | -14 | $4 \quad 55 \quad 52 \cdot 3$ | -16 | $4554 \mathrm{I} \cdot 8$ | -18 | $45530 \cdot 1$ | 1 |
| 18 | 4484.7 | 3 | 4475 | - - 15 | $447 \quad 46 \cdot 3$ | 18 | $44734 \cdot 8$ | - 20 | 447 2I•8 | - . 23 | 447 7*3 | - $\cdot 25$ |
| 20 | $43953 \cdot 7$ | -16 | $43943 \cdot 2$ | -1 | $43931 \cdot 0$ | 22 | $43917 \cdot 2$ | -24 | 439 I.6 | $\cdot 27$ | 438443 | 30 |
| 22 | $\begin{array}{llll}4 & 31 & 42 \cdot 5\end{array}$ | 9 | 4313 | $\cdot 2$ | $43115 \cdot 5$ | -26 | $43059 \cdot 2$ | -29 | $4304 \mathrm{I} \cdot 0$ | $\cdot 32$ | $43020 \cdot 8$ | $\cdot 35$ |
| 24 | 423 31•1 | -23 | 42316.5 | $\cdot 26$ | $\begin{array}{lllll}4 & 22 & 59 & 7\end{array}$ | -30 | $42240 \cdot 9$ | $\cdot 33$ | $4 \begin{array}{llll}4 & 22 & 19.9\end{array}$ | $\cdot 37$ | $42156 \cdot 8$ | 40 |
| 26 | $4 \begin{array}{llll}4 & 15 & 19.5\end{array}$ |  | $\begin{array}{llll}4 & 15 & 2 \cdot 7\end{array}$ | $\cdot 30$ | $\begin{array}{lllll}4 & 14 & 43 \cdot 6\end{array}$ | -34 | $414 \quad 22 \cdot 2$ | $\cdot 38$ | $4 \begin{array}{llllll}4 & 13 & 58 \cdot 4\end{array}$ | -41 | $413 \quad 32 \cdot 3$ | 46 |
| 28 | $\begin{array}{llll}4 & 7 & 7 \cdot 6\end{array}$ |  | $4 \quad 6 \quad 48 \cdot 6$ | - 34 | $4 \quad 6 \quad 27 \cdot 0$ | - 38 | $\begin{array}{lll}4 & 6 & 2.9\end{array}$ | -42 | $4 \begin{array}{lll}4 & 56 \cdot 3\end{array}$ | - $\cdot 46$ | $4 \begin{array}{lll}4 & 5 & 7 \cdot 0\end{array}$ | . 51 |
| 30 | $\begin{array}{llll}3 & 58 & 55 \cdot 4\end{array}$ | $\cdot 33$ | 3 58 $34 \cdot 1$ | $\cdot 38$ | $35810 \cdot 0$ | $\cdot 42$ | $\begin{array}{llll}3 & 57 & 43 \cdot 1\end{array}$ | - 47 | $\begin{array}{llll}3 & 57 & 13.4\end{array}$ | . 52 | $\begin{array}{llll}3 & 56 & 40 \cdot 9\end{array}$ | 57 |
| 31 | $\begin{array}{llllll}3 & 54 & 49 \cdot 2\end{array}$ | -35 | 3542 | $\cdot 4$ | $\begin{array}{llll}3 & 54 & 1 \cdot 2\end{array}$ | -45 | $353133 \cdot 0$ | -50 | $\begin{array}{llll}3 & 53 & 1 \cdot 7\end{array}$ | $\cdot 54$ | $3 \begin{array}{llll}3 & 52 & 27 \cdot 5\end{array}$ | 59 |
| 32 | $35042 \cdot 9$ | -37 | $35019 \cdot 1$ | $\cdot 42$ | $34952 \cdot 3$ | -47 | $314922 \cdot 6$ | -52 | $\begin{array}{llllllllllllllllll}3 & 48 & 49\end{array}$ | . 57 | $\begin{array}{llllll}3 & 48 & 13.9\end{array}$ | 62 |
| 33 | $34636 \cdot 5$ | -39 | 346 II* 4 | *44 | $\begin{array}{llll}3 & 45 & 43 \cdot 3\end{array}$ | -49 | $34512 \cdot 1$ | -55 | $\begin{array}{llll}3 & 44 & 37\end{array}$ |  | $\begin{array}{lll}3 & 44 & 0.0\end{array}$ | 66 |
| 34 | $\begin{array}{lllll}3 & 42 & 29.9\end{array}$ | -41 | $\begin{array}{lll}3 & 42 & 3.6\end{array}$ | - 46 | 34134.1 | '52 | 34154 | -57 | $34025 \cdot 3$ | -63 | $\begin{array}{lllllllllll}3 & 39 & 45\end{array}$ | . 69 |
| 35 | $\begin{array}{llll}3 & 3^{8} & 23 \cdot 3\end{array}$ | -43 | $\begin{array}{lllllllllllllll}3 & 37 & 55 \cdot 6\end{array}$ | -49 | $\begin{array}{lllll}3 & 37 & 24.7\end{array}$ | -54 | $3 \begin{array}{llll}36 & 50 \cdot 4\end{array}$ | -60 | $\begin{array}{lllllllllllllll}3 & 36 & 12.6\end{array}$ | -66 | $3 \begin{array}{llll}35 & 31 \cdot 3\end{array}$ | $\cdot 72$ |
| 36 | $\begin{array}{llll}3 & 34 & 16 \cdot 5\end{array}$ | $\cdot 45$ | $\begin{array}{llll}3 & 33 & 47 \cdot 5\end{array}$ | -51 | $\begin{array}{llll}3 & 33 & 15 \cdot 1 \\ 3 & 1\end{array}$ | -57 | $\begin{array}{llll}3 & 32 & 39 \cdot 2\end{array}$ | 6 | 3 31 59  | -69 | $3 \mathrm{3I}$ I $6 \cdot 5$ | 75 |
| 37 | $\begin{array}{llll}3 & 30 & 9 \cdot 5\end{array}$ | -47 | $\begin{array}{llll}3 & 29 & 39 \cdot 2\end{array}$ | . 53 | $\begin{array}{llll}3 & 29 & 5 \cdot 3\end{array}$ | - 59 | $\begin{array}{llll}3 & 28 & 27 \cdot 8\end{array}$ | -66 |  | $\cdot 72$ | $3 \begin{array}{lll}3 & 27 & 1\end{array}$ | $\cdot 79$ |
| 38 | $\begin{array}{llll}3 & 26 & 2.4\end{array}$ | . 50 | $\begin{array}{lllll}3 & 25 & 30 \cdot 7\end{array}$ | -56 | $\begin{array}{llll}3 & 24 & 55 \cdot 3\end{array}$ | -62 | 324 I6.I | -69 | $\begin{array}{llll}3 & 23 & 32 \cdot 9\end{array}$ | $\cdot 75$ | $\begin{array}{lllll}3 & 22 & 45 \%\end{array}$ | . 82 |
| 39 | $\begin{array}{llll}3 & 21 & 55.2\end{array}$ | . 52 | 321 | -. 58 | $32045 \cdot 0$ | 5 | 320411 | $\cdots 2$ | 31919.0 | - 78 | $\begin{array}{llll}3 & 18 & 29 \cdot 8\end{array}$ | 86 |
| 40 | 3 I7 47.7 | - 54 |  | -61 | $\begin{array}{llll}3 & 16 & 34 \cdot 5\end{array}$ | -68 | $31551 \cdot 7$ | $\cdot 75$ | $\begin{array}{llll}3 & 15 & 4.7\end{array}$ | -82 | $\begin{array}{llll}3 & 14 & 13.4\end{array}$ | 89 |
| 41 | $\begin{array}{llll}3 & 13 & 40 \cdot 1\end{array}$ | -57 | $\begin{array}{llrr}3 & 13 & 4.0 \\ 3 & 8 & 5 \cdot 6\end{array}$ | -64 | $\begin{array}{crrr}3 & 12 & 23 \cdot 7\end{array}$ | $\cdot 71$ | 3 II $39 \cdot 1$ | $\cdot 78$ | 3 10 $50 \cdot 1$ | . 85 | $\begin{array}{llll}3 & 9 & 56 \cdot 5\end{array}$ | 93 |
| 42 | $\begin{array}{llll}3 & 9 & 32 \cdot 3\end{array}$ | -59 | $\begin{array}{llll}3 & 8 & 54 \cdot 6\end{array}$ | -66 | $\begin{array}{llll}3 & 8 & \text { I2.6 }\end{array}$ | $\cdot 74$ | $37826 \cdot 1$ | -8I | $\begin{array}{llll}3 & 6 & 35 \cdot 0\end{array}$ | .89 | $3{ }^{3} 5159 \cdot 1$ | 97 |
| 43 | $\begin{array}{llll}3 & 5 & 24.3\end{array}$ | . 62 | $3444^{\circ}$ | -69 | $\begin{array}{llll}3 & 4 & \text { 1*2 }\end{array}$ | $\cdot 77$ | $\begin{array}{llll}3 & 3 & 12.7\end{array}$ | -85 | $\begin{array}{llll}3 & 2 & 19.4\end{array}$ | -93 | 3 I 2I.2 | - 01 |
| 44 | $\begin{array}{lrrr}3 & 1 & 16 \cdot 0\end{array}$ | 6 | 3 O | $\cdot 72$ | $2 \begin{array}{llll}2 & 59 & 49 \cdot 4\end{array}$ | - 80 | $25^{2} 5858.8$ | 88 | $2 \begin{array}{lll}28 & 3 \cdot 3\end{array}$ | -97 | $2 \begin{array}{lll}2 & 57 & 2 \cdot 7\end{array}$ | - I.05 |
| 6 | $\begin{array}{lll}2 & 57 & 7.5\end{array}$ | -67 | $2 \begin{array}{llll}2 & 56 & 24.7\end{array}$ | $\bullet 75$ | $2 \begin{array}{llllllll}2 & 55 & 37 \cdot 2\end{array}$ | -83 | 25444.5 | .92 | $25346 \cdot 7$ | 1.OI | $25243 \cdot 5$ | 10 |
| 46 | $\begin{array}{llll}2 & 52 & 58 \cdot 7\end{array}$ | $\cdot 70$ | $2 \begin{array}{llll}2 & 52 & 14.2\end{array}$ | $\cdot 78$ | $25124 \cdot 6$ | -87 | $25029 \cdot 8$ | $\cdot 96$ | $2 \begin{array}{llll}2 & 49 & 29 \cdot 5\end{array}$ | 1.05 | $24823 \cdot 7$ | -15 |
| 4 | $\begin{array}{lllll}2 & 48 & 49 \cdot 6\end{array}$ | $\cdot 73$ | $\begin{array}{lll}2 & 48 & 3 \cdot 3 \\ 2 & 43 & 51\end{array}$ | -82 | $\begin{array}{llll}2 & 47 & 11 & 6\end{array}$ | -91 | $\begin{array}{lllll}2 & 46 & 14.5 \\ 2 & 41 & 58.6\end{array}$ | 1.00 | $2 \begin{array}{lllllll}2 & 45 & I I \cdot 7\end{array}$ | 1.09 | $\begin{array}{llll}2 & 44 & 3 \cdot 1\end{array}$ | -19 |
| 48 | $24440 \cdot 2$ | $\cdot 76$ | $\begin{array}{llllllllll}2 & 43 & 51 \cdot 9\end{array}$ | -85 | 242 <br> $8 \cdot 1$ | -94 | $24158 \cdot 6$ | I.04 | $240 \quad 53 \cdot 2$ | I•I4 | 239 41•7 | I. 24 |
| 49 | $\begin{array}{llll}2 & 40 & 30 \cdot 5\end{array}$ |  | 2394 | - 89 | $23^{8}$ | - 98 | $23742 \cdot 1$ | - I. 08 | $2 \begin{array}{llll}26 & 33.9\end{array}$ | - I-19 | 2351904 | - I.30 |
| 5 | $\begin{array}{lllll}2 & 36 & 20 \cdot 4\end{array}$ | - | $2 \begin{array}{llll}2 & 35 & 27 \cdot 9\end{array}$ | -93 | $2 \begin{array}{llll}2 & 34 & 29 \cdot 3\end{array}$ | 1.02 | $\begin{array}{lllll}2 & 33 & 24 \cdot 9\end{array}$ | 1.13 | $\begin{array}{llll}2 & 32 & 13.9\end{array}$ | 1. 24 | $23056 \cdot 2$ | I•35 |
| 51 | $\begin{array}{lll}2 & 32 & 9 \cdot 8 \\ 2 & 27 & 5 \cdot 0 \cdot 9\end{array}$ | -86 | $\begin{array}{llll}2 & 31 & 15.2\end{array}$ | -96 | $\begin{array}{lllll}2 & 30 & 14.3\end{array}$ | 1.07 | 22970 | I.I | 22752.9 | 1-29 | $22631 \cdot 9$ | 1.41 |
| 52 | $\begin{array}{llll}2 & 27 & 58 \cdot 9 \\ 2 & 2 & 3 & 4.5\end{array}$ | $\cdot 90$ | 2 27 1.9 <br> 2 2 18 | 1.00 | 2 25 $58 \cdot 5$ <br> 2 21  | 1.11 | $\begin{array}{llllllllllll}2 & 24 & 48 \cdot 3\end{array}$ | 1.23 | 233 31.0 | 1.35 | $\begin{array}{llll}2 & 22 & 6 \cdot 5\end{array}$ | 1.47 |
| 53 | $22347 \cdot 5$ | -93 | 222 48•1 | I.05 | $22141 \cdot 9$ | I•16 | $22028 \cdot 6$ | I. 28 | 21980 | 1.41 | 2 17 39.8 | I. 54 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $1^{17^{\circ}} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | s. | S. | S. | S. | s. | S. | s. |
| 0 | +.85 | -4.09 | + 922 | -4.II | +1.00 | $-4 \cdot 12$ | +1.07 | $-4 \cdot 14$ | +1.15 | $-4 \cdot 16$ | +1.22 | $-4 \cdot 18$ |
| 2 | . 85 | 4.09 | $\cdot 92$ | 4.II | $\cdot 99$ | $4 \cdot 12$ | I.07 | $4 \cdot 14$ | I-14 | 4.16 | I 22 | 4.18 |
| 4 | -84 | $4 \cdot 09$ | -92 | $4 \cdot 10$ | $\cdot 99$ | $4 \cdot 12$ | I.06 | $4 \cdot 14$ | I-14 | $4 \cdot 16$ | I 22 | $4 \cdot 18$ |
| 6 | . 84 | $4 \cdot 09$ | $\cdot 91$ | $4 \cdot 10$ | -99 | $4 \cdot 12$ | I.06 | 4.14 | I-14 | 4.16 | I. 21 | $4 \cdot 18$ |
| 8 | . 84 | 4.09 | -91 | $4 \cdot 10$ | -99 | $4 \cdot 12$ | 1.06 | 4.14 | I-14 | $4 \cdot 16$ | I-2I | 4.18 |
| 10 | + 8.84 | 4.09 | + .91 | $4 \cdot 10$ | + 99 | 4•12 | +1.06 | $4 \cdot 14$ | +I.14 | $4 \cdot 16$ | +1.22 | $4 \cdot 18$ |
| 12 | . 84 | 4.09 | -91 | $4 \cdot 10$ | -99 | $4 \cdot 12$ | 1.06 | $4 \cdot 14$ | I'14 | $4 \cdot 16$ | 1.22 | $4 \cdot 18$ |
| 14 | - 84 | 4.09 | -92 | 4.10 | -99 | $4 \cdot 12$ | 1.07 | $4 \cdot 14$ | I'15 | $4 \cdot 16$ | I-22 | $4 \cdot 19$ |
| 16 | - 84 | $4 \cdot 09$ | -92 | $4 \cdot 10$ | 1.00 | $4 \cdot 12$ | 1.07 | 4.14 | I'I5 | $4 \cdot 16$ | $1 \cdot 23$ | $4 \cdot 19$ |
| 18 | .85 | 4.09 | $\cdot 92$ | 4•II | I.00 | 4-12 | I.08 | $4 \cdot 15$ | I.I6 | $4 \cdot 17$ | I•24 | 4.19 |
| 20 | +.85 | 4.09 | + .93 | $4 \cdot 11$ | +1.01 | $4 \cdot 13$ | +1.09 | $4 \cdot 15$ | +1.17 | 4.17 | +I.25 | 4.19 |
| 22 | . 86 | 4.09 | -94 | $4 \cdot 11$ | 1.02 | $4 \cdot 13$ | I.ro | $4 \cdot 15$ | I•18 | $4 \cdot 17$ | I. 26 | $4 \cdot 20$ |
| 24 | -87 | $4 \cdot 09$ | -95 | 4-11 | I.03 | 4.13 | I'II | $4 \cdot 15$ | I. 20 | $4 \cdot 18$ | I•28 | $4 \cdot 20$ |
| 26 | -88 | $4 \cdot 10$ | -96 | 4-II | I.04 | 4-13 | I'I3 | 4*16 | I-2I | $4 \cdot 18$ | I.30 | $4 \cdot 21$ |
| 28 | . 89 | $4 \cdot 10$ | -97 | 4-12 | 1.06 | 4-14 | I'14 | $4 \cdot 16$ | I. 23 | $4 \cdot 19$ | 1.32 | $4 \cdot 2 \mathrm{I}$ |
| 30 | + 90 | $4 \cdot 10$ | +.99 | 4.12 | +1.07 | $4 \cdot 14$ | +1.16 | 4.17 | +1.25 | $4 \cdot 19$ | +1.34 | 4.22 |
| 32 | $\cdot 92$ | 4.10 | 1.00 | 4.13 | I.09 | $4 \cdot 15$ | I.I8 | $4 \cdot 17$ | I-27 | $4 \cdot 20$ | 1-37 | $4 \cdot 23$ |
| 34 | -93 | $4 \cdot 11$ | I. 02 | 4-13 | I•II | $4 \cdot 15$ | I.2I | 4-18 | I.30 | 4.21 | 1-39 | $4 \cdot 24$ |
| 36 | -95 | $4 \cdot 11$ | I.05 | $4 \cdot 14$ | I-14 | 4-16 | I. 23 | $4 \cdot 19$ | I.33 | 4.22 | 1.43 | 4.25 |
| $3^{8}$ | -97 | $4 \cdot 12$ | I.07 | 4.14 | I'I7 | 4.17 | I. 26 | $4 \cdot 20$ | I.36 | $4 \cdot 23$ | 1.47 | $4 \cdot 26$ |
| 40 | +1.00 | $4 \cdot 12$ | +1.10 | 4•15 | +1.20 | 4.18 | $+1.30$ | 4.21 | +1.40 | 4.24 | +1.51 | $4 \cdot 28$ |
| 42 | I.03 | $4 \cdot 13$ | I'13 | 4.16 | 1.23 | $4 \cdot 19$ | I.34 | $4 \cdot 22$ | I.44 | 4.25 | I.55 | 4.29 |
| 44 | I. 06 | $4 \cdot 14$ | I'16 | $4 \cdot 17$ | 1.27 | $4 \cdot 20$ | I 38 | $4 \cdot 23$ | I-49 | 4.27 | 1.6I | 4.31 |
| 46 | 1.09 | $4 \cdot 15$ | I 20 | $4 \cdot 18$ | I. 32 | $4 \cdot 21$ | I.43 | 4.25 | I. 55 | 4.29 | $\underline{1.67}$ | $4 \cdot 34$ |
| 48 | I•13 | $4 \cdot 16$ | I 25 | $4 \cdot 19$ | I.37 | $4 \cdot 23$ | 1.49 | $4 \cdot 27$ | I'6I | 4.31 | $1 \cdot 74$ | $4 \cdot 36$ |
| 50 | +I.I8 | 4.17 | +1.30 | 4.21 | +1.42 | 4.25 | +1.55 | 4.29 | +1.68 | 4.34 | +1.82 | $4 \cdot 40$ |
| 52 | 1.23 | $4 \cdot 19$ | I•36 | $4 \cdot 23$ | I*49 | $4 \cdot 27$ | 1.62 | $4 \cdot 32$ | I•76 | $4 \cdot 37$ | 1.91 | $4 \cdot 43$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl Var | $19^{\circ}$ | $\begin{aligned} & \text { Dec } \\ & \text { Var } \end{aligned}$ | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 2 & 36 \cdot I \end{array}$ | + ${ }^{\text {S }}$ [ | $\left\lvert\, \begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 2 & 45 \cdot 4 \end{array}\right.$ | + S. | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 2 & 54 \cdot 8 \end{array}$ | + - 6 | $\begin{array}{\|lrl} \text { H. M. } & \text { S. } \\ 6 & 3 & 4 \cdot 3 \end{array}$ | + 16 | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 3 & \text { I4.O } \end{array}$ | + ${ }^{\text {S }}$. 6 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 23.9 \end{array}$ | S. $+\quad .16$ |
| 0 | $\begin{array}{llll}5 & 20 & 32 \cdot 1\end{array}$ | - .08 | $5 \quad 2026 \cdot 6$ | -10 | $5 \quad 20 \quad 20 \cdot 3$ | - - II | $52013 \cdot 1$ | 13 | $5 \quad 20 \quad 50$ | -14 | 5 I9 56.0 | - - 16 |
| 12 | $\begin{array}{llll}5 & 12 & 7 \cdot 2\end{array}$ | -1 | 5 II $58 \cdot 7$ | -15 | 5 II 49.2 | -17 | 5 II 38.6 | 18 | 5 II 26.9 | 20 | 5 II 14.0 | 2 |
| 14 | $\begin{array}{llll}5 & 3 & 42 \cdot 2\end{array}$ | - 18 | $\begin{array}{lll}5 & 3 & 30 \cdot 6\end{array}$ | 20 |  | -22 | $\begin{array}{llll}5 & 3 & 3 \cdot 8\end{array}$ | -24 | 5 2 $48 \cdot 4$ | -27 | $5 \quad 2 \quad 3 \mathrm{I} \cdot 6$ | 29 |
| 16 | $455 \quad 16 \cdot 8$ | $\cdot 23$ | $455 \quad 2 \cdot 2$ | $\cdot 25$ | 454 46•I | $\cdot 28$ | $454 \quad 28 \cdot 6$ | $\cdot 30$ | 454 | -33 | 453 48.7 | 36 |
| 18 | $4465 \mathrm{I} \cdot 2$ | $\cdot 28$ | $44633 \cdot 5$ | $\cdot 31$ | $44614{ }^{\circ} \mathrm{O}$ | $\cdot 34$ | $44552 \cdot 8$ | - 37 | $445 \quad 29.9$ | - 40 | $445 \quad 5 \cdot 1$ | -43 |
| 20 | 43825 | -33 | $43^{48} 4 \cdot 1$ | $\cdot 36$ | 43741.3 | -40 | 43716.4 | 43 | $43649 \cdot 6$ | $\cdot 46$ | $436 \quad 20 \cdot 7$ | 50 |
| 22 | $42958 \cdot 6$ | -39 | 42934.3 | -42 | 42978 | $\cdot 46$ | $4 \quad 28393$ |  | 42888 | -53 | 42735 | 57 |
| 24 | 42 I 314 | -44 | 4213.8 | $\cdot 48$ | $42033 \cdot 7$ | $\cdot 52$ | $420 \quad 1 \cdot 3$ | - 56 | $4 \begin{array}{lll}49 & 26 \cdot 3\end{array}$ | -60 | 4 I8 48.8 | 65 |
| 26 | $4 \begin{array}{llll}4 & 13\end{array}$ | $\cdot 50$ | 41232.4 | -54 | 4 II 58.6 | . 58 | 4 II 22-2 | . 63 | 4 10 42.9 | -68 | 4100.8 | $\cdot 73$ |
| 28 | 4434 | $\cdot 56$ | 4 | \% | $\begin{array}{llll}4 & 3 & 22.4\end{array}$ | -65 | $4 \quad 2$4 4 | $\cdot 70$ | 4 I 58.I | $\cdot 75$ | 4 I II.3 | .81 |
| 30 | $\begin{array}{llll}3 & 56 & 5 \cdot 3\end{array}$ | - 62 | $\begin{array}{llll}3 & 55 & 26 \cdot 8\end{array}$ | . 67 | $35445 \%$ | $\cdot 72$ | $354 \quad 0 \cdot 1$ | $\cdot 78$ | 3531117 | -83 | 352200 | 89 |
| 31 | $\begin{array}{llll}3 & 51 & 50 \cdot 2\end{array}$ | . 65 | $\begin{array}{llll}3 & 51 & 9.6 \\ 3 & 4 & \end{array}$ | $\cdot 70$ | $3{ }^{3} 5025 \cdot 8$ | $\cdot 76$ | $\begin{array}{llll}3 & 49 & 38 \cdot 6\end{array}$ | - | $\begin{array}{llll}3 & 48 & 47 \cdot 9 \\ 3 & 44 & 23.5\end{array}$ | $\cdot 87$ | 34753 | 94 |
| 32 | 34734.7 | -6 | 346 52.I | $\cdot 74$ | $346 \quad 6 \cdot 2$ | -79 | $34516 \cdot 7$ | -85 | $34423 \cdot 5$ | -92 | $\begin{array}{llllllllllll}3 & 43 & 26 \cdot 5\end{array}$ | 98 |
| 33 | $\begin{array}{lllll}3 & 43 & 18.9\end{array}$ | $\cdot 71$ | $\begin{array}{lllll}3 & 42 & 34\end{array}$ | $\cdot 77$ | $34146 \cdot 1$ | -83 | $340 \quad 54 \cdot 3$ | -90 | 339588.6 | $\cdot 96$ | $\begin{array}{lllll}3 & 38 & 58 \cdot 9\end{array}$ | I.03 |
| 34 | $\begin{array}{llll}3 & 39 & 2.8\end{array}$ | $\cdot 75$ | $\begin{array}{llll}3 & 3^{8} & 16 \cdot 1\end{array}$ | .81 | $\begin{array}{llll}3 & 37 & 25.7\end{array}$ | $-.87$ | $3 \begin{array}{llll}36 & 31 \cdot 4\end{array}$ | -94 | 335 33.I | -I.OI | $33430 \cdot 6$ | - I.08 |
| 35 | $\begin{array}{llll}3 & 34 & 46 \cdot 3\end{array}$ | $\cdot 78$ | $3 \begin{array}{lllll}3 & 33 & 57 \cdot 4\end{array}$ | . 85 | $\begin{array}{llll}3 & 33 & 4 *\end{array}$ | 91 | $\begin{array}{llll}3 & 32 & 7 \cdot 9\end{array}$ | $\cdot 98$ | $\begin{array}{llll}3 & 31 & 7 \cdot 0\end{array}$ | I.05 | 3301.6 | 13 |
| 36 | 33029.4 | -82 | $3 \begin{array}{lllll}3 & 29 & 38.4\end{array}$ | . 88 |  | -95 | $\begin{array}{llllllll}3 & 27 & 43.9\end{array}$ | I-02 | $\begin{array}{lllllllllllll}3 & 26 & 40 \cdot 2\end{array}$ | 0 | $325131 \cdot 9$ | I |
| 37 | $32612 \cdot 1$ | -85 | $\begin{array}{llllllll}3 & 25 & 18.8\end{array}$ | -92 |  | -99 | $\begin{array}{llll}3 & 23 & 19 \cdot 3\end{array}$ | $1 \cdot 07$ | $\begin{array}{llll}3 & 22 & 12.7\end{array}$ | I'15 | $\begin{array}{lll}3 & 21 & 1 \cdot 3\end{array}$ | 23 |
| 8 | 32154.4 | . 89 | $32058 \cdot 7$ | $\cdot 96$ | $\begin{array}{lllllllllll}3 & 19 & 58.6\end{array}$ | I-04 | $3 \begin{array}{llllll}3 & 18 & 53.9\end{array}$ | I•I2 | $3 \begin{array}{llllll}3 & 174\end{array}$ | . 20 | $\begin{array}{lllll}3 & 16 & 29 \cdot 9\end{array}$ | 28 |
| 39 | $\begin{array}{llll}3 & 17 & 36 \cdot 2\end{array}$ | - 93 | $31638 \cdot$ | -I.OI | 3 I5 35.4 | - I | 314127.9 | -I'I | $\begin{array}{llll}3 & 13 & 15.4\end{array}$ | - I. 25 | 3 II 57.6 | - I•34 |
| 40 | 3 I 317.5 | -97 | 31216.9 | 1.0 | 3 II II• | I.13 | 3 IO 1.0 | 2 | $\begin{array}{llll}3 & 8 & 45 \cdot 3\end{array}$ | I | $\begin{array}{llll}3 & 7 & 24.2\end{array}$ | -40 |
| 41 | $\begin{array}{llll}3 & 8 & 58 \cdot 2\end{array}$ | OI | $\begin{array}{llll}3 & 7 & 55 \cdot 1\end{array}$ | I 09 | $3646 \cdot$ | I'18 | $3{ }_{3} 5$ | I. 27 | $\begin{array}{llll}3 & 4 & 14.4\end{array}$ | 1.36 | $\begin{array}{lrrr}3 & 2 & 49 \cdot 7\end{array}$ | I.46 |
| 42 | $\begin{array}{lll}3 & 4 & 38 \cdot 4\end{array}$ | r.05 | $\begin{array}{lrrr}3 & 3 & 32 \cdot 5 \\ 2 & 5 & \end{array}$ | I•I4 | 3 2 21.4 <br> 2 5  | 1 | 3 1 $4 \cdot 8$ <br>  56 $35 \cdot 2$ | I.32 | $\begin{array}{llll}2 & 59 & 42.4 \\ 2 & 55 & 9.2\end{array}$ |  | $25^{2} 814{ }^{1}$ | 52 |
| 43 | 3 0-17.9 | I•IO | 2589 | I-19 | 257551.1 | I. 28 | $2 \begin{array}{lllll}26 & 35\end{array}$ | 1.38 | 255092 | 1.48 | 253 37*0 | 1-59 |
| 44 | 25556 | $\rightarrow$ I. 15 | $2 \begin{array}{llllllll}2 & 54 & 45\end{array}$ | - I. 24 | $253127 \cdot$ | - I'34 | 252485 | - I. 44 | 25034.9 | - I 55 |  | - r. 66 |
| 45 | 25134 | $1 \cdot 1$ | 250 | I. 2 | $24859 \cdot$ | I.40 | $24732 \cdot 7$ | I 5 | 245 59 | I.62 |  | 74 |
| 46 | 24712.0 | I. | 245154.3 | 1-35 | 244 30. | I. 45 | 24259.6 | I. 57 | 24122 | I-69 | 239371 | I |
| 47 | $24248 \cdot 4$ | I.30 | $2 \begin{array}{llllll}2 & 41 & 27 \cdot 4\end{array}$ | I.40 | $23959 \cdot$ | I.52 | $2{ }_{2} 3^{8} \quad 25 \cdot 2$ | I. 64 | $2 \begin{array}{lllll}26 & 43 \cdot 3\end{array}$ | $\cdot 76$ |  | -90 |
| 48 | $2 \begin{array}{llll}28 & 23.9\end{array}$ | I.35 | $236 \quad 59 \cdot 4$ | 1.47 | 23528 | I. 58 | 23349 |  | $232 \quad 2 \cdot$ |  | $2308 \cdot 1$ | I.98 |
| 49 | $23358 \cdot 3$ | - I 41 | $2 \begin{array}{lll}22 & 30 \cdot 3\end{array}$ | - I. 53 | 23054.7 | - I. 66 | 229 II. 6 | - $1 \cdot 7$ | 22720 | - I.93 | $225120 \cdot 5$ | $-2.07$ |
| 5 | 22931 | 1.47 |  | 1 | $2 \begin{array}{llll}26 & 26 & 19.9\end{array}$ | 73 | $\begin{array}{lllll}2 & 24 & 32 \cdot 2\end{array}$ | 1.87 | $\begin{array}{llll}2 & 22 & 35 \cdot 8\end{array}$ | OI | $220030 \cdot 4$ | $2 \cdot 17$ |
| 51 | $\begin{array}{llll}2 & 25 & 3.6\end{array}$ | 1.54 | $2 \begin{array}{llll}2 & 23 & 27.5\end{array}$ | I. 67 | 2214304 | 1.81 | $2 \begin{array}{llll}2 & 19 & 50.7\end{array}$ | 1.95 | $\begin{array}{lllll}2 & 17 & 48.9\end{array}$ | 2.II |  | $\cdot 28$ |
| 52 | 22034.2 |  | 2 I 8153.9 | I.74 | 2   <br> 17 5 0 | I.89 | 2 I5 7.1 | 2.05 | $2 \begin{array}{llll}12 & 59.5\end{array}$ | $2 \cdot 21$ | 21041.6 | $2 \cdot 39$ |
| 53 | 2163 | I. 6 | $14 \begin{array}{ll}18.5\end{array}$ | I.82 | 1224.5 | 1.98 | I0 20.9 | $2 \cdot 14$ | $8 \quad 7 \cdot 2$ | $2 \cdot 32$ | $542 \cdot 3$ | $2 \cdot 51$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18{ }^{\circ}$ | ${ }^{\circ} \mathrm{A}$. | L. $19^{\circ}$ | - A. | L. $20^{\circ}$ | - A. | L. $21^{\circ}$ | A. | L. $22^{\circ}$ | A. | L. $23^{\circ}$ | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 30 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4.2 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{r} \cdot 3^{8} \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4.23 \end{gathered}$ | $\begin{gathered} \mathrm{S.} \\ +\mathrm{I} \cdot 46 \end{gathered}$ | $\begin{gathered} \text { S. } \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 54 \end{gathered}$ | $\begin{gathered} s . \\ -4.29 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 62 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 3 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 70 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 35 \end{gathered}$ |
| 2 | I 30 | $4 \cdot 21$ | 1.37 | 4.23 | 1.45 | 4.26 | I. 53 | $4 \cdot 28$ | 1.61 | $4 \cdot 31$ | 1.69 | 4 |
| 4 | 1-29 | $4 \cdot 21$ | 1.37 | $4 \cdot 23$ | I. 45 | $4 \cdot 26$ | I•53 | $4 \cdot 28$ | I.6I | $4 \cdot 31$ | I• 69 | $4 \cdot 34$ |
| 6 | I. 29 | $4 \cdot 20$ | I.37 | $4 \cdot 23$ | I.45 | $4 \cdot 26$ | I.53 | $4 \cdot 28$ | I-6I | $4 \cdot 31$ | I. 69 | $4 \cdot 34$ |
| 8 | I-29 | $4 \cdot 20$ | I.37 | $4 \cdot 23$ | I.45 | 4.26 | I. 53 | $4 \cdot 28$ | I.6I | $4 \cdot 31$ | I.69 | $4 \cdot 34$ |
| 10 | + I. 29 | $4 \cdot 21$ | +1.37 | $4 \cdot 23$ | + 1.45 | $4 \cdot 26$ | + I. 53 | $4 \cdot 29$ | +1.62 | $4 \cdot 32$ | +1.70 | $4 \cdot 35$ |
| 12 | I.30 | $4 \cdot 21$ | $1 \cdot 38$ | 4.23 | 1.46 | $4 \cdot 26$ | I.54 | $4 \cdot 29$ | I. 62 | $4 \cdot 32$ | 1•71 | $4 \cdot 35$ |
| 14 | I 30 | $4 \cdot 21$ | I-38 | 4.23 | 1.47 | $4 \cdot 26$ | I. 55 | $4 \cdot 29$ | I. 63 | $4 \cdot 32$ | I'72 | 4.35 |
| 16 | I-3I | $4 \cdot 21$ | r 39 | $4 \cdot 24$ | I-48 | $4 \cdot 26$ | r.56 | $4 \cdot 29$ | I. 64 | $4 \cdot 32$ | $1 \cdot 73$ | $4 \cdot 36$ |
| 18 | 1.32 | $4 \cdot 21$ | 1.40 | $4 \cdot 24$ | I.49 | $4 \cdot 27$ | I.57 | $4 \cdot 30$ | I. 66 | $4 \cdot 33$ | 1.74 | $4 \cdot 36$ |
| 20 | +I.33 | $4 \cdot 22$ | +1.42 | $4 \cdot 24$ | +1.50 | $4 \cdot 27$ | +1.59 | $4 \cdot 30$ | +1.67 | $4 \cdot 34$ | +1.76 | 4.37 |
| 22 | I.35 | $4 \cdot 22$ | I. 43 | $4 \cdot 25$ | 1.52 | $4 \cdot 28$ | I 61 | 4.31 | I 69 | $4 \cdot 35$ | 1.79 | $4 \cdot 38$ |
| 24 | I.36 | $4 \cdot 23$ | I 45 | $4 \cdot 26$ | I. 54 | $4 \cdot 29$ | I. 63 | $4 \cdot 32$ | $1 \cdot 72$ | $4 \cdot 35$ | I.8I | $4 \cdot 39$ |
| 26 | I.38 | $4 \cdot 23$ | I. 47 | $4 \cdot 26$ | I.56 | 4.29 | I. 65 | $4 \cdot 33$ | I•75 | $4 \cdot 37$ | I. 84 | 4.41 |
| 28 | I-41 | $4 \cdot 24$ | I. 50 | $4 \cdot 27$ | I.59 | 4.30 | I. 68 | $4 \cdot 34$ | I•78 | $4 \cdot 38$ | I.87 | $4 \cdot 42$ |
| 30 | +1.43 | $4 \cdot 25$ | +1.52 | $4 \cdot 28$ | +1.62 | 4.31 | +1.71 | $4 \cdot 35$ | +1.81 | 4.39 | +1.91 | 4.43 |
| 32 | 1.46 | $4 \cdot 26$ | 1.56 | 4.29 | 1.65 | $4 \cdot 33$ | ェ・75 | 4.37 | I. 85 | $4 \cdot 4 \mathrm{I}$ | I.96 | $4 \cdot 45$ |
| 34 | I 49 | 4.27 | I 59 | $4 \cdot 31$ | I. 69 | $4 \cdot 34$ | I.79 | $4 \cdot 38$ | I.90 | 4.43 | 2.01 | $4 \cdot 48$ |
| 36 | I. 53 | $4 \cdot 28$ | I. 63 | $4 \cdot 32$ | I.73 | $4 \cdot 36$ | I. 84 | $4 \cdot 40$ | I 95 | $4 \cdot 45$ | $2 \cdot 06$ | $4 \cdot 50$ |
| $3^{8}$ | I.57 | $4 \cdot 30$ | I. 67 | $4 \cdot 34$ | I•78 | $4 \cdot 38$ | I.89 | $4 \cdot 43$ | 2.01 | $4 \cdot 48$ | $2 \cdot 12$ | 4.53 |
| 40 | +r.6I | 4.31 | +1.72 | $4 \cdot 36$ | + $\mathrm{I} \cdot 84$ | $4 \cdot 40$ | + I. 95 | 4.45 | $+2.07$ | $4 \cdot 5 \mathrm{I}$ | +2.20 | $4 \cdot 56$ |
| 42 | I. 67 | $4 \cdot 33$ | 1.78 | $4 \cdot 38$ | I.90 | $4 \cdot 43$ | $2 \cdot 02$ | $4 \cdot 48$ | $2 \cdot 15$ | $4 \cdot 54$ | $2 \cdot 28$ | $4 \cdot 60$ |
| 44 | I•73 | $4 \cdot 36$ | I.85 | $4 \cdot 4 \mathrm{I}$ | $1 \cdot 97$ | $4 \cdot 46$ | $2 \cdot 10$ | 4.52 | $2 \cdot 23$ | $4 \cdot 58$ | $2 \cdot 37$ | $4 \cdot 65$ |
| 46 | 1.79 | $4 \cdot 39$ | 1.92 | 4.44 | $2 \cdot 05$ | $4 \cdot 50$ | $2 \cdot 19$ | $4 \cdot 56$ | $2 \cdot 33$ | $4 \cdot 63$ | $2 \cdot 48$ | $4 \cdot 71$ |
| 48 | 1.87 | $4 \cdot 42$ | $2 \cdot 01$ | $4 \cdot 48$ | $2 \cdot 15$ | 4.54 | $2 \cdot 29$ | $4 \cdot 61$ | 2.45 | $4 \cdot 69$ | $2 \cdot 61$ | $4 \cdot 78$ |
| 50 | +1.96 | $4 \cdot 46$ | $+2.10$ | $4 \cdot 52$ | +2.26 | 4.59 | +2.41 | $4 \cdot 67$ | +2.53 | $4 \cdot 76$ | +2.75 | 4.86 |
| 52 | 2.06 | $4 \cdot 50$ | $2 \cdot 22$ | $4 \cdot 57$ | $2 \cdot 38$ | $4 \cdot 66$ | $2 \cdot 55$ | $4 \cdot 75$ | $2 \cdot 74$ | $4 \cdot 85$ | $2 \cdot 93$ | 4.96 |

14 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $3^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | II. M. S. <br> 600.0 | $\begin{aligned} & \mathrm{s} \\ & +\quad \cdot 2 \mathrm{I} \end{aligned}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 12.6 \end{array}$ | $+\stackrel{31}{ }$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 25 \cdot 2 \end{array}$ | + 5. | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { O } & 37 \cdot 8 \end{array}$ | + S. | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 50 \cdot 6 \end{array}$ |  | $\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 3 \cdot I \end{array}$ | S. $\cdot 21$ |
| 0 | $519.56 \cdot 7$ | -21 | 520911 | -20 | $52020 \cdot 8$ | - 19 | $5 \quad 2031 \cdot 7$ | -17 | $52041 \cdot 9$ | 16 | 52051.4 |  |
| 12 | 5 II' $56 \cdot 0$ | - 21 | $\begin{array}{llll}5 & 12 & 8 \cdot 4\end{array}$ | -20 | $\begin{array}{llll}5 & 12 & 20 \cdot 0\end{array}$ | -18 | $\begin{array}{lllll}5 & 12 & 30 \cdot 6\end{array}$ | -17 | $\begin{array}{llllll}5 & 12 & 40 \cdot 4\end{array}$ | -15 | $\begin{array}{lllll}5 & 12 & 49 \cdot 2\end{array}$ | 14 |
|  | $5 \quad 3 \quad 55 \cdot 3$ | - 21 | $\begin{array}{llll}5 & 4 & 7 \cdot 7\end{array}$ | $\cdot 20$ |  | -18 | $\begin{array}{llll}5 & 4 & 29.5\end{array}$ | -16 | $\begin{array}{llll}5 & 4 & 38 \cdot 8\end{array}$ | -15 | 5447 | 13 |
| 16 | $455 \quad 54 \cdot 6$ | 22 | $4 \begin{array}{lll}46 & 7 \cdot 1\end{array}$ | 2 | $4 \begin{array}{llll}4 & 56 & 18.4\end{array}$ | -18 | $4 \begin{array}{llll}4 & 56 & 28 \cdot 5\end{array}$ | -16 | $4 \quad 5637 \cdot 4$ | -14 | $45645 \cdot 1$ | 12 |
| 18 | 44753.9 | + $\cdot 22$ | 4486.4 | + 20 | $448 \quad 17.6$ | + - I7 | $448 \quad 27 \cdot 5$ | + - I5 | $4 \begin{array}{llll}48 & 35\end{array}$ | + - 13 | $44^{8} 43 \cdot 0$ | + - II |
| 20 | 439 53.1 | - 22 | $440 \quad 5 \cdot 8$ | - 20 | $44016 \cdot 9$ | -17 | $4 \quad 40 \quad 26 \cdot 5$ | - 15 | $4 \quad 40 \quad 34 \cdot 5$ | - 12 | 440 4I'I | 10 |
| 2 | 4 3I 52.4 | $\cdot 22$ | $\begin{array}{llll}4 & 32 & 5 \cdot 1\end{array}$ | 20 | 432 I6•I | -17 | $\begin{array}{llll}4 & 32 & 25 \cdot 5\end{array}$ | -14 | $43233 \cdot 1$ | -II | $43239 \cdot 1$ | -8 |
| 24 | 423 51.6 | -23 | $\begin{array}{lll}4 & 24 & 4 * 4\end{array}$ | - 20 | $4 \quad 24 \begin{array}{lll}4 & 154\end{array}$ | -17 | $4 \quad 24 \quad 24.5$ | -14 | $42431 \cdot 8$ | 10 | $42437 \cdot 2$ | 07 |
| 26 | $41550 \cdot 3$ | 23 | $416 \quad 3 \cdot 7$ | $\cdot 2$. | 41614.7 | -16 | $\begin{array}{lllll}4 & 16 & 23.6\end{array}$ | -13 | $41630 \cdot 5$ | -10 | 4 I6 $35 \cdot 3$ | -6 |
| 28 | $4750 \cdot 0$ | $\cdot 24$ | 48 | 20 | 4814.0 | + 16 |  | + 13 | $4 \quad 8 \quad 29 \cdot 1$ | + .09 | $4 \quad 8 \quad 33 \cdot 4$ | + . 05 |
| 30 | $35949 \cdot 1$ | $\cdot 24$ | $\begin{array}{lll}4 & 0 & 2.4\end{array}$ | - 20 | $4 \quad 0 \quad 13.3$ | 16 | $4 \quad 0 \quad 2 \mathrm{I} \cdot 8$ | 12 | $4 \quad 0 \quad 27 \cdot 9$ | -08 | $4 \quad 031 \cdot 5$ | -04 |
| 31 | $35548 \cdot 7$ | - 24 | $356 \quad 2 \cdot 1$ | -20 | $35613 \cdot 0$ | 6 | $\begin{array}{llll}3 & 56 & 21.4\end{array}$ | -12 | $\begin{array}{llllllllll}3 & 56 & 27 \cdot 2\end{array}$ | -08 | $35630 \cdot 6$ | -03 |
| 32 | 3 5I 48.2 | -25 | 352 | -20 | 352 12.6 | 6 | $35220 \cdot 9$ | $\cdot 12$ | $35226 \cdot 6$ | -07 | 352297 | -03 |
| 33 | $34747 \cdot 7$ | - 25 | $\begin{array}{llll}3 & 48 & \mathrm{I} \cdot 4\end{array}$ | 20 | $3 \quad 48$ I2.3 | -16 | $34^{3} 4820 \cdot 5$ | - II | $34^{3} \quad 26 \cdot 0$ | -07 | $\begin{array}{lllllllllllllllll}3 & 48 & 28 \cdot 7\end{array}$ | - 02 |
| 34 | 34347 | + $\cdot 25$ | 344 | $\cdot 20$ | $34412 \cdot 0$ | + .16 | $344{ }^{20 \cdot 1}$ | + III | 34425.4 | + .06 | 34427.8 | + .02 |
| 35 | $\left\lvert\, \begin{array}{llll}3 & 39 & 46 \cdot 8\end{array}\right.$ | $\cdot 25$ | $\begin{array}{lll}3 & 40 & 0 \cdot 7 \\ 3 & 36 & 0.3\end{array}$ | 21 | 340 II' 6 | 16 | $3 \begin{array}{llll}3 & 40 & 19.7\end{array}$ | -II | $34024 \cdot 7$ | -06 | $3 \quad 40 \quad 26 \cdot 9$ | . OI |
| 36 | $\begin{array}{llll}3 & 35 & 46 \cdot 3\end{array}$ | -26 | $\begin{array}{llll}3 & 36 & 0.3\end{array}$ | -21 | $33^{3} \mathbf{6}$ II•3 | 6 |  | - II | $\begin{array}{llll}3 & 36 & 24 \cdot 1\end{array}$ | -05 | $\begin{array}{llll}3 & 36 & 26 \cdot 0\end{array}$ | . 00 |
| 37 | $\begin{array}{llll}3 & 31 & 45 \cdot 8\end{array}$ | -26 | $\begin{array}{lll}3 & 32 & 0 \cdot 0\end{array}$ | -2I | 332 II•O | 16 | $\begin{array}{llll}3 & 32 & 18 \cdot 3\end{array}$ | -10 | $\begin{array}{llll}3 & 32 & 23.5\end{array}$ | -05 | $33^{32} \quad 25 \cdot 1$ | 00 |
| 38 | $32745 \cdot 3$ | - 26 | $\begin{array}{llllllllllll}3 & 27 & 59.6\end{array}$ | 21 | 32810.6 | 16 |  | -10 | $32822 \cdot 9$ | -05 | $\begin{array}{llll}3 & 28 & 24.2\end{array}$ | . 01 |
| 39 | $3 \begin{array}{llll}3 & 23 & 44^{\circ} 7\end{array}$ | . 27 | 3235 | + 21 | 324 IO.3 | + -16 | $32418 \cdot 0$ | + .10 | $\begin{array}{llll}3 & 24 & 22 \cdot 3\end{array}$ | +.04 | 32423.2 | OI |
| 40 | 31944.2 | $\cdot 27$ | 319588.8 | - 21 | $32010 \cdot 0$ | -16 | 32017.6 | -10 | $32021 \cdot 7$ | -04 | $32022 \cdot 3$ | 02 |
| 41 |  | - 28 |  | -22 | $\begin{array}{llll}3 & 16 & 9 \cdot 6\end{array}$ | -15 | 31617.2 | 09 | 3 I6 2I-I | 3 | $3{ }^{3} 162144$ | 2 |
| 42 | 3 II 43.0 | -28 | 3 II 58*0 | - 22 | $\begin{array}{llll}3 & 12 & 9 \cdot 3\end{array}$ | -16 | $\begin{array}{llll}3 & 12 & 16.8\end{array}$ | -09 | $\begin{array}{llll}3 & 12 & 20 \cdot 5\end{array}$ | - 03 | $\begin{array}{llll}3 & 12 & 20.5\end{array}$ | . 03 |
| 43 | $\begin{array}{llll}3 & 7 & 42 \cdot 4\end{array}$ |  | $\begin{array}{lllll}3 & 7 & 57.6\end{array}$ | 22 | 38890 | 6 | 38 | -09 | $\begin{array}{llll}3 & 8 & 19.9\end{array}$ | -03 | $\begin{array}{llll}3 & 8 & 19.5\end{array}$ | . 04 |
| 44 | $\begin{array}{llll}3 & 3 & 4 \mathrm{I} & 7\end{array}$ | + $\cdot 29$ | $3 \begin{array}{llll}3 & 3 & 57 \cdot 2\end{array}$ | + 22 | $\begin{array}{lll}3 & 4 & 8 \cdot 7\end{array}$ | + .16 | $3 \quad 4 \begin{array}{lll}3 & 16 \cdot 0\end{array}$ | +.09 | $3{ }^{3} 419193$ | +.02 | $3 \quad 418.6$ | -05 |
| 4 | $2594 \mathrm{I} \cdot \mathrm{I}$ | $\cdot 30$ | $2{ }_{2} 5956 \cdot 8$ | $\cdot 23$ | 3 lll | -16 | $3 \quad 0 \quad 15.7$ | -09 | $3{ }^{3}$ | - 02 | $\begin{array}{llll}3 & 0 & 17.7\end{array}$ | -05 |
| 46 | $2 \begin{array}{lllll}2 & 55 & 40 \cdot 4\end{array}$ | $\cdot 30$ | $255156 \cdot 4$ | -23 | $\begin{array}{llll}2 & 56 & 8 \cdot 0\end{array}$ | -16 | $\begin{array}{llll}2 & 56 & 15 \cdot 3\end{array}$ | 8 | $\begin{array}{llll}2 & 56 & 18 \cdot 2\end{array}$ | -OI |  | -06 |
| 47 | $25139 \cdot 8$ | -3I | 2 51 55.9 | -23 | $\begin{array}{lllll}2 & 52 & 7 \cdot 7\end{array}$ | -16 | 25214.9 | -08 | 2521776 | -OI | $252515 \cdot 8$ | -07 |
| 48 | 24739.0 | -3I | 24755.5 |  | $\begin{array}{llll}2 & 48 & 7 \cdot 3\end{array}$ | -16 | 24814.5 | . 08 | 24817.0 | -00 | $\begin{array}{lllll}2 & 48 & 14.8\end{array}$ | -07 |
| 49 | $2 \begin{array}{lllll}2 & 43 & 38 \cdot 3\end{array}$ | + 32 | 24355.0 | + 24 | 24470 | + 16 | 244 I4.I | +.08 | 24416.4 | - | $2 \begin{array}{lll}2 & 44 & 13.8\end{array}$ | -08 |
| 50 | $\begin{array}{llllllllll}2 & 39 & 37 \cdot 5\end{array}$ | -33 | 23954.6 | -24 | 2406.6 | -16 | $2 \begin{array}{llll} & 40 & 13 \cdot 7\end{array}$ | -08 | 2.4015 .8 | OI | 24012 | -09 |
| 51 | 2 2 $3536 \cdot 7$ | -33 | $23554 \cdot 1$ | -25 | $\begin{array}{lll}2 & 36 & 6 \cdot 3\end{array}$ | -16 | $\begin{array}{llll}2 & 36 & 13.4\end{array}$ | $\cdot 07$ | $\begin{array}{llll}2 & 36 & 15 \cdot 2 \\ 2 & 32 & \end{array}$ | - 01 | $2 \begin{array}{llll} & 36 & \text { II } 9\end{array}$ | 0 |
| 52 | 2 l 3 I | -34 | $23153 \cdot 6$ | . 25 | $2326 \cdot 0$ | -16 | 23213.0 | -07 | 23214.7 | . 02 | 23210.9 | 11 |
| 53 | 22734.9 | -35 | 22753 | 26 | 22856 | -16 | 22812.6 | $\cdot 07$ | 228 14.1 | - | $\begin{array}{lll} 2 & 28 & 9.9 \end{array}$ | 12 |
| 54 | 22334.0 | + 36 | 22352.5 | + .26 | $224 \quad 5 \cdot 3$ | + -16 | 22412.3 | + 07 | 22413.5 | - .03 | 224889 | 2 |
| 55 | 21933.0 | -36 | 219520 | -27 | 22046 | -17 | 220 II.9 | -07 | 22012.9 | . 03 | $220 \quad 7 \cdot 9$ | -13 |
| 56 | 2 I5 $32 \cdot 0$ | $\cdot 37$ | 2 I5 5I*4 | -27 | 2 I6 $4 \cdot 6$ | -17 | 2 16 II. | -06 | $21612 \cdot 3$ | -04 | 216 | 14 |
| 57 | 2 II $30 \cdot 9$ | $\cdot 38$ | 2 II 50.8 | - 28 | $\begin{array}{llll}2 & 12 & 4 \cdot 2\end{array}$ | 17 | $212 \mathrm{II} \cdot 2$ | -06 |  | -05 | 2 12 57 | 15 |
| 58 | 2729.8 | -39 | $2750 \cdot 2$ | $\cdot 28$ | $\begin{array}{llll}2 & 8 & 3\end{array}$ | -17 | $\begin{array}{lllllllllll} & 2 & 8 & 10.8\end{array}$ | .06 | $8 \mathrm{II} \cdot \mathrm{I}$ | -05 |  | -16 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.


## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 15 LATITUDE $3^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $7^{\circ}$ | ecl. | $8^{\circ}$ |  | $9^{\circ}$ |  | 10 |  | $11^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\lvert\, \begin{aligned} & \mathrm{H} . \\ & 6 . \end{aligned}\right.$ | $\left\lvert\, \begin{gathered} 5 \\ +\quad 21 \end{gathered}\right.$ |  | $\cdot 21$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 4 \mathrm{I} \cdot 3 \end{array}\right.$ | $\cdot 21$ | $\begin{gathered} \text { S. } \\ 54 \cdot \mathrm{I} \end{gathered}$ |  | $\begin{array}{rl} \mathbf{M} . & \mathrm{S} . \\ 2 & \mathrm{~J} \cdot \mathrm{I} \end{array}$ |  | $\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & 2 & 20 \cdot 1 \end{array}$ |  |
| 10 | 521 | $\cdot 14$ | $\begin{array}{lll}5 & 21 & 8 \cdot 3\end{array}$ | 13 | 21 | 2 | 52122.3 | 10 | 2128.2 | 09 | 2133.4 |  |
| 12 | 51257 |  | 513 |  | 513 |  | 51316.2 | 08 | 1320.7 | 7 | I3 24.4 | 5 |
| 14 | 5 |  | 5 |  | 5 |  | 5 IOPI | -06 | 51333 | -04 | 15. | 2 |
| 16 | 456 |  | 45656 |  | 57 | . 06 | $4574 \cdot 1$ | -04 | 575 | + .02 | $57 \quad 6 \cdot 4$ | -0 |
| 18 | 448 | + -0 | 448 | $+$ | 448 | + 04 | $44^{88} 58 \cdot 1$ | + . 02 | $4858 \cdot 5$ | - . OI | 88 |  |
| 20 | 440 | . 07 | 44049.6 | . 04 | 44051 | . 02 | 440 | .00 | 40 | 03 | 40 | -06 |
| 22 | 432 | . 06 | $43246 \cdot 0$ | -03 | + 3246 |  | 432 | . 03 | 32 | -06 | 3239 | 8 |
| 24 | 424 | -04 | 424 | + 01 | 424 | - .02 | 424 | -05 | 24 | -08 | 24 | - 11 |
| 26 | 416 | . 03 | 416 |  | 16 | .04 | 416 | -07 | 6 | -II | $4 \begin{aligned} & 46 \\ & 20.9\end{aligned}$ |  |
| 28 | 4 | + . 01 | 4 |  |  |  | $4 \begin{array}{lll}4 & 8 & 28.0\end{array}$ | ro |  | - 14 | 48 II 6 | $\cdot 17$ |
| 30 | $4 \quad 03$ | . 0 | $4{ }^{4} 51$ | . 04 | $\begin{array}{llll}4 & 0 & 27.9\end{array}$ | .08 |  | -12 | - 13.2 |  | 5 | I |
| 31 | 35631.4 | - 0 Or | $35629 \cdot 7$ |  | $\begin{array}{llll}3 & 56 & 25 \cdot 5\end{array}$ |  | 356 | - 13 | 56 | -18 | 355 | . 22 |
| 32 | $35230 \cdot 1$ | - 01 | 35227.9 | .06 | 5223.0 | 10 | 352 | -15 | 52 | -19 | 351 | -24 |
| 33 | 348 |  | 348 | .07 | 48 | II | 348 |  | 48 |  | 347 |  |
| 34 | 344 | - 03 | 344 | - .08 | 344 | - 12 | 344 | - 17 | $4357 \cdot 3$ |  | 3 |  |
|  | 340 | . 04 | 340 | -09 | 340 | -14 | 340 | -19 | 3953.2 | - 24 | 39 | 29 |
| 36 |  | -04 | 336 |  | $36 \quad 13.2$ |  | $\begin{array}{llll}3 & 36 & 2 \cdot 7\end{array}$ |  | 35 |  | 35 | 31 |
| 37 |  | -05 |  | - II | $32 \begin{array}{lllll} & 10 \cdot 6\end{array}$ |  | $\begin{array}{llllllllllllll}3 & 31 & 59\end{array}$ | $\cdot 21$ | 31 |  | 331 | $\cdot 32$ |
| 38 |  | .06 |  | - 12 |  | -17 | 327 | $\cdot 23$ | 27 |  | 327 |  |
| 39 | 24 |  | $\begin{array}{llll}3 & 24 & 14.8 \\ 3\end{array}$ |  | 24 |  | $\begin{array}{lllllllllllllll}3 & 23 & 52 \cdot 6\end{array}$ | $\cdot 2$ | I |  | $\begin{array}{llll}3 & 23 & 16 \cdot 2\end{array}$ |  |
| 40 | 320 | -08 | 320 |  | 20 | 20 | 319 |  | 19 |  | $31910 \cdot 7$ |  |
| 41 | 316 | -09 | $\begin{array}{llll}3 & 16 & 10 \cdot 9\end{array}$ | -15 | 16 | - 21 | 315 | $\cdot 27$ | $\begin{array}{lllllllll}3 & 15 & 27 \cdot 3\end{array}$ |  | $\begin{array}{lll}3 & 15 & 5 \cdot 1\end{array}$ | $\cdot 40$ |
| 42 |  | -10 | 312 | -16 | 3 II 57-4 | $\cdot 22$ | 3 II 42.0 | - 29 | 31122.7 | $\cdot 35$ | 10 59.3 | $\cdot 42$ |
| 43 | 38 | -10 | 3 | -17 | 375 | - 24 | 3 |  | $\begin{array}{llll}3 & 7 & 18.0\end{array}$ | $37$ | $3 \begin{array}{llll}3 & 6 & 53.4\end{array}$ |  |
|  |  | - 11 |  |  | $3-351.9$ | -25 | 3 3 34 | . 2 | $3{ }_{3} 3113.2$ | - 39 | $47 \cdot 4$ |  |
| 45 | $\begin{array}{llll}3 & 0 & 12.4\end{array}$ |  | $3{ }^{0}$ | -19 | 25949.0 | $\cdot 27$ | $25930 \cdot 9$ |  | $\begin{array}{lll}59 & 8 \cdot 3\end{array}$ | 4 | $584 \mathrm{I} \cdot 3$ | 析 |
| 46 | $\begin{array}{lllll}2 & 56 & 11\end{array}$ | $\cdot 13$ | $\begin{array}{llll}2 & 56 & 0 \cdot 8 \\ 2 & 51\end{array}$ | 21 | $25546 \cdot 1$ |  | $25527 \cdot 0$ |  | $\begin{array}{llll}55 & 3 \cdot 3\end{array}$ |  | $5435 \cdot 0$ | . 51 |
| 47 | 2 2 | $\cdot 14$ .15 | $2 \begin{array}{llll}21 & 58.6\end{array}$ | -22 | $25143 \cdot 1$ | -30 | 25123.0 | - 37 | 5058 |  | $\begin{array}{llll}2 & 50 & 28.5\end{array}$ |  |
| 48 | 248 | -15 | 247 | $\cdot 23$ | $247$ |  | 247 |  | 46 |  | $246$ |  |
| 49 | 244 | $\cdot 16$ | 243 | - 25 | 43136.9 | . 33 |  | -41 | $4247 \cdot 4$ | . 50 | 42.14 .8 |  |
| 50 | 240 | -1 | 239 | $\cdot 26$ | $3933 \cdot 8$ |  | 239 | $\cdot 43$ | 23841.8 | -52 | $\begin{array}{llll}2 & 38 & 7.7\end{array}$ | .61 |
| 5 I | 236 | -19 | 235 | $\cdot 27$ | $23530 \cdot 5$ | $\cdot 36$ | $\begin{array}{llll}2 & 35 & 6 \cdot 0\end{array}$ | -45 | $34.36 \cdot 0$ |  | $\begin{array}{llll}2 & 34 & 0.4\end{array}$ | -6 |
| 52 | 2 2 | 20 | 231 | 29 | $231127 \cdot 1$ | - | 2 31 1.4 <br> 2   | -48 | $3030 \cdot 0$ | . 5 | $2 \begin{array}{llll}29 & 52 \cdot 7\end{array}$ | -67 |
| 53 | 228 | $\cdot 21$ | 227 | $-30$ | 22723.6 | $\cdot 40$ | 226 |  | 2623 |  | 22544.9 |  |
| 54 | 223 | $\cdot 22$ | 22342.2 | $\cdot 32$ | $22320 \cdot 0$ | ${ }^{4} 4$ | $22251 \cdot 7$ | - $\cdot 52$ | 22 17.3 | $\cdot 63$ | $22136 \cdot 6$ |  |
| 55 | $1 \begin{array}{lll}2 & 19 & 56 \\ 2 & 15\end{array}$ | - 24 | $\begin{array}{lllllllllllllll}2 & 19 & 396\end{array}$ | 34 | $\begin{array}{lllllll}2 & 19 & 16.3\end{array}$ | -44 | $2 \begin{array}{lll}18 & 46 \cdot 6\end{array}$ | 55 | 18 10.6 | . 65 | 21728.0 | . 77 |
| 56 | $1555^{\circ}$ | -2 |  | 35 | $\begin{array}{lllll}2 & 15 & 12.4 \\ 2 & 12.4\end{array}$ | -46 | 214 |  | 214 | -69 | $\begin{array}{llll}2 & 13 & 19.0\end{array}$ | -80 |
|  | $1153{ }^{\circ}$ | $\cdot 26$ | $1153{ }^{\circ}$ | - 37 | $\begin{array}{ll}11 & 8.4 \\ 7 & 4\end{array}$ | 49 | 2 10 35 |  | 95 | ${ }^{\cdot} 72$ | ${ }_{5}{ }^{\text {9.6 }}$ |  |
| 58 | 751 |  | 7 | - 39 | 274.2 |  | 3 | 63 | 548 | -75 | 459 |  |

VARIATION TO I' OF LATITUDE AND ALTITUDE.


16 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. Latitude $3^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{\circ}$ | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 2 & 33^{\prime} \end{array}$ | $\begin{array}{r} \mathrm{S} . \\ +\quad .22 \end{array}$ | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 2 & 46 \cdot 4 \end{array}$ | S. $+\quad .22$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 2 & 59 \cdot 7 \end{array}$ | S. $+\quad .22$ | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 3 & 13 \cdot 2 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\quad .22 \end{gathered}$ | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 3 & 26 \cdot 7 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\quad .22 \end{gathered}$ | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 3 & 40 \cdot 3 \end{array}$ | S. 23 |
| 10 | $521 \quad 37 \cdot 9$ | -07 | $52141 \times 7$ | -06 | 52144.7 | -04 | $52147 \cdot 0$ | + -03 | $52148 \cdot 6$ | +. 02 | 5 2I $49 \cdot 4$ | + . OI |
| 12 | $513127 \cdot 2$ | -04 | 51329.0 | + 02 | 5 13 30.0 | + .OI | $51330 \cdot 1$ | OI | $\begin{array}{llll}5 & 13 & 29.3\end{array}$ | 2 | $\begin{array}{llll}5 & 13 & 27 \cdot 5\end{array}$ | . 04 |
| 14 | $\begin{array}{lllll}5 & 5 & 16.4\end{array}$ | + OI | $\begin{array}{llll}5 & 5 & 16.4\end{array}$ | . OI | $\begin{array}{lrrr}5 & 5 & 15 \cdot 3\end{array}$ | .03 | $\begin{array}{llll}5 & 5 & 13 \cdot 1\end{array}$ | -04 | $\begin{array}{lrr}5 & 5 & 9 \cdot 9\end{array}$ | -06 | $\begin{array}{llll}5 & 5 & 5 \cdot 5\end{array}$ | -08 |
| 16 | 4575 | . 02 | 4575 | -04 | 4575 | . 06 | $45656 \cdot \mathrm{I}$ | -08 | $4 \begin{array}{llll}466 & 50 \cdot 4\end{array}$ | -II | $4 \quad 56 \quad 43.4$ | 13 |
| 18 | $448 \quad 54.9$ | 05 | 448 5I•I | -08 | $44845 \cdot 8$ | - .10 | $448 \quad 39 \cdot 1$ | - 12 | $448 \quad 30 \cdot 8$ | - 15 | 448 2I•I | - -17 |
| 20 | $44044 \cdot 2$ | . 08 | $44038 \cdot 3$ | II | $4 \quad 4030.9$ | -14 | 440 2I-8 | -16 | 440 II•I | -19 | $439 \begin{array}{llll}48 \cdot 6\end{array}$ | - 22 |
| 22 | $43233 \cdot 3$ | II | $432 \quad 25 \cdot 5$ | 4 | 432 15.9 | -17 | $\begin{array}{lll}4 & 32 & 4.4\end{array}$ | 21 | $43151 \cdot 0$ | - 24 | $431535 \cdot 8$ | -27 |
| 24 | $42422 \cdot 3$ | -15 | 42412.5 | 18 | $\begin{array}{lll}4 & 24 & 0.6\end{array}$ | -21 | $4 \begin{array}{lllll}4 & 23 & 46 \cdot 7\end{array}$ | - 25 | $42330 \cdot 7$ | -28 | 42312.6 | -32 |
| 26 | 4 16 1r*2 | -18 | $4 \begin{array}{llll}45 & 59\end{array}$ | - 22 | $\begin{array}{llllllll}4 & 15 & 45\end{array}$ | - 25 |  | -29 | $41510 \cdot 0$ | -33 | $41449{ }^{\prime}$ | $\cdot 37$ |
| 28 | $\begin{array}{llll}4 & 7 & 59.9\end{array}$ | -21 | $\begin{array}{lrrr}4 & 7 & 45 \cdot 8\end{array}$ | $\cdot 25$ | $\begin{array}{llll}4 & 7 & 29 & 3\end{array}$ | 29 | $\begin{array}{lll}4 & 7 & 10 \cdot 3\end{array}$ | - 34 | $4 \begin{array}{rrrr}4 & 6 & 48 \cdot 8\end{array}$ | - 38 | $\begin{array}{llll}4 & 6 & 24.8\end{array}$ |  |
| 30 | $35948 \cdot 4$ | -25 | $\begin{array}{llll}3 & 59 & 32 \cdot \mathrm{I}\end{array}$ | -29 | $3 \begin{array}{lllll}3 & 59 & 13\end{array}$ | -34 | 358515 | - 38 | $\begin{array}{llll}3 & 58 & 27.2\end{array}$ | - 43 | $\begin{array}{llll}3 & 58 & 0.0\end{array}$ | -48 |
| 31 | $\begin{array}{llll}3 & 55 & 42 \cdot 5\end{array}$ | -27 | $\begin{array}{llll}3 & 55 & 25 \cdot 1 \\ 3 & 51\end{array}$ | $\cdot 31$ | $\begin{array}{llr}3 & 55 & 4.9 \\ 3 & 50 & 56\end{array}$ | $\cdot 36$ | $\begin{array}{lllll}3 & 54 & 41.9 \\ 3 & 50 & 31.2\end{array}$ | -41 | 3 54 $16 \cdot 1$ | -45 | $\begin{array}{llll}3 & 53 & 47 \cdot 3\end{array}$ | -50 |
| 32 | $3515136 \cdot 6$ | -29 | $3 \mathrm{5I} 18.0$ | -33 | $35056 \cdot 6$ | $\cdot 38$ | 350 | -43 | 350 | -48 | 34934.4 | . 53 |
| 33 | $34730 \cdot 6$ | -30 | 34710.9 | -35 | $34648 \cdot 1$ | -40 | $\begin{array}{llll}3 & 46 & 22 \cdot 3\end{array}$ | -45 | $\begin{array}{llll}3 & 45 & 53.4\end{array}$ | -51 | $345 \quad 21 \cdot 3$ | $\cdot 56$ |
| 34 | $\begin{array}{llll}3 & 43 & 24.5\end{array}$ | $\cdot 32$ | $\begin{array}{llr}3 & 43 & 3.6 \\ 3 & 38 & 56.2\end{array}$ |  | $\begin{array}{llll}3 & 42 & 39^{\circ}\end{array}$ | -43 | $\begin{array}{llll}3 & 42 & 12.3\end{array}$ | -48 | $3{ }^{3} 4 \mathrm{II} 4 \mathrm{4} \cdot 7$ | -54 | $\begin{array}{llll}3 & 41 & 7 \cdot 9\end{array}$ | -59 |
| 35 | $\begin{array}{llll}3 & 39 & 18.4 \\ 3 & 35 & 12.1\end{array}$ | -34 | $\begin{array}{llll}3 & 38 & 56 \cdot 2 \\ 3 & 36\end{array}$ | $\cdot 40$ | $\begin{array}{llll}3 & 38 & 30 \cdot 8 \\ 3 & 34 & \end{array}$ | -45 | $\begin{array}{rrrr}3 & 38 & 2 \cdot 0 \\ 3 & 33 & 5\end{array}$ | $\cdot 51$ | $\begin{array}{llll}3 & 37 & 29.9\end{array}$ | $\cdot 56$ | $\begin{array}{lllll}3 & 36 & 54 \cdot 3\end{array}$ | -62 |
| 36 37 | 3 35 $12 \cdot 1$ <br> 3 31 $5 \cdot 7$ | $\cdot 36$ | $\begin{array}{llll}3 & 34 & 48 \cdot 7 \\ 3 & 30 & 41 \cdot 0\end{array}$ | -42 |  | -47 | 3 33 $5 \mathbf{r} \cdot 6$ <br> 3 29  | - 53 | $\begin{array}{llll}3 & 33 & 17 & 7 \\ 3 & 29 & 5 \cdot 5\end{array}$ | - 59 | $\begin{array}{llll}3 & 32 & 40 \cdot 5 \\ 3 & 28 & 26 \cdot 3\end{array}$ | -65 |
| 37 38 | $\begin{array}{lllr}3 & 31 & 5 \cdot 7 \\ 3 & 26 & 59 \cdot 2\end{array}$ | - | $\begin{array}{llll}3 & 30 & 41 \cdot 0 \\ 3 & 26 & 33 \cdot 2\end{array}$ | -44 | $\begin{array}{\|rrr\|}3 & 30 & 12.8 \\ 3 & 26 & 3.5\end{array}$ | - 50 | $\begin{array}{llll}3 & 29 & 41 \cdot 0 \\ 3 & 25 & 30\end{array}$ | $\cdot 56$ | $\begin{array}{llr}3 & 29 & 5 \cdot 5 \\ 3 & 24 & 5\end{array}$ | -62 | $\begin{array}{llll}3 & 28 & 26 \cdot 3\end{array}$ | -68 |
| 3 | 32659.2 | -40 | $\begin{array}{llll}3 & 26 & 3\end{array}$ | -46 | $\begin{array}{llll}3 & 26 & 3.5\end{array}$ | -52 | $32530 \cdot 2$ | -59 | $32452 \cdot 9$ | -65 | 32411.8 | 72 |
| 39 | $\begin{array}{lll}3 & 22 & 52.6 \\ 3 & 18 & 45.8\end{array}$ | $\cdot 42$ | $\begin{array}{llll}3 & 22 & 25.2 \\ 3 & 18 & 5 & 1\end{array}$ | - 49 | $32154 \cdot 1$ | -55 | $\begin{array}{lll}3 & 21 & 19.1 \\ 3 & 1 & 7\end{array}$ | -62 | $32040 \cdot 1$ | -68 | $\begin{array}{llll}3 & 19 & 57.0\end{array}$ | $\cdot 75$ |
| 40 | $\begin{array}{lllll}3 & 18 & 45 \cdot 8 \\ 3 & 14 & \end{array}$ | -45 | $\begin{array}{rrrr}3 & 18 & 17 \cdot 1 \\ 3 & 14 & 8.8\end{array}$ | $\cdot 51$ | $\begin{array}{lllll}3 & 17 & 44^{\prime} 5 \\ 3 & 13 & \end{array}$ | -58 | $\begin{array}{llll}3 & 17 & 7 \cdot 7 \\ 3 & 12 & 56 \cdot 1\end{array}$ | -65 | $31626 \cdot 9$ | $\cdot 71$ | $3{ }^{3}$ 15 511.8 | $\cdot 79$ |
| 4 | 3144390 | -47 | $\begin{array}{llll}3 & 14 & 8.8 \\ 3 & 1 & 0.3\end{array}$ | - 54 | $3 \begin{array}{llll}3 & 13 & 34.6\end{array}$ | -60 | $31256 \cdot 1$ | - 68 | $3 \begin{array}{lllll}3 & 12 & 13.4\end{array}$ | $\cdot 75$ | 3 II 26.2 | 82 |
| 42 | 3 10 $31 \cdot 9$ <br>  6 24.7 | -49 | 3 10 0.3 <br> 3 5 5 | $\cdot 56$ | $\begin{array}{llll}3 & 9 & 24.4 \\ 3 & 5 & 4.1\end{array}$ | . 63 | $\begin{array}{lllll}3 & 8 & 44.2\end{array}$ | $\cdot 71$ | $\begin{array}{llll}3 & 7 & 59 \cdot 5 \\ 3 & 3 & 45 \cdot 3\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 7 & 10.2 \\ 3 & 2 & 53.8\end{array}$ | 86 |
| 43 | 3 3 6 24'7 | $\cdot 51$ | $\begin{array}{lllll}3 & 5 & 51.6\end{array}$ | -59 | $3{ }^{3} 5154 \cdot 1$ | . 66 | $3 \quad 4 \quad 32 \cdot 0$ | -74 | $\begin{array}{llll}3 & 3 & 45 \cdot 3\end{array}$ | -82 | $\begin{array}{llll}3 & 2 & 53.8\end{array}$ | 90 |
| 44 | $\begin{array}{lcrl}3 & 2 & 17 \cdot 3\end{array}$ | -54 | $\begin{array}{rrrr}3 & 1 & 42 \cdot 6\end{array}$ | - . 62 |  | - 69 | 3 l | $\cdot 77$ | $25930 \cdot 6$ | - 8.85 | $2 \begin{array}{llll}2 & 58 & 36 \cdot 8\end{array}$ |  |
| 45 | $\begin{array}{llll}2 & 58 & 9 \cdot 7 \\ 2 & 54 & \end{array}$ | - 57 | $2 \begin{array}{llll}27 & 57 & 33.4\end{array}$ | -64 | $2{ }^{2} 56652 \cdot 4$ | $\cdot 72$ | $\begin{array}{llll}2 & 56 & 6 \cdot 5\end{array}$ | -81 | $2 \begin{array}{llll}25 & 15 \cdot 5\end{array}$ | -89 | $2 \begin{array}{llll}2 & 54 & 19 & 3\end{array}$ | -98 |
| 46 | $\begin{array}{rrrr}2 & 54 & 1 \cdot 9 \\ 2 & 49 & 53 \cdot 9\end{array}$ | - 59 | $\begin{array}{llll}2 & 53 & 24.0 \\ 2 & 40\end{array}$ | -67 | $2 \begin{array}{llll}22 & 41 \cdot 1\end{array}$ | $\cdot 76$ | $2 \begin{array}{llll} & 51 & 53 \cdot 1\end{array}$ |  | 25059.9 | -93 | $\begin{array}{lll}2 & 50 & 1.2 \\ 2 & 45 & \end{array}$ | -02 |
| 47 | $\begin{array}{llll}2 & 49 & 53.9\end{array}$ | -62 | $2 \begin{array}{llllll}2 & 49 & 14.2\end{array}$ | $\cdot 70$ | $2 \begin{array}{lllll}2 & 48 & 29.4\end{array}$ | $\cdot 79$ | $2 \begin{array}{lllll}2 & 47 & 39\end{array}$ | -88 | $2 \begin{array}{lllllll}2 & 46 & 43 \cdot 8\end{array}$ | -97 | $24542 \cdot 5$ | 1.07 |
| 48 | $2 \begin{array}{lllllllll}2 & 45 & 45\end{array}$ | -65 | 2454.2 | -73 | 2441774 | -83 | 243 25.1 | -92 | 22 42 27 | I. 02 | $24123 \cdot 1$ | I'I2 |
| 49 | $2 \mathrm{l}^{2} \mathbf{4 1} 37{ }^{\circ} \mathrm{O}$ | - 67 | $2{ }^{2} 4040$ | $\cdot 77$ | $\begin{array}{llr}2 & 40 & 4.9\end{array}$ | - 86 | $23910 \cdot 3$ | - 96 | $\begin{array}{llll}2 & 38 & 9 \cdot 7 \\ 2 & 33 & 51\end{array}$ | -I.06 | $\begin{array}{llll}2 & 37 & 3.0\end{array}$ | - I•16 |
| 50 | 2 37 $28 \cdot 2$ <br> 2 33  | $\cdot 71$ | 22 36 $43 \cdot 0$ <br> 2 32  | -80 | $2 \begin{array}{llll}25 & 52 \cdot 0\end{array}$ | -90 | 23445.0 | 1.00 | $\begin{array}{llll}2 & 33 & 5 \pm \cdot 7 \\ 2 & 29 & 33 \cdot 0\end{array}$ | 11 | $\begin{array}{llll}2 & 32 & 42 \cdot 1 \\ 2 & 28 & \\ \end{array}$ | . 22 |
| 5 | $\begin{array}{llll}2 & 33 & 19 \cdot 1\end{array}$ | $\cdot 74$ | $\begin{array}{llll}2 & 32 & 31.8 \\ 2 & 28 & 20.2\end{array}$ | $\cdot 84$ | $\begin{array}{llll}2 & 31 & 38 \cdot 6 \\ 2 & 27 & 24.6\end{array}$ | -94 | 230390 | 1.05 | $\begin{array}{llll}2 & 29 & 33 \cdot 0\end{array}$ | I-16 | 22820 | 27 |
| 52 | $\begin{array}{lll}2 & 29 & 9 \cdot 6 \\ 2 & 24 & 59\end{array}$ | $\cdot 77$ | $\begin{array}{ccc}2 & 28 & 20 \cdot 2 \\ 2 & 24 & 8.2\end{array}$ | $\cdot 87$ | $\begin{array}{llll}2 & 27 & 24.6\end{array}$ | $\cdot 98$ | 226122.4 | I.09 | $\begin{array}{llll}2 & 25 & 13.5 \\ 2 & 20 & 53 \cdot 1\end{array}$ | . 21 |  | I.33 |
| 53 | 22459.7 | I | 22488 | -91 | $\begin{array}{llll}2 & 23 & 10.2\end{array}$ | 1.03 | 222 5.1 | $1 \cdot 14$ | $22053 \cdot 1$ | 26 | $2 \begin{array}{llllllllll} & 19 & 33.6\end{array}$ | I. 39 |
| 5 | $\begin{array}{llll}2 & 20 & 49 \cdot 4\end{array}$ | -.84 | $\begin{array}{llll}2 & 19 & 55.5\end{array}$ | - 95 | $2 \begin{array}{llll}18 & 54.8\end{array}$ | -I.07 | $21746 \cdot 9$ | -I'I9 | $21631 \cdot 7$ | - I. 32 | 215086 | -I.45 |
| 55 | 2 I 16 $68 \cdot 7$ | -88 | 2 I5 42.4 | 1.00 | $2 \begin{array}{llll}14 & 38 \cdot 9\end{array}$ | -12 | $2 \begin{array}{llll}13 & 27.9\end{array}$ | I. 25 | 21293 | I.38 | 2 Io 42.3 | I. 52 |
| 56 | $\begin{array}{llll}2 & 12 & 27.4 \\ 2 & 8 & 15.7\end{array}$ | -92 | $\begin{array}{llll}2 & 11 & 28 \cdot 6\end{array}$ | I.04 | 2 IO 22.2 | 1.17 | $2 \begin{array}{lll}2 & 9 & 7.9\end{array}$ | $1 \cdot 30$ | $27845 \cdot 6$ | I. 44 | $2 \begin{array}{llllll} & 6 & 14.6\end{array}$ | I. 59 |
| 57 | $\begin{array}{llll}2 & 8 & 15.7 \\ 2 & 4 & \end{array}$ | -96 | $\begin{array}{llll}2 & 7 & 14.1 \\ 2 & 2 & 58.8\end{array}$ | I.09 | $\begin{array}{lll}2 & 6 & 4 \cdot 6 \\ 2 & 1 & 4.1\end{array}$ | I. 23 | $\begin{array}{llll}2 & 4 & 46 \cdot 9\end{array}$ | $1 \cdot 37$ | $\begin{array}{lrrr}2 & 3 & 20.7\end{array}$ | I. 51 | 2 I I 45.3 | I. 67 |
| 58 | $\begin{array}{lll}2 & 4 & 3\end{array}$ | I'OI | $\left\lvert\, \begin{array}{lll}2 & 2 & 58.8\end{array}\right.$ | I'14 | 2 I 46.1 | I. 28 | $2 \quad 0 \quad 24 \% 7$ | I-43 | I $5854 \cdot 2$ | I. 59 | I 5714.2 | I.75 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ}$ |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. 1 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} \\ +\quad .85 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.09 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .92 \end{aligned}$ | $\begin{gathered} S . \\ -4 \cdot I I \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 00 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot \mathrm{I} 3 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 07 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 15 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 15 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 17 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} .23 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 4 \cdot 19 \end{gathered}$ |
| 4 | -.84 | 4.09 | .91 | 4.II | -99 | 4.12 | 1.06 | $4 \cdot 14$ | I.14 | 4.16 | I.2I | $4 \cdot 18$ |
| 8 | -83 | 4.09 | -90 | 4.11 | -98 | $4 \cdot 12$ | I 05 | $4 \cdot 14$ | I-13 | $4 \cdot 16$ | 1.21 | 4.18 |
| 12 | $\cdot 82$ | 4.09 | -90 | 4.10 | -97 | $4 \cdot 12$ | 1.05 | $4 \cdot 14$ | I•I3 | $4 \cdot 16$ | I 20 | $4 \cdot 18$ |
| 16 | -82 | 4.09 | -90 | 4.10 | -98 | $4 \cdot 12$ | I 05 | $4 \cdot 14$ | I'I3 | 4•16 | I 21 | 4.18 |
| 20 | +.83 | 4.09 | + -9I | 4•10 | + 98 | 4•12 | + I.06 | $4 \cdot 14$ | +I.14 | $4 \cdot 16$ | +1.22 | 4.19 |
| 22 | -83 | 4.09 | -91 | 4.II | -99 | 4*12 | I'07 | 4.14 | I'15 | $4 \cdot 17$ | I 23 | 4*19 |
| 24 | -84 | 4.09 | -92 | 4.II | I 00 | 4*13 | I 08 | 4.15 | I•I6 | $4 \cdot 17$ | I. 25 | $4 \cdot 19$ |
| 26 | -84 | 4.09 | -92 | 4.II | I OI | $4 \cdot 13$ | I.09 | $4 \cdot 15$ | I.I7 | 4.17 | I. 26 | $4 \cdot 20$ |
| 28 | -85 | 4.09 | -93 | 4.II | I. 02 | 4.13 | I'IO | 4-15 | I•I9 | 4.18 | 1.28 | $4 \cdot 20$ |
| 30 | +.86 | 4.09 | + 94 | 4.II | +r.03 | $4 \times 13$ | +1.12 | $4 \cdot 16$ | +I.2I | 4.18 | +1.29 | 4.21 |
| 32 | $\cdot 87$ | $4 \cdot 10$ | -96 | 4.12 | 1.05 | 4.14 | I. 14 | 4-16 | I. 23 | 4-19 | I 32 | $4 \cdot 22$ |
| 34 | -88 | 4.IO | -97 | $4 \cdot 12$ | r.06 | 4.14 | I'I5 | $4 \cdot 17$ | I. 25 | $4 \cdot 19$ | I•34 | $4 \cdot 22$ |
| 36 | -90 | 4.10 | -99 | 4•13 | I.08 | $4 \cdot 15$ | I'I8 | $4 \cdot 17$ | I. 27 | $4 \cdot 20$ | 1.37 | $4 \cdot 23$ |
| 38 | -92 | 4.II | $\mathrm{I} \cdot \mathrm{OI}$ | 4.13 | I•II | 4.15 | I. 20 | 4.18 | I.30 | $4 \cdot 21$ | 1.40 | $4 \cdot 24$ |
| 40 | +.94 | 4.II | +1.03 | $4 \cdot 14$ | +I.I3 | $4 \cdot 16$ | +1.23 | 4.19 | +I.33 | 4.22 | +1.44 | $4 \cdot 26$ |
| 42 | . 96 | 4.12 | 1.06 | 4.14 | I-I6 | $4 \cdot 17$ | 1.27 | $4 \cdot 20$ | 1.37 | 4.23 | I.48 | $4 \cdot 27$ |
| 44 | -98 | 4.12 | I.09 | 4.15 | I. 20 | 4.18 | I 30 | $4 \cdot 21$ | 1.41 | $4 \cdot 25$ | I. 53 | $4 \cdot 29$ |
| 46 | $\underline{1}$ OI | $4 \cdot 13$ | I•I2 | 4.16 | I 23 | $4 \cdot 19$ | I. 35 | 4.23 | I. 46 | $4 \cdot 26$ | 1.58 | 4.31 |
| 48 | 1.05 | $4 \cdot 14$ | I•16 | 4•17 | I•28 | $4 \cdot 20$ | I.40 | 4.24 | I 52 | $4 \cdot 28$ | I•64 | $4 \cdot 33$ |
| 50 | +1.08 | 4.15 | + $\mathrm{I} \cdot 20$ | 4.18 | +1.33 | $4 \cdot 22$ | +1.45 | 4.26 | +1.58 | 4.31 | +1.71 | $4 \cdot 36$ |
| 52 | 1.13 | 4.16 | I.25 | 4.20 | I.38 | $4 \cdot 24$ | 1.52 | 4.28 | 1.65 | $4 \cdot 33$ | I•79 | $4 \cdot 39$ |
| 54 | I•18 | $4 \cdot 17$ | I.3I | $4 \cdot 21$ | $\underline{1} 45$ | $4 \cdot 26$ | I.59 | $4 \cdot 31$ | I.74 | 4.37 | 1.89 | $4 \cdot 43$ |
| 56 | I. 24 | 4.19 | I.38 | $4 \cdot 24$ | I.52 | $4 \cdot 29$ | I. 68 | 4.34 | r.83 | 4.40 | 2.00 | 4.47 |
| 58 | I.30 | $4 \cdot 21$ | I*46 | $4 \cdot 26$ | I-6I | $4 \cdot 32$ | I*78 | $4 \cdot 38$ | I.95 | 4.45 | $2 \cdot 13$ | $4 \cdot 53$ |

## LATITUDE $3^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{lll}\text { H. M. } & \text { S. } \\ 6 & 3 & 54.2\end{array}$ | + ${ }^{\text {S }}$ | $\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & 4 & 8 \cdot 2 \end{array}$ | + ${ }^{\text {S }}$ | $\left\lvert\, \begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 4 & 22 \cdot 3 \end{array}\right.$ | S. $+\quad .24$ | $\left\{\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 36 \cdot 7 \end{array}\right.$ | S. .24 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 5 I \cdot 2 \end{array}$ | S. 24 | H. M. S. | S. |
| Io | 5 21 49.5 | .00 | $5{ }_{5} 21484$ | - . 02 | $5 \mathrm{~S}_{5} 2147 \cdot 1$ | - .03 | 5 21 $44 \cdot 3$ | - 04 | 5 2I 4I•6 | . 06 | $\begin{array}{lrrr}5 & 21 & 37 \cdot 6\end{array}$ | -07 |
| 12 | 5 13 24.7 | . 05 | 513210 | -07 | $\begin{array}{llll}5 & 13 & 16 \cdot 3\end{array}$ | -09 | $\begin{array}{lll}5 & 13 & 10 \cdot 5\end{array}$ | -10 | $\begin{array}{llll}5 & 13 & 3.8\end{array}$ | 12 | $\begin{array}{llllll}5 & 12 & 55.9\end{array}$ | 14 |
| 14 | $\begin{array}{llll}5 & 4 & 59.9\end{array}$ | - Io | $\begin{array}{llll}5 & 4 & 53 \cdot 2\end{array}$ | -12 | $\begin{array}{llll}5 & 4 & 45 \cdot 3\end{array}$ | -14 | $\begin{array}{llll}5 & 4 & 36 \cdot 1\end{array}$ | 16 | $\begin{array}{llll}5 & 4 & 25 \cdot 7\end{array}$ | 18 | $\begin{array}{llll}5 & 4 & 14.0\end{array}$ | 21 |
| 16 | $45635^{\circ} \mathrm{O}$ | -15 | $4 \quad 56 \quad 25 \cdot 2$ | -17 | $456 \mathrm{I} \cdot \mathrm{I}$ I | -20 | 45615 | - 22 | $455 \quad 47 \cdot 4$ | -25 | 45531.8 | $\cdot 27$ |
| 18 | $\begin{array}{lll}4 & 48 & 9.8\end{array}$ | 20 | $44757 \cdot 0$ | - 23 | $44742 \cdot 6$ | $\cdot 25$ | $\begin{array}{llll}4 & 47 & 26 \cdot 4\end{array}$ | $\cdot 28$ | 44786 | -3I | 446 49•I | $\cdot 34$ |
| 20 | 43944.4 | $\cdot 25$ | $43928 \cdot 4$ | -28 | $43910 \cdot 6$ | $\cdot 31$ | $\begin{array}{llll}4 & 38 & 50 \cdot 9\end{array}$ | 34 | $\begin{array}{llll}4 & 38 & 29 \cdot 2\end{array}$ | 38 | $438 \quad 5 \cdot 7$ | -4I |
| 22 | 43118.6 | -30 | 43059.4 | $\cdot 34$ | $43038 \cdot 1$ | $\cdot 37$ | 43014.7 | $\cdot 41$ | $42949 \cdot 2$ | -44 | 42921.5 | 48 |
| 24 | $\begin{array}{llll}4 & 22 & 52.4\end{array}$ | $\cdot 36$ | 42229.8 | $\cdot 39$ | 4 22 $5 \cdot 1$ <br> 4 I  | -43 | 4 21 37.9 | $\cdot 47$ | $\begin{array}{lll}4 & 21 & 8.4\end{array}$ | $\cdot 51$ | $4 \quad 2036 \cdot 3$ | 55 |
| 26 | $41425 \cdot 6$ | -41 | $4 \begin{array}{lllllllllllll}4 & 59.6\end{array}$ | $\cdot 45$ | 413 3I•2 | -49 | $\begin{array}{lll}4 & 13 & 0.2\end{array}$ | -54 | $41226 \cdot 5$ | -58 | 4 II $50 \cdot 0$ | 63 |
| 28 | 45588 | $\cdot 47$ | $\begin{array}{llll}4 & 5 & 28 \cdot 7\end{array}$ | $\cdot 51$ | $\begin{array}{llll}4 & 4 & 56 \cdot 5\end{array}$ | $\cdot 56$ | $\begin{array}{llll}4 & 4 & 21.4\end{array}$ | 61 | $\begin{array}{llll}4 & 3 & 43.4\end{array}$ | -66 | $\begin{array}{lll}4 & 3 & 2.4\end{array}$ | -71 |
| 30 | 357.29 .9 | - 52 | $\begin{array}{lllll}3 & 56 & 56 \cdot 9\end{array}$ | - 57 | $35620 \cdot 7$ | . 63 | $35541 \cdot 5$ | -68 | $35459 \cdot 0$ | $\cdot 73$ | $\begin{array}{llll}3 & 54 & 13 \cdot 2\end{array}$ | $\cdot 79$ |
| 31 |  | $\cdot 56$ | $\begin{array}{lllll}3 & 52 & 40 \cdot 5\end{array}$ | -61 | $\begin{array}{lll}3 & 52 & 2.4\end{array}$ | -66 | $35121 \cdot 0$ | $\cdot 72$ | $35036 \cdot 3$ | $\cdot 77$ | $34947 \cdot 9$ | 83 |
| 32 | 34900.8 | -59 | $34^{3} \quad 24^{\circ} \mathrm{O}$ | -64 | $34743 \cdot 8$ | -70 | $\begin{array}{lll}3 & 47 & 0.2\end{array}$ | $\cdot 76$ | 346 13.0 | - 82 | $345 \quad 22 \cdot 2$ | -89 |
| 33 | $34445 \cdot 9$ | . 62 | 344 7•1 | -67 | $343 \quad 24 \cdot 8$ | $\cdot 73$ | 3423 3 | -79 | 3 4I 49*4 | -86 | $340 \quad 55 \cdot 9$ | $\cdot 92$ |
| 34 | $3 \begin{array}{lllll}30 & 40.7\end{array}$ | . 65 | $\begin{array}{lllll}3 & 39 & 49.9\end{array}$ | $\cdot 71$ | $\begin{array}{lll}3 & 39 & 5.4\end{array}$ | $\bullet 77$ | $\begin{array}{llllllll}3 & 38 & 17 & 3\end{array}$ | . 83 | $\begin{array}{llll}3 & 37 & 25 \cdot 2\end{array}$ | - 900 | $\begin{array}{llll}3 & 36 & 29 \cdot 1\end{array}$ | $\cdot 96$ |
| 3 | $\begin{array}{llll}3 & 36 & 15 \cdot 2\end{array}$ | . 68 | $\begin{array}{lllll}3 & 35 & 32 \cdot 3\end{array}$ | $\cdot 74$ | $\begin{array}{lllll}3 & 34 & 45 \cdot 7\end{array}$ | -81 | $\begin{array}{lllll}3 & 33 & 55 \cdot 1\end{array}$ | -88 | $\begin{array}{llll}3 & 33 & 0.5\end{array}$ | -94 | $\begin{array}{lll}3 & 32 & 1 \cdot 6\end{array}$ | 1.02 |
| 36 | 3 3I 59.3 | $\cdot 72$ | 3 3I 14.4 | $\cdot 78$ | $\begin{array}{llll}3 & 30 & 25 \cdot 4\end{array}$ | -85 | $3 \begin{array}{llll}3 & 29 & 32.4\end{array}$ | -92 | $\begin{array}{llll}3 & 28 & 35 \cdot 2\end{array}$ | -99 | $\begin{array}{llllllllllllll}3 & 27 & 33 \cdot 5\end{array}$ | -06 |
| 37 |  | $\cdot 75$ | $\begin{array}{llll}3 & 26 & 56 \cdot 0\end{array}$ | . 82 | $\begin{array}{llll}3 & 26 & 4 \cdot 8\end{array}$ | -89 | $3125 \quad 9 \cdot 3$ | -96 | $\begin{array}{llll}3 & 24 & 9 \cdot 3\end{array}$ | I. 04 | $3 \begin{array}{llll}3 & 23 & 4 \%\end{array}$ | I II |
| 38 | $\begin{array}{llll}3 & 23 & 26 \cdot 6\end{array}$ | $\cdot 79$ | $322 \begin{array}{llll}3 & 37\end{array}$ | -86 | $32143 \cdot 6$ | 93 | $32045 \cdot 5$ | r.OI | 3 I9 42.7 | I.08 | 3 I8 $35 \cdot 2$ | I-17 |
| 39 | $\begin{array}{llll}3 & 19 & 9.7\end{array}$ | . 82 | $\begin{array}{llllll}3 & 18 & 18 \cdot 0\end{array}$ | - 90 | 3 I7 21.9 | -97 | 3 16 2I-I | -I.05 | $3 \begin{array}{llll}3 & 15 & 15.4\end{array}$ | -I•I3 | $3{ }^{3} 1444.7$ | - I. 22 |
| 40 | $\begin{array}{llll}3 & 14 & 52 \cdot 3\end{array}$ | - 86 | $\begin{array}{llll}3 & 13 & 58 \cdot 3\end{array}$ | -94 | $\begin{array}{llll}3 & 12 & 59.6\end{array}$ | I. 02 | 3 II $56 \cdot 0$ | I•I | 3 10 $47 \cdot 4$ | I.r9 | $\begin{array}{llll}3 & 9 & 33 \cdot 5\end{array}$ | . 28 |
| 4 | $311034 \cdot 5$ | -9 | $3 \quad 9 \quad 38 \cdot 0$ | -98 | $38836 \cdot 6$ | I.06 | $\begin{array}{llll}3 & 7 & 30 \cdot 2\end{array}$ | I.15 | $\begin{array}{llll}3 & 6 & 18 \cdot 5\end{array}$ | I. 24 | $\begin{array}{lll}3 & 5 & 1 \cdot 2\end{array}$ | - 33 |
| 42 | $3 \begin{array}{llll}3 & 6 & 16.2\end{array}$ | -94 | $\begin{array}{llll}3 & 5 & 17.2\end{array}$ | I.03 | $\begin{array}{lllll}3 & 4 & 13.0\end{array}$ | I•II | $\begin{array}{lrrr}3 & 3 & 3 \cdot 6 \\ 2 & 5 & 36\end{array}$ | I. 20 | $\begin{array}{llll}3 & 1 & 48 \cdot 7\end{array}$ | 30 | $\begin{array}{lrrr}3 & 0 & 27 \cdot 9\end{array}$ | $\cdot 39$ |
| 43 | 3 I 57.3 | $\cdot 98$ | $3 \quad 0 \quad 55.7$ | 1.07 | $25948 \cdot 7$ | I•16 | $2 \begin{array}{llll}28 & 36 \cdot 2\end{array}$ | I. 26 | 25717.9 | I. 36 | $255 \quad 53 \cdot 5$ | 46 |
| 44 | $2 \begin{array}{llll}2 & 57 & 37 \cdot 8\end{array}$ | - I .03 | $\begin{array}{llll}2 & 56 & 33 \cdot 5\end{array}$ | -1.12 | $255123 \cdot 5$ | -I. 2 | $\begin{array}{llll}2 & 54 & 7 \cdot 8\end{array}$ | - I•3I | $25246 \cdot 0$ | - 1.42 | 25117.9 | - I. 52 |
| 45 | $25317 \cdot 7$ | I.07 | $2 \begin{array}{llll}2 & 52 & 10.5\end{array}$ | I•17 | $250 \quad 57 \cdot 5$ | I. 27 | $2 \begin{array}{llllllllllllll}2 & 49 & 38\end{array}$ | I. 37 | $2 \begin{array}{llll}28 & 18.0\end{array}$ | I. 48 | $24640 \cdot 9$ | . 59 |
| 46 | $\begin{array}{lllll}2 & 48 & 57 \cdot 0\end{array}$ | I-12 | $\begin{array}{lllll}2 & 47 & 46 \cdot 8 \\ 2 & 43 & 22 .\end{array}$ | I. 22 | $\begin{array}{llllllllllllllll}2 & 46 & 30 \cdot 6\end{array}$ | 1.32 | 245880 | I. 43 | $\begin{array}{lllll}2 & 43 & 38 \cdot 7\end{array}$ | 1.55 | $\begin{array}{llll}2 & 42 & 2.5\end{array}$ | . 66 |
| 47 | $2 \begin{array}{lllll}2 & 44 & 35.4\end{array}$ | I.17 | $\begin{array}{lllll}2 & 43 & 22.2\end{array}$ | 1.27 | $\begin{array}{lll}2 & 42 & 2 \cdot 6\end{array}$ | I. 38 | $24036 \cdot 3$ | 1.50 | $2 \begin{array}{lll}29 & 3 \cdot 1\end{array}$ | I. 61 | $2 \begin{array}{lllll}2 & 37 & 22.5\end{array}$ | $\cdot 74$ |
| 48 | $24013 \cdot 1$ | I. 22 | $23^{8}$ 56.6 | $1 \cdot 33$ | $237 \begin{array}{llll}23 & 3 & 5\end{array}$ | 1.44 | $\begin{array}{llll}2 & 36 & 3 \cdot 4\end{array}$ | I.56 | $234 \begin{array}{lll}25 \cdot 9\end{array}$ | I.69 | $23240 \cdot 7$ | I. 82 |
| 49 | $\begin{array}{llll}2 & 35 & 49.9\end{array}$ | - 1.27 | 234 30.1 | - I. 39 | $\begin{array}{llll}2 & 33 & 3 \cdot 2\end{array}$ | - I. 5 | $23129^{\circ} \mathrm{O}$ | - I. 63 | $22947 \cdot 1$ | - $\times 77$ | 227 57.0 | - I.95 |
| 50 | 231125.7 | I•33 | $23002 \cdot 3$ | I. 45 |  | 1.58 |  | I•71 | 2256.5 | I.85 | 223 II.2 | 00 |
| 51 | $\begin{array}{lll}2 & 27 & 0.5\end{array}$ | I.39 | $\begin{array}{lllll}2 & 25 & 33.4\end{array}$ | 1.52 |  | I.65 | $2 \begin{array}{llll}22 & 15 \cdot 5\end{array}$ | 1.79 | $2 \begin{array}{llll}2 & 20 & 23.9\end{array}$ | I•94 | 218123.1 | 2.09 |
| 52 | $22234 \cdot 1$ | I. 45 | 22130 | I. 59 | $\begin{array}{llll}2 & 19 & 23 \cdot 8\end{array}$ | 1.72 | $21736 \cdot 0$ | r.87 | $21539^{\circ} \mathrm{O}$ | 2.03 | $\begin{array}{llllllllllllllll}2 & 13 & 32.4\end{array}$ | 2 |
| 53 | $\begin{array}{llll}2 & 18 & 6.5\end{array}$ | I. 52 | $21631 \cdot 2$ | I. 66 | $2 \begin{array}{llllllllll} & 1 & 47\end{array}$ | 1.81 | 21254.3 | I.96 | 2 10 51.7 | $2 \cdot 13$ | $2 \begin{array}{llll}2 & 8 & 38 \cdot 8\end{array}$ | $2 \cdot 31$ |
| 54 | $\begin{array}{lllll}2 & 13 & 37.5\end{array}$ | - I 59 | 2 II 57.7 | - I•74 | 2 10 $\begin{array}{ll}8.8\end{array}$ | - 1.89 | $2 \begin{array}{llll}2 & 8 & 10.4\end{array}$ | $-2.06$ | $\begin{array}{llll}2 & 6 & 1 & 7\end{array}$ | -2.24 | $2 \begin{array}{lll}2 & 3 & 419\end{array}$ | $-2.43$ |
| 55 | $2 \begin{array}{lll}2 & 9 & 6 \cdot 9\end{array}$ | I.67 | $2722 \cdot 2$ | I. 82 | $2 \begin{array}{llll}2 & 5 & 28 \cdot 2\end{array}$ | $\mathbf{1} \cdot 99$ | $\begin{array}{llll}2 & 3 & 23 \cdot 9\end{array}$ | $2 \cdot 16$ | $\begin{array}{lll}2 & 1 & 8.6\end{array}$ | $2 \cdot 35$ | $1{ }^{1} 584 \mathrm{ll} 4$ | $2 \cdot 56$ |
| 56 | $\begin{array}{llll}2 & 4 & 34 \cdot 6\end{array}$ | 1.75 | $\begin{array}{rrrr}2 & 2 & 44.9 \\ 1 & 5 & \end{array}$ | I.91 | $2 \quad 0 \quad 45 \cdot 1$ | 2.09 | 15834.4 | $2 \cdot 28$ | $1 \begin{array}{llll}56 & 11.9\end{array}$ | $2 \cdot 48$ | $15336 \cdot 7$ | $2 \cdot 70$ |
| 57 | $\begin{array}{lll}2 & 0 & 0.3\end{array}$ | I.83 | $1 \begin{array}{lll}58 & 5 \cdot 3\end{array}$ | 2.01 | $155 \quad 59 \cdot 3$ | $2 \cdot 20$ | I 53 4I•7 | 2.40 | $15111 \cdot 4$ | $2 \cdot 62$ | $1{ }_{1}{ }^{8} \quad 27 \cdot 3$ | 2.86 |
| 58 | I 5524.0 | I.93 | $15323 \cdot 0$ | $2 \cdot 1$ | $5110 \cdot 3$ | $2 \cdot 32$ | $4845 \cdot \mathrm{I}$ | $2 \cdot 53$ | $46 \quad 6 \cdot 3$ | 2.77 | $1 \begin{array}{lll}13 & 12.5\end{array}$ | 3.02 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 30 \end{gathered}$ | $\begin{gathered} S \\ -4 \cdot 2 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{x} \cdot \mathrm{l}^{2} \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 24 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 46 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 54 \end{gathered}$ | $\begin{gathered} \text { S. } \\ -4 \cdot 29 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 62 \end{gathered}$ | $\begin{gathered} s \\ -4 \cdot 32 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 70 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 35 \end{gathered}$ |
| 4 | I.29 | $4 \cdot 21$ | 1.37 | 4.23 | 1.45 | $4 \cdot 26$ | I. 53 | 4.29 | I.6I | $4 \cdot 32$ | 1.69 | $4 \cdot 35$ |
| 8 | 1.28 | $4 \cdot 20$ | 1.36 | $4 \cdot 23$ | I. 44 | $4 \cdot 26$ | 1.52 | $4 \cdot 28$ | I-60 | $4 \cdot 31$ | 1.68 | $4 \cdot 34$ |
| 12 | 1. 28 | $4 \cdot 21$ | I. 36 | 4.23 | I 44 | $4 \cdot 26$ | 1.52 | $4 \cdot 28$ | I.6I | 4.31 | I. 69 | $4 \cdot 35$ |
| 16 | 1.29 | $4 \cdot 21$ | 1.37 | $4 \cdot 23$ | I. 45 | $4 \cdot 26$ | 1.54 | $4 \cdot 29$ | I. 62 | $4 \cdot 32$ | I•7I | $4 \cdot 35$ |
| 20 | +r.3I | $4 \cdot 21$ | + 1 . 39 | $4 \cdot 24$ | +1.47 | $4 \cdot 27$ | +1.56 | $4 \cdot 30$ | + I .65 | 4.33 | + I 73 | $4 \cdot 36$ |
| 22 | 1.32 | $4 \cdot 21$ | I. 40 | $4 \cdot 24$ | I. 49 | $4 \cdot 27$ | 1.57 | $4 \cdot 30$ | I. 66 | $4 \cdot 33$ | I-75 | $4 \cdot 37$ |
| 24 | I-33 | $4 \cdot 22$ | 1.42 | $4 \cdot 25$ | I 50 | 4.28 | I. 59 | $4 \cdot 31$ | I. 68 | $4 \cdot 34$ | 1.77 | $4 \cdot 38$ |
| 26 | 1.35 | $4 \cdot 22$ | 1.43 | $4 \cdot 25$ | I. 52 | $4 \cdot 28$ | I.6I | $4 \cdot 32$ | I•70 | 4.35 | I.80 | 4.39 |
| 28 | I. 36 | $4 \cdot 23$ | 1.45 | $4 \cdot 26$ | I. 54 | $4 \cdot 29$ | I. 64 | $4 \cdot 33$ | $1 \cdot 73$ | $4 \cdot 36$ | I.83 | $4 \cdot 40$ |
| 30 | +1.38 | $4 \cdot 24$ | +1.48 | $4 \cdot 27$ | +1.57 | $4 \cdot 30$ | +r.67 | $4 \cdot 33$ | +1.76 | $4 \cdot 37$ | + I .86 | 4.41 |
| 32 | I.41 | $4 \cdot 25$ | I. 50 | $4 \cdot 28$ | I. 60 | $4 \cdot 31$ | I•70 | $4 \cdot 35$ | 1.80 | 4.39 | I.90 | $4 \cdot 43$ |
| 34 | I. 44 | $4 \cdot 25$ | I. 53 | $4 \cdot 29$ | I. 63 | 4.32 | 1.73 | $4 \cdot 36$ | 1.84 | 4.41 | I.94 | $4 \cdot 45$ |
| 36 | 1.47 | $4 \cdot 27$ | 1.57 | $4 \cdot 30$ | I. 67 | $4 \cdot 34$ | 1.78 | $4 \cdot 38$ | I.88 | 4.43 | I.99 | $4 \cdot 47$ |
| 38 | 1.50 | $4 \cdot 28$ | I.6r | $4 \cdot 32$ | 1.71 | $4 \cdot 36$ | 1.82 | 4.40 | 1.93 | $4 \cdot 45$ | $2 \cdot 05$ | $4 \cdot 50$ |
| 40 | +1.54 | $4 \cdot 29$ | +r.65 | $4 \cdot 33$ | + $1 \cdot 76$ | $4 \cdot 38$ | + I .88 | 4.42 | +1.99 | 4.47 | $+2.11$ | 4.53 |
| 42 | I•59 | $4 \cdot 31$ | I.70 | $4 \cdot 35$ | I. 82 | $4 \cdot 40$ | I•94 | 4.45 | $2 \cdot 06$ | $4 \cdot 50$ | $2 \cdot 19$ | $4 \cdot 56$ |
| 44 | I. 64 | $4 \cdot 33$ | I.76 | $4 \cdot 38$ | I.88 | $4 \cdot 43$ | $2 \cdot 01$ | $4 \cdot 48$ | $2 \cdot 14$ | $4 \cdot 54$ | $2 \cdot 27$ | $4 \cdot 60$ |
| 46 | 1.70 | $4 \cdot 35$ | 5.83 | $4 \cdot 40$ | I.96 | $4 \cdot 46$ | 2.09 | $4 \cdot 52$ | $2 \cdot 23$ | $4 \cdot 58$ | $2 \cdot 37$ | $4 \cdot 65$ |
| 48 | 1•77 | $4 \cdot 38$ | I 90 | $4 \cdot 43$ | $2 \cdot 04$ | $4 \cdot 49$ | 2.18 | $4 \cdot 56$ | $2 \cdot 33$ | 4.63 | $2 \cdot 48$ | 4.71 |
| 50 | +1.85 | 4.41 | +1.99 | 4.47 | +2.14 | $4 \cdot 54$ | +2.29 | 4.61 | +2.45 | $4 \cdot 69$ | +2.6I | $4 \cdot 78$ |
| 52 | 1.94 | 4.45 | 2.09 | $4 \cdot 52$ | $2 \cdot 25$ | $4 \cdot 59$ | 2.41 | $4 \cdot 68$ | $2 \cdot 58$ | $4 \cdot 77$ | $2 \cdot 77$ | $4 \cdot 87$ |
| 54 | $2 \cdot 04$ | 4.50 | $2 \cdot 21$ | 4.57 | $2 \cdot 33$ | $4 \cdot 66$ | $2 \cdot 56$ | $4 \cdot 75$ | $2 \cdot 75$ | $4 \cdot 86$ | 2.96 | 4.98 |
| 56 | $2 \cdot 17$ | 4.55 | $2 \cdot 35$ | $4 \cdot 64$ | 2.54 | 4:74 | $2 \cdot 74$ | $4 \cdot 85$ | $2 \cdot 95$ | 4.98 | $3 \cdot 19$ | $5 \cdot 12$ |
| 58 | $2 \cdot 31$ | $4 \cdot 63$ | 2.51 | 4.73 | $2 \cdot 73$ | $4 \cdot 84$ | 2.95 | 4.98 | $3 \cdot 20$ | $5 \cdot 12$ | $3 \cdot 47$ | $5 \cdot 30$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0{ }^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2{ }^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0 \\ 0.0 \end{array}\right.$ | S. <br> $+\quad .28$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { о } & \text { r. } 8 \end{array}\right.$ | $\begin{array}{r} \mathrm{s} . \\ +\quad .28 \end{array}$ | $\left\|\begin{array}{ccc} \text { H. м. } & \text { s. } \\ 6 & \text { o } & 33 \cdot 6 \end{array}\right\|$ | $\begin{gathered} \text { s. } \\ +\quad .28 \\ \hline \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & \text { o } & 50 \cdot 6 \end{array}$ | $\begin{gathered} \text { s. } \\ +\quad .28 \end{gathered}$ |  |  | $\boldsymbol{H}_{6}^{\mathrm{H} . \mathrm{M} .} \begin{gathered} \mathrm{I} . \\ 24 \cdot \mathrm{I} \end{gathered}$ | $\begin{array}{r} \mathrm{S} \\ +\quad .28 \end{array}$ |
| ro | 519 54•I | $\cdot 28$ | $52010 \cdot 7$ | $\cdot 27$ | 5 2026.7 | $\cdot 26$ | $52041 \cdot 9$ | $\cdot 25$ | $5 \quad 2056 \cdot 4$ | $\cdot 23$ | $\begin{array}{llll}5 & 21 & 10 \cdot 2\end{array}$ | $\cdot 22$ |
| 12 | $\begin{array}{lllllllllllll}5 & \text { II } & 2\end{array}$ | -28 | $\begin{array}{llll}5 & 12 & 9.5\end{array}$ | $\cdot 27$ | 5 5 2225.4 | - 26 |  | -24 | 51254.4 | $\cdot 23$ | $\begin{array}{llll}5 & 13 & 7 \cdot 7\end{array}$ | -21 |
| 14 | 351.6 | 29 | $\begin{array}{llll}5 & 4 & 8.4\end{array}$ | -27 | 4 24.1 | - 25 | 5 5 4 $488 \cdot 8$ | . 23 | $\begin{array}{llll}5 & 4 & 52 \cdot 5\end{array}$ | -22 | $\begin{array}{llll}5 & 5 & 5 \cdot 2\end{array}$ | . 20 |
| 16 | $5550 \cdot 4$ | -29 | $4 \begin{array}{lll}46 & 7 \cdot 2\end{array}$ | -27 | $1 \begin{array}{llll}4 & 56 & 22 \cdot 9\end{array}$ | 25 | $45^{56} 37 \cdot 4$ | . 23 | $45650 \cdot 6$ | . 21 | $4 \begin{array}{lll}57 & 2 \cdot 8\end{array}$ | 19 |
| 18 | $44749 \cdot 1$ | + 29 | 4486.0 | $+\cdot 27$ | 4829.7 | + 25 | $4 \begin{array}{llll}48 & 35 \cdot 9\end{array}$ | + 22 | $44848 \cdot 8$ | + 20 | 449 0.4 | + . 8 |
| 20 | $43947 \cdot 8$ | $\cdot 30$ | 4404.9 | $\cdot 27$ | $4020 \cdot 5$ | - 25 | $44034 \cdot 5$ | 22 | 44047.0 | -20 | $44058 \cdot \mathrm{I}$ | 17 |
| 2 | $43146 \cdot 4$ | $\cdot 30$ | $\begin{array}{llll}4 & 32 & 3.7\end{array}$ | -27 | $4_{4}^{4} 32 \begin{array}{lll}19 & 2\end{array}$ | $\cdot 24$ | 4 $3233 \cdot 1$ | 22 | $43245 \cdot 3$ | -19 | $43255 \cdot 8$ | 16 |
| 24 | 42345.0 | -31 | $424 \quad 2 \cdot 5$ | -27 | $4 \begin{array}{lll}4 & 24 & 18 \cdot 1\end{array}$ | - 24 | $42431 \cdot 8$ | -21 | $42443 \cdot 6$ | -18 | $42453 \cdot 6$ | 15 |
| 26 | $4 \times 543.6$ | $\cdot 3 \mathrm{I}$ | $4 \begin{array}{lll}46 & \mathrm{I}\end{array}$ | -28 | 16 16.9 | 24 | $41630 \cdot 5$ | . 21 | $41642 \cdot 0$ | 17 | $41651 \cdot 5$ | - 14 |
| 28 | $742 \cdot \mathrm{x}$ | + 32 | $480 \cdot 0$ | + . 28 | 815.7 | + 24 | $48829 \cdot 1$ | + . 20 | $\begin{array}{llll}4 & 8 & 40 \cdot 3\end{array}$ | $+\cdot 17$ | $\begin{array}{llll}4 & 8 & 49 \cdot 4\end{array}$ | + 13 |
| 30 | $5940 \cdot 6$ | $\cdot 32$ | $35958 \cdot 8$ | - 28 | - 14.5 | $\cdot 24$ | 44 0 27.9 <br> 3 56  | 20 | $\begin{array}{llll}4 & 0 & 38 \cdot 8 \\ 3 & 5 & \end{array}$ | $\cdot 16$ | $4 \quad 0 \quad 473$ | - 12 |
| 31 | $\begin{array}{llllllllllll}3 & 55 & 39 \cdot 8\end{array}$ | $\cdot 32$ | $35558 \cdot \mathrm{I}$ | -28 | 5614.0 | - 24 |  | - 20 | $35638 \cdot 0$ | - 16 | $\begin{array}{lllll}3 & 5646 \cdot 3\end{array}$ | 2 |
| 3 | 35139.0 | $\cdot 3$ | $35157 \cdot 5$ | -29 | 5213.3 | - 24 | $35226 \cdot 6$ | -20 | $\begin{array}{llllllll}3 & 52 & 37 \cdot 2\end{array}$ | $\cdot 1$ | $\begin{array}{llll}3 & 52 & 45\end{array}$ | II |
| 33 | 34738.2 | -33 | $34756 \cdot 8$ | -29 | $\begin{array}{llll}3 & 48 & 12.8\end{array}$ | 24 | 34826.0 | -20 | $\begin{array}{lllll}3 & 48 & 36 \cdot 5\end{array}$ | - 15 | $\begin{array}{llll}3 & 48 & 44\end{array}$ | - II |
| 34 | 4337 | + 34 | $34356 \cdot 2$ | + 29 | 4412.2 | + 24 | $34425 \cdot 4$ | + 19 | $34435 \cdot 7$ | +.15 | $34443 \cdot 3$ | + 10 |
| 35 |  | 34 |  | $\cdot 29$ | 40 II. 6 | -24 | $34^{40} 24 \cdot 7$ | -19 | $34035{ }^{\circ}$ | - 14 | $34042 \cdot 3$ | -10 |
| 36 | 3 $3535 \cdot 6$ | -34 |  | -29 | $3611 \cdot 0$ | - 24 | 3 36 $24 \cdot x$ | -19 | $\begin{array}{lllllllllll}3 & 364.2\end{array}$ | - 14 | $\begin{array}{llll}3 & 36 & 4 \mathrm{r} \cdot 3\end{array}$ | -09 |
| 37 | $\begin{array}{llll}3 & 31 & 34 \cdot 7\end{array}$ | 35 | 3 $3154 \cdot 1$ | $\cdot 30$ | 3210.4 | - 24 | 3 32 23.5 <br> 3 28  | - 9 | $\begin{array}{llll}3 & 32 & 33.5\end{array}$ | -14 | $\begin{array}{llll}3 & 3240 \cdot 3\end{array}$ | -09 |
| 38 | $\begin{array}{lllll}3 & 27 & 33.7\end{array}$ | 35 | 32753.4 | -30 | $28 \quad 98$ | 24 | $\begin{array}{llll}3 & 28 & 22 \cdot 9\end{array}$ | 19 | $32832 \cdot 7$ | $\cdot 14$ | $3 \quad 2839 \cdot 3$ |  |
| 39 | $\begin{array}{lllll}3 & 23 & 32 \cdot 8\end{array}$ | + 36 | $32352 \cdot 7$ | + 30 | $\begin{array}{lll}24 & 9 \cdot 2\end{array}$ | $+\cdot 25$ | $\begin{array}{lllll}3 & 24 & 22.3\end{array}$ | + . 19 | $32432 \cdot 0$ | + 13 | $32438 \cdot 4$ | + .08 |
| 40 | 3 19 $3 \mathrm{x} \cdot 8$ | $\cdot 36$ | $31952 \cdot 0$ | $\cdot 31$ | 208.6 | $\cdot 25$ | $32021 \cdot 7$ | -19 | $320031 \cdot 3$ | $\cdot 13$ | $32037 \cdot 4$ | - 07 |
| 41 | $\begin{array}{llll}3 & 15 & 30 \cdot 8\end{array}$ | -37 | $\begin{array}{llll}3 & 15 & 51.2\end{array}$ | $\cdot 31$ | $168 \cdot 0$ | - 25 | 3 16 21.1 | -19 | $\begin{array}{llll}3 & 16 & 30 \cdot 6\end{array}$ | -13 | $\begin{array}{llll}3 & 16 & 36 \cdot 5\end{array}$ | $\cdot 07$ |
| 42 | $\begin{array}{llll}3 & 10 & 29 \cdot 7\end{array}$ | 38 | 3 II $50 \cdot 4$ | 31 | $\begin{array}{llll}3 & 12 & 7.4\end{array}$ | $\cdot 25$ | 31220.5 | -I9 | $\begin{array}{llll}312 & 29.9\end{array}$ | -12 | $\begin{array}{llll}3 & 12 & 35.5\end{array}$ | -06 |
| 43 | $\begin{array}{llll}3 & 7 & 28 \cdot 6\end{array}$ | 8 | $3 \quad 749 \cdot 6$ | $\cdot 32$ | $6 \cdot 7$ | 25 | $\begin{array}{llll}3 & 8 & 19.9\end{array}$ | -I9 | $\begin{array}{llll}3 & 8 & 29.4\end{array}$ | -12 | $\begin{array}{llll}3 & 8 & 34 \cdot 6\end{array}$ | 5 |
| 44 | $\begin{array}{llll}3 & 3 & 27.5\end{array}$ | + 39 | $\begin{array}{llllllll}3 & 3 & 48 \cdot 9\end{array}$ | + 32 | 4 6.I | + 25 | $\begin{array}{lllllllll}3 & 4 & 19.3\end{array}$ | + 19 |  | + 12 |  | +.05 |
| 45 | 25926.4 | $\cdot 40$ | $25948 \cdot 0$ | -33 | 05 | - 26 | 3 O | -19 | $3 \quad 0 \quad 27.8$ | -12 | $3 \quad 0 \quad 32 \cdot 7$ | . 05 |
| 46 | $255 \quad 25.2$ | $\cdot 40$ | $25547 \cdot 2$ | -33 | $\begin{array}{lll}2 & 56 & 4.9\end{array}$ | - 26 | $2 \begin{array}{llll}26 & 18.2\end{array}$ | - 19 | $25627 \cdot 1$ | - II | $2563 \mathrm{I} \cdot 8$ | . 04 |
| 47 | $\begin{array}{lllll}2 & 51 & 23.9\end{array}$ | 4 4 | $25146 \cdot 3$ | $\cdot 34$ |  | - 26 | $\begin{array}{lllll}2 & 52 & 17 \cdot 6 \\ 2 & 48 & \end{array}$ |  | $\begin{array}{llll}2 & 52 & 26 \cdot 4\end{array}$ | - II | 2 52 $30 \cdot 8$ <br> 2 4  | . 04 |
| 43 | 24722.6 | $\cdot 42$ | $24745 \cdot 4$ | 34 | $48 \quad 3 \cdot 5$ | 26 | 248 <br> 8 <br> 170 | -19 | $24825 \cdot 8$ | - II | 24829.9 | -03 |
| 49 | $2432 \mathrm{r} \cdot 3$ | + 43 | $24344 \cdot 5$ | + 35 | $244 \begin{array}{ll}2 \cdot 9\end{array}$ | + 27 | $2 \begin{array}{lllllll} & 44 & 16.4\end{array}$ | + 19 | $24425 \cdot 1$ | + . 10 | 24429.0 | + . 02 |
| 50 | $\begin{array}{lllll}2 & 39 & 19.9\end{array}$ | -44 | $23943 \cdot 5$ | -35 | $2{ }^{2} 40$ | -27 | $24^{40} 15 \cdot 8$ | -19 | 24024.4 | -10 | $24028 \cdot \mathrm{r}$ | -02 |
| 51 | $2 \begin{array}{llll}25 & 18.5\end{array}$ | 45 | $23542 \cdot 5$ | $\cdot 36$ | $\begin{array}{lll}26 & 1 & \text { 5 }\end{array}$ | $\cdot 27$ | 23615.2 | -19 |  | -ro | $23627 \cdot 2$ | - 01 |
| 52 | 231186 | $\cdot 46$ | $23141 \cdot 6$ | -37 | 32 0.8 | - 28 | $23214 \cdot 7$ | -19 | $\begin{array}{llll}2 & 32 & 23 \cdot 1\end{array}$ | -ro | $232 \quad 26 \cdot 2$ | - |
| 53 | $22^{\prime} 1515$ | 47 | $22740 \cdot 5$ | $\cdot 37$ | 28 0.1 | 28 | 228 14 | -19 | 22822.5 | -09 | 22825.3 | -00 |
| 54 |  | + ${ }^{48}$ |  | $+\cdot 3^{8}$ | 2359.3 | $+28$ |  | + 19 | 22421.8 | + .09 | 22424.4 | -00 |
| 55 | $\begin{array}{lllll}2 & 19 & 17.9\end{array}$ | 49 | $\begin{array}{llll}2 & 19 & 38 \cdot 3\end{array}$ | $\cdot 39$ | 1958.6 | -29 | $2 \begin{array}{lll}20 & 12.9\end{array}$ | -19 | 22021.2 | $\bullet 9$ | 22023.5 | - 01 |
| 56 | $21510 \cdot 1$ | 50 | $21537 \cdot 1$ | 40 | 15 57.8 | -29 | $2 \begin{array}{lll}16 & 12 \cdot 3\end{array}$ | -19 | $21620 \cdot 5$ | -09 | 1622.6 | $\cdot 02$ |
| 57 | 2 II 8 81 | 51 | 2 II 35.9 | 4 I | II 57.0 | 30 | $2 \begin{array}{llllll} \\ 12 & \text { II }\end{array}$ | -19 | $2 \begin{array}{llll}2 & 19 & 19.9\end{array}$ | 8 | 1221.6 | -02 |
| 58 | $7.6 \cdot 1$ | 53 | $734 \cdot 6$ | 42 | 756 | $\cdot 30$ | II |  | 2819.2 | .08 | $820 \cdot 7$ | 3 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.


HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 19

## LATITUDE $4^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. <br> Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\lvert\, \begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 4 \mathrm{I} \cdot \mathrm{O} \end{array}\right.$ | + ${ }^{\text {S }}$ | $\left\|\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 58.0 \end{array}\right\|$ | $\stackrel{\text { S. }}{+}$ | $\left\|\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & 2 & 15 \cdot \mathrm{I} \end{array}\right\|$ | + ${ }^{\text {S }}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 2 & 32 \cdot 3 \end{array}\right\|$ | $29$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 2 & 49 \cdot 5 \end{array}\right\|$ |  | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \\ 6.9 .9 \end{array}\right\|$ |  |
| 10 | $\begin{array}{llll}5 & 21 & 23.3\end{array}$ |  | $5 \begin{array}{llll}5 & 21 & 35 \cdot 6\end{array}$ |  | $\begin{array}{llllllllllll}5 & 21 & 47 \cdot 3\end{array}$ | -19 | $5 \begin{array}{llll}5 & 21 & 58.3\end{array}$ | -18 | $\begin{array}{llll}5 & 22 & 8.6\end{array}$ | -17 |  | 15 |
| 12 | $51320 \cdot 0$ | - 20 | $\begin{array}{lllll}5 & 13 & 31.5\end{array}$ | -18 | $\begin{array}{llll}5 & 13 & 42 \cdot \mathrm{I}\end{array}$ | -17 | $\begin{array}{lllllllllll}5 & 13 & 52\end{array}$ | 16 | $\begin{array}{llll}5 & 14 & 0.9\end{array}$ | -14 | $\begin{array}{llll}5 & 14 & 9 \cdot 0\end{array}$ | -13 |
| 14 | 5 5 16.8 | - 18 | 5 5 5 $\quad 27 \cdot 4$ | -17 | $\begin{array}{llll}5 & 5 & 37 \cdot 0\end{array}$ | -15 | $\begin{array}{lllll}5 & 5 & 45 \cdot 6\end{array}$ | -13 | $\begin{array}{llllllll}5 & 5 & 53.2\end{array}$ | -12 | $\begin{array}{llll}5 & 5 & 59 \cdot 8\end{array}$ | o |
| 16 | $1 \begin{array}{llll}4 & 57 & 13.7\end{array}$ | -17 | 45723.4 | $\cdot 15$ | $45732 \cdot 0$ | -13 | $45739 \cdot 4$ | -11 | $5745 \cdot 6$ | -09 | 57 50.6 | 07 |
| 18 | $44910 \cdot 6$ | + - 16 | 44919.5 | + 14 | $44927 \cdot \mathrm{I}$ | + $\cdot 11$ | $44933 \cdot 3$ | + .09 | $44938 \cdot 2$ | + -07 | 49 41•7 | + .05 |
| 20 | $\begin{array}{llll}4 & 41 & 7 \cdot 6\end{array}$ | - 15 | 441515.7 | $\cdot 12$ | $4 \begin{array}{lll}4 & 41 & 22.2 \\ 4 & 3\end{array}$ | -09 | 44127.2 | -07 | $44130 \cdot 7$ | . 04 | $4 \mathrm{I} 32 \cdot 7$ | -02 |
| 22 | $\begin{array}{llll}4 & 33 & 4.7\end{array}$ | - 13 | $433 \mathrm{Ir} \cdot 9$ | -10 | 43317.4 | . 08 | $43321 \cdot 2$ | -05 | 43323.3 | + 02 | $433 \quad 23.7$ | - 01 |
| 24 | $\begin{array}{llll}4 & 25 & 1.8 \\ 4 & 16 & 50\end{array}$ | - 12 | $\begin{array}{lll}4 & 25 & 8 \cdot I \\ 4 & 17 & 4 \cdot 4\end{array}$ | -09 | $\begin{array}{llll}4 & 25 & 12.6 \\ 4 & 17 & 7.8\end{array}$ | . 06 | $\begin{array}{lllllll}4 & 25 & 15.2\end{array}$ | +-01 | $\begin{array}{lllllll}4 & 25 & 15.9\end{array}$ | - ${ }^{\circ} 00$ |  | 6 |
| 26 | $41659 \cdot 0$ |  | 417 | -07 | $\begin{array}{llll}4 & 17 & 7.8\end{array}$ | . 04 | $417 \quad 9 \cdot 2$ | + 0 | 41785 | - .03 | $17 \quad 5 \%$ | .06 |
| 28 | 4856 | $+$ | $\begin{array}{llll}4 & 9 & 0 \cdot 7 \\ 4 & 0 & 57\end{array}$ | +.06 | 4 9 $3 \cdot 1$ <br> 4 5  | + 02 | $\begin{array}{llll}4 & 9 & 3.2\end{array}$ | -02 | 9 <br> 1.0 <br> 5.6 | -05 | 856.6 | . 09 |
| 30 | $4 \quad 053.4$ | .08 | $4{ }^{4} \mathrm{o}$ 57.1 | . 04 | 44 0 58.4 | . 0 | 4 O $57 \cdot 2$ | - 04 | $4 \quad 0 \quad 53.6$ | . 08 | - 47 | 12 |
| 31 | $35652 \cdot 0$ | . 07 | $3 \quad 5655 \cdot 3$ | -03 | $3 \begin{array}{llllllllll}3 & 56 & 56\end{array}$ | - . 01 | $35654 \cdot 2$ | -05 | 35649.8 | -09 | 35642 | 14 |
| 32 | $35250 \cdot 7$ | -07 |  | -02 | $\begin{array}{lllll}3 & 52 & 53.6\end{array}$ | -02 | $35^{2}$ 5I'I | -06 | $35246 \cdot 0$ | - II | $35238 \cdot 1$ | 15 |
| 33 | $34849 \cdot 4$ |  | $34851 \cdot 7$ | Or | $3485 \mathrm{I} \cdot 2$ | -03 | $3{ }^{3} 4848 \cdot 1$ | 07 | $34842 \cdot 2$ | -12 | $34833 \cdot 5$ | 7 |
| 34 | $34448 \cdot 0$ | + .05 | $34449{ }^{3} 9$ | + -or | $\begin{array}{llll}3 & 44 & 48 \cdot 9\end{array}$ | -04 | $34^{3} 445^{\circ} \mathrm{I}$ | -09 | $34438 \cdot 4$ | - 13 | $34428 \cdot 7$ | 18 |
| 35 | $\begin{array}{lllllllllll}3 & 40 & 46 \cdot 7\end{array}$ | $\cdot 05$ | $34048 \cdot 1$ |  | $\begin{array}{lllll}3 & 40 & 46 \cdot 5\end{array}$ | 05 | $34042 \cdot 0$ | -10 | $3{ }^{30} 34 \cdot 6$ | 5 | $34^{40} 24^{\circ} \mathrm{O}$ | $\cdot 20$ |
| 36 |  | -04 | $\begin{array}{llllllllll}36 & 46 \cdot 3\end{array}$ | - . 01 | 3 3 36 $44 \cdot \mathrm{I}$ | .06 | $\begin{array}{llll}3 & 36 & 39.0\end{array}$ | - II | $\begin{array}{llll}3 & 36 & 30 \cdot 6\end{array}$ | 6 |  | 22 |
| 37 | $\begin{array}{llllll}3 & 32 & 44 \cdot 0 \\ 3 & 28 & \end{array}$ | -03 | $\begin{array}{llll}3 & 32 & 44 \cdot 4\end{array}$ | -02 | 3 32 $4 \mathrm{I} \cdot 8$ | 07 | 3 32 $35 \cdot 8$ | -12 | $\begin{array}{llll}3 & 32 & 26 \cdot 7\end{array}$ | -18 |  | 23 |
| 38 | $\begin{array}{lllllllllll}3 & 28 & 42 \cdot 6\end{array}$ | -03 | $32842 \cdot 7$ | . 03 | $\begin{array}{lllll}3 & 28 & 39.3\end{array}$ |  |  |  | 32822 | 9 | 3188 | 5 |
| 39 | 3 3 3 | + 02 | $\begin{array}{lllllllllll}3 & 24 & 40 \cdot 8 \\ 3 & 20 & 39 \cdot 0\end{array}$ | -03 | $\begin{array}{llllllllllll}3 & 24 & 37.0 \\ 3 & 20 & 34.5\end{array}$ | - . 09 | $\begin{array}{llll}3 & 24 & 29 \cdot 6\end{array}$ | - 15 | $\begin{array}{llll}3 & 24 & 18.8\end{array}$ | - 21 | 4 | 27 |
| 4 |  | -01 | $\begin{array}{llll}3 & 20 & 39 \cdot 0 \\ 3 & 16 & 37.2\end{array}$ |  | $\begin{array}{llll}3 & 20 & 34.5\end{array}$ |  |  |  |  | 3 | 1959.3 | 29 |
| 41 |  | -00 | 3 16 $37 \cdot 2$ | - 06 | $\begin{array}{llll}3 & 16 & 32 \cdot 0 \\ 3 & 12 & 20\end{array}$ |  | $\begin{array}{llll}3 & 16 & 23.2\end{array}$ |  | $\begin{array}{llll}3 & 16 & 10 \cdot 6 \\ 3 & 12 & 6.4\end{array}$ |  | $\begin{array}{llllll}3 & 15 & 54 \cdot 2 \\ 3 & 15 & 49\end{array}$ | 30 |
| 42 | 3 12373 | -00 | 31235 | -06 | $\begin{array}{\|ccc\|}3 & 12 & 29 \cdot 6 \\ 3 & 8 & 29 \cdot 1\end{array}$ |  | 31220 |  | $\begin{array}{llll}3 & 12 & 6.4 \\ 3 & 8 & 2.2\end{array}$ |  | 3 II 49.0 | 2 |
| 43 | 3 |  | 3 | . 07 | $\begin{array}{llll}3 & 8 & 27 \cdot 1\end{array}$ |  | 3 |  | 3 8 2.2 |  | $\begin{array}{llll}3 & 7 & 43.6\end{array}$ | 4 |
| 44 | 3 | - . 02 |  | .08 |  |  |  |  | $\begin{array}{rrrr}3 & 3 & 58 \cdot 0 \\ 2 & 59 & 53 \cdot 6\end{array}$ | - 29 |  | . 36 |
| 45 | $3{ }^{2} 5633 \cdot 4$ | . 02 | $\begin{array}{lrrr}3 & 0 & 29.8 \\ 766 & 28.0\end{array}$ | . 09 | $\begin{array}{llll}3 & 0 & 22.0 \\ 2 & 56 & 19.4\end{array}$ | 16 | $\begin{array}{lrrr}3 & 0 & \text { ro } \\ 2 & 56 & 6\end{array}$ |  | $\begin{array}{llllll}2 & 59 & 53 \cdot 6 \\ 2 & 55 & 49 \cdot 1\end{array}$ | -31 | 2 59 $32 \cdot 7$  <br>  5 5 27 | 38 |
| 4 | llllll $\begin{array}{llll}2 & 56 & 32 \cdot 0 \\ 2 & 52 & 30 \cdot 7 \\ 2 & 4 & 29\end{array}$ | $\begin{array}{r} .03 \\ .04 \end{array}$ | $\begin{array}{llll}2 & 56 & 28 \cdot 0 \\ 2 & 52 & 26 \cdot 1\end{array}$ | 12 |  | - 18 $\cdot 19$ | $\begin{array}{llll}2 & 56 & 6 \cdot 5 \\ 2 & 52 & 3.0\end{array}$ |  | $\begin{array}{llll}2 & 55 & 49 \cdot 1 \\ 2 & 51 & 44 \cdot 5\end{array}$ | 33 | $\begin{array}{lll}55 & 27.0 \\ 51 & 21.3\end{array}$ | 4 |
| 48 |  | - | $24^{4} 24 \cdot \mathrm{I}$ | -13 | $2 \begin{array}{ll}48 & 14.2\end{array}$ | . 20 | $24759 \cdot 5$ | - 29 | 7 | - 37 | 4715.4 |  |
| 49 | $\begin{array}{llll}2 & 44 & 28.0\end{array}$ | -0 | 244 | - 14 | $4411 \cdot 5$ | - 22 | $24355 \cdot 8$ | - 30 | $2 \begin{array}{llll}23512\end{array}$ | - 39 | 24319 | 47 |
| 50 | $24026 \cdot 7$ | .06 | $24020 \cdot 3$ |  | 2408.7 | 23 | $23952 \cdot \mathrm{I}$ | ${ }^{3}$ |  | 41 | 39 3.1 | 50 |
| 51 | $2{ }_{2} 3^{6} \quad 25 \cdot 3$ | -07 | $2{ }_{26} 3618 \cdot 3$ | - 16 | 236 6.0 | 25 |  | 3 | $35 \quad 25 \cdot 3$ | 43 | $23456 \cdot 71$ | 52 |
| 52 | $\begin{array}{llll}2 & 32 & 24 \cdot 0 \\ 2 & 28 & 22.6\end{array}$ | . 08 | $\begin{array}{llll}2 & 32 & 16 \cdot 3\end{array}$ | -17 | $\begin{array}{llll}2 & 32 & 3.1 \\ 2 & 28 & 0.2\end{array}$ | $\cdot 26$ | $\begin{array}{llll}2 & 31 & 44.5 \\ 2 & 27 & 40.4\end{array}$ | $\cdot 36$ | $3 \mathrm{I} 20 \cdot 2$ | 45 | $2 \begin{array}{lllll}2 & 30 & 50 \cdot 2\end{array}$ | 55 |
| 53 | $\begin{array}{ll}2 & 28 \\ 22 & 22\end{array}$ | -09 | $2 \begin{array}{llll}28 & 14.2\end{array}$ | 19 | $2 \begin{array}{lll}28 & 0.2\end{array}$ | -28 | $22740 \cdot 4$ |  | $2 \begin{array}{lllll}27 & 14.9\end{array}$ | $\cdot 48$ | 26 43.3 | 58 |
| 54 | $\begin{array}{ll}2 & 24 \\ 2 & 2\end{array}$ | - Io | 2 24 $12 \cdot 1$ <br> 2   | - 20 | $\begin{array}{llll}2 & 23 & 57 \cdot 2\end{array}$ | - 30 | $\begin{array}{llll}2 & 23 & 36 \cdot 3\end{array}$ | $\cdot 40$ | 2 23 9.4 <br> 2 1  | - 50 | $\begin{array}{llll}2 & 22 & 36 \cdot 3\end{array}$ | . 60 |
| 55 | $\begin{array}{llll}2 & 20 & 19.8\end{array}$ | - II | $22010 \cdot 0$ | 2 | $\begin{array}{llll}2 & 19 & 54 \cdot 2 \\ 2 & 1 & 5\end{array}$ | 32 | 2 19 $32 \cdot 1$ <br>  19 37.8 | 42 | $19 \begin{array}{ll}19 & 3.8\end{array}$ | 53 | $\begin{array}{llll}2 & 18 & 29.0\end{array}$ | 63 |
| 56 | $\begin{array}{llllll}2 & 16 & 18.4\end{array}$ | -12 | 16 | -23 | $21551 \cdot 0$ | 33 | 2 lllll | 44 | $1457 \cdot 9$ | -55 | 1421.4 | 66 |
| 57 | $\begin{array}{llllll}2 & 12 & 16.9\end{array}$ | - 3 | $12 \quad 5 \cdot 6$ | -24 | 2 II 47.8 | 35 | 2 II 23.2 |  | 1051.9 | -58 | 1013.5 | 70 |
| 58 | $\begin{array}{llllll}2 & 8 & 15.5\end{array}$ |  | $8 \quad 3 \cdot 4$ | 26 | $744 \cdot 5$ | 37 | 718.6 | -49 | $645 \cdot 6$ |  | 65 | $\cdot 73$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 24^{\prime} 4 \end{array}$ | S. $+\quad .29$ | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 3 & 42 \cdot 0 \end{array}$ |  | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 59 \cdot 7 \end{array}$ | S. $+\quad 30$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 17.7 \end{array}\right.$ | + 3.30 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 35 \cdot 7 \end{array}$ | s. $+\quad .30$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 54^{\circ} \mathrm{O} \end{array}$ | S. |
| 10 | $1 \begin{array}{lll}5 & 22 & 27 \cdot 2\end{array}$ | -14 | $\begin{array}{llll}5 & 22 & 35 \cdot 4\end{array}$ | -13 | $\begin{array}{llll}5 & 22 & 43 \cdot 0\end{array}$ | -12 |  | - II | $\begin{array}{llll}5 & 22 & 55 \cdot 9\end{array}$ | + 09 | $\begin{array}{llll}5 & 23 & 1 \cdot 3\end{array}$ | -8 |
| 12 | $5 \mathrm{I} 4 \mathrm{I} 6 \cdot 2$ | - I 1 | $\begin{array}{lllll}5 & 14 & 22.5\end{array}$ | -10 | $\begin{array}{llllll}5 & 14 & 28 \cdot 1\end{array}$ | -08 | $\begin{array}{lllll}5 & 14 & 32 \cdot 7\end{array}$ | . 07 | $\begin{array}{llll}5 & 14 & 36 \cdot 5\end{array}$ | .05 | $\begin{array}{llll}5 & 14 & 39.4\end{array}$ | + 0.04 |
| 14 | $\left\lvert\, \begin{array}{lll}5 & 6 & 5.4\end{array}\right.$ | -08 | $5669 \cdot 8$ | -06 | $5 \quad 6 \quad 13 \cdot 3$ | . 05 | $5 \quad 6 \quad 15 \cdot 7$ | + .03 | $5 \quad 6 \quad 17 \cdot 1$ | + OI | $\begin{array}{lllll}5 & 6 & 17\end{array}$ | . 00 |
| 16 | $45754 \cdot 6$ |  | $45757 \cdot 2$ | +.03 | $4 \quad 57 \quad 58.6$ | + . OI | 45758.8 | - 01 | $45757 \cdot 7$ | . 03 | $457 \quad 55 \cdot 5$ | . 05 |
| 18 | $44943 \cdot 8$ | + 02 | $44944 \cdot 8$ | -00 | $44943 \cdot 9$ | -02 | 44941.9 | - 04 | $44938 \cdot 4$ | - 07 | $44933 \cdot 4$ | -09 |
| 20 | $44133 \cdot 1$ | - 01 | $44 \mathrm{I} 32 \cdot 0$ | - 03 | $44129 \cdot 2$ | . 06 | 4 41 24.8 | . 08 | $441 \begin{array}{ll}18 \cdot 9\end{array}$ | -II | 441 II•3 | -14 |
| 22 | $433 \quad 22 \cdot 3$ | . 04 | $4 \begin{array}{llll}43 & 19.2\end{array}$ | -07 | 43314.4 | -09 | $\begin{array}{llll}4 & 33 & 7 \cdot 8\end{array}$ | -12 | $4 \begin{array}{llll}4 & 32 & 59 \cdot 3\end{array}$ | -16 | $43249 \cdot 0$ | -19 |
| 24 | 425 II. 6 | -07 | $4 \begin{array}{lll}4 & 25 & 6 \cdot 5\end{array}$ | -10 | $4 \begin{array}{lll}4 & 24 & 59.5\end{array}$ | -13 | ${ }_{4}^{4} 224 \begin{array}{lll}50 \cdot 5\end{array}$ | -17 | $42439 \cdot 5$ | -20 | $42426 \cdot 4$ | -23 |
| 26 | 417007 | 10 | 41653.7 | 13 | -4 $16644 \cdot 5$ | -17 | 4 16 33.1 | $\cdot 21$ | $4 \begin{array}{llll}4 & 16 \quad 19.4\end{array}$ | - 25 | $416 \quad 3 \cdot 5$ | - 28 |
| 28 | $\begin{array}{llll}4 & 8 & 49 \cdot 8\end{array}$ | -13 | $840 \cdot 7$ | -17 | $4 \begin{array}{lll}4 & 8 & 29 \cdot 3\end{array}$ | $\cdot 21$ | $\begin{array}{llll}4 & 8 & 15.4\end{array}$ | - 25 | $4 \quad 7 \quad 59.0$ | -29 | $4 \quad 7 \quad 40 \cdot 2$ | $\cdot 33$ |
| 30 | $4 \quad 0 \quad 38.8$ | 16 | $4 \quad 0 \quad 27 \cdot 5$ | 21 | $4 \quad 0933.8$ | $\cdot 25$ | 35957 | - 29 | $359588 \cdot 3$ | $\cdot 3$ | $\begin{array}{lllllllllllll}3 & 59 & 16 \cdot 4\end{array}$ | $\cdot 39$ |
| 31 | $\begin{array}{llllll}3 & 56 & 33 \cdot 3\end{array}$ | -18 | $\begin{array}{llll}3 & 56 & 20.9\end{array}$ | $\cdot 23$ | $356 \quad 6 \cdot 0$ | - 27 | $\begin{array}{lllllllllll}3 & 55 & 48 \cdot 2\end{array}$ | - 32 | $355127 \cdot 7$ | -36 | 355 | 41 |
| 32 | $\begin{array}{lllll}3 & 52 & 27 \cdot 6\end{array}$ | -20 | 35214.2 | $\cdot 25$ | $35158 \cdot 0$ | -29 | 3 I5 3900 | -34 | 3 51 17.0 | -39 | $350 \quad 52 \cdot 0$ | 44 |
| 33 | $\begin{array}{lllll}3 & 48 & 21.9\end{array}$ | -22 | $\begin{array}{llll}3 & 48 & 7 \cdot 4\end{array}$ | -26 | $34750 \cdot 0$ | $\cdot 31$ | 34729.6 | $\cdot 36$ | $3476 \cdot 1$ | -42 | $346 \quad 39 \cdot 5$ | $\cdot 47$ |
| 34 | $\begin{array}{llll}3 & 44 & 16 \cdot 1\end{array}$ | $\cdot 23$ | $\begin{array}{lll}3 & 44 & 0.5\end{array}$ | -28 | 34341.9 | $\cdot 34$ | $\begin{array}{llll}3 & 43 & 20 \cdot 1\end{array}$ | - 39 | $34255 \cdot 1$ | $\cdot 44$ | $\begin{array}{llll}3 & 42 & 26 \cdot 9\end{array}$ | $\cdot 50$ |
| 3 |  | $\cdot 25$ | $\begin{array}{llllllllllllllll}3 & 39 & 53 \cdot 6\end{array}$ | -30 | $\begin{array}{llllll}3 & 39 & 33 \cdot 7\end{array}$ | $\cdot 36$ | $\begin{array}{llll}3 & 39 & 10.5\end{array}$ | 4 4 | $\begin{array}{llll}3 & 38 & 43.9\end{array}$ | $\cdot 47$ | $33^{38} 14.0$ | . 53 |
| 36 | 3 36 $4 \cdot 5$ | -27 | $\begin{array}{llllllllllll}3 & 35 & 46 \cdot 6\end{array}$ | -33 | $\begin{array}{llll}3 & 35 & 25 \cdot 3\end{array}$ | $\cdot 38$ | 3 35 $0 \cdot 7$ | -44 | $\begin{array}{llll}3 & 34 & 32 \cdot 6\end{array}$ | -50 | 3 34 10 | - 56 |
| 37 | $\begin{array}{lllll}3 & 31 & 58 \cdot 6\end{array}$ | -29 |  | -35 | $3 \mathrm{3I} 16.8$ | -40 | $33050 \cdot 7$ | -46 | $3{ }^{30} 21 \cdot I$ | - 52 |  | - 59 |
| 38 | $\begin{array}{lllll}3 & 27 & 52.5\end{array}$ | $\cdot 31$ | $32732 \cdot 2$ | -37 | $\begin{array}{llll}3 & 27 & 8 \cdot 2\end{array}$ | -43 | $32640 \cdot 6$ | -49 | $\begin{array}{llll}3 & 26 & 9 \cdot 3\end{array}$ | - 55 | $32534 \cdot 1$ | $\cdot 62$ |
| 39 | $\begin{array}{llll}3 & 23 & 46 \cdot 5\end{array}$ | - 23 | $\begin{array}{lllll}3 & 23 & 24.8\end{array}$ | -39 | 32259.4 | $\cdot 45$ | $\begin{array}{llll}3 & 22 & 30 \cdot 3\end{array}$ | -52 | $\begin{array}{llll}3 & 21 & 57 \cdot 3\end{array}$ | -. 58 | $32120 \cdot 3$ | . 65 |
| 40 | $\begin{array}{llll}3 & 19 & 40 \cdot 2\end{array}$ | $\cdot 35$ | $\begin{array}{llll}3 & 19 & 17 \cdot 3\end{array}$ | -4I | $31850 \cdot 5$ | $\cdot 48$ | $\begin{array}{llll}3 & 18 & 19.8\end{array}$ | - 54 | 3 17 45.1 | -6I | 3176 | - 68 |
| 41 | $\begin{array}{llll}3 & 15 & 33.9\end{array}$ | $\cdot 37$ | $\begin{array}{llll}3 & 15 & 9 \cdot 7\end{array}$ | -44 | $\begin{array}{llllll}3 & 14 & 41 & 4\end{array}$ | -50 | $3 \begin{array}{lll}3 & 14 & 9 \cdot 1\end{array}$ | -57 | $\begin{array}{lllll}3 & 13 & 32 \cdot 5\end{array}$ | -64 | $31251 \cdot 7$ | $\cdot 72$ |
| 42 | 3 II 27-5 | -39 | 31119 | $\cdot 46$ | 3 10 $32 \cdot 2$ | -53 | $3 \begin{array}{llll}3 & 9 & 58 \cdot 1\end{array}$ | -60 | $\begin{array}{llll}3 & 9 & 19.7\end{array}$ | -68 | $\begin{array}{llll}3 & 8 & 36 \cdot 9\end{array}$ | $\cdot 75$ |
| 43 | $\begin{array}{lllll}3 & 7 & 20 \cdot 9\end{array}$ | $\cdot 42$ | $\begin{array}{llllll}3 & 6 & 53 \cdot 7\end{array}$ | -48 | $\begin{array}{llll}3 & 6 & 22 \cdot 7\end{array}$ | $\cdot 56$ | $\begin{array}{llll}3 & 5 & 46 \cdot 9\end{array}$ | -63 | $\begin{array}{llll}3 & 5 & 6.6\end{array}$ | $\cdot 71$ | $\begin{array}{llll}3 & 4 & 2 I \cdot 7\end{array}$ | -79 |
| 44 | $\|$3 3 $14 \cdot 2$ | -44 | $\begin{array}{llll}3 & 2 & 45 \cdot 8\end{array}$ | . 51 | $\begin{array}{lrrr}3 & 2 & 13.0\end{array}$ | -59 | 3 l | -66 | $3 \quad 0 \quad 53.2$ | $\cdot 74$ | $3 \quad 0 \quad 6 \cdot 1$ | -83 |
| 45 | $2 \begin{array}{lll}2 & 59 & 7 \cdot 4\end{array}$ | -46 | $2 \begin{array}{llll}28 & 37 \cdot 5\end{array}$ | -54 | 25810 | -62 | 25723.6 | $\cdot 70$ | $2 \begin{array}{lllllllllll} & 56 & 39.4\end{array}$ | -78 | $255150 \cdot 0$ | -87 |
| 4 | $\begin{array}{lll}2 & 55 & 0.4\end{array}$ | $\cdot 48$ | $25429 \cdot 0$ | -56 | $2{ }_{2} 53152 \cdot 7$ | . 65 | 25311.5 | $\cdot 73$ | $25225 \cdot 1$ | . 32 | $25133 \cdot 5$ | -91 |
| 47 | $250 \quad 53 \cdot 3$ | -51 | $25020 \cdot 3$ | -59 | $24942 \cdot 2$ | -68 | $24^{2} 8159^{\circ}$ | $\cdot 76$ |  | -85 | $24716 \cdot 5$ | $\cdot 95$ |
| 48 | 24645.9 | $\cdot 53$ | 246 II 3 | -62 |  | $\cdot 71$ | $24446 \cdot 2$ | -80 | $24355 \cdot 4$ | -89 | $\begin{array}{lllll}2 & 42 & 58 \cdot 9\end{array}$ | -99 |
| 49 | $2 \begin{array}{lllll}2 & 42 & 38.4\end{array}$ | - . 56 | $242 \begin{array}{ll}2.0\end{array}$ | - 6.5 | 2415003 | $\cdot 74$ | 24032.9 | - .84 | 239 39•7 | - 94 | $23840 \cdot 6$ | - I.04 |
| 50 | $2 \begin{array}{lllll}2 & 38 & 30 \cdot 6\end{array}$ | - 59 | 23752.5 | . 68 | $\begin{array}{llll}2 & 37 & 8 \cdot 7\end{array}$ | $\cdot 78$ | $2 \begin{array}{llll} & 36 & 19.2\end{array}$ | . 88 | 235123.5 | -98 | $23421 \cdot 7$ | 1.08 |
| 51 | 23422.6 | - 62 | $23342 \cdot 6$ | $\cdot 71$ | 23256.9 | . 81 | $232 \begin{array}{ll}2 & 4.9\end{array}$ | -92 | 23116.8 | 1-02 | $2302 \cdot 1$ | I 13 |
| 52 | 23014.3 | -65 | 22932.5 | $\cdot 75$ | $\begin{array}{llll}2 & 28 & 44 \cdot 5\end{array}$ | . 85 | $\begin{array}{lllll}2 & 27 & 50 \cdot 2\end{array}$ | $\cdot 96$ | $\begin{array}{lllll}2 & 26 & 49 \cdot 3\end{array}$ | $1 \cdot 07$ | $22541 \cdot 7$ | I•19 |
| 53 | $\begin{array}{llll}2 & 26 & 5 \cdot 8\end{array}$ | -68 | $\begin{array}{lllll}2 & 25 & 21.9\end{array}$ | $\cdot 78$ | $22431 \cdot 7$ | . 89 | 22334.9 | I. 00 | 222 31.2 | 1-12 | $22120 \cdot 2$ | I. 24 |
| 54 | 22156.9 | - 71 | $22110 \cdot 9$ | - . 82 |  | - 93 | $2 \begin{array}{llll}19 & 18.9\end{array}$ | -I.05 | $\begin{array}{llllll}2 & 18 & 12.2\end{array}$ | -1.r7 | $2 \mathrm{l} 6168 \cdot 0$ | I 30 |
| 5 | 2 I7 $47 \%$ | $\cdot 74$ | 2 16 69.6 | -86 | $2 \mathrm{l} 614 \cdot 5$ | -98 | $2 \begin{array}{lll}15 & 2 \cdot 1\end{array}$ | I'IO | 2 I3 52.3 | 1. 23 | $21234{ }^{1} 7$ | I.36 |
| 56 | 2 13 $38 \cdot 1$ | $\cdot 78$ | $2 \begin{array}{llll}12 & 47 \cdot 6\end{array}$ | -90 | $\begin{array}{lllllllllllll}2 & \text { II } & 49 \cdot 9\end{array}$ | 1.02 | 2 Io 44*7 | I. 15 | $2 \begin{array}{llll} & 9 & 3 I \cdot 3\end{array}$ | 1-29 | $2 \begin{array}{llll}2 & 8 & 10.2\end{array}$ | 1.43 |
| 58 | $\begin{array}{llll}2 & 9 & 28.0 \\ 2 & 5 & 17.6\end{array}$ |  | $\begin{array}{llll}2 & 8 & 35 \cdot 2 \\ 2 & 4 & 22.1\end{array}$ | $\cdot 94$ | $\begin{array}{llll}2 & 7 & 34 \cdot 7 \\ 2 & 3 & 18.7\end{array}$ | $1 \cdot 07$ | $\begin{array}{lll}2 & 6 & 26 \cdot 3 \\ 2 & 2 & 7 \cdot 0\end{array}$ | I. 21 | $2 \begin{array}{llr}2 & 5 & 9 \cdot 6\end{array}$ | 1.35 | $\begin{array}{lrrr}2 & 3 & 44.3\end{array}$ | I. 50 |
| 58 |  | - | $2422 \cdot \mathrm{I}$ | -99 | $2 \begin{array}{llll}2 & 3 & 18.7\end{array}$ | I•13 | $2 \quad 2 \quad 7 \cdot 0$ | I. 27 | - $46 \cdot 6$ | 1.42 | I $59 \quad 17.0$ | I 57 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .85 \end{aligned}$ | S. | S. $+\quad .93$ | S. $-4 \cdot I \mathrm{I}$ | $\begin{gathered} \mathrm{s} . \\ +\mathbf{I} \cdot \mathrm{oo} \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 13 \end{gathered}$ | $\begin{gathered} s . \\ +\mathbf{1 . 0 8} \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 15 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot \mathrm{I} 5 \end{gathered}$ | $\stackrel{s .}{-4 \cdot 17}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 23 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 19 \end{gathered}$ |
| 4 | . 83 | 4.03 | .91 | 4.II | . 98 | $4 \cdot 13$ | I. 06 | $4 \cdot 15$ | I'13 | $4 \cdot 17$ | 1.21 | $4 \cdot 19$ |
| 8 | . 82 | 4.09 | . 89 | 4.11 | $\cdot 97$ | $4 \cdot 12$ | 1.04 | $4 \cdot 14$ | I-12 | $4 \cdot 16$ | 1.20 | $4 \cdot 18$ |
| 12 | .81 | 4.09 | . 88 | $4 \cdot 11$ | -96 | $4 \cdot 12$ | 1.04 | $4 \cdot 14$ | I-II | $4 \cdot 16$ | 1.19 | $4 \cdot 18$ |
| 16 | -80 | 4.09 | -88 | $4 \cdot 10$ | -96 | $4 \cdot 12$ | I.O3 | 4.14 | I'II | 4.16 | I•19 | $4 \cdot 18$ |
| 20 | +.80 | 4.09 | +.88 | $4 \cdot 10$ | + .96 | 4.12 | +1.04 | $4 \cdot 14$ | +1.12 | $4 \cdot 16$ | +1.20 | $4 \cdot 18$ |
| 22 | . 80 | 4.09 | . 88 | $4 \cdot 10$ | . 96 | $4 \cdot 12$ | 1.04 | $4 \cdot 14$ | IT2 | $4 \cdot 16$ | 1.20 | 4.19 |
| 24 | -80 | 4.09 | -88 | $4 \cdot 10$ | -97 | $4 \cdot 12$ | I.05 | 4-14 | I'13 | 4.16 | I. 21 | 4.19 |
| 26 | -8I | 4.09 | -89 | $4 \cdot 10$ | -97 | $4 \cdot 12$ | I. 05 | $4 \cdot 14$ | I.14 | $4 \cdot 17$ | I. 22 | 4.19 |
| 28 | -8I | 4.09 | -90 | $4 \cdot 11$ | $\cdot 98$ | 4.13 | 2.06 | 4.15 | I'I5 | 4.17 | 1.24 | $4 \cdot 19$ |
| 30 | +.82 | 4.09 | + 90 | $4 \cdot 11$ | +.99 | $4 \cdot 13$ | + 1.08 | $4 \cdot 15$ | +1.16 | $4 \cdot 17$ | +1.25 | $4 \cdot 20$ |
| 32 | . 83 | 4.09 | -91 | $4 \cdot \mathrm{Ir}$ | 1.00 | $4 \cdot 13$ | I.09 | $4 \cdot 15$ | I.18 | $4 \cdot 18$ | I.27 | $4 \cdot 21$ |
| 34 | $\cdot 84$ | 4.09 | .92 | $4 \cdot 11$ | 1.01 | $4 \cdot 13$ | I-10 | 4.16 | I. 20 | $4 \cdot 18$ | I-29 | 4.21 |
| 36 | . 85 | 4.10 | $\cdot 94$ | 4.12 | 1.03 | $4 \cdot 14$ | I+12 | 4.16 | I. 22 | 4.19 | I-3I | $4 \cdot 22$ |
| 38 | . 86 | 4.10 | . 95 | 4.12 | I.05 | 4-14 | I•14 | 4.17 | I. 24 | $4 \cdot 20$ | r.34 | $4 \cdot 23$ |
| 40 | +.87 | 4.10 | + .97 | 4.13 | +1.07 | $4 \cdot 15$ | +1.17 | 4.18 | +1.27 | $4 \cdot 20$ | +1.37 | $4 \cdot 24$ |
| 42 | . 89 | $4 \cdot 11$ | - 99 | $4 \cdot 13$ | I.09 | $4 \cdot 15$ | 1.20 | $4 \cdot 18$ | I. 30 | 4.21 | 1.41 | 4.25 |
| 44 | -91 | 4.II | 1.02 | $4 \cdot 13$ | I-12 | $4 \cdot 16$ | I. 23 | $4 \cdot 19$ | I 34 | 4.23 | I. 45 | $4 \cdot 26$ |
| 46 | -94 | 4.12 | I. 04 | $4 \cdot 14$ | I-15 | $4 \cdot 17$ | I. 27 | $4 \cdot 20$ | I. 38 | $4 \cdot 24$ | I.50 | $4 \cdot 28$ |
| 48 | $\cdot 96$ | $4 \cdot 12$ | I. 08 | $4 \cdot 15$ | I-19 | 4-18 | 1-3I | 4.22 | I 43 | $4 \cdot 26$ | 1.55 | $4 \cdot 30$ |
| 50 | +1.00 | 4.13 | +I.11 | 4.16 | + I. 23 | 4.19 | + $\mathrm{I} \cdot 36$ | 4.23 | +1.48 | $4 \cdot 27$ | +r.6r | $4 \cdot 32$ |
| 52 | I.03 | 4.14 | I•I6 | $4 \cdot 17$ | 1.28 | $4 \cdot 21$ | 1.41 | 4.25 | I. 54 | 4.30 | x. 68 | $4 \cdot 35$ |
| 54 | 1.07 | $4 \cdot 15$ | 1.20 | $4 \cdot 19$ | 1-34 | $4 \cdot 23$ | 1.47 | $4 \cdot 27$ | 1.62 | $4 \cdot 32$ | ¢.76 | $4 \cdot 38$ |
| 56 | I-12 | 4.16 | I. 26 | $4 \cdot 20$ | 1.40 | $4 \cdot 25$ | I. 55 | $4 \cdot 30$ | 1.70 | $4 \cdot 36$ | 1.86 | 4.42 |
| 58 | I-18 | 4•18 | I 32 | $4 \cdot 22$ | 1.48 | 4.27 | I. 64 | $4 \cdot 33$ | 1.30 | $4 \cdot 39$ | 1.97 | 4.47 | LATITUDE $4^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

|  | $18^{\circ}$ |  | $19^{\circ}$ |  | $20^{\circ}$ |  | 21 |  | $22^{\circ}$ |  | $23^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $6$ | $+$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 5 \\ \hline \text { I•• } \end{array}\right.$ | 1 | M. | 2 |  |  |  |  |  |  |
| 10 | 23 |  | 23 | -06 | 523 | +.05 | $\begin{array}{lllll}5 & 23 & 15 \cdot 7\end{array}$ | $+.03$ |  | + 02 | 5 $23 \begin{array}{llll}5 & 18.4\end{array}$ |  |
| 12 | 14 | $+$ | 1442 | , | 1442 | - 01 | $51441 \cdot 5$ | - 22 |  | $\cdot 04$ | $1436 \cdot 9$ | 5 |
| 14 | 5 |  |  | - .04 | 6 | -06 | $\begin{array}{llll}5 & 6 & 7 \cdot 4\end{array}$ | . 08 | $5 \quad 6 \quad 2 \cdot 0$ | -10 | $555 \cdot 3$ | $\cdot 12$ |
| 16 | 45751.8 |  | $45746 \cdot 9$ |  | $5740 \cdot 7$ | - II | 45733 | 14 | 44724.0 | -16 | 57 | 19 |
| 18 | 49 |  |  |  |  |  | 4 | - 20 | $44^{48} 45 \cdot 8$ | 2 | 4 48 481.4 | - 25 |
| 20 | 41 |  | 40 |  | 4038 |  | 440 | 26 | $\begin{array}{llll}4 & 40 & 7.2\end{array}$ | - 29 | $\begin{array}{llll}4 & 39 & 48 \cdot 8\end{array}$ | -32 |
| 22 | 32 |  | 32 |  | 32 |  | 431 | $\cdot 32$ | 43128 | $\cdot 36$ | 4318.6 | $\cdot 39$ |
| 24 | 424 | -32 | 423 |  | $\begin{array}{rrrr}23 & 34.2 \\ \\ 15 & 1.5\end{array}$ | $\begin{array}{r} \\ \cdot \\ \cdot \\ \hline\end{array}$ | $\begin{array}{ll}4 & 23 \\ 4 & 14\end{array}$ | 38 | $\begin{array}{cccr}4 & 22 & 48 \cdot 2 \\ 4 & 14 & 7 \cdot 6\end{array}$ | $\begin{array}{r}42 \\ .49 \\ \hline 4\end{array}$ | $\begin{array}{llll}4 & 22 & 21.6 \\ 4 & 13 & 36.8\end{array}$ | - 46 <br> .54 |
| 26 | 415 | $\cdot 32$ | 415 |  | $15 \quad 1 \cdot 5$ |  | 414 |  | $414 \quad 7 \cdot 6$ |  | 413 | - 54 |
| 28 | 58 | - 38 | 58 |  |  | - 47 | 4 5 $58 \cdot 4$ <br> 3 5  | . 51 | 356 | . 56 | [ $4 \begin{array}{ccc}4 & 50 \cdot 7 \\ 3 & 56 & 3.4\end{array}$ |  |
| 30 | 58 | 43 | 58 | 48 | 575 |  | 35720 | 58 | 356 |  | 56 $3 \cdot 4$ | 69 |
| 31 | 54 |  | 54 |  | $53 \quad 36$ |  | $\begin{array}{llr}3 & 53 & 0 \cdot 5\end{array}$ |  | 352 |  | $\begin{array}{llll}3 & 51 & 39 \\ 3 & 47\end{array}$ |  |
| 32 | $50-23.9$ |  | $4952 \cdot 7$ |  | $49 \begin{array}{ll} & 18 \cdot 3\end{array}$ |  | $\begin{array}{llllllllll}3 & 48 \\ 3 & 40 \cdot 5\end{array}$ |  | 347 |  | 347 |  |
| 33 | 46 | . 52 | $4536 \cdot 7$ |  | $\begin{array}{lll}3 & 45 & 0 \cdot 2\end{array}$ | . 64 | $3 \quad 44 \quad 20 \cdot 2$ |  | 343 | $\cdot 76$ | 342 |  |
| 34 | 4 I | - .55 | $4120 \cdot 3$ |  | 40 | . 67 | 3 39 | $\cdot 73$ | 339 |  | 338 |  |
|  | 337 |  | 37 |  | $3623 \cdot 1$ | 71 | 35 | $\cdot 77$ | 334 |  | 3 | -91 |
|  | $\begin{array}{lllll}3 & 33 & 25\end{array}$ |  | 3246 |  | 324.0 |  | $\begin{array}{llllllllll}3 & 31 & 17 \cdot 2\end{array}$ | . 81 | $3 \quad 3026$ |  | 329 | -95 |
|  | 329 |  | 28 | . 72 | 2744.5 |  | $\begin{array}{llll}3 & 26 & 55 \cdot 3\end{array}$ | . 85 | 326 |  | $\begin{array}{llll}3 & 25 & 3.9\end{array}$ |  |
| 3 | 324 |  | 324 |  | 32324.5 |  | $32232 \cdot 9$ |  | 21 | -97 | 320 |  |
|  | 20 | - | 19 | - .79 | I9 4. ${ }^{\text {r }}$ | - 86 | , | -94 | I2 | - 1 | 3 316 |  |
| 40 | 1623 | -76 | $1535 \cdot$ | . 83 | 31443.3 |  | 31346 |  | ${ }^{3} 12$ |  | 3 II |  |
|  | 312 |  | $1116 \cdot$ |  | 1021 |  |  |  |  |  | $\begin{array}{llll}3 & 7 & 7 \cdot 7\end{array}$ |  |
| 42 | $49 \cdot 4$ |  | $657 \cdot 1$ |  | 5 59•8 |  | $7 \cdot 5$ |  | 3 3 3 $49 \cdot 8$ |  | 6 |  |
| 43 | 3 |  | 3 |  |  |  | $2 \cdot 0$ |  | 2 5 |  | $3{ }^{58} 4.5$ |  |
|  | 259 |  | 5816.7 |  | 57 |  |  |  | $2{ }_{2} 545 \mathrm{I} \cdot 5$ | - 1 | 53 31.3 | -1.3 |
| 45 | 54 | $\cdot 95$ | $5355 \cdot 5$ |  | $\begin{array}{llllll}2 & 52 & 49.9\end{array}$ |  | 251388 |  | $25020 \cdot 9$ | $1 \cdot 34$ | $248 \quad 57 \cdot 0$ |  |
| 46 | 250 | 1.00 | $4933 . \%$ |  | $\begin{array}{lllll}2 & 48 & 25 \cdot 1\end{array}$ |  | 247 |  | 24549.2 |  | 244 |  |
|  | 246 |  | 45 |  | 243 |  | 42 | $1 \cdot 36$ | $24116 \cdot 3$ |  | 5 |  |
| 48 | 2415 | 1.0 | 40 |  | 39 |  | 238 II.0 |  | $23642 \cdot 2$ |  | 2 |  |
|  | 37 | -1 | 36 | - I | 35 | -I | 33 | - 1 | $\begin{array}{llll}2 & 32 & 6.6\end{array}$ | - 1.61 | 23025.9 | -1.75 |
| 50 | 33 |  | 23158.3 |  | $23036 \cdot 2$ |  | $\begin{array}{llll}2 & 29 & 6 \cdot 7 \\ 2 & 2 & \end{array}$ |  | $\begin{array}{lll}2 & 27 & 29\end{array}$ |  | $22544^{\circ}$ | - |
| 51 | 28 50.6 | $1 \cdot 25$ |  |  |  |  | $\begin{array}{llll}2 & 24 & 32 \cdot 5 \\ 2 & 19 & 56 .\end{array}$ |  |  |  | 2 21 0.0 <br> 2 16 1 | . 92 |
| 5 | $\begin{array}{cc}24 & 26 \cdot 9 \\ 20 & 2 \cdot 1\end{array}$ |  | $\begin{array}{cccc}2 & 23 & 4 \cdot 7 \\ 2 & 18 & 36 \cdot 1\end{array}$ |  | $\begin{array}{cccc}2 & 21 & 34 \cdot 8 \\ 2 & 17 & 1.8\end{array}$ |  | $\begin{array}{ll}2 & 19 \\ 2 & 15\end{array}$ |  |  |  | $\begin{array}{llll}2 & 16 & 13.9 \\ 2 & \text { II } & 25 \cdot 3\end{array}$ | 2.01 |
|  | $\begin{array}{lllll}2 & 15 & 36 \cdot 1\end{array}$ |  | $14 \quad 6.0$ |  | 12 |  | 10 | - | 8 | -2. | $2 \begin{array}{llll}2 & 63.9\end{array}$ | 2 |
|  | 2 II 8.9 |  |  |  | $750 \cdot 8$ |  | $2 \quad 5 \quad 57 \cdot 6$ |  | 2354 |  | 39.5 | $2 \cdot 34$ |
| 56 | $2640 \cdot 2$ |  | $51 \cdot 1$ |  | $3 \times 2$ | 1 | $2 \begin{array}{llll} \\ 1 & 13.4\end{array}$ | 2.07 | I 593.4 | 2 | I $5641 \cdot 7$ |  |
|  | $\begin{array}{llll}2 & 2 & 9.9\end{array}$ | 1.65 | - 25.9 | 82 | 5831 | $2 \cdot 00$ | I $5626 \cdot 3$ | $2 \cdot 19$ | I 54 | $2 \cdot 39$ | $5139 \cdot 6$ | 2.60 |
| 58 | 5737 | 1.74 | $5548 \cdot 5$ | 1-91 | 5348.2 | 2.10 | $5136 \cdot 2$ | $2 \cdot 30$ | 49 |  | 4633 | 2.76 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. +r 3 l | $\begin{gathered} \mathrm{s} . \\ -4.22 \end{gathered}$ | $\begin{gathered} s . \\ +r \cdot 38 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 24 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +1 \cdot 46 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +1 \cdot 54 \end{gathered}$ | $\begin{gathered} 5 . \\ -4 \cdot 29 \end{gathered}$ | $\begin{gathered} \text { s. } \\ +1 \cdot 62 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 32 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 7 \mathrm{I} . \end{gathered}$ | s. $4 \cdot 36$ |
| 4 | 1.29 | 4.21 | I. 36 | $4 \cdot 24$ | 1-44 | $4 \cdot 26$ | I. 52 | 4.29 | 1.60 | $4 \cdot 32$ | 1.69 | $4 \cdot 35$ |
| 8 | 1.27 | 4.21 | I 35 | $4 \cdot 23$ | 1.43 | $4 \cdot 26$ | 1.51 | $4 \cdot 28$ | I. 59 | $4 \cdot 31$ | 1.67 | $4 \cdot 35$ |
| 12 | 1.27 | $4 \cdot 20$ | 1-35 | $4 \cdot 23$ | $1 \cdot 43$ | $4 \cdot 26$ | 1.51 | $4 \cdot 28$ | 1.59 | $4 \cdot 31$ | $1 \cdot 67$ | $4 \cdot 34$ |
| 16 | $1 \cdot 27$ | $4 \cdot 20$ | 1-35 | $4 \cdot 23$ | $1 \cdot 43$ | $4 \cdot 26$ | 1.51 | $4 \cdot 29$ | 1.60 | $4 \cdot 32$ | 1.68 | 4.35 |
| 20 | +1.28 | 4.21 | +1.36 | $4 \cdot 23$ | +1.45 | $4 \cdot 26$ | +1.53 | $4 \cdot 29$ | $+\mathrm{I} .62$ | $4 \cdot 32$ | +1.70 | $4 \cdot 35$ |
| 22 | 1.29 | 4.21 | $1 \cdot 37$ | 4.24 | $1 \cdot 46$ | $4 \cdot 26$ | $1 \cdot 54$ | 4.29 | 1.63 | $4 \cdot 33$ | 1.72 | $4 \cdot 36$ |
| 24 | $1 \cdot 30$ | 4.21 | $1 \cdot 38$ | $4 \cdot 24$ | 1.47 | $4 \cdot 27$ | 1.56 | $4 \cdot 30$ | 1.65 | $4 \cdot 33$ | $1 \cdot 74$ | $4 \cdot 37$ |
| 26 | $1 \cdot 31$ | $4 \cdot 22$ | $1 \cdot 40$ | $4 \cdot 24$ | $1 \cdot 48$ | $4 \cdot 27$ | 1.57 | $4 \cdot 31$ | 1.67 | 4.34 | $1 \cdot 76$ | $4 \cdot 38$ |
| 28 | 1-32 | $4 \cdot 22$ | 141 | 4.25 | 1.50 | $4 \cdot 28$ | 1.59 | 4.32 | 1.69 | $4 \cdot 35$ | I-78 | $4 \cdot 39$ |
| 30 | +1.34 | 4.23 | +1.43 | 4.25 | +r.52 | $4 \cdot 29$ | +1.62 | $4 \cdot 32$ | +1.71 | $4 \cdot 36$ | + I .81 | $4 \cdot 40$ |
| 32 | 1.36 | $4 \cdot 23$ | 1.45 | 4.26 | 1.55 | $4 \cdot 30$ | 1.65 | $4 \cdot 33$ | $1 \cdot 74$ | 4.37 | 1.84 | 4.41 |
| 34 | $1 \cdot 38$ | $4 \cdot 24$ | 1.48 | 4.27 | $\underline{158}$ | $4 \cdot 31$ | 1.68 | $4 \cdot 34$ | $\underline{1.78}$ | 4.39 | I. 88 | 4.43 |
| 36 | 1.41 | $4 \cdot 25$ | 1.51 | $4 \cdot 28$ | 1.61 | $4 \cdot 32$ | 1.71 | $4 \cdot 36$ | I. 82 | 4.40 | 1.93 | $4 \cdot 45$ |
| 38 | 1.44 | 4.26 | 1.54 | 4.30 | 1.65 | $4 \cdot 33$ | 1.76 | $4 \cdot 38$ | 1.87 | $4 \cdot 42$ | 1.98 | $4 \cdot 47$ |
| 40 | +1.48 | 4.27 | +1.58 | $4 \cdot 31$ | +x.69 | $4 \cdot 35$ | +r.80 | 4.40 | +1.92 | 4.44 | $+2.03$ | $4 \cdot 49$ |
| 42 | I.52 | 4.29 | x.63 | $4 \cdot 33$ | 1.74 | 4.37 | I.86 | $4 \cdot 42$ | 1.98 | $4 \cdot 47$ | $2 \cdot 10$ | $4 \cdot 52$ |
| 44 | $\underline{1} 56$ | 4.30 | x.68 | 4.35 |  | 4.39 | I.92 | 4.45 | 2.05 | 4.50 | 2.18 | 4.56 |
| 46 | I.61 | $4 \cdot 32$ | 1.74 | 4.37 | $\mathbf{1} \cdot 86$ | 4.42 | 1.99 | 4.48 | $2 \cdot 12$ | 4.54 | 2.26 2.36 | 4.60 |
| 48 | I.67 | $4 \cdot 35$ | I.80 | $4 \cdot 40$ | I•94 | $4 \cdot 45$ | 2.07 | $4 \cdot 51$ | $2 \cdot 22$ | $4 \cdot 58$ | $2 \cdot 36$ | 4.65 |
| 50 | +1.74 | 4.37 | + x . 88 | $4 \cdot 43$ | $+2.02$ | 4.49 | +2.17 | $4 \cdot 56$ | +2.32 | 4.63 | +2.48 | $4 \cdot 72$ |
| 52 | 1.82 | $4 \cdot 40$ | 1.97 | 4.47 | 2.12 | $4 \cdot 54$ | 2.28 | $4 \cdot 61$ | $2 \cdot 45$ | 4.70 | 2.62 | $4 \cdot 79$ |
| 54. | $\underline{191}$ | $4 \cdot 44$ | 2.07 | $4 \cdot 51$ | 2.24 | $4 \cdot 59$ | 2.41 | 4.68 | $2 \cdot 59$ | 4.77 | $2 \cdot 78$ | 4.88 |
| 55 | 2.02 2.15 | 4.49 | $2 \cdot 20$ | 4.57 | $2 \cdot 38$ 2.54 | $4 \cdot 66$ | $2 \cdot 57$ | $4 \cdot 76$ | $2 \cdot 77$ | $4 \cdot 87$ | 2.98 | $5 \cdot 00$ |
| 58 | $2 \cdot 15$ | $4 \cdot 55$ | $2 \cdot 34$ | 4.64 | 2.54 | $4 \cdot 75$ | $2 \cdot 76$ | 4.87 | 2.98 | $5 \cdot 00$ | $3 \cdot 23$ | 5.15 |

## 22 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

 LATITUDE $5^{\circ}$.DECLINATION-SAME NAME AS—LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { o } & \text { O.o } \end{array}$ | S. $+\quad .35$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 2 \mathrm{I} \cdot \mathrm{O} \end{array}$ | S. $+\quad .35$ |  | S. $+\quad .35$ | $\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 3 \cdot I \end{array}$ | S. | H. M. S. <br> 6 I 24.1 | S. 35 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 45^{\prime} \cdot \end{array}$ | S. $\cdot 35$ |
| 10 | 5 19 50.7 | $\cdot 36$ | $5 \quad 20$ II 7 | + 34 | $5 \quad 20 \quad 31 \cdot 9$ | - 33 | $\begin{array}{llll}5 & 20 & 5 \mathrm{I} \cdot 4\end{array}$ | $\cdot 32$ | $\begin{array}{llll}5 & 21 & 10 \cdot 2\end{array}$ | $\cdot 31$ | $\begin{array}{llll}5 & 21 & 28 \cdot 3\end{array}$ |  |
| 12 | 5 II 48.9 | $\cdot 36$ | $\begin{array}{llll}5 & 12 & 9 \cdot 9\end{array}$ | -34 | $51230 \cdot 0$ | -33 | $\begin{array}{lllll}5 & 12 & 49 \cdot 2\end{array}$ | -3I | $\begin{array}{lll}5 & 13 & 7 \cdot 7\end{array}$ | - 30 | $\begin{array}{llll}5 & 13 & 25 \cdot 2\end{array}$ | 28 |
| 14 | $5 \begin{array}{llll}5 & 3 & 46 \cdot 9\end{array}$ | -36 | $5 \quad 4 \quad 8 \cdot 0$ | $\cdot 34$ | $5 \begin{array}{lll}5 & 4 & 28 \cdot I\end{array}$ | -33 | $54447 \cdot 1$ | -3I | $\begin{array}{lll}5 & 5 & 5 \cdot 2\end{array}$ | -29 | $\begin{array}{llll}5 & 5 & 22 \cdot 2\end{array}$ | 27 |
| 16 | $45545 \cdot 0$ | -36 | $4 \begin{array}{lll}4 & 56 & 6 \cdot 2\end{array}$ | $\cdot 34$ | $4 \begin{array}{lll}56 & 26 \cdot 2\end{array}$ | $\cdot 32$ | $45645 \cdot 1$ | -30 | 4572.8 | -28 | 457193 | 26 |
| 18 | 44742.9 | $+37$ | $\begin{array}{lll}4 & 48 & 4 \cdot 3\end{array}$ | + 34 | 44824.4 | $\cdot 32$ | $44843{ }^{\circ} 0$ | + 30 | $449 \quad 0.4$ | - 28 | $44916 \cdot 4$ | $\cdot 25$ |
| 20 | $43940 \cdot 9$ | $\cdot 37$ | $440 \quad 2 \cdot 5$ | - 35 | $4 \quad 4022 \cdot 5$ | $\cdot 32$ | 440 4I•1 | -30 | 440 | $\cdot 27$ | $44^{4} 1213.6$ | . 25 |
| 22 | $4 \begin{array}{llllllllll}4 & 31 & 38.8\end{array}$ | -38 | $\begin{array}{lll}4 & 32 & 0.6\end{array}$ | -35 | $\begin{array}{llll}4 & 32 & 20 \cdot 7\end{array}$ | '32 | $\begin{array}{llll}4 & 32 & 39 \cdot 1\end{array}$ | $\cdot 29$ | $4 \begin{array}{llll}4 & 32 & 55 \cdot 8\end{array}$ | - 2 | 43311.0 | -24 |
| 2 | $42336 \cdot 6$ | -38 | $\begin{array}{llll}4 & 23 & 58 \cdot 7\end{array}$ | '35 | $\begin{array}{llll}4 & 24 & 18 \cdot 9\end{array}$ | $\cdot 32$ | $42437 \cdot 2$ | -29 | $4 \quad 2453.6$ | -26 | $\begin{array}{llll}4 & 25 & 8 \cdot 3\end{array}$ | -23 |
| 26 | $\begin{array}{lllll}4 & 15 & 34.4\end{array}$ | $\cdot 39$ | 4 I5 56.7 | -35 | 4 16 17.0 | $\cdot 32$ | $4 \begin{array}{lllll}4 & 16 & 35\end{array}$ | -29 | 4 I6 5I.5 | -25 | $\begin{array}{llll}4 & 17 & 5 \%\end{array}$ | 22 |
| 28 | 473321 | + 39 | $4 \quad 7 \quad 54.7$ | + 36 | $4 \quad 8 \quad 15.2$ | + 32 | $4 \quad 8 \quad 3 \quad 33 \cdot 4$ | + 28 | $\begin{array}{llll}4 & 8 & 49.4\end{array}$ | - 25 | $4 \quad 9 \quad 3.2$ | + $\cdot 2 \mathrm{I}$ |
| 3 | $\begin{array}{llll}3 & 59 & 29 \cdot 7\end{array}$ | $\cdot 40$ | $\begin{array}{llll}3 & 59 & 52 \cdot 7\end{array}$ | - 36 | $4{ }^{4}$ O 13.3 | $\cdot 32$ | 4 0 31.5 | - 28 | $4 \quad 0 \quad 47 \cdot 3$ | . 24 | $4 \begin{array}{lll}4 & 1 & 0 \cdot 7\end{array}$ | $\cdot 20$ |
| 31 | $\begin{array}{llllllllllllllll}3 & 55 & 28 \cdot 4\end{array}$ | 4 | $355 \quad 5 \mathrm{I} \cdot 7$ | -37 | $\begin{array}{llllll}3 & 56 & 12 \cdot 4\end{array}$ | $\cdot 32$ | $35630 \cdot 6$ | - 28 | $35646 \cdot 3$ | -24 |  | 0 |
| 32 | 351271 | -41 | $35150 \cdot 6$ | -37 | $\begin{array}{lllll}3 & 52 & 11 & 5\end{array}$ | $\cdot 32$ | $355229 \cdot 7$ | -28 | $35245 \cdot 3$ | -24 | $3 \begin{array}{llll}3 & 52 & 58 \cdot 3\end{array}$ | 19 |
| 33 | $\begin{array}{lllll}3 & 47 & 25.9\end{array}$ | -42 | 34749.6 | -37 | $\begin{array}{llll}3 & 48 & 10 \cdot 5\end{array}$ | $\cdot 33$ | $\begin{array}{lllll}3 & 48 & 28 \cdot 7\end{array}$ | - 28 | $\begin{array}{lllllll}3 & 48 & 44\end{array}$ | -23 | $\begin{array}{llllll}3 & 48 & 57 \cdot 1\end{array}$ | -19 |
| 34 | $\begin{array}{llll}3 & 43 & 24.5\end{array}$ | + 42 | $34348 \cdot 5$ | + 37 | $344 \quad 9 \cdot 6$ | + 33 |  | + $\cdot 28$ | $34443 \cdot 3$ | + $\cdot 23$ | 34455.9 | - 19 |
| 35 | $\begin{array}{lllll}3 & 39 & 23 \cdot 2\end{array}$ | -43 | $3 \quad 3947 \cdot 4$ | $\cdot 38$ | $\begin{array}{llll}3 & 40 & 8 \cdot 6\end{array}$ | $\cdot 33$ | $34026 \cdot 9$ | -28 | $34042 \cdot 3$ | -23 | 340 | - 18 |
| 36 | $\begin{array}{llll}3 & 35 & 21.8\end{array}$ | -43 | 2 3 $3546 \cdot 3$ | $\cdot 38$ | $\begin{array}{llll}3 & 36 & 7 \cdot 7\end{array}$ | -33 | $\begin{array}{llll}3 & 36 & 26 \cdot 0\end{array}$ | $\cdot 28$ | $\begin{array}{llll}3 & 36 & 41 \cdot 3\end{array}$ | -23 | $\begin{array}{lllll}3 & 36 & 53.6\end{array}$ | 8 |
| 37 | $3 \mathrm{3I} \mathrm{20.4}$ | -44 | 3 31 $\mathbf{4 5}^{1} \mathrm{I}$ | -38 | $\begin{array}{llll}3 & 32 & 6 \cdot 7\end{array}$ | -33 | $\begin{array}{llll}3 & 32 & 25 \cdot 1\end{array}$ | -28 | $\begin{array}{llll}3 & 32 & 40 \cdot 3\end{array}$ | $\cdot 23$ | $\begin{array}{llll}3 & 32 & 52 \cdot 4\end{array}$ | -17 |
| 38 | $\begin{array}{lllll}3 & 27 & 18 \cdot 9\end{array}$ | -44 | $\begin{array}{llll}3 & 27 & 44^{\circ} 0\end{array}$ | -39 | $\begin{array}{llll}3 & 28 & 5 \%\end{array}$ | -33 | $\begin{array}{llll}3 & 28 & 24.2\end{array}$ | $\cdot 28$ | $\begin{array}{lllll}3 & 28 & 39 \cdot 3\end{array}$ | -22 | $\begin{array}{llllll}3 & 28 & 51 \cdot 3\end{array}$ | -17 |
| 39 | $\begin{array}{llll}3 & 23 & 17 & 4\end{array}$ | + 45 | $\begin{array}{llll}3 & 23 & 42 \cdot 8\end{array}$ | + 39 | 3 24 47 | + 34 | 32423.2 | + $\cdot 28$ | $324 \begin{array}{llll}38 \cdot 4\end{array}$ | + 22 | 324 50•1 | + •17 |
| 40 | 31915.9 | -46 | 3 19 41.6 | - 40 | $\begin{array}{lll}3 & 20 & 3\end{array}$ | - 34 | $32022 \cdot 3$ | -28 | 3203 3  | 22 | $32049 \cdot 0$ | -16 |
| 4 | $\begin{array}{llllll}3 & 15 & 14.3\end{array}$ | $\cdot 46$ | $\begin{array}{llll}3 & 15 & 40 \cdot 3\end{array}$ | -40 | $\begin{array}{llll}3 & 16 & 2 \cdot 7\end{array}$ | -34 | $3 \mathrm{I} 621 \cdot 4$ | - 28 | $\begin{array}{llll}3 & 16 & 36 \cdot 5\end{array}$ | - 22 | $\begin{array}{llll}3 & 16 & 47.9\end{array}$ | 16 |
| 42 | 3 III 12.6 | 47 | 3 II 39.0 | -4 | $\begin{array}{llll}3 & 12 & 1 \cdot 7\end{array}$ | -34 | $\begin{array}{llll}3 & 12 & 20 \cdot 5\end{array}$ | -28 | $\begin{array}{lllll}3 & 12 & 35 \cdot 5\end{array}$ | -22 | $\begin{array}{llll}3 & 12 & 46 \cdot 8\end{array}$ | I6 |
| 43 | 3710 | -48 | $\begin{array}{llll}3 & 7 & 37 \cdot 7\end{array}$ | -41 | $\begin{array}{lll}3 & 8 & 0.6\end{array}$ | $\cdot 35$ | $\begin{array}{llll}3 & 8 & 19.6\end{array}$ | -28 | $\begin{array}{lllll}3 & 8 & 34.6\end{array}$ | $\cdot 22$ | $\begin{array}{llll}3 & 8 & 45 \cdot 7\end{array}$ | 15 |
| 5 | 3 3 9.2 <br> 2 5  | + $\quad 49$ | 3 3 $36 \cdot 4$ | + 42 | $\begin{array}{llll}3 & 3 & 59.5\end{array}$ | + 35 | $\begin{array}{llll}3 & 4 & 18.6\end{array}$ | + 28 | $\begin{array}{llll}3 & 4 & 33 \cdot 7\end{array}$ | + 22 | $\begin{array}{llll}3 & 4 & 44 \cdot 6\end{array}$ | + 15 |
| 45 | $\begin{array}{llll}2 & 59 & 7 \cdot 4\end{array}$ | -50 | $\begin{array}{llll}2 & 59 & 34 \cdot 9\end{array}$ | -43 | $\begin{array}{llllllllllllllllll}2 & 59 & 58 \cdot 5\end{array}$ | - 36 | 3 \% $017 \cdot 7$ | -28 | $\begin{array}{llll}3 & 0 & 32 \cdot 7\end{array}$ | -2I | 3 3 $0433 \cdot 5$ | -I4 |
| 46 | $\begin{array}{lll}2 & 55 & 5 \cdot 5 \\ 2 & 51\end{array}$ | $\cdot 51$ | $\begin{array}{lllll}2 & 55 & 33 \cdot 6\end{array}$ | -43 | $2 \begin{array}{llll}2 & 55 & 57 \cdot 4\end{array}$ | $\cdot 36$ | $\begin{array}{llll}2 & 56 & 16 \cdot 7\end{array}$ | $\cdot 29$ | $\begin{array}{llll}2 & 56 & 31 \cdot 8 \\ 2 & 52 & 3\end{array}$ | -21 | $\begin{array}{llll}2 & 56 & 42 \cdot 5\end{array}$ | 14 |
| 47 | $\begin{array}{llll}2 & 51 & 3 \cdot 5\end{array}$ | $\cdot 52$ | $25132 \cdot 2$ | -44 | $25156 \cdot 3$ | $\cdot 36$ | $\begin{array}{llll}2 & 52 & 15 \cdot 8\end{array}$ | $\cdot 29$ | $2 \begin{array}{llll}2 & 52 & 30 \cdot 8\end{array}$ | 21 | 252414 | 14 |
| 48 | 2471.5 | -53 | $24730 \cdot 7$ | $\cdot 45$ | $24755 \cdot 1$ | $\cdot 37$ | $2 \begin{array}{llllll} & 48 & 14.9\end{array}$ | $\cdot 29$ | $\begin{array}{lllll}2 & 48 & 29.9\end{array}$ | 21 | $24840 \cdot 4$ | - 13 |
| 49 | $2 \begin{array}{llll}2 & 42 & 59.4\end{array}$ | + . 54 | $2 \begin{array}{lll}2 & 43 & 29 \cdot 1\end{array}$ | + 45 | $2 \begin{array}{lllll}2 & 43 & 53.9\end{array}$ | + 37 | 24413.9 | $+\cdot 29$ | $24429 \cdot 0$ | + .2I |  | + - 13 |
| 50 | $\begin{array}{llll}2 & 38 & 57 \cdot 3\end{array}$ | - 55 | $\begin{array}{llll}2 & 39 & 27.5\end{array}$ | $\cdot 46$ | $\begin{array}{llll}2 & 39 & 52 \cdot 7 \\ 2 & 35 & 51\end{array}$ | $\cdot 38$ | $240 \begin{array}{lll}2 & 40 \cdot 9\end{array}$ | -29 | $2 \begin{array}{lll}2 & 40 & 28 \cdot 1\end{array}$ | $\cdot 2$ | $2 \begin{array}{llll}2 & 40 & 38 \cdot 3\end{array}$ | - 13 |
| 51 | $\begin{array}{llll}2 & 34 & 54.9\end{array}$ | -56 | $\begin{array}{llll}2 & 35 & 25 \cdot 9\end{array}$ | -47 | $\begin{array}{llllll}2 & 35 & 51 \cdot 5\end{array}$ | $\cdot 38$ |  | -30 | $2 \begin{array}{lllll}2 & 36 & 27 \cdot 2\end{array}$ | -2I | $\begin{array}{lllll}2 & 36 & 37 \cdot 2\end{array}$ | 12 |
| 52 | 23052.6 | -57 | $23124 \cdot 1$ | $\cdot 48$ | $23150 \cdot 2$ | -39 |  | $\cdot 30$ | $\begin{array}{llll}2 & 32 & 26 \cdot 2\end{array}$ | -21 | $\begin{array}{llll}2 & 32 & 36 \cdot 2\end{array}$ | 12 |
| 53 | $22650 \cdot 1$ | . 59 | $2 \quad 27 \quad 22 \cdot 3$ | -49 | $2 \quad 2748 \cdot 9$ | -40 | $\begin{array}{lll}2 & 28 & 9 \cdot 9\end{array}$ | - 30 | $\begin{array}{llll}2 & 28 & 25 \cdot 3\end{array}$ | -2I | $22835 \cdot 2$ | -12 |
| 54 | $22247 \cdot 4$ | + 60 | $223 \quad 20 \cdot 5$ | + 50 | $2 \quad 2347 \cdot 6$ | + 40 | $22488 \cdot 9$ | + 31 | $2 \begin{array}{lll}2 & 24 & 24.4\end{array}$ | + 21 | $22434^{\circ} \mathrm{I}$ | + - II |
| 55 | 2 I8 44.7 | -62 | 21918.5 | -51 | 2 I9 46.2 | -41 |  | $\cdot 31$ | $22023 \cdot 5$ | - 21 | $22033 \cdot 2$ | -II |
| 56 | 2 14 41.8 <br> 2   | -63 | 2 I5 16.5 | $\cdot 52$ | $\begin{array}{llll}2 & 15 & 44.8\end{array}$ | -42 | $\begin{array}{lll}2 & 16 & 6.8\end{array}$ | 31 | $2 \begin{array}{llll}2 & 16 & 22.6\end{array}$ | -2I | $\begin{array}{llll}2 & 16 & 32 \cdot 1\end{array}$ | II |
| 58 | $\begin{array}{rrr}2 & 10 & 38 \cdot 8 \\ 2 & 6 & 35 \cdot 5\end{array}$ | . 65 | $\begin{array}{llll}2 & 11 & 14.3\end{array}$ | $\cdot 54$ | 2 II 43.3 | -43 | $\begin{array}{llll}2 & 12 & 5 \cdot 7\end{array}$ |  | $2 \begin{array}{llll}2 & 12 & 21.7\end{array}$ |  | $21231 \cdot 1$ | 10 |
| 58 | $2635 \cdot 5$ | . 66 | $2712 \cdot 1$ | $\cdot 55$ | $2741 \cdot 8$ | -44 | 2884.6 | $\cdot 32$ | $2 \quad 8 \quad 20 \cdot 8$ | -21 | $2830 \cdot 1$ | 10 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | - A. | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ}$ A. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  |  | L. $5^{\circ} \mathrm{A}$. |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. $\cdot 00$ | $\begin{gathered} \mathrm{s} \\ -4.0 \mathrm{I} \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +\quad .07 \end{aligned}$ | $\begin{gathered} \mathrm{s} . \\ -4.0 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +{ }^{\prime} \mathrm{I}_{4} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.02 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\quad \cdot 2 \mathrm{I} \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.02 \end{gathered}$ |  | $\begin{aligned} & \text { s. } \\ & 28 \end{aligned}$ | s. -4.02 |  | s. $-35$ | $\begin{gathered} \text { s. } \\ -4 \cdot 03 \end{gathered}$ |
| 4 | - .02 | 4.01 | - 04 | 4 -or | + 12 | 4.02 | -19 | 4.02 |  | - 26 | -4.02 4.02 |  | -33 | -4.03 4.03 |
| 8 | . 05 | 4.01 | -02 | $4 \cdot \mathrm{Or}$ | -09 | 4.02 | -16 | 4.02 |  | $\cdot 23$ | $4 \cdot 02$ |  | $\cdot 31$ | $4 \cdot 03$ |
| 12 | -07 | 4.01 | -00 | $4 \cdot \mathrm{Or}$ | - 07 | 4.02 | -14 | 4.02 |  | -21 | 4.02 |  | -28 | 4.02 |
| 16 | -10 | 4.01 | - .03 | 4.01 | - 04 | 4.01 | -12 | $4 \cdot 02$ |  | -19 | 4.02 |  | -26 | 4.02 |
| 20 | - .13 | 4.02 | - . 05 | 4.01 | +.02 | $4 \cdot \mathrm{OI}$ | + 10 | 4.01 |  | $\cdot 17$ | 4.02 |  | . 25 | 4.02 |
| 22 | -14 | 4.02 | -06 | 4.01 | - 01 | 4.01 | . 08 | 4.01 |  | -16 | 4.02 |  | - 24 | 4.02 |
| 24 | -15 | 4.02 | -08 | 4.01 | -00 | 4.0 I | . 07 | 4.01 |  | - 15 | 4.02 |  | - 23 | 4.02 |
| 26 | -17 | 4.02 | -09 | 4.01 | - -01 | 4.01 | .06 | 4.01 |  | - 14 | 4.02 |  | $\cdot 22$ | 4.02 |
| 28 | -19 | 4.02 | - II | 4.02 | . 03 | 4.01 | -05 | 4.01 |  | - 13 | 4.02 |  | -21 | $4^{\text {.02 }}$ |
| 30 | . 20 | 4.02 | . 12 | 4.02 | -. 04 | 4.01 | + .04 | 4.01 |  | -12 | 4.02 |  | . 20 | 4.02 |
| 32 | - 22 | 4.02 | -14 | 4.02 | . 05 | 4.01 | .03 | 4.01 |  | - II | 4.02 |  | -19 | 4.02 |
| 34 | - 24 | 4.02 | -15 | 4.02 | -07 | 4.01 | $\cdot{ }^{\circ} 2$ | 4.01 |  | -10 | 4.02 |  | -19 | 4.02 |
| 36 | $-25$ | 4.02 | -17 | 4.02 | -08 | $4 \cdot \mathrm{OI}$ | -00 | 4.01 |  | -09 | $4 . \mathrm{OI}$ |  | - 18 | 4.02 |
| 38 | -27 | 4.02 | -18 | 4.02 | -09 | 4.01 | . 1 | 4.01 |  | -08 | 4.01 |  | -17 | $4^{.02}$ |
| 40 | - 29 | 4.02 | -20 | 4.02 | - II | $4 . \mathrm{or}$ | - . 02 | 4.01 |  | . 07 | 4.01 |  | . 16 | 4.02 |
| 42 | $\cdot 32$ | $4 \cdot 03$ | - 22 | 4.02 | ${ }^{1} 3$ | 4.01 | -03 | 4.01 |  | -06 | 4.01 |  | -16 | 4.02 |
| 44 | $\cdot 34$ | 4.03 | - 24 | 4.02 | - 14 | 4.02 | -05 | 4.01 |  | -05 | $4 \cdot 02$ |  | -15 | 4.02 |
| 46 | $\cdot 37$ | 4.03 | -26 | 4.02 | -16 | 4.02 | -06 | 4.02 |  | $\cdot 04$ | 4.02 |  | -14 | 4.02 |
| 48 | -39 | 4.03 | -29 | 4.03 | -18 | 4.02 | -07 | 4.02 |  | -03 | 4.02 |  | - I3 | 4.02 |
| 50 | . 42 | 4.04 | - 31 | 4.03 | - . 20 | 4.02 | -.09 | 4.02 |  | . 02 | 4.02 |  | -13 | 4.02 |
| 52 | $\cdot 45$ | 4.04 | -34 | 4.03 | - 22 | 4.02 | -II | $4 \cdot 02$ |  | - Or | 4.02 |  | -12 | 4.02 |
| 54 | -49 | 4.04 | $\cdot 37$ | 4.03 | - 24 | 4.02 | -12 | 4.02 |  | -00 | 4.02 |  | -II | 4.02 |
| 56 58 | . 53 | 4.05 4.05 | $\cdot 40$ $\cdot 43$ | 4.03 4.04 | $\cdot 27$ $\cdot 30$ | 4.02 4.03 | - 14 | 4.02 4.02 |  |  | 4.02 4.02 |  | -11 | 4.02 4.02 |
| 5 | $\cdot 57$ | 4.05 | $\cdot 43$ | 4.04 | -30 | 4.03 | '16 | $4 \cdot 02$ |  | - 03 | 4.02 |  | $\cdot 10$ | 4.02 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\text {c }}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| O | $\begin{array}{\|rr} \text { H. M. } & \text { S. } \\ 6 & 2 \end{array}$ | $\begin{array}{r} \mathrm{s} . \\ +\quad 35 \end{array}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 27.7 \end{array}$ | $\begin{aligned} & \text { S. } \\ & \hline 35 \end{aligned}$ | $\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 2 \\ \hline 49 \cdot I \end{array}$ |  | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 3 & 10.5 \end{array}\right.$ |  | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 32 \cdot 3 \end{array}\right.$ | $\begin{array}{r} \text { S. } \\ +\quad 36 \end{array}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 53 \cdot 8 \end{array}\right\|$ |  |
| ro | $1 \begin{array}{llll}5 & 21 & 45 \cdot 7\end{array}$ |  | $\begin{array}{llll}5 & 22 & 2 \cdot 4\end{array}$ | -27 | $\begin{array}{llllll}5 & 22 & 18.4\end{array}$ | - 26 |  | $\cdot 25$ | $\begin{array}{llll}5 & 22 & 48 \cdot 4\end{array}$ | $\cdot 24$ | $\begin{array}{llll}5 & 23 & 2.4 \\ 5 & 1\end{array}$ |  |
| 12 | $\begin{array}{llllllll}5 & 13 & 4 \\ 1\end{array} 9$ | -27 |  | . 26 |  | 24 | $\begin{array}{llllllllll}5 & 14 & 26.9\end{array}$ | 23 | $1440 \cdot 3$ | -21 |  | - 20 |
| 14 | $\begin{array}{llll}5 & 5 & 38.2\end{array}$ | -26 | $\begin{array}{lllll}5 & 5 & 53.2\end{array}$ | - 24 | $\begin{array}{lll}5 & 6 & 7 \cdot 2\end{array}$ | . 22 | $\begin{array}{lll}5 & 6 & 20 \cdot 2\end{array}$ | - 21 | $632 \cdot 2$ | -19 | $\begin{array}{llll}5 & 6 & 43 \cdot 2\end{array}$ | -17 |
| 16 | $45734 \cdot 6$ | . 24 | $45748 \cdot 8$ | . 23 | 58-8.8 | . 21 | $4 \begin{array}{llll}58 & 13 & 6\end{array}$ | -19 | 58 24.4 | -17 | 5833.9 | 5 |
| 18 | 449 3r•I | + 23 | $44944 \cdot 4$ | + 21 | $44956 \cdot 5$ | + -19 | $4 \begin{array}{llll}50 & 7 \cdot 2\end{array}$ | + 17 | $5016 \cdot 6$ | + . 14 | 450 <br> 124.6 | + 12 |
| 20 | $\begin{array}{lllllll}4 & 41 & 27.7\end{array}$ | $\cdot 22$ | $44 \mathrm{I} 40 \cdot 2$ | -20 | $44 \mathrm{I} 5 \mathrm{I} \cdot 3$ | -17 | 4 42 0.8 <br> 4   | -15 | $428 \cdot 9$ | $\cdot 12$ | 4 42 $15 \cdot 5$ <br> 4   |  |
| 22 | $\begin{array}{llll}4 & 33 & 24 \cdot 3\end{array}$ | -21 | 433 36-I | -18 | $43346 \cdot 2$ | - 5 | $43354 \cdot 6$ | -12 | $434 \begin{array}{ll}4 \cdot 3\end{array}$ | -10 | $\begin{array}{lll}4 & 34 & 6 \cdot 4\end{array}$ | -07 |
| 24 | 425 2r.r | - 20 | $42532 \cdot 0$ | -17 | $4254 \mathrm{r} \cdot \mathrm{r}$ | 14 | $42548 \cdot 4$ | -10 | 44 25 53.8 <br> 4   | . 07 | $42557 \cdot 4$ | -04 $+\quad .01$ |
| 26 | $\begin{array}{llllllll}4 & 17 & 17.9\end{array}$ |  | $4 \begin{array}{llll}47 & 28 \cdot 0\end{array}$ | -15 | $\begin{array}{llllllllllllll}4 & 17 & 36.2\end{array}$ | -12 | 4 17 $42 \cdot 3$ |  | 4 17 $46 \cdot 4$ | -05 | 417483 | $+$ |
| 28 | $\begin{array}{lllllllllll}4 & 9 & 14.8\end{array}$ | + 17 | $4 \quad 924 \cdot \mathrm{I}$ | + 14 | 931.3 | + .ro | $93.6 \cdot 2$ | + .06 | 938.9 | + .03 | 9 | - -0I |
| 30 | 4 I II• 7 | -16 | $4 \quad 120 \cdot 2$ | -12 | $\begin{array}{llll}4 & 1 & 26 \cdot 4\end{array}$ | -08 | 30 | .04 | 3 | . 00 | I | 4 |
| 31 |  | - 16 |  | - II | $35724^{\circ} \mathrm{O}$ | -07 | $\begin{array}{lllllll}3 & 57 & 27.2\end{array}$ | ${ }^{\circ} \mathrm{O}$ | 35727 | - -01 | 35725 | ${ }^{\circ} \mathrm{O}$ |
| 32 | $\begin{array}{llll}3 & 53 & 8.7\end{array}$ | - 15 |  | - II | $3532 \mathrm{I} \cdot 6$ | .06 | $\begin{array}{llll}3 & 53 & 24 \cdot 2\end{array}$ | $\stackrel{-02}{ }$ | 3 $53324 \cdot \mathrm{I}$ | - 02 | 35321 | .07 |
| 33 | $349 \quad 7 \cdot 2$ | $\cdot 14$ | 34914.6 | -10 | 349193 | -05 | 34921 | + 01 | 34920 | . 04 | 349 |  |
| 34 | 345 | + -14 | 34512.7 | + .09 | 34516.9 | +.04 | $\begin{array}{llll}3 & 45 & 18.2\end{array}$ | -00 | $\begin{array}{llllll}3 & 45 & 16 \cdot 7\end{array}$ | . 05 | 345 |  |
| 35 | $\begin{array}{llll}3 & 41 & 4 \cdot 2\end{array}$ | $\cdot 13$ |  |  | 3 41 14.5 | ${ }^{\circ} 04$ | $3{ }^{3} 1115 \cdot 2$ | - -or | 3 41 12.9 |  |  | -11 |
| 36 | $\begin{array}{llll}3 & 37 & 2 \cdot 8\end{array}$ | -1 | $\begin{array}{llll}3 & 37 & 9.0\end{array}$ | -08 | 3 37 $12 \cdot \mathrm{I}$ | -3 | 337 | -02 | 337 |  | $\begin{array}{llll}3 & 37 & 3\end{array}$ | -13 |
| 37 | $\begin{array}{llll}3 & 33 & 1.4\end{array}$ | -12 | $\begin{array}{llll}3 & 33 & 7 \cdot 1 \\ 3 & \text { 2 } & 5 \cdot 3\end{array}$ | -07 | 3 33 $9 \cdot 8$ |  | 333 | $\cdot 03$ | $\begin{array}{llll}3 & 33 & 5 \cdot 5\end{array}$ | -09 | $\begin{array}{lllll}3 & 32 & 58.5 \\ 3 & 28 & 53.8\end{array}$ | -14 |
| 38 | $\begin{array}{llll}3 & 28 & 59.9\end{array}$ | -12 | $\begin{array}{llll}3 & 29 & 5 \cdot 3\end{array}$ | . 06 | $\begin{array}{llll}3 & 29 & 7 \cdot 4\end{array}$ | + -0I | 329 | 5 | $\begin{array}{llll}3 & 29 & 1 \cdot 7\end{array}$ |  | $32853 \cdot 8$ |  |
| 39 | $32458 \cdot 5$ | + 11 | $\begin{array}{llll}3 & 25 & 3.5 \\ 3 & 25 & 1\end{array}$ | +.05 | $\begin{array}{lll}3 & 25 & 5.0 \\ 3 & 25 & \end{array}$ | -00 | $\begin{array}{lll}3 & 25 & 3.2\end{array}$ | . 06 | $\begin{array}{llll}3 & 24 & 57 \cdot 9\end{array}$ |  | $\begin{array}{llll}3 & 24 & 49 \cdot 1 \\ 3 & 20 & 44 \cdot 3\end{array}$ |  |
| 40 | $3{ }^{3} 2057 \cdot 1$ | -10 | 3 21 $1 \cdot 7$ <br>  16 5 | -05 | $\begin{array}{lll}3 & 21 & 2.7\end{array}$ | - 01 | $\begin{array}{lll}3 & 21 & 0.2\end{array}$ | 7 | $32054 \cdot \mathrm{I}$ | $\cdot{ }^{-13}$ | $\begin{array}{llll}3 & 20 & 44 \cdot 3\end{array}$ |  |
| 4 I |  | -10 |  | -04 | $\begin{array}{llrr}3 & 17 & 0.3\end{array}$ | - | $3{ }^{3} 1657 \cdot \mathrm{I}$ | - 08 |  |  | $\begin{array}{llll}3 & 16 & 39^{\circ} \\ 3 & 12 & \\ 3\end{array}$ | 21 |
| 4 | $\begin{array}{crrrr}3 & 12 & 54.3 \\ 3 & 8 & 52 \cdot 9\end{array}$ | +09 <br> -09 | $\begin{array}{rrrrr}3 & 12 & 58 \cdot 0 \\ 3 & 8 & 56 \cdot 2\end{array}$ | $\cdot 03$ <br> $\cdot 02$ | $\begin{array}{rrrr}3 & 12 & 58 \cdot 0 \\ 3 & 8 & 55 \cdot 6\end{array}$ | .03 .04 | $\begin{array}{crrrr}3 & 12 & 54 \cdot \mathrm{I} \\ 3 & 8 & 5 \mathrm{I} \cdot \mathrm{O}\end{array}$ | $\begin{array}{r}\text { - } 10 \\ \cdot 1 \mathrm{I} \\ \hline\end{array}$ | $\begin{array}{rrrr}3 & 12 & 46 \cdot 4 \\ 3 & 8 & 42 \cdot 5\end{array}$ | 18 | $\begin{array}{crrr}3 & 12 & 34 \\ 3 & 8 & 29 .\end{array}$ | 23 <br> .24 |
| 43 | $\begin{array}{llll}3 & 8 & 52 \cdot 9\end{array}$ |  | 385 |  | 3855 |  | $3$ |  | $\begin{array}{llll}3 & 8 & 42 \cdot 5 \\ 3 & 4 & 38 \cdot 5\end{array}$ | - 18 | $\begin{array}{llll}3 & 8 & 29.8 \\ 3 & 4 & 24.9\end{array}$ | 26 |
| 44 | $\begin{array}{llll}3 & 4 & 51 \cdot 6 \\ 3 & 0 & 50 \cdot 2\end{array}$ | + 0.08 | $\begin{array}{llll}3 & 4 & 54.4 \\ 3 & 0 & 52 \cdot 6 \\ & 5 & \\ \end{array}$ | + .01 | 4 53.2 <br> 0 50.8 <br>   | . 06 | 3 ol 44.8 | - .12 | $\begin{array}{ll}4 & 38 \cdot 5 \\ 0 & 34 \cdot 5\end{array}$ | $\cdot 19$ | $\begin{array}{ccc}3 & 4 & 24.9 \\ 3 & 0 & 19.8 \\ & 6 & \\ \end{array}$ | $\begin{array}{r} \cdot 26 \\ \cdot 28 \end{array}$ |
| 46 | 3 0 $50 \cdot 2$ <br> 2 56  | . 08 | (rrrer | - | 3 2 $5648 \cdot 4$ | -6 |    <br> 2 56 41 | - | $\begin{array}{lllll} \\ 2 & 56 & 30 \cdot 5\end{array}$ | . 22 | $\begin{array}{llllllll}2 & 56 & 14 \cdot 7\end{array}$ |  |
| 47 | $25247 \cdot 5$ | .06 | $25249 \cdot 0$ | - .or | $25246 \cdot 0$ | -09 | $25238 \cdot 5$ | -16 | 25226.4 | - 24 | $2 \begin{array}{lll}52 & 9 \cdot 5\end{array}$ | -32 |
| 48 | $24846 \cdot \mathrm{I}$ | . 06 | $24847 \cdot 2$ | . 02 | $24^{8} 43 \cdot 6$ | -10 | $24^{8} 35 \cdot 3$ | -18 | $24822 \cdot 2$ | . 26 | $2 \begin{array}{llll} & 48 & 4 \cdot 2\end{array}$ | $\cdot 34$ |
| 49 | $24444 \cdot 8$ | +.05 | $24445 \cdot 4$ | - .03 | $2 \begin{array}{lllll} \\ 2 & 41 \cdot 2\end{array}$ | - . II | $24432 \cdot 0$ | - 19 | 244179 | - . 28 | $24358 \cdot 7$ |  |
| 50 | 4043.4 | . 04 | $24043 \cdot 6$ | . 04 | $24038 \cdot 7$ | - 12 | 24028.7 | . 21 | 24013.7 | -29 | $23953 \cdot 3$ | $\cdot 38$ |
| 51 | 2 36 | $\cdot 04$ | 2 36 41 | -05 | $2 \begin{array}{lll}26 & 36 \cdot 2\end{array}$ | - 14 | 23625.4 | $\cdot 22$ | $\begin{array}{llll}2 & 36 & 9 \cdot 2\end{array}$ | -31 | $23547 \cdot 7$ | 40 |
| 52 | $\begin{array}{lllll}2 & 32 & 40 \cdot 8 \\ 2\end{array}$ | . 03 |  | .06 | $\begin{array}{llll}2 & 32 & 33 \cdot 7\end{array}$ | -15 | $\begin{array}{llll}2 & 32 & 22 \cdot 0 \\ 2 & 28 & 18.6\end{array}$ | 24 | $\begin{array}{llll}2 & 32 & 4.8 \\ 2 & 28 & 0.2\end{array}$ | $\cdot 33$ | $\begin{array}{lllllll}2 & 31 & 41.9\end{array}$ | 43 |
| 53 | $\begin{array}{lllll}2 & 28 & 39 \cdot 4\end{array}$ | . 02 | $2 \begin{array}{llll}28 & 38\end{array}$ | $\cdot 07$ | $2 \begin{aligned} & 28 \\ & 3\end{aligned}$ | $\cdot 16$ | $2 \begin{array}{llll}28 & 18.6\end{array}$ | $\cdot 26$ | $\begin{array}{ll}28 & 0.2\end{array}$ | $\cdot 35$ | $22736 \cdot$ | $\cdot 45$ |
| 54 | $\begin{array}{lllll}2 & 24 & 38 \cdot 1 \\ 2 & 2 & 36.8 \\ 2 & 16 & \\ \end{array}$ | + 02 | $\begin{array}{llll}2 & 24 & 36 \cdot 3\end{array}$ | -08 | $\begin{array}{llll}2 & 24 & 28 \cdot 6 \\ 2 & 20 & 26 \cdot 0\end{array}$ | - . 18 | $2 \begin{array}{lll}24 & 15 \cdot 1\end{array}$ | - 28 | $\begin{array}{llll}2 & 23 & 55 \\ 2\end{array}$ | - 38 | $\begin{array}{llll}2 & 23 & 29.9\end{array}$ | 48 |
| 55 | $22036 \cdot 8$ | . 01 | 22034.4 | -09 | 22026.0 | -19 | 22011.5 | -29 | 21950 | 40 | $21923 \cdot 7$ | 51 |
| 56 | $2 \begin{array}{llll}2 & 16 & 35 \cdot 5\end{array}$ | -00 | $\begin{array}{lllll}2 & 16 & 32.5 \\ 2 & 1 & 32.7\end{array}$ | -10 | $\begin{array}{llll}2 & 16 & 23.3\end{array}$ | $\cdot 21$ | $\begin{array}{lll}2 & 16 & 7 \cdot 8\end{array}$ | 31 | $2 \begin{array}{llllllll}2 & 15 & 45\end{array}$ | $\begin{array}{r}-42 \\ \hline\end{array}$ | $\begin{array}{llll}2 & 15 & 17.2\end{array}$ | 53 |
| 58 | $\begin{array}{lllll}2 & 12 & 34 \cdot 1 \\ 2 & 8 & 32 \cdot 9\end{array}$ | -00 | 12 | - 11 | $\begin{array}{llll}2 & 12 & 20.7 \\ 2 & 8 & 17.9\end{array}$ | - 22 | 2 | $\bigcirc 33$ | $\begin{array}{lllllllllll}2 & 11 & 40 \cdot 7 \\ 2 & 7 & 35 \cdot 4\end{array}$ | -45 | 1110 | $\begin{array}{r}56 \\ 59 \\ \hline\end{array}$ |
| 58 | $\begin{array}{lllll}2 & 8 & 32.9\end{array}$ |  |  |  | $8 \quad 17.9$ | - 24 |  | -35 | $735 \cdot$ |  | 7 | 59 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. |  | L. | A. |  | L. | A. |  | L. 8 | A. |  | L. | A. |  | L. 1 | - A. |  | L. 1 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $+$ | S. .42 | $\begin{gathered} s . \\ -4^{\circ 04} \end{gathered}$ |  | $\begin{aligned} & \text { S. } \\ & -\quad 49 \end{aligned}$ | $\begin{gathered} s . \\ -4.04 \end{gathered}$ |  | S. $\cdot 57$ | $\begin{gathered} s . \\ -4.05 \end{gathered}$ |  | S. $.64$ | $\begin{gathered} s . \\ -4.06 \end{gathered}$ |  | S. $\cdot 71$ | $\begin{gathered} s . \\ -4.08 \end{gathered}$ |  | $\stackrel{s}{ } \cdot 78$ | $\begin{gathered} s . \\ -4.09 \end{gathered}$ |
| 4 |  | $\cdot 40$ | $4 \cdot 03$ |  | -47 | 4.04 |  | -54 | $4 \cdot 05$ |  | -61 | $4 \cdot 06$ |  | -69 | 4.07 |  | $\cdot 76$ | $4 \cdot 09$ |
| 8 |  | -38 | 4.03 |  | -45 | 4.04 |  | -52 | 4.05 |  | -59 | 4.06 |  | -67 | 4.07 |  | $\cdot 74$ | $4 \cdot 08$ |
| 12 |  | -36 | $4 \cdot 03$ |  | -43 | 4.04 |  | -50 | 4.05 |  | -57 | 4.06 |  | -65 | 4.07 |  | $\cdot 72$ | 4.08 |
| 16 |  | - 34 | 4.03 |  | -41 | $4 \cdot 04$ |  | -49 | $4 \cdot 04$ |  | $\cdot 56$ | 4.05 |  | -63 | $4 \cdot 06$ |  | -71 | $4 \cdot 08$ |
| 20 | + | -32 | 4.03 | $+$ | $\cdot 40$ | 4.03 | $+$ | -47 | 4.04 | $+$ | $\cdot 55$ | 4.05 |  | - 62 | $4 \cdot 06$ | $+$ | $\cdot 70$ | 4.07 |
| 22 |  | $\cdot 31$ | 4.03 |  | - 39 | 4.03 |  | $\cdot 46$ | 4.04 |  | -54 | $4 \cdot 05$ |  | - 62 | $4 \cdot 06$ |  | $\cdot 70$ | $4 \cdot 07$ |
| 24 |  | -30 | 4.03 |  | $\cdot 38$ | 4.03 |  | -46 | $4 \cdot 04$ |  | -54 | 4.05 |  | . 62 | $4 \cdot 06$ |  | -69 | 4.07 |
| 26 |  | $\cdot 30$ | $4 \cdot 03$ |  | $\cdot 38$ | 4.03 |  | -45 | 4.04 |  | - 53 | 4.05 |  | -61 | $4 \cdot 06$ |  | -69 | 4.07 |
| 28 |  | -29 | 4.03 |  | -37 | 4.03 |  | -45 | 4.04 |  | -53 | 4.05 |  | -6I | $4 \cdot 06$ |  | -69 | $4 \cdot 07$ |
| 30 | $+$ | $\cdot 28$ | 4.03 |  | - 36 | 4.03 | $+$ | -45 | 4.04 |  | -53 | 4.05 |  | -61 | 4.06 | + | . 69 | 4.07 |
| 32 |  | -28 | 4.02 |  | -36 | 4.03 |  | -44 | 4.04 |  | -53 | 4.05 |  | -6I | $4 \cdot 06$ |  | $\cdot 70$ | $4 \cdot 07$ |
| 34 |  | -27 | 4.02 |  | $\cdot 36$ | $4 \cdot 03$ |  | -44 | 4.04 |  | -53 | 4.05 |  | -6I | 4.06 |  | $\cdot 70$ | 4.08 |
| 36 |  | -27 | 4.02 |  | $\cdot 35$ | 4.03 |  | -44 | 4.04 |  | -53 | 4.05 |  | -62 | 4.06 |  | $\cdot 70$ | 4.08 |
| 38 |  | -26 | 4.02 |  | $\cdot 35$ | 4.03 |  | -44 | 4.04 |  | -53 | 4.05 |  | -62 | $4 \cdot 06$ |  | $\cdot 71$ | $4 \cdot 08$ |
| 40 | $+$ | $\cdot 25$ | 4.02 |  | $\cdot 35$ | 4.03 | $+$ | -44 | 4.04 |  |  | 4.05 |  | . 63 | $4 \cdot 06$ |  | $\cdot 72$ | 4.08 |
| 42 |  | - 25 | 4.02 |  | - 34 | $4 \cdot 03$ |  | -44 | 4.04 |  | $\cdot 54$ | 4.05 |  | . 63 | 4.06 |  | $\cdot 73$ | 4.08 |
| 44 |  | $\cdot 25$ | 4.02 |  | $\cdot 34$ | 4.03 |  | -44 | 4.04 |  | -54 | 4.05 |  | -64 | 4.07 |  | $\cdot 74$ | 4.08 |
| 46 |  | - 24 | 4.02 |  | -34 | 4.03 |  | $\cdot 45$ | 4.04 |  | -55 | 4.05 |  | -65 | $4 \cdot 07$ |  | $\cdot 76$ | 4.09 |
| 48 |  | - 24 | 4.02 |  | -34 | 4.03 |  | -45 | 4.04 |  | $\cdot 56$ | 4.05 |  | -66 | $4 \cdot 07$ |  | $\cdot 77$ | 4.09 |
| 50 | + | - 24 | 4.02 | $+$ | $\cdot 35$ | 4.03 |  | $\cdot 46$ | 4.04 |  | $\cdot 57$ | 4.05 |  | . 68 | 4.07 |  | $\cdot 79$ | 4.09 |
| 52 |  | - 23 | 4.02 |  | $\cdot 35$ | 4.03 |  | $\cdot 46$ | 4.04 |  | $\cdot 58$ | $4 \cdot 06$ |  | $\cdot 70$ | 4.07 |  | . 82 | 4.10 |
| 54 |  | - 23 | 4.02 |  | -35 | 4.03 |  | $\cdot 47$ | 4.04 |  | -60 | 4.06 |  | $\cdot 72$ | 4.08 |  | -84 | $4 \cdot 10$ |
| 56 |  | -23 | 4.02 |  | $\cdot 36$ | 4.03 |  | -49 | 4.04 |  | -61 | 4.06 |  | $\cdot 74$ | 4.08 |  | $\cdot 87$ | 4•II |
| 58 |  | $\cdot 23$ | 4.02 |  | $\cdot 37$ | 4.03 |  | $\cdot 50$ | 4.04 |  | $\cdot 63$ | 4.06 |  | $\cdot 77$ | 4.09 |  | -91 | 4-12 |

## 24 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $5^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 15.8 \end{array}\right.$ | + 37 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 37 \cdot 8 \end{array}$ | $\begin{gathered} 5 . \\ +\quad .37 \end{gathered}$ | $\left\lvert\, \begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & 5 & 0 \cdot 0 \end{array}\right.$ | $\begin{gathered} \mathrm{s} . \\ +\quad .37 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & 22 \cdot 4 \end{array}$ | S. -37 | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 5 & 45 \cdot \end{array}$ | $\begin{gathered} s . \\ +\quad .38 \end{gathered}$ | $\begin{array}{\|lrl} \text { H. } & \text { M. } & \text { S. } \\ 6 & 6 & 8 \cdot 0 \end{array}$ |  |
| 10 | $1 \begin{array}{llll}5 & 23 & 15.8\end{array}$ | - 22 | $\begin{array}{llll}5 & 23 & 28 \cdot 5\end{array}$ | - 20 | $\begin{array}{llll}5 & 23 & 40 \cdot 5\end{array}$ | -19 | $5 \quad 23$ 51.9 | -18 | $\begin{array}{lll}5 & 24 & 2.6\end{array}$ | -17 | $\begin{array}{llll}5 & 24 & 12.6\end{array}$ | 16 |
| 12 | $\begin{array}{llll}5 & 15 & 4.5\end{array}$ | 19 | $\begin{array}{lllll}5 & 15 & 15 \cdot 3\end{array}$ | -17 | $\begin{array}{llll}5 & 15 & 25 \cdot 4\end{array}$ | -16 | $\begin{array}{lllllllllllllll}5 & 15 & 34 \cdot 6\end{array}$ | -14 | $\begin{array}{lllllllll}5 & 15 & 42.9\end{array}$ | -13 | $\begin{array}{llllllllllllllll}5 & 15 & 50 \cdot 4\end{array}$ | 12 |
| 1 | $\begin{array}{llll}5 & 6 & 53 \cdot 3\end{array}$ | - I6 | $\begin{array}{lll}5 & 7 & 2 \cdot 3\end{array}$ | -14 | $5 \quad 7$ IO. 3 | - I2 | $\begin{array}{lllll}5 & 7 & 17 \cdot 4\end{array}$ | - II | $\begin{array}{llll}5 & 7 & 23.4\end{array}$ | -09 | $\begin{array}{llll}5 & 7 & 28 \cdot 3\end{array}$ | . 07 |
| 16 | $\begin{array}{lllll}4 & 58 & 42 \cdot 3\end{array}$ | -13 | $45849 \cdot 5$ | -II | $45855 \cdot 5$ | -09 | $459 \quad 0 \cdot 3$ | -07 | 45953 | . 05 | 45966 | +.03 |
| 18 | 45031.4 | + 10 | $45036 \cdot 7$ | +.08 | $45040 \cdot 7$ | + •05 | 45043.4 | + .03 | $45044 \cdot 6$ | + 01 | $5044 \cdot 4$ | 1 |
| 20 | $44220 \cdot 5$ | -07 | 44224.0 | -04 | $44226 \cdot 0$ | + .02 | $442 \quad 26.4$ | - 00 | $442 \quad 25.2$ | -03 | $442 \quad 22 \cdot 5$ | 06 |
| 22 | $\begin{array}{llrr}4 & 34 & 9 \cdot 8\end{array}$ | . 04 | 434111.4 | + OI | $43411 \cdot 3$ | 2 | $\begin{array}{lll}4 & 34 & 9 \cdot 5\end{array}$ | 04 | $\begin{array}{lll}4 & 34 & 5 \cdot 9\end{array}$ | -07 | $\begin{array}{llr}4 & 34 & 0.4\end{array}$ | -10 |
| 2 | $\begin{array}{llll}4 & 25 & 59 \cdot 0\end{array}$ | + - OI | $42558 \cdot 7$ | . 02 | $42556 \cdot 6$ | -05 | $\begin{array}{llll}4 & 25 & 52 \cdot 5\end{array}$ | - 08 | $42546 \cdot 4$ | 12 | $425138 \cdot 3$ | - 15 |
| 26 | 4 17 $48 \cdot 3$ | -. 02 | 4 I7 46.1 | . 05 | 4 I7 4I•8 | -09 | $41735 \cdot 4$ | - 12 | $417726 \cdot 7$ | -16 | $4 \begin{array}{lllll}4 & 1759\end{array}$ | -20 |
| 28 | $4 \begin{array}{llll}4 & 9 & 37 \cdot 6\end{array}$ | -05 | $4 \begin{array}{lll}4 & 9 & 33\end{array}$ | 09 | $4 \quad 927 \cdot 0$ | - -13 | $\begin{array}{llll}4 & 9 & 18 \cdot 2\end{array}$ | I | $4 \begin{array}{lll}4 & 9 & 6 \cdot 9\end{array}$ | '21 | $\begin{array}{llll}4 & 8 & 53 \cdot 2\end{array}$ | $\cdot 25$ |
| 30 | 4 I $26 \cdot 7$ | 08 | 4 I $20 \cdot 6$ | - 12 | 4111.9 | 6 | $4 \begin{array}{lll}4 & 1 & 0.7\end{array}$ | 1 | $4 \quad 0 \quad 46 \cdot 8$ | $\cdot 25$ | $4 \quad 0 \quad 30 \cdot 2$ | -30 |
| 3 | $\begin{array}{llll}3 & 5 & 7 & 21 \cdot 3\end{array}$ | -10 | $\begin{array}{lllll}3 & 57 & 14.2\end{array}$ | -14 | $\begin{array}{llll}3 & 57 & 4.4\end{array}$ | - 18 | $\begin{array}{llll}3 & 56 & 51 \cdot 9\end{array}$ | -23 | $\begin{array}{llll}3 & 56 & 36 \cdot 6\end{array}$ | - 28 | $\begin{array}{lllll}3 & 56 & 18 \cdot 6\end{array}$ | 2 |
| 32 | $3 \begin{array}{llll}3 & 53 & 15 \cdot 9\end{array}$ | $\cdot \mathrm{II}$ | 35317 | 16 | $35256 \cdot 7$ | 20 | $35243 \cdot 0$ | - 25 | $\begin{array}{llll}3 & 52 & 26 \cdot 3\end{array}$ | -30 | $\begin{array}{llll}3 & 52 & 6 \cdot 8\end{array}$ | $\cdot 35$ |
| 33 | $\begin{array}{llll}3 & 49 & 10 \cdot 4\end{array}$ | -13 | $\begin{array}{llll}3 & 49 & 1 \cdot 2\end{array}$ | 18 | $34^{3} 849 \cdot 1$ | $\cdot 23$ | $34^{3} 4844^{\circ}$ | $\cdot 27$ | 348 16.0 | $\cdot 32$ | $\begin{array}{llllll}3 & 47 & 54.9\end{array}$ | $\cdot 38$ |
| 34 | $\begin{array}{llll}3 & 45 & 4.9 \\ 3 & 40 & \end{array}$ | 5 | $34454 \cdot 6$ | 21 | 3 44 41 <br>    <br>    | $\cdot 25$ | $\begin{array}{llll}3 & 44 & 24.9\end{array}$ | - 30 | $\begin{array}{lll}3 & 44 & 5 \cdot 5\end{array}$ | - 35 | $\begin{array}{llll}3 & 43 & 42 \cdot 8\end{array}$ | 0 |
|  | $\begin{array}{llll}3 & 40 & 59.4 \\ 3 & 36 & 53.8\end{array}$ | -16 | 34048 | 21 | 340 | $\cdot 27$ | $3{ }_{3} 40115.8$ | $\cdot 32$ | $\begin{array}{llll}3 & 39 & 54 \cdot 8\end{array}$ | - 38 | $\begin{array}{llll}3 & 39 & 30 \cdot 6\end{array}$ | 43 |
| 36 | $\begin{array}{llll}3 & 36 & 53 \cdot 8 \\ 3 & 3 & \end{array}$ | -18 | $\begin{array}{lllll}3 & 36 & 41 \cdot 3\end{array}$ | $\bullet 23$ |  | -29 | $\begin{array}{lll}3 & 36 & 6 \cdot 5\end{array}$ | $\cdot 34$ | $\begin{array}{llll}3 & 35 & 44 \cdot 1\end{array}$ | -40 | $\begin{array}{llll}3 & 35 & 18 \cdot 2\end{array}$ | $\cdot 46$ |
| 37 | $\begin{array}{lllll}3 & 32 & 48 \cdot 2\end{array}$ | $\cdot 20$ | $\begin{array}{llll}3 & 32 & 34 \cdot 6\end{array}$ | - 25 |  | $\cdot 31$ | 3 31 57-1 | $\cdot 37$ | $\begin{array}{lllllllllllll}3 & 31 & 33 \cdot 2\end{array}$ | -43 | $\begin{array}{llll}3 & 31 & 5 \cdot 6\end{array}$ | - 49 |
| 3 | $\begin{array}{llll}3 & 28 & 42\end{array}$ | - 22 | $\begin{array}{llll}3 & 28 & 27\end{array}$ | -27 | $\begin{array}{llll}3 & 28 & 9.5\end{array}$ | - 33 | $\begin{array}{lllllllllll}3 & 27 & 47 \cdot 6\end{array}$ | $\cdot 3$ | $\begin{array}{lllll}3 & 27 & 22 \cdot 1\end{array}$ | 45 | $326582 \cdot 8$ | $\cdot 52$ |
| 39 | $\begin{array}{llll}3 & 24 & 36 \cdot 8\end{array}$ | -23 | $\begin{array}{llll}3 & 24 & 20 \cdot 8\end{array}$ | '30 | 32415 | -36 | $323 \begin{array}{llll}3 & 37 \cdot 9\end{array}$ | 4 | 32310.8 | -48 | $\begin{array}{llllllllllll}3 & 22 & 39 \cdot 8\end{array}$ | -55 |
| 40 | $32030 \cdot 9$ | -25 |  | - 32 | $\begin{array}{llll}3 & 19 & 52 \cdot 9\end{array}$ | - 38 | $31928 \cdot 1$ | 4 | 318189.4 | -51 | $\begin{array}{llll}3 & \text { I8 } & 26 \cdot 6\end{array}$ | - 58 |
| 41 | $\begin{array}{llll}3 & 16 & 25 \cdot 1 \\ 3 & 1 & \end{array}$ | $\cdot 27$ | $\begin{array}{llrr}3 & 16 & 6 \cdot 7 \\ 3 & 11 & 50.5\end{array}$ | -34 | $\begin{array}{llll}3 & 15 & 44.4 \\ 3 & 11 & 35.8\end{array}$ | $\cdot 40$ | $\begin{array}{llll}3 & 15 & 18 \cdot 1\end{array}$ | $\cdot 4$ | $\begin{array}{llll}3 & 1 & 4 & 47 \cdot 7\end{array}$ | - 54 | $\begin{array}{llll}3 & 14 & 13 \cdot 1\end{array}$ | . 61 |
| 4 | $3_{3} 121219 \cdot 1$ | -29 | 3 II 59.5 | -36 | $\begin{array}{lllll}3 & 11 & 35 \cdot 8\end{array}$ | -43 | 3 11 7.9 <br>  6 5 | $\cdot 50$ | $31035 \cdot 8$ | $\cdot 57$ | $\begin{array}{llll}3 & 9 & 59 \cdot 3\end{array}$ | . 65 |
| 43 | $\begin{array}{llll}3 & 8 & 13 \cdot 1\end{array}$ | $\cdot 31$ | $\begin{array}{llll}3 & 7 & 52 \cdot 2\end{array}$ | $\cdot 38$ | $\begin{array}{llll}3 & 7 & 27 \cdot 1\end{array}$ | -45 |  | -53 | $\begin{array}{llll}3 & 6 & 23 \cdot 7\end{array}$ | -60 | $3 \quad 5 \quad 45 \cdot 2$ | -68 |
| 4 | $\left\lvert\, \begin{array}{lll}3 & 4 & 6 \cdot 9 \\ 3 & 0 & 0 \cdot 7\end{array}\right.$ | -33 | $\begin{array}{lrrr}3 & 3 & 44 \cdot 8\end{array}$ | 41 | $\begin{array}{llll}3 & 3 & 18 \cdot 1\end{array}$ | $\cdot 48$ | 3 2 $47 \cdot 0$ <br> 2 5  | - $\cdot 56$ | $\begin{array}{lrrr}3 & 2 & 11.2 \\ & 5 & 58.5\end{array}$ | -64 | $\begin{array}{rrrr}3 & 1 & 30 \cdot \\ 2 & 57 & 10 \cdot\end{array}$ | $\cdot 71$ |
| 4 | 3 $30000 \cdot 7$ | $\cdot 36$ | $\begin{array}{llll}2 & 59 & 37 \cdot 1 \\ 2 & 55 & 29 \cdot 4\end{array}$ | $\cdot 43$ | $\begin{array}{llrr}2 & 59 & 9 \cdot 0 \\ 2 & 5 & 50 \cdot 7\end{array}$ | $\cdot 51$ | $\begin{array}{llll}2 & 58 & 36 \cdot 2 \\ 2 & 54 & 25 \cdot 1\end{array}$ | - 59 | $\begin{array}{llll}2 & 57 & 58 \cdot 5\end{array}$ | $\cdot 67$ | $25716 \cdot 0$ | $\cdot 75$ |
| 46 | 2 55 54.4 <br> 2 5  | $\cdot 38$ | $\begin{array}{llll}2 & 55 & 29.4 \\ 2 & 5 & \end{array}$ | $\cdot 46$ | $\begin{array}{lllll}2 & 54 & 59 \cdot 7\end{array}$ | $\cdot 54$ | $\begin{array}{llll}2 & 54 & 25 \cdot 1 \\ 2 & 50 & 1\end{array}$ | -62 | $\begin{array}{llllllllllll}2 & 53 & 45 \cdot 5\end{array}$ | $\cdot 70$ | $\begin{array}{llr}2 & 53 & 0.8 \\ 2 & 48 & 45 \cdot 2\end{array}$ | -79 |
| 47 | $\begin{array}{lllll}2 & 5 & \text { I } & 47 \cdot 9\end{array}$ | -40 | $\begin{array}{llll}2 & 51 & 21.5\end{array}$ | $\cdot 48$ | 2505 | $\cdot 56$ |  | . 68 | $\begin{array}{llll}2 & 49 & 32 \cdot 1\end{array}$ | $\cdot 74$ | $\begin{array}{lllllllllll}2 & 48 & 45 \cdot 2\end{array}$ | . 83 |
| 48 | 2   <br> 2 47 41 | -42 |  | $\cdot 51$ | $24640 \cdot 4$ | . 59 | $246 \quad 2 \cdot 1$ | -68 | 24518.4 | $\cdot 77$ | 244 29.1 | -87 |
| 49 | $2 \begin{array}{llll}2 & 43 & 34\end{array}$ | - $\cdot 45$ | $\begin{array}{lll}2 & 43 & 5 \cdot 1\end{array}$ | $\cdot 54$ | $24230 \cdot 3$ | . 62 | $24150 \cdot 1$ | - $\cdot 72$ | 24114.2 | - .81 | 24012.5 | -91 |
| 50 | $\begin{array}{llll}2 & 39 & 27 \cdot 7\end{array}$ | -47 | $\begin{array}{lllllllllllllll}2 & 38 & 56 \cdot 6\end{array}$ | -56 | $23820 \cdot 0$ | -66 | $23737 \cdot 7$ | $\cdot 75$ | $\begin{array}{llllllllllllllll}2 & 36 & 49 \cdot 6\end{array}$ | $\cdot 85$ |  | -95 |
| 51 | $2 \begin{array}{llll}2 & 35 & 20 \cdot 6\end{array}$ | $\cdot 50$ | $23447 \cdot 9$ | -59 | $\begin{array}{llll}2 & 34 & 9 \cdot 4\end{array}$ | -69 | 2 33 $25 \%$ | $\cdot 79$ | $232 \begin{array}{llll}24.5\end{array}$ | $\cdot 89$ | $23137 \%$ | I.00 |
| 52 | $\begin{array}{lll}2 & 31 & 13.3 \\ 2 & 27 & 5.8\end{array}$ | $\cdot 52$ | $\begin{array}{llll}2 & 30 & 38 \cdot 9\end{array}$ | . 62 | $\begin{array}{llll}2 & 29 & 58 \cdot 4\end{array}$ | $\cdot 73$ | 2 29 11.8  <br> 2 24 5  | -83 | $\begin{array}{llll}2 & 28 & 18.8 \\ 2 & 24 & 2.6\end{array}$ | -94 | $2{ }^{2} 27 \begin{array}{lll}19 \cdot 2\end{array}$ | I.05 |
| 53 | $\begin{array}{llll}2 & 27 & 5\end{array}$ | $\cdot 55$ | 22629.6 | -66 | $22547 \cdot 1$ | $\cdot 76$ | 224 58.2 | -87 | 224206 | -98 | $2230 \cdot 1$ | I.IO |
| 54 | $2 \begin{array}{llll}2 & 22 & 58\end{array}$ | - .58 | $22220 \cdot 0$ | - 69 | 22135.4 | -80 | $22044{ }^{\circ} \mathrm{O}$ | - 91 | $21945{ }^{2} 7$ | - I.03 | $2 \begin{array}{lllll}2 & 18 & 40 \cdot 2\end{array}$ | -I.15 |
| 55 | $\begin{array}{lllll}2 & 18 & 50 \cdot 1\end{array}$ | . 61 | 2181 | $\cdot 72$ | $\begin{array}{lllll}2 & 17 & 23.2\end{array}$ | $\cdot 84$ | $2 \begin{array}{lll}16 & 29 \cdot 3\end{array}$ | -96 | $215158 \cdot 1$ | $\underline{1} \cdot 08$ | $\begin{array}{llllll}2 & 14 & 19.5\end{array}$ | I. 21 |
| 56 | $\begin{array}{lllll}2 & 14 & 41 \cdot 9 \\ 2 & 10 & \end{array}$ | . 65 | 2 13 59.7 <br> 2   | $\cdot 76$ | $\begin{array}{llll}2 & 13 & 10.5 \\ 2 & 8 & 57.3\end{array}$ | -88 | $\begin{array}{llll}2 & 12 & 13.9\end{array}$ | $1 \cdot 01$ | $\begin{array}{rrrr}2 & 11 & 9 \cdot 8 \\ 2 & 6 & 50 \cdot 5\end{array}$ | 1.13 | $2 \begin{array}{llll}2 & 9 & 57 \cdot 7 \\ 2 & 5 & 34 \cdot 9\end{array}$ | $\underline{1.27}$ |
| 58 | $\begin{array}{rrrr}2 & 10 & 33 \cdot 4 \\ 2 & 6 & 24.5\end{array}$ | $\cdot 68$ | $\begin{array}{llll}2 & 9 & 49.0 \\ 2 & 5 & 37.8\end{array}$ |  | $\begin{array}{llll}2 & 8 & 57.3 \\ 2 & 4 & 43 \cdot 5\end{array}$ | $\cdot 93$ | $\begin{array}{lllll}2 & 7 & 57.9 \\ 2 & 3 & 41.1\end{array}$ | I.06 | $650 \cdot 5$ | I-19 | 534.9 | I.33 |
| 58 | $2 \quad 6 \quad 24.5$ | $\cdot 71$ | $2 \quad 5 \quad 37 \cdot 8$ | -84 | $2 \quad 4 \quad 43 \cdot 5$ | -97 | 234 I I | I•II | $2 \quad 230 \cdot 4$ | I 25 | $2 \quad 1 \begin{array}{lll}10.9\end{array}$ | I 40 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 1 | ${ }^{\circ} \mathrm{A}$. | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. $+\quad .86$ | S. $-4 \cdot 11$ | $\begin{gathered} \mathrm{s} . \\ +\stackrel{93}{ } \end{gathered}$ | $\underset{-4 \cdot \mathrm{I} 2}{ }$ | $\begin{gathered} s . \\ +1 \cdot 00 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot \mathrm{I}_{4} \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 08 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 16 \end{gathered}$ | $\begin{gathered} s . \\ +r \cdot 15 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 18 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 23 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.20 \end{gathered}$ |
| 4 | . 83 | $4 \cdot 10$ | -91 | $4 \cdot 12$ | . 98 | $4 \cdot 13$ | I.05 | $4 \cdot 15$ | 1.13 | 4.17 | 1.21 | $4 \cdot 19$ |
| 8 | .81 | $4 \cdot 10$ | -89 | $4 \cdot 11$ | -96 | $4 \cdot 13$ | I. 04 | $4 \cdot 15$ | I'II | $4 \cdot 17$ | 1-19 | $4 \cdot 19$ |
| 12 | -80 | 4.09 | - 87 | $4 \cdot 11$ | $\cdot 95$ | $4 \cdot 12$ | 1.02 | $4 \cdot 14$ | $1 \cdot 10$ | $4 \cdot 16$ | 1-18 | $4 \cdot 18$ |
| 16 | $\cdot 78$ | 4.09 | . 86 | $4 \cdot 11$ | $\cdot 94$ | 4.12 | I.OI | $4 \cdot 14$ | I.09 | 4-16 | 1-17 | 4.18 |
| 20 | + 78 | 4.09 | + 85 | $4 \cdot 10$ | + 93 | $4 \cdot 12$ | +ror | $4 \cdot 14$ | +1.09 | 4.16 | +1.17 | 4.18 |
| 22 | . 77 | 4.09 | . 85 | $4 \cdot 10$ | . 93 | $4 \cdot 12$ | I OI | $4 \cdot 14$ | 1.09 | 4.16 | I-18 | 4-18 |
| 24 | $\cdot 77$ | 4.09 | $\cdot 85$ | $4 \cdot 10$ | $\cdot 93$ | $4 \cdot 12$ | 1.02 | $4 \cdot 14$ | I•10 | 4.16 | I•18 | $4 \cdot 18$ |
| 26 | $\cdot 77$ | 4.09 | . 86 | $4 \cdot 10$ | -94 | $4 \cdot 12$ | 1.02 | 4.14 | I•10 | $4 \cdot 16$ | I.19 | $4 \cdot 19$ |
| 28 | $\cdot 77$ | 4.09 | . 86 | 4-10 | -94 | 4.12 | 1.03 | $4^{\cdot 1} 14$ | I•II | $4 \cdot 16$ | $1 \cdot 20$ | $4 \cdot 19$ |
| 30 | + 78 | 4.09 | + 86 | $4 \cdot \mathrm{II}$ | + 95 | $4 \cdot 12$ | +r.03 | $4 \cdot 14$ | +1.12 | 4.17 | +1.2I | $4 \cdot 19$ |
| 32 | $\cdot 78$ | 4.09 | . 87 | $4 \cdot 11$ | -96 | $4 \cdot 13$ | I. 04 | 4. 15 | 1.13 | $4 \cdot 17$ | 1.22 | $4 \cdot 20$ |
| 34 | $\cdot 79$ | 4.09 | $\cdot 88$ | $4 \cdot 11$ | $\cdot 96$ | $4 \cdot 13$ | 1.06 | $4 \cdot 15$ | $1 \cdot 15$ | $4 \cdot 17$ | 1.24 | 4.20 |
| 36 | $\cdot 79$ | 4.09 | $\cdot 89$ | $4 \cdot 11$ | $\cdot 98$ | $4 \cdot 13$ | 1.07 | $4 \cdot 15$ | I.16 | $4 \cdot 18$ | I. 26 | 4.21 |
| 38 | -80 | 4.09 | -90 | $4 \cdot 11$ | -99 | $4 \cdot 13$ | I.09 | $4 \cdot 16$ | I•18 | $4 \cdot 18$ | 1.28 | 4.21 |
| 40 | + 8 l | $4 \cdot 10$ | + $9 \mathrm{9r}$ | $4 \cdot 12$ | +1.01 | $4 \cdot 14$ | +1.11 | $4 \cdot 16$ | +1.21 | $4 \cdot 19$ | +1.31 | 4.22 |
| 42 | $\cdot 83$ | $4 \cdot 10$ | $\cdot 93$ | 4-12 | $\underline{1} \cdot 03$ | $4 \cdot 14$ | $1 \cdot 13$ | 4.17 | 1.23 | $4 \cdot 20$ | 1.34 | 4.23 |
| 44 | $\cdot 84$ | $4 \cdot 10$ | -95 | $4 \cdot 13$ | I.05 | $4 \cdot 15$ | 1.16 | $4 \cdot 18$ | 1.26 | 4.21 | 1-37 | $4 \cdot 24$ |
| 46 | -86 | $4 \cdot 11$ | -97 | $4 \cdot 13$ | I.08 | 4-16 | I•19 | $4 \cdot 19$ | $1 \cdot 30$ | 4.22 | 1.41 | $4 \cdot 26$ |
| 48 | $\cdot 88$ | 4.II | -99 | 4.14 | I•II | 4.16 | I 22 | $4 \cdot 20$ | I. 34 | 4.23 | 1.46 | $4 \cdot 27$ |
| 50 | + 9.91 | $4 \cdot 12$ | +1.02 | $4 \cdot 14$ | +1.14 | 4.17 | +1.26 | $4 \cdot 21$ | +1.39 | 4.25 | +1.51 | 4.29 |
| 52 | -94 | $4 \cdot 12$ | I.06 | $4 \cdot 15$ | $1 \cdot 18$ | 4-19 | $1 \cdot 31$ | $4 \cdot 22$ | I.44 | $4 \cdot 27$ | $1 \cdot 57$ | $4 \cdot 31$ |
| 54 | $\cdot 97$ | $4 \cdot 13$ | I-10 | $4 \cdot 16$ | 1.23 | 4.20 | $1 \cdot 36$ | 4.24 | 1.50 1.58 | 4.29 | I. 64 | $4 \cdot 34$ |
| 56 | 1.01 | 4.14 | 1.14 | $4 \cdot 17$ | I. 28 | 4.22 | 1.43 | 4.26 4.28 | I.58 | 4.31 | 1.73 $\mathbf{1} \cdot 83$ | 4.37 |
| 58 | 1.05 | $4 \cdot 15$ | 1. 20 | $4 \cdot 19$ | $1 \cdot 35$ | 4.23 | 1.50 | $4 \cdot 28$ | I. 66 | 4.34 | 1.83 | $4 \cdot 41$ |

## LATITUDE $5^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True <br> Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ |  | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 6 & 3 I \cdot \end{array}$ | + $\cdot 38$ | $\begin{array}{ccc}\text { H. M. } & \text { S. } \\ 6 & 6 & 54 \cdot 3\end{array}$ | + -39 | $\left\lvert\, \begin{array}{cc} \text { H. M. } \\ 6 & \text { I8. } \end{array}\right.$ | + ${ }^{\text {S }}$ | $\begin{array}{cc} \text { M. } & \text { S. } \\ 7 & 4 \times 9 \end{array}$ | . 40 | $\left\|\begin{array}{\|cc} \text { H. M. } & \text { S. } \\ 6 & 6 \end{array}\right\|$ | $-4 x$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 8 & 30.8 \end{array}\right\|$ |  |
| 10 | $52422 \cdot 0$ |  | $52430 \cdot 7$ | -14 | $5 \begin{array}{lllll}5 & 24 & 38 \cdot 7\end{array}$ | 13 | $52446 \cdot 0$ | - 11 | 524 52.6 | - 10 | $524 \quad 58 \cdot 5$ |  |
| 12 | 515 57.1 |  | $\begin{array}{llll}5 & 16 & 2.8\end{array}$ | -09 | $16 \quad 7 \cdot 7$ | 07 | $\begin{array}{lllll}5 & 16 & 11 \cdot 7\end{array}$ | + .06 | $\begin{array}{lllll}5 & 16 & 14.9\end{array}$ | +.04 | $\begin{array}{lllllllll}5 & 16 & 17 & 0\end{array}$ | +.03 |
| 14 | $\begin{array}{lllll}5 & 7 & 32 \cdot 3\end{array}$ | -05 | $\begin{array}{lllll}5 & 7 & 35 \cdot 1\end{array}$ | + 04 | $\begin{array}{llll}5 & 7 & 36 \cdot 9\end{array}$ | + 0 | $737 \cdot 6$ | -00 | [ $\begin{array}{cccc}5 & 7 & 37 \cdot 1 \\ 4 & 58 & 59 \cdot 4\end{array}$ | . 02 | 5 7 $35 \cdot 6$ <br> 4 58 $54 \cdot 0$ | - 03 |
| 16 | $4 \begin{array}{lll} & 59 & 7 \cdot 5\end{array}$ | + - 01 | $4 \begin{array}{lll} & 59 & 7.5\end{array}$ | - 01 | $4596 \cdot 1$ | . 03 | 4593.4 | -05 | 45859.4 | . 08 | $45854 \cdot 0$ |  |
| 18 | $45042 \cdot 8$ | -. 04 | $45039 \cdot 8$ | -06 | 45035.2 | 9 | $45^{50} 29 \cdot 1$ | 1 | $45021 \cdot 6$ | - 14 | $4 \begin{array}{llll}40 & 12.3\end{array}$ |  |
| 20 | $44218 \cdot x$ | .09 | 44212.0 | - II | 4424.2 | 14 | 44154.7 | . 17 | 44143.4 | 20 | $44130 \cdot 3$ | 3 |
| 22 | 43353.2 | -13 | $43344 \cdot 1$ | -17 | 43333.0 | - 20 | $43320 \cdot 0$ | - 23 | 43350 | 7 | $\begin{array}{llll}4 & 32 & 47.9\end{array}$ | -30 |
| 24 | $42588 \cdot 1$ | -19 | 2515.9 | $\cdot 22$ | $\begin{array}{lll}4 & 25 & 1.4\end{array}$ | - 26 | 424 44.8 | $\cdot 29$ | ${ }_{4}^{4} 224 \begin{array}{ll}26 \cdot 0\end{array}$ | - 33 | ${ }^{4} 224 \begin{aligned} & 4 \cdot 9\end{aligned}$ | $\cdot 37$ |
| 26 | $\begin{array}{llll}4 & 17 & 2.7\end{array}$ | - 24 | $1647 \cdot 3$ | -28 | 41629.5 | - 32 | $4 \begin{array}{lll}16 & 9.2\end{array}$ | $\cdot 36$ | $41546 \cdot 5$ | 40 | $41521 \cdot \mathrm{I}$ | -44 |
| 28 | 4 | - 29 | 4 50 48.8 | $\cdot 33$ | 757.0 | - 38 | 4 32.9  <br>  58 55.8 | 2 | 4 7 $6 \cdot 1$ <br> 3 58  | $\cdot 47$ | $\begin{array}{rrrrr}4 & 6 & 36 \cdot 4 \\ 3 & 5 & 50.4\end{array}$ | . 52 |
| 30 | 4 O 10 | $\cdot 34$ | $\begin{array}{lllllll}3 & 59 & 48 \cdot 8\end{array}$ | $\cdot 39$ | 35923.8 | $\cdot 44$ | $\begin{array}{lllll}3 & 58 & 55 \cdot 8\end{array}$ | - 49 | 3 58 24.9 <br> 3 54  | 54 | $5750 \cdot 7$ | 59 |
| 31 | 35557.6 | - 37 | $\begin{array}{lllll}3 & 55 & 33.8\end{array}$ | $\cdot 42$ | $\begin{array}{lll}3 & 55 & 6 \cdot 9\end{array}$ | $\cdot 47$ | $35437 \cdot 0$ | 52 | 3 54 3.8 | . 58 | $\begin{array}{lllll}3 & 53 & 27 \cdot 4\end{array}$ | 63 |
| 32 | 5144.2 | -40 | $\begin{array}{llllllllllllllll}3 & 51 & 18.6\end{array}$ | $\cdot 45$ | $35049 \cdot 8$ | $\cdot 51$ | 35017.8 | -56 | $34942 \cdot 5$ | -62 | 349307 | 7 |
| 33 | $34730 \cdot 6$ | 43 | $\begin{array}{llll}3 & 47 & 3.2\end{array}$ |  | $346 \quad 32 \cdot 5$ | 54 | $34558 \cdot 4$ | . 60 | $\begin{array}{llll}3 & 45 & 20 \cdot 9\end{array}$ | 65 | $4439 \cdot$ | -72 |
| 34 | 4316.9 | - 46 | $34247 \cdot 6$ | - 52 |  | - $\cdot 57$ |  | - . 63 |  | - 69 |  | 76 |
| 35 | $\begin{array}{llll}3 & 39 & 2.9\end{array}$ | 9 | $\begin{array}{llll}3 & 38 & 3 \mathrm{I} \cdot 8\end{array}$ | . 55 | $\begin{array}{llll}3 & 37 & 57 \cdot 1\end{array}$ | . 61 | $\begin{array}{lllllllll}3 & 37 & 18 \cdot 7\end{array}$ | $\cdot 67$ | $\begin{array}{lllll}3 & 36 & 36 \cdot 5\end{array}$ | $\cdot 73$ | 35 50.3 |  |
| 36 | $\begin{array}{llllllllllll}3 & 34 & 48 \cdot 8\end{array}$ | -52 | $\begin{array}{llll}3 & 34 & 15.7\end{array}$ | . 58 | $\begin{array}{lllll}3 & 33 & 3.9\end{array}$ | . 64 | 3 32 58 | $\cdot 71$ | $\begin{array}{llll}3 & 3213.7\end{array}$ | -78 | 3 <br> 31 <br> 154.9 | -85 |
| 37 |  | $\cdot 55$ | $32959 \cdot 3$ | -62 | $2920 \cdot 4$ | . 68 | $2837 \cdot 5$ | $\cdot 75$ | 32750.4 | . 82 | $32659 \cdot 0$ | -89 |
| 38 |  |  | $32542 \cdot 7$ |  | 3251.6 | $\cdot 72$ | $3 \quad 2416 \cdot 3$ | -79 | $32326 \cdot 7$ |  | $2232 \cdot 6$ | -94 |
| 39 | $\begin{array}{llll}3 & 22 & 4.8\end{array}$ | . 62 | 32125.7 | $\cdot 69$ | 32042.4 | $\cdot 76$ | $31954 \cdot 7$ | 3 | 319 | - 91 | $\begin{array}{llll}3 & 18 & 5.5\end{array}$ | 9 |
| 40 | $\begin{array}{llllllllll}3 & 17 & 49 \cdot 6\end{array}$ | . 65 | 3 17 8.4 <br>  12 50.7 |  | $1622 \cdot 7$ |  | $315532 \cdot 5$ |  | $\begin{array}{llll}3 & 14 & 37 \cdot 6\end{array}$ | $95$ | 3 13 $37 \cdot 8$ <br> 3   | 04 |
| 4 I | $\begin{array}{llllll}3 & 13 & 34.1 \\ 3 & 9 & 18.2\end{array}$ | -69 | $\begin{array}{cccc}3 & 12 & 50 \cdot 7 \\ 3 & 8 & 32.6\end{array}$ | $\cdot 76$ | $\begin{array}{llll}3 & 12 & 2 \cdot 7 \\ 3 & 7 & 4.7\end{array}$ |  | $\begin{array}{llll}3 & 11 & 9.9\end{array}$ | $\cdot 92$ | 3 10 12.2 | 1.00 | $\begin{array}{llr}3 & 9 & 9 \cdot 3\end{array}$ | 09 |
| 42 | $\begin{array}{cccc}3 & 9 & 18.2 \\ 3 & 5 & 2.0\end{array}$ | - | $\begin{array}{lll}3 & 8 & 32 \cdot 6 \\ 3 & 4 & 14 \cdot 0\end{array}$ | . 80 | $\begin{array}{llll}3 & 7 & 42 \cdot 1 \\ 3 & 3 & 2 \mathrm{I} \cdot 0\end{array}$ | .88 .93 | 646.7  <br> 2 22.8 | -97 | $\begin{array}{lll}3 & 5 & 46 \cdot 1 \\ 3 & 1 & 19.2\end{array}$ | 1. | $\begin{array}{cc}4 & 40 \cdot 1 \\ 0 & 10 \cdot 1\end{array}$ |  |
| 43 | $\begin{array}{llll}3 & 5 & 2.0\end{array}$ | -76 | 3414.0 |  | 3 | -93 | 22 |  | 119.2 |  |  |  |
| 44 | $\begin{array}{rrrr}3 & 0 & 45.4 \\ 2 & 56 & 28.3\end{array}$ | . 80 | $\begin{array}{llll}2 & 59 & 54.9 \\ 2 & 55 & 35.4\end{array}$ | . 88 | $\begin{array}{lllll}2 & 58 & 59 \cdot 3 \\ 2 & 54 & 37 \cdot 0\end{array}$ | -93 -.92 r | $\begin{array}{llll}2 & 57 & 58 \cdot 3 \\ 2 & 53 & 33 \cdot 0\end{array}$ | 1.06 1.12 | $\begin{array}{llll}2 & 56 & 51 \cdot 6 \\ 2 & 52 & 23 \cdot 1\end{array}$ | -1.16 | $\begin{array}{cccc}2 & 55 & 39 \cdot 1 \\ 2 & 51 & 7 \\ & 7 & 7\end{array}$ |  |
| 4 | $\begin{array}{lll}2 & 56 & 28 \cdot 3 \\ 2 & 52 & 10 \cdot 8\end{array}$ | . 88 | $\begin{array}{llll}2 & 55 & 35 \cdot 4 \\ 2 & 51 & 15 \cdot 2\end{array}$ | -93 | $\begin{array}{lll}2 & 54 & 37 \cdot 0 \\ 2 & 50 & 14.1\end{array}$ | 02 | $\begin{array}{llll}2 & 53 & 33 \cdot 0 \\ 2 & 49 & 7 \cdot 0\end{array}$ | I 12 $\mathrm{I} \cdot 17$ | $\begin{array}{llll}2 & 52 & 23 \cdot 1 \\ 2 & 47 & 53 \cdot 8\end{array}$ |  | $\begin{array}{rrrr}2 & 51 & 7 \cdot 1 \\ 2 & 46 & 34 \cdot 1\end{array}$ | 1.32 <br> 1.38 |
| 47 | $24752 \cdot 7$ | $\cdot 92$ | $24654 \cdot 5$ | 1.02 | 245 50.4 | I-12 | 44 40.1 | 1.22 | 24323.4 | 33 | $4 \mathrm{I} 59 \cdot 9$ | 1.45 |
| 48 | 2433411 | 97 | $24233 \cdot 1$ | $\mathbf{1} \cdot 07$ | 24125 | 1.17 | 40 | $1 \cdot 28$ | $\begin{array}{lllll}28 & 51 & \text {-9 }\end{array}$ | 1.40 | 23724.4 | 1.52 |
| 49 | $\begin{array}{llllll}2 & 39 & 14.8\end{array}$ | - 1.01 | $\begin{array}{llllllllllll}2 & 38 & 10.9\end{array}$ | -1. | $37 \quad 0.5$ | $-1.23$ | 23543.4 | - $\mathrm{I} \cdot 34$ | $2{ }^{2} 34$ I9.I | - 1.47 | $3247 \cdot 5$ | 9 |
| 50 | 2 <br> 34 <br> 14.9 | 1.06 | 3347.9 | 1 | 3234.2 | 1 | 23113.3 | 1 | $22945 \cdot \mathrm{x}$ |  | 28 9.0 | . 67 |
| 51 | $\begin{array}{lllll}2 & 30 & 34.3\end{array}$ | I•II | 2 29 $24 \cdot 1$ <br> 2 24  | $\underline{1}$ | $\begin{array}{llll}2 & 28 & 6 \cdot 8\end{array}$ | 35 | $22642 \cdot \mathrm{I}$ | 1.48 | $\begin{array}{llll}2 & 25 & 9 \cdot 6\end{array}$ | 1.61 |  | 8 |
| 52 | $\begin{array}{llll}2 & 26 & 12.8 \\ 2 & 21 & 50.5\end{array}$ | 1-17 | $\begin{array}{lllll}2 & 24 & 59 \cdot 3 \\ 2 & 2\end{array}$ | I 29 | $\begin{array}{lllll}2 & 23 & 38 \cdot 3\end{array}$ |  | $\begin{array}{llll}2 & 22 & 9.5\end{array}$ |  | $\begin{array}{llll}2 & 20 & 32.5 \\ 2 & 15 & 53.6\end{array}$ |  | $2 \begin{array}{llll}2 & 18 & 46 \cdot 7\end{array}$ | 1.84 |
| 53 | $22150 \cdot 5$ | 22 | 22033.4 | 1.35 | 21988 | $1.48$ | $1735 \cdot 4$ | 1. | 21553.6 | I•77 | $2 \begin{array}{lll}2 & 14 & 2 \cdot 6\end{array}$ | -93 |
| 54 | $\begin{array}{llllll}2 & 17 & 27.3\end{array}$ | - 1.28 | $\begin{array}{llll}2 & 16 & 6.4\end{array}$ | - 1.42 | $21437 \cdot 4$ | - 1.56 | 1259.6 | - $\mathrm{x} \cdot 7 \mathrm{x}$ | I1 12.7 | - 1.86 | 916.0 | 2.03 |
| 55 | $\begin{array}{llll}2 & 13 & 2.9\end{array}$ | 134 | 2 II $38 \cdot \mathrm{I}$ | I.48 | 104.7 | 1.63 | 822.0 | $1 \cdot 79$ | 629.7 |  | $426 \cdot 9$ | - 1 |
| 56 | $\begin{array}{llllllll}2 & 8 & 37.4\end{array}$ | 4 I | $\begin{array}{llll}2 & 7 & 8 \cdot 4 \\ 2 & 2 & 3\end{array}$ | r 56 |  | 1.72 | $342 \cdot 3$ | I | $1{ }^{1} 44.2$ | 2.06 | $5934 \cdot 9$ | 25 |
| 57 58 | 2 4 $10 \cdot 5$ <br>    | 1.4 | 37 | 1.64 | 53.9 | I 81 | 59 0.4 | I.98 | $5655 \cdot 9$ | $2 \cdot 1$ | $5439 \cdot 5$ | 31 |
|  | $5942 \cdot 3$ | I.5 | 58 | 1.72 | 56 |  | $54 \quad 15 \cdot 8$ | 2.09 | 52 | $2 \cdot 2$ | 4940 | 2.51 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ}$ | ${ }^{\circ}$ A. | L. $19^{\circ}$ | $9^{\circ} \mathrm{A}$. | L. 20 | $0^{\circ} \mathrm{A}$. | L. $21{ }^{\circ}$ | - A. | L. $22^{\circ}$ | A. | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. +1.31 | S. | S. $+\mathbf{1} 39$ | S. -4.25 | S. +1.47 | S. -4.27 | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 55 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 30 \end{gathered}$ | $\begin{gathered} s . \\ +\mathrm{x} \cdot 63 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4: 33 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 7 \mathrm{I} \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 36 \end{gathered}$ |
| 4 | I.28 | 4.22 | 1.36 | 4.24 | 1.44 | 4.26 | I. 52 | $4 \cdot 29$ | I.60 | $4 \cdot 32$ | 1.69 | 4 |
| 8 | $1 \cdot 27$ | $4 \cdot 21$ | 1.35 | 4.23 | 1.42 | $4 \cdot 26$ | I. 50 | $4 \cdot 29$ | I 59 | $4 \cdot 32$ | 1.67 | $4 \cdot 35$ |
| 12 | 1.25 | $4 \cdot 21$ | I-33 | $4 \cdot 23$ | I.4I | $4 \cdot 26$ | I-50 | $4 \cdot 28$ | I•58 | $4 \cdot 31$ | I. 66 | $4 \cdot 34$ |
| 16 | I. 25 | $4 \cdot 20$ | I.33 | $4 \cdot 23$ | 1.4I | $4 \cdot 26$ | I.49 | $4 \cdot 28$ | I. 58 | $4 \cdot 3 \mathrm{I}$ | I. 66 | $4 \cdot 34$ |
| 20 | + I. 25 | $4 \cdot 20$ | + 1.34 | $4 \cdot 23$ | +1.42 | $4 \cdot 26$ | +1.50 | $4 \cdot 29$ | +1.59 | $4 \cdot 32$ | +1.68 | $4 \cdot 35$ |
| 22 | I. 26 | $4 \cdot 21$ | I. 34 | 4.23 | 1.43 | $4 \cdot 26$ | 1.51 | $4 \cdot 29$ | 1.60 | $4 \cdot 32$ | 1. 69 | $4 \cdot 35$ |
| 24 | I 26 | $4 \cdot 21$ | I.35 | $4 \cdot 23$ | I.44 | $4 \cdot 26$ | I. 52 | $4 \cdot 29$ | I-6I | $4 \cdot 33$ | 1-70 | $4 \cdot 36$ |
| 26 | $1 \cdot 27$ | 4.2I | 1.36 | $4 \cdot 24$ | 1.45 | $4 \cdot 27$ | I.54 | $4 \cdot 30$ | I 63 | 4.33 | I•72 | $4 \cdot 37$ |
| 28 | I. 28 | $4 \cdot 21$ | 1.37 | $4 \cdot 24$ | I. 46 | $4 \cdot 27$ | x 55 | 4330 | 1.65 | $4 \cdot 34$ | I'74 | $4 \cdot 37$ |
| 30 | +1.30 | $4 \cdot 22$ | +1.39 | 4.25 | +1.48 | $4 \cdot 28$ | +1.57 | $4 \cdot 31$ | +r.67 | 4.34 | + 176 | $4 \cdot 38$ |
| 32 | 1-3I | $4 \cdot 22$ | 1.41 | $4 \cdot 25$ | I. 50 | $4 \cdot 29$ | I. 60 | $4 \cdot 32$ | 1.69 | $4 \cdot 36$ | I'79 | $4 \cdot 40$ |
| 34 | I 33 | 4.23 | I. 43 | $4 \cdot 26$ | I. 52 | 4.29 | I. 62 | $4 \cdot 33$ | I. 72 | $4 \cdot 37$ | I.83 | 4.41 |
| 36 | I.35 | $4 \cdot 24$ | I 45 | $4 \cdot 27$ | I. 55 | $4 \cdot 30$ | I. 65 | 434 | I•76 | $43^{8}$ | I.86 | 4.43 |
| 38 | I-38 | $4 \cdot 25$ | I.48 | $4 \cdot 28$ | 1.58 | $4 \cdot 32$ | I. 69 | $4 \cdot 36$ | x.80 | $4 \cdot 40$ | I'91 | $4 \cdot 44$ |
| 40 | +1.4I | 425 | +1.52 | 4.29 | +1.62 | 4.33 | +1.73 | $4 \cdot 37$ | + $\mathrm{x} \cdot 84$ | 4.42 | +1.96 | 4.47 |
| 42 | I 44 | $4 \cdot 26$ | I 55 | $4 \cdot 30$ | I 66 | $4 \cdot 34$ | I•78 | 439 | $1 \cdot 90$ | 4.44 | $2 \cdot 02$ | $4 \cdot 49$ |
| 44 | 1.48 | $4 \cdot 28$ | I. 60 | $4 \cdot 32$ | I•72 | $4 \cdot 37$ | I-84 | 4.41 | I-96 | 4.47 | 2.08 | $4 \cdot 52$ |
| 46 | I.53 | $4 \cdot 30$ | I. 65 | $4 \cdot 34$ | 1.77 | $4 \cdot 39$ | I.90 | $4 \cdot 44$ | $2 \cdot 03$ | $4 \cdot 50$ | $2 \cdot 16$ | $4 \cdot 56$ |
| 48 | I-58 | $4 \cdot 32$ | エ・71 | $4 \cdot 36$ | I. 84 | 4.41 | 1.97 | $4 \cdot 47$ | 2.11 | $4 \cdot 53$ | $2 \cdot 25$ | $4 \cdot 60$ |
| 50 | +1.64 | $4 \cdot 34$ | +1.77 | $4 \cdot 39$ | +1.91 | 4.45 | $+2.05$ | $4 \cdot 51$ | $+2.20$ | $4 \cdot 58$ | $+2 \cdot 36$ | 4.66 |
| 52 | x•71 | $4 \cdot 36$ | I.85 | 4.42 | $2 \cdot 00$ | $4 \cdot 48$ | $2 \cdot 15$ | $4 \cdot 56$ | $2 \cdot 31$ | $4 \cdot 63$ | $2 \cdot 48$ | $4 \cdot 72$ |
| 54 | I•79 | 4.40 | I.94 | $4 \cdot 46$ | $2 \cdot 10$ | $4 \cdot 53$ | 2.27 | $4 \cdot 61$ | $2 \cdot 44$ | $4 \cdot 70$ | $2 \cdot 62$ | $4 \cdot 80$ |
| 56 | r.89 | $4 \cdot 44$ | $2 \cdot 05$ | $4 \cdot 51$ | 2.22 | $4 \cdot 59$ | 2.41 | $4 \cdot 68$ | $2 \cdot 60$ | $4 \cdot 78$ | 2.80 | 4.89 |
| 58 | $2 \cdot 00$ | $4 \cdot 48$ | 2.18 | 4.57 | $2 \cdot 37$ | $4 \cdot 66$ | $2 \cdot 57$ | 4•77 | $2 \cdot 78$ | $4 \cdot 89$ | 3.01 | $5 \cdot 02$ |

## LATITUDE $6^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

|  | $0^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $1{ }^{\circ}$ |  | $2{ }^{\circ}$ |  | $3{ }^{\circ}$ |  | $4^{\circ}$ |  | $5{ }^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\left\lvert\, \begin{aligned} & \text { H. M. } \\ & 6 \end{aligned}\right.$ | S. $+\quad .42$ |  | $+\cdot 42$ | м. |  | $\begin{array}{cc} \text { M. S. } \\ \text { I } & \text { I5. } \end{array}$ |  | $\text { I. } 418$ |  | $\begin{array}{ll} 1 . & \text { S. } \\ 2 & 6.5 \end{array}$ |  |
| 10 | 1946 | 3 | 520 | 41 | 520 | - | 21 |  | 2123.3 |  | $5 \begin{array}{llll}5 & 21 & 45 \cdot 7\end{array}$ | $\cdot 37$ |
| 12 | II 43 |  | 12 | 4 | $51233 \cdot$ |  |  |  | 513 | - 37 | $1341 \times 9$ | 36 |
| 14 | $4{ }^{1 \cdot 1}$ | -43 | 6 | -41 | $5{ }^{5} 4{ }^{4} 3 \mathrm{I} \cdot \mathrm{O}$ | 40 | 5484.5 |  | $5 \quad 516$ |  | $5 \quad 538$ | -35 |
| 16 | $553^{8 \cdot 3}$ |  | 456 | $\cdot 42$ | $4 \begin{array}{llll}46 & 28 \cdot 4\end{array}$ | $\cdot 40$ | $45651 \cdot 6$ |  | 457 I |  | 45734.6 |  |
| 18 | 47 |  | 448 | + 42 | 448 | + 40 | 448 | + 37 | 449 10.6 | + 35 | 449 |  |
| 20 | 393 | -45 | 43958 | $\cdot 42$ | 440 | -40 | 440 |  | 44176 | 35 | 44127.7 | $\cdot 32$ |
| 22 | 312 | $\cdot 45$ | 431 | $\cdot 42$ | 432 |  | 432 |  | 433 | 34 | 433 | 3 I |
| 24 | 232 | $\cdot 46$ | 423 | 43 | 424 | 40 | $\begin{array}{llll}4 & 24 & 40 \cdot 7\end{array}$ |  | $\begin{array}{llll}4 & 25 & \text { I } 8 \\ 4 & \text { c } & 50\end{array}$ |  |  | 30 |
| 26 | 15 | 47 | 415 | $\cdot 43$ | 416 | 40 | $4 \mathrm{Cl}_{46} 3^{8 \cdot \mathrm{I}}$ |  | $416 \quad 59 \cdot 0$ | 33 | $4 \begin{array}{llllll}4 & 17.9\end{array}$ | 30 |
| 28 | $4 \quad 719.7$ | $\cdot 48$ | 7 | 4 |  | + 40 |  |  |  | + 33 | $4 \quad 9 \quad 14.8$ |  |
| 30 | 591 | 49 | 59 | $\cdot 44$ | $\begin{array}{llll}4 & 0 & 9 \cdot 7\end{array}$ | $\cdot 40$ | $4 \quad 0 \quad 32 \cdot 8$ |  | $4 \quad 0 \quad 53.4$ | $\cdot 32$ | 44 1119 | 28 |
| 31 | 551 | 49 | 3554 | 45 | $\begin{array}{llll}3 & 56 & 8 \cdot 3\end{array}$ | 40 | 356 |  | 356 | 32 | 357 | - 28 |
| 32 | 51 | 49 | 351 | 45 | 352 | 41 | 352 |  | 352 | 32 | $\begin{array}{llll}3 & 53 & 8 \cdot 7 \\ 3 & 49 & 7.2\end{array}$ | 28 |
| 33 | 47 | 50 | 347 | 45 | 348 | 4 I |  | $\cdot 36$ | 348 | 32 | 349 | $\cdot 27$ |
|  | 43 | + 51 | 43 | + 46 | 344 | + 41 | $34427 \cdot 5$ | + 36 | $34448 \cdot 0$ | + 32 | $3 \begin{array}{llll}3 & 45 & 5 \cdot 7\end{array}$ | $\cdot 27$ |
| 35 | 39 | -51 | $\begin{array}{lllll}3 & 39 & 36 \cdot 3\end{array}$ | 46 | 340 | 41 | 3 40 $26 \cdot 1$ | $\cdot 37$ | $34046 \cdot 7$ | 32 | 341 | -27 |
| 3 | 35 | -52 | 3 $355 \begin{array}{ll}34 \cdot 6\end{array}$ | 47 | $\begin{array}{lll}3 & 36\end{array}$ | 42 | $\begin{array}{llll}3 & 36 & 24 \cdot 8\end{array}$ |  | $\begin{array}{lllll}3 & 36 & 45 \cdot 3\end{array}$ |  | 337 | $\begin{array}{r}\cdot 27 \\ \hline 26\end{array}$ |
| 37 | 31 | -53 | $\begin{array}{lllll}3 & 31 & 32.9\end{array}$ | 47 | 3 31 51 | 42 | 332 |  | $\begin{array}{llll}3 & 32 & 44 \cdot 0\end{array}$ | -3I | 333 |  |
| 38 | 27 0.7 | 53 | 27 31•2 |  | 327 | 42 | $\begin{array}{llll}3 & 28 & 22 \cdot I\end{array}$ |  | $32842 \cdot 6$ | 1 | 328 |  |
| 39 | 22 | + 54 | 323 | + 48 | 323 | + 43 |  | + 37 |  | + 31 | $\left\lvert\, \begin{array}{llll}3 & 24 & 58 \cdot 5 \\ 3 & 20 & 57 \cdot 1\end{array}\right.$ | +.26 |
| 40 | 18 | - 55 | 319 | $\cdot 49$ | 319 |  |  |  |  |  |  |  |
| 41 | 1454.0 | -56 | 315 | -50 | 315 | -43 | 31618.0 |  | 316 |  | 316 |  |
| 42 | 3 10 $51 \cdot 7$ | $\cdot 57$ | $\begin{array}{llllllllllll}3 & 11 & 23.8\end{array}$ | 50 | $3 \mathrm{II} 52 \cdot \mathrm{I}$ | $\cdot 44$ | 3 121216.6 |  | $\begin{array}{lllll}3 & 12 & 37.4\end{array}$ | -31 | 312 | - 25 |
| 43 | 3 | 58 | $\begin{array}{lllll}3 & 7 & 21.8\end{array}$ | 51 | $\begin{array}{llll}3 & 7 & 50 \cdot 5\end{array}$ | $\cdot 44$ |  | $\cdot 3^{8}$ | - 8 36 | 3 r |  | - 25 |
| 44 | $5843 \cdot 9$ |  | $\begin{array}{rrr}3 & 3 \\ 2 & 59 \\ 2\end{array}$ | + 5.52 | $\begin{array}{rrrr}3 & 3 & 48 \cdot \\ 2 & 59 & 47 \cdot \\ 2\end{array}$ | $\cdot 45$ | 3 31413.8 | $\begin{array}{r}+38 \\ \hline .38\end{array}$ |  | + $3 \mathrm{3I}$ | $\begin{array}{lll}3 & 4 & 51 \cdot 5 \\ 3 & 0 & 50 \cdot 2 \\ 2\end{array}$ |  |
| 45 | $\begin{array}{lll}58 & 43 \cdot 9 \\ 54 & 41 \cdot 3\end{array}$ |  | $\begin{array}{llll}2 & 59 & 17.8 \\ 2 & 55 & 15.6 \\ 2 & 5\end{array}$ | . 53 | $\begin{array}{llll}2 & 59 & 47 \cdot 2 \\ 2 & 55 & 45 \cdot 5\end{array}$ |  |  |  | $\begin{array}{rrrr}3 & 0 & 33 \cdot 4 \\ 2 & 56 & 32 \cdot 1 \\ & 5 & \end{array}$ |  | $\begin{array}{rrrr}3 & 0 & 50 \cdot 2 \\ 2 & 56 & 48.8 \\ & & \end{array}$ |  |
| 47 | 2 2 2 5048485 |  | (1) | -54 | $\begin{array}{llll}2 & 51 & 43 \cdot 7\end{array}$ | -47 | $\begin{array}{lll}2 & 52 & 9 \cdot 5\end{array}$ | - 39 | 252 | 3 | $52.47 \cdot 5$ | . 24 |
| 48 | $24635 \cdot 7$ |  | 247 II.2 | 55 | 247 | -47 | 2 | - 39 | 248 | 32 | 2 | $\cdot 24$ |
| 49 | $4232 \cdot 5$ | + | 243 | + $\cdot 56$ | 243 | + 48 | $2446 \cdot 5$ | + 40 | 244 | + 32 | 244 | $\cdot 24$ |
| 50 | 3829.4 | . 66 | 239 | - 57 | 239 | $\cdot 49$ | 240 | $\cdot 40$ | $24026 \cdot 7$ | 32 | $124043 \cdot 4$ |  |
| 51 | $3426 \cdot \mathrm{I}$ | . 67 | 2 35 3.8 <br> 2 31  |  | $\left\lvert\, \begin{array}{llll}2 & 35 & 36 \cdot 2\end{array}\right.$ |  | $1 \begin{array}{lll}2 & 36 & 3.4 \\ 2 & 3\end{array}$ | $\cdot 41$ | $\begin{array}{llll}2 & 36 & 25 \cdot 3\end{array}$ | 32 |  |  |
| 5 | $3022 \cdot 6$ | 69 |  |  | $\left\|\begin{array}{llll} 2 & 31 & 34 \cdot 2 \\ 2 & 27 & 32 \cdot I \end{array}\right\|$ | 50 | $\begin{array}{lll}2 & 32 & 1.8 \\ 2 & 28 & 0.2\end{array}$ | 41 | $\begin{array}{llll}2 & 32 & 24 \cdot 0 \\ 2 & 28 & 22 \cdot 6\end{array}$ | 32 | $\begin{array}{llll}2 & 32 & 40 \cdot 8 \\ 2 & 28 & 39 \cdot 4\end{array}$ | 23 |
| 53 | 26 | 71 | 22 26 58.4 |  | 22732 |  | $\begin{array}{ll}2 & 28 \\ 2\end{array}$ |  | 228 | $\cdot 33$ $+\quad .33$ | $\begin{array}{lll}2 & 28 & 39 \cdot 4 \\ 2 & 24 & 38 \cdot \mathrm{r}\end{array}$ | 3 |
| 54 55 | $\begin{array}{llll}2 & 22 & 15.2 \\ 2 & 18 & 11.2\end{array}$ | + 72 | $\begin{array}{llll}2 & 22 & 55 \cdot 6 \\ 2 & 18 & 52.5\end{array}$ | $\begin{array}{r} \\ +\quad .62 \\ \hline .64\end{array}$ | $\begin{aligned} & 223 \\ & 2 \mathrm{r} 9 \end{aligned}$ |  | $\begin{array}{lll} 2 & 23 & 58 . \\ 2 & 19 & 56 . \end{array}$ |  |  |  |  |  |
|  | 1811.2 |  | $\begin{array}{llll}2 & 18 & 52 \cdot 5 \\ 2 & 14 & 49 \cdot 4\end{array}$ | . 65 | $\begin{array}{lll} 2 & 19 & 27 \cdot 8 \\ 2 & 15 & 25 \cdot 4 \end{array}$ | 54 | $\begin{array}{lll} 2 & 19 & 56 \cdot 8 \\ 2 & 15 & 55 \cdot 0 \end{array}$ |  | $\begin{array}{lll}2 & 20 & 19.8 \\ 2 & 16 & 18.4\end{array}$ | $33$ | 2 20 $36 \cdot 8$ <br> 2 16 $35 \cdot 5$ <br> 15   | $\begin{array}{r}\cdot 23 \\ .23 \\ \\ \hline 23\end{array}$ |
|  | 2 10 2.6 | 8 | $\begin{array}{llll} \\ 2 & 1 & 10 & 49 \cdot 4 \\ 2 & 46 \cdot 1\end{array}$ | 67 | $\begin{array}{lll}2 & \text { II } & 23.0\end{array}$ | . 56 | $2 \mathrm{II} 53 \cdot 2$ |  | $\begin{array}{lllll}2 & 12 & 16 \cdot 9\end{array}$ | - 34 | $21234 \cdot \mathrm{r}$ |  |
| 58 | $5 \quad 57 \cdot 9$ | . 80 | $642 \cdot 6$ | . 69 | 720.5 |  | 751.4 | 4 | $815 \cdot 5$ | - 35 | 832 | . 23 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS-LATITUDE.

| True | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 2 & \text { 3I• } \end{array}\right.$ | + ${ }^{\text {S }}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 2 & 57 \cdot 5 \end{array}$ | $+43$ | H. M. S. <br> $\begin{array}{lll}6 & 3 & 23 \cdot 1\end{array}$ | + 43 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 48 \cdot 9 \end{array}\right.$ | $+\cdot 43$ | $\left\lvert\, \begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & 4 & \text { I4.9 } \end{array}\right.$ | $\cdot 43$ | $\left\|\begin{array}{lrc} \text { H. M. } \\ 6 & 4 & \text { S. } \end{array}\right\|$ |  |
| 10 | $\begin{array}{llll}5 & 22 & 7 \cdot 3\end{array}$ | $\cdot 35$ | $\begin{array}{llll}5 & 22 & 28.4\end{array}$ | - 34 | $5 \begin{array}{llll}5 & 22 & 48 \cdot 8\end{array}$ | $\cdot 33$ | 5 $23 \begin{array}{lll}5 & 8.5\end{array}$ | - 32 | $52327 \cdot 6$ | $\cdot 31$ | 523 46.0 | $\cdot 30$ |
| 12 | $\begin{array}{llll}5 & 14 & 2.9\end{array}$ | -34 | $51423 \cdot 1$ | -33 | $1442 \cdot 5$ | $\cdot 31$ | $\begin{array}{llll}5 & 15 & 1 \cdot 0\end{array}$ | $\cdot 30$ | $\begin{array}{llll}5 & 15 & 18.8\end{array}$ | -29 | $1535 \cdot 8$ | 27 |
| 14 | $\begin{array}{lllll}5 & 5 & 58.5\end{array}$ | -33 | $\begin{array}{llll}5 & 6 & 18 \cdot 0\end{array}$ | $\cdot 3 \mathrm{I}$ | $\begin{array}{llll}5 & 6 & 36 \cdot 4\end{array}$ | $\cdot 30$ | $\begin{array}{llll}5 & 6 & 53 \cdot 8\end{array}$ | - 28 | $5{ }_{5}^{5} 710 \cdot 3$ | . 27 | 725.7 | 25 |
| 16 | 45754.4 | -32 | $458 \mathrm{I} 3 \cdot 0$ | $\cdot 30$ | $5830 \cdot 4$ | 28 | $45^{58} 46 \cdot 7$ | -26 | $4 \begin{array}{lll}59 & 1 \cdot 9\end{array}$ | $\cdot 24$ | 59 16 | . 22 |
| 18 | $44950 \cdot 2$ | + 3 r | $4508 \cdot 1$ | + 28 | $\begin{array}{lllll}4 & 50 & 24.6\end{array}$ | + 26 | $1 \begin{array}{llll}4 & 50 & 39.8 \\ 4 & 42 & 33.0\end{array}$ | + 24 | $45053 \cdot 7$ | $+\cdot 22$ | 51.6 .3 | + 20 |
| 20 | $44146 \cdot 2$ | - | $442 \begin{array}{lll}4.3\end{array}$ | $\cdot 27$ | $\begin{array}{lllll}4 & 42 & 18.9\end{array}$ | $\cdot 25$ | $44233 \cdot 0$ | $\cdot 22$ | $44245 \cdot 7$ | $\cdot 20$ | $4256 \cdot 8$ | -17 |
| 22 | $\begin{array}{llllllllllllllll}4 & 33 & 42\end{array}$ | 28 | $\begin{array}{llllllllllllll}4 & 33 & 58.6\end{array}$ | -26 | $\begin{array}{llllllll}4 & 34 & 13.3\end{array}$ | 23 | $434 \begin{array}{lll}4 & 263\end{array}$ | - 20 | $43437 \cdot 7$ | -17 | $43447 \cdot 4$ | -15 |
| 24 | $\begin{array}{llllll}4 & 25 & 38.5 \\ 4 & \text { 17 } & 3\end{array}$ | $\cdot 27$ | $\begin{array}{llll}4 & 25 & 54.1 \\ 4 & \text { I } & 49.7\end{array}$ | - 24 | $\begin{array}{llll}4 & 26 & 7.9\end{array}$ | - 21 | 4 26 $19 \cdot 8$ <br> 4 18 13.4 | -18 | $\begin{array}{llll}4 & 26 & 29.9\end{array}$ | - 15 | $4 \begin{array}{ll} \\ 26 & 38 \cdot 1\end{array}$ | 12 |
| 26 | 4 I7 | - 26 | $41749 \cdot 7$ | -23 | I8 $2 \cdot 5$ | - 20 | 41813.4 |  | $41822 \cdot 2$ | -13 | 18 | -10 |
| 28 | $\begin{array}{llll}4 & 9 & 31 \cdot 1\end{array}$ | + 25 | $45 \cdot 3$ | + 22 | $\begin{array}{lllllll}9 & 57 \cdot 3\end{array}$ | + +18 | $\begin{array}{llll}4 & 10 & 7.0 \\ 4 & 2 & 0.8\end{array}$ | + 14 | 4 10 14.6 | + r II | 10 19.9 | +.07 |
| 30 | $\begin{array}{llll}4 & 1 & 27.5 \\ 3 & 57 & 25.8\end{array}$ | 24 | $4 \mathrm{I} \cdot 0$ | - 20 | $152 \cdot 1$ | - 6 | $\begin{array}{llll}4 & 2 & 0.8 \\ 3 & 57 & 576\end{array}$ | -12 | 4 2 $7 \cdot 1$ <br> 3 5  | .08 | $2 \begin{array}{ll}2 & 10.9\end{array}$ | . 04 |
| 31 |  | $\cdot 24$ | $\begin{array}{llllllllll}3 & 57 & 38 \cdot 9\end{array}$ | - 20 | $5749 \cdot 5$ | -16 | 35757.6 | - I 1 | $\begin{array}{llll}3 & 58 & 3.3\end{array}$ | -07 | $\begin{array}{lll}3 & 58 & 6 \cdot 4\end{array}$ | . 03 |
| 32 | $\begin{array}{llll}3 & 53 & 24 \cdot 1\end{array}$ | 23 | $\begin{array}{llll}3 & 53 & 36 \cdot 8\end{array}$ | -19 | $5347 \cdot 0$ | - 15 | $\begin{array}{llllllllllll}3 & 53 & 54.6\end{array}$ | -10 | $\begin{array}{llll}3 & 53 & 59 \cdot 6\end{array}$ | -06 | $54 \begin{array}{rrr}1 \cdot 9\end{array}$ | +.02 |
| 33 | $\begin{array}{llllll}3 & 49 & 22 \cdot 3\end{array}$ | 23 |  | -18 | $4944 \cdot 5$ | -14 | $34951 \cdot 5$ | 9 | $\begin{array}{llll}3 & 49 & 55 \cdot 8\end{array}$ | -05 | $4957 \cdot 4$ | .oo |
| 34 | $34520 \cdot 6$ | + 22 |  | + . 18 | $34542 \cdot 0$ | + 13 | $34548 \cdot 5$ | +.08 | 345 52. 1 | + .04 | $\begin{array}{lllllllllll}3 & 45 & 529\end{array}$ | 1 |
| 35 | 34119.0 | . 22 | $34130 \cdot 7$ | -17 | $34139 \cdot 5$ | 12 | $34 \mathrm{I} 45 \cdot 4$ |  | $34148 \cdot 4$ | 2 | $34148 \cdot 4$ | 2 |
| 36 |  | -21 | $\begin{array}{llll}3 & 37 & 28.7\end{array}$ | -16 | $33737 \cdot 0$ | -II | $\begin{array}{llll}3 & 3742.4\end{array}$ | 6 | $3 \begin{array}{lll}37 & 44 \%\end{array}$ | + .or | $\begin{array}{llll}3 & 3743.9\end{array}$ | . 04 |
| 37 |  | -2I | $\begin{array}{llll}3 & 33 & 26 \cdot 7\end{array}$ | -16 | 33 34.6 | - 10 | $\begin{array}{llll}3 & 33 & 39 \cdot 4\end{array}$ | -05 | $33341 \cdot 0$ | .oo | $\begin{array}{lllllllllllllll}3 & 39 \cdot 4\end{array}$ | -05 |
| 38 | 32914.0 | 21 | $\begin{array}{llll}3 & 29 & 24.7\end{array}$ | -15 | $2932 \cdot 2$ |  | $\begin{array}{lll}3 \quad 29 & 36 \cdot 4\end{array}$ | . 04 | $\begin{array}{lllll} & 29 & 37 \cdot 3\end{array}$ | -OI | 32934.9 | 07 |
| 39 |  | + 20 |  | + 14 | $25 \quad 29 \cdot 7$ | + 09 |  | +.03 | $\begin{array}{lllll}3 & 25 & 33 \cdot 6\end{array}$ |  |  |  |
| 40 |  | . 20 |  |  | $\begin{array}{llll}3 & 21 & 27 \cdot 4 \\ 3 & \text { I } & 25 \cdot 0\end{array}$ | -08 | $\begin{array}{llll}3 & 21 & 30 \cdot 4 \\ 3 & 17 & 27\end{array}$ | -21 |  | . 04 | 3 21 25.8 <br> 3 1  | o |
| 4 I | $\begin{array}{llll}3 & 17 & 9 \cdot 1 \\ 3 & 13 & 7.5\end{array}$ | -19 | $\begin{array}{lllll}3 & 17 & 18.8 \\ 3 & 13 & 16.9\end{array}$ | -13 | $\begin{array}{lllll}3 & 17 & 25 \cdot 0 \\ 3 & 13 & 22.5\end{array}$ | .07 | $\begin{array}{llll}3 & 17 & 27.4 \\ 3 & 13 & 24.4\end{array}$ | +.01 | $\begin{array}{llll}3 & 17 & 26 \cdot 2 \\ 3 & 13 & 22 \cdot 4\end{array}$ | .05 | $\begin{array}{llll}3 & 17 & 21.2 \\ 3 & 13 & 16.6\end{array}$ | 15 |
| 43 | $\begin{array}{crrr}3 & 13 & 7 \cdot 5 \\ 3 & 9 & 5 \cdot 9\end{array}$ | 8 | $\begin{array}{cccc}3 & 13 & 16.9 \\ 3 & 9 & 15.0\end{array}$ | $\cdot 12$ | $\begin{array}{rrrr}13 & 22.5 \\ 9 & 20.2\end{array}$ | . 06 | $\begin{array}{rrrr}3 & 13 & 24.4 \\ 3 & 9 & 21.4\end{array}$ | -00 | [ $\begin{array}{ccc}3 & 13 & 22.4 \\ 3 & 9 & 18.7\end{array}$ |  | $\begin{array}{rrrrr}3 & 13 & 16 \cdot 6 \\ 3 & 9 & 12.0\end{array}$ | 15 |
| 43 | 3 | I8 | $9 \mathrm{I}$ | - 12 | 920 | 05 | 3 9 2I |  | $3 \quad 918$ |  | 9 I | 15 |
| 44 | 3 | + 18 | $513 \cdot 1$ | + II | 517.8 | +.04 | $\begin{array}{llll}3 & 5 & 18.4\end{array}$ |  | 35150 |  | $\begin{array}{lll}3 & 5 & 7 \cdot 3\end{array}$ |  |
| 45 | 3 | -17 | II-2 | -10 | 1 15.4 | $\cdot 03$ | $\begin{array}{llll}3 & 1 & 15.4 \\ 2 & 57 & 5.4\end{array}$ | .03 | $\mathrm{llll}_{3} \mathrm{I}$ III 2 | - II |  | 18 |
| 46 | $\begin{array}{llll}2 & 57 & 1.2 \\ 2 & 52\end{array}$ | -17 | $\begin{array}{llll}2 & 57 & 9.3 \\ 2 & 53 & 7.5\end{array}$ | -10 | $25713 \cdot 1$ | $\bigcirc 3$ |  | - 06 |  | -12 | $\begin{array}{llllllllllll}2 & 56 & 57\end{array}$ | - 20 |
| 47 | ${ }^{2} 52259 \cdot 7$ | -16 | $\begin{array}{lll}2 & 53 & 7 \cdot 5 \\ 2 & 49 & 5 \cdot 5\end{array}$ | .09 | $25310 \cdot 7$ | $\stackrel{.02}{ }$ | $\begin{array}{lll}2 & 53 & 9.4\end{array}$ | -06 | $\begin{array}{lllll}2 & 53 & 3 \cdot 6\end{array}$ | 14 | $25253 \cdot \mathrm{I}$ | 1 |
| 48 | $24858 \cdot 2$ | -16 | 49 | -08 | 49 | + 0 | 249 | . 07 | $24^{2} 5059$ | -15 | 24848 | 23 |
| 49 | $\begin{array}{llllllllllllllll}2 & 44 & 56 \cdot 7\end{array}$ | + 16 | $\begin{array}{llll}2 & 45 & 3.7 \\ 2 & 7\end{array}$ | + .08 | $45 \quad 6 \cdot 0$ | -00 | $\begin{array}{lll}2 & 45 & 3.4 \\ 2.4\end{array}$ | -08 | $24455 \cdot 8$ |  | $24443 \cdot 3$ |  |
| 50 | $24055 \cdot 2$ | 15 | $2 \begin{array}{lll}21 & 1.9\end{array}$ | . 07 | 2413.6 | - | $\begin{array}{lll}2 & 41 & 0.3\end{array}$ | -ro | 24051.9 |  | 24038.3 | 27 |
| 51 |  | -15 | 2 37 $0 \cdot 1$ <br> 2   | -06 | $\begin{array}{lll}37 & 1 \cdot 3\end{array}$ | 02 | $\begin{array}{lllll}2 & 36 & 57 \cdot 2\end{array}$ | -II | $\begin{array}{llll}2 & 36 & 47 \cdot 9\end{array}$ | - 20 | 3633.3 | 29 |
| 52 | 2. $32 \begin{array}{ll}52.2\end{array}$ | -14 | $\begin{array}{llllllllllll}2 & 32 & 58 \cdot 2 \\ 2 & 28 & 56.4\end{array}$ | .06 | $\begin{array}{llll}2 & 32 & 58 \cdot 9 \\ 2 & 28 & 56 \cdot 5\end{array}$ | $\cdot 03$ | $\begin{array}{llll}2 & 32 & 54 \cdot \mathrm{I} \\ 2 & 28 & 5\end{array}$ | - 12 | $\begin{array}{llll}2 & 32 & 43 \cdot 9 \\ 2 & 28 & 30.8\end{array}$ | -22 | $\begin{array}{lll}32 & 28 \cdot x \\ 28 & 22.8\end{array}$ | 31 |
| 53 | $22850 \cdot 7$ | -14 | $22856 \cdot 4$ | . 05 | $22856 \cdot 5$ | -04 | 22851.0 | $\cdot 14$ | $22839 \cdot 8$ | $.23$ | 28 | 33 |
| 54 | 24 49.2 | + 14 | $2454 \cdot 6$ | + .04 | 2454.2 | -06 | $2 \begin{array}{llll}2 & 47 \cdot 9\end{array}$ | . 15 | $22435 \cdot 7$ | -25 | $2 \begin{array}{llll}24 & 17.5\end{array}$ |  |
| 55 | 22047.8 | -13 | $2052 \cdot 8$ | -03 | $2051 \cdot 8$ | 07 | $2{ }^{2} 2044.7$ | -17 | 22031.5 | - 27 | 2012.0 | $\cdot 38$ |
| 56 | $\begin{array}{llllll}2 & 16 & 46 \cdot 3\end{array}$ | -13 | $165 \mathrm{I} \cdot 0$ | . 3 | $1649 \cdot 4$ | -08 | $\begin{array}{lllll}2 & 16 & 4 \\ 5 & 5\end{array}$ | 18 | $\begin{array}{llll}2 & 16 & 27 \cdot 2\end{array}$ | 29 | $16 \quad 6 \cdot 4$ | - |
| 57 | $\begin{array}{lllllll}2 & 12 & 44 \cdot 8 \\ 2 & 8 & 43.5\end{array}$ | - 13 | 1249.2 |  | $1247 \cdot 0$ | 9 |  | - 20 | $\begin{array}{lllll}2 & 12 & 22 \cdot 8 \\ 2 & 8 & 18\end{array}$ | 1 | 120.7 | 43 |
| 58 | $43 \cdot 5$ | 12 | $47 \cdot 4$ |  | 844.5 | $\cdot \mathrm{ro}$ | 834.8 |  | $8 \quad 18.3$ | 33 | 754 | 45 |

VARIATION TO $\mathbf{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. |  | L. 6 | A. |  | L. 7 | A. |  | L. 8 | A. |  | L. 9 | A. |  | L. 10 | A. |  | L. 11 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ |  | S. | s. -4.04 |  | $\stackrel{\text { s. }}{ }$ | $\begin{gathered} \text { s. } \\ -4.05 \end{gathered}$ |  | $\stackrel{\text { s. }}{.} 5$ | $\begin{gathered} \text { s. } \\ -4 \cdot 06 \end{gathered}$ |  | s. 64 | $\begin{gathered} \text { s. } \\ -4 \bullet 07 \end{gathered}$ |  | s. | $\begin{gathered} \text { s. } \\ -4.08 \end{gathered}$ |  | $\stackrel{\text { s. }}{79}$ | S. |
| 4 |  | $\cdot 40$ | 4.04 |  | $\cdot 47$ | 4.05 |  | $\cdot 54$ | $4 \cdot 06$ |  | . 61 | 4.07 |  | . 68 | 4.08 |  | $\cdot 76$ | 4.09 |
| 8 |  | $\cdot 37$ | $4 \cdot 04$ |  | -44 | 4.05 |  | $\cdot 51$ | 4.05 |  | $\cdot 58$ | 4.06 |  | . 66 | 4.07 |  | $\cdot 73$ | 4.09 |
| 12 |  | $\cdot 34$ | 4.04 |  | $\cdot 42$ | 4.04 |  | $\cdot 49$ | $4 \cdot 05$ |  | $\cdot 56$ | $4 \cdot 06$ |  | .63 | 4.07 |  | -71 | 4.08 |
| 16 |  | $\cdot 32$ | 4.03 |  | $\cdot 39$ | 4.04 |  | -47 | 4.05 |  | -54 | 4.06 |  | . 62 | 4.07 |  | - 69 | 4.08 |
| 20 |  | -30 | 4.03 | $+$ | $\cdot 37$ | 4.04 |  | $\cdot 45$ | 4.05 | $+$ | $\cdot 52$ | 4.06 |  | . 60 | 4.07 |  | . 68 | 4.08 |
| 22 |  | -28 | 4.03 |  | $\cdot 36$ | $4 \cdot 04$ |  | -44 | $4 \cdot 05$ |  | -5I | 4.05 |  | . 59 | 4.07 |  | -67 | 4.08 |
| 24 |  | -27 | 4.03 |  | -35 | $4 \cdot 04$ |  | -43 | $4 \cdot 04$ |  | -51 | 4.05 |  | - 59 | 4.06 |  | - 66 | 4.08 |
| 26 |  | $\cdot 26$ | $4 \cdot 03$ |  | $\cdot 34$ | 4.04 |  | $\cdot 42$ | $4 \cdot 04$ |  | . 50 | 4.05 |  | - 58 | $4 \cdot 06$ |  | . 66 | 4.08 |
| 28 |  | -25 | 4.03 |  | $\cdot 33$ | 4.04 |  | 4 r | $4 \cdot 04$ |  | -49 | 4.05 |  | -58 | 4.06 |  | . 66 | 4.07 |
| 30 |  | - 24 | 4.03 | $+$ | $\cdot 33$ | 4.03 |  | -41 | $4 \cdot 04$ |  | $\cdot 49$ | 4.05 |  | $\cdot 57$ | 4.06 |  | . 65 | 4.07 |
| 32 |  | $\cdot 23$ | $4 \cdot 03$ |  | $\cdot 32$ | 4.03 |  | $\cdot 40$ | 4.04 |  | -48 | 4.05 |  | $\cdot 57$ | 4.06 |  | . 65 | 4.07 |
| 34 |  | - 22 | 4.03 |  | $\cdot 31$ | $4 \cdot 03$ |  | - 39 | 4.04 |  | -48 | 4.05 |  | . 57 | 4.06 |  | . 65 | 4.07 |
| 36 |  | -21 | 4.03 |  | 30 | 4.03 |  | $\cdot 39$ | 4.04 |  | $\cdot 48$ | 4.05 |  | . 57 | 4.06 |  | . 65 | 4.67 |
| $3^{8}$ |  | $\cdot 21$ | $4 \cdot 03$ |  | -29 | $4 \cdot 03$ |  | -38 | 4.04 |  | -47 | 4.05 |  | -57 | $4 \cdot 06$ |  | . 66 | $4 \cdot 07$ |
| 40 |  | - 20 | 4.03 |  | -29 | 4.03 |  | $\cdot 38$ | 4.04 |  | $\cdot 47$ | 4.05 |  | $\cdot 57$ | 4.06 |  | . 66 | 4.07 |
| 42 |  | -19 | 4.03 |  | -28 | 4.03 |  | $\cdot 38$ | $4 \cdot 04$ |  | $\cdot 47$ | 4.03 |  | $\cdot 57$ | 4.06 |  | . 67 | 4.08 |
| 44 |  | -18 | 4.03 |  | $\cdot 28$ | 4.03 |  | $\cdot 38$ | 4.04 |  | -47 | 4.05 |  | $\cdot 57$ | 4.06 |  | $\cdot 67$ | 4.08 |
| 46 |  | $\cdot 17$ | 4.03 |  | $\cdot 27$ | 4.03 |  | $\cdot 37$ | 4.04 |  | $\cdot 48$ | 4.05 |  | . 58 | 4.06 |  | -68 | 4.08 |
| 48 |  | $\cdot 16$ | 4.03 |  | $\cdot 27$ | $4 \cdot 03$ |  | $\cdot 37$ | $4 \cdot 04$ |  | 48 | 4.05 |  | -59 | 4.06 |  | . 69 | 4.68 |
| 50 | + | -15 | 4.02 |  | $\cdot 26$ | 4.03 |  | . 37 | $4 \cdot 04$ |  | $\cdot 48$ | 4.05 |  | $\cdot 59$ | 4.07 |  | -71 | 4.08 |
| 52 |  | -14 | 4.02 |  | -26 | 4.03 |  | $\cdot 37$ | 4.04 |  | -49 | 4.05 |  | . 61 | 4.07 |  | $\cdot 72$ | 4.09 |
| 54 |  | - 14 | 4.02 |  | - 26 | 4.03 |  | $\cdot 38$ | $4 \cdot 04$ |  | - 50 | 4.05 |  | -62 | 4.07 |  | $\cdot 74$ | 4.09 |
| 56 |  | -13 | 4.02 |  | - 26 | 4.03 |  | $\cdot 38$ | 4.04 |  | -51 | 4.05 |  | -64 | 4.07 |  | $\cdot 77$ | 4.09 |
| 58 |  | -12 | 4.02 |  | - 25 | $4 \cdot 03$ |  | $\cdot 39$ | $4 \cdot 04$ |  | $\cdot 52$ | 4.06 |  | . 66 | $4 \cdot 07$ |  | 79 | $4 \cdot 10$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | ecl. ar. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | ecl. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{aligned} & \mathrm{H} . \mathrm{M} . \\ & 6 \quad 5 \end{aligned}$ | $+\cdot 44$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 5 & 33.7 \end{array}\right.$ | $+44$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 6 \\ 0 \cdot 4 \end{array}\right.$ | $+\stackrel{s}{45}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 6 \\ 27 \cdot 3 \end{array}\right.$ | $+45$ | $\begin{array}{\|l\|l} \text { H. M. } & \text { S. } \\ 6 & 6 \\ 54 \cdot 5 \end{array}$ | $+45$ | $\left\lvert\, \begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & 722 \cdot 0 \end{array}\right.$ | $+46$ |
| 10 | 243.7 | 29 | $52420 \cdot 9$ | - 28 | 52437.5 | $\cdot 27$ | 52453.3 | $\cdot 26$ | 5258.6 | $\cdot 25$ | $525 \quad 23.3$ | $\cdot 24$ |
| 12 | 15 52.0 | 6 | $5 \begin{array}{lll}5 & 16 & 7 \cdot 3\end{array}$ | -25 | $\begin{array}{lllllllllll}5 & 16 & 21.8\end{array}$ | -23 |  | . 22 | $\begin{array}{llllll}5 & 1648.5\end{array}$ | - 21 | $\begin{array}{lllll}5 & 17 & 0 \cdot 7\end{array}$ | -19 |
| 14 | $740 \cdot 3$ | . 23 | $\begin{array}{llll}5 & 7 & 53\end{array}$ | - 22 | $\begin{array}{llll}5 & 8 & 6 \cdot 4\end{array}$ | $\cdot 20$ | $\begin{array}{llll}5 & 8 & 18.0\end{array}$ | - 18 | $\begin{array}{llll}5 & 8 & 28.7\end{array}$ | -17 | $\begin{array}{lllll}5 & 8 & 38.3\end{array}$ | - 15 |
| 16 | $5928 \cdot 8$ | -20 | $45940 \cdot 6$ | -18 | $45951 \cdot 2$ |  | - 0.7 | - 15 | - 9.0 | -13 | - 16.1 | II |
| 18 | 5117.6 | + -18 | 51 | + $\cdot 1$ | 4513 | + 13 | $5143 \cdot 5$ | + - II | 45149.5 | + .09 | $5154 \cdot \mathrm{I}$ | + .06 |
| 20 | $43 \quad 6.5$ | $\cdot 15$ | 44314.7 | $\cdot 12$ | 44321.3 | -10 | 44326.5 | -07 | $44330 \cdot 1$ | + .05 | 443 32.1 | . 02 |
| 22 | $3455 \cdot 5$ | 12 | $\begin{array}{llll}4 & 35 & 1.8\end{array}$ | -09 | $\begin{array}{llll}4 & 35 & 6 \cdot 5\end{array}$ | -06 | $\begin{array}{llll}4 & 35 & 9.5\end{array}$ | + .03 | $43510 \cdot 7$ | .00 | 43510.2 |  |
| 24 | $2644 \cdot 6$ | -09 | $\begin{array}{llll}4 & 26 & 49 \cdot 8\end{array}$ | . 06 | ${ }_{4}^{4} 268515$ | + .03 | $\begin{array}{llll}4 & 26 & 52 \cdot 6\end{array}$ | .oo | $\begin{array}{llllllllll}4 & 26 & 51.4\end{array}$ | . 03 | 42648.2 | - 07 |
| 26 | 1833.8 | .06 | $418 \quad 36 \cdot 5$ | + .03 | 18 37.1 |  | $41835 \cdot 6$ |  | $41832 \cdot 0$ |  | 18 | -11 |
| 28 | 1023.0 | + .03 | 41023.8 |  | 41022.4 | - . 04 | 10 | - .08 | 4 10 $12 \cdot 5$ | - 12 | 104.0 | - .16 |
| 30 | $212 \cdot 3$ | -00 | 211.2 | . 04 | $4 \quad 2 \quad 7 \cdot 7$ | . 08 | 21.5 | -12 | 4 I 52.8 | -17 | 141.5 | . 21 |
| 31 | 58 | 1 | $\begin{array}{lll}3 & 58 & 4.9\end{array}$ | . 06 | $\begin{array}{lll}3 & 58 & 0.2\end{array}$ | -10 | 5752.9 | - 14 | 35742.9 | -19 | $35730 \cdot 2$ | 23 |
| 32 | $\begin{array}{ll}54 & 1 \cdot 6\end{array}$ | . 03 | $35358 \cdot 5$ | $\cdot 07$ | $\begin{array}{llllllllll}3 & 52 \cdot 8\end{array}$ | - 12 | $\begin{array}{lllllllll}3 & 53 & 44 \cdot 3\end{array}$ | -16 | $\begin{array}{llll}3 & 53 & 33.0\end{array}$ | - 21 | $\begin{array}{lll}53 & 18 \cdot 8\end{array}$ | 26 |
| 33 | $4956 \cdot 2$ | . 04 | $34952 \cdot 2$ | . 09 | $34945 \cdot 3$ | -14 | $34935 \cdot 6$ | -19 | $\begin{array}{llll}3 & 49 & 22 \cdot 9\end{array}$ | -23 | $49 \quad 7 \cdot 3$ | 29 |
| 34 | 45 50.8 | - .06 | $4545 \cdot 8$ | - $\cdot 11$ | $4537 \cdot 8$ | -16 | $\begin{array}{lllll}3 & 45 & 26 \cdot 8\end{array}$ | 21 | 34512.8 | - 26 | 44 55•7 |  |
| 35 | $4145 \cdot 4$ | $\cdot 07$ | $4139 \cdot 4$ | 3 |  | $\cdot 18$ | 4118.0 | $\cdot 23$ | $\begin{array}{llll}3 & 41 & 2 \cdot 6\end{array}$ | $\cdot 28$ | 34044.0 | 34 |
| 36 | $3740 \cdot 0$ | $\cdot 09$ | 3733.0 | -14 | $\begin{array}{llll}3 & 37 & 22 \cdot 7\end{array}$ | - 20 | 37 9'1 | $\cdot 25$ |  | $\cdot 31$ | $\begin{array}{llll}3 & 36 & 32 \cdot 1\end{array}$ |  |
| 37 | 33 34.6 | -II | $3326 \cdot 6$ | -16 | 3315.0 | $\cdot 22$ | 33 | -27 | 33241.9 | 33 | 332  <br> 3  | 9 |
| 38 | 29 29•I | 12 | 32920 |  | $29 \quad 7 \cdot 3$ | . 24 | 28 | $\cdot 30$ | $\begin{array}{llll}3 & 28 & 31.4\end{array}$ | 6 | $\begin{array}{llll}3 & 28 & 8.0\end{array}$ |  |
| 39 | 252 |  | 3251 | - . 20 | 2459.4 | - 226 | 324 | - 32 | $32420 \cdot 7$ |  | $32355 \cdot 7$ |  |
| 40 |  | -16 | $\begin{array}{llll}3 & 21 & 6 \cdot 7\end{array}$ | $\cdot 22$ |  |  |  |  |  | 41 | $31943 \cdot 1$ | -48 |
| 4 I | $\begin{array}{llll}17 & 12.5\end{array}$ | -18 | $\begin{array}{lll} 3 & 17 & 000 \end{array}$ | - 26 | 3 16 $43 \cdot 6$ <br> 3 12  | $\cdot 30$ | $31623 \cdot 3$ | 3 | $\begin{array}{lllll}3 & 15 & 58.9 \\ 3 & 51 & 47.7\end{array}$ | -44 |  |  |
| 4 | 136 | -19 | $\begin{array}{rrrr}3 & 12 & 53.2 \\ 3 & 8 & 46.4\end{array}$ | . 26 | $\left\lvert\, \begin{array}{rrr} 3 & 12 & 35 \cdot 5 \\ 3 & 8 & 27 \cdot 3 \end{array}\right.$ |  | $\begin{array}{ccr}3 & 12 & 13.7 \\ 3 & 8 & 4.0\end{array}$ | 40 | $\begin{array}{crrrr}3 & 11 & 47 \cdot 7 \\ 3 & 7 & 36.4\end{array}$ | - 47 $\cdot 50$ | $\begin{array}{rrrr}3 & 11 & 17.5 \\ 3 & 7 & 4.3\end{array}$ |  |
|  |  |  |  |  | $\begin{array}{ll}8 \quad 27 \cdot 3 \\ 4 & 19.1\end{array}$ | $\cdot 35$ $-\quad .38$ | $\begin{array}{rrrr}3 & 8 & 4.0 \\ 3 & 3 & 54.2\end{array}$ |  | $\begin{array}{llll}3 & 7 & 36 \cdot 4 \\ 3 & 3 & 24.9\end{array}$ |  | 74.3 |  |
| 4 | - $49 \cdot 7$ | -25 | - $32 \cdot 4$ | $\cdot 33$ | $\begin{array}{ll}4 & 19.1 \\ 0 & 10.6\end{array}$ | $\cdot 38$ | $\begin{array}{lrrr}3 & 3 & 54 \cdot 2 \\ 2 & 59 & 44 \cdot 2\end{array}$ | $\cdot 45$ | $\begin{array}{rrrr}3 & 3 & 24 \cdot 9 \\ 2 & 59 & 13 \cdot 1\end{array}$ | $\cdot 53$ | $\begin{array}{cccc}3 & 2 & 50 \cdot 9 \\ 2 & 58 & 37 \cdot 1\end{array}$ |  |
| 46 | 5643.9 | - 27 | $25625 \cdot 3$ | -35 | $56 \quad 2 \cdot 0$ | -43 | $\begin{array}{lllllllll}2 & 55 & 33.9\end{array}$ | -51 | $2551 \cdot 0$ | 9 | $25423 \cdot 1$ | . 67 |
| 47 | $5237 \cdot 9$ | -29 | $25218 \cdot 0$ | $\cdot 37$ | 25153.2 | -45 |  | 54 | $25048 \cdot 7$ | 22 | $2508 \cdot 7$ | $\cdot 71$ |
| 48 | $24831 \cdot 9$ |  | 48 10 | -40 | 24744.3 |  | $\begin{array}{lllllll}2 & 47 & 12.9\end{array}$ | $\cdot 57$ | $24636 \cdot 1$ |  | $4553 \cdot 9$ | $\cdot 75$ |
| 49 | $4425 \cdot 8$ | - 33 | $\begin{array}{llr}2 & 44 & 3 \cdot 1 \\ 2 & 39 & 5.4\end{array}$ | 45 | 43 35 35 | - $\cdot 51$ |  |  | $\begin{array}{llll}2 & 42 & 23.2\end{array}$ | $\cdot 69$ | $24 \mathrm{I} 38 \cdot 8$ |  |
| 50 | $40 \quad 19.4$ | 36 | 23955.4 | 45 | $\begin{array}{llll}2 & 39 & 25.9\end{array}$ | . 54 | $\begin{array}{llll}2 & 38 & 50 \cdot 6\end{array}$ | 6 | $\begin{array}{lll}2 & 38 & 9.9\end{array}$ | 3 | 23723.2 |  |
| 51 | 3613.2 | 3 | $23547 \cdot 5$ | 47 | $1 \begin{array}{llll}2 & 35 & 16.3\end{array}$ |  | 3439.2 | 67 | $23356 \cdot 2$ | $\begin{array}{r}\text { •77 } \\ \hline 81\end{array}$ | 2 33 $7 \cdot 1$ <br> 2 88  | - |
| 52 53 | $\begin{array}{llll}2 & 32 & 6 \cdot 7 \\ 2 & 28 & 0 \cdot 0\end{array}$ | -40 | $\begin{array}{llll}2 & 31 & 39 \cdot 5 \\ 2 & 27 & 31 \cdot 2\end{array}$ | . 50 | $\begin{array}{lll}2 & 31 & 6 \cdot 5 \\ 2 & 26 & 56 \cdot 4\end{array}$ |  | $3027 \cdot 4$ | 0 | $22942 \cdot 1$ |  | $22850 \cdot 5$ |  |
| 54 | $2 \begin{aligned} & 23 \\ & 23 \\ & 53.2\end{aligned}$ |  | $2322 \cdot 8$ |  |  |  | $22 \quad 2 \cdot 6$ |  |  | 89 | 2015.4 |  |
| 55 | 19 46.3 | $\cdot 48$ | 21914.0 | $\cdot 59$ | $21835 \cdot 2$ | $\cdot 70$ | $21749 \cdot 5$ |  | 21656 | 94 | 15 56.9 | 1.06 |
| 56 | 15 39•I | $\cdot 51$ | $15 \quad 5 \cdot$ | . 62 | 1424.1 |  | $1336 \cdot 0$ | - 86 | $21240 \cdot 6$ | 9 | 1137.5 | 1-12 |
| 57 | $11317 \cdot 7$ | 54 | 10 55.7 | . 66 | 012.6 | $\cdot 78$ | 922.0 | -91 | $823 \cdot 7$ | I.04 | 717.3 | 1.17 |
| 58 | 724.1 | . 5 | $646 \cdot 1$ | $\cdot 70$ | 0.5 |  | $7 \cdot 3$ | $\cdot 95$ | 4 | 1.09 | $2 \quad 256 \cdot 2$ | 1.23 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{19} \mathrm{~A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $+\quad .86$ | S. $-4 \cdot 11$ | S. | S. | S. +1.01 | S. | + ${ }_{\text {S }}$ | S. | ¢ ${ }_{\text {S. }}$ | S. | S. | S. 4.21 |
| 4 | +.83 | $4 \cdot 10$ | + 90 | -4.12 | $\begin{array}{r}+1.01 \\ \hline .98\end{array}$ | -4.15 4.14 | 1.05 +1 | $-4 \cdot 17$ $4 \cdot 16$ | +1.16 1.13 | 4.18 4.18 | +1.23 1.21 | 4.21 4.20 |
| 8 | -80 | $4 \cdot 10$ | . 88 | $4 \cdot 12$ | $\cdot 95$ | $4 \cdot 13$ | 1.03 | 4-15 | $1 \cdot 10$ | $4 \cdot 17$ | $1 \cdot 18$ | $4 \cdot 19$ |
| 12 | $\cdot 78$ | $4 \cdot 10$ | . 86 | $4 \cdot 11$ | -93 | $4 \cdot 13$ | I 01 | $4 \cdot 15$ | I-09 | $4 \cdot 17$ | 1-16 | $4 \cdot 19$ |
| 16 | $\cdot 77$ | 4.09 | . 84 | 4.11 | $\cdot 92$ | $4 \cdot 12$ | 1.00 | 4-14 | 1.07 | 4•16 | $1 \cdot 15$ | 4.18 |
| 20 | +.75 | 4.09 | +.83 | $4 \cdot 11$ | + 91 | $4 \cdot 12$ | + 99 | 4.14 | $+\mathrm{r} .07$ | $4 \cdot 16$ | +1.15 | $4 \cdot 18$ |
| 22 | $\cdot 75$ | $4 \cdot 09$ | . 83 | $4 \cdot 11$ | -91 | $4 \cdot 12$ | -99 | 4.14 | 1.07 | $4 \cdot 16$ | 1.15 | $4 \cdot 18$ |
| 24 | $\cdot 74$ | 4.09 | -82 | $4 \cdot 10$ | -90 | $4 \cdot 12$ | $\cdot 98$ | $4 \cdot 14$ | 1.07 | 4.16 | $1 \cdot 15$ | 4.18 |
| 26 | $\cdot 74$ | 4.09 | . 82 | $4 \cdot 10$ | -90 | $4 \cdot 12$ | $\cdot 99$ | $4 \cdot 14$ | 1.07 | 4•16 | $1 \cdot 15$ | $4 \cdot 18$ |
| 28 | 74 | 4.09 | . 82 | 4.10 | -90 | $4 \cdot 12$ | -99 | 4.14 | 1.07 | 4.16 | 1-16 | 4.18 |
| 30 | + 74 | $4 \cdot 09$ | +.82 | $4 \cdot 10$ | + 9 II | $4 \cdot 12$ | + 99 | $4 \cdot 14$ | +1.08 | $4 \cdot 16$ | +1.17 | 4.19 |
| 32 | $\cdot 74$ | 4.09 | . 82 | $4 \cdot 10$ | $\cdot 91$ | $4 \cdot 12$ | 1.00 | 4.14 | 1.09 | 4.16 | 1-18 | $4 \cdot 19$ |
| 34 | $\cdot 74$ | 4.09 | . 83 | $4 \cdot 11$ | $\cdot 92$ | $4 \cdot 12$ | 1.01 | $4 \cdot 14$ | $1 \cdot 10$ | $4 \cdot 17$ | $1 \cdot 19$ | $4 \cdot 19$ |
| 36 | $\cdot 74$ | 4.09 | . 83 | 4.II | -92 | $4 \cdot 13$ | 1.02 | $4 \cdot 15$ | 11 | $4 \cdot 17$ | 1.20 | $4 \cdot 20$ |
| 38 | $\cdot 75$ | $4 \cdot 09$ | . 84 | 4.1I | '93 | $4 \cdot 13$ | 1.03 | 4.15 | $1 \cdot 12$ | 4.18 | 1.22 | $4 \cdot 20$ |
| 40 | + 75 | 4.09 | + 85 | $4 \cdot 11$ | + 95 | $4 \cdot 13$ | +1.05 | $4 \cdot 15$ | +1.14 | 4.18 | +1.24 | 4.21 |
| 42 | $\cdot 76$ | 4.09 | $\cdot 86$ | $4 \cdot 11$ | $\cdot 96$ | $4 \cdot 13$ | 1.06 | $4 \cdot 16$ | $1 \cdot 16$ | $4 \cdot 19$ | 1.27 | 4.21 |
| 44 | $\cdot 77$ | $4 \cdot 10$ | - 88 | $4 \cdot 12$ | $\cdot 98$ | $4 \cdot 14$ | 1.08 | $4 \cdot 16$ | I•19 | $4 \cdot 19$ | $1 \cdot 30$ | 4.23 |
| 46 | $\cdot 79$ | $4 \cdot 10$ | -89 | $4 \cdot 12$ | 1.00 | $4 \cdot 14$ | $1 \cdot 11$ | $4 \cdot 17$ | $1 \cdot 22$ | $4 \cdot 20$ | $1 \cdot 33$ | $4 \cdot 24$ |
| 48 | -80 | $4 \cdot 10$ | -91 | $4 \cdot 12$ | 1.02 | $4 \cdot 15$ | 1.14 | 4.18 | 1.25 | 4.21 | I.37 | 4.25 |
| 50 | +.82 | 4.10 | + 94 | $4 \cdot 13$ | +1.05 | $4 \cdot 16$ | +1.17 | $4 \cdot 19$ | +1.29 | 4.22 | +1.42 | $4 \cdot 26$ |
| 52 | $\cdot 84$ | $4 \cdot 11$ | $\cdot 96$ | 4.14 | 1.09 | $4 \cdot 17$ | 1.21 | $4 \cdot 20$ | $1 \cdot 34$ | $4 \cdot 24$ | 1.47 | $4 \cdot 28$ |
| 54 | -87 | $4 \cdot 11$ | -99 | 4.14 | $1 \cdot 12$ | 4.18 | $1 \cdot 26$ | $4 \cdot 21$ | $1 \cdot 39$ | 4.26 | I. 53 | $4 \cdot 30$ |
| 56 | -90 | $4 \cdot 12$ | 1.03 | $4 \cdot 15$ | $1 \cdot 17$ | 4.19 | $1 \cdot 31$ | 4.23 | $1 \cdot 45$ | $4 \cdot 28$ | 1.60 | $4 \cdot 33$ |
| 58 | $\cdot 93$ | $4 \cdot 13$ | I.08 | $4 \cdot 16$ | I 22 | $4 \cdot 20$ | $1 \cdot 37$ | $4 \cdot 25$ | I. 53 | $4 \cdot 30$ | 1.69 | $4 \cdot 36$ |

## LATITUDE $6^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True <br> Alt. | $18^{\circ}$ | Decl. Var. | $18^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Deci. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 49 \cdot 7 \end{array}\right.$ | + 46 | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 8 & \text { I7.8 } \end{array}\right.$ | + 47 | $\begin{gathered} \mathrm{s} . \\ 46 \cdot 2 \end{gathered}$ |  |  |  | $\begin{array}{lc} \text { H. M. S. } \\ 6 & 9 \\ 44 \cdot I \end{array}$ |  | $\begin{aligned} & \text { H. M. S. } \\ & 6 \text { ro } \end{aligned}$ |  |
| - | $1 \begin{array}{lll}5 & 25 & 37 \cdot 4\end{array}$ | - 23 | 525 50.7 | . 22 | 263.5 | -21 | $\begin{array}{llll}5 & 26 & 15.7\end{array}$ |  | $526 \quad 27 \cdot 2$ | -19 | 526 38.I |  |
| 12 | 51712.0 | - 18 |  | -17 | $1732 \cdot 3$ | - 15 | $51741 \cdot 1$ | 14 | $51749 \cdot 1$ | -13 |  | - II |
| 14 | $\begin{array}{llll}5 & 8 & 47 \cdot 0\end{array}$ | 13 | $\begin{array}{llll}5 & 8 & 54.6\end{array}$ | 2 | $\begin{array}{ll}9 & 1 \cdot 2\end{array}$ | -10 | 5 5 9 6 6.8 |  | 911.3 | $+.07$ | $\begin{array}{lllllll}9 & 14 \cdot 8\end{array}$ | 05 |
| 16 | 5 ¢ $022 \cdot \mathrm{I}$ | 09 | $5{ }_{5} \quad 0 \quad 26 \cdot 8$ | -07 | - $30 \cdot 3$ | . 05 | $\begin{array}{llll}5 & 0 & 326\end{array}$ | +.03 | - $33 \cdot 6$ | .00 | $5 \quad 0 \quad 33 \cdot 3$ | r |
| 18 | 451 | +.04 | 451 | + .02 | $5159 \cdot 5$ | . 01 | $4 \begin{array}{llll}41 & 58.4\end{array}$ | - .03 | 4 51 55.9 |  | 451 | .08 |
| 20 | 44332 | . 00 | 443 3r.5 | - 03 | 44328.7 | .06 | $4 \begin{aligned} & 43 \\ & 4 \\ & 24 \cdot 2\end{aligned}$ | -09 | 443 I8.I | -12 | $44310 \cdot 2$ | 15 |
| 22 | $\begin{array}{llll}4 & 35 & 7.9\end{array}$ | .05 | $4 \begin{array}{lll}45 & 3.8\end{array}$ | .08 | $43457 \cdot 8$ | - II | 43449.9 | -15 | 434 40•I | -18 | $43428 \cdot 3$ |  |
| 24 | $\begin{array}{llllll}4 & 26 & 43 \cdot 1\end{array}$ | -10 | $42635 \cdot 9$ | - 14 | $4 \begin{array}{ll}46 & 26 \cdot 7 \\ 4\end{array}$ | $\cdot 17$ | $\begin{array}{llll}4 & 26 & 15 \cdot 3\end{array}$ | - 21 | $4 \begin{array}{lll}46 & 1.8 \\ 4 & \end{array}$ | - 24 | $42546 \cdot 0$ | . 28 |
| 26 | 41818.2 | -15 | $4 \begin{array}{lll}18 & 7 \cdot 9\end{array}$ | -19 | $417 \quad 55 \cdot 3$ | $\cdot 23$ | $4 \begin{array}{llll}4 & 170 \cdot 4\end{array}$ | $\cdot 27$ | 4178230 | $\cdot 31$ | $4 \begin{array}{lll}47 & 3\end{array}$ | $\cdot 35$ |
| 28 | 27. | - 20 | Io | $\cdot 24$ | $\begin{array}{llll}9 & 23.6 \\ 0 & 51.3\end{array}$ | . 29 | $\begin{array}{lr}9 & 5.0 \\ 0 & 8.0\end{array}$ | $\cdot 33$ | $\begin{array}{ll}8 & 43 \cdot 7 \\ 0 & 3.6\end{array}$ |  | $\begin{array}{rrrr}4 & 8 & 19 \cdot 6 \\ 3 & 59 & 35 \cdot 2\end{array}$ | - 42 |
| 30 | $\begin{array}{llll}4 & 1 & 27 \\ 3 & 57\end{array}$ | -25 | 110 | $\cdot 30$ | - $51 \mathrm{I} \cdot 3$ | $\cdot 35$ | $\begin{array}{ccc}4 & 0 & 28.9 \\ 3 & 56 & 10.6\end{array}$ | 40 | - ${ }^{3} 5$ | 45 | 3 59 $35 \cdot 2$ <br> 3 55  | - 50 |
| 31 | 5714.7 | $\cdot 28$ | $5656 \cdot 3$ | 33 | $35635 \cdot 0$ | $\cdot 38$ | $\begin{array}{llll}3 & 56 & 10 \cdot 6\end{array}$ |  | $\begin{array}{lllllll}3 & 55 & 43 \cdot 2\end{array}$ | 48 | $\begin{array}{lllllllll}3 & 55 & 12 \cdot 7 \\ 3 & 50 & 408\end{array}$ | . 54 |
| 32 | 3 53 $1 \cdot 7$ <br> 3 48  | 31 | 3 52 $4 \mathrm{I} \cdot 6$ | $\cdot 36$ |  | 41 | $\begin{array}{lllllllllllll}3 & 51 & 52.2 \\ 3 & 47 & 33.5\end{array}$ | -46 | 3 51 22.6 <br> 3 47  | . 52 | 3 50 $49 \cdot 8$ <br> 3 46  |  |
| 33 | 34848 | 4 | 34826.8 | $\cdot 39$ | 48 1.8 | 44 | $\begin{array}{lllll}3 & 47 & 33 \cdot 5\end{array}$ |  | 347 1.8 | -56 | $34626 \cdot 7$ |  |
| 34 | $4435 \cdot 4$ | - 36 | $\begin{array}{llllll}3 & 44 \\ \text { II }\end{array}$ | $\cdot 42$ | $\begin{array}{lllllll}3 & 43 & 44.9\end{array}$ | $\cdot 48$ |  | -53 | 3 42 $40 \cdot 7$ <br> 3 38  | $\cdot 59$ | 3 42 $3 \cdot 1$ <br> 3 37  | . 66 |
| 36 | 40 <br> 12 <br> 36 <br> 8.5 | $\cdot 39$ | $3956 \cdot 6$ | 45 | $\begin{array}{lllllllllllllllll}3 & 39 & 27 \cdot 8\end{array}$ | $\cdot 51$ | 3 3 38 $575 \cdot 3$ | . 57 | $\begin{array}{lllllll}3 & 38 & 19.2\end{array}$ | -63 | $3739 \cdot 3$ | $\cdot 70$ |
| 36 | $\begin{array}{llll}3 & 36 & 8 \cdot 5\end{array}$ | 42 | 3541.2 | 48 |  | -54 | $1 \begin{array}{llll}3 & 34 & 35.8\end{array}$ | 61 | $\begin{array}{llllll}3 & 33 & 574\end{array}$ | $\cdot 67$ | $\begin{array}{llll}3 & 33 & 15.0\end{array}$ |  |
| 37 |  | 45 | $\begin{array}{llll}3 & 31 & 25 \cdot 7\end{array}$ | $\cdot 52$ | $3 \begin{array}{llll}3 & 30 & 52 \cdot 8\end{array}$ | 58 | $\begin{array}{llll}3 & 30 & 16 \cdot 0 \\ 3 & 25 & 5.8\end{array}$ | . 65 | 3 29 $35 \cdot 2$ <br> 3 25  | 71 | $32850 \cdot 3$ |  |
| 38 | $\begin{array}{llllllllllll}3 & 27 & 40 \cdot 8\end{array}$ | 48 | $\begin{array}{lll}3 & 27 & 9.8\end{array}$ | -55 | $\begin{array}{llll}3 & 26 & 34.9\end{array}$ |  | $\begin{array}{llll}3 & 25 & 55.8\end{array}$ |  | 32512.7 | 5 | $32425 \cdot 1$ | 3 |
| 39 | $\begin{array}{llll}3 & 23 & 26 \cdot 7\end{array}$ | $\cdot 52$ | $2253 \cdot 7$ | -. 58 |  | . 65 | $32135 \cdot 3$ | $\cdot 72$ | $32049 \cdot 6$ | -80 | 1959 | . 88 |
| 40 | 1912.3 | 5 | $\begin{array}{ll}18 & 37 \cdot 3\end{array}$ | $\cdot 62$ | 3 17 $58 \cdot 1$ <br> 3 1  | $\cdot 69$ | $\begin{array}{llll}3 & 17 & 14.4\end{array}$ | $\cdot 76$ | $\begin{array}{llll}3 & 16 & 26 \cdot r\end{array}$ | $\cdot 84$ | 15 33.1 | 92 |
| 41 | 14 57•7 | . 58 | $\begin{array}{cccc}3 & 14 & 20 \cdot 7 \\ 3 & 10 & 3 \cdot 7\end{array}$ | -65 | 39.2 | $\cdot 73$ | 3 12 53.0 <br> 3 8  <br> 1.2   | $8 \mathrm{8r}$ | $\begin{array}{crr}3 & 12 & 2 \cdot 1 \\ 3 & 7\end{array}$ | 89 | $\begin{array}{llll}3 & \text { II } & 6 \cdot 3\end{array}$ | 97 |
| 42 | $\begin{array}{llll}3 & 10 & 42 \cdot 8\end{array}$ | .61 | 3 10 3.7 <br>  5 46.3 | 69 | 3 9 19.8 | -77 | $\begin{array}{llll}3 & 8 & 3 \mathrm{I} \cdot 2 \\ 3 & 4 & 8.8\end{array}$ | 85 | $737 \cdot 5$ | -94 | $\begin{array}{llll}6 & 38 \cdot 8\end{array}$ |  |
| 43 | $\begin{array}{llll}3 & 6 & 27.7\end{array}$ |  | $\begin{array}{lllllllllllll}3 & 5 & 46\end{array}$ | 73 | $3 \begin{array}{lll}3 & 5 & 0 \cdot 1\end{array}$ |  | 34 | 90 | $\begin{array}{llll}3 & 312.4\end{array}$ | -99 | $210 \cdot 5$ |  |
| 44 |  | - 69 | $\begin{array}{llll}3 & 1 & 28.5 \\ 2 & 57 & 10.3\end{array}$ | - 77 |  | - 8.85 |  | - . 94 | $2{ }_{28} 5846$ | - I. 04 | 25741.5 | I. 13 |
| 45 | $\left\|\begin{array}{llll} 2 & 57 & 56 \\ 2 & 52 & 6 \end{array}\right\|$ | 72 .76 | $\begin{array}{llll}2 & 57 & 10 \cdot 3 \\ 2 & 52 & 51.6\end{array}$ | .81 | $\begin{array}{lll}2 & 56-19 \cdot 0 \\ 2 & 51 & 57 \cdot 7\end{array}$ | -90 |  | $\cdot 99$ | $\begin{array}{llll}2 & 54 & 19.9\end{array}$ | r.09 | $25311 \cdot 7$ | 1.19 |
| 46 | $\left\|\begin{array}{lll} 2 & 53 & 40 \cdot 0 \\ 2 & 49 & 23 \cdot 3 \end{array}\right\|$ | .76 | $\begin{array}{llll}2 & 52 & 51 \cdot 6 \\ 2 & 48 & 32 \cdot 4 \\ & 4 & \end{array}$ | . 85 | $\begin{array}{llll}2 & 51 & 57 \cdot 7 \\ 2 & 47 & 35.8 \\ & 4\end{array}$ | -95 | $\begin{array}{lll}2 & 50 & 58 \cdot 1 \\ 2 & 46 & 33 \cdot 2\end{array}$ | 1.04 1.09 | $\begin{array}{llll}2 & 49 & 52 \cdot 6 \\ 2 & 45 & 24.4\end{array}$ | -14 | 228 | 1.25 |
| 48 | $\begin{array}{llll}2 & 49 & 23.3 \\ 2 & 45 & 6.2\end{array}$ | $\cdot 80$ | 224 $32 \cdot 4$ <br>   | $\cdot 90$ | $24735 \cdot 8$ | . 99 | $2{ }^{2} 46$ 33.2 | 1.09 | 245424.4 | I $\cdot 20$ I 26 | $\begin{array}{rrrr}2 & 44 & 9 \cdot 1 \\ 2 & 39 & 36 \cdot 2\end{array}$ | I.3I |
| 49 | $24048 \cdot 6$ | - 89 | 39 52.3 | - 99 | $23^{8} 149 \cdot 8$ | - 1 | $123740 \cdot 8$ | - 1.21 | $23625 \cdot 0$ | - 1.32 | $\begin{array}{\|cr\|}39 & 36 \cdot 2 \\ 35 & 2 \cdot 1\end{array}$ | 144 |
| 50 | $\begin{array}{llllll}2 & 36 & 30 \cdot 4\end{array}$ | . 93 | $2 \begin{array}{llll}25 & 31 \cdot 3\end{array}$ | $\underline{1}$ | $23425 \cdot 7$ | 1.15 | $1 \begin{array}{lll}2 & 33 & 13.3\end{array}$ | 1.27 | $23153 \cdot 7$ | $\underline{1} 39$ | $23026 \cdot 7$ | 52 |
| 51 | 23211.6 | 98 | 23119.6 | 1.09 | $2 \begin{array}{lll}230 & 0.7\end{array}$ | 1.21 | $\begin{array}{llllll}2 & 28 & 44.7\end{array}$ | 1.33 | 22721.2 | 1.46 | $22549 \cdot 8$ | . 59 |
| 52 | $22752 \cdot 2$ | r.03 | $22647 \cdot 0$ | I-15 | 25 34.7 | 1.27 | $22415 \%$ | I 39 | 222473 | 1.53 | 22111.4 | $\underline{1} 67$ |
| 53 | 22332 | 1.08 | 22223.7 | 1-20 | $21 \quad 7 \cdot 8$ | 33 | 2 19 44.0 | 1.47 | 1811.9 | 1-6x | 16 3r-1 | I.76 |
| 54 | 19 | $-1.13$ |  | - I 26 | $2 \begin{array}{lll}16 & 39 \cdot 6\end{array}$ | - $\mathrm{I} \cdot 40$ |  | - 1.54 | $\begin{array}{llllll}2 & 13 & 34.8\end{array}$ | -1. | 2 II 48.9 | I.85 |
| 55 | 1449 | 1.19 | $\begin{array}{lllllllll}2 & 13 & 33.9\end{array}$ | I.33 | $21210 \cdot 1$ | r 47 | $1037 \cdot 6$ | . 62 | $855^{\circ}$ | r 78 | 74.5 | I.94 |
| 57 | $\begin{array}{rrrr}2 & 10 & 26.6 \\ 2 & 6 & 2.7\end{array}$ | 25 | 9 <br>  <br> 4 <br> 4 <br> $10 \cdot 3$ | 39 | $\begin{array}{llll}2 & 7 & 39.2 \\ 2 & 3 & 6.7\end{array}$ | 1.54 r .62 | 6 $2 \cdot 0$ | 1.70 | $\begin{array}{lrr}2 & 15.0 \\ 1 & 59\end{array}$ | 1.87 | ${ }_{2}^{2} 178.6$ | $2 \cdot 05$ |
| 57 <br> 58 | $\begin{array}{rrrr}2 & 6 & 2.7 \\ 2 & 1 & 37.7\end{array}$ | 1.32 $\mathrm{I} \cdot 38$ | (1) $\begin{gathered}4 \\ 4 \\ 0\end{gathered} 19.3$ | 47 | $\begin{array}{rrrr}2 & 3 & 6 \cdot 7 \\ 1 & 58 & 32 \cdot 5\end{array}$ | 62 | I 24.4 5644.7 |  |  | 1.97 2.08 | $5727 \cdot 9$ $5235 \cdot 1$ | 6 |

VARIATION TO $1^{\prime}$ OF LATITUDE AND ALTITUDE

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{x} \cdot 3 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.23 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 39 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 26 \end{gathered}$ | $\stackrel{s}{s .}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 28 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathbf{1} \cdot 55 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 31 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 63 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 34 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 72 \end{gathered}$ | s. |
| 4 | 1.28 | 4.22 | 1.36 | 4.24 | 1.44 | 4.27 | 1.52 | $4 \cdot 30$ | 1.60 | $4 \cdot 33$ | I.68 | 4.36 |
| 8 | I 26 | $4 \cdot 21$ | I-34 | $4 \cdot 24$ | 1.42 | $4 \cdot 26$ | I-50 | $4 \cdot 29$ | 1.58 | $4 \cdot 32$ | 1.66 | $4 \cdot 35$ |
| 12 | I. 24 | $4 \cdot 21$ | 1.32 | $4 \cdot 23$ | I. 40 | $4 \cdot 26$ | $1 \cdot 48$ | $4 \cdot 29$ | I-56 | $4 \cdot 31$ | 1.65 | $4 \cdot 35$ |
| 16 | 1.23 | 4.21 | I.3I | 4.23 | 1-39 | $4 \cdot 26$ | $1 \cdot 48$ | $4 \cdot 28$ | 1.56 | $4 \cdot 31$ | 1.64 | $4 \cdot 34$ |
| 20 | +1.23 | $4 \cdot 20$ | +1.3I | $4 \cdot 23$ | +r.39 | $4 \cdot 26$ | +1.48 | $4 \cdot 28$ | +r.56 | $4 \cdot 31$ | +1.65 | $4 \cdot 35$ |
| 22 | $1 \cdot 23$ | $4 \cdot 20$ | I-31 | $4 \cdot 23$ | $1 \cdot 40$ | $4 \cdot 26$ | 1.48 | $4 \cdot 28$ | 1.57 | $4 \cdot 32$ | I-66 | $4 \cdot 35$ |
| 24 | 1.23 | 4.21 | I. 32 | 4.23 | 1.40 | $4 \cdot 26$ | 1.49 | 4.29 | I.58 | $4 \cdot 32$ | r.67 | $4 \cdot 35$ |
| 26 | I 24 | 4.21 | I.32 | $4 \cdot 23$ | 1.41 | $4 \cdot 26$ | I 50 | $4 \cdot 29$ | I. 59 | $4 \cdot 32$ | - 68 | $4 \cdot 36$ |
| 28 | 1.25 | 4.21 | I.33 | $4 \cdot 24$ | 1.42 | $4 \cdot 26$ | I-5I | $4 \cdot 30$ | I 60 | $4 \cdot 33$ | I.70 | $4 \cdot 36$ |
| 30 | +1.25 | $4 \cdot 21$ | +r.34 | $4 \cdot 24$ | +1.44 | $4 \cdot 27$ | +1.53 | $4 \cdot 30$ | +r.62 | $4 \cdot 34$ | +r.72 | $4 \cdot 37$ |
| 32 | 1.27 | $4 \cdot 22$ | I. 36 | 4.24 | r.45 | 4.28 | 1.55 | $4 \cdot 31$ | I. 64 | $4 \cdot 34$ | 1.74 | $4 \cdot 38$ |
| 34 | I 28 | 4.22 | - 38 | 4.25 | I. 47 | 4.28 | $1 \cdot 57$ | $4 \cdot 32$ | r 67 | $4 \cdot 35$ | $1 \cdot 77$ | 4.39 |
| 36 | I.30 | 4.23 | I. 40 | $4 \cdot 26$ | I. 50 | $4 \cdot 29$ | I. 60 | $4 \cdot 33$ | 1.70 | $4 \cdot 37$ | 1.80 | $4 \cdot 45$ |
| 38 | I. 32 | 4.23 | I. 42 | 4.27 | 1.52 | 4.30 | I. 63 | 4.34 | 1.73 | $4 \cdot 38$ | 1.84 | $4 \cdot 42$ |
| 40 | +1.35 | $4 \cdot 24$ | +r.45 | 4.27 | + 1.55 |  | +1.66 |  | +1.77 |  | +1.89 | $4 \cdot 44$ |
| 42 | 1.37 | 4.25 | 1.48 | $4 \cdot 28$ | I. 59 | $4 \cdot 32$ | I.70 | $4 \cdot 37$ | 1.82 | $4 \cdot 41$ | 1.94 | $4 \cdot 46$ |
| 44 | 1.41 | $4 \cdot 26$ | 1.52 | 4.30 | I. 63 | $4 \cdot 34$ | 1.75 | 4.39 | I. 87 | $4 \cdot 44$ | $2 \cdot 00$ | 4.49 |
| 46 | 1.45 | $4 \cdot 27$ | 1-56 | $4 \cdot 32$ | 1.68 | $4 \cdot 36$ | I.81 | $4 \cdot 41$ | I.93 | $4 \cdot 46$ | $2 \cdot 06$ | $4 \cdot 52$ |
| 48 | 1.49 | 4.29 | I.61 | $4 \cdot 33$ | 1.74 | $4 \cdot 38$ | 1.87 | $4 \cdot 44$ | $2 \cdot \mathrm{Or}$ | $4 \cdot 49$ | $2 \cdot 14$ | $4 \cdot 56$ |
| 50 | +1.54 | $4 \cdot 31$ | +1.67 | 4.36 | +r.81 | $4 \cdot 41$ | +r.95 | $4 \cdot 47$ | +2.09 | 4.53 | +2.24 | $4 \cdot 60$ |
| 52 | 1.60 | $4 \cdot 33$ | I•74 | $4 \cdot 38$ | $\underline{1} 88$ | $4 \cdot 44$ | $2 \cdot 03$ | 4.51 | $2 \cdot 18$ | 4.58 | $2 \cdot 35$ | $4 \cdot 66$ |
| 54 | 1.67 | $4 \cdot 36$ | I.82 | 4.41 | 1.97 | 4.48 | $2 \cdot 13$ | 4.55 | $2 \cdot 30$ | $4 \cdot 63$ | 2.47 | $4 \cdot 72$ |
| 56 58 | 1.75 1.85 | 4.39 4.43 | 1.91 2.03 | 4.45 4.50 | 2.03 2.21 | 4.53 4.59 | 2.25 2.40 | 4.61 4.68 | 2.43 2.60 | $4 \cdot 70$ 4.79 | 2.63 2.82 | 4.80 4.91 |
| 5 | 1.8 | 443 | $2 \cdot 3$ | 4.50 | 2.21 | 459 | $2 \cdot 40$ | $4 \cdot 68$ | 2.60 | 4.79 | 2.62 | 4.91 |

DECLINATION-SAME NAME AS—LATITUDE.

| True Alt. | $0{ }^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. | $2^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $3^{\circ}$ | Decl. <br> Var. | $4{ }^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 0 & \text { o } \end{array}\right.$ | $\text { \|+ } 49 \mid$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 29 \cdot 4 \end{array}$ | + 49 | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & \text { o } \\ 59.0 \end{array}\right.$ |  | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 28.5 \end{array}\right.$ | $\begin{aligned} & \text { s. } \\ & \cdot 49 \end{aligned}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 58 \cdot 0 \end{array}$ | $\begin{array}{r} 5 . \\ +\quad \cdot 49 \end{array}$ | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 2 & 27.7 \end{array}$ | $49$ |
| 10 | 5 519414.8 | $\cdot 50$ | $\begin{array}{llll}5 & 20 & \text { II } & 3\end{array}$ | 1 | $52040 \cdot 2$ | + 4 | $\begin{array}{llll}5 & \text { I } & 88\end{array}$ | . 49 | $\begin{array}{llll}6 \\ 5 & \text { I } & 38 \cdot 0\end{array}$ | + ${ }^{-49}$ |  | 49 |
| 12 | 5 II 38.0 | $\cdot 50$ | $512 \quad 7 \cdot 7$ | -49 | $\begin{array}{llll}5 & 12 & 36 \cdot 5\end{array}$ | $\cdot 47$ | $\begin{array}{llll}5 & 13 & 4.4\end{array}$ | 46 | $\begin{array}{llll}5 & 13 & 31.5\end{array}$ | 44 | $51357 \cdot 7$ | 43 |
| 14 | $\begin{array}{llll}5 & 3 & 34.2\end{array}$ | - 50 | $\begin{array}{lll}5 & 4 & 4 \cdot 1\end{array}$ | 49 | $\begin{array}{llll}5 & 4 & 32.9\end{array}$ | -47 | $\begin{array}{llll}5 & 5 & 0.7\end{array}$ | $\cdot 45$ | $\begin{array}{lllll}5 & 5 & 27 \cdot 4\end{array}$ | -44 | 553.2 | 2 |
| 16 | $4 \quad 55 \quad 30 \cdot 4$ | -5 | $\begin{array}{lll}4 & 56 & 0 \cdot 4\end{array}$ | $\cdot 49$ | $4 \begin{array}{llll}46 & 29.3\end{array}$ | -47 | $45657 \cdot 0$ | $\cdot 45$ | $4 \begin{array}{lllll}57 & 23.4\end{array}$ | 43 | 45748.8 | 4 |
| 18 | 44726.5 | + 52 | 44756.8 | + 49 | 44825.7 | + 47 | $44853 \cdot 3$ | + 45 | 44919.5 | + 43 | 44944.4 | + 40 |
| 20 | 43922.4 | $\cdot 52$ | 43953.0 | $\cdot 50$ | 4 40 $22 \cdot 1$ | $\cdot 47$ | $44049 \cdot 6$ | -45 | 441159 | $\cdot 42$ | $44140 \cdot 2$ | 40 |
| 22 | $\begin{array}{lllll}4 & 31 & 18 \cdot 3\end{array}$ | $\cdot 53$ | $\begin{array}{llll}4 & 31 & 49.2\end{array}$ | $\cdot 50$ | $\begin{array}{llll}4 & 32 & 18 \\ 4 & 2 & 5\end{array}$ | $\cdot 47$ | $\begin{array}{lllllllllll}4 & 32 & 46 \cdot 0\end{array}$ | - | $4{ }_{4}^{43} \begin{array}{ll}11 & \cdot 9\end{array}$ | $\cdot 42$ | $43336 \cdot 1$ | 39 |
| 24 26 | [ $\begin{array}{rrrr}4 & 23 & 14 \cdot 0 \\ 4 & 15 & 0.6 \\ 0.6\end{array}$ | $\cdot 55$ | $\begin{array}{llll}4 & 23 & 45 \cdot 3 \\ 4 & 15 & 4.4\end{array}$ | . 51 |  | $\cdot 47$ | $\begin{array}{llll}4 & 24 & 42.4 \\ 4 & 16 & 38.8\end{array}$ | $\stackrel{4}{4}$ | 4 25 $8 \cdot 1$ <br> 4 I 4 | $\cdot 41$ | 445 | 8 |
| 26 | $4 \begin{array}{lll}4 & 15 & 9.6\end{array}$ | $\cdot 55$ | 41541.4 | 51 | 4 Y6 II• | $\cdot 48$ | $4 \begin{array}{llll}46 & 38.8\end{array}$ | -44 | $\begin{array}{lllll}4 & 17 & 4\end{array}$ | $\cdot 41$ | 41728.0 | 38 |
| 28 | 47 | + $\cdot 56$ | $\begin{array}{llll}4 & 7 & 37.3 \\ 3 & 59 & 3\end{array}$ | $+.52$ | 4 | + 48 | $\begin{array}{llll}4 & 8 & 35 \cdot 2\end{array}$ | + 4 | $9{ }^{9}$ 0.7 | + 41 | $\begin{array}{llll}4 & 9 & 24 \cdot 1 \\ 4 & \text { I }\end{array}$ | $\begin{array}{r}\text { + } \\ +\quad 37 \\ .36 \\ \hline 36\end{array}$ |
| 30 | $\begin{array}{llll}3 & 59 & 0 \cdot 3\end{array}$ | - 57 | $\begin{array}{lllll}3 & 59 & 33 \cdot 2\end{array}$ | $\cdot 53$ | $4{ }^{4} \times 0.3 .6$ | -49 | 3 x 6 | $\cdot 44$ | - $57 \cdot 1$ | 40 | 4 I $20 \cdot 2$ | 36 |
| 31 | $\begin{array}{llll}3 & 54 & 57 \cdot 9\end{array}$ | $\cdot 57$ | 3 55 31.0 <br> 3 51  <br> 8.0   | - 53 | $\begin{array}{llll}3 & 56 & 1.7 \\ 3 & 51 & 50\end{array}$ | 49 | $\begin{array}{llll}3 & 56 & 29 \cdot 7 \\ 3 & 5 & 29\end{array}$ | 45 | $\begin{array}{lllllllll}3 & 56 & 55 \cdot 3\end{array}$ | 40 |  | 6 |
| 32 | $\begin{array}{llll}3 & 50 & 55.4 \\ 3 & 46 & 5.8\end{array}$ | $\cdot 58$ | $\begin{array}{llll}3 & 51 & 28.9 \\ 3 & 47 & 26.7\end{array}$ | 53 |  | -49 | $\begin{array}{llll}3 & 52 & 27.9 \\ 3 & 48 & 26.1\end{array}$ | $\stackrel{45}{4}$ | $\begin{array}{llll}3 & 52 & 53 \cdot 5\end{array}$ | 40 | $\begin{array}{lllll}3 & 53 & 16 \cdot 4\end{array}$ | 6 |
| 33 | 3465 | 59 | $\begin{array}{lllll}3 & 47 & 26.7\end{array}$ | 54 | $\begin{array}{llllllll}3 & 47 & 57\end{array}$ | 49 | $\begin{array}{llll}3 & 48 & 26 \cdot 1\end{array}$ | $\cdot 45$ | $3485 \mathrm{r} \cdot 7$ | -40 | 34914. | 36 |
| 34 35 | $\begin{array}{lllllllllllllllllllllll}3 & 42 & 50 \cdot 2\end{array}$ | + . 59 | $\begin{array}{llll}3 & 43 & 24.4 \\ 3 & \\ 3\end{array}$ | + 55 |  | $+.50$ | 34424.2 | + 45 | $34449 \cdot 9$ | + 40 | $3{ }^{3} 4512 \cdot 7$ | + 36 |
| 35 |  | . 60 |  | -55 |  | - 50 | $\begin{array}{lllll}3 & 40 & 22.4\end{array}$ | $\cdot 45$ | $34048 \cdot 1$ |  | 3 4 I $10 \cdot 8$ | 35 |
| 36 | $\begin{array}{llll}3 & 34 & 44 \cdot 8\end{array}$ | -61 | $\begin{array}{llll}3 & 35 & 19 \cdot 8\end{array}$ | -56 |  | 50 | $\begin{array}{llll}3 & 36 & 20 \cdot 5\end{array}$ | -45 | $\begin{array}{llll}3 & 36 & 46 \cdot 3\end{array}$ | 40 | 337 | 35 |
| 37 | 330420 | $\cdot 62$ | $\begin{array}{lllllllllll}3 & 31 & 17.4 \\ 3 & 27 & 5.0\end{array}$ | $\cdot 56$ |  | 51 | $\begin{array}{llllllllllllllll}3 & 32 & 18.6\end{array}$ | -46 | $\begin{array}{llll}3 & 32 & 44 \cdot 4\end{array}$ | $\cdot 40$ | $\begin{array}{lll}3 & 33 & 7 \cdot 1\end{array}$ | 35 |
| 38 | $32639 \cdot 1$ |  | $\begin{array}{llllll}3 & 27 & 15.0\end{array}$ | 57 | $\begin{array}{lllllllll}3 & 27 & 47\end{array}$ | 51 | 28 | $\cdot 46$ | $\begin{array}{llll}3 & 28 & 42 \cdot 7\end{array}$ | $\cdot 40$ | 329 5.3 | 35 |
| 39 | $\begin{array}{llll}3 & 22 & 36 \cdot 1 \\ \\ & 18 & \\ \end{array}$ | +.63 | $\begin{array}{llll}3 & 23 & 12.5\end{array}$ | + 58 | $\begin{array}{llll}3 & 2345.4\end{array}$ | + 52 |  | + 46 | $32440 \cdot 8$ | + 40 | $\begin{array}{lll}3 & 25 & 3\end{array}$ | $\cdot 35$ |
| 40 | 3 18 $33 \cdot 1$ <br> 3 1  | . 64 | $\begin{array}{llllll}3 & 19 & 10.0 \\ 3 & 15 & 7\end{array}$ | $\cdot 58$ | $\begin{array}{llllll}3 & 19 & 43 \cdot 2\end{array}$ | 5 | 2012.9 | 4 | $\begin{array}{lll}3 & 20 & 39.0\end{array}$ | $\cdot 41$ | 321 | 35 |
| 4 I | $\begin{array}{lllll}3 & 14 & 30 \cdot 0\end{array}$ | $\cdot 65$ | $\begin{array}{llll}3 & 15 & 7 \cdot 3 \\ 3 & 15 & \end{array}$ | 59 | 3 15 41 <br> 10   | -53 | $3 \mathrm{I6}$ II | $\cdot 47$ | $\begin{array}{llllllllll}3 & 16 & 37 \cdot 2\end{array}$ | 4 | 3 I6 59.8 | 35 |
| 42 | $\begin{array}{llll}3 & 10 & 26.7\end{array}$ | -66 | $\begin{array}{llll}3 & \text { II } & 4.5 \\ 3 & 7 & \end{array}$ | . 60 | $\begin{array}{lllll}3 & 11 & 38 \cdot 7 \\ 3 & 7 & 36.4\end{array}$ | . 54 | $\begin{array}{ccc}3 & 12 & 9 \cdot 0\end{array}$ |  | $\begin{array}{llll}3 & 12 & 35.4\end{array}$ | 41 | $\begin{array}{llll}3 & 12 & 58 \cdot 0\end{array}$ |  |
| 43 | $\begin{array}{lll}3 & 6 & 23.4\end{array}$ |  | $\begin{array}{llll}3 & 7 & 1 \cdot 9\end{array}$ | 61 | $\begin{array}{lllll}3 & 7 & 36.4\end{array}$ | 54 | $6 \cdot 9$ |  | $\begin{array}{llll}3 & 8 & 33 \cdot 6\end{array}$ | 4 I | 6 | 34 |
| 44 | $\begin{array}{lrrr}3 & 2 & 19.9 \\ 2 & 58 & 16.9\end{array}$ | + 69 | $\begin{array}{lll}3 & 2 & 59 \cdot 1 \\ 2 & 58 & 59 \cdot \mathrm{I}\end{array}$ | + 62 | 3 $34 \cdot 1$ | + 55 | $\begin{array}{ll}4 & 4 \cdot 9\end{array}$ | + 48 | $43 \mathrm{I} \cdot 7$ | + 41 | $454 \cdot 4$ |  |
| 45 | $\begin{array}{llll}2 & 58 & 16.4 \\ 2 & 54 & 12.6\end{array}$ | $\cdot 70$ |  | . 63 | 5931.6 55 20.2 | . 56 | $\begin{array}{rrr}0 \\ 56 & 2 \cdot 9 \\ 50.8\end{array}$ | $\cdot 48$ | 3 0 $29 \cdot 8$ <br>  56 $27 \cdot 9$ | $\cdot 41$ | 3 0 | 34 |
| 46 | $\begin{array}{llllll}2 & 54 & 12.6\end{array}$ | -7 | 25453.1 | -64 | 25529.2 | $\cdot 56$ | $\begin{array}{lll}56 & 0.8\end{array}$ | $\cdot 49$ | 25627.9 | 42 | 25650 | 34 |
| 47 | $\begin{array}{llll}2 & 50 & 8.8 \\ 2 & 46 & 4.8\end{array}$ | 73 | $25050 \cdot 0$ | . 65 | $25126 \cdot 6$ | 57 | $5158 \cdot 6$ | 50 | $25226 \cdot 1$ | 2 | $25249 \cdot 0$ | 34 |
| 48 | 46 | 74 | 246 |  | 24724.0 | -58 | 4756 | $\cdot 50$ | $24^{8} \quad 24.2$ | ${ }^{42}$ | 248 | -34 |
| 49 | $\begin{array}{llll}2 & 42 & 0.6\end{array}$ | + 76 |  | +.67 | $\begin{array}{lllll}2 & 43 & 21.3\end{array}$ | + 59 | 24354.2 | + 51 | $24422 \cdot 3$ | + 43 | 244 | $\cdot 34$ |
| 50 | $\begin{array}{lllll}2 & 37 & 56 \\ 2\end{array}$ | $\cdot 77$ | $\begin{array}{lllll}2 & 38 & 40 \cdot 0 \\ 2 & 34 & \\ \end{array}$ | - 68 | $\begin{array}{lllll}2 & 39 & 18.5\end{array}$ |  | $23951 \cdot 9$ |  | $24020 \cdot 3$ | 43 | $24043 \cdot 6$ | 35 |
| 51 | 2 33 $51 \cdot 7$ <br> 2   | .79 | $\begin{array}{llll}2 & 34 & 36 \cdot 4 \\ 2 & 30 & 3\end{array}$ | $\cdot 70$ |  | .61 | $\begin{array}{lllllllllllll}2 & 35 & 49 \\ 2\end{array}$ | $\cdot 52$ | $2 \begin{array}{lllllllll}26 & 18 \cdot 3\end{array}$ | 43 | $2364 \mathrm{I} \cdot 8$ | 55 |
| 5 | $\begin{array}{llll}2 & 29 & 47 \cdot 0 \\ 2 & 25 & 42 \cdot 1\end{array}$ | . 83 | $\begin{array}{llll}2 & 30 & 32 \cdot 6 \\ 2 & 26 & 28 \cdot 7\end{array}$ | $\cdot 71$ | $\begin{array}{ccc}2 & 31 & 12.7 \\ 2 & 27 & 0.6\end{array}$ | . 62 | $\begin{array}{llllllllllll}2 & 31 & 47 \cdot 2 \\ 2 & 27 & 44 \cdot 8\end{array}$ | $\cdot 53$ | $\begin{array}{llll}2 & 32 & 16 \cdot 3 \\ 2 & 28 & 14 \cdot 3\end{array}$ | 44 | $\begin{array}{llllll}2 & 32 & 39.9 \\ 2 & 28 & 38 \cdot 1\end{array}$ | 35 |
| 53 | $22542 \cdot 1$ | . 83 | $\begin{array}{ll}2 & 2628.7\end{array}$ | $\cdot 73$ | $\begin{array}{llll}2 & 27 & 9.6\end{array}$ | . 63 | 2744.8 | $\cdot 54$ | $2 \begin{array}{llll}28 & 14.3\end{array}$ | $\cdot 44$ | 2838 | 35 |
| 54 | $\begin{array}{llllll}2 & 21 & 36.8\end{array}$ | + 85 |  | + 75 | $\begin{array}{llll}2 & 23 & 6 \cdot 4\end{array}$ | + . 65 | $2342 \cdot 2$ | + 55 | 22412.2 | + 45 | $2436 \cdot 3$ | $\cdot 35$ |
| 55 | $\begin{array}{lllllll}2 & 17 & 31.4\end{array}$ | 8 | $\begin{array}{llll}2 & 18 & 20 \cdot 4\end{array}$ | $\cdot 76$ | $\begin{array}{llll}2 & 19 & 3 \cdot 1\end{array}$ | 6 | 21939.6 | $\cdot 56$ | 22010.0 | $\cdot 46$ | 22034.4 |  |
| 56 | $\begin{array}{crrr}2 & 13 & 25.6 \\ 2 & 9 & 19.6\end{array}$ | . 89 |  | -78 | $\begin{array}{llll}2 & 1 & 4 & 59 \cdot 6 \\ 2 & 10 & 56 \cdot 0\end{array}$ | $\cdot 67$ | $\begin{array}{lllll}2 & 15 & 36.9\end{array}$ | 57 | $\begin{array}{llll}2 & 16 & 7 \cdot 9\end{array}$ | 46 | 21632 | 36 <br> 36 |
| 57 58 | $\begin{array}{llll}2 & 9 & 19.6 \\ 2 & 5 & 13.1\end{array}$ | .91 |  | .80 | $\begin{array}{rrrr}2 & 10 & 56 \cdot 0 \\ 2 & 6 & 52 \cdot 2\end{array}$ | -69 | $\begin{array}{rl}11 & 34 \cdot 3 \\ 7 & 31.2\end{array}$ | $\cdot 58$ | 12 | 7 | $\begin{array}{rrrr}2 & 12 & 30 \\ 2 & 8 & 28\end{array}$ | 36 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ}$ |  | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. . 00 | $\begin{gathered} \text { s. } \\ -4.03 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\cdot 07 \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4.03 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +{ }^{\prime} \mathrm{I}_{4} \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 03 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +2 I \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 03 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +\quad .28 \end{aligned}$ | s. -4.04 |  | S. $\cdot 35$ | $\begin{gathered} \text { s. } \\ -4 \cdot 04 \end{gathered}$ |
| 4 | -. 03 | 4.03 | . 04 | 4.03 | -II | 4.03 | .18 | 4.03 | . 25 | 4.04 |  | $\cdot 32$ | 4.04 |
| 8 | . 07 | 4.03 | -0 | 4.03 | $\cdot 07$ | 4.03 | -14 | 4.03 | - 22 | 4.03 |  | - 29 | 4.04 |
| 12 | -10 | 4.03 | .03 | 4.03 | -04 | 4.03 | - II | 4.03 | -18 | 4.03 |  | -26 | 4.04 |
| 16 | -14 | 4.03 | . 07 | 4.03 | -00 | $4 \cdot 3$ | -08 | 4.03 | -I5 | 4.03 |  | -23 | 4.04 |
| 20 | -.18 | 4.03 | -10 | 4.03 | -. 03 | 4.03 | + .04 | 4.03 | + .12 | 4.03 |  | $\cdot 20$ | 4.03 |
| 22 | -20 | 4.03 | -12 | 4.03 | -05 | 4.03 | .03 | 4.03 | $\cdot 10$ | 4.03 |  | -18 | 4.03 |
| 24 | . 22 | $4 \cdot 03$ | - 14 | $4 \cdot 03$ | -06 | 4.03 | + -01 | 4.03 | $\cdot 99$ | 4.03 |  | -17 | 4.03 |
| 26 | -24 | 4.04 | -16 | 4.03 | -08 | 4.03 | $\cdot 00$ | 4.03 | $\cdot 07$ | 4.03 |  | $\cdot 15$ | 4.03 |
| 28 | -26 | 4.04 | -18 | 4.03 | -10 | $4 \cdot 03$ | . 02 | $4 \cdot 03$ | -06 | 4.03 |  | - 14 | 4.03 |
| 30 | -. 28 | $4 \cdot 04$ | $\cdot 20$ | 4.03 | . 12 | 4.03 | . 04 | 4.03 | +.04 | 4.03 | $+$ | $\cdot 12$ | 4.03 |
| 32 | $\cdot 31$ | $4 \cdot 04$ | -22 | $4 \cdot 03$ | $\cdot 14$ | $4 \cdot 03$ | . 06 | 4.03 | -02 | $4 \cdot 03$ |  | - II | $4 \cdot 03$ |
| 34 | $\cdot 33$ | 4.04 | -25 | 4.04 | -16 | 4.03 | $\cdot 08$ | 4.03 | - 01 | $4 \cdot 03$ |  | $\cdot 09$ | 4.03 |
| 36 | $\cdot 36$ | 4.04 | $\cdot 27$ | 4.04 | - 18 | 4.03 | -10 | 4.03 | - or | 4.03 |  | -08 | 4.03 |
| 38 | -39 | 4.05 | $\cdot 30$ | 4.04 | 2 I | 4.03 | -12 | 4.03 | . 03 | 4.03 |  | -06 | 4.03 |
| 40 | - 42 | $4 \cdot 05$ | - 32 | 4.04 | -. 23 | $4 \cdot 03$ | - . 14 | 4.03 | -.04 | $4 \cdot 03$ |  | -05 | 4.03 |
| 42 | -45 | 4.05 | $\cdot 35$ | 4.05 | -25 | 4.04 | -16 | 4.03 | .06 | 4.03 |  | -03 | 4.03 |
| 44 | -48 | $4 \cdot 06$ | $\cdot 38$ | 4.05 | -28 | 4.04 | -18 | 4.03 | -08 | $4 \cdot 03$ |  | - 01 | $4 \cdot 03$ |
| 46 | $\cdot 52$ | 4.06 | 4 4 | 4.05 | -31 | $4 \cdot 04$ | -21 | $4 \cdot 04$ | -10 | 4.03 |  | -00 | 4.03 |
| 48 | -56 | 4.07 | -45 | 4.05 | -34 | 4.04 | -23 | 4.04 | . 13 | 4.03 |  | -02 | 4.03 |
| 50 | - . 60 | 4.07 | - 48 | 4.06 | - 37 | 4.05 | -. 26 | $4 \cdot 04$ | - . 15 | 4.03 |  |  |  |
| 52 | - 64 | 4.08 | $\cdot 52$ | 4.06 | - 40 | 4.05 | - 29 | 4.04 | -17 | 4.03 |  | .06 | 4.03 |
| 54 | -69 | 4.09 $4 \cdot 10$ | . 57 | 4.07 4.08 | . 44 | 4.05 4.06 | .32 .35 | 4.04 4.04 | - 20 | 4.03 |  | . 08 | 4.03 |
| 56 | $\cdot 75$ | $4 \cdot 10$ | $\cdot 61$ | 4.08 | $\cdot 48$ | 4.06 | -35 | 4.04 | -23 | $4 \cdot 04$ |  | -10 | 4.03 |
| 58 | -81 | $4 \cdot 11$ | $\cdot 67$ | $4 \cdot 08$ | 53 | 4.06 | 39 | $4 \cdot 05$ | $\cdot 26$ | $4 \cdot 04$ |  | . 12 | 4.03 |

## LATITUDE $7^{\circ}$.

DECLINATION—SAME NAME AS—LATITUDE.

| $\begin{array}{\|c\|} \hline \text { True } \\ \text { Alt. } \end{array}$ | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 2 & 57.5 \end{array}$ | + 50 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 27 \cdot 3 \end{array}\right.$ | + 50 | $\begin{array}{\|lll} 6 & 3 & 57 \cdot 3 \end{array}$ | + 5 | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 27 \cdot 4 \end{array}\right\|$ | + 50 | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 57 \cdot 7 \end{array}\right\|$ | $+\cdot 5 I$ | $\left.\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & 28.2 \end{array} \right\rvert\,$ | 51 |
| 10 | $\begin{array}{llll}5 & 22 & 28.4\end{array}$ | $\cdot 43$ | 5225 2 7 | -42 | 23 18.5 | $\cdot 41$ | 5 23 42.6 | $\cdot 39$ | $524 \quad 6 \cdot 0$ | $\cdot 38$ | $\begin{array}{llll}5 & 24 & 28.9\end{array}$ | $\cdot 37$ |
| 12 | $51423 \cdot 1$ | 42 | $51447 \cdot 7$ | 40 | 15114 | $\cdot 39$ | 1534.4 | $\cdot 37$ |  | $\cdot 36$ | $\begin{array}{lllllll}5 & 16 & 17.9\end{array}$ | 35 |
| 14 | $\begin{array}{llll}5 & 6 & 17.9\end{array}$ | 40 | $\begin{array}{llll}5 & 6 & 41 \cdot 7\end{array}$ | 39 | $7{ }^{7} 4.5$ | 37 | 726.4 | $\cdot 36$ | $5 \quad 747 \cdot 3$ | -34 | $\begin{array}{llll}5 & 8 & 7 \cdot 3\end{array}$ | $\cdot 32$ |
| 16 | 45812.9 | 39 | $45^{58} 35.9$ | $\cdot 37$ | $58 \quad 57 \cdot 9$ | 35 | 459 I8.6 | 34 | $45938 \cdot 4$ | $\cdot 32$ | 45956 | $\cdot 30$ |
| 18 | $450 \quad 8 \cdot 1$ | + 38 | $45030 \cdot 3$ | $+\cdot 36$ | 5051.4 | + 34 | 51 II•I | + 32 | $45129 \cdot 5$ | + 30 | $45146 \cdot 7$ | $+\cdot 27$ |
| 20 |  | 37 | $\begin{array}{lllll}4 & 42 & 24 \cdot 8\end{array}$ | $\cdot 35$ | $44245 \cdot 0$ | $\cdot 32$ |  | $\cdot 30$ | $\begin{array}{llll}4 & 43 & 20 \cdot 9\end{array}$ | $\cdot 27$ | $\begin{array}{lllll}4 & 43 & 36 \cdot 7\end{array}$ | . 25 |
| 22 | 43358.6 | $\cdot 36$ | $\begin{array}{lllll}4 & 34 & 19.5\end{array}$ | $\cdot 33$ | $43438 \cdot 8$ | $\cdot 31$ | $43456 \cdot 4$ | - 28 | $435 \quad 12 \cdot 5$ | 25 | $\begin{array}{llll}4 & 35 & 26 \cdot 8\end{array}$ | 2 |
| 24 | 42554.1 | 35 | $4 \begin{array}{llll}4 & 26 & 14.3\end{array}$ | $\cdot 32$ | $\begin{array}{llll}4 & 26 & 32 \cdot 8\end{array}$ | - 29 | $\begin{array}{llll}4 & 26 & 49 \cdot 4\end{array}$ | -26 | $\begin{array}{lll}4 & 27 & 4.2 \\ 4 & \text { 18 } & 56.1\end{array}$ | -23 |  | - 20 |
| 26 | 41749.7 | -34 | $\begin{array}{llll}4 & 18 & 9 \cdot 2\end{array}$ | 31 | $4 \begin{array}{llll}48 & 26.9\end{array}$ | -28 | $\begin{array}{llll}4 & 18 & 42 \cdot 5\end{array}$ | 24 | 4 I8 56-I | -21 | $419 \quad 7 \cdot 7$ | -18 |
| 28 | $4 \quad 945 \cdot 3$ | + 33 | 4104.2 | + 30 | 10 | + 26 | I0 $35 \cdot 7$ | + 22 | 4 10 $48 \cdot \mathrm{I}$ | + 19 | $41058 \cdot 3$ | + 15 |
| 30 | 4 I 41.0 | -33 | $4 \begin{array}{lll}4 & 1 & 59.4\end{array}$ | - 29 | 215.4 | 25 | 229.0 | -21 | $240 \cdot 2$ | -17 | 249.0 | 13 |
| 31 | $\begin{array}{llllllllll}3 & 57 & 38.9\end{array}$ | $\cdot 32$ | $\begin{array}{llllllllll}3 & 57 & 57\end{array}$ | . 28 |  | 24 |  | - 20 | $\begin{array}{llll}3 & 58 & 36 \cdot 3\end{array}$ | - 15 | 35844 | - II |
| 32 | $\begin{array}{llll}3 & 53 & 36 \cdot 8\end{array}$ | $\cdot 32$ | $\begin{array}{llllllllllll}3 & 53 & 54 \cdot 6\end{array}$ | -27 | $\begin{array}{lll}3 & 54 & 9 \cdot 8\end{array}$ | . 23 | $35422 \cdot 4$ | -19 | $\begin{array}{lllll}3 & 54 & 32.5\end{array}$ | - 14 | $\begin{array}{llll}3 & 54 & 39 \cdot 8\end{array}$ | -10 |
| 33 | $34934 \cdot 7$ | -3I | $\begin{array}{lllll}3 & 49 & 52 \cdot 3\end{array}$ | 27 | $\begin{array}{llll}3 & 50 & 7 \cdot 0\end{array}$ | . 22 | $35019 \cdot 2$ |  | 350 | -13 | $35035 \cdot 3$ | 09 |
| 34 |  | $+3 \mathrm{I}$ | $34549 \cdot 9$ | + 26 | 3464.3 | + 22 | 346 16.0 | + 17 | 34624.8 | + 12 | $34630 \cdot 7$ | + .07 |
| 35 |  | $\cdot 31$ | $34147 \cdot 6$ |  | $\begin{array}{llll}3 & 42 & 1 \cdot 6\end{array}$ | 2r | $\begin{array}{llllllllllll}3 & 42 & 12 \cdot 8\end{array}$ | - 16 | $\begin{array}{llll}3 & 42 & 21 \cdot 0\end{array}$ | 11 | $\begin{array}{llll}3 & 42 & 26 \cdot 2\end{array}$ | . 06 |
| 36 | $\begin{array}{llll}3 & 37 & 28 \cdot 7\end{array}$ | -30 | $\begin{array}{lllll}3 & 37 & 45 \\ \\ \end{array}$ | - 25 | 3 <br> 37 $5^{\circ} \mathrm{O}$ | - 20 | $\begin{array}{llll}3 & 38 & 9 \cdot 6\end{array}$ | - 15 | $\begin{array}{llll}3 & 38 & 17 \cdot 2\end{array}$ | -10 | 3 38 $21 \cdot 71$ | -05 |
| 37 |  | 30 | $33343 \cdot 0$ | $\cdot 25$ | $\begin{array}{llll}3 & 33 & 56 \cdot 3\end{array}$ | -19 | $\begin{array}{llll}3 & 34 & 6 \cdot 4\end{array}$ | - 14 |  | -09 | $\begin{array}{llll}3 & 34 & 17 \cdot 2\end{array}$ | -04 |
| 38 | $\begin{array}{ll}3 & 29 \\ 24 \cdot 7\end{array}$ | 29 | $\begin{array}{llll}3 & 29 & 40 \cdot 8\end{array}$ | 24 | $\begin{array}{lllll}3 & 29 & 53\end{array}$ | 9 | 3 30 $3 \cdot 3$ | 'I3 | $\begin{array}{llll}3 & 30 & 9 \cdot 7\end{array}$ |  | 33012.7 | -02 |
| 39 | 3252 | + 29 | 32538.6 | + 24 | 325 5I•I | +.18 | 326 | + 12 | $\begin{array}{llll}3 & 26 & 5 \cdot 9\end{array}$ | + .07 | $\begin{array}{llll}3 & 26 & 8 \cdot 2\end{array}$ | + or |
| 40 |  | 29 | $\begin{array}{llll}3 & 21 & 36 \cdot 4\end{array}$ | $\cdot 23$ | $\begin{array}{llll}3 & 21 & 48.5\end{array}$ |  |  |  |  |  | $\begin{array}{llll}3 & 22 & 3 \cdot 7\end{array}$ | $\cdot 0$ |
| 41 | $\begin{array}{llll}3 & 17 & 18.8\end{array}$ | -29 | $\begin{array}{llllll}3 & 17 & 34.2\end{array}$ | -22 | $\begin{array}{llllllll}3 & 17 & 45.9\end{array}$ | -16 | 31754.0 |  |  | -04 | $\begin{array}{llllllllllllll}3 & 17 & \end{array}$ | 02 |
| 42 | $\begin{array}{llll}3 & 13 & 16.9\end{array}$ | -28 | $\begin{array}{lllll}3 & 13 & 32 \cdot 0\end{array}$ | -22 | $\begin{array}{lllllllllllllll}3 & 13 & 43.4\end{array}$ | 6 | $3 \mathrm{I} 3 \mathrm{5I} \cdot 0$ | -09 |  | -03 | $3 \mathrm{I} 3154 \cdot 7$ | 03 |
| 43 | $\begin{array}{llll}3 & 9 & 150\end{array}$ |  | $\begin{array}{llll}3 & 9 & 29.9\end{array}$ | 21 | $3 \quad 940 \cdot 8$ | 15 | 947 | -09 | 3 3 5I•I |  | $\begin{array}{llll}3 & 9 & 50 \cdot 2\end{array}$ | 05 |
| 44 | 3 5 13.1 <br> 3 1 1 <br> 1.2   | + 28 | $\begin{array}{llll}3 & 5 & 27.7 \\ 3 & 1 & 25.6\end{array}$ | + .21 | $38 \cdot 3$ $35 \cdot 8$ | + -14 |  | + .07 | $\begin{array}{llll}3 & 5 & 47 \cdot 4 \\ 3 & 1 & 43.6\end{array}$ | + .OI | $\begin{array}{llll}3 & 5 & 45 \cdot 7 \\ 3 & 1 & 45 \cdot 2\end{array}$ |  |
| 46 | $\begin{array}{rrr}3 & 1 \\ 2 & 57\end{array}$ | . 27 | $\begin{array}{rrrr}3 & 1 & 25.6 \\ 2 & 57 & 23.5\end{array}$ | 20 | $\begin{array}{rrrr}\text { I } & 35 \cdot 8 \\ 57 & 33 \cdot 3\end{array}$ | ${ }_{-13}{ }^{1}$ | $\begin{array}{rrrr} 3 & I & 4 I \cdot 8 \\ 2 & 57 & 38 \cdot 8 \end{array}$ | . 06 | $\begin{array}{rrrr}3 & 1 & 43 \\ 2 & 57 \\ & & 39\end{array}$ | . 02 | $\begin{array}{rrrr}3 & 1 & 4 \cdot 2 \\ 2 & 57 & 36 \cdot 6\end{array}$ | .08 |
| 47 | $\begin{array}{llll} \\ 2 & 53 & 7.5\end{array}$ | - 27 | $\begin{array}{llll}2 & 53 & 21.4\end{array}$ | -19 | 2 2 53 30.9 | -12 | $2 \begin{array}{llll}2 & 53 & 35.8\end{array}$ | . 04 | $2 \begin{aligned} & 23 \\ & 2\end{aligned}$ | 03 | 253 32•I | - II |
| 48 | $\begin{array}{lll}249 & 5.5\end{array}$ | . 27 | $\begin{array}{llllll}2 & 49 & 19.3\end{array}$ | -19 | 49 | 11 | 49 | . 03 | 249 | . 04 | 24927 | -12 |
| 49 | $\begin{array}{llll}2 & 45 & 3.7\end{array}$ | + 27 | $2 \begin{array}{lllllll} & 45 & 17\end{array}$ | $+.18$ | 24525.9 | + - 10 |  | + -02 | $2 \begin{array}{llll}2 & 45 & 28\end{array}$ | -.06 | $2 \begin{array}{lllllll}2 & 45 & 22.9\end{array}$ | 14 |
| 50 | $\begin{array}{llll}2 & 41 & 1.9\end{array}$ | . 26 | 24115.2 | -18 | 24123.5 | -10 | $\begin{array}{llllllll}2 & 41 & 26.8\end{array}$ | + 0 I | $24^{1} 25 \cdot 1$ | . 07 | $2 \begin{array}{llll} & 41 & 18.2\end{array}$ | -16 |
| 51 | 2 37 $0 \cdot 1$ | -26 | 23713.2 | 17 | $23721 \cdot \mathrm{I}$ | $\cdot 09$ | $2 \begin{array}{lllllllll}23 & 23.8\end{array}$ |  | $2 \begin{array}{llll} & 37 & 21.3\end{array}$ | . 09 | $2 \begin{array}{llllllll} & 37 & 13.5\end{array}$ | 17 |
| 52 | $\begin{array}{llll}2 & 32 & 58.2 \\ 2 & 28 & 56.4\end{array}$ | - 26 | 233 Ir ¢ 1 | $\cdot 17$ | $\begin{array}{llll}2 & 33 & 18 \cdot 7\end{array}$ | -8 | 2 33 $20 \cdot 8$ <br> 2 2 1 |  | $23317.6$ | -10 | $2338 \cdot 8$ | 19 |
| 53 | ${ }_{2}^{2} 2856.4$ | $\cdot 26$ | 229 9•I | 17 | $22916 \cdot 3$ | .07 | $\left\lvert\, \begin{array}{lll} 2 & 29 & 17 \cdot 8 \end{array}\right.$ |  | $\begin{array}{lll} 2 & 29 & 13 \end{array}$ | - II | 2294.0 | -2I |
| 54 | $\begin{array}{lllll}2 & 24 & 54.6\end{array}$ | + 26 | $225 \quad 7 \cdot 1$ | + .16 | $2 \begin{array}{llllll}25 & 13.9\end{array}$ | +.06 | $\begin{array}{llllllll}2 & 25 & 14.8 \\ 2 & 21\end{array}$ | - 03 | $225 \quad 9 \cdot 9$ | - .13 | 224 59•I | $\cdot 23$ |
| 55 | $22052 \cdot 8$ | -26 | $2215 \cdot 1$ | -16 | 21115 | . 06 | $\begin{array}{lllllll}2 & 21 & 119\end{array}$ | 04 | 2 I | 15 | $2 \begin{array}{ll}20 & 54 \cdot 2\end{array}$ | $\cdot 25$ |
| 56 | $21651 \cdot 0$ | -26 | 17 | 15 | $\begin{array}{ll}17 & 9 \cdot 1\end{array}$ | . 05 | $\begin{array}{llll}2 & 17 & 8.8\end{array}$ | .06 | $\begin{array}{llll}2 & 17 & 2.2\end{array}$ |  | $21649 \cdot 2$ | 27 |
| 58 | 21249.2 | $\cdot 25$ | 13 I.2 | -15 | 1368 | 04 | $13 \quad 5 \cdot 8$ | 7 | $2 \begin{array}{llll}2 & 12 & 58 \cdot 3\end{array}$ | 8 | 1244.2 | 29 |
| 58 | $2847 \% 4$ | -2 | 59.2 | 14 | $9 \quad 4.4$ | 03 | $2 \cdot 8$ | .08 | 854. | -20 | 839.0 | 31 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | S. | s. | s. | s. | s. | s. | S. | s. | S. |  | s. | s. |
| 0 | $\begin{array}{r} \\ +\quad 43 \\ \hline .39\end{array}$ | -4.05 4.05 | $\begin{array}{r}\text { + } 50 \\ \hline .46\end{array}$ | 4.06 4.06 | $\begin{array}{r}\text { a } \\ +\quad .57 \\ \hline .54\end{array}$ | -4.07 4.06 | + 6.64 | -4.08 4.08 | + 71 +68 | -4.09 |  | $\cdot 79$ | $4 \cdot 10$ |
| 8 | -36 | 4.05 | -43 | 4.05 | -50 | 4.06 | . 58 | 4.07 | .65 | 4.09 4.08 |  | -75 | 4.10 4.09 |
| 12 | $\cdot 33$ | 4.04 | -40 | 4.05 | -47 | 4.06 | $\cdot 55$ | 4.07 | -62 | 4.08 |  | $\cdot 70$ | 4.09 |
| 16 | $\cdot 30$ | 4.04 | $\cdot 37$ | 4.05 | -45 | 4.05 | $\cdot 52$ | 4.06 | -60 | 4.07 |  | . 67 | 4.08 |
| 20 | + 27 | $4 \cdot 04$ | + 35 | 4.04 | + 42 | 4.05 | + 50 | 4.06 | + 57 | 4.07 |  | . 65 | 4.08 |
| 22 | -26 | 4.04 | -33 | 4.04 | $\cdot 41$ | 4.05 | $\cdot 49$ | 4.06 | $\cdot 56$ | 4.07 |  | $\cdot 64$ | 4.08 |
| 24 | -24 | 4.04 | -32 | 4.04 | $\cdot 40$ | 4.05 | -48 | 4.06 | $\cdot 56$ | 4.07 |  | . 63 | 4.08 |
| 26 | $\cdot 23$ | 4.04 | -31 | $4 \cdot 04$ | -39 | 4.05 | -47 | 4.06 | -55 | 4.07 |  | -63 | 4.08 |
| 28 | $\cdot 22$ | 4.04 | $\cdot 30$ | 4.04 | $\cdot 38$ | 4.05 | $\cdot 46$ | 4.06 | -54 | 4.07 |  | . 62 | 4.08 |
| 30 | + 20 | 4.03 | + 29 | 4.04 | $+37$ | 4.05 | + ${ }^{45}$ | 4.05 | + ${ }^{5} 5$ | $4 \cdot 06$ |  | . 61 | 4.08 |
| 32 | -19 | 4.03 | - 27 | 4.04 | $\cdot 36$ | $4 \cdot 04$ | -44 | 4.05 | . 53 | 4.06 |  | $\cdot 61$ | 4.07 |
| 34 | -18 | 4.03 | - 26 | 4.04 | -35 | 4.04 | -43 | 4.05 | $\cdot 52$ | 4.06 |  | $\cdot 61$ | 4.07 |
| 36 | -16 | 4.03 | -25 | $4 \cdot 04$ | -34 | $4 \cdot 04$ | $\cdot 43$ | 4.05 | $\cdot 52$ | 4.06 |  | -60 | 4.07 |
| 38 | -15 | 4.03 | -24 | 4.04 | -33 | 4.04 | $\cdot 42$ | 4.05 | -51 | $4 \cdot 06$ |  | . 60 | 4.07 |
| 40 | + 14 | 4.03 | + 23 | 4.04 | + 32 | $4 \cdot 04$ | + 41 | 4.05 | $+51$ | 4.06 |  | . 60 | 4.07 |
| 42 | -12 | 4.03 | . 22 | 4.04 | -31 | $4 \cdot 04$ | -4I | 4.05 | . 51 | 4.06 |  | -60 | 4.07 |
| 44 | -II | 4.03 | $\cdot 21$ | 4.04 | $\cdot 31$ | 4.04 | 4 T | 4.05 | -51 | 4.06 |  | $\cdot 61$ | 4.07 |
| 46 | -10 | 4.03 | - 20 | 4.03 | $\cdot 30$ | $4 \cdot 04$ | $\cdot 40$ | 4.05 | -51 | 4.06 |  | $\cdot 61$ | 4.08 |
| 48 | -08 | 4.03 | -19 | 4.03 | -29 | $4 \cdot 04$ | -40 | 4.05 | -51 | $4 \cdot 06$ |  | $\cdot 61$ | 4.08 |
| 50 | + 0.07 | 4.03 | + - 18 | 4.03 | + 29 | $4 \cdot 04$ | + ${ }^{40}$ | 4.05 | + 5 5 | 4.06 |  |  | 4.08 |
| 52 | . 06 | 4.03 | $\cdot 17$ | 4.03 | . 28 | $4 \cdot 04$ | $\cdot 40$ | 4.05 | -52 | 4.06 |  | $\cdot 63$ | 4.08 |
| 54 | $\cdot 04$ | 4.03 | -16 | 4.03 | $\cdot 28$ | $4 \cdot 04$ | $\cdot 40$ | 4.05 | -52 | 4.06 |  | -64 | 4.08 |
| 56 58 | .03 | 4.03 | -15 | 4.03 | $\cdot 28$ | 4.04 | $\cdot 40$ | 4.05 | . 53 | 4.06 |  | . 66 | 4.08 |
| 58 | - 01 | 4.03 | -14 | 4.03 | $\cdot 27$ | $4 \cdot 04$ | 41 | 4.05 | -54 | $4 \cdot 07$ |  | -68 | 4.09 |

DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{gathered} \text { True } \\ \text { Alt. } \end{gathered}$ | $12^{\circ}$ |  | $13^{\circ}$ |  | $14^{\circ}$ |  | $15^{\circ}$ |  | $16^{\circ}$ | cl. | $17^{\circ}$ | $\begin{gathered} \text { ecl. } \\ \text { ar. } \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| ro | $524$ |  | 5 |  | 5 $25 \begin{array}{ll}53 \cdot 8\end{array}$ |  |  |  | ${ }^{6}$ |  | 3'3 |  |
| 12 |  | $\begin{array}{r} 36 \\ \hline \end{array}$ | 5 58 | 32 |  | -31 |  |  | 5517 5 |  |  | $27$ |
| 14 $\times 6$ $\times 6$ |  |  | 58 |  |  |  | $\begin{array}{llll}5 & 9 & 178\end{array}$ |  |  |  | $5 \quad 9473$ | $\begin{aligned} & 23 \\ & 19 \end{aligned}$ |
| ${ }^{18}$ | $\begin{array}{llll}4 & 52 & 2.5\end{array}$ |  |  | + 23 |  |  |  |  |  |  |  |  |
| 20 | 44351 | $\cdot 22$ | 444 | 20 | $444 \times 5.2$ | . 8 | 44425. | -15 | 444 |  | 4 |  |
| 22 | 4 3539 |  | 43550 |  | 4 <br> 4 |  |  |  | 4 |  | 4 |  |
| 24 26 | 4 |  | ${ }^{4}$ |  | 4274 |  | $\begin{array}{llll}4 & 27 & 50.8 \\ 4 & 19 & 33.8 \\ 4\end{array}$ |  | 4 |  | 4 |  |
| 28 | $41917 \cdot 3$ |  | 4 I |  | $\begin{array}{lllll}4 & 19 & 30.3 \\ 4 & \text { Ir } & 15.6\end{array}$ |  | 4 I 933.8 |  |  |  | 4 |  |
| 30 | ${ }_{4}^{4} 2255.5$ |  | 4259.4 | . 04 | $\begin{array}{llll}4 \\ 4 & 0.9\end{array}$ |  | $4{ }^{4}$ |  | 4256.4 |  |  |  |
| $3{ }^{1}$ | 35850 |  | 358 |  | 35 |  | $3585 \times 4$ |  | 358 |  | 358 |  |
|  | 3 |  | 3 |  | 3 $54{ }^{4} 46 \cdot 2$ |  | 354 |  | 3 3 3 5 |  |  |  |
| 33 | 350 | . 04 | 350 |  | 350 |  | $35034 \cdot 4$ |  | 35 |  | $35016 \cdot 9$ |  |
| 34 <br> 35 | 3 | + | 346 | - . 02 | 3463 Br 5 | - .07 | 34625.9 |  | 346 |  | $3{ }^{46} \quad 5 \cdot 6$ |  |
| 35 |  |  | 342 |  | 3 42 <br> 24.1  |  | - $17 \cdot 3$ |  | 42 |  | $4154 \cdot 3$ |  |
|  |  |  |  |  | 334 |  | 33400 | -18 | 33 |  |  |  |
| 38 | $\begin{array}{llllll}3 & 30 & 12.4\end{array}$ | . 03 | 3 3 30 | -09 |  | $\times 5$ | 3 34 |  | 329 3 $37 \cdot 2$ |  | 29 |  |
|  | 3 |  | $326 \quad 2.4$ |  | 3 25 54.2 |  | $32542 \cdot 4$ |  | 32 |  | $325 \quad 7 \cdot 8$ |  |
| 40 | 322 |  | 3215 |  | 321 |  | 321 |  | 321 | 3 x | 32055 |  |
| $4{ }^{41}$ | H17 |  | 3 3 3 3 3 |  | 3 3 3 17 | -23 | $\begin{array}{llll}3 & 17 & 2 \\ 3 & 13 & 1 \\ 3 & 9\end{array}$ |  | (1) $\begin{aligned} & 3 \\ & 3 \\ & 3\end{aligned}$ |  | ${ }_{3}^{3}$ |  |
| 4 | $\begin{array}{r}312 \\ 3 \\ \hline\end{array}$ |  | 3 | ${ }_{-18}$ | 3 |  | [ |  | $\begin{array}{rrrr}3 & 8 & \\ 3 & 8 & 45 \%\end{array}$ |  | . 2 |  |
| 44 |  |  |  |  |  |  | 3 4 57 <br> 1   |  |  |  |  |  |
| 45 |  |  | 5 |  |  | . 30 |  | -37 |  | 8 | 5 |  |
| 46 | 25 |  | 25716 |  | 2565 | 32 | 256 | ${ }^{40}$ | 256 rr 9 |  | 255 |  |
| 47 | 2 |  | $\begin{array}{lll}2 & 53 \\ 2 & 49 & 2 \\ 2\end{array}$ |  | (1) $\begin{aligned} & 2 \\ & 2\end{aligned}$ |  |  |  | $2{ }^{52}$ |  | $2 \begin{aligned} & 2 \\ & 2 \\ & 47 \\ & 2\end{aligned}$ |  |
|  | 2 |  | 2 |  | 24434.9 |  | 22 44 |  | 243 |  | 24259.7 |  |
| 5 | 241 | . 24 | 240 |  | 2 40 | ${ }^{-4}$ | $2 \begin{aligned} & 2 \\ & 2 \\ & 295 \\ & 25\end{aligned}$ | -51 | 239 | 5r | $\begin{array}{llll}2 & 38 \\ 2 & 45 \cdot 3\end{array}$ |  |
| 51 52 | 23 2 2 3 |  | 2 36 <br> 2 3 <br> 2 4 <br> 2 3 |  |  |  | $1 \begin{array}{lll}2 & 35 \\ 2 & 4 \\ 2\end{array}$ |  | 235 |  | $\begin{array}{lllll}2 & 34 & 30.6 \\ 2 & 30 & 15.5\end{array}$ |  |
| 52 53 | 2 238 |  | ${ }_{2}^{2} 3234$ |  | 232 |  | 231 |  |  |  |  |  |
|  |  |  | $2 \begin{array}{lll}2 & 249.4 \\ 2 & 19\end{array}$ |  | 2 |  |  |  |  |  | $\begin{array}{llll}2 & 2 \times 43.9 \\ 2 & 17 \\ 27.2\end{array}$ |  |
|  |  |  | I6 |  |  |  | 2 |  | 2 |  | 2 |  |
|  | 2 21 |  |  |  | 2   <br> 2 15 3 <br> 2 XY  |  | 2  <br> 2  <br> 2  <br> 20 31 |  |  |  | \|rer |  |
| 58 | \% 8 r |  | 2  <br> 2 7 |  | $\left.\right\|_{2} ^{2} \begin{aligned} & 2 \\ & 2\end{aligned}$ |  | 2625 |  | 53 | $.94$ | 433 |  |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.


## LATITUDE $7^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ |  | $21^{\circ}$ |  | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 9 & 8.8 \end{array}\right.$ | $+\cdot 54$ | $\left.\right\|_{6} ^{\text {H. M. }} \text { S. } \text { S. }_{4 \mathrm{I} \cdot 6}$ | + 55 | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & \text { Io } & 14 \cdot 7 \end{array}\right\|$ | $\cdot 55$ | $\left\|\begin{array}{ccc} \text { H. м. } & \text { s. } \\ 6 & \text { 10 } & 48 \cdot 3 \end{array}\right\|$ | $\cdot 56$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & \text { II } & 22.4 \end{array}\right\|$ |  | $\left\|\begin{array}{\|cc} \text { H. M. } \\ 6 & \text { II } \\ 57 \cdot 0 \end{array}\right\|$ | 8 |
| 10 | 26 52-1 |  | $52710 \cdot 2$ | . 30 | $5 \quad 27 \quad 27 \cdot 8$ |  | 5 $27 \begin{array}{lll} & 44 \cdot 8\end{array}$ | - 28 | 5 288 | 27 | ${ }_{5} \mathbf{2 8} 817 \cdot 1$ |  |
| 12 | 1826.2 | -26 | 1841.5 | - 25 | $\begin{array}{lllll}5 & 18 & 56 \cdot 0\end{array}$ | $\cdot 23$ | $\begin{array}{llll}5 & 19 & 9.8\end{array}$ | $\cdot 22$ | $\begin{array}{lllll}5 & 19 & 22.7\end{array}$ | - 21 | $\begin{array}{llll}5 & 19 & 34.9\end{array}$ | . 20 |
| 14 | 10, 0.7 | -21 | 5 10 I3.I | - 20 | 5 10 24.6 |  | 5 10 $35 \cdot 1$ | -17 | 5 10 44.6 | $\cdot 15$ | 5 10 $53 \cdot \mathrm{I}$ | - 13 |
| I6 | 5 1 $35 \cdot 5$ | -17 | 5 1 $45^{\circ} \mathrm{O}$ | - 15 | 5 I 53.5 | -13 | $\begin{array}{llll}5 & 2 & 0.6\end{array}$ | - II | $\begin{array}{llll}5 & 2 & 6 \cdot 7\end{array}$ | -09 | $\begin{array}{lll}5 & 2 & 11.5\end{array}$ | + . 07 |
| 18 | 53 |  | 53 |  | 53 | $+$ | 453 | + | 453 | + .03 | 453 |  |
| 20 | $4445 \cdot 7$ | -08 | 4449 | + | $44451 \times 7$ | + | $44452 \cdot 2$ | -00 | $44451 \cdot 2$ | -03 | $44448 \cdot 5$ |  |
| 22 | $3620 \cdot 9$ | +.03 | 3621 | -00 | $4 \quad 36 \quad 20.9$ | -.03 | 436 I8•I | - -06 | $\begin{array}{llll}4 & 36 & 13.5\end{array}$ | $\cdot 09$ | 4366.9 | - 12 |
| 24 | $2756 \cdot 2$ | - 02 | 427 54.I | - .05 | $42750 \cdot 0$ | - 08 | $42743 \cdot 8$ | $\cdot 12$ | $\begin{array}{llll}4 & 27 & 35 \cdot 5 \\ 4 & 18 & 5 \cdot 3\end{array}$ | -15 | 4 27 25.1 <br> 4 18  <br> 10   | 9 |
| 26 | 19 31.5 | . 07 | $4 \begin{array}{llll}19 & 26.4\end{array}$ |  | 419 19.0 | - 14 | $419 \quad 9 \cdot 3$ |  | $418 \quad 57 \cdot 3$ |  | 41843.0 | 26 |
| 28 | II 6 |  | 4 10 | - .16 | $4 \begin{array}{llll}4 & 10 & 47.8\end{array}$ | - 20 | $4 \begin{array}{llll}4 & \text { 10 } & 34.6\end{array}$ | $\cdot 2$ | 4 10 18.8 | - . 28 | $4{ }^{4}$ ro 00.4 | - 33 |
| 30 | $241 \cdot 7$ | -17 | 30 | -21 | $4 \begin{array}{lll}4 & 2 & 16 \cdot 3\end{array}$ | $\cdot 26$ | 4 I 59 | -30 | 4 I | $\cdot 35$ | $4 \quad 1780$ | $\cdot 40$ |
| 3 3 | 58 29.1 | -19 | $35^{58} 16 \cdot \mathrm{r}$ | $\cdot 24$ | $\begin{array}{lll}3 & 58 & 0.3\end{array}$ | -29 | $35741 \cdot 6$ | -34 | $\begin{array}{lllllll}3 & 57 & 19.9\end{array}$ | -39 | 3 56 $55 \cdot 1$ | $\cdot 44$ |
| 32 | $\begin{array}{llll}54 & 16 \cdot 4\end{array}$ | $\cdot 22$ | 54 | 27 | $\begin{array}{lllll}3 & 53 & 44 \cdot 3\end{array}$ | 32 |  | 37 | $\begin{array}{llllll}3 & 52 & 59.9\end{array}$ | -42 | $\begin{array}{lllll}3 & 52 & 32.9\end{array}$ | $\cdot 48$ |
| 33 | 5037 | -24 | 349 | 30 | 349 | 35 | $349 \quad 5 \cdot 5$ | $\cdot 40$ | $\begin{array}{lllll}3 & 48 & 39 \cdot 7\end{array}$ | $\cdot 46$ | 348 10 | -51 |
| 34 | 45 50.9 | - 27 | $\begin{array}{lllllllllll}3 & 45 & 32 \cdot 9\end{array}$ | $\cdot 33$ | $345 \mathrm{II} \cdot 7$ | $\cdot 38$ | $34447 \cdot 2$ | -44 | $\begin{array}{lllllllll}3 & 44 & 19.3\end{array}$ | $\cdot 49$ |  | 55 |
| 35 | 4137.9 | $\cdot 30$ | 4118.3 | -35 | $34055 \cdot 2$ | 41 | 34028.7 | $\cdot 47$ | 3. 39 | -53 | 33924.8 | 59 |
| 36 | 3724.9 | -33 | $37 \quad 3.5$ | - 39 | $\begin{array}{llll}3 & 36 & 38 \cdot 5\end{array}$ | 44 | $\begin{array}{llll}3 & 36 & 100\end{array}$ | 51 |  | 57 | 3351. | 63 |
| 37 | $33 \mathrm{II} \cdot 7$ | $\cdot 36$ | 3248.5 | 42 | $33^{3} 221.6$ | 48 | $\begin{array}{llll}3 & 3150.9\end{array}$ | $\cdot 54$ | $3 \mathrm{3r} 16.4$ | .6r | $\begin{array}{llll}3 & 30 & 37.8\end{array}$ | . 68 |
| 38 |  |  | $\begin{array}{llll}3 & 28 & 33 \cdot 3\end{array}$ |  | $\begin{array}{llll}3 & 28 & 4 \cdot 5\end{array}$ | 51 | $3 \begin{array}{llll}3 & 27 & 3\end{array}$ | -58 | 3265477 | 65 | $\begin{array}{llll}3 & 2613.7\end{array}$ | -72 |
| 39 | 2444.9 | 41 | 32418.0 | - $\cdot 48$ | 323 47.1 | $\cdot 55$ |  | - . 62 | $\begin{array}{llll}3 & 22 & 32 \cdot 8\end{array}$ | - . 69 | 3 3149.2 | $\cdot 76$ |
| 40 | $2031 \cdot 2$ | $\cdot 44$ | $\begin{array}{lll}20 & 2.4 \\ & 15 & 4.6\end{array}$ | $\cdot 51$ | $1 \begin{array}{llll}3 & 19 & 29 \cdot 4 \\ 3 & 15\end{array}$ | . 6 | $\begin{array}{llllll}3 & 18 & 52.2\end{array}$ | $\cdot 66$ | 3 18 <br>  $10 \cdot 5$ | $\cdot 73$ | $\begin{array}{llll}3 & 17 & 24 . \\ 3 & 172\end{array}$ | I |
| 4 4 | 16 17.3 | . 51 |  | - 55 | $\begin{array}{llll}3 & 15 & 11 \\ 3 & 10 \\ 3 & 53.2\end{array}$ | . 62 | $\begin{array}{llll}3 & 14 & 31.9 \\ 3 & 10 & \\ \end{array}$ | $\cdot 70$ | $\begin{array}{rrrr}3 & 13 & 47 \cdot 7 \\ 3 & 9 & 24 \cdot 6\end{array}$ | .78 |  | I |
| 42 43 | [rrrr $\begin{array}{rrrr}3 & 12 & 3.3 \\ 3 & 7 & 48.9\end{array}$ | . 51 | $\begin{array}{crrrr}3 & \text { II } & 30 \cdot 5 \\ 3 & 7 & 14 \cdot \mathrm{I}\end{array}$ |  |  | -66 | $\begin{array}{rrrr}3 & \text { ro } & \text { II. } 2 \\ 3 & 5 & 50.2\end{array}$ | $\cdot 74$ | $\begin{array}{ccc}3 & 9 & 24 \cdot 6 \\ 3 & 5 & 0 \cdot 7\end{array}$ | $\cdot 82$ | [ $\begin{array}{ccc}3 & 8 & 32 \cdot 7 \\ 3 & 4 & 6 \cdot 1\end{array}$ | 96 |
| 43 | $\begin{array}{llll}3 & 7 & 48 \cdot 9\end{array}$ | $\begin{array}{r}.54 \\ -.58 \\ \hline\end{array}$ | $3 \quad 714.1$ |  | 3 | - $\quad .70$ | $\begin{array}{llll}3 & 5 & 50 \\ 3 & 1 & 28\end{array}$ |  | $\begin{array}{ccc}3 & 5 & 0 \cdot 7 \\ 3 & 0 & 36.4\end{array}$ |  | $\begin{array}{crrr}3 & 4 & 6 \cdot 1 \\ 2 & 59 & 38 \cdot 8\end{array}$ | -96 |
| 45 | 5919.5 | - $\cdot 58$ | $\begin{array}{rrrr}3 & 2 & 57 \cdot 4 \\ 2 & 58 & 40 \cdot 4 \\ & 54 & 2 \cdot 4\end{array}$ | . 66 |  | $\cdot 78$ | [ $\begin{array}{ccc}3 & 1 & 28.6 \\ 2 & 57 & 6.6 \\ 2 & 5 & 3\end{array}$ | - 88 -87 .87 |  | .91 | $\begin{array}{llll}2 & 59 & 38 \cdot 8 \\ 2 & 55 & 10.8\end{array}$ | I.01 r.06 - |
| 46 | $55 \quad 4.4$ | . 65 | $5422 \cdot 9$ | $\cdot 73$ | 253 36.2 | . 82 | $25243 \cdot 9$ | 92 | $25145 \cdot 9$ | 1.02 | $25042 \cdot 0$ | I•12 |
| 47 | $25048 \cdot 9$ | -68 | $2505 \cdot \mathrm{I}$ |  | $24915 \cdot 8$ | -87 | $24^{8} 20 \cdot 7$ | 97 | $24719 \cdot 6$ | $1 \cdot 07$ | $246 \quad 12 \cdot 3$ | 1-18 |
| 48 | $24633 \cdot 1$ | 72 | $24546 \cdot 8$ |  | 224 <br> 154 | 92 | 24356 | 1.02 | $24252 \cdot 6$ | I'12 | 2414 r 7 | 1.24 |
| 49 | 42 I 6.8 | - 76 | $2{ }_{2} 4128.0$ | - 86 | $24033 \cdot 3$ | -. 96 | 23932.2 | -r.07 | 2 238824.6 | - $1 \cdot 18$ | $23710 \cdot 2$ | 1.30 |
| 50 | $3^{8} \quad 0 \cdot 1$ | -80 | $378 \cdot 7$ | 91 | $236 \mathrm{II} \cdot \mathrm{I}$ | I.02 | $2 \begin{array}{llll}25 & 6 \cdot 8\end{array}$ |  | $\begin{array}{ll}2 & 33 \\ 5 \\ \\ 2\end{array}$ | . 24 |  | r 37 |
| 51 | $\begin{array}{ll}33 & 42 \cdot 9\end{array}$ | 85 | $\begin{array}{llll}2 & 32 & 48 \cdot 8\end{array}$ | $\cdot 96$ | $23148 \cdot \mathrm{I}$ | 07 | $\begin{array}{ll}2 & 30 \\ 2 & 40 \cdot 6\end{array}$ | 1.19 | $\begin{array}{llll}2 & 29 & 25 \cdot 8 \\ 2 & 24 & 5\end{array}$ | . 31 | $\begin{array}{llll}2 & 28 & 3.5\end{array}$ | - 44 |
| 52 | $\begin{array}{llll}29 & 25 \cdot 2 \\ 25 & 6.9\end{array}$ | $\cdot 89$ | $\begin{array}{llll}2 & 28 & 28 \cdot 3\end{array}$ | $1 \cdot 01$ |  | 12 | $\begin{array}{llll}2 & 26 & 13.3 \\ 2 & 21 & 45\end{array}$ | 1.2 | $\begin{array}{llll}2 & 24 & 54.7 \\ 2 & 20 & \end{array}$ | . 38 | $\begin{array}{llll}2 & 23 & 28 \cdot 2 \\ 2 & 18 & 51.4\end{array}$ | I.51 |
| 53 | $\begin{array}{llll}2 & 25 & 6.9\end{array}$ | $\cdot 94$ | $224 \quad 7 \cdot 0$ |  | $22259 \cdot 8$ |  | 22145.0 | 1.31 | 22022.4 | I 45 | 21851.4 |  |
| 54 | 20 | 99 | 1944.9 | -I'I | $2 \begin{array}{llll}2 & 18 & 3.2\end{array}$ | - 1.2 | 21715.6 | - $\mathrm{I} \cdot 38$ |  | - I. 52 | $2 \begin{array}{llllll}14 & 12.9\end{array}$ | r. 67 |
| 55 | 1628 | $\underline{1}$ | $15 \quad 22.0$ | I-17 | $2 \begin{array}{llll}14 & 7.6\end{array}$ | I.31 | 21244. | - 145 | $2 \begin{array}{llll}215 & 13.4\end{array}$ | I 60 | 32 | 76 |
| 56 | 12 | I-10 | \% $58 \cdot \mathrm{I}$ | 1.23 | $\begin{array}{llll}9 & 39 \cdot 8 \\ 5 & 1\end{array}$ | . 38 | 12. | 3 | $\begin{array}{llll}2 & 6 & 36.4 \\ 2 & 1 & 57.5\end{array}$ |  | - | 6 |
| 58 | $\begin{array}{ll}7 & 46 \cdot 8 \\ 3 & 24.6\end{array}$ | 22 | $\begin{array}{rrr}6 & 33 \cdot \mathrm{I} \\ 2 & 7 \cdot 0\end{array}$ |  | $\begin{array}{ll} \\ 5 & 10 \cdot 7 \\ 0 & 40.2\end{array}$ | 5 | $\begin{array}{rrrr}2 & 3 & 39.0 \\ 1 & 59 & 3.5\end{array}$ | I. | $\begin{array}{rrrr}2 & 1 & 57 \\ 1 & 57 & 16\end{array}$ | r.88 |  |  |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 32 \end{gathered}$ | S. | S. $+\mathrm{I} \cdot 40$ | S. -4.26 | S. $+\mathrm{I} \cdot 48$ | S. | S. | S. | $\begin{gathered} s . \\ +\mathrm{I} \cdot 64 \end{gathered}$ | S. | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 72 \end{gathered}$ | S. |
| 4 | 1.28 | 4.23 | 1.36 | 4.25 | +1.44 | 4.28 4.27 | +1.52 | $4 \cdot 31$ | 1.60 1.60 | $4 \cdot 34$ | +1.72 r. \% | 4.37 |
| 8 | I 25 | $4 \cdot 22$ | I•33 | $4 \cdot 24$ | I.41 | $4 \cdot 27$ | I.49 | $4 \cdot 30$ | I 57 | $4 \cdot 33$ | I 66 | $4 \cdot 36$ |
| 12 | I. 23 | 4.21 | I•3I | $4 \cdot 24$ | I-39 | $4 \cdot 26$ | 1.47 | $4 \cdot 29$ | I•55 | $4 \cdot 32$ | I. 64 | $4 \cdot 35$ |
| 16 | I'2I | 4.21 | I.29 | $4 \cdot 23$ | I.38 | 4.26 | I.46 | $4 \cdot 28$ | I.54 | 4.31 | I. 63 | $4 \cdot 35$ |
| 20 | +1.20 | 4.21 | +1.29 | 4.23 | +1.37 | $4 \cdot 26$ | +I.45 | 4.28 | + I. 54 | $4 \cdot 31$ | +1.63 | $4 \cdot 34$ |
| 22 | 1.20 | $4 \cdot 20$ | I-29 | $4 \cdot 23$ | 1.37 | $4 \cdot 26$ | I. 46 | $4 \cdot 28$ | I'54 | 4.31 | I.63 | $4 \cdot 34$ |
| 24 | 1.20 | $4 \cdot 20$ | I-29 | $4 \cdot 23$ | I.37 | $4 \cdot 26$ | I-46 | $4 \cdot 29$ | I. 55 | $4 \cdot 32$ | I. 64 | $4 \cdot 35$ |
| 26 | I. 20 | $4 \cdot 2 \mathrm{I}$ | I. 29 | 4.23 | r.38 | $4 \cdot 26$ | I.46 | 4.29 | I. 55 | $4 \cdot 32$ | I. 64 | 4.35 |
| 28 | I-2I | 4.21 | I-29 | 4.23 | 1.38 | $4 \cdot 26$ | I 47 | 4.29 | I. 56 | $4 \cdot 32$ | I.66 | $4 \cdot 36$ |
| 30 | +1.2I | 4.21 | +1.30 | $4 \cdot 23$ | +1.39 | $4 \cdot 26$ | + $\mathbf{1} 49$ | $4 \cdot 29$ | +r.58 | 4.33 | +1.67 | $4 \cdot 36$ |
| 32 | 1.22 | $4 \cdot 21$ | I-3I | $4 \cdot 24$ | I.4I | $4 \cdot 27$ | I 50 | 4.30 | I. 60 | $4 \cdot 33$ | r 69 | $4 \cdot 37$ |
| 34 | I 23 | 4.21 | I•33 | $4 \cdot 24$ | I. 42 | $4 \cdot 27$ | I 52 | 4.3I | 1.62 | $4 \cdot 34$ | I*72 | $4 \cdot 38$ |
| 36 | I. 25 | $4 \cdot 22$ | I-34 | 4.25 | I.44 | $4 \cdot 28$ | 1.54 | $4 \cdot 31$ | I. 64 | $4 \cdot 35$ | I•74 | $4 \cdot 39$ |
| 38 | I. 26 | $4 \cdot 22$ | 1.36 | $4 \cdot 25$ | 1.46 | $4 \cdot 29$ | I 57 | $4 \cdot 32$ | I.67 | $4 \cdot 36$ | 1•78 | 4.40 |
| 40 | + 1.28 | $4 \cdot 23$ | +1.38 | $4 \cdot 26$ | +1.49 | 4.30. | +1.60 | 4.33 | +1.70 | 4.37 | +1.82 | 4.42 |
| 42 | I-3I | $4 \cdot 23$ | 1.41 | $4 \cdot 27$ | I.52 | $4 \cdot 31$ | I. 63 | $4 \cdot 35$ | r 74 | $4 \cdot 39$ | 1.86 | $4 \cdot 44$ |
| 44 | 1.33 | $4 \cdot 24$ | I. 44 | $4 \cdot 28$ | I.56 | $4 \cdot 32$ | 1.67 | $4 \cdot 36$ | 1•79 | 4.41 | r•91 | $4 \cdot 46$ |
| 46 | 1.37 | 4.25 | $1 \cdot 48$ | $4 \cdot 29$ | 1.60 | 4.34 | 1.72 | $4 \cdot 38$ | I.84 | 4.43 | 1.97 | 4.49 |
| 48 | 1.40 | $4 \cdot 27$ | I'52 | 4.31 | I.65 | $4 \cdot 35$ | I.78 | $4 \cdot 40$ | - I.91 | $4 \cdot 46$ | $2 \cdot 04$ | 4.52 |
| 50 | +1.45 | $4 \cdot 28$ | +1.57 | $4 \cdot 33$ | +1.71 | $4 \cdot 38$ | +r.84 | 4.43 | +1.98 | 4.49 | +2.12 | $4 \cdot 56$ |
| 52 | 1.50 | $4 \cdot 30$ | I.63 | $4 \cdot 35$ | 1.77 | $4 \cdot 40$ | I.92 | $4 \cdot 46$ | 2.06 | 4.53 | $2 \cdot 22$ | $4 \cdot 60$ |
| 54 | 1.56 | $4 \cdot 32$ | I•70 | $4 \cdot 37$ | I.85 | 4.43 | 2.00 | 4.50 | $2 \cdot 16$ | $4 \cdot 57$ | $2 \cdot 33$ | $4 \cdot 66$ |
| 56 | I.63 | 4.35 | I.78 | $4 \cdot 4 \mathrm{I}$ | I.94 | 4.47 | $2 \cdot 11$ | 4.55 | $2 \cdot 28$ | $4 \cdot 63$ | 2.47 | $4 \cdot 73$ |
| 58 | I•71 | $4 \cdot 38$ | I. 88 | 4.45 | 2.05 | $4 \cdot 52$ | 2.24 | $4 \cdot 61$ | $2 \cdot 43$ | $4 \cdot 70$ | $2 \cdot 63$ | $4 \cdot 81$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0{ }^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. Var. | $2{ }^{\circ}$ | Decl. Var. | $3{ }^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left.\right\|_{6} ^{\text {H. M. }} \begin{gathered} \text {. } \end{gathered}$ | + ${ }^{\text {S }}$ + 56 | H. M. S. <br> $6 \quad 033 \cdot 7$ | $+\begin{array}{\|c} \mathrm{s} . \\ +\quad 56 \end{array}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { I } \\ 7 \cdot 5 \end{array}\right.$ | $\begin{array}{r} \mathrm{S} . \\ +\quad .56 \end{array}$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { I } \\ 4 \mathrm{I} \cdot 3 \end{array}\right\|$ | $+\begin{aligned} & \mathrm{s} . \\ & +56 \end{aligned}$ | $\left\|\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 2 & 15 \cdot 0 \end{array}\right\|$ | + s. | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 2 & 49 \cdot I \end{array}\right\|$ |  |
| ${ }_{1}$ | 51936.2 | $\cdot 57$ | 20 10\% | . 56 | 52043.2 | - 55 |  | $\cdot 53$ | $2147 \cdot 3$ | . 52 | 5 22218.4 | 51 |
| 12 | 5 II 31.3 | $\cdot 57$ | $12 \quad 5 \cdot 3$ | - 56 | $\begin{array}{llllllllllllll}5 & 12 & 38 \cdot 5\end{array}$ | $\cdot 54$ | $\begin{array}{llll}5 & 13 & 10.8\end{array}$ | -53 | $51342 \cdot 1$ | -51 |  | 50 |
| 14 | $\begin{array}{llll}5 & 3 & 26 \cdot 3\end{array}$ | $\cdot 58$ | 4 $0 \cdot 5$ <br> 5  | - 56 | 5 4 $33 \cdot 7$  <br> 4 5 3  | $\cdot 54$ | $\begin{array}{llll}5 & 5 & 5.9\end{array}$ | - 53 | $537 \cdot 0$ | 1 | $\begin{array}{lll}5 & 6 & 7 \cdot 2\end{array}$ | 9 |
| 10 | $+552 \mathrm{I} \cdot 2$ | $\cdot 58$ | $45555 \cdot 7$ | $\cdot 56$ | 45629.0 | 54 | 57 1•I | $\cdot 52$ | $5732 \cdot 0$ | -50 | 458 I.8 | 49 |
| 18 | 447 16.I | + .59 | $44750 \cdot 9$ | + 57 | 44824.3 | + .54 |  | + .52 | $44927 \cdot 1$ | + 50 | $44956 \cdot 5$ | $+\cdot 48$ |
| 20 | 43910.8 | . 60 | $3945 \cdot 9$ | $\cdot 57$ | $44019 \cdot 6$ | $\cdot 55$ | $44051 \cdot 6$ | 52 | 44122.2 | -50 | $4415 \mathrm{I} \cdot 3$ | 47 |
| 22 | 43 I | -61 | $43140 \cdot 9$ | - 58 | $4 \begin{array}{lllll} & 32 & 14.8\end{array}$ | 55 | 4 4246.9 | . 52 | $\begin{array}{llll}4 & 33 & 17 \cdot 4\end{array}$ |  | $43346 \cdot 2$ | 46 |
| 24 | $42259 \cdot 8$ | -62 | $\begin{array}{llll}4 & 23 & 35.8 \\ 4 & 15 & 30.6\end{array}$ | - 58 | 424100 | 55 | $\begin{array}{llll}4 & 24 & 42 \cdot 2\end{array}$ | . 52 | $\begin{array}{lllllllllll}4 & 25 & 12 \cdot 6\end{array}$ | 49 | $4254 \mathrm{I} \cdot \mathrm{I}$ | 46 |
| 26 | 41454.0 |  | 41530 | -59 | 41650 | 56 | $41637 \cdot 5$ | 52 | $\begin{array}{llll}4 & 17 & 7.8\end{array}$ | -49 | 41736.2 | 45 |
| 28 | $4 \quad 548 \cdot 0$ | + 64 | 4 $4 \begin{array}{ccc}7 & 25.2 \\ 3 & 59\end{array}$ | + . 60 |  | + 56 | $832 \cdot 7$ <br> 18 | + 52 |  | + 49 |  | + 45 |
| 30 |  | $\cdot 65$ |  | $\cdot 61$ | 359550 | $\cdot 57$ | $\begin{array}{llll}4 & 0 & 27.9 \\ 3 & 56 & 25.9\end{array}$ | $\cdot 53$ | $\begin{array}{lll}4 & 0 & 58.4\end{array}$ | 49 | $4{ }^{4}$1 $26 \cdot 4$ | 45 |
| 31 | $\begin{array}{llll}3 & 54 & 38 \cdot 6\end{array}$ | -66 |  | .6I | $35552 \cdot 4$ | $\cdot 57$ | $\begin{array}{llll}3 & 56 & 25 \cdot 5\end{array}$ | $\cdot 53$ | $\begin{array}{llll}3 & 56 & 56 \cdot 0\end{array}$ | $\cdot 49$ | $35724^{\circ} \mathrm{O}$ | ${ }_{-4}$ |
| 32 | $\begin{array}{lllll}3 & 50 & 35 \cdot 4\end{array}$ | -66 | $\begin{array}{llllllll}3 & 51 & 14 \cdot 0 \\ 3 & 47 & \end{array}$ | . 62 | $35149 \cdot 8$ | 57 | 3 52 $23^{\circ}$ <br>    | -53 |  | $\cdot 49$ | 3532216 | $\cdot 44$ |
| 33 | $34632 \cdot 1$ | . 67 | $347 \mathrm{II} \cdot 0$ |  | $34747 \cdot 2$ | . 58 | $34820 \cdot 6$ | 53 | 348 | -49 | 349193 | -44 |
| 34 | $\begin{array}{llll}3 & 42 & 28 \cdot 6 \\ 3 & 38 & 25 \cdot 1\end{array}$ | + 68 | $\begin{array}{ll}3 & 43 \\ 3\end{array}$ | + .63 | 343 | + 58 | 344 | $+\cdot 54$ | $\begin{array}{lllllllll}3 & 44 & 48 \cdot 9\end{array}$ | + 49 | $3 \begin{array}{llll}35 & 16 \cdot 9\end{array}$ | + 44 |
| 35 | $\begin{array}{lllll}3 & 38 & 25 \cdot 1\end{array}$ | - 6 | 39 | . 64 | 339 | $\cdot 59$ |  | $\cdot 54$ | $34046 \cdot 5$ | -49 | $3{ }^{3} 41154.5$ | $\cdot 44$ |
| 36 |  | $\cdot 70$ | 3 35 1 |  | $\begin{array}{llll}3 & 35 & 39 \cdot 1 \\ \\ 3\end{array}$ | . 59 |  |  | 3 $36444 \cdot 1$ |  | 3 37 | $\cdot 44$ |
| 37 | $\begin{array}{llllll}3 & 30 & 17.9 \\ 3 & 20 & 14.9\end{array}$ | $\cdot 71$ | $\begin{array}{lllll}3 & 30 & 58 \cdot 7 \\ 3 & 26 & 55 \cdot 5\end{array}$ | . 65 | $\begin{array}{lllll}3 & 31 & 36 \cdot 3 \\ 3 & 27 & 33 \cdot 4\end{array}$ | . 60 | $\begin{array}{ccc}3 & 32 & 10 \cdot 6 \\ 3 & 28 & 8 \cdot \mathrm{I}\end{array}$ |  | $\begin{array}{llll}3 & 32 & 41 \cdot 8 \\ 3 & 28 & 39\end{array}$ | 49 -49 | $\begin{array}{llll}3 & 33 & 9 \cdot 8 \\ 3 & 29 & 7 \cdot 4\end{array}$ |  |
| 38 | 32614. | 72 | 32655 | . 66 | $32733 \cdot 4$ | . 60 | 328 8•I |  | 328 |  | $\begin{array}{llll}3 & 29 & 7 \cdot 4\end{array}$ | $\cdot 44$ |
| 39 |  | + 73 | $2252 \cdot I$ | + -67 | $\begin{array}{lllllllllllllllllll}3 & 23 & 30 \cdot 5\end{array}$ | +61 | $\begin{array}{lll}3 & 24 & 5.4\end{array}$ | $+\cdot 55$ | $32437 \cdot 0$ | + 49 | $325 \quad 5 \cdot 0$ | 44 |
| 4 | 318 | $\cdot 74$ | $3{ }^{3} 1848 \cdot 7$ | . 68 | $311927 \cdot 5$ | . 62 | 3 20 2.8 <br> 1 1  | - 56 | $32034 \cdot 5$ | 50 | 3 21 $2 \cdot 7$ |  |
| 4 | 3 14 $2 \cdot 1$ <br> 3   | $\cdot 75$ | 31445.2 |  | 31524.5 | -62 | $\begin{array}{llrr}3 & 16 & 0 \cdot 2 \\ 3 & 11 & 57.4\end{array}$ | $\cdot 56$ | $\begin{array}{llll}3 & 16 & 32 \cdot 0\end{array}$ | 50 | 3178003 | $\cdot 44$ |
| 42 | $\begin{array}{lllllllllllll}3 & 9 & 57.8\end{array}$ | $\cdot 76$ | 3 $10.41 \cdot 6$ | $\cdot 70$ | $\begin{array}{lllll}3 & 11 & 21.5 \\ 3 & 7 & 18 \cdot 3\end{array}$ | . 63 | $\begin{array}{crrr}311 & 57 \cdot 4 \\ 3 & 7 & 54 \cdot 7\end{array}$ | $\cdot 57$ | $\begin{array}{crrrr}3 & 12 & 29 \cdot 6 \\ 3 & 8 & 27 \cdot 1\end{array}$ |  | $\begin{array}{crrr}3 & 12 & 58 \cdot 0 \\ 3 & 8 & 55 \cdot 6\end{array}$ | -44 |
| 43 | $\begin{array}{llll}3 & 5 & 53.4\end{array}$ | $\cdot 78$ | $\left\|\begin{array}{lll} 3 & 6 & 37.9 \end{array}\right\|$ |  | $\begin{array}{lllll}3 & 7 & 18 \cdot 3\end{array}$ |  | $3754 \cdot 7$ | $\cdot 57$ | $\begin{array}{lll} 3 & 8 & 27 \cdot 1 \end{array}$ |  | $3855 \cdot 6$ |  |
| 44 | $\begin{array}{lllll}3 & 1 & 48 \cdot 9\end{array}$ | $\begin{array}{r} \\ +\quad .79 \\ \hline 80\end{array}$ | 2 $34 \cdot 1$ <br> 58  | $+\cdot 72$ | 3 3 $15 \cdot 1$ <br> 2 59 15 | + .65 | 3 3 51 9 <br> 2 59   | + $\quad .58$ | 3 4 $24 \cdot 6$ <br> 3   | + 51 | $\begin{array}{llllllll}3 & 4 & 53.2 \\ 3 & 0 & 50.8\end{array}$ | + 44 |
| 45 | $5744 \cdot 2$ | $\cdot 80$ | $\begin{array}{lll}58 & 30 \cdot 2\end{array}$ | $\cdot 73$ | 22 59 11 8 <br> 2 5   | -66 | 259 49•I | '59 | ${ }^{3}$ | 51 | 3 O $50 \cdot 8$ |  |
| 46 | $\begin{array}{lllll}2 & 53 & 39 \cdot 3\end{array}$ | -82 | $25426 \cdot 1$ | $\cdot 74$ | $\begin{array}{lll}2 & 55 & 8 \cdot 4\end{array}$ | 68 | $25546 \cdot \mathrm{I}$ | 5 | $2{ }_{2} 5619.5$ | 5 | $2{ }^{2} 5648 \cdot 4$ |  |
| 47 | $\begin{array}{llllllllll}2 & 49 & 34 \cdot 3\end{array}$ | .83 | 2 50 21.9 <br> 2 46  | $\cdot 75$ | $\begin{array}{lll}2 & 51 & 4 \cdot 9\end{array}$ | 68 | $25143 \cdot \mathrm{I}$ |  | $\begin{array}{llll}22 & 52 & 16 \cdot 9\end{array}$ | 52 | $25246 \cdot 0$ |  |
| 48 | 24529.0 | . 85 | 2 7.6 | $\cdot 77$ | 247192 | $69$ | $24740 \cdot \mathrm{I}$ | -6I | 24814.2 | $\cdot 53$ | $24843 \cdot 6$ |  |
| 49 | $\begin{array}{llll}2 & 41 & 23.5 \\ 2 & 37 & 7.8\end{array}$ | + 87 | $\begin{array}{lllll}2 & 42 & 13.0\end{array}$ | + 78 |  | + 70 | $\begin{array}{lllllll}2 & 43 & 36 \cdot 9 \\ 2\end{array}$ | +62 | $2 \begin{array}{lllllll} & 44 & 115\end{array}$ | $+\cdot 54$ | $2444 \mathrm{I} \cdot 2$ | + 45 |
| 50 | $\begin{array}{llllll}2 & 37 & 17.8\end{array}$ | $\cdot 89$ | 2 38 $8 \cdot 4$ <br> 2 3  | .80 | 2 38 <br> 83  | $\cdot 71$ | 23933.8 | . 6 | 24088 | . 5 | $24038 \cdot 7$ |  |
| 51 | $\begin{array}{lllll}2 & 33 & 11.8\end{array}$ | 91 | 2 34 $3 \cdot 5$ <br> 24 5  | . 82 | $23449 \cdot 7$ | $\cdot 72$ | $23530 \cdot 5$ | . 64 | 236 | 55 | $23636 \cdot 2$ | 46 |
| 52 |  | 93 |  | 83 | $23045 \cdot 6$ | + | $23127 \cdot \mathrm{I}$ | . 65 | $\begin{array}{llll}2 & 32 & 3 \cdot 1\end{array}$ | 55 | $23233 \cdot 7$ | $\cdot 46$ |
| 53 | $22459 \cdot 1$ | 95 | $2 \begin{array}{llll}2 & 25 & 5 \cdot 1\end{array}$ | 85 | $22641 \cdot 3$ | 75 | 22723.6 |  | 228 | -56 | $2283 \mathrm{I} \cdot 2$ | -47 |
| 54 |  | + 97 |  | + 88 | $\begin{array}{lllll}2 & 22 & 36 \cdot 8 \\ 2\end{array}$ |  | $22320 \cdot 0$ | + 67 | $22357 \cdot 2$ | $+\cdot 57$ | $22428 \cdot 6$ | + 47 |
| 55 | $\begin{array}{llllll}2 & 16 & 45 \cdot 0\end{array}$ | 1.00 |  | $\cdot 89$ | $\begin{array}{llll}2 & 18 & 36.2 \\ 2 & 1 & 32 \cdot 3\end{array}$ | $\begin{array}{r}79 \\ 8 \\ \hline\end{array}$ | $\begin{array}{llll}2 & 19 & 16 \cdot 3 \\ 2 & 15 & 12.4\end{array}$ | . 68 | $2 \begin{array}{llll}2 & 19 & 54.2 \\ 2\end{array}$ | 5 | 220 | 4 |
| 56 | $\begin{array}{crrrr}2 & 12 & 37 \cdot 4 \\ 2 & 8 & 29 \cdot 4\end{array}$ | 1.02 <br> 1.05 | $\begin{array}{rrrrr}2 & 13 & 35 \cdot 7 \\ 2 & 0 & 20 \cdot 3\end{array}$ | -92 | $\begin{array}{llll}2 & 14 & 27.3 \\ 2 & 10 & 22.3\end{array}$ | 81 | $\begin{array}{cccc}2 & 15 & 12.4 \\ 2 & 11 & 8.4\end{array}$ | $\cdot 70$ | $2 \begin{array}{llll}2 & 151 \cdot 1 \\ 21\end{array}$ | 59 | $2 \begin{array}{llll}216 & 23.3\end{array}$ | 49 |
| 57 | 829 | 1.05 | 929.3 | -94 | 21022.3 | . 83 | 118 | - | 2 11 47.8 | . 60 | $21220 \cdot 7$ | -49 |
| 58 | 42 | I. | 522 | $\cdot 97$ | 2 $2 \quad 6 \quad 16 \cdot 9$ |  | \|274.2 | -73 | 44 |  | $\left\lvert\, \begin{array}{llll}2 & 8 & 17.9\end{array}\right.$ | $\cdot 50$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.


HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 35 LATITUDE $8^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 23^{\circ} \mathrm{O} \end{array}\right.$ | + 57 | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 57 \cdot 3 \end{array}$ | + 5.5 | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 4 & 3 I \cdot 5 \end{array}$ | $\begin{array}{r} \mathrm{S} \\ +\quad .57 \end{array}$ | $\begin{array}{\|lrl} \text { H. M. } & \text { S. } \\ 6 & 5 & 6 \cdot I \end{array}$ | + 5 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & 40 \cdot 8 \end{array}\right.$ | + ${ }^{\text {S }}$. | $\begin{array}{\|ccc\|} \hline \text { H. } & \text { M. } & \text { S. } \\ 6 & 6 & 15 \cdot 7 \end{array}$ | S. $+\quad .58$ |
| 10 | $\begin{array}{llll}5 & 22 & 48 \cdot 8\end{array}$ | $\cdot 50$ | $\begin{array}{llll}5 & 23 & 18 \cdot 5\end{array}$ | -49 | $52347 \cdot 6$ | $\cdot 48$ | $\begin{array}{llll}5 & 24 & 16 \cdot 0\end{array}$ | -47 | $52443 \cdot 9$ | $\cdot 46$ | 525 II 2 | $\cdot 45$ |
| 12 | $51442 \cdot 5$ | -49 | 5 I5 II.4 | -47 | $\begin{array}{llllllllllllllll}5 & 15 & 39 \cdot 6\end{array}$ | -46 | 51670 | -45 | $51633 \cdot 5$ | -44 | 5 16 59.4 | -42 |
| 14 | $\begin{array}{llll}5 & 6 & 36 \cdot 4\end{array}$ | -48 | $\begin{array}{llll}5 & 7 & 4 \cdot 5\end{array}$ | -46 | $\begin{array}{llll}5 & 7 & 31 \\ 4\end{array}$ | -45 | $\begin{array}{llll}5 & 7 & 58 \cdot 1\end{array}$ | -43 | $5{ }^{5} \quad 8 \quad 833 \cdot 5$ | -41 | $55847 \cdot 9$ | 40 |
| 16 | $45830 \cdot 4$ | $\cdot 47$ | $458 \quad 57 \cdot 9$ | -45 | 459 24.2 | -43 | $45949 \cdot 5$ | -4I | $5 \quad 5013.7$ | -39 | $5 \quad 0 \quad 36 \cdot 7$ | 37 |
| 18 | $45024 \cdot 6$ | + $\cdot 46$ | 5051.4 | + $\cdot 43$ | 45116.9 | + 41 | 45 I 41• | + 39 | 452 4.I | + 37 | $4 \quad 5225 \cdot 8$ | $+\cdot 35$ |
| 20 | $4 \begin{array}{llllll}4 & 42 & 18\end{array}$ | $\cdot 45$ | 44245.0 | -42 | 443 9.7 | -40 | 44333.0 | $\cdot 37$ | 443 | -35 | 444 I5.I | $\cdot 33$ |
| 22 | $\begin{array}{lllll}4 & 34 & 13.3\end{array}$ | -44 | $434 \begin{array}{llll}4 & 38 \cdot 8\end{array}$ | -41 | $\begin{array}{lll}4 & 35 & 2 \cdot 7\end{array}$ | -38 | $435 \quad 25 \cdot 0$ | $\cdot 36$ | $43545 \cdot 6$ | -33 | $4 \begin{array}{lll}4 & 36 & 4 \cdot 7\end{array}$ | -30 |
| 2 | $\begin{array}{llll}4 & 26 & 7 \cdot 9\end{array}$ | $\cdot 43$ | $4 \begin{array}{llll}4 & 26 & 32 \cdot 8\end{array}$ | -40 | 42655.9 | $\cdot 37$ | $42717 \cdot 2$ | -34 | $42736 \cdot 7$ | -3I | $427 \quad 54.4$ | - 28 |
| 26 | $\begin{array}{llll}4 & 18 & 2.5\end{array}$ | $\cdot 42$ | $\begin{array}{lllll}4 & 18 & 26.9\end{array}$ | -39 | $4 \begin{array}{lllllll}4 & 189\end{array}$ | -35 | $4 \begin{array}{lll}4 & 19 & 9 \cdot 6\end{array}$ | -32 | 4 19 28.0 | -29 | 41944.4 | -26 |
| 28 | $4 \quad 957 \cdot 3$ | + 4 I | 1021.0 | + 38 | $41042 \cdot 7$ | + 34 | 4 II 2•I | + 30 | 4 II 19*4 | + 27 | 4 II $34 \cdot 5$ | + $\cdot 23$ |
| 30 | 4 I 52.I | -41 | $\begin{array}{lrrr}4 & 2 & 15.4\end{array}$ | $\cdot 37$ | $4 \quad 2 \begin{array}{lll}4 & 36 \cdot 3\end{array}$ | -33 | 4 2 $54 \cdot 8$ | $\cdot 29$ | $4 \quad 3110$ | -25 | $\begin{array}{llll}4 & 3 & 24 \cdot 8\end{array}$ | -21 |
| 31 | $\begin{array}{llll}3 & 57 & 49 \cdot 5\end{array}$ | $\cdot 40$ |  | - 36 |  | -32 | $\begin{array}{llll}3 & 58 & 5 \mathrm{I} \cdot 2\end{array}$ | - 28 | 35960 | -24 | $35920 \cdot 0$ | - 20 |
| 32 | $35347 \cdot 0$ | $\cdot 40$ | $\begin{array}{lll}3 & 54 & 9 \cdot 8\end{array}$ | -36 | $35430 \cdot 0$ | -3I | $35447 \cdot 7$ | $\cdot 27$ | $\begin{array}{llll}3 & 55 & 2 \cdot 8\end{array}$ | -23 | $35515 \cdot 2$ | -19 |
| 33 | $34944 \cdot 5$ | -40 | $350 \quad 7 \cdot 0$ | -35 | $35027 \cdot 0$ | -3I | $35044 \cdot 2$ | -26 | $35058 \cdot 7$ | -22 | 3 51 10. 5 | $\cdot 17$ |
| 34 | $34542 \cdot 0$ | + 39 | 34643 | + 35 | $3 \begin{array}{llll}36 & 23.9\end{array}$ | + 30 | $34^{3} 4640 \cdot 7$ | $+.26$ | $34654 \cdot 6$ | $+21$ | 347508 | -16 |
| 35 | 34139.5 | -39 | $\begin{array}{lll}3 & 42 & \text { 1.6 }\end{array}$ | -34 | $34220 \cdot 9$ | -29 | $\begin{array}{lllll}3 & 42 & 37 \cdot 2\end{array}$ | - 25 | $34250 \cdot 6$ | 20 | 343 I I I | -15 |
| 3 | $33737 \cdot 0$ | -39 | $3 \begin{array}{llll}37 & 59 & 0\end{array}$ | -34 | $\begin{array}{llll}3 & 38 & 17.9\end{array}$ | -29 | 3 $33^{88} 333 \cdot 8$ | . 24 | $\begin{array}{lllllllllllllll}3 & 38 & 46 \cdot 6\end{array}$ | -19 | $\begin{array}{lllllllllllllll}3 & 38 & 56 \cdot 5\end{array}$ | -14 |
| 37 | $\begin{array}{lllll}3 & 33 & 34 \cdot 6\end{array}$ | -39 | $3 \begin{array}{llllllllllll}3 & 36 \cdot 3\end{array}$ | -33 | 33414.9 | -28 | $\begin{array}{lllll}3 & 34 & 30 \cdot 4\end{array}$ | - 23 |  | - 18 | $\begin{array}{lllll}3 & 34 & 5 \mathrm{I} \cdot 8\end{array}$ | -13 |
| 38 | $32932 \cdot 2$ | -38 | $32953 \cdot 7$ | -33 | 33012.0 | $\cdot 28$ | $33027 \cdot 0$ | - 22 | $3 \begin{array}{llll}3 & 30 & 38 \cdot 8\end{array}$ | -17 | $3 \begin{array}{llll}3 & 30 & 47 & \end{array}$ | -II |
| 39 | $\begin{array}{llll}3 & 25 & 29.7\end{array}$ | + 38 | 325 5I•I | + 33 | $\begin{array}{lll}3 & 26 & 9 \cdot 0\end{array}$ | + 27 | $\begin{array}{llll}3 & 26 & 23 \cdot 6\end{array}$ | + 21 | $\begin{array}{llll}3 & 26 & 34.9\end{array}$ | + -16 | $\begin{array}{lllll}3 & 26 & 42 \cdot 7\end{array}$ | + -10 |
| 4 | $\begin{array}{llll}3 & 21 & 27.4\end{array}$ | -38 | $3 \begin{array}{llllllllllll}3 & 21 & 48 \cdot 5\end{array}$ | -32 | $3226 \cdot 1$ | -26 | $\begin{array}{llll}3 & 22 & 20 \cdot 3\end{array}$ | -2I | $32231 \cdot 0$ | - I5 | $\begin{array}{llll}3 & 22 & 38 \cdot 1\end{array}$ | -09 |
| 4 | 3 I7 25.0 | -38 | $31745 \cdot 9$ | -32 | $\begin{array}{llll}3 & 18 & 3 \cdot 3\end{array}$ | -26 | $\begin{array}{llllll}3 & 18 & 17 & 0\end{array}$ | -20 | 3 I8 $27 \cdot 1$ | -14 | 3 I8 $33 \cdot 6$ | 08 |
| 4 | $\begin{array}{llll}3 & 13 & 22.5\end{array}$ | - 8 | $3 \begin{array}{llll}3 & \text { I3 } & 43.4\end{array}$ | -31 | $\begin{array}{llr}3 & 14 & 0.4 \\ 3 & 9 & 57.6\end{array}$ | $\cdot 25$ | $\begin{array}{llll}3 & 14 & 13.8\end{array}$ | -19 | $\begin{array}{llll}3 & 14 & 23 \cdot 3\end{array}$ | - I3 | 314429.0 | -06 |
| 43 | $\begin{array}{llll}3 & 9 & 20.2\end{array}$ | -38 | $\begin{array}{lllll}3 & 9 & 40 \cdot 8\end{array}$ | -3I | $\begin{array}{llllllllllllll}3 & 9 & 57 \cdot 6\end{array}$ | -25 | $31010 \cdot 5$ | - I8 | 3 10 19.5 | -12 | 3 10 24.5 | -05 |
| 44 | 35177.8 | $\cdot 38$ | $3 \quad 5 \quad 38$ | + 31 | $\begin{array}{llll}3 & 5 & 54 \cdot 8\end{array}$ | + 24 | $\begin{array}{lll}3 & 6 & 7 \cdot 3\end{array}$ | + -17 | $3 \begin{array}{llll}3 & 6 & 15.7\end{array}$ | + - II | $3620 \cdot 0$ | + 04 |
| 45 | 3 1 15.4 <br>  57 15.4 | $\cdot 37$ | $\begin{array}{rrrr}3 & 1 & 35 \cdot 8 \\ 2 & 57 & 33.3\end{array}$ | $\cdot 30$ | 3 1 52.0 <br> 2 5  | $\cdot 24$ | [2 $4 \cdot 1$  <br> 2 58  | -17 | $\begin{array}{lrr}3 & 2 & 115 \\ 2 & 5 & 9\end{array}$ | -10 | $\begin{array}{lrrr}3 & 2 & 15 \cdot 5 \\ 2 & 5 & 5\end{array}$ | -02 |
| 46 | $25713 \cdot 1$ | $\cdot 37$ |  | -30 | $25749 \cdot 3$ | -23 | $\begin{array}{llll}2 & 58 & 0.9\end{array}$ | -16 | $\begin{array}{llll}2 & 58 & 8 \cdot 2\end{array}$ | -08 | 258 II•I | Or |
| 47 | $2 \begin{array}{llll}2 & 53 & 10 \cdot 7\end{array}$ | $\cdot 37$ | $\begin{array}{lllll}2 & 53 & 30 \cdot 9\end{array}$ | $\cdot 30$ | $25346 \cdot 5$ | - 22 | $25357 \cdot 7$ | -15 | $2 \begin{array}{lll}2 & 54 & 4 \cdot 4\end{array}$ | -07 | 25466 | -00 |
| 4 | $\begin{array}{llll}2 & 49 & 8 \cdot 4\end{array}$ | $\cdot 37$ | $249 \quad 28 \cdot 4$ | $\cdot 29$ | $24943 \cdot 8$ | $\cdot 22$ | $24954 \cdot 6$ | -14 | 250 | 6 | $250 \quad 2 \cdot 1$ | - 02 |
| 49 | $245 \quad 6 \cdot 0$ | + 37 | $2 \begin{array}{lll}2 & 45 & 25.9\end{array}$ | + . 29 | $2454 \mathrm{I} \cdot \mathrm{I}$ | + 21 | $2455 \mathrm{I} \cdot 4$ | + 13 | 245 57.0 | +.05 | $245 \quad 57 \cdot 6$ | .03 |
| 50 | 2415 | $\cdot 37$ | 24123.5 | -29 | 2 | -2I | $24148 \cdot 4$ | -12 | $24 \mathrm{I} 53 \cdot 3$ | - | $24 \mathrm{I} 53 \cdot \mathrm{I}$ | -04 |
| 51 | $\begin{array}{llll}2 & 37 & 1 \cdot 2\end{array}$ | $\cdot 37$ | $23712 I \cdot I$ | $\cdot 29$ |  | -20 | $23745 \cdot 2$ | -II | $23749 \cdot 5$ | . 03 | $23748 \cdot 5$ | 06 |
| 52 | $23258 \cdot 9$ | -37 | $2 \begin{array}{lllll} & 33 & 18 \cdot 7\end{array}$ | -28 | 233 33-1 | -20 | $23342 \cdot 2$ | -II | $23345 \cdot 8$ | + OI | $23344^{\circ} \mathrm{O}$ | 08 |
| 53 | $22856 \cdot 5$ | -37 | 229 16.3 | -28 | $22930 \cdot 5$ | -19 | $22939 \cdot 1$ | 10 | $22942 \cdot 1$ | . 00 | 22939.5 | -09 |
| 54 | 22454.2 | + 38 | 22513.9 | + 28 | $225 \quad 27 \cdot 8$ | + 18 | $22536 \cdot 0$ | + .09 | $225138 \cdot 4$ | - 01 | 22534.9 | 11 |
| 55 | $2205 \mathrm{I} \cdot 8$ | $\cdot 38$ | 221 II.5 | - 28 | 22125.2 | -18 | 22133.0 | -08 | 22134.7 | $\cdot 02$ | $22130 \cdot 3$ | 12 |
| 56 | $2 \mathrm{I} 649 \cdot 4$ | -38 | $\begin{array}{llll}2 & 17 & 9 \cdot 1 \\ 2 & 13 & 6 \cdot 8\end{array}$ | $\cdot 28$ | $\begin{array}{lllll}2 & 17 & 22.6\end{array}$ | 17 | $\begin{array}{llll}2 & 17 & 30.0\end{array}$ | -07 | $\begin{array}{llll}2 & 17 & 31.0\end{array}$ | -04 | $\begin{array}{llll}2 & 17 & 25 \cdot 7\end{array}$ | 14 |
| 57 | $\begin{array}{rrrr}2 & 12 & 47 \cdot 0 \\ 2 & 8 & 44.5\end{array}$ | -38 | $\begin{array}{rrrr}2 & 13 & 6 \cdot 8 \\ 2 & 9 & 4 \cdot 4\end{array}$ | - 28 | $\begin{array}{llll}2 & 13 & 20 \cdot 1 \\ 2 & 9 & 17.5\end{array}$ | $\cdot 17$ | $\begin{array}{llll}2 & 13 & 27.0 \\ 2 & 9 & 23.9\end{array}$ | -06 | $\begin{array}{llll}2 & 13 & 27.3\end{array}$ | -05 | $\begin{array}{llll}2 & 13 & 21.1 \\ 2\end{array}$ | 16 |
| 58 | 2844.5 | $\cdot 39$ | $\begin{array}{lll}2 & 9 & 4.4\end{array}$ | $\cdot 27$ | 2917.5 | $\cdot 16$ | $2 \quad 9 \quad 23.9$ | $\cdot 05$ | $923 \cdot 6$ | -06 | $2 \quad 916.4$ | -18 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ | A. | L. 7 | A. |  | L. $8^{\circ}$ | A. |  | L. $9^{\circ}$ | A. |  | L. 10 | A. | L. $11^{\circ} \mathrm{A}$. |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. $+\quad .43$ | $\begin{gathered} \text { s. } \\ -4 \cdot 06 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad-50 \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4.07 \end{gathered}$ |  | ${ }^{\text {s. }}$ | $\begin{gathered} \text { s. } \\ -4 \bullet 08 \end{gathered}$ |  | S. .65 | $\begin{gathered} \text { s. } \\ -4.09 \end{gathered}$ |  | S. $\cdot 72$ | $\begin{gathered} \text { s. } \\ -4 \cdot 10 \end{gathered}$ |  | s. $\cdot 79$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot \mathrm{II} \end{gathered}$ |
| 4 | - 39 | 4.06 | -. 46 | 4.06 |  | . 53 | 4.07 |  | . 61 | 4.08 |  | . 68 | -4.09 |  | .75 | 4.11 |
| 8 | $\cdot 35$ | 4.05 | $\cdot 42$ | 4.06 |  | - 50 | 4.07 |  | $\cdot 57$ | 4.08 |  | - 64 | 4.09 |  | $\cdot 72$ | $4 \cdot 10$ |
| 12 | -31 | 4.05 | $\cdot 39$ | 4.06 |  | -46 | 4.06 |  | - 54 | 4.07 |  | -61 | 4.08 |  | -68 | $4 \cdot 10$ |
| 16 | -28 | 4.05 | -35 | 4.05 |  | -43 | 4.06 |  | - 50 | $4 \cdot 07$ |  | -58 | 4.08 |  | . 65 | 4.09 |
| 20 | + 25 | 4.05 | + 32 | 4.05 |  |  | 4.06 |  | -47 | 4.07 |  | $\cdot 55$ | 4.08 |  | . 63 | 4.09 |
| 22 | - 23 | 4.05 | $\cdot 31$ | $4 \cdot 05$ |  | $\cdot 38$ | 4.06 |  | $\cdot 46$ | 4.06 |  | - 54 | 4.07 |  | . 62 | 4.09 |
| 24 | -21 | 4.04 | $\cdot 29$ | 4.05 |  | -37 | 4.05 |  | $\cdot 45$ | 4.06 |  | -53 | $4 \cdot 07$ |  | -60 | 4.08 |
| 26 | - 20 | 4.04 | -28 | $4 \cdot 05$ |  | -35 | $4 \cdot 05$ |  | -43 | 4.06 |  | $\stackrel{.51}{ }$ | $4 \cdot 07$ |  | $\cdot 59$ | 4.08 |
| 28 | -18 | 4.04 | -26 | 4.05 |  | -34 | 4.05 |  | $\cdot 42$ | 4.06 |  | -50 | $4 \cdot 07$ |  | $\cdot 58$ | 4.08 |
| 30 | + . 16 | 4.04 | + 25 | 4.05 | $+$ | $\cdot 33$ | 4.05 |  | 4 I | 4.06 |  | $\cdot 49$ | 4.07 |  | -58 | 4.08 |
| 32 | $\cdot 15$ | $4 \cdot 04$ | $\cdot 23$ | $4 \cdot 04$ |  | $\cdot 31$ | $4 \cdot 05$ |  | 40 | 4.06 |  | 48 | 4.07 |  | - 57 | 4.08 |
| 34 | -13 | $4 \cdot 04$ | - 22 | $4 \cdot 04$ |  | $\cdot 30$ | 4.05 |  | -39 | $4 \cdot 06$ |  | $\cdot 47$ | 4.07 |  | $\cdot 56$ | 4.08 |
| 36 | -II | 4.04 | -20 | $4 \cdot 04$ |  | -29 | 4.05 |  | -38 | 4.06 |  | -46 | 4.07 |  | $\cdot 55$ | 4.08 |
| 38 | - 10 | 4.04 | -19 | $4 \cdot 04$ |  | -28 | 4.05 |  | -37 | 4.05 |  | $\cdot 46$ | 4.06 |  | $\cdot 55$ | 4.08 |
| 40 | +.08 | $4 \cdot 04$ | + 17 | $4 \cdot 04$ |  | . 26 | $4 \cdot 05$ |  | $\cdot 36$ | 4.05 |  | $\cdot 45$ | 4.06 |  | - 54 | 4.07 |
| 42 | . 06 | $4 \cdot 04$ | -16 | 4.04 |  | $\cdot 25$ | 4.05 |  | $\cdot 35$ | 4.05 |  | -44 | 4.06 |  | -54 | 4.07 |
| 44 | - 04 | 4.04 | - 14 | 4.04 |  | - 24 | 4.05 |  | -34 | 4.05 |  | $\cdot 44$ | 4.06 |  | - 54 | 4.07 |
| 46 | . 03 | 4.04 | -13 | $4 \cdot 04$ |  | -23 | 4.05 |  | $\cdot 33$ | 4.05 |  | $\cdot 43$ | 4.06 |  | -54 | 4.07 |
| 48 | + -01 | $4 \cdot 04$ | - II | $4 \cdot 04$ |  | $\cdot 22$ | 4.04 |  | -32 | 4.05 |  | $\cdot 43$ | 4.06 |  | - 54 | $4 \cdot 07$ |
| 50 | - . 01 | 4.04 | + 10 | $4 \cdot 04$ |  | . 21 | $4 \cdot 04$ |  |  | 4.05 |  |  | 4.06 |  |  | 4.08 |
| 52 | $\cdot 03$ | $4 \cdot 04$ | $\bullet 8$ | $4 \cdot 04$ |  | - 20 | 4.04 |  | $\cdot 31$ | 4.05 |  | $\cdot 43$ | 4.06 |  | - 54 | 4.08 |
| 54 | -06 | 4.04 | $\bullet 06$ | $4 \cdot 04$ |  | -18 | $4 \cdot 04$ |  | $\cdot 30$ | 4.05 |  | $\cdot 43$ | 4.06 |  | - 54 | 4.08 |
| 56 | - 08 | 4.04 | $\bullet 05$ | 4.04 |  | $\cdot \cdot 17$ | $4 \cdot 04$ |  | $\cdot 30$ | 4.05 |  | $\cdot 43$ | 4.06 |  | - 56 | 4.08 |
| 58 | 10 | $4 \cdot 04$ | -03 | $4 \cdot 04$ |  | -16 | 4.04 |  | $\cdot 30$ | 4.05 |  | -43 | 4.06 |  | -57 | 4.08 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl Var | $14^{\circ}$ | Dec | $15^{\circ}$ | De | $16^{\circ}$ | Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \mathrm{H}, \mathrm{M} . & \mathrm{S} . \\ 6 & 6 & 50 \cdot 8 \end{array}$ | S. $+\quad .59$ | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 7 & 26 \cdot 2 \end{array}$ | $+\cdot 59$ | $\begin{array}{\|ccl} \text { H. M. } & \text { S. } \\ 6 & 8 & \text { I. } 9 \end{array}$ | $+.60$ | $\begin{array}{\|ccc\|} \text { H. M. } & \text { S. } \\ 6 & 8 & 37 \cdot 9 \end{array}$ | $+.60$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 9 & 14 \cdot 3 \end{array}\right\|$ |  | $\begin{array}{lccc} \text { H. M. } & \text { S. } \\ 6 & 9 & 5 \mathrm{I} \cdot \mathrm{O} \end{array}$ | $\begin{aligned} & \mathrm{s} \\ & .6 \end{aligned}$ |
| IO | $5 \begin{array}{llll}5 & 25 & 37.9\end{array}$ | + 44 | $\begin{array}{lll}5 & 26 & 4.0\end{array}$ | + 43 | $\begin{array}{llll}5 & 26 & 29.5\end{array}$ | + 42 | $\begin{array}{lll}6 & 86 & 37 \cdot 9 \\ 5 & 26 & 54.6\end{array}$ | + 60 |  9 10.3 <br> 5 27 19.0 | + 61 | 9 27 27 $43 \cdot 0$ |  |
| 12 | 51724.5 | $\cdot 41$ | $\begin{array}{lllll}5 & 17 & 48.9\end{array}$ | -40 | $\begin{array}{llll}5 & 18 & 12.5\end{array}$ | -39 | $\begin{array}{llll}5 & 18 & 35 \cdot 4\end{array}$ | $\cdot 37$ | $\begin{array}{lllll}5 & 18 & 57.6\end{array}$ | -36 | $\begin{array}{ll}5 & 19 \\ 19 & 19\end{array}$ | 35 |
| 14 | $5{ }_{5}^{5} 9111 \cdot 5$ | -38 | $5 \quad 9 \quad 34 \cdot 1$ | -37 | $\begin{array}{lllll}5 & 9 & 55.8\end{array}$ | -35 | $5 \quad 1016 \cdot 6$ | -34 | 5 10 $36 \cdot 5$ | -32 | 5 10 $55 \cdot 5$ | 31 |
| 16 | $5 \quad 0 \quad 58 \cdot 7$ | -36 | 5 I 19.6 | $\cdot 34$ | 5 I I 39.4 | -32 | 5 I $58 \cdot 2$ | 0 | $\begin{array}{llll}5 & 2 & 15.8\end{array}$ | -28 | $\begin{array}{llll}5 & 2 & 32.4\end{array}$ | 27 |
| 18 | $45246 \cdot 3$ | + 33 | $453 \quad 5 \cdot 4$ | + 31 | 45323.4 | + 29 | 453 40•1 | + 27 | $45355 \cdot 5$ | + 24 | $454 \quad 9 \cdot 6$ | + 22 |
| 20 | $44434 \cdot 1$ | -30 | 444 5I.5 | -28 | $445 \quad 7 \cdot 6$ | -26 | $\begin{array}{llll}4 & 45 & 22 \cdot 3\end{array}$ | -23 | $4 \quad 45 \quad 35 \cdot 4$ | $\cdot 2$ | $44547 \cdot 1$ | 8 |
| 22 | $43622 \cdot I$ | -28 | $\begin{array}{lllll}4 & 36 & 37 \cdot 9\end{array}$ | $\cdot 25$ | $436 \quad 52 \cdot \mathrm{I}$ | -22 | $43704 \cdot 6$ | -19 | $437 \quad 15.5$ | 7 | $437 \quad 24 \cdot 8$ | 14 |
| 24 | 42810.4 | $\cdot 25$ | $428 \quad 24 \cdot 5$ | - 22 | $428136 \cdot 8$ | -19 | 4288773 | -16 | $4 \quad 28 \quad 55.8$ | 13 | $\begin{array}{lll}4 & 29 & 2.6\end{array}$ | 10 |
| 26 | $\begin{array}{llll}4 & 19 & 58.8\end{array}$ | -22 | 420 II. 2 | -19 | $42021 \cdot 6$ | -15 | $42030 \cdot 0$ | -12 | $4 \quad 20 \quad 36 \cdot 4$ | -09 | $42040 \cdot 6$ |  |
| 28 | 4 II $47 \cdot 4$ | + 20 | 4 II 58.2 | + -16 |  | + •12 | 41212.9 | + 08 | 4 I2 17.0 | +.05 | 41218.6 | + |
| 30 | $\begin{array}{llll}4 & 3 & 36 \cdot 2\end{array}$ | -17 | $4 \quad 3 \quad 45 \cdot 2$ | - 13 | $4 \quad 3$ 5I•8 | -09 | $4 \quad 3 \quad 55 \cdot 9$ | -05 | $4 \quad 3 \quad 57 \cdot 6$ | + -01 | $4 \quad 3 \quad 56 \cdot 7$ | - 03 |
| 31 | $35930 \%$ | -16 | $\begin{array}{lllll}3 & 59 & 38 \cdot 8\end{array}$ | -1 | 35944.4 | -07 | $35947 \cdot 5$ | -03 | $35947 \cdot 9$ | - -OI | $35945 \cdot 8$ | 06 |
| 32 | $35^{3} 5512511$ | -I4 | $355 \quad 32 \cdot 4$ | 10 | $355 \quad 37 \cdot 1$ | -05 | $35539 \cdot 0$ | + . OI | $355188 \cdot 3$ | -03 |  | 08 |
| 33 | 3519.6 | -1 | $35126 \cdot 0$ | 8 |  | - 0 | $35130 \cdot 5$ | - or |  | -06 | 3 51 23.7 |  |
| 34 | 347 I4.1 | + | $34719 \%$ | + .07 | $\begin{array}{llll}3 & 47 & 22 \cdot 3\end{array}$ | + .02 | $34722 \cdot 0$ | . 03 | 34748.8 | - . 08 | 347 12.7 | 13 |
| 3 | $\left\lvert\, \begin{array}{llll}3 & 43 & 8 \cdot 7\end{array}\right.$ | -10 | $3 \quad 43$ I $3 \cdot 3$ | . 05 | $34315 \cdot 0$ | -00 | $\begin{array}{lllllllllll}3 & 43 & 13.6\end{array}$ | 5 | $\begin{array}{llll}3 & 43 & 9 \cdot 1\end{array}$ | 0 | $\begin{array}{llll}3 & 43 & 1 \cdot 5\end{array}$ | 5 |
| 36 | $\begin{array}{llll}3 & 39 & 3 \cdot 3\end{array}$ | -09 | $\begin{array}{llll}3 & 39 & 7 \cdot 0\end{array}$ | . 03 | $\begin{array}{llll}3 & 39 & 7 \cdot 6\end{array}$ | -02 | $\begin{array}{llll}3 & 39 & 5 \cdot 1\end{array}$ | 7 | $\begin{array}{lllll}3 & 38 & 59 \cdot 3\end{array}$ | -12 | $\begin{array}{llll}3 & 38 & 50 \cdot 4\end{array}$ |  |
| 37 | $\begin{array}{llllll}3 & 34 & 57 \cdot 9\end{array}$ | - 07 | $\begin{array}{llll}3 & 35 & 0.7\end{array}$ | + .02 | $\begin{array}{llll}3 & 35 & 0.3\end{array}$ | . 03 | $\begin{array}{llll}3 & 34 & 56 \cdot 5\end{array}$ | -09 | $3 \begin{array}{lllllllllll}3 & 34 & 49\end{array}$ | $\cdot 14$ | $\begin{array}{lllll}3 & 34 & 39 \cdot 2\end{array}$ |  |
| 38 | $33052 \cdot 5$ | -06 | 33054.4 | 0 | $3 \begin{array}{llll}3 & 30 & 52 \cdot 9\end{array}$ | -05 | $33048 \cdot 0$ | $\cdot \mathrm{I}$ | $\begin{array}{lllll}3 & 30 & 39.7\end{array}$ | -17 | $3 \begin{array}{llll}3 & 30 & 27 \cdot 8\end{array}$ | 23 |
| 39 | $\begin{array}{llll}3 & 26 & 47 \cdot 1\end{array}$ | + | $32648 \cdot 1$ | - | $\begin{array}{llll}3 & 26 & 45 \cdot 5\end{array}$ | -07 | $\begin{array}{llll}3 & 26 & 39 \cdot 5\end{array}$ | - -13 | $\begin{array}{llll}3 & 26 & 29 \cdot 8\end{array}$ | -19 |  | 25 |
| 40 | $32241 \cdot 7$ | .03 | 322 4I•8 | -03 | $32238 \cdot 1$ | 9 | $\begin{array}{llll}3 & 22 & 30 \cdot 8\end{array}$ | -15 |  | - 21 | $3225 \cdot 0$ | 2 |
| 41 | $\begin{array}{lllll}3 & \text { I8 } & 36 \cdot 4\end{array}$ | + -01 | $\begin{array}{llll}3 & 18 & 35 \cdot 4\end{array}$ | . 05 | $\begin{array}{lllll}3 & 18 & 30 \%\end{array}$ | - II | 318 | 7 | $\begin{array}{llll}3 & 18 & 9.8\end{array}$ | - 24 |  | -30 |
| 42 | $31431 \cdot 0$ | -00 | 3 I4 29.I |  | $314 \begin{array}{llll}3 & 14 & 3\end{array}$ | 13 |  | -20 | $\begin{array}{lllll}3 & 13 & 59.6\end{array}$ | - 26 | $31341 \cdot 7$ | $\cdot 33$ |
| 43 | $31025 \cdot 6$ | - 01 | 3 10 22.7 | -08 | 3 10 15.8 | -15 | $3104 \%$ | -22 | $\begin{array}{lllll}3 & 9 & 49.4\end{array}$ | - 29 | $\begin{array}{llll}3 & 9 & 29.9\end{array}$ |  |
| 44 | $\left(\begin{array}{lll}3 & 6 & 20 \cdot 3\end{array}\right.$ | 3 |  | - -10 | $\begin{array}{lll}3 & 6 & 8 \cdot 3\end{array}$ | 17 | $\begin{array}{llll}3 & 5 & 55 \cdot 8\end{array}$ |  |  | $\cdot 31$ | 33 5 17 | -39 |
| 45 | $\begin{array}{llllll}3 & 2 & 14.9\end{array}$ |  | $3 \quad 2100$ | -12 | $\begin{array}{llll}3 & 2 & 0.6\end{array}$ | 19 | 3 I $46 \cdot 9$ | $\cdot 27$ | $\begin{array}{llll}3 & 1 & 28.6\end{array}$ | -34 | $3 \begin{array}{lll}3 & 1 & 5.8\end{array}$ | 4 |
| 46 | $\begin{array}{llll}2 & 58 & 9 \cdot 5\end{array}$ | -06 | $\begin{array}{lll}2 & 58 & 3 \cdot 5\end{array}$ | 14 | 25753.0 | 21 | $\begin{array}{llll}2 & 57 & 37 \cdot 9\end{array}$ | -29 | 25717.9 | $\cdot 37$ | $\begin{array}{lllllllllllllllll}2 & 56 & 53 \cdot 4\end{array}$ | 45 |
| 47 | 2 54 $4 \cdot 1$ <br> 2   | -08 | 253 57.1 | -16 | $25315 \cdot 3$ | -24 | $2 \begin{array}{llll}2 & 53 & 28 \cdot 8\end{array}$ | $\cdot 32$ | $2 \begin{array}{llll}2 & 53 & 7.4\end{array}$ | O | $25241 \cdot 0$ | 4 |
| 48 | $24958 \cdot 7$ | 1 | $24950 \cdot 5$ | -18 | $24937 \cdot 5$ | - 26 | $2 \quad 4919.5$ | $\cdot 34$ | $248 \quad 56 \cdot 5$ | -43 | $\begin{array}{lllll}2 & 48 & 28 \cdot 2\end{array}$ | 51 |
| 49 | 24553 | - - II | $24544{ }^{\circ} \mathrm{O}$ | - 20 | $245 \quad 29.6$ | $\cdot 28$ | 245 IO.I | -37 | $24445 \cdot 4$ | - 46 | $24415 \cdot 2$ | . 55 |
| 50 | $24147 \cdot 8$ | -13 | $2 \begin{array}{lllll}2 & 41 & 37 \cdot 4\end{array}$ |  | $24121 \cdot 7$ | -31 | $2 \begin{array}{lll}2 & 41 & 0.6\end{array}$ | -40 | 240 34.I | -49 | $240 \begin{array}{ll}2 \cdot 0\end{array}$ | 5 |
| 51 | $\begin{array}{llllll}2 & 37 & 42 \cdot 3\end{array}$ | - 15 | $23730 \cdot 7$ | - 24 | 23713.6 | -33 | $23^{2} 3650 \cdot 8$ | -42 |  | $\cdot 52$ | 23548.4 | -62 |
| 52 | $1 \begin{array}{lll}2 & 33 & 36 \cdot 7\end{array}$ | 17 | $\begin{array}{llll}2 & 33 & 23.9\end{array}$ | - 26 | $\begin{array}{llll}2 & 33 & 5.4\end{array}$ | -36 | $23241 \cdot 0$ | -45 | $\begin{array}{lllllllllllllllll}2 & 32 & 10.9\end{array}$ | -55 | $2 \mathrm{lll} 34 \cdot 6$ | 66 |
| 53 | $2293 \mathrm{I} \cdot \mathrm{I}$ | 9 | 229 I7.0 | - 28 | 228 57.0 | $\cdot 3^{8}$ | 22831.0 | -48 | 22758.8 | -59 | $227 \quad 20 \cdot 4$ | . 69 |
| 54 | $\begin{array}{llll}2 & 25 & 2\end{array}$ | - 21 | 225 10.1 | - 31 | $224 \begin{array}{llll}2 & 48 & 5\end{array}$ | -41 | $22420 \cdot 7$ | $\cdot 52$ | $22346 \cdot 5$ | - 62 | $\begin{array}{llll}2 & 23 & 5.8\end{array}$ | 74 |
| 55 | $\begin{array}{llll}2 & 21 & 19.8\end{array}$ | $\cdot 23$ | $\begin{array}{llll}2 & 21 & 3.0 \\ 2\end{array}$ | -33 | $220 \begin{array}{llll}2 & 39 \cdot 9\end{array}$ | 44 | 22010.3 | $\cdot 55$ | $2 \begin{array}{llll}2 & 19 & 33.9\end{array}$ | 66 | $2 \begin{array}{llll}2 & 18 & 50.7\end{array}$ | 78 |
| 56 | $2 \begin{array}{llll}2 & 17 & 14.0\end{array}$ | $\cdot 25$ | 2 I6 55.8 |  | $21631 \cdot 0$ | $\cdot 47$ | $2 \begin{array}{lllllll} & 15 & 59.4\end{array}$ | 5 | $2 \begin{array}{lllll} & 15 & 20.9\end{array}$ | $\cdot 70$ | $2 \begin{array}{llll}14 & 35 \cdot 2\end{array}$ | 82 |
| 58 | $\begin{array}{lll}2 & 13 & 8 \cdot 2 \\ 2 & 9 & 2 \cdot 2\end{array}$ | - 27 | $\begin{array}{rrrr}2 & 12 & 48 \cdot 5\end{array}$ | $\cdot 38$ | $\begin{array}{rrrr}2 & 12 & 22.0 \\ 2 & 8 & 12.7\end{array}$ | -50 | $2 \begin{array}{llll}2 & \text { I } & 48 \cdot 4\end{array}$ | . 62 | 2   <br>  II $7 \cdot 5$ | $\cdot 74$ | 2 10 19.2 | $\cdot 87$ |
| 58 | $\begin{array}{lll}2 & 9 & 2 \cdot 2\end{array}$ | -29 | 2841.0 |  | 812.7 | $\cdot 53$ | 12737.0 | -66 | $2 \quad 653.6$ |  | 2662.5 | $\cdot 92$ |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.


## LATITUDE $8^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\begin{array}{lcc}\text { H. M. } & \text { S. } \\ 6 & \text { IO } & 28 \cdot 1\end{array}$ | + ${ }^{\text {S }}$. 62 | $\begin{array}{lll}\text { H. M. } & \text { S. } \\ 6 \mathrm{II} & 5 \cdot 7\end{array}$ | + .63 | $\begin{array}{lcc}\text { H. M. } & \text { S. } \\ 6 & \text { II } & 43 \cdot 7\end{array}$ | + 64 | $\begin{array}{ccc}\text { H. M. } & \text { S. } \\ 6 & \text { I2 } & 22.2\end{array}$ | + 64 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 13 & \mathrm{I} \cdot 2 \end{array}$ | -65 | $\begin{array}{llc}\text { H. M. } & \text { S. } \\ 6 & 13 & 40 \cdot 8\end{array}$ | + ${ }^{\text {S }}$ |
| 0 | 6 10 $28 \cdot 1$ | +.62 | $\begin{array}{rrrr}6 & \text { II } & 5 \cdot 7 \\ 5 & 28 & \\ 5 & \text { P }\end{array}$ | $+.63$ | $\begin{array}{llll}6 & \text { II } & 43 \cdot 7 \\ 5 & 28 & 51 \cdot 6\end{array}$ | + 64 | 6 $61222 \cdot 2$ | +64 .36 | 6 13 $1 \cdot 2$ <br> 5 29 $34 \cdot 8$ | . 65 .35 | $\begin{array}{llll}6 & 13 & 40 \cdot 8 \\ 5 & 29 & 55 \cdot 7\end{array}$ | +.66 .34 |
| 10 | $\begin{array}{llll}5 & 28 & 6 \cdot 4\end{array}$ | $\cdot 3^{8}$ | $\begin{array}{llll}5 & 28 & 29 \cdot 2\end{array}$ | - 38 |  | $\cdot 37$ | $\begin{array}{lllll}5 & 29 & 13.4\end{array}$ | $\cdot 36$ | $\begin{array}{llll}5 & 29 & 34 \cdot 8\end{array}$ | -35 | $\begin{array}{lllll}5 & 29 & 55 \cdot 7\end{array}$ | -34 |
| 12 | $\begin{array}{lllll}5 & 19 & 39 \cdot 7\end{array}$ | -34 | $\begin{array}{lllll}5 & 19 & 59 \cdot 8\end{array}$ | -33 | $512019 \cdot 1$ | - 32 | $5 \quad 2037 \cdot 7$ | -30 | (1)20 $5155 \cdot 6$ | -29 | $\begin{array}{lllllllllllllll}5 & 21 & 12.8\end{array}$ | -28 |
| 14 | 5 II 13.7 | -29 | 5 II 30.9 | -28 | 5 II 47.I | -26 | $\begin{array}{llll}5 & 12 & 2.5\end{array}$ | -25 | $\begin{array}{lllll}5 & 12 & 17 & 0\end{array}$ | - 23 | $\begin{array}{llll}5 & 12 & 30 \cdot 5\end{array}$ | 22 |
| I6 | $5 \quad 2 \quad 47 \cdot 9$ | - 25 | $\begin{array}{lll}5 & 3 & 2 \cdot 3\end{array}$ | 23 | $\begin{array}{lll}5 & 3 & 15 \cdot 5\end{array}$ | - 21 | 5 $513 \quad 27: 7$ | -19 | $\begin{array}{llll}5 & 3 & 38 \cdot 7\end{array}$ | - 17 | $\begin{array}{llll}5 & 3 & 48 \cdot 6\end{array}$ | -15 |
| 18 | $45422 \cdot 5$ | + 20 | $45434{ }^{\circ}$ | + .18 | $45444 \cdot 2$ | + •16 | $45453 \cdot \mathrm{I}$ | -14 | $45500 \cdot 7$ | + - II | $455 \quad 6 \cdot 9$ | +.09 |
| 20 | $445 \quad 57 \cdot 3$ | -16 | 446 6.0 | $\cdot 13$ | $4 \begin{array}{llll}46 & 13 \cdot 2\end{array}$ | -II | $4 \begin{array}{llll}46 & 18.8\end{array}$ | -08 | $4 \begin{array}{llll}4 & 46 & 22.9\end{array}$ | +.05 | $4 \quad 46 \quad 25 \cdot 4$ | +.03 |
| 22 | $43732 \cdot 3$ | II | $43738 \cdot 2$ | -08 | $43742 \cdot 3$ | + .05 | $43744 \cdot 7$ | + .02 | $43745 \cdot 2$ | . OI | 43743.9 | $\cdot 03$ |
| 24 | $4 \begin{array}{lll}4 & 29 & 7 \cdot 5\end{array}$ | 6 | $42910 \cdot 5$ | + .03 | 429 II•5 | - 00 | $42910 \cdot 5$ | . 03 | $4 \begin{array}{lll}4 & 29 & 7 \cdot 5\end{array}$ | 07 | $\begin{array}{lll}4 & 29 & 2.4\end{array}$ | 0 |
| 26 | $42042 \cdot 8$ | + . 02 | $42042 \cdot 8$ | 02 | $42040 \cdot 6$ | -.05 | $42036 \cdot 3$ | -09 | 42029.6 | 13 | $42020 \cdot 7$ | 17 |
| 28 | 412 | - .03 | 412 | - 007 | 412980 | - 'II | $\begin{array}{lll}4 & 12 & 1.9\end{array}$ | 15 | 4 II 5I.6 |  | 4 II $38 \cdot 7$ | 23 |
| 30 | $4 \quad 353 \cdot 3$ | -08 | $4 \quad 3 \quad 47 \cdot 3$ | -12 | $4 \begin{array}{lll}4 & 3 & 38 \cdot 7\end{array}$ | - 16 | $\begin{array}{llll}4 & 3 & 27 \cdot 3\end{array}$ | 21 | $\begin{array}{llll}4 & 3 & 13.2\end{array}$ | -26 | $\begin{array}{lrr}4 & 2 & 56 \cdot 2\end{array}$ | 31 |
| 31 | $35940 \cdot 9$ | -10 | $35933 \cdot 3$ | -15 | $\begin{array}{llll}3 & 59 & 23 \cdot 0\end{array}$ | -19 | $\begin{array}{llll}3 & 59 & 9.9\end{array}$ | - 24 | $\begin{array}{llll}3 & 58 & 53 \cdot 8\end{array}$ | -29 |  | 34 |
| 32 | $\begin{array}{lllllllllllllll}3 & 55 & 28 \cdot 5\end{array}$ | 13 | 35519.3 | -I8 | 35578 | $\cdot 22$ | $35452 \cdot 3$ | -27 | 354434.3 | -33 |  | 38 |
| 33 | $35116 \cdot 0$ | -15 | $3515 \cdot 3$ | $\cdot 20$ | 35051.5 | $\cdot 25$ | $35034 \cdot 6$ | -31 |  | $\cdot 36$ | $3 \begin{array}{lllll}3 & 49 & 51\end{array}$ | 4 I |
| 3 | 347 | -18 | , | 3 | $346 \begin{array}{lll}35 \cdot 6\end{array}$ | -2 | $34616 \cdot 8$ | -34 | 345154.8 | $\cdot 4$ | $\begin{array}{llll}3 & 45 & 29.2\end{array}$ | -45 |
| 35 | $34250 \cdot 8$ | - 20 | $34236 \cdot 8$ | - 26 | $3 \quad 42$ I9.5 | $\cdot 32$ | $34158 \cdot 9$ | - 37 | $3 \begin{array}{llll}3 & 4 & 34 \cdot 8\end{array}$ | 3 | $34 \mathrm{I} \quad 7 \cdot 0$ | -49 |
| 3 | $\begin{array}{llll}3 & 38 & 38 \cdot 1\end{array}$ | -23 | $\begin{array}{llll}3 & 38 & 22.5\end{array}$ | -29 | $\begin{array}{llll}3 & 38 & 3 \cdot 4\end{array}$ | - 35 | $\begin{array}{llllllllllllllllllllll}3 & 37 & 40.7\end{array}$ | -41 | $\begin{array}{lllll}3 & 37 & 14.5\end{array}$ | $\cdot 47$ | $\begin{array}{lllll}3 & 36 & 44 \cdot 5\end{array}$ | 53 |
| 37 | $33425 \cdot 3$ | -26 | $\begin{array}{llr}3 & 34 & 8 \cdot 0\end{array}$ | 2 | $\begin{array}{llll}3 & 33 & 47 \%\end{array}$ | $\cdot 3$ | $\begin{array}{llll}3 & 33 & 22.4\end{array}$ | -44 | $\begin{array}{llll}3 & 32 & 54.0\end{array}$ | $\cdot 51$ | $\begin{array}{llll}3 & 32 & 21 \cdot 7\end{array}$ | 57 |
| 38 | $\begin{array}{llll}3 & 30 & 12.5\end{array}$ | -29 | $32953 \cdot$ | 35 | $3 \begin{array}{llll}3 & 29 & 30 \cdot 5\end{array}$ |  | $\begin{array}{lll}3 & 29 & 3.8\end{array}$ | -48 | $\begin{array}{llll}3 & 28 & 33.2\end{array}$ | -54 | $32758 \cdot 5$ | I |
| 3 | $\begin{array}{llll}3 & 25 & 59.5\end{array}$ | - | $325 \begin{array}{llll}38 \cdot 6\end{array}$ | - 38 | $\begin{array}{llll}3 & 25 & 13.8\end{array}$ |  | 324 45.I | $\cdot 51$ | $32412 \cdot 1$ | - . 58 | 323 35-0 | -65 |
| 40 | $32146 \cdot 4$ | $\cdot 3$ | 321023.7 | . 41 | $32056 \cdot 9$ | -48 | $32026 \cdot 0$ | $\cdot 55$ | 3 19 $50 \cdot 8$ | . 62 | 3 I9 II•I | 70 |
| 41 | $\begin{array}{lllll}3 & 17 & 33 \cdot 1\end{array}$ | $\cdot 37$ | $3 \begin{array}{lll}3 & 17 & 8.5\end{array}$ | 44 | $\begin{array}{llll}3 & 16 & 39 \cdot 8\end{array}$ | -51 | $\begin{array}{llll}3 & 16 & 6 \cdot 6\end{array}$ | - 59 | $3 \begin{array}{llll}3 & 15 & 29\end{array}$ | 66 | 3 I4 $46 \cdot 8$ | 74 |
| 42 | $3 \begin{array}{llll}3 & 13 & 19.6\end{array}$ | -40 | $3 \begin{array}{llll}3 & 12 & 5 & 2\end{array}$ | - 48 | $\begin{array}{llll}3 & 12 & 22.4\end{array}$ | -55 | 3 II $47 \cdot 0$ | -63 | $\begin{array}{llll}3 & 11 & 7 \cdot 0\end{array}$ | -71 | $31022 \cdot 1$ | 79 |
| 43 | $\begin{array}{llll}3 & 9 & 6.0\end{array}$ |  | $\begin{array}{llll}3 & 8 & 37 \cdot 6\end{array}$ | -51 | $\begin{array}{llll}3 & 8 & 4.7\end{array}$ |  | $3 \begin{array}{llll}3 & 7 & 27.0\end{array}$ | . 67 | 36644.5 | -75 | 35 | 4 |
| 44 | $\begin{array}{llll}3 & 4 & 52.2\end{array}$ | -47 | $3 \begin{array}{llll}3 & 4 & 21.8\end{array}$ | $\cdot 55$ | $\begin{array}{llll}3 & 3 & 46 \cdot 7\end{array}$ | -63 | $\begin{array}{llll}3 & 3 & 6 \cdot 7\end{array}$ | $\cdot 71$ | $\begin{array}{llll}3 & 2 & 2 I \cdot 5\end{array}$ | -80 | 3 I 31.0 | -89 |
| 4 | 3 O $38 \cdot 2$ | -50 | $\begin{array}{lll}3 & 0 & 5.8\end{array}$ | $\cdot 58$ | $\begin{array}{llll}2 & 59 & 28 \cdot 4\end{array}$ | -67 | $\begin{array}{llll}2 & 58 & 45 \cdot 8\end{array}$ | $\cdot 75$ | $25758 \cdot 0$ | . 84 | $2 \begin{array}{llll}2 & 57 & 4.6\end{array}$ | -94 |
| 46 | 25624.0 | $\cdot 5$ | $25549 \cdot 4$ | - 62 | $\begin{array}{llll}2 & 55 & 9 \cdot 7\end{array}$ | $\cdot 71$ | $2542.4 \cdot 6$ | -80 | $25334{ }^{\circ} \mathrm{O}$ | 89 | $2 \begin{array}{llll}2 & 52 & 37 \cdot 6\end{array}$ | 99 |
| 47 | $\begin{array}{llll}2 & 52 & 9.5\end{array}$ | $\cdot 57$ | $25132 \cdot 7$ | -66 | $25050 \cdot 6$ | $\cdot 75$ | 250 | -8 | $249 \quad 9.4$ | -94 | 24848 | - 04 |
| 4 | 24754.7 | - 60 | $24715 \cdot 7$ |  | 246 3I•I |  | $24540 \cdot 6$ | -89 | $24444^{\prime} \mathrm{I}$ | -99 | $24341 \cdot 3$ |  |
| 49 | $24339^{\circ}$ | - 64 | $24258 \cdot 2$ | 74 | 242 II.0 | - | $24117 \times 7$ | - 94 | 240 18.1 | - I.05 | 239 II.9 | -I•I6 |
| 50 | $23924 \cdot 2$ | -68 | $\begin{array}{lllll}2 & 38 & 40 \cdot 4\end{array}$ | $\cdot 78$ | $237 \begin{array}{llll} & 3 & 50.5\end{array}$ | -8 | 23654.2 | -99 | $2 \begin{array}{lllllll}2 & 35 & 51 & 3\end{array}$ | I-IO | 234 4I•6 | 22 |
| 51 | $\begin{array}{lll}2 & 35 & 8 \cdot 3\end{array}$ | $\bullet 72$ | $23422 \cdot 0$ | 82 | $233129 \cdot 3$ | -93 | 23229.9 | I 05 | $231123 \cdot 7$ |  | $23010 \cdot 2$ | 29 |
| 52 | $23052 \cdot 1$ | $\cdot 76$ | $2303 \cdot 1$ | $\cdot 87$ | $\begin{array}{lllllllllllllll}2 & 29 & 7 \cdot 5\end{array}$ | $\cdot 98$ | $\begin{array}{llll}2 & 28 & 4.9\end{array}$ | 10 | $22655 \cdot 1$ | 1.23 | $\begin{array}{lllllllllllllll}2 & 25 & 37 \cdot 7\end{array}$ | $1 \cdot 36$ |
| 53 | 22635 | -8I | $22543 \cdot 7$ | . 92 | $22445 \cdot 0$ | $1 \cdot 04$ | 223 39.0 | I•16 | $222 \quad 25 \cdot 5$ | I 29 | 221309 | I 43 |
| 5 | $2 \begin{array}{llll}22 & 18.2\end{array}$ | -.85 | 22123.6 | - 97 | $22021 \cdot 7$ | - I.09 | 21912.2 | -r23 | 2 17 54.6 | -I.36 | $2 \begin{array}{llll}2 & 16 & 28 \cdot 8\end{array}$ | I. 50 |
| 55 | $\begin{array}{llll}2 & 18 & 0.5\end{array}$ | -90 | $2 \begin{array}{lll}2 & 17 & 2.8\end{array}$ | I. 02 | $215 \quad 57 \cdot 5$ | 1•15 | 21444.2 | I 29 |  | I. 43 | 2 II 52.1 | 58 |
| 56 | $21342 \cdot 1$ | 95 | $211241 \cdot 3$ | I.08 | 2 II 32.4 | I. 22 | $21015 \cdot 2$ | I.36 | 28849 I | I•5 | $\begin{array}{llll}2 & 7 & 13.7\end{array}$ | I. 67 |
| 57 | $\begin{array}{llll}2 & 9 & 23 \cdot 0\end{array}$ | I.00 | 2 8 $18 \cdot 9$ | I.14 | $\begin{array}{lll}2 & 7 & 6 \cdot 3\end{array}$ | 1.28 | $2 \begin{array}{llll}2 & 5 & 44 \cdot 8\end{array}$ | $1 \cdot 44$ | $\begin{array}{llll}2 & 4 & 14 \% \\ & 5\end{array}$ | I. 60 | 2 2 $33 \cdot 3$ | 1.76 -87 |
| 58 | $2{ }^{2} 503 \cdot 2$ | $1 \cdot 06$ | $355 \cdot 5$ |  | $238 \cdot 9$ | 1-3 | 1 13.1 | I. 51 | 259 37.1 | I. 69 | 57 50.8 | 工.87 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | +1.33 | -4.25 | +1.40 | $-4.28$ | +1.49 | $-4 \cdot 30$ | +1.57 | $-4.33$ | +1.65 | $-4 \cdot 36$ | +1.73 | $-4.39$ |
| 4 | I.28 | $4 \cdot 24$ | I. 36 | $4 \cdot 26$ | I. 44 | $4 \cdot 29$ | I. 52 | $4 \cdot 32$ | I.6I | $4 \cdot 35$ | I. 69 | $4 \cdot 38$ |
| 8 | I. 25 | $4 \cdot 23$ | 1-33 | $4 \cdot 25$ | 1.41 | $4 \cdot 28$ | - 1.49 | $4 \cdot 30$ | 1.57 | $4 \cdot 33$ | I. 65 | $4 \cdot 36$ |
| 12 | I 22 | $4 \cdot 22$ | I. 30 | $4 \cdot 24$ | I.38 | 4.27 | 1.46 | $4 \cdot 29$ | I. 54 | 4.32 | I-63 | $4 \cdot 35$ |
| 16 | I-20 | $4 \cdot 21$ | I-28 | $4 \cdot 24$ | I•36 | $4 \cdot 26$ | I-44 | $4 \cdot 29$ | 1.52 | $4 \cdot 32$ | I•6I | $4 \cdot 35$ |
| 20 | +1.18 | $4 \cdot 21$ | +1.26 | 4.23 | +1.35 | $4 \cdot 26$ | +1.43 | $4 \cdot 28$ | +1.52 | 4.31 | +1.60 | $4 \cdot 34$ |
| 22 | I.18 | $4 \cdot 21$ | 1.26 | 4.23 | I. 34 | $4 \cdot 26$ | 1.43 | $4 \cdot 28$ | I.51 | $4 \cdot 31$ | I. 60 | $4 \cdot 34$ |
| 24 | 1-17 | 4.21 | I.26 | 4.23 | I. 34 | $4 \cdot 26$ | I-43 | $4 \cdot 28$ | 1.52 | $4 \cdot 31$ | I. 60 | $4 \cdot 34$ |
| 26 | 1-17 | $4 \cdot 20$ | I. 26 | 4.23 | 1.34 | $4 \cdot 26$ | 1.43 | $4 \cdot 28$ | 1.52 | $4 \cdot 31$ | I.6I | $4 \cdot 35$ |
| 28 | 1-17 | $4 \cdot 20$ | 1.26 | $4 \cdot 23$ | 1.35 | $4 \cdot 26$ | I. 44 | $4 \cdot 29$ | 1.53 | $4 \cdot 32$ | I. 62 | $4 \cdot 35$ |
| 30 | +I.I7 | 4.21 | +I.26 | 4.23 | +1.35 | $4 \cdot 26$ | +1.44 | $4 \cdot 29$ | +1.54 | $4 \cdot 32$ | +1.63 | $4 \cdot 35$ |
| 32 | 1.18 | $4 \cdot 21$ | I. 27 | 4.23 | I.36 | $4 \cdot 26$ | 1.45 | $4 \cdot 29$ | 1.55 | $4 \cdot 33$ | I.65 | $4 \cdot 36$ |
| 34 | I-18 | 4.21 | 1. 28 | $4 \cdot 24$ | 1.37 | $4 \cdot 27$ | 1.47 | 4.30 | - 57 | $4 \cdot 33$ | I. 66 | $4 \cdot 37$ |
| 36 | I•I9 | 4.21 | I. 29 | $4 \cdot 24$ | 1-39 | $4 \cdot 27$ | I. 48 | $4 \cdot 30$ | 1.59 | $4 \cdot 34$ | I. 69 | 4.38 |
| 38 | I-2I | $4 \cdot 21$ | 1.30 | 4.24 | $1 \cdot 40$ | $4 \cdot 27$ | I.51 | $4 \cdot 31$ | 1.6I | $4 \cdot 35$ | 1-71 | 4.39 |
| 40 | +I.22 | $4 \cdot 22$ | +1.32 | 4.25 | +1.42 | $4 \cdot 28$ | +1.53 | 4.32 | +1.64 | $4 \cdot 36$ | +1.75 | $4 \cdot 4{ }^{\circ}$ |
| 42 | I 24 | $4 \cdot 22$ | I•34 | $4 \cdot 26$ | I.45 | $4 \cdot 29$ | I.56 | $4 \cdot 33$ | I. 67 | $4 \cdot 37$ | I.79 | $4 \cdot 4$ |
| 44 | I-26 | $4 \cdot 23$ | I•37 | 4.26 | I. 48 | $4 \cdot 30$ | I. 60 | 4.34 | 1.71 | 4.39 | I.83 | 4.43 |
| 46 | I. 29 | $4 \cdot 24$ | 1.40 | $4 \cdot 28$ | I.52 | $4 \cdot 31$ | I. 64 | $4 \cdot 36$ | 1.76 | 4.40 | I. 88 | $4 \cdot 46$ |
| 48 | I•32 | $4 \cdot 25$ | I 44 | $4 \cdot 29$ | 1.56 | $4 \cdot 33$ | I. 68 | $4 \cdot 38$ | I•8I | $4 \cdot 43$ | I•94 | $4 \cdot 48$ |
| 50 | +1.35 | $4 \cdot 26$ | +1.48 | 4.30 | +1.61 | $4 \cdot 35$ | +1.74 | 4.40 | + $\mathbf{I} .88$ | $4 \cdot 45$ | +2.01 | $4 \cdot 51$ |
| 52 | I.40 | $4 \cdot 27$ | I.53 | $4 \cdot 32$ | I.67 | $4 \cdot 37$ | I.8I | $4 \cdot 42$ | I.95 | $4 \cdot 48$ | $2 \cdot 10$ | $4 \cdot 55$ |
| 54 | I*45 | $4 \cdot 29$ | 1.59 | $4 \cdot 34$ | 1.73 | $4 \cdot 40$ | 1.88 | $4 \cdot 46$ | $2 \cdot 04$ | $4 \cdot 52$ | $2 \cdot 20$ | $4 \cdot 60$ |
| 56 | I.51 | 4.31 | I. 66 | 4.37 | I 8 8 | 4.43 | 1.97 | $4 \cdot 49$ | 2.14 2.26 | 4.57 | 2.32 2.46 | 4.66 4.73 |
| 58 | I.58 | 4.34 | $1 \cdot 74$ | 4.40 | I.91 | 4.47 | $2 \cdot 08$ | 4.54 | $2 \cdot 26$ | $4 \cdot 63$ | $2 \cdot 46$ | $4 \cdot 73$ |

DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{array}{\|l\|l} \hline \text { True } \\ \text { Alt. } \end{array}$ | $0^{\circ}$ |  | $1{ }^{\circ}$ |  | $2{ }^{\circ}$ |  | $3^{\circ}$ |  | $4^{\circ}$ |  | $5^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{10}$ | ${ }^{5} 191929.8$ |  | 52080 |  | ${ }^{5} 20245 \cdot 5$ |  |  |  | ( |  | ${ }^{6}$ |  |
| I2 | $\begin{array}{llll}5 & 11 & 23.5 \\ 5 & 3 & 17.2\end{array}$ |  | $\left\|\begin{array}{rrr} 5 & 12 & 2 \cdot 0 \\ 5 & 3 & 55 \cdot 0 \end{array}\right\|$ |  | $\begin{array}{llll}5 & 12 & 39.5 \\ 5 & 3 \\ 5 & 3 & 39.5 \\ 4\end{array}$ |  | 5 13 $16 \cdot 2$ <br> 5 16  <br> 5 $10 \cdot 1$  <br> 1   |  | (1) |  |  |  |
| I4 14 | (1) $\begin{array}{ccc}5 & 3 & 17.2 \\ 4 & 55 & 10.8\end{array}$ |  | $\left\|\begin{array}{rrr} 5 & 3 & 55 \cdot 9 \\ 4 & 55 & 49 \cdot 8 \end{array}\right\|$ |  | $\left\lvert\, \begin{array}{rrr} 5 & 4 & 33 \cdot 5 \\ 4 & 56 & 27 \cdot 5 \end{array}\right.$ |  | [ ${ }^{5}$ |  | $\left\lvert\, \begin{array}{ccc}5 & 5 & 45 \cdot 6 \\ 4 & 57 & 39 \cdot 4 \\ 4\end{array}\right.$ |  | ( ${ }_{5}^{5}$ |  |
| 18 |  |  |  |  |  |  | 44858.1 | + 6 |  |  |  |  |
| 20 | 438 |  | $43937 \cdot 3$ |  | 44015 |  | $44052 \cdot \mathrm{I}$ |  | 44 |  | 442 |  |
| 22 | 43050 |  | 4313130.9 |  | $4{ }_{4}{ }^{32}$ |  | $\begin{array}{llll}4 & 32 & 46 \cdot I \\ 4 & 24 & \\ 4\end{array}$ |  |  |  |  |  |
| 24 26 | 422 |  | [123 4 |  | 4 $\begin{aligned} & 4 \\ & 4 \\ & 45 \\ & 4\end{aligned}$ |  | 424 4 46 4 4 |  |  |  |  |  |
| 28 | $4 \quad 628.7$ |  |  | + 68 |  |  |  |  |  |  |  |  |
| 30 | 58 |  | 359 |  | 359 |  |  |  | 4 o 57.2 |  | 1 |  |
| 3 3 | 35416 |  | 55 |  | $35540 \cdot 6$ |  | 356 |  | $35654 \cdot 2$ |  | 357 |  |
| 32 | 12.6 |  | $35056 \cdot 3$ |  | 351 |  | 352 |  | 3 52 51- I |  | 353 |  |
| 33 | $\begin{array}{lll}346 & 8.4\end{array}$ |  | $34652 \cdot 5$ | -71 | 347 |  | 3 |  | 3 |  | 34 |  |
| 34 | 42 4.1 <br> 15  | + 77 | 342 | + 72 | 343 | $+$ | 3 44 $9 \cdot 2$ <br> 3   | + 6 | 344 |  | $1 \begin{array}{lllllll}3 & 45 & 18.2 \\ 3 & 45\end{array}$ | +.53 |
| $\begin{aligned} & 35 \\ & 36 \end{aligned}$ | 3759.6 |  | 3 |  | 339 |  | 3 40 6.0 <br> 3 36 2.7 |  | 340 |  |  |  |
| 37 |  | . 80 | 3 |  | 3 3 31 19.6 |  | $3{ }^{31}$ |  | 呥 |  |  |  |
| 38 | $32545 \cdot 5$ | 81 | 3 | 75 | 3 | . 69 | 327 |  | 328 $32 \cdot 7$ |  | . 2 | -53 |
| 39 | $32140 \cdot 6$ | + 88 | 3 | + 76 | 3-231817 | + 70 | $3 \begin{aligned} & 3 \\ & 3 \\ & 3 \\ & 5 \\ & 52 \cdot 6\end{aligned}$ | + | $\begin{array}{ll}3 & 24 \\ 29 & 29.6 \\ 3 & 20\end{array}$ |  | 3 | + 53 |
|  | $31735 \cdot 5$ |  | 3 |  | $\begin{array}{ll}3 & 19 \\ 3 & 15\end{array}$ |  | 315 |  | 320 316 |  | (1) $\begin{array}{ccc}3 & 21 & 0 \cdot 2 \\ 3 & 16 & 57 \cdot 1 \\ & 1\end{array}$ |  |
| 42 | 3 9 <br>  $24 \cdot 9$ |  | $\begin{array}{llll}3 & 10 & 14.5\end{array}$ |  |  |  | 3 II |  |  |  | 咗 |  |
| 43 | $\begin{array}{lllll}3 & 5 & 19.3\end{array}$ | . 88 | $\begin{array}{lll}3 & 6 & 9 \cdot 7\end{array}$ | .81 | . |  | , | 67 | $\begin{array}{llll}3 & 8 & 16 \cdot 7\end{array}$ |  | 851.0 |  |
|  | 257 | + 89 | 3 2 $4 \cdot 8$ <br> 2 57 597 | + | 25847.5 | + 75 | 3 |  | ${ }_{3}{ }^{3}$ |  | 4 |  |
| 46 |  |  | 2 57 <br> 2 59 <br>  $54 \cdot 7$ |  | 2 <br> 2 <br> 284 <br> 24 |  | 2-59 30.9 |  | \|rrrer |  | 256 |  |
| 47 | 2 48 <br> 2 54.9 <br> 24.9  | -94 | ${ }^{2} 4949{ }^{\circ}{ }^{\circ}$ |  | 2 5 50 38.4 |  | $\begin{array}{llll}2 & 51 & 23.0 \\ 2 & 4 \\ 2 & 18.0\end{array}$ | 70 | [20.32 3.0 |  |  |  |
| 48 | $24448 \cdot 2$ |  | $24543 \cdot 3$ |  | $2{ }^{2} 4633 \cdot 6$ |  | 24718.9 |  | 24759.5 |  | $2{ }^{48} 35 \cdot 3$ |  |
| 49 | ${ }^{2} 404041$ I | 98 | $\begin{array}{lllll}2 & 41 & 37.5 \\ 2 & 37 & \\ 2\end{array}$ | + 98 |  |  |  | + 77 |  |  |  |  |
| 50 51 |  | ros | $\begin{array}{llll}2 & 37 & 31.4 \\ 2 & 33 & 25.4 \\ 2 & \end{array}$ |  | (1)2 38 23.5 <br> 2 34 18.2 |  |  |  |  |  | 2 40 <br> 2 38 <br>  28.7 <br> $25 \cdot 4$  |  |
| 52 | $2 \begin{array}{lllll}28 & 18 \cdot 3\end{array}$ |  | 2 |  | $23012 \cdot 8$ |  |  |  | $23 \mathrm{I} 44 \cdot 5$ |  | $23222 \cdot 0$ |  |
| 53 | ${ }^{2} 224909$ | 1.08 | 25 |  |  |  | 226 |  | 227 |  |  | -59 |
|  | 2201.2 |  | $2214 \cdot 3$ |  | 2 | + 89 |  |  | ${ }_{2}^{2} 2336364$ | + 69 | 24 |  |
|  | 55 | I. | 216 |  | $\begin{array}{llll}2 & 17 & 54.8 \\ 2\end{array}$ |  | $21846 \cdot 6$ |  | 19 |  | $2 \begin{array}{ll}20 & 11.4\end{array}$ |  |
|  | $\begin{array}{rl}2 & \text { II } \\ 2 & 72 \cdot 3 \\ & 7 \\ & 32 \cdot 0\end{array}$ |  |  |  | 2 13 $48 \cdot 4$ <br> 2 9 $4 \mathrm{r} \cdot 6$ |  |  |  | 215 |  |  |  |
| 58 | $232 \mathrm{I} \cdot \mathrm{I}$ |  | 43 |  | 534 |  | $\begin{array}{llll} \\ 2 & 6 & 30 \cdot 1\end{array}$ |  | H |  | $\begin{array}{lll} \\ 2 & 8 & 0.2\end{array}$ |  |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. 00 | $\begin{gathered} \mathrm{s} \\ -4.05 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\quad .07 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.05 \end{gathered}$ | + ${ }^{\text {s. }}$. 14 | $\begin{gathered} \mathrm{S} \\ -4.05 \end{gathered}$ | $\begin{gathered} s . \\ +\quad \cdot 2 I \end{gathered}$ | $\begin{gathered} s . \\ -4.05 \end{gathered}$ | S. $+\quad .29$ | $\begin{gathered} s . \\ -4.06 \end{gathered}$ | s. $+\quad 36$ | S. |
| 4 | -. 04 | 4.05 | .03 | 4.05 | -10 | 4.05 | -17 | 4.05 | -24 | 4.06 | -3I | 4.06 |
| 8 | -09 | 4.05 | - .02 | 4.05 | . 05 | 4.05 | -13 | 4.05 | - 20 | $4 \cdot 05$ | $\cdot 27$ | $4 \cdot 06$ |
| 12 | -14 | 4.05 | .06 | 4.05 | + . Or | 4.05 | .08 | 4.05 | - 16 | $4 \cdot 05$ | $\cdot 23$ | 4.06 |
| 16 | - I8 | 4.05 | -II | 4.05 | - 03 | 4.05 | $+.04$ | 4.05 | -II | 4.05 | -19 | $4 \cdot 05$ |
| 20 | - . 23 | 4.05 | - .16 | 4.05 | -.08 | $4 \cdot 05$ | -00 | 4.05 | + .07 | 4.05 | + .15 | 4.05 |
| 22 | - 26 | 4.06 | -18 | 4.05 | -10 | 4.05 | - 03 | 4.05 | . 05 | 4.05 | -12 | 4.05 |
| 24 | -29 | 4.06 | -21 | 4.05 | -13 | 4.05 | . 05 | $4 \cdot 05$ | - 03 | 4.05 | -10 | 4.05 |
| 26 | -3I | 4.06 | -23 | 4.06 | - 15 | 4.05 | -07 | 4.05 | - 00 | 4.05 | -08 | 4.05 |
| 28 | $\cdot 34$ | $4 \cdot 06$ | - 26 | 4.06 | -18 | 4.05 | -10 | 4.05 | . 02 | $4 \cdot 05$ | -06 | 4.05 |
| 30 | - 37 | 4.06 | - 29 | 4.06 | - 20 | 4.05 | -12 | $4 \cdot 05$ | -.04 | 4.05 | +.04 | 4.05 |
| 32 | -40 | 4.07 | $\cdot 32$ | 4.06 | -23 | $4 \cdot 06$ | -15 | 4.05 | -06 | 4.05 | . 02 | 4.05 |
| 34 | -43 | 4.07 | -35 | 4.06 | -26 | 4.06 | -17 | 4.05 | -09 | 4.05 | -00 | 4.05 |
| 36 | -47 | 4.08 | $\cdot 3^{8}$ | 4.07 | -29 | $4 \cdot 06$ | -20 | 4.05 | -II | 4.05 | - 02 | 4.05 |
| 38 | -50 | $4 \cdot 08$ | -41 | $4 \cdot 07$ | $\cdot 32$ | $4 \cdot 06$ | -23 | 4.06 | -14 | 4.05 | $\cdot 05$ | $4 \cdot 05$ |
| 40 | -. 54 | 4.08 | - 45 | 4.07 | - 35 | 4.06 | - . 26 | 4.06 | - .16 | 4.05 | - . 07 | 4.05 |
| 42 | $\cdot 58$ | 4.09 | -48 | 4.08 | - 39 | $4 \cdot 07$ | -29 | 4.06 | -19 | 4.05 | -10 | 4.05 |
| 44 | . 63 | $4 \cdot 10$ | -52 | $4 \cdot 08$ | -42 | $4 \cdot 07$ | $\cdot 32$ | 4.06 | $\cdot 22$ | 4.06 | -12 | 4.05 |
| 46 | -67 | $4 \cdot 10$ | $\cdot 57$ | $4 \cdot 09$ | -46 | $4 \cdot 08$ | -36 | 4.07 | $\cdot 25$ | 4.06 | - I5 | 4.05 |
| 48 | $\cdot 72$ | $4 \cdot 11$ | -6I | $4 \cdot 10$ | . 50 | $4 \cdot 08$ | $\cdot 39$ | 4.07 | $\cdot 29$ | 4.06 | -18 | 4.05 |
| 50 | -.78 | $4 \cdot 12$ | -. 66 | $4 \cdot 10$ | -. 55 | 4.09 | - 43 | 4.07 | - 32 | $4 \cdot 06$ | - 21 | 4.05 |
| 52 | -84 | $4 \cdot 14$ | $\cdot 72$ | $4 \cdot 11$ | - 60 | $4 \cdot 09$ | -48 | 4.08 | $\cdot 36$ | $4 \cdot 07$ | -24 | $4 \cdot 06$ |
| 54 | $\cdot 91$ | $4 \cdot 15$ | $\cdot 78$ | $4 \cdot 12$ | -65 | $4 \cdot 10$ | $\cdot 52$ | 4.08 | -40 | 4.07 | -28 | $4 \cdot 06$ |
| 56 | $\cdot 98$ | $4 \cdot 17$ | -84 | $4 \cdot 14$ | $\cdot 71$ | $4 \cdot 11$ | - 57 | 4.09 | -44 | 4.07 | -3I | 4.06 |
| 58 | 1.06 | $4 \cdot 19$ | $\cdot 91$ | 4.15 | $\cdot 77$ | $4 \cdot 12$ | . 63 | 4.10 | -49 | $4 \cdot 08$ | $\cdot 35$ | 4.06 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 48 \cdot 9 \end{array}$ | $+.64$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 27 \cdot 4 \end{array}\right.$ | $\begin{array}{r} 5 . \\ +\quad .64 \end{array}$ | $\begin{array}{rrr} \text { H. M. } & \text { S. } \\ 6 & 5 & 6 \cdot \mathrm{I} \end{array}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad \cdot 65 \end{aligned}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & 45 \cdot 0 \end{array}$ |  | $\left.\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 6 & 24^{\prime} \mathrm{I} \end{array} \right\rvert\,$ | $\begin{array}{r} \text { s. } \\ +\quad \cdot 65 \end{array}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 7 & 3.4 \end{array}$ |  |
| 10 | $\begin{array}{llll}5 & 23 & 8 \cdot 5\end{array}$ | 57 | $52342 \cdot 6$ | $\cdot 56$ | $52416 \cdot 0$ | $\cdot 55$ | $52448 \cdot 9$ | $\cdot 54$ | $525 \quad 21.2$ | . 53 | $525 \quad 52 \cdot 9$ | $\cdot 52$ |
| 12 | 5151.0 | $\cdot 56$ | 51534.4 | $\cdot 55$ | $516 \quad 70$ | - 54 | $5 \begin{array}{lllll}5 & 16 & 388\end{array}$ | $\cdot 52$ |  | $\cdot 51$ | $51740 \cdot 1$ | 50 |
| 14 | 6 $53 \cdot 8$ 58 | $\cdot 55$ | $\begin{array}{llll}5 & 7 & 26 \cdot 4\end{array}$ | $\cdot 53$ | $\begin{array}{llll}5 & 7 & 58 \cdot 1\end{array}$ | -52 | $\begin{array}{llll}5 & 8 & 28.9\end{array}$ | $\cdot 50$ | $5{ }_{5}^{5} 88$ | -49 | $5{ }_{5} 927.7$ | 47 |
| 16 | $5846 \cdot 7$ | -54 | 5918.6 | $\cdot 52$ | 45949.5 | $\cdot 50$ | 5 ¢ 019.2 | - | $5 \quad 5 \quad 47 \cdot 9$ | -47 | 5 1 1 15.5 | 45 |
| 18 | $45039 \cdot 8$ | + 53 | 51 II•I | + 51 | $5 \mathrm{I} 4 \mathrm{I} \cdot \mathrm{I}$ | + 49 | $4 \begin{array}{lll}42 & 9.9\end{array}$ | + 47 | $4 \begin{array}{llll}4 & 52 & 37.4\end{array}$ | + $\cdot 45$ |  | $+\cdot 43$ |
| 20 | $44233 \cdot 0$ | $\cdot 52$ | 44313.7 | $\cdot 50$ | 4333.0 | -47 | $444 \begin{array}{ll}4 & 0.8 \\ 4\end{array}$ | 45 | $44427 \cdot 2$ | $\cdot 43$ | $44452 \cdot 2$ | $\cdot 40$ |
| 22 | $43426 \cdot 3$ | -51 | $43456 \cdot 4$ | $\cdot 49$ | $43525^{\circ} \mathrm{O}$ | $\cdot 46$ | $\begin{array}{llllllllllll}4 & 35 & 51.9\end{array}$ | -43 | $\begin{array}{lllll}4 & 36 & 17.2 \\ 4 & 28 & 7.5\end{array}$ | -41 | 4 36 $40 \cdot 9$ <br> 4 28  | -38 |
| 24 | $4 \begin{array}{lll}4 & 26 & 19 \cdot 8\end{array}$ | -5I | $42649 \cdot 4$ | $\cdot 48$ | 42717.2 | -45 | $42743 \cdot 2$ | -42 | $\begin{array}{llll}4 & 28 & 7 \cdot 5\end{array}$ | $\cdot 39$ | 42829.9 | 36 |
| 26 | $4 \begin{array}{llllll}48 & 13\end{array}$ | $\cdot 50$ | $41842 \cdot 5$ | 47 | 4 I9 9.6 | -43 | $41934 \cdot 7$ | 40 | 4 I9 57.9 | $\cdot 37$ | 420 Ig - 1 | 34 |
| 28 | 107. | + 49 | 10 $35 \cdot 7$ | + 46 | II 2.I | + ${ }^{42}$ | 4 II 26.4 | + 39 | 4 II 48.6 | + 35 | $4 \begin{array}{lll}12 & 8.6\end{array}$ | + 31 |
| 30 | 4 2 0.8 <br>  5  | 49 | 229.0 | 45 | $254 \cdot 8$ | 4 I |  | -37 | $4 \begin{array}{lll}4 & 3 & 39 \cdot 5\end{array}$ | $\cdot 33$ | $4 \begin{array}{llll}4 & 38 \cdot 2\end{array}$ |  |
| 31 |  | 49 | $3{ }^{3} 5825 \cdot 7$ | 44 | $\begin{array}{llllll}3 & 58 & 51 \cdot 2\end{array}$ | 40 |  | $\cdot 36$ | $\begin{array}{llll}3 & 59 & 35.0 \\ 3 & 5\end{array}$ | -32 | $35953 \cdot \mathrm{I}$ | 8 |
| 32 | $\begin{array}{llll}3 & 53 & 54 \cdot 6\end{array}$ | $\cdot 48$ | $\begin{array}{llll}3 & 54 & 22.4\end{array}$ | $\cdot 44$ | $35447 \cdot 7$ | 40 | $\begin{array}{llll}3 & 55 & 10 \cdot 4\end{array}$ | $\cdot 36$ | 3 55 $30 \cdot 5$ <br> 3 5  | $\cdot 31$ | 3 55 $48 \cdot \mathrm{I}$ | 7 |
| 33 | $34951 \cdot 5$ | 48 | $\begin{array}{lllllllllllll}3 & 50 & 19.2\end{array}$ | -44 | $35044 \cdot 2$ | 39 | $\begin{array}{llll}3 & 51 & 6.5\end{array}$ | 5 | 3 31 $26 \cdot \mathrm{I}$ | $\cdot 30$ | 3 5I 43•I | 6 |
| 35 | $\begin{array}{llll}3 & 45 & 48 \cdot 5 \\ 3 & 41 & 45 \cdot 4\end{array}$ | + 488 | $\begin{array}{llll}3 & 46 & 16 \cdot 0 \\ 3 & 42 & 12.8\end{array}$ | + 4 |  | + 39 | $\begin{array}{llll}3 & 47 & 2.6 \\ 3 & 42 & 58.8\end{array}$ | + 34 |  | + 29 |  | $\begin{array}{r}+25 \\ \hline .24\end{array}$ |
| 35 | 3 41 $45 \cdot 4$ <br> 3 37  | 48 | 42 12.8 <br> 38  | $\cdot 43$ | 42 $37 \cdot 2$ <br> 38  | -38 | $\begin{array}{llllll}3 & 42 & 58 \\ 3 & 88\end{array}$ | -33 | $3 \begin{array}{llll}3 & 43 & 17.4\end{array}$ | -29 | $34333 \cdot 2$ |  |
| 36 | $1 \begin{array}{llll}3 & 37 & 42.4 \\ 3 & 33\end{array}$ | 48 | $\begin{array}{ll}38 & 9.6\end{array}$ | 43 | $3833 \cdot 8$ | $\cdot 38$ | $\begin{array}{llllll}3 & 38 & 55 \\ 3 & 0\end{array}$ | 33 |  | - 28 | $\begin{array}{llll}3 & 39 & 28.3\end{array}$ | - 23 |
| 37 | 3 $333139 \cdot 4$ | 48 | $\begin{array}{ll}34 & 6 \cdot 4\end{array}$ | 42 |  | -37 | $\begin{array}{lllllll}3 & 34 & 51 \cdot 2\end{array}$ | -32 | $\begin{array}{llll}3 & 35 & 8 \cdot 9\end{array}$ | -27 | $335 \quad 23.4$ | 22 |
| 38 | $\begin{array}{llll}3 & 29 & 36 \cdot 4\end{array}$ | $\cdot 47$ | $30 \quad 3 \cdot 3$ | -42 | $33027 \cdot 0$ | 37 | $3 \begin{array}{llll}3 & 30 & 47\end{array}$ | $\cdot 31$ | $33^{31} 4.7$ |  | $33^{1} 18$ | 20 |
| 39 | 2533.4 | + 47 | 26 | + 42 |  | + 36 | $32643 \cdot 7$ | + 31 | 327005 | + 25 | 32713.8 | 19 |
| 40 | $2130 \cdot 4$ | -47 | $2157 \cdot 1$ | 4 4 | 2220.3 | $\cdot 36$ | 3 $22240 \cdot 1$ | $\cdot 30$ | $\begin{array}{llll}3 & 22 & 56 \cdot 3\end{array}$ | $\cdot 24$ | $\begin{array}{llll}3 & 23 & 9 \cdot 1\end{array}$ | 18 |
| 41 | $\begin{array}{lllll}3 & 17 & 27 \cdot 4\end{array}$ | 47 | $1754{ }^{\circ}$ | 41 |  18 <br> 170  | -35 | $\begin{array}{lllll}3 & 18 & 36.4\end{array}$ | -29 |  | -23 | $\begin{array}{lll}3 & 19 & 4.3\end{array}$ | 17 |
| 42 | $\begin{array}{lllll}3 & 13 & 24.4\end{array}$ | $\cdot 47$ | $\begin{array}{llll}3 & 13 & 51.0\end{array}$ | 41 |  | $\cdot 35$ | $\begin{array}{lllllllllllllllll}3 & 14 & 32 \cdot 8\end{array}$ | -28 | 3 14 $48 \cdot I$ | $\cdot 22$ | $\begin{array}{llll}3 & 14 & 59 \cdot 6\end{array}$ | 16 |
| 43 | $\begin{array}{llll}3 & 9 & 21.4\end{array}$ | 47 | $947 \cdot 9$ | 41 | 31010.5 | -34 | 3 10 29.3 | -28 | 3 10 44.1 | -21 | 3 1o $55^{\circ}$ | 15 |
| 44 | $\begin{array}{llll}3 & 5 & 18.4 \\ 3 & 5 & 1\end{array}$ | $+\cdot 47$ | 544.9 | $+4 \mathrm{t}$ | $\begin{array}{ll}6 & 7 \cdot 3\end{array}$ | + 34 | $\begin{array}{lll}3 & 6 & 25.7\end{array}$ | + 27 | $\begin{array}{lll}3 & 6 & 40 \cdot 1 \\ 3 & \end{array}$ | + 20 | $\begin{array}{llll}3 & 6 & 50 \cdot 3\end{array}$ | + 14 |
| 45 | 3 1 15.4 <br> 2 57 15.4 | 47 | 148 | 41 | $2{ }^{4}$ | -34 | ${ }^{3}$ | -27 | 3 $20236 \cdot 0$ |  | $\begin{array}{llll}3 & 2 & 45 \cdot 7\end{array}$ | . 13 |
| 46 | 25712.4 | 48 | 5738.8 | 40 | $\begin{array}{ll}58 & 0.9\end{array}$ | -33 | 58 18.6 | -26 | 2 58 $32 \cdot \mathrm{I}$ | 1 | $2584 \mathrm{I} \cdot \mathrm{I}$ | I |
| 47 | $\begin{array}{lll}2 & 53 & 9 \cdot 4 \\ 2 & 4 & 4\end{array}$ | $\cdot 48$ | $\begin{array}{llll}2 & 53 & 35 \cdot 8 \\ 2 & 4 & 3\end{array}$ | 40 | $\begin{array}{lllllllllllll}2 & 53 & 57\end{array}$ | -33 | $\begin{array}{lllllll}2 & 54 & 15.2 \\ 2 & 50 & 517\end{array}$ | - 25 | $\begin{array}{llll}2 & 54 & 28 \cdot I \\ 2 & 5\end{array}$ |  | 254 54 2 | 10 |
| 48 | 249 | ${ }^{48}$ | $4932 \cdot 8$ | 40 | $24954 \cdot 6$ | $\cdot 32$ | 25011.7 | $\cdot 25$ | $25024 \cdot 2$ | 17 | $25032 \cdot 0$ | 09 |
| 49 | $\begin{array}{llll}2 & 45 & 3.4\end{array}$ | + 48 | $45 \quad 29.8$ | + 40 | $\begin{array}{llllllll}2 & 45 & 51\end{array}$ | + 32 | $\begin{array}{lll}2 & 46 & 8 \cdot 3\end{array}$ | + 24 | $\begin{array}{llll}2 & 46 & 20 \cdot 3\end{array}$ | + 16 | 24627.4 | + .08 |
| 50 | 2 4 I $0 \cdot 3$ <br> 2 31  | 48 | 4 I 26.8 | 40 | $24148 \cdot 4$ | $\cdot 32$ | $\begin{array}{llll}2 & 42 & 4.9\end{array}$ | . 23 | $\begin{array}{llllllll}2 & 42 & 16.4\end{array}$ | $\cdot 15$ | 24222.9 | . 07 |
| 51 | $\begin{array}{lllllllll}2 & 36 & 57 \cdot 2\end{array}$ | 49 | 2 37 23.8 <br> 2 3  | 40 | $23745 \cdot 2$ | -3I | $\begin{array}{llll}2 & 38 & 1 & 5\end{array}$ |  |  | -14 | $\begin{array}{lllll}2 & 38 & 18.4\end{array}$ | . 05 |
| 52 | 2 32 $54 \cdot \mathrm{I}$ <br> 2   | 49 | $\begin{array}{llll}2 & 33 & 20 \cdot 8\end{array}$ | $\cdot 40$ | $23342 \cdot 2$ | -3I | $23358 \cdot \mathrm{I}$ | $\cdot 22$ | $\begin{array}{lll}2 & 34 & 8.7\end{array}$ | -13 | 23413.9 | $\cdot 04$ |
| 53 | 22851.0 | 49 | $2 \begin{array}{lllll}29 & 17.8\end{array}$ | 40 | $22939 \cdot \mathrm{I}$ | -3I | 22954.7 | -21 | $\begin{array}{lll}2 & 30 & 4.9\end{array}$ | -12 | 30 | . 03 |
| 54 | $\begin{array}{llllll}2 & 24 & 47 \cdot 9 \\ 2 & 20\end{array}$ | $+.50$ | $\begin{array}{llll}25 & 14.8 \\ \\ 21\end{array}$ | + 40 | 22536.0 | + 30 | $\begin{array}{llll}2 & 25 & 51.4\end{array}$ | $+21$ | 2 26 $1 \cdot I$ <br> 2   | + II | 2264.9 | + 0 I |
| 55 56 | $\begin{array}{llll}2 & 20 & 44 \cdot 7 \\ 2 & 16 & 4 \mathrm{I} \cdot 5\end{array}$ | . 50 | $\begin{array}{rrr}211.9 \\ \text { I7 } & 8.8\end{array}$ | $\cdot 40$ | 2 21 $33^{\circ}$ <br> 2 17 30 | -30 | $\begin{array}{lllll}2 & 21 & 48 \cdot 2 \\ 2 & 1 & 4\end{array}$ | . 20 | $\begin{array}{llll}2 & 21 & 57.3 \\ 2 & 17 & 53.5\end{array}$ | -10 | $\begin{array}{lll}2 & 22 & 0.4\end{array}$ | -00 |
| 56 | $2 \mathrm{I}^{16} 4 \mathrm{4} \cdot 5$ | $\cdot 51$ | 1788 | 40 | 2173000 | $\cdot 30$ | 21744.8 | 20 | $\begin{array}{lllllllllllllllll}2 & 17 & 53.5\end{array}$ | -09 | 21755.9 | . 01 |
| 57 | $\begin{array}{llllllll}2 & 12 & 38.2\end{array}$ | $\cdot 51$ | $\begin{array}{lll}13 & 5.8\end{array}$ | 4 I | 1327.0 | 30 | $2 \mathrm{I} 34 \mathrm{I} \cdot 6$ | -9 | 2 I 349.8 | .08 | $2 \mathrm{I} 35 \mathrm{I} \cdot 4$ | . 03 |
| 58 | 8 |  |  |  | 923.9 |  | 938 |  | $946 \cdot 0$ | . 07 | $946 \cdot 9$ | 4 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. $+\quad \cdot 43$ | $\begin{gathered} s \\ -4^{\circ 07} \end{gathered}$ | + ${ }^{\text {s. }}$. 50 | $\begin{gathered} s . \\ -4.08 \end{gathered}$ | + ${ }^{\text {S }} .58$ | s. -4.09 | $\begin{aligned} & \mathrm{s} \\ & +\quad .65 \end{aligned}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot \mathrm{IO} \end{gathered}$ | S. $+\quad .72$ | $\begin{gathered} s . \\ -4 \cdot I I \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\quad .80 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 13 \end{gathered}$ |
| 4 | -39 | 4.07 | . 46 | 4.08 | +.53 | 4.08 | +60 | 4.09 | +.68 | $4 \cdot \mathrm{II}$ | +.75 | $4 \cdot 12$ |
| 8 | -34 | $4 \cdot 06$ | -42 | 4.07 | -49 | 4.08 | $\cdot 56$ | 4.09 | - 64 | 4.10 | . 71 | $4 \cdot 11$ |
| 12 | -30 | 4.06 | $\cdot 37$ | 4.07 | -45 | 4.07 | - 52 | 4.08 | -60 | 4.09 | . 67 | $4 \cdot 10$ |
| I6 | - 26 | 4.06 | $\cdot 34$ | 4.06 | -41 | $4 \cdot 07$ | - 49 | 4.08 | $\cdot 56$ | 4.09 | -64 | $4 \cdot 10$ |
| 20 | + $\cdot 22$ | 4.06 | + 30 | 4.06 | + 37 | 4.07 | + 45 | 4.07 | +.53 | 4.08 | + 60 | 4.09 |
| 22 | - 20 | 4.05 | . 28 | 4.06 | -36 | 4.06 | $\cdot 43$ | 4.07 | -51 | 4.08 | - 59 | $4 \cdot 09$ |
| 24 | -18 | $4 \cdot 05$ | $\cdot 26$ | 4.06 | -34 | 4.06 | -42 | $4 \cdot 07$ | $\cdot 50$ | 4.08 | - 58 | 4.09 |
| 26 | -16 | 4.05 | $\cdot 24$ | 4.06 | $\cdot 32$ | 4.06 | -40 | 4.07 | -48 | 4.08 | - 56 | 4.09 |
| 28 | -14 | 4.05 | - 22 | 4.06 | $\cdot 30$ | $4 \cdot 06$ | - 39 | $4 \cdot 07$ | -47 | 4.08 | $\cdot 55$ | 4.09 |
| 30 | +.12 | 4.05 | + . 21 | 4.05 | + 29 | 4.06 | + 37 | $4 \cdot 07$ | + 45 | 4.07 | +.54 | 4.08 |
| 32 | -10 | 4.05 | -19 | 4.05 | . 27 | 4.06 | -36 | 4.06 | - 44 | 4.07 | - 52 | 4.08 |
| 34 | -08 | 4.05 | -17 | 4.05 | $\cdot 26$ | 4.06 | -34 | 4.06 | -43 | 4.07 | - 51 | 4.08 |
| 36 | -06 | 4.05 | - 15 | 4.05 | $\cdot 24$ | 4.06 | -33 | 4.06 | -42 | 4.07 | - 50 | 4.08 |
| 38 | - 04 | $4 \cdot 05$ | - 13 | * 4.05 | - 22 | 4.05 | $\cdot 31$ | $4 \cdot 06$ | -40 | 4.07 | -49 | $4 \cdot 08$ |
| 40 | +.02 | 4.05 | + - II | 4.05 | + . 21 | 4.05 | + 30 | 4.06 | + 39 | 4.07 | + 48 | 4.08 |
| 42 | -00 | 4.05 | -09 | 4.05 | -19 | 4.05 | - 28 | 4.06 | -38 | 4.07 | . 48 | 4.08 |
| 44 | -. 02 | 4.05 | -07 | 4.05 | -17 | 4.05 | $\cdot 27$ | $4 \cdot 06$ | $\cdot 37$ | 4.07 | $\cdot 47$ | $4 \cdot 08$ |
| 46 | $\cdot 05$ | 4.05 | $\cdot 05$ | 4.05 | -16 | 4.05 | -26 | 4.06 | $\cdot 36$ | 4.07 | -46 | 4.08 |
| 48 | $\cdot 07$ | 4.05 | . 03 | 4.05 | -I4 | 4.05 | $\cdot 25$ | 4.06 | $\cdot 35$ | 4.06 | $\cdot 46$ | 4.08 |
| 50 | - - Io | $4 \cdot 05$ | + - OI | 4.05 | -12 | 4.05 | + 23 | 4.06 | +.34 | 4.06 | +.46 | 4.07 |
| 52 | -12 | 4.05 | -.OI | 4.05 | - II | 4.05 | . 22 | 4.06 | $\cdot 34$ | $4 \cdot 06$ | . 45 | 4.07 |
| 54 | -15 | 4.05 | $\cdot 03$ | 4.05 | $\cdot 09$ | 4.05 | $\cdot 21$ | 4.06 | $\cdot 33$ | 4.06 | $\cdot 45$ | 4.07 |
| 56 | -18 | 4.05 | -06 | 4.05 | -07 | 4.05 | -20 | 4.06 | $\cdot 32$ | 4.06 | -45 | 4.07 |
| 58 | $\cdot 22$ | 4.06 | .08 | 4.05 | .05 | 4.05 | -18 | 4.05 | $\cdot 32$ | 4.06 | $\cdot 45$ | 4.07 |

40 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $9^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{array}{\|c\|c} \text { True } \\ \text { Alt. } \end{array}$ | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{lcc} \text { H. м. } & \text { s. } \\ 6 & 7 & 43 \cdot 0 \end{array}\right.$ | . 66 | H. M. S. $\left\lvert\, \begin{array}{lll} 1 & 8 & 22.9 \end{array}\right.$ | s. 67 | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 9.2 \end{array}\right.$ | $\begin{gathered} s . \\ +.67 \end{gathered}$ | $\left.\begin{array}{\|cc} \text { H. M. } & \text { S. } \\ 6 & 9 \\ 43 \cdot 7 \end{array} \right\rvert\,$ |  | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { Io } & 24^{\circ} 7 \end{array}\right\|$ |  | $\left\|\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { II } & 6 \cdot I \end{array}\right\|$ |  |
| 10 | $52624 \cdot \mathrm{I}$ | 51 | $\begin{array}{llll}5 & 26 & 54 \cdot 7\end{array}$ | $\cdot 50$ | $5 \begin{array}{lll}5 & 27 & 24.8\end{array}$ | $\cdot 50$ | 52754.4 | 49 | 5 28823.5 | 48 | $\begin{array}{llll}5 & 28 & 52 \cdot \mathrm{I}\end{array}$ | 47 |
| 12 | $\begin{array}{lllllllllll}5 & 18 & 9 \cdot 7\end{array}$ | 49 | $\begin{array}{llllllllllll}5 & 18 & 38.6\end{array}$ | 47 | $\begin{array}{lll}5 & 19 & 6.8\end{array}$ | 46 | 5 $51934 \cdot 3$ | 45 | 5201.0 | -44 | $52027 \cdot 5$ | 43 |
| 14 | $955 \cdot 7$ | 46 | 5 10 22.9 | 44 | 5 10 $49 \cdot 2$ | 43 | 5 II 14.6 | -42 | 5 II 39.2 | $\cdot 40$ | $12 \quad 2.9$ | -39 |
| 16 | 5 I $42 \cdot \mathrm{I}$ | 43 | $\begin{array}{llll}5 & 2 & 7.5\end{array}$ | 41 | $\begin{array}{llll}5 & 2 & 32 \cdot 0\end{array}$ | 40 |  | $\cdot 38$ | $\begin{array}{llll}5 & 3 & 17.7\end{array}$ | -36 | 339.0 | 35 |
| 18 | $45328 \cdot 8$ | + 41 | $45352 \cdot 6$ | + 39 | 45415.2 | + 36 | $45436 \cdot 5$ | + 34 | $45456 \cdot 7$ | $+32$ | $45515 \cdot 6$ | $\cdot 30$ |
| 20 | $4 \begin{array}{llll}45 & 15\end{array}$ | $\cdot 38$ | 44537.9 | -36 | 44558.7 | 33 | $44618 \cdot 0$ | $\cdot 31$ | $44636 \cdot 0$ | - 29 | $44652 \cdot 5$ | $\cdot 26$ |
| 22 | $4 \begin{array}{llll}47 & 3 \cdot 1\end{array}$ | -35 | 43723.6 | -33 | 43742.5 | 30 | $4 \begin{array}{llll}4 & 37 & 59.9\end{array}$ | - 27 | $1 \begin{array}{llll}48 & 15.6\end{array}$ | -25 | 43829.7 | 22 |
| 24 | $42850 \cdot 6$ | -33 | $429 \quad 9 \cdot 5$ | $\cdot 30$ | 42926.6 | -27 | $42942 \cdot 0$ | -24 | 42955.5 | -21 | $430 \quad 7 \cdot 2$ | 18 |
| 26 | 42038.4 | - 30 | 42055.7 | $\cdot 27$ | 421110 | - 24 | 42124.3 | -20 | 42135.6 | -17 | 42144.9 | 14 |
| 28 | 41226.4 | + 28 | $41242 \cdot \mathrm{I}$ | + . 24 | 41255.6 | + 21 | $4 \begin{array}{llll}4 & 13 & 6.9\end{array}$ | + 17 | $4 \begin{array}{llll}4 & 13 & 15.9\end{array}$ | + .13 | 1322.8 | + .09 |
| 30 | 414.7 | 25 | $4 \begin{array}{lll}4 & 428.7\end{array}$ | - 21 | $440 \cdot 4$ | -17 | $4 \begin{array}{llll}4 & 4 & 49.6\end{array}$ | 13 | $4 \quad 456 \cdot 4$ | -09 | 50.8 | . 05 |
| 31 | 4 0 8.8 | - 24 | 4 O 22.1 | - 20 | - 32.8 | -16 | - 41.0 | -I1 | 4 0 46.7 | -07 | - $49 \cdot 8$ | .03 |
| 32 | 3 56 $3 \cdot 1$ <br>  51  | - 23 |  | -18 | $\begin{array}{lllllllllllllllllll}3 & 56 & 25 \cdot 3\end{array}$ | -14 | $\begin{array}{llll}3 & 56 & 32 \cdot 5\end{array}$ | -10 | $\begin{array}{llll}3 & 56 & 37.0\end{array}$ | -05 | $\begin{array}{llll}3 & 56 & 38 \cdot 8\end{array}$ | + 0 I |
| 33 | 3 51 57.4 | . 21 | $\begin{array}{lll}3 & 52 & 8.9\end{array}$ | $\cdot 17$ |  | -12 | $3 \begin{array}{llll}3 & 52 & 23.9\end{array}$ | -08 | $3 \begin{array}{llll}3 & 52 & 27.3\end{array}$ | -03 | $3 \begin{array}{llll}32 & 27.9\end{array}$ | - 1 |
| 34 | $34751 \cdot 7$ | + 20 | $\begin{array}{llll}3 & 48 & 2.4\end{array}$ | $+\cdot 15$ |  | + II | $\begin{array}{lllllll}3 & 48 & 15.3\end{array}$ | + .06 |  | + . OI | 3 48 <br> 169  | -04 |
| 35 | $34346 \cdot 0$ | -19 | $\begin{array}{llll}3 & 43 & 56 \cdot 0\end{array}$ | $\cdot \mathrm{I} 4$ | 3 44 2.9 <br> 3 39  | $\cdot 09$ | $\begin{array}{lllll}3 & 44 & 7 \cdot 0\end{array}$ | -04 | $\begin{array}{llll}3 & 44 & 7.9\end{array}$ | - 1 | $\begin{array}{llll}3 & 44 & 5 \cdot 9\end{array}$ | -06 |
| 36 | $33940 \cdot 4$ | - 18 | $\begin{array}{lllll}3 & 39 & 49 \cdot 5\end{array}$ | -13 |  | 7 | $3 \begin{array}{llll}3 & 39 & 58 \cdot 5\end{array}$ | + | $\begin{array}{llll}3 & 39 & 58 \cdot 3\end{array}$ | .03 | 33954.9 | 8 |
| 37 | 3 35 $34 \cdot 8$ <br> 3   | -16 |  | 11 | $\begin{array}{lllllllllllll}3 & 35 & 48 \cdot 2 \\ 3 & 31 & 40.8\end{array}$ | -06 | 3 35 $50 \cdot 0$ | -00 | $\begin{array}{lllll}3 & 35 & 48 \cdot 6\end{array}$ | 5 | $3543 \cdot 9$ | -11 |
| 38 | 33129.3 | -15 | $\begin{array}{llll}3 & 31 & 36 \cdot 7\end{array}$ | -09 | $3 \begin{array}{llll}3 & 31 & 40\end{array}$ | . 04 | 3 3I 4I•5 | - 01 | 33138.9 | . 07 | $3 \mathrm{I} 32 \cdot 8$ | 13 |
| 39 | $\begin{array}{llllllll}3 & 27 & 23.8 \\ 3 & 23\end{array}$ | $+\cdot 14$ | $32730 \cdot 3$ | +.08 | $\begin{array}{llll}3 & 27 & 33.5\end{array}$ | +.02 | 3 $327 \begin{array}{ll}33 \cdot 1 \\ 3 & 23\end{array}$ | -.03 | $\begin{array}{llll}3 & 27 & 29.1\end{array}$ | - -09 | 327 21•7 |  |
| 4 |  | -12 | $\begin{array}{ll}3 & 23 \\ 3 & 24.0\end{array}$ | -06 | $\begin{array}{llll}3 & 23 & 26 \cdot 1 \\ \end{array}$ | - | $\begin{array}{lllll}3 & 23 & 24 \cdot 6\end{array}$ | -05 | $\begin{array}{llll}3 & 23 & 19.4\end{array}$ | $\cdot 12$ | 32310.5 | -18 |
| 41 | $3191912 \cdot 8$ | -Ir | $\begin{array}{llllllll}3 & 19 & 17.6\end{array}$ | -05 | $\begin{array}{llll}3 & 19 & 18 \cdot 8\end{array}$ | - 01 | $\begin{array}{llllll}3 & 19 & 16 \cdot 1 \\ 3 & 1 & 7\end{array}$ | . 08 | $\begin{array}{llll}3 & 19 & 9.6\end{array}$ | - 14 | $3 \mathrm{l}^{18} 595 \cdot 3$ | 20 |
| 42 | $\begin{array}{llll}3 & 15 & 7 \cdot 4\end{array}$ | -10 |  | -03 | $\begin{array}{lllllll}3 & 1 & 5 & 11\end{array}$ | -03 | 3 150 | -10 | $\begin{array}{lllllllllllllllll}3 & 14 & 59.8\end{array}$ | 'I6 | $31448 \cdot 0$ | 23 |
| 43 | 3 II 2.0 | -08 | 3 II 5\%0 | . 02 | 3 II $4 \cdot 1$ | . 05 | 3 10 59.0 |  | 3 10 49.9 | 9 | 3 10 $36 \cdot 6$ | 26 |
| 45 | $\begin{array}{llll}3 & 6 & 56 \cdot 6\end{array}$ | + .07 |  | $\cdot 0$ |  | .07 |  | - -14 |  |  | $\begin{array}{llll}3 & 6 & 25 \cdot 1\end{array}$ | $\cdot 28$ |
| 45 | 3 2 $51 \cdot 2$ <br> 2 58  | . 06 | $\begin{array}{llll}3 & 2 & 52.4 \\ 2 & 58 & 56.1\end{array}$ | -02 | 33 2 $49 \cdot 3$ <br> 2 58  | -09 | [ $\begin{array}{ccc}3 & 2 & 4 \mathrm{I} \cdot 8 \\ 2 & 58 & 33 \cdot 1 \\ 2 & 54\end{array}$ |  | 3 2 29.9 <br> 2 58  |  | 3 2 $13 \cdot 5$ <br>  58  | $\cdot 31$ |
| 46 | ${ }_{2}^{2} 5845 \cdot 8$ | -4 | $\begin{array}{llll}2 & 58 & 46 \cdot 1\end{array}$ | -03 | 2 58 41 | -II | $\begin{array}{lllll}2 & 58 & 33 \cdot 1 \\ 2 & 5\end{array}$ | -18 | $\begin{array}{lllllllllllllll}2 & 58 & 19.8\end{array}$ | -26 | $\begin{array}{lll}2 & 58 & 1 \cdot 7\end{array}$ | 34 |
| 48 | $25440 \cdot 5$ | O3 | $25439 \cdot 8$ |  | 25434.4 | -13 | 25424.4 | . 21 | $\begin{array}{llllllllllllllll}2 & 54 & 9 \cdot 6\end{array}$ | 29 | 25349.9 | 37 |
| 48 | $25035 \cdot 1$ | + - 01 | 25033.4 | -07 | 25026 | - 15 | 25015.6 | - 23 | $2 \begin{array}{lllll} & 49 & 59\end{array}$ | -31 | 249 | 10 |
| 49 | $\begin{array}{ll}2 & 46 \\ 2 & 29.7\end{array}$ | -00 | $24627 \cdot 1$ | -09 |  | - 17 | $2 \begin{array}{llll}2 & 46 & 6 \cdot 7\end{array}$ |  |  |  |  |  |
| 50 | $\begin{array}{lllllll}2 & 42 & 24.4 \\ 2 & 38\end{array}$ | . 02 |  | -10 | $\begin{array}{lllll}2 & 42 \\ 2 & 111\end{array}$ | -19 |  | - 28 | 2 412188.2 |  | $\begin{array}{llllllll}2 & 41 & 13.3\end{array}$ | 46 |
| 51 | $\begin{array}{llll}2 & 38 & 19.0\end{array}$ | -03 |  | -12 | 2 38 $4 \cdot 2$ <br> 2   | 21 | $\begin{array}{lllll}2 & 37 & 48 \cdot 6\end{array}$ | $\cdot 31$ | $\begin{array}{llll}2 & 37 & 27.5\end{array}$ | -40 | $\begin{array}{llll}2 & 37 & 0.7\end{array}$ | -50 |
| 52 | $\begin{array}{lllllllllllll}2 & 34 & 13.6\end{array}$ | -05 | $\begin{array}{llll}2 & 34 & 7 \cdot 8\end{array}$ | . 14 | $\begin{array}{llll}2 & 33 & 56 \cdot 5\end{array}$ | . 24 | 2 33 $39 \cdot 4$ <br> 2 2  | -33 | $\begin{array}{llll}2 & 33 & 16.6\end{array}$ | 43 | $\begin{array}{llllll}2 & 32 & 47 \cdot 8\end{array}$ | 53 |
| 53 | 230 | -07 | $2 \begin{array}{lll}20 & 1.4\end{array}$ | -16 | $22948 \cdot 6$ | -26 | $22930 \cdot 1$ | -36 | $\begin{array}{ll}2 & 29 \\ 5\end{array}$ | -46 | 28 34•7 | 5 |
| 54 | 2 26 $2 \cdot 8$ | -.08 | $\begin{array}{llll}2 & 25 & 54.8 \\ 2 & 2\end{array}$ | $\cdot 18$ | $\begin{array}{llll}2 & 25 & 40 \cdot 8\end{array}$ | - 28 | $\begin{array}{lllll}2 & 25 & 20 \cdot 6\end{array}$ |  | 22454.2 |  | $22421 \cdot 3$ |  |
| 55 | 22157.4 | -10 | 22148.2 | 20 | $\begin{array}{llll}2 & 21 & 32.8 \\ 2\end{array}$ | 31 | 22 IIP | 42 | $22042 \cdot 7$ | 仡 | $2 \begin{array}{lll}20 & 7 \cdot 6\end{array}$ | . 64 |
| 56 | $\begin{array}{lllllllll}2 & 17 & 51\end{array}$ | $\cdot 12$ | $2174 r \cdot 6$ | -23 | $\begin{array}{llllll}2 & 17 & 24.7\end{array}$ | 34 | $\begin{array}{llll}2 & 17 & 1.2\end{array}$ | -45 | $\begin{array}{llllllllllllll}2 & 16 & 30 \cdot 8\end{array}$ | - 56 | $215 \quad 53.5$ | . 68 |
| 57 | $21346 \cdot 5$ | - 14 | $\begin{array}{llllllll}2 & 13 & 34.9\end{array}$ | $\cdot 25$ |  | 36 | $2 \begin{array}{llll}2 & 12 & 51 \cdot 1\end{array}$ | 48 |  | . 60 | 2 II 39•I | 72 |
| 58 | $2940 \cdot 9$ |  | $2 \quad 928 \cdot 0$ | $\cdot 27$ | $98 \cdot \mathrm{I}$ | 39 | $840 \cdot 9$ | $\cdot 51$ | $6 \cdot 3$ | -64 | 724.1 | 77 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ}$ | - A. | L. $13^{\circ}$ | - A. | L. $14^{\circ}$ | ${ }^{\circ} \mathrm{A}$. | L. $15^{\circ}$ | - A. | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{aligned} & \mathrm{s} .87 \\ & +.87 \end{aligned}$ | $\begin{gathered} s . \\ -4 \cdot 14 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad 95 \end{aligned}$ | $\begin{gathered} s . \\ -4 \cdot 16 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot \mathrm{O} 2 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 17 \end{gathered}$ | $\stackrel{s .}{+i \cdot 10}$ | $\begin{gathered} \mathrm{s} \\ 4 \cdot 19 \end{gathered}$ | $\begin{gathered} s . \\ +I \cdot I 8 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4^{\cdot 22} \end{gathered}$ | S. $+\mathrm{I} \cdot 25$ | S. -4.24 |
| 4 | . 83 | $4 \cdot 13$ | -90 | 4.15 | . 98 | $4 \cdot 17$ | 1.05 | $4 \cdot 18$ | I.13 | 4.20 | I.21 | -4.24 4.22 |
| 8 | -78 | $4 \cdot 12$ | - 86 | $4 \cdot 14$ | -93 | $4 \cdot 15$ | I $\cdot 1$ | $4 \cdot 17$ | 1.09 | $4 \cdot 19$ | I'I7 | $4 \cdot 21$ |
| 12 | -75 | $4 \cdot 12$ | -82 | $4 \cdot 13$ | -90 | $4 \cdot 15$ | -97 | $4 \cdot 16$ | 1.05 | $4 \cdot 18$ | I'13 | $4 \cdot 20$ |
| I6 | -71 | 4-II | -79 | 4-12 | -87 | $4 \cdot 14$ | -94 | 4.16 | 1.02 | 4.18 | I•IO | $4 \cdot 20$ |
| 20 | +.68 | $4 \cdot 11$ | + 76 | 4-12 | +.84 | 4-13 | + 92 | 4•15 | +1.00 | 4•I7 | +1.08 | 4.19 |
| 22 | $\cdot 67$ | $4 \cdot 10$ | $\cdot 75$ | 4.12 | -83 | $4 \cdot 13$ | -91 | $4 \cdot 15$ | -99 | 4.17 | 1.07 | 4.19 |
| - 24 | -66 | $4 \cdot 10$ | -73 | 4-11 | . 82 | $4 \cdot 13$ | -90 | $4 \cdot 15$ | -98 | 4-17 | 1.06 | $4 \cdot 19$ |
| 26 | . 64 | $4 \cdot 10$ | -72 | 4-II | .81 | $4 \cdot 13$ | . 89 | $4 \cdot 15$ | -97 | 4-16 | I.05 | 4-18 |
| 28 | . 63 | 4.10 | -71 | 4-II | . 80 | $4 \cdot 13$ | . 88 | $4 \cdot 14$ | -96 | 4.16 | I.05 | $4 \cdot 18$ |
| 30 | $+.62$ | $4 \cdot 10$ | + 70 | 4.II | + 79 | $4 \cdot 12$ | $+.87$ | $4 \cdot 14$ | +.96 | $4 \cdot 16$ | +1.05 | $4 \cdot 18$ |
| 32 | .6I | 4.09 | -70 | $4 \cdot 11$ | -78 | $4 \cdot 12$ | . 87 | $4 \cdot 14$ | . 96 | 4.16 | I. 04 | $4 \cdot 18$ |
| 34 | . 60 | 4.09 | -69 | 4.II | -78 | $4 \cdot 12$ | . 87 | $4 \cdot 14$ | -95 | $4 \cdot 16$ | I.05 | $4 \cdot 18$ |
| 36 | -59 | 4.09 | . 68 | $4 \cdot 11$ | -77 | $4 \cdot 12$ | . 86 | $4 \cdot 14$ | -96 | 4.16 | I 05 | $4 \cdot 18$ |
| 38 | -59 | 4.09 | -68 | 4.10 | -77 | $4 \cdot 12$ | . 86 | $4 \cdot 14$ | -96 | 4.16 | I. 05 | $4 \cdot 18$ |
| 40 | + 58 | 4.09 | +.67 | $4 \cdot 10$ | + 77 | $4 \cdot 12$ | $+.87$ | 4.14 | +.96 | 4.16 | +1.06 | 4.19 |
| 42 | $\cdot 57$ | 4.09 | . 67 | 4.10 | -77 | $4 \cdot 12$ | . 87 | $4 \cdot 14$ | -97 | 4.16 | I.07 | 4.19 |
| 44 | -57 | 4.09 | -67 | 4.10 | -77 | $4 \cdot 12$ | -88 | $4 \cdot 14$ | -98 | 4.17 | I.08 | 4.19 |
| 46 | $\cdot 57$ | 4.09 | -67 | 4.10 | $\cdot 78$ | $4 \cdot 12$ | -88 | $4 \cdot 14$ | -99 | 4.17 | I-10 | $4 \cdot 20$ |
| 48 | $\cdot 57$ | $4 \cdot 09$ | . 68 | 4-11 | $\cdot 78$ | $4 \cdot 12$ | -89 | $4 \cdot 15$ | 1.OI | 4-17 | I'I2 | $4 \cdot 20$ |
| 50 | +.57 | 4.09 | +.68 | 4•II | + .79 | $4 \cdot 13$ | +.91. | 4•15 | +1.02 | 4.18 | +I.14 | $4 \cdot 21$ |
| 52 | -57 | 4.09 | -69 | 4-II | -8I | 4-13 | -93 | 4.15 | I.05 | 4.18 | I•17 | $4 \cdot 22$ |
| 54 | -57 | $4 \cdot 09$ | $\cdot 70$ | $4 \cdot 11$ | -82 | 4-13 | -95 | 4.16 | 1.08 | $4 \cdot 19$ | I-2I | $4 \cdot 23$ |
| 56 | - 58 | $4 \cdot 09$ | $\cdot 71$ | 4.11 | -84 | $4 \cdot 14$ | -97 | $4 \cdot 17$ | I'II | $4 \cdot 20$ | I. 25 | $4 \cdot 24$ |
| 58 | -59 | $4 \cdot 09$ | $\cdot 73$ | $4 \cdot 11$ | -86 | $4 \cdot 14$ | I 01 | 4.17 | I'I5 | $4 \cdot 21$ | I-30 | $4 \cdot 25$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { II } & 48 \cdot 0 \end{array}\right.$ | s. $+\quad .70$ | $\begin{array}{lll} \text { H. M. } \\ 6 & \text { I2 } & 30 \end{array}$ | + S. | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I3 } & 13 \cdot 2 \end{array}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .72 \end{aligned}$ | $\begin{array}{ccc} \text { H. м. } & \text { S. } \\ 6 & \text { I3 } & 56 \cdot 6 \end{array}$ | S. | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I4 } & 40 \cdot 5 \end{array}$ | S. $\cdot 74$ | H. M. S. $\begin{array}{lll}6 & \text { I5 } & 25 \cdot 2\end{array}$ | S. ${ }^{\text {. }}$ |
| 0 | $1 \begin{array}{llll}6 & 11 & 48 \cdot 0 \\ 5 & 29 & 20 \cdot 2\end{array}$ | + 4 | $\begin{array}{llll}6 & 12 & 30 \cdot 3 \\ 5 & 29 & 47 \cdot 8\end{array}$ | $+\quad .71$ .46 | (1) $\begin{array}{llll}5 & 13 & 13.2 \\ 5 & 30 & 14.9\end{array}$ | $+\quad 72$ .45 |  | -44 |  | $\cdot 74$ | $\begin{array}{llll}6 & 15 & 25 \cdot 2 \\ 5 & 31 & 33 \cdot 7\end{array}$ | 43 |
| 12 | $\begin{array}{llll}5 & 20 & 52.7\end{array}$ | $\cdot 42$ | 5 21 177.5 | -41 |  | -40 | $\begin{array}{lll}5 & 22 & 5 \cdot 1\end{array}$ | -39 | $\begin{array}{llll}5 & 22 & 27 \cdot 9\end{array}$ | $\cdot 37$ | 522 50.1 | -36 |
| 14 | $\begin{array}{llll}5 & 12 & 25 \cdot 7\end{array}$ | -37 | $51247 \cdot 7$ | -36 | $\begin{array}{llll}5 & \text { I3 } & 8 \cdot 9\end{array}$ | -34 | $\begin{array}{llll}5 & 13 & 29 \cdot 1\end{array}$ | -33 | $\begin{array}{lllll}5 & 13 & 48 \cdot 6\end{array}$ | $\cdot 31$ | $5 \begin{array}{llll}5 & 14 & 7 \cdot 1\end{array}$ | -30 |
| 16 | $\begin{array}{llll}5 & 3 & 59 \cdot 3\end{array}$ | -33 | $\begin{array}{llll}5 & 4 & 18 \cdot 5\end{array}$ | -3I | $\begin{array}{llll}5 & 4 & 36 \cdot 6\end{array}$ | -29 | $\begin{array}{llll}5 & 4 & 53 \cdot 7\end{array}$ | $\cdot 27$ | $\begin{array}{\|ccc\|}5 & 5 & 9 \cdot 7\end{array}$ | -26 | $\begin{array}{llll}5 & 5 & 24.6\end{array}$ | -24 |
| I8 | $45533 \cdot 2$ | + $\cdot 28$ | $45549 \cdot 6$ | + .26 | $4 \begin{array}{lll}4 & 56 & 4 \cdot 8\end{array}$ | + 24 | $\begin{array}{lllll}4 & 56 & 18 \cdot 7\end{array}$ | $+.22$ | $45^{5} 6631 \cdot 3$ | + 20 | $45642 \cdot 6$ | + -18 |
| 20 | 44773 | $\cdot 24$ | 447 2I-2 | $\cdot 21$ | $4 \begin{array}{lllll}4 & 47 & 33\end{array}$ | -19 | 44744.0 | -16 | $44753 \cdot 2$ | 14 | 4480.8 | - II |
| 22 | $4 \begin{array}{llll}4 & 38 & 42 \cdot 2\end{array}$ | -19 | $43853 \cdot 0$ | $\cdot 17$ | $43932 \cdot 2$ | -14 | $\begin{array}{llll}4 & 39 & 9 \cdot 6\end{array}$ | - II | $43915 \cdot 3$ | . 08 | 43919.3 | + 05 |
| 24 | $43017 \cdot 0$ | -15 | $430 \quad 25 \cdot 1$ | -12 | $43031 \cdot 2$ | -08 | $43035 \cdot 4$ | + .05 | $43037 \cdot 6$ | +.02 | $43037 \cdot 8$ | - $\cdot \mathrm{OI}$ |
| 26 | 42 I 51 | -10 | $42157 \cdot 3$ | -07 | $\begin{array}{lll}4 & 22 & 0.3\end{array}$ | +.03 | 422 I.2 | -00 | 42159.9 | . 04 | $42156 \cdot 4$ | 08 |
| 28 | $41327 \cdot 3$ | + .06 | $413 \quad 29 \cdot 6$ | + 02 | $4 \begin{array}{llll}4 & 29.5\end{array}$ | $\cdot 02$ | $\begin{array}{llll}4 & 13 & 27 \cdot 0\end{array}$ | . 06 | $413{ }^{4}$ 22.1 | - •10 | $\begin{array}{llllll}4 & 13 & 14.7\end{array}$ | $\cdot 14$ |
| 30 | $4 \begin{array}{lll}4 & 5 & 2.6\end{array}$ | + or | $4 \quad 5 \quad 1 \cdot 9$ | . 03 | $\begin{array}{llll}4 & 4 & 58 \cdot 6\end{array}$ | -08 | $\begin{array}{llll}4 & 4 & 52.7\end{array}$ | 2 | $\begin{array}{lll}4 & 4 & 44.2\end{array}$ | 16 | $\begin{array}{llll}4 & 4 & 32 \cdot 8\end{array}$ | 21 |
| 31 | 4 ○ 50.3 | OI | $4048 \cdot 1$ | -06 | $4 \quad 0 \quad 43 \cdot 2$ | -10 | $4 \quad 0 \quad 35 \cdot 5$ | 5 | $4025 \cdot 1$ | - 20 | $4 \quad 0 \quad 11.7$ | 25 |
| 32 | $\begin{array}{lllll}3 & 56 & 37 \cdot 9\end{array}$ | $\cdot 04$ | $356134 \cdot 2$ | . 08 | $356127 \cdot 7$ | - I3 | $35618 \cdot 3$ | -18 | $\begin{array}{lll}3 & 56 & 5 \cdot 9\end{array}$ | - 23 | $355 \quad 50 \cdot 5$ | -28 |
| 33 | $\begin{array}{lllll}3 & 52 & 25.5\end{array}$ | . 06 | $\begin{array}{llll}3 & 52 & 20 \cdot 3\end{array}$ | - II | $3 \begin{array}{llll}3 & 52 & 12 \cdot 1\end{array}$ | 6 | $\begin{array}{lll}3 & 52 & 0.9\end{array}$ | -2I | $35146 \cdot 6$ | -26 | $35129 \cdot 1$ | 32 |
| 34 | $\begin{array}{lllllllllll}3 & 48 & 13.2\end{array}$ | -09 | $\begin{array}{llll}3 & 48 & 6 \cdot 4\end{array}$ | -14 | $\begin{array}{llll}3 & 47 & 56 \cdot 5\end{array}$ | -19 | $34743 \cdot 5$ | -24 | $347 \quad 27 \cdot 2$ | $\cdot 30$ | $\begin{array}{llll}3 & 47 & 7 \cdot 6\end{array}$ | $\cdot 35$ |
|  | $\begin{array}{llll}3 & 44 & 0 \cdot 7 \\ 3 & 39 & 78\end{array}$ | I |  | -16 | $3 \begin{array}{llll}3 & 43 & 40 \cdot 8\end{array}$ | - 22 | $\begin{array}{llll}3 & 43 & 25 \cdot 9\end{array}$ | -27 | $\begin{array}{llll}3 & 43 & 7 \cdot 7\end{array}$ | . 33 | $\begin{array}{llll}3 & 42 & 46 \cdot 0\end{array}$ | - 39 |
| 36 | $\begin{array}{llll}3 & 39 & 48 \cdot 3\end{array}$ | 1 | $\begin{array}{lllll}3 & 39 & 38 \cdot 3\end{array}$ | -19 | $\begin{array}{llll}3 & 39 & 25 \cdot 0\end{array}$ | - 25 | $\begin{array}{llll}3 & 39 & 8 \cdot 3\end{array}$ | -31 | $\begin{array}{lllllllllll}3 & 38 & 48 \cdot 0\end{array}$ | -37 | $\begin{array}{llll}3 & 3^{8} & 24 \cdot 1\end{array}$ | -43 |
| 37 | $\begin{array}{llll}3 & 35 & 35 \cdot 7\end{array}$ | $\cdot 16$ | $3 \quad 35 \quad 24 \cdot 2$ | 2 | $\begin{array}{llll}3 & 35 & 9 \cdot 1\end{array}$ | -28 | $3 \begin{array}{llll}3 & 34 & 50 \cdot 5\end{array}$ | -34 | $\begin{array}{llll}3 & 34 & 28 \cdot 1\end{array}$ | -40 | $\begin{array}{llll}3 & 34 & 2 \cdot 0\end{array}$ | $\cdot 47$ |
| 38 | 3 31 23.2 | -19 | $33^{1} 10 \cdot 0$ | - 25 | $\begin{array}{lllll}3 & 30 & 53 \cdot 1\end{array}$ | $\cdot 31$ | $3 \begin{array}{llll}3 & 30 & 32 \cdot 5\end{array}$ | -37 | $33^{30} 8 \cdot 0$ | -44 | $\begin{array}{llll}3 & 29 & 39 \cdot 6\end{array}$ | $\cdot 51$ |
| 39 | $\begin{array}{llll}3 & 27 & 10 \cdot 5 \\ 3 & 22 & 5\end{array}$ | -22 | $\begin{array}{llll}3 & 26 & 55 \cdot 6\end{array}$ | . 28 | $326 \begin{array}{lll}36 \cdot 9\end{array}$ | '34 | $\begin{array}{llll}3 & 26 & 14.3\end{array}$ | 41 | $3 \begin{array}{llll}3 & 25 & 47 \%\end{array}$ | - $\cdot 48$ | $32517 \cdot 0$ | -55 |
| 40 | $\begin{array}{llll}3 & 22 & 57 \cdot 8\end{array}$ | -24 | $\begin{array}{lllll}3 & 22 & 41 \cdot 2\end{array}$ | -31 | $\begin{array}{llll}3 & 22 & 20.6\end{array}$ | $\cdot 38$ | $32156 \cdot 0$ | -44 |  | - 52 | $32054{ }^{\circ}$ | - 59 |
| 41 | $\begin{array}{llll}3 & 18 & 45 \cdot 0\end{array}$ | - 27 | $\begin{array}{llll}3 & 18 & 26.6\end{array}$ | -34 | $\begin{array}{llll}3 & 18 & 4^{\cdot 1}\end{array}$ | - 41 | 31737.4 | -48 | 3 I7 $6 \cdot 3$ | - 55 | $31630 \cdot 7$ | 63 |
| 42 | $314332 \cdot 0$ | - 30 | 3141919 | -37 | 31313470 | -44 |  | - 52 | $\begin{array}{lllllllll}3 & 12 & 45\end{array}$ | -59 | $312 \begin{array}{llll}3 & 71\end{array}$ | -67 |
| 43 | 3 10 19.0 | -33 | $3 \quad 957 \cdot 0$ | -40 | $\begin{array}{llll}3 & 9 & 30.6\end{array}$ | $\cdot 48$ | $\begin{array}{lllll}3 & 8 & 59.5\end{array}$ | . 56 | $3 \begin{array}{llll}3 & 8 & 23.7\end{array}$ | -64 | $3743 \cdot 0$ | $\cdot 72$ |
| 44 | $\begin{array}{llr}3 & 6 & 5.8\end{array}$ | -36 | $\begin{array}{llll}3 & 5 & 419\end{array}$ | $\bullet 44$ | $\begin{array}{lll}3 & 5 & 13.4 \\ 3 & 5\end{array}$ | $\cdot 51$ | $\begin{array}{lll}3 & 4 & 40 \cdot 1\end{array}$ | . 60 | $\begin{array}{llll}3 & 4 & 19\end{array}$ | -68 | $\begin{array}{llll}3 & 3 & 18.5\end{array}$ | 77 |
| 45 | $\begin{array}{llll}3 & 1 & 52.4\end{array}$ | -39 | $3 \mathrm{I} 26 \cdot 6$ | $\cdot 47$ | 3 o 56.0 | -55 | 3 3 $\quad 0 \quad 20 \cdot 4$ | -64 | $2 \begin{array}{llll}2 & 59 & 39 \cdot 6\end{array}$ | -72 | $\begin{array}{llllllllllllllllll}2 & 58 & 53 \cdot 5\end{array}$ | -81 |
| 46 | $\begin{array}{llllllllll}2 & 57 & 38 \cdot 9\end{array}$ | -42 | 25711.2 | $\cdot 50$ | $2 \begin{array}{lllll}26 & 38 \cdot 3\end{array}$ | - 59 | $\begin{array}{lll}2 & 56 & 0.3\end{array}$ | -68 | $\begin{array}{llllllllllllllll}2 & 55 & 16.9\end{array}$ | $\cdot 77$ | $25428 \cdot 0$ | . 86 |
| 47 | $253125 \cdot 2$ | -45 | $\begin{array}{lllll}2 & 52 & 55.4\end{array}$ | - 54 | $\begin{array}{lllll}2 & 52 & 20 \cdot 3\end{array}$ | -63 | $2515139 \cdot 8$ | $\cdot 72$ |  | -82 | $250 \quad 1.8$ | 91 |
| 48 | 249 II.3 | -49 | $248 \quad 39 \cdot 3$ | - 58 | $248 \quad 2 \cdot 0$ | $\cdot 67$ | $2 \begin{array}{lllllll}2 & 47 & 18.9\end{array}$ | $\cdot 77$ | $24630 \cdot 1$ | -86 | $24535 \cdot 0$ | -97 |
| 49 | $2 \begin{array}{lllll}2 & 44 & 57 \cdot 1\end{array}$ | $\cdot 52$ | $24423 \cdot 0$ | . 62 | $24343 \cdot 2$ | $\cdot 71$ | $24257 \cdot 5$ | -81 | 242507 | - 92 | 24176 | - I.02 |
| 50 | $24042 \cdot 7$ | -56 | 24063 | -65 | 239 24.1 | $\cdot 76$ | $23835 \cdot 6$ | -86 | $23740 \cdot 8$ | $\cdot 97$ | $2 \begin{array}{lllll}2 & 36 & 39\end{array}$ | 1.08 |
| 51 | $2 \begin{array}{llll}2 & 36 & 28 \cdot 0\end{array}$ | -59 | $23549 \cdot 3$ | $\cdot 70$ | $2 \begin{array}{lll}255 & 4.4\end{array}$ | .80 | $23413 \cdot 1$ | -91 | $23315 \cdot 1$ | 1.02 | $23210 \cdot 2$ | $1 \cdot 14$ |
| 52 | $\begin{array}{llll}2 & 32 & 13 \cdot 0 \\ 2 & 27 & 57.6\end{array}$ | - 63 | $23131 \cdot 9$ | $\cdot 74$ | $\begin{array}{lllll}2 & 30 & 44 \cdot 3\end{array}$ | . 85 | 22950.0 | -96 |  | 1.08 | $22740 \cdot 1$ | I |
| 53 | $22757 \cdot 6$ | -67 | 22714.0 | $\cdot 78$ | $226 \quad 23 \cdot 5$ | -90 | $22526 \cdot 1$ | 1.02 | 22421.4 | 1.14 | $223 \quad 9.0$ | I. 27 |
| 54 | $\begin{array}{llll}2 & 23 & 41.9\end{array}$ | $\cdot 71$ | $22255 \cdot 6$ | -83 | 2222.2 | -95 | 22115 | - I. 08 | 21953.1 | - I. 21 | 2 I8 $36 \cdot 7$ | - I. 34 |
| 55 | $2 \begin{array}{llll}2 & 19 & 25 \%\end{array}$ | $\cdot 76$ | $2 \begin{array}{llll}2 & 18 & 36 \cdot 6\end{array}$ | . 88 | $2 \begin{array}{llll}17 & 40 \cdot 2\end{array}$ | 1.00 | $21636 \cdot 0$ | I'14 |  | 1.27 | $2 \begin{array}{llll}2 & 14 & 3 \cdot 2\end{array}$ | 1.42 |
| 56 | $\begin{array}{lll}2 & 15 & 9.0\end{array}$ | -80 | 21417.0 | -93 | $2{ }^{1} 131793$ | 1.06 | $2 \begin{array}{llll}2 & 12 & 9.6\end{array}$ | I-20 | 2 10 53.4 | $1 \cdot 34$ | $\begin{array}{llll}2 & 9 & 28 \cdot 2\end{array}$ | I 50 |
| 57 | 2 10 5I•8 | -85 | $2 \quad 9 \quad 56.8$ | $\cdot 98$ | $2 \begin{array}{lllll}2 & 8 & 53.7\end{array}$ | $\cdot 12$ | $2.742 \cdot 1$ | $1 \cdot 27$ | $2621 \cdot 6$ | 1.42 | $2 \begin{array}{llll}2 & 4 & 51\end{array} 7$ | I. 58 |
| 58 | $2634 \cdot 1$ | $\cdot 90$ | $2 \quad 5 \quad 35 \cdot 8$ | I. 04 | 24 29.I | I•19 | $2 \begin{array}{llll}2 & 3 & 13.4\end{array}$ | 1.34 | 2 I 48.3 | 1.50 | $2 \quad 0 \quad 13 \cdot 3$ | I. 67 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18{ }^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. 23 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | +1.33 | $-4 \cdot 26$ | +1.41 | $-4.29$ | +1.49 | -4.3I | +1.58 | -4.35 | +1.66 | $-4.38$ | +1.74 | $-4.41$ |
| 4 | 1.28 | $4 \cdot 25$ | I•36 | $4 \cdot 27$ | 1.44 | $4 \cdot 30$ | I 53 | $4 \cdot 33$ | I-6I | $4 \cdot 36$ | I 69 | $4 \cdot 39$ |
| 8 | 1.24 | $4 \cdot 23$ | I-32 | $4 \cdot 26$ | 1.40 | $4 \cdot 29$ | 1.48 | $4 \cdot 31$ | I 57 | $4 \cdot 34$ | I. 65 | $4 \cdot 37$ |
| 12 | 1.2I | 4.23 | I-29 | $4 \cdot 25$ | $1 \cdot 37$ | $4 \cdot 27$ | 1.45 | $4 \cdot 30$ | I•53 | 4.33 | I 62 | $4 \cdot 36$ |
| 16 | 1-18 | $4 \cdot 22$ | I. 26 | $4 \cdot 24$ | I•34 | $4 \cdot 27$ | 1.42 | $4 \cdot 29$ | I-5I | $4 \cdot 32$ | I-59 | $4 \cdot 35$ |
| 20 | +1.16 | $4 \cdot 21$ | +1.24 | $4 \cdot 23$ | +1.32 | $4 \cdot 26$ | +1.41 | 4.29 | +1.49 | $4 \cdot 32$ | +1.58 | $4 \cdot 35$ |
| 22 | 1-15 | $4 \cdot 21$ | 1.23 | $4 \cdot 23$ | $1 \cdot 32$ | $4 \cdot 26$ | 1.40 | 4-29 | I.49 | $4 \cdot 31$ | I. 58 | $4 \cdot 34$ |
| 24 | I-14 | $4 \cdot 21$ | I. 23 | $4 \cdot 23$ | I.3I | $4 \cdot 26$ | 1.40 | $4 \cdot 28$ | I-49 | 4.31 | I 57 | $4 \cdot 34$ |
| 26 | $1 \cdot 14$ | $4 \cdot 21$ | I. 22 | $4 \cdot 23$ | I.3I | $4 \cdot 26$ | 1.40 | $4 \cdot 28$ | I-49 | 4.31 | I. 58 | $4 \cdot 34$ |
| 28 | I'I4 | $4 \cdot 20$ | I. 22 | 4.23 | I•3I | $4 \cdot 26$ | $1 \cdot 40$ | $4 \cdot 28$ | I.49 | $4 \cdot 31$ | I. 58 | $4 \cdot 35$ |
| 30 | +1.13 | $4 \cdot 20$ | +1.22 | $4 \cdot 23$ | +1.31 | $4 \cdot 26$ | +1.40 | $4 \cdot 29$ | +1.49 | $4 \cdot 32$ | +I.59 | $4 \cdot 35$ |
| 32 | I-13 | $4 \cdot 20$ | I-22 | $4 \cdot 23$ | I.32 | $4 \cdot 26$ | I.41 | $4 \cdot 29$ | 1.50 | $4 \cdot 32$ | I. 60 | $4 \cdot 35$ |
| 34 | I•14 | $4 \cdot 21$ | 1.23 | $4 \cdot 23$ | I.32 | $4 \cdot 26$ | I. 42 | $4 \cdot 29$ | I.52 | 4.32 | I-6I | $4 \cdot 36$ |
| 36 | I-14 | $4 \cdot 21$ | I. 24 | $4 \cdot 23$ | I.33 | $4 \cdot 26$ | I. 43 | $4 \cdot 29$ | I. 53 | $4 \cdot 33$ | 1.63 | $4 \cdot 37$ |
| 38 | I.15 | $4 \cdot 21$ | I 25 | $4 \cdot 24$ | I.35 | $4 \cdot 27$ | I.45 | $4 \cdot 30$ | I. 55 | $4 \cdot 34$ | I. 65 | $4 \cdot 37$ |
| 40 | +1.16 | $4 \cdot 21$ | +1.26 | $4 \cdot 24$ | +1.36 | $4 \cdot 27$ | +1.47 | 4.31 | $+1.57$ | $4 \cdot 34$ | + $\mathrm{I} \cdot 68$ | 4.38 |
| 42 | 1-17 | $4 \cdot 21$ | 1.28 | $4 \cdot 24$ | I 38 | $4 \cdot 28$ | 1.49 | $4 \cdot 31$ | I. 60 | $4 \cdot 35$ | I•71 | $4 \cdot 40$ |
| 44 | I-I9 | 4.22 | $1 \cdot 30$ | $4 \cdot 25$ | I 41 | $4 \cdot 29$ | I-52 | 4.33 | I. 63 | $4 \cdot 37$ | 1.75 | $4 \cdot 41$ |
| 46 | I'2I | $4 \cdot 23$ | I.32 | $4 \cdot 26$ | I. 44 | $4 \cdot 30$ | I. 55 | $4 \cdot 34$ | 1.67 | $4 \cdot 38$ | I.80 | $4 \cdot 43$ |
| 48 | I. 23 | $4 \cdot 23$ | I-35 | $4 \cdot 27$ | I 47 | $4 \cdot 31$ | I. 59 | $4 \cdot 35$ | I•72 | $4 \cdot 40$ | I.85 | $4 \cdot 45$ |
| 50 | +I.26 | $4 \cdot 24$ | +1.39 | $4 \cdot 28$ | +I.5I | $4 \cdot 32$ | +1.64 | $4 \cdot 37$ | $+1.77$ | $4 \cdot 42$ | +I.91 | $4 \cdot 48$ |
| 52 | I. 30 | 4.25 | 1.43 | 4.29 | I. 56 | $4 \cdot 34$ | $1 \cdot 70$ | $4 \cdot 39$ | I.84 | $4 \cdot 45$ | I.98 | $4 \cdot 51$ |
| 54 | 1-34 | 4.27 | I-48 | 4.31 | I. 62 | $4 \cdot 36$ | I.76 | $4 * 42$ | I.91 | $4 \cdot 48$ | 2.07 | $4 \cdot 55$ |
| 56 | I.39 | $4 \cdot 28$ | I. 54 | $4 \cdot 33$ | I. 69 | $4 \cdot 39$ | I. 84 | $4 \cdot 45$ | $2 \cdot 00$ | $4 \cdot 52$ | $2 \cdot 17$ | 4.60 |
| 58 | 1.45 | $4 \cdot 30$ | I.6I | 4.35 | 1.77 | 4.42 | I.93 | $4 \cdot 49$ | $2 \cdot 11$ | $4 \cdot 57$ | $2 \cdot 30$ | 4.65 |

42 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $\mathbf{1 0}^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0{ }^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. Var. | $2{ }^{\circ}$ | Decl. Var. | $3^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $4{ }^{\circ}$ | Decl. Var. | $5{ }^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0.0 \end{array}\right\|$ |  | $\begin{array}{lll}\text { H. M. } \\ 6 & \text { o } & 42 \cdot 3\end{array}$ | + 70 | $\left.\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { 24: } \end{array}\right.\right]$ |  | $\begin{array}{\|cc\|} \text { H. M. } & \text { S. } \\ 6 & 2 \end{array}$ |  | $\left\|\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & 29 \cdot 5 \end{array}\right\|$ |  | $\left\|\begin{array}{ccc} \text { H. . . s. } \\ 6 & 3 & 32 \cdot 2 \end{array}\right\|$ |  |
| ro | (191922.6 |  |  |  | ${ }^{5} 22047 \mathrm{l}$ |  | ${ }_{5} 2128$ |  | ${ }_{5} 22288$ |  | (1) |  |
| 12 | (5llllla | $\cdot 72$ |  | 71 |  | . 69 | $\begin{array}{llllll}5 & 13 & 20.7 \\ 5 & 5 & \\ 5 & 5.7\end{array}$ |  | $\begin{array}{llll}5 & 14 & 0.9 \\ 5 & 5 & 53 \\ 5 & 5\end{array}$ |  |  | 5 |
| 14 <br> 16 <br> 18 | ( $\begin{array}{llll}5 & 3 & 3 & 7 \cdot 1 \\ 4 & 54 & 59 \cdot 2\end{array}$ | 73 |  | 71 |  | . 69 | 5 5 $13 \cdot 3$ <br> 4 57 $5 \cdot 8$ | . 67 | $\begin{array}{lllll}5 & 5 & 53 \cdot 2 \\ 4 & 57 & 45 \cdot 6\end{array}$ | ${ }^{66}$ | ( ${ }_{5}^{5}$ | 64 63 63 |
| 18 | - 4 | + 74 | ${ }_{4}^{4} 473$ | + 72 | $\begin{array}{llllll}4 & 48 & 17.3 \\ 4 & 40 & 9.8\end{array}$ | + 70 | $\begin{array}{ll}4 & 48 \\ 4 & 58 \\ 4 & 5 \\ 5\end{array}$ | $+$ | 4 49 38.2 <br> 4 31  <br> 180   | + 65 | [40016.6 | + 6.63 |
| 20 22 | [43842 | . 76 |  | $\stackrel{72}{7}$ |  | .70 | 4 40 <br> 4 32 <br> 15 4.6 | . 67 | 4 4 II $30 \cdot 7$ <br> 4 33 $23 \cdot 3$ <br> 1   |  |  |  |
| 24 | ${ }_{4}^{4} 2225 \cdot 4$ | $\cdot 77$ | 423 10.9 | 74 | $42354 \cdot 4$ | 71 | $42436 \cdot \mathrm{I}$ | 68 | 4 5155 |  | [425 $43 \cdot 8$ |  |
| 26 | 4 I 416 | 79 | $4 \begin{array}{lll}45 & 2 \cdot 5\end{array}$ | 75 | $41546 \cdot 6$ | . 72 | 41628.6 | 68 | $\begin{array}{llll}4 & 17 & 8.5\end{array}$ | 5 | $4 \mathrm{I7} 46 \cdot 4$ | .61 |
| 28 30 | [rrrr | + 8.80 | -4 6 53.9 <br> 3 58  | + 76 | $\begin{array}{lllll}4 & 7 & 38 \cdot 6 \\ 3 & 59 & 30 \cdot 4\end{array}$ | + 72 | $4 \quad 0 \quad 13 \cdot 2$ | + 69 | 4   <br> 4 9 $\mathrm{r} \cdot 0$ <br> 4 0 53 |  |  | I |
| 30 <br> 3 r |  | . 2 | 3 <br> 3 <br> 3 <br> 54 <br> 54 <br> 4 <br> 40.5 | $\begin{array}{r}78 \\ .78 \\ \hline 8\end{array}$ |  | - |  |  |  |  | ${ }^{4}$ |  |
| 32 | 34947 |  | $35035 \cdot 9$ |  | 351 | 74 | $\begin{array}{llll} & 52 & 5 \cdot 3\end{array}$ | 70 | $35246 \cdot 0$ |  | $35324 \cdot \mathrm{I}$ |  |
| 33 | 34541 |  | 346$3 \mathrm{r} \cdot \mathrm{I}$ |  | 34717.6 | .75 | $\begin{array}{lll}3 & 48 & \text { r.3 }\end{array}$ | 70 | $34842 \cdot 2$ |  | 34920.4 |  |
| 34 |  | + 86 | 3 42 $26 \cdot 3$ <br> 3 38  | + 8.8 x | 3 43 13 3 <br> 3 39   <br> 3 8   | + 76 |  | + $7 \mathrm{7x}$ | $\begin{array}{llll}3 & 44 & 38 \cdot 4 \\ 3 & 40 & 34 \cdot 6\end{array}$ | + .66 | $1 \begin{array}{lllllllll}3 & 45 & 16 \cdot 7 \\ 3\end{array}$ | 6 fr |
| 35 36 3 |  | . 87 |  | . 82 |  |  |  | 72 | 3 40 $34 \cdot 6$ <br> 3 36 $30 \cdot 6$ |  |  |  |
| 37 |  | . 89 | 3 $30011 \cdot 2$ | 83 |  | .78 | 3 $3 \mathrm{3I} 44 \cdot 8$ |  | $\begin{array}{llll}3 & 32 & 26 \cdot 7\end{array}$ |  | $\begin{array}{llll}3 & 33 & 5.5\end{array}$ | 62 |
| 38 | 3 $25 \begin{array}{lllll}3 & 15\end{array}$ | -90 | 326 | 84 | 3 26 55\% | -79 | $\begin{array}{ll}3 & 2740 \cdot 61\end{array}$ | 73 |  | . 67 | 3 29 | 62 |
| 39 | 3 | + 9 9 | ${ }_{3}^{3} 22.00 .5$ | + 86 | $\begin{array}{llll}3 & 22 & 50 \cdot \mathrm{I} \\ 3 & 18 & 45 \\ 3\end{array}$ | $+\quad .80$ | $\begin{array}{lll}3 & 23 & 36.2\end{array}$ | + 74 | $\begin{array}{llll}3 & 24 & 18.8 \\ 3 & 20 & \\ \text { I4.7 }\end{array}$ | + 688 | $\begin{array}{llll}3 & 24 & 57.9 \\ 3 & 20 \\ 3 & 54 \cdot 1\end{array}$ | . 62 |
| $4{ }_{4}$ | ( 317 |  | $\begin{array}{llll}3 & 17 & 55.0 \\ 3 & \text { r3 } & 49.3\end{array}$ | . 88 |  | .82 |  |  | 3 20 18.7 <br> 3 16 $10 \cdot 6$ <br> 10   |  |  |  |
| 42 | ${ }^{3} 8$ |  | (rrrer | . 89 | ${ }^{3}$ | . 83 | 3 II 22.7 | 76 | $\begin{array}{llll}3 & 12 & 6 \cdot 4\end{array}$ |  | 3   <br> 3 12 46.4 |  |
| 43 | 34 |  | $\begin{array}{llllll}3 & 5 & 37 \cdot 4\end{array}$ | 91 | 33 $29 \cdot 7$ |  | 3718.0 |  | $\begin{array}{llll}3 & 8 & 2 \cdot 2\end{array}$ |  | $\begin{array}{llll}3 & 8 & 42 \cdot 5\end{array}$ | 64 |
| 44 | ( $\begin{array}{ccc}3 & 0 & 33.7 \\ 2 & 56 & 26.2\end{array}$ |  | ( | + 92 |  | $+{ }^{+85}$ |  | + 78 | 3 3 57 <br> 2 59 53 | + 71 | 3 4 $38 \cdot 5$ <br> 3 0 3 |  |
| 46 |  | $\stackrel{+}{1} \cdot 101$ |  | .94 | 2 58 <br> 2 54 <br> 2 I $3 \%$ | . 88 |  | . 80 | $2{ }^{2} 595953 \cdot 6$ | - 2 | (rrers | 5 |
| 47 | $2{ }^{4} 8818.5$ | r 05 | 249 Ir-2 | -97 | 250 | 89 | 25058.2 | -81 | $25 \mathrm{I} 44 \cdot 6$ | . 73 | ${ }_{2}^{2} 5226 \cdot 4$ | -66 |
| 48 | 2  <br> 1 $2 \cdot 1$ |  | 2454 4'I | 99 | $2 \begin{array}{lll}46 & 0.9\end{array}$ | 91 | $24652 \cdot 9$ |  | $24739 \cdot 9$ | 74 | $24^{8} 22 \cdot 2$ | . 66 |
| 49 50 | $\left\|\begin{array}{lll} 2 & 39 & 53 \cdot \\ 2 & 3 & 4 \\ 2 \end{array}\right\|$ | $\underline{\mathrm{r}} \mathrm{r}$ | 2 <br> 2 <br> 2 <br> 20 <br> 30 | $\xrightarrow[+1.09]{\text { r.o3 }}$ |  | + 92 | - 4 | + $8^{8}$ | $\begin{array}{llll}2 & 43 & 35 \cdot 2 \\ 2 & 39 & 30 \cdot 3 \\ 2\end{array}$ |  | 2 44 17.9 <br> 2 40 17.7 <br> 3.7   |  |
| 51 | ${ }_{2}$ | - | ${ }_{2} 3^{2} 440 \cdot 9$ | 1.05 | $\begin{array}{ll}2 & 31 \\ 2 & 31 \\ 4 & 41 \cdot 2\end{array}$ | ${ }^{-96}$ | 234360 | . 87 | 2 <br> 25 <br> $25 \cdot 3$ |  | ${ }_{2}{ }^{2} 4$ |  |
| 52 | ${ }^{2} 2725.0$ |  | $\begin{array}{ll}2 & 28 \\ 28 & 32 \cdot 5\end{array}$ | 1.08 |  | $\cdot 98$ | 230 | . 88 | $23120 \cdot 2$ |  | 2 32 $4 \cdot 8$ |  |
| 53 | 22314.5 | 121 | 22423.8 | 1.10 | 22526.8 | I.OO | $\begin{array}{llllll}26 & 23 & 23\end{array}$ | $\cdot 90$ | $2 \begin{array}{llll}27 & 14.9\end{array}$ |  | $\begin{array}{lll}288 & 0.2\end{array}$ | 7 r |
| 54 55 | $\begin{array}{cccc}2 & 19 & 3 \cdot 6 \\ 2 & 14 & 52 \cdot \mathrm{I}\end{array}$ | +1 | 22014.6 | +r. 3 | 2 21 19 <br> 2 17  | + P . 02 | $\begin{array}{llll}2 & 22 & 17.3 \\ 2 & 18 & 10.6 \\ & 1 & \end{array}$ |  |  |  | 223 |  |
| 56 | , |  | ${ }^{2} \mathbf{2 1 8}$ |  | 2r3 |  | $2{ }^{2} 143.6$ |  |  |  | 21545 |  |
| 57 58 | $\begin{array}{lll}2 & 6 & 27 \cdot 1 \\ 2 & 2 & 13.5\end{array}$ |  |  |  | 2 |  |  |  | - |  |  | 7 <br> 76 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. | A. | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ}$ A. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | S. 00 | $\begin{gathered} s . \\ -4.06 \end{gathered}$ | + ${ }^{\text {s. }}$ | $\begin{gathered} \text { s. } \\ -4.06 \end{gathered}$ | S. $+\quad .14$ | $\begin{gathered} s . \\ -4.06 \end{gathered}$ | S. $+\quad .22$ | $\begin{gathered} \mathrm{s} . \\ -4.07 \end{gathered}$ | $\begin{gathered} s . \\ +\quad .29 \end{gathered}$ | $\begin{gathered} s . \\ -4.07 \end{gathered}$ | s. $+\quad .36$ | S. |
| 4 | -.05 | 4.06 | . 02 | $4 \cdot 06$ | .09 | $4 \cdot 06$ | -17 | 4.06 | - 24 | 4.07 | -31 | 4.07 |
| 8 | -10 | $4 \cdot 06$ | -.03 | 4.06 | +.04 | 4.06 | -12 | $4 \cdot 06$ | -19 | $4 \cdot 07$ | - 26 | 4.07 |
| 12 | - 55 | $4 \cdot 06$ | -08 | 4.06 | $\cdot 00$ | 4.06 | . 07 | $4 \cdot 06$ | -14 | $4 \cdot 06$ | -21 | 4.07 |
| 16 | $\cdot 20$ | $4 \cdot 07$ | -13 | 4.06 | -. 05 | 4.06 | + 02 | $4 \cdot 06$ | -09 | $4 \cdot 06$ | -17 | $4 \cdot 06$ |
| 20 | -. 26 | $4 \cdot 07$ | - .18 | 4.06 | - -II | 4.06 | -.03 | 4.06 | +.04 | 4.06 | + 12 | 4.06 |
| 22 | - 29 | $4 \cdot 07$ | $\cdot 21$ | 4.07 | -14 | 4.06 | . 06 | $4 \cdot 06$ | -02 | 4.06 | -10 | 4.06 |
| 24 | $\cdot 32$ | 4.07 | $\cdot 24$ | 4.07 | -16 | 4.06 | -08 | $4 \cdot 06$ | -00 | $4 \cdot 06$ | -07 | 4.06 |
| 26 | $\cdot 35$ | $4 \cdot 08$ | $\cdot 27$ | 4.07 | -19 | 4.07 | -II | 4.06 | -.03 | $4 \cdot 06$ | -05 | $4 \cdot 06$ |
| 28 | $\cdot 38$ | $4 \cdot 08$ | -30 | 4.07 | -22 | 4.07 | -14 | $4 \cdot 06$ | .05 | $4 \cdot 06$ | -03 | 4:06 |
| 30 | - $\cdot 42$ | 4.08 | $\cdot 33$ | 4.08 | - 25 | 4.07 | - - I7 | 4.07 | -.08 | 4.06 | -00 | 4.06 |
| 32 | -45 | $4 \cdot 09$ | $\cdot 36$ | 4.08 | $\cdot 28$ | 4.07 | -19 | 4.07 | -II | $4 \cdot 06$ | -. 02 | $4 \cdot 06$ |
| 34 | -49 | $4 \cdot 09$ | -40 | 4.08 | $\cdot 31$ | 4.07 | -22 | 4.07 | -I4 | 4.06 | -05 | 4.06 |
| 36 | -52 | $4 \cdot 09$ | -43 | 4.08 | $\cdot 34$ | 4.07 | -25 | 4.07 | -16 | 4.06 | $\cdot 07$ | 4.06 |
| 38 | -57 | $4 \cdot 10$ | -47 | $4 \cdot 09$ | $\cdot 38$ | 4.08 | -29 | 4.07 | -20 | $4 \cdot 06$ | -10 | 4.06 |
| 40 | - .6I | 4-II | - 5.51 | $4 \cdot 09$ | - 4 I | 4.08 | - 32 | 4.07 | - $\cdot 23$ | 4.07 | - •13 | 4.06 |
| 42 | . 65 | 4.II | . 55 | $4 \cdot 10$ | $\cdot 45$ | 4.08 | $\cdot 35$ | 4.08 | - 26 | 4.07 | -16 | 4.06 |
| 44 | $\cdot 70$ | $4 \cdot 12$ | - 60 | $4 \cdot 11$ | -49 | 4.09 | -39 | 4.08 | -29 | $4 \cdot 07$ | -19 | 4.07 |
| 46 | $\cdot 75$ | 4-13 | -65 | 4.II | - 54 | $4 \cdot 10$ | -43 | 4.08 | -33 | 4.07 | - 22 | 4.07 |
| 48 | -8I | 4-14 | $\cdot 70$ | $4 \cdot 12$ | -59 | 4.10 | -48 | 4.09 | $\cdot 37$ | $4 \cdot 08$ | -26 | . 4.07 |
| 50 | -.87 | $4 \cdot 15$ |  | $4 \cdot 13$ | -. 64 | 4•II | -. 52 | $4 \cdot 09$ | - $4 \mathrm{4I}$ | $4 \cdot 08$ | - . 29 | 4.07 |
| 52 | -94 | 4.17 | . 82 | $4 \cdot 14$ | -69 | $4 \cdot 12$ | - 57 | 4.10 | $\cdot 45$ | $4 \cdot 09$ | -33 | 4.07 |
| 54 | I. 02 | 4.19 | - 88 | $4 \cdot 16$ | $\cdot 75$ | $4 \cdot 13$ | -63 | $4 \cdot 11$ | . 50 | $4 \cdot 09$ | $\cdot 38$ | 4.08 |
| 56 | I•10 | $4 \cdot 2 \mathrm{I}$ | $\bullet 96$ | $4 \cdot 17$ | -82 | $4 \cdot 14$ | -69 | 4.12 | $\cdot 55$ | $4 \cdot 10$ | $\cdot 42$ | 4.08 |
| 58 | I•19 | $4 \cdot 23$ | I. 04 | $4 \cdot 19$ | $\cdot 90$ | $4 \cdot 16$ | $\cdot 75$ | $4 \cdot 13$ | -6I | $4 \cdot 10$ | $\bullet 47$ | 4.09 |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 43 LATITUDE $10^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{llcc} \text { H. M. } & \text { S. } \\ 6 & 4 & 14.9 \end{array}$ | + ${ }^{\text {S }}$ | $\begin{array}{lccc} \text { H. м. } & \text { S. } \\ 6 & 4 & 57.7 \end{array}$ | S. $+\quad .71$ | H. M. S. $6 \quad 5 \quad 40 \cdot 8$ | S. $+\quad .72$ | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 6 & 24^{\circ} \mathrm{I} \end{array}$ | + 72 | $\begin{array}{lrl} \text { H. s. } & \text { S. } \\ 6 & 7 & 7 \cdot 6 \end{array}$ | - 73 | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 7 & 5 \mathrm{I} \cdot 4 \end{array}\right\|$ | S. 73 |
| 10 | $\begin{array}{llll}5 & 23 & 27.6\end{array}$ | -65 | 52460 | . 63 | $\begin{array}{lllll}5 & 24 & 43.9\end{array}$ | . 63 | $\begin{array}{llll}5 & 25 & 2 \mathrm{I} \cdot 2\end{array}$ | . 62 | $\begin{array}{llll}5 & 25 & 58\end{array}$ | -6I | $\begin{array}{llll}5 & 26 & 34-2\end{array}$ | 60 |
| 12 | $\begin{array}{llll}5 & 15 & 18.8\end{array}$ | -63 | $\begin{array}{lllll}5 & 15 & 56 \cdot 5\end{array}$ | - 62 | $\begin{array}{llllllllllll}5 & 16 & 33 \cdot 5\end{array}$ | -6I | $\begin{array}{llll}5 & 17 & 9 \cdot 8\end{array}$ | -60 | 5 I7 45.4 | -59 | 5 I8 20.2 | 57 |
| 14 | $\begin{array}{llll}5 & 7 & 10 \cdot 3\end{array}$ | -63 | $5 \quad 747 \cdot 3$ | .61 | $5 \quad 8 \quad 833 \cdot 5$ | $\cdot 59$ |  | -58 | $\begin{array}{llll}5 & 9 & 33 \cdot 1\end{array}$ | $\cdot 56$ | 5 10 6.5 | - |
| 16 | 459 1.9 | -62 | $45938 \cdot 4$ | -60 | 5 0-13.7 | 8 | 5 O $48 \cdot 0$ | -56 | 5 I 2I-I | -54 | 5 I 53.3 | 5 |
| 18 | $45053 \cdot 7$ | + .6I | 45129.5 | + $\cdot 59$ | 452 4.I | + 57 | $45237 \cdot 4$ | + •54 | 453 | $\cdot 52$ | $45340 \cdot 4$ | '50 |
| 20 | $44245 \cdot 7$ | . 60 | $44320 \cdot 9$ | $\cdot 57$ | $4 \quad 43 \quad 54.8$ | $\cdot 55$ | $44427 \cdot 2$ | -53 | $44458 \cdot 3$ | $\cdot 50$ | $445 \quad 27 \cdot 8$ | . 48 |
| 22 | $43437 \cdot 7$ | -5 | 435 12.5 | - 56 | $43545 \cdot 6$ | -54 | 436 I\% 2 | - 51 | $436 \quad 47 \cdot 2$ | -49 | 43715.6 | 46 |
| 24 | 42629.9 | $\cdot 59$ | 42742 | $\cdot 56$ | $42736 \cdot 7$ | -53 | $\begin{array}{llll}4 & 28 & 7 \cdot 5\end{array}$ | -50 | $42836 \cdot 5$ | 47 | $\begin{array}{lll}4 & 29 & 3.6\end{array}$ | 44 |
| 26 | 4 I8 22.2 | $\cdot 58$ | 4 I8 56.I | -55 | 4 I9 28.0 | -5I | 4 I9 58.0 | 48 | $42025 \cdot 9$ | -45 | $42052 \cdot 0$ | -42 |
| 28 | 4 10 14.6 | + $\cdot 58$ | 4 10 $48 \cdot \mathrm{I}$ | + •54 | 4 II 19.4 | $+\cdot 50$ | 4 II 48.6 | + $\cdot 47$ | 4 I2 I5.7 | -43 | 4 I2 $40 \cdot 5$ | 0 |
| 30 | $\begin{array}{llll}4 & 2 & 7 \cdot 1\end{array}$ | $\cdot 57$ | $4 \quad 2 \quad 40 \cdot 2$ | - 53 | 43 II•O | -49 | $\begin{array}{lll}4 & 3 & 39 \cdot 5\end{array}$ | -45 | $4 \quad 4 \quad 5 \cdot 6$ | -4I | $4 \quad 4 \quad 29.4$ | $\cdot 38$ |
| 31 | $\begin{array}{llll}3 & 58 & 3 \cdot 3\end{array}$ | $\cdot 57$ | $\begin{array}{llll}3 & 58 & 36 \cdot 3\end{array}$ | - 53 | $\begin{array}{llll}3 & 59 & 6.9\end{array}$ | -49 | 3559350 | -45 | $\begin{array}{llll}4 & 0 & 0.7\end{array}$ | 4 I | $\begin{array}{llll}4 & 0 & 23.8\end{array}$ | 6 |
| 32 | 35359.6 | $\cdot 57$ | $35432 \cdot 5$ | -53 | $\begin{array}{lll}3 & 55 & 2 \cdot 8\end{array}$ |  | 355 | 44 | $355 \quad 55^{\prime} 7$ | $\cdot 40$ | $\begin{array}{llll}3 & 56 & 18 \cdot 4\end{array}$ | 36 |
| 33 | $34955 \cdot 8$ | -57 | $35028 \cdot 6$ | $\cdot 52$ | $35058 \cdot 7$ | $\cdot 48$ | $35126 \cdot 1$ | -43 | 35150.9 | - 39 | 35213.0 | 35 |
| 3 | 34552 | + 57 | $346 \quad 24.8$ | + 52 | 34654 | $+47$ | $34721 \cdot 7$ | + $\cdot 43$ | 34746 | $\cdot 38$ | $\begin{array}{llll}3 & 48 & 7 \cdot 6\end{array}$ | + 34 |
| 35 | $3 \mathrm{4I} 48 \cdot 4$ | $\cdot 57$ | $3 \begin{array}{llll}3 & 42 & 21 \cdot 0\end{array}$ | $\cdot 52$ | $\begin{array}{llll}3 & 42 & 50 \cdot 6\end{array}$ | . 47 | $3 \begin{array}{llll}3 & 43 & 17.4\end{array}$ | -42 | $34341 \cdot 3$ | - 37 | $\begin{array}{llr}3 & 44 & 2 \cdot 3\end{array}$ | $\cdot 32$ |
| 36 | 33744.7 | -57 |  | $\cdot 52$ | $\begin{array}{llll}3 & 38 & 46 \cdot 6\end{array}$ | 46 | $33913 \cdot 1$ | 42 | $\begin{array}{llll}3 & 39 & 36 \cdot 6\end{array}$ | -37 | $3 \begin{array}{llll}3 & 39 & 57 \cdot 1\end{array}$ | 3 I |
| 37 | $\begin{array}{llll}3 & 33 & 41 \cdot 0\end{array}$ | $\cdot 56$ | 3 34 13.4 <br> 3 30  | $\cdot 51$ |  | -46 | $\begin{array}{llll}3 & 35 & 8 \cdot 9 \\ 3 & 31 & 4 \cdot 7\end{array}$ | 4 4 | $3 \begin{array}{llll}3 & 35 & 31.9\end{array}$ | $\cdot 36$ | $\begin{array}{llll}3 & 35 & 51 \cdot 9 \\ 3 & 31 & 4\end{array}$ | I |
| 38 | $\begin{array}{llll}3 & 29 & 37 \cdot 3\end{array}$ | -57 | $\begin{array}{llll}3 & 30 & 9 \cdot 7\end{array}$ | $\cdot 51$ | $3 \begin{array}{llll}30 & 38 \cdot 8\end{array}$ | $\cdot 46$ | $33^{31} 40 \cdot 7$ | -40 | 3 31 27.3 | -35 | $33146 \cdot 7$ | $\cdot 30$ |
| 39 | $\begin{array}{lllll}3 & 25 & 33 \cdot 6\end{array}$ | + 57 | $\begin{array}{lll}3 & 26 & 5 \cdot 9\end{array}$ | + .51 | 3 26634.9 | $+.45$ | $\begin{array}{llll}3 & 27 & 0.5\end{array}$ | + 40 | $\begin{array}{llll}3 & 27 & 22 \cdot 7\end{array}$ | + 34 | $32741 \cdot 6$ |  |
| 40 | 312129.9 | -57 | $\begin{array}{llll}3 & 22 & 2 \cdot 2\end{array}$ | $\cdot 51$ | $\begin{array}{llll}3 & 22 & 31 \cdot 0\end{array}$ | - 45 | $\begin{array}{llll}3 & 22 & 56 \cdot 3\end{array}$ | - 39 | $\begin{array}{llll}3 & 23 & 18 \cdot 2\end{array}$ | - 33 | $\begin{array}{llll}3 & 23 & 36 \cdot 5\end{array}$ |  |
| 4 | 3 I7 26.2 | -57 | 31758.5 | -5I | $\begin{array}{llll}3 & 18 & 27 \cdot 1\end{array}$ | -45 | $\begin{array}{llllllllllllll}3 & \text { I } & 52 \cdot 2\end{array}$ | -39 |  | -33 | 3 I9 3I•5 | 27 |
| 42 | $\begin{array}{llll}3 & 13 & 22.4\end{array}$ | - 57 | 3 I3 $54 \cdot 7$ | $\cdot 51$ | $\begin{array}{llll}3 & 14 & 23 \cdot 3\end{array}$ | -44 | $3 \mathrm{I} 44^{8 \cdot \mathrm{I}}$ | 8 | $\begin{array}{llll}3 & 15 & 9 \cdot 2 \\ 3 & \text { II } & 4.8\end{array}$ | $\cdot 32$ | $\begin{array}{llll}3 & 15 & 26 \cdot 5\end{array}$ | -26 |
| 43 |  | $\cdot 57$ | $\begin{array}{llll}3 & 9 & 5 I \cdot I\end{array}$ | $\cdot 51$ | 3 10 19.5 | -44 | 3 Io $44^{\text {I }}$ |  | 3 II $4 \cdot 8$ | $\cdot 3 \mathrm{I}$ | 3 II 2I•5 | -25 |
| 44 | 35150 | + 57 | $3547{ }^{\circ}$ | + .5I | 3 C | + 44 | $3 \quad 6 \quad 40 \cdot 1$ | + 37 | $\begin{array}{lll} 3 & 7 & 0.4 \end{array}$ | + 30 | 37716.7 | + 24 |
| 4 | 3 I II.2 | - 58 | $\begin{array}{lrrr}3 & 1 & 43.6\end{array}$ | $\cdot 51$ | $\begin{array}{\|ccc\|}3 & 2 & 11\end{array}$ | -44 | $\begin{array}{rrrr}3 & 2 & 36 \cdot 0\end{array}$ | $\cdot 37$ | $\begin{array}{lrrr}3 & 2 & 56 \cdot 0\end{array}$ | -30 | $3 \begin{array}{llll}3 & 3 & 11 \cdot 7\end{array}$ | -23 |
| 46 | $\begin{array}{llll}2 & 57 & 7 \cdot 4\end{array}$ | - 58 | $\begin{array}{lllll}2 & 57 & 39.9\end{array}$ | $\cdot 51$ | $\begin{array}{lll}2 & 58 & 8 \cdot 2 \\ 2 & 5 & \end{array}$ | -43 | $\begin{array}{llll}2 & 58 & 32 \cdot I \\ 2 & 5\end{array}$ | -36 | $\begin{array}{lllll}2 & 58 & 51.6\end{array}$ | -29 | $\begin{array}{llll}2 & 59 & 6 \cdot 9 \\ 2 & 55 & 29\end{array}$ | -22 |
| 47 | $\begin{array}{llll}2 & 53 & 3 \cdot 6\end{array}$ | -58 | 253 36.2 | $\cdot 51$ | $\begin{array}{lll}2 & 54 & 4.4\end{array}$ | -43 | $25428 \cdot I$ | -36 | $25447 \cdot 3$ | - 28 | $2 \begin{array}{lll}2 & 55 & 2 \cdot 0\end{array}$ | -21 |
| 4 |  | $\cdot 5$ | $24932 \cdot 5$ | . 51 | 250 | -43 | $25024 \cdot 2$ |  | $25043 \cdot 1$ | $\cdot 27$ | $250 \quad 57 \cdot 2$ | -20 |
| 49 | 24455.8 | + 59 | $2 \begin{array}{lllll}2 & 45 & 28.8\end{array}$ | + . 51 | $24557 \cdot 0$ | + 43 | $246 \quad 20 \cdot 3$ | + 35 | $2 \begin{array}{lllllll} & 46 & 3\end{array}$ | + 27 | 24652.5 |  |
| 50 | 24051.9 | $\cdot 59$ | $24125 \cdot 1$ | -5I | 24153.3 | -43 | 24216.4 | +34 | $24234 \cdot 6$ | -26 | 24247 \% |  |
| 5 | $2 \begin{array}{lllll}26 & 47 \cdot 9\end{array}$ | -60 | $2 \begin{array}{llll}2 & 37 & 21 \cdot 3\end{array}$ | $\cdot 51$ | $\begin{array}{lllll}2 & 37 & 49 \cdot 5\end{array}$ | -43 | 23812.5 | -34 | $\begin{array}{lllll}2 & 38 & 30 \cdot 4\end{array}$ | $\cdot 25$ | $\begin{array}{lllll}2 & 38 & 43.0\end{array}$ | I |
| 52 | $\begin{array}{llll}2 & 32 & 43.9 \\ 2 & 28 & 43.8\end{array}$ | . 61 | $\begin{array}{lllll}2 & 33 & 17.6\end{array}$ | $\cdot 52$ | $\begin{array}{llll}2 & 33 & 45 \cdot 8 \\ 2 & 29 & 4\end{array}$ | -43 | $\begin{array}{llll}2 & 34 & 8 \cdot 7\end{array}$ | $\cdot 34$ | $234 \begin{array}{llll}26 \cdot 2\end{array}$ | - 25 | 22 34 3  |  |
| 5 | 22839.8 | -6 | $2 \begin{array}{lllll}2 & 29 & 13.8\end{array}$ | $\cdot 52$ | 229 42.I | -43 | 2304.9 | -33 | $23022 \cdot 1$ | -24 | $23033 \cdot 7$ | -I5 |
| 5 | $2 \begin{array}{lllll}2 & 24 & 35 \cdot 7\end{array}$ | $+.62$ | $225 \quad 9 \cdot 9$ | + 52 | $2 \begin{array}{lllll}2 & 25 & 38.4\end{array}$ | + 43 | 226 I | + 33 | $22618 \cdot 0$ | + 23 | $22629 \cdot 0$ | + 14 |
| 55 | $22031 \cdot 5$ | -63 | $2216 \cdot 1$ | - 53 | 2 21 34.7 | -43 | 2 21 57.3 | $\cdot 33$ |  | -23 | 22224.4 |  |
| 5 | $\begin{array}{lllll}2 & 16 & 27 \cdot 2\end{array}$ | -64 | $2 \begin{array}{llr} \\ 17 & 2 \cdot 2\end{array}$ | $\cdot 53$ | 21731.0 | -43 | 2 I7 53.5 | $\cdot 32$ | $\begin{array}{llll}2 & 18 & 9.8\end{array}$ | - 22 | 2 I8 I9.8 |  |
| 5 | $\begin{array}{lllll}2 & 12 & 22.8\end{array}$ | -65 | 212888 | $\cdot 54$ | $\begin{array}{lllll}2 & 13 & 27.3\end{array}$ | -43 | 2 I3 49.8 | $\cdot 32$ | $\begin{array}{llll}2 & 14 & 5 \cdot 8\end{array}$ | 21 |  | -10 |
| 58 | $2 \begin{array}{llllllll} & 8 & 18.3\end{array}$ | -66 | 2854.4 | $\cdot 54$ | $\left\lvert\, \begin{array}{llll}2 & 9 & 23.6\end{array}\right.$ | -43 | $2946 \cdot 0$ | $\cdot 32$ | 2 10 I.8 | -2I | 21010.7 | -09 |



DECLINATION-SAME NAME AS-LATITUDE.

| True <br> Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ |  | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\left.\right\|_{6} ^{\mathrm{H}} \mathrm{H}_{\mathrm{M}}^{8} . \underset{35 \cdot 5}{\text { S. }}$ | + S | $\left\lvert\, \begin{array}{ccc} \text { H. } & \text { M. } & \text { S. } \\ 6 & 9 & 19 \cdot 9 \end{array}\right.$ | $\begin{gathered} \mathrm{S} \\ +\quad .74 \end{gathered}$ | H. M. s. | $+\stackrel{s}{ }$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. M. } & \text { S. } \\ 6 & \text { Io } & 49 \cdot 9 \end{array}\right.$ | $\begin{array}{r} \text { s. } \\ +\quad 76 \end{array}$ | $\left\|\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & \text { II } \\ 35 \cdot 6 \end{array}\right\|$ | $+\stackrel{s}{7}$ | $\left\|\begin{array}{\|cc\|} \text { H. M. } & \text { S. } \\ \text { I2 } & 2 \mathrm{I} \cdot 7 \end{array}\right\|$ |  |
| 19 | $\begin{array}{llll}5 & 27 & 9.8\end{array}$ | $\cdot 59$ | $52745 \cdot 0$ | $\cdot 58$ | $5 \quad 2819.6$ | . 57 | 52853.7 | $\cdot 56$ | 5 2929274 | $\cdot 56$ | $530 \quad 0.7$ | 55 |
| 12 | 5 518 54.2 | - 56 | 51927.7 | -55 | 520004 | 54 | $52032 \cdot 5$ | -53 | 52140 | $\cdot 52$ | $52134 \cdot 8$ | $\cdot 51$ |
| 14 | 5 10 39.1 | -54 | 5 II 10.9 | 52 | 5 II $41 \times 7$ | -51 |  | - 49 | $5124 \mathrm{I} \cdot 0$ | $\cdot 48$ | $\begin{array}{llll}5 & 13 & 9 \cdot 4\end{array}$ | 47 |
| 16 | $\begin{array}{lll}5 & 2 & 24.4\end{array}$ | $\cdot 51$ | $\begin{array}{llll}5 & 2 & 54.5\end{array}$ | - 49 | $\begin{array}{llll}5 & 3 & 23.5\end{array}$ | $\cdot 47$ | $\begin{array}{llll}5 & 3 & 51.6\end{array}$ | $\cdot 46$ | 5418 | $\cdot 44$ | 5444 | 42 |
| 18 | $45410 \cdot 1$ | + 48 | 45438.5 | + $\cdot 46$ | 455 | + $\cdot 4$ | $45531 \cdot 8$ | + 42 | $45556 \cdot 7$ | + 40 | 446 | $+\cdot 38$ |
| 20 | 445 56.1 | $\cdot 46$ | 44623.0 | $\cdot 44$ | $44648 \cdot 4$ | - 41 | $\begin{array}{llllll}4 & 47 & 12.5\end{array}$ | $\cdot 39$ | $44735 \cdot 2$ | $\cdot 37$ | $4 \begin{array}{llllll}4 & 47 & 56 \cdot 6\end{array}$ | $\cdot 34$ |
| 22 | 43742.4 | -43 | $438 \quad 7 \cdot 7$ | 41 | $4 \begin{array}{llll}4 & 38 & 315\end{array}$ | -38 | 43853.5 | -35 | $43914 \cdot 1$ | - 33 | $43933 \cdot 1$ | 30 |
| 24 | $\\|_{4}^{4} 2929.1$ | -41 | $\begin{array}{llll}4 & 29 & 52 \cdot 8\end{array}$ | $\cdot 38$ | $4 \begin{array}{llllll}4 & 30 & 14.7\end{array}$ | 35 | 43035.0 | -32 | $43053 \cdot 4$ | -29 | 44 31 <br> 4 10.0 | 26 |
| 26 | $42116 \cdot \mathrm{I}$ | -38 | $42138 \cdot 2$ | 35 | $42158 \cdot 4$ | 32 | $\begin{array}{llll}4 & 22 & 16.7\end{array}$ | -29 | $42233 \cdot 0$ | . 25 | $422 \begin{aligned} & 47 \cdot 2\end{aligned}$ | 2 |
| 28 | 13 | + 36 | 41323.9 | + 32 | $41342 \cdot 4$ | + 29 | 41358.6 | + 25 | $41412 \cdot 8$ | + 22 | 41424.8 | + . 8 |
| 30 | 50 | $\cdot 34$ | 45 | $\cdot 30$ | $4 \quad 5 \quad 26 \cdot 6$ | - 26 | 4541.0 | - 22 | $4 \quad 5 \quad 52 \cdot 9$ | ${ }^{-18}$ | $1 \begin{array}{lll}4 & 6 & 2.4\end{array}$ | 14 |
| 31 | 4 o 44 | $\cdot 32$ | $\begin{array}{lll}4 & 1 & 2.9\end{array}$ | -28 | 4 I I | - 24 | 413 | -20 | 143.0 | -16 | 4 1 51 | -12 |
| 32 | $\begin{array}{llll}3 & 56 & 38 \cdot 5\end{array}$ | 31 | 3 56 $56 \cdot 1$ | 27 | 3 57 <br> 150  | 23 | 35723.4 | - 18 | $\begin{array}{lllllllllll}3 & 5 & 33 \cdot 2\end{array}$ | - 14 | $35740 \cdot 3$ | -10 |
| 33 | $35232 \cdot 5$ | -30 | $\begin{array}{lllllllll}3 & 52 & 49\end{array}$ | - 26 | $\begin{array}{llll}3 & 53 & 3 \cdot 3\end{array}$ | 1 | 35314.7 | -17 | $\begin{array}{llllllllllllll}3 & 53 & \end{array}$ | - 12 | 353293 | . 07 |
| 34 | $34826 \cdot 5$ | + 29 | $\begin{array}{llllllllllll}3 & 48 & 42 \cdot 5\end{array}$ | + 24 | $34855 \cdot 7$ | + 20 | 3496.1 | + •15 | $34913: 6$ | + rO | 349 I8.3 | . 05 |
| 35 |  | - 28 |  | - 23 |  | 18 | 3 44 57 | 3 | $\begin{array}{llll}3 & 45 & 3 \cdot 9 \\ 3\end{array}$ | . 08 | 3 45 $7 \cdot 3$ <br> 3 40  | . 03 |
| 36 |  | -27 | $\begin{array}{llll}3 & 40 & 29.1\end{array}$ | -21 | $\begin{array}{lllllll}3 & 40 & 40.5\end{array}$ | -16 | $34048 \cdot 9$ | -II | 3 40 $54 \cdot \mathrm{I}$ | -06 | $34056 \cdot 3$ | - 01 |
| 37 | $\begin{array}{llll}3 & 36 & 8.7\end{array}$ | - 25 |  | - 20 | $\begin{array}{llll}3 & 36 & 33.0\end{array}$ | - 15 | $\begin{array}{lllll}3 & 36 & 40 \cdot 3\end{array}$ | -09 | $33644 \cdot 5$ | - 04 | $\begin{array}{llll}3 & 3645 *\end{array}$ |  |
| 38 | $\begin{array}{lll}3 & 32 & 2 \cdot 9\end{array}$ |  | $\begin{array}{llll}3 & 32 & 15.8\end{array}$ | -19 | $\begin{array}{llll}3 & 3225.5\end{array}$ | 13 | $\begin{array}{llll}3 & 32 & 31.8\end{array}$ |  | $3 \begin{array}{llll}32 & 34 \cdot 8\end{array}$ | + . 02 | $3 \begin{array}{llll}32 & 34\end{array}$ | -03 |
| 39 | 27 | + 23 |  | + -17 |  | + 12 |  | +.06 | 3 28 $25 \cdot$ <br> 3 18  |  |  |  |
| 40 | 32351.4 | $\cdot 22$ | $\begin{array}{llll}3 & 24 & 2 \\ 3 & 2\end{array}$ | $\text { - } 6$ | $\begin{array}{lllll}3 & 24 & 10.6\end{array}$ |  | $\begin{array}{llll}3 & 24 & 14.8 \\ 3 & 20 & 6.4\end{array}$ |  | 3 24 15.4 <br> 3 2  |  | $\begin{array}{llll} 3 & 24 & 12.4 \end{array}$ | 10 |
| 4 |  | $\cdot 21$ | $\begin{array}{llllllllllllllllllll}3 & 19 & 56 \cdot 3 \\ 3 & 15 & 49.8\end{array}$ |  | $\begin{array}{llll}3 & 20 & 3.2 \\ 3 & 15 & 5.8\end{array}$ | $.08$ | $\begin{array}{llll}3 & 20 & 6.4 \\ 3 & 15 & 57.9\end{array}$ | + .02 | 3 20 $5 \cdot 8$ <br> 3 15 56.1 |  | $320 \quad 14$ | -10 |
| 42 43 | $\begin{array}{llll}3 & 15 & 40 \cdot 1 \\ 3 & \text { II } & 34 \cdot 4\end{array}$ | 19 | $\begin{array}{llll}3 & 15 & 49 \cdot 8 \\ 3 & \text { II } & 43 \cdot 4\end{array}$ |  | $\begin{array}{llll}3 & 15 & 55.8 \\ 3 & \text { II } & 48.4\end{array}$ | $071$ | $\begin{array}{llll}3 & 15 & 57.9 \\ 3 & \text { II } & 49.4\end{array}$ |  | $\begin{array}{llll}3 & 15 & 56 \cdot 1 \\ 3 & \text { II } & 46 \cdot 4\end{array}$ |  | $\begin{array}{llll}3 & \text { I5 } & 50 \cdot 3 \\ 3 & \text { II } & 39 \cdot 2\end{array}$ | 5 |
|  | 311 | $+\cdot 17$ | 3 II 43.4 <br> 3 7 37.0 | + .10 | 3 II |  | $\begin{array}{rrrr}3 & \text { II } & 49.4 \\ 3 & 7 & 40 \cdot 9\end{array}$ |  | $\begin{array}{rrr} 3 & \text { II } & 46 \cdot 4 \\ 3 & 7 & 36 \cdot 7 \end{array}$ |  | 3 II $39 \cdot 2$ <br> 3 7 $28 \cdot 1$ |  |
| 45 | $\begin{array}{lllll}3 & 3 & 23.3\end{array}$ | 16 | 3.3 | -09 | $\begin{array}{llll}3 & 3 & 33.7\end{array}$ | + 02 | $332 \cdot 5$ | . 06 | 26.9 | 13 | $316 \cdot 9$ | - 21 |
| 46 | $5917 \cdot 8$ | - 14 | 25924.3 | - 07 | 25926.2 | -00 | 25924.0 | . 08 | $2{ }^{5} 59$ I7.I | 15 | $\begin{array}{llll}2 & 59 & 5 \cdot 5\end{array}$ | 23 |
| 4 | 25512.3 | -13 | 25517.9 | .06 | 25519.0 | . 02 | $255 \quad 15.5$ | -ro | $2 \begin{array}{llll} & 55 & 7 \cdot 2\end{array}$ | -18 | 254 54•r | - 26 |
| 48 | 2516.8 |  | ${ }^{2} 51511.6$ | .04 | ${ }^{2} 51119$ | . 04 | $2516 \cdot 9$ | . 12 | $25057 \cdot 2$ | - 20 | 250 | 9 |
| 49 | 47173 | + II | $\begin{array}{llll}2 & 47 & 5 & 3\end{array}$ | + 02 | 2474.3 | -06 | $24658 \cdot 3$ | - ${ }^{1} 4$ | $24647 \cdot 3$ | -23 | 24631.0 | $\cdot 31$ |
| 50 | $\begin{array}{llll}2 & 42 & 55.9\end{array}$ | . 09 | $24258 \cdot 9$ | $+$ | $24256 \cdot 9$ | -08 | 24249.7 | -16 | $24237 \cdot 2$ | . 25 | 24219.3 | 34 |
| 51 | $23850 \cdot 4$ | .08 | $23852 \cdot 6$ | - 01 | $2 \begin{array}{llll}2 & 38 & 49 & 5\end{array}$ | - | $2384 \mathrm{I} \cdot 0$ |  | 23827.0 | - 28 | $\begin{array}{llll}2 & 38 & 7 \cdot 4\end{array}$ | 37 |
| 52 | $\begin{array}{lllll}2 & 34 & 45 \cdot 1 \\ 2\end{array}$ | -07 | $\begin{array}{ll}2 & 34 \\ 2 & 46 \cdot 3\end{array}$ | -02 | 2 3442 <br> 2 42 | -12 | $\begin{array}{lllllllllll}2 & 34 & 32 \cdot 2\end{array}$ | - 21 | $\begin{array}{llll}2 & 34 & 16 \cdot 7\end{array}$ | 31 | 2 $335 \cdot 3$ | 41 |
| 53 | $23039 \cdot 7$ | 05 | $23040 \cdot 0$ | . 04 | 23034.6 | 14 | 23023.4 | - 24 | $230 \quad 6 \cdot 3$ | 34 | $22943 \cdot 1$ | 44 |
| 54 | $2634 \cdot 3$ | +.04 |  | - .06 | $\begin{array}{llll}2 & 26 & 27 \cdot 1\end{array}$ | - 16 |  | - 26 | 22555.7 | $\cdot 36$ | $\begin{array}{lllllllllllllllllllll}2 & 25 & 30 \cdot 7\end{array}$ | $\cdot 47$ |
| 55 | 222 |  | $22227 \cdot 3$ | . 08 | 22219.5 | I8 | 2225.5 | 29 | 22145.0 | 40 | 22118.0 | 51 |
| 56 | 18 | + - 01 | $21821 \cdot 0$ | -10 | $\begin{array}{lllllll}2 & 18 & 119\end{array}$ | 21 | $21756 \cdot 3$ | 31 | 21734.1 | 43 | 217515 | $\cdot 54$ |
| 57 58 | 14 | -00 | 1414 | - 12 | $\begin{array}{llll}2 & 14 & 4 \cdot 2 \\ 2 & 9 & 56.5\end{array}$ | 23 | 213 47.1 | -34 | $21313{ }^{2}$ | $\cdot 46$ | $\begin{array}{llllll}2 & 12 & 51.9 \\ 8 & 8 & 38.9\end{array}$ | - ${ }^{.58}$ |
| 58 | 10 | - .02 | 10 | . 14 | $2 \quad 956.5$ |  | 937 |  | 9 II |  | $2 \quad 838.3$ |  |

VARIATION TO $x^{\prime}$ OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | $\left\lvert\, \begin{array}{lll} \text { H. м. } & \text { s. } \\ 6 & \text { 13 } & 8 \cdot 3 \end{array}\right.$ | + $\cdot 78$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { r3 } & 55 \cdot 4 \end{array}\right.$ | $+\quad 79$ | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 14 \\ 43 \cdot 1 \end{array}$ | $\begin{array}{r} \text { s. } \\ +\quad .80 \end{array}$ | H. M. S. | $\begin{array}{r} 5 . \\ +\quad .8 I \end{array}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { I6 } \\ 20.6 \end{array}\right.$ | $\begin{array}{r} \mathrm{s} .{ }^{2} \end{array}$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I7 } & 10 \cdot 2 \end{array}\right.$ |  |
| 10 | $53033 \cdot 5$ | - 54 | $\begin{array}{llll}5 & 31 & 5.9\end{array}$ | $\cdot 54$ | $5 \begin{array}{llll}5 & 31 & 37 \cdot 8\end{array}$ | $\cdot 53$ | $\begin{array}{lllll}5 & 32 & 9.5\end{array}$ | $\cdot 52$ | $532 \begin{array}{llll}5 & 40 \cdot 7\end{array}$ | $\cdot 52$ | 533 Ir 5 | . 51 |
| 12 | 22 5\% | - 50 | 522234.5 | -49 | $\begin{array}{llll}5 & 23 & 3.5\end{array}$ | 48 | $\begin{array}{lllll}5 & 23 & 31 \cdot 8\end{array}$ | 47 | $5 \quad 23$ 59.7 | 6 | $53426 \cdot 9$ | 45 |
| 14 |  | -45 |  | 44 | $\begin{array}{lllllllllllllll}5 & 14 & 29.8\end{array}$ | 43 | $5 \mathrm{I} 45^{5} 50$ | 41 | $5 \begin{array}{llll}5 & 15 & 19.5\end{array}$ | 40 | 51543.0 | 38 |
| 16 | $\begin{array}{llll}5 & 5 & 9.7\end{array}$ | 4 I | $\begin{array}{lllll}5 & 5 & 33\end{array}$ | - 39 | $\begin{array}{lllll}5 & 5 & 56 \cdot 7\end{array}$ | $\cdot 37$ | $\begin{array}{llll}5 & 6 & 18.7\end{array}$ | 36 | $\begin{array}{llll}5 & 6 & 39 \cdot 8\end{array}$ | $\cdot 34$ | $5 \quad 6 \quad 59 \cdot 8$ | 32 |
| 18 | $\begin{array}{llll}4 & 56 & 42 \cdot 9\end{array}$ | + 36 | $4 \begin{array}{lll}4 & 57 & 4.2 \\ 4 & 48 & 3\end{array}$ | + 34 | $4 \begin{array}{lll}4 & 57 & 24.2\end{array}$ | + 32 | 457 43.1 | $+\quad 30$ | 4 58 0.8 <br> 4 4  | + 28 | $4 \begin{aligned} & 58 \\ & 4 \\ & 17.2\end{aligned}$ | + 26 |
| 20 | $44816 \cdot 5$ | $\cdot 32$ | $44^{8} 35 \cdot 0$ | $\cdot 30$ | $44852 \cdot 1$ | $\cdot 27$ | 449 7.9 | -25 | 449 22.1 | . 22 | $44935{ }^{\circ}$ | . 20 |
| 22 | $43950 \cdot 5$ | - 28 | 4406.3 | - 25 | $44020 \cdot 5$ | $\cdot 22$ | 44033.0 | -19 | 44043.9 | 17 | 440 53 1 | 14 |
| 24 | 43124.9 | - 23 | $\begin{array}{lllll}4 & 31 & 37.9\end{array}$ | - 20 | 431491 | 7 | $\begin{array}{llllllllllllll}4 & 31 & 58.5\end{array}$ | - 14 | 4326.0 | - II | 432 II 4 | 7 |
| 26 | $42259 \cdot 6$ | 19 | $4 \begin{array}{lll}4 & 23 & 9.8\end{array}$ | -15 | 42318.0 | 12 | $423 \quad 24.2$ |  | 42328 | + 05 | 423 30.0 | I |
| 28 30 | $\begin{array}{crr}4 & 14 & 34 \\ 4 & 6 & 9\end{array}$ | + $\mathrm{I}_{4}$ | $\begin{array}{rrr}14 & 41.9 \\ 6 & 14.2\end{array}$ | + . 10 |  | + 07 | 14 | +.03 | 1450.5 | - 01 | $41448 \cdot 5$ | -05 |
| 31 | $\begin{array}{llll}4 & \text { I } & \\ 4 & 57 \cdot 1\end{array}$ | 07 | $\begin{array}{ccc}4 & 6 & 1.2 \\ 4 & 2 & 0.3\end{array}$ | + 03 | $\begin{array}{ccc}4 & 6 & 16.2 \\ 4 & 2 & 0.8 \\ 3 & 5 & 3\end{array}$ | $\pm .01$ | - 7 | - 0.03 | $\begin{array}{llllllllll} \\ 4 & 1 & 53.8\end{array}$ | . 10 |  | 2 |
| 32 | $5744 \cdot 8$ | -05 | $35746 \cdot 5$ | -00 | 35745.5 | . 04 | $35741 \cdot 6$ | -09 | $3 \begin{array}{llll} & 57 & 34\end{array}$ | 14 | $3 \begin{array}{llll} \\ 3 & 57 & 25 \cdot 2\end{array}$ | -15 |
| 33 | $5332 \cdot 4$ | + 03 | $35312 \cdot 6$ | 2 | $35330 \cdot 0$ | . 07 | $\begin{array}{llllllllllll}3 & 53 & 24.5\end{array}$ | -12 | 35315.9 | -17 | 3 53 $4 \cdot 1$ | 22 |
| 34 | 49 20.0 | . | 34918.8 | -04 | 34914.6 | -10 | $349 \quad 7 \cdot 2$ | - -15 | 34856.8 | -20 | 348 43. 1 |  |
| 35 | 45. $7 \cdot 7$ | . 0 | 3 45 $5 \cdot 0$ | -07 | 3 44 $59 \cdot 1$ | -12 | $\begin{array}{llll}3 & 44 & 50 \cdot 0\end{array}$ | -18 | $34437 \cdot 6$ | $\cdot 23$ | 34421.8 | 29 |
| 36 | $4055 \cdot 3$ | -04 | $3{ }_{3} 40 \begin{array}{lll}51 \cdot I\end{array}$ | 10 | $\begin{array}{llll}3 & 40 & 43 \cdot 5\end{array}$ | 15 | $\begin{array}{llll}3 & 40 & 32 \cdot 6\end{array}$ | -21 | $34018 \cdot 3$ | 27 | 3 40 | 3 |
| 37 | 3 36 $43 \cdot 0$ <br> 3   | -07 | $\begin{array}{lllll}3 & 36 & 37 \cdot 1 \\ 3 & 32 & 23 \cdot 2\end{array}$ | 12 | $\begin{array}{llll}3 & 36 & 27.9\end{array}$ | 18 | $\begin{array}{llll}3 & 36 & 15 \cdot 2 \\ 3 & 31 & 5\end{array}$ | 24 | $335 \times 58 \cdot 9$ | - 30 | $335 \begin{array}{lll}38 \cdot 9\end{array}$ | 36 |
| 38 | $\begin{array}{llll}3 & 32 & 30.5\end{array}$ | $\cdot 09$ | $\begin{array}{llll}3 & 32 & 23.2\end{array}$ | 15 |  | 21 | $3 \begin{array}{llll}31 & 57\end{array}$ | 27 | 33139.3 | 4 | 3 31 17.I | 40 |
| 39 40 | $\begin{array}{ccc} 3 & 28 & 18 \cdot I \\ 3 & 24 & 5 \cdot 6 \end{array}$ | - 12 | $\begin{array}{rrrr}3 & 28 & 9 \cdot 2 \\ 3 & 23 & 55 \cdot 1\end{array}$ | - $\cdot 18$ | $\begin{array}{llll}3 & 27 & 56 \cdot 5 \\ 3 & 23 & 40 \cdot 6\end{array}$ | $\stackrel{24}{ } \cdot 2$ | $\begin{array}{lll}3 & 27 \\ 3 & 23 & 22\end{array}$ | -31 | $\begin{array}{llll}3 & 27 & 19 \cdot 6 \\ 3 & 2 & 59 \cdot 7\end{array}$ | -37 | $\begin{array}{llll}3 & 26 & 55.2 \\ 3 & 22 & 33.0\end{array}$ |  |
| 4 4 | $\begin{array}{rrrr}24 & 5 \cdot 6 \\ 19 & 53 \cdot 1\end{array}$ | -17 |  | . 21 | $\begin{array}{llll}3 & 23 & 40 \cdot 6 \\ 3 & 19 & 24 \cdot 6\end{array}$ | 27 | $\begin{array}{rrrr}3 & 23 & 22.2 \\ 3 & 19 & 4.2\end{array}$ | 34 | $\begin{array}{llll}3 & 22 & 59 \cdot 7 \\ 3 & \text { 18 } & 39 \cdot 5\end{array}$ | 4 4 | $\begin{array}{lll}3 & 22 & 33.0 \\ 3 & 18 & 10.5\end{array}$ |  |
| 42 | $31540 \cdot 5$ | -20 | $\begin{array}{llll}3 & 15 & 26.6\end{array}$ | -27 | $\begin{array}{llll}3 & 15 & 8.5\end{array}$ | 4 | $\begin{array}{llll}3 & 14 & 46 \cdot 1\end{array}$ | 4 |  | 48 |  |  |
| 43 | 3 II 27.9 |  | 11 | 30 | 3 10 52. | $\cdot 37$ | 3 10 27.7 | -45 | $\begin{array}{llllllllllll}3 & 9 & 58.6\end{array}$ | $\cdot 52$ | $3 \quad 924.7$ |  |
| 4 | 15 | . 28 | I | $\cdot 33$ | $\begin{array}{lll}3 & 6 & 35.8 \\ 3 & 2\end{array}$ | -40 | $6 \quad 9.1$ <br> 15 | - $\cdot 48$ | $3 \begin{array}{llll}3 & 5 & 37.7\end{array}$ | - 56 | $\begin{array}{lll}3 & 5 & 1.3\end{array}$ | 65 |
| 46 | $5849 \cdot 3$ | -28 | 58 | 3 | 3 2 19 <br>  19  | 44 | 3 18 |  | $\begin{array}{llll}3 & 1 & 16 \cdot 5\end{array}$ | 6 | $3 \quad 0 \quad 37 \cdot 5$ | 69 |
| 46 | $\begin{array}{llllll}2 & 58 & 49 \cdot 3\end{array}$ |  | $\begin{array}{llll}2 & 58 & 28 \cdot 2\end{array}$ | -39 | $\begin{array}{llll}2 & 58 & 2 \cdot 2 \\ 2 & 53 & \end{array}$ | $\cdot 47$ | $\begin{array}{llllll}2 & 57 & 31.2\end{array}$ | . 56 | $2 \begin{array}{llll} \\ 2 & 56 \\ 2 & 54\end{array}$ | . 65 | 25613.2 | 74 |
| 47 | $\begin{array}{llll}2 & 54 & 36 \cdot 2 \\ 2 & 50 & 22 \cdot 9\end{array}$ | -34 | $\begin{array}{llllllllllllllll}2 & 54 & 13.2 \\ 2 & 49 & 58.0\end{array}$ | 43 |  | $\cdot 51$ | 2 53 11.8 <br> 2 48  | -60 | $25233{ }^{\circ}$ | -69 | 25148.5 | 79 |
| 48 | $25022 \cdot 9$ |  | 249 |  | 24927.7 | $\cdot 55$ | 24852.0 | . 64 | $24810 \cdot 6$ | 74 | 24723.2 | 84 |
| 49 50 | $\begin{array}{lllr}2 & 46 & 9.5 \\ 2 & 41 & 55.9\end{array}$ | - 40 | $\begin{array}{llll}2 & 45 & 42 \cdot 6 \\ 2 & 41 & 26 \cdot 9\end{array}$ | . 49 | $\begin{array}{llll}2 & 45 & 10 \cdot I \\ 2 & 40 & 52 \cdot I\end{array}$ | - 59 | $\begin{array}{llll}2 & 44 & 31 \cdot 8 \\ 2 & 40 & \text { II } 3 \\ 2 & 35 & 50\end{array}$ | - . 69 | 2 43 $47 \cdot 7$ <br> 2 39  <br> 2   | - 79 | 24257.4 | - 89 |
| 51 | $23742 \cdot \mathrm{I}$ | $\cdot 47$ | $23710 \cdot 9$ | . 57 |  | . 67 |  | -78 |  | . 89 | $\begin{array}{rrrr}2 & 38 & 30 \cdot 9 \\ 2 & 34 & 3 \cdot 8\end{array}$ | -94 |
| 52 | $23328 \cdot 0$ | $\cdot 51$ | $23254 \cdot 6$ | -61 | $232 \begin{array}{lll}2 & 15\end{array}$ | $\cdot 72$ |  | . 83 |  | $\cdot 94$ | $\begin{array}{lll}2 & 34 & 3 \\ 2 & 29 & 35\end{array}$ | .06 |
| 53 | $\begin{array}{ll}2 & 2913.8\end{array}$ | $\cdot 54$ | $22838 \cdot 0$ | . 65 | $22755 \cdot 7$ | $\cdot 76$ | $\begin{array}{llll}2 & 27 & 6.6\end{array}$ | .88 | $22610 \cdot 5$ |  | $225 \quad 70$ | 1-12 |
| 54 | $\begin{array}{lllllllllllll}2 & 24 & 59 \cdot 2 \\ 2 & 20 & 44 \cdot 3\end{array}$ | -. 58 | $\begin{array}{llll}2 & 24 & 21 \cdot 0 \\ 2 & 20 & 3.6\end{array}$ | - 69 | $\begin{array}{llll}2 & 23 & 36 \cdot 0\end{array}$ | -.81 | $2 \begin{aligned} & 22 \\ & 2\end{aligned}$ | - 93 | 22144.4 | - I.05 | $22037 \cdot 3$ | 19 |
| 55 | $22044 \cdot 3$ | 62 | $\begin{array}{llll}2 & 20 & 3 \cdot 6\end{array}$ | $\cdot 74$ |  | - 86 | $\begin{array}{llll}2 & 18 & 20.5\end{array}$ | . 99 | 21717.5 | 1.12 | $2 \begin{array}{lll}16 & 6\end{array}$ | . 25 |
| 56 | $\begin{array}{llll}2 & 16 & 29 \cdot 0 \\ 2 & 12 & 13 \cdot 4\end{array}$ | $\cdot 66$ | $\begin{array}{llll}2 & 15 & 45 \cdot 7\end{array}$ | $\cdot 78$ | $\begin{array}{lllllll}2 & 14 & 54.9\end{array}$ | 9 9 | $\begin{array}{lllll}2 & 13 & 56 \cdot 3\end{array}$ | 1.04 | $2 \mathrm{I} 2849 \cdot 6$ | I-18 | 2 II $34 \cdot 5$ | 33 |
| 57 |  | $\cdot 70$ | 2 II 27.3 |  | Io 33.4 | 97 | $2 \quad 931 \cdot 3$ | $1 \cdot 1$ | 820.7 | 5 | I. 2 | 1.40 |
| 58 | 757 | $\cdot 75$ | 7 |  | $26 \mathrm{II} \cdot \mathrm{I}$ | $\mathrm{I} \cdot 02$ | $\begin{array}{ll}5 & 5 \cdot 3\end{array}$ |  | 3 | I.32 | 2226 | 1.48 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ}$ | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 34 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -4 \cdot 28 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 42 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.30 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 50 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 33 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathbf{r} \cdot 59 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 36 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} .67 \end{gathered}$ | $\begin{gathered} s \\ -4 \cdot 39 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 76 \end{gathered}$ | S. |
| 4 | I. 29 | $4 \cdot 26$ | $1 \cdot 37$ | $4 \cdot 28$ | 1.45 | $4 \cdot 31$ | 1.53 | $4 \cdot 34$ | I.6I | 4.37 | I.70 | $4 \cdot 42$ |
| 8 | I. 24 | 4.25 | I. 32 | $4 \cdot 27$ | 1.40 | $4 \cdot 30$ | 1.48 | $4 \cdot 32$ | I. 56 | - 4.35 | I. 65 | $4 \cdot 38$ |
| 12 | I-20 | $4 \cdot 23$ | I. 28 | $4 \cdot 26$ | I.36 | $4 \cdot 28$ | 1.44 | 4.31 | I. 52 | $4 \cdot 34$ | I. 61 | 4.37 |
| I6 | I•I6 | 4.22 | I. 24 | $4 \cdot 25$ | I.33 | $4 \cdot 27$ | 1.41 | $4 \cdot 30$ | I.49 | $4 \cdot 33$ | I.58 | $4 \cdot 36$ |
| 20 | +1.14 | 4.22 | +r.22 | 4.24 | +1.30 | 4.26 | +I.39 | $4 \cdot 29$ | +1.47 | 4.32 | +1.56 | $4 \cdot 35$ |
| 22 | I.I3 | $4 \cdot 22$ | I.21 | $4 \cdot 24$ | I.29 | $4 \cdot 26$ | I.38 | $4 \cdot 29$ | 1.47 | $4 \cdot 32$ | I. 55 | $4 \cdot 35$ |
| 24 | I'I2 | 4.21 | I. 20 | $4 \cdot 23$ | I'28 | $4 \cdot 26$ | I. 37 | $4 \cdot 29$ | I. 46 | 4.31 | I. 55 | $4 \cdot 35$ |
| 26 | I•II | $4 \cdot 21$ | I.19 | $4 \cdot 24$ | I-28 | 4.26 | 1.37 | $4 \cdot 29$ | I. 46 | $4 \cdot 32$ | I-55 | $4 \cdot 35$ |
| 28 | I'IO | 4.2I | I-I9 | $4 \cdot 23$ | 1.27 | - $4 \cdot 26$ | 1.36 | $4 \cdot 28$ | I-45 | 4.31 | I.54 | $4 \cdot 34$ |
| 30 | +1.10 | 4.21 | +I.19 | $4 \cdot 23$ | +1.27 | $4 \cdot 26$ | +1.37 | 4.29 | +r.46 | $4 \cdot 32$ | +1.55 | $4 \cdot 35$ |
| 32 | I.09 | $4 \cdot 20$ | I-I8 | $4 \cdot 23$ | 1.27 | $4 \cdot 26$ | 1.37 | $4 \cdot 28$ | 1.46 | 4.31 | 1.56 | $4 \cdot 35$ |
| 34 | I.09 | 4.21 | I.19 | $4 \cdot 23$ | I. 28 | $4 \cdot 26$ | I. 37 | $4 \cdot 29$ | I. 47 | $4 \cdot 32$ | I.57 | $4 \cdot 35$ |
| 36 | I.09 | $4 \cdot 20$ | I•19 | $4 \cdot 23$ | I-28 | $4 \cdot 26$ | I.38 | $4 \cdot 29$ | $1 \cdot 48$ | 4.32 | I.58 | $4 \cdot 36$ |
| 38 | I.10 | 4.21 | I.19 | $4 \cdot 23$ | I. 29 | $4 \cdot 26$ | I.39 | $4 \cdot 29$ | I-49 | $4 \cdot 33$ | I. 60 | $4 \cdot 36$ |
| 40 | +1.10 | 4.2I | +I.20 | 4.23 | +1.30 | $4 \cdot 26$ | + I. 40 | 4.30 | +1.5I | $4 \cdot 33$ | +I. 62 | $4 \cdot 37$ |
| 42 | I•II | $4 \cdot 21$ | I-2I | $4 \cdot 24$ | I-32 | $4 \cdot 27$ | 1.42 | $4 \cdot 30$ | I.53 | $4 \cdot 34$ | I. 64 | $4 \cdot 38$ |
| 44 | I'12 | $4 \cdot 21$ | I. 23 | $4 \cdot 24$ | I.34 | $4 \cdot 28$ | I. 45 | $4 \cdot 31$ | I. 56 | $4 \cdot 35$ | I. 68 | $4 \cdot 39$ |
| 46 | I-13 | $4 \cdot 22$ | I. 25 | $4 \cdot 25$ | I.36 | $4 \cdot 28$ | 1.47 | $4 \cdot 32$ | I. 59 | $4 \cdot 36$ | I.71 | $4 \cdot 41$ |
| 48 | I'15 | $4 \cdot 22$ | I. 27 | $4 \cdot 25$ | I.39 | $4 \cdot 29$ | I. 51 | $4 \cdot 33$ | I. 63 | $4 \cdot 38$ | I.76 | $4 \cdot 43$ |
| 50 | +1.18 | $4 \cdot 23$ | +1.30 | $4 \cdot 26$ | +1.42 | $4 \cdot 30$ | +1.55 | $4 \cdot 35$ | +I. 68 | $4 \cdot 39$ | +I.8I | 4.45 |
| 52 | I. 20 | $4 \cdot 24$ | I.33 | $4 \cdot 27$ | I. 46 | $4 \cdot 32$ | I.59 | $4 \cdot 36$ | $1 \cdot 73$ | 4.41 | I. 87 | $4 \cdot 47$ |
| 54 | 1.24 | $4 \cdot 25$ | I.37 | $4 \cdot 29$ | I-51 | $4 \cdot 33$ | 1.65 | $4 \cdot 38$ | I.80 | 4.44 | I.95 | $4 \cdot 50$ |
| 56 | 1.28 | 4.26 | 1.42 | $4 \cdot 30$ | 1.57 | 4.35 | I.72 | 4.41 | I.87 | 4.47 | $2 \cdot 04$ | $4 \cdot 54$ |
| 58 | $1 \cdot 32$ | $4 \cdot 27$ | I* 48 | $4 \cdot 32$ | I. 63 | $4 \cdot 38$ | 1.80 | $4 \cdot 44$ | I.97 | 4.5 I | $2 \cdot 14$ | $4 \cdot 59$ |

46 HOUR－ANGLES AND VARIATIONS TO 1＇OF LAT．，DECL．，AND ALT． LATITUDE $11^{\circ}$ ．

DECLINATION－SAME NAME AS－LATITUDE．

| True Alt． | $0^{\circ}$ | Decl． <br> Var． | $1{ }^{\circ}$ | Decl． <br> Var． | $2^{\circ}$ | Decl． <br> Var． | $3^{\circ}$ | Decl． <br> Var． | $4^{\circ}$ | Decl． <br> Var． | $5^{\circ}$ | Decl． <br> Var． |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 0 & 0.0 \end{array}$ | S． $+\quad .78$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 46 \cdot 6 \end{array}$ | S． $+\quad .78$ | $\begin{array}{ccc} \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 33 \cdot 3 \end{array}{ }^{2} . \end{array}$ | ＋${ }^{\text {S }}$ | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 2 & 20 \cdot 1 \end{array}$ | $\stackrel{\text { S．}}{.} 78$ | $\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & 3 & 6 \cdot 9 \end{array}$ |  | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 3 & 53 \cdot 8 \end{array}$ |  |
| 10 | $\begin{array}{llll}5 & 19 & 14.6\end{array}$ | － 79 | $520 \quad 16$ | － 78 | $5 \quad 2047 \cdot 9$ | － 76 | $\begin{array}{llll}5 & 21 & 33 \cdot 4\end{array}$ | －75 | $\begin{array}{llll}5 & 22 & 18 \cdot 2\end{array}$ | $\cdot 74$ | $\begin{array}{llrr}5 & 23 & 2.4\end{array}$ | 73 |
| 12 | 5 II $5 \cdot 2$ | － 79 | 5 II 52.5 | －78 | $\begin{array}{lllllllll}5 & 12 & 38 \cdot 9\end{array}$ | $\cdot 76$ | $\begin{array}{llll}5 & 13 & 24.4\end{array}$ | －75 | 5 I4 $9 \cdot 0$ | －74 | $\begin{array}{llllllllllllllll}5 & 14 & 52 \cdot 8\end{array}$ | 72 |
| 14 | $\begin{array}{llll}5 & 2 & 55.8\end{array}$ | －80 | $\begin{array}{llll}5 & 3 & 43 \cdot 4\end{array}$ | $\cdot 78$ | $\begin{array}{llll}5 & 4 & 29 \cdot 9\end{array}$ | 7 | $\begin{array}{lrrr}5 & 5 & 15 \cdot 4\end{array}$ | 75 | $\begin{array}{llll}5 & 5 & 59 \cdot 8\end{array}$ | －73 | $\begin{array}{lll}5 & 6 & 43 \cdot 2\end{array}$ | －72 |
| 16 | 454 46．1 | －81 | 455 34－I | －79 | $4 \quad 56 \quad 20 \cdot 9$ | $\cdot 77$ | $4 \begin{array}{lll}47 & 6.4\end{array}$ | $\cdot 75$ | $45750 \cdot 6$ | －73 | $\begin{array}{llllllllll}4 & 58 & 33 \cdot 9\end{array}$ | －71 |
| 18 | $44636 \cdot 3$ | ＋ 82 | $44724^{\circ} 7$ | ＋ 79 | 448 II•7 | ＋•77 | $4 \quad 48 \quad 57 \cdot 4$ | ＋$\cdot 75$ | 449 4「• | ＋ 73 | $45024 \cdot 6$ | ＋$\cdot 70$ |
| 20 | $43826 \cdot 2$ | ． 83 | 439 I5•I | －80 | $440 \quad 2 \cdot 5$ | －78 | $44048 \cdot 4$ | $\cdot 75$ | $44132 \cdot 7$ | － 7 | 44215.5 | 7 |
| 22 | 430 I5．8 | － 84 | 4315 | ． 8 I | $43153 \cdot 2$ | 78 | $43239 \cdot 3$ | $\cdot 75$ | $433 \quad 25 \cdot 7$ | $\cdot 72$ | $\begin{array}{llll}4 & 34 & 6 \cdot 4\end{array}$ | －70 |
| 24 | $4 \begin{array}{lll}42 & 5 \cdot 2\end{array}$ | ． 85 | $\begin{array}{llll}4 & 22 & 55 \cdot 4\end{array}$ | ． 82 | $\begin{array}{lllllllllllll}4 & 23 & 43 \cdot 8\end{array}$ | 9 | $42430 \cdot 1$ | $\cdot 76$ | $42514 \cdot 7$ |  | $425 \quad 57 \cdot 4$ | 6 |
| 26 | $413 \quad 54.2$ | 7 | 4 I4 $45 \cdot 2$ | ． 83 | $41534 \cdot 2$ | O | $416 \quad 20 \cdot 9$ | $\cdot 76$ | $4 \begin{array}{lll}47 & 5 \%\end{array}$ | －73 | 4 17 48．3 | ． 69 |
| 28 | $\begin{array}{rrrr}4 & 5 & 42 \cdot 8\end{array}$ | ＋．88 | $\begin{array}{lrrr}4 & 6 & 34.7\end{array}$ | ＋．8 | $\begin{array}{llll}4 & 7 & 24.3\end{array}$ | ＋ 8.81 | 8 II． 6 | ＋ 77 | $\begin{array}{llll}4 & 8 & 56 \cdot 6\end{array}$ | ＋•73 | $939 \cdot 4$ | ＋． 69 |
| 30 | $\begin{array}{lllll}3 & 57 & 30.9\end{array}$ | －90 | $\begin{array}{llll}3 & 58 & 23.8\end{array}$ | ． 86 | 315914.2 | ． 82 | $4 \quad 0 \quad 2 \cdot 1$ | $\cdot 78$ | $4 \quad 0 \quad 47 \cdot 4$ | $\cdot 73$ | 4 I $30 \cdot 4$ | 69 |
| 3 | $\begin{array}{lllll}3 & 53 & 24 \cdot 8\end{array}$ | －91 | 35418.3 |  | $355 \quad 9^{\circ} \mathrm{O}$ | $\cdot 82$ | $355 \quad 57 \cdot 2$ | 78 | $\begin{array}{lllllllllllll}3 & 56 & 42 \cdot 8\end{array}$ | 74 | 35725.8 | $\cdot 70$ |
| 3 | $\begin{array}{llllllllllllll}3 & 49 & 18 \cdot 6\end{array}$ | －92 | 350 I2．6 | －88 | 35153.8 | ． 83 | 35 I $52 \cdot 3$ | －79 | $\begin{array}{llll}3 & 52 & 38 \cdot 1\end{array}$ | $\cdot 74$ | 355 2I－3 | －70 |
| 33 | 34512 | $\cdot 93$ | $346 \quad 6 \cdot 8$ |  |  | ． 84 | $3 \begin{array}{lllllll}3 & 47 & 47 \cdot 4\end{array}$ | －79 | $\begin{array}{llllllllllll}3 & 48 & 33 \cdot 5\end{array}$ | －74 | 34916.8 | ． 70 |
| 3 | $3 \mathrm{4I} 5 \cdot 6$ | 4 | $\begin{array}{llll}3 & 42 & 0.9\end{array}$ | ＋ 68 | $314253 \cdot 1$ | ＋ 88 | $34342 \cdot$ | ＋．80 | $34428 \cdot 7$ | ＋ 75 | 34512.2 | ＋ 70 |
| 35 | $\begin{array}{lllll}3 & 36 & 58 \cdot 9\end{array}$ | －96 | $\begin{array}{llllllll}3 & 37 & 54\end{array}$ | －90 | $\begin{array}{llllllllllllllll}3 & 38 & 47 \cdot 6\end{array}$ | ． 85 | $\begin{array}{llll}3 & 39 & 37 \cdot 3\end{array}$ | ． 80 | $34024^{\circ} \mathrm{O}$ | $\cdot 7$ | 3415 | $\cdot 70$ |
| 3 | $\begin{array}{llll}3 & 32 & 52 \cdot 1\end{array}$ | 97 | $\begin{array}{lllll}3 & 33 & 48 \cdot 7\end{array}$ | －91 | $33442 \cdot 0$ | －86 | $33532 \cdot 2$ | I | $\begin{array}{llllllll}3 & 36 & 19.2\end{array}$ | 76 | $\begin{array}{llll}3 & 37 & 3 \cdot 1\end{array}$ | －70 |
| 37 | 3 28 45 | 8 | 32942 | 3 | $33036 \cdot 3$ | －87 | 3 31 $27 \cdot 0$ | －82 | $\begin{array}{llllll}3 & 32 & 14.3\end{array}$ | $\cdot 76$ | $\begin{array}{lllllllllllllll}3 & 32 & 58 \cdot 5\end{array}$ | 71 |
| 38 | 32437 | － | 3253 | $\cdot 94$ | $32630 \cdot 5$ |  | $\begin{array}{llll}3 & 27 & 21.6\end{array}$ | 82 | $\begin{array}{llll}3 & 28 & 9 \cdot 4\end{array}$ | －77 |  | －クI |
| 39 | $32030 \cdot 3$ | ＋I．OI | 32129.2 | ＋ 95 | 32224.5 | ＋ 89 | 32316.2 | ＋ .83 | 32444 | ＋•77 | 324 49＇I | ＋ 72 |
|  | $\begin{array}{llll}3 & 16 & 22 \cdot 6\end{array}$ | 1.03 | 31722.4 | －96 | $\begin{array}{lllll}3 & 18 & 18.4\end{array}$ | $\cdot 90$ | 3 I9 10．7 | －84 | 3 I9 59.3 | －78 | $32044 \cdot 3$ | $\cdot 72$ |
| 4 | $\begin{array}{rrrr}3 & 12 & 14.6\end{array}$ | 1.04 | $\begin{array}{lllll}3 & 13 & 15.4\end{array}$ | －98 | $\begin{array}{llll}3 & 14 & 12 \cdot 1 \\ 3\end{array}$ | $\cdot 91$ | $\begin{array}{lll}3 & 15 & 5 \cdot 1\end{array}$ | －85 | 3 I5 $54 \cdot 2$ | $\cdot 79$ | $\begin{array}{llll}3 & 16 & 39 \cdot 5\end{array}$ | $\cdots 7$ |
| 4 | $\begin{array}{rrr}3 & 8 & 6 \cdot 4 \\ 3 & 3 & 57 \cdot 9\end{array}$ |  | $\begin{array}{lll}3 & 9 & 8 \cdot 1 \\ 3 & 5 & 0 \cdot 7\end{array}$ | －99 | 3 10 $5 \cdot 7$ | －93 | 3 10 59.3 | －86 | 3 II $49 \cdot 0$ | 9 |  | 73 |
| 43 | $\begin{array}{llll}3 & 3 & 57 \cdot 9\end{array}$ | 1 | $\begin{array}{lll}3 & 5 & 0 \cdot 7\end{array}$ | － OI | $3 \quad 5 \quad 59.2$ | －94 | $3 \quad 6 \quad 53 \cdot 5$ | ． 87 | $\begin{array}{lllllllllll}3 & 7 & 43 \cdot 6\end{array}$ | －80 | $\begin{array}{llll}3 & 8 & 29.8\end{array}$ | $\cdot 74$ |
| 44 | $25949 \cdot 2$ | ＋I•IO | 3053.0 | ＋I．03 | $\begin{array}{llll}3 & 1 & 52.4\end{array}$ | ＋ 95 | $3 \quad 2 \begin{array}{lll}3 & 27 & 5\end{array}$ | ＋ 88 | $\begin{array}{llll}3 & 3 & 38 \cdot 2\end{array}$ | ＋ $8 \mathrm{8I}$ | $424 \cdot 9$ | ＋－ 7 |
| 45 | $25540 \cdot 1$ | I＇12 | 25645 | I－0 | $25745 \cdot 4$ | －97 | $25841 \cdot 3$ | ． 89 | $25932 \cdot 7$ | ． 82 | 3 0－19．8 | －75 |
| 46 | $\begin{array}{llll}2 & 51 & 30 \cdot 7\end{array}$ | I＇14 | $\begin{array}{llll}2 & 52 & 36 \cdot 9\end{array}$ | I．06 | $2 \begin{array}{llll}2 & 53 & 38 \cdot 3\end{array}$ | －98 | $\begin{array}{lllll}2 & 54 & 34 \cdot 9\end{array}$ | 91 | $255127 \cdot 1$ | 3 | 25614.7 | 76 |
| 47 | $24720 \cdot 9$ | I•I7 | $2 \begin{array}{llll}2 & 48 & 28.4\end{array}$ | I．08 | $\begin{array}{llll}2 & 49 & 30 \cdot 9\end{array}$ | －00 | $25028 \cdot 5$ | 92 | $25121 \cdot 3$ | － 84 | $252 \quad 9 \cdot 5$ | 76 |
| 48 | $24310 \cdot 8$ | I•19 | 24419.5 | I＇10 | $2 \quad 45 \quad 23 \cdot 2$ | $1 \cdot 02$ | $24^{46} 2 \mathrm{I} \cdot 8$ | －93 | $2 \begin{array}{llllll}2 & 47 & 15.4\end{array}$ | ． 85 | 2484 | 77 |
| 49 | 2 39 $0 \cdot 1$ <br> 2 34  | ＋I．22 | 24010.4 | ＋I•I3 | 2 41 15.2 <br> 2   | ＋I．0 | 24214.9 | ＋•95 | $\begin{array}{lll}2 & 43 & 9.4\end{array}$ | ＋．86 | $24358 \cdot 7$ | ＋$\cdot 78$ |
| 5 | 2 34 $49 \cdot 1$ <br> 2   | 1.24 | $\begin{array}{rrr}2 & 36 & 0.8 \\ 2 & 31 & 50.9\end{array}$ | I．15 | $\begin{array}{llll}2 & 37 & 7 \cdot 0 \\ 2 & 32 & 58 \cdot\end{array}$ | I．O | $\begin{array}{llll}2 & 38 & 7 \cdot 7\end{array}$ | $\cdot 97$ | $\begin{array}{llll}2 & 39 & 3 \cdot 2\end{array}$ | ． 88 | $23953 \cdot 3$ | 79 |
| 51 | $\begin{array}{llll}2 & 30 & 37.5\end{array}$ | 1.27 | $\begin{array}{llll}2 & 31 & 50.9 \\ 2 & 27 & 40.5\end{array}$ | I•17 | $\begin{array}{llll}2 & 32 & 58 \cdot 4\end{array}$ | I．08 | $\begin{array}{lll}2 & 34 & 0.4\end{array}$ | －99 | $234 \begin{array}{llll}2 & 56 \cdot 8\end{array}$ | －89 | $23547 \cdot 7$ | 80 |
| 52 | $\begin{array}{llll}2 & 26 & 25 \cdot 3\end{array}$ | － 30 | $\begin{array}{llll}2 & 27 & 40 \cdot 5 \\ 2 & 23 & 20.6\end{array}$ | I． 20 | $\begin{array}{llll}2 & 28 & 49 \cdot 6\end{array}$ | I＇IO | $\begin{array}{llll}2 & 29 & 52 \cdot 7\end{array}$ | －00 | $\begin{array}{llll}2 & 30 & 50.2\end{array}$ | －91 | $2 \begin{array}{llll}21 & 31 & 4 \cdot 9\end{array}$ | 82 |
| 53 | 22212.6 | I．34 | 22329.6 | I．23 | $22440 \cdot 3$ | I•I3 | 22544.9 | I．O3 | 22643.4 | －93 | 22736.0 | ．83 |
| 54 |  | ＋1．37 | $2 \begin{array}{llllll}2 & 19 & 18\end{array}$ | ＋I．26 | $22030 \cdot 6$ | ＋I•I5 | $22136 \cdot 6$ | ＋1．05 | $22236 \cdot 3$ | ＋ 9.94 | 22329.9 | ＋ 84 |
| 55 | $\begin{array}{llll}2 & 13 & 45 \cdot 1\end{array}$ | I．41 | 2 $15 \begin{array}{rrr}6.2 \\ 2 & 15 & 53.6\end{array}$ | I． 29 | $\begin{array}{llll}2 & 16 & 20 \cdot 4\end{array}$ | I＇I8 | $21728 \cdot 0$ | 1.07 | $2 \begin{array}{lll}2 & 18 & 29.0\end{array}$ | $\cdot 96$ | $2 \begin{array}{llll} & 19 & 23 \cdot 7\end{array}$ | ． 86 |
| 56 | $2930 \cdot 2$ | I．45 | 2 Io $53 \cdot 6$ | I．33 | $2 \begin{array}{lll}2 & 12 & 9 \cdot 8\end{array}$ | 21 | 2 I3 19．0 | I－10 | 21421.4 | －98 | 2 I5 17．2 | ． 87 |
| 5 | $\begin{array}{llll}2 & 5 & 14.4 \\ 2 & 0 & 57.4\end{array}$ | 1.49 +154 | $\begin{array}{llll}2 & 6 & 40 \cdot 3 \\ 2 & 2 & 26 \cdot 2\end{array}$ | 1．37 | $\begin{array}{llll}2 & 7 & 58.7 \\ 2 & 3 & 46.8\end{array}$ | I． 24 | $\begin{array}{llll}2 & 9 & 9 \cdot 6 \\ 2 & 4 & 5\end{array}$ | I－12 | $2 \begin{array}{llll}2 & 10 & 13.5\end{array}$ | I－OI | 2 II 10．5 | －89 |
| 58 | $2057 \cdot 7$ | I 54 | 2226.2 | I．41 | $2346 \cdot 8$ | I－28 | $2 \quad 459.8$ | I•I5 | $\left\lvert\, \begin{array}{lll}2 & 6 & 5 \cdot 3\end{array}\right.$ | I． 03 | $7 \quad 3 \cdot 6$ | ＇97 |

VARIATION TO I＇OF LATITUDE AND ALTITUDE．

| Alt． | L． $0^{\circ} \mathrm{A}$ ． |  | L． $1^{\circ} \mathrm{A}$ ． |  | L． $2^{\circ} \mathrm{A}$ ． |  | L． $3^{\circ} \mathrm{A}$ ． |  | L． $4^{\circ} \mathrm{A}$ ． |  | L． $5^{\circ} \mathrm{A}$ ． |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| \％ | s． ． 00 | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 07 \end{gathered}$ | s． $+\quad .07$ | s． -4.07 | s． $+\quad .14$ | s． | s． $+\quad .22$ | s． -4.08 | s． $+\quad .29$ | s． -4.08 | S． $+\quad .36$ | $\begin{gathered} \text { s. } \\ -4.09 \end{gathered}$ |
| 4 | －．05 | 4.07 | ＋．02 | 4.07 | ． 09 | 4.07 | －16 | 4.08 | ． 23 | 4.08 | －31 | 4.09 |
| 8 | －II | 4.08 | －．04 | 4.07 | ＋．03 | 4.07 | －II | 4.08 | －18 | 4.08 | $\cdot 25$ | $4 \cdot 08$ |
| 12 | －17 | 4.08 | $\cdot 09$ | $4 \cdot 07$ | －． 02 | 4.07 | －05 | 4.07 | －13 | 4.08 | － 20 | 4.08 |
| 16 | －23 | 4.08 | －15 | 4.08 | $\cdot 07$ | 4.07 | －00 | $4 \cdot 07$ | －07 | 4.07 | － 15 | 4.08 |
| 20 | －． 29 | $4 \cdot 08$ | －．21 | 4.08 | $-.13$ | 4.08 | －．06 | 4.07 | ＋．02 | 4.07 | ＋＂．10 | 4.07 |
| 22 | $\cdot 32$ | $4 \cdot 09$ | －24 | 4.08 | $\cdot 17$ | $4 \cdot 08$ | －09 | 4.08 | －or | 4.08 | ．07 | 4.08 |
| 24 | $\cdot 35$ | 4.09 | $\cdot 27$ | 4.08 | －19 | 4.08 | －11 | 4.07 | －03 | 4.07 | ． 04 | 4.07 |
| 26 | － 39 | $4 \cdot 09$ | $\cdot 31$ | 4.09 | $\cdot 23$ | 4.08 | －15 | 4.08 | －07 | 4.08 | ＋ 02 | 4.08 |
| 28 | $\cdot 42$ | $4 \cdot 10$ | $\cdot 34$ | 4.09 | － 26 | 4.08 | －17 | 4.08 | ． 09 | 4.07 | －or | 4.07 |
| 30 | －$\cdot 46$ | $4 \cdot 10$ | － 38 | 4.09 | － 29 | 4.09 | ． 21 | 4.08 | ． 12 | $4 \cdot 08$ | －． 04 | 4.08 |
| 32 | － 50 | $4 \cdot 10$ | $\cdot 41$ | 4.09 | $\cdot 32$ | 4.09 | $\cdot 24$ | $4 \cdot 08$ | － 15 | 4.08 | －07 | 4.07 |
| 34 | －54 | $4 \cdot 11$ | $\cdot 45$ | $4 \cdot 10$ | $\cdot 36$ | $4 \cdot 09$ | ． 27 | 4.08 | －19 | 4.08 | －10 | 4.08 |
| 36 | $\cdot 58$ | $4 \cdot 11$ | $\cdot 49$ | $4 \cdot 10$ | $\cdot 40$ | $4 \cdot 09$ | －3I | 4.08 | －22 | 4.08 | －13 | 4.08 |
| 38 | ． 63 | 4．12 | $\cdot 53$ | $4 \cdot 11$ | $\cdot 44$ | $4 \cdot 10$ | $\cdot 35$ | 4.09 | － 25 | 4.08 | －16 | 4.08 |
| 40 | －． 67 | $4 \cdot 13$ | －． 57 | $4 \cdot 11$ | － 48 | $4 \cdot 10$ | $-\cdot 38$ | 4.09 | － 29 | $4 \cdot 08$ | － 19 | 4.08 |
| 42 | $\cdot 72$ | 4．14 | ． 62 | $4 \cdot 12$ | － 52 | $4 \cdot \mathrm{II}$ | $\cdot 42$ | 4.09 | $\cdot 32$ | 4.08 | $\cdot 23$ | 4.08 |
| 44 | $\cdot 78$ | $4 \cdot 15$ | $\cdot 67$ | $4 \cdot 13$ | $\cdot 57$ | $4 \cdot 11$ | $\cdot 47$ | $4 \cdot 10$ | $\cdot 36$ | 4.09 | － 26 | 4.08 |
| 46 | －84 | $4 \cdot 16$ | $\cdot 73$ | $4 \cdot 14$ | ． 62 | $4 \cdot 12$ | －51 | $4 \cdot 11$ | －41 | 4.09 | $\cdot 30$ | $4 \cdot 09$ |
| 48 | －90 | 4．17 | －79 | $4 \cdot 15$ | $\cdot 67$ | $4 \cdot 13$ | $\cdot 56$ | $4 \cdot 11$ | －45 | $4 \cdot 10$ | －34 | 4.09 |
| 50 | －． 97 | 4．19 | －．85 | $4 \cdot 16$ | －． 73 | $4 \cdot 14$ | － 61 | $4 \cdot 12$ | －． 50 | $4 \cdot 10$ | －．38 | 4.09 |
| 52 | $\underline{1.05}$ | 4.21 | ．92 | 4－18 | －79 | $4 \cdot 15$ | $\cdot 67$ | $4 \cdot 13$ | ． 55 | $4 \cdot 11$ | －43 | $4 \cdot 10$ |
| 54 | I．13 | 4.23 | 1.00 1.08 | 4.19 4.22 | ． 86 | $4 \cdot 57$ 4.18 | .73 .80 | $4 \cdot 14$ $4 \cdot 15$ | ． 60 | 4.12 | －48 | $4 \cdot 10$ |
| 56 58 | I 23 I 33 | 4.26 4.29 | 1.08 I． 18 | 4.22 | － 94 1．03 | $4 \cdot 18$ | ．80 | 4．15 | － 66 | $4 \cdot 13$ | $\cdot 53$ | $4 \cdot 11$ |
| 58 | I•33 | 4.29 | 1－18 | 4.24 | 1．03 | $4 \cdot 20$ | ． 88 | $4 \cdot 17$ | －73 | 4．14 | $\cdot 59$ | 4•12 |

# HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 47 LATITUDE $11^{\circ}$. 

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ |  | $7{ }^{\circ}$ |  | $8{ }^{\circ}$ |  | $9^{\circ}$ |  | $10^{\circ}$ |  | 11 | Decl. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\begin{array}{\|l\|l\|l} \text { H. M. M. } \end{array}$ |  | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & 28 \cdot 2 \end{array}\right.$ |  | $\left\|\begin{array}{lcl} \text { H. } & \text { M. } & \text { S. } \\ 6 & \text { I5. } \end{array}\right\|$ | + 79 | $7 \quad 3.4$ | + .80 | $51 \cdot 4$ | . 80 | $\left\lvert\, \begin{array}{ccc} \text { H. } & \text { M. } & \text { S. } \\ 6 & 39 \% \end{array}\right.$ |  |
| 10 | 52346 | $\cdot 72$ | 52428 |  | $5 \begin{array}{llll}5 & 25 & \text { II-2 }\end{array}$ | $\cdot 70$ | $525 \quad 53.0$ | -69 | $5 \quad 26$ 34-2 | . 68 | $5 \quad 2714.8$ | $\cdot 67$ |
| 12 |  | 71 | 51618.0 | -70 | $\begin{array}{lllll}5 & 16 & 59.4\end{array}$ | . 68 | 5 I7 40.1 | . 67 | $\begin{array}{llllll}5 & 18 & 20.2\end{array}$ | - 66 | $\begin{array}{lllll}5 & 18 & 59.4\end{array}$ | 5 |
| 14 | $5 \quad 725.7$ | $\cdot 70$ | $\begin{array}{llll}5 & 8 & 7 \cdot 3\end{array}$ | 68 | $\begin{array}{llll}5 & 8 & 47.9 \\ 5 & 0 & 36.7\end{array}$ | $\cdot 67$ | $927 \cdot 7$ | . 65 | 5 10 $6 \cdot 5$ | . 64 | 10 $44 \cdot 5$ | 3 |
| 16 | 459 16.0 | $\cdot 69$ | $45956 \cdot 8$ |  | - 36.7 |  | $\begin{array}{llll}5 & 1 & 15.5\end{array}$ |  | $\begin{array}{llll}5 & 1 & 53\end{array}$ |  | 0.0 | \% |
| 18 | 51 | + 68 | $45146 \cdot 7$ | + 66 | $45225 \cdot 8$ | + .64 | $4 \begin{array}{llll}4 & 53 & 3.7\end{array}$ | + 62 | $45340 \cdot 4$ | + 60 | 45415.8 | + 58 |
| 20 | $44256 \cdot 8$ | . 68 | $44336 \cdot 7$ | $\cdot 65$ | 444 I5.I | . 63 | $44452 \cdot 2$ | . 60 | 44527.8 | $\cdot 58$ | 44 46 $2 \cdot 1$ <br> 4 37  | - 56 |
| 22 | 43447 | $\cdot 67$ | $435 \quad 26 \cdot 8$ | 4 | $4 \begin{array}{lll}4 & 36 & 4.7\end{array}$ | -62 | $43640 \cdot 9$ | - 59 | 43715 | - 56 | 43748.7 | 4 |
| 24 | 42638 | -66 | $42717 \cdot 1$ | 63 | 42754.4 | $\cdot 60$ | 42829.9 | $\cdot 58$ | $\begin{array}{lll}4 & 29 & 36\end{array}$ | $\cdot 55$ | 42935.6 | 2 |
| 26 | 41829.0 |  | 41973 |  | 41944.4 | . 59 | 420 19•I | $\cdot 56$ | $42052 \cdot 0$ | 53 | 42122.8 | O |
| 28 | 410 | + 66 | $41058 \cdot 3$ | + 62 | 4 II 34.5 | + 58 | 412 | + 55 | $4 \begin{array}{llll}4 & 12 & 40 \cdot 5\end{array}$ | + 51 | $\begin{array}{llll}4 & 13 & 10 \cdot 3\end{array}$ | + 48 |
| 30 | $\begin{array}{lllll}4 & 2 & 10.9\end{array}$ | $\cdot 65$ | $4 \begin{array}{rrrr} \\ 4 & 49 \cdot 0\end{array}$ | -6I | $\begin{array}{llll}4 & 3 & 24.8\end{array}$ | $\cdot 58$ | $4 \quad 358$ |  | $4 \begin{array}{lll}4 & 49.4\end{array}$ |  | $4 \quad 4 \quad 58 \cdot \mathrm{I}$ | 46 |
| 31 | $\begin{array}{llll}3 & 58 & 6 \cdot 4\end{array}$ | . 65 | 3 518844.4 | 6 I | $35920 \cdot 0$ | $\cdot 57$ | 3595 | - 53 | $4{ }^{1}$ | $\cdot 49$ | $4{ }^{4}$ | 45 |
| 32 | 3 54 1 |  | $\begin{array}{llll}3 & 54 & 39 \cdot 8\end{array}$ | 61 | $35515 \cdot 2$ | . 57 | 3554 | -52 | $3 \begin{array}{llll}3 & 56 \\ 3 & 18\end{array}$ |  | 356 | 44 |
| 33 | $34957 \cdot 4$ |  | $35035 \cdot 3$ |  | 351 | -56 | 351 | - 52 | 352 |  | 352 | 4 |
| 34 | 3 45 5 <br> 3 41  | + 6.65 | $\begin{array}{llll}3 & 46 & 30 \cdot 7 \\ 3 & 42 & 26 \cdot 2\end{array}$ | + 6 I | 3 47 $5 \cdot 8$ <br> 3 43 $1 \cdot 1$ <br>    | + ${ }^{.56}$ | $\begin{array}{lll} 3 & 47 & 38 \cdot I \\ \hline \end{array}$ | + ${ }^{51}$ | $\left\lvert\, \begin{array}{llll}3 & 48 & 7 \cdot 6 \\ 3 & 44 & 2 \cdot 3\end{array}\right.$ | + 47 | $\begin{array}{ll}3 & 48 \\ 3\end{array}$ | 41 |
| 35 | $\begin{array}{llll}3 & 41 & 48 \cdot 4 \\ 3 & 37 & 43 \cdot 9\end{array}$ | . 65 | 3 3 3 38 2 | . 61 |  | $\cdot 56$ |  | $\cdot 5$ |  |  | 344 | 41 |
| 36 |  | 5 |  |  | $\begin{array}{lllllllllll}38 & 56 \cdot 5\end{array}$ | $\cdot 55$ | $\begin{array}{llllll}3 & 39 & 28 \cdot 3 \\ 3 & 35 & 23.4\end{array}$ |  | $33957 \cdot \mathrm{I}$ |  | 340 | 40 |
| 37 38 | $\begin{array}{llll}3 & 33 & 39 \cdot 4 \\ 3 & 29 & 34 \cdot 9\end{array}$ | $\cdot 65$ | $\begin{array}{llllllllllllllll}3 & 34 & 17.2 \\ 3 & 30 & 12.7\end{array}$ | $\cdot 60$ | $\begin{array}{llllllllll}3 & 34 & 51 \cdot 8 \\ 3 & 30 & 47 \cdot 3\end{array}$ | 5 | 3 35 23.4 <br> 3 31  |  | 33551 |  | 336 | 40 |
| 38 | 3293 |  | 330 | . 60 | $3047 \cdot 3$ | 55 | $33^{1}$ | -49 | 331 | 44 | 332 | 39 |
| 40 | $\begin{array}{ll}3 & 25 \\ 3 & 21\end{array}$ | $\begin{array}{r}+66 \\ \hline .66\end{array}$ | $\begin{array}{lll}3 & 26 & 8 \cdot 2 \\ 3 & 22 & 3 \cdot 7\end{array}$ | + 60 | $\begin{array}{llll}3 & 26 & 42 \cdot 7 \\ 3 & 22 & 38 \cdot 7 \\ & 18 & \end{array}$ | + $\quad .55$ | 3 27 $13 \cdot 8$ <br> 3 23  | + 49 | $\begin{array}{lllll}3 & 27 & 4 \mathrm{I} \cdot 6 \\ 3 & 2 & \\ & 2 & 36 \cdot 5\end{array}$ | + 43 | 328 | + 38 |
| 40 | 321 | 66 | $\begin{array}{llll}3 & 22 & 3.7\end{array}$ |  | 3 22 <br> $38 \cdot \mathrm{I}$  | -54 | $\begin{array}{llll}3 & 23 & 9 \cdot 1 \\ 3 & 1\end{array}$ |  | $\begin{array}{lllll}3 & 23 & 36 \cdot 5\end{array}$ |  | 324 | 37 |
| 41 | 317 | 66 | $\begin{array}{lllll}3 & 17 & 59.2 \\ 3 & 13 & 5 \cdot 7\end{array}$ |  | $31833 \cdot 6$ | - 54 | $\begin{array}{llll}3 & 19 & 4.3 \\ 3 & 1 & 59.6\end{array}$ |  | $\begin{array}{llll}3 & 19 & 31 \cdot 5\end{array}$ | $\cdot 42$ | $3 \begin{array}{lll}3 & 19 & 55\end{array}$ | 36 |
| 42 |  | $\cdot 67$ | $\begin{array}{lllll}3 & 13 & 54.7\end{array}$ |  | 31429.0 | $\cdot 54$ | $\begin{array}{llll}3 & 14 & 59 \cdot 6\end{array}$ | $\cdot 48$ | 3 115 | -42 | $31549 \cdot 6$ | 35 |
| 43 | $\begin{array}{lllll}3 & 9 & 12.0\end{array}$ | .6 | 39 |  | 31024.5 | $\cdot 54$ | 3 10 $55^{\circ} 0$ |  | 3 II 21.5 |  | 3 II | 35 |
| 44 | $\begin{array}{llll}3 & 5 & 7.3\end{array}$ | + 67 |  | + 6 I | - 5 | + 54 | $\begin{array}{llll}3 & 6 & 50 \cdot 3 \\ 3 & 2 & 45\end{array}$ | + 47 | $3{ }^{3} 7116 \cdot 7$ | $+40$ |  | + 34 |
| 45 | 3 | . 68 | 3 I 4112 | 61 | $15 \cdot$ | 54 | 457 | 4 | $3 \begin{array}{llll}3 & 3117\end{array}$ | -40 | 333 | 33 |
| 4 | $\begin{array}{llllll}2 & 56 & 57.9\end{array}$ | . 68 | $\begin{array}{lllll}2 & 57 & 36 \cdot 6\end{array}$ |  | 258 II•I | 54 | $2584 \mathrm{I} \cdot \mathrm{I}$ | 4 | $\begin{array}{lll}2 & 59 & 6 \cdot 9\end{array}$ |  | $25928 \cdot 3$ | 32 |
| 47 | 2525 | -69 | $\begin{array}{llll}2 & 53 & 32 \cdot 1 \\ 2\end{array}$ | -6I | $254 \quad 6 \cdot 6$ | $\cdot 54$ | $\begin{array}{lllll}2 & 54 & 36 \cdot 5\end{array}$ | $\cdot 46$ | $\begin{array}{lll}2 & 55 & 2 \cdot 0 \\ 20\end{array}$ |  | 5523.0 | 31 |
| 48 | 248 | $\cdot 69$ | 24927.5 | .61 | $50 \quad 2 \cdot \mathrm{I}$ | $\cdot 54$ | $25032 \cdot 0$ | -46 | 250 |  | 5117.9 | 30 |
| 49 | $24443 \cdot 3$ | + 70 | $\begin{array}{lllll}2 & 45 & 22.9\end{array}$ | + .62 | $24557 \cdot 6$ | + 54 | $\begin{array}{lllllll}2 & 46 & 27 \cdot 4\end{array}$ | + 46 | 46 | +-38 | 24712.7 | + 30 |
| 50 | $24038 \cdot 3$ | $\cdot 71$ | 24118.2 | . 62 | $24153 \cdot \mathrm{I}$ | $\cdot 54$ | 24222.9 | $\cdot 46$ | 242478 | 37 | $243 \quad 7 \cdot 6$ | 29 |
| 5 I | 236 | $\cdot 71$ | 23713 |  | $3748 \cdot 5$ | 54 |  | 4 | ${ }_{2}^{2} 38433^{\circ}$ |  | $\begin{array}{lll}2 & 39 & 2 \cdot 5\end{array}$ | -28 |
| 52 | $\begin{array}{lllll}2 & 32 & 28 \cdot 1 \\ 2 & 28 & 22.8\end{array}$ | $\cdot 72$ | $\begin{array}{llll}2 & 33 & 8.8\end{array}$ | . 63 | $23344^{\circ}$ | -54 | $\begin{array}{lllll}2 & 34 & 13.9\end{array}$ | $\cdot 45$ | $\begin{array}{llll}2 & 34 & 38 \cdot 4\end{array}$ |  | $23457 \cdot 4$ | 7 |
| 53 | $2 \begin{array}{llll}2 & 28 & 22.8\end{array}$ | $\cdot 73$ | 2294.0 | 64 | 229 | 54 | 30 |  | 230 | 6 | 230 | $\cdot 27$ |
|  | $\begin{array}{llll}2 & 24 & 17.5 \\ 2 & 2\end{array}$ | + 74 | $22459 \cdot 1$ | + 64 | 225 | $+.55$ | $\begin{array}{lll}2 & 26 & 4.9 \\ 2\end{array}$ | + 45 | 22629.0 | + 35 | $22647 \cdot 4$ | + $\cdot 26$ |
| 55 56 | $\begin{array}{rrrr}2 & 20 & 12.0 \\ 2 & 16 & 6.4\end{array}$ | $\cdot 75$ | 22054.2 21649.2 | . 65 | $22130 \cdot 3$ | $\begin{array}{r} \\ \hline\end{array} 5$ | 2 22 0.4 <br> 2   | $\cdot 45$ | $\begin{array}{llll}2 & 22 & 24.4 \\ 2 & 18\end{array}$ | 3 | $22242 \cdot 5$ | 25 |
|  | 216 | 7 | $21649 \cdot 2$ |  | $21725 \cdot 7$ | 56 | $\begin{array}{lllllll}2 & 17 & 55.9\end{array}$ | 45 | $2 \begin{array}{llll}28 & 19.8\end{array}$ | 5 | 21837 | 24 |
|  | $\begin{array}{llll}2 & 12 & 0\end{array}$ | $\cdot 78$ | 12 24.2 |  | $1321 \cdot \mathrm{I}$ | $\cdot 56$ | $2 \begin{array}{llll}2 & 51.4\end{array}$ | $\begin{array}{r}45 \\ \hline 45\end{array}$ |  | - 34 | 1432.6 | 23 |
| 58 | 754 | $\cdot 79$ | 83 |  | 916 | $\cdot 57$ | 946 |  | Io |  | I0 27.7 | $\cdot 23$ |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. |  | L. 6 | A. | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ |  | S. | $\begin{gathered} \mathrm{s} \\ -4 \cdot 10 \end{gathered}$ | $\underline{\text { s. }}$ | S. | s. $+\quad .58$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot I I \end{gathered}$ |  | S. 66 | S. | S. | S. | S. 81 | S. |
| 4 |  | - 38 | 4.09 | $\cdot 45$ | $4 \cdot 10$ | . 53 | 4.II |  | . 60 | 4.12 | . 68 | $4 \cdot 13$ | . 75 | 4.14 |
| 8 |  | -33 | 4.09 | -40 | 4.09 | -47 | 4.10 |  | $\cdot 55$ | 4.II | -62 | $4 \cdot 12$ | -70 | $4 \cdot 13$ |
| 12 |  | -27 | 4.08 | -35 | 4.09 | -42 | $4 \cdot 10$ |  | - 50 | $4 \cdot 10$ | -57 | $4 \cdot 11$ | -65 | 4-12 |
| 16 |  | - 22 | $4 \cdot 08$ | -30 | 4.08 | -37 | 4.09 |  | -45 | $4 \cdot 10$ | - 53 | 4-II | - 60 | 4.12 |
| 20 | $+$ | -17 | 4.08 | + 25 | 4.08 | + 33 | 4.09 |  | - 40 | $4 \cdot 09$ | + 48 | 4.10 | + 56 | 4•II |
| 22 |  | -15 | 4.08 | -23 | 4.08 | -30 | 4.09 |  | $\cdot 38$ | 4.09 | $\cdot 46$ | 4.10 | . 54 | $4 \cdot \mathrm{Ir}$ |
| 24 |  | -12 | 4.08 | - 20 | 4.08 | -28 | 4.08 |  | -36 | 4.09 | $\cdot 44$ | $4 \cdot 10$ | $\cdot 52$ | $4 \cdot 11$ |
| 26 |  | -10 | 4.08 | -18 | 4.08 | -26 | 4.08 |  | -34 | 4.09 | -42 | 4.10 | $\cdot 50$ | $4 \cdot 10$ |
| 28 |  | -07 | $4 \cdot 07$ | -15 | 4.08 | $\cdot 23$ | 4.08 |  | -31 | 4.09 | -40 | 4.09 | -48 | 4.10 |
| 30 | $+$ | -04 | 4.07 | + 13 | 4.08 | + 21 | 4.08 |  | $\cdot 29$ | 4.08 | + 38 | 4.09 | + 46 | $4 \cdot 10$ |
| 32 |  | -02 | $4 \cdot 07$ | -10 | 4.07 | -19 | 4.08 |  | $\cdot 27$ | 4.08 | -36 | 4.09 | -44 | $4 \cdot 10$ |
| 34 | - | - 01 | $4 \cdot 07$ | -08 | 4.07 | - I6 | $4 \cdot 08$ |  | $\cdot 25$ | 4.08 | -34 | 4.09 | -42 | 4.10 |
| 36 |  | $\cdot 04$ | 4.07 | . 05 | 4.07 | -14 | $4 \cdot 08$ |  | - 23 | 4.08 | -3I | 4.09 | -40 | 4.09 |
| 38 |  | - 07 | $4 \cdot 07$ | - 02 | 4.07 | -12 | $4 \cdot 08$ |  | $\cdot 21$ | 4.08 | -30 | 4.08 | -39 | 4.09 |
| 40 | - | -10 | 4.07 | -00 | 4.07 | +.09 | 4.07 |  | -18 | 4.08 | + 28 | 4.08 | $+\cdot 37$ | $4 \cdot 09$ |
| 42 |  | -13 | $4 \cdot 08$ | -. 03 | 4.07 | . 06 | 4.07 |  | -16 | 4.08 | $\cdot 26$ | 4.08 | $\cdot 35$ | 4.09 |
| 44 |  | -16 | $4 \cdot 08$ | -06 | 4.07 | . 04 | $4 \cdot 07$ |  | -14 | 4.08 | -24 | 4.08 | -34 | 4.09 |
| 46 |  | - 20 | 4.08 | -09 | 4.08 | + - OI | 4.07 |  | - II | $4 \cdot 08$ | -22 | 4.08 | -32 | 4.09 |
| 48 |  | $\cdot 23$ | $4 \cdot 08$ | -12 | 4.08 | - 02 | $4 \cdot 07$ |  | -09 | 4.08 | -20 | 4.08 | -30 | 4.09 |
| 50 | - | $\cdot 27$ | 4.08 | - -16 | 4.08 | - 04 | $4 \cdot 07$ |  | .07 | 4.07 | + -18 | 4.08 | + 29 | 4.08 |
| 52 |  | -31 | $4 \cdot 09$ | -19 | $4 \cdot 08$ | . 08 | 4.07 |  | . 04 | 4.07 | -16 | $4 \cdot 08$ | . 27 | $4 \cdot 08$ |
| 54 |  | -35 | 4.09 | $\cdot 23$ | 4.08 | -II | 4.08 |  | - OI | $4 \cdot 07$ | - I4 | 4.08 | -26 | $4 \cdot 08$ |
| 56 58 |  | -40 | 4.09 | $\cdot 27$ | $4 \cdot 08$ | -14 | 4.08 |  | - 01 | 4.07 | - II | 4.08 | - 24 | 4.08 |
| 58 |  | $\cdot 45$ | $4 \cdot 10$ | -31 | 4.09 | -18 | 4.08 |  | $\cdot 04$ | 4.07 | . 09 | 4.08 | $\cdot 23$ | 4.08 |

48 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $11^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{array}{\|l\|l\|} \hline \text { True } \\ \text { Alt. } \end{array}$ | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $14^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $15^{\circ}$ | Decl. Far. | $16^{\circ}$ |  | 170 | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | \%. M. S. |  | 6. 1. |  |  |  | 6. M. ${ }^{\text {S }}$ |  | H. M. S. |  |
| - |  | + 8.81 |  | + ${ }_{\text {. } 62} \mathbf{6}$ | $\begin{array}{ccc}6 & \text { II } & 6 \cdot 7 \\ 5 & 29 & 13.9\end{array}$ | + ${ }^{\text {. }} 83$ | $\begin{array}{llll}6 & \text { II } & 56 \cdot 5 \\ 5 & 29 & 52 \cdot 6\end{array}$ | + 8.83 | $\begin{array}{llll}6 & 12 & 46.8 \\ 5 & 30 & 3 \mathrm{~F} \cdot 0\end{array}$ | -84 |  |  |
| 12 | $5{ }^{5} 191938.1$ |  | ${ }^{5} 20$ |  | $\begin{array}{llll}5 & 20 & 53.4 \\ 5 & 1 & \end{array}$ | . 62 | ${ }_{5} 2130 \cdot 1$ | . 6 I | 5 22 6-2 |  | [ 5 | 59 |
| ${ }_{16}^{14}$ | 5 II 21.7 | . 69 | 5 II 58.0 <br> 5 3 40.4 |  |  | . 58 | 5 5 5 5 | $\cdot 57$ |  | . <br> 5 <br> - 5 | [514.15.2 | -55 |
| 18 | $\begin{array}{rl} 3 & 5 \cdot 7 \\ 54 & 50 \cdot 1 \end{array}$ | + 56 | $\left\lvert\, \begin{array}{cc} 5 & 3 \\ 4 & 55 \end{array}\right.$ | + 54 | $\begin{array}{ll} 5 & \\ 4 & 5 \end{array}$ |  |  |  | $\begin{array}{cccc}5 & 5 & 18 \cdot 5 \\ 4 & 56 & 55 \cdot 6\end{array}$ |  | 3 | $\begin{array}{r}\text {-50 } \\ +\quad 46 \\ \hline\end{array}$ |
| 20 | 446350 |  | 447 | -51 | 44736.7 |  | $4{ }_{4}^{48} 5$ | 47 | $44833 \cdot \mathrm{r}$ | + ${ }_{45}$ | ${ }^{4} 48859$ |  |
| 22 |  | -51 |  | 49 | 4 3918.8 | 46 | 4 3945 |  | 4 40 III | 析 | ${ }^{4} 403500$ |  |
| 24 26 | 4 30 3.9 <br> 4 21 51 | -49 |  | $\stackrel{46}{ } \cdot 4$ |  | 43 | $\left\|\begin{array}{rrr} 4 & 31 & 26 \cdot 2 \\ 4 & 23 & 7 \cdot 1 \end{array}\right\|$ | 40 | $\begin{array}{llll}4 & 31 & 49.5 \\ 4 & 23 & 28.4\end{array}$ |  |  | -34 <br> .30 |
| 28 | 1338 | 44 | $4 \begin{array}{llll}4 & 14 & 3.6 \\ 4 & 5\end{array}$ | + 41 | $41427 \cdot 1$ | + 37 | 414484 | -34 | 4157.5 | + 30 | ${ }_{4}^{4} 15152.6$ | + 27 |
| 30 | ${ }^{4}$ |  |  |  | $\begin{array}{cc} 4 \\ 4 & 6 \\ \hline \end{array}$ |  | 4 61  <br> 4 30.0 |  | ${ }_{4}^{4} 66475$ |  | [15lll | $.22$ |
| 31 32 |  |  | [ | 37 36 | $\begin{array}{ccc}4 & 2 & 2 \cdot 3 \\ 3 & 57 & 54 \cdot 2\end{array}$ | ${ }_{-31} 3$ | 4-20 | $\stackrel{29}{ } \cdot 2$ | $\begin{array}{cccc}4 & 2 & 36 \cdot 9 \\ 3 & 58 & 26 \cdot 8 \\ & & \end{array}$ | $5$ | [ $\begin{array}{ccc}4 & 2 & 50 \cdot 5 \\ 3 & 58 \\ 3 & 30 \cdot 3\end{array}$ | 20 |
| 33 | $\begin{array}{llll}3 & 53 & 4.9\end{array}$ | -39 | 3 3326.9 | 34 | $35346 \cdot 2$ | - 30 | 3 $5442 \cdot 8$ |  | 35416.8 |  | 35428.1 | -16 |
| 34 | $3{ }^{3} 4858.5$ | + ${ }^{38}$ | 3 49 19.7 <br> 3 45  | + 33 | $\begin{array}{llll}3 & 49 & 38.2\end{array}$ | - 28 | $34954 \cdot 0$ | + 24 | 3 50 6.8 <br> 3 45 56.9 | + 19 | 3 50 16.9 <br> 3 46 5 |  |
| 35 36 |  |  |  |  | $\begin{array}{llll}3 & 45 & 30 \cdot 3 \\ 3 & 41 & 22 \cdot 4\end{array}$ | $\cdot 27$ | 3 45 <br> 3 $45 \cdot 1$ <br>  45 <br> $36 \cdot 3$  |  | $\begin{array}{llll}3 & 45 & 56 \cdot 9 \\ 3 & 41 \\ 47 \cdot \mathrm{I}\end{array}$ |  |  | $\begin{aligned} & 12 \\ & -10 \end{aligned}$ |
| 37 | 3 $3639 \cdot 5$ |  | 3 3658.6 | 29 | 33714.7 | -24 | 33727 | -19 | $3 \quad 37$ 37/2 |  | 3 3743 4.8 | 8 |
| 38 | $33233 \cdot 3$ | 33 | 332 51 | $\cdot 28$ | $\begin{array}{llll}3 & 33 & 6.9\end{array}$ | 23 | 33318 | -17 | 3 33 <br> 27.5  |  | \| 3 3 33 32.81 | 6 |
| 49 | $\left\lvert\, \begin{array}{rrr} 3 & 28 & 27 \cdot I \\ 3 & 24 & 21 \cdot 0 \end{array}\right.$ | + 32 |  | + 2 | 3 2859 <br> 12  | + 21 |  | + ${ }_{\text {. } 15}$ |  |  |  | 04 |
| $4{ }_{4}$ | $\begin{array}{llll}3 & 24 & 21.0 \\ 3 & 20 & 150\end{array}$ | .31 .30 |  |  | (1) | . 18 | (rers | 4 | $\begin{array}{llr}3 & 25 & 80 \\ 3 & 20 & 58.3\end{array}$ |  |  |  |
| 42 | $\begin{array}{lll}3 & 16 & 90\end{array}$ | -29 | (164.5 | 23 |  | -17 | $\begin{array}{llll}3 & 16444\end{array}$ |  | $\begin{array}{llll}3 & 16 & 48.6\end{array}$ | 04 | 3 16 <br> 3 48.8 |  |
| 43 | 31230 | $\cdot 28$ | $\begin{array}{llllll}3 & 12 & 17.9\end{array}$ | 22 | $\begin{array}{llll}3 & 12 & 28.9\end{array}$ | 15 | $\begin{array}{llll}312 & 3509\end{array}$ | .08 | $\begin{array}{llll}312 & 389\end{array}$ | + 02 | $3 \begin{array}{llll}3 \\ 3 & 12 & 37.9\end{array}$ |  |
| 44 | I | + 27 | 38 | + 20 | 382214 | + ${ }^{13}$ | $\begin{array}{ll}3 & 8 \\ 27.4\end{array}$ | + .06 | $3 \quad 829.2$ |  | $\begin{array}{ll}3 & 8 \\ 26.9\end{array}$ |  |
| 46 |  |  | ( |  |  | 12 |  | 05 | $\begin{array}{ccc}3 & 4 & 19.6 \\ 3 & 0 & 9.9\end{array}$ |  |  | 10 |
| 47 | $25539 \cdot 6$ | 24 | 2 25551.6 | - | 25559.0 | $\bigcirc 9$ | 256 | + ${ }^{\text {or }}$ | 3 566 |  | 3 0  <br> 2 59 53.7 | 5 |
| 48 | ${ }^{2} 5153$ | -23 | ${ }^{2} 5145 \cdot \mathrm{I}$ | ${ }^{15}$ | 25151.8 |  | 25153.5 |  | $25150 \cdot 5$ |  | $25142 \cdot 6$ | 7 |
| 49 | $\begin{array}{llll}2 & 47 & 28 \cdot 1 \\ 2 & 43 & 22.4 \\ 2\end{array}$ | + |  | + ${ }_{\text {. } 12}$ |  | + .05 | 2 47 450 <br> 2 43  |  | $\begin{array}{llll}2 & 47 & 40 \cdot 7 \\ 2 & 43 & 30 \cdot 9\end{array}$ |  | (1) $\begin{aligned} & 2 \\ & 2 \\ & 2 \\ & 2\end{aligned}$ |  |
| 5 | $\begin{array}{llll}2 & 43 & 22.4 \\ 2 & 39 & 16.7\end{array}$ | - |  | ${ }_{-12} 1$ | 2 43 $37 \cdot 0$ <br> 2 39 29.5 | + ${ }^{\circ} \mathrm{O}$ | 2 43 $36 \cdot 5$ <br> 2 39 28.0 | ${ }_{-05}^{0.05}$ | 2 43 $30 \cdot 9$ <br> 2 39 $2 \mathrm{r} \cdot \mathrm{I}$ |  |  | 3 |
| 52 | $235 \mathrm{Ir} \cdot \mathrm{I}$ | -18 | ${ }_{2} 35119.4$ | -09 | $235 \quad 22 \cdot 2$ | .oo | $\begin{array}{llll}25 & 19.5\end{array}$ | -99 | 235 I1-2 |  | 224 <br> $27 \cdot 3$ | 28 |
| 53 | $\begin{array}{llll}2 & 31 & 5 \cdot 6\end{array}$ | - 17 | $2 \begin{aligned} & 31 \\ & 2 \\ & 13 \cdot 1\end{aligned}$ | 9 | 231 <br> 31 <br> 14.9 |  | 2351150 |  | 235 <br> 15 | -21 | 23045.6 | 35 |
| 54 | $\begin{array}{llll}2 & 27 & 0.0\end{array}$ | + $\cdot 16$ | ${ }_{2}^{2} 27676$ | +.06 | $\begin{array}{lll}2 & 27 & 7.5\end{array}$ |  | $\begin{array}{llll}2 & 27 & 2.4\end{array}$ |  | $2 \begin{array}{lll}26 & 51-2\end{array}$ |  | $22633 \cdot 9$ |  |
| 55 | $\begin{array}{llll}2 & 22 & 54.4 \\ 2 & 18 & 40.0\end{array}$ | . 15 | 22304 | .05 | 223 | .05 |  | - 16 |  |  | ${ }^{2} 222823.0$ |  |
|  | 2 18 <br> 2 14 |  |  |  |  |  | $2{ }_{2}{ }_{2} 18$ |  |  |  | 21810 |  |
| 58 | 21038.0 |  | Io 41-4 |  | 2 1038 |  | 2 102706 |  | $\|$2   <br> 2 10 10.0 |  | [ 294503 | 7 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | ¢ ${ }^{\text {s. }}$ |  | + ${ }^{\text {s. }}$ |  | S. | 4.20 | + I'II |  | +1.19 | $4 \cdot 24$ | 1.27 | 27 |
| 4 | . 83 | ${ }_{4} \cdot 16$ |  | $4 \cdot 17$ | . 98 | $4 \cdot 19$ | ${ }_{\text {r }} \times 1.05$ | 4.21 | +r19 | ${ }_{4} \cdot 23$ | ${ }_{1} \cdot 21$ | 4.25 |
| 8 | . 77 | $4 \cdot 15$ | . 85 | $4 \cdot 16$ | -92 | 4.18 | r.oo | $4 \cdot 19$ | 1.08 | $4 \cdot 21$ | r.r6 | 4.24 |
| 12 | .72 | $4 \cdot 14$ | . 80 | $4 \cdot 15$ | -88 | 4.17 | '95 | 4.18 | 1.03 | $4 \cdot 20$ | $1 \cdot 11$ | 4.22 |
| 16 | . 68 | 4.13 | .76 | $4 \cdot 14$ | .83 | 4.16 | 9 r | 4.77 | -99 | 4.19 | 1.07 | $4 \cdot 21$ |
| 20 | + 64 | $4 \cdot 12$ | + 71 | $4 \cdot 14$ | + 79 | $4 \cdot 15$ | + 87 | 4.17 | + 95 | 4.18 | +r.03 | 4.20 |
| 22 | . 62 | $4 \cdot 12$ | .70 | $4 \cdot 14$ | 78 | $4 \cdot 15$ |  | 4.17 | -94 | 4.18 | 1.02 | 4.20 |
| 24 | -60 | ${ }^{4 \cdot 12}$ | . 68 | $4 \cdot 13$ | $\cdot 76$ | 4.14 | . 84 | 4. 16 | -92 | 4.18 | 1.00 | 4.20 |
| 26 | $\cdot 58$ | $4 \cdot 12$ | . 66 | $4 \cdot 13$ | $\cdot 74$ | $4 \cdot 14$ | .83 | 4. 16 | -91 | 4.18 | .99 | $4 \cdot 19$ |
| 28 | . 56 | $4 \cdot \mathrm{II}$ | . 64 | $4 \cdot 12$ | 73 | $4 \cdot 14$ | .81 | $4 \cdot 15$ | $\cdot 89$ | 4•17 | .98 | $4 \cdot 19$ |
| 30 | + 55 | $4 \cdot 11$ | + 63 | ${ }^{4} \cdot 1.12$ | + 71 | $4 \cdot 14$ | + 80 | 4.15 | + 8.89 | $4 \cdot 17$ | + 97 | $4 \cdot 19$ |
| 32 | -53 | $4 \cdot \mathrm{II}$ | .61 | $4 \cdot 12$ | .70 | 4. 13 | .79 | $4 \cdot 15$ | .87 | $4 \cdot 17$ | . 96 | 4.19 4.18 |
| 34 36 36 | - 51 | 4.11 4.10 | . 68 | ${ }_{4}^{4.12}$ | .69 | $4 \cdot 13$ 4.13 | . 76 | 4.15 | . 86 | ${ }_{4}^{4 \cdot 16}$ | .96 | ${ }_{4}^{4.18}$ |
| 38 | ${ }^{48}$ | $4 \cdot 10$ | . 57 | $4 \cdot \mathrm{Ir}$ | . 67 | $4 \cdot 13$ | $\cdot 76$ | $4 \cdot 15$ | . 85 | $4 \cdot 16$ | -95 | $4 \cdot 18$ |
| 40 | + 46 | $4 \cdot 10$ | + 56 | $4 \cdot \mathrm{II}$ | + 65 | $4 \cdot 13$ | + 75 | $4 \cdot 14$ | + 85 | $4 \cdot 16$ | + 94 | 4.18 |
| 42 | 45 | 4.10 | . 55 | $4 \cdot 11$ | . 65 | $4 \cdot 12$ | $\cdot 74$ | $4 \cdot 14$ | . 84 | $4 \cdot 16$ | -94 | 4.18 |
| 44 | -44 | 4.10 4.10 | - 54 | ${ }_{4 \cdot 11}^{4.11}$ | . 63 | ${ }_{4}^{4 \cdot 12}$ | .74 .74 | $4 \cdot 14$ 4.14 4 | . 84 | + $\begin{array}{r}4 \cdot 16 \\ 4.16\end{array}$ | .95 | 4.18 4.18 |
| 48 | $\cdot 41$ | $4 \cdot \mathrm{ro}$ | . 52 | ${ }_{4 \cdot 1 \mathrm{II}}$ | . 63 | $4 \cdot \mathrm{I2}$ | ${ }^{74}$ | ${ }_{4 \cdot 14}$ | . 85 | $4 \cdot 16$ | -96 | $4 \cdot 19$ |
| 50 | + ${ }^{40}$ | $4 \cdot 09$ | + 5 5 | 4.11 | + 63 | $4 \cdot 12$ | + 74 | $4 \cdot 14$ | $+.85$ | 4.16 | + 97 | 4.19 |
| 52 | $\cdot 39$ | $4 \cdot 99$ | -51 | $4 \cdot 11$ |  | $4 \cdot 12$ |  | $4 \cdot 14$ |  | 4.16 |  | $4 \cdot 19$ |
| 54 | - 38 | 4.09 | - 50 | $4 \cdot 11$ | . 63 | $4 \cdot 12$ | 75 | $4 \cdot 14$ |  | 4.17 | r.00 | $4 \cdot 20$ |
| 56 | $\cdot 37$ | 4.09 | . 50 | $4 \cdot \mathrm{II}$ | . 63 | $4 \cdot 12$ | $\cdot 76$ | $4 \cdot 14$ | $\cdot 89$ | 4.17 | r.03 | 4.20 |
| 58 | $\cdot 36$ | 4.09 | $\cdot 50$ | 4.1 r | . 63 | 4.12 | $\cdot 77$ | $4 \cdot 15$ | -91 | $4 \cdot 17$ | 1.06 | 4.21 |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 49

 LATITUDE $11^{\circ}$.DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { I4 } \\ 29 \cdot 1 \end{array}$ | S. 86 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I5 } & 2 I \cdot 0 \end{array}$ | + $\cdot 87$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & \text { I6 } & 13.7 \end{array}\right.$ | . 88 | $\begin{array}{lll} \text { H. M. } & \text { s. } \\ 6 & 17 & 7 \cdot 0 \end{array}$ | . 89 | $\left\|\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I } 8 & \mathrm{I} \cdot \mathrm{O} \end{array}\right\|$ | -91 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I8 } & 56 \cdot 0 \end{array}$ | S. |
| 10 | $53146 \cdot 5$ | . 62 | $\begin{array}{llllllllllll}5 & 32 & 23.6\end{array}$ | . 62 | $\begin{array}{llll}5 & 33 & 0.5\end{array}$ | -61 | $53336 \cdot 9$ | . 60 | $\begin{array}{llll}5 & 34 & 13 \cdot 1\end{array}$ | -60 | $\begin{array}{lllll}5 & 34 & 48 \cdot 9\end{array}$ | - 59 |
| 12 | $\begin{array}{lllllllllll}5 & 23 & 16 \cdot 7\end{array}$ | $\cdot 58$ | 523 51.0 | $\cdot 57$ | $\begin{array}{llll}5 & 24 & 24.8\end{array}$ | $\cdot 56$ | $52458 \cdot 1$ | -55 | $52530 \cdot 8$ | -54 | 5 266 | 53 |
| 14 | $\begin{array}{lllllllllllllllll}5 & 14 & 47\end{array}$ | $\cdot 53$ | $5 \begin{array}{lllll}5 & 15 & 19\end{array}$ | $\cdot 52$ |  | $\cdot 51$ | $\begin{array}{llll}5 & 16 & 20 \cdot 2\end{array}$ | -50 | $\begin{array}{llll}5 & 16 & 49 \cdot 5\end{array}$ | $\cdot 4$ | 5 17 18.2 | 47 |
| 16 | $\begin{array}{llll}5 & 6 & \text { I9.I }\end{array}$ | -49 | $5648 \cdot 0$ | $\cdot 47$ | $\begin{array}{llll}5 & 7 & 16 \cdot 0\end{array}$ | -46 | $5 \quad 743 \cdot 0$ | 44 | $\begin{array}{lll}5 & 8 & 9^{\circ} 0\end{array}$ | 42 | 5834.0 | 41 |
| 18 | 45751.4 | + 44 | $45^{88}$ I7.5 | - 42 | $45842 \cdot 5$ | -4I | 4596.4 | -39 | 459 29'I | + 37 | $459 \quad 50 \cdot 6$ | + 35 |
| 20 | 449 24.I | $\cdot 40$ | $44947 \cdot 6$ | -38 | 45097 | $\cdot 36$ | $450 \quad 30 \cdot 4$ | -33 | $45049 \cdot 8$ | -31 | 4517 | 29 |
| 22 | $4 \quad 40$ 57.3 | -36 | 44 I I8•I | -33 | $44137 \cdot 3$ | -31 | $44155 * 0$ | 28 | 442 II.O | -25 | $4 \begin{array}{llll}4 & 42 & 25\end{array}$ | 23 |
| 24 | 43231.0 | -31 | $43249 \cdot 1$ | -29 | $\begin{array}{lll}4 & 33 & 5.4\end{array}$ | -26 | 43319.9 | -23 | $433 \quad 32 \cdot 6$ | -19 | $43343 \cdot 4$ |  |
| 26 | $424 \begin{array}{ll}4 \cdot 1\end{array}$ | $\cdot 27$ | $424 \quad 20 \cdot 4$ | $\cdot 24$ | $42433 \cdot 8$ | -21 | $42445 \cdot 2$ | -17 | 42454.5 | -14 | 425 1.7 | IO |
| 28 | $41539 \cdot 5$ | + $\cdot 23$ | 4 I5 52.1 | + -19 | 4162.5 | - 15 | 41610.7 | + 12 | $41616 \cdot 6$ | +.08 | 41620.1 | + . 04 |
| 30 | $4714 \cdot 1$ | -18 | $4724 \cdot 1$ | -14 | 4731.5 | -10 | $4 \quad 7 \quad 36 \cdot 4$ | . 06 | 4738.9 | + . 02 | $47338 \cdot 7$ | -. 02 |
| 31 | $\begin{array}{lll}4 & 3 & 1 \cdot 6\end{array}$ | 16 | 431 | -12 | $4316 \cdot 0$ | -08 | 319.4 | . 03 | $4320 \cdot 0$ | - | $\begin{array}{llll}4 & 3 & 18 \cdot 0\end{array}$ | 6 |
| 32 | $35^{38} 49.0$ | 14 | $\begin{array}{llll}3 & 58 & 56 \cdot 2\end{array}$ | 10 | 3590.6 | .05 | $3592 \cdot 3$ | -00 | 35915 | 4 | $3 \quad 58 \quad 57 \cdot 3$ | 09 |
| 33 | $35436 \cdot 6$ | -12 | $\begin{array}{llll}3 & 54 & 42 \cdot 3\end{array}$ | . 07 | $35445 \cdot 2$ | $+.02$ | $35445 \cdot 2$ | . 02 | $354.42 \cdot 3$ | - 07 | $35436 \cdot 4$ | -12 |
| 34 | $35024 \cdot 1$ | $+$ | $\begin{array}{llll}3 & 50 & 28 \cdot 5\end{array}$ | + 05 | $35029 \cdot 8$ | -00 | 350 28.I | 05 | 35023.4 | 10 | 35015.5 | 15 |
| 35 | 346 II 7 | . 07 | $3 \begin{array}{llll}3 & 46 & 14.6\end{array}$ | + 02 |  | . 03 | 346 1110 | -08 | $\begin{array}{lll}3 & 46 & 4.4\end{array}$ | -14 | 3454546 | 19 |
| 3 | 34159.4 | .05 | $\begin{array}{lll}3 & 42 & 0.8\end{array}$ | -00 | $34159 \cdot 0$ | 6 | 341533.9 | 1 | $34 \mathrm{I} 45 \cdot 4$ | 7 | 34133.6 | 2 |
| 37 | $33747 \cdot 0$ | + 03 | $\begin{array}{lllll}3 & 37 & 47 \cdot 0\end{array}$ | - .03 | $\begin{array}{lllll}3 & 37 & 43.5\end{array}$ | -0 |  | 4 | $\begin{array}{llll}3 & 37 & 26 \cdot 3\end{array}$ | 20 |  | 26 |
| 38 | $33334 \cdot 7$ | -00 | $\begin{array}{llll}3 & 33 & 33 \cdot 1\end{array}$ | . 05 | $\begin{array}{llll}3 & 33 & 28 \cdot I\end{array}$ | -II | $\begin{array}{lllll}3 & 33 & 19.4\end{array}$ | 17 | $\begin{array}{llll}3 & 33 & 7 \cdot 2\end{array}$ | -23 | $3325 \mathrm{I} \cdot 2$ | 30 |
| 39 | 32922 | -02 |  |  | $\begin{array}{llllll}3 & 29 & 12.5\end{array}$ | 14 | $\begin{array}{lll}3 & 29 & 2 \cdot 1\end{array}$ | -20 |  | - 27 | $328129 \cdot 7$ | -33 |
| 4 | $\begin{array}{lll}3 & 25 & 9.9\end{array}$ | - 04 | $\begin{array}{llll}3 & 25 & 5 \cdot 3\end{array}$ | - II | $32457 \cdot 0$ | -17 | $32444 \cdot 7$ | -24 | 3124188.4 | 30 | $3248 \cdot 1$ | 37 |
| 4 | $32057 \cdot 6$ | -07 | $3205 \mathrm{I} \cdot 4$ | -13 | $3204 \mathrm{I} \cdot 3$ | -20 | $32027 \cdot 2$ | -27 | $\begin{array}{lll}3 & 20 & 8 \cdot 9\end{array}$ | -34 | $31946 \cdot 3$ | I |
| 42 | $\begin{array}{lllllllll}3 & 16 & 45.2\end{array}$ | -09 | $\begin{array}{llll}3 & 16 & 37 \cdot 4\end{array}$ | -16 | $\begin{array}{llll}3 & 16 & 25 \cdot 6\end{array}$ | $\cdot 23$ | $\begin{array}{llrr}3 & 16 & 9 \cdot 5\end{array}$ | -30 | $\begin{array}{lllll}3 & 15 & 49 \cdot 2\end{array}$ | $\cdot 37$ |  | 45 |
| 43 | $\begin{array}{\|llll\|}3 & 12 & 32.7\end{array}$ | 2 | $\begin{array}{llll}3 & 12 & 23.4\end{array}$ | 1 | $\begin{array}{llll}3 & 12 & 9.7\end{array}$ |  | 3 III 51.7 | 4 | 3 II 29:2 | -41 | 3 II 2.I | -49 |
| 44 | $3{ }_{3} 3820 \cdot 3$ | $\cdot 15$ | $\begin{array}{lll}3 & 8 & 9 \cdot 3\end{array}$ | 22 | $\begin{array}{lllll}3 & 7 & 53.8\end{array}$ |  | $733 \cdot 8$ |  | $\begin{array}{lll}3 & 7 & 9 \cdot 1\end{array}$ | -45 | $\begin{array}{llll}3 & 6 & 39 \cdot 6\end{array}$ | -53 |
| 4 | $\begin{array}{llll}3 & 4 & 7 \cdot 8\end{array}$ | -1 ${ }^{\prime}$ | $\begin{array}{llll}3 & 3 & 55 \cdot 0\end{array}$ | - | $\begin{array}{llll}3 & 3 & 37 \cdot 7\end{array}$ |  | $\begin{array}{lrrr}3 & 3 & 15 \cdot 6\end{array}$ | - 41 | $\begin{array}{llll}3 & 2 & 48 \cdot 7\end{array}$ | -49 | $\begin{array}{llll}3 & 2 & 16 \cdot 7\end{array}$ | 5 |
| 4 | $25955 \cdot 1$ | 20 | $25940 \cdot 7$ | - 28 | $\begin{array}{llll}2 & 59 & 2 I \cdot 5\end{array}$ | -36 |  | -44 | $\begin{array}{llll}2 & 58 & 28 \cdot 0\end{array}$ | -53 | $25753 \cdot 5$ | . 62 |
| 47 | $25542 \cdot 5$ | -23 | $\begin{array}{llll}2 & 55 & 26 \cdot 3\end{array}$ | $\cdot 31$ | $\begin{array}{llll}2 & 55 & 5 \cdot 1\end{array}$ |  | $25438 \cdot 7$ | -48 | $2 \begin{array}{lll}254 & 7 \cdot 1\end{array}$ | -57 | 253 30.0 | 67 |
| 48 | 25129.7 | 6 | 251117 | -34 | $25048 \cdot 5$ | -43 | $2 \begin{array}{llll}50 & 19.9\end{array}$ | - 52 | $24945 \cdot 8$ | . 62 | 249 | 71 |
| 49 | 24716.8 | $\cdot 29$ | $2 \begin{array}{lllllll}2 & 46 & 56.9\end{array}$ | - 38 | $24631 \cdot 6$ | $\cdot 47$ | 2460.8 | -.56 | 24524.2 | . 66 | $24441 \cdot 5$ |  |
| 50 | $\begin{array}{llll}2 & 43 & 3 \cdot 8\end{array}$ | $\cdot 32$ | $24242 \cdot 0$ | -4 | $2 \begin{array}{lllll}2 & 42 & 14.5\end{array}$ | -5I | $24 \mathrm{I} 4 \mathrm{I} \cdot 3$ | 6 | $2412 \cdot 1$ | 71 | $24016 \cdot 6$ | I |
| 51 | $\begin{array}{lllll}2 & 38 & 50.5\end{array}$ | -35 | $\begin{array}{llll}2 & 38 & 26 \cdot 9\end{array}$ | -44 | $\begin{array}{lllllllll}2 & 37 & 57.2\end{array}$ | -54 | $2 \begin{array}{llll}2 & 37 & 2 I \cdot 5\end{array}$ | -65 | $2 \begin{array}{llll}2 & 36 & 39 \cdot 6\end{array}$ | $\cdot 75$ | 235 51•I | 86 |
| 52 | $23437 \cdot 4$ | $\cdot 38$ | $2 \begin{array}{llll}2 & 34 & 11.6\end{array}$ | $\cdot 48$ | $2 \begin{array}{llll}2 & 33 & 39 \cdot 6\end{array}$ | -59 | 23315 | -69 | $2 \begin{array}{llll}2 & 32 & 16.5\end{array}$ | -80 | $23125 \cdot 0$ | 92 |
| 53 | 23023.9 | -41 | $\begin{array}{lllll}2 & 29 & 55.9\end{array}$ | $\cdot 52$ | $22921 \cdot 6$ | -63 | $22840 \cdot 7$ | $\cdot 74$ | 22752.9 | $\cdot 85$ | $22658 \cdot \mathrm{I}$ | 97 |
| 34 | 22610.2 | -45 | $22540 \cdot 1$ | -. 56 | $\begin{array}{lll}2 & 25 & 3 \cdot 3\end{array}$ | . 67 | 22419.6 | - 79 | $2 \begin{array}{llll}2 & 23 & 28.8\end{array}$ | -91 | $22230 \cdot 5$ | I. 04 |
| 55 | $22156 \cdot 3$ | -48 | $2 \begin{array}{lllllll}21 & 23\end{array}$ | . 60 | $22044 \cdot 5$ |  | $2 \begin{array}{llllllll} & 19 & 57.9\end{array}$ | . 84 | $2 \begin{array}{lll}2 & 19 & 3.9\end{array}$ | $\cdot 96$ | 21812.1 | . 10 |
| 56 | 2 I7 $42 \cdot 2$ | $\cdot 52$ | $\begin{array}{rrrr}2 & 17 & 7.4\end{array}$ | . 64 | $\begin{array}{llll}2 & 16 & 25 \cdot 3\end{array}$ |  | $\begin{array}{llll}2 & 15 & 35 \cdot 7 \\ 2 & 1 & 12.8\end{array}$ | -89 | $\begin{array}{llll}2 & 14 & 38 \cdot 3\end{array}$ | 1.02 | $\begin{array}{llll}2 & 13 & 32.7\end{array}$ | I•16 |
| 57 | $\begin{array}{llll}2 & 13 & 27 \cdot 8\end{array}$ | . 56 | $\begin{array}{llll}2 & 12 & 50.5\end{array}$ | -68 | $\begin{array}{llll}2 & 12 & 5 \cdot 6\end{array}$ | -81 | 21112.8 | -95 | 2 IO 11.8 | I.09 | $\begin{array}{lll}2 & 9 & 2.2\end{array}$ | I-24 |
| 58 | 2913.0 |  | $2833 \cdot 1$ | $\cdot 73$ | 2745 | . 87 | 2649.1 | I'OI | 544.4 | I.15 | $2430 \cdot 6$ | I.3I |

VARIATION TO $x^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. 23 | $3^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | $\begin{gathered} \mathrm{S} . \\ +1 \cdot 35 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4.29 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 43 \end{gathered}$ | $\begin{gathered} s \\ -4 \cdot 32 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 5 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 35 \end{gathered}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 60 \end{gathered}$ | $\begin{gathered} s \\ -4 \cdot 37 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 68 \end{gathered}$ | $\begin{gathered} s . \\ -4.4 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{x} \cdot 77 \end{gathered}$ | $\begin{gathered} \text { S. } \\ -4.44 \end{gathered}$ |
| 4 | 1.29 | $4 \cdot 27$ | 1.37 | $4 \cdot 30$ | 1.45 | $4 \cdot 33$ | I. 53 | $4 \cdot 35$ | I.62 | $4 \cdot 38$ | I.70 | 4.41 |
| 8 | 1. 24 | $4 \cdot 26$ | I. 32 | $4 \cdot 28$ | 1.40 | 4.31 | 1.48 | $4 \cdot 33$ | 1.56 | $4 \cdot 36$ | I. 65 | $4 \cdot 39$ |
| 12 | I.I9 | $4 \cdot 24$ | I. 25 | $4 \cdot 27$ | I 35 | $4 \cdot 29$ | I.43 | $4 \cdot 32$ | 1.52 | $4 \cdot 35$ | I. 60 | $4 \cdot 38$ |
| I6 | 1.15 | $4 \cdot 23$ | I. 23 | $4 \cdot 26$ | I 31 | $4 \cdot 28$ | I•39 | $4 \cdot 31$ | 1.48 | $4 \cdot 33$ | I.56 | $4 \cdot 36$ |
| 20 | +I.I2 | $4 \cdot 22$ | +1.20 | $4 \cdot 25$ | +1.28 | $4 \cdot 27$ | +I.36 | $4 \cdot 30$ | +1.45 | $4 \cdot 32$ | +1.54 | $4 \cdot 35$ |
| 22 | 1.10 | $4 \cdot 22$ | I.19 | $4 \cdot 25$ | I. 27 | $4 \cdot 27$ | 1.36 | $4 \cdot 29$ | I. 44 | $4 \cdot 32$ | I. 53 | $4 \cdot 35$ |
| 24 | 1.09 | $4 \cdot 22$ | 1.17 | $4 \cdot 24$ | I 26 | $4 \cdot 26$ | I. 34 | $4 \cdot 29$ | 1.43 | $4 \cdot 32$ | I. 52 | $4 \cdot 35$ |
| 26 | 1.08 | $4 \cdot 22$ | I•16 | $4 \cdot 24$ | I 25 | $4 \cdot 26$ | I•34 | $4 \cdot 29$ | 1.42 | $4 \cdot 32$ | I.5I | $4 \cdot 35$ |
| 28 | 1.07 | $4 \cdot 21$ | I•I5 | $4 \cdot 23$ | I. 24 | $4 \cdot 26$ | I. 33 | $4 \cdot 28$ | 1.42 | $4 \cdot 31$ | I.5I | $4 \cdot 34$ |
| 30 | +1.06 | 4.21 | +1.15 | $4 \cdot 23$ | +1.24 | $4 \cdot 26$ | +I.33 | $4 \cdot 29$ | +1.42 | $4 \cdot 32$ | +1.51 | $4 \cdot 34$ |
| 32 | 1.05 | $4 \cdot 21$ | I.14 | 4.23 | I 23 | $4 \cdot 26$ | I+32 | $4 \cdot 28$ | 1.42 | $4 \cdot 31$ | 1.5I | $4 \cdot 34$ |
| 34 | I. 05 | $4 \cdot 2 \mathrm{I}$ | I-14 | 4.23 | I. 23 | $4 \cdot 26$ | I 33 | 4.28 | 1.42 | 4.31 | I 52 | $4 \cdot 35$ |
| 36 | I. 04 | 4.21 | I•14 | $4 \cdot 23$ | I 23 | $4 \cdot 26$ | I-33 | $4 \cdot 28$ | I.43 | $4 \cdot 32$ | I. 53 | $4 \cdot 35$ |
| 38 | I. 04 | 4.21 | I•I4 | $4 \cdot 23$ | I. 24 | $4 \cdot 26$ | I-34 | $4 \cdot 29$ | 1.44 | $4 \cdot 32$ | I. 54 | $4 \cdot 36$ |
| 40 | +1.04 | $4 \cdot 20$ | +1.14 | $4 \cdot 23$ | +1.24 | $4 \cdot 26$ | +1.34 | $4 \cdot 29$ | +1.45 | $4 \cdot 32$ | +1.55 | $4 \cdot 36$ |
| 42 | I. 04 | $4 \cdot 20$ | 1-15 | 4.23 | I 25 | $4 \cdot 26$ | I.36 | $4 \cdot 29$ | 1.47 | $4 \cdot 33$ | 1.57 | $4 \cdot 37$ |
| 44 | I. 05 | $4 \cdot 21$ | I-16 | $4 \cdot 24$ | $\underline{1.27}$ | $4 \cdot 27$ | I•38 | $4 \cdot 30$ | 1.49 | $4 \cdot 34$ | 1.60 | $4 \cdot 38$ |
| 46 | 1.06 | $4 \cdot 21$ | 1-17 | $4 \cdot 24$ | I. 28 | $4 \cdot 27$ | I. 40 | $4 \cdot 31$ | I.5I | 4.35 | I. 63 | $4 \cdot 39$ |
| 48 | 1.07 | $4 \cdot 21$ | I•I9 | $4 \cdot 24$ | I•30 | $4 \cdot 28$ | 1.42 | $4 \cdot 32$ | 1.54 | 4.36 | I. 67 | $4 \cdot 40$ |
| 50 | +1.09 | 4.22 | $+1.21$ | $4 \cdot 25$ | + 1.33 | $4 \cdot 29$ | +1.45 | $4 \cdot 33$ | +1.58 | $4 \cdot 37$ | +1.71 | $4 \cdot 42$ |
| 52 | I•II | $4 \cdot 22$ | . I. 23 | 4.26 | I.36 | $4 \cdot 30$ | 1.49 | $4 \cdot 34$ | I. 63 | $4 \cdot 39$ | 1.77 | $4 \cdot 44$ |
| 54 | I.13 | 4.23 | 1.27 | 4.27 | $\underline{1.40}$ | $4 \cdot 31$ | I. 54 | $4 \cdot 36$ | 1.68 | 4.41 | I.83 | $4 \cdot 47$ |
| 56 58 | I.16 | 4.24 | 1.31 | $4 \cdot 28$ | I 45 | $4 \cdot 32$ | I. 60 | $4 \cdot 38$ | 1.75 | $4 \cdot 43$ | I.91 | $4 \cdot 50$ |
| 58 | I. 20 | $4 \cdot 25$ | 1.35 | 4.29 | I. 51 | $4 \cdot 34$ | I. 67 | $4 \cdot 40$ | I. 83 | 4.47 | $2 \cdot 00$ | $4 \cdot 54$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2{ }^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. <br> Var. | $5{ }^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| O | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0 \\ 0.0 \end{array}\right.$ | + | $\left\|\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & \text { o } \\ 5 \mathrm{I} \cdot \mathrm{o} \end{array}\right\|$ | . 85 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 42 \cdot I \end{array}\right.$ | . 85 | $\begin{array}{rlc} \mathrm{I}_{\mathrm{M}} & \mathrm{~S} \\ \hline & 33.2 \end{array}$ | S. 85 | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 34^{\circ} 4 \end{array}$ |  | $\left\lvert\, \begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & 4 & \text { I5. } \end{array}\right.$ |  |
| Io | $\begin{array}{llll}5 & 19 & 5\end{array}$ |  | $51957 \cdot 3$ | . 85 | 2048.0 | . 84 | 52138.0 | . 83 | $\begin{array}{llll}5 & 22 & 27 \cdot 2\end{array}$ | 8 r | $\begin{array}{llll}5 & 23 & 15 \cdot 8\end{array}$ | 80 |
| 12 | $51054 \cdot 7$ | 87 | 5 II 46.4 | - 85 | 51237.2 | 84 | 513127.2 | 82 | $51416 \cdot 2$ | .81 | $\begin{array}{lll}5 & 15 & 4.5\end{array}$ |  |
| 14 | $\begin{array}{llll}5 & 2 & 43 \cdot 4\end{array}$ |  | $335 \cdot 5$ | . 86 | $426 \cdot 5$ | 84 | $\begin{array}{lllll}5 & 5 & 16.4\end{array}$ | . 82 | $\begin{array}{lll}5 & 6 & 5.4\end{array}$ | . 88 r | $\begin{array}{llll}5 & 6 & 53 \cdot 3\end{array}$ | -79 |
| 16 | $4543 \mathrm{r} \cdot 8$ | . 88 | 5524.4 | . 86 | $4 \begin{array}{llll}46 & 157\end{array}$ |  | $4 \begin{array}{lll}57 & 5 \cdot 7\end{array}$ |  | $45754 \cdot 6$ | -80 | $45842 \cdot 3$ | 8 |
| 18 | $44620 \cdot 1$ | + 89 | 447 I3.I | + 87 | 48 4.7 | + 85 | $44^{4} 5550$ | + 82 | $44943 \cdot 8$ | $+80$ | 45031.4 | + 78 |
| 20 | $\begin{array}{llll}4 & 38 & 8.0\end{array}$ | $\cdot 91$ | 439 I 7 | . 88 | $\begin{array}{lllll}4 & 39 & 53.7\end{array}$ | .85 | 44044.2 | . 83 | $44 \mathrm{I} 33 \cdot \mathrm{I}$ | 80 | $44220 \cdot 5$ | 78 |
| 22 | $\begin{array}{llll}4 & 29 & 55.6\end{array}$ | $\cdot 92$ | $43050 \cdot 0$ | $\cdot 89$ | 43142.5 | 86 | 43233.3 | 83 | $\begin{array}{llll}4 & 33 & 22.3\end{array}$ | . 80 | $434 \begin{array}{lll}4 & 9.8\end{array}$ | 7 |
| 24 | $4 \begin{array}{lll}4 & 2142.9\end{array}$ | -93 | 43238.0 | $\cdot 90$ | $4233 \mathrm{I} \cdot \mathrm{I}$ | 7 | $42422 \cdot 3$ | 84 | $\begin{array}{llllllllllllll}4 & 25 & 11.6\end{array}$ | . 80 | 42559.0 | 7 |
| 26 | $\begin{array}{llll}4 & 13 & 29.8\end{array}$ | -95 | 41425.7 | I | 1519.5 |  | $41615 \cdot 2$ | 84 | $\begin{array}{lll}4 & 17 & 0.7\end{array}$ | -8I | 41748.3 | 7 |
| 28 | $\begin{array}{llll}4 & 5 & 16 \cdot 1\end{array}$ | + 97 | ${ }^{6} \mathrm{I} 3 \cdot 1$ | + 93 | 776 | + 89 | 759.9 | + 85 | ${ }^{8} 49.8$ | + $8 \mathrm{8r}$ | $\begin{array}{ll}9 & 37 \cdot 6\end{array}$ | + 77 |
| 30 | $57 \quad 2 \cdot 0$ | . 99 | 358 | 94 | $5855 \cdot 4$ | . 90 | 5948.4 | . 86 | $4 \begin{array}{llll}4 & 0 & 38 \cdot 8\end{array}$ | 82 | $\begin{array}{llll}4 & 1 & 26.7\end{array}$ |  |
| 31 | $35254 \cdot 7$ | 0 |  | -95 | $35449 \cdot 2$ | $\cdot 91$ | $35542 \cdot 5$ | $\cdot 87$ | $3 \begin{array}{lllll} & 56 & 33\end{array}$ | . 82 | 35721.3 | $\cdot 78$ |
| 32 | $\begin{array}{lllllll}3 & 48 & 47 \cdot 2\end{array}$ | I-Or | $\begin{array}{llll}3 & 49 & 46 \cdot 5\end{array}$ | -96 | $\begin{array}{llllllllll}3 & 50 & 42 \cdot 9\end{array}$ | $\cdot 92$ |  | . 87 | $\begin{array}{llll}3 & 52 & 27 \cdot 6\end{array}$ | -83 | $\begin{array}{lllll}3 & 53 & 15.9\end{array}$ | - 78 |
| 33 | $34439 \cdot 6$ | 1.02 | $\begin{array}{llll}3 & 45 & 39 \cdot 5\end{array}$ | 97 | $346 \quad 36 \cdot 5$ | 92 | $34730 \cdot 6$ | . 88 | $\begin{array}{lllllllll}3 & 48 & 219\end{array}$ |  | $\begin{array}{llllllllllllllll}3 & 49 & \mathbf{1 0} 4\end{array}$ | - 78 |
| 34 | 3403 | + I | $34132 \cdot 3$ | + 98 | 34229.9 | + 93 | 4324.5 | + 88 | 344 16.1 | + 8 | 3454.9 | 79 |
| 35 | $3623 \cdot 7$ | r.05 | 37 25.1 | 1.00 | 3823.3 | -94 | 3918.4 | . 89 | $34010 \cdot 4$ |  | 34059.4 | 79 |
| 36 |  | I.06 | $\begin{array}{llll}33 & 17.6\end{array}$ | 1.01 | $34 \quad 16 \cdot 5$ | $\cdot 95$ | $3 \begin{array}{lll}3512 \cdot 1\end{array}$ | -90 |  | 85 |  | 79 |
| 37 | $\begin{array}{llll}3 & 28 & 7 \cdot 0 \\ 3 & 2 & 58\end{array}$ | 1.08 | 3.2910 .0 | 1.02 | 309.5 | $\cdot 96$ | $\begin{array}{llll}3 & 31 & 5 \cdot 7 \\ 3 & 6 & 50 \cdot 2\end{array}$ | -91 |  | 85 | $\begin{array}{llllllllllllll}3 & 32 & 48 \cdot 2\end{array}$ |  |
| 38 | 32358.3 | 1.09 | $\begin{array}{llll}3 & 25 & 2 \cdot 1\end{array}$ | 1.03 | 6 | $\cdot 97$ | 2659.2 | $\cdot 92$ | $\begin{array}{llll}3 & 27 & 52 \cdot 5\end{array}$ |  | $\begin{array}{llll}3 & 2842 \cdot 5\end{array}$ |  |
| 39 | $\begin{array}{llll}3 & 19 & 49.4\end{array}$ | +I.II | $32054 \cdot 1$ | +1.05 | 32155.2 | + 99 |  | + 93 | $32346 \cdot 5$ | + $\cdot 87$ | $\begin{array}{llllllllllll}3 & 24 & 36 \cdot 8\end{array}$ | $+.8 \mathrm{r}$ |
| 4 | $\begin{array}{lllllllllll}3 & 15 & 40 \cdot 1\end{array}$ |  | $\begin{array}{llll}3 & 16 & 45 \cdot 9\end{array}$ |  | $\begin{array}{llllllllllll}3 & 17 & 47 \cdot 7\end{array}$ | $\underline{1}$ | $\begin{array}{llll}3 & 18 & 45 \cdot 8\end{array}$ | -94 | $\begin{array}{llllllllll}3 & 19 & 40.2\end{array}$ |  | $32031 \cdot 0$ |  |
| 4 I | $3 \mathrm{II} 30 \cdot 6$ | I.15 |  | I 08 | $3 \mathrm{I} 340 \cdot \mathrm{I}$ | r - 1 | 31439.0 | 95 | $\begin{array}{llllll}3 & 15 & 33.9\end{array}$ | -88 | $\begin{array}{llll}3 & 16 & 25 \cdot 1\end{array}$ | . 82 |
| 42 | 3 7 $20 \cdot 8$ <br> 3   | I-17 | $828 \cdot 6$ | I.09 | $\begin{array}{llll}3 & 9 & 32 \cdot 3\end{array}$ | 1.03 | $\begin{array}{llll}3 & 10 & 31.9\end{array}$ | -96 |  | -89 | $\begin{array}{cccc}3 & 12 & 19 & 1 \\ 3 & 8 & 19\end{array}$ | 83 |
| 43 | 3 | 19 | . 6 | I'II | $524 \cdot 3$ | 04 | 24.7 | -97 | $\begin{array}{llll}3 & 720 \cdot 9\end{array}$ | 90 | 8 13•1 | . 84 |
| 44 | $\begin{array}{llll}2 & 59 & 0 \cdot 2 \\ 2 & 54 & \end{array}$ | + $\mathrm{I} \cdot 21$ | $\bigcirc 10.4$ | +1.13 | 116.0 | +r.06 | $\begin{array}{lrrr}3 & 2 & 17 \cdot 3\end{array}$ | $+.98$ | $\begin{array}{llllllll}3 & 3 & 14.2\end{array}$ | + 91 | 4 6 6 | 84 |
| 45 | $\begin{array}{lllll}2 & 54 & 49\end{array}$ | 23 | $\begin{array}{lll}2 & 56 & 0 \cdot 7\end{array}$ | I.15 | $\begin{array}{lllll}2 & 57 & 7 \cdot 5\end{array}$ | 1.07 | $\begin{array}{llll}2 & 58 & 9 \cdot 7\end{array}$ | O | $\begin{array}{llll}2 & 59 & 7.4 \\ 2 & 55 & \end{array}$ | $\cdot 92$ | $\begin{array}{llll}3 & 0 & 0 \cdot 7\end{array}$ |  |
| 46 | 25037.9 | 1.26 | $25150 \cdot 8$ | 1-17 |  | 9 | $\begin{array}{llll}2 & 54 & 1 & 9\end{array}$ |  | $\begin{array}{llll}2 & 55 & 0.4 \\ 2 & 50 & \end{array}$ |  | 25554.4 | . 86 |
| 47 | $24626 \cdot 2$ | 28 | 2 47 $0 \cdot 5$ | I•19 | $24849 \cdot 6$ | I | 24953.9 | . 03 | $25053 \cdot 3$ | 95 | $25147 \cdot 9$ | 87 |
| 48 | $\begin{array}{lllll}2 & 42 & 13.9\end{array}$ | 1.3I | 24329.7 | I. 22 | 44 | .13 | 24545 |  | $24645 \cdot 9$ | 96 | $24741 \cdot 4$ |  |
| 49 | $\begin{array}{llll}2 & 38 & 1.2 \\ 2 & 33 & 47 \cdot 9\end{array}$ | +1.34 | $\begin{array}{llll}2 & 39 & 18.6 \\ 2 & 35 & 7.0\end{array}$ | + 1.24 |  | +1.15 |  | $+\mathrm{I} .07$ |  | + 98 | $2 \begin{array}{lllll}2 & 43 & 34 \cdot 6\end{array}$ | + 89 |
| 50 | $\begin{array}{llllllll}2 & 33 & 47.9 \\ 2 & 2 & 4\end{array}$ | 37 | 2 35 $7 \cdot 0$ <br> 2 3  | 27 | $\begin{array}{lllll}2 & 36 & 20 \cdot 4 \\ 2 & 32\end{array}$ | I.18 | $\begin{array}{llll}2 & 37 & 28 \cdot 2 \\ 2 & 33 & 19.1\end{array}$ | 1.08 | $2 \begin{array}{llll}28 & 30 \cdot 6\end{array}$ | I.00 | $\begin{array}{lllllll}2 & 39 & 27.7 \\ 2 & 35 & 20.6\end{array}$ | 91 |
| 51 | $\begin{array}{lllll}2 & 29 & 33 \cdot 9 \\ 2 & 25 & 10.3\end{array}$ | I 40 | $\begin{array}{llll}2 & 30 & 54.8 \\ 2 & 26 & 4\end{array}$ | 1.30 r 23 | $\begin{array}{llll}2 & 32 & 9 \cdot 8 \\ 2 & 2 & 5\end{array}$ | 1.20 | 2 3 19 19 <br> 2 2 1  | I.İ | $\begin{array}{llll}2 & 34 & 22 \cdot 6 \\ 2 & 30\end{array}$ | 1.01 |  | 92 |
| 52 53 | $\begin{array}{llll}2 & 25 & 19.3 \\ 2 & 21 & 3.9\end{array}$ | 1.44 1.47 | $\begin{array}{lll}2 & 26 & 42.2 \\ 2 & 22 & 28.9\end{array}$ | 33 | $\begin{array}{lllll}2 & 27 & 58.9 \\ 2 & 23 & 47.5\end{array}$ | 1.23 1.26 | $\begin{array}{llrr}2 & 29 & 9 \cdot 6 \\ 2 & 24 & 59 \cdot 7\end{array}$ | I.13 I. 15 | $\begin{array}{lrrr}2 & 30 & 14.3 \\ 2 & 26 & 5.8\end{array}$ | 1.03 1.05 | $\begin{array}{rrrr}2 & 31 & 13.3 \\ 2 & 27 & 5.8\end{array}$ | .94 .95 |
| 53 | $\begin{array}{llllllllllll}2 & 25 & 3.9\end{array}$ | 47 | 22228.9 | 36 | $22347 \cdot 5$ | I.26 | 22459.7 | I.15 | 26 5.8 | 1.05 | $\begin{array}{lllll}2 & 27 & 5 \cdot 8\end{array}$ | -95 |
| 54 | $\begin{array}{lllll}2 & 16 & 47 \cdot 8 \\ 2 & 12 & 37\end{array}$ | +1.51 | $\begin{array}{lllll}2 & 18 & 15.0\end{array}$ | +1.40 | 1935.5 | +1.29 | $2{ }_{2}^{20} 49494$ | +1.18 | 2156.9 | +1.07 | 22 58.1 | + 97 |
| 55 | $\begin{array}{rrrr}2 & 12 & 30.7\end{array}$ | 1.55 | $140 \cdot 4$ | 44 | $2 \begin{array}{llll}2 & 15 & 23.0\end{array}$ | 1.32 |  | 12 | $1747 \cdot 7$ | 1.09 | 18 50. ${ }^{\text {r }}$ | -99 |
| 56 | $\begin{array}{llll}2 & 8 & 12.7 \\ 2 & 3 & 53.6\end{array}$ | x 59 | 945.0 | I.48 |  | r.35 | $2 \begin{array}{lll}2 & 12 & 27.4\end{array}$ | I. 24 | 13 38.1 | 1-12 | $1441 \cdot 9$ | r.or |
| 58 | $\begin{array}{rrrr}2 & 3 & 53.6 \\ 1 & 59 & 33.3\end{array}$ |  | 5128.7 | I. 52 | 656.0 241.4 | I.39 | $\begin{array}{llll}2 & 8 & 15 \cdot 7 \\ 2 & 4 & 3.3\end{array}$ | 1.27 | $\begin{array}{ll}928.1 \\ 5 & \text { I7.6 }\end{array}$ | $\begin{array}{r}1.15 \\ \text { 1. } \\ \hline\end{array}$ | Io 33.4 | 1.03 |
| 58 | 15933.3 |  | 1 Ir 5 | 1.57 | 2414 | 1.4 | 2463.3 | 1-30 | $5 \quad 17.6$ | I.18 | 624.5 | I. |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline Alt. \& L. \(0^{\circ}\) \& A. \& L. \(1^{\circ}\) \& A. \& L. \(2^{\circ}\) \& A. \& L. \(3^{\circ}\) \& A. \& L. \(4^{\circ}\) \& A. \& L. \(5^{\circ}\) \& A. \\
\hline \& -.00 \& 4.09 \& + 07 \& 4.09 \& + 15 \& -4.09 \& \(+.22\) \& \& + 29 \& \& . 37 \& s.ir \\
\hline \({ }_{8}^{4}\) \& - \(\begin{array}{r}\text {-06 } \\ .12 \\ \hline 1\end{array}\) \&  \& + \& \({ }_{4}^{4.09}\) \& \begin{tabular}{l}
+.15 \\
+.08 \\
\hline
\end{tabular} \& \({ }^{4.09}\) \& \& 4.09 \& + 23 \& 4.09 \& \& 4.15 \\
\hline \& \({ }_{.} \mathrm{r}_{18}\) \& + 4.09 \& - 0.11 \& \({ }_{4}^{4.09}\) \& +.02 \& \({ }_{4}^{4.09}\) \& + 04 \& + 4.09 \& -17 \& \begin{tabular}{|c}
4.09 \\
4.09 \\
\hline
\end{tabular} \& -19 \& 4.10
4.09
4 \\
\hline \({ }_{16}^{12}\) \& . 25 \& \({ }_{4}^{4.90}\) \& \({ }_{1}{ }_{7}\) \& \({ }_{4.09}^{4.09}\) \& -10 \& \({ }_{4} \cdot 909\) \& +.04 \& 4.09 \& + 05 \& 4.09 \& \({ }_{13}^{19}\) \& + 4.09 \\
\hline 20
22
20 \& \(\begin{array}{r}.32 \\ .35 \\ \hline\end{array}\) \& 4.10 \& - 24 \& 4.90 \& -. \({ }^{.16}\) \& 4 4.09 \& - \({ }_{-128}^{\text {. } 28}\) \& \& - 00 \& \& + \({ }^{\text {. }} \mathrm{0} 7\) \&  \\
\hline 22
24
24 \& 35

39 \& ${ }_{\text {4.11 }}^{4 \cdot 10}$ \& - ${ }_{-37}$ \& ${ }_{4}^{4 \cdot 10}$ \& . 23 \& ${ }_{4}^{4.09}$ \& ${ }_{\cdot}{ }^{12}$ \& ${ }_{4}^{4.09}$ \& -04 \& ${ }_{4}^{4.09}$ \& $\begin{array}{r}\text { or } \\ +\quad 04 \\ \hline\end{array}$ \& ${ }_{4}^{4.09}$ <br>
\hline 26
28
28 \& . 43 \&  \& - 35 \& +1. \& ${ }_{26}$ \& 4.to \& . 8 \& 4.00 \& .13 \& 4.9 \& -. 02 \& 4.99 <br>
\hline \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline 30
32
3 \& -.55 \& ${ }_{\substack{4 \\ 4 \\ 4 \\ 4 \\ \hline 12 \\ \hline}}$ \& - ${ }^{-42}$ \& ${ }_{4 \cdot 1 \mathrm{II}}^{4}$ \& - 38 \& ${ }_{4}^{4.10}$ \& - 2.25 \& $\xrightarrow{4.10}$ \& - 20 \& + 4.09 \& ${ }_{\text {II }}$ \& ${ }_{4}^{4.09}$ <br>
\hline 34
36

36 \& . 59 \&  \& - 50 \& ${ }_{4}^{4.12}$ \& | 41 |
| :--- |
| .45 | \&  \& . 32 \& +i.10 \& 24

.27 \& $\substack{4.10 \\ 4 \\ 4 \\ \text { 10 }}$ \& . 18 \& 4.90 <br>

\hline | 36 |
| :---: |
| 38 |
| 8 | \& -64 \& ${ }_{4}^{4 \cdot 15}$ \& . 59 \& ${ }_{4 \cdot 13}^{412}$ \& 45

50 \& ${ }_{4}^{4} \mathrm{r} 2$ \& ${ }^{3} 40$ \& 4.11 \& ${ }^{21}$ \& ${ }_{4}+10$ \& ${ }^{22}$ \& 4.10 <br>
\hline ${ }^{40}$ \& . 74 \& 4.15 \& - $\mathrm{C}_{6}$ \& ${ }_{4} \cdot 1.5$ \& . 54 \& \& - 4 \& \& . 35 \& \& -25 \& <br>
\hline ${ }_{4}^{42}$ \& . 86 \& ${ }_{4 \cdot 18}^{4 \times 1}$ \& . 75 \& ${ }_{4}^{4.15}$ \& 64 \& ${ }_{4}^{4.14}$ \& . 54 \& ${ }_{4}^{4.12}$ \& -44 \&  \& .33 \& + 4.15 <br>
\hline $4{ }_{4}$ \& .92 \& $4 \cdot 1.19$ \& . 88 \& 4.18 \& . 76 \& 4.15 \& - 59 \&  \& -48 \& 4.12 \& ${ }^{38}$ \& $4 \cdot 1.15$ <br>
\hline 48 \& \& $4 \cdot 21$ \& \& 4.18 \& \& $4 \cdot 16$ \& 65 \& 4.14 \& 53 \& $4 \cdot \mathrm{I} 2$ \& \& $4 \cdot \mathrm{II}$ <br>
\hline 50
52
5 \&  \& \& - ${ }_{\text {- } 03}$ \& ${ }_{4}^{4: 20}$ \& -.83 \& \& \& \& - 5.65 \& \& - ${ }^{42}$ \& <br>
\hline 50
54
56
56 \& +1.25 \&  \&  \& 4.24 \& +98 \& + $\begin{aligned} & 4.20 \\ & 4.23\end{aligned}$ \& -84 \& $\xrightarrow{4.17}$ \& . 78 \& $\xrightarrow{4+5}$ \& \& ¢ <br>

\hline | 58 |
| :---: |
| 58 | \& +1.48 \& $4 \cdot 35$

4.35 \& ${ }_{\text {r }}$ \& ${ }_{4}^{4.30}$ \& r.16 \& ${ }_{4}+25$ \& r. Or \& ${ }_{4.21}$ \& . 86 \& ${ }_{4} \times 1$ \& 7 \& ${ }_{4}{ }_{4} \cdot 15$ <br>
\hline
\end{tabular}

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 |  | . 86 | $\begin{aligned} & \text { H. M. } \\ & 6 \\ & 5 \end{aligned} \underset{58.0}{ }$ | . 86 | $\left\lvert\, \begin{array}{ccc} \text { H. M. S. } \\ 6 & \text { S. } \end{array}\right.$ |  |  |  | $\begin{aligned} & \text { H. M. } \\ & 6 \\ & 8 \end{aligned}$ |  | $\left\|\begin{array}{lrr} \text { H. M. } & \text { S. } \\ 6 & 9 & 28 \cdot 3 \end{array}\right\|$ |  |
| 10 | $\begin{array}{llll}6 & 5 & 7.2 \\ 5 & 24 & 3.7\end{array}$ | $\cdot 79$ | $524510 \cdot 1$ | + $\cdot 78$ | $\begin{array}{llll}5 & 25 & 37.9\end{array}$ | $\cdot 77$ | $\begin{array}{llll}5 & 26 & 24 \cdot 1\end{array}$ |  | $\begin{array}{llll}5 & 27 & 9.8\end{array}$ | $\cdot 76$ |  | 75 |
| 12 | $515 \quad 52 \cdot 0$ | $\cdot 78$ |  | $\cdot 77$ | 5 l 17 24.5 | $\cdot 76$ | $\begin{array}{llll}5 & 18 & 9 \cdot 7\end{array}$ | $\cdot 75$ |  | $\cdot 74$ | 5 19 198.1. | 72 |
| 14 | $5740 \cdot 3$ | $\cdot 77$ | $\begin{array}{llll}5 & 8 & 26 \cdot 3\end{array}$ | $\cdot 76$ | $\begin{array}{lllll}5 & 9 & 11\end{array} 5$ | 74 | $\begin{array}{llll}5 & 9 & 55 \% \\ 5 & 5 & \end{array}$ | $\cdot 73$ | $51039 \cdot 1$ | - 71 |  | 70 |
| 16 | $4 \begin{array}{lll}4 & 59 & 28.8\end{array}$ | $\cdot 77$ | 5 - 14.3 | $\cdot 75$ | $\begin{array}{llll}5 & 0 & 58.7\end{array}$ | $\cdot 73$ | 5 I $42 \cdot 1$ | $\cdot 71$ | $\begin{array}{llll}5 & 2 & 24.4\end{array}$ | 70 | $\begin{array}{llll}5 & 3 & 5 \%\end{array}$ | 68 |
| 18 | 451176 | + 76 | 452 | $\cdot 74$ | 452 | + 72 | $\begin{array}{llll}4 & 53 & 28.8 \\ 4 & 4 & 15\end{array}$ | + 70 | 454 10.1 | + | $45450 \cdot \mathrm{r}$ | + 66 |
| 20 | 4436.5 | $\cdot 75$ | $44351 \cdot 0$ | $\cdot 73$ | $44434 \cdot \mathrm{I}$ | $\cdot 71$ |  | . 68 | 445 56. I |  | $44635^{\circ} \mathrm{O}$ | 64 |
| 22 | $43455 \cdot 5$ | $\cdot 75$ | $43539 \cdot 6$ | $\cdot 72$ | $43622 \cdot 1$ | -69 | $\begin{array}{llll}4 & 37 & 3 \cdot 1 \\ 4 & 2 & 5\end{array}$ | $\cdot 67$ | $43742 \cdot 4$ | . 64 | $4 \quad 38 \quad 20 \cdot 2$ | 62 |
| 24 | $\begin{array}{llllllllllll}4 & 26 & 44.6 \\ 4 & 18 & 33.8\end{array}$ | $\cdot 74$ | $\begin{array}{llll}4 & 27 & 28.4 \\ 4 & 19 & \end{array}$ | -71 | $\begin{array}{llll}4 & 28 & 10.4 \\ 4 & 59 & 58.8\end{array}$ | . 68 | $\begin{array}{llll}4 & 28 & 50 \cdot 6 \\ 4 & 20 & 38 \cdot 4\end{array}$ | -66 | $\begin{array}{llll}4 & 29 & 29 \cdot 1 \\ 4 & 21 & 16 \cdot I\end{array}$ | $\cdot 6$ | 4 30 $5 \cdot 9$ <br> 4 21 5 | 60 |
| 26 | 41833.8 | $\cdot 74$ | $41917 \cdot 3$ | $\cdot 71$ | 41958.8 | $\cdot 67$ | $42038 \cdot 4$ | . 64 | $42116 \cdot 1$ | -61 | 4 21 5I•8 | 58 |
| 28 | 1023 | + 74 | 411 | + 70 | 1147.4 | + 67 | $\begin{array}{llll}4 & 12 & 26.4\end{array}$ | $+.63$ | $\begin{array}{llrr}4 & 13 & 3.3 \\ 4 & 4\end{array}$ | + 59 | $4 \begin{array}{llll}4 & 38 \cdot 0\end{array}$ | + 56 |
| 30 | $2 \begin{array}{ll}2 & 12 \cdot 3\end{array}$ | $\cdot 74$ | $\begin{array}{llll}4 & 2 & 55 \cdot 5 \\ 3 & 58 & 50\end{array}$ | $\cdot 70$ | $\begin{array}{llll}4 & 3 & 36 \cdot 2 \\ 3 & 59 & 30 \cdot 7\end{array}$ | . 66 | 4 4 14.7 <br> 4 8.8  | $\cdot 62$ | $\begin{array}{llll}4 & 4 & 50 \cdot 8 \\ 4 & \\ 0 & 4 & 6\end{array}$ | . 58 | $4 \begin{array}{llll}4 & 5 & 24 \cdot 6\end{array}$ | . 54 |
| 31 | $58 \quad 7 \cdot 0$ | 74 | $35850 \cdot 0$ | $\cdot 70$ | $\begin{array}{llll}3 & 59 & 30 \cdot 7\end{array}$ | -66 | - 8.8 | 61 | 4 0 $44 \cdot 6$ <br> 3 56  | 57 | $\begin{array}{llll}4 & 1 & 17.9\end{array}$ | 53 |
| 32 | $\begin{array}{lr}54 & 1 \cdot 6\end{array}$ | $\cdot 74$ | $\begin{array}{llllllllll}3 & 54 & 44 \cdot 6 \\ 3 & 50\end{array}$ | $\cdot 70$ | $\begin{array}{llll}3 & 55 & 25 \cdot 1 \\ 3 & 51 & 5\end{array}$ | . 65 | $\begin{array}{llll}3 & 56 & 3.1 \\ 3 & 51 & 57.4\end{array}$ | 1 | $\begin{array}{lllllllll}3 & 56 & 38 \cdot 5 \\ 3 & 52 & 32.5\end{array}$ | -5 | $\begin{array}{lllll}3 & 57 & 11 \cdot 4 \\ 3 & 53\end{array}$ | 53 |
| 33 | $34956 \cdot 2$ | -74 | 350 | $\cdot 69$ | $3 \begin{array}{llll}3 & 51 & 19.6\end{array}$ | . 65 |  | .61 | $3 \begin{array}{lllll} & 52 & 32 \cdot 5\end{array}$ | $\cdot 56$ | $\begin{array}{lll}3 & 53 & 4 \cdot 9\end{array}$ | 52 |
| 34 | $34550 \cdot 8$ | + 77 | $34633 \cdot 9$ | + 69 |  | + 65 | $4751 \cdot 7$ | + 60 | $348 \quad 26 \cdot 5$ | + 56 | $34858 \cdot 5$ | + 51 |
| 35 | $34145 \cdot 4$ | $\cdot 74$ | $\begin{array}{lllll}3 & 42 & 28 \cdot 5\end{array}$ | . 69 | $\begin{array}{llll}3 & 43 & 8 \cdot 7\end{array}$ | . 64 | $\begin{array}{llll}3 & 43 & 46 \cdot 0\end{array}$ | . 60 | $34420 \cdot 5$ | . 5 | $34452 \cdot \mathrm{I}$ | -50 |
| 36 | $3740 \cdot 0$ | $\cdot 74$ |  | 69 | $\begin{array}{llll}3 & 39 & 3 \cdot 3\end{array}$ | . 64 | 3 394040 | -59 | $34^{40} 14.6$ | 5 | $34045 \cdot 7$ | - 49 |
| 37 |  | $\cdot 75$ | $3{ }^{3} 3417.8$ | -69 | $\begin{array}{llll}3 & 34 & 57.9 \\ 3 & 30 & 5\end{array}$ | $\cdot 64$ | $\begin{array}{lllll}3 & 35 & 34 \cdot 8\end{array}$ | -59 | 3 36 $8 \cdot 7$ <br> 3   | -5 | 3 36 $39 \cdot 5$ | 49 |
| 38 | $\begin{array}{llll}3 & 29 & 29 \cdot 1\end{array}$ | $\cdot 75$ |  | $\cdot 69$ | $\begin{array}{llll}3 & 30 & 52.5\end{array}$ | $\cdot 64$ | $3_{3}^{3} 3129.3$ | -59 | $\begin{array}{llll}3 & 32 & 2.9\end{array}$ | 53 | $\begin{array}{lllll}3 & 32 & 33.3\end{array}$ | -48 |
| 39 |  | + 75 | $\begin{array}{lll}3 & 26 & 7 \cdot 1\end{array}$ | + 70 | $32647 \cdot 1$ | + 64 | $\begin{array}{lllll}3 & 27 & 23.8\end{array}$ | + 58 | 327 57•1 | + 53 | $3 \begin{array}{llll}3 & 28 & 27 \cdot 1\end{array}$ | + 47 |
| 40 | $\begin{array}{llllll}3 & 21 & 18 \cdot 1\end{array}$ | $\cdot 75$ | $\begin{array}{llll}3 & 22 & 1 \cdot 7\end{array}$ | $\cdot 70$ | $3^{\circ} 22418$ | -64 | $\begin{array}{llllll}3 & 23 & 18.3\end{array}$ | - 58 | $\begin{array}{llllllll}3 & 23 & 51.4\end{array}$ | $\cdot 52$ | $\begin{array}{llll}3 & 24 & 21.0\end{array}$ | $\cdot 46$ |
| 41 | $\begin{array}{lllll}3 & 17 & 12.5\end{array}$ | $\cdot 76$ |  | $\cdot 70$ | $\begin{array}{llllllllllll}3 & 18 & 36 \cdot 4\end{array}$ | . 64 | $\begin{array}{llll}3 & 19 & 12.8\end{array}$ | -58 | $31945 \%$ | -52 | 32015.0 | 46 |
| 42 | $\begin{array}{llll}3 & 13 & 6.9\end{array}$ | $\cdot 76$ |  | $\cdot 70$ | 314310 | -64 | $\begin{array}{llll}3 & 15 & 7.4\end{array}$ | -57 | $31540 \cdot 1$ | . 51 | $\begin{array}{lll}3 & 16 & 9 \cdot 0\end{array}$ | 45 |
| 43 | $\begin{array}{llll}3 & 9 & 1.2\end{array}$ | $\cdot 77$ | $945 \cdot 4$ | $\cdot 70$ | 31025.6 |  | 31120 | 57 | 315 | 51 | $312 \quad 3 \cdot 0$ | 44 |
| 44 | $455 \cdot 5$ | + 77 | $539 \cdot 9$ | + 71 | $620 \cdot 3$ | + 64 | 3 3 6 $56 \cdot 6$ | + 57 | $\begin{array}{llll}3 & 7 & 28.9\end{array}$ | + 50 | $37757 \cdot 1$ | + $\cdot 44$ |
| 45 | 3 0 $49 \cdot 7$ <br> 2 56  | $\cdot 78$ | 3 1 34.4 <br> 2 57 28.9 | $\cdot 71$ | $\begin{array}{lrrr}3 & 2 & 14.9 \\ 2 & 58 & 9.5\end{array}$ | . 64 | 3 2 51.2 <br> 2 58  | -57 | $\begin{array}{ccc}3 & 3 & 23.3 \\ 2 & 59 & 17.8\end{array}$ | $\cdot 50$ | [3 3 51.2 <br> 2 50  | $\cdot 43$ |
| 46 | 25643.9 | $\cdot 79$ | $2 \begin{array}{llllll} & 57 & 28.9\end{array}$ | $\cdot 7$ | $\begin{array}{lll}2 & 58 & 9 \cdot 5\end{array}$ | -64 | 2 58 | 57 | $2{ }^{2} 59178$ | $\cdot 50$ | $\begin{array}{lllll}2 & 59 & 45 \cdot 4 \\ 2 & 5\end{array}$ | $\cdot 42$ |
| 47 | $5237 \cdot 9$ | $\cdot 79$ | $25323 \cdot 3$ | $\cdot 72$ | $\begin{array}{llll}2 & 54 & 4 \cdot 7 \\ 2 & 49 & 58\end{array}$ | . 6 |  | 7 | $\begin{array}{ccc}2 & 55 & 12 \cdot 3 \\ 2 & 51 & 6.8\end{array}$ | $\begin{array}{r} \\ \hline\end{array} 4$ |  | -42 |
| 48 | $4831 \cdot 9$ |  | 49 17•7 | ${ }^{7} 72$ | $24958 \cdot 7$ |  | 25035 | 7 | 251 | -49 | 2 51 $33 \cdot 8$ | 1 |
| 49 50 |  |  | $\begin{array}{llrl}2 & 45 & 12.0 \\ 2 & 41 & 6.2\end{array}$ | + 73 | $\begin{array}{llll}2 & 45 & 53.3 \\ 2 & 4 T & 47.8\end{array}$ | + .65 | $\begin{array}{lllll}2 & 46 & 29 \cdot 7 \\ 2 & 4\end{array}$ | + 57 | $\begin{array}{llr}2 & 47 & 1.3 \\ 2\end{array}$ |  | $\begin{array}{llllll}2 & 47 & 28 \cdot 1 \\ 2 & 43\end{array}$ | + 41 |
| 50 | $\begin{array}{lllll}2 & 40 & 19.4 \\ 2 & 36 & 13.2\end{array}$ | $82$ | $\begin{array}{llll}2 & 41 & 6.2 \\ 2 & 37 & 0.4\end{array}$ | $\cdot 74$ |  | . 65 | $\begin{array}{llll}2 & 42 & 24.4 \\ 2 & 38 & 49.0\end{array}$ | . 57 | $\begin{array}{llll}2 & 42 & 55 \cdot 9 \\ 2 & 38 & 50 \cdot 4\end{array}$ | -48 | $\begin{array}{llllll}2 & 43 & 22.4 \\ 2 & 39 & 16.7\end{array}$ | -40 |
| 51 | $\begin{array}{cccc}2 & 36 & 13.2 \\ 2 & 32 & 6.7\end{array}$ | .83 | $\begin{array}{rrrr}2 & 37 & 0.4 \\ 2 & 32 & 54.5\end{array}$ | $\cdot 74$ | [ $\begin{array}{llll}2 & 37 & 42 \cdot 3 \\ 2 & 33 & 36 \cdot 7 \\ 2\end{array}$ | 65 | $\begin{array}{lll}2 & 38 & 19.0 \\ 2 & 34 & 13.6 \\ 2 & 30\end{array}$ | -57 | $\begin{array}{llll}2 & 38 & 50 \cdot 4 \\ 2 & 34 & 45 \cdot 1\end{array}$ | -48 | $\begin{array}{lllll}2 & 39 & 16 \cdot 7 \\ 2 & 35 & 11 \cdot I\end{array}$ | 40 |
| 52 53 | $\begin{array}{lll}32 & 6 \cdot 7 \\ 28 & 0.0\end{array}$ | -84 | $\begin{array}{llll}2 & 32 & 54 \cdot 5 \\ 2 & 28 & 48 \cdot 4\end{array}$ | .75 .76 |  | . 66 | $\left[\begin{array}{lll}2 & 34 & 13.6\end{array}\right.$ | 57 57 | $\begin{array}{llll}2 & 34 & 45 \cdot 1 \\ 2 & 30 & 39 \cdot 7\end{array}$ |  | 2351115 | 39 |
| 54 | $\begin{array}{cccc}2 & 28 & 0.0 \\ 2 & 23 & 53.2\end{array}$ | + 87 | $\begin{array}{llll}2 & 28 & 48 \cdot 4 \\ 2 & 24 & 42 \cdot 3\end{array}$ | + 77 | 22525.5 | + 67 | $\begin{array}{lll}2 & 26 & 2.8\end{array}$ | + 57 | $\begin{array}{llll}2 & 30 & 39 \cdot 7 \\ 2 & 26 & 34 \cdot 3\end{array}$ | + 48 | 2270.0 | + 38 |
| 55 | $21946 \cdot 3$ | . 88 | $22036 \cdot \mathrm{I}$ | $\cdot 78$ | $2 \begin{array}{llll}21 & 19.8\end{array}$ | . 68 | 22157.4 | . 58 | 22228.9 | $\cdot 47$ | 22254.4 | $\cdot 37$ |
| 56 | $\begin{array}{llll}2 & 15 & 39 \\ 29\end{array}$ | 90 | $\begin{array}{llll}2 & 16 & 29.8\end{array}$ | $\cdot 79$ | $\begin{array}{lllll}2 & 17 & 14.0 \\ 2 & 18 & 8.2\end{array}$ | 68 | $\begin{array}{llllll}2 & 17 & 51.9 \\ 2 & \text { 1 }\end{array}$ | -58 | $\begin{array}{llll}2 & 18 & 23.6\end{array}$ | 48 | $\begin{array}{lllll}2 & 18 & 49 \cdot 0\end{array}$ | 37 |
| 57 | $\begin{array}{llllll}2 & 11 & 31.7\end{array}$ | 92 | 1223.3 | 80 | $\begin{array}{llll}2 & 13 & 8.2\end{array}$ | 69 | $\begin{array}{lllll}2 & 13 & 46 \cdot 5\end{array}$ | 58 |  |  |  | 37 |
| 58 | 7 24.1 | 93 | 8 16.7 |  | $2 \begin{array}{lll}2 & 9.2\end{array}$ | $\cdot 70$ | $940 \cdot 9$ |  | 21012. |  | 1038 | - 36 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ}$ A. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | s. | s. | S. $+\quad .51$ | S. | + ${ }^{\text {s. }}$ | S. | + ${ }^{\text {S }}$ | S. -4.14 | + ${ }^{\text {S }}$ | S. | S. $+\quad .81$ | S. |
| 4 | $\begin{array}{r}\text { + } \\ \hline\end{array}$ | -4.10 | +.45 | -4.11 | $\begin{array}{r}\text { a } \\ +\quad .53 \\ \hline\end{array}$ | -4.12 | + 6.6 | - 4.13 | $\begin{array}{r}\text { a } \\ +68 \\ \hline .68\end{array}$ | -4.14 | +.75 | $4 \cdot 16$ |
| 8 | $\cdot 32$ | $4 \cdot 10$ | -39 | $4 \cdot 11$ | -47 | $4 \cdot 11$ | $\cdot 54$ | $4 \cdot 12$ | -62 | $4 \cdot 13$ | -69 | $4 \cdot 15$ |
| 12 | -26 | $4 \cdot 10$ | $\cdot 34$ | $4 \cdot 10$ | -41 | $4 \cdot 11$ | -49 | $4 \cdot 12$ | $\cdot 56$ | $4 \cdot 13$ | -64 | $4 \cdot 14$ |
| 16 | -20 | 4.09 | -28 | $4 \cdot 10$ | -36 | 4.10 | -43 | $4 \cdot 11$ | $\cdot 51$ | $4 \cdot 12$ | -59 | $4 \cdot 13$ |
| 20 | + 15 | 4.09 | + . 22 | 4.09 | + 30 | $4 \cdot 10$ | + 38 | $4 \cdot 11$ | + 46 | $4 \cdot 11$ | + 54 | $4 \cdot 12$ |
| 22 | -12 | 4.09 | - 20 | 4.09 | - 28 | $4 \cdot 10$ | $\cdot 36$ | $4 \cdot 11$ | -44 | $4 \cdot 11$ | . 51 | $4 \cdot 12$ |
| 24 | -09 | 4.09 | $\cdot 17$ | 4.09 | -25 | $4 \cdot 10$ | -33 | $4 \cdot 10$ | 41 | $4 \cdot 11$ | -49 | $4 \cdot 12$ |
| 26 | -06 | 4.09 | -14 | 4.09 | -23 | $4 \cdot 10$ | -31 | $4 \cdot 10$ | -39 | $4 \cdot 11$ | -47 | $4 \cdot 12$ |
| 28 | +.03 | 4.09 | -11 | 4.09 | - 20 | 4.09 | -28 | $4 \cdot 10$ | $\cdot 36$ | $4^{1} 10$ | -44 | 4.11 |
| 30 | -00 | 4.09 | +.09 | $4 \cdot 09$ | + 17 | 4.09 | + 26 | 4.10 | + 34 | $4 \cdot 10$ | + 42 | $4 \cdot 11$ |
| 32 | -.03 | 4.09 | . 06 | 4.09 | -I4 | $4 \cdot 09$ | $\cdot 23$ | $4 \cdot 09$ | $\cdot 31$ | $4 \cdot 10$ | - 40 | $4 \cdot 11$ |
| 34 | .06 | 4.09 | -03 | 4.09 | -12 | 4.09 | - 20 | 4.09 | - 29 | $4 \cdot 10$ | $\cdot 38$ | $4 \cdot 11$ |
| 36 | -09 | 4.09 | -00 | $4 \cdot 09$ | -09 | 4.09 | -18 | 4.09 | $\cdot 27$ | $4 \cdot \mathrm{ro}$ | $\cdot 35$ | $4 \cdot 10$ |
| 38 | -13 | 4.09 。 | - 03 | $4 \cdot 09$ | -06 | $4 \cdot 09$ | $\cdot 15$ | 4.09 | $\cdot 24$ | $4 \cdot 10$ | -34 | $4 \cdot 10$ |
| 40 | -16 | 4.09 | -.06 | 4.09 | + 03 | 4.09 | + 12 | 4.09 | + 22 | 4.09 | + 31 | $4 \cdot 10$ |
| 42 | -19 | 4.09 | -10 | $4 \cdot 09$ | -00 | $4 \cdot 09$ | -10 | 4.09 | -19 | 4.09 | $\cdot 29$ | $4 \cdot 10$ |
| 44 | - 23 | $4 \cdot 10$ | -13 | $4 \cdot 09$ | -.03 | $4 \cdot 09$ | -07 | 4.09 | -17 | 4.09 | -27 | $4 \cdot 10$ |
| 46 | -27 | $4 \cdot 10$ | $\cdot 17$ | 4.09 | -06 | 4.09 | .04 +.01 | 4.09 | -14 | 4.09 | $\cdot 25$ | $4 \cdot 10$ |
| 48 | -31 | $4 \cdot 10$ | -20 | $4 \cdot 09$ | -10 | 4.09 | + 0 Or | 4.09 | $\cdot 12$ | $4 \cdot 09$ | $\cdot 23$ | $4 \cdot 10$ |
| 50 | - 36 | $4 \cdot 10$ | - 24 | $4 \cdot 10$ | - . 13 | 4.09 | -.02 | $4 \cdot 09$ | + 00 | 4.09 | + 20 | 4.09 |
| 52 | - 40 | $4 \cdot 11$ | 29 | $4 \cdot 10$ | -17 | 4.09 | -05 | $4 \cdot 09$ | . 07 | $4 \cdot 09$ | -18 | 4.09 |
| 54 | -46 | $4 \cdot 11$ | -33 | $4 \cdot 10$ | -21 | 4.09 | -08 | $4 \cdot 09$ | . 04 | 4.09 | -16 | 4.09 |
| 56 | . 51 | 4.12 | $\cdot 38$ | $4 \cdot 11$ | $\cdot 25$ | $4 \cdot 10$ | - 12 | 4.09 | + 01 | 4.09 | - 14 | 4.09 |
| 58 | $\cdot 57$ | 4.13 | -43 | 4.15 | -29 | $4 \cdot 10$ | '16 | 4.09 | -. 02 | 4.09 | -11 | $4 \cdot 09$ |

## 52 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

 LATITUDE $12^{\circ}$.DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\begin{array}{ccc}\text { H. M. } & \text { S. } \\ 6 & 10 & 21 \cdot 5\end{array}$ | + $\cdot 89$ | M. | S. | M. | S. | . M. | S. | M. | S. | M. | S. |
| 0 | $\begin{array}{llll}6 & 10 & 21 \cdot 5\end{array}$ | + | 6 II 15.1 | + 90 | $\begin{array}{lll}6 & 12 & 9 \cdot 1\end{array}$ | + 90 | $\begin{array}{lllll}6 & 1 & 3 & 3.6\end{array}$ | + 91 | $\begin{array}{llll}6 & 13 & 58\end{array}$ | + 92 | 61454.3 | '93 |
| 10 | $52839 \cdot 7$ | $\cdot 74$ | $\begin{array}{llll}5 & 29 & 24 \cdot 0\end{array}$ | -73 | $\begin{array}{llll}5 & 30 & 7.8\end{array}$ | -73 | $5305 \mathrm{I} \cdot 2$ | - 72 | $5 \begin{array}{llll}5 & 31 & 34.2\end{array}$ | -71 | $\begin{array}{llll}5 & 32 & 16 \cdot 8\end{array}$ | 71 |
| 12 | $5{ }_{5}^{5} 2021213$ | $\cdot 71$ | $\begin{array}{llll}5 & 21 & 3.9\end{array}$ | $\cdot 70$ | $512145 \cdot 8$ | -69 | $52227 \cdot 1$ | -68 | $\begin{array}{llll}5 & 23 & 7 \cdot 9\end{array}$ | -67 | $\begin{array}{llll}5 & 23 & 48 \cdot 2\end{array}$ | . 66 |
| 1 | $\begin{array}{llll}5 & 12 & 3.4\end{array}$ | -69 | $\begin{array}{lllll}5 & 12 & 44.3\end{array}$ | -67 | $\begin{array}{llll}5 & 13 & 24.5\end{array}$ | - 66 | $\begin{array}{llll}5 & 14 & 3.8\end{array}$ | . 65 | $\begin{array}{llllllllllllllll}5 & 14 & 42 \cdot 4\end{array}$ | -64 | $\begin{array}{llll}5 & 15 & 20 \cdot 3\end{array}$ | . 62 |
| 16 | $53146 \cdot 0$ | - 66 | $\begin{array}{llll}5 & 4 & 25 \cdot 3\end{array}$ | . 65 | $\begin{array}{llll}5 & 5 & 3 \cdot 7\end{array}$ | -63 | $5 \quad 54 \mathrm{I} \cdot \mathrm{I}$ | -61 | $\begin{array}{lllll}5 & 6 & \text { I7. }\end{array}$ | -60 | $\begin{array}{llll}5 & 6 & 53 \cdot 2\end{array}$ | $\cdot 58$ |
| 18 | 455 29•1 | + 64 | $4 \begin{array}{lll}4 & 56 & 6 \cdot 9\end{array}$ | $+.62$ | $45643 \cdot 5$ | + . 60 | 457 I9.0 | + 58 | 45753.4 | + 56 | $4 \quad 58 \quad 26 \cdot 7$ | + 54 |
| 20 | $44712 \cdot 6$ | -6I | $44748 \cdot 9$ | $\cdot 59$ | $4 \quad 48 \quad 23.8$ | -57 | $44^{8} 57 \cdot 4$ | -55 | $44929 \cdot 8$ | - 53 | 45008 | . 50 |
| 22 | $4 \begin{array}{llll}4 & 38 & 56 \cdot 6\end{array}$ | - 59 | $43935 \cdot 3$ | $\cdot 57$ | $4404 \cdot 6$ | - 54 | $4 \begin{array}{lll}4 & 40 & 36 \cdot 4\end{array}$ | - 52 | $4416 \cdot 7$ | -49 | 4 4I $35 \cdot 5$ | -47 |
| 24 | $43040 \cdot 9$ | -57 | 4 31 14.2 | -54 | 4 31 45.9 | -51 | $432 \begin{array}{llll}4 & 15\end{array}$ | -48 | $432 \begin{array}{lll}4 & 4 \cdot x\end{array}$ | -46 | 433107 | 43 |
| 26 | $42225 \cdot 6$ | - 55 | $4 \quad 22 \begin{array}{llll}4 & 57 & 6\end{array}$ | . 51 | $423 \quad 27 \cdot 6$ | $\cdot 48$ | 423 55.7 | -45 | $42422 \cdot 0$ | - 42 | $42446 \cdot 3$ | 39 |
| 28 | $41410 \cdot 7$ | + 53 | 4 I4 4I•2 | + 49 | $415 \quad 9 \cdot 7$ | + 45 | $41536 \cdot 0$ | + 42 | 4160.3 | + 39 | 41622.4 | + 35 |
| 30 | $4 \quad 5 \quad 56 \cdot 1$ | . 50 | $4 \quad 6 \quad 25 \cdot 3$ | $\cdot 47$ | $\begin{array}{llll}4 & 6 & 52.2\end{array}$ | -43 | $4716 \cdot 7$ | -39 | $4 \quad 7 \quad 39 \cdot 0$ | -35 | $4758 \cdot 9$ | -37 |
| 31 | 4 I $48 \cdot 9$ | -49 | $\begin{array}{lllll}4 & 2 & 17 \cdot 4\end{array}$ | -45 | $\begin{array}{llll}4 & 2 & 43.5\end{array}$ | -41 | $\begin{array}{llll}4 & 3 & 7 \cdot 2\end{array}$ | -37 | $\begin{array}{llll}4 & 3 & 28 \cdot 4\end{array}$ | -33 | $4347 \cdot 3$ | -29 |
| 32 | $3{ }^{3} 5754 \mathrm{I} \cdot 8$ | $\cdot 48$ | $\begin{array}{llll}3 & 58 & 9 \cdot 6\end{array}$ | -44 | $\begin{array}{llll}3 & 58 & 34 \cdot 9\end{array}$ | -40 | $\begin{array}{llllllllllllllll}3 & 58 & 57 \cdot 8\end{array}$ | $\cdot 36$ | $\begin{array}{llllllllllll}3 & 59 & 18 \cdot 0\end{array}$ | -31 | $35935 \cdot 7$ | -27 |
| 33 | $35334 \cdot 7$ | -47 | $\begin{array}{lll}3 & 54 & 1\end{array} 9$ | -43 | $35426 \cdot 5$ | -39 | 354488.4 | -34 | $35507 \cdot 7$ | -30 | $355 \quad 24 \cdot 3$ | . 25 |
| 34 | $\begin{array}{llll}3 & 49 & 27 \cdot 7\end{array}$ | + 46 | $\begin{array}{lllll}3 & 49 & 54 \cdot 3\end{array}$ | + 42 | $350 \times 8 \cdot 1$ | + 37 | 350 | + 33 | 35057.4 | + 28 | 35112.9 | + 23 |
| 35 | $345120 \cdot 8$ | - 45 |  | -41 | $3 \begin{array}{lll}3 & 46 & 9 \cdot 7\end{array}$ | $\cdot 36$ | $3 \begin{array}{llll}3 & 46 & 29.9\end{array}$ | $\cdot 3 \mathrm{I}$ | $346 \quad 47 \cdot 2$ | -26 | $\begin{array}{llll}3 & 47 & 1.5\end{array}$ | - 21 |
| 36 | 34114.0 | -44 | $341139 \cdot 2$ | - 39 | $\begin{array}{llll}3 & 42 & 1.5\end{array}$ | -34 | $\begin{array}{llll}3 & 42 & 20 \cdot 8\end{array}$ | -29 | $\begin{array}{llll}3 & 42 & 37.0\end{array}$ | - 24 | $\begin{array}{llll}3 & 42 & 50 \cdot 3\end{array}$ | 19 |
| 37 | $\begin{array}{lllllllllllll}3 & 37 & 7 \cdot 2\end{array}$ | -43 | $\begin{array}{lllll}3 & 37 & 3 \mathrm{I} \cdot 8\end{array}$ | -38 | $\begin{array}{llll}3 & 37 & 53 \cdot 3\end{array}$ | -33 | 3138 II•7 | -28 |  | - 23 | 3 38 <br> 3  | 17 |
| $3^{8}$ | $\begin{array}{llll}3 & 33 & 0.5\end{array}$ | -42 | $\begin{array}{llll}3 & 33 & 24.4\end{array}$ | $\cdot 37$ | $3 \begin{array}{lllllll}3 & 33\end{array}$ | -32 | $\begin{array}{llll}3 & 34 & 2 \cdot 7\end{array}$ | $\cdot 26$ | 33416.9 | - 21 | $33427 \cdot 9$ | 15 |
| 39 | $\begin{array}{llllllllllll}3 & 28 & 53 \cdot 8\end{array}$ | + 42 | 329 17.1 | + 36 | $\begin{array}{llll}3 & 29 & 37 \cdot 1\end{array}$ | + 30 | 32953.8 | + 25 | $330 \quad 7 \cdot 0$ | + -19 | 33016.8 | + - 13 |
| 40 | $324 \begin{array}{llll}3 & 472\end{array}$ | -4I | $\begin{array}{lll}3 & 25 & 9 \cdot 9\end{array}$ | $\cdot 35$ | $\begin{array}{llll}3 & 25 & 29 \cdot 1\end{array}$ | -29 | 32544.9 | - 23 | 325 57.1 | - 17 | $\begin{array}{llll}3 & 26 & 5 \cdot 7\end{array}$ | -II |
| 41 | $32040 \cdot 7$ | -40 | $\begin{array}{llll}3 & 21 & 2 \cdot 7\end{array}$ | -34 | $32121 \cdot 2$ | -28 | $32136 \cdot 0$ | 2 | $312147 \cdot 2$ | - 15 | 3 21 54.7 | -09 |
| 42 | $31634 \cdot 2$ | -39 | $\begin{array}{llll}3 & 16 & 55 \cdot 6\end{array}$ | -33 |  | -26 | 317873 | -20 |  | $\cdot 14$ | $31743 \cdot 6$ | -07 |
| 43 | $31227 \cdot 7$ | - 38 | $31248 \cdot 6$ | -31 | $\begin{array}{llll}3 & 13 & 5 \cdot 5\end{array}$ | $\cdot 25$ | 31318.5 | -18 | $31327 \cdot 6$ | -12 | $\begin{array}{lllllllllllllllll} & 1 & 32 \cdot 7\end{array}$ | . 05 |
| 44 | $3 \begin{array}{lll}3 & 8 & 21.4\end{array}$ | + 37 | $3{ }^{3} 8841 \cdot 6$ | + 30 | $\begin{array}{llll}3 & 8 & 57 \cdot 7\end{array}$ | $+.23$ | $\begin{array}{lll}3 & 9 & 9.8\end{array}$ | + 27 | $3 \begin{array}{llll}3 & 9 & 17.8\end{array}$ | + 10 | $3 \begin{array}{llll}3 & 9 & 21 \cdot 7\end{array}$ | $+.03$ |
| 45 | $3{ }^{3} 4155$ | $\cdot 36$ | $\begin{array}{llll}3 & 4 & 34 \cdot 6\end{array}$ | - 29 | $\begin{array}{llll}3 & 4 & 50 \cdot 0\end{array}$ | - 22 | $\begin{array}{llll}3 & 5 & I \cdot I\end{array}$ | - 15 | $\begin{array}{llll}3 & 5 & 8 \cdot 1\end{array}$ | - 08 | $3 \quad 510 \cdot 7$ | + OI |
| 46 | $\begin{array}{llll}3 & 0 & 8 \cdot 7\end{array}$ | -35 | $3 \begin{array}{llll}3 & 0 & 27 & 7\end{array}$ | - 28 | $\begin{array}{llll}3 & 0 & 42 \cdot 3\end{array}$ | - 21 | 3 O 05052.6 | - 13 | $\begin{array}{llllll}3 & 0 & 58 \cdot 4\end{array}$ | -06 | $3 \quad 059 \cdot 8$ | OI |
| 47 | $\begin{array}{lll}2 & 56 & 2 \cdot 4\end{array}$ | -34 | $2 \begin{array}{lll}266 & 20 \cdot 8\end{array}$ | $\cdot 27$ | $256134 \cdot 7$ | -19 | 25644.0 | 1 | $25648 \cdot 7$ | . 04 | $25648 \cdot 8$ | 04 |
| 48 | $25 \mathrm{I} 56 \cdot 3$ | , 33 | 25214.0 | - 26 | $25227 \cdot 1$ | -18 | $25235 \cdot 5$ | -10 | 252 39.1 | + . 02 | $25237 \cdot 8$ | . 06 |
| 49 | $24750 \cdot 1$ | + 33 | $\begin{array}{llll}2 & 48 & 7 \cdot 2\end{array}$ | + 24 | $2 \begin{array}{llllll}2 & 48 & 19.5\end{array}$ | + .16 | $248 \quad 26 \cdot 9$ | + .08 | $2 \begin{array}{llll}2 & 48 & 29.4\end{array}$ | -00 | $2 \begin{array}{llll}2 & 48 & 26 \cdot 8\end{array}$ | . 08 |
| 50 | $24344 \%$ | $\cdot 32$ | $2 \begin{array}{lll}2 & 44 & 0.5\end{array}$ | - 23 | 24412.0 | - 15 |  | -06 | 24419.7 | -02 | $2 \begin{array}{llllll}2 & 44 & 15\end{array}$ | II |
| 51 | $\begin{array}{llll}2 & 39 & 37 \cdot 9\end{array}$ | -3I | $239.53 \cdot 8$ | - 22 | 24046 | -13 | 240 | -05 | 2401000 | . 04 | $\begin{array}{llll}2 & 40 & 4 \cdot 7\end{array}$ | 13 |
| 52 | 23531.8 | - 30 | $23547 \cdot 2$ | - 21 | $23557 \cdot 0$ | -12 | $\begin{array}{llll}2 & 36 & 1 & 4\end{array}$ | . 03 | $\begin{array}{lll}2 & 36 & 0.3\end{array}$ | .06 |  | 16 |
| 53 | 23515.8 | -29 | $23140 \cdot 6$ | - 20 | $23549 \cdot 6$ | $\cdot 10$ | $23^{1} 53 \cdot 0$ | + 01 | $23150 \cdot 6$ | -09 | 23142.4 | -19 |
| 54 | $2 \begin{array}{lllllll}2 & 27 & 19.9\end{array}$ | $+.28$ | $\begin{array}{lllll}2 & 27 & 33.9\end{array}$ | + 19 | 22742.2 | + -09 | $22744 \cdot 5$ | - 01 | $227.40 \cdot 9$ | - -II | 22731.2 | . 21 |
| 55 | 223.13 .9 | -27 | $\begin{array}{llll}2 & 23 & 27 \cdot 4\end{array}$ | -17 | $2 \begin{array}{llll}2 & 23 & 34.8\end{array}$ |  | 223 36.1 | -03 | 223 3I•I |  | $2 \begin{array}{llllll} & 23 & 19\end{array}$ | $\cdot 24$ |
| 56 | $\begin{array}{lll}2 & 19 & 8 \cdot 1\end{array}$ | -27 | $\begin{array}{llll}2 & 19 & 20.9\end{array}$ | -16 | $2 \begin{array}{llllll}2 & 19 & 27.4\end{array}$ | . 06 | $21927 \cdot 6$ | -05 | 2 19 2I.3 |  | $2 \begin{array}{lll}2 & 19 & 8.4\end{array}$ | -27 |
| 57 | $\begin{array}{lll}2 & 15 & 2 \cdot 2\end{array}$ | -26 | $\begin{array}{llllll}2 & 15 & 14.4\end{array}$ | -15 | $21520 \cdot 1$ |  | 21519.1 | -07 | 2151514 |  | $21456 \cdot 9$ | -30 |
| 58 | 21056.4 | -25 | 2 II $7 \cdot 9$ | -14 | 2 II 12.7 | -02 | $21110 \cdot 5$ | -09 | 2 II 1.4 | -21 | 2 10 45.2 | -33 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ}$ A. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | + ${ }^{\text {S }}$ | S. | $\begin{aligned} & \mathrm{s} \cdot 97 \end{aligned}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 20 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 04 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.22 \end{gathered}$ | $\stackrel{\mathrm{s} \cdot}{+1 \cdot 12}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 24 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 20 \end{gathered}$ | $\begin{gathered} \text { S. } \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 28 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 28 \end{gathered}$ |
| 4 | . 83 | $4 \cdot 17$ | -90 | $4 \cdot 19$ | . 98 | 4.20 | r.06 | 4.22 | 1.14 | 4.24 | I.21 | $4 \cdot 26$ |
| 8 | $\cdot 77$ | $4 \cdot 16$ | $\cdot 84$ | $4 \cdot 17$ | $\cdot 92$ | $4 \cdot 19$ | 1.00 | $4 \cdot 21$ | 1.08 | 4.23 | 1.15 | $4 \cdot 25$ |
| 12 | $\cdot 71$ | $4 \cdot 15$ | $\cdot 79$ | $4 \cdot 16$ | - 87 | $4 \cdot 18$ | -94 | $4 \cdot 20$ | 102 | $4 \cdot 2 \mathrm{I}$ | x-10 | $4 \cdot 23$ |
| 16 | . 66 | $4 \cdot 14$ | $\cdot 74$ | $4 \cdot 15$ | $\cdot 82$ | $4 \cdot 17$ | $\cdot 90$ | 4-19 | - 97 | $4 \cdot 20$ | 1.05 | $4 \cdot 22$ |
| 20 | + 6 x | $4 \cdot 13$ | + 69 | $4 \cdot 15$ | + 77 | $4 \cdot 16$ | +.85 | $4 \cdot 88$ | + 93 | $4 \cdot 19$ | +r.or | $4 \cdot 2 \mathrm{I}$ |
| 22 | $\cdot 59$ | $4 \cdot 13$ | -67 | $4 \cdot 14$ | $\cdot 75$ | $4 \cdot 16$ | -83 | $4 \cdot 17$ | $\cdot 92$ | $4 \cdot 19$ | 1.00 | 4.21 |
| 24 | -57 | 4.13 | -65 | $4 \cdot 14$ | $\cdot 73$ | $4 \cdot 15$ | -8x | $4 \cdot 17$ | -89 | $4 \cdot 18$ | $\cdot 98$ | $4 \cdot 20$ |
| 26 | -55 | $4 \cdot 13$ | $\cdot 63$ | $4 \cdot 14$ | -7x | $4 \cdot 15$ | -80 | 4-17 | . 88 | $4 \cdot 18$ | $\cdot 96$ | $4 \cdot 20$ |
| 28 | -53 | $4 \cdot 12$ | . 61 | 4.13 | $\cdot 69$ | $4 \cdot 15$ | $\cdot 78$ | 4-16 | . 86 | 4.18 | -95 | $4 \cdot 20$ |
| 30 | + 5 I | $4 \cdot 12$ | + 59 | $4 \cdot 13$ | +.68 | $4 \cdot 15$ | + 76 | $4 \cdot 16$ | +.85 | $4 \cdot 18$ | + 93 | $4 \cdot 20$ |
| 32 | $\cdot 48$ | $4 \cdot 12$ | $\cdot 57$ | $4 \cdot 13$ | . 66 | $4 \cdot 14$ | $\cdot 74$ | 4•6 | . 83 | $4 \cdot 17$ | - 92 | 4-19 |
| 34 | -47 | $4 \cdot 11$ | - 55 | $4 \cdot 13$ | . 64 | $4 \cdot 14$ | $\cdot 73$ | $4 \cdot 15$ | . 82 | $4 \cdot 17$ | -91 | 4-19 |
| 36 | -44 | $4 \cdot 11$ | - 53 | $4 \cdot 12$ | . 62 | $4 \cdot 14$ | $\cdot 72$ | $4 \cdot 15$ | -81 | $4 \cdot 17$ | -90 | 4-19 |
| 38 | -43 | 4.1I | $\cdot 52$ | $4 \cdot 12$ | . 61 | $4 \cdot 13$ | $\cdot 71$ | 4•15 | -80 | $4 \cdot 17$ | - 89 | 4•9 |
| 40 | + 4 4 | $4 \cdot 11$ | + 50 | $4 \cdot 12$ | + 60 | $4 \cdot 13$ | + 69 | $4 \cdot 15$ | + 79 | $4 \cdot 16$ | + 89 | 4•18 |
| 42 | -39 | $4 \cdot 11$ | -49 | $4 \cdot 12$ | $\cdot 58$ | $4 \cdot 13$ | . 68 | $4 \cdot 15$ | $\cdot 78$ | $4 \cdot 16$ | . 88 | 4.18 |
| 44 | $\cdot 37$ | $4 \cdot 11$ | $\cdot 47$ | $4 \cdot 11$ | - 57 | 4.13 | -67 | $4 \cdot 14$ | $\cdot 78$ | $4 \cdot 16$ | $\cdot 88$ | 4.18 |
| 46 | $\cdot 35$ | $4 \cdot 10$ | -46 | $4 \cdot 11$ | -56 | $4 \cdot 13$ | . 67 | $4 \cdot 14$ | $\cdot 77$ | $4 \cdot 16$ | - 88 | 4.18 |
| 48 | -33 | $4 \cdot 10$ | -44 | $4 \cdot 11$ | $\cdot 55$ | $4 \cdot 13$ | - 66 | 4.14 | $\cdot 77$ | $4 \cdot 16$ | $\cdot 88$ | 4-18 |
| 50 | + 32 | $4 \cdot 10$ | + 43 | $4 \cdot 11$ | + 54 | $4 \cdot 12$ | +.66 | $4 \cdot 14$ | + 77 | $4 \cdot 16$ | + 89 | $4 \cdot 18$ |
| 52 | $\cdot 30$ | $4 \cdot 10$ | $\cdot 42$ | $4 \cdot 11$ | . 53 | $4 \cdot 12$ | . 65 | $4 \cdot 14$ | $\cdot 77$ | $4 \cdot 16$ | $\cdot 89$ | 4•9 |
| 54 | - 28 | $4 \cdot 10$ | -41 | $4 \cdot 11$ | - 53 | $4 \cdot 12$ | . 65 | $4 \cdot 14$ | $\cdot 78$ | 4.16 | $\cdot 90$ | 4-19 |
| 56 | -27 | $4 \cdot 10$ | $\cdot 40$ | 4•II | $\cdot 52$ | $4 \cdot 12$ | . 65 | $4 \cdot 14$ | -79 | $4 \cdot 16$ | $\cdot 92$ | $4 \cdot 19$ |
| 58 | $\cdot 25$ | $4 \cdot 10$ | $\cdot 39$ | $4 \cdot 11$ | $\cdot 52$ | $4 \cdot 12$ | . 66 | 4.14 | . 80 | $4 \cdot 16$ | $\cdot 94$ | 4-19 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & \text { I5 } & 50 \cdot 5 \end{array}$ | S. $+\quad .94$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { I6 } & 47 \cdot 3 \end{array}$ | S. $+\quad .95$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & \text { I7 } & 44^{\circ} 9 \end{array}$ | + ${ }^{\text {s. }}$ + 97 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I8 } & 43 \cdot 2 \end{array}$ | S. $+\quad .98$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { 19 } & 42.4 \end{array}\right\|$ | -99 | $\left\lvert\, \begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 20 & 42.4 \end{array}\right.$ | S. |
| 10 | $\begin{array}{llll}5 & 32 & 59 \cdot 1\end{array}$ | -70 | $5334 \mathrm{I} \cdot \mathrm{I}$ | $\cdot 70$ | $\begin{array}{llll}5 & 34 & 22 \cdot 8\end{array}$ | -69 | $\begin{array}{lll}5 & 35 & 4 \cdot 2\end{array}$ | -69 | $\begin{array}{llll}5 & 35 & 45 \cdot 3\end{array}$ | . 68 | $\begin{array}{llll}5 & 36 & 26 \cdot 2\end{array}$ | -68 |
| 12 | $\begin{array}{lllll}5 & 24 & 27 \cdot 9\end{array}$ | -66 | $\begin{array}{lllll}5 & 25 & 7 \cdot 1\end{array}$ | - 65 | $5 \quad 2545 \cdot 7$ | -64 | $\begin{array}{lllll}5 & 26 & 23.9\end{array}$ | - 63 | $5 \begin{array}{lll}5 & 27 & 1.7\end{array}$ | . 62 | 52739.0 | -62 |
| 14 | $515157 \cdot 5$ | -61 | $5 \begin{array}{llll}5 & 16 & 33.9\end{array}$ | - 60 | 5 I7 $9 \cdot 6$ | $\cdot 59$ | 517447 | $\cdot 58$ | $\begin{array}{llll}5 & 18 & 19 \cdot 1\end{array}$ | -57 | $\begin{array}{llll}5 & 18 & 52 \cdot 8\end{array}$ | -55 |
| 16 | $5 \quad 7 \quad 27 \cdot 8$ | -57 | $\begin{array}{llll}5 & 8 & \mathrm{I} \cdot 5\end{array}$ | $\cdot 55$ | $\begin{array}{llll}5 & 8 & 34.4\end{array}$ | -54 | $\begin{array}{lll}5 & 9 & 6 \cdot 3\end{array}$ | $\cdot 52$ | $\begin{array}{llll}5 & 9 & 37 \cdot 3\end{array}$ | $\cdot 51$ | 5 10 70.5 | 49 |
| 18 | $4 \quad 58 \quad 58 \cdot 8$ | + 53 | 45929.9 | + 51 | $45959 \cdot 8$ | + 49 | $5 \quad 0 \quad 28 \cdot 6$ | + 47 | $5 \quad 0 \quad 56 \cdot 4$ | + 45 | $5 \quad 123 \cdot 1$ | + 43 |
| 20 | $45030 \cdot 5$ | -48 | $4 \quad 50 \quad 58 \cdot 9$ | -46 | 4 5I $26 \cdot 0$ | -44 | $4515 \mathrm{I} \cdot 8$ | - 42 | $4 \quad 52 \begin{array}{lll}4 & 16 \cdot 2\end{array}$ | -40 | $4 \begin{array}{lll}42 & 39 & 3\end{array}$ | -37 |
| 22 | $442 \quad 2 \cdot 7$ | -44 | $442 \quad 28 \cdot 5$ | -42 | $4 \quad 42 \quad 52 \cdot 7$ | -39 | $4 \begin{array}{lll}4 & 43 & 15 \cdot 5\end{array}$ | $\cdot 36$ | $44336 \cdot 6$ | -34 | $44356 \cdot 3$ | 3 I |
| 24 | $433 \quad 35 \cdot 5$ | -40 | $43358 \cdot 7$ | $\cdot 37$ | $43420 \cdot 0$ | $\cdot 34$ | $43439 \cdot 7$ | $\cdot 31$ | 434 57.6 | $\cdot 28$ | 43513.7 | $\cdot 25$ |
| 26 | $425 \quad 8 \cdot 7$ | $\cdot 36$ | $425 \quad 29 \cdot 2$ | $\cdot 32$ | $42547 \cdot 8$ | $\cdot 29$ | 42644 | - 26 | 42619.0 | -23 | $42631 \cdot 6$ | -19 |
| 28 | 4 16 $42 \cdot 4$ | + 31 | 4 I7 $0 \cdot 3$ | + 28 | $41716 \cdot 0$ | + $\cdot 24$ | 417829.5 | + $\cdot 21$ | $41740 \cdot 7$ | $+\cdot 17$ | 4 I7 49.7 | + -13 |
| 30 | $48816 \cdot 5$ | $\cdot 27$ | $483 \mathrm{I} \cdot 7$ | . 23 | $4 \quad 8 \quad 44 \cdot 5$ | -19 | $4 \begin{array}{llll}4 & 8 & 54 \cdot 8\end{array}$ | - 15 | $\begin{array}{llll}4 & 9 & 2 \cdot 7\end{array}$ | -1 1 | $4 \quad 9 \quad 8 \cdot 1$ | . 07 |
| 31 | $\begin{array}{llll}4 & 4 & 3 \cdot 7\end{array}$ | $\cdot 25$ | $\begin{array}{llll}4 & 4 & 17 \cdot 4\end{array}$ | -21 | $4 \begin{array}{lll}4 & 4 & 28 \cdot 8\end{array}$ | -17 | $4437 \cdot 7$ | -12 | $\begin{array}{lllll}4 & 4 & 43 \cdot 8\end{array}$ | -08 | $4 \quad 4 \quad 47 \cdot 4$ | +.04 |
| 32 | $3595050 \cdot 9$ | -23 | $\begin{array}{lll}4 & 0 & 3 \cdot 4\end{array}$ | -19 | 4 0 13.3 <br>  5  | - 14 | $4 \quad 0 \quad 20 \cdot 5$ | -10 | 40250 | -05 | $\begin{array}{llll}4 & 0 & 26 \cdot 7\end{array}$ | -00 |
| 33 | $35538 \cdot 2$ | -21 | $35549 \cdot 4$ | I6 | $35557 \cdot 8$ | 2 | $\begin{array}{lll}3 & 56 & 3.4\end{array}$ | -07 | $3566 \cdot 1$ | +.02 | $\begin{array}{llll}3 & 56 & 5 \cdot 9\end{array}$ | $-.02$ |
| 34 | $3 \mathrm{5I} 25 \cdot 6$ | + -19 | $\begin{array}{llll}3 & 51 & 35.4\end{array}$ | + •I4 | $35142 \cdot$ | +-09 | 3 51 $46 \cdot 3$ | + 04 | 351473 | - 0 | 35145.2 | -06 |
| 35 | 34713.0 | -16 | 347 21.4 | 1 | $\begin{array}{lllll}3 & 47 & 26 \cdot 8\end{array}$ | -06 | 347 29.2 | + .OI | 34728.4 | -04 | 34724.4 | -09 |
| 36 | $\begin{array}{llll}3 & 43 & 0 \cdot 4\end{array}$ | 14 | $\begin{array}{llllllllllllllllll}3 & 43 & 7.5\end{array}$ | -09 | 343 II.4 | -04 | 343 12.I | Or | 34319.5 | -07 | $\begin{array}{llll}3 & 43 & 3 \cdot 6\end{array}$ | -13 |
| 37 | $\begin{array}{lllll}3 & 38 & 48 \cdot 0\end{array}$ | - I2 | $\begin{array}{llll}3 & 38 & 53 \cdot 6\end{array}$ | -07 | $\begin{array}{llll}3 & 38 & 56 \cdot 0\end{array}$ | + OI | $\begin{array}{lllll}3 & 38 & 55 \cdot 0\end{array}$ | -04 | $\begin{array}{lllll}3 & 38 & 50 \cdot 6\end{array}$ | -10 |  | 16 |
| 38 | $33435 \cdot 5$ | -10 | $\begin{array}{llll}3 & 34 & 39 \cdot 8\end{array}$ | . 04 | $33440 \cdot 6$ | or | $\begin{array}{lllllllll}3 & 34 & 37 \cdot 9\end{array}$ | -07 | 334 31•7 | -13 | $\begin{array}{lllll}3 & 34 & 21.8\end{array}$ | -19 |
| 39 | $\begin{array}{llll}3 & 30 & 23 \cdot 1\end{array}$ | +.08 | $3 \begin{array}{llll}3 & 30 & 25.9\end{array}$ | + .02 | $3 \begin{array}{lll}30 & 25.2\end{array}$ | $\cdot 04$ | $3 \quad 30 \quad 20 \cdot 8$ | -10 | 313012.7 | -17 | 330008 | - 23 |
| 40 |  | -05 | $\begin{array}{llll}3 & 26 & 12 \cdot I\end{array}$ | - OI | $\begin{array}{llll}3 & 26 & 9 \cdot 8\end{array}$ | -07 | $\begin{array}{llll}3 & 26 & 3 \cdot 7\end{array}$ | - I3 |  | - 20 | 325039.6 | -27 |
| 4 I | $32158 \cdot 4$ | -03 |  | -03 | 3 2I 54.3 | 0 | $32146 \cdot 4$ | -16 | $3 \mathrm{lll} 34 \cdot 4$ | -23 |  | $\cdot 30$ |
| 42 | 3 17 46.0 | + -01 | $\begin{array}{lllll}3 & \text { I7 } & 44.5\end{array}$ | -06 | $\begin{array}{llll}3 & 17 & 38 \cdot 8\end{array}$ | -13 | $\begin{array}{llll}3 & 17 & 29 \cdot 1\end{array}$ | - 20 | 3 17 $15 \cdot 1$ | $\cdot 27$ | $\begin{array}{llll}3 & 16 & 56 \cdot 9\end{array}$ | 34 |
| 43 | 3 I3 33.7 | 2 | 3 I3 30.6 | -09 | $\begin{array}{llll}3 & 13 & 23.3\end{array}$ | 16 | 3 I 3 II•7 | -23 |  | - 30 | 31235.3 | 8 |
| 44 | $3 \begin{array}{lll}3 & 9 & 21.4\end{array}$ | $\cdot 04$ | $\begin{array}{llll}3 & 9 & 16.7\end{array}$ | 1 | $\begin{array}{llrr}3 & 9 & 7 \cdot 7\end{array}$ | 'I9 | $3 \begin{array}{llll}3 & 8 & 54.2\end{array}$ | - 26 | $\begin{array}{llll}3 & 8 & 36 \cdot 2\end{array}$ | -34 | $\begin{array}{llll}3 & 8 & 13.4\end{array}$ | - 42 |
| 4 | 35190 | $\cdot 07$ | $\begin{array}{lll}3 & 5 & 2 \cdot 7 \\ 3 & 0 & 4\end{array}$ | -14 | $\begin{array}{llll}3 & 4 & 52 \cdot 0\end{array}$ | -22 | $\begin{array}{llll}3 & 4 & 36 \cdot 6\end{array}$ | -30 | $3 \quad 4 \begin{array}{lll}3 & 4 & 1\end{array}$ | $\cdot 38$ | $\begin{array}{llll}3 & 3 & 51.4\end{array}$ | $\cdot 46$ |
| 46 | 3 O $56 \cdot 6$ | -09 | $3 \quad 0 \quad 48 \cdot 7$ | -17 | $3 \quad 0 \quad 36 \cdot 2$ | - 25 | $\begin{array}{llll}3 & 0 & 18.8\end{array}$ | -33 | $25956 \cdot 5$ | $\cdot 41$ | 25929.1 | -50 |
| 47 | $2{ }^{2} 5644^{\prime} \mathrm{I}$ | -12 | 2 | -20 | $\begin{array}{llll}2 & 56 & 20 \cdot 3\end{array}$ | -28 | $\begin{array}{llll}2 & 56 & 0.9\end{array}$ | -37 | $25536 \cdot 4$ | -45 | $\begin{array}{lll}2 & 55 & 6 \cdot 5\end{array}$ | -54 |
| 48 | $25231 \cdot 7$ | 14 | $25220 \cdot 5$ | -23 | $\begin{array}{llll}2 & 52 & 4 & 3\end{array}$ | -31 | $25142 \cdot 8$ | $\cdot 40$ | $2 \begin{array}{lllll} & 51 & 15\end{array}$ | -49 | $25043 \cdot 5$ | $\cdot 59$ |
| 49 | $2 \begin{array}{llllllll} & 48 & 19.2\end{array}$ | $\cdot 17$ | $\begin{array}{lll}2 & 48 & 6 \cdot 3\end{array}$ | - $\cdot 26$ | $2 \begin{array}{lllll}2 & 47 & 48 \cdot 1\end{array}$ | $\cdot 35$ | $\begin{array}{lllll}2 & 47 & 24.5\end{array}$ | - 44 | $2 \begin{array}{lllll}2 & 46 & 55\end{array}$ | - 53 | $24620 \cdot 3$ |  |
| 50 | $\begin{array}{lll}2 & 44 & 6 \cdot 6\end{array}$ | -20 | $\begin{array}{llll}2 & 43 & 51.9\end{array}$ | -29 | $2{ }_{2} 43313177$ | $\cdot 38$ | $\begin{array}{llll}2 & 43 & 5 \cdot 9\end{array}$ | $\cdot 48$ | $242 \begin{array}{llll} \\ 2 & 42\end{array}$ | -58 |  | . 68 |
| 51 | $\begin{array}{lllll}2 & 39 & 53.9\end{array}$ | -23 | $\begin{array}{lllll}2 & 39 & 37 \cdot 4\end{array}$ | $\cdot 32$ | $\begin{array}{llll}2 & 39 & 15 \cdot 2\end{array}$ | -42 |  | $\cdot 52$ | $\begin{array}{lllll}2 & 38 & 12 \cdot 9\end{array}$ | -62 | $\begin{array}{llllllllllllll}2 & 37 & 32 \cdot 8\end{array}$ | 73 |
| 52 | $235415 \cdot 1$ | $\cdot 26$ | $2 \begin{array}{llll}2 & 35 & 22.8\end{array}$ | $\cdot 35$ | $\begin{array}{llll}2 & 34 & 58 \cdot 5\end{array}$ | -46 | $234 \begin{array}{llll}28 \cdot 0\end{array}$ | -56 | $2335 \mathrm{I} \cdot 2$ | -67 | $\begin{array}{llll}2 & 33 & 7 \cdot 9\end{array}$ | $\cdot 78$ |
| 53 | $23128 \cdot 2$ | -29 | 2318.0 | $\cdot 39$ | $2304 \mathrm{I} \cdot 5$ | 49 | 230 |  | 229 29.1 |  | $22842 \cdot 7$ | 83 |
| 54 | $\begin{array}{llllll}2 & 27 & 15.2\end{array}$ | $\cdot 32$ | 22653.0 | -42 | $\begin{array}{llll}2 & 26 & 24.2\end{array}$ | - . 53 | $22548 \cdot 8$ | - 65 | $\begin{array}{lll}2 & 25 & 6 \cdot 4\end{array}$ | $\cdot 77$ | $2 \begin{array}{llll}2 & 24 & 16 \cdot 9\end{array}$ | -.89 |
| 55 | $\begin{array}{llll}2 & 23 & 2 \\ 2 & 18\end{array}$ | -35 | $\begin{array}{llll}2 & 22 & 37 \cdot 8\end{array}$ | -46 | $\begin{array}{llll}2 & 22 & 6 \cdot 6\end{array}$ | -58 |  |  | $22043 \cdot 3$ | . 82 | $21950 \cdot 5$ | -95 |
| 56 | $\begin{array}{lllllllllll}2 & 18 & 48 \cdot 8\end{array}$ | $\cdot 38$ | $\begin{array}{llll}2 & 18 & 22 \cdot 3\end{array}$ | -50 |  | . 62 | $\begin{array}{lll}2 & 17 & 7 \cdot 9\end{array}$ | - 74 | $2 \begin{array}{llll}2 & 16 & 19.4\end{array}$ | . 87 | $2 \begin{array}{llll}2 & 15 & 23.3\end{array}$ | I.OI |
| 57 | $\begin{array}{llll}2 & 14 & 35 \cdot 3\end{array}$ | -42 | $\begin{array}{llr}2 & \text { I4 } & 6 \cdot 6\end{array}$ | $\cdot 54$ | $\begin{array}{llll}2 & 13 & 30 \cdot 5\end{array}$ | -67 | $2 \begin{array}{llll}2 & 12 & 46 \cdot 7\end{array}$ | $\cdot 79$ | 2 II $55^{\prime} \mathrm{I}$ | -93 | $21055^{2}$ | 1.07 |
| 58 | $21021 \cdot 6$ | $\cdot 45$ | $2 \quad 950 \cdot 6$ | -58 | $2 \begin{array}{llll}2 & 9 & \text { II } 8\end{array}$ | $\cdot 71$ | $28 \quad 250$ | $\cdot 85$ | $2 \quad 7 \quad 29.9$ | -99 | 6 26.2 | I'I4 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$ |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 36 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 3 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s.} \\ +\mathrm{I} \cdot 44 \end{gathered}$ | $\begin{gathered} s . \\ -4.34 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} .53 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 36 \end{gathered}$ | $\begin{gathered} s . \\ +1.6 I \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 39 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 69 \end{gathered}$ | $\begin{gathered} s . \\ -4.43 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 78 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 46 \end{gathered}$ |
| 4 | I. 29 | 4.29 | I. 37 | $4 \cdot 35$ | 1.46 | $4 \cdot 34$ | I.54 | 4.37 | I. 62 | 4.40 | I•71 | 4.43 |
| 8 | I. 23 | $4 \cdot 27$ | I-31 | $4 \cdot 30$ | I. 40 | $4 \cdot 32$ | 1.48 | $4 \cdot 35$ | I. 56 | $4 \cdot 38$ | I. 65 | 4.41 |
| 12 | I-18 | $4 \cdot 26$ | I. 26 | $4 \cdot 28$ | I-34 | $4 \cdot 30$ | 1.43 | $4 \cdot 33$ | I. 51 | $4 \cdot 36$ | I. 59 | $4 \cdot 39$ |
| I6 | I.I3 | $4 \cdot 24$ | I-22 | $4 \cdot 27$ | I.30 | $4 \cdot 29$ | 1-38 | $4 \cdot 32$ | 1.47 | $4 \cdot 34$ | I.55 | $4 \cdot 37$ |
| 20 | +I.09 | $4 \cdot 23$ | +I.18 | $4 \cdot 25$ | +1.26 | $4 \cdot 28$ | +r.34 | $4 \cdot 30$ | +1.43 | $4 \cdot 33$ | +1.52 | $4 \cdot 36$ |
| 22 | I.08 | $4 \cdot 23$ | I• 16 | $4 \cdot 25$ | I. 25 | $4 \cdot 28$ | r. 33 | $4 \cdot 30$ | I. 42 | $4 \cdot 33$ | I 50 | $4 \cdot 36$ |
| 24 | r.06 | $4 \cdot 22$ | I.14 | $4 \cdot 25$ | 1.23 | $4 \cdot 27$ | $1 \cdot 32$ | $4 \cdot 29$ | I-40 | $4 \cdot 32$ | I.49 | $4 \cdot 35$ |
| 26 | I.05 | $4 \cdot 22$ | I'I3 | $4 \cdot 24$ | I 22 | $4 \cdot 27$ | $1 \cdot 31$ | $4 \cdot 29$ | I•39 | $4 \cdot 32$ | I 48 | 4.35 |
| 28 | I.O3 | $4 \cdot 22$ | I•I2 | $4 \cdot 24$ | I-2I | $4 \cdot 26$ | 1.29 | $4 \cdot 29$ | I.38 | $4 \cdot 32$ | $1 \cdot 47$ | 4.35 |
| 30 | +1.02 | $4 \cdot 22$ | +III | $4 \cdot 24$ | +1.20 | $4 \cdot 26$ | +1.29 | $4 \cdot 29$ | + $5 \cdot 38$ | $4 \cdot 32$ | $+1.47$ | $4 \cdot 35$ |
| 32 | I.OI | $4 \cdot 21$ | 1.10 | $4 \cdot 23$ | I•19 | $4 \cdot 26$ | $1 \cdot 28$ | $4 \cdot 28$ | I 37 | $4 \cdot 31$ | I. 47 | $4 \cdot 34$ |
| 34 | I.OO | 4.21 | r.09 | 4.23 | I'19 | $4 \cdot 26$ | 1.28 | 4.28 | I-38 | $4 \cdot 3 \mathrm{I}$ | 1.47 | $4 \cdot 34$ |
| 36 | -99 | $4 \cdot 21$ | r 09 | 4.23 | I.I8 | $4 \cdot 26$ | 1.28 | $4 \cdot 28$ | I.38 | 4.31 | 1.47 | $4 \cdot 35$ |
| 38 | -99 | $4 \cdot 2 \mathrm{I}$ | 1.09 | 4.23 | I•I8 | $4 \cdot 26$ | 1.28 | $4 \cdot 29$ | I.38 | $4 \cdot 32$ | 1.48 | $4 \cdot 35$ |
| 40 | + 98 | 4.20 | +1.08 | $4 \cdot 23$ | +1.18 | $4 \cdot 26$ | + $\mathbf{r} \cdot 28$ | 4.29 | +1.39 | $4 \cdot 32$ | +1.49 | $4 \cdot 35$ |
| 42 | -98 | $4 \cdot 20$ | 1.08 | $4 \cdot 23$ | 1.19 | $4 \cdot 26$ | I. 29 | $4 \cdot 29$ | 1.40 | $4 \cdot 32$ | I•5I | 4.36 |
| 44 | - 98 | 4.21 | 1.09 | 4.23 | I. 20 | $4 \cdot 26$ | 1-31 | $4 \cdot 29$ | 1.42 | 4.33 | I.53 | $4 \cdot 36$ |
| 46 | -99 | $4 \cdot 21$ | I-10 | $4 \cdot 23$ | 1.2I | $4 \cdot 26$ | $1 \cdot 32$ | $4 \cdot 30$ | 1.43 | $4 \cdot 33$ | I 55 | 4.37 |
| 48 | -99 | $4 \cdot 2 \mathrm{I}$ | I•II | $4 \cdot 24$ | 1.22 | $4 \cdot 27$ | 1-34 | $4 \cdot 30$ | I.46 | $4 \cdot 34$ | I.58 | $4 \cdot 38$ |
| 50 | +1.00 | $4 \cdot 2 \mathrm{I}$ | +1.12 | $4 \cdot 24$ | +1.24 | $4 \cdot 27$ | +1.37 | 4.31 | +1.49 | $4 \cdot 35$ | +1.62 | $4 \cdot 40$ |
| 52 | 1.02 | $4 \cdot 2 \mathrm{I}$ | 1-14 | $4 \cdot 24$ | 1.27 | $4 \cdot 28$ | 1.40 | $4 \cdot 32$ | 1.53 | $4 \cdot 36$ | I. 66 | 4.42 |
| 54 | 1.03 | $4 \cdot 22$ | I•I6 | $4 \cdot 25$ | 1.30 | $4 \cdot 29$ | 1.43 | $4 \cdot 33$ | I. 57 | $4 \cdot 38$ | I• 72 | $4 \cdot 43$ |
| 56 | I.06 | $4 \cdot 22$ | I-19 | $4 \cdot 26$ | 1.33 | $4 \cdot 30$ | 1.48 | $4 \cdot 35$ | 1.63 | $4 \cdot 40$ | r 78 | 4.46 |
| 58 | I.08 | $4 \cdot 23$ | I. 23 | $4 \cdot 27$ | 1.38 | $4 \cdot 31$ | I.53 | $4 \cdot 37$ | I. 69 | $4 \cdot 42$ | I.86 | 4.49 |

54 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $13^{\circ}$.

## DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 0 & 0 \cdot 0 \end{array}$ | + 92 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 55 \cdot 5 \end{array}\right.$ | S. $+\quad .92$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 50 \cdot 9 \end{array}$ | S. $+\quad .92$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 2 & 46 \cdot 4 \end{array}$ | S. .92 | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 3 & 42 \cdot 0 \end{array}$ |  | $\left\{\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 37 \cdot 8 \end{array}\right.$ | S. |
| 10 | $\begin{array}{lllll}5 & 18 & 56 \cdot 2\end{array}$ | $\cdot 94$ | $\begin{array}{llll}5 & 19 & 52 \cdot 1\end{array}$ | -92 | $5 \quad 20 \quad 47 \cdot 3$ | 91 | 5 2I $4 \mathrm{I} \cdot 7$ | 90 | $\begin{array}{lll}5 & 22 & 35 \cdot 4\end{array}$ |  | 23 28.5 | 88 |
| 12 | $51043 \cdot 1$ | $\cdot 94$ | 5 II $39 \cdot 3$ | $\cdot 93$ | 51234.6 | $\cdot 91$ | 5 I3 $29 \cdot 0$ | -90 | $51422 \cdot 5$ | 88 | $\begin{array}{llll}5 & 15 & 15 \cdot 3\end{array}$ | 87 |
| 14 | $\begin{array}{llll}5 & 2 & 29.7\end{array}$ | -95 | $\begin{array}{llll}5 & 3 & 26 \cdot 4\end{array}$ | -93 | $\begin{array}{llll}5 & 4 & 21 \cdot 9\end{array}$ | -92 | $\begin{array}{llll}5 & 5 & 16.4\end{array}$ | -90 | $\begin{array}{lll}5 & 6 & 9.8\end{array}$ | . 88 | $\begin{array}{llll}5 & 7 & 2 \cdot 3\end{array}$ | . 87 |
| 16 | 454 I6.2 | -96 | $\begin{array}{lllllll}4 & 55 & 13\end{array}$ | -94 | $456 \quad 9 \cdot 1$ | -92 | $\begin{array}{llll}4 & 57 & 3.8\end{array}$ | - | $457 \quad 57 \cdot 2$ | . 88 | $\begin{array}{llll}4 & 58 & 49 \cdot 5\end{array}$ | . 86 |
| 18 | $446 \quad 2 \cdot 3$ | $\cdot 97$ | 44700 | + 95 | $44756 \cdot 3$ | + 92 | $44^{8} 5 \mathrm{I} \cdot \mathrm{I}$ | + 90 | $44944 \cdot 8$ | + 888 | $45036 \cdot 7$ | +.86 |
| 2 | $43748 \cdot \mathrm{I}$ | $\cdot 98$ | $4 \begin{array}{lll}4 & 38 & 46 \cdot 5\end{array}$ | -96 | 439 43.2 | -93 | $44038 \cdot 3$ | -91 | $44132 \cdot 0$ | -88 | 44224.0 | . 85 |
| 22 | $42933 \cdot 5$ | I 00 | $4 \quad 3032.6$ | -97 | $43130 \cdot 0$ | 4 | $432 \begin{array}{llll}4 & 25 \cdot 5\end{array}$ | -91 | 43319.2 | . 88 | 43411.4 | 85 |
| 24 | $42118 \cdot 5$ | 1.02 | $\begin{array}{llll}4 & 22 & 18 \cdot 5\end{array}$ | -98 | $\begin{array}{llll}4 & 23 & 16 \cdot 5\end{array}$ | -95 | $\begin{array}{lllllllllllllllll}4 & 24 & 12.5\end{array}$ | -92 | $425 \quad 6.5$ | -88 | $425 \begin{array}{llll}4 & 58\end{array}$ | 85 |
| 26 | $4 \mathrm{I} 3 \quad 3 \cdot 0$ | I.03 | 414309 | I 00 | $\begin{array}{llll}4 & 15 & 2 \cdot 7\end{array}$ | $\cdot 96$ | $415 \quad 59 \cdot 3$ | -92 | $\begin{array}{lllll}4 & 16 & 53.7\end{array}$ | 9 | $41746 \cdot 1$ | . 86 |
| 28 | $\begin{array}{llll}4 & 4 & 46 \cdot 9\end{array}$ | +I.05 | $4 \quad 549.0$ | +I.O | $4 \begin{array}{lll}4 & 68 \cdot 6\end{array}$ | + 97 | $4 \quad 745 \cdot 8$ | + 93 | $840 \cdot 7$ | + 90 | 933.4 | + $\cdot 86$ |
| 30 | $\begin{array}{llll}3 & 56 & 30 \cdot 3\end{array}$ | 1.07 | $3 \begin{array}{llll}3 & 57 & 33.4\end{array}$ | I. 03 | $\begin{array}{llll}3 & 58 & 34 \cdot 1\end{array}$ | -99 | $35932 \cdot 1$ | . 94 | $4 \quad 0 \quad 27 \cdot 5$ | $\cdot 90$ | $4 \quad 120 \cdot 6$ | . 86 |
| 31 | $35221 \cdot 6$ | I 09 | $\begin{array}{llll}3 & 53 & 25 \cdot 5\end{array}$ | I. 04 | $\begin{array}{llll}3 & 54 & 26 \cdot 6\end{array}$ | I.00 | $355125 \cdot 1$ | 5 | $\begin{array}{llll}3 & 56 & 20 \cdot 9\end{array}$ | -91 | 35714.2 | -87 |
| 32 | 3 48 <br> 12.8  | I'10 | $3 \begin{array}{lllll} & 49 & 17 \cdot 4\end{array}$ | 5 | $35019 \cdot 1$ | I 00 | $35118 \cdot 0$ | -96 | $\begin{array}{llll}3 & 52 & 14.2\end{array}$ | 1 | 35317 | $\cdot 87$ |
| 33 | $\begin{array}{llll}3 & 44 & 3 \cdot 8\end{array}$ | I'II | $345 \quad 9 \cdot 1$ | I.06 | $346 \mathrm{II} \cdot 4$ | 1 | $34710 \cdot 9$ | -97 | $\begin{array}{llll}3 & 48 & 7 \cdot 4\end{array}$ | -92 | $349 \begin{array}{lll}3 & 1 & 2\end{array}$ | .87 |
| 34 | 33954.5 | +1.13 | $3 \begin{array}{lll}3 & 41 & 0.6\end{array}$ | +1.07 | $\begin{array}{llll}3 & 42 & 3.6\end{array}$ | +I.O2 | $343 \quad 3.6$ | + 97 | $344 \quad 0.5$ | + 92 | $34454 \cdot 6$ | +.88 |
| 35 | $3{ }_{3} 3545 \cdot 1$ | I. 14 | $\begin{array}{llll}3 & 36 & 52 \cdot 0\end{array}$ | I.09 | $\begin{array}{llll}3 & 37 & 55 \cdot 6\end{array}$ | 1.03 | $\begin{array}{llllllllllllllllll}3 & 38 & 56 \cdot 2\end{array}$ | $\cdot 98$ | $\begin{array}{llll}3 & 39 & 53.6\end{array}$ | -93 | $34048 \cdot 0$ | - 88 |
| 3 | $\begin{array}{\|lll\|}3 & 31 & 35 \cdot 3\end{array}$ | I•16 | $\begin{array}{llll}3 & 32 & 43 \cdot 1\end{array}$ | I'IO | $\begin{array}{lllll}3 & 33 & 47 \cdot 5\end{array}$ | I.05 | $3 \begin{array}{lllll}3 & 34 & 48\end{array}$ | -99 | $\begin{array}{llll}3 & 35 & 46 \cdot 6\end{array}$ | 4 | 3364 | 89 |
| 37 | $\begin{array}{llll}3 & 27 & 25 \cdot 3\end{array}$ | I•1 | $3 \begin{array}{llll}3 & 28 & 34^{\circ} 0\end{array}$ |  | $\begin{array}{llll}3 & 29 & 39 \cdot 2\end{array}$ | r.06 | $33041 \cdot 0$ | 1.00 | $3 \mathrm{3I}$ | 5 | $3 \begin{array}{llll}32 & 34 \cdot 6\end{array}$ | -89 |
| 38 | $32315 \cdot 1$ | I.I9 | 32424.7 | I•I3 | $32530 \cdot 7$ | I.07 | $\begin{array}{lllll}3 & 26 & 33 \cdot 2\end{array}$ | 1. | $\begin{array}{lllllllllll}3 & 27 & 32 \cdot 2\end{array}$ | -95 |  | -90 |
| 39 | $\begin{array}{llll}3 & 19 & 4.5\end{array}$ | $+1.21$ | $32015 \cdot 1$ | +1.14 | 32122.0 | +1.08 | 32225.2 | +r.02 | $323124 \cdot 8$ | + 96 | $\begin{array}{llll}3 & 24 & 20 \cdot 8\end{array}$ | + 90 |
| 40 | $\begin{array}{llll}3 & 14 & 53 \cdot 6 \\ 3 & 1\end{array}$ | I. 23 | $\begin{array}{rrrr}3 & 16 & 5 \cdot 3 \\ 3 & 15 & 55 \cdot 2\end{array}$ | I• 16 | $\begin{array}{llll}3 & 17 & 13 \cdot 1\end{array}$ | I'IO | $\begin{array}{lllll}3 & 18 & 17 \cdot 1\end{array}$ | 1.03 | $\begin{array}{lllll}3 & 19 & 17 \cdot 3\end{array}$ | -97 |  | .91 |
| 41 | 3 10 $42 \cdot 3$ | I. 25 | 3 II 55.2 | r.18 | 31340 | I-II | $\begin{array}{lll}3 & 14 & 8.8\end{array}$ | I.05 | $\begin{array}{llll}3 & 15 & 9 \%\end{array}$ | -98 | $3 \begin{array}{lll}3 & 16 & 7\end{array}$ | 92 |
| 42 | $\begin{array}{llll}3 & 6 & 30 \cdot 7\end{array}$ | $\underline{1} 27$ | $\begin{array}{llll}3 & 7 & 44 \cdot 8 \\ 3 & 3 & 34.1\end{array}$ | 0 | $\begin{array}{llll}3 & 8 & 54 \cdot 6\end{array}$ | I'I3 | 3 10 0.3 | I 0 | $\begin{array}{lrrr}3 & \text { II } & \text { I.9 }\end{array}$ | 99 | 3 II 59.5 | 93 |
| 43 | $\begin{array}{lllll}3 & 2 & 18.7\end{array}$ | I. 29 | $3 \begin{array}{lll}3 & 3 & 34 \cdot 1\end{array}$ | I. 22 | $3 \begin{array}{lll}3 & 4 & 44.9\end{array}$ | I'I5 | $35551 \cdot 6$ | 1.07 | $\begin{array}{llll}3 & 6 & 53 \cdot 7\end{array}$ | I 00 | $\begin{array}{llll}3 & 7 & 52 \cdot 2\end{array}$ | $\cdot 94$ |
| 44 | $\begin{array}{llll}2 & 58 & 6 \cdot 3\end{array}$ | + I. 32 | $\begin{array}{llll}2 & 59 & 22 \cdot 9\end{array}$ | +I.2 | $3 \begin{array}{lll}3 & 0 & 35 \cdot 1\end{array}$ | 1 | 3 I 42.6 | + I.09 | $\begin{array}{lrrr}3 & 2 & 45 \cdot 8\end{array}$ | +1.02 | $\begin{array}{llll}3 & 3 & 44 \cdot 8\end{array}$ | + 95 |
| 45 | $\begin{array}{llll}2 & 53 & 53.4 \\ 2 & 4\end{array}$ | I. 34 | $\begin{array}{llll}2 & 55 & 11.5\end{array}$ | I. 26 | $\begin{array}{llll}2 & 56 & 24 \cdot 8\end{array}$ | I. 1 | $2 \begin{array}{llll}2 & 57 & 33.4\end{array}$ | I•II | $\begin{array}{lllll}2 & 58 & 37 \cdot 5\end{array}$ | 1.03 | $\begin{array}{llll}2 & 59 & 37 \cdot 1\end{array}$ | $\cdot 96$ |
| 46 | $\begin{array}{llll}2 & 49 & 39 \cdot 9\end{array}$ | 1.3 | $2 \begin{array}{llll}2 & 50 & 59.6\end{array}$ | I. 28 | $\begin{array}{lllll}2 & 52 & 14.2\end{array}$ | $1 \cdot 20$ | $25324{ }^{\circ} \mathrm{O}$ | I-12 | $25429 \cdot 0$ | 04 | $2 \begin{array}{lllllll}2 & 55 & 29 \cdot 4\end{array}$ | 97 |
| 47 | $\begin{array}{llll}2 & 45 & 26 \cdot 0\end{array}$ | 1.40 | $2{ }_{2}{ }^{2} 647 \cdot 2$ | I•3I | $\begin{array}{llll}2 & 48 & 3 \cdot 3\end{array}$ | 2 | $2 \begin{array}{llllll}2 & 49 & 14.2\end{array}$ | I•14 | $\begin{array}{lllll}2 & 50 & 20 \cdot 3\end{array}$ | .06 | $25121 \cdot 5$ | 98 |
| 48 | 24111.5 | I.43 | 24234.4 | I.34 | 243 5I•9 | 1.25 | $2 \begin{array}{lll}2 & 45 & 4.2\end{array}$ | I•I | $246 \mathrm{II} \cdot 3$ | I.08 | 24713.4 | -99 |
|  | $2 \begin{array}{llll}2 & 36 & 56 \cdot 3\end{array}$ | +1.46 | $23^{2} 82 \mathrm{I} \cdot \mathrm{I}$ | +1.37 | $23940 \cdot 2$ | +1.27 | 24053.8 | +I.I | $42 \quad 2 \cdot 1$ | + I.09 | 243 | +I.OI |
| 50 | $\begin{array}{llll}2 & 32 & 40 \cdot 5\end{array}$ | 1.49 | $\begin{array}{llll}2 & 34 & 7 \cdot 2\end{array}$ | 1.39 | $235127 \cdot 9$ | I. 30 | 23643.0 | 2 | $23752 \cdot 5$ | I•II | $238 \quad 56 \cdot 6$ | I. 02 |
| 51 | $\begin{array}{llll}2 & 28 & 23.9\end{array}$ | I. 53 | $\begin{array}{llll}2 & 29 & 52 \cdot 6\end{array}$ | I. 43 | $23115 \cdot 2$ | I 33 | 23231.8 | I.23 | $23342 \cdot 7$ | I-13 | $23447 \cdot 9$ | I. 04 |
| 52 | $\begin{array}{lll}2 & 24 & 6 \cdot 5\end{array}$ | 1.57 | $\begin{array}{lllll}2 & 25 & 37.4\end{array}$ | I.46 | $\begin{array}{llll}2 & 27 & 1.9\end{array}$ | 1.36 | $228 \quad 20 \cdot 2$ | 1.25 | $22932 \cdot 5$ | I•I6 | $23038 \cdot 9$ | I.06 |
| 53 | $21948 \cdot 2$ | 6 | 22121.5 | 1.50 | $22248 \cdot 1$ | 1.39 | 2248 | I 2 | $225 \quad 21 \cdot 9$ | I•I | $226 \quad 29 \cdot 6$ | I.08 |
| 54 | $2 \begin{array}{llll}2 & 15 & 28.9\end{array}$ | +1.65 | 2 I 74.8 | + I. 54 | $2 \begin{array}{llllllll} & 18 & 33.5\end{array}$ | +1.42 | 2 I9 55.6 | +1.3I | 22110.9 | + 1.20 | $22220 \cdot 0$ | +I•10 |
| 55 | 2 II 8.6 | I•70 | 2 I2 47.2 | I. 58 | 21418.3 | 1.46 | 21542.4 | $1 \cdot 34$ | 2 I6 59.6 | $1 \cdot 23$ | $21810 \cdot 0$ | I•I2 |
| 56 | $\begin{array}{llll}2 & 6 & 47 \cdot 1 \\ 2 & 2 & 24.3\end{array}$ | 1.74 | $\begin{array}{llll}2 & 8 & 28 \cdot 6\end{array}$ | I. 62 | $2 \begin{array}{lrr}2 & 10 & 2 \cdot 1 \\ 2\end{array}$ | 1.50 | 2 II 28.6 | I-38 | $\begin{array}{llll}2 & 12 & 47 \cdot 6\end{array}$ | I. 26 | $2 \begin{array}{llll}2 & 13 & 59.7\end{array}$ | I-14 |
| 57 | $\begin{array}{lrr}2 & 2 & 24.3\end{array}$ | 1.79 | 2 4 $9 \cdot 0$ <br>  5  <br> 8   | 1.67 | $2 \quad 5 \quad 45 \cdot 2$ | I. 54 | 2714.1 | 1.42 | $2835 \cdot 2$ | 1-29 | 2949.0 | I•I7 |
| 58 | 15800 | I.84 | I 59 48.1 | $1 \cdot 73$ | I 27.3 | I. 59 | $2 \quad 2 \quad 58 \cdot 9$ | 1.46 | $422 \cdot 2$ | 1.32 | $2 \quad 5 \quad 37.8$ | I 20 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.


## LATITUDE $13^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | $\begin{aligned} & \text { Decl } \\ & \text { Var. } \end{aligned}$ | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | $\left\lvert\, \begin{array}{rr} \text { H. M. } & \text { S. } \\ 6 & 53 \cdot 7 \end{array}\right.$ | + ${ }^{\text {S }}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 6 & 29 \cdot 9 \end{array}\right\|$ | + $\cdot 94$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 26 \cdot 2 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} . \\ +\quad \cdot 94 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 8 & 22 \cdot 9 \end{array}\right\|$ | $\left\|\begin{array}{c} \mathrm{s} . \\ +\quad 95 \end{array}\right\|$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 9 & \text { r9.9 } \end{array}\right\|$ | + ${ }^{\text {S }}$ | $\left\lvert\, \begin{array}{cc} \text { H. м. } & \text { s. } \\ 6 & \text { ro } \\ \text { I } \end{array}\right.$ |  |
| 10 | $\begin{array}{llll}5 & 24 & 20.9\end{array}$ | . 87 |  | - 86 | $526 \quad 40$ | . 85 | $52654 \cdot 7$ | . 84 | $\begin{array}{llll}5 & 27 & 45 \cdot 0\end{array}$ | + 95 | $5 \begin{array}{ll}5 & 28 \\ 34 \cdot 6\end{array}$ |  |
| 12 | $\begin{array}{llll}5 & 16 & 7 \cdot 3\end{array}$ | . 86 |  | . 85 | $\begin{array}{llllllll}5 & 17 & 48.9\end{array}$ | . 83 | $\begin{array}{llll}5 & 18 & 38 \cdot 6\end{array}$ | . 82 | $5 \begin{array}{llll}5 & 19 & 27 \cdot 7\end{array}$ | .8I | 52016.0 | 80 |
| 14 | $\begin{array}{llll}5 & 7 & 53 \cdot 8\end{array}$ | . 85 | 58844.4 |  | $5{ }_{5}^{5} 934 \cdot \mathrm{I}$ | . 82 | 51022.9 | .81 | 5 II 10.9 | 79 | 5 II 57.9 | 8 |
| 16 | $45940 \cdot 6$ |  | 5 - $30 \cdot 6$ | 82 | 5 I 1 19.6 | -81 | $\begin{array}{llll}5 & 2 & 7 \cdot 5\end{array}$ | 79 | $\begin{array}{llll}5 & 2 & 54.5\end{array}$ | 7 | $5 \quad 3 \quad 40 \cdot 4$ | 6 |
| 18 | 45127 | + | $45217 \cdot 1$ | $+$ | 453 | + 79 | $5352 \cdot 6$ | + 77 | $45438 \cdot 5$ | + 75 | 45523.2 |  |
| 20 | 44314.7 | . 83 | 4443.8 | 8 I | 444515 | $\cdot 78$ | $44537 \cdot 9$ | $\cdot 76$ | $44633 \cdot 0$ | $\cdot 74$ | 4476.6 | 71 |
| 22 | $\begin{array}{lll}4 & 35 & 1.8\end{array}$ | . 83 | $435 \quad 50 \cdot 7$ | -80 | $43637 \cdot 9$ | $\cdot 77$ | 43723.6 | $\cdot 75$ |  | 72 | $43850 \cdot 3$ | 70 |
| 24 | $42649 \cdot 1$ | .82 | $42737 \cdot 7$ | $\cdot 79$ | $42824 \cdot 5$ | $\cdot 76$ | $4 \begin{array}{llll}4 & 29 & 9 \cdot 5\end{array}$ | $\cdot 73$ | $\begin{array}{llll}4 & 29 & 52.8 \\ 4 & 25 & 38.2\end{array}$ | $\cdot 71$ | 4 30 <br> 4  <br> 4 32.4 <br> 18.8  | 68 |
| 26 | 41836.5 |  | $4 \begin{array}{ll}19 & 24.8\end{array}$ | $\cdot 79$ | 420 II 2 | $\cdot 76$ | $42055 \cdot 7$ | 72 | 42138.2 | -69 | 42218.8 |  |
| 28 | 4 10 23.8 | + 88 | II | + 78 | 4 II | + 75 | $4{ }^{12} 42{ }^{2 \cdot 1}$ | + 71 | 41323.9 | + . 68 | $4 \begin{array}{llll}4 & 3 & 3.6\end{array}$ |  |
| 30 | $4 \begin{array}{ccc}4 & 1112\end{array}$ | . 82 | $4 \begin{array}{llllll}4 & 2 & 59.4\end{array}$ | $\cdot 78$ | $4 \begin{array}{lllllll}4 & 3 & 45 \cdot 2\end{array}$ | $\cdot 74$ | $\begin{array}{lll}4 & 4 & 28 \cdot 7\end{array}$ | $\cdot 70$ | 45 | $\cdot 67$ | $4548 \cdot 7$ | . 63 |
| 31 | 58 | -82 | $35853 \cdot \mathrm{I}$ | $\cdot 78$ | $\begin{array}{lllllllllll}3 & 59 & 38\end{array}$ | 74 | 4 0 $22 \cdot 1$ | 70 | $\begin{array}{lrrr}4 & 1 & 2.9 \\ 3 & 56 & 56.9\end{array}$ | -66 | $\begin{array}{llll}4 & 1 & 41 \\ 3\end{array}$ | . 62 |
| 32 | $5358 \cdot 5$ | -82 | $3{ }^{3} 5446 \cdot 7$ | $\cdot 78$ | $355132 \cdot 4$ | 74 | $3{ }^{3} 5615 \cdot 5$ | -70 | 3 56 $56 \cdot \mathrm{I}$ <br> 3 52  | $.65$ | 3 57 $34 \cdot \mathrm{I}$ <br>  53 $26 \cdot 9$ | -61 |
| 33 | $4952 \cdot 2$ | . 83 | $35040 \cdot 4$ | 78 | $35126 \cdot 0$ | 74 | 3529.0 |  | $35249 \cdot 3$ |  | 353 |  |
| 34 |  | + 83 | 3 46 $34 \cdot \mathrm{I}$ | + 78 | 34779.7 | + 74 | 34882.4 | + 69 | $3 \begin{array}{llll}3 & 48 & 42 \cdot 5\end{array}$ | + 64 | 349819.7 | $+.60$ |
| 35 | $4 \mathrm{I} 39 \cdot 4$ | . 83 | $3{ }^{3} 4227 \cdot 8$ | $\cdot 78$ |  | $\cdot 73$ | $34356 \cdot 0$ | . 69 | $34435 \cdot 7$ | . 64 | $34512 \cdot 6$ |  |
| 36 | 3733.0 | . 83 | $\begin{array}{llll}3 & 38 & 21.5\end{array}$ | -7 | 33970 | $\cdot 73$ | $33949 \cdot 5$ | . 68 | $34029 \cdot 1$ | . 63 | 341 | - 58 |
| 37 | $3326 \cdot 6$ | -84 | $\begin{array}{llllllll}3 & 34 & 15.2\end{array}$ | $\cdot 78$ | $\begin{array}{lll}3 & 35 & 0 \cdot 7\end{array}$ | -73 | $33543 \cdot \mathrm{I}$ |  | $\begin{array}{llll}3 & 36 & 22 \cdot 4\end{array}$ |  | 33658.6 | 58 |
| 38 | 29 20.0 |  | 30 | -79 | $33054 \cdot 4$ |  | $33136 \cdot 7$ |  | 332 |  | $33251 \cdot 7$ | 57 |
| 39 | 25 | $\begin{array}{r}+85 \\ \hline 85\end{array}$ | 326 | + 79 | $3 \begin{array}{lll}3 & 26 & 48 \cdot I \\ 3\end{array}$ | $\begin{array}{r} \\ +\quad .73 \\ \hline\end{array}$ | $\begin{array}{llll}3 & 27 & 30 \cdot 3 \\ 3 & 23 & 34\end{array}$ | . 68 | $\begin{array}{llll}3 & 28 & 9 \cdot 3 \\ 3 & 24 & 2 \cdot 8 \\ \end{array}$ | + .62 | $\begin{array}{lllllllll}3 & 28 & 44 \cdot 8 \\ 3 & 24 & 38 \cdot 5\end{array}$ | + 56 |
| 40 | $\begin{array}{lll}3 & 21 & 6 \cdot 7 \\ 3 & 17 & 0.0\end{array}$ |  | $\begin{array}{llll}3 & 21 & 56 \cdot 0 \\ 3 & 17 & 49 \cdot 5\end{array}$ | $\begin{array}{r} 79 \\ .79 \end{array}$ | 3 22 $41 \cdot 8$ <br> 3 18 $35 \cdot 4$ | $\begin{aligned} & 73 \\ & .73 \end{aligned}$ | $\begin{array}{lll}3 & 23 & 24 \cdot 0 \\ 3 & 19 & 17 \cdot 6\end{array}$ | -67 | $\begin{array}{ccc}3 & 24 & 2 \cdot \\ 3 & 19 & 56 \cdot\end{array}$ | $\begin{aligned} & .62 \\ & .6 \mathrm{I} \end{aligned}$ | $\begin{array}{llll}3 & 24 & 38 \cdot 1 \\ 3 & 20 & 31 \cdot 3 \\ & \end{array}$ |  |
| 4 | $\begin{array}{lllll}3 & 12 & 53.2\end{array}$ | . 86 | $\begin{array}{llll}3 & 13 & 43 \cdot 1\end{array}$ | . 80 | 31414  | $\cdot 73$ | 31511.3 | -67 | $31549 \cdot 8$ | .6x | $\begin{array}{llllllllll}3 & 164 \cdot 5\end{array}$ | -55 |
| 43 | $\begin{array}{llll}3 & 8 & 46 \cdot 4\end{array}$ | . 87 | $\begin{array}{llll}3 & 9 & 36 \cdot 5\end{array}$ | .80 | 3 10 22.7 | $\cdot 74$ | 3 II $5 \cdot 0$ | . 67 | 3 II 43.4 |  | $\begin{array}{llllll}3 & 12 & 17 & 9\end{array}$ | -54 |
| 44 | 39.4 | + 88 | $\begin{array}{llll}3 & 5 & 29.9\end{array}$ | $+.8 \mathrm{r}$ | $3{ }^{3}$ | + 74 | $\begin{array}{llll}3 & 6 & 58 \cdot 7\end{array}$ | $+67$ | $3{ }^{3} 783 \cdot 0$ | + 60 | $3{ }^{3} 811 \cdot 3$ | $\cdot 54$ |
| 45 | 3 0 32.4 <br> 2 56  | . 88 | $\begin{array}{llll}3 & 1 & 23.3\end{array}$ | .81 | 3 2 $10 \cdot 0$ <br>  58  | $\cdot 74$ | 3 2 $52 \cdot 4$ <br>  58  | 67 | 3 3 3 $30 \cdot 6$ <br> 2 5   | . 60 |  | 53 |
| 46 | $\begin{array}{lllll}2 & 56 & 25.3\end{array}$ | $\cdot 89$ | $2 \begin{array}{llll}57 & 16 \cdot 6\end{array}$ | -82 | $2 \begin{array}{lll}28 & 3 \cdot 5\end{array}$ | $\cdot 75$ | 228 $46 \cdot \mathrm{I}$ | . 67 | $25924 \cdot 3$ | -60 | $25958 \cdot \mathrm{I}$ | . 53 |
| 4 | $25218 \cdot 0$ | -90 | $2 \begin{array}{lll}23 & 9 \cdot 8\end{array}$ | -83 | $25357 \cdot 1$ |  | $2 \begin{array}{llll}24 & 39 \cdot 8\end{array}$ | . 67 | $25517 \cdot 9$ |  | $25551 \cdot 6$ | 2 |
| 48 | $24810 \cdot 6$ | '91 | $249 \quad 2 \cdot 9$ | $\cdot 83$ | $24950 \cdot 5$ |  | $25033 \cdot 4$ |  | 251 |  | $25145 \cdot \mathrm{I}$ |  |
| 49 | $\begin{array}{lllr}2 & 44 & 3 \cdot 1 \\ 2 & \text { I }\end{array}$ | + 92 | $24456 \cdot 0$ | + 88 | 24544.0 | + 76 | $24627 \cdot 1$ |  | $2 \begin{array}{lll}2 & 47 & 5.3 \\ 2 & 4 & 5\end{array}$ | + 60 | $24738 \cdot 6$ | + 52 |
| 50 | 2 39 55.4 <br> 2   | $\cdot 94$ | $24048 \cdot 9$ |  | 24137.4 |  |  |  | 2 42 $58 \cdot 9$ <br> 2 3  |  | 2 43 $32 \cdot 2$ <br> 2   | 51 |
| 51 |  | $\cdot 95$ | $23641 \cdot 8$ | . 86 | $\begin{array}{llllll}2 & 37 & 30 \cdot 7\end{array}$ | $\cdot 77$ | 2 38 14.3  <br> 2 3 7  | . 68 | $\begin{array}{llll}2 & 38 \\ 2 & 52 \cdot 6\end{array}$ |  | $\begin{array}{lllll}2 & 39 & 25 \cdot 8 \\ 2 & 35 & 19\end{array}$ | .51 |
| 52 | 2 3 I $39 \cdot 5$ <br> 2 27  <br> 15   | -96 | $23234 \cdot 5$ | .87 .88 | $\begin{array}{lll} 2 & 33 & 23.9 \end{array}$ | $78$ | $\begin{array}{lll}2 & 34 & 7 \cdot 8 \\ 2 & 30 & 1.4\end{array}$ | $\begin{array}{r}.69 \\ \hline 69\end{array}$ | 2 2 $34 \begin{array}{ll}46 \cdot 3 \\ 2 & 30 \cdot 0\end{array}$ |  | $\begin{array}{llll}2 & 35 & 19.4 \\ 2 & 31\end{array}$ | 5 I |
| 53 | $2273 \mathrm{r} \cdot 2$ | $\cdot 98$ | $22827 \cdot 0$ |  | 229 17.0 | $\cdot 79$ | 23014 | -69 | $230$ |  | 23113. | -50 |
| 54 | $\begin{array}{lllll}2 & 23 & 22.8\end{array}$ | 99 | $2 \begin{array}{lllllll}24 & 24 & 19.4\end{array}$ | + 89 | 225 | + 79 | $22554 \cdot 8$ | + 70 | $22633 \cdot 7$ |  | 22767 | + 50 |
| 55 | 1914.0 | 1 | $22011 \cdot 7$ | 91 | $2 \begin{array}{lll}2 & 21 & 3.0 \\ 2 & 16\end{array}$ | . 80 | $22148 \cdot 2$ | - | $22227 \cdot 3$ |  | 2 23 0.4 | . 50 |
| 56 | 15 5.0 | $1 \cdot 03$ | $\begin{array}{llll}2 & 16 & 3 \cdot 7\end{array}$ | 92 |  | . 82 | $21741 \cdot 6$ | $\cdot 71$ | $21821 \cdot 0$ | . 60 | 21854.0 | 50 |
| 58 | $\begin{array}{rrrr}2 & 10 & 55 \cdot 7 \\ 2 & 6 & 46 \cdot 1\end{array}$ | 1.05 1.08 | $\begin{array}{lllll}2 & \text { II } & 55 \cdot 5 \\ 2 & 7 & 47 \cdot 1\end{array}$ | . 94 | $\begin{array}{crrrr}2 & 12 & 48 \cdot 5 \\ 2 & 8 & 4 \mathrm{I} \cdot 0\end{array}$ | .83 .84 | $\begin{array}{rrrrr}2 & 13 & 34.9 \\ 2 & 0 & 28.0\end{array}$ | $\cdot 72$ | $\begin{array}{cccc}2 & 18 & 14.6 \\ 2 & 10 & 8.7\end{array}$ | . 61 | $2 \begin{array}{lllll}2 & 14 & 47 \cdot 7 \\ 2 & 10 & 4\end{array}$ | 50 |
| 58 | $646 \cdot 1$ |  | $2747 \cdot 1$ |  | 841.0 |  | 9 | -73 | 10 |  | 2104 I | - 50 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ}$ |  | L. 10 | - A. | L. 11 | ${ }^{\circ}$ A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | + 44 | $-4 \cdot 13$ | +.52 | $-4 \cdot 14$ | +.59 | $-4.15$ | $+.67$ | $-4 \cdot 16$ | + 74 | $-4 \cdot 17$ | +.82 | $-4 \cdot 19$ |
| 4 | -38 | $4 \cdot 12$ | -45 | $4 \cdot 13$ | $\cdot 52$ | $4 \cdot 14$ | -60 | $4 \cdot 15$ | -68 | 4.16 | $\cdot 75$ | 4.17 |
| 8 | -31 | $4 \cdot 12$ | -39 | $4 \cdot 12$ | -46 | 4.13 | - 54 | 4.14 | -61 | $4 \cdot 15$ | -69 | $4 \cdot 16$ |
| 12 | - 25 | $4 \cdot 11$ | $\cdot 32$ | $4 \cdot 12$ | -40 | $4 \cdot 12$ | $\cdot 47$ | $4 \cdot 13$ | $\cdot 55$ | 4-14 | -63 | $4 \cdot 15$ |
| 16 | -18 | $4 \cdot 11$ | $\cdot 26$ | 4.1I | $\cdot 34$ | $4 \cdot 12$ | $\cdot 41$ | $4 \cdot 12$ | -49 | $4 \cdot 13$ | $\cdot 57$ | $4 \cdot 14$ |
| 20 | + 12 | $4 \cdot 11$ | $+\cdot 20$ | 4.II | + 28 | 4.II | + 36 | $4 \cdot 12$ | + 44 | $4 \cdot 13$ | + . 51 | $4 \cdot 14$ |
| 22 | -09 | $4 \cdot 11$ | $\cdot 17$ | $4 \cdot 11$ | $\cdot 25$ | 4.II | -33 | $4 \cdot 12$ | -41 | $4 \cdot 13$ | -49 | $4 \cdot 14$ |
| 24 | -06 | $4 \cdot 10$ | -14 | $4 \cdot 11$ | - 22 | 4.II | -30 | 4.11 | $\cdot 38$ | $4 \cdot 12$ | $\cdot 46$ | $4 \cdot 13$ |
| 26 | -03 | $4 \cdot 10$ | -II | $4 \cdot 11$ | -19 | 4.1I | $\cdot 27$ | 4•II | $\cdot 35$ | $4 \cdot 12$ | -44 | $4 \cdot 13$ |
| 28 | -00 | 4.10 | . 08 | $4 \cdot 10$ | -16 | 4.II | -24 | 4•II | $\cdot 32$ | $4 \cdot 12$ | -41 | 4.12 |
| 30 | - 04 | 4.10 | +.05 | $4 \cdot 10$ | + .13 | 4.11 | + $\cdot 22$ | 4.11 | + 30 | $4 \cdot 12$ | + 38 | 4-12 |
| 32 | -07 | $4 \cdot 10$ | + - OI | $4 \cdot 10$ | -10 | $4 \cdot 11$ | -18 | $4 \cdot 11$ | $\cdot 27$ | $4 \cdot 11$ | $\cdot 36$ | $4 \cdot 12$ |
| 34 | -11 | $4 \cdot 11$ | - 02 | $4 \cdot 10$ | -07 | $4 \cdot 11$ | -16 | 4.11 | - 24 | $4 \cdot 11$ | -33 | $4 \cdot 12$ |
| 36 | -14 | $4 \cdot 11$ | $\cdot 05$ | $4 \cdot 10$ | . 03 | $4 \cdot 10$ | -13 | 4.II | -21 | $4 \cdot 11$ | -30 | $4 \cdot 12$ |
| 38 | -18 | $4 \cdot 11$ | -09 | $4 \cdot 11$ | + . OI | 4.10 | -10 | 4.11 | -19 | 4.II | - 28 | 4.II |
| 40 | $\cdot 22$ | 4.II | -12 | 4.II | - 03 | 4.10 | +.06 | 4.10 | + 16 | $4 \cdot 11$ | +.25 | 4.II |
| 42 | $\cdot 26$ | $4 \cdot 11$ | -16 | 4.II | . 06 | $4 \cdot 10$ | - 03 | $4 \cdot 10$ | -13 | 4-11 | - 23 | 4-11 |
| 44 | $\cdot 30$ | $4 \cdot 12$ | -20 | $4 \cdot 11$ | -10 | $4 \cdot 11$ | -00 | $4 \cdot 10$ | -10. | 4.11 | - 20 | 4.II |
| 46 | $\cdot 35$ | $4 \cdot 12$ | -24 | 4.II | -14 | 4•II | -.03 | $4 \cdot 10$ | $\cdot 07$ | $4 \cdot 11$ | -18 | $4 \cdot 11$ |
| 48 | -40 | $4 \cdot 12$ | -29 | $4 \cdot 11$ | $\cdot 18$ | 4.II | $\cdot 07$ | 4.II | -04 | $4 \cdot 10$ | $\cdot 15$ | 4•II |
| 50 | - 45 | 4.13 | - 33 | $4 \cdot 12$ | - . 22 | $4 \cdot 11$ | -10 | 4.II | + .01 | $4 \cdot 10$ | + 12 | 4.II |
| 52 | -50 | 4.14 | $\cdot 38$ | $4 \cdot 12$ | $\cdot 26$ | 4.II | -14 | 4.II | - 02 | $4 \cdot 10$ | $\cdot 09$ | 4-II |
| 54 | - 56 | 4.14 | $\cdot 43$ | 4.13 | -31 | 4.12 | -18 | 4.II | . 06 | $4 \cdot 11$ | -06 | $4 \cdot 11$ |
| 56 58 | -62 | $4 \cdot 15$ | $\cdot 49$ . | $4 \cdot 13$ | $\cdot 36$ | $4 \cdot 12$ | $\cdot 23$ | 4.11 | -10 | $4 \cdot 11$ | .03 | $4 \cdot 10$ |
| 58 | $\cdot 70$ | 4.16 | $\cdot 55$ | 4.14 | $\cdot 41$ | $4 \cdot 12$ | $\cdot 27$ | $4 \cdot 11$ | -14 | $4 \cdot 11$ | $\cdot 00$ | $4 \cdot 10$ |

56 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. latitude $13^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { II } & \text { I5. } \end{array}\right.$ | + S .97 | $\begin{array}{ccc} \text { If. M. } & \text { S. } \\ 6 & \text { I2 } & 13 \cdot 3 \end{array}$ | S. <br> $+\quad .97$ | $\begin{array}{lll} \text { H. M. S. } \\ 6 & \text { I3 } \\ \text { I } \end{array}$ | + ${ }^{\text {S }}$. 98 | $\begin{array}{lcc} \text { H. M. S. } \\ 6 \text { I4 II I } \end{array}$ | s. $+\quad .99$ | $\begin{aligned} & \text { H. M. S. } \\ & 6 \text { I } 5 \text { II } \end{aligned}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 00 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & \text { I } 6 & \text { II. } 4 \end{array}\right\|$ | S. ${ }^{\text {OI }}$ |
| 10 | 52924.0 | . 82 | $5 \quad 3012.8$ | . 81 | $\begin{array}{llll}5 & 31 & 1 \cdot 2\end{array}$ | -80 | 5 3I $49 \cdot 3$ | . 80 | $\begin{array}{lllll}5 & 32 & 37 \cdot 0\end{array}$ | $\cdot 79$ | $533 \quad 24 \cdot 4$ | $\cdot 79$ |
| 12 | $1 \begin{array}{lll}5 & 21 & 3.9\end{array}$ | -7 | 5 2I $51 \cdot 0$ | $\cdot 78$ | $\begin{array}{llll}5 & 22 & 37 \cdot 6\end{array}$ | $\cdot 77$ | $\begin{array}{llllllllllllll}5 & 23 & 23 \cdot 6\end{array}$ | $\cdot 76$ | $\begin{array}{lll}5 & 24 & 9 \cdot 1\end{array}$ | $\cdot 75$ | $5 \begin{array}{llll}5 & 24 & 54 \cdot 1\end{array}$ | $\cdot 74$ |
| 14 | $\begin{array}{llll}5 & 12 & 44 \cdot 3\end{array}$ | -76 | $\begin{array}{llll}5 & 13 & 29.8\end{array}$ | $\cdot 75$ |  | $\cdot 74$ | 5 14 $58 \cdot 7$ | -73 | $\begin{array}{lllllllllll}5 & 15 & 42 \cdot 0\end{array}$ | -72 | $\begin{array}{lllll}5 & 16 & 24 \cdot 7\end{array}$ | -70 |
| 16 | $\begin{array}{llll}5 & 4 & 25.3\end{array}$ | $\cdot 74$ | $\begin{array}{lll}5 & 5 & 9 \cdot 3\end{array}$ | $\cdot 72$ | $5 \quad 5 \quad 52 \cdot 3$ | $\cdot 71$ | $\begin{array}{llll}5 & 6 & 34 \cdot 5\end{array}$ | -69 | $5 \quad 7157$ | -68 | $5756 \cdot 1$ | . 66 |
| 18 | $4 \begin{array}{lll}4 & 56 & 6 \cdot 9\end{array}$ | $\cdot 72$ | $45649 \cdot 3$ | + 70 | $45730 \cdot 7$ | + 68 | $458 \quad 10 \cdot 9$ | + .66 | $45850 \cdot 1$ | $+\cdot 64$ | $45928 \cdot 2$ | . 62 |
| 20 | $44748 \cdot 9$ | - 69 | $\begin{array}{llll}4 & 48 & 29 \cdot 9\end{array}$ | -67 | $449 \quad 9 \cdot 6$ | -65 | 449 48.0 | -63 | $45025 \cdot 1$ | -61 | 45 I I'O | -59 |
| 22 | $43931 \cdot 3$ | - 67 | 440 II O | -65 | $44049 \cdot 0$ | - 62 | $44125 \cdot 6$ | -60 | $\begin{array}{lll}4 & 42 & 0.8\end{array}$ | . 57 | $44234 \cdot 5$ | -55 |
| 24 | 43114.2 | - 65 | 43152.4 | -62 | $432 \quad 28 \cdot 9$ | -59 | $\begin{array}{llll}4 & 33 & 3 \cdot 8\end{array}$ | $\cdot 57$ | $433 \quad 37 \cdot 0$ | -54 | $\begin{array}{llll}4 & 34 & 8 \cdot 5\end{array}$ | -51 |
| 26 | $422 \quad 57 \cdot 6$ | . 63 | 42334.4 | -60 | $\begin{array}{lll}4 & 24 & 9 \cdot 4\end{array}$ | $\cdot 57$ | $4 \quad 24 \quad 42 \cdot 5$ | -53 | 42513.7 | -50 | $42543 \cdot 1$ | $\cdot 47$ |
| 28 | 414 41.2 | -61 | 4 I5 16.8 | + .67 | $41550 \cdot 2$ | + .54 | 4 I6 21.6 | + 50 | 4 16 50.9 | + $\cdot 47$ | $\begin{array}{lllllll}4 & 17 & 18.2\end{array}$ | + $\cdot 44$ |
| 30 | $4 \quad 6 \quad 25 \cdot 3$ | - 59 | $4 \quad 6 \quad 59 \cdot 5$ | $\cdot 55$ | $4731 \cdot 5$ | -5I | $\begin{array}{llll}4 & 8 & \mathrm{I} \cdot 2\end{array}$ | $\cdot 48$ | $4 \begin{array}{lll}4 & 8 & 28.6\end{array}$ | -44 | $\begin{array}{llll}4 & 8 & 53.8\end{array}$ | -40 |
| 31 | $\begin{array}{rrrr}4 & 2 & 17.4\end{array}$ | - 58 | $4 \quad 2 \quad 51 \cdot 0$ | -54 | $\begin{array}{llll}4 & 3 & 22 \cdot 3\end{array}$ | -50 | $\begin{array}{llll}4 & 3 & 5 I \cdot 2\end{array}$ | -46 | $\begin{array}{llll}4 & 4 & 17.6\end{array}$ | -42 | $\begin{array}{lllll}4 & 4 & 41 \cdot 7\end{array}$ | -38 |
| 32 | $\begin{array}{llll}3 & 58 & 9 \cdot 6\end{array}$ | -57 | $\begin{array}{llllllllllllll}3 & 58 & 42 \cdot 6\end{array}$ | -53 | 35913.2 | -49 | $3594 \mathrm{I} \cdot 2$ | -44 | $\begin{array}{lll}4 & 0 & 6 \cdot 7\end{array}$ | -40 | $\begin{array}{llll}4 & 0 & 29.7\end{array}$ | $\cdot 36$ |
| 33 | $\begin{array}{llll}3 & 54 & 1 & 9\end{array}$ | -56 |  | -52 | 3554.1 | $\cdot 47$ | 355 3I 3 | $\cdot 43$ | $355 \quad 55 \cdot 9$ | -39 | $3 \begin{array}{lllllll}3 & 56 & 17 & 9\end{array}$ | $\cdot 34$ |
| 34 | 34954 | -55 | $35026 \cdot 1$ | + .5I | $35055 \cdot 2$ | + 46 | $35 \mathrm{I} 2 \mathrm{I} \cdot 6$ | + 42 | 3 5I 45.2 | + $\cdot 37$ | $3526 \cdot 1$ | + 32 |
| 35 | $3 \begin{array}{llll}3 & 45 & 46 \cdot 7\end{array}$ | -54 | 346 18.0 | . 50 | $34646 \cdot 3$ | -45 | 347 II.9 | -40 | $3{ }^{3} 47 \begin{array}{lll} & 34\end{array}$ | -35 | $3 \begin{array}{llll}3 & 47 & 54.4\end{array}$ | -31 |
| 3 | $\begin{array}{llll}3 & 41 & 39.2\end{array}$ | $\cdot 53$ | $\begin{array}{llll}3 & 42 & 9 \cdot 9\end{array}$ | -48 |  | -44 | $\begin{array}{llll}3 & 43 & 2 \cdot 3\end{array}$ | -39 | $\begin{array}{llll}3 & 43 & 24 \cdot 1\end{array}$ | -34 | $\begin{array}{lllllllllll}3 & 43\end{array}$ | - 29 |
| 37 | 3 37 $3 \mathrm{I} \cdot 8$ | -53 | $\begin{array}{llll}3 & 38 & 1.8\end{array}$ | -47 | $\begin{array}{lllll}3 & 38 & 28 \cdot 9\end{array}$ | -42 | $\begin{array}{lllll}3 & 38 & 52 \cdot 8\end{array}$ | -37 | $\begin{array}{llll}3 & 39 & 13 \cdot 6\end{array}$ | -32 | $\begin{array}{llll}3 & 39 & 31 \cdot 3\end{array}$ | -27 |
| 38 | $\begin{array}{llll}3 & 33 & 24.4\end{array}$ | -52 | $\begin{array}{llll}3 & 33 & 54 \cdot 0\end{array}$ | -46 | $\begin{array}{lllll}3 & 34 & 20 \cdot 2\end{array}$ | -41 | $\begin{array}{lllll}3 & 34 & 43.4\end{array}$ | $\cdot 36$ | $\begin{array}{llll}3 & 35 & 3 \cdot 2\end{array}$ | -30 | $\begin{array}{lllllll}3 & 35 & 19.8\end{array}$ | $\cdot 25$ |
| 39 | $32917 \cdot 1$ | -51 | $32946 \cdot 1$ | + 45 | 330 | -40 | 33034.0 | + 34 | $33052 \cdot 9$ | + 29 | $3318 \cdot 5$ | + 23 |
| 40 | $325 \quad 9.9$ | . 50 | $\begin{array}{llll}3 & 25 & 38 \cdot 3\end{array}$ | . 44 | $\begin{array}{llll}3 & 26 & 3 \cdot 2\end{array}$ | -39 | $\begin{array}{lllll}3 & 26 & 24 \cdot 7\end{array}$ | - 33 | $\begin{array}{llll}3 & 26 & 42 \cdot 7\end{array}$ | -27 | $\begin{array}{lllll}3 & 26 & 57 \cdot 2\end{array}$ | -2I |
| 41 | $\begin{array}{llll}3 & 21 & 2 \cdot 7\end{array}$ | -49 | $32130 \cdot 6$ | -43 |  | -37 | $\begin{array}{lllll}3 & 22 & 15 \cdot 5\end{array}$ | -31 | $\begin{array}{llll}3 & 22 & 32 \cdot 5\end{array}$ | -25 | $\begin{array}{lllll}3 & 22 & 45.9\end{array}$ | -19 |
| 42 | 3 I6 $55 \cdot 6$ | -49 | $\begin{array}{lllll}3 & 17 & 22.9\end{array}$ | -4 | 3 I7 $46 \cdot 5$ | $\cdot 36$ | $\begin{array}{llrr}3 & 18 & 6 \cdot 3\end{array}$ | $\cdot 30$ | $\begin{array}{llll}3 & 18 & 22.4\end{array}$ | $\cdot 23$ | $\begin{array}{llll}3 & 18 & 34 \cdot 6\end{array}$ | -17 |
| 43 | $\begin{array}{llllllllllll}3 & 12 & 48 \cdot 6\end{array}$ | -48 | $\begin{array}{lllll}3 & 13 & 15 \cdot 3\end{array}$ | 4 | $\begin{array}{llll}3 & 13 & 38 \cdot 3\end{array}$ | -35 | $\begin{array}{llll}3 & 13 & 57 \cdot 3\end{array}$ | -28 | $\begin{array}{llll}3 & 14 & 12.4\end{array}$ | $\cdot 22$ | 31483.6 | -15 |
| 44 | $3 \quad 841 \cdot 6$ | + 47 | $\begin{array}{llll}3 & 9 & 7 \cdot 8 \\ 3 & 5 & \end{array}$ | + 40 | $3{ }^{3} 9630 \cdot 1$ | + 34 | $\begin{array}{lllll}3 & 9 & 48 \cdot 3\end{array}$ | $+\cdot 27$ | 3 IO 2.4 | + 20 | 3 IO 12.5 | + 13 |
| 45 | $\begin{array}{llll}3 & 4 & 34 \cdot 6\end{array}$ | . 46 | $\begin{array}{lll}3 & 5 & 0.3\end{array}$ | - 39 | $3{ }^{3}$ | - 32 | $\begin{array}{llll}3 & 5 & 39 \cdot 3\end{array}$ | $\cdot 25$ | $\begin{array}{llll}3 & 5 & 52 \cdot 5\end{array}$ | -18 | $\begin{array}{llr}3 & 6 & 1.4\end{array}$ | - II |
| 4 | $3027 \cdot 7$ | -46 | $\begin{array}{llll}3 & 0 & 52 \cdot 9\end{array}$ | $\cdot 38$ | $\begin{array}{llll}3 & 1 & 1 & 3.8\end{array}$ | -31 | $\begin{array}{llll}3 & 1 & 30 \cdot 4\end{array}$ | - 24 | $\begin{array}{llll}3 & 1 & 42 \cdot 6\end{array}$ | -17 | $\begin{array}{llll}3 & 1 & 50 \cdot 4\end{array}$ | -09 |
| 47 | $25620 \cdot 8$ | -45 | $2{ }^{2} 56645 \cdot 5$ | $\cdot 37$ | 2 57 5.8 | $\cdot 30$ | $25721 \cdot 5$ | -22 | $\begin{array}{llll}2 & 57 & 32 \cdot 7\end{array}$ | -15 |  | -07 |
| 48 | 25214.0 | 44 | $25238 \cdot 2$ | $\cdot 36$ | $2 \begin{array}{llll}52 & 57.8\end{array}$ | -29 | $2 \begin{array}{lllll}2 & 53 & 12.7\end{array}$ | -21 | $25322 \cdot 9$ | -13 | $253128 \cdot 3$ | . 05 |
| 49 | $\begin{array}{llll}2 & 48 & 7.2\end{array}$ | + $\cdot 44$ | 248310 | + 36 | 24849.9 | + 27 | $\begin{array}{llll}2 & 49 & 3.9\end{array}$ | + 19 | $2 \begin{array}{llll}2 & 49 & 13 \cdot 1\end{array}$ | + $\cdot 1$ | 249 17.4 | +.03 |
| 50 | $\begin{array}{llll}2 & 44 & 0.5\end{array}$ | -43 | $\begin{array}{llll}2 & 44 & 23.8 \\ 2\end{array}$ | $\cdot 35$ | $24442 \cdot 0$ | -26 |  | -18 | $\begin{array}{lll}2 & 45 & 3.4 \\ 2 & 4 & \end{array}$ | -09 | $\begin{array}{lll}2 & 45 & 6 \cdot 4\end{array}$ | + .01 |
| 51 | $\begin{array}{lllll}2 & 39 & 53 \cdot 8\end{array}$ | -42 |  | -34 | 24034.2 | $\cdot 25$ | $24046 \cdot 5$ | 16 | 240 | -07 | $240 \quad 55.4$ | O |
| 52 | $23547 \cdot 2$, | -42 | $\left\lvert\, \begin{array}{lll}2 & 36 & 9.5\end{array}\right.$ | -33 | $2 \begin{array}{llll}26 & 26.4\end{array}$ | - 24 | $2 \begin{array}{lllll}26 & 37 \cdot 9\end{array}$ | - 15 | $23644^{\circ} \mathrm{O}$ | -05 | $23644 * 4$ | $\cdot 04$ |
| 53 | $23140 \cdot 6$ | 1 | $\begin{array}{llll}2 & 32 & 2.4\end{array}$ | -32 | 2 32 $18 \cdot 7$ | $\cdot 22$ | $\begin{array}{\|llll\|}2 & 32 & 29 \cdot 3\end{array}$ | -13 | $\begin{array}{llll}2 & 32 & 34 & 3\end{array}$ | - 03 | $23233 \cdot 5$ | .06 |
| 54 | 22733.9 | + 4 II | $2 \begin{array}{llll}2 & 2755\end{array}$ | + 31 | 228 II.0 | + 21 | $\begin{array}{llll}2 & 28 & 20 \cdot 7\end{array}$ | + $\cdot 11$ | 22824.6 | + OI | $2 \begin{array}{llll}28 & 22 \cdot 5\end{array}$ | +.09 |
| 55 | 223127.4 | $\cdot 40$ | $2 \begin{array}{llll}2 & 23 & 48 \cdot 4\end{array}$ | - 30 | $224 \begin{array}{lll}2 & 24\end{array}$ | -20 | 224 I2.2 | -10 | $2 \begin{array}{llllllll} & 24 & 14.9\end{array}$ | - OI | 224 II.4 | 1 I |
| 56 | $2 \begin{array}{llll}2 & 19 & 20.9\end{array}$ | -40 | 2 I9 4I•5 | -29 | 2 I9 $55 \cdot 8$ | - 18 | $2 \begin{array}{lll}20 & 3 & 3\end{array}$ | - 08 | 220503 | -03 | $\begin{array}{lll}2 & 20 & 0.4\end{array}$ | 14 |
| 57 | 2 I5 14.4 | -39 | $2 \begin{array}{llll}2 & 15 & 34 \cdot 6\end{array}$ |  | 2 I |  | $2 \begin{array}{lllll}2 & 15 & 55 \cdot 2\end{array}$ | -06 |  |  | $21^{15} 489 \cdot 1$ | -16 |
| 58 | 2 II 7-9 | -39 | $\mid 2$ II 27.7\| | $\cdot 27$ | 2 II 40.6\| | . 16 | 2 II $46 \cdot 7$ | . 04 | 2 II 45.9 | . 07 | 2 II $38 \cdot 0$ | -19 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ |  | $21^{\circ}$ |  | $22^{\circ}$ | Decl. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I\% } & 12.5 \end{array}\right.$ | $\left\lvert\, \begin{gathered} s . \\ +r \cdot 02 \end{gathered}\right.$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I8 } & 14 * 3 \end{array}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 04 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. м. } & \text { S. } \\ 6 & 19 & \text { r6. } \end{array}\right\|$ | $\begin{gathered} \mathrm{s} .05 \\ +\mathrm{r} \cdot 05 \end{gathered}$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 20 \\ 20 & 20 \end{array}\right\|$ | $\left\lvert\, \begin{gathered} \text { s. } \\ +r \cdot 06 \end{gathered}\right.$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 2 \mathrm{II} \\ 24 \cdot 5 \end{array}\right\|$ | $\left\lvert\, \begin{gathered} \mathrm{s} .0 \\ \mathrm{r} \cdot 08 \end{gathered}\right.$ | $\begin{array}{\|ccc} \text { H. м. } & \text { S. } \\ 6 & 22 & 29.7 \end{array}$ | $\begin{gathered} \text { S. } \\ \mathrm{r} \cdot 08 \end{gathered}$ |
| 10 | ${ }_{5}^{5} 34 \begin{array}{ll}\text { II-5 }\end{array}$ | - 78 |  | - 78 | 5 $3544 \cdot 8$ | - 77 | $53631 \cdot 2$ | $\cdot 77$ | $\begin{array}{lllll}5 & 37 & 17 \cdot 3\end{array}$ | - 77 | $\begin{array}{llll}5 & 38 & 3.2\end{array}$ | $\cdot 76$ |
| 12 | $\begin{array}{lllll}5 & 25 & 38 \cdot 6\end{array}$ | $\cdot 74$ | $52622 \cdot 6$ | $\cdot 73$ | $\begin{array}{llll}5 & 27 & 6.2\end{array}$ | $\cdot 72$ | $52749 \cdot 3$ | $\cdot 71$ | $52832 \cdot 1$ | $\cdot 71$ |  | 70 |
| 14 | $\begin{array}{lllll}5 & 17 & 6 \cdot 6\end{array}$ | -69 | 5 17 $47 \cdot 9$ | . 68 | $\begin{array}{llll}5 & 18 & 28 \cdot 6\end{array}$ | $\cdot 67$ | $\begin{array}{llll}5 & 19 & 8.6\end{array}$ | . 66 | $\begin{array}{llll}5 & 19 & 48 \cdot 0\end{array}$ | -65 | $52026 \cdot 8$ | 64 |
| 16 | $\begin{array}{llll}5 & 8 & 35.5\end{array}$ | . 65 | 5 9 I4.I | $\cdot 64$ | $\begin{array}{lllll}5 & 9 & 51 \cdot 9\end{array}$ | $\cdot 62$ | 5 10 28.8 | .61 | 5 II 4.9 | 59 | 5 II $40 \cdot 2$ | 8 |
| 18 | $5 \quad 0 \quad 5 \cdot 2$ | $+6 \mathrm{r}$ | 5 0 41-2 | + + 59 | 5 I I6.r | $\cdot 57$ | 5 I 49.9 | + $\cdot 55$ | $\begin{array}{llll}5 & 2 & 22 \cdot 8\end{array}$ | + $\cdot 54$ | $5 \quad 254 \cdot 6$ | $\cdot 52$ |
| 20 | 45135.6 | $\cdot 57$ | 4529.0 | - 54 | $4524 \mathrm{r} \cdot \mathrm{O}$ | $\cdot 52$ | 4531119 | $\cdot 50$ | $4534 \mathrm{I} \cdot 5$ | 48 | $4 \begin{array}{lll}4 & 54 & 9.8\end{array}$ | $\cdot 46$ |
| 22 | 4436.7 | -52 | $44337 \cdot 4$ | 50 | $4446 \cdot 7$ | 48 | $44434 \cdot 6$ | -45 | 445009 | -43 | $445 \quad 25 \cdot 8$ | 40 |
| 24 | $\begin{array}{llll}4 & 34 & 38 \cdot 4\end{array}$ | $\cdot 48$ | $\begin{array}{llll}4 & 35 & 6 \cdot 5\end{array}$ | 45 | $43533^{\circ} \mathrm{O}$ | $\cdot 43$ | $\begin{array}{llll}4 & 35 & 57.9\end{array}$ | -40 |  | 37 | $\begin{array}{lllll}4 & 36 & 42.4\end{array}$ | 34 |
| 26 | $4 \quad 26 \quad 10 \cdot 6$ | 44 | $42636 \cdot 2$ | 41 | 42700 | 38 | 42721.7 | $\cdot 35$ | 42748.7 | -3I | $4 \begin{array}{llll}4 & 59 & 6\end{array}$ | 8 |
| 28 | 41743.4 | $\cdot 40$ | 4 I8 | + 37 | $41827 \cdot 4$ | + 33 | $4_{4} 1846 \cdot 1$ | + 29 | $4 \begin{array}{lll}4 & 19 & 2.8\end{array}$ | + 26 | 419 17.2 | + 22 |
| 30 | $\begin{array}{lllllllllllll}4 & 9 & 16.6\end{array}$ | $\cdot 36$ | 37.1 | 32 | $4 \quad 955.2$ | . 28 | 41011.0 | 24 | 4 10 24.4 | . 20 | 4 ro 35.3 | -16 |
| 3 I | $\begin{array}{llll}4 & 5 & 3 & 3\end{array}$ | $\cdot 34$ | $\begin{array}{llll}4 & 5 & 22.5\end{array}$ | $\cdot 30$ | $4 \begin{array}{lllll}4 & 5 & 39\end{array}$ | -26 | $4 \begin{array}{lll}4 & 5 & 53.5\end{array}$ | 22 | $\begin{array}{lll}4 & 6 & 5 \cdot 3\end{array}$ | -17 | 4614 | 13 |
| 32 | $4 \quad 0 \quad 50 \cdot 2$ | . 32 | $\begin{array}{lll}4 & 1 & 8.2\end{array}$ | . 28 | $\begin{array}{llll}4 & 1 & 23 \cdot 5\end{array}$ | -23 | $4 \begin{array}{lll}4 & 1 & 36 \cdot 2\end{array}$ | 19 | $\begin{array}{lll}4 & 1 & 46 \cdot 2 \\ 3 & 5 & \end{array}$ | $\cdot 14$ | $\begin{array}{llll}4 & 1 & 53.6\end{array}$ | -10 |
| 33 | $35637 \cdot 2$ | O |  | $\cdot 25$ | $3 \begin{array}{lll} & 57 & 7 \cdot 7\end{array}$ |  | $\begin{array}{llllll}3 & 57 & 18.9\end{array}$ |  | $3 \begin{array}{llll}3 & 57 & 27 & 3\end{array}$ |  |  | . 07 |
| 34 | 35224.3 | + 28 | $35239 \cdot 6$ | + 23 | $35252 \cdot 0$ | + $\cdot 18$ | $\begin{array}{llll}3 & 53 & 1.7\end{array}$ | + 14 | $\begin{array}{lll}3 & 53 & 8.4\end{array}$ | + 09 | $\begin{array}{lllll}3 & 53 & \text { 12 } 21\end{array}$ | + . 04 |
| 35 | $\begin{array}{llllll}3 & 48 & 115\end{array}$ | $\cdot 26$ | $34825 \cdot 4$ | 21 | $3{ }^{3} 4836 \cdot 4$ | I6 | $3 \begin{array}{llll}3 & 48 & 44 \cdot 5\end{array}$ |  | 3 4 49  | -06 |  |  |
| 36 | $\begin{array}{llllllllllll}3 & 43 & 58 \cdot 6\end{array}$ | - 24 | 344 II•3 | 8 | $34420 \cdot 9$ | - 13 | $\begin{array}{llllllll}3 & 44 & 27 \cdot 3\end{array}$ | . 08 | 34430.6 | + .03 | 34430 | . 02 |
| 37 | $\begin{array}{llllllllllll}3 & 39 & 45 \cdot 8\end{array}$ | -21 | $3 \begin{array}{llll}3 & 39 & 57 \cdot 2 \\ 3\end{array}$ | 16 | $34^{40} 5 \cdot 4$ | 'ri | $\begin{array}{llll}3 & 40 & 10 \cdot 2 \\ 3 & 35 & 53\end{array}$ | -05 | 340 Ir 7 | OO | 3409.8 | .06 |
| 38 |  | 19 | $33543 \cdot 2$ | 14 | $33549 \cdot 9$ |  | $\begin{array}{lllllllllll}3 & 35 & 53 \cdot 1\end{array}$ | + .02 | 3 35 $52 \cdot 9$ | . 03 | $3 \quad 3549 \cdot$ | 9 |
| 39 |  | + 17 | $\begin{array}{llll}3 & 31 & 29.3\end{array}$ | + II | 33134.5 | $+$ | $\begin{array}{llll}3 & 31 & 36 \cdot 1\end{array}$ |  | 33134.0 | . 06 | $\begin{array}{llll}3 & 31 & 28.3\end{array}$ |  |
| 40 | $\begin{array}{llll}3 & 27 & 8 \cdot 1 \\ 3 & 2 & 5\end{array}$ | - 15 | $\begin{array}{llll}3 & 27 & 15.4\end{array}$ |  | 32719.0 | +.03 | $\begin{array}{lll} 3 & 27 & 9.0 \end{array}$ | . 03 | $\begin{array}{llll}3 & 27 & 15 \cdot 1 \\ 3 & 2 & 15 \cdot 2\end{array}$ |  | $\begin{array}{llll}3 & 27 & 7 \cdot 4 \\ 3 & 2 & 76.5\end{array}$ | -16 |
| 4 4 | $\begin{array}{cccc}3 & 22 & 55 \cdot 6 \\ 3 & 18 & 43 \cdot 1\end{array}$ | -13 | $\begin{array}{lll}3 & 23 & 1.5 \\ 3 & 18 & 47.7\end{array}$ | $\cdot 07$ | $\begin{array}{llrr}3 & 23 & 3.6 \\ 3 & 18 & 48.2\end{array}$ | $\begin{aligned} & .00 \\ & .02 \end{aligned}$ |  | $\begin{aligned} & .06 \\ & .00 \end{aligned}$ | $\begin{array}{llll}3 & 22 & 56 \cdot 2 \\ 3 & 18 & 37 \cdot 2\end{array}$ |  | $\begin{array}{llll}3 & 22 & 46 \cdot 5 \\ 3 & 18 & 25 \cdot 4\end{array}$ | 19 |
| 43 | $\begin{array}{llll}3 & 18 & 43 \cdot 1 \\ 3 & 14 & 30 \cdot 7\end{array}$ | II | $\begin{array}{llll}3 & 18 & 47 \cdot 7 \\ 3 & 14 & 33 \cdot 8\end{array}$ | $\begin{array}{r}\text { O4 } \\ +\quad .02 \\ \hline\end{array}$ | $\begin{array}{llll}3 & 18 & 48 \cdot 2 \\ 3 & 14 & 32 \cdot 9\end{array}$ | -. 02 | [10 $\begin{array}{llll}3 & 18 & 44.8 \\ 3 & 14 & 27.6\end{array}$ | $09$ | (1) $\begin{array}{llll}3 & 18 & 37.2 \\ 3 & 14 & 18.2\end{array}$ |  | $\begin{array}{cccc}3 & 18 & 25.4 \\ 3 & 14 & 4.3\end{array}$ | 23 |
| 43 | 3 I 430 | -08 | 3 I 43 | + 0 | 3143 |  | $\begin{array}{llllll}3 & 14 & 27 \cdot 6\end{array}$ |  | 314 |  | 314 |  |
| 44 | $\left\lvert\, \begin{array}{rrr} 3 & \text { ro } & 18 \cdot 3 \\ 3 & 6 & 6.0 \end{array}\right.$ | + .06 | $\begin{array}{rrr} 3 & 10 & 20 \cdot 0 \\ 3 & 6 & 6 \cdot 2 \end{array}$ | . 01 | $\begin{array}{rrrr}3 & 10 & 17.4 \\ 3 & 6 & 1.9\end{array}$ | . 08 | (rrrrl $\begin{array}{rrr}3 & 10 & 10 \cdot 5 \\ 3 & 5 & 53 \cdot 1\end{array}$ | .15 | $\left\|\begin{array}{lll} 3 & 9 & 59^{\circ} 0 \\ 3 & 5 & 39 \cdot 8 \end{array}\right\|$ |  | $\begin{array}{llll}3 & 9 & 43 \cdot 0 \\ 3 & 5 & 21.6 \\ 3 & 0 & \end{array}$ |  |
| 45 | $\left\lvert\, \begin{array}{rrr} 3 & 6 & 6 \cdot 0 \\ 3 & 1 & 53.6 \end{array}\right.$ | .04 | $\left\|\begin{array}{rrr} 3 & 6 & 6 \cdot 2 \\ 3 & 1 & 52 \cdot 3 \end{array}\right\|$ | -03 | $\begin{array}{rrr} 3 & 6 & r \cdot 9 \\ 3 & I & 46 \cdot 4 \end{array}$ | ${ }_{\cdot} \cdot 11$ | 3 5 $53 \cdot 1$ <br> 3 $\mathbf{1}$ $35 \cdot 8$ <br> $\mathbf{2}$   | 22 | $\left\|\begin{array}{lll} 3 & 5 & 39 \cdot 8 \\ 3 & 1 & 20 \cdot 3 \end{array}\right\|$ | 26 | $\begin{array}{llll}3 & 5 & 21.6 \\ 3 & 0 & 59.9\end{array}$ | 34 |
| 47 | $\begin{array}{llllll}2 & 57 & 4 \mathrm{r} & 3\end{array}$ | - 01 | $\begin{array}{lllll}2 & 57 & 38.5\end{array}$ | -09 | $25730 \cdot 9$ | - | $2 \begin{array}{llll}2 & 57 & 18.2\end{array}$ |  | $\begin{array}{lll}2 & 57 & 0.8\end{array}$ |  | $25638 \cdot \mathrm{I}$ |  |
| 48 | $\begin{array}{llll}2 & 53 & 28.9\end{array}$ | .03 | 25324.5 | 'II | $2 \begin{array}{llll} & 53 & 15\end{array}$ | - 20 | $\begin{array}{lll}2 & 53 & 0.8\end{array}$ |  | $2524 \mathrm{r} \cdot \mathrm{I}$ | $\cdot 37$ | $25216 \cdot 0$ | $\cdot 46$ |
| 49 | $\begin{array}{lllll}2 & 49 & 16.5\end{array}$ | .06 | $\begin{array}{llll}2 & 49 & 10 \cdot 6\end{array}$ | - 14 | $24^{48} 59 \cdot 5$ | - 23 | $\begin{array}{ll}2 & 48 \\ 2 & 43 \cdot 1\end{array}$ | - 32 | $2 \begin{array}{lll}2 & 21.2\end{array}$ | - 41 | $24753 \cdot 6$ | . 51 |
| 50 | $\begin{array}{lllll}2 & 45 & 4.2\end{array}$ | $\cdot 08$ | $\begin{array}{lllllllllllll}2 & 44 & 56 \cdot 7\end{array}$ | 17 | $24443 \cdot 5$ | -26 |  | 35 | $\begin{array}{lll}2 & 44 & 10\end{array}$ | 45 | $\begin{array}{lllll}2 & 43 & 31 \cdot 0\end{array}$ | 55 |
| 51 | $2405 \mathrm{I} \cdot 6$ | - Ir | $\begin{array}{lllll}2 & 40 & 42 \cdot 6\end{array}$ | - 20 | $24027 \cdot 6$ | 30 | $\begin{array}{llll}2 & 40 & 7 \cdot 1 \\ 2 & \end{array}$ | -39 | $\begin{array}{lllll}2 & 39 & 40 \cdot 6\end{array}$ |  | $\begin{array}{llll}2 & 39 & 8.0\end{array}$ | 60 |
| 52 | $\begin{array}{lllll}2 & 36 & 39 \cdot 3\end{array}$ | -13 |  | 23 | 2 36 117 | 33 | $2 \begin{array}{llll}2 & 35 & 48.9\end{array}$ | 43 | $23520 \cdot 0$ | $\cdot 5$ | $23444 \cdot 6$ | 64 |
| 53 | ${ }_{2}^{2} 3226.8$ |  | 23214.2 | 26 | 23155.4 | 37 | $2 \begin{array}{llll}2 & 31 & 30 \cdot 3\end{array}$ |  | 23058.9 |  | 230 | . 69 |
| 54 | $\begin{array}{llll}2 & 28 \\ 2 & 24\end{array}$ | - 19 | $\begin{array}{llll}2 & 27 & 59.8 \\ 2 & 23 & 45 \cdot 3\end{array}$ | $\cdot 29$ | $\begin{array}{llll}2 & 27 & 39 \cdot 0 \\ 2 & 23 & 22 \cdot 3\end{array}$ | 40 | $\begin{array}{llll}2 & 27 & 11.6 \\ 2 & 22 & 52.6\end{array}$ | -. ${ }^{-51}$ | $\begin{array}{llll}2 & 26 & 37.6 \\ 2 & 2 & 3\end{array}$ | $\cdot 62$ | $\begin{array}{llll}2 & 25 & 56 \cdot 6\end{array}$ |  |
| 55 | $\begin{array}{llll}2 & 24 & 1 \cdot 6\end{array}$ | 22 | 22345.3 | 33 | 22322.3 | 44 | $\begin{array}{llllll}2 & 22 & 52 \cdot 6\end{array}$ | $\cdot 55$ | $\begin{array}{lllll}2 & 22 & 15.8\end{array}$ | 7 | 22131.8 | 80 |
| 56 | $\begin{array}{lllll}2 & 19 & 48 \cdot 9 \\ 2\end{array}$ | 25 | $\begin{array}{lllll}2 & 19 & 30.6\end{array}$ |  | 2 19 $5 \cdot 5$ <br> 19   | 4 | $2 \begin{array}{llll}2 & 18 & 33.3\end{array}$ | -60 | $2 \begin{array}{llllll}2 & 17 & 53.6\end{array}$ | 析 | $\begin{array}{llll}2 & 17 & 6.4\end{array}$ | 85 |
| 57 58 | $\begin{array}{llll}2 & 15 & 36 \cdot 0 \\ 2 & 11 & 23.0\end{array}$ | -28 | $\begin{array}{cccc}2 & 15 & 15.8 \\ 2 & 11 & 0.7\end{array}$ | 40 | $\begin{array}{llllll}2 & 14 & 48 \cdot 3 \\ 2 & \text { io } & 30 \cdot 9\end{array}$ | 52 | $\begin{array}{lllll}2 & 14 & 13.5 \\ 2 & 9 & 53.3\end{array}$ | . 64 | $\begin{array}{lllll}2 & 13 & 30 \cdot 9\end{array}$ | $\cdot 78$ | $2 \mathrm{I} 2240 \cdot 4$ | 91 |
| 58 | 2 II 23.0 | 3 | 2 II 0.7 |  | $\underline{2} 1030.9$ | 56 | $12 \quad 9 \quad 53.3$ |  |  |  | $2 \begin{array}{llll} & 8 & 13\end{array}$ | 97 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ}$ A. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. +1.37 | s. -4.33 | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} 45 \end{gathered}$ | s. -4.35 | S. +I .54 | S. -4.38 | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 62 \end{gathered}$ | S. -4.41 | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 7 \mathrm{I} \end{gathered}$ | $\begin{gathered} s . \\ -4.44 \end{gathered}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 80 \end{gathered}$ | s. -4.48 |
| 4 | I.30 | $4 \cdot 31$ | r. ${ }^{8}$ | $4 \cdot 33$ | I. 46 | $4 \cdot 36$ | I. 55 | $4 \cdot 39$ | I. 63 | 4.42 | 1.72 | $4 \cdot 45$ |
| 8 | I. 23 | $4 \cdot 28$ | I-3I | $4 \cdot 31$ | I 40 | $4 \cdot 34$ | I. 48 | $4 \cdot 36$ | 1.56 | $4 \cdot 39$ | I. 65 | $4 \cdot 42$ |
| 12 | I.17 | 4.27 | I. 25 | 4:29 | I 34 | $4 \cdot 32$ | I.42 | $4 \cdot 34$ | 1.50 | $4 \cdot 37$ | I. 59 | 4.40 |
| 16 | I'12 | $4 \cdot 26$ | I 20 | $4 \cdot 28$ | I. 28 | $4 \cdot 30$ | $1 \cdot 37$ | 4.33 | 1.45 | 4.35 | I. 54 | $4 \cdot 38$ |
| 20 | +1.07 | $4 \cdot 24$ | +I. I 6 | $4 \cdot 26$ | +I. 24 | $4 \cdot 29$ | +1.32 | $4 \cdot 31$ | +1.41 | $4 \cdot 34$ | +1.50 | $4 \cdot 37$ |
| 22 | I 06 | $4 \cdot 24$ | I 14 | $4 \cdot 26$ | 1.22 | $4 \cdot 28$ | 1-3I | $4 \cdot 31$ | I.39 | $4 \cdot 34$ | 1.48 | $4 \cdot 37$ |
| 24 | 1.03 | 4.23 | I-12 | 4.25 | I 20 | $4 \cdot 28$ | 1-29 | $4 \cdot 30$ | - 38 | $4 \cdot 33$ | I. 46 | $4 \cdot 36$ |
| 26 | I. 02 | $4 \cdot 23$ | I Io | 4.25 | I'19 | $4 \cdot 27$ | I 28 | $4 \cdot 30$ | I.36 | $4 \cdot 33$ | I 45 | $4 \cdot 36$ |
| 28 | I.OO | $4 \cdot 22$ | I.08 | $4 \cdot 24$ | I'I7 | $4 \cdot 27$ | I. 26 | $4 \cdot 29$ | 1.35 | $4 \cdot 32$ | 1.44 | $4 \cdot 35$ |
| 30 | + 98 | $4 \cdot 22$ | +1.07 | $4 \cdot 24$ | +I.I6 | $4 \cdot 27$ | +1.25 | $4 \cdot 29$ | +1.34 | $4 \cdot 32$ | +1.43 | $4 \cdot 35$ |
| 32 | -97 | $4 \cdot 22$ | I.06 | $4 \cdot 24$ | I'I5 | $4 \cdot 26$ | I 24 | $4 \cdot 29$ | 1.33 | $4 \cdot 32$ | I. 43 | $4 \cdot 35$ |
| 34 | -96 | $4 \cdot 22$ | I.05 | 4.24 | I'I4 | $4 \cdot 26$ | I. 24 | 4.29 | I.33 | $4 \cdot 31$ | I. 43 | $4 \cdot 34$ |
| 36 | $\cdot 94$ | $4 \cdot 21$ | r-04 | $4 \cdot 23$ | r-13 | $4 \cdot 26$ | I. 23 | $4 \cdot 28$ | I.33 | 4.31 | I-42 | $4 \cdot 34$ |
| 38 | -94 | $4 \cdot 21$ | I-03 | $4 \cdot 23$ | I'I3 | $4 \cdot 26$ | I. 23 | $4 \cdot 29$ | I.33 | $4 \cdot 31$ | I•43 | $4 \cdot 34$ |
| 40 | + 9.93 | $4 \cdot 21$ | $+\mathrm{I} \cdot \mathrm{O} 2$ | $4 \cdot 23$ | +1.12 | 4.26 | +1.23 | $4 \cdot 28$ | + 1.33 | $4 \cdot 31$ | +1.43 | $4 \cdot 35$ |
| 42 | $\cdot 92$ | $4 \cdot 20$ | $\mathrm{I} \cdot \mathrm{O} 2$ | 4.23 | I.13 | $4 \cdot 25$ | I. 23 | $4 \cdot 28$ | I.33 | $4 \cdot 32$ | I. 44 | 4.35 |
| 44 | -92 | 4.21 | I. 02 | 4.23 | I'I3 | $4 \cdot 26$ | I. 24 | 4.29 | I.35 | $4 \cdot 32$ | $1 \cdot 46$ | 4.36 |
| 46 | $\cdot 91$ | $4 \cdot 2 \mathrm{I}$ | I.02 | $4 \cdot 23$ | I-13 | $4 \cdot 26$ | I. 25 | 4.29 | I.36 | $4 \cdot 32$ | I. 47 | $4 \cdot 36$ |
| 48 | -91 | $4 \cdot 2 \mathrm{I}$ | I.03 | $4 \cdot 23$ | I•14 | $4 \cdot 26$ | I.26 | 4.29 | 1.38 | $4 \cdot 33$ | $1 \cdot 50$ | $4 \cdot 37$ |
| 50 | + 92 | $4 \cdot 2 \mathrm{I}$ | +1.04 | $4 \cdot 23$ | +1.15 | $4 \cdot 27$ | +1.28 | 4.30 | +1.40 | 4'34 | +1.53 | $4 \cdot 38$ |
| 52 | .92 | $4 \cdot 21$ | 1.05 | $4 \cdot 24$ | I.17 | $4 \cdot 27$ | I.30 | $4 \cdot 31$ | I. 43 | $4 \cdot 35$ | $1 \cdot 56$ | 4.39 |
| 54 | -93 | $4 \cdot 21$ | I.06 | $4 \cdot 24$ | I'19 | $4 \cdot 28$ | 1.33 | $4 \cdot 31$ | 1.47 | $4 \cdot 36$ | r.61 | 4.41 |
| 56 | $\cdot 95$ | $4 \cdot 21$ | r.08 | 4.25 | I. 22 | $4 \cdot 28$ | I.36 | 4.33 | I.51 | $4 \cdot 37$ | 1.66 | 4.43 |
| 58 | -97 | $4 \cdot 22$ | $\mathbf{I} \cdot \mathrm{II}$ | 4.25 | I 26 | $4 \cdot 29$ | 1.41 | 4.34 | I.56 | 4.39 | $1 \cdot 72$ | $4 \cdot 45$ |

58 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $14^{\circ}$.

## DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{\circ}{\circ}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}$ | S. $+\quad .99$ | $\left\lvert\, \begin{array}{\|cc\|} \text { H. M. } & \text { S. } \\ 6 & 0 \\ 59.8 \end{array}\right.$ | $\begin{gathered} s . \\ +I \cdot 00 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 59.8 \end{array}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 00 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 2 & 59 \cdot 7 \end{array}$ | $\left\lvert\, \begin{gathered} s . \\ +\mathrm{I} \cdot 00 \end{gathered}\right.$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 0 \cdot 0 \end{array}\right\|$ | $\left\|\begin{array}{c} s . \\ +I \cdot 00 \end{array}\right\|$ | $\left\lvert\, \begin{array}{ccc} \text { H. } & \text { M. } & \text { S. } \\ 6 & 5 & 0.0 \end{array}\right.$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 00 \end{gathered}$ |
| 10 | 5181845 | I-OI | 5 19 46.I | I. 00 | $5 \quad 2045 \cdot 8$ | -99 | 52144.7 | $\cdot 98$ | $52243 \cdot 0$ | -96 | $52340 \cdot 5$ | . 95 |
| 12 | $5 \quad 1030 \cdot 5$ | I. 02 | 5 II 3I•2 | 1.00 | 5 I2 3I•I | -99 | $\begin{array}{llll}5 & 13 & 30 \cdot 0\end{array}$ | -97 | 5 I4 28.1 | -96 | $\begin{array}{llll}5 & 15 & 25.4\end{array}$ | 95 |
| 1 | $\begin{array}{llrr}5 & 2 & 14.9\end{array}$ | I.03 | $\begin{array}{llll}5 & 3 & 16 \cdot 2\end{array}$ | I•OI | $\begin{array}{llll}5 & 4 & 16 \cdot 3\end{array}$ | -99 | $\begin{array}{lrrr}5 & 5 & 15 \cdot 3\end{array}$ | -97 | $\begin{array}{rrrr}5 & 6 & 13.3\end{array}$ |  | $\begin{array}{lrrr}5 & 7 & 10.3\end{array}$ | 4 |
| 16 | $45359 \cdot 1$ | 1 | 4550.9 |  | $\begin{array}{lll}4 & 56 & 1 \cdot 4\end{array}$ | 1.00 | 4570.6 | -98 | 45758.6 | -96 | $45855 \cdot 5$ | 94 |
| 18 | $44543 \cdot 0$ | +1.05 | $446 \quad 45 \cdot 4$ | + $\mathrm{I} \cdot 03$ | $44746 \cdot 3$ | +1.00 | $4 \quad 48 \quad 45 \cdot 8$ | + 98 | $44943 \cdot 9$ | + .96 | $45040 \cdot 7$ | + 93 |
| 20 | 43726.5 | I. 06 | $43^{48} \quad 29 \cdot 6$ | 1.04 | $43931 \cdot 0$ | I•OI | $4 \quad 4030 \cdot 9$ | -98 | 4 41 29:2 | -96 | 442 26.0 | 93 |
| 22 | $\begin{array}{lll}4 & 29 & 9.5\end{array}$ | I $\cdot 08$ | 43013.4 | I.05 | $43115 \cdot 5$ |  | $432 \begin{array}{llll}42 & 15\end{array}$ | -99 | $4 \begin{array}{llll}4 & 33 & 14.4\end{array}$ | 96 | $43411 \cdot 3$ | 93 |
| 24 | $42052 \cdot 0$ | 1.10 | 4 2I $56 \cdot 9$ | 1.06 | $\begin{array}{lllllllllll}4 & 22 & 59 \cdot 7\end{array}$ | 1 | $424 \quad 0.6$ | 0 | $424 \quad 59 \cdot 5$ | 97 | $425 \quad 56 \cdot 6$ | $\cdot 93$ |
| 26 | $41233 \cdot 9$ | 1-12 | 4 I3 $39 \cdot 8$ | 1.08 | 4 I4 43.6 | r•0 | 4 I5 45.1 | I•OI | $41644 \cdot 5$ | -97 | 4 17 41•8 | 4 |
| 28 | $4415 \cdot 2$ | +1.14 | $4 \quad 5 \quad 22 \cdot 3$ | +I.10 | $4627 \cdot 0$ | +1.0 | $4 \quad 7 \quad 29.3$ | +1.02 | $\begin{array}{llll}4 & 8 & 29.3\end{array}$ | + 98 | $4 \quad 9 \quad 27.0$ | + 9.94 |
| 30 | $35555 \cdot 7$ | I•16 | $\begin{array}{llll}3 & 57 & 4.2\end{array}$ | 1.12 | 35810.0 | 1.07 | $3 \quad 5913.2$ | I. 03 | $4 \quad 0 \quad 13.8$ | -99 | 4 I 12.0 | -95 |
| 3 | 3 51 45.6 | I-18 | $\begin{array}{llll}3 & 52 & 54.9\end{array}$ | 1-13 | $\begin{array}{llll}3 & 54 & 1 \cdot 2\end{array}$ | 1.08 | $\begin{array}{llll}3 & 55 & 4 \cdot 9\end{array}$ | 1.04 | $356 \quad 6 \cdot 0$ | 9 | $\begin{array}{lll}3 & 57 & 4.4\end{array}$ | 5 |
| 32 |  | I•19 | $34845 \cdot 3$ | I-I4 | $34952 \cdot 3$ | 1.09 | $35056 \cdot 6$ | 1.05 | 35158.0 | 00 | $35256 \cdot 7$ | $\cdot 96$ |
| 33 | 34324. | 1.20 |  | I•I5 | $\begin{array}{lllllll}3 & 45 & 43 \cdot 3\end{array}$ | 1 | $34^{6} 48 \cdot 1$ | I.05 | $34750 \cdot 0$ | I 0 | $34849 \cdot 1$ | $\cdot 96$ |
| 3 | 33914.0 | + I. 22 | $34025 \cdot 6$ | +I•I7 | 341 34.I | +I•II | 34239.5 | +r.06 | $34341 \cdot 9$ | +I.OI | 344 4I•3 | +.96 |
| 35 | 335300 | 1.23 |  | I'I8 | 33724.7 | I•13 | $\begin{array}{llll}3 & 38 & 30 \cdot 8\end{array}$ | 1.07 | $3 \quad 3933 \cdot 7$ | 1.02 | $340 \quad 33 \cdot 5$ | $\cdot 97$ |
| 36 | $33051 \cdot 6$ | I. 25 | $\begin{array}{llll}3 & 32 & 5 \cdot 1\end{array}$ | 1.20 | $33315 \cdot 1$ | I.I4 | $\begin{array}{llll}3 & 34 & 21.9\end{array}$ | I-08 |  | 3 | $\begin{array}{llllllllllllllllll}3 & 36 & 25 \cdot 6\end{array}$ | 8 |
| 37 | $3 \begin{array}{llll}3 & 26 & 39.9\end{array}$ | 1.2 | $\begin{array}{lllll}3 & 27 & 54.4\end{array}$ | I. 21 | $329 \quad 5 \cdot 3$ | I'I5 | $33012 \cdot 8$ |  | 33116.8 | I-04 |  | 98 |
| 38 | 32227.9 | I-29 | $32343 \cdot 5$ | I. 23 | $\begin{array}{llll}3 & 24 & 55 \cdot 3\end{array}$ | I•I7 | $\begin{array}{lll}3 & 26 & 3.5\end{array}$ | I•II | $\begin{array}{llll}3 & 27 & 8.2\end{array}$ | 1.05 | $3 \quad 28 \quad 9 \cdot 5$ | -99 |
| 39 | 3 I8 15.6 | +1.3I | $\begin{array}{llll}3 & 19 & 32 \cdot 2\end{array}$ | + I 2 | $32045{ }^{\circ}$ | +1.18 | $32154 \cdot 1$ | +I.I2 | $3 \quad 2259.4$ | + $\mathbf{1 . 0 6}$ | 324 I.2 | - I.00 |
| 40 | $\begin{array}{llll}3 & 14 & 2.8\end{array}$ | I.33 | $\begin{array}{llll}3 & 15 & 20 \cdot 7\end{array}$ | I. 26 | $\begin{array}{llll}3 & 16 & 34 \cdot 5\end{array}$ | I. 20 | 3 I7 $44 \cdot 5$ | I•I3 | $\begin{array}{llll}3 & 18 & 50 \cdot 5\end{array}$ | I.07 | $\begin{array}{llll}3 & 19 & 52.9\end{array}$ | I.OI |
| 41 | $\begin{array}{llll}3 & 9 & 49 \cdot 7\end{array}$ | I. 35 | $\begin{array}{lrrr}3 & \text { II } & 8 \cdot 8\end{array}$ | I. 28 | $\begin{array}{llll}3 & 12 & 23.7\end{array}$ | I.2I | $\begin{array}{llll}3 & \text { I } & 34 \cdot 6\end{array}$ | I'I5 | 3 I4 41.4 | I.08 | $\begin{array}{llll}3 & 15 & 44.4\end{array}$ | 2 |
| 42 | $\begin{array}{llll}3 & 5 & 36 \cdot 1 \\ & 1\end{array}$ | I. 38 | $\begin{array}{llll}3 & 6 & 56 \cdot 5\end{array}$ | I'30 | $\begin{array}{llll}3 & 8 & 12.6\end{array}$ | I. 23 | $\begin{array}{llll}3 & 9 & 24.4\end{array}$ | I.I6 | 3 IO $32 \cdot 2$ | I | 3 II $35 \cdot 8$ | . 03 |
| 43 | 312220 | 1.40 | $\begin{array}{lllll}3 & 2 & 43 \cdot 8\end{array}$ | 1-33 | $\begin{array}{llll}3 & 4 & 1 \cdot 2\end{array}$ | I 25 | $3 \quad 514 \cdot \mathrm{I}$ | I-I8 | $\begin{array}{llll}3 & 6 & 22 \cdot 7\end{array}$ | I•II | $3727 \cdot 1$ | 4 |
| 44 | $\begin{array}{lll}2 & 57 & 7 \cdot 4\end{array}$ | +I.43 | $2 \begin{array}{llll}2 & 58 & 30 \cdot 8\end{array}$ | +I.3 | $25949 \cdot 4$ | + $\mathrm{I} \cdot 27$ | $\begin{array}{llll}3 & 1 & 3.4\end{array}$ | +I. 20 | $\begin{array}{llll}3 & 2 & 12.9\end{array}$ | +1.12 | $3 \quad 318 \cdot 1$ | $+\mathbf{1 . 0 5}$ |
| 45 | $252252 \cdot 3$ | 1.46 | $2 \begin{array}{llll}2 & 54 & 17 \cdot 2\end{array}$ | I.3 | $255137 \cdot 2$ | I.29 | $2{ }_{2} 56$ | I.2I | $\begin{array}{llll}2 & 58 & 30 \\ 2 & 5\end{array}$ | I.14 | $\begin{array}{llll}2 & 59 & 9 \cdot 0\end{array}$ | 1.06 |
| 46 | $24836 \cdot 6$ | I. 49 | 250 | 40 | 25124.6 | 1.32 | $25241 \cdot 1$ | I. 23 | $25352 \cdot 8$ | 1.15 | $25459 \cdot 7$ | $1 \cdot 08$ |
| 47 | $\begin{array}{llll}2 & 44 & 20 \cdot 3\end{array}$ | I. 52 | $2 \begin{array}{llllllll}2 & 45 & 48 \cdot 6\end{array}$ |  | 24711.6 |  | $\begin{array}{llll}2 & 48 & 29.5\end{array}$ | I. 25 | $\begin{array}{lllllllllll}2 & 49 & 42 \cdot 2\end{array}$ | I.17 | $25050 \cdot 2$ | I.09 |
| 48 | 2403.2 | I.55 | 241333.4 | 1.46 | $24258 \cdot 1$ | 1.37 | $24417 \cdot 4$ | 1.28 | $24531 \cdot 4$ | I-19 | $24640 \cdot 4$ | I-II |
| 49 | 23545 | +1.59 | $2 \begin{array}{lllll}2 & 37 & 17.6\end{array}$ | +1.49 | $\begin{array}{lllllllllllll}2 & 38 & 44 \cdot 1\end{array}$ | + I. 39 | $24^{2} 404.9$ | + I. 30 | 24120.3 | +I. 21 | $24230 \cdot 3$ | +I•12 |
| 50 | $23126 \cdot 8$ | 1.63 | $\begin{array}{lll}2 & 33 & 1 \cdot 2\end{array}$ | I. 5 | $2 \begin{array}{llll}2 & 34 & 29 \cdot 3\end{array}$ | I.42 | $2 \begin{array}{llll}25 & 52 \cdot 0\end{array}$ | I.33 | $\begin{array}{llll}2 & 37 & 8 \cdot 8\end{array}$ | I. 23 | $23820 \cdot 0$ | 14 |
| 5 I |  | I. 67 | $22844^{\circ} \mathrm{O}$ | I. 5 | 23014.3 | 1.45 | $2 \mathrm{lll} 38 \cdot 6$ | I.35 | 23256.9 | I. 26 | $\begin{array}{llll}2 & 34 & 9 \cdot 4\end{array}$ | 16 |
| 52 | $\begin{array}{llll}2 & 22 & 46 \cdot 8\end{array}$ | I.71 | $22426 \cdot 0$ |  |  | 1.49 |  | I.38 | $\begin{array}{llll}2 & 28 & 44 \cdot 5\end{array}$ | I-28 | $\begin{array}{llll}2 & 29 & 58 \cdot 4\end{array}$ | I.18 |
| 53 | 2 I8 25.2 | 1.76 | $220 \quad 7 \cdot 1$ | r 6 | 2 2I 4I•9 | I. 52 | 22310.0 | I.41 | $22431 \cdot 7$ | I.3I | $22547 \cdot 1$ | 1.21 |
|  | $\begin{array}{llll}2 & 14 & 2.5\end{array}$ | + I .81 | 2 I5 47.2 | +1.68 | 2 I7 24.5 | +1.56 | 2 I8 $54 \cdot 8$ | +1.45 | 220188.4 | +1.34 | 2 2I 35.4 | +1.23 |
| 55 | $\begin{array}{llll}2 & 9 & 38 \cdot 5\end{array}$ | . 86 | 2 II 26.2 | I.73 | $\begin{array}{llll}2 & 13 & 6 \cdot 3\end{array}$ | 1.6I | $1438 \cdot 9$ | 1.48 | $2 \begin{array}{lll}2 & 16 & 4.5\end{array}$ | 1.37 | $\begin{array}{llll}2 & 17 & 23.2\end{array}$ | 26 |
| 56 | $\begin{array}{llll}2 & 5 & 13 \cdot 1 \\ 2 & 0 & 46 \cdot 1\end{array}$ | 1.91 | $\begin{array}{llll}2 & 7 & 4 \cdot 1 \\ 2 & 2 & 40\end{array}$ | 1.78 | $28847 \cdot 0$ | I. 65 | 2 10 $22 \cdot 2$ | 1.52 | 2 II 419.9 | I. 40 | $\begin{array}{llll}2 & 13 & 10 \cdot 5 \\ 2 & 8 & 57.3\end{array}$ | - 28 |
| 5 | 2 0 $46 \cdot 1$ <br> I 5 1 | 1.96 | 2 2 40.6 <br> 7 5 1 | I.84 | $\begin{array}{lll}2 & 4 & 26 \cdot 6 \\ 2 & 0 & 5.3\end{array}$ | 1.70 | 2 6 $4 \cdot 6$ <br> 2 1 $46 \cdot 1$ | 1.57 | $\begin{array}{llll}2 & 7 & 34.7 \\ 2 & 3 & 18.7\end{array}$ | I. 44 | $\begin{array}{llll}2 & 8 & 57 \cdot 3 \\ 2 & 4 & 43.5\end{array}$ | I.32 |
| 5 | I 56 17*3 | $2 \cdot 02$ | I 58 I 5.8 | I.90 | - $5 \cdot 2$ | 1.75 | I $46 \cdot 1$ | I.6I | $2 \begin{array}{llll}2 & 3 & 18 \cdot 7\end{array}$ | 1.48 | $2443 \cdot 5$ | I•35 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. 1 | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | S. | s. | s. | s. | -1 | S. | -I | $\cdot 3$ | 4.13 | $\cdot 37$ | 4•I4 |
| 0 | - 00 | $4 \cdot 12$ | $+.07$ | $4 \cdot 12$ | + 15 | $4 \cdot 12$ | + 22 | $-4.13$ | + 30 | -4.13 | $\cdot 37$ | $4 \cdot 14$ |
| 4 | -07 | $4 \cdot 12$ | -00 | $4 \cdot 12$ | +.08 | $4 \cdot 12$ | -15 | $4 \cdot 12$ | $\cdot 22$ | $4 \cdot 13$ | $\cdot 30$ | $4 \cdot 13$ |
| 8 | -14 | $4 \cdot 12$ | - . 07 | $4 \cdot 12$ | -00 | $4 \cdot 12$ | .08 | $4 \cdot 12$ | -15 | $4 \cdot 12$ | - 23 | $4 \cdot 13$ |
| 12 | $\cdot 22$ | $4 \cdot 13$ | $\cdot 14$ | $4 \cdot 12$ | - -07 | $4 \cdot 12$ | + -01 | $4 \cdot 12$ | -08 | $4 \cdot 12$ | -16 | $4 \cdot 12$ |
| 16 | -29 | $4 \cdot 13$ | - 22 | 4.13 | - I4 | $4 \cdot 12$ | - .06 | $4 \cdot 12$ | + OI | $4 \cdot 12$ | $\cdot 09$ | $4^{\wedge 12}$ |
| 20 | - 37 | $4 \cdot 14$ | - 30 | $4 \cdot 13$ | $\cdot 22$ | $4 \cdot 13$ | - .14 | $4 \cdot 12$ | - .06 | $4 \cdot 12$ | + 02 | $4 \cdot 12$ |
| 22 | $\cdot 42$ | 4•14 | $\cdot 34$ | $4 \cdot 14$ | -26 | $4 \cdot 13$ | - 18 | $4 \cdot 13$ | -10 | $4 \cdot 12$ | -.02 | $4 \cdot 12$ |
| 24 | -46 | $4 \cdot 15$ | $\cdot 38$ | $4 \cdot 14$ | $\cdot 30$ | $4 \cdot 13$ | $\cdot 21$ | $4 \cdot 13$ | -13 | $4 \cdot 12$ | . 05 | $4 \cdot 12$ |
| 26 | -51 | $4 \cdot 15$ | $\cdot 42$ | $4 \cdot 14$ | $\cdot 34$ | 4.14 | -26 | $4 \cdot 13$ | $\cdot 17$ | $4 \cdot 13$ | -99 | $4 \cdot 12$ |
| 28 | $\cdot 55$ | $4 \cdot 16$ | $\cdot 46$ | $4 \cdot 15$ | $\cdot 38$ | $4 \cdot 14$ | $\cdot 29$ | $4 \cdot 13$ | -21 | $4 \cdot 13$ | -13 | $4 \cdot 12$ |
| 30 | - . 60 | $4 \cdot 16$ | .51 | $4 \cdot 15$ | - 43 | $4 \cdot 15$ | - 34 | $4 \cdot 14$ | - 25 | $4 \cdot 13$ | - . 17 | $4 \cdot 13$ |
| 32 | $\cdot 65$ | $4 \cdot 17$ | $\cdot 56$ | 4.16 | -47 | $4 \cdot 15$ | $\cdot 38$ | 4.14 | -29 | $4 \cdot 13$ | - 20 | $4 \cdot 13$ |
| 34 | $\cdot 70$ | $4 \cdot 18$ | -69 | $4 \cdot 17$ | $\cdot 52$ | $4 \cdot 16$ | $\cdot 43$ | $4 \cdot 14$ | $\cdot 34$ | 4.14 | -25 | $4 \cdot 13$ |
| 36 | $\cdot 76$ | 4•19 | $\cdot 66$ | 4•17 | $\cdot 57$ | 4.16 | 47 | $4 \cdot 15$ | $\cdot 38$ | 4.14 | -29 | $4 \cdot 13$ |
| 38 | . 82 | $4 \cdot 20$ | $\cdot 72$ | $4 \cdot 19$ | . 62 | $4 \cdot 17$ | . 53 | $4 \cdot 16$ | -43 | $4 \cdot 15$ | $\cdot 34$ | $4 \cdot 14$ |
| 40 | - 88 | 4.21 | -.78 | $4 \cdot 19$ | - . 68 | $4 \cdot 18$ | -. 58 | $4 \cdot 16$ | - . 48 | $4 \cdot 15$ | - 38 | $4 \cdot 14$ |
| 42 | -95 | $4 \cdot 23$ | . 84 | 4.21 | $\bigcirc 74$ | $4 \cdot 19$ | . 63 | $4 \cdot 17$ | . 53 | $4 \cdot 15$ | -48 | $4 \cdot 14$ |
| 44 | 1.02 | 4.25 | $\cdot 91$ | 4.22 | .80 | $4 \cdot 20$ | -69 | $4 \cdot 18$ | . 59 | $4 \cdot 16$ | -48 | 4.15 4.16 |
| 46 | I•10 | 4.27 | -98 | 4.24 | $\cdot 87$ | 4.21 | $\cdot 76$ | $4 \cdot 19$ | -65 | $4 \cdot 17$ | $\cdot 54$ | $4 \cdot 16$ |
| 48 | I•19 | $4 \cdot 29$ | I.06 | $4 \cdot 26$ | -94 | $4 \cdot 23$ | . 83 | 4.20 | -71 | $4 \cdot 18$ | -59 | $4 \cdot 16$ |
| 50 | -r.28 | $4 \cdot 32$ | -1.15 | $4 \cdot 28$ | -1.02 | 4.25 | - 90 | 4.22 | -.78 | 4.19 | -. 66 | $4 \cdot 17$ |
| 52 | I.39 | $4 \cdot 35$ | 1.25 | $4 \cdot 31$ | $1 \cdot 11$ | $4 \cdot 27$ | . 98 | 4.24 | $\cdot 85$ | $=4.21$ | . 73 | $4 \cdot 19$ |
| 54 | 1.51 | 4.39 |  |  | I. 21 | $4 \cdot 30$ |  | 4.26 | $\begin{array}{r}.93 \\ \times .02 \\ \hline\end{array}$ | 4.23 4.25 |  | 4.20 4.22 |
| 56 58 | 1.64 1.80 | 4.44 4.50 | 1.48 I. 62 | 4.38 | 1.32 1.45 | 4.33 4.37 | 1.17 1.28 | 4.29 4.32 | 1.02 1.13 | 4.25 4.27 | . 88 | 4.22 4.24 |
| 58 | 1.80 | $4 \cdot 50$ | - I .62 | 4.43 | 1.45 | $4 \cdot 37$ | $1 \cdot 28$ | $4 \cdot 32$ | $1 \cdot 13$ | 4.27 | -97 | 4.24 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. <br> Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\|\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 6 & 0.4 \end{array}\right\|$ | $\left\lvert\, \begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot \mathrm{OI} \end{gathered}\right.$ | $\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & 7 & \text { I•O } \end{array}$ | $\begin{gathered} 5 . \\ +\mathrm{I} \cdot \mathrm{Or} \end{gathered}$ | $\begin{array}{\|lll} \text { H. M. } & \text { S. } \\ 6 & 8 & \text { I• } 9 \end{array}$ | $\begin{gathered} 5 . \\ +\mathrm{I} \cdot \mathrm{O} 2 \end{gathered}$ | $\left\|\begin{array}{rrr} \text { H. M. } & \text { S. } \\ 6 & 9 & 3.2 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{r} \cdot \mathrm{O} 2 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { 10 } & 4.7 \end{array}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 03 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { II } & 6 \cdot 7 \end{array}$ | $\begin{gathered} 5 . \\ +\mathrm{x} \cdot 04 \end{gathered}$ |
| 10 | $\begin{array}{llll}5 & 24 & 37 \cdot 5\end{array}$ | -94 | $\left\lvert\, \begin{array}{llll}5 & 25 & 33 \cdot 8\end{array}\right.$ | -93 | $\begin{array}{llll}5 & 26 & 29.5\end{array}$ | $\cdot 92$ | $\begin{array}{lllllllllllllllll}5 & 27 & 24.8\end{array}$ | $\cdot 92$ | 52819.6 | -91 | $\begin{array}{llll}5 & 29 & 13.9\end{array}$ | -90 |
| 12 | 5 16 $21 \cdot 8$ | -93 | $1 \begin{array}{lllllllll}5 & 17 & 17.5\end{array}$ | -92 | 5 18 $12 \cdot 5$ | -91 | $\begin{array}{lll}5 & 19 & 6.8\end{array}$ | $\cdot 90$ | 5200.4 | -89 | $5 \quad 20 \quad 53.4$ | - 88 |
| 14 | $\begin{array}{lll}5 & 8 & 6.4\end{array}$ | -93 | $\begin{array}{lll}5 & 9 & 1.6\end{array}$ | $\cdot 91$ | $\begin{array}{llll}5 & 9 & 55 \cdot 8\end{array}$ | -90 | 5 10 $49 \cdot 2$ | -88 | 5 II 4I'7 | -87 | 51233.5 | - 85 |
| 16 | $4595 \mathrm{I} \cdot 2$ | -92 | $5 \quad 0 \quad 45 \cdot 9$ | -90 | $5 \quad 1 \quad 39.4$ | -88 | $\begin{array}{llll}5 & 2 & 32.0\end{array}$ | -87 | $\begin{array}{llll}5 & 3 & 23.5\end{array}$ | -85 | $5 \begin{array}{llll}5 & 4 & 14 \cdot 1\end{array}$ | $\cdot 83$ |
| I 8 | $45136 \cdot 2$ | + 9I | $45230 \cdot 4$ | + .89 | 45323.4 | +.87 | $45415 \cdot 2$ | + 85 | $\begin{array}{lll}4 & 55 & 5.8\end{array}$ | $+.83$ | 455 55.2 | +.8I |
| 20 | $4432 \mathrm{x} \cdot 3$ | $\cdot 91$ | $44415 \cdot 2$ | .89 | $445 \begin{array}{lll}4 & 7 \cdot 6\end{array}$ | . 86 | $\begin{array}{llll}4 & 45 & 58 \cdot 7\end{array}$ | . 84 | 446 | .82 | $44736 \cdot 7$ | -79 |
| 22 | $\begin{array}{lll}4 & 35 & 6 \cdot 5\end{array}$ | '91 | $4 \begin{array}{lll}4 & 36 & 0 \cdot 1\end{array}$ | -88 | $43652 \cdot 1$ | . 85 | $43742 \cdot 5$ | -83 | $43831 \cdot 5$ | -80 | 43918.8 | -78 |
| 24 | 44 26 $5 \mathrm{I} \cdot 8$ <br> 4 8  | -90 | $42745 \cdot 2$ | $\cdot 87$ | $4 \begin{array}{lll}4 & 28 & 36 \cdot 8\end{array}$ | -84 | $42926 \cdot 6$ | -82 | 43014.7 | $\cdot 79$ | 431512 | $\cdot 76$ |
| 26 | $4 \begin{array}{llll}48 & 37 \cdot 1\end{array}$ | -90 | $4 \begin{array}{llll}4 & 19 & 3\end{array}$ | $\cdot 87$ | $42021 \cdot 6$ | -84 | 4 21 II.O | -81 | 42158.4 | $\cdot 77$ | 42244.0 | 74 |
| 28 | 41022.4 | + 90 | 4 II 15.6 | + 87 | 4 I2 6.6 | $+.83$ | $41255 \cdot 6$ | + 80 | $\begin{array}{llll}4 & 13 & 42\end{array}$ | + $\cdot 76$ | $41427 \cdot 1$ | + 73 |
| 30 | 4 2 $7 \cdot 7$ <br> 3 5  | $\cdot 91$ | $\begin{array}{rrrr}4 & 3 & 0.9 \\ 3 & 5 & 53.6\end{array}$ | . 87 | $\begin{array}{lrrr}4 & 3 & 5 \mathrm{r} \cdot 8\end{array}$ | -83 | $4 \begin{array}{lll}4 & 4 & 40 \cdot 4\end{array}$ | $\cdot 79$ | 45566 | $\cdot 75$ | $4 \quad 6 \quad 10 \cdot 5$ | $\cdot 71$ |
| 31 | $\begin{array}{llll}3 & 58 & 0.2\end{array}$ | -91 | $\begin{array}{llllllllllllllll}3 & 58 & 53 \cdot 6\end{array}$ | $\cdot 87$ | $3 \begin{array}{llll}3 & 59 & 44.4\end{array}$ | -83 | $\begin{array}{rrrr}4 & 0 & 32.8\end{array}$ | -79 | $\begin{array}{rrrr}4 & \text { I } & 18.8\end{array}$ | -74 | $\begin{array}{lrrr}4 & 2 & 2 \cdot 3\end{array}$ | $\cdot 70$ |
| 32 | $\begin{array}{lllll}3 & 53 & 52 \cdot 8\end{array}$ | -91 | $355446 \cdot 2$ | -87 |  | -82 | $\begin{array}{llll}3 & 56 & 25 \cdot 3\end{array}$ | $\cdot 78$ | 3571110 | $\cdot 74$ | $\begin{array}{lllllllll}3 & 57 & 54.2\end{array}$ | -70 |
| 33 | $\begin{array}{llllllll}3 & 49 & 45 \cdot 3\end{array}$ | -9 | $35038 \cdot 9$ | -87 | 35129.6 | -82 | $\begin{array}{lllll}3 & 52 & 17 \cdot 8\end{array}$ | $\cdot 78$ | $3 \begin{array}{lll}3 & 53 & 3 \cdot 3\end{array}$ | -74 | $35316 \cdot 2$ | -69 |
| 34 | $3 \begin{array}{lllll}3 & 45 & 37 \cdot 8\end{array}$ | + 92 | $34631 \cdot 5$ | + 87 | $\begin{array}{lllll}3 & 47 & 22 \cdot 3\end{array}$ | + 82 | $3 \begin{array}{lll}3 & 48 & 10.4\end{array}$ | + $\cdot 78$ | $34^{3} 855 \cdot \%$ | + 73 | $\begin{array}{lllll}3 & 49 & 38 \cdot 2\end{array}$ | + 69 |
| 35 | $\begin{array}{llll}3 & 41 & 30 \cdot 3\end{array}$ | -92 | 3 42 $24 \cdot 1$ | -87 | $34315{ }^{3}$ | . 82 | $\begin{array}{llll}3 & 44 & 3 & 0\end{array}$ | $\cdot 77$ | 344 48.1 | -73 | $\begin{array}{llllllllllllllll}3 & 45 & 30 \cdot 3\end{array}$ | -68 |
| 36 | $\begin{array}{llll}3 & 37 & 22 \cdot 7\end{array}$ | -92 | $\begin{array}{llll}3 & 38 & 16 \cdot 7\end{array}$ | -87 | $\begin{array}{llll}3 & 39 & 7 \cdot 6\end{array}$ | -82 | $\begin{array}{llll}3 & 39 & 55 \cdot 6\end{array}$ | -77 | $3 \begin{array}{llll}3 & 40 & 40 \cdot 5\end{array}$ | $\cdot 72$ | $3{ }^{3} 412224$ | -67 |
| 37 | $\begin{array}{llll}3 & 33 & 15.0\end{array}$ | -93 | $\begin{array}{llll}3 & 34 & 9 \cdot 2\end{array}$ | -88 | $\begin{array}{llll}3 & 35 & 0.3\end{array}$ | . 82 | $\begin{array}{lllll}3 & 35 & 48 \cdot 2\end{array}$ | -77 | $\begin{array}{llll}3 & 36 & 33 \cdot 0\end{array}$ | -72 | $\begin{array}{llllllll}3 & 37 & 14.7\end{array}$ | - 67 |
| 38 | $\begin{array}{llll}3 & 29 & 7 \cdot 3\end{array}$ | -93 | 330 1.7 | -88 | $\begin{array}{llllllllllllllll}3 & 30 & 52 \cdot 9\end{array}$ | -82 | 3 35 40.8 | $\cdot 77$ | $\begin{array}{llll}3 & 32 & 25 \cdot 5\end{array}$ | $\cdot 72$ | $\begin{array}{llll}3 & 33 & 6 \cdot 9\end{array}$ | -66 |
| 39 | $3 \begin{array}{lll}3 & 24 & 59.4\end{array}$ | + 94 | 325154.2 | + 88 |  | $+.83$ | $3 \begin{array}{llll}3 & 27 & 33.5\end{array}$ | + -77 | 32818.0 | + 71 | $\begin{array}{llll}3 & 28 & 59.2\end{array}$ | +.66 |
| 40 | $32051 \cdot 6$ | -95 | $\begin{array}{llll}3 & 21 & 46 \cdot 6\end{array}$ | -89 |  | -83 | $\begin{array}{llll}3 & 23 & 26 \cdot I\end{array}$ | -77 | $32410 \cdot 6$ | $\cdot 7 \mathrm{I}$ | 3245 5.6 | - 65 |
| 41 | $\begin{array}{llll}3 & 16 & 43 \cdot 6\end{array}$ | -95 | $\begin{array}{lllll}3 & 17 & 39.0\end{array}$ | -89 | $\begin{array}{lllll}3 & 18 & 30 \cdot 7\end{array}$ | -83 | $\begin{array}{llll}3 & 19 & 18.8\end{array}$ | $\cdot 77$ | $\begin{array}{llll}3 & 20 & 3 \cdot 2\end{array}$ | $\cdot 71$ | $32044^{\circ} \mathrm{O}$ | - 65 |
| 42 | $\begin{array}{llll}3 & 12 & 35 \cdot 5\end{array}$ | -96 | $\begin{array}{llll}3 & 13 & 31.3\end{array}$ | -90 | $\begin{array}{llll}3 & 14 & 23 \cdot 3\end{array}$ | -83 | 3 I5 II. 4 | -77 | $\begin{array}{lllll}3 & 15 & 55 \cdot 8\end{array}$ | $\cdot 7 \mathrm{I}$ | $\begin{array}{llll}3 & 16 & 36 \cdot 4\end{array}$ | -65 |
| 43 | $\begin{array}{lllll}3 & 8 & 27 \cdot 3\end{array}$ | -97 | $3 \quad 9 \quad 23 \cdot 6$ | -90 | 3 10 15.8 | -84 | 3 II 4.1 | $\cdot 77$ | 3 II 48.4 | $\cdot 71$ | $\begin{array}{llll}3 & 12 & 28 \cdot 9\end{array}$ | -64 |
| 44 | $3 \begin{array}{lll}3 & 4 \\ 3 & \text { 91 }\end{array}$ | + 98 | $3 \begin{array}{llll}3 & 5 & 15.7\end{array}$ | + 91 | $\begin{array}{lll}3 & 6 & 8 \cdot 3\end{array}$ | + .84 | $\begin{array}{llll}3 & 6 & 56 \cdot 7\end{array}$ | + •77 | $374 \mathrm{I} \cdot \mathrm{I}$ | + •7I | $3882 r .4$ | - 64 |
| 45 | $\begin{array}{llll}3 & 0 & 10.6\end{array}$ | -99 | $\begin{array}{llll}3 & 1 & 7 \cdot 8\end{array}$ | -92 | $\begin{array}{lrrr}3 & 2 & 0.6\end{array}$ | -85 | $\begin{array}{rrrr}3 & 2 & 49 \cdot 3\end{array}$ | - 78 | $\begin{array}{llll}3 & 3 & 33 \cdot 7\end{array}$ | $\cdot 7 \mathrm{I}$ | $\begin{array}{llll}3 & 4 & 13.9\end{array}$ | -64 |
| 46 | $\begin{array}{lll}2 & 56 & 2 \cdot 0\end{array}$ | -00 | $\begin{array}{llll}2 & 56 & 59 \cdot 7\end{array}$ | $\cdot 92$ | $2 \begin{array}{lllllll}2 & 57 & 53\end{array}$ | .85 | $\begin{array}{llll}2 & 58 & 4 \mathrm{I} \cdot 9\end{array}$ | $\cdot 78$ | $2 \begin{array}{llll}2 & 59 & 26 \cdot 2\end{array}$ | $\cdot 71$ | $3 \quad 0 \quad 6 \cdot 5$ | . 63 |
| 48 | $\begin{array}{llll}2 & 51 & 53 \cdot 2 \\ 2 & 47 & 44.3\end{array}$ | 1 | $\begin{array}{lllll}2 & 52 & 51 \cdot 6 \\ 2 & 48 & 4\end{array}$ | -93 | $\begin{array}{lllll}2 & 53 & 45 \cdot 3\end{array}$ | . 86 | $\begin{array}{llll}2 & 54 & 34.4 \\ 2 & 50 & 26.9\end{array}$ | $\cdot 78$ | 25519.0 | $\cdot 71$ | $2 \begin{array}{lll}25 & 59.0 \\ 2 & 55 & 5\end{array}$ | -63 |
| 48 | 22 47 44 <br>    | 1.02 | $2 \begin{array}{llllllll}2 & 48 & 43 \cdot 3\end{array}$ | -94 | $24937 \cdot 5$ | -86 | $2 \begin{array}{llll}2 & 50 & 26 \cdot 9\end{array}$ | $\cdot 78$ | $25119 \cdot 7$ | $\cdot 71$ | $2515 \mathrm{~F} \cdot 8$ | . 63 |
| 49 | $\begin{array}{llll}2 & 43 & 35 \cdot 2\end{array}$ | +1.04 | $2 \begin{array}{llll}2 & 44 & 34.9\end{array}$ | + 95 | $\begin{array}{llll}2 & 45 & 29.6\end{array}$ | +.87 | $2 \begin{array}{llll}2 & 46 & 19.4\end{array}$ | + •79 | $\begin{array}{llll}2 & 47 & 4.3\end{array}$ | + 71 | $24744 \cdot 3$ | +.63 |
| 50 | $2 \begin{array}{llll}2 & 39 & 25.9\end{array}$ | I 0 | $240 \begin{array}{llll} & 40 & 26 \cdot 4\end{array}$ | -96 | 24121.7 | -88 | 242 II*7 | $\cdot 79$ | $2 \begin{array}{llll}2 & 42 & 56 \cdot 9\end{array}$ | . 7 I | $24336 \cdot 9$ | . 63 |
| 51 | $2 \begin{array}{llll}2 & 35 & 16 \cdot 3\end{array}$ | I.07 |  | -98 |  | -89 | $\begin{array}{llll}2 & 38 & 4 \cdot 2\end{array}$ | -80 | $\begin{array}{lllllllllllll}2 & 38 & 49\end{array}$ | $\cdot 71$ | $2 \begin{array}{lllll}2 & 39 & 29 \cdot 5\end{array}$ | - 62 |
| 52 | $\begin{array}{llll}2 & 31 & 6 \cdot 5\end{array}$ | I.09 | $\begin{array}{llll}2 & 32 & 8 \cdot 7\end{array}$ | -99 | 23315 | -90 | $23356 \cdot 5$ | -8I | $23442 \cdot 1$ | $\cdot 71$ | $235 \quad 22 \cdot 2$ | -62 |
| 53 | 22656.4 | I-ro | 22759.6 | 1.00 | $22857 \cdot 0$ | $\cdot 91$ | $2 \begin{array}{lllll}2 & 29 & 48 \cdot 6\end{array}$ | -81 | 23034.6 | $\cdot 72$ | 23514.9 | 2 |
| 54 | $22245 \cdot 9$ | +1.12 | $22350 \cdot 3$ | + I. 02 |  | + 922 | $22540 \cdot 8$ | +.82 | $\begin{array}{llll}2 & 26 & 27 \cdot 1\end{array}$ | + 72 | $\begin{array}{llll}2 & 27 & 7 \cdot 5\end{array}$ | +.63 |
| 55 | $2 \begin{array}{lll}2 & 18 & 35 \cdot 2\end{array}$ | I•15 | 2 I9 $40 \cdot 7$ | I.04 | $2 \begin{array}{llll}20 & 39 \cdot 9\end{array}$ | -93 | $2 \mathrm{2I}$ | -83 | 222219.5 | $\cdot 73$ | $\begin{array}{llr}2 & 23 & 0.2 \\ 2 & 18 & 5.8\end{array}$ | - 63 |
| 56 | 21424.1 | I•17 |  | 1.06 | $21635 \cdot 0$ | -95 | 2 I7 24.7 | -84 | 2 I8 II.9 | $\cdot 73$ | $\begin{array}{lllll}2 & 18 & 52.8\end{array}$ | -63 |
| 57 | $2 \begin{array}{lll}2 & 10 & 12.6\end{array}$ | I-19 | 2 II $20 \cdot 7$ | I.08 | $21222 \cdot 0$ |  | $2 \mathrm{I} 316 \cdot 5$ | -85 | $\begin{array}{llll}2 & 1 & 4 & 4.2\end{array}$ |  | $2 \begin{array}{llllllll}14 & 45.4\end{array}$ | -63 |
| 58 | $2 \begin{array}{lll}2 & 6 & 0.6\end{array}$ | I. 22 | $2710 \cdot 3$ | 1 | $2 \quad 8 \quad 12.7$ | $\cdot 98$ | $98 \cdot 1$ | -86 | $2 \begin{array}{llll} & 9 & 56 \cdot 5\end{array}$ | $\cdot 75$ | 2 10 38.0 | $\cdot 63$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $\mathrm{y}^{\circ} \mathrm{A}$. |  | L. $8^{\circ}$ A. |  | L. $8^{\circ}$ A. |  | L. $10^{\circ}$ A. |  | L. 1 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | s. | S. | s. | s. | s. | s. | s. | s. | s. |
| 0 | + 4.45 | $-4.15$ | +.52 | $-4 \cdot 15$ | +.60 | $-4 \cdot 16$ | $+\cdot 67$ | $-4 \cdot 17$ | +.75 | $-4 \cdot 19$ | +.83 | $-4.20$ |
| 4 | $\cdot 37$ | $4 \cdot 14$ | -45 | $4 \cdot 15$ | $\cdot 52$ | $4 \cdot 15$ | -60 | $4 \cdot 17$ | -68 | $4 \cdot 18$ | $\cdot 75$ | $4 \cdot 19$ |
| 8 | -30 | $4 \cdot 13$ | -38 | $4 \cdot 14$ | -45 | 4.15 | - 53 | $4 \cdot 15$ | -61 | 4.17 | -68 | 4.18 |
| 12 | - 23 | $4 \cdot 13$ | -31 | $4 \cdot 13$ | -39 | 4.14 | $\cdot 46$ | $4 \cdot 15$ | $\cdot 54$ | 4-16 | -62 | $4 \cdot 17$ |
| 16 | -17 | $4 \cdot 12$ | - 24 | $4 \cdot 13$ | -32 | 4.13 | -40 | $4 \cdot 14$ | -47 | 4.15 | -55 | $4 \cdot 16$ |
| 20 | + -10 | $4 \cdot 12$ | + - 18 | 4•13 | +.26 | $4 \cdot 13$ | + 33 | 4.13 | + 4 II | $4 \cdot 14$ | + 49 | $4 \cdot 15$ |
| 22 | -06 | $4 \cdot 12$ | -14 | $4 \cdot 12$ | - 22 | 4.13 | $\cdot 30$ | $4 \cdot 13$ | $\cdot 38$ | 4-14 | $\cdot 46$ | $4 \cdot 15$ |
| 24 | +.03 | $4 \cdot 12$ | -II | $4 \cdot 12$ | -19 | $4 \cdot 13$ | $\cdot 27$ | $4 \cdot 13$ | -35. | $4 \cdot 14$ | -43 | $4 \cdot 14$ |
| 26 | - 01 | $4 \cdot 12$ | -08 | $4 \cdot 12$ | -16 | $4 \cdot 13$ | -24 | $4 \cdot 13$ | $\cdot 32$ | 4-14 | $\cdot 40$ | $4 \cdot 14$ |
| 28 | $\cdot 04$ | $4 \cdot 12$ | - 04 | 4.12 | -12 | 4-12 | -2I | 4.13 | -29 | 4.13 | -37 | $4 \cdot 14$ |
| 30 | .08 | $4 \cdot 12$ | +.OI | $4 \cdot 12$ | +.09 | $4 \cdot 12$ | +.18 | $4 \cdot 13$ | + $\cdot 26$ | $4 \cdot 13$ | + 35 | $4 \cdot 14$ |
| 32 | -12 | $4 \cdot 12$ | -03 | $4 \cdot 12$ | . 05 | 4-12 | -14 | $4 \cdot 12$ | $\cdot 23$ | $4 \cdot 13$ | -31 | $4 \cdot 13$ |
| 34 | -16 | $4 \cdot 12$ | . 07 | $4 \cdot 12$ | - 02 | $4 \cdot 12$ | - II | $4 \cdot 12$ | - 20 | 4-13 | - 29 | 4.13 |
| 36 | -20 | $4 \cdot 13$ | -11 | 4.12 | - 01 | $4 \cdot 12$ | -07 | $4 \cdot 12$ | - I6 | 4-12 | -25 | 4.13 |
| 38 | $\cdot 24$ | 4-13 | - 15 | 4.13 | -05 | 4-12 | + . 04 | $4 \cdot 12$ | -13 | $4^{\cdot 13}$ | $\cdot 23$ | $4 \cdot 13$ |
| 40 | - . 28 | $4 \cdot 13$ | - .18 | 4.12 | - .09 | $4 \cdot 12$ | - 00 | $4^{\cdot 12}$ | + - 10 | $4 \cdot 12$ | + -19 | $4 \cdot 13$ |
| 42 | -33 | $4 \cdot 13$ | - 23 | 4.13 | -13 | 4-12 | -03 | $4 \cdot 12$ | . 07 | $4 \cdot 12$ | $\cdot 17$ | $4 \cdot 12$ |
| 44 | -38 | $4 \cdot 14$ | $\cdot 27$ | $4 \cdot 13$ | -17 | 4-13 | -07 | $4 \cdot 12$ | . 03 | 4.12 | -13 | $4 \cdot 12$ |
| 46 | -43 | $4 \cdot 14$ | $\cdot 32$ | $4 \cdot 13$ | -21 | $4 \cdot 13$ | - II | $4 \cdot 12$ | - 00 | $4 \cdot 12$ | $4 \cdot 10$ | $4 \cdot 12$ |
| 48 | $\cdot 48$ | $4 \cdot 15$ | $\cdot 37$ | $4 \cdot 14$ | $\cdot 26$ | 4.13 | -15 | $4 \cdot 12$ | - 04 | 4-12 | $\cdots 7$ | $4 \cdot 12$ |
| 50 | - 54 | $4 \cdot 16$ | -42 | 4.14 | - 31 | $4 \cdot 13$ | - -19 | $4 \cdot 13$ | -. 08 | 4.12 | +.04 | $4 \cdot 12$ |
| 52 | -60 | $4 \cdot 17$ | -48 | $4 \cdot 15$ | $\cdot 36$ | $4 \cdot 14$ | - 24 | $4 \cdot 13$ | -12 | $4 \cdot 12$ | . 00 | $4 \cdot 12$ |
| 54 | $\cdot 67$ | 4.18 | -54 | $4 \cdot 16$ | -41 | $4 \cdot 14$ | $\cdot 28$ | $4 \cdot 13$ | -16 | $4 \cdot 13$ | - 04 | $4 \cdot 12$ |
| 56 | $\cdot 74$ | $4 \cdot 19$ | -60 | $4 \cdot 17$ | $\cdot 47$ | $4 \cdot 15$ | -34 | $4 \cdot 14$ | -21 | $4 \cdot 13$ | $\cdot 07$ | $4 \cdot 12$ |
| 58 | -82 | $4 \cdot 20$ | -68 | 4.18 | $\cdot 53$ | $4 \cdot 16$ | -39 | $4 \cdot 14$ | $\cdot 25$ | 4.13 | -II | $4 \cdot 12$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & \text { I2 } \\ 9 \cdot I \end{array}\right.$ | $\begin{gathered} s . \\ +1 \cdot 04 \end{gathered}$ | $\begin{array}{ccc} \mathrm{H} . & \mathrm{M} . & \mathrm{S} . \\ 6 & \mathrm{r} 3 & 12 \cdot \mathrm{O} \end{array}$ | $+\mathrm{r} \cdot 05$ | $\begin{array}{ccc} \mathrm{H} . \mathrm{M} & \mathrm{~S} . \\ 6 & 14 & 15 \cdot 3 \end{array}$ | $\begin{gathered} S . \\ +r \cdot 06 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I5 } & 19 \cdot 3 \end{array}$ | $\left\lvert\, \begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 07 \end{gathered}\right.$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } 6 & 23 \cdot 9 \end{array}$ | $\begin{gathered} s . \\ +1 \cdot 08 \end{gathered}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 17 \\ 29 \cdot 2 \end{array}\right.$ | S. |
| 10 | $\begin{array}{llll}5 & 30 & 7.8\end{array}$ | . 89 | $5 \begin{array}{lll}51 & 1.2\end{array}$ | . 89 | 5 31 $54 \cdot 3$ | . 88 | $\begin{array}{llll}5 & 32 & 47 \cdot 1\end{array}$ | . 88 | $\begin{array}{lllllllllllllll}5 & 33 & 39 \cdot 5\end{array}$ | . 87 | $\begin{array}{llll}5 & 34 & 31 \cdot 7\end{array}$ | . 87 |
| 12 | 5 21 $45 \cdot 8$ | . 87 | $\begin{array}{llll}5 & 22 & 37 \cdot 6\end{array}$ | . 86 | $\begin{array}{llll}5 & 23 & 28 \cdot 8\end{array}$ | . 85 | $\begin{array}{llll}5 & 24 & 19.6\end{array}$ | - 84 | $\begin{array}{llll}5 & 25 & 9 \cdot 8\end{array}$ | -83 | $\begin{array}{llll}5 & 25 & 59 \cdot 6\end{array}$ | . 82 |
| 14 | $\begin{array}{llll}5 & 13 & 24.5\end{array}$ | - 84 | $\begin{array}{llllllllll}5 & 1 & 1\end{array}$ | - 83 | $\begin{array}{lll}5 & 15 & 4 \cdot 1\end{array}$ | -82 | $\begin{array}{lllllllllll}5 & 15 & 5 \cdot 9\end{array}$ | -8r | 5 I6 41.0 | -80 | 5 17 28.5 | $\cdot 78$ |
| 16 | $\begin{array}{llll}5 & 5 & 3 \cdot 7\end{array}$ | . 82 | $\begin{array}{llll}5 & 5 & 52 \cdot 3\end{array}$ | . 80 | $5640 \cdot 1$ | $\cdot 79$ | $\begin{array}{llll}5 & 7 & 27 & 0\end{array}$ | $\cdot 77$ | $5 \quad 8 \quad 13.0$ | $\cdot 76$ | $\begin{array}{llll}5 & 8 & 58 \cdot 2\end{array}$ | 74 |
| 18 | $45643 \cdot 5$ | + •79 | $45730 \cdot 7$ | $+\cdot 78$ | $458 \times 6.8$ | + •76 | $4 \begin{array}{lll}59 & \text { I } 8\end{array}$ | + $\cdot 74$ | $45945 \%$ | + 72 | $5 \quad 0 \quad 28 \cdot 7$ | + •71 |
| 20 | $4 \begin{array}{llll}48 & 23.8\end{array}$ | $\cdot 77$ | $449 \quad 9.6$ | $\cdot 75$ | 44954.1 | $\cdot 73$ | $450 \quad 37 \cdot 3$ | - 71 | 4 5I 19.3 | . 69 | $4520 \cdot 0$ | . 67 |
| 22 | 4404.6 | $\cdot 75$ | $44049 \cdot 0$ | $\cdot 73$ | $44 \mathrm{I} 32 \cdot 0$ | $\cdot 70$ | $4 \quad 42 \quad 13.4$ | -68 | $\begin{array}{llll}4 & 42 & 53.4\end{array}$ | - 65 | $44332 \cdot 1$ | . 63 |
| 24 | 4 3I 45.9 | $\cdot 73$ | 43229.0 | - 70 | 43310.4 | -67 | 433 50•1 | -65 | $434 \quad 28 \cdot 3$ | - 62 | $4354 \cdot 7$ | 59 |
| 2 | $\begin{array}{llll}4 & 23 & 27 \cdot 6\end{array}$ | $\cdot 71$ | $4 \begin{array}{lll}4 & 24 & 9.4\end{array}$ | . 68 | $42449 \cdot 3$ | . 65 | $\begin{array}{llllll}4 & 25 & 27 \cdot 4\end{array}$ | . 62 | $\begin{array}{llll}4 & 26 & 3 \cdot 7\end{array}$ | -59 | $42638 \cdot 1$ | 56 |
| 28 | $415 \quad 9.7$ | $+.69$ | 41550.2 | + 66 | $41628 \cdot$ | + 62 | 4 I7 5.2 | + . 59 | 4 I7 $39 \cdot 6$ | + 56 | 418 12.0 | + $\cdot 52$ |
| 30 | $4 \quad 6 \quad 52 \cdot 2$ | . 67 | 4731.5 | . 64 | 4888.6 | . 60 | $48843 \cdot 4$ | . 56 | 4981 | . 52 | $4 \quad 9 \quad 46 \cdot 4$ | . 49 |
| 31 | $\begin{array}{lrrr}4 & 2 & 43 \cdot 5\end{array}$ | - 67 | $4 \quad 322 \cdot 3$ | -63 | $4 \begin{array}{lll}4 & 3 & 58 \cdot 7\end{array}$ | -59 | $\begin{array}{llll}4 & 4 & 32 \cdot 8\end{array}$ | - 55 | 4504.5 | -51 | $4 \begin{array}{llll}4 & 5 & 33.8\end{array}$ | -47 |
| 32 | $\begin{array}{llll}3 & 58 & 35 \cdot 0\end{array}$ | - 66 | $\begin{array}{lllllllll}3 & 59 & 13 \cdot 2\end{array}$ | -6I | $35948 \cdot 9$ | -57 | $4 \quad 0 \quad 22 \cdot 2$ | -53 | $4053 \cdot 0$ | -49 | 4 I $21 \cdot 3$ | $\cdot 45$ |
| 33 | $354 \quad 26 \cdot 5$ | -65 | 3554.1 | -6I | $35539 \cdot 2$ | -56 | $35611 \cdot 7$ | . 52 | $35641 \cdot 6$ | $\cdot 48$ | $\begin{array}{llll}3 & 57 & 9 \cdot 0\end{array}$ | 43 |
| 3 | $350 \mathrm{I} 8 \cdot \mathrm{I}$ | +.64 | $35055 \cdot 2$ | + 59 | 3 5I 29.6 | + 55 | $\begin{array}{llll}3 & 52 & 1.4\end{array}$ | + 515 | $35230 \cdot 4$ | + $\cdot 46$ | $35256 \cdot 7$ | + 41 |
| 35 | 346 | . 63 | $34646 \cdot 3$ | -59 | 347 20.1 | $\cdot 54$ | 34751 | - 49 | 348 I9.2 | $\cdot 44$ |  | $\cdot 40$ |
| 3 | $\begin{array}{llll}3 & 42 & 1.5\end{array}$ | -62 | $\begin{array}{llll}3 & 42 & 37 \cdot 6\end{array}$ | -58 | $\begin{array}{llll}3 & 43 & 10 \%\end{array}$ | - 53 | $\begin{array}{lllllllll}3 & 43 & 40 \cdot 9\end{array}$ | - 48 | $\begin{array}{llll}3 & 44 & 8 \cdot 2\end{array}$ | -43 | $34432 \cdot 5$ | 38 |
| 37 | $\begin{array}{llll}3 & 37 & 53 \cdot 3\end{array}$ | -62 | $\begin{array}{llll}3 & 38 & 28 \cdot 9\end{array}$ | -57 | $\begin{array}{llll}3 & 39 & 1.4\end{array}$ | - 52 | $\begin{array}{lllll}3 & 39 & 30 \cdot 8\end{array}$ | -46 | $\begin{array}{lllll}3 & 39 & 57 \cdot 2\end{array}$ | $\cdot 41$ | $340 \quad 20 \cdot 5$ | -36 |
| 3 | $33345 \cdot 2$ | -61 | $33420 \cdot 2$ | $\cdot 56$ | $\begin{array}{llll}3 & 34 & 52 \cdot x\end{array}$ | -50 | $3 \quad 35 \quad 20 \cdot 8$ | -45 | 33546.4 | -40 |  | -34 |
| 39 | $3 \begin{array}{llll}3 & 29 & 37 \cdot 1\end{array}$ | + . 60 | 3 30 11.7 | + .55 | $33043 \cdot 0$ | + 49 | 33110.9 | + 44 | 3 31 $35 \cdot 6$ | + 38 | 3 3I 56.9 | + 33 |
| 40 | $\begin{array}{llll}3 & 25 & 29 \cdot 1\end{array}$ | -60 | $\begin{array}{llll}3 & 26 & 3 \cdot 2\end{array}$ | -54 | $\begin{array}{llll}3 & 26 & 33.9\end{array}$ | -48 | 327 I•1 | $\cdot 42$ | $3 \begin{array}{llll}3 & 27 & 24.9\end{array}$ | - 37 | $\begin{array}{llllllll}3 & 27 & 45\end{array}$ | $\cdot 3 \mathrm{I}$ |
| 41 | 3 2I 2I•2 | -59 | 32154.8 | -53 | $\begin{array}{llll}3 & 22 & 24.9\end{array}$ | -47 | 32251.4 | -41 | $3 \quad 2314.3$ | -35 |  | -29 |
| 42 | $\begin{array}{lllll}3 & 17 & 13\end{array}$ | -58 | 3 17746.5 | -52 | 3 I 8 16.0 | -46 | $\begin{array}{lllll}3 & 18 & 41 \cdot 8\end{array}$ | -40 | $\begin{array}{llll}3 & 19 & 3.8\end{array}$ | - 33 | $\begin{array}{lllll}3 & 19 & 22 \cdot 1\end{array}$ | $\cdot 27$ |
| 43 | $\begin{array}{llll}3 & 13 & 5 \cdot 5\end{array}$ | - 58 | 3 I3 $38 \cdot 3$ | . 51 | $\begin{array}{llll}3 & 14 & 7 \cdot 2\end{array}$ | -45 | 3 I4 $32 \cdot 3$ | -38 | $\begin{array}{lllll}3 & 14 & 53.4\end{array}$ | $\cdot 32$ |  | -25 |
|  | $\begin{array}{llll}3 & 8 & 57 \cdot 7\end{array}$ | +-57 | $3 \begin{array}{lll}3 & 9 & 30 \cdot 1\end{array}$ | + 51 | $3 \begin{array}{lll}3 & 9 & 5\end{array}$ | + 44 | 3 IO $22 \cdot 7$ | + 37 | 3 IO 43.0 | + 30 | 3 IO 59.2 | + 24 |
| 4 | $3{ }^{3}$ | . 57 | $3 \begin{array}{llll}3 & 5 & 21.9\end{array}$ | -50 | $3 \begin{array}{lll}3 & 5 & 49 \cdot 7\end{array}$ | $\cdot 43$ | $3 \begin{array}{lll}3 & 6 & 13 \cdot 3\end{array}$ | -36 | $\begin{array}{llll}3 & 6 & 32 \cdot 7\end{array}$ | -29 | $\begin{array}{llll}3 & 6 & 47 \cdot 9\end{array}$ | $\cdot 22$ |
| 46 | $3 \quad 0 \quad 42 \cdot 3$ | -56 | $\begin{array}{llll}3 & 1 & 13.8\end{array}$ | -49 | 3 I 4I.0 | -42 | $\begin{array}{llll}3 & 2 & 3 \cdot 9\end{array}$ |  | $\begin{array}{llll}3 & 2 & 22 \cdot 5\end{array}$ | -27 | $\begin{array}{llll}3 & 2 & 36 \cdot 6\end{array}$ | 20 |
| 47 | $2 \begin{array}{llll}2 & 56 & 34 \cdot 7\end{array}$ | $\cdot 56$ | $\begin{array}{llll}2 & 57 & 5.8 \\ 2 & 52 & 57.8\end{array}$ | $\cdot 48$ | $\begin{array}{llll}2 & 57 & 32.4\end{array}$ | -41 | $2 \begin{array}{llllll}2 & 5 & 54.6\end{array}$ | -33 | $2 \begin{array}{llll}2 & 58 & 12 \cdot 3\end{array}$ | -26 | $\begin{array}{llll}2 & 58 & 25 \cdot 4\end{array}$ | 18 |
| 48 | $25227 \cdot 1$ | -55 | $2 \begin{array}{llll} & 52 & 57 \cdot 8\end{array}$ | -47 | 253123.9 | -40 | $25345 \cdot 4$ |  | $254 \quad 2 \cdot 2$ | $\cdot 2$ | $25414 \cdot 2$ | 6 |
| 49 | $2 \begin{array}{llll} & 48 & 19.5\end{array}$ | + $\cdot 55$ | $24^{2} 4849 \cdot 9$ | + 47 | 249 I5.5 | + 39 | $24936 \cdot 2$ | + 30 | 249 52.I | + 22 | $250 \quad 3 \cdot 1$ | $+\cdot 14$ |
| 50 | $24412 \cdot 0$ | $\cdot 54$ | $24442 \cdot 0$ | -46 | $2 \begin{array}{lll}2 & 45 & 7 \cdot 1\end{array}$ | $\cdot 38$ | $245 \begin{array}{lllll} & 27 & 1\end{array}$ |  |  | -21 | $245152 \cdot 0$ | 2 |
| 51 | 24040 | -54 | 24034.2 | $\cdot 45$ | $240 \quad 58 \cdot 7$ | $\cdot 37$ | 24 I I8.I |  | $24132 \cdot 1$ | 19 | $24140 \cdot 9$ | 10 |
| 52 | $235157 \cdot 0$ | -53 | $2 \begin{array}{llll}26 & 26 \cdot 4\end{array}$ | -44 | $\begin{array}{lllll}2 & 36 & 50 \cdot 4\end{array}$ | -35 | $2379{ }^{2} 30$ | - 26 | $237 \quad 22 \cdot 2$ | -17 | $2 \begin{array}{llll}27 & 29 \cdot 9\end{array}$ | -08 |
| 53 | 23149.6 | -53 | $23218 \cdot 7$ | $\cdot 44$ | $\begin{array}{lllll}2 & 32 & 42 \cdot 2\end{array}$ | -34 | $\begin{array}{llll}2 & 33 & 0 \cdot 1\end{array}$ | . 25 | 23312.4 | -16 | $\begin{array}{llllll}2 & 33 & 18.9\end{array}$ | 06 |
| 5 | 22742.2 | + 53 | 228 II.O | + 43 | $\begin{array}{llll}2 & 28 & 34 \cdot 0\end{array}$ | + 33 | 228 5I.2 | + $\cdot 24$ | $\begin{array}{lll}2 & 29 & 2.5\end{array}$ | + 14 | $\begin{array}{llll}2 & 29 & 7 \cdot 9\end{array}$ | + 04 |
| 55 |  | $\cdot 52$ | $\begin{array}{lll}2 & 24 & 3.2\end{array}$ | -43 | $\begin{array}{llll}2 & 24 & 25.9\end{array}$ | - 33 | $22442 \cdot 3$ |  | $22452 \cdot 7$ |  | $22456 \cdot 9$ | + 02 |
| 56 | $\begin{array}{llll}2 & 19 & 27 \cdot 4\end{array}$ | $\cdot 52$ | $2 \mathrm{I} 955 \cdot 8$ | -42 | 220177.8 | $\cdot 31$ | $22033 \cdot 6$ |  | $22043 \cdot 0$ | -10 | $22046 \cdot 0$ | 00 |
| 57 | $21520 \cdot 1$ | -52 |  | -41 | $2 \mathrm{l} 6 \quad 9 \cdot 7$ | $\cdot 30$ | $216 \quad 24.8$ |  | $21633 \cdot 2$ | . 08 | $21635 \cdot 0$ | -. 03 |
| 58 | 21112.7 | $\cdot 52$ | 2 II $40 \cdot 6$ | * 4 | 2 l 21.8 | $\cdot 30$ | $2 \mathrm{I} 2 \mathrm{I} 6 \cdot \mathrm{I}$ |  | 21223.5 | $\cdot 07$ | $2 \mathrm{I} 224^{\circ} \mathrm{O}$ | .05 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  |  | L. $13^{\circ}$ A. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $1^{1 y^{\circ}} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{cc} \text { s. } & \text { S. } \\ +.90 & -4.22 \end{array}$ |  |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ +\quad .98 & -4.23 \end{array}$ |  | $\begin{array}{cc} \text { S. } & \text { s. } \\ +\mathrm{I} \cdot 06 & -4.25 \end{array}$ |  | $\begin{array}{cc} \text { S. } & \text { S. } \\ +\mathrm{I} \cdot \mathrm{I}_{4} & -4 \cdot 28 \end{array}$ |  | $\begin{array}{cc} \mathrm{s} . & \mathrm{s} . \\ +\mathrm{r} \cdot 22 & -4.30 \end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ +\mathrm{I} \cdot 30 & -4 \cdot 32 \end{array}$ |  |
| 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | . 834.20 |  |  | .91 4.22 |  | .98 4.24 |  | $\begin{array}{rr} +I \cdot 14 & -4.28 \\ I .06 & 4.26 \end{array}$ |  | $\begin{array}{rr} +\mathrm{r} .22 & -4.30 \\ \mathrm{I} .14 & 4.28 \end{array}$ |  | $\begin{array}{rr} +1.30 & -4.32 \\ 1.22 & 4.30 \end{array}$ |  |
| 8 | -76 4.19 |  |  | -84 4.21 |  | -91 4.22 |  | . 994.24 |  | 1.074 .26 |  | I.15 4.28 |  |
| 12 | -69 4.18 |  |  | -77 4.19 |  | . 854.21 |  | -93 4.22 |  | ror 4.24 |  | 1.094 .26 |  |
| 16 |  | -63 | 4.17 | -71 | $4 \cdot 18$ | -79 | $4 \cdot 20$ | . 87 | $4 \cdot 21$ | -95 | $4 \cdot 23$ | 1.03 | $4 \cdot 25$ |
| 20 | + | . 57 | 4.16 | +.65 | $4 \cdot 17$ | r+.73.70.67.65.62 | $4 \cdot 19$ | r+.81.79.76.73.71 | $4 \cdot 20$ | $+\quad .89$.87.84.82 | $4 \cdot 22$ | + 97 |  |
| 22 |  | . 54 | $4 \cdot 16$ | . 62 | $4 \cdot 17$ |  | $4 \cdot 18$ |  | $4 \cdot 20$ |  | $4 \cdot 21$ | . 95 | 4.23 |
| 24 |  | -51 | $4 \cdot 15$ | . 59 | $4 \cdot 16$ |  | 4.18 |  | 4.19 |  | $4 \cdot 21$ | -92 | 4.22 |
| 26 |  | -49 | $4 \cdot 15$ | -57 | $4 \cdot \mathrm{x} 6$ |  | $4 \cdot 17$ |  | $4 \cdot 19$ |  | $4 \cdot 20$ | -90 | $4 \cdot 22$ |
| 28 |  | $\cdot 45$ | $4 \cdot 15$ | $\cdot 54$ | $4 \cdot 16$ |  | 4.17 |  | $4 \cdot 18$ |  | $4 \cdot 20$ | . 88 | $4 \cdot 21$ |
| 30 | $+$ | $\cdot 43$ | 4-15 | .54$+\quad .52$.49.44 | $4 \cdot 16$ | r+.60.57.55.53 | 4-17 | +.69+66.64.62.60 | $4 \cdot 18$ | +.77 <br> .75 <br> .73 <br> .71 <br> .69 | $4 \cdot 20$ | r+.86.84.82.80.79 | $4 \cdot 21$ |
| 32 |  | -40 | $4 \cdot 14$ |  | $4 \cdot 15$ |  | $4 \cdot 16$ |  | $4 \cdot 17$ |  | $4 \cdot 19$ |  | $4 \cdot 21$ |
| 34 |  | $\cdot 37$ | $4 \cdot 14$ |  | $4 \cdot 15$ |  | $4 \cdot 16$ |  | $4 \cdot 17$ |  | $4 \cdot 19$ |  | $4 \cdot 20$ |
| 36 |  | $\cdot 34$ | $4 \cdot 14$ |  | $4 \cdot 14$ |  | $4 \cdot 16$ |  | 4.17 |  | $4 \cdot 18$ |  | $4 \cdot 20$ |
| 38 |  | $\cdot 32$ | $4 \cdot 13$ |  | $4 \cdot 14$ |  | $4 \cdot 15$ |  | 4.17 |  | $4 \cdot 18$ |  | $4 \cdot 20$ |
| 40 | $+$ | - 29 | $4 \cdot 13$ | r$+\quad .39$.36.34.31.29 | $4 \cdot 14$ | ++.48.46.44.42.40 | $4 \cdot 15$ | r+.58.56.54.52.51 | 4.16 | +.67.66.64.63.61 | $4 \cdot 18$ | $+\quad .77$$\cdot 76$$\cdot 75$$\cdot 73$$\cdot 73$ | $4 \cdot 19$ |
| 42 |  | -26 | $4 \cdot 13$ |  | $4 \cdot 14$ |  | 4.15 |  | 4.16 |  | $4 \cdot 17$ |  | $4 \cdot 19$ |
| 44 |  | -23 | $4 \cdot 13$ |  | $4 \cdot 14$ |  | $4 \cdot 15$ |  | $4 \cdot 16$ |  | 4.17 |  | $4 \cdot 19$ |
| 46 |  | -21 | $4 \cdot 13$ |  | $4 \cdot 13$ |  | $4 \cdot 14$ |  | $4 \cdot 15$ |  | $4 \cdot 17$ |  | $4 \cdot 19$ |
| 48 |  | - 18 | $4 \cdot 13$ |  | $4 \cdot 13$ |  | $4 \cdot 14$ |  | $4 \cdot 15$ |  | $4 \cdot 17$ |  | 4-19 |
| 50 | $+$ | - 15 | 4.12 | + .26 | $4 \cdot 13$ | + 38 | $4 \cdot 14$ | + 49 | $4 \cdot 15$ | +.60 | 4.17 | + 72 | 4.18 |
| 52 |  | -12 | $4 \cdot 12$ | -24 | $4 \cdot 13$ | -35 | $4 \cdot 14$ | -47 | $4 \cdot 15$ | . 59 | 4-16 | - 71 | $4 \cdot 18$ |
| 54 |  | -09 | $4 \cdot 12$ | $\cdot 21$ | $4 \cdot 13$ | -33 | $4 \cdot 14$ | -46 | $4 \cdot 15$ | . 58 | $4 \cdot 16$ | $\cdot 71$ | 4.18 |
| 56 |  | -06 | $4 \cdot 12$ | -18 | $4 \cdot 13$ | -31 | $4 \cdot 13$ | -44 | $4 \cdot 15$ | $\cdot 58$ | $4 \cdot 16$ | $\cdot 71$ | $4 \cdot 18$ |
| 58 |  | -02 | $4 \cdot 12$ | -16 | $4 \cdot 13$ | $\cdot 30$ | $4 \cdot 13$ | -43 | 4.15 | $\cdot 57$ | $4 \cdot 16$ | -71 | $4 \cdot 18$ |

DECLINATION—SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { 18 } \end{array} 3_{5 \cdot 2}\right\|$ | $\begin{gathered} 5 . \\ +r \cdot I I \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 19 & 42.0 \end{array}$ | $\begin{gathered} 5 . \\ +1 \cdot 12 \end{gathered}$ |  | $+1 \cdot 13$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 2 \mathrm{I} \end{array}\right.$ | $\begin{gathered} s . \\ +r \cdot 15 \end{gathered}$ | $\left\|\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 23 \\ 7.5 \end{array}\right\|$ | $\begin{gathered} \text { S. } \\ +1 \cdot 17 \end{gathered}$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 24 \\ \text { I } \cdot I \end{array}\right\|$ | $6$ |
| 10 | $1 \begin{array}{llll}5 & 35 & 23.6\end{array}$ | . 86 | $5 \quad 3615 \cdot 2$ | . 86 | $\begin{array}{llll}5 & 37 & 6.7\end{array}$ | - 86 | 53758.0 | . 85 | ${ }_{5}^{5} 38484.2$ | . 85 | $53940 \cdot 2$ | .85 |
| 12 | $1 \begin{array}{llll}5 & 26 & 48 \cdot 8\end{array}$ | - 82 | $527 \begin{array}{llll} & 37 \cdot 8\end{array}$ | -81 | $52826 \cdot 3$ | -80 | 52914.4 | $\cdot 80$ | $5302 \cdot 1$ | $\cdot 79$ | $53049 \cdot 6$ | 79 |
| 14 |  | $\cdot 77$ | $\begin{array}{lll}5 & 19 & 1.4\end{array}$ | $\cdot 76$ | 51947.0 | $\cdot 75$ | $52032 \cdot 0$ | $\cdot 74$ | $\begin{array}{llll}5 & 21 & 16.4\end{array}$ | -73 | 5220.2 | -73 |
| 16 | $1 \begin{array}{lll}5 & 9 & 42.5\end{array}$ | $\cdot 73$ | 5 10 26.0 | $\cdot 72$ | 5 II 8.7 | $\cdot 70$ | 5 II $50 \cdot 6$ | -69 | $\begin{array}{lllll}5 & 12 & 31.8\end{array}$ |  | $\begin{array}{llllllllllll}5 & 12 \cdot 2\end{array}$ | 7 |
| 18 | $5 \begin{array}{rrr}5 & 1 \\ 4 & 10\end{array}$ | $+.69$ | $5 \begin{array}{lll}5 & 1 & 51.5\end{array}$ | + 67 | $\begin{array}{llll}5 & 2 & 31 \cdot 4\end{array}$ | + 66 | $5{ }_{5} 310 \cdot 3$ | + 64 | $\begin{array}{llll}5 & 3 & 48.2\end{array}$ | + 62 | $5{ }^{5} 425 \cdot 1$ | + 61 |
| 20 | ${ }_{4}^{4} 52339.6$ | . 65 | 45317.9 | -63 | $45355 \cdot 0$ | .6I | $45430 \cdot 9$ | $\cdot 59$ | $1 \begin{array}{lll}4 & 55 & 5.6 \\ 4 & 4 & 23.8\end{array}$ | $\cdot 57$ | ${ }^{4} 55539 \cdot \mathrm{I}$ | 55 |
| 22 | $\begin{array}{llll}4 & 44 & 9.3\end{array}$ | I | $44445 \cdot 0$ | $\cdot 58$ | 44519.4 | $\cdot 56$ | $44552 \cdot 3$ | $\cdot 54$ | $4 \begin{array}{lll}4 & 46 & 23.8\end{array}$ | 51 | 44653.9 | 49 |
| 24 | $\left[\begin{array}{llll}4 & 35 & 39 \cdot 6\end{array}\right.$ | $\cdot 57$ | $\begin{array}{llll}4 & 36 & 12.9\end{array}$ | $\cdot 54$ | $43644 \cdot 5$ | 51 | $\begin{array}{llll}4 & 37 & 14.5\end{array}$ | 48 | $43742 \cdot 8$ | 46 | $\begin{array}{lll}4 & 38 & 9 \cdot 5\end{array}$ | 43 |
| 26 | 42710.7 | 53 | $42741 \cdot 4$ | . 50 | $42810 \cdot 3$ | $\cdot 47$ | $42837 \cdot 4$ | -43 | $4292 \cdot 6$ | 40 | 42925.9 | 37 |
| 28 | $41842 \cdot 3$ | + 49 | 4191010.6 | + 45 | $41936 \cdot 8$ | + 42 | 420009 | + 38 | 42022.9 | + 35 | $42042 \cdot 8$ | + 3 I |
| 30 | 4 10 14.5 | 45 | 4 10 $40 \cdot 3$ | 4 4 | $\begin{array}{lllll}4 & \text { II } & 3.8\end{array}$ | - 37 | 4 II 24.9 | -3 | $4 \mathrm{ll} 43 \cdot 8$ | . 29 | $\begin{array}{llll}4 & 12 & 0.2\end{array}$ | . 25 |
| 31 | $\begin{array}{lll}4 & 6 & 0.8\end{array}$ | 43 | $4 \quad 6 \quad 25 \cdot 3$ | -39 | $\begin{array}{llll}4 & 6 & 47\end{array}$ | $\cdot 35$ | $\begin{array}{llll}4 & 7 & 7 \cdot 1\end{array}$ | -31 | $4 \quad 724 \cdot 3$ | 26 | $4 \quad 739 \cdot 1$ | -22 |
| 32 |  | 4 I | $\begin{array}{llll}4 & 2 & 10.4 \\ 3 & 5 & \end{array}$ | -37 | $\begin{array}{lllll}4 & 2 & 31 \cdot 3 \\ 3 & 5 & 1\end{array}$ | -32 | $\begin{array}{llll}4 & 2 & 49 \cdot 4 \\ 3 & 58\end{array}$ | $\cdot 28$ | 4 3 $5 \cdot 1$ <br> 3 58  | - 24 | 4 3 $18 \cdot I$ <br> 3 58  | 19 |
| 33 | $35733 \cdot 6$ | $\cdot 39$ | $35755 \%$ | 34 | $35815 \cdot 1$ | $\cdot 30$ | $\begin{array}{llll}3 & 58 & 31 \cdot 9\end{array}$ | -25 | 35845.9 | -21 | 3 58 57 <br> 1   | -16 |
| 34 | $35320 \cdot 3$ | + 37 | $3534 \mathrm{I} \cdot \mathrm{I}$ | + $\cdot 32$ | $35359 \cdot 1$ | $\cdot 28$ | $3 \begin{array}{llll}3 & 14.4\end{array}$ | + 23 | $35426 \cdot 8$ | + 18 | $35436 \cdot 3$ | + 13 |
| 35 | $\begin{array}{lllllllllllllll}3 & 49 & 7 \cdot 0\end{array}$ | -35 | 349 26.6 | 30 | $\begin{array}{lllllllll}3 & 49 & 43 \cdot 2\end{array}$ | 25 | 34957.0 |  | 33 50 7.7 |  | 35015.4 | Io |
| 36 | $\begin{array}{lllll}3 & 44 & 53 \cdot 8\end{array}$ | -33 | $34512 \cdot \mathrm{I}$ | 28 |  | 23 | 3 $345 \begin{array}{ll}39 & 6\end{array}$ | -18 | $34548 \cdot 7$ | -12 | 34554.6 | -07 |
| 37 | $34040 \cdot 7$ | -31 | $34057 \cdot 8$ | 26 | 341119 | - 20 | $\begin{array}{llll}3 & 41 & 22.4\end{array}$ | -15 | 34129.8 | -09 | 34153.9 | 04 |
| 38 |  | -29 | $33643 \cdot 6$ | 23 | $33^{6} \quad 56 \cdot 0$ |  | 3 37 $5 \cdot 2$ |  | $3 \begin{array}{llll}3 & 37 & 10.9\end{array}$ | 07 | $\begin{array}{lllll}3 & 37 & 13 \cdot 1\end{array}$ | + 01 |
| 39 | $\begin{array}{rrr} 3 & 32 & 14 \cdot 8 \\ 3 & 28 & 2 \cdot 0 \end{array}$ | + 27 | 3 32 $29 \cdot 4$ <br> 3 28  <br> $15 \cdot 2$   | + . 21 | $\begin{array}{lllll}3 & 32 & 40 \cdot 5 \\ 3 & 28 & 24 \cdot 9\end{array}$ | + 15 |  | + .09 |  |  |  |  |
| 40 | $\begin{array}{rrr} 2 \cdot 0 \\ 3 & 28 & 2 \cdot 0 \end{array}$ | $\begin{array}{r} 25 \\ 0,25 \end{array}$ | $\begin{array}{llll}3 & 28 & 15 \cdot 2 \\ 3 & 24 & 1.2\end{array}$ | -19 | $\begin{array}{llll}3 & 28 & 24.9 \\ 3 & 24 & \\ \end{array}$ | - 13 | $\begin{array}{\|ccc\|}3 & 28 & 30 \cdot 9 \\ 3 & 24 & 13.8 \\ 3\end{array}$ | $.07$ | $\begin{array}{llll}3 & 28 & 33 \cdot 2 \\ 3 & 24 & 14 \cdot 3\end{array}$ | $\pm$ +01 | $\begin{array}{lllll}3 & 28 \\ 3 & 31 \cdot 7 \\ 3 & 24 & 10 \cdot 9\end{array}$ | 5 |
| 42 | $\left\|\begin{array}{lll} 3 & 23 & 49 \cdot 2 \\ 3 & 19 & 36 \cdot 5 \end{array}\right\|$ | $\begin{aligned} & .23 \\ & .27 \end{aligned}$ | $\begin{array}{rrrr}3 & 24 & 1 \cdot 2 \\ 3 & 19 & 47 \cdot 2 \\ & 1 & \end{array}$ | . 17 | $\begin{array}{cccc}3 & 24 & 9 \cdot 4 \\ 3 & 19 & 53.9\end{array}$ | . 10 | (1) $\begin{array}{llll}3 & 24 & 13.8 \\ 3 & 19 & 56.7 \\ 3 & 15 & 39.7\end{array}$ | $\begin{array}{r}.04 \\ +.01 \\ \hline\end{array}$ | 3 24 $14 \cdot 3$ <br> 3 19 55.5 | -.02 | $\left\|\begin{array}{lll} 3 & 24 & 10 \cdot 9 \\ 3 & 10 & 50 \cdot 1 \end{array}\right\|$ | -09 |
| 42 | $\begin{array}{llll}3 & 19 & 36.5 \\ 3 & 15 & 23.9\end{array}$ | - 21 | $\begin{array}{llll}3 & 19 & 47 \cdot 2 \\ 3 & 15 & 33 \cdot 2\end{array}$ | -14 | $\begin{array}{llll}3 & 19 & 53.9 \\ 3 & 15 & 38.5\end{array}$ | 08 | $\left\lvert\, \begin{array}{llll}3 & 19 & 56 \cdot 7 \\ 3 & 15 & 39 \cdot 7\end{array}\right.$ | + 01 | $\begin{array}{llll}3 & 19 & 55.5 \\ 3 & 15 & 36.6\end{array}$ |  | $\left\|\begin{array}{lll} 3 & 19 & 50 \cdot I \\ 3 & 15 & 20 \cdot 3 \end{array}\right\|$ | 12 |
| 43 | $\begin{array}{llll}3 & 15 & 23.9 \\ 3 & 11 & 11.4\end{array}$ | 119 $+\quad 17$ | $\begin{array}{llll}3 & 15 & 33.2 \\ 3 & 11 & 19.3\end{array}$ |  | $\begin{array}{cccc}3 & \text { I5 } & 38 \cdot 5 \\ 3 & \text { II } & 23 \cdot 1\end{array}$ | +.03 | $\begin{array}{llll}3 & 15 & 39 \cdot 7 \\ 3 & \text { II } & 22 \cdot 6\end{array}$ |  | 3 $\begin{array}{llll}3 & 15 & 36.6 \\ 3 & 11 & 17.7\end{array}$ |  | $\begin{array}{llll}3 & 15 & 29 \cdot 3 \\ 3 & \text { II } & 8 \cdot 3\end{array}$ | 16 |
| 44 | [rrrrer | + 17 | 3 II 19. | $\begin{array}{r}+\quad 10 \\ \hline 07\end{array}$ | (rrrrs | + .03 | (rrrer | 04 |  | '15 | $\begin{array}{crrr}3 & 11 & 8 \cdot 3 \\ 3 & 6 & 47 \cdot 3\end{array}$ |  |
| 46 | $\begin{array}{llll}3 & 2 & 46 \cdot 4 \\ 2 & 58\end{array}$ | -I2 | $\begin{array}{cccc}3 & 2 & 51.6\end{array}$ | . 05 | $\begin{array}{lccc}3 & 2 & 52 \cdot 3\end{array}$ | - . 03 | $\begin{array}{llll}3 & 2 & 48 \cdot 3\end{array}$ | -ro | $\begin{array}{llll}3 & 2 & 39 \cdot 7\end{array}$ |  | 3 2 $26 \cdot 1$ | 27 |
| 47 | ${ }_{2} 58833 \cdot 9$ | -10 | $25837 \cdot 7$ | + 02 | $\begin{array}{llll}2 & 58 & 36 \cdot 9\end{array}$ | . 0 | $2{ }_{2} 5831 \cdot 2$ | -14 | $2{ }^{2} 5820 \cdot 5$ | - 22 | $\begin{array}{lll}2 & 58 & 4 \cdot 8\end{array}$ | 0 |
| 48 | $2542 \mathrm{I} \cdot 5$ | -8 | 25423.9 | -0 | $25421 \cdot 4$ | -08 | $2 \begin{array}{llll}2 & 54 & 13.9\end{array}$ | $\cdot 17$ | $2 \begin{array}{ll}24 & 1 \% 3\end{array}$ | - 25 | $2 \begin{array}{llll}2 & 53\end{array}$ | 34 |
| 49 | $\begin{array}{llll}2 & 50 & 9 \cdot 1 \\ 2 & 45 & 56.7 \\ 2\end{array}$ | +.06 | $\begin{array}{llll}2 & 50 & 10 \cdot 1 \\ 2 & 45 & 5 \cdot 3\end{array}$ | -. 03 | $\begin{array}{rrrr}2 & 50 & 6.0 \\ 2 & 45 & 50 \cdot 3\end{array}$ | - II | $2 \begin{array}{llllll}2 & 49 & 56 \cdot 6\end{array}$ | - 20 | 249 4I•9 |  | 24921.8 | $\cdot 38$ |
| 50 | $24556 \cdot 7$ | . 03 | $24556 \cdot 3$ | . 05 | $\begin{array}{lllll}2 & 45 & 50 \cdot 3\end{array}$ | 14 | $24539 \cdot 2$ | 23 | $2 \begin{array}{llll}2 & 45 & 22.4\end{array}$ | $\cdot 33$ | $1 \begin{array}{lllllll}2 & 44 & 59\end{array}$ | 42 |
| 51 | $\begin{array}{llllll}2 & 41 & 44 \cdot 3 \\ 2 & 37\end{array}$ | $\pm .01$ | $\begin{array}{lllll}2 & 41 & 42.4 \\ 2 & 37 & 28.5\end{array}$ | -08 | $\begin{array}{lllll}2 & 41 & 34.9\end{array}$ | -17 | $2 \begin{array}{llll}2 & 41 & 21 \cdot 7\end{array}$ | $\cdot 27$ | $\begin{array}{llll}2 & 41 & 2 \cdot 7 \\ 2\end{array}$ |  | 2 40 37.8 <br> 2   | 47 |
| 52 | $\begin{array}{lllll}2 & 37 & 32 \cdot 0 \\ 2 & 3 & 19\end{array}$ | . 01 | $\begin{array}{llll}2 & 37 & 28 \cdot 5 \\ 2 & 33 & 1\end{array}$ | -11 | $\begin{array}{llll}2 & 37 & 19.2 \\ 2 & 33 & 3.5\end{array}$ | - 20 | $\begin{array}{lll}2 & 37 & 4 \cdot 1 \\ 2 & 3 & 4\end{array}$ | $\cdot 30$ | $\begin{array}{lllll}2 & 36 & 42 \cdot 9 \\ 2 & 3 & 42\end{array}$ | $\cdot 40$ | $\begin{array}{llll}2 & 36 & 15.5 \\ 2 & 31 & 52.8\end{array}$ | 51 |
| 53 | $\begin{array}{llllll}2 & 33 & 19.7\end{array}$ | . 04 | 23314.6 | -13 | $\begin{array}{llll}2 & 33 & 3.5\end{array}$ | -24 | $23246 \cdot 3$ | 34 | $23222 \cdot 8$ | 45 | 23152.8 | 55 |
| 54 | $\begin{array}{lllll}2 & 29 & 7 \\ 2 & 24 & 5\end{array}$ | . 06 | $\begin{array}{lll}2 & 29 & 0.6\end{array}$ | - . 16 |  | $\cdot$ | $\begin{array}{llllll}2 & 28 & 28 \cdot 3\end{array}$ | - 38 | 228 |  | $\begin{array}{lllll}2 & 27 & 29.8\end{array}$ | 60 |
| 55 | $\begin{array}{lllllll}2 & 24 & 54.9 \\ 2 & 2 & \end{array}$ | . 17 | $\begin{array}{llll}2 & 24 & 46 \cdot 5\end{array}$ | -19 | $\begin{array}{llllll}2 & 24 & 31.7\end{array}$ | 30 | $22410 \cdot 1$ | $\cdot 42$ | 22341.7 | . 53 | $\begin{array}{lll}2 & 23 & 6.4\end{array}$ | 65 |
| 56 | $\begin{array}{llll}2 & 20 & 42 \cdot 5 \\ 2 & 16 & 30 \cdot 0\end{array}$ | -11 | $\begin{array}{llll}2 & 20 & 32.4\end{array}$ |  | $\begin{array}{lllll}2 & 20 & 15.5\end{array}$ | 34 | 22 19 51 | 46 | $21920 \cdot 8$ |  | 21842.5 | $\cdot 70$ |
| 57 <br> 58 | $\begin{array}{llll}2 & 16 & 30 \cdot 0 \\ 2 & 12 & 17 \cdot 5\end{array}$ | -14 | $\begin{array}{cccc}2 & 16 & 18.2 \\ 2 & 12 & 3.8\end{array}$ |  | $\begin{array}{llll}2 & 15 & 59 \cdot 3 \\ 2 & \text { II } & 42 \cdot 7\end{array}$ |  | $\left\lvert\, \begin{array}{cccc}2 & 15 & 33 \cdot I \\ 2 & \text { II } & 14 \cdot I\end{array}\right.$ | 50 |  | - 62 .67 | $\begin{array}{rrrr}2 & 14 & 18.2 \\ 2 & 9 & 53.2\end{array}$ | . 76 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} . \\ +1 \cdot 38 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 35 \end{gathered}$ | $\stackrel{\text { s. }}{+1 \cdot 47}$ | $\begin{gathered} s . \\ -4.37 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 55 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 40 \end{gathered}$ | $\begin{gathered} \text { s. } \\ +\mathrm{r} \cdot 64 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 43 \end{gathered}$ | $\begin{gathered} s \\ +1 \cdot 72 \end{gathered}$ | $\frac{s .}{4 \cdot 47}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 8 \mathrm{r} \end{gathered}$ | s. <br> 4.50 |
| 4 | r.30 | $4 \cdot 32$ | I-39 | $4 \cdot 35$ | $1 \cdot 47$ | $4 \cdot 38$ | I.55 | 4.40 | 1.64 | $4 \cdot 43$ | 1.73 | $4 \cdot 47$ |
| 8 | 1.23 | 4.30 | I-31 | 4.33 | I 40 | $4 \cdot 35$ | I. 48 | $4 \cdot 38$ | I. 56 | $4 \cdot 4 \mathrm{r}$ | 1.65 | $4 \cdot 44$ |
| 12 | 1.17 | $4 \cdot 28$ | 1.25 | $4 \cdot 31$ | $1 \cdot 33$ | $4 \cdot 33$ | $1 \cdot 41$ | $4 \cdot 36$ | 1.50 | $4 \cdot 39$ | I. 58 | $4 \cdot 42$ |
| 16 | I•II | 4.27 | I-19 | 4.29 | 1.27 | 4.31 | $1 \cdot 36$ | $4 \cdot 34$ | 1.44 | $4 \cdot 37$ | 1.53 | $4 \cdot 39$ |
| 20 | +r.06 | $4 \cdot 25$ | +1.14 | $4 \cdot 28$ | +1.22 | 4.30 | +1.31 | $4 \cdot 32$ | +1.39 | $4 \cdot 35$ | +1.48 | $4 \cdot 38$ |
| 22 | 1.03 | 4.25 | 1-12 | $4 \cdot 27$ | 1.20 | $4 \cdot 29$ | 1.29 | $4 \cdot 32$ | $1 \cdot 37$ | $4 \cdot 35$ | $1 \cdot 46$ | $4 \cdot 37$ |
| 24 | 1.01 | $4 \cdot 24$ | I. 09 | $4 \cdot 26$ | 1.18 | $4 \cdot 29$ | $1 \cdot 26$ | $4 * 31$ | $1 \cdot 35$ | $4 \cdot 34$ | I 44 | $4 \cdot 37$ |
| 26 | -99 | $4 \cdot 24$ | $1 \cdot 07$ | $4 \cdot 26$ | I.16 | $4 \cdot 28$ | 1.25 | $4 \cdot 31$ | 1.34 | $4 \cdot 33$ | $1 \cdot 43$ | $4 \cdot 36$ |
| 28 | -96 | $4 \cdot 23$ | 1.05 | $4 \cdot 25$ | 1.14 | $4 \cdot 28$ | 1.23 | $4 \cdot 30$ | $1 \cdot 32$ | $4 \cdot 33$ | $1 \cdot 41$ | $4 \cdot 36$ |
| 30 | + 95 | 4.23 | +r.04 | $4 \cdot 25$ | +1.13 | 4.27 | +1.22 | $4 \cdot 30$ | +1.31 | 4.33 | +1.40 | $4 \cdot 35$ |
| 32 | -93 | 4.22 | 1.02 | $4 \cdot 25$ | I'II | 4.27 | 1.20 | $4 \cdot 29$ | 1.29 | $4 \cdot 32$ | I 39 | $4 \cdot 35$ |
| 34 | -91 | $4 \cdot 22$ | 1.00 | $4 \cdot 24$ | I• 10 | $4 \cdot 26$ | I•I9 | $4 \cdot 29$ | $1 \cdot 29$ | $4 \cdot 32$ | $1 \cdot 38$ | $4 \cdot 35$ |
| 36 | -90 | $4 \cdot 22$ | -99 | $4 \cdot 24$ | I.08 | $4 \cdot 26$ | 1-18 | $4 \cdot 29$ | 1.28 | $4 \cdot 32$ | I-38 | $4 \cdot 35$ |
| 38 | $\cdot 88$ | 4.22 | $\cdot 98$ | $4 \cdot 24$ | 1.08 | $4 \cdot 26$ | $1 \cdot 17$ | $4 \cdot 29$ | 1.28 | $4 \cdot 32$ | 1.38 | $4 \cdot 35$ |
| 40 | + 87 | 4.21 | + 97 | 4.23 | +1.07 | $4 \cdot 26$ | +1.17 | $4 \cdot 28$ | +1.27 | $4 \cdot 31$ | $+\mathrm{I} \cdot 37$ | $4 \cdot 34$ |
| 42 | . 86 | $4 \cdot 2 \mathrm{I}$ | -96 | $4 \cdot 23$ | I.06 | $4 \cdot 26$ | $1 \cdot 17$ | $4 \cdot 28$ | $1 \cdot 27$ | 4.31 | 1.38 | $4 \cdot 34$ |
| 44 | $\cdot 85$ | 4.21 | -95 | 4.23 | r.06 | $4 \cdot 26$ | 1-17 | $4 \cdot 28$ | 1.28 | $4 \cdot 32$ | I-39 | $4 \cdot 35$ |
| 46 | . 84 | $4 \cdot 21$ | -95 | $4 \cdot 23$ | I.06 | $4 \cdot 26$ | $1 \cdot 17$ | $4 \cdot 29$ | 1.28 | $4 \cdot 32$ | 1.40 | $4 \cdot 35$ |
| 48 | -84 | 4.21 | -95 | $4 \cdot 23$ | I.06 | $4 \cdot 26$ | I•I8 | $4 \cdot 29$ | 1.30 | $4 \cdot 32$ | 1.42 | $4 \cdot 36$ |
| 50 | + 88 | 4.21 | + 95 | $4 \cdot 23$ | +1.07 | $4 \cdot 26$ | +1.19 | $4 \cdot 29$ | +1.3I |  | +1.44 | $4 \cdot 37$ |
| 52 | . 83 | 4.20 | -.96 | $4 \cdot 23$ | I.08 | $4 \cdot 26$ | 1.21 | $4 \cdot 29$ | $1 \cdot 33$ | 4.33 | I. 47 | $4 \cdot 37$ |
| 54 | . 84 | 4.21 | $\cdot 96$ | 4.23 | r.09 | 4.26 | 1.23 | $4 \cdot 30$ | I. 36 | $4 \cdot 34$ | I. 50 | $4 \cdot 39$ |
| 56 | -84 | $4 \cdot 21$ | -98 | $4 \cdot 24$ | I•II | 4.27 | $1 \cdot 25$ | $4 \cdot 31$ | 1.40 | $4 \cdot 35$ | I.54 | $4 \cdot 40$ |
| 58 | . 85 | 4.21 | -99 | 4.24 | I'14 | $4 \cdot 28$ | r. 29 | $4 \cdot 32$ | I 44 | $4 \cdot 37$ | I.60 | $4 \cdot 42$ |

## 62 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $15^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{aligned} & \text { True } \\ & \text { Alt. } \end{aligned}$ | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ |  | $4{ }^{\circ}$ | ecl. <br> Var. | $5{ }^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & \text { O } \\ \hline \end{array}$ | $\left\lvert\, \begin{gathered} 5 . \\ +1.07 \end{gathered}\right.$ | $\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 4 \cdot 3 \end{array}$ | $+1.07$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 2 & 8.7 \end{array}\right\|$ | $\|+x \cdot 07\|$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 2 \cdot 2 \end{array}\right\|$ | $+1.07$ | $\left\|\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I7.7 } \end{array}\right\|$ | $+1.08$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & 22 \cdot 4 \end{array}$ | 1•08 |
| 10 | 51834 | I. 09 | $51939 \cdot 4$ | 1.07 | $52043 \cdot 6$ | 1.06 | $52147 \cdot 0$ | 1.05 | $52249 \cdot 7$ | I. 04 | 55 23 51 | 1.03 |
| 12 | 1016.8 | 1.10 | II $22 \cdot 2$ | I.08 | 1226.6 | 1.06 | $1330 \cdot 1$ | 1.05 | $51432 \cdot 7$ | 1.04 | $1534 \cdot 6$ | 02 |
| 14 | $\mathrm{S}_{5} 1158.9$ | I-II | $4 \cdot 7$ | 1.09 | $4 \quad 9.5$ | 1-07 | 513.1 | 1.05 | $\begin{array}{lllll}5 & 6 & 15 \cdot 7\end{array}$ | 1.03 | 5 5 7 177.4 | I.02 |
| 16 | $45340 \cdot 7$ |  | 454 47•1 | 1-10 | $45552 \cdot 3$ | 1.07 | 56 56-1 | 1-05 | 45758.8 | 1.03 | 44 59 | I-01 |
| 18 | 445 22.I | +1.1 | $44629 \cdot 2$ | +1 | $44734 \cdot 8$ | +1 | $44839 \cdot 1$ | +1 | 449 4199 | $+\mathrm{I} \cdot 03$ | $5043 \cdot 4$ | 1 |
| 20 | 4373.0 |  | $4 \begin{array}{llll}38 & 10.9\end{array}$ | I'12 | 4391772 | I | 44021.8 | 1.06 | 44 I | 1.04 | 44226.4 | I |
| 22 | 42843.4 |  | $42952 \cdot 2$ | 1.13 | 43059.2 |  | 4324.4 | I.07 | $\begin{array}{llll}4 & 33 & 7 \cdot 8\end{array}$ | I. 04 | $4 \begin{array}{lll}4 & 34 & 9.5\end{array}$ | ror |
| 24 | $1 \begin{array}{llll}4 & 20 & 23.2\end{array}$ |  | $4 \begin{array}{llll}41 & 33.1\end{array}$ |  | $42240 \cdot 9$ |  | $42346 \cdot 7$ | I.08 | $4 \begin{array}{lll}4 & 24 & 50 \cdot 5\end{array}$ | .05 | $\begin{array}{llll}4 & 25 & 52.5\end{array}$ | I.02 |
| 26 | 412 | 120 | $4 \begin{array}{lllll} & 13 & 13\end{array}$ |  | $41422 \cdot 2$ | 1-13 | $41528 \cdot 7$ | I.09 | 4 I6 33-I | I 05 | 4 17 35.4 | 1.02 |
| 28 | $\begin{array}{llll}4 & 3 & 40 \cdot 8\end{array}$ | +1.22 | $53 \cdot 1$ | +1. | $2 \cdot 9$ | +1. | $4 \begin{array}{llll}4 & 70 \cdot 3\end{array}$ | +1.10 | $4 \quad 8 \quad 15.4$ | + 1.06 | 918.2 | +1.03 |
| 30 | 35518.2 | 1.25 | $35632 \cdot 0$ | 1.21 | $35743 \cdot 1$ | I | $35851 \cdot 5$ | I'12 | $35957{ }^{\circ}$ |  | $4{ }^{4}$ I 0.7 | I. 03 |
| 31 | $3 \mathrm{5I} 6.6$ | 1.27 | 35221.2 | $1 \cdot 22$ | $35333 \cdot 0$ | 17 | $35442 \cdot 0$ | I•I3 | 35548 | .08 | $\begin{array}{lllll}3 & 56 & 51 \cdot 9\end{array}$ | 4 |
| 32 | $4654 \cdot 7$ | 28 | 3 48 $10 \cdot 1$ | $1 \cdot 23$ | $34922 \cdot 6$ | I8 | $35032 \cdot 2$ | 1 | $\begin{array}{llll}3 & 51 & 39 & 0\end{array}$ | .09 | $\begin{array}{lllll}3 & 52 & 43 \cdot 0 \\ 3 & \end{array}$ | 04 |
| 33 | 3424 | O | 343 | 1. 24 | $34512 \cdot 1$ | 1.19 | $3 \begin{array}{llll}36 & 22 \cdot 3\end{array}$ | 1.14 | $\begin{array}{llll}3 & 47 & 29.6\end{array}$ |  | $34834 \cdot 0$ | 05 |
| 34 | $\begin{array}{lllllllllllll}3 & 38 & 301\end{array}$ | +1.31 | $3 \begin{array}{llllllllll}3 & 47\end{array}$ | +1.26 | 34114 | +1.2I |  | +1.15 | $34320 \cdot 1$ | +1.10 | 34425.0 | 06 |
| 35 | $3417 \cdot 3$ | I.33 |  |  | $3 \begin{array}{llll}36 & 50 \cdot 4\end{array}$ | I | 3 38 $2 \cdot 0$ <br> 3   | I-17 | $\begin{array}{llll}3 & 39 & 10 \cdot 5\end{array}$ |  |  |  |
| 36 | 304.2 |  | $\begin{array}{llll}3 & 31 & 23.4\end{array}$ | $1 \cdot 29$ | $\begin{array}{llll}3 & 32 & 39 \cdot 2\end{array}$ | I 23 | 3 3 33 51•6 | 1.18 | $\begin{array}{llll}3 & 35 & 0.7\end{array}$ |  | $\begin{array}{llll}3 & 36 & 6 \cdot 5\end{array}$ | 7 |
| 37 | $32550 \cdot 7$ | 1.37 | $32711 \cdot 0$ | 1-31 |  | . 25 | 3 29 41 | 1-19 | $33050 \cdot 7$ | . 13 | $33157 \cdot 1$ | I.08 |
| 38 | 3213 | I-39 | 322 | - 33 | 32416 |  | $3 \quad 25 \quad 30 \cdot 2$ |  | $\begin{array}{llll}3 & 26 & 40 \cdot 6\end{array}$ | I. 14 | $32747 \cdot 6$ | .09 |
| 39 | 17 | $+1$ | 31845.2 | $+1$ | 3 20 $4 \cdot 1$ | + | 3 21 19 1 | +1. |  | +1.16 | $\begin{array}{lllll}3 & 23 & 38 \cdot 0\end{array}$ | -10 |
| 40 | 13 | I. 44 | $\begin{array}{lllllllllll}3 & 14 & 31-8\end{array}$ |  | 3 15 51 | $1 \cdot 3$ | $\begin{array}{lllllllllllll}3 & 17 & 7.7\end{array}$ | 1.23 | 3 18819.8 | 1.17 | $\begin{array}{llll}3 & 19 & 28 \cdot 1 \\ 3\end{array}$ | I-II |
| 41 | $8 \quad 52.5$ |  |  | I•39 |  | 1 | $\begin{array}{llll}3 & 12 & 56 \cdot 1 \\ 3 & 5\end{array}$ | 1.25 | 3143 9 |  | $\begin{array}{llll}3 & 15 & 18 \\ 3 & 18\end{array}$ |  |
| 42 | 3448 | $1 \cdot 49$ | 3 | 1.41 | $726 \cdot x$ |  | $\begin{array}{llll}3 & 8 & 44.2\end{array}$ |  | 958.1 |  | 311 | 3 |
| 43 | 30 | 1-51 | 48.9 | 1.44 | $\begin{array}{llll}3 & 3 & 12 \cdot 7\end{array}$ | I•36 | 32.0 |  | 3 | 1.21 | $3 \quad 657$ | I.14 |
| 44 | $\begin{array}{lll}2 & 56 & 3.5\end{array}$ | +x.54 | $2 \begin{array}{lllllll}2 & 57 & 33\end{array}$ | +1.46 | 258 | + 1.38 | 3 30019.4 | +1.30 | 4 | +1.23 | $3{ }^{3}$ | +1.16 |
| 45 | 25145.9 |  | $25317 \cdot 8$ | $1 \cdot 49$ |  | 1.41 | $\begin{array}{llll}2 & 56 & 6 \cdot 5 \\ 2 & 51\end{array}$ | I.32 | $\begin{array}{llll}2 & 57 & 23 \cdot 6\end{array}$ | 1.25 | 2 $258836 \cdot 2$ | 17 |
| 46 | $24727 \cdot 7$ | I.61 |  | 1.52 | $\begin{array}{llll}2 & 50 & 29.8\end{array}$ |  | $\begin{array}{llll}2 & 51 & 53 \cdot 1 \\ 2 & 47 & 39 \cdot 4\end{array}$ | $1 \cdot 35$ |  | 1.27 1.29 |  | 1.19 <br> 120 |
| 47 | [ $\begin{array}{ccc}2 & 43 & 8 \cdot 7 \\ 2 & 38 & 48 \cdot 8\end{array}$ | I. 64 <br> I 68 <br> 1 | $\begin{array}{llll}2 & 44 & 44 \cdot 3 \\ 2 & 40 & 26.6\end{array}$ | $\begin{array}{r}1.55 \\ \text { I. } 58 \\ \hline\end{array}$ | $\begin{array}{llll}2 & 46 & 14.5 \\ 2 & 41 & 58.6\end{array}$ | 1.46 | 2 $247739 \cdot 4$ | 1.37 | $\begin{array}{llll}2 & 48 & 59.0 \\ 2 & 44 & 46.2\end{array}$ | 1.29 | $\left\lvert\, \begin{array}{ccc}2 & 50 & 13 \cdot 7 \\ 2 & 46 & 2 \cdot 1\end{array}\right.$ | 1.20 |
|  | $\|$2 38 $48 \cdot 8$ <br> 2 34 $28 \cdot 1$ <br> 2 3  |  | 36 |  | $\begin{array}{ll}2 & 415 \\ 2 & 37\end{array}$ |  | $\begin{array}{llll}2 & 43 & 25 \cdot 1 \\ 2 & 39 & 10 \cdot 3\end{array}$ |  | $\begin{array}{llll}2 & 44 & 46 \cdot 2 \\ 2 & 40 & 32 \cdot 9\end{array}$ |  | [246-2.I |  |
| 49 50 | $\left\lvert\, \begin{array}{ccc}2 & 34 & 28 \cdot 1 \\ 2 & 30 & 6 \cdot 5\end{array}\right.$ | + $\begin{array}{r}1.72 \\ \mathrm{I} .76\end{array}$ | $\begin{array}{rrr}2 & 36 & 8 \cdot 1 \\ 2 & 31 & 48 \cdot 8 \\ 2 & \end{array}$ | +1.62 1.65 | $\begin{array}{llll}2 & 37 & 42 \cdot 1 \\ 2 & 33 & 24 \cdot 9\end{array}$ | 1.45 +1.52 1.55 | 20, $\begin{array}{llll}2 & 39 & 10 \cdot 3 \\ 2 & 34 & 55 \cdot 0\end{array}$ | $\begin{array}{r}\text { + } 1.42 \\ +145 \\ \\ \hline\end{array}$ |  | 1.31 +1.33 1.36 | $\begin{array}{llll}2 & 41 & 50 \cdot 1 \\ 2 & 37 & 37 \cdot 7\end{array}$ |  |
| 51 |  | I.81 | 22728.6 | 1.69 | $\begin{array}{llll}2 & 29 & 7.0\end{array}$ | $1 \cdot 59$ | $23039 \cdot 0$ | 1.48 | $\begin{array}{lllll}2 & 32 & 4.9\end{array}$ | 1.38 | 23325.0 | . 29 |
| 52 | $2 \begin{array}{lll}2 & 21 & 19.8\end{array}$ | I. 86 | $2 \begin{array}{lll}23 & 7 \cdot 5\end{array}$ | 174 | $22448 \cdot 3$ | 62 | $\begin{array}{ll}2 & 2622.4\end{array}$ | 1.52 | $\begin{array}{lllll}2 & 27 & 50 \cdot 2\end{array}$ | 41 | 229118 | 31 |
| 53 | $2 \begin{array}{llll}2 & 54 \cdot 6\end{array}$ | 91 | $21845 \cdot 3$ | 1.78 | 22028.6 | 1.66 | $225 \cdot 1$ | 1.5 | $\begin{array}{llll}2 & 23 & 34.9\end{array}$ | 1.44 | $2 \begin{array}{llll}24 & 58\end{array}$ | -34 |
| 54 |  | +1.96 | $\begin{array}{lllllllll}2 & 14 & 21.9\end{array}$ | $+\mathrm{r} .83$ | 2 I6 | +1.71 | 21747.0 | +1.59 | $\begin{array}{llllll}2 & 19 & 18.9\end{array}$ | +1.47 | 22044.0 | I•36 |
| 55 | 8 0.1 | 2.02 | $957 \cdot 2$ | I.89 | 2 II 46.4 | I• | 21328.0 | 1.63 | 21515 | 1.51 | $2 \begin{array}{lll}2 & 16 & 29.3\end{array}$ | . 39 |
| 56 | ${ }^{3} \quad 30 \cdot 2$ | 2.08 | 51 31.1 | 1.94 | 723.6 2504 | $\begin{array}{r}\text { r. } \\ \mathrm{I} \\ .81 \\ \hline 18\end{array}$ | $7 \cdot 9$ | I.68 | $\begin{array}{rrrr}2 & 10 & 44.7\end{array}$ | 5 | $\begin{array}{rrrr}2 & 12 & 13.9 \\ 2 & 7 & 57.9\end{array}$ | 43 |
| 57 58 | 58 <br> 54 <br> 54 | 2.15 2.22 | 173 5633.0 |  | 259.4 5833.8 | I.86 | $446 \cdot 9$ 0 | I• | 7.3 | 9 | 757.9 <br> 3 <br> 1.1 | r.46 I. 50 |
| 58 | 5424 |  | 5633.9 |  | $5833 \cdot 8$ |  | - 24 |  | $7 \cdot 0$ |  |  | I.50 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | s. | s. | s. | s. | S. | s. | S. | s. | s. | s. | s. |
| 0 | . 00 | $-4.14$ | + 07 | $-4 \cdot 14$ | + 15 | -4.4 | + 22 | $-4.15$ | + 30 | $4 \cdot 15$ | + 37 | 4.16 |
| 4 | . 08 | 4.14 | -00 | $4 \cdot 14$ | . 07 | 4.14 | $\cdot 15$ | $4 \cdot 14$ | $\cdot 22$ | $4 \cdot 15$ | $\cdot 30$ | $4 \cdot 15$ |
| 8 | -15 | $4 \cdot 14$ | - .08 | 4.14 | -00 | $4 \cdot 14$ | $+.07$ | $4 \cdot 14$ | -14 | $4 \cdot 14$ | - 22 | 4-15 |
| 12 | - 24 | $4 \cdot 15$ | -16 | 4•14 | .08 | $4 \cdot 14$ | -0 | $4 \cdot 14$ | + 07 | $4 \cdot 14$ | -14 | $4 \cdot 14$ |
| 16 | -32 | $4 \cdot 15$ | . 24 | 4.15 | -16 | $4 \cdot 14$ | .08 | 4.I4 | - 01 | $4 \cdot 14$ | + 07 | $4 \cdot 14$ |
| 20 | - 40 | $4 \cdot 16$ | - 32 | $4 \cdot 15$ | - . 24 | $4 \cdot 15$ | - .16 | $4 \cdot 14$ | -. 08 | $4 \cdot 14$ | - .00 | $4 \cdot 14$ |
| 22 | $\cdot 45$ | $4 \cdot 17$ | $\cdot 37$ | 4•16 | - 29 | $4 \cdot 15$ | $\cdot 21$ | $4 \cdot 15$ | -13 | $4 \cdot 14$ | -05 | 4•14 |
| 24 | -50 | $4 \cdot 17$ | -41 | $4 \cdot 16$ | -33 | $4 \cdot 15$ | $\cdot 25$ | $4 \cdot 15$ | -17 | $4 \cdot 14$ | -08 | 4.14 |
| 26 | - 55 | $4 \cdot 18$ | :46 | 4.17 | $\cdot 38$ | $4 \cdot 16$ | -29 | $4 \cdot 15$ | -21 | 4.15 | -13 | 4.14 |
| 28 | $\cdot 60$ | 4.18 | ${ }^{51}$ | 4.17 | -42 | 4•16 | -34 | 4.15 | - 25 | 4.15 | -17 | $4 \cdot 14$ |
| 30 | - . 65 | $4 \cdot 19$ | . 56 | 4-18 | - 47 | $4 \cdot 17$ | - 38 | $4 \cdot 16$ | - 30 | 4.15 | . 21 | $4 \cdot 15$ |
| 32 | $\cdot 70$ | $4 \cdot 20$ | . 61 | 4.18 | $\cdot 52$ | $4 \cdot 17$ | . 43 | $4 \cdot 16$ | $\cdot 34$ | $4 \cdot 15$ | - 25 | $4 \cdot 15$ |
| 34 | $\cdot 76$ | 4.21 | -67 | 4•19 | $\cdot 57$ | $4 \cdot 18$ | -48 | $4 \cdot 17$ | -39 | $4 \cdot 16$ | $\cdot 30$ | 4.15 |
| 36 | .82 | 4.22 | $\cdot 72$ | $4 \cdot 20$ | . 63 | $4 \cdot 19$ | . 53 | $4 \cdot 17$ | -44 | $4 \cdot 16$ | -34 | $4 \cdot 15$ |
| 38 | . 89 | $4 \cdot 24$ | -79 | $4 \cdot 22$ | -69 | $4 \cdot 20$ | -59 | 4.18 | -49 | 4.17 | -40 | $4 \cdot 16$ |
| 40 | -. 95 | $4 \cdot 25$ | -.85 | $4 \cdot 23$ | -.75 | $4 \cdot 21$ | -. 65 | $4 \cdot 19$ | - . 54 | $4 \cdot 18$ | - . 44 | $4 \cdot 16$ |
| 42 | 1.03 | $4 \cdot 26$ | -92 | $4 \cdot 24$ | -8I | $4 \cdot 22$ | $\cdot 71$ | $4 \cdot 20$ | - 60 | $4 \cdot 18$ | - 50 | $4 \cdot 17$ |
| 44 | $1 \cdot 11$ | $4 \cdot 29$ | -99 | $4 \cdot 26$ | - 88 | $4 \cdot 23$ | $\cdot 77$ | 4.21 | -66 | $4 \cdot 19$ | $\cdot 56$ | $4 \cdot 18$ |
| 46 | $1 \cdot 20$ | $4 \cdot 31$ | 1.08 | $4 \cdot 28$ | $\cdot 96$ | $4 \cdot 25$ | - 84 | $4 \cdot 23$ | $\cdot 73$ | $4 \cdot 20$ | -62 | $4 \cdot 19$ |
| 48 | 1.29 | $4 \cdot 34$ | 1.16 | $4 \cdot 30$ | x-04 | $4 \cdot 27$ | $\cdot 92$ | $4 \cdot 24$ | -80 | $4 \cdot 22$ | -68 | $4 \cdot 20$ |
| 50 | -1.40 | 4.37 | -I. 26 | 4.33 | -r.13 | $4 \cdot 29$ | - 1.00 | $4 \cdot 26$ | - . 88 | $4 \cdot 23$ | - 75 | 4.21 |
| 52 | 1.51 | 4.41 | $1 \cdot 37$ | $4 \cdot 36$ | I 23 | $4 \cdot 32$ | 1.09 | $4 \cdot 28$ | .96 | 4.25 | -83 | 4.22 |
| 54 | I. 64 | 4.45 | I. 49 | $4 \cdot 40$ | I.34 | $4 \cdot 35$ | $1 \cdot 19$ | $4 \cdot 31$ | $\underline{1} 05$ | 4.27 | $\cdot 91$ | 4.24 |
| 56 58 | $1 \cdot 79$ $\mathrm{r} \cdot 97$ | 4.51 4.58 |  | 4.45 | $1 \cdot 46$ 1.60 | 4.39 | $1 \cdot 30$ | $4 \cdot 34$ | $1 \cdot 15$ | $4 \cdot 30$ | I.OI |  |
| 58 | 1•97 | 4.58 | I•78 | 4.51 | I.60 | $4 \cdot 44$ | 1443 | $4 \cdot 38$ | $1 \cdot 27$ | $4 \cdot 33$ | I•II | 4.28 |

DECLINATION—SAME NAME AS—LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\left\lvert\, \begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & 27 \cdot 3 \end{array}\right.$ | +r.08 | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } & 32 \cdot 5 \end{array}$ | +1.09 | $\left\lvert\, \begin{array}{lrl} \text { H. M. } & \text { S. } \\ 68 & 87 \cdot 9 \end{array}\right.$ | $+1 \cdot 09$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 9 & 43 \cdot 7 \end{array}\right.$ | $\left\lvert\, \begin{gathered} S . \\ +r \cdot 10 \end{gathered}\right.$ | $\left\lvert\, \begin{array}{ccc} \text { H. м. s. } \\ 6 & \text { ro } & 49 \cdot 9 \end{array}\right.$ | +1-1 | $\left\lvert\, \begin{array}{cc} \mathrm{H}, \mathrm{M} . & \mathrm{S} . \\ 6 \mathrm{II} & 56.5 \end{array}\right.$ | $+1 \cdot I I$ |
| 10 | 52453.3 | 1.0 | $\begin{array}{llll}5 \quad 25 & 54.2\end{array}$ | I.OI | 5 $26 \begin{array}{lll}54 \cdot 6\end{array}$ | I-00 | $\begin{array}{llll}5 & 27 & 54.4\end{array}$ | $\cdot 99$ | $\begin{array}{llll}5 & 28 & 53.7\end{array}$ | $\cdot 98$ | $\begin{array}{llll}5 & 29 & 52 \cdot 6\end{array}$ | $\cdot 98$ |
| 12 | $1 \begin{array}{llll}5 & 16 & 35.6\end{array}$ | I. O | $\begin{array}{llllllll}5 & 17 & 35\end{array}$ | r.oo | 51835.4 | 99 | $51934 \cdot 3$ | -97 | $52032 \cdot 5$ | $\cdot 96$ | $52130 \cdot 1$ | -95 |
| 14 | $\begin{array}{llllll}5 & 8 & 18.0\end{array}$ | 1.00 | $\begin{array}{llll}5 & 9 & 17 & 8\end{array}$ | -99 | 5 10 $16 \cdot 6$ | $\cdot 97$ | 5 II 14.6 | -96 |  | $\cdot 95$ | $5 \mathrm{I} 38 \cdot \mathrm{I}$ | -93 |
| 16 | $\begin{array}{lll}5 & 0 & 0.7\end{array}$ | 1.00 | $\begin{array}{llll}5 & 1 & 0.0\end{array}$ | $\cdot 98$ | 5 I 158.2 | $\cdot 96$ | $\begin{array}{llll}5 & 2 & 55 \cdot 4\end{array}$ | -94 | $\begin{array}{llll}5 & 3 & 51.6\end{array}$ | -93 | $\begin{array}{llll}5 & 4 & 46 \cdot 7\end{array}$ | 1 |
| 18 | 45143.5 | + •99 | $45242 \cdot 4$ | + '97 | $45340 \cdot \mathrm{I}$ | + 95 | $45436 \cdot 5$ | + 93 | $45531 \cdot 8$ | + 91 | $45626 \cdot 0$ | $+.89$ |
| 20 | 44326.5 | -99 | $44425 \cdot 0$ | -96 | $4 \begin{array}{llll}4 & 45 & 22 \cdot 3\end{array}$ | $\cdot 94$ | 44618.0 | -92 | 44712.5 | -90 | $448 \quad 5 \cdot 6$ | . 87 |
| 22 | $435 \quad 9.5$ | -99 | $436 \quad 7 \cdot 8$ | -96 | $\begin{array}{llll}4 & 37 & 4 \cdot 6\end{array}$ | 93 | 43759.9 | -91 | $43^{8} 53.5$ | 8 | 43945.7 | -86 |
| 24 | $\begin{array}{llll}4 & 26 & 52 \cdot 6\end{array}$ | -98 | 42750.8 | . 95 | $42847 \cdot 3$ | 93 | $42942 \cdot 0$ | -90 | $43035 \cdot 0$ | . 87 | $4 \begin{array}{llll}4 & 31 & 26 \cdot 2\end{array}$ | 84 |
| 26 | 41835.6 | 99 | 41933.8 | -95 | $42030 \cdot 0$ | -92 | 42124.3 |  | $42216 \cdot 7$ |  | $423 \quad 7 \cdot I$ | 82 |
| 28 | 41018.6 | + 99 | 4 II 16.9 | + 95 | $\begin{array}{lllll}4 & 12 & 12.9\end{array}$ | + 92 | $4 \begin{array}{lll}4 & 13 & 6.9\end{array}$ | + 88 |  | + 884 | 41448. | .81 |
| 30 | $\begin{array}{ccc}4 & 2 & 1.5\end{array}$ | -99 | 259.9 | -95 | $\begin{array}{llll}4 & 3 & 55.9 \\ 3 & 59\end{array}$ | $\cdot 91$ | $449 \cdot 6$ | -87 | $4 \quad 54 \mathrm{r} \cdot 0$ | $\cdot 84$ | $630 \cdot 0$ | 80 |
| 31 |  | -99 | $3585 \mathrm{I} \cdot 4$ | -95 |  | 91 | $\bigcirc 4 \mathrm{I} \cdot 0$ | . 87 | $4 \quad 1 \begin{array}{lll} \\ 4 & 32\end{array}$ | -83 | $220 \cdot 8$ | 79 |
| 32 | $\begin{array}{llllllll}3 & 53 & 44\end{array}$ | 1.00 | $35443 \cdot 0$ | -95 |  | 9r | $35632 \cdot 5$ | 87 | $\begin{array}{llll}3 & 57 & 23.4\end{array}$ | . 83 | $\begin{array}{llll}3 & 58 & \text { II } 8\end{array}$ | 79 |
| 33 | $34935 \cdot 6$ | 1.00 | 35034.4 | $\cdot 96$ | $35130 \cdot 5$ | 91 | 35224.0 |  | 35314.7 |  | 354 | 8 |
| 34 | $\begin{array}{ll}3 & 45 \\ 26 \cdot 8\end{array}$ | +r.or | 34625.9 | + 96 | $\begin{array}{lllll}3 & 47 & 22.0\end{array}$ | + 91 | 34815.3 | +.87 | $\begin{array}{llll}3 & 49 & 6 \cdot 1\end{array}$ | + 822 | 34954.0 | $\cdot 77$ |
| 35 |  | 1.0 | 3 42 17.3 <br>  38 8.7 | -96 |  | 91 | $344 \begin{aligned} & 7 \cdot 0\end{aligned}$ | . 86 | $\begin{array}{llllllllllllllllll}3 & 44 & 57 \cdot 5\end{array}$ | . 82 |  | 77 |
| 36 | 3 37 $9 \cdot 1$ <br> 3 33  | I. 02 | $\begin{array}{llll}3 & 38 & 8 \cdot 7\end{array}$ | -96 | $\begin{array}{llll}3 & 39 & 5 \cdot 1\end{array}$ | 91 | $\begin{array}{llll}3 & 39 & 58.5\end{array}$ | . 86 | $\begin{array}{lllllllllll}3 & 40 & 48 \cdot 9\end{array}$ | .8I |  | 76 |
| 37 | 3 33 $0 \cdot$ <br> 3 2  | 1.02 | $\begin{array}{lll}3 & 34 & \text { 0.0 }\end{array}$ | $\cdot 97$ | $\begin{array}{llllllllllllllll}3 & 34 & 56 \cdot 5\end{array}$ | 92 | $33550 \cdot 0$ | . 86 |  | . 81 |  | 76 |
| 8 | $\begin{array}{llll}3 & 28 & 51 \cdot 1\end{array}$ | 1.03 | $3295 \mathrm{I} \cdot 2$ | -97 | $33048 \cdot 0$ | 92 | 3 3I $41 \cdot 5$ |  | 33231 |  | 33318 | 76 |
| 39 | $\begin{array}{llll}3 & 24 & 42.0 \\ 3 & 20 & 32.7\end{array}$ | +I.04 |  | + 98 | 3 $26639 \cdot 5$ | + 92 | $\begin{array}{lllll}3 & 27 & 33 \cdot 1 \\ 3 & 2\end{array}$ | +.86 | $\begin{array}{llll}3 & 28 & 23 \cdot 3\end{array}$ | + 8 8 |  | $+\cdot 75$ |
| 40 | $\begin{array}{llll}3 & 20 & 32.7 \\ 3 & 16 & 23.3\end{array}$ | 1.05 | $\begin{array}{llll}3 & 21 & 33.6 \\ 3 & 17 & 24.6\end{array}$ | $\cdot 98$ | $\begin{array}{llll}3 & 22 & 30 \cdot 8 \\ 3 & 18 & 22.2\end{array}$ |  |  |  |  | 81 | $\begin{array}{rrrr}3 & 25 & 1.5 \\ 3 & 20 & 53 \cdot 0\end{array}$ | .75 |
| 41 | $\begin{array}{lll}3 & 16 & 23.3 \\ 3 & 12 & 13.7\end{array}$ |  | $\begin{array}{llll}3 & 17 & 24.6 \\ 3 & 13 & 15.5\end{array}$ | 99 $\times 100$ | $\begin{array}{llll}3 & 18 & 22.2 \\ 3 & 14 & 13.5\end{array}$ | -93 | $\begin{array}{llll}3 & 19 & 16.1 \\ 3 & 15 & 7.6\end{array}$ | . 87 | $\begin{array}{lllr}3 & 20 & 6 \cdot 4 \\ 3 & 15 & 57.9\end{array}$ | . 8 I | $\begin{array}{lllll}3 & 20 & 53 \cdot 0 \\ 3 & 16 & 44 \cdot 4\end{array}$ | $\cdot 75$ |
| 42 | $\begin{array}{rrrr}3 & 12 & 13 \cdot 7 \\ 3 & 8 & 4.0\end{array}$ | 1.07 | $\begin{array}{rrrr}3 & 13 & 15.5 \\ 3 & 9 & 6.4\end{array}$ | . 00 | $\begin{array}{rrrr}3 & 14 & 13.5 \\ 3 & 10 & 4.7\end{array}$ | -93 | $\begin{array}{lllr}3 & 15 & 7 \cdot 6 \\ 3 & 10 & 59.0\end{array}$ | $\cdot 87$ | $\begin{array}{llll}3 & 15 & 57.9 \\ 3 & 11 & 49.4\end{array}$ | $\cdot 8$ | $\begin{array}{llll}3 & 16 & 44.4 \\ 3 & 12 & 35.9\end{array}$ | $\cdot 74$ |
| 43 | $\begin{array}{llll}3 & 8 & 4.0\end{array}$ | 1.07 | $\begin{array}{llll}3 & 9 & 6 \cdot 4\end{array}$ | 1.01 +1.01 | $\begin{array}{rrrr}3 & 10 & 4.7 \\ 3 & 5 & 55.8\end{array}$ |  | 31059.0 | + 88 | 3 II 49.4 <br> 3 7 40.9 |  | 3 $\begin{array}{rrrr}3 & 125.9 \\ 3 & 8 & 27.4\end{array}$ | .74 $+\quad .74$ |
| 44 45 |  | +1.08 $\mathbf{1} 10$ | $\begin{array}{llll}3 & 4 & 57 \cdot 1 \\ 3 & 0 & 47 \cdot 7 \\ & 5 & \end{array}$ | +r.01 | 3 5 55.8 <br> 3 1 46.9 <br> 2 57  | + 9.94 | 3 6 $50 \cdot 5$ <br> 3 2 $41 \cdot 8$ <br> 2   | $\begin{array}{r}\text { + } 88 \\ \hline .88 \\ \hline\end{array}$ | $\begin{array}{llll}3 & 7 & 40 \cdot 9 \\ 3 & 3 & 32 \cdot 5\end{array}$ |  | $\begin{array}{lll}3 & 8 & 27.4 \\ 3 & 4 & 18.9 \\ 3 & 5 & \end{array}$ | $+\quad .74$ .74 74 |
| 46 | 25533.9 | I.II | $2 \begin{array}{llll} & 56 & 38\end{array}$ | 1.03 | 25737.9 | $\cdot 96$ | $25833 \cdot 1$ | -88 | 25924.0 | . 81 | $\begin{array}{llll}3 & 0 & 10.4\end{array}$ | $\cdot 74$ |
| 47 | 25123.5 | I.12 | 25228.5 | 0 | $\begin{array}{llll}2 & 53 & 28.8\end{array}$ | $\cdot 97$ | 25424.4 | 9 |  | -81 | 256 | 74 |
| 48 | $\begin{array}{lllll}2 & 47 & 12.9\end{array}$ | I. 14 |  | r.05 | $2 \begin{array}{llll}29 & 19.5\end{array}$ | $\cdot 97$ | $25015 \cdot 6$ | -89 | 25 L 6.9 | . 82 | 25153.5 | 4 |
| 49 | $\begin{array}{llll}2 & 43 & 1.9 \\ 2 & 38 & 5\end{array}$ | +1.15 | $\begin{array}{llll}2 & 44 & 8.6\end{array}$ | +1.07 | $24510 \cdot 1$ | + 98 | $2 \begin{array}{lll}2 & 46 & 6 \cdot 7\end{array}$ | + 90 |  | + 82 | $24745 \cdot 0$ | + 74 |
| 5 | $\begin{array}{llllll}2 & 38 & 50 \cdot 6\end{array}$ | 17 | 23958.3 | I.08 | $\begin{array}{llll}2 & 41 & 0.6 \\ 2 & 36 & 5\end{array}$ | $\cdot 99$ | 24157.7 |  |  | . 82 | $24336 \cdot 5$ | 74 |
| 51 | $\begin{array}{llll}2 & 34 & 39 \cdot 2\end{array}$ | I•19 | $\begin{array}{lllll}2 & 35 & 47 \\ 2\end{array}$ | 1-10 | $\begin{array}{llll}2 & 36 & 50 \cdot 8\end{array}$ | 1.01 | $23748 \cdot 6$ | '92 | $\begin{array}{lllll}2 & 3^{8} & 410\end{array}$ | . 83 | $\begin{array}{ll}2 & 39 \\ 28 & 280\end{array}$ | 74 |
| 52 | $\begin{array}{llll}2 & 30 & 27.4\end{array}$ | 21 | $\begin{array}{lllllll}2 & 31 & 37 \cdot 1 \\ 2 & 27 & 26 \cdot 1\end{array}$ | I•II |  | 1.02 | $\begin{array}{lllll}2 & 33 & 39.4 \\ 2 & 39 & \end{array}$ |  | $\left\|\begin{array}{lll} 2 & 34 & 32 \cdot 2 \\ 2 & 30 & 22 \cdot 0 \end{array}\right\|$ |  | $\begin{array}{lllllllllllllll}2 & 35 & 19.5\end{array}$ | 74 75 |
| 53 | $2 \begin{array}{llll}26 & 15.2\end{array}$ | I.23 | 227 26•I | 13 | 22831.0 | I. 03 | $22930 \cdot 1$ |  | $230 \quad 23.4$ |  | 231110 | 75 |
| 54 | $\begin{array}{llll}2 & 22 & 2.6\end{array}$ | + 1.26 |  | +1.15 | $22420 \cdot 7$ | +1.05 | $22520 \cdot 6$ | + 95 | 22614.5 | + 8 | 2272.4 | + 75 |
| 55 | $\begin{array}{llllllllll}2 & 17 & 49 \cdot 5 \\ 2 & 13\end{array}$ | $1 \cdot 28$ | 22 19 $3 \cdot 1$ <br> 2 1  | 1.17 | $22010 \cdot 3$ | 1.07 | 22 IIIO | '96 | $\begin{array}{llll}2 & 22 & 5 \cdot 5\end{array}$ | .86 | $22253 \cdot 8$ | 75 |
| 56 | $\begin{array}{lllll}2 & 13 & 36 \cdot 0\end{array}$ | 1.31 |  | 19 |  | I.08 | $\begin{array}{llll}2 & 17 & 1 \cdot 2 \\ 2 & 12 & \end{array}$ | 97 |  | .87 | $\begin{array}{lllll}2 & 18 & 45 \\ 2\end{array}$ | 76 |
| 58 | $\begin{array}{lrrr}2 & 9 & 22 \cdot 0 \\ 2 & 5 & 7 \cdot 3\end{array}$ | 1.3 | $\begin{array}{lrrrr}2 & 10 & 38.7 \\ 2 & 6 & 25.8\end{array}$ | 1.25 | $\begin{array}{rrrrr}2 & \text { II } & 48.4 \\ 2 & 7 & 37.0\end{array}$ | I•I | $\begin{array}{crrrr}2 & 12 & 1.1 \\ 2 & 8 & 40 \cdot 9\end{array}$ | $\underline{1}$ | $\begin{array}{rrrrr}2 & 13 & 47 \cdot I \\ 2 & 9 & 37.7\end{array}$ |  | $\begin{array}{lllll}2 & 14 & 36 \cdot 4 \\ 2 & 10 & 27.6\end{array}$ | 77 77 |
| 58 | $\begin{array}{llll}2 & 5 & 7 \cdot 3\end{array}$ | I 3 | $2 \quad 625.8$ | 1.25 | $2737 \cdot 0$ | I•I3 | $840 \cdot 9$ | I.0 | $2 \quad 937 \cdot 7$ |  | $21027 \cdot 6$ | 77 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ}, \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $+\quad .45$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot \mathrm{I7} \end{gathered}$ | S. $+\quad .53$ | S. | S. $+\quad .60$ | $\begin{gathered} \text { S. } \\ -4 \cdot 18 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\quad .68 \end{gathered}$ |  | S. $+\quad .76$ | S. | S. 83 |  |
| 4 | $\begin{array}{r}+.37 \\ \hline+\end{array}$ | - 4 -16 | $\begin{array}{r}+.55 \\ \hline .45\end{array}$ | -4.17 | +.52 +.65 | -4.17 | +68 $+\quad 60$ | -4.18 | +.68 | -4.19 4.19 | .75 | 4.22 4.21 |
| 8 | $\cdot 30$ | $4 \cdot 15$ | $\cdot 37$ | $4 \cdot 16$ | -45 | $4 \cdot 16$ | $\cdot 52$ | $4 \cdot 17$ | -60 | $4 \cdot 18$ | -68 | $4 \cdot 19$ |
| 12 | - 22 | $4 \cdot 15$ | - 30 | 4.15 | -37 | 4-16 | -45 | $4 \cdot 16$ | -53 | $4 \cdot 17$ | -61 | $4 \cdot 18$ |
| 16 | - 15 | $4 \cdot 14$ | -22 | 4.15 | - 30 | 4-15 | 38 | $4 \cdot 16$ | -46 | $4 \cdot 17$ | - 54 | 4.17 |
| 20 | + 07 | $4 \cdot 14$ | +.15 | 4.14 | + 23 | $4 \cdot 15$ | + 3 I | $4 \cdot 15$ | + 39 | $4 \cdot 16$ | $+\cdot 47$ | $4 \cdot 17$ |
| 22 | . 04 | $4 \cdot 14$ | -12 | 4-14 | - 20 | 4. 15 | -28 | $4 \cdot 15$ | 36 | $4 \cdot 16$ | -44 | $4 \cdot 17$ |
| 24 | -00 | 4.14 | -08 | 4.14 | -16 | $4 \cdot 14$ | - 24 | $4 \cdot 15$ | $\cdot 32$ | $4 \cdot 15$ | $\cdot 40$ | 4. 56 |
| 26 | -. 04 | $4 \cdot 14$ | $\cdot 04$ | 4.14 | - 12 | $4 \cdot 15$ | - 21 | $4 \cdot 15$ | -29 | $4 \cdot 15$ | $\cdot 37$ | 4. 16 |
| 28 | -08 | 4.14 | -00 | 4-14 | -08 | 4-14 | $\cdot 17$ | $4 \cdot 14$ | . 25 | $4 \cdot 15$ | $\cdot 34$ | 4.16 |
| 30 | - .13 | $4 \cdot 14$ | $-.04$ | $4 \cdot 14$ | +.05 | 4.14 | + .13 | $4 \cdot 14$ | + 22 | $4 \cdot 15$ | + 3 3 | $4 \cdot 15$ |
| 32 | -16 | $4 \cdot 14$ | .08 | $4 \cdot 14$ | + Or | 4.14 | -10 | $4 \cdot 14$ | -18 | $4 \cdot 14$ | $\cdot 27$ | $4 \cdot 15$ |
| 34 | -21 | $4 \cdot 15$ | $\cdot 12$ | $4 \cdot 14$ | -.03 | 4.14 | -06 | $4 \cdot 14$ | -15 | $4 \cdot 14$ | $\cdot 24$ | $4 \cdot 15$ |
| 36 | $\cdot 25$ | $4 \cdot 15$ | - 16 | $4 \cdot 14$ | . 07 | $4 \cdot 14$ | + .02 | $4 \cdot 14$ | -11 | $4 \cdot 14$ | -20 | $4 \cdot 15$ |
| 38 | -30 | $4 \cdot 15$ | -21 | 4.15 | -II | 4.14 | $-.02$ | $4 \cdot 14$ | .08 | 4.14 | -17 | $4 \cdot 15$ |
| 40 | - 35 | $4 \cdot 15$ | - 25 | $4 \cdot 15$ | - . 15 | 4.14 | $-.05$ | $4 \cdot 14$ | +.04 | $4 \cdot 14$ | + $\mathrm{I}_{4}$ | $4 \cdot 14$ |
| 42 | $\cdot 40$ | $4 \cdot 16$ | $\cdot 30$ | $4 \cdot 15$ | - 20 | $4 \cdot 14$ | -10 | $4 \cdot 14$ | -00 | $4 \cdot 14$ | -10 | $4 \cdot 14$ |
| 44 | - 45 | $4 \cdot 16$ | $\cdot 35$ | $4 \cdot 16$ | - 24 | $4 \cdot 15$ | -14 | $4 \cdot 14$ | -. 04 | 4.14 | -06 | $4 \cdot 14$ |
| 46 | .51 | $4 \cdot 17$ | -40 | $4 \cdot 16$ | -29 | $4 \cdot 15$ | -18 | $4 \cdot 14$ | - 08 | $4 \cdot 14$ | -03 | 4. 14 |
| 48 | $\cdot 57$ | $4 \cdot 18$ | -45 | $4 \cdot 17$ | $\cdot 34$ | 4.16 | - 23 | $4 \cdot 15$ | -12 | 4.14 | + -01 | $4 \cdot 14$ |
| 50 | $-.63$ | $4 \cdot 19$ | -51 | 4.17 | - $\cdot 40$ | $4 \cdot 16$ | -. 28 | $4 \cdot 15$ | - .16 | $4 \cdot 14$ | $-.05$ | $4 \cdot 14$ |
| 52 | $\cdot 70$ | $4 \cdot 20$ | . 58 | 4.18 | $\cdot 45$ | $4 \cdot 16$ | -33 | $4 \cdot 15$ | -21 | $4 \cdot 15$ | -09 | $4 \cdot 14$ |
| 54 | $\cdot 78$ | $4 \cdot 21$ | . 65 | $4 \cdot 19$ | $\cdot 52$ | $4 \cdot 17$ | -39 | $4 \cdot 16$ | - 26 | $4 \cdot 15$ | -14 | $4 \cdot 14$ |
| 56 | . 86 | 4.23 | $\cdot 72$ | $4 \cdot 20$ | $\cdot 58$ | 4.18 | $\cdot 45$ | $4 \cdot 17$ | -31 | $4 \cdot 15$ | -18 | 4.14 |
| 58 | $\cdot 95$ | $4 \cdot 25$ | . 81 | 4.22 | . 66 | 4-19 | $\cdot 51$ | $4 \cdot 17$ | $\cdot 37$ | $4 \cdot 16$ | - 23 | $4 \cdot 15$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\begin{array}{lll} \text { H. M. } & \text { s. } \\ 6 & \text { I3 } & 3.6 \end{array}$ | $1.1$ | $\begin{aligned} & \text { H. M. } \\ & 6 \mathrm{If} \text { II } \end{aligned}$ | $+1 \cdot 13$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { I5 } \\ 19.3 \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \mathrm{I}_{1} \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I6 } & 28 \cdot(1) \end{array}$ | $\begin{gathered} \text { S. } \\ \mathrm{I} \cdot \mathrm{I}^{2} \end{gathered}$ | $\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & \text { I7 } \\ 37 \end{array}$ | s. $1 \cdot 16$ | $\begin{array}{lc} \text { H. M. S. } \\ 6 & \text { I8 } \\ 47 \cdot 7 \end{array}$ |  |
| 10 | $5305 \mathrm{I} \cdot 2$ | . 97 | 531493 | $\cdot 96$ | $\mathrm{lllll}_{5}^{5} 32$47 | $\cdot 96$ | $53344 \cdot 5$ | $\cdot 95$ | $53441 \cdot 7$ | $\cdot 95$ | 53538.7 | 95 |
| 12 | $\begin{array}{llll}5 & 22 & 27 \cdot 1 \\ 5\end{array}$ | -04 |  | $\cdot 94$ | $\begin{array}{lllll}5 & 24 & 19 \cdot 6\end{array}$ |  | 52515.0 | -92 | ${ }_{5}^{5} 26110 \cdot 1$ | -91 | $527 \quad 4 \cdot 6$ | 90 |
| 14 | $\begin{array}{llll}5 & 14 & 3.8 \\ 5 & 5 & 4\end{array}$ | $\bullet 92$ | $5{ }_{5}^{5} 14.58 \cdot 7$ | -91 | $\begin{array}{lllll}5 & 15 & 52.9\end{array}$ | $\bullet 90$ | $5{ }_{5}^{5} 16846.4$ | . 89 | $5{ }_{5}^{5} 717393$ | . 88 | $\begin{array}{lllll}5 & 18 & 31.5\end{array}$ | 87 |
| 16 | $5 \quad 541 \cdot 1$ | $\cdot 90$ | $\begin{array}{lllll}5 & 6 & 34 \cdot 5\end{array}$ |  | $\begin{array}{llll}5 & 7 & 27.0\end{array}$ | -87 | $\begin{array}{llll}5 & 8 & 18.6\end{array}$ | . 85 | $\begin{array}{llll}5 & 9 & 9 \cdot 4\end{array}$ | -84 | $\begin{array}{llll}5 & 9 & 59 \cdot 4\end{array}$ | 83 |
| 18 | 45719.0 | + 87 | $448810 \cdot 9$ | $+.86$ | $4{ }_{4}^{59} 51.8$ | + 88 | $45951 \cdot 6$ | + 82 | $040 \cdot 4$ | + 80 | $\begin{array}{llll}5 & 1 & 28.2\end{array}$ |  |
| 20 | 44757.4 | . 85 | 449 48.0 | $\cdot 83$ | $45037 \cdot 3$ | . 81 | 45125.3 | $\cdot 79$ | $4 \begin{array}{llll} & 52 & 12 \cdot 2\end{array}$ | $\cdot 77$ | 45257.9 | 75 |
| 22 | $44036 \cdot 4$ | $\cdot 83$ | 44125.6 | -81 | 442123.4 | 78 | $44259 \cdot 8$ | $\cdot 76$ | $44344 \cdot 7$ | 7 | $44428 \cdot 3$ | 1 |
| 24 | 43215.8 | . 81 | $\begin{array}{lll}4 & 33 & 3 \cdot 8\end{array}$ | $\cdot 78$ | $43350 \cdot 1$ | $\cdot 76$ | $43434 \cdot 8$ | -73 | $435 \quad 17.9$ | $\cdot 70$ | $435 \quad 59 \cdot 5$ | 8 |
| 26 | $42355 \cdot 7$ | 79 | $42442 \cdot 5$ | 76 | $4 \begin{array}{llll}4 & 25 & 27 \cdot 4\end{array}$ | 73 | 42610.5 | $\cdot 70$ | 42651.8 | 7 | $42731 \cdot 3$ | 4 |
| 28 | $41536 \cdot 0$ | + 78 | $4{ }_{4}^{46} 21 \cdot 6$ | + 74 | $\begin{array}{lll}4 & 17 & 5.2\end{array}$ | + 71 | $41746 \cdot 7$ | + 67 | 41826.2 | + 64 |  | $+61$ |
| 30 | $4{ }^{4} 716 \cdot 7$ | $\cdot 76$ | $\begin{array}{llll}4 & 8 & \mathrm{I} \cdot 2 \\ 4 & 3 & 5\end{array}$ | 72 | $\begin{array}{llll}4 & 8 & 43.4 \\ 4 & 4 & 32.8\end{array}$ | $\cdot 68$ | $4 \begin{array}{lll}4 & 9 & 23.5\end{array}$ | . 65 | $4 \begin{array}{lll}40 & 1.2\end{array}$ | . 61 | 4 10 36.8 |  |
| 31 | $\begin{array}{llll}4 & 3 & 7 \cdot 2 \\ 3 & 58 & 5\end{array}$ | $\cdot 75$ | $\begin{array}{lllll}4 & 3 & 5 \mathrm{I} \cdot 2\end{array}$ | 71 | 4 4 $32 \cdot 8$ <br> 4   | . 67 | $\begin{array}{lllll}4 & 5 & 12 \cdot 1\end{array}$ | - 63 | 4549.0 | 59 | $4 \quad 623.6$ | 56 |
| 32 |  | $\cdot 74$ | $35941 \cdot 2$ | $\cdot 70$ | 4 0 $22 \cdot 2$ <br> 3 56  <br> 15   | -66 |  | 62 | $\begin{array}{llll}4 & 1 & 36 \cdot 8 \\ 3 & 51 & \end{array}$ |  | $\begin{array}{llll}4 & 2 & 10 \cdot 5 \\ 3 & 5 & \end{array}$ | - 54 |
| 33 | $35448 \cdot 4$ | 74 | $35531 \cdot 3$ |  | $35611 \cdot 7$ | $\cdot 65$ | $35649 \cdot 5$ |  | 35724.8 | - 56 | $35757 \cdot 5$ | 2 |
| 34 | 3 51 $39 \cdot 1$ <br> 3 46 29.9 <br>    <br> 10   | + 73 | $\begin{array}{llll}3 & 51 & 2 I \cdot 6 \\ 3 & 47 & I I \cdot 0\end{array}$ | + .68 | $\begin{array}{cccc}3 & 52 & 1 \cdot 4 \\ 3 & 47 & 5 \\ \text { r }\end{array}$ | + 6.64 | $\begin{array}{llll}3 & 52 & 38.4 \\ 3 & 48 & 27.5\end{array}$ | $\begin{array}{r}\text { + } 59 \\ +.58 \\ \hline\end{array}$ | 3 53 $12 \cdot 9$ <br> 3 49  | $+.55$ | 3 53 $44 \cdot 6$ <br> 3 49  | + 51 |
| 35 <br> 36 | $\left\lvert\, \begin{array}{llll}3 & 46 & 29.9 \\ 3 & 42 & 20.8 \\ 3 & 38 & 1\end{array}\right.$ | $\cdot 72$ |  |  | $34751 \cdot 1$ | . 63 |  |  | 349 I•I | 54 | $3 \begin{array}{llll}39 & 31 \cdot 9\end{array}$ | 49 |
| 37 | 3 42 <br> 3 38 | 7 | $\begin{array}{rrr}43 & 2 \cdot 3 \\ 38 & 52.8 \\ & \end{array}$ | . 66 | 43 | . 62 | 3 44 16.6 <br> 3 40 5.8 | -57 | 3 <br> 3 <br> 34 <br> 40 | 52 | $\begin{array}{lllllllllll}3 & 45 & 19 \cdot 3 \\ 3 & 41 & 6.7\end{array}$ | 7 |
| 38 | $\begin{array}{llll}3 & 34 & 2 \cdot 7\end{array}$ | -\% | $1 \begin{array}{llll}3 & 34 & 43 \cdot 4\end{array}$ | 65 | $\begin{array}{lllll}3 & 35 & 20 \cdot 8\end{array}$ | . 60 | $\begin{array}{lllllllllll}3 & 35 & 55 \cdot 2\end{array}$ | 4 | $34037 \cdot 8$ 3 36 |  | 3 41 $6 \cdot 7$ <br> 3 36 $54 \cdot 3$ |  |
| 39 | $\begin{array}{llll}3 & 29 & 53 \cdot 8 \\ 3 & 25 & 44 \cdot 9 \\ 3 & 21\end{array}$ | + $\cdot 70$ |  | +64 +63 | 3 31 $11 \cdot 0$ <br> 3 27  | + .59 | 3 3 31 44.6 | $+\cdot 53$ | $\begin{array}{lllllllllllllll}3 & 32 & 15.0 \\ 3 & 28 & 3.7\end{array}$ | + 48 | 3 3 32 $42 \cdot \mathrm{I}$ | + 42 |
| 40 | $\begin{array}{llllllll}3 & 25 & 44.9 \\ 3 & 21 & 46\end{array}$ | $\cdot 69$ |  | . 63 | $3 \begin{array}{llll}3 & 27 & 1 \cdot 1\end{array}$ | $\cdot 58$ | $\begin{array}{llll}3 & 27 & 34.2\end{array}$ | 52 | $\begin{array}{llll}3 & 28 & 3.7\end{array}$ | 46 | $\begin{array}{llll}3 & 28 & 29.8 \\ 3 & \end{array}$ | $\cdot 41$ |
| 41 | $32136 \cdot 0$ |  |  | - | $\begin{array}{llllll}3 & 22 & 51 \cdot 4 \\ 3\end{array}$ | $\cdot 57$ | $\begin{array}{llll}3 & 23 & 23.8\end{array}$ | -51 | $\begin{array}{llll}3 & 23 & 52.5\end{array}$ | 45 | $\begin{array}{llll}3 & 24 & 17.8 \\ 3 & \end{array}$ | -39 |
| 42 | $\begin{array}{lllll}3 & 17 & 27.3 \\ 3 & 1 & 18\end{array}$ | -68 | $\begin{array}{llll}3 & 18 & 6 \cdot 3\end{array}$ | . 62 | $\begin{array}{llll}3 & 18 & 41 \cdot 8\end{array}$ | $\cdot 56$ | $\begin{array}{lllllllll}3 & 19 & 13.5\end{array}$ | -50 | $\begin{array}{llllllllll}3 & 19 & 41 \cdot 5\end{array}$ | 43 | $\begin{array}{llll}3 & 20 & 5.7 \\ 3 & 5\end{array}$ | $\cdot 37$ |
| 43 |  |  | 313573 | . 61 | $31432 \cdot 2$ | -55 | $\begin{array}{llll}3 & 15 & 3.3\end{array}$ | 49 | $\begin{array}{llllll}3 & 15 & 30.5\end{array}$ | $\cdot 42$ | 3 15 53.8 | 36 |
| 44 | 3 | + 67 | $\begin{array}{llll}9 & 48 \cdot 3 \\ 5\end{array}$ | + 61 |  | + 54 | 3 10 53.2 | + 47 | $\begin{array}{lllll}3 & 11 & 19.6\end{array}$ | + 41 | $3{ }_{3} 1142 \cdot 0$ | + 34 |
| 4 | 5.52 .6 | $\cdot 67$ | $\begin{array}{ll}5 & 39 \cdot 3\end{array}$ | . 60 | ${ }^{3}$ | 53 | $\begin{array}{llllll}3 & 6 & 43 \cdot 1\end{array}$ | 45 | 378 | -39 | $\begin{array}{llll}3 & 7 & 30 \cdot 3\end{array}$ | 32 |
| 46 | $\begin{array}{llll}3 & 0 & 52 \cdot 6\end{array}$ | -67 | $\begin{array}{llll}3 & 1 & 30 \cdot 4\end{array}$ | 5 | $\begin{array}{llll}3 & 2 & 3.9 \\ 2 & 57 & \end{array}$ | 51 | $\begin{array}{lllll}3 & 2 & 33 \cdot 1\end{array}$ | -45 | $\begin{array}{llll}3 & 2 & 58.0\end{array}$ | $\cdot 38$ | $\begin{array}{lllll}3 & 3 & 18.6\end{array}$ | 3 I |
| 47 | $\begin{array}{llll}2 & 56 & 44.0 \\ 2 & 52 & \\ \end{array}$ | -66 | $\begin{array}{llll}2 & 57 & 21.5 \\ 2 & 5 & 1\end{array}$ | . 59 | $\begin{array}{llllll}2 & 57 & 54 \cdot 6 \\ 2 & 53\end{array}$ | -51 | $\begin{array}{llll}2 & 58 & 23.2\end{array}$ | 4 | $\begin{array}{lllll}2 & 58 & 47\end{array}$ | $\cdot 36$ | 2597.0 | 29 |
| 48 | $25235 \cdot 5$ | - 66 | $2 \begin{array}{llll}23 & 12.7\end{array}$ | -58 | $25345 \cdot 4$ | 51 |  | 43 | $25436 \cdot 7$ | $\cdot 35$ | $25455 \cdot 4$ | 7 |
| 49 | $\begin{array}{llll}2 & 48 & 26.9 \\ 2 & 44 & 18.4\end{array}$ | + . 66 | $\begin{array}{llll}2 & 49 & 3.9 \\ 2 & 44 & 55 \cdot 3\end{array}$ | + $\quad .58$ | $\begin{array}{llll}2 & 49 & 36 \cdot 2 \\ 2 & 45 & 27 \cdot 5\end{array}$ | + 50 | $\begin{array}{llrr}2 & 50 & 3.6 \\ 2 & 45 & 53.9\end{array}$ | + 42 | $\begin{array}{llll}2 & 50 & 26.2\end{array}$ | + 34 | 25044.0 | + 25 |
| 50 | $\begin{array}{lllllll}2 & 44 & 18.4\end{array}$ | . 66 | 24455.3 | . 57 | 2 45 27 <br> 2 1  | -49 | $\begin{array}{lllllll}2 & 45 & 53.9\end{array}$ | -41 | 2 | $\cdot 32$ | $24632 \cdot 6$ | - 24 |
| 51 | $\begin{array}{llll}2 & 40 & 9.9\end{array}$ | 65 | $2 \begin{array}{llll}2 & 40 & 46 \cdot 5\end{array}$ | 57 | 24118 | 48 | 241443 | -39 | $\begin{array}{llll}2 & 42 & 5.4\end{array}$ | 31 | 24221.2 | $\cdot 22$ |
| 5 | $\begin{array}{llll}2 & 36 & 1.4\end{array}$ | 65 | $2 \begin{array}{llll}26 & 37.9\end{array}$ | 5 | $\begin{array}{lll}2 & 37 & 90\end{array}$ | 47 | $237734 \cdot 7$ |  | $23755 \cdot 1$ | -29 | 23810.0 |  |
| 53 | 23153.0 | $\cdot 65$ | $\begin{array}{lllll}2 & 32 & 29.3\end{array}$ | 56 | 2330 | 47 | 233 | $\cdot 37$ | 23344 |  | 233 | -18 |
| 54 | $\begin{array}{llll}2 & 27 & 44.5\end{array}$ | $+.65$ |  | + 56 | 22851.2 | + 46 | $\begin{array}{llll}2 & 29 & 15.8\end{array}$ | + 36 | $\begin{array}{llll}2 & 29 & 34.6\end{array}$ | + 26 | $22947 \cdot 5$ | + 17 |
| 55 | $\begin{array}{lllll}2 & 23 & 36 \cdot 1 \\ 2 & 19 & 27.6\end{array}$ | $\cdot 65$ | $\begin{array}{lllll}2 & 24 & 12.2 \\ 2 & 20 & 3.7\end{array}$ | . 55 | $\begin{array}{llllll}2 & 24 & 42 \\ 2 & 2 & 3\end{array}$ | $\cdot 45$ | $\begin{array}{llll}2 & 25 & 6 \cdot 4 \\ 2 & 20 & 5\end{array}$ | -35 | $\begin{array}{llll}2 & 25 & 24.5\end{array}$ |  | $2 \begin{array}{lll}2 & 25 & 36 \cdot 4\end{array}$ | -15 |
| 56 57 | $\begin{array}{llll}2 & 19 & 27.6 \\ 2 & 15 & 19.1\end{array}$ | 65 | $\begin{array}{lll}2 & 20 & 3.7 \\ 2 & 15 & 55.2\end{array}$ | 55 | $\begin{array}{llll}2 & 20 & 33.6 \\ 2 & 16 & 24.8\end{array}$ | -44 | $\begin{array}{llll}2 & 20 & 57 \cdot 1 \\ 2 & 16 & 47.8\end{array}$ | -34 | $\begin{array}{llllll}2 & 21 & 14.4 \\ 2 & 17 & 4.3\end{array}$ | -23 | $\begin{array}{llll}2 & 21 & 25 \cdot 3 \\ 2\end{array}$ | 13 |
| 57 | $\begin{array}{lllll}2 & 15 & 19.1 \\ 2 & 11 & 19.5\end{array}$ | -66 | 21555.2 | -55 | $2 \begin{array}{llll}2 & 16 & 24.8\end{array}$ | 44 | 21647.8 | 33 | 2174.3 | 2 | $\begin{array}{llllll}2 & 17 & 14.2 \\ 2\end{array}$ | Ir |
| 58 | $1110 \cdot 5$ | -66 | II 46 | $\cdot 55$ | 212 | $\cdot 43$ | 212 | $\cdot 32$ | 1254 |  | 13 | $\cdot 09$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{\|lcc} \text { H. M. } & \text { S. } \\ 6 & \text { I9 } & 58 \cdot 7 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot \mathrm{I} 9 \end{gathered}$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 2 \mathrm{I} & 10 \cdot 5 \end{array}$ | $\begin{gathered} 5 \\ +\mathrm{I} \cdot 20 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 22 & 23 \cdot 2 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 22 \end{gathered}$ | $\begin{array}{\|lcc} \text { H. M. } & \text { S. } \\ 6 & 23 & 36 \cdot 9 \end{array}$ | $\begin{gathered} \mathrm{s} . \\ +\mathbf{r} \cdot 24 \end{gathered}$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 24 & 5 \text { I. } 6 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 25 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 26 & 7 \cdot 4 \end{array}$ | S. $\cdot 27$ |
| 10 | $\begin{array}{lllll}5 & 36 & 35 \cdot 5\end{array}$ | . 94 | $5 \quad 37 \quad 32 \cdot 0$ | . 94 | $\begin{array}{llll}5 & 38 & 28 \cdot 4\end{array}$ | -94 | $\begin{array}{lllllllllllllllll}5 & 39 & 24 \cdot 7\end{array}$ | -94 | $54021 \cdot 0$ | . 94 | 541179 | . 94 |
| 12 | $5 \quad 2758 \cdot 8$ | -90 | $5 \quad 28 \quad 52 \cdot 6$ | -89 | $52946 \cdot 0$ | -89 | $53039 \cdot 1$ | -88 | 5 31 31•9 | -88 | $\begin{array}{llll}5 & 32 & 24.5\end{array}$ | 87 |
| 14 | 51923.2 | . 85 | $\begin{array}{lllllll}5 & 20 & 14.3\end{array}$ | -84 | $\begin{array}{llll}5 & 21 & 4.8\end{array}$ | -84 |  | -83 | $52244 \cdot 3$ | -82 | $\begin{array}{lllll}5 & 23 & 33 \cdot 3\end{array}$ | -81 |
| 16 | 5 10 48.7 | .81 | 5 II 37.1 | -80 | $\begin{array}{lllll}5 & 12 & 24.8\end{array}$ | $\cdot 79$ | 5 I3 II'7 | $\cdot 77$ | $\begin{array}{llllllllllll}5 & 13 & 57.9\end{array}$ | $\cdot 76$ | $51443 \cdot 5$ | $\cdot 75$ |
| 18 | $5 \quad 2 \quad 15.0$ | + 77 | $5 \quad 3 \quad 0.9$ | + 76 | $5 \quad 3 \quad 45 \cdot 8$ | + •74 | $\begin{array}{lll}5 & 4 & 29 \cdot 7\end{array}$ | + 72 | $5 \quad 5 \quad 12.8$ | + •71 | $\begin{array}{llll}5 & 5 & 54.8\end{array}$ | + . 69 |
| 20 | $4 \quad 53 \quad 42 \cdot 3$ | - 73 | $4 \begin{array}{lrr} & 54 & 25 \cdot 6\end{array}$ | -7I | $\begin{array}{llll}4 & 55 & 7 \cdot 8\end{array}$ | - 69 | $45548 \cdot 8$ | -67 | $456 \quad 28 \cdot 6$ | - 65 | $4 \begin{array}{lll}4 & 57 & 7 \cdot 3\end{array}$ | - 63 |
| 22 | $445 \quad 10 \cdot 5$ | - 69 | 445 5I*3 | -67 | $44630 \cdot 7$ | -64 | 447808 | -62 | $44745 \cdot 5$ | -60 | $\begin{array}{llll}4 & 48 & 20 \cdot 8\end{array}$ | $\cdot 58$ |
| 24 | 43639.4 | . 65 | $43717 \cdot 7$ | -62 | 43754.5 | -60 | $4 \begin{array}{lll}4 & 38 & 29 \cdot 6\end{array}$ | -57 | $\begin{array}{lll}4 & 39 & 3 \cdot 2\end{array}$ | - 55 | $4 \quad 39 \quad 35 \cdot 2$ | $\cdot 52$ |
| 26 | $428 \quad 9 \cdot 0$ | -6I | $42844 * 9$ | -58 | 42919.0 | -55 | $4295 \mathrm{I} \cdot 3$ | $\cdot 52$ | $4302 \mathrm{~S} \cdot 8$ | $\cdot 49$ | $4 \quad 30 \quad 50 \cdot 4$ | $\cdot 46$ |
| 28 | 4 I9 39.3 | + 57 | 42012.8 | $\cdot 54$ | 42044.2 | + 51 | 42113.7 | + 47 | 4 2I 4I•I | + $\cdot 44$ | $\begin{array}{lll}4 & 22 & 6.4\end{array}$ | 40 |
| 30 | 4 II 10.2 | - 54 | 4 II 4I•3 | - 50 | 4 I2 10.1 | $\cdot 46$ | $41236 \cdot 7$ | -42 | 4 I3 I.O | $\cdot 38$ | 4 I3 23.0 | -35 |
| 3 | $4 \quad 6 \quad 55 \cdot 8$ | - 52 | $4725 \cdot 8$ | -48 | $4 \begin{array}{lllllll}4 & 7 & 53\end{array}$ | -44 | $\begin{array}{lllll}4 & 8 & 18 & 4\end{array}$ | 4 | $4841 \cdot 2$ | $\cdot 36$ | $\begin{array}{lll}4 & 9 & 1.5\end{array}$ | -33 |
| 32 | $4 \quad 241 \cdot 7$ | - 50 | $\begin{array}{llll}4 & 3 & 10.4\end{array}$ | $\cdot 46$ | $\begin{array}{llll}4 & 3 & 36 \cdot 6\end{array}$ | -4 | $\begin{array}{lll}4 & 4 & 0 \cdot 3\end{array}$ | $\cdot 37$ | 441215 | -33 | $44840 \cdot I$ | $\cdot 2$ |
| 33 | $3 \begin{array}{llll}3 & 58 & 27 \cdot 6\end{array}$ | $\cdot 48$ | $\begin{array}{llll}3 & 58 & 55 \cdot 1\end{array}$ | -44 | 359 20.0 | -39 | $3 \begin{array}{llll}3 & 59 & 42 \cdot 3\end{array}$ | -35 | 4020 | $\cdot 30$ | $\begin{array}{llll}4 & 0 & 18.9\end{array}$ | -26 |
| 34 |  | + 46 | $35440 \cdot 0$ | + $4 \mathrm{4I}$ | $\begin{array}{llll}3 & 55 & 3.6\end{array}$ | +.37 | $3 \begin{array}{llll}3 & 55 & 24 \cdot 5\end{array}$ | + 32 | $35542 \cdot 5$ | + .28 | $3 \begin{array}{lll}3 & 55 & 57 \cdot 7\end{array}$ | + 23 |
| 35 | 34959.9 | -44 | 350250 | -39 | $35047 \cdot 3$ | -35 | 351507 | -30 | $35123 \cdot 2$ | -25 | $3 \mathrm{lll} 36 \cdot 7$ | -20 |
| 36 | $\begin{array}{llll}3 & 45 & 46 \cdot 2\end{array}$ | -42 | $3{ }^{3} 4610 \cdot 1$ | -37 | $3{ }^{3} 46$ 3I•I | -32 | $\begin{array}{llll}3 & 46 & 49 \cdot 1\end{array}$ | -27 | 3474.0 | 22 |  | 17 |
| 37 | 3 4I $32 \cdot 6$ | -40 | $34 \mathrm{I} 55 \cdot 4$ | -35 | $34215 \cdot 0$ | -30 | $34231 \cdot 5$ | - 25 | $34244 \cdot 8$ | -19 | $\begin{array}{lllll}3 & 42 & 54.9\end{array}$ | 14 |
| 38 | $\begin{array}{lllll}3 & 37 & 19.2\end{array}$ | $\cdot 38$ | $\begin{array}{lllll}3 & 37 & 40 \cdot 7\end{array}$ | -33 | $33759 \cdot 0$ | 28 | $\begin{array}{llllllll}3 & 38 & 14.0\end{array}$ | - 22 | $\begin{array}{llll}3 & 38 & 25 \cdot 7\end{array}$ | -17 | $\begin{array}{lllll}3 & 38 & 34 \cdot 0\end{array}$ | II |
| 39 | $\begin{array}{llll}3 & 33 & 5\end{array}$ | + 37 | $\begin{array}{llll}3 & 33 & 26 \cdot 2\end{array}$ | + 31 | 333 43.1 | + 25 | $\begin{array}{llll}3 & 33 & 567\end{array}$ | + 20 | $\begin{array}{llll}3 & 34 & 6 \cdot\end{array}$ | + •I4 | 313413.2 | $+.08$ |
| 40 |  | -35 | $3 \quad 29$ 11•7 | - 29 | $\begin{array}{llll}3 & 29 & 27.3\end{array}$ | -23 | $\begin{array}{llll}3 & 29 & 39 & 3\end{array}$ | I7 | $32947 \cdot 8$ | - II | $\begin{array}{llll}3 & 29 & 52.5\end{array}$ | . 05 |
| 41 | $32439 \cdot 3$ | -33 | $\begin{array}{llll}3 & 24 & 57: 3\end{array}$ | -27 | 325 II.6 | -2I | $\begin{array}{lllll}3 & 25 & 22 \cdot 1\end{array}$ | -14 | $325128 \cdot 8$ | 08 | $32531 \cdot 7$ | + 01 |
| 42 | $32026 \cdot 3$ | -31 | $\begin{array}{llll}3 & 20 & 43.0 \\ 3 & 16 & 2\end{array}$ | - 25 | $\begin{array}{lllllllll}3 & 20 & 55 \cdot 9\end{array}$ | -18 | $\begin{array}{llll}3 & 21 & 4.9 \\ 3 & 16 & 4\end{array}$ | -12 | $32110 \cdot 0$ | -05 | 321110 | 02 |
| 43 | 31613.3 | $\cdot 29$ | $\begin{array}{llll}3 & 16 & 28.8\end{array}$ | -22 | 3 I6 40*3 | 16 | $31647 \cdot 8$ | -09 | $31651 \cdot 1$ | $+.02$ | $\begin{array}{lllll}3 & 16 & 50 \cdot 3\end{array}$ | -05 |
| 44 | $\begin{array}{llll}3 & 12 & 0.4\end{array}$ | + $\cdot 27$ | $\begin{array}{llll}3 & 12 & 14.6\end{array}$ | + 20 | 3 I2 24.7 | + I3 | $3 \begin{array}{llll}3 & 12 & 30 \cdot 7\end{array}$ | +.06 | $\begin{array}{llll}3 & 12 & 32 \cdot 3\end{array}$ | - 01 | 31229.5 | -08 |
| 45 | $\begin{array}{llll}3 & 7 & 47 \cdot 5 \\ 3 & 3 & 34 \cdot 7\end{array}$ | - 25 | $\begin{array}{rrrr}3 & 8 & 0.5 \\ 3 & 3 & 4.5\end{array}$ | 18 | $\begin{array}{llr}3 & 8 & 9 \cdot 2 \\ 3 & 3 & 53 \cdot 8\end{array}$ | -II | $\begin{array}{llll}3 & 8 & 13.6 \\ 3 & 3 & 56.5\end{array}$ | . 03 | $\begin{array}{llll}3 & 8 & 13 \\ 3 & 3\end{array}$ | - 04 | 3 8 $8 \cdot 7$ <br>    | 2 |
| 46 | $\begin{array}{llll}3 & 3 & 34 \cdot 7\end{array}$ | -23 | $\begin{array}{llll}3 & 3 & 46 \cdot 5\end{array}$ | -16 | $\begin{array}{llll}3 & 3 & 53 \cdot 8\end{array}$ | - 08 | $\begin{array}{llll}3 & 3 & 56 \cdot 5\end{array}$ | + .0I | $\begin{array}{llll}3 & 3 & 54.6\end{array}$ | -07 | $\begin{array}{llll}3 & 3 & 47 \cdot 9\end{array}$ | - 15 |
| 47 | $\begin{array}{llll}2 & 59 & 22 \cdot 0 \\ 2 & 55 & 0 \cdot 4\end{array}$ | - 21 | $\begin{array}{llll}2 & 59 & 32 \cdot 5\end{array}$ | -14 | $2 \begin{array}{llll}2 & 59 & 38 \cdot 3\end{array}$ | . 06 | $\begin{array}{llll}2 & 59 & 39 \cdot 5 \\ 2 & 59 & 32 \cdot 3\end{array}$ | -02 | $2 \begin{array}{lllll}2 & 59 & 35 \cdot 7\end{array}$ | - 10 | $\begin{array}{llll}2 & 59 & 27 \cdot 0 \\ 2 & 55 & 6\end{array}$ | -19 |
| 48 | $\begin{array}{llll}2 & 55 & 9.4\end{array}$ | 19 |  | -II | $255 \quad 22 \cdot 9$ | +.03 | $2 \begin{array}{llll}2 & 55 & 22 \cdot 3\end{array}$ | -05 | $25516 \cdot 7$ | -14 | $255 \quad 6 \cdot 0$ | - 22 |
| 49 | $25056 \cdot 8$ | + -17 | $\begin{array}{llll}2 & 51 & 4.7\end{array}$ | + .09 | $\begin{array}{lll}2 & 51 & 7 \cdot 5\end{array}$ | +.00 | $\begin{array}{lll}2 & 51 & 5 \cdot 2 \\ 2 & 4 & \end{array}$ | . 08 | $25057 \cdot 7$ | - 17 | 250044.8 | . 26 |
| 50 | $2 \begin{array}{lllllllll} & 46 & 44 \cdot 3\end{array}$ | - I5 | $\begin{array}{lllll}2 & 46 & 50 \cdot 8\end{array}$ | -06 | $24^{2} 5152 \cdot 1$ | 02 | $2{ }_{2} 4648 \cdot 1$ | -11 | $2 \begin{array}{llll}2 & 46 & 38 \cdot 6\end{array}$ | - 20 |  | 30 |
| 51 | $2 \begin{array}{llll}2 & 42 & 3 I \cdot 8\end{array}$ | 13 | $\begin{array}{lllll}2 & 42 & 36 \cdot 9\end{array}$ | -04 | $24236 \cdot 7$ | . 05 | $24230 \cdot 9$ | - I5 | 242190.2 | $\cdot 24$ | $\begin{array}{lll}2 & 42 & 2 \cdot 1\end{array}$ | 34 |
| 52 | $\begin{array}{\|ccc\|}2 & 38 & 19.3 \\ 2 & 34 & 6.9\end{array}$ | II | $\begin{array}{lll}2 & 38 & 23 \cdot 1 \\ 2 & 34 & \\ \\ & \end{array}$ | +.02 | $\begin{array}{rrrr}2 & 38 & 2 I \cdot 3 \\ 2 & 34 & 5 \cdot 8\end{array}$ | -08 | $\begin{array}{llll}2 & 38 & 13.6 \\ 2 & 33 & 56.3\end{array}$ | 18 | $\begin{array}{llr}2 & 38 & 0 \cdot 1 \\ 2 & 33 & 40.7\end{array}$ | $\cdot 28$ | $\begin{array}{llll}2 & 37 & 40 \cdot 5 \\ 2 & 33 & 18.7\end{array}$ | -38 |
| 53 | $\begin{array}{llll}2 & 34 & 6 \cdot 9\end{array}$ | -09 | $\begin{array}{llll}2 & 34 & 9 \cdot 3\end{array}$ | - or | $\begin{array}{llll}2 & 34 & 5 \cdot 8\end{array}$ | - II | $\begin{array}{llll}2 & 33 & 56 \cdot 3\end{array}$ | '2I | $23340 \cdot 7$ | 31 | $\begin{array}{llll}2 & 33 & 18 \cdot 7\end{array}$ | -42 |
| 54 | $\begin{array}{llll}2 & 29 & 54 \cdot 5\end{array}$ | + .07 | $\begin{array}{llll}2 & 29 & 55.4\end{array}$ | -03 | $22950 \cdot 3$ | - -14 | $\begin{array}{llll}2 & 29 & 38 \cdot 8\end{array}$ | - 24 | 22921.0 | - 35 |  | - .46 |
| 55 | $\begin{array}{llll}2 & 25 & 42 \cdot 1 \\ 2 & 21 & \end{array}$ | -04 | $\begin{array}{llll}2 & 25 & 41 \cdot 6\end{array}$ | -06 | $\begin{array}{llll}2 & 25 & 34 \cdot 7\end{array}$ | $\cdot 17$ | $\begin{array}{llll}2 & 25 & 21 \cdot 3\end{array}$ | - 28 | $22^{2} 501 \cdot 2$ | - 39 | $22434 \cdot 3$ | 51 |
| 5 | $\begin{array}{llll}2 & 21 & 29 \cdot 8\end{array}$ | + .02 | $\begin{array}{llll}2 & 21 & 27 \cdot 7\end{array}$ | -09 | $22119 \cdot 1$ | 20 | $\begin{array}{lll}2 & 21 & 3.6\end{array}$ | $\cdot 32$ | $22041 \cdot 2$ | -43 | 22011.6 | $\cdot 55$ |
| 57 58 | $\begin{array}{llll}2 & 17 & 17.4 \\ 2 & 13 & 5.1\end{array}$ | .00 | $\begin{array}{llll}2 & 17 & 13.8 \\ 2 & 17 & 50.9\end{array}$ | - I2 | $\begin{array}{llll}2 & 17 & 3.4 \\ 2 & 12 & 4.5\end{array}$ | $\cdot 23$ | $\begin{array}{llll}2 & 16 & 45 \cdot 8 \\ 2 & 12 & 27\end{array}$ | -35 | $\begin{array}{llll}2 & 16 & 20 \cdot 9\end{array}$ | -48 | $21548 \cdot 6$ | -60 |
| 58 | 21351 | 3 | 21259.9 | 15 | $21247 \cdot 5$ | -27 | $\|$2 12 27.7 | -39 | 2120.4 | -52 | 2 II 25.2 | -65 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 40 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 37 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 48 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 40 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 57 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 * 43 \end{gathered}$ | $\begin{gathered} s . \\ +r \cdot 65 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 46 \end{gathered}$ | $\stackrel{\mathrm{s}}{\substack{\mathrm{r} \\ \hline \\ \hline}}$ | S. -4.49 | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 8_{3} \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 53 \end{gathered}$ |
| 4 | 1.31 | $4 \cdot 34$ | 1.39 | 4.37 | 1.48 | $4 \cdot 40$ | 1.56 | $4 \cdot 42$ | Y. 65 | $4 \cdot 46$ | 1.74 | $4 \cdot 49$ |
| 8 | $1 \cdot 23$ | $4 \cdot 32$ | I.3I | $4 \cdot 34$ | 140 | $4 \cdot 37$ | 1.48 | $4 \cdot 40$ | r.57 | $4 \cdot 43$ | I. 65 | $4 * 46$ |
| 12 | I.16 | $4 \cdot 30$ | I. 24 | $4 \cdot 32$ | I. 33 | $4 \cdot 35$ | 1.41 | $4 \cdot 37$ | 1.49 | $4 \cdot 40$ | r. 58 | $4 \cdot 43$ |
| 16 | $1 \cdot 10$ | 4.28 | 1-18 | $4 \cdot 30$ | I. 26 | $4 \cdot 33$ | I. 35 | $4 \cdot 35$ | $1 \cdot 43$ | $4 \cdot 38$ | 1.52 | $4 \cdot 4 \mathrm{I}$ |
| 20 | +r.04 | 4.27 | +1.12 | 4.29 | +1.20 | $4 \cdot 31$ | + $\mathrm{I} \cdot 29$ | $4 \cdot 34$ | +r.37 | $4 \cdot 36$ | +r.46 | $4 \cdot 39$ |
| 22 | I-0I | $4 \cdot 26$ | I. 10 | $4 \cdot 28$ | I•I8 | $4 \cdot 30$ | 1.27 | $4 \cdot 33$ | I 35 | $4 \cdot 35$ | 1.44 | $4 \cdot 38$ |
| 24 | $\cdot 98$ | $4 \cdot 25$ | 1.07 | $4 \cdot 28$ | I. 15 | $4 \cdot 30$ | I. 24 | $4 \cdot 32$ | I.33 | $4 \cdot 35$ | $1 \cdot 41$ | $4 \cdot 37$ |
| 26 | $\cdot 96$ | $4 \cdot 25$ | I. 05 | $4 \cdot 27$ | I. 13 | 4.29 | I. 22 | $4 \cdot 32$ | 1.35 | $4 \cdot 34$ | 1.40 | $4 \cdot 37$ |
| 28 | $\cdot 93$ | $4 \cdot 24$ | I. 02 | $4 \cdot 26$ | I•II | $4 \cdot 29$ | I 20 | $4 \cdot 31$ | I-29 | $4 \cdot 33$ | 1.38 | $4 \cdot 36$ |
| 30 | + 9 r | $4 \cdot 24$ | $+\mathrm{r} .00$ | 4.26 | +1.09 | $4 \cdot 28$ | +r.18 | 4.31 | +1.27 | 4.33 | +1.36 | $4 \cdot 36$ |
| 32 | $\cdot 89$ | 4.23 | $\cdot 98$ | $4 \cdot 25$ | r.07 | $4 \cdot 28$ | 1.16 | $4 \cdot 30$ | r 25 | $4 \cdot 33$ | $1 \cdot 35$ | $4 \cdot 35$ |
| 34 | $\cdot 87$ | $4 \cdot 23$ | $\cdot 96$ | $4 \cdot 25$ | 1.05 | $4 \cdot 27$ | I-15 | $4 \cdot 30$ | 1.24 | $4 \cdot 32$ | I 34 | $4 \cdot 35$ |
| 36 | $\cdot 85$ | $4 \cdot 23$ | $\cdot 94$ | $4 \cdot 25$ | $1 \cdot 04$ | $4 \cdot 27$ | I. 3 | $4 \cdot 29$ | I. 23 | $4 \cdot 32$ | $1 \cdot 33$ | $4 \cdot 35$ |
| 38 | $\cdot 83$ | $4 \cdot 22$ | $\cdot 93$ | $4 \cdot 24$ | 1.03 | $4 \cdot 27$ | I-I2 | $4 \cdot 29$ | I. 22 | $4 \cdot 32$ | $1 \cdot 32$ | $4 \cdot 35$ |
| 40 | + 8.81 | 4.22 | + 9 II | $4 \cdot 24$ | +1.01 | $4 \cdot 26$ | +r.II | 4.29 | + $\mathrm{Y} \cdot 2 \mathrm{I}$ | $4 \cdot 31$ | +1.32 | $4 \cdot 34$ |
| 42 | . 80 | $4 \cdot 22$ | -90 | $4 \cdot 24$ | 1-00 | $4 \cdot 26$ | 1.10 | $4 \cdot 29$ | I.21 | $4 \cdot 31$ | 1.32 | $4 \cdot 34$ |
| 44 | $\cdot 78$ | 4.21 | . 89 | $4 \cdot 24$ | -99 | $4 \cdot 26$ | $1 \cdot 10$ | $4 \cdot 28$ | $\underline{1.25}$ | 4.31 | I. 32 | $4 \cdot 35$ |
| 46 | $\cdot 77$ | $4 \cdot 21$ | $\cdot 88$ | 4.23 | -99 | $4 \cdot 26$ | I•IO | $4 \cdot 28$ | 1.21 | $4 \cdot 31$ | I 33 | $4 \cdot 35$ |
| 48 | $\cdot 76$ | $4 \cdot 21$ | -87 | 4.23 | -99 | $4 \cdot 26$ | 1.10 | $4 \cdot 29$ | 1.22 | $4 \cdot 32$ | 1.34 | $4 \cdot 35$ |
| 50 | + 75 | 4.21 | + 87 | 4.23 | + 99 | $4 \cdot 26$ | +r.10 | $4 \cdot 29$ | +1.23 | $4 \cdot 32$ | +r.35 | $4 \cdot 36$ |
| 52 | $\cdot 74$ | $4 \cdot 21$ | . 86 | $4 \cdot 23$ | -99 | $4 \cdot 26$ | I.II | $4 \cdot 29$ | 1.24 | $4 \cdot 32$ | r 37 | $4 \cdot 36$ |
| 54 | $\cdot 74$ | 4.21 | $\cdot 87$ | $4 \cdot 23$ | $\cdot 99$ | $4 \cdot 26$ | r 13 | 4.29 | 1.26 | $4 \cdot 33$ | 1.40 | $4 \cdot 37$ |
| 56 58 | $\cdot 74$ | 4.21 | -87 | 4.23 | I.OI | 4.26 | I. 14 | $4 \cdot 30$ | I 28 | $4 \cdot 34$ | $1 \cdot 43$ | $4 \cdot 38$ |
| 58 | $\cdot 74$ | 4.21 | . 88 | 4.23 | I. 02 | $4 \cdot 26$ | I•I7 | $4 \cdot 30$ | 1.32 | $4 \cdot 34$ | 1.47 | $4 \cdot 39$ |

## LATITUDE $16^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 0.0 \end{array}$ | $+\mathbf{I} \cdot I_{5}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 8.8 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot \mathrm{I}_{5} \end{gathered}$ | H. M. S. | S. | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 26 \cdot 7 \end{array}\right\|$ | S. I.I5 | $\begin{array}{rr} \text { H. M. } & \text { S. } \\ \hline \end{array}$ | S. | H. M. S. $\begin{array}{lll} 6 & 5 & 45 \cdot 0 \end{array}$ | S. |
| 10 | $\begin{array}{lllll}5 & 18 & 22 \cdot 2\end{array}$ | I•16 | 1931.8 | I. 5 | $52040 \cdot 6$ | I-14 | 5 21 $48 \cdot 6$ |  | 22 | I'I2 | $42 \cdot 6$ | 0 |
| 12 | $5102 \cdot 1$ | I•I7 | 5 II 12.1 | I• 16 | $51221 \cdot 1$ | I'I4 | 5 I3 29*3 | I'I3 | $\begin{array}{lllll}5 & 14 & 36 \cdot 5\end{array}$ | II | $15 \quad 42 \cdot 9$ | 10 |
| 14 | 5 I 41.6 | I'I8 | $\begin{array}{llll}5 & 2 & 52 \cdot 2\end{array}$ | I'17 | $\begin{array}{\|ccc\|}5 & 4 & 1 \cdot 6\end{array}$ | I•I5 | $\begin{array}{lll}5 & 5 & 9 \cdot 9\end{array}$ | I-13 | $\begin{array}{llll}5 & 6 & 17 \cdot 1\end{array}$ | I'II | $5 \quad 7 \quad 23.4$ | Io |
| 16 | $453 \quad 20 \cdot 8$ | 1 | $45432 \cdot 0$ | I'I7 | $45541 \cdot 8$ | $1 \cdot 15$ | $45650 \cdot 4$ | I•13 | $45757 \cdot 7$ | I•II | $4594 \cdot 0$ | -09 |
| 18 | $44459 \cdot 5$ | +I.2I | 46 II•5 | +1.18 | 447 2I•8 | +I•16 | $4 \quad 48 \quad 30 \cdot 8$ | +I•14 | $44938 \cdot 4$ | +I'II | $45044 \cdot 6$ | + I.09 |
| 20 | $43637 \cdot 7$ | I. 23 | $43750 \cdot 5$ | I 20 | 439 I•6 | I•17 | 440 II•I | I•14 | $44118 \cdot 9$ | $1 \cdot 12$ | $442 \quad 25 \cdot 2$ | 1.09 |
| 22 | 42815.4 | $1 \cdot 2$ | 429 29•1 | I-2I | $4304 \mathrm{I} \cdot 0$ | I•18 | $43151 \cdot 0$ | I•15 | 43259.3 | I'12 | 434519 | . 09 |
| 24 | $4 \begin{array}{llll}4 & 19 & 52 \cdot 3\end{array}$ | I.26 | 4 21 7-1 | 23 | 42219.9 | 1. 20 | $4 \begin{array}{llll}4 & 23 & 30 \cdot 7\end{array}$ | I'I6 | $42439 \cdot 5$ | I•13 | $42546 \cdot 4$ | 10 |
| 2 | 4 II $28 \cdot 4$ | I. 29 | $41244 \cdot 5$ | I-25 | $4 \begin{array}{lll}4 & 58 \cdot 4\end{array}$ | I.2I | 415 10.0 | I•I7 | 4 I6 19.4 | I-I4 | 4 17 26.7 | 10 |
| 28 | 4330.6 | +I•3I | 442 l - 2 | +1.27 | $4 \quad 5 \quad 36 \cdot 3$ | +I.23 | $\begin{array}{llll}4 & 6 & 48 \cdot 8\end{array}$ | +I•I9 | $4759 \cdot 0$ | +1.15 | $\begin{array}{lll}4 & 9 & 6 \cdot 9\end{array}$ | I•II |
| 30 | $35437 \cdot 8$ | I 34 | $35557 \cdot 0$ | 1.30 | $3 \begin{array}{llllll}3 & 57 & 13.4\end{array}$ | I. 25 | $\begin{array}{lllllllllllll}3 & 58 & 27 \cdot 2\end{array}$ | I.2I | $35938 \cdot 3$ | I-16 | $4 \quad 0 \quad 46 \cdot 8$ | 12 |
| 32 | $34610 \cdot 9$ | I 37 | 347 3I•9 | I•32 | $\begin{array}{lllllllllllllllll}3 & 48 & 49\end{array}$ | I.27 | $\begin{array}{llll}3 & 50 & 4 \cdot 8\end{array}$ | I.23 | 351570 | 1-18 | $35226 \cdot 3$ | I'13 |
| 33 | 34157.0 | 1•39 | $34318 \cdot 9$ | 34 | $\begin{array}{lllllllllllllllll}3 & 44\end{array}$ | I.29 |  | I. 24 | $3476 \cdot 1$ | I.19 | 348 16.0 | -14 |
| 34 | $33742 \cdot 7$ | I 4 | $\begin{array}{llll}3 & 39 & 5 \cdot 6\end{array}$ | I•35 | $3 \quad 40 \quad 25 \cdot 3$ | I.30 | $34141 \cdot 7$ | I. 25 | $34255 \cdot 1$ | I. 20 | $\begin{array}{lll}3 & 44 & 5 \cdot 5\end{array}$ | I•15 |
|  | 33328 | +1.43 | $\begin{array}{llll}3 & 342 \cdot 0\end{array}$ | + 1.37 |  | + I.3I | $\begin{array}{llll}3 & 37 & 29.9\end{array}$ | +I.26 | $\begin{array}{llll}3 & 38 & 43.9\end{array}$ | + I. 21 | 33954.8 | +1.15 |
| 36 | 329 I2 | I. 45 | 3 30 38•1 | 1.39 |  | I•33 |  | I 27 | $\begin{array}{lllll}3 & 34 & 32 \cdot 6\end{array}$ | 1.22 | $3 \begin{array}{llll}3 & 35 & 44\end{array}$ | I.16 |
| 37 | 32457.4 | I.47 | $\begin{array}{llll}3 & 26 & 23 \cdot 8\end{array}$ | I-4I | $32746 \cdot 4$ | I 35 | $\begin{array}{lll}3 & 29 & 5 \cdot 5\end{array}$ | I-29 | $3{ }^{3} 3021 \cdot I$ | 1.23 | $3 \mathrm{lll} 313 \cdot 2$ | $\cdot 17$ |
| 38 | $32041 \cdot 5$ | I 49 | $\begin{array}{llll}3 & 22 & 9 \cdot 1\end{array}$ | 1.43 | $\begin{array}{llll}3 & 23 & 32.9\end{array}$ | -36 | $\begin{array}{llll}3 & 24 & 53 \cdot 0\end{array}$ | I•30 | $\begin{array}{llr}3 & 26 & 9 \cdot 3\end{array}$ | I. 24 | 327122.1 | -18 |
| 39 | 3 I6 25.1 | I. 52 | 3 I7 54.0 | 1.45 | 31919.0 |  | $32040 \cdot 1$ | I.32 | 32157.3 | I 25 | $\begin{array}{llll}3 & 23 & 10.8\end{array}$ | I'I9 |
| 4 | $3128 \cdot 1$ | +I.54 | $311338 \cdot 5$ | +1.47 | 3 I5 4•7 | +1.40 | 3 16 26.9 | +1.33 | 3 I7 45'I | +1.27 | 31859.4 | + $\mathrm{I} \cdot 2 \mathrm{I}$ |
| 41 | $\begin{array}{llll}3 & 7 & 50.6\end{array}$ | I. 57 | 31922.5 | I.49 | 3 10 50.1 | 1.42 |  | 1-35 | 313132.5 | I 28 | $31447 \cdot 7$ | - 22 |
| 42 | $\begin{array}{lllll}3 & 3 & 32 \cdot 5\end{array}$ | I. 60 | 35150 | I-52 | $\begin{array}{llll}3 & 6 & 35 \cdot 0\end{array}$ | I 44 | $\begin{array}{llll}3 & 7 & 59.5\end{array}$ | 1.37 | $\begin{array}{llll}3 & 9 & 19.7\end{array}$ | I 30 | 3 Io $35 \cdot 8$ | 1.23 |
| 43 | $25913 \%$ | . 63 | $3048 \cdot 9$ | -55 | $\begin{array}{llll}3 & 2 & 19.4\end{array}$ | 7 | $\begin{array}{lllll}3 & 3 & 45 & 3\end{array}$ | I•39 | $\begin{array}{llll}3 & 5 & 6 \cdot 6\end{array}$ | I-32 | $\begin{array}{llll}3 & 6 & 23 \cdot 7\end{array}$ | I. 25 |
| 4 | $25454 \cdot 2$ | I.66 | $256131 \cdot 3$ | I-58 | $2 \begin{array}{lll}2 & 58 & 3.4\end{array}$ | I*49 | $25930 \cdot 6$ | 1.41 | $3 \quad 053.2$ | 1 34 | $3 \quad 2 \begin{array}{llll}3 & 11.2\end{array}$ | I. 26 |
| 4 | $25034 \cdot 1$ | + I. 69 | 25213.0 | +1.60 | $25346 \cdot 7$ | +I.52 | $25515 \cdot 5$ | +1.44 | $2 \begin{array}{lllll}2 & 56 & 39.4\end{array}$ | +1.36 | $25758 \cdot 5$ | +I.28 |
| 46 | 246 I 3.0 | I•73 | 24754.0 | 1. 64 | 24929.6 | I. 55 | 250 | I.46 | $25225 \cdot 1$ | I•38 | $25345 \cdot 5$ | I.30 |
| 47 | $24 \mathrm{I} 5 \mathrm{I} \cdot \mathrm{I}$ | I•77 | $\begin{array}{lllll}2 & 43 & 34 \cdot 2\end{array}$ | 1.67 | $2 \begin{array}{lllllll} \\ 2 & 45 & \text { IF }\end{array}$ | I. 58 | $2 \begin{array}{lllll}2 & 46 & 43 \cdot 8\end{array}$ | 1.49 | $\begin{array}{llllll}2 & 48 & \text { IO. }\end{array}$ | 1.40 | 249 32.I | I-32 |
| 48 | $23728 \cdot 2$ | $1 \cdot 8$ | $2 \begin{array}{llll} & 39 & 13 \cdot 7\end{array}$ | $1 \cdot 71$ | $2 \begin{array}{llllllll} & 40 & 53 \cdot 2\end{array}$ | $1 \cdot 61$ | $\begin{array}{lllll}2 & 42 & 27 \cdot 1\end{array}$ | 1.52 | $2 \begin{array}{llll}2 & 43 & 55 \cdot 4\end{array}$ | I 43 |  | - 34 |
| 49 | 2334 | I.85 | $23452 \cdot 2$ | 1•75 | 23634.0 | 1.65 | $\begin{array}{llll}2 & 38 & 9 \cdot 8\end{array}$ | I 55 | 23939307 | 1.45 | 2414.1 | I.36 |
| 50 | $2 \begin{aligned} & 2 \\ & 2\end{aligned} 2839 \cdot 2$ | +1.90 | 23029.8 | +1•79 | $2 \begin{array}{llll} & 32 & 13.9\end{array}$ | +1.68 | $2 \begin{array}{llll}2 & 33 & 51 \cdot 7\end{array}$ | +1.58 | $235123 \cdot 6$ | +1.48 | $23649 \cdot 6$ | +I.39 |
| 51 | 22412.9 | I.95 | $\begin{array}{lll}2 & 26 & 6 \cdot 3\end{array}$ | 1.83 | $2 \begin{array}{llllllll} & 27 & 52.9\end{array}$ | I•72 | $2 \begin{array}{lllllll} & 29 & 33 \cdot 0\end{array}$ | I. 61 | 23156 | I'51 | $23234 \cdot 5$ | I.4I |
| 52 | $\begin{array}{llll}2 & 19 & 45 \cdot 3\end{array}$ | 2.01 | 2 21 4I•7 | $\underline{1.88}$ | $22331 \cdot 0$ | I.76 | $\begin{array}{llllllllllllllll}2 & 25 & 13.5\end{array}$ | I. 65 | $2 \begin{array}{lllll}26 & 26 & 49\end{array}$ | I 54 | $2 \begin{array}{llll}28 & 18.8\end{array}$ | I. 44 |
| 53 | $\begin{array}{llll}2 & 15 & 16 \cdot 1 \\ 2 & 10 & 45.4\end{array}$ | 2.06 | $\begin{array}{llll}2 & 17 & 15.8 \\ 2 & 12 & 4\end{array}$ | $\underline{1.93}$ | $\begin{array}{llll}2 & 19 & 8 \cdot 1 \\ 2 & 1\end{array}$ | I | $22053 \cdot 1$ | I.69 | $22231 \cdot I$ | I.58 | $\begin{array}{lll}2 & 24 & 2.6\end{array}$ | 1.47 |
| 54 | 2 IO $45 \cdot 4$ | $2 \cdot 13$ | $21248 \cdot 5$ | I.99 | 2 I4 43.9 | I. | $21631 \cdot 7$ | I•74 | 2 I8 12.2 | 1.62 | $21945 \%$ | I. 50 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{1}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | - ${ }^{\text {Som }}$ | -4.16 | + 07 | s. -4.16 | + ${ }^{\text {+ }}$ + | s. ${ }_{\text {s. }}$ | + ${ }^{52}$ |  | + ${ }^{\text {s. }}$ | $4 \cdot 17$ | + ${ }^{\text {S }} 38$ | s. |
| 2 | . 04 | $4 \cdot 16$ | +.04 | $4 \cdot 16$ | ${ }^{\text {If }}$ | 4.16 | -19 | $4 \cdot 17$ | . 26 | $4 \cdot 17$ | ${ }^{34}$ | $4 \cdot 17$ |
| 4 | -08 | $4 \cdot 16$ | - or | $4 \cdot 16$ | . 07 | $4 \cdot 16$ | -I4 | 4.16 | . 22 | $4 \cdot 17$ | -29 | $4 \cdot 17$ |
| 6 | . 13 | $4 \cdot 16$ | . 05 | $4 \cdot 16$ | +.03 | $4 \cdot 16$ | - 10 | $4 \cdot 16$ | . 18 | $4 \cdot 17$ | $\cdot 26$ | $4 \cdot 17$ |
|  | -17 | $4 \cdot 16$ | -9 | $4 \cdot 16$ | - or | $4 \cdot 16$ | . 06 | $4 \cdot 16$ | -14 | $4 \cdot 16$ | $\cdot 21$ | $4 \cdot 17$ |
| 10 | $\cdot 21$ | $4 \cdot 17$ | - 13 | $4 \cdot 16$ | -.06 | $4 \cdot 16$ | + 02 | $4 \cdot 16$ | + 10 | 4.16 | + 17 | 4.16 |
| 12 | $\cdot 25$ | 4.17 | - 8 | $4 \cdot 16$ | - 10 | $4 \cdot 16$ | - . 02 | $4 \cdot 16$ | . 05 | $4 \cdot 16$ |  | $4 \cdot 16$ |
| 14 | $\cdot 30$ | $4 \cdot 17$ | $\cdot 22$ | $4 \cdot 17$ | . 14 | $4 \cdot 16$ | .06 | $4 \cdot 16$ | + - ${ }^{\text {or }}$ | $4 \cdot 16$ | -99 | $4 \cdot 16$ |
| 18 | $\cdot 34$ | $4 \cdot 17$ | $\cdot 26$ | $4 \cdot 17$ | -18 | $4 \cdot 16$ | II | $4 \cdot 16$ | -. 03 | $4 \cdot 16$ | $\cdot 05$ | $4 \cdot 16$ |
| 18 | $\cdot 39$ | $4 \cdot 18$ | $\cdot 31$ | $4 \cdot 17$ | $\cdot 23$ | $4 \cdot 17$ | $\cdot{ }^{15}$ | $4 \cdot 16$ | . 07 | $4 \cdot 16$ | + - ${ }^{\text {or }}$ | $4 \cdot 16$ |
| 20 | $\cdot 44$ | 4. | $\cdot 35$ | $4 \cdot 17$ | - 27 | $4 \cdot 17$ | -19 | $4 \cdot 16$ | ${ }^{\text {II }}$ | $4 \cdot 16$ | - .03 | $4 \cdot 16$ |
| 22 | $\cdot 48$ | $4 \cdot 19$ | -40 |  | $\cdot 32$ | 4.17 | . 24 | $4 \cdot 17$ | -16 | $4 \cdot 16$ | . 07 | $4 \cdot 16$ |
| 24 | $\cdot 53$ | $4 \cdot 19$ | $\cdot 45$ | 4.18 | $\cdot 37$ | 4.18 | -28 | $4 \cdot 17$ | -20 | $4 \cdot 16$ | . 12 | $4 \cdot 16$ |
| 26 | -59 | 4.20 | $\cdot 50$ | $4 \cdot 19$ | $\cdot 41$ | 4.18 | . 38 | $4 \cdot 17$ | -25 | $4 \cdot 17$ | -16 | $4 \cdot 16$ |
| 28 | . 64 | 4.21 | $\cdot 55$ | 4.20 | $\cdot 46$ | $4 \cdot 19$ | 38 | $4 \cdot 18$ | -29 | $4 \cdot 17$ | . 21 | 4.16 |
| 30 | .70 | 4.22 | -.65 | 4.20 | -52 | $4 \cdot 19$ | - 43 | $4 \cdot 18$ | - 34 | $4 \cdot 17$ | - 25 | 4-17 |
| 32 | .76 | 4.23 | -66 | 4.21 | - 57 | 4.20 | $\cdot 48$. | 4.19 | - 39 | 4.18 | . 30 | $4 \cdot 17$ |
| 34 | -82 | $4 \cdot 24$ | $\cdot 72$ | $4 \cdot 22$ | -63 | $4 \cdot 2 \mathrm{I}$ | $\cdot 54$ | $4 \cdot 19$ | $\cdot 44$ | 4.18 | $\cdot 35$ | $4 \cdot 17$ |
| 36 | -89 | $4 \cdot 25$ |  | $4 \cdot 23$ | . 69 | $4 \cdot 22$ | $\cdot 59$ | $4 \cdot 20$ | -50 | $4 \cdot 19$ | -40 | $4 \cdot 18$ |
| 38 | -96 | $4 \cdot 27$ | . 85 | $4 \cdot 25$ | $\cdot 75$ | $4 \cdot 23$ | . 65 | $4 \cdot 2 \mathrm{I}$ | -55 | $4 \cdot 20$ | $\cdot 45$ | $4 \cdot 18$ |
| 40 | $-\mathrm{I} .03$ | 4.29 | -. 92 | $4 \cdot 26$ | - 82 | 4.24 | -71 | 4.22 | - 6 I | $4 \cdot 20$ | -.5I | 4.19 |
| 42 | I•II | $4 \cdot 31$ |  | $4 \cdot 28$ | -89 | $4 \cdot 25$ |  | $4 \cdot 23$ | . 68 | 4.21 |  | $4 \cdot 20$ |
| 44 | 1.20 | $4 \cdot 33$ | 1.08 | $4 \cdot 30$ | -97 | 4.27 | . 85 | $4 \cdot 25$ | $\cdot 74$ | $4 \cdot 23$ | . 64 | $4 \cdot 21$ |
| 46 | 1.29 | $4 \cdot 36$ | $1 \cdot 17$ | $4 \cdot 32$ | 1.05 | 4.29 | .93 | 4.26 | .82 | $4 \cdot 24$ | -\% | $4 \cdot 22$ |
| 48 | $1 \cdot 40$ | $4 \cdot 39$ | 1.27 | $4 \cdot 35$ | r. 14 | $4 \cdot 3 \mathrm{I}$ | I-02 | $4 \cdot 28$ | . 89 | $4 \cdot 26$ | $\cdot 77$ | $4 \cdot 23$ |
| 50 | -1.51 | $4 \cdot 43$ | -1.37 | $4 \cdot 38$ | -1.24 |  | -1.11 | $4 \cdot 3 \mathrm{I}$ | -. 98 | $4 \cdot 27$ | -. 85 | $4 \cdot 25$ |
| 52 | I. 64 | $4 \cdot 47$ | ${ }^{1} 49$ | $4 \cdot 42$ | $1 \cdot 35$ | $4 \cdot 37$ | $1 \cdot 21$ | $4 \cdot 33$ | 1-07 | 4:30 | .94 | $4 \cdot 27$ |
| 54 | 1.79 | $4 \cdot 53$ | 1.63 | $4 \cdot 47$ | $1 \cdot 47$ | $4 \cdot 4 \mathrm{t}$ | 1.32 | $4 \cdot 37$ | 1-17 | $4 \cdot 32$ | 1.03 | $4 \cdot 29$ |

LATITUDE $16^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{aligned} & \text { True } \\ & \text { Alt. } \end{aligned}$ | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left.\right\|_{6} ^{\text {H. M. M. s. }} \underset{54 \cdot 5}{ }$ | $1 \cdot 16$ | $\left\lvert\, \begin{array}{cc} \text { н. м. } & \text { S. } \\ 6 & 8 \end{array}\right.$ | $\begin{gathered} s . \\ +\mathrm{r} \cdot 16 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 9 & \text { I } 4 \cdot 3 \end{array}$ | $\mid+1 \cdot 17$ | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 \text { IO } & 24 \cdot 7 \end{array}$ | $\begin{aligned} \mathrm{S} \\ +\mathrm{r} \cdot \mathrm{I} \end{aligned}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { II } & 35^{\circ} 6 \end{array}\right.$ | $\begin{gathered} \text { S. } \\ +\mathrm{r} \cdot 18 \end{gathered}$ | $\left\lvert\, \begin{array}{cc} \text { H. м. } & \text { S. } \\ 6 & \text { I2 } \end{array}\right.$ | I |
| 10 | $\begin{array}{llll}5 & 25 & 8.6\end{array}$ | I.09 | ${ }_{5}^{5} 2614 \cdot \mathrm{I}$ | I.09 | 52719.0 | 1.08 | $\begin{array}{llll}5 & 28 & 23.5\end{array}$ | 1.07 | $\begin{array}{llll}5 & 29 & 27 \cdot 4\end{array}$ | 1.06 | $5303 \mathrm{I} \cdot \mathrm{O}$ | $\begin{aligned} & 1 \cdot 9 \\ & x \end{aligned}$ |
| 12 | 1648.5 | I-09 | 51753.4 | 1•07 | $\begin{array}{lllllllllllll}5 & 18\end{array}$ | r.06 | 520 I•O | 1.05 | 5214.0 | 1.04 | 5226.2 | 1.03 |
| 14 | 828.7 | I. 08 | $5 \quad 933 \cdot 0$ | I.06 | 5 10 $36 \cdot 5$ | $1 \cdot 05$ | 5 II 39.2 | . 04 | $51241 \cdot 0$ | I.02 | $51342 \cdot 0$ | 1.01 |
| 16 | 5 ○ 900 | 1.07 | 5 I I3.0 | I.06 | $\begin{array}{llll}5 & 2 & 15.8\end{array}$ | 1.04 | $\begin{array}{lllll}5 & 3 & 17.7\end{array}$ | 1.02 | 54818.6 | I.OI | $\begin{array}{llll}5 & 5 & 18.5\end{array}$ | 99 |
| 18 | 5149.5 | + 1.07 | $45253 \cdot 1$ | $+1.05$ | $45355 \cdot 5$ | +1.03 | $45456 \cdot 7$ | + I . 01 | $45556 \cdot 7$ | + 99 | $45655 \cdot 6$ | + 97 |
| 20 | 43 30.1 | 1.07 | $44433 \cdot 5$ | I.04 | 44535.4 | 1. | $44636 \cdot 0$ | I.00 | $44735 \cdot 2$ | . 97 | $44^{48} 33 \cdot 1$ | .95 |
| 22 | $3510 \cdot 7$ | x.07 | 43613.9 | I. 04 | 43715.5 | 1.01 | $\begin{array}{lllll}4 & 38 & 15.6\end{array}$ | -99 | $43914 \cdot 1$ | -96 | 440 II |  |
| 24 | 26 51.4 | 1.07 | 42754.5 | I. 04 | $42855 \cdot 8$ | I.OI | 42955.5 | 98 | 43053.4 | -95 | 43149.5 | 92 |
| 26 | I8 $32 \cdot 0$ | 1.07 | $41935 \cdot 2$ | I. 04 | $42036 \cdot 4$ | 1.00 | 42135.6 | $\cdot 97$ | $42233 \cdot 0$ | 94 | 42328.4 | 1 |
| 28 | IO 12.5 | +1.07 | 4 II 15.8 | + 1.04 | 41217.0 | +1.00 | 41315.9 | + 96 |  | + 93 | $\begin{array}{llll}4 & 15 & 7 \cdot 5\end{array}$ |  |
| 30 | $4 \begin{array}{lll}4 & 1 & 52 \cdot 8\end{array}$ |  | $\begin{array}{llll}4 & 2 & 56 \cdot 4\end{array}$ | I. 04 | $4 \quad 3 \quad 57 \cdot 6$ | I 00 | $4 \begin{array}{llll}4 & 4 & 56.4\end{array}$ | $\cdot 96$ | $\begin{array}{lllll}4 & 5 & 52 \cdot 9\end{array}$ | $\cdot 92$ | $4 \quad 6 \quad 47 \cdot 1$ |  |
| 32 | 353 33.0 | I. 09 | $\begin{array}{llll}3 & 54 & 36 \cdot 9\end{array}$ | 1.04 | $355 \quad 38 \cdot 3$ | I.00 | $\begin{array}{ll}3 & 56 \\ 37 \cdot 0\end{array}$ | . 96 | $35733 \cdot 2$ | $\cdot 92$ | $3 \begin{array}{llll}386.8\end{array}$ | 7 |
| 33 | 4923.0 | r.09 | 3 50 $27 \cdot 1$ <br>  46  | I.05 | $\begin{array}{llll}3 & 51 & 28 \cdot 6\end{array}$ | I-00 |  | . 96 | $\begin{array}{llll}3 & 53 & 23.4\end{array}$ | -91 | $\begin{array}{llll}3 & 54 & 16 \cdot 8 \\ 3 & 5 & 6.8\end{array}$ | 7 |
| 34 | $34512 \cdot 8$ | I•IO | 34617.3 | I.05 | 347188 | I-00 | $\begin{array}{lllll}3 & 48 & 17.6\end{array}$ | . 95 |  | $\cdot 91$ | 350 | 6 |
| 35 | $\begin{array}{lllll}3 & 41 \\ 3 & 2\end{array}$ | +1.10 | $\begin{array}{lllll}3 & 42 & 7 \cdot 3\end{array}$ | + I | $\begin{array}{llll}3 & 43 & 9 \cdot 1\end{array}$ | +1.00 |  | + 95 | $\begin{array}{llll}3 & 45 & 3.9\end{array}$ | + 9I | $3 \begin{array}{llll}3 & 45 & 56 \cdot 9\end{array}$ | . 86 |
| 36 | $3652 \cdot 3$ | 1. | $3 \begin{array}{llll}37 & 57 \cdot 4\end{array}$ | I | $\begin{array}{lllll}3 & 38 & 59.3\end{array}$ | I-OI |  | $\cdot 96$ | 340 54-I | -91 |  |  |
| 37 | 3 32 41 | I•12 | 3 33 47 <br>    | 1.06 | $\begin{array}{llll}3 & 34 & 49 \cdot 6\end{array}$ | $1 \cdot 01$ |  | -96 | $\begin{array}{lllll}3 & 36 & 44 \cdot 5\end{array}$ | $\cdot 90$ | $\begin{array}{llll}3 & 37 & 37 \cdot 2\end{array}$ | . 5 |
| 38 | $\begin{array}{llll}3 & 28 & 31.4\end{array}$ | I-12 | $3 \quad 2937.2$ | 07 | $3 \quad 3039 \cdot 7$ | $1 \cdot 01$ | $\begin{array}{lllll}3 & 31 & 38.9\end{array}$ | '96 | 3 $322 \begin{array}{lll}34 \cdot 8\end{array}$ | -90 | $3 \quad 33 \quad 27 \cdot 5$ |  |
| 39 | 32420.7 | I•I3 | 32527.0 | 1.07 | $\begin{array}{llll}3 & 26 & 29.8\end{array}$ | 1.02 | 3 $27 \begin{array}{lll}3 & 29\end{array}$ | -96 | $\begin{array}{llll}3 & 28 & 25 \cdot 1\end{array}$ | -90 | $32917 \cdot 7$ | 5 |
| 40 | $\begin{array}{llll}3 & 20 & 9.9\end{array}$ | + $\mathrm{I} \cdot 14$ | 32116.7 | +1.08 | 32219.8 | +1.02 |  | + 96 | $32415 \cdot 4$ | + 90 | $3258 \cdot 0$ | +.85 |
| 41 |  |  | $\begin{array}{llll}3 & 17 & 6 \cdot 2\end{array}$ | 1.09 | $\begin{array}{llll}3 & 18 & 9.8\end{array}$ | I.03 | $\begin{array}{llll}3 & 19 & 9.6\end{array}$ | 97 | 3205.8 | -90 | 32058 | . 84 |
| 42 | $311147 \cdot 7$ | I.16 | 31255.7 | 10 | $31359 \cdot 6$ | r 03 | $\begin{array}{llllllllllllll}3 & 14 & 59\end{array}$ | -97 |  | $\cdot 9 \mathrm{I}$ | $\begin{array}{llll}3 & 16 & 48 \cdot 6\end{array}$ | 84 |
| 43 | $\begin{array}{llll}3 & 7 & 36.4\end{array}$ | I. 18 | $\begin{array}{llll}3 & 8 & 45\end{array}$ | I•II | $3 \quad 949.4$ | I. 04 | 3 10 49.9 | . 97 | 3 II $46 \cdot 4$ | 9 I | $\begin{array}{llll}3 & 12 & 38.9\end{array}$ | 4 |
| 44 | $\begin{array}{llll}3 & 3 & 24.9\end{array}$ | I.19 | $\begin{array}{llll}3 & 4 & 34 \cdot I\end{array}$ | 1.12 | 3 5 39 | 05 | $\begin{array}{llll}3 & 6 & 39.9\end{array}$ |  | $\begin{array}{llll}3 & 7 & 36 \cdot 7\end{array}$ | 91 | $\begin{array}{llll}3 & 8 & 29.2\end{array}$ | 84 |
| 45 | $\begin{array}{lllllll}2 & 59 & 13 \cdot 1\end{array}$ | + 1.20 | $\begin{array}{llll}3 & 0 & 23 \cdot 1 \\ 2 & 56\end{array}$ | +1.13 | $\begin{array}{llll}3 & 1 & 28.6\end{array}$ | +1.06 | $\begin{array}{cccc}3 & 2 & 29.9 \\ 2 & 5 & 8\end{array}$ | + 99 | $\begin{array}{llll}3 & 3 & 26 \cdot 9\end{array}$ | + 91 |  |  |
| 46 | 255 I.O | 1.22 | 25611.9 | I•14 | 25718.0 | 1.07 |  | 99 | $2 \begin{array}{llll} & 59 & 17 \cdot 1\end{array}$ | 92 | 3 O 9.9 |  |
| 47 | 25048.7 | I. 24 | $\begin{array}{llll}2 & 52 & 0.4\end{array}$ | I.16 | $253 \quad 74$ | I | $\begin{array}{llll}2 & 54 & 9.6\end{array}$ | 1. | $\begin{array}{llll}2 & 55 & 7 \cdot 2\end{array}$ | 92 | $2 \begin{array}{lll}26 & 0.2\end{array}$ | 85 |
| 48 | $\begin{array}{lllll}2 & 46 & 36 \cdot 1 \\ 2\end{array}$ | I. 25 | $\begin{array}{lllll}2 & 47 & 48 \cdot 8\end{array}$ | 17 | $24856 \cdot 5$ | $1 \cdot 09$ | 2 49 59.3 <br> 2 45  | OI | $\begin{array}{llll}2 & 50 & 57 \cdot 2\end{array}$ | $\cdot 93$ | $25150 \cdot 5$ | 85 |
| 49 | 24223.2 | 27 | $24336 \cdot 9$ | 18 | $24445 \cdot 4$ | I•IO | $24548 \cdot 8$ | I.02 | $24647 \cdot 3$ | -93 | $24740 \cdot 7$ | 85 |
| 50 | $\begin{array}{llll}2 & 38 & 9.9\end{array}$ | +1.29 | 23924.7 | + 1.20 | $24034 \cdot 1$ | +1.11 | 24138.2 | +1.02 | 24237.2 | + 94 | 24331.0 | +.85 |
| 51 | $23356 \cdot 2$ | I•31 | 23512.3 | I 22 | 23622.6 | $1 \cdot 13$ | 23727.5 | 1.04 | $\begin{array}{llll}2 & 38 & 27.0\end{array}$ | $\cdot 95$ | $23921 \cdot 1$ | . 86 |
| 52 | $\begin{array}{ll}2 & 29 \\ 2 & 42 \cdot 1\end{array}$ | 1.34 | $\begin{array}{llll}2 & 30 & 59 \\ 2\end{array}$ | 1.24 | 2 32 $10 \cdot 9$ <br> 2   | I.I4 |  | 1.05 |  | $\cdot 95$ | ${ }_{2}^{2} 355 \mathrm{II} \cdot 2$ | 86 |
| 53 54 | $22527 \cdot 5$ | I. 36 | $22646 \cdot 2$ | 1. | 22758.8 | $\underline{1}$ | $\begin{array}{llll}2 & 29 & 5.5\end{array}$ | I.06 | 23063 | -96 | $\begin{array}{lll}2 & 31 & 1.3\end{array}$ | 87 |
| 54 | 2112.5 | $1 \cdot 3$ | $2232 \cdot 7$ | 1.2 | 22346 | $1 \cdot$ | 22454.2 |  | $22555 \cdot 7$ | $\cdot 97$ | $22651 \cdot 2$ | 88 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. yo | A. | L. 8 | A. | L. 9 | A. | L. 10 | - A. | L. 11 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. | S. | S. | S. | S. $+\quad .6 I$ | S. | s. | S. | S. | S. | S. $+\quad .84$ | S. |
| 0 | $\begin{array}{r}+45 \\ \hline .45\end{array}$ | -4.18 4.18 | $\begin{array}{r}\text { + } 53 \\ \hline .49\end{array}$ | -4.19 4.19 | +.61 .57 | -4.20 4.20 | +.69 .65 | -4.22 4.21 | +76 +72 | 4.23 4.22 | P +.84 .80 | 4.24 4.24 |
| 4 | -37 | 4.18 | -45 | $4 \cdot 18$ | -52 | 4.19 | . 60 | 4.20 | . 68 | $4 \cdot 22$ | $\cdot 76$ | $4 \cdot 23$ |
| 6 | -33 | 4.18 | -41 | 4.18 | $\cdot 48$ | 4-19 | $\cdot 56$ | $4 \cdot 20$ | -64 | $4 \cdot 21$ | $\cdot 72$ | $4 \cdot 22$ |
| 8 | -29 | 4.17 | +37 | 4.18 | -44 | 4.18 | -52 | $4 \cdot 19$ | -60 | $4 \cdot 20$ | $\cdot 67$ | 4.21 |
| 10 | + 25 | 4-17 | + 33 | 4.18 | + $\cdot 40$ | 4-18 | + 48 | $4 \cdot 19$ | +.56 | 4.20 | +.64 | $4 \cdot 21$ |
| 12 | - 21 | 4-17 | -29 | 4-17 | -36 | 4.17 | -44 | 4.18 | $\cdot 52$ | 4.19 | -60 | $4 \cdot 20$ |
| 14 | -17 | $4 \cdot 16$ | $\cdot 25$ | 4.17 | -32 | 4.17 | $\cdot 40$ | $4 \cdot 18$ | -48 | 4*19 | -56 | $4 \cdot 20$ |
| 16 | - I3 | 4.16 | -21 | 4-16 | -28 | 4.17 | $\cdot 36$ | 4*18 | -44 | $4 \cdot 18$ | $\cdot 52$ | $4 \cdot 19$ |
| 18 | -09 | 4.16 | -17 | 4.16 | - 24 | 4-17 | $\cdot 32$ | $4 \cdot 17$ | $\cdot 40$ | 4-18 | -48 | 4.19 |
| 20 | +.05 | $4 \cdot 16$ | + 13 | 4.16 | $+21$ | 4*17 | + 29 | 4.17 | + 37 | 4.18 | + $\cdot 45$ | 4.18 |
| 22 | -00 | 4.16 | -09 | 4-16 | -17 | 4-16 | -25 | 4.17 | -33 | 4.17 | -4I | 4.18 |
| 24 | - 03 | 4•16 | + -04 | 4.16 | -13 | 4-16 | -21 | 4.17 | -29 | $4 \cdot 17$ | $\cdot 37$ | 4.18 |
| 26 | -08 | $4 \cdot 16$ | -00 | 4.16 | -09 | 4.16 | -17 | $4 \cdot 16$ | - 25 | 4-17 | -34 | 4.17 |
| 28 | -12 | $4 \cdot 16$ | -. 04 | $4 \cdot 16$ | -05 | $4 \cdot 16$ | -13 | $4 \cdot 16$ | -22 | 4.17 | -30 | 4-17 |
| 30 | - 17 | 4.16 | -.08 | 4.16 | + .01 | 4.16 | +.09 | $4 \cdot 16$ | +.18 | 4.16 | + 26 | 4・エ7 |
| 32 | - 21 | 4-16 | -12 | 4.16 | -.03 | $4 \cdot 16$ | . 05 | $4 \cdot 16$ | $\cdot 14$ | $4 \cdot 16$ | . 23 | 4.17 |
| 34 | -26 | $4 \cdot 17$ | -17 | 4.16 | -08 | 4.16 | +.01 | $4 \cdot 16$ | -10 | 4.16 | -19 | $4 \cdot 16$ |
| 36 | $\cdot 31$ | $4 \cdot 17$ | -21 | $4 \cdot 17$ | -12 | $4 \cdot 16$ | -. 03 | $4 \cdot 16$ | -06 | $4 \cdot 16$ | -15 | $4 \cdot 16$ |
| 38 | $\cdot 36$ | $4 \cdot 18$ | -26 | 4.17 | -17 | 4.16 | -07 | 4•16 | + 02 | 4.16 | -II | 4.16 |
| 40 | - 41 | 4-18 | - 31 | $4 \cdot 17$ | $\cdot 2 \mathrm{I}$ | 4.17 | - 12 | $4 \cdot 16$ | - 02 | $4 \cdot 16$ | +.08 | $4 \cdot 16$ |
| 42 | -47 | $4 \cdot 19$ | $\cdot 36$ | $4 \cdot 18$ | - 26 | $4 \cdot 17$ | -16 | $4 \cdot 16$ | - 06 | 4.16 | . 04 | $4 \cdot 16$ |
| 44 | -53 | 4.19 | -42 | $4 \cdot 18$ | -31 | $4 \cdot 17$ | -21 | 4*17 | -II | 4•16 | -00 | 4.16 |
| 46 | -59 | $4 \cdot 20$ | $\cdot 48$ | $4 \cdot 19$ | $\cdot 37$ | $4 \cdot 18$ | -26 | $4 \cdot 17$ | -15 | $4 \cdot 16$ | -. 05 | $4 \cdot 16$ |
| 48 | -66 | 4.21 | -54 | $4 \cdot 20$ | $\bullet 43$ | 4.18 | -31 | 4.17 | -20 | 4•17 | -09 | 4.16 |
| 50 | - $\cdot 73$ | $4 \cdot 22$ | -.6I | $4 \cdot 20$ | - . 49 | 4-19 | - 37 | 4.18 | - 225 | 4.17 | - .14 | $4 \cdot 16$ |
| 52 | -81 | $4 \cdot 24$ | -68 | $4 \cdot 22$ | $\cdot 55$ | 4.20 | -43 | $4 \cdot 18$ | $\cdot 31$ | $4 \cdot 17$ | - I8 | $4 \cdot 16$ |
| 54 | . 89 | 4.26 | $\cdot 76$ | $4 \cdot 23$ | -62 | $4 \cdot 21$ | -49 | $4 \cdot 19$ | $\cdot 36$ | 4.18 | $\cdot 24$ | $4 \cdot 17$ |

68 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT. LATITUDE $16^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I3 } & 58 \cdot 6 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 20 \end{gathered}$ | $\begin{array}{lc} \text { H. M. S. } \\ 6 & \text { I5 II O } \end{array}$ | $\begin{array}{r} 5 . \\ +\mathrm{I} \cdot 2 \mathrm{I} \end{array}$ | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { I6 } \\ 23.9 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 22 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I7 } & 37 \cdot 6 \end{array}$ | $\begin{gathered} 5 \\ +\mathrm{r} \cdot 23 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } 8 & 5 \text { r. } 9 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 24 \end{gathered}$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 20 & 7 \cdot I \end{array}\right.$ | $\begin{gathered} s . \\ +r \cdot 26 \end{gathered}$ |
| 10 | 5 3I 34.2 | I'05 | $53237 \cdot 0$ | I. 04 | $\begin{array}{llll}5 & 33 & 39 \cdot 5\end{array}$ | I'04 | $53441 \cdot 7$ | I.03 | $53543 \cdot 7$ | I.03 | $5{ }_{5}^{5} 3645 \cdot 5$ | I. 03 |
| 12 | $\begin{array}{llll}5 & 23 & 8 \cdot 0\end{array}$ | 2 | $524 \quad 9 \cdot 1$ | I $\cdot \mathrm{OI}$ | $\begin{array}{llll}5 & 25 & 9 \cdot 8\end{array}$ | I OI | 526 Io.I | I. 00 | $\begin{array}{llll}5 & 27 & 9.8\end{array}$ | -99 | $\begin{array}{lll}5 & 28 & 9 \cdot 3\end{array}$ | -99 |
| 14 | $\begin{array}{llll}5 & 14 & 42 \cdot 4\end{array}$ | I.00 | $51542 \cdot 0$ | -99 | 5 16 4I'0 | -98 | 5 17 $39 \cdot 3$ | -97 | $\begin{array}{lllll}5 & 18 & 37 \cdot 0\end{array}$ | -96 | 5 I9 34.I | -95 |
| 16 | $5 \quad 6 \mathrm{I} 7 \times 5$ | '97 | $5 \quad 715 \cdot 7$ | -96 | $5 \quad 813.0$ | $\bullet 95$ | $\begin{array}{llll}5 & 9 & 9 \cdot 4\end{array}$ | -93 | 5 10 5.1 | -92 | 5 II 0.0 | -91 |
| $\underline{18}$ | 45753.4 | + 95 | $45850 \cdot 1$ | + •94 | $45945 \cdot 7$ | + 92 | $5 \quad 0 \quad 40 \cdot 4$ | + 90 | $5 \quad 1334 \cdot 1$ | + .89 | $\begin{array}{llll}5 & 2 & 26.8\end{array}$ | $+.87$ |
| 20 | 44929.8 | -93 | $45025 \cdot 1$ | $\cdot 91$ | 451193 | . 89 | $\begin{array}{llll}4 & 52 & 12 \cdot 2\end{array}$ | . 87 | $\begin{array}{llll}4 & 53 & 3.9\end{array}$ | .85 | $4 \begin{array}{llll}4 & 53 & 54 \cdot 6\end{array}$ | . 83 |
| 22 | 44 I 6.7 | -91 | 4420.8 | -89 | 44253.4 | -86 | $44344 \cdot 7$ | . 84 | $44434 \cdot 6$ | -82 | $445 \quad 23 \cdot 2$ | -80 |
| 24 | $432 \begin{array}{lll}4 & 44 \\ 4\end{array}$ | -89 | $\begin{array}{lllll}4 & 33 & 37.0\end{array}$ | -87 | $\begin{array}{llll}4 & 34 & 28 \cdot 3\end{array}$ | -84 | $\begin{array}{llllll}4 & 35 & 17.9\end{array}$ | -81 | 43660 | $\cdot 79$ | $\begin{array}{llll}4 & 36 & 52 \cdot 6 \\ 4 & 28 & 22.8\end{array}$ | $\cdot 76$ |
| 26 | $42422 \cdot 0$ | . 88 | $4 \quad 2513.7$ | -85 | $\begin{array}{lll}4 & 26 & 3.7\end{array}$ | -82 | 42651.8 | '79 | 427 38.1 | $\cdot 76$ | 42822.8 | 73 |
| 28 | $4160 \cdot 3$ | +.86 | $41650 \cdot 9$ | $+.83$ | $41739 \cdot 6$ | + •79 | $\begin{array}{llll}4 & 18 & 26 \cdot 2\end{array}$ | + •76 | 4 19 10.9 | + 73 | 4 I9 53.6 | + .69 |
| 30 | $4739 \cdot 0$ | -85 | 48188.6 | -81 | $4 \quad 9 \mathrm{I} \cdot 1$ | $\cdot 77$ | 41012 | $\cdot 73$ | 4 10 44.3 | $\cdot 70$ | 4 II 25.I | -66 |
| 3 | $\begin{array}{lrrr}4 & 3 & 28 \cdot 4\end{array}$ | -84 | $\begin{array}{llll}4 & 4 & 17.6\end{array}$ | -80 | $\begin{array}{lll}4 & 5 & 4 \cdot 5\end{array}$ | $\cdot 76$ | 451490 | $\cdot 72$ | $463 \mathrm{I} \cdot 2$ | -68 | $47 \mathrm{II} \cdot \mathrm{I}$ | -64 |
| 32 | $\begin{array}{llll}3 & 59 & 18 \cdot 0\end{array}$ | -83 | $\begin{array}{rrrr}4 & 0 & 6 \cdot 7\end{array}$ | $\cdot 79$ | $4 \quad 0 \quad 53 \cdot 0$ | $\cdot 75$ | 4 I $36 \cdot 8$ | -71 | $\begin{array}{llll}4 & 2 & 18 \cdot 2\end{array}$ | - 67 | $\begin{array}{llll}4 & 2 & 57 \cdot 2\end{array}$ | . 63 |
| 33 | $\begin{array}{llll}3 & 55 & 7 \cdot 7\end{array}$ | . 8 | $35556 \cdot 0$ | 8 | $3564 \mathrm{I} \cdot 6$ | -7 | $\begin{array}{lllllllll}3 & 57 & 24.8\end{array}$ | $\cdot 70$ | $\begin{array}{llll}3 & 58 & 5 \cdot 4\end{array}$ | -65 | $\begin{array}{llll}3 & 58 & 43 \cdot 5\end{array}$ | -61 |
| 34 | $35057 \cdot 4$ | +.82 | 3 51 45.2 | +.77 | $35230 \cdot 4$ | + 73 | 353512.9 | + .68 | $\begin{array}{llll}3 & 53 & 52.7\end{array}$ | + .64 | 3.5429 .9 | . 60 |
| 35 | $3{ }^{3} 4647 \cdot 2$ | -81 | 3. $4734 \cdot 6$ | $\cdot 77$ | $34^{38}$ I9.2 | $\cdot 72$ | 349 I•I | -67 | $34940 \cdot 0$ | . 63 | 35016.5 | $\cdot 58$ |
| 36 | $\begin{array}{llll}3 & 42 & 37 \cdot 0\end{array}$ | -81 | $\begin{array}{llllllllllllll}3 & 43 & 24 \cdot 1\end{array}$ | $\cdot 76$ | $\begin{array}{llr}3 & 44 & 8 \cdot 2\end{array}$ | $\cdot 71$ | $\begin{array}{lllll}3 & 44 & 49 \cdot 4\end{array}$ | -66 |  | -6I | $\begin{array}{lll}3 & 46 & 3 \cdot 2\end{array}$ | -57 |
| 37 | $\begin{array}{llll}3 & 38 & 27 \cdot 0\end{array}$ | -80 | $\begin{array}{llll}3 & 39 & 13.6\end{array}$ | $\cdot 75$ | $\begin{array}{llllllll}3 & 39 & 57 \cdot 2\end{array}$ | -70 | 3403 40 | -65 | $3 \mathrm{4I} 15.4$ | -60 | $34150 \cdot 0$ | - 55 |
| 38 | 33417.0 | -80 | $\begin{array}{llll}3 & 35 & 3 \cdot 2\end{array}$ | $\cdot 74$ | $\begin{array}{lllll}3 & 35 & 46 \cdot 4\end{array}$ | -69 | $\begin{array}{llll}3 & 36 & 26 \cdot 3\end{array}$ | -64 | $\begin{array}{llll}3 & 37 & 3 \cdot 2\end{array}$ | -59 | $\left\lvert\, \begin{array}{llll}3 & 37 & 36 \cdot 9\end{array}\right.$ | -53 |
| 39 | $3{ }^{3} 30 \quad 7 \cdot 0$ | + 79 | $3 \begin{array}{llll}30 & 52.9\end{array}$ | + $\cdot 74$ | $3 \mathrm{3I} 35 \cdot 6$ | + . 68 | $332 \begin{array}{lll}3 & 150\end{array}$ | + .63 | $33^{32} 5 \mathrm{I} \cdot \mathrm{I}$ | + 57 | 333323.9 | + 52 |
| 40 | $\begin{array}{llll}3 & 25 & 57 \cdot 1\end{array}$ | -79 | $\begin{array}{lllllllllllllll}3 & 26 & 42 \cdot 7\end{array}$ | -73 | $\begin{array}{llll}3 & 27 & 24.9\end{array}$ | - 67 | $\begin{array}{llll}3 & 28 & 3 \cdot 7\end{array}$ | -62 | $\begin{array}{llll}3 & 28 & 39 \cdot 1\end{array}$ | - 56 | $\begin{array}{llll}3 & 29 & \text { II•I }\end{array}$ |  |
| 41 | $\begin{array}{llll}3 & 21 & 47 \cdot 2 \\ 3 & 1 & 7 & \\ 3\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 22 & 32 \cdot 5 \\ 3 & 18 & 22.4\end{array}$ | $\cdot 72$ | $\begin{array}{rrrr}3 & 23 & 14.3 \\ 3 & 19 & 3.8\end{array}$ | - 66 | $\begin{array}{llll}3 & 23 & 52 \cdot 5\end{array}$ | -6r | $\begin{array}{llll}3 & 24 & 27.2 \\ 3 & 20 & 15.4\end{array}$ | - 55 | $\begin{array}{llll}3 & 24 & 58 \cdot 3 \\ 3 & 20 & 45.8\end{array}$ | $\cdot 49$ |
| 42 | $\begin{array}{lllllllllll}3 & 17 & 37.4\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 18 & 22.4\end{array}$ | $\cdot 72$ | $\begin{array}{llrr}3 & 19 & 3.8 \\ 3 & \text { I4 } & 53 \cdot 3\end{array}$ | -66 | $\begin{array}{llll}3 & 19 & 41 \cdot 5\end{array}$ | -60 | $\begin{array}{llll}3 & 20 & 15.4\end{array}$ | -53 | $32045 \cdot 8$ | $\cdot 47$ |
| 43 |  | $\cdot 78$ | $\begin{array}{lllll}3 & 14 & 12.4\end{array}$ | $\cdot 71$ | $\begin{array}{lllllllll}3 & 14 & 53 \cdot 3\end{array}$ | $\cdot 65$ | 3 I5 $30 \cdot 5$ | -59 | 3 I6 $\begin{array}{lll}3.8\end{array}$ | . 52 | $\begin{array}{llll}3 & 16 & 33 \cdot 2\end{array}$ | -46 |
| 44 | $\begin{array}{lll}3 & 9 & 17.8 \\ 3 & 5 & 8.1\end{array}$ | + 78 | $\begin{array}{lrr}3 & \text { IO } & 2.4\end{array}$ | + 71 | 3 10 43.0 | + 64 | 3 II 19.6 | $+.58$ | 3 II $52 \cdot 2$ | + 51 | $\begin{array}{llll}3 & 12 & 20 \cdot 8\end{array}$ | + 44 |
| 45 | $3 \begin{array}{llr}3 & 5 & 8 \cdot 1\end{array}$ | $\cdot 77$ | $3 \begin{array}{llll}3 & 5 & 52 \cdot 5\end{array}$ | $\cdot 70$ | $\begin{array}{llll}3 & 6 & 32 \cdot 7\end{array}$ | . 63 | $\begin{array}{llll}3 & 7 & 8 \cdot 7\end{array}$ | - 57 | $\begin{array}{llll}3 & 7 & 40 \cdot 7\end{array}$ | -50 | $\begin{array}{lll}3 & 8 & 8 \cdot 5\end{array}$ | $\cdot 43$ |
| 46 | $3 \quad 058 \cdot 4$ | $\cdot 77$ | $\begin{array}{rrrr}3 & 1 & 42 \cdot 5\end{array}$ | $\cdot 70$ | $\begin{array}{llll}3 & 2 & 22.4\end{array}$ | -63 | $3 \quad 2588 \cdot 0$ | -56 | $\begin{array}{llll}3 & 3 & 29 \cdot 3\end{array}$ | -48 | $\begin{array}{llll}3 & 3 & 56 \cdot 3\end{array}$ | 4 I |
| 48 | $\begin{array}{llll}2 & 56 & 48 \cdot 7\end{array}$ | $\cdot 77$ | $\begin{array}{llll}2 & 57 & 32.7 \\ 2 & 5 & 3 & 22.9\end{array}$ | $\cdot 70$ | $\begin{array}{rrrr}2 & 58 & 12 \cdot 3 \\ 2 & 54 & 2.2\end{array}$ | -62 | $\begin{array}{llll}2 & 58 & 47 \cdot 3\end{array}$ | - 55 | $\begin{array}{lllll}2 & 59 & 17.9 \\ 2 & 55 & 6.7\end{array}$ | $\cdot 47$ | $\begin{array}{llll}2 & 59 & 44 \cdot \mathrm{I} \\ 2 & 55 & 32 \cdot \mathrm{I}\end{array}$ | $\cdot 40$ |
| 48 | $25239 \cdot 1$ | $\cdot 77$ | 25322.9 | -69 | $2 \begin{array}{lll}24 & 2 \cdot 2\end{array}$ | -6I | 254 36.7 | -54 | $2 \begin{array}{lll}25 & 6 \cdot 7\end{array}$ | $\cdot 46$ | $25532 \cdot \mathrm{I}$ | $\cdot 38$ |
| 49 | $2 \begin{array}{llll}2 & 48 & 29 \cdot 3\end{array}$ | + 777 | $2 \begin{array}{llll}2 & 49 & 13.1\end{array}$ | + 69 | $2 \begin{array}{llll}2 & 49 & 52 \cdot \mathrm{I}\end{array}$ | + .6I | $25026 \cdot 2$ | + .53 | $25055 \cdot 5$ | + 45 | $25120 \cdot 1$ | + 37 |
| 50 | $2 \begin{array}{llll}2 & 44 & 197\end{array}$ | $\cdot 77$ | $\begin{array}{llll}2 & 45 & 3.4 \\ 2\end{array}$ | -69 | $2 \begin{array}{llll}2 & 45 & 42 \cdot I\end{array}$ | -60 | $2{ }_{2} 46150.8$ | $\cdot 52$ | $\begin{array}{lllllllllll}2 & 46 & 44.5\end{array}$ | -44 | $\left\lvert\, \begin{array}{lll}2 & 47 & 8 \cdot 2 \\ 2 & 42 & 5\end{array}\right.$ | -35 |
| 51 | $2{ }^{2} 40$ 10.0 |  | $\begin{array}{lllll}2 & 40 & 53.6\end{array}$ | -68 | $24^{2} \mathrm{I} 32 \cdot \mathrm{I}$ | -60 | $\begin{array}{rrrr}2 & 42 & 5 \cdot 4\end{array}$ |  | $\begin{array}{llll}2 & 42 & 33 \cdot 5\end{array}$ | -42 | $\begin{array}{llll}2 & 42 & 56 \cdot 4\end{array}$ | -34 |
| 52 | $\begin{array}{llr}2 & 36 & 0 \cdot 3 \\ 2 & 31 & 50 \cdot 6\end{array}$ | $\cdot 77$ | $\begin{array}{llll}2 & 36 & 44.0 \\ 2 & 3 & \end{array}$ | . 68 | $\begin{array}{llll}2 & 37 & 22.2 \\ 2 & 3 & \end{array}$ | -59 | $\begin{array}{llll}2 & 37 & 55 \cdot 1 \\ 2 & 33 & 4.8\end{array}$ | - 50 | $\begin{array}{llll}2 & 38 & 22.5 \\ 2 & 34 & 1\end{array}$ | $\cdot 41$ | $\begin{array}{llll}2 & 38 & 44 \cdot 6 \\ 2 & 34 & 32 \cdot 9\end{array}$ | $\cdot 32$ |
| 53 | $235150 \cdot 6$ | $\cdot 77$ | $\begin{array}{llll}2 & 32 & 34 \cdot 3\end{array}$ | . 68 | $\begin{array}{lllllllllllll}2 & 33 & 12.3\end{array}$ | -59 | $23344 \cdot 8$ | -49 | 234115 | . 40 | 23432.9 | $\cdot 31$ |
| 54 | $\begin{array}{lllllllllll}2 & 27 & 40 \cdot 8\end{array}$ | + 78 | $2 \begin{array}{llll}2 & 28 & 24.6\end{array}$ | +.68 | $\begin{array}{lll}2 & 29 & 2 \cdot 5\end{array}$ | + 58 | $2 \begin{array}{llllllll}2 & 29 & 34.6\end{array}$ | + 49 | $\begin{array}{llll}2 & 30 & 0.9\end{array}$ | + 39 | 2 30 2I•3 | + 29 |
| 55 | $2233 \mathrm{I} \cdot \mathrm{I}$ | $\cdot 78$ | $\begin{array}{rrrr}2 & 24 & 14.9 \\ 2 & 20 & 5.9\end{array}$ | . 68 | $\begin{array}{llll}2 & 24 & 52 \cdot 7 \\ 2 & 20 & 43.0\end{array}$ | . 58 | $\begin{array}{llll}2 & 25 & 24.4 \\ 2 & 25\end{array}$ |  | $2 \begin{array}{llll}2 & 25 & 50 \cdot 3\end{array}$ | $\cdot 38$ | $\begin{array}{llr}2 & 26 & 9 \cdot 8 \\ 2 & 21 & 58\end{array}$ | $\cdot 27$ |
| 56 | $\begin{array}{llll}2 & 19 & 2 I \cdot 2 \\ 2 & 15 & \\ \end{array}$ | $\cdot 79$ | 2 20 $5 \cdot 2$ <br> 2 1 5 | -68 | $22043 \cdot 0$ | -58 | $\begin{array}{lll}2 & 21 & 14.4\end{array}$ |  | $2 \begin{array}{llll}21 & 39 \cdot 5\end{array}$ | -37 | $22158 \cdot 3$ | -26 |
| 57 58 | $\begin{array}{llll}2 & 15 & \text { II } \\ 2 & \text { I } \\ \end{array}$ | .79 | $\begin{array}{llll}2 & 15 & 55 \cdot 6 \\ 2 & 15 & \end{array}$ | . 68 | $\begin{array}{lll}2 & 16 & 33 \cdot 2 \\ 2 & 12 & 23.5\end{array}$ | -57 | $\begin{array}{llll}2 & 17 & 4.3\end{array}$ |  | $\begin{array}{lllll}2 & 17 & 28.9\end{array}$ | -35 | 2 I7 46.9 | -24 |
| 58 | 2 II I.4 | . 80 | 2 II 45.9 | . 68 | 21223.5 | -57 | $\left\lvert\, \begin{array}{llll}2 & 12 & 54.3\end{array}\right.$ | $\cdot 46$ | $2 \begin{array}{llllllll} & 13 & 18.3\end{array}$ | $\cdot 34$ | 2 I3 35.5 | $\cdot 23$ |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ}$ A. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ}$ A. |  | L. $17^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad 92 \end{aligned}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{r} \cdot 00 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -4 \cdot 28 \end{gathered}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 08 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 30 \end{gathered}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot \mathrm{I} 6 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 32 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 24 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -4 \cdot 35 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 33 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 37 \end{gathered}$ |
| 4 | +.83 | $4 \cdot 24$ | \% 91 | 4.26 | + 9 | $4 \cdot 28$ | +.07 | 4.30 | I.15 | - $4 \cdot 32$ | I. 24 | 4.34 |
| 8 | -75 | 4.23 | -83 | $4 \cdot 24$ | -91 | $4 \cdot 26$ | -99 | $4 \cdot 28$ | 1.07 | $4 \cdot 30$ | I'15 | $4 \cdot 32$ |
| 12 | -67 | $4 \cdot 2 \mathrm{I}$ | $\cdot 75$ | $4 \cdot 23$ | -83 | $4 \cdot 24$ | -91 | $4 \cdot 26$ | -99 | $4 \cdot 28$ | 1.07 | $4 \cdot 30$ |
| 16 | -60 | $4 \cdot 20$ | -68 | $4 \cdot 22$ | $\cdot 76$ | $4 \cdot 23$ | . 84 | $4 \cdot 24$ | $\cdot 92$ | $4 \cdot 26$ | I 00 | $4 \cdot 28$ |
| 20 | +.53 | $4 \cdot 19$ | + . 6 r | $4 \cdot 20$ | + . 69 | $4 \cdot 22$ | + 777 | 4.23 | +.85 | $4 \cdot 25$ | + 93 | $4 \cdot 26$ |
| 22 | - 49 | $4 \cdot 19$ | -58 | $4 \cdot 20$ | . 66 | $4 \cdot 21$ | -74 | 4.23 | .82 | $4 \cdot 24$ | -91 | $4 \cdot 26$ |
| 24 | -46 | $4 \cdot 18$ | -54 | 4.19 | -62 | $4 \cdot 21$ | $\cdot 70$ | $4 \cdot 22$ | $\cdot 79$ | $4 \cdot 23$ | . 87 | $4 \cdot 25$ |
| 26 | -42 | 4.18 | -51 | $4 \cdot 19$ | - 59 | $4 \cdot 20$ | - 67 | 4.22 | $\cdot 76$ | $4 \cdot 23$ | . 84 | $4 \cdot 24$ |
| 28 | -39 | 4.18 | -47 | 4.19 | $\cdot 56$ | $4 \cdot 20$ | . 64 | $4 \cdot 21$ | -73 | $4 \cdot 22$ | .81 | $4 \cdot 24$ |
| 30 | + 35 | 4.18 | + $\cdot 44$ | $4 \cdot 19$ | +.53 | 4*19 | + . 6 r | 4.21 | + 70 | $4 \cdot 22$ | + •79 | $4 \cdot 23$ |
| 32 | -31 | 4.17 | -40 | $4 \cdot 18$ | -49 | 4-19 | $\cdot 58$ | 4.20 | . 67 | $4 \cdot 21$ | $\cdot 76$ | $4 \cdot 23$ |
| 34 | -28 | 4.17 | $\cdot 37$ | $4 \cdot 18$ | -46 | 4.18 | $\cdot 55$ | $4 \cdot 20$ | -64 | 4.21 | $\cdot 73$ | $4 \cdot 22$ |
| 36 | - 24 | 4.17 | $\cdot 34$ | $4 \cdot 17$ | -43 | $4 \cdot 18$ | $\cdot 52$ | $4 \cdot 19$ | -61 | $4 \cdot 20$ | $\cdot 71$ | $4 \cdot 22$ |
| 38 | -21 | 4.17 | -31 | 4.17 | -40 | $4 \cdot 18$ | - 49 | 4.19 | -59 | $4 \cdot 20$ | . 68 | $4 \cdot 22$ |
| 40 | +.17 | 4.16 | + 27 | 4.17 | + 37 | $4 \cdot 18$ | + 46 | 4-19 | +.56 | $4 \cdot 20$ | +.66 | $4 \cdot 21$ |
| 42 | -14 | 4.16 | . 23 | $4 \cdot 17$ | -33 | $4 \cdot 17$ | . 43 | $4 \cdot 18$ | . 53 | $4 \cdot 20$ | -64 | $4 \cdot 21$ |
| 44 | -10 | 4.16 | - 20 | $4 \cdot 17$ | -30 | $4 \cdot 17$ | -41 | $4 \cdot 18$ | - 51 | $4 \cdot 19$ | -61 | $4 \cdot 21$ |
| 46 | . 06 | 4.16 | - I7 | 4.16 | $\cdot 27$ | 4.17 | $\cdot 38$ | 4.18 | -48 | $4 \cdot 19$ | $\cdot 59$ | $4 \cdot 20$ |
| 48 | $+.02$ | 4.16 | -13 | $4 \cdot 16$ | $\cdot 24$ | 4.17 | - 35 | 4-18 | -46 | $4 \cdot 19$ | $\cdot 57$ | $4 \cdot 20$ |
| 50 | -.02 | $4 \cdot 16$ | + .09 | $4 \cdot 16$ | + 21 | $4 \cdot 17$ | + 32 | 4.17 | + $\cdot 44$ | $4 \cdot 18$ | +. 55 | $4 \cdot 20$ |
| 52 | .06 | 4-16 | . 05 | $4 \cdot 16$ | -17 | 4.16 | - 29 | $4 \cdot 17$ | . 41 | 4.18 | . 53 | $4 \cdot 20$ |
| 54 | -11 | 4.16 | + +0I | $4 \cdot 16$ | -14 | 4•16 | - 26 | 4.17 | -39 | 4-18 | $\cdot 51$ | 4-19 |
| 56 | -16 | 4.16 | -.03 | $4 \cdot 16$ | $\cdot 10$ | 4.16 | $\cdot 23$ | $4 \cdot 17$ | $\cdot 37$ | $4 \cdot 18$ | - 50 | 4-19 |
| 58 | $\cdot 2 \mathrm{I}$ | $4 \cdot 16$ | $\cdot 07$ | 4.16 | $\cdot 07$ | 4.16 | $\cdot 20$ | 4.17 | -34 | $4 \cdot 18$ | $\cdot 48$ | $4 \cdot 19$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 69 LATITUDE $16^{\circ}$.

DECLINATION—SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 2 \mathrm{I} & 23 \cdot 0 \end{array}$ | $+1.27$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 22 & 39^{\circ} 9 \end{array}$ | $+1 \cdot 29$ | $\left.\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 23 \end{array}\right\| \begin{aligned} & \text { P7.7 } \end{aligned} \right\rvert\,$ | $+1 \cdot 3 I$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 25 & 16 \cdot 6 \end{array}\right\|$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 32 \end{gathered}$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 26 & 36 \cdot 6 \end{array}$ | $+1 \cdot 34$ | $\left.\begin{array}{ccc} \text { H. } & \text { м. } & \text { S. } \\ 6 & 27 & 57 \bullet 9 \end{array} \right\rvert\,$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{r} \cdot 36 \end{gathered}$ |
| 10 | $53747 \cdot 2$ | 1.03 | $513848 \cdot 7$ | I.02 | $\begin{array}{llll}5 & 39 & 50 \cdot 1\end{array}$ | I. 02 | $5{ }_{5} 40$ 5I* 4 | 1.02 | $54152 \cdot 8$ | 1.02 | 5 $4242 \begin{array}{llll} & 54\end{array}$ | I. 02 |
| 12 | $\begin{array}{llll}5 & 29 & 8 \cdot 3\end{array}$ | -98 | $530 \quad 7 \cdot 0$ | -98 | $\begin{array}{llll}5 & 31 & 5.4\end{array}$ | -97 | $\begin{array}{llll}5 & 32 & 3 \cdot 6\end{array}$ | -97 | $\begin{array}{llll}5 & 33 & 1 \cdot 5\end{array}$ | -96 | $533159 \cdot 3$ | $\cdot 96$ |
| 14 | $52030 \cdot 6$ | -94 | 52126 | -93 | $\begin{array}{llll}5 & 22 & 22 \cdot 2\end{array}$ | -92 |  | -91 | $\begin{array}{llll}5 & 24 & 11.8 \\ 5 & 15 & 23.5\end{array}$ | 1 | $\begin{array}{llll}5 & 25 & 6 \cdot 0\end{array}$ | O |
| 16 | 5 II 54.1 | - 89 | $\begin{array}{lllll}5 & 12 & 47 \cdot 5\end{array}$ |  | 5 13 40.1 | $\cdot 87$ | $\begin{array}{llll}5 & 14 & 32 \cdot 2\end{array}$ | -86 | $\begin{array}{llll}5 & 15 & 23.5\end{array}$ | 85 | 51614.2 | 4 |
| 18 | $\begin{array}{llll}5 & 3 & 18.5\end{array}$ | -85 | 54 | + $\cdot 84$ | $5 \quad 4 \quad 59 \cdot 3$ | + 8.82 | $\begin{array}{llll}5 & 5 & 48 \cdot 3\end{array}$ | + 8 I | $5 \begin{array}{lll}5 & 6 & 36 \cdot 5\end{array}$ | + 79 | 5 7 $23 \cdot 8$ | $\cdot 78$ |
| 20 | $45444 \cdot 0$ | -8I | $45532 \cdot 3$ | $\cdot 79$ | $4 \begin{array}{lll}46 & 19.5\end{array}$ | $\cdot 78$ | $\begin{array}{llll}4 & 57 & 5 \cdot 6\end{array}$ | 76 | $45750 \cdot 6$ | -74 | $\begin{array}{lllll}4 & 58 & 34 \cdot 6\end{array}$ | $\cdot 72$ |
| 22 | $44610 \cdot 4$ | $\cdot 77$ | $44^{46} 56 \cdot 2$ | $\cdot 75$ | $44740 \cdot 8$ | -73 | $\begin{array}{llll}4 & 48 & 23 \cdot 9\end{array}$ | -71 | $449 \quad 5 \cdot 9$ | -69 | $\begin{array}{llllllllll}4 & 49 & 46 \cdot 5\end{array}$ | 66 |
| 2 | $43737 \cdot 6$ | $\cdot 74$ | $43821 \cdot 0$ | $\cdot 71$ | $\begin{array}{lll}4 & 39 & 2 \cdot 9\end{array}$ | . 68 | $439 \quad 43 \cdot 3$ | 66 | 440 22.I | . 63 | $4 \quad 40 \quad 59.4$ | 1 |
| 26 | $4295 \cdot 5$ | $\cdot 70$ | $42946 \cdot 6$ | . 67 | $430 \quad 26 \cdot 0$ | . 64 | 4313.5 | -61 | $43139 \cdot 3$ | - 58 | $\begin{array}{llll}4 & 32 & 13 & 3\end{array}$ | . 55 |
| 28 | 42034.3 | + . 66 | 42113.0 | + .63 | $42149 \cdot 8$ | $+\cdot 60$ | 42224.5 | + 5.56 | $42257 \cdot 3$ | + .53 | $42328 \cdot 1$ | + 49 |
| 30 | $412 \quad 3 \cdot 7$ | - 62 | $41240 \cdot 1$ | - 59 | $4 \begin{array}{llll}4 & 13 & 14\end{array}$ | -55 | $41346 \cdot 4$ | . 51 | 4 14 16.1 | $\cdot 48$ | $4 \begin{array}{llll}4 & 14 & 43 \cdot 6\end{array}$ | -44 |
| 3 | $\begin{array}{lllll}4 & 7 & 48 \cdot 7\end{array}$ | -61 | $4 \begin{array}{llll}4 & 8 & 23.9\end{array}$ | - 57 | $\begin{array}{llll}4 & 8 & 56 \cdot 9\end{array}$ | . 53 | $4{ }^{4} 9278.5$ | 49 | $\begin{array}{llll}4 & 9 & 55.8\end{array}$ | -4 | 4 10 $21 \cdot 7$ | 4 |
| 32 | $43333 \cdot 8$ | -59 | $\begin{array}{lll}4 & 4 & 7 \cdot 9\end{array}$ | -55 | $4439 \cdot 6$ | -5I | $\begin{array}{llll}4 & 5 & 8 \cdot 8\end{array}$ | -47 | $\begin{array}{llll}4 & 5 & 35 \cdot 6\end{array}$ | 42 | $\begin{array}{lllll}4 & 5 & 59 \cdot 8\end{array}$ | -38 |
| 33 | 359 19.1 | $\cdot 57$ | $35952 \cdot 0$ | -53 | 4 0 22.5 | 48 | 4 O 50.3 | -44 | 4 I 15.5 | -40 | 4 I $38 \cdot 2$ | -35 |
| 3 | $\begin{array}{lll}3 & 55 & 4.4\end{array}$ | + 55 | $355136 \cdot 3$ | + . 51 | $\begin{array}{llll}3 & 56 & 5 \cdot 5\end{array}$ | + 46 | $\begin{array}{llll}3 & 56 & 32 \cdot 0\end{array}$ | + 42 | $\begin{array}{llll}3 & 56 & 55.7\end{array}$ | + 37 | $3{ }^{3} 5716 \cdot 7$ | -33 |
| 35 | $35050 \cdot 0$ | - 53 | $35120 \cdot 7$ | -49 | $35148 \cdot 6$ | 44 |  | -39 | $35236 \cdot 0$ | -35 | $35255 \cdot 3$ | -29 |
| 3 | $34635 \cdot 7$ | -52 | $\begin{array}{llll}3 & 47 & 5 \cdot 3\end{array}$ | 47 | 34731.9 | 42 | $\begin{array}{llllllllllll}3 & 47 & 55\end{array}$ | -37 | 34816.3 | -32 | 34844.0 | 27 |
| 37 | $\begin{array}{llllllllll}3 & 42 & 21 \cdot 5\end{array}$ | -50 | $\begin{array}{llll}3 & 42 & 49 \cdot 9\end{array}$ | 45 | $\begin{array}{lllll}3 & 43 & 15 \cdot 4\end{array}$ | 40 | $\begin{array}{llll}3 & 43 & 37 \cdot 6\end{array}$ | - 34 | $\begin{array}{llll}3 & 43 & 56 \cdot 8\end{array}$ | -29 | $\begin{array}{llll}3 & 44 & 12.8\end{array}$ | - 24 |
| 38 | $\begin{array}{llll}3 & 38 & 7 \cdot 4\end{array}$ | $\cdot 48$ | $\begin{array}{lllll}3 & 38 & 34 \cdot 8\end{array}$ | 43 | $\begin{array}{lllll}3 & 38 & 58 \cdot 9\end{array}$ | $\cdot 37$ | $\begin{array}{llll}3 & 39 & 19.8\end{array}$ | $\cdot 32$ | $\begin{array}{llllllllllll}3 & 39 & 37 \cdot 4\end{array}$ | $\cdot 27$ | $\begin{array}{llll}3 & 39 & 51 \cdot 7\end{array}$ | -21 |
| 39 | 33353 | + 46 | 313419.7 | + 41 | $33442 \cdot 6$ | + 35 | $3135 \quad 2 \cdot 1$ | + 30 | $\begin{array}{lllllllllllll}3 & 35 & 18 \cdot 2\end{array}$ | + 24 | $33530 \cdot 7$ | + - 18 |
| 40 | $\begin{array}{llll}3 & 29 & 39.6\end{array}$ | -45 | $3 \begin{array}{llll}3 & 30 & 4.7\end{array}$ | -39 | $3 \begin{array}{lll}30 & 26 \cdot 3\end{array}$ | -33 | 33044.4 | -27 | $3 \begin{array}{lllll}3 & 30 & 58 \cdot 9\end{array}$ | 21 | 3 31 $9 \cdot 8$ | -15 |
| 41 | 32525.9 | -43 | 32549.9 | -37 | $32610 \cdot 2$ | -3I | 326126.9 | -25 | $\begin{array}{llll}3 & 26 & 39 \cdot 8\end{array}$ | -18 | $32649 \cdot 0$ | 12 |
| 42 | 3211203 | -41 | 3 21 35.1 | -35 | 32154.2 | -28 | $\begin{array}{lll}3 & 22 & 9.4\end{array}$ | - 22 | $\begin{array}{llll}3 & 22 & 20 \cdot 8\end{array}$ | -16 | $\begin{array}{llll}3 & 22 & 28 \cdot 2\end{array}$ | 09 |
| 43 | $31658 \cdot 8$ | 39 | $31 \begin{array}{llll}3 & 20.5\end{array}$ | -33 | $31738 \cdot 2$ | 6 | 31752.0 | 0 | $\begin{array}{llll}3 & 18 & 1.8\end{array}$ | 13 | $\begin{array}{llll}3 & 18 & 7.4\end{array}$ | . 06 |
| 4 | 312245.4 | + 38 | 3136 | + 31 | 31322.4 | $+.24$ | $\begin{array}{lllll}3 & 13 & 34.7\end{array}$ | + -17 | $\begin{array}{llll}3 & 13 & 42.9\end{array}$ | + 10 | $31346 \cdot 6$ | + .03 |
| 45 | $38832 \cdot 1$ | -36 | $\begin{array}{lllll}3 & 8 & 51.4\end{array}$ | -29 | $\begin{array}{llll}3 & 9 & 6.6\end{array}$ | - 22 | 3 9 1 7 \% 5 | 14 | $\begin{array}{llll}3 & 9 & 23 \cdot 9\end{array}$ | -07 | $\begin{array}{llll}3 & 9 & 25.9\end{array}$ | :00 |
| 46 | $\begin{array}{llll}3 & 4 & 18.9\end{array}$ | -34 | $\begin{array}{llll}3 & 4 & 37 \cdot 1\end{array}$ | -27 | $\begin{array}{llll}3 & 4 & 51 \cdot 0\end{array}$ | -19 | $\begin{array}{lll}3 & 5 & 0 \cdot 3\end{array}$ | -12 | $\begin{array}{llll}3 & 5 & 5 \cdot 1\end{array}$ | . 04 | $\begin{array}{llll}3 & 5 & 5 \cdot 2\end{array}$ | -04 |
| 47 | $\begin{array}{llll}3 & 0 & 5 \cdot 7\end{array}$ | - 32 | $\begin{array}{lllllllllllllllll}3 & 0 & 22 \cdot 8\end{array}$ | - 25 | $\begin{array}{llll}3 & 0 & 35 \cdot 3\end{array}$ | -17 | $3 \quad 0 \quad 43 \cdot 1$ | -09 | $3 \quad 0 \quad 46 \cdot 2$ | + . OI | 3 3 $0444 \cdot 5$ | -07 |
| 48 |  | - 30 | $2 \begin{array}{lll}26 & 8 \cdot 6\end{array}$ | . 22 | $2 \begin{array}{llll}56 & 19.7\end{array}$ | -14 | $25626 \cdot 0$ | -06 | $2 \begin{array}{llll} & 56 & 27.4\end{array}$ | 2 | $2 \begin{array}{llll}26 & 23.7\end{array}$ | - |
| 49 | $25139 \cdot 7$ | + 29 | 2515 | + 20 | $2 \begin{array}{lll}2 & 52 & 4 \cdot 2\end{array}$ | + 12 | $\begin{array}{llll}2 & 52 & 8 \cdot 9\end{array}$ | + .04 | 2528.5 | - . 05 | $252 \quad 2.9$ | 14 |
| 50 | 24726.8 | $\cdot 27$ | $24740 \cdot 3$ | - 18 | $24748 \cdot 7$ | -10 | $24751 \cdot 9$ | + -OI | $24749 \cdot 6$ | -08 | $24742 \cdot 0$ | 17 |
| 51 | $\begin{array}{llll}2 & 43 & 13.9\end{array}$ | . 25 | $124326 \cdot 3$ | 6 | $2 \begin{array}{llll}2 & 43 & 33 \cdot 3\end{array}$ | $\cdot 07$ | $\begin{array}{llll}2 & 43 & 34 \cdot 8 \\ 2 & 39 & \end{array}$ | . 02 | 2 43 $30 \cdot 7$ <br> 2 38  |  | $\begin{array}{lllll}2 & 43 & 20 \cdot 9\end{array}$ | 1 |
| 52 | $\begin{array}{llll}2 & 39 & 1.2\end{array}$ | -23 | $\begin{array}{llll}2 & 39 & 12 \cdot 3\end{array}$ | 14 | 23917.9 | - 04 | 239917.7 | . 05 | 239 II•8 | 15 | $\begin{array}{lllll}2 & 38 & 59.9\end{array}$ | - 25 |
| 53 | $23448 \cdot 5$ | - 21 | $23458 \cdot 4$ | 12 | 23512.4 | + . 02 | 2350.6 | -08 | $23452 \cdot 7$ | -18 | 234 | -29 |
| 54 | $23035 \cdot 9$ | + -19 | 23044.5 | + 09 | 23047.0 | - OI | 23043.5 | - I | $23033 \cdot 6$ | - | 2301773 | -33 |
| 55 | 226123.3 | -17 | $22630 \cdot 6$ | -07 | 22631.6 | -04 | $226126 \cdot 3$ | -14 | $2 \begin{array}{llll}26 & 14.4\end{array}$ | 25 | 22555.7 | $\cdot 37$ |
| 56 | $\begin{array}{llll}2 & 22 & 10 \cdot 8\end{array}$ | - I5 |  | -04 | 222216.2 | -06 | $222 \begin{array}{llll}2 & 9 & 0\end{array}$ |  | 22154.9 | -29 | 22133.9 | 4 I |
| 57 | $\begin{array}{llll}2 & 1 & 7 & 58.2 \\ 2 & 13 & 45.8\end{array}$ | -13 | $\begin{array}{rrr}2 & 18 & 2.9\end{array}$ | - 02 | $\begin{array}{rlr}2 & 18 & 0.8\end{array}$ | -09 | $2 \mathrm{I} 7 \mathrm{l}_{1} 51.7$ |  | $\begin{array}{llll}2 & 17 & 35 \cdot 5\end{array}$ | -33 | $2 \begin{array}{lllllll} & 17 & 11\end{array} 9$ | 45 |
| 58 | $2 \begin{array}{llll}2 & 13 & 45.8\end{array}$ |  | 2 I3 49.1 | -00 | $21345 \cdot 3$ |  | 21334.2 | -25 | 21315.8 | 37 | $21249 \%$ | 50 |

VARIATION TO r' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | s. $+\mathrm{I} \cdot 4 \mathrm{I}$ | S. -4.39 | $\begin{gathered} s . \\ +1 \cdot 50 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.42 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 58 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 45 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 67 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 * 48 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{i} \cdot 76 \end{gathered}$ | s. -4.52 | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 85 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 55 \end{gathered}$ |
| 4 | I•32 | $4 \cdot 36$ | 1.40 | $4 \cdot 39$ | $1 \cdot 49$ | $4 \cdot 42$ | 1.57 | $4 \cdot 45$ | 1.66 | $4 \cdot 48$ | 1.75 | $4 \cdot 51$ |
| 8 | 1.23 | $4 \cdot 34$ | I 32 | $4 \cdot 36$ | 1.40 | $4 \cdot 39$ | 1.48 | $4 \cdot 42$ | $1 \cdot 57$ | 4.45 | I. 66 | 4.48 |
| 12 | I•16 | $4 \cdot 32$ | I 24 | $4 \cdot 34$ | $1 \cdot 32$ | $4 \cdot 36$ | 1.41 | $4 \cdot 39$ | 1.49 | $4 \cdot 42$ | I. 58 | 4.45 |
| 16 | 1.08 | $4 \cdot 30$ | $1 \cdot 17$ | $4 \cdot 32$ | 1.25 | $4 \cdot 34$ | 1.33 | $4 \cdot 37$ | 1.42 | 4.40 | 1.51 | 4.42 |
| 20 | +1.02 | $4 \cdot 28$ | +1.10 | $4 \cdot 30$ | +1.19 | $4 \cdot 33$ | +1.27 | $4 \cdot 35$ | +1.36 | $4 \cdot 38$ | +1.44 | 4.40 |
| 22 | $\cdot 99$ | $4 \cdot 27$ | 1.07 | $4 \cdot 29$ | I•16 | $4 \cdot 32$ | I. 24 | $4 \cdot 34$ | I. 33 | $4 \cdot 37$ | $1 \cdot 42$ | $4 \cdot 39$ |
| 24 | -96 | $4 \cdot 27$ | I. 04 | 4.29 | I-13 | $4 \cdot 31$ | I.21 | $4 \cdot 33$ | I. 30 | $4 \cdot 36$ | I.39 | $4 \cdot 39$ |
| 26 | -93 | $4 \cdot 26$ | I.02 | $4 \cdot 28$ | I 10 | $4 \cdot 31$ | $1 \cdot 19$ | $4 \cdot 33$ | I. 28 | $4 \cdot 36$ | I. 37 | $4 \cdot 38$ |
| 28 | -90 | $4 \cdot 26$ | -99 | $4 \cdot 28$ | I.08 | $4 \cdot 30$ | I•16 | $4 \cdot 32$ | I. 25 | $4 \cdot 35$ | I. 35 | $4 \cdot 37$ |
| 30 | + 88 | $4 \cdot 25$ | + 96 | $4 \cdot 27$ | +1.05 | $4 \cdot 29$ | +1.14 | $4 \cdot 32$ | +1.24 | $4 \cdot 34$ | + +33 | $4 \cdot 37$ |
| 32 | . 85 | $4 \cdot 25$ | . 94 | $4 \cdot 26$ | 1.03 | 4.29 | 1.12 | $4 \cdot 31$ | I. 21 | $4 \cdot 33$ | 1.3I | $4 \cdot 36$ |
| 34 | . 83 | $4 \cdot 24$ | $\cdot 92$ | $4 \cdot 26$ | I.OI | $4 \cdot 28$ | 1.10 | $4 \cdot 31$ | 1.20 | 4.33 | 1.29 | $4 \cdot 36$ |
| 36 | $\cdot 80$ | $4 \cdot 24$ | - 89 | 4.25 | -99 | $4 \cdot 28$ | 1.08 | $4 \cdot 30$ | I•18 | $4 \cdot 32$ | 1.28 | $4 \cdot 35$ |
| 38 | $\cdot 78$ | 4.23 | $\cdot 87$ | 4.25 | $\bullet 97$ | 4.27 | 1.07 | $4 \cdot 30$ | 1-17 | $4 \cdot 32$ | 1.27 | $4 \cdot 35$ |
| 40 | + 76 | 4.23 | + 85 | 4.25 | + 95 | $4 \cdot 27$ | +r.06 | 4.29 | +1.16 | $4 \cdot 32$ | +1.26 | $4 \cdot 35$ |
| 42 | $\cdot 74$ | $4 \cdot 22$ | . 84 | 4.24 | -94 | $4 \cdot 26$ | I. 04 | $4 \cdot 29$ | I•15 | $4 \cdot 32$ | 1.25 | $4 \cdot 35$ |
| 44 | $\cdot 72$ | $4 \cdot 22$ | -82 | $4 \cdot 24$ | -93 | $4 \cdot 26$ | 1.03 | $4 \cdot 29$ | 1.14 | $4 \cdot 32$ | 1.25 | $4 \cdot 35$ |
| 46 | $\cdot 70$ | 4.22 | $\cdot 8 \mathrm{I}$ | $4 \cdot 24$ | -92 | $4 \cdot 26$ | 1.03 | 4.29 | I.14 | $4 \cdot 31$ | 1.25 | $4 \cdot 34$ |
| 48 | -68 | 4.22 | $\cdot 79$ | 4.24 | -91 | $4 \cdot 26$ | 1.02 | 4-28 | I.14 | $4 \cdot 31$ | 1.26 | $4 \cdot 35$ |
| 50 | $+.67$ | $4 \cdot 21$ | + 78 | $4 \cdot 23$ | + 90 | $4 \cdot 26$ | + 1.02 | $4 \cdot 28$ | +1.14 | $4 \cdot 31$ | +1.26 | $4 \cdot 35$ |
| 52 | . 65 | 4.21 | $\cdot 77$ | $4 \cdot 23$ | -90 | $4 \cdot 26$ | I. 02 | $4 \cdot 28$ | $1 \cdot 15$ | $4 \cdot 32$ | 1.28 | $4 \cdot 35$ |
| 54 | -64 | 4.21 | $\cdot 77$ | 4.23 | -90 | $4 \cdot 26$ | I.03 | $4 \cdot 29$ | I• 16 | $4 \cdot 32$ | 1.29 | $4 \cdot 36$ |
| 56 | -63 | 4.21 | $\cdot 76$ | 4.23 | -90 | $4 \cdot 26$ | I. 04 | $4 \cdot 29$ | I•18 | $4 \cdot 32$ | 1.32 | $4 \cdot 36$ |
| 58 | $\cdot 62$ | 4.21 | $\cdot 76$ | 4.23 | -91 | $4 \cdot 26$ | $1 \cdot 05$ | $4 \cdot 29$ | 1.20 | $4 \cdot 33$ | I. 35 | $4 \cdot 37$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True <br> Alt. | $0^{\circ}$ | Decl Var. | $1{ }^{\circ}$ | Dec <br> Var | $2^{\circ}$ | Decl. Var. | 3 | $\begin{aligned} & \text { Dec } \\ & \text { Var } \end{aligned}$ | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{aligned} & \text { H. M. } \\ & 6 \quad 0 \end{aligned}$ | $+1 \cdot 2$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & \text { I3: } \end{array}$ | $+1 \cdot 2$ | $\begin{array}{\|rrr} \text { H. M. } & \text { S. } \\ 6 & 2 & 26.8 \end{array}$ | $+1 \cdot 22$ | $\left\|\begin{array}{ccc} \mathrm{H}, & \mathrm{M} . & \mathrm{S} . \\ 6 & 3 & 40 \cdot 3 \end{array}\right\|$ | $+1 \cdot 23$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 54^{\circ} \mathrm{O} \end{array}$ | $+1 \cdot 23$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 6 & 8 \cdot 0 \end{array}$ |  |
| 10 | 518 | +1 | $\begin{array}{llll}5 & 19 & 23.4\end{array}$ | I-2 | 52036 | I.22 | $\begin{array}{llll}5 & 21 & 49 \cdot 4\end{array}$ | +123 | $\begin{array}{llr}5 & 23 & 1 \cdot 3\end{array}$ | I. 19 | $\begin{array}{llll}5 & 24 & 12.6\end{array}$ | 8 |
| 12 | $5 \quad 946$ | I.25 | 5 II I•O | 24 | $51214{ }^{\prime}$ | $\cdot 22$ | $\begin{array}{llll}5 & 13 & 27 \cdot 5\end{array}$ |  | $\begin{array}{llll}5 & 14 & 39 \cdot 4\end{array}$ |  | 51550 | -18 |
|  | 5 I 23. |  | $\begin{array}{llll}5 & 2 & 38 \cdot 4\end{array}$ |  | $\begin{array}{llll}5 & 3 & 52 \cdot 5\end{array}$ |  | $\begin{array}{llll}5 & 5 & 5 \cdot 5\end{array}$ |  | $\begin{array}{llll}5 & 6 & 17 & 4\end{array}$ |  | 5728 |  |
|  | 4525 | 1.28 | 454 I5 | 1.25 | 455 30'I | 3 | 45643.4 |  | 4575 |  | 4596 | 7 |
|  | 444 | + 1 | 44552 | +1 | $447 \quad 7 \cdot 3$ | $+1$ | $44^{8} 2 \mathrm{I} \cdot$ | + 1 | 44933.4 | +I | $45044 * 4$ | +I•17 |
|  | 436 I | I•3I | $437 \quad 28 \cdot 3$ | 1.28 | 43844 |  | 4395 | 1.22 | 44 I II•3 | I 20 | $44222 \cdot 5$ | 7 |
| 22 | 4274 | 1•33 | 42940 | 1-30 | 430 | I.26 | 43135 | -23 | 432490 | -20 | 434 | 18 |
|  | 4 I9 19.0 | 1-35 | 42039.0 |  | 421 |  | 42312.6 |  | $424 \quad 26 \cdot 4$ |  | $425 \quad 38 \cdot 3$ |  |
| 26 | 4 10 5I•8 | I•37 | 412 I3 | 34 | 4 I3 $32 \cdot$ | 1 | 414 49.0 | I.26 | $\begin{array}{llll}4 & 16 & 3 \cdot 5\end{array}$ | $1 \cdot 22$ | $4 \begin{array}{llllllll}4 & 17\end{array}$ |  |
| 28 | $4 \quad 2 \quad 23$ | + 1 | $4 \quad 34$ | $+\mathrm{I} \cdot 3$ | 4 | +1.3 |  | +1. | 474 | +1. | 4853.2 | +I.20 |
| 30 | 35354.4 | 1.43 | 355 19 | I•39 | $315640 \cdot 9$ | 1.3 | $358 \quad 0 \cdot 0$ | I 29 | 35916.4 | I. | $4030 \cdot 2$ | 21 |
| 32 | $34523 \cdot$ | $1 \cdot 47$ | 3465 |  | $\begin{array}{lllll}3 & 48 & 13.9\end{array}$ | $\cdot 37$ | 34934 |  | 350 |  | 3526. | 122 |
| 33 | 34179 |  | $\begin{array}{llll}3 & 42 & 35\end{array}$ |  | $344 \quad 0 \cdot 0$ |  | 345 2I*3 | 3 | 3 46  |  | 34754.9 | 23 |
| 3 | $33^{3651 \cdot 6}$ | 1 | $\begin{array}{llll}3 & 3^{8} & 20 \cdot 4\end{array}$ | 1.45 | $\begin{array}{llll}3 & 39 & 45 \cdot 8\end{array}$ | I'3 | 341579 | r.34 | $\begin{array}{llll}3 & 42 & 26 \cdot 9\end{array}$ | 1.29 | $34342 \cdot 8$ |  |
|  | 3323 | + 1.53 | $\begin{array}{llll}3 & 34 & 4.8\end{array}$ | +1.4 | $3 \begin{array}{llll}3 & 35 & 31 \cdot 3\end{array}$ | +I.4I | $3 \begin{array}{llll}3 & 36 & 54\end{array}$ | + I•35 | $\begin{array}{llll}3 & 38 & 14.0\end{array}$ | + 1.30 | $33930 \cdot 6$ | + I |
| 36 | 328 I |  | $\begin{array}{llll}3 & 29 & 48 \cdot 9\end{array}$ | I 4 | 3 3 1216.5 |  | 3324 |  | $\begin{array}{llll}3 & 34 & 1 \cdot 0\end{array}$ |  | $\begin{array}{lllll}3 & 35 & 18 \cdot 2\end{array}$ |  |
|  | 324 |  | 3253 |  | 327193 | 45 | 328 | -39 | $32947 \cdot 7$ | I•33 | 3315 |  |
| 38 | 3194 |  | 32115 |  | $32245 \cdot 7$ |  | 324 |  | 325 34.1 |  | 3 26  |  |
| 3 | 31512 | I. 62 | 3 I6 58 | 1.55 | $\begin{array}{llll}3 & 18 & 29 \cdot 8\end{array}$ | I.49 | 3195 | I*42 | $32120 \cdot 3$ | 1.36 | 32239 |  |
|  | 3 II | + | 3 I2 40 | + I | 314 | + I-5 | 315 | +1 | 3 I7 6.1 | +r.37 | 3 I8 $26 \cdot 6$ | + I |
| 41 | $36643 \cdot 9$ |  | $\begin{array}{llll}3 & 8 & 22.5\end{array}$ | I.60 | 395 |  | 3 II |  | $31251 \cdot 7$ |  | 3 I 4 I 3 |  |
|  | $3 \quad 223 \cdot$ |  | $\begin{array}{llll}3 & 4 & 3 \cdot 5\end{array}$ |  | $\begin{array}{llll}3 & 5 & 39 \cdot 1\end{array}$ |  | 37 10 |  | 3836 | I.4I | $3 \quad 959$ |  |
|  | 258 |  | $\begin{array}{llll}2 & 59 & 43.9\end{array}$ |  | $\begin{array}{llll}3 & 1 & 2 I \cdot 2\end{array}$ |  | $\begin{array}{rrrr}3 & 2 & 53.8\end{array}$ |  | $3 \quad 4 \begin{array}{lll}3 & 2 I \cdot 7\end{array}$ | 3 | 35154.2 |  |
|  | $25339^{\circ}$ | $1 \cdot 7$ | $2 \begin{array}{llll}2 & 55 & 23 \cdot 7\end{array}$ | I.69 | $\begin{array}{llll}2 & 57 & 2 \cdot 7\end{array}$ |  | $2 \begin{array}{llll}28 & 36 \cdot 8\end{array}$ | I.53 | $306 \cdot 1$ | 1.45 | 3 I $130 \cdot 7$ | 1 |
|  | 2491 | + 1 | $2512 \cdot 7$ | +1•7 | 2524 | +1. | 25419.3 | + 1 | 255 50.0 | + I 4 | 25716.0 | +I |
|  | $24452 \cdot 3$ |  | $24640 \cdot 8$ | I• | $\begin{array}{lllll}2 & 48 & 23 \cdot 7\end{array}$ |  | 250 I• |  | 251 |  | 25300 |  |
|  | $240 \quad 27 \cdot 2$ |  | 242 |  | 2443 3 |  | $24542 \cdot 5$ |  | $24716 \cdot 5$ | 52 | $24845 \cdot 2$ |  |
|  | 236 I'O |  | 23754.4 |  | $\begin{array}{lllll}2 & 39 & 4 \mathrm{I} & 7\end{array}$ |  | $2 \begin{array}{llllll}2 & 41 & 23.2\end{array}$ |  | $24258 \cdot 9$ | . 55 | $244^{29} 1$ |  |
|  | 23133.6 | 1-9 | 2 33 29.7 | I.8 | $2 \begin{array}{llll}2 & 35 & 19.5\end{array}$ | I.78 | 23730 | 1.68 | $23^{8} \quad 40 \cdot 6$ | I.58 | $240 \quad 12.5$ | - I 49 |
|  | 2274.8 | $+2.0$ | 229 |  | 23056 | +1.8 | 2324 | +1.7 | 23421.7 | + 1.61 | 23555 | +I. |
| 51 | $\begin{array}{lllll}2 & 22 & 34 \cdot 5\end{array}$ |  | $22436 \cdot 8$ | r-98 | $2263 \mathrm{I} \cdot$ | 1 | $\begin{array}{llll}2 & 28 & 20 \cdot 3\end{array}$ | $1 \cdot 7$ | $230 \quad 2 \cdot 1$ |  | $23137 \cdot 7$ |  |
|  | $\begin{array}{llll}2 & 18 & 2\end{array}$ |  | $2 \begin{array}{llll}20 & 8 \cdot 3\end{array}$ | 03 | 2226 |  | $22357 \cdot 5$ |  | $22541 \cdot 7$ | . 6 | 22719.2 |  |
| 5 | $\begin{array}{llll}2 & 13 & 29.0\end{array}$ |  | $\begin{array}{llll}2 & 15 & 38 \cdot 4\end{array}$ | 2.09 | 2 I7 $39 \cdot 8$ | I.96 | $2 \begin{array}{lllll}2 & 19 & 33 \cdot 7\end{array}$ | 18 |  | 1.72 | $2230 \cdot 1$ |  |
| 54 | $2 \quad 8 \quad 53.5$ | $2 \cdot 29$ | 2 II $6 \cdot 7$ | $2 \cdot 15$ | 2131177 | 2.02 | $2 \begin{array}{llll}15 & 8 \cdot 7\end{array}$ | I.89 | 2 I6 58.1 | $1 \cdot 76$ | $21840 \cdot 2$ | I.6 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 0 | A. | L. 1 | A. | L. 2 | A. | L. $3^{\circ}$ | A. | L. 4 | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | s. |  | s. | s. | S. | s. | s. | s. | S. | S. | S. |
| 2 | -00 | $4 \cdot 18$ $4 \cdot 18$ | +.08 +.03 | $-4 \cdot 18$ $4 \cdot 18$ | + ${ }_{\text {- } 15}$ | $-4 \cdot 18$ $4 \cdot 18$ | +.23 .18 | -4.19 4.19 | a $+\quad 30$ .26 | -4.19 | $\begin{array}{r}\text { + } \\ +\quad 38 \\ \hline\end{array}$ | -4.20 |
| 2 | -04 | $4 \cdot 18$ $4 \cdot 18$ | $\begin{array}{r}+.03 \\ \hline-.01\end{array}$ | $4 \cdot 18$ $4 \cdot 18$ | . II | $4 \cdot 18$ $4 \cdot 18$ | -18 | 4.19 4.18 | - 26 | 4.19 4.19 | .34 .29 | 4.20 $4 \cdot 19$ |
| 6 | - 13 | 4.18 | -06 | $4 \cdot 18$ | $+.02$ | 4.18 | -10 | $4 \cdot 18$ | -17 | $4 \cdot 19$ | .25 | $4 \cdot 19$ |
| 8 | -18 | 4.19 | -10 | $4 \cdot 18$ | . 02 | 4•18 | -05 | 4.18 | -13 | 4.18 | -20 | 4.19 |
| 10 | - 22 | 4.19 | - - I5 | $4 \cdot 18$ | - 07 | $4 \cdot 18$ | + . OI | 4.18 | +.08 | $4 \cdot 18$ | + .16 | 4-19 |
| 12 | $\cdot 27$ | 4•19 | -19 | $4 \cdot 19$ | - II | $4 \cdot 18$ | - . 04 | 4.18 | +.04 | $4 \cdot 18$ | -12 | $4 \cdot 18$ |
| 14 | -32 | 4.19 | - 24 | 4.19 | - I6 | $4 \cdot 19$ | -08 | 4.18 | . 00 | $4 \cdot 18$ | . 07 | 4-18 |
| I6 | $\cdot 37$ | $4 \cdot 20$ | -29 | 4-19 | -2I | $4 \cdot 19$ | - 13 | $4 \cdot 18$ | -. 05 | $4 \cdot 18$ | +.03 | $4 \cdot 18$ |
| 18 | -42 | $4 \cdot 20$ | -34 | 4.19 | $\cdot 25$ | 4.19 | -17 | $4 \cdot 19$ | -09 | $4 \cdot 18$ | - 01 | 4.18 |
| 20 | - $\cdot 47$ | 4.21 | - 38 | $4 \cdot 20$ | - 30 | 4.19 | - 22 | 4.19 | - . 14 | 4.18 | -.06 | $4 \cdot 18$ |
| 22 | $\cdot 52$ | $4 \cdot 2 \mathrm{I}$ | -44 | $4 \cdot 20$ | -35 | $4 \cdot 20$ | -27 | $4 \cdot 19$ | -19 | 4.19 | -10 | $4 \cdot 18$ |
| 24 | -57 | $4 \cdot 22$ | -49 | $4 \cdot 2 \mathrm{I}$ | $\cdot 40$ | $4 \cdot 20$ | -32 | $4 \cdot 19$ | -23 | 4.19 | -15 | 4-18 |
| 26 | -63 | $4 \cdot 23$ | -54 | $4 \cdot 22$ | -46 | $4 \cdot 2 \mathrm{I}$ | -37 | $4 \cdot 20$ | $\cdot 28$ | 4.19 | -20 | 4.19 |
| 28 | . 69 | $4 \cdot 24$ | . 60 | $4 \cdot 22$ | -51 | 4.21 | -42 | $4 \cdot 20$ | -33 | 4.19 | $\cdot 25$ | 4.19 |
| 30 | - 75 | 4.25 | -. 66 | $4 \cdot 23$ | - 57 | 4.22 | -.48 | 4.21 | - 39 | $4 \cdot 20$ | - 30 | 4.19 |
| 32 | -81 | $4 \cdot 26$ | $\cdot 72$ | $4 \cdot 24$ | -62 | $4 \cdot 23$ | $\cdot 53$ | $4 \cdot 22$ | - 44 | 4.21 | $\cdot 35$ | $4 \cdot 20$ |
| 34 | -88 | $4 \cdot 27$ | $\cdot 78$ | 4.25 | -69 | $4 \cdot 24$ | $\cdot 59$ | $4 \cdot 22$ | -50 | 4.21 | -40 | $4 \cdot 20$ |
| 36 | $\cdot 95$ | $4 \cdot 29$ | -85 | $4 \cdot 27$ | $\cdot 75$ | 4.25 | -65 | $4 \cdot 23$ | $\cdot 56$ | $4 \cdot 22$ | -46 | 4.21 |
| 38 | I.O3 | $4 \cdot 31$ | -92 | $4 \cdot 28$ | -82 | $4 \cdot 26$ | $\cdot 72$ | $4 \cdot 24$ | -62 | $4 \cdot 23$ | - 52 | $4 \cdot 21$ |
| 40 | -I•II | $4 \cdot 33$ | - I.00 | $4 \cdot 30$ | - . 89 | $4 \cdot 28$ | - 79 | $4 \cdot 26$ | -. 68 | 4.24 | -. 58 | $4 \cdot 22$ |
| 42 | 1. 20 | $4 \cdot 35$ | I.08 | $4 \cdot 32$ | -97 | $4 \cdot 29$ | - 86 | $4 \cdot 27$ | $\cdot 75$ | 4.25 | - 64 | $4 \cdot 23$ |
| 44 | I. 29 | $4 \cdot 38$ | I'17 | $4 \cdot 34$ | I.05 | 4.31 | -94 | $4 \cdot 29$ | -83 | $4 \cdot 26$, | $\cdot 71$ | $4 \cdot 24$ |
| 46 | 1.40 | $4 \cdot 41$ | I 27 | $4 \cdot 37$ | I•I5 | $4 \cdot 34$ | I. 02 | 4.31 | -91 | $4 \cdot 28$ | -79 | 4.26 |
| 48 | I-51 | $4 * 45$ | 1•37 | $4 * 40$ | I. 24 | $4 \cdot 36$ | I•I2 | $4 \cdot 33$ | -99 | $4 \cdot 30$ | $\cdot 87$ | $4 \cdot 27$ |
| 50 | - I. 64 | 4.49 | - I. 49 | 4.44 | - I.35 | 4.40 | - I. 22 | $4 \cdot 36$ | - $\mathbf{1} \cdot 08$ | $4 \cdot 32$ | -.95 | 4.29 |
| 52 | r.78 | 4.55 | 1.62 | $4 \cdot 49$ | I. 47 | 4.43 | I 33 | $4 \cdot 39$ | 1-19 | $4 \cdot 35$ | I.05 | $4 \cdot 31$ |
| 54 | I 94 | $4 \cdot 61$ | 1•77 | $4 \cdot 54$ | I.6I | 4.48 | I. 45 | 4.43 | 1.30 | $4 \cdot 38$ | I• 15 | $4 \cdot 34$ |

## LATITUDE $17^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | $\begin{aligned} & \text { Dec } \\ & \text { Val } \end{aligned}$ | $8^{\circ}$ |  | $9^{\circ}$ | De | $10^{\circ}$ |  | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | н. м. $6722$ | $+\mathrm{r} \cdot 2$ | H. M. <br> 68 | $+1 \cdot 2$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 9 & 5 \mathrm{I} \cdot \mathrm{O} \end{array}$ | $+1 \cdot 2$ | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 \text { II } & 6 \cdot I \end{array}$ | $\begin{gathered} \mathrm{S} \\ \mathbf{1} \cdot 25 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 12 & 2 \mathrm{I} \cdot 7 \end{array}\right.$ | $+I \cdot 26$ | $\begin{array}{ccc} \text { H. м. } & \text { s. } \\ 6 & \text { I3 } & 37 \cdot 7 \end{array}$ | S. |
| 10 | $\begin{array}{llll}5 & 25 & 23 \cdot 3\end{array}$ | I-17 | $\begin{array}{llll}5 & 26 & 33 \cdot 4\end{array}$ | I'I | $5 \quad 2743 \cdot 0$ | I.15 | $\begin{array}{llll}5 & 28 & 52 \cdot 1\end{array}$ | $1 \cdot 15$ | $\begin{array}{llll}5 & 30 & 0.7\end{array}$ | I.14 | 53188.9 | 3 |
|  | $\begin{array}{llll}5 & 17 & 0.7\end{array}$ | -16 | 51810.2 | I'15 | 519 19* | I.14 | $5 \quad 20 \quad 27 \cdot 5$ | 13 | 52134.8 |  | $52241 \cdot 7$ | -II |
|  | $\begin{array}{llll}5 & 8 & 38 \cdot 3\end{array}$ | -16 | $\begin{array}{llll}5 & 9 & 47 \cdot 3\end{array}$ | I.14 | 5 10 $55^{\circ}$ |  | 5 12 $2 \cdot 9$ | 12 | 513 |  | $\begin{array}{llll}5 & 14 & 15 \cdot 2\end{array}$ |  |
|  | 5 O I6.I | I•15 | $5 \begin{array}{llll}5 & 1 & 24.8\end{array}$ | I-I | $\begin{array}{llll}5 & 2 & 32.4\end{array}$ | I. 12 | $\begin{array}{llll}5 & 3 & 39\end{array}$ | 0 | 54444.6 |  | $\begin{array}{lllll}5 & 5 & 49 \cdot 3\end{array}$ | 7 |
| 18 | 4 5I 54. | +ris | $453 \quad 2 \cdot 5$ | +1.13 | $454 \quad 9 \cdot 6$ | +1 | 45515 | +1. | $4 \begin{array}{llll}46 & 20 \cdot 4\end{array}$ | +1.07 | 45724.1 | 5 |
| 20 | 44332 | I'I5 | 444 40.3 | I-12 | $44547{ }^{\circ}$ | I.10 | $44652 \cdot 5$ | I.08 | 447 56.6 | I. 06 | 448 59.3 | 3 |
| 22 | $43510 \cdot$ | -15 | $43618 \cdot 3$ | $1 \cdot 1$ | 43724.8 |  | $438 \quad 29 \cdot 7$ | -07 | 439 33.I |  | $44035 \cdot 0$ | 2 |
| 24 | $42648 \cdot$ | I 5 | 4275 | I'I2 | $4292 \cdot 6$ | 1.09 | $43007 \cdot 2$ | .06 | $43110 \cdot 0$ | I.O3 | $432 \quad 11 \cdot 2$ | 0 |
|  | 4182 | I'I5 | 4 I9 34.4 | I'I2 | $42040 \cdot 6$ | $1 \cdot$ | 42144.9 | $1 \cdot 05$ | $422 \quad 47 \cdot 2$ | 1.02 |  | 9 |
| 28 | 4 10 4.0 | +I•16 | 4 II 12.5 | +I•1 | 41218.6 | $+1$ | 4 I3 22.8 | +1.05 | 41424.8 | + 1 | $4 \begin{array}{lll}45 & 24.6\end{array}$ | -98 |
| 30 | 4 I 41 | -17 | $4 \quad 2 \quad 50 \cdot 3$ | $1 \cdot$ | 4356 | I.09 | $\begin{array}{lll}4 & 5 & 0.8\end{array}$ | I.05 | $\begin{array}{lll}4 & 6 & 2 \cdot 4\end{array}$ | I'OI | $\begin{array}{lll}4 & 7 & 1.8\end{array}$ | -97 |
| 32 | 35318 |  | $354128 \cdot I$ | I•13 | $35534 \cdot$ |  | $356638 \cdot$ | 4 | $\begin{array}{lllllllllllllll}3 & 57 & 40 \cdot 3\end{array}$ |  | $\begin{array}{llll}3 & 58 & 39 \cdot 3\end{array}$ | -96 |
| 33 | $\begin{array}{lllll}3 & 49 & 7 \cdot 3\end{array}$ | I•18 | 35016.9 | I-14 | $35123 \cdot$ |  | 35227 | 5 | $\begin{array}{llll}3 & 53 & 29 \cdot 3\end{array}$ |  | 354 28•1 | 96 |
| 34 | 34455 | 1'19 | 346 | I'14 | 34712 | I 09 | 348 I | 5 |  |  | $35016 \cdot 9$ | 5 |
| 35 | 34044 | +I | 341 | +I•I | $343 \quad 1 \cdot 5$ | +1 | $\begin{array}{llll}3 & 44 & 5 \cdot 9\end{array}$ | +1.05 | $\begin{array}{llr}3 & 45 & 7 \cdot 3\end{array}$ | +I.00 | $\begin{array}{llr}3 & 46 & 5 \cdot 8 \\ 3 & 41\end{array}$ | -95 |
| 36 | $\begin{array}{llll}3 & 36 & 32\end{array}$ | 1.20 | $3 \quad 374$ | I'I | $\begin{array}{llll}3 & 38 & 50 \cdot 4\end{array}$ | I•IO | $\begin{array}{lllll}3 & 39 & 54.9\end{array}$ | I.05 | $340 \quad 56 \cdot 3$ |  | 34154.8 | -95 |
| 37 | $\begin{array}{llll}3 & 32 & 20\end{array}$ |  | $\begin{array}{llll}3 & 33 & 31 \cdot 3\end{array}$ | I'16 | $\begin{array}{llll}3 & 34 & 39 \cdot 2 \\ 3 & 30 & 27 \cdot 8\end{array}$ |  | $\begin{array}{llll}3 & 35 & 43 \cdot 9\end{array}$ | 5 | $\begin{array}{llll}3 & 36 & 45\end{array}$ |  | $\begin{array}{llll}3 & 37 & 43 \cdot 8 \\ 3 & 33 & 3\end{array}$ | 95 |
| 38 | $\begin{array}{ll}3 & 28\end{array}$ | $1 \cdot 22$ | $\begin{array}{llllllll}3 & 29 & 19.6\end{array}$ |  | 3 30 $27 \cdot 8$ |  | $\begin{array}{llll} \\ 3 & 31 & 32\end{array}$ |  | $\begin{array}{llll}3 & 32 & 34 \cdot 4\end{array}$ |  | $\begin{array}{llll}3 & 33 & 32.8 \\ 3 & 29 & 21.8\end{array}$ | .94 |
| 39 | 32355 | $1 \cdot 23$ | $\begin{array}{llll}3 & 25 & 7.8\end{array}$ |  | 326 I6 |  | $32721 \cdot 7$ |  | 3282 |  | 32921.8 | -94 |
| 40 | 3 I9 43.1 | $+1$ | 320555.9 | +I | 32250 | +I•12 | 32310.5 | + 1.06 | 32412.4 | +1.00 | 32510.8 | 4 |
| 41 | 3 I5 $30 \cdot 4$ | I-26 | $31643 \cdot 8$ | I. | 3 17 53.4 | I•I3 | 3181890 |  | 320 1* |  | 32059.8 |  |
| 42 | 3 II 17 75 | $1 \cdot 27$ | 3 I2 3I.6 | I. 2 | 3 I3 4I | I.14 | 3 I4 | 7 | 31550 |  | 3 工6 $48 \cdot 8$ |  |
| 43 | $\begin{array}{lll}3 & 7 & 4 \cdot 3\end{array}$ |  | $3 \begin{array}{llllllll}3 & 8 & 19.2\end{array}$ |  | 3929 |  | 3 Io | 8 | 3 II 3 |  | $\begin{array}{lllll}3 & 12 & 37.9\end{array}$ | -95 |
| 44 | $\begin{array}{llll}3 & 2 & 50.9\end{array}$ | I.30 | $\begin{array}{llll}3 & 4 & 6 \cdot 7\end{array}$ | I. 22 | $3 \begin{array}{llll}3 & 5 & 18.0\end{array}$ | I'I5 | 36 |  | $3 \quad 7 \quad 28 \cdot 1$ | I.OI | $\begin{array}{llll}3 & 8 & 26 \cdot 9\end{array}$ | -95 |
| 45 | $\begin{array}{llll}2 & 58 & 37 \cdot 1 \\ 2 & 54 & \end{array}$ | +1.31 | 25953 | +I. | $\begin{array}{rrrr}3 & 1 & 5.8\end{array}$ | +I•I | $\begin{array}{lrrr}3 & 2 & 13.5\end{array}$ | + I.09 | $\begin{array}{lrrr}3 & 3 & 16.9\end{array}$ | +1.02 |  | + 95 |
| 46 | 2 54 $23 \cdot 1$ <br> 2 5  | 1.33 | $25540 \cdot 6$ | I. 2 | $\begin{array}{llll}2 & 56 & 53.4 \\ 2 & 5 & \end{array}$ | I 1 | $\begin{array}{llll}2 & 58 \\ 2 & \text { I }\end{array}$ | 促 | $\begin{array}{lll}2 & 59 & 5 \cdot 5\end{array}$ | 2 | $\begin{array}{lrrr}3 & 0 & 4 \cdot 8 \\ 2 & 5 & 5 & 53.7\end{array}$ |  |
|  | $\begin{array}{llrr}2 & 50 & 8 \cdot 7 \\ 2 & 45 & 54 \cdot 0\end{array}$ | 35 | 2 5 127.3 | 1.27 | $\begin{array}{llll}2 & 52 & 4 \mathrm{I} \cdot 0 \\ 2 & 48 & \end{array}$ | I.19 | $\begin{array}{lllll}2 & 53 & 49.9 \\ 2 & 49 & \end{array}$ | 1 | $\begin{array}{llll}2 & 54 & 54.1\end{array}$ | $1 \cdot 03$ | $\begin{array}{llll}2 & 55 & 53.7 \\ 2 & 51 & 4\end{array}$ | -96 |
| 48 | $\begin{array}{lllll}2 & 45 & 54.0\end{array}$ | $1 \cdot 37$ | $\begin{array}{llll}2 & 47 & 13.6 \\ 2 & 42 & 59.7\end{array}$ | $\underline{1} \cdot 28$ | 2482 | I. 20 | $\begin{array}{llll}2 & 49 & 37 \cdot 9\end{array}$ | 12 | $25042 \cdot 6$ |  | $\begin{array}{llll}2 & 51 & 42 \cdot 6\end{array}$ | -96 |
| 49 | $24138 \cdot 9$ | I•39 | $2 \begin{array}{llll}2 & 42 & 59 \cdot 7\end{array}$ | $1 \cdot 30$ | $2 \begin{array}{llll}2 & 44 & 15 \cdot 2\end{array}$ | 1.22 |  | I•I3 | $24631 \cdot 0$ | $1 \cdot 05$ | 24731.4 |  |
| 51 | $\begin{array}{llll}2 & 37 & 23 \cdot 2 \\ 2 & 33 & 7.1\end{array}$ | +1.42 | $\begin{array}{llll}2 & 38 & 4\end{array}$ | +1. | 24080.0 | +1.23 | $\begin{array}{llll}2 & 41 & 13.3\end{array}$ | +I•14 | $2 \begin{array}{lllll}2 & 42 & 19.3\end{array}$ | + I.06 | 243 20.1 | + 97 |
| 51 | $\begin{array}{llll}2 & 33 & 7 \cdot 1\end{array}$ | 144 | $234430 \cdot 6$ |  | $23548 \cdot$ | 1.25 | $\begin{array}{llll}2 & 37 & 0.7\end{array}$ | I'16 | $\begin{array}{llll}2 & 38 & 7 \cdot 4\end{array}$ | 1.07 | $\begin{array}{lllll}2 & 39 & 8 \cdot 7\end{array}$ | 98 |
| 52 | $\begin{array}{llll}2 & 28 & 50 \cdot 5 \\ 2 & 24 & 33.3\end{array}$ | I 47 | $2 \begin{array}{llll}2 & 30 & 15.5\end{array}$ | 37 | $\begin{array}{llll}2 & 31 & 34 \cdot 6\end{array}$ | $\underline{1} 27$ | $\begin{array}{llll}2 & 32 & 47 \cdot 8\end{array}$ | I•I7 | $\begin{array}{llll}2 & 33 & 55 \cdot 3\end{array}$ | I.08 | 23457.3 | 99 |
| 53 | $\begin{array}{llll}2 & 24 & 33 \cdot 3\end{array}$ | I. 50 | $\begin{array}{llll}2 & 25 & 59.9\end{array}$ | I.39 | 22720 | I. 29 | $\begin{array}{llll}2 & 28 & 34.7\end{array}$ | 1-19 | $\begin{array}{llll}2 & 29 & 43 \cdot 1\end{array}$ | - | $23045 \cdot 6$ | 99 |
| 54 | $22015 \cdot 4$ | I.53 | 22143.9 | 1.42 | $\begin{array}{lll}2 & 23 & 5 \cdot 8\end{array}$ | I.3I | $22421 \cdot 3$ | I:2 I | $22530 \cdot 7$ | I $\cdot 10$ | $22633 \cdot$ | 1.0 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.


72 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $17^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{array}{\|c} \text { True } \\ \text { Alt. } \end{array}$ | $12^{\circ}$ |  | $13^{\circ}$ |  | $14^{\circ}$ |  | $15^{\circ}$ |  | $16^{\circ}$ |  | $17^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | $52348 \cdot 2$ |  | 524 |  | 52 |  | 527 |  | 528 | -07 |  | - |
| 14 |  |  |  |  |  |  | $\begin{array}{lllll}5 & 18 & 31 \cdot 5\end{array}$ |  |  |  | $52036 \cdot \mathrm{I}$ |  |
| 16 |  |  | $5756 \cdot 1$ |  |  |  | 5 |  |  |  | 5 | 99 |
| 18 20 | 45826.7 | $+1.03$ | 45928.2 | +1.02 | 4520.0 | +1.00 | 51928.2 | + ${ }^{\text {P }} 8$ | ${ }_{5}^{5}$ |  | $5 \begin{array}{llll}5 & 3 & 24.5 \\ 4 & 5 & 5\end{array}$ | + 9.95 |
| $\begin{aligned} & 20 \\ & 22 \end{aligned}$ | 44135 |  |  |  | 4 52 <br> 4 43 <br> 4 $32 \cdot 1$ <br> 1  |  | 4 <br> 4 <br> 4 <br> 4 <br> 42 58.9 |  | 445 |  | $44616 \cdot 8$ | .88 |
| 24 | 433 |  | 43 |  | 43 | 92 | 435 |  | 4 |  | $43744 \cdot 2$ |  |
| 26 | 424 | $\cdot 96$ | 425 | 93 | 4 | 90 | $42731 \cdot 3$ |  | 42 |  | 429 |  |
| 28 | 416 | + 95 | 8 | + 9 | 418 | + 88 | 4193.8 | + 85 | 419 | I | 420 |  |
| 30 | $4 \quad 758.9$ |  | 8 |  | 4 9 46.4 <br> 4 5  |  | 4 10 36.8 <br> 4 6  |  | 41 |  | 412 |  |
| $\begin{aligned} & 3 \mathrm{I} \\ & 32 \end{aligned}$ | $\begin{array}{llll}4 & 3 & 47.3 \\ 3 & 59 & 35.7 \\ & 5 & \text { che }\end{array}$ |  | ${ }^{4} \begin{aligned} & 417.7 \\ & 0 \\ & 29.7\end{aligned}$ |  | 121 |  | 4 6 23.6 <br> 4 2 10.5 |  | $\begin{array}{llll}4 & 7 & 11 \cdot 1 \\ 4 & 2 & 57 \cdot 2 \\ \end{array}$ |  | $\left\lvert\, \begin{array}{llll}4 & 7 & 56 \cdot 3 \\ 4 & 3 & 4 \mathrm{I} \cdot 6 \\ 3\end{array}\right.$ |  |
| 32 <br> 33 | 55 | 91 | 356 |  | ${ }_{3}^{4} 57$ | 8 | 357 | 79 | 4 5 5 57.1 | 74 | 4 3 5 ${ }^{2} 27 \cdot 0$ |  |
|  | 35 | + | I | + 86 | $35256 \cdot 7$ | + 82 | $35344 \cdot 6$ | 78 |  |  | $3 \begin{aligned} & 5512 \cdot 6\end{aligned}$ |  |
| 35 | 3 47 |  | 34754.4 |  |  |  |  |  |  |  |  |  |
|  | $\left\|\begin{array}{ccc} 3 & 42 & 50 \cdot 3 \\ 3 & 28 & 30 \cdot 1 \end{array}\right\|$ |  | 34342 |  | 344 |  | 345 | 75 | 34 | 7 |  |  |
| $\begin{aligned} & 37 \\ & 38 \end{aligned}$ | $\left\|\begin{array}{llll} 3 & 38 & 39 \cdot I \\ 3 & 34 & 27 \cdot 9 \end{array}\right\|$ | . 89 | (139 | $\cdot 84$ | 3 4020.50 | 79 |  | $\begin{array}{r}74 \\ .73 \\ \hline\end{array}$ | $34736 \cdot 9$ |  |  | . 63 |
| 39 | 330 | + | $\begin{array}{lll}3 & 31 & 8.5\end{array}$ | + 88 | $\begin{array}{llll}3 & 31 & 56.9\end{array}$ | + 78 | 33 | + 72 | 333 |  | $\begin{array}{llll}3 & 34 & 2.6 \\ 3\end{array}$ |  |
| 40 |  |  |  |  |  |  | $\begin{array}{llll}3 & 28 & 29.8 \\ 3 & 24 & 17.8\end{array}$ |  |  |  |  |  |
| $\begin{aligned} & 41 \\ & 42 \end{aligned}$ | $\left\lvert\, \begin{array}{lll} 3 & 21 & 54 \\ 3 & 17 & 43 \end{array}\right.$ |  | $\begin{array}{llll}3 & 22 \\ 3 & 18 \\ 3 & 34\end{array}$ |  | [123 $\begin{aligned} & 3 \\ & 3 \\ & 19\end{aligned}$ |  | $\begin{array}{llll}3 & 24 & 178 \\ 3 & 20 & 5.7 \\ 3 & 5 & 5\end{array}$ |  | 324 320 3 |  | $32535 \cdot 5$ |  |
| 43 | 313 |  | 3 |  | 31510.6 | 75 | 3 15 | 69 | 316 |  |  |  |
|  | 39 | + 88 | 5 | + 8 81 | 31059.2 | + 75 | 31142.0 | + 68 |  | 61 | 1 |  |
| 46 |  |  | 4 |  |  |  |  |  |  |  |  |  |
| 47 | 256 | . 88 | 57 | . 80 | $25825 \cdot 4$ |  | 259 | 66 | 25944 |  | 16.8 |  |
| 48 | 252 | 88 | 53 | 80 | 254 14. | 73 | 254 | 65 | 255 |  | 256 4-1 |  |
| 49 50 | 2 48  <br> 2 48 $26 \cdot 8$ <br>  15 8 | + 88 | 2 2 2 | + 8.80 |  | + 72 |  | + 64 |  |  | 25151.4 |  |
| 5 5 |  |  | $24055 \cdot 4$ |  | I | - 7 | 242 |  |  |  | 243 |  |
| 52 | 2 |  | $3644 \cdot 4$ | . 80 | 2 | 7 | 238 |  | 23844 |  | - |  |
| 53 | 231 | -90 | 232 |  | 233 | 71 | 233 | 62 | 234 | 52 | $2 \begin{array}{lll}235 & 1.6\end{array}$ | 43 |
| 54 55 | 2 | + 90 | 228 |  | $\begin{array}{llll}29 & 769\end{array}$ |  | 2 |  |  |  | 2 |  |
| 55 <br> 56 | 2 23 19.8 <br> 2 19 8.4 |  |  |  | $\begin{array}{llll}2 & 24 & 56.9 \\ 2 & 20 & 46.0\end{array}$ |  | 225 |  | 226 221 |  |  |  |
|  | ${ }_{2} \mathbf{1 4} 456.9$ |  | 154 |  | $216{ }^{3}{ }^{\circ}$ | 71 | 21714 | . 6 | 21746 |  | 21813 |  |
| 58 | 2 10 $45 \cdot 2$ |  | 113 |  |  |  | $213 \quad 3.2$ |  | 21335 |  | 214 |  |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{cc} \text { s. } & \text { s. } \\ +\quad 93 & -4.28 \end{array}$ |  | $\begin{array}{cc} \text { S. } & \text { s. } \\ +\mathbf{1} \cdot 01 & -4 \cdot 30 \end{array}$ |  | $\begin{array}{cc} \text { S. } & \text { s. } \\ +1.09 & -4.32 \end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ +1 \cdot 17 & -4 \cdot 34 \end{array}$ |  | $\begin{array}{cc} \text { S. } & \text { S. } \\ +\mathrm{I} \cdot 26 & -4.37 \end{array}$ |  | $\begin{array}{cc} \mathrm{S} & \mathrm{~S} \\ +\mathrm{r} \cdot 34 & -4 \cdot 39 \end{array}$ |  |
| 4 | . 84 | 4.26 | . 92 | $4 \cdot 28$ | 1.00 | 4.30 | I.08 | 4.32 | 1.16 | 4.34 | I. 24 | 4.36 |
| 8 | $\cdot 75$ | 4.25 | - 83 | $4 \cdot 26$ | -91 | $4 \cdot 28$ | -99 | $4 \cdot 30$ | 1.07 | $4 \cdot 32$ | I-15 | $4 \cdot 34$ |
| 12 | -66 | 4.23 | $\cdot 74$ | $4 \cdot 25$ | - 82 | $4 \cdot 26$ | -90 | $4 \cdot 28$ | -99 | $4 \cdot 30$ | $1 \cdot 07$ | $4 \cdot 32$ |
| 16 | -58 | $4 \cdot 22$ | -66 | $4 \cdot 23$ | -74 | $4 \cdot 25$ | -83 | $4 \cdot 26$ | -91 | $4 \cdot 28$ | -99 | $4 \cdot 30$ |
| 20 |  | $4 \cdot 21$ | r+.59.55.51.47.44 | $4 \cdot 22$ | a+.67.63.59.56.52 | $4 \cdot 23$ | r+.75.71.68.64.61 | $4 \cdot 25$ | r+.83.80.76.73.69 | $\begin{aligned} & 4 \cdot 26 \\ & 4 \cdot 26 \end{aligned}$ | r+.92.88.85.81 | $\begin{aligned} & 4 \cdot 28 \\ & 4 \cdot 28 \\ & 4 \cdot 27 \\ & 4 \cdot 26 \\ & 4 \cdot 25 \end{aligned}$ |
| 22 | +.5 <br> .4 <br> $\cdot 4$ <br> $\cdot$ <br> $\cdot 39$ <br> $\cdot 35$ | $4 \cdot 21$ |  | $4 \cdot 22$ |  | 4.23 |  | $4 \cdot 25$ |  |  |  |  |
| 24 |  | $4 \cdot 20$ |  | $4 \cdot 21$ |  | $4 \cdot 22$ |  | $4 \cdot 24$ |  | $4 \cdot 25$ |  |  |
| 26 |  | 4.20 |  | 4.21 |  | $4 \cdot 22$ |  | $4 \cdot 23$ |  | $4 \cdot 25$ |  |  |
| 28 |  | $4 \cdot 20$ |  | $4 \cdot 20$ |  | 4.21 |  | $4 \cdot 23$ |  | $4 \cdot 24$ |  |  |
| 30 | $+\quad .31$$\cdot 2$$\cdot 2$$\cdot$$\cdot 19$ | $4 \cdot 20$ | $+\quad .40$.36.32.29.25 | $4 \cdot 20$ | +49+45.42.38.34 | 4.21 | a+.57.54.51.47.44 | $4 \cdot 22$ | a+.66.63.60.57.54 | $\begin{aligned} & 4 \cdot 24 \\ & 4 \cdot 23 \\ & 4 \cdot 23 \\ & 4 \cdot 22 \\ & 4 \cdot 22 \end{aligned}$ | (+.75.72.69.66 | $\begin{aligned} & 4.25 \\ & 4.24 \\ & 4.24 \\ & 4.23 \\ & 4.23 \end{aligned}$ |
| 32 |  | $4 \cdot 19$ |  | $4 \cdot 20$ |  | $4 \cdot 21$ |  | $4 \cdot 22$ |  |  |  |  |
| 34 |  | $4 \cdot 19$ |  | $4 \cdot 20$ |  | $4 \cdot 20$ |  | $4 \cdot 21$ |  |  |  |  |
| 36 |  | 4.19 |  | $4 \cdot 19$ |  | $4 \cdot 20$ |  | $4 \cdot 21$ |  |  |  |  |
| 38 |  | $4 \cdot 19$ |  | 4.19 |  | $4 \cdot 20$ |  | $4 \cdot 2 \mathrm{I}$ |  |  |  |  |
| 40 | + | 4-18 | .$+\quad .21$.17.13.09.05 | $4 \cdot 19$ | r$+\quad 31$.27.24.20.16 | $4 \cdot 19$ | r$+\quad .41$.37.34.31.27 | $4 \cdot 20$ | r+.50.47.44.41 | $\begin{aligned} & 4 \cdot 2 I \\ & 4 \cdot 2 I \\ & 4 \cdot 2 I \\ & 4 \cdot 20 \\ & 4 \cdot 20 \end{aligned}$ | $\begin{array}{r} +60 \\ .57 \\ .55 \\ .52 \\ .49 \end{array}$ | $\begin{aligned} & 4 \cdot 22 \\ & 4.22 \\ & 4 \cdot 22 \\ & 4 \cdot 21 \\ & 4 \cdot 21 \end{aligned}$ |
| 42 |  | $4 \cdot 18$ |  | $4 \cdot 18$ |  | 4.19 |  | $4 \cdot 20$ |  |  |  |  |
| 44 | + . 03 | $4 \cdot 18$ |  | $4 \cdot 18$ |  | $4 \cdot 19$ |  | $4 \cdot 20$ |  |  |  |  |
| 46 | - 01 | $4 \cdot 18$ |  | $4 \cdot 18$ |  | 4.19 |  | $4 \cdot 19$ |  |  |  |  |
| 48 | -06 | $4 \cdot 18$ |  | $4 \cdot 18$ |  | 4.19 |  | 4.19 |  |  |  |  |
| 50 | - II | 4.18 | + -0I | $4 \cdot 18$ | (+.12.08.04.00 | $4 \cdot 18$ | + $\cdot 24$ | $4 \cdot 19$ | + 35 | $4 \cdot 20$ | + 47 | $4 \cdot 21$ |
| 52 | -16 | 4.19 | - .04 | $4 \cdot 18$ |  | $4 \cdot 18$ | -20 | 4.19 | $\cdot 32$ | $4 \cdot 20$ | -44 | 4.21 |
| 54 | - 21 | 4.19 | -09 | 4.18 |  | 4.18 | -17 | 4.19 | - 29 | 4.19 | -42 | $4 \cdot 20$ |
| 56 | $\cdot 27$ | $4 \cdot 19$ | -14 | $4 \cdot 19$ |  | 4.18 | -13 | 4.18 | - 26 | 4.19 | -39 | $4 \cdot 20$ |
| 58 | -33 | 4.19 | -19 | 4.19 | -.05 | 4.18 | -09 | 4.18 | - 23 = | 4.19 | $\cdot 37$ | $4 \cdot 20$ |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 73 LATITUDE $17^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | $\begin{aligned} & \text { Decl } \\ & \text { Var. } \end{aligned}$ | $19^{\circ}$ |  | $20^{\circ}$ | Decl | $21^{\circ}$ |  | $22^{\circ}$ |  | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{aligned} & \text { H. M. } \\ & 622 \end{aligned}$ | $\begin{gathered} \text { s. } \\ +r \cdot 36 \end{gathered}$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 24 \\ \text { IO. } \end{array}\right\|$ | $+1 \cdot 37$ | H. M. S. | $\begin{gathered} \mathrm{S} . \\ +\mathrm{r} \cdot 39 \end{gathered}$ | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 26 \\ 57 \cdot 5 \end{array}\right.$ | $+1.4 I$ | $\left.\begin{array}{\|ccc\|} \hline \text { H. M. } & \text { S. } \\ 6 & 28 & 22 \cdot 9 \end{array} \right\rvert\,$ | 1.43 | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 29 \end{array}\right\|$ | S. |
| 10 | 5385 | 1. | $\begin{array}{llll}5 & 40 & 5 \cdot 3\end{array}$ | I-II | 54111.7 | I-It | $54218 \cdot 2$ | I-II | 54324.6 | I.II | 544 3r•3 | II |
| 12 | 5301 | 1.06 | 53121.2 | 06 | $53224 \cdot 7$ | I.05 | 53327.9 | $1 \cdot 05$ | $5343 \mathrm{r} \cdot \mathrm{O}$ | I. 05 | 53534.0 | . 05 |
|  | $52137 \cdot 6$ | $1 \cdot 02$ | 52238.6 | . 01 | 523 39•I | 1.00 | $52439 \cdot 2$ | $1 \cdot 00$ | $52539 \cdot 0$ | 99 | 52638.4 | 99 |
| 16 | 512 | $\cdot 98$ | $\left\lvert\, \begin{array}{lllll}5 & 13 & 57 \cdot 2\end{array}\right.$ | -97 | $514 \quad 54.9$ | 96 | $515 \quad 52 \cdot \mathrm{O}$ | '95 | $51648 \cdot 5$ | 94 | $51744 \cdot 4$ | 93 |
| 18 | 5 4 412 | + 94 | $5 \quad 517 \times 0$ | + 92 | 56 | + 91 | $5{ }_{5} 78 \cdot 1$ | + 89 | $5 \quad 759.4$ | + 88 | 852.0 | $+.87$ |
| 20 | $45544 \cdot 6$ | -90 | $45638 \cdot 0$ | $\cdot 88$ | $45730 \cdot 2$ | . 86 | $458 \quad 21 \cdot 5$ | -84 | $459 \mathrm{II} \cdot 7$ | . 83 | 5 5 0-0.9 | .81 |
| 22 | 447 9.0 | -86 | 44759.9 | -84 | $44849 \cdot 6$ | 82 | $44938 \cdot 0$ | $\cdot 79$ | $45025 \cdot 1$ | $\cdot 77$ | $45111 \cdot 0$ | $\cdot 75$ |
| 24 | $43^{88} 34 \cdot 3$ | $\cdot 82$ | 43922.9 |  | 4409.9 | 77 | 44055.5 | 5 | 44139.7 | $\cdot 72$ | $\begin{array}{llll}4 & 42 & 22 \cdot 3\end{array}$ | 70 |
| 26 | $\begin{array}{ll}30 & 0.5\end{array}$ | 78 | $43046 \cdot 7$ | $\cdot 76$ | 43131 | 73 | $432 \mathrm{I} 4 . \mathrm{I}$ | $\cdot 70$ | $43255 \cdot 2$ |  | 433 34.6 | 64 |
| 28 | $42127 \cdot 4$ | + 75 | 422 | + 72 | 422 | + 68 | 42333.6 | + 65 | 42411.8 | + 62 | $4244^{8 \cdot 0}$ | + 59 |
| 30 | $1255 \cdot 1$ | $\cdot 71$ | $4 \begin{array}{llllll}4 & 36.9\end{array}$ | . 68 | 41416.5 | 64 | 41453.9 | . 60 | 4151592 | 57 | $4 \begin{array}{lll}4 & 16 & 2 \cdot 3\end{array}$ | 53 |
| 31 | 839.3 |  | $4 \begin{array}{lll}4 & 9 & 19.9\end{array}$ | -66 | $\begin{array}{lllll}4 & 9 & 58 \cdot 3\end{array}$ | -62 | 4 10 34.4 | -58 | 4 II 8.2 | 54 | 4 II 39.7 | 50 |
| 32 | $423 \cdot 6$ | - 68 | $\begin{array}{llll}4 & 5 & 3 \cdot 1 \\ 4 & 0 & 46.5\end{array}$ | -64 | $\begin{array}{llll}4 & 5 & 40 \cdot 3\end{array}$ | -60 | $\begin{array}{llll}4 & 6 & 15.0 \\ 4 & 15\end{array}$ | 56 | $\begin{array}{llll}4 & 6 & 47 \cdot 4\end{array}$ | 52 | 4717 | - 48 |
| 33 | 4 | -66 | 4 - $046 \cdot 5$ |  | $4 \begin{array}{lll}4 & 1 & 22.4\end{array}$ | 58 | 4 I 55 | 53 | $226 \cdot 7$ | 49 | 4 | -45 |
| 34 |  | + 64 | $\begin{array}{lllll}3 & 56 & 30 \cdot 0\end{array}$ | + 60 | 357 | + 56 | 35736 | + 51 | $\begin{array}{lll}3 & 58 & 6 \cdot 3\end{array}$ | $+$ | $35^{58} 33.0$ | + $\cdot 42$ |
|  | $\begin{array}{lllllll}3 & 51 & 37.4\end{array}$ | . 63 |  | $\cdot 58$ |  | 53 | 35318 | -49 | $35346 \cdot 0$ | $\cdot 44$ | $35411 \cdot 2$ | 39 |
| 36 | $34722 \cdot 3$ | -61 | $34757 \cdot 6$ | $\cdot 56$ | $\begin{array}{llll}3 & 48 & 29.9\end{array}$ | 51 | 34859.4 | 47 | 34925.9 | 42 | 349 | 37 |
| 37 | $\begin{array}{lllll}3 & 43 & 7 \cdot 4 \\ 3 & 38 & 5\end{array}$ | $\cdot 59$ | $\begin{array}{llll}3 & 43 & 41 \cdot 6\end{array}$ | 54 |  | 49 | $34440 \cdot 9$ | 44 | $\begin{array}{lll}3 & 45 & 5 \cdot 9\end{array}$ |  | $\begin{array}{lllllllllll} & 45 & 27.8\end{array}$ | -34 |
| 38 | $3{ }^{3} 5$ | -58 | $3 \quad 3925.7$ | 52 | 339 | 47 | $34022 \cdot 5$ | 42 | $34046 \cdot 1$ |  | $3 \begin{array}{lll}31 & 6 \cdot 4\end{array}$ | -31 |
| 39 | 34 | + 56 | $3 \begin{array}{llll}3 & 35 & 10 \cdot 0\end{array}$ | + 51 | $\begin{array}{lllll}3 & 35 & 38 \cdot 8\end{array}$ | + 45 | $\begin{array}{llll}3 & 36 & 4 \cdot 3\end{array}$ | + 40 | $3 \begin{array}{llll}36 & 26 \cdot 3\end{array}$ | + 34 |  | + 28 |
| 40 | 3023.4 | -54 | 33054.4 | 49 | 33122.0 | 43 | 3 31 46•I | . 37 | $\begin{array}{lll}3 & 32 & 6 \cdot 8\end{array}$ | 1 | 33223.8 | -25 |
| 41 | $\begin{array}{llll}3 & 26 & 9^{\circ} \mathrm{O} \\ 3 & 21\end{array}$ | 53 | $\begin{array}{llll}3 & 26 & 39^{\circ} \mathrm{O}\end{array}$ | 47 | $\begin{array}{lll}3 & 27 & 5.4 \\ 3 & 22 & 4\end{array}$ | 41 | $\begin{array}{llll}3 & 27 & 28 \cdot 1 \\ 3 & 23\end{array}$ | 5 | $\begin{array}{llllllll}3 & 27 & 47 \cdot 3\end{array}$ |  | 3 28 2.7 | 23 |
| 42 | $\begin{array}{lllllllllllll}3 & 21 & 54.7\end{array}$ | -51 |  | 45 | 3 $322 \begin{array}{lll}48\end{array}$ | 39 | $\begin{array}{llll}3 & 23 & 10 \cdot 3\end{array}$ | $\cdot 32$ | $\begin{array}{llll}3 & 23 & 27 \cdot 9\end{array}$ |  | 323 41.6 | 20 |
| 43 | 317 | -50 | $\begin{array}{lllll}3 & 18 & 8.5\end{array}$ | 43 |  | 37 | $\begin{array}{lllllllllllllllll}3 & 18 & 52 \cdot 5\end{array}$ | $\cdot 30$ | $\begin{array}{llllllllllll}3 & 19 & 8\end{array}$ | 23 | $31920 \cdot 7$ | -17 |
| 44 | 313 | + 48 | $\begin{array}{lllll}3 & 13 & 53.3\end{array}$ | + 41 |  | + 35 |  | + 28 | 314494.4 | $+21$ | $\begin{array}{llllllllll}3 & 14 & 59 \\ 3\end{array}$ | 14 |
| 46 | 8.7 | -46 | 38 | $\cdot 39$ | $\begin{array}{llll}3 & 9 & 59.9\end{array}$ | -32 | 31017.3 | 5 | 3 10 $30 \cdot 3$ | -18 | 3 10 $38 \cdot 9$ |  |
| 46 | $\begin{array}{llll}3 & 4 & 58 \cdot 7\end{array}$ | 45 | $23 \cdot 5$ | 36 | $\begin{array}{llll}3 & 5 & 44.0\end{array}$ | -30 | $\begin{array}{lllll}3 & 5 & 59.8\end{array}$ | - 23 | 3 6 11•3 |  | $\begin{array}{llllll}3 & 6 & 18.2\end{array}$ | -8 |
| 47 | $\begin{array}{llll}3 & 0 & 45 \cdot 0\end{array}$ | -43 | 3 1 $8 \cdot 7$ <br> 2 56 54 | $\cdot 36$ | $\begin{array}{llll}3 & 1 & 27.9 \\ 2 & 57 & 11\end{array}$ | 28 | $\begin{array}{llll}3 & 1 & 42.4 \\ 2 & 57 & \end{array}$ | 20 | $\begin{array}{llllll}3 & 1 & 52 \cdot 3\end{array}$ | 12 | 57.4 | 04 |
| 48 | $25631 \cdot 4$ | -42 | 25654.0 | -34 | 257119 | -26 | $25725: 1$ | -18 | $25733 \cdot 4$ | -10 | $25736 \cdot 7$ | + or |
| 49 | $\begin{array}{lllllll}2 & 52 & 17 & \\ 2 & 48\end{array}$ | + 40 | ${ }_{2}^{2} 52239.4$ | + 32 | $25256 \cdot 1$ | + 24 | $\begin{array}{llll}2 & 53 & 7 \cdot 8\end{array}$ | + 15 | $2{ }_{2} 5314.5$ | + .07 | 25316.0 |  |
| 50 | $\begin{array}{llll}2 & 48 & 4 \cdot 4 \\ 2 & 43\end{array}$ | $\cdot 38$ | $\begin{array}{llll}2 & 48 & 24.9\end{array}$ | 30 | $\begin{array}{llll}248 & 40 \cdot 4\end{array}$ | 21 | $\begin{array}{llll}2 & 48 & 50 \cdot 6\end{array}$ | 13 | $24^{2} 555 \cdot 6$ | - 04 | 2 <br> 48 <br> 2 $5^{\prime} 2$ | ${ }^{\circ} 8$ |
| 51 | $\begin{array}{llllll}2 & 43 & 51 \cdot 0 \\ 2 & 30\end{array}$ | $\cdot 37$ |  | 28 |  | -19 | 24433. | - 10 | $24436 \cdot 8$ | + | $\begin{array}{ll}2 & 44 \\ 2 & 34.5\end{array}$ | -08 |
| 52 | $\begin{array}{llllll}2 & 39 & 37 \cdot 7\end{array}$ | 35 | $23956 \cdot \mathrm{I}$ | -26 | $\begin{array}{llll}2 & 40 & 9.0\end{array}$ | -17 | 24016.3 | -07 | $\begin{array}{llll}2 & 40 & 17.9\end{array}$ | - 02 | $2 \begin{array}{llllllll}2 & 40.7\end{array}$ | 12 |
| 53 | 23524.5 | 34 | 23541.9 | 24 | $235 \quad 53.4$ | -14 | 235159.2 | -05 | 23559.0 | -05 | $235 \quad 52 \cdot 8$ | 15 |
| 54 | $\begin{array}{lllll}2 & 31 & 1114 \\ 2 & 26 & 58.4\end{array}$ | + 32 | $\begin{array}{lllll}2 & 31 & 27 \cdot 7 \\ 2 & 27 & 13.5\end{array}$ | + 22 | $\begin{array}{lllll}2 & 31 & 37.9\end{array}$ | $+\cdot 12$ | $\begin{array}{llll}2 & 31 & 42 \cdot 1\end{array}$ | +.02 | $2 \begin{array}{llll}21 & 40 \cdot 2\end{array}$ | -08 | 23131.9 | -19 |
| 55 | $\begin{array}{lllll}2 & 26 & 58 \cdot 4 \\ 2 & 22 & 45 \cdot 4\end{array}$ | -30 | $\begin{array}{llll}2 & 27 & 13.5 \\ 2 & 22 & 59.5\end{array}$ | 20 | $\begin{array}{lllll}2 & 27 & 22.4 \\ 2 & 23 & 6.9\end{array}$ | 10 | $\begin{array}{lllll}2 & 27 & 25.0\end{array}$ | - O | $\begin{array}{lll}2 & 27 & 21.2 \\ 2 & 23 & 2.3\end{array}$ | -12 | $22710 \cdot 9$ | 23 |
| 56 | 2 22 $45 \cdot 4$ <br> 2 18  | 29 | $\begin{array}{lllll}2 & 22 & 59.5\end{array}$ | 18 | $\begin{array}{llll}2 & 23 & 6.9\end{array}$ | 07 | $\begin{array}{llll}2 & 23 & 7.9\end{array}$ | 04 | $\begin{array}{lll}2 & 23 & 2 \cdot 3\end{array}$ | 15 | 22249.7 | 27 |
| 57 | $\begin{array}{lllll}2 & 18 & 32.5\end{array}$ | 27 | $\begin{array}{lllll}2 & 18 & 45.4\end{array}$ | 16 | $\begin{array}{llllll}2 & 18 & 51.5\end{array}$ | 05 | $\begin{array}{llll}2 & 18 & 50 \\ 2\end{array}$ | 07 | 2 I 843.2 | 19 | $2 \begin{array}{lllllll} & 18 & 28.3\end{array}$ | 31 |
| 58 | 21419.7 | 25 | 2143 | ${ }^{1} 14$ | 21436 | . 02 | 21433 |  | 14 |  | 214 | -35 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. 23 | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | S. +1.43 | $\begin{gathered} s \\ -4.42 \end{gathered}$ | $\stackrel{s}{s}+1 \times 5$ | $\begin{gathered} \mathrm{S} \\ -4.45 \end{gathered}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 60 \end{gathered}$ | S. -4.48 | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 69 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4.5 \mathrm{I} \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 78 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 54 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 87 \end{gathered}$ | $\begin{gathered} s \\ -4 \cdot 58 \end{gathered}$ |
| 4 | 1.33 | $4 \cdot 39$ | 1.41 | 4.41 | I.50 | 4 | I.58 | 4.47 | 1.67 | 4.50 | I.76 | 4.54 |
| 8 | 1. 24 | $4 \cdot 36$ | $1 \cdot 32$ | $4 \cdot 38$ | I. 40 | $4 \cdot 41$ | 1.49 | $4 \cdot 44$ | $1 \cdot 58$ | 4.47 | I. 66 | 4.50 |
| 12 | I-15 | 4.34 | 1.23 | $4 \cdot 36$ | 1-32 | $4 \cdot 38$ | 1.40 | 4.41 | 1.49 | $4 \cdot 44$ | I. 58 | $4 \cdot 47$ |
| 16 | I•07 | 4.32 | I•16 | $4 \cdot 34$ | 1.24 | $4 \cdot 36$ | $1 \cdot 32$ | $4 \cdot 39$ | 1.41 | $4 \cdot 41$ | 1.50 | 4.44 |
| 20 | +1.00 | $4 \cdot 30$ | +I.08 | $4 \cdot 32$ | +1.17 | $4 \cdot 34$ | +I.26 | $4 \cdot 37$ | +1.34 | 4.39 | +1.43 | $4 \cdot 42$ |
| 22 | -96 | $4 \cdot 29$ | I.05 | $4 \cdot 31$ | I-14 | $4 \cdot 33$ | I. 22 | $4 \cdot 36$ | $1 \cdot 31$ | $4 \cdot 38$ | I 40 | $4 \cdot 41$ |
| 24 | -93 | $4 \cdot 28$ | I.02 | $4 \cdot 30$ | 1-II | $4 \cdot 32$ | I-19 | $4 \cdot 35$ | 1. 28 | $4 \cdot 37$ | 1.37 | $4 \cdot 40$ |
| 26 | -90 | $4 \cdot 28$ | '99 | $4 \cdot 30$ | 1.07 | $4 \cdot 32$ | I•16 | $4 \cdot 34$ | 1.25 | $4 \cdot 36$ | 1.34 | $4 \cdot 39$ |
| 28 | $\cdot 87$ | $4 \cdot 27$ | $\cdot 96$ | $4 \cdot 29$ | 1.04 | $4 \cdot 31$ | I•13 | $4 \cdot 33$ | I'22 | $4 \cdot 36$ | I•3 | $4 \cdot 38$ |
| 30 | +.84 | 4.27 | + 93 | $4 \cdot 29$ | +1.02 | $4 \cdot 30$ | +1.11 | $4 \cdot 33$ | +1.20 | $4 \cdot 35$ | +1.29 | $4 \cdot 38$ |
| 32 | -81 | $4 \cdot 26$ | -90 | $4 \cdot 28$ | -99 | $4 \cdot 30$ | 1.08 | $4 \cdot 32$ | 1-18 | $4 \cdot 34$ | I. 27 | $4 \cdot 37$ |
| 34 | $\cdot 78$ | $4 \cdot 26$ | . 87 | $4 \cdot 27$ | -97 | $4 \cdot 29$ | 1.06 | $4 \cdot 31$ | I'15 | $4 \cdot 34$ | I. 25 | $4 \cdot 37$ |
| 36 | $\cdot 75$ | $4 \cdot 25$ | - 85 | $4 \cdot 27$ | -94 | $4 \cdot 29$ | 1.04 | 4.31 | 1.14 | $4 \cdot 33$ | I 23 | $4 \cdot 36$ |
| 38 | -73 | $4 \cdot 24$ | -82 | $4 \cdot 26$ | $\cdot 92$ | $4 \cdot 28$ | 1.02 | 4.31 | 1.12 | $4 \cdot 33$ | I.22 | $4 \cdot 36$ |
| 40 | + 70 | $4 \cdot 24$ | +.80 | $4 \cdot 26$ | + 90 | $4 \cdot 28$ | +1.00 | 4.30 | +1.10 | $4 \cdot 32$ | +1.20 | $4 \cdot 35$ |
| 42 | - 68 | $4 \cdot 24$ | -78 | $4 \cdot 25$ | . 88 | $4 \cdot 27$ | $\cdot 98$ | $4 \cdot 30$ | 1.09 | $4 \cdot 32$ | I'19 | $4 \cdot 35$ |
| 44 | -65 | 4.23 | $\cdot 76$ | 4.25 | -86 | $4 \cdot 27$ | -97 | 4.29 | 1.08 | $4 \cdot 32$ | I-I9 | $4 \cdot 35$ |
| 46 | -63 | 4.23 | $\cdot 74$ | 4.25 | . 85 | $4 \cdot 27$ | $\cdot 96$ | 4.29 | 1.07 | $4 \cdot 32$ | I-I8 | $4 \cdot 35$ |
| 48 | -61 | 4.23 | $\cdot 72$ | $4 \cdot 24$ | . 83 | $4 \cdot 26$ | -95 | $4 \cdot 29$ | 1.06 | $4 \cdot 31$ | I-18 | $4 \cdot 34$ |
| 50 | + . 58 | $4 \cdot 22$ | + 70 | $4 \cdot 24$ | +.82 | $4 \cdot 26$ | + 94 | $4 \cdot 29$ | + I.06 | 4.31 | +I.18 | $4 \cdot 35$ |
| 52 | - 56 | $4 \cdot 22$ | + 69 | $4 \cdot 24$ | .81 | $4 \cdot 26$ | -93 | $4 \cdot 28$ | I.06 | $4 \cdot 31$ | I'I8 | $4 \cdot 35$ |
| 54 | -54 | $4 \cdot 22$ | -67 | 4.24 | -80 | $4 \cdot 26$ | -93 | $4 \cdot 28$ | 1.06 | $4 \cdot 31$ | I•9 | $4 \cdot 35$ |
| 56 | -52 | 4.22 | -66 | $4 \cdot 23$ | $\cdot 79$ | $4 \cdot 26$ | $\cdot 93$ | $4 \cdot 28$ | 1.07 | $4 \cdot 32$ | I-21 | $4 \cdot 35$ |
| 58 | -51 | 4.21 | . 65 | 4.23 | -79 | $4 \cdot 25$ | $\cdot 93$ | $4 \cdot 28$ | I.08 | $4 \cdot 32$ | I. 23 | $4 \cdot 36$ |

# 74 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT. LATITUDE $18^{\circ}$. 

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}\right.$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 30 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & \text { I } 8 \cdot 0 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 30 \end{gathered}$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 2 & 36 \cdot I \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 30 \end{gathered}$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 . & 3 & 54^{\circ} 2 \end{array}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 30 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & \text { I2. } \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 3 \mathrm{I} \end{gathered}$ | $\begin{array}{ccc} \mathrm{H}, \mathrm{M} . & \mathrm{S} . \\ 6 & 6 & 3 \mathrm{I} \cdot \mathrm{o} \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 3 \mathrm{I} \end{gathered}$ |
| 10 | $51785 \cdot 1$ | I. 32 | 5 I9 14.0 | I•31 | $52032 \cdot 1$ | I. 29 | $\begin{array}{llll}5 & 21 & 49.5\end{array}$ | I. 28 | $\begin{array}{llll}5 & 23 & 6 \cdot 0\end{array}$ | I.27 | $\begin{array}{llll}5 & 24 & 22 \cdot 0\end{array}$ | I. 26 |
| 12 | $\begin{array}{llll}5 & 9 & 29.4\end{array}$ | I. 33 | 5 IO $48 \cdot 8$ | I 31 | $512 \quad 7 \cdot 2$ | I. 30 | 513124.7 | I 28 | 5 I4 4I'3 | 1.27 |  | $1 \cdot 25$ |
| 14 | $\begin{array}{llll}5 & 1 & 3 \cdot 3\end{array}$ | I. 34 | $\begin{array}{llll}5 & 2 & 23 \cdot 3\end{array}$ | I 32 | $\begin{array}{llll}5 & 3 & 42 \cdot 2\end{array}$ | I 30 | 5 4 59  | I 29 | $\begin{array}{llll}5 & 6 & 16 \cdot 6\end{array}$ | 1.27 | $\begin{array}{llll}5 & 7 & 32 \cdot 3\end{array}$ | I. 25 |
| 16 | $4 \begin{array}{llll}4 & 52 & 36 \cdot 6\end{array}$ | I.36 | $4 \begin{array}{lllll}4 & 53 & 57 \cdot 4\end{array}$ | I.33 | 45516.8 | I'3I | $45635^{\circ} \mathrm{O}$ | I.29 | $4575 x \cdot 8$ | I.27 | 45975 | I. 25 |
| 18 | $444 \quad 9.4$ | +1.37 | $4453 \mathrm{I} \cdot 1$ | + I•35 | $4465 \mathrm{I} \cdot 2$ | +1.32 | $4 \begin{array}{lll}4 & 48 & 9 \cdot 8\end{array}$ | +1.30 | $44927 \cdot 0$ | + I. 27 | $45042 \cdot 8$ | + 1.25 |
| 20 | 435415 | 1-39 | $\begin{array}{lll}4 & 37 & 4.2\end{array}$ | I.36 | $43825 \cdot 1$ | $1 \cdot 33$ | $43944 \cdot 4$ | $1 \cdot 31$ | $44 \mathrm{I} 2 \cdot 0$ | 1-28 | 442 18.1 | I 25 |
| 22 | 42712.9 | 1.41 | $42836 \cdot 7$ | I $3^{8}$ | $42958 \cdot 6$ | I-35 | 43118.6 | 1.32 | $43236 \cdot 8$ | 1.29 | $433 \begin{array}{llll}4 & 53 \cdot 2\end{array}$ | I. 26 |
| 24 | 4 I8 43.3 | I 44 | 42080.5 | I.40 | 42131.4 | I.36 | $\begin{array}{llll}4 & 22 & 52.4\end{array}$ | I-33 | 424 II.2 | I 30 | $425 \quad 28 \cdot 1$ | 26 |
| 26 | 4 10 12.7 | I.46 | 4 II $39 \cdot 3$ | I.42 | $\begin{array}{llll}4 & 13 & 3.6\end{array}$ | I.38 | $4 \begin{array}{llll}4 & 14 & 25 \cdot 6\end{array}$ | 1.35 | $41545 \cdot 2$ | I.3I | 4 17 $2 \cdot 7$ | I. 27 |
| 28 | 4 I 40.9 | +I.49 | $4 \begin{array}{lll}4 & 3 & 9 \cdot 3\end{array}$ | +I.45 | $4 \quad 435^{\circ} \mathrm{O}$ | +1.4 | $4 \quad 5 \quad 58 \cdot \mathrm{I}$ | +1.36 | $4 \quad 718.8$ | +1.32 | $4 \quad 8 \quad 37 \cdot 0$ | +1.28 |
| 30 | $\begin{array}{llll}3 & 53 & 7.8\end{array}$ | I.53 | $\begin{array}{llll}3 & 54 & 38 \cdot 0\end{array}$ | I.48 | $\begin{array}{llll}3 & 56 & 5 \cdot 3\end{array}$ | I.43 | 3575729 | I.38 | $\begin{array}{lllll}3 & 58 & 51 \cdot 7\end{array}$ | I.34 | 4 O II.0 | I.30 |
| 32 | $34433 \cdot 2$ | I. 56 | $34^{3} 465.5$ | I.5I | $34734 \cdot 7$ | 1.46 | $349 \quad 0.8$ | 1.41 | $35024{ }^{\circ}$ | I. 36 | 35144.2 | I.3I |
| 33 | $34015 \cdot 2$ | I. 58 | $34148 \cdot 7$ | I.53 | $34318 \cdot 9$ | $1 \cdot 48$ | $34445 \cdot 9$ | 1.42 | $346 \quad 9.7$ | I•37 | $34730 \cdot 6$ | r.32 |
| 34 | $\begin{array}{llll}3 & 35 & 56 \cdot 8\end{array}$ | 1.60 | $\begin{array}{llll}3 & 37 & 31.5\end{array}$ | I.55 | $\begin{array}{llll}3 & 39 & 2 \cdot 8\end{array}$ | 1.49 | $34030 \cdot 7$ | 1.44 | $34155 \cdot 3$ | I. 38 | $34316 \cdot 9$ | I.33 |
| 35 | $33^{31} 38 \cdot 0$ | +1.63 | 33313.9 | +1.57 | $3 \begin{array}{lllllllll}3 & 34 & 46 \cdot 3\end{array}$ | +1.51 | $3 \quad 3615 \cdot 2$ | +I.45 | $313740 \cdot 7$ | +1.40 | $\begin{array}{lll}3 & 39 & 3.0\end{array}$ | + I. 34 |
| 36 |  | I. 65 | $\begin{array}{llll}3 & 28 & 55 \cdot 8\end{array}$ | I. 59 | $3 \begin{array}{llll}3 & 30 & 29.4\end{array}$ | I.53 | 3 31 59'3 | 1.47 | $\begin{array}{llll}3 & 33 & 25 \cdot 8\end{array}$ | I.4I | $3 \begin{array}{lllll}3 & 34 & 48 \cdot 8\end{array}$ | I.35 |
| 37 | $\begin{array}{llll}3 & 22 & 58 \cdot 6\end{array}$ | I. 68 | $\begin{array}{lllll}3 & 24 & 37 \cdot 3\end{array}$ | I.6I | $32612 \cdot 1$ | I. 55 | 32743.2 | 1.49 | $3 \begin{array}{llll}3 & 29 & 10.5\end{array}$ | I.43 | $33034 \cdot 5$ | 1.37 |
| 38 | $\begin{array}{lllllllllll}3 & 18 & 38\end{array}$ | I.70 |  | I. 64 | 32154.4 | I. 57 | $\begin{array}{llll}3 & 23 & 26 \cdot 6\end{array}$ | I. 50 | 3124550 | I.44 |  | I.38 |
| 39 |  | 1.73 | 3 I5 $58 \cdot 6$ | I. 66 | 3 I7 $36 \cdot 2$ | I.59 | 31989 | 1.52 | $320 \quad 39 \cdot 2$ | I 46 | $\begin{array}{lll}3 & 22 & 4.8\end{array}$ | I.39 |
| 40 | $\begin{array}{llll}3 & 9 & 54.8\end{array}$ | + $1 \cdot 76$ | 3 II $38 \cdot 4$ | +1.69 | 31317.5 | +r.6r | $31452 \cdot 3$ | +1.54 | 31623.0 | +1.48 | 3 I7 $49 \cdot 6$ | $+1.41$ |
| 41 | $\begin{array}{llll}3 & 5 & 32 \cdot 2\end{array}$ | I.79 | 3 7 17.5 | I•72 | $3{ }^{3}$ | I. 64 | 3 IO $34 \cdot 5$ | 1.57 | $\begin{array}{llll}3 & 12 & 6.4\end{array}$ | 1.50 | 3 I3 $34 \cdot 1$ | I. 43 |
| 42 | $\begin{array}{llll}3 & 1 & 8 \cdot 7\end{array}$ | I.83 | $\left[\begin{array}{rrrr}3 & 2 & 56 \cdot 0 \\ 2 & 58 & 33 \cdot\end{array}\right.$ | I.75 | $\begin{array}{llll}3 & 4 & 38 \cdot 4\end{array}$ | 1.67 | $3 \begin{array}{llll}3 & 6 & 16.2\end{array}$ | 1.59 | $\begin{array}{llll}3 & 7 & 49 \cdot 4\end{array}$ | I. 52 | $\begin{array}{llll}3 & 9 & 18.2 \\ 3 & 5 & 2.0\end{array}$ | . 44 |
| 43 | $\begin{array}{llll}2 & 56 & 44.4\end{array}$ | I.87 |  | I•78 | $3 \quad 0 \quad 17 \cdot 9$ | I.70 | 3 Irrer | I. 62 | $\begin{array}{lrrr}3 & 3 & 31 \cdot 9\end{array}$ | 1.54 | $\begin{array}{lll}3 & 5 & 2.0\end{array}$ | 1.46 |
| 44 | $25^{2} 2119 \cdot 1$ | I.90 | $25410 \cdot 6$ | I.81 | $2 \begin{array}{lllll} & 55 & 56 \cdot 7\end{array}$ | 1.73 | $2 \begin{array}{llllllll} & 57 & 37 \cdot 8\end{array}$ | I. 64 | 25913.9 | 1.56 | $3 \quad 0 \quad 45 \cdot 4$ | 1.48 |
| 45 | $2 \begin{array}{lllll}2 & 47 & 52.8\end{array}$ | + I.94 | $24946 \cdot 6$ | + 1.85 | $25134 \cdot 8$ | +1.76 | 25317.7 | +1.67 | $25455 \cdot 5$ | +1.59 | $\begin{array}{llll}2 & 56 & 28 \cdot 3\end{array}$ | +I.5I |
| 46 | $2 \begin{array}{llll}2 & 43 & 25.4\end{array}$ | I•99 | $245 \quad 21.6$ | I.89 | 247 12.1 | 1.79 | $248 \quad 57 \cdot 0$ | 1.70 | $25036 \cdot 4$ | 1.6I | $25210 \cdot 8$ | I. 53 |
| 47 | $2 \begin{array}{llll}2 & 38 & 56 \cdot 8\end{array}$ | 2.03 |  | I.93 | $2 \begin{array}{lllll}2 & 42 & 48 \cdot 4\end{array}$ | I. 83 | $24435 \cdot 4$ | $1 \cdot 74$ | $24616 \cdot 8$ | I. 64 | $\begin{array}{lllllllllllllllll}2 & 47 & 52 \cdot 7\end{array}$ | I. 55 |
| 48 | $23426 \cdot 9$ | $2 \cdot 08$ | $\begin{array}{llll}2 & 36 & 28 \cdot 7\end{array}$ | 1.97 | $\begin{array}{llll}2 & 38 & 23.9\end{array}$ | I.87 | $\begin{array}{lllll}2 & 40 & 13 & 1\end{array}$ | 1.77 | $\begin{array}{lllll}2 & 41 & 56.4\end{array}$ | I. 67 | $\begin{array}{llll}2 & 43 & 34 \cdot 1 \\ 2\end{array}$ | I. 58 |
| 49 | $2 \quad 2955 \cdot 6$ | $2 \cdot 14$ | $\begin{array}{lll}2 & 32 & 0.3\end{array}$ | 2.02 | $233 \begin{array}{llll} \\ 4 & 58\end{array}$ | I'9I | 23549.9 | 1.81 | $23735 \cdot 3$ | I• 7 | $2 \begin{array}{llll}2 & 39 & 14.8\end{array}$ | I. 1 |
| 50 | $\begin{array}{llll}2 & 25 & 22.7\end{array}$ | +2.19 | $22730 \cdot 7$ | $+2.07$ | 22931.6 | + I.96 | $2 \begin{array}{llll}21 & 25 \cdot 7\end{array}$ | +1.85 | 233153.4 | +I•74 | $2 \begin{array}{llll}2 & 34 & 54.9\end{array}$ | +I. 64 |
| 51 | $22048 \cdot 1$ | $2 \cdot 25$ | $1 \begin{array}{llll}2 & 22 & 59 \cdot 6\end{array}$ | $2 \cdot 13$ | $2 \begin{array}{lll}2 & 25 & 3.6\end{array}$ | $2 \cdot \mathrm{OI}$ | 2270.5 | I. 89 | 22850.6 | I.78 | $23034 \cdot 3$ | I. 67 |
| 52 | 2 I6 II•6 | $2 \cdot 32$ | $\begin{array}{llll}2 & 18 & 26 \cdot 9\end{array}$ | $2 \cdot 19$ | $22034 \cdot 2$ | 2.06 | $22234 \cdot 1$ | I.94 | $22426 \cdot 9$ | I.82 | $\begin{array}{lllll}2 & 26 & 12.8\end{array}$ | I•71 |
| 53 | $\begin{array}{llll}2 & 11 & 33 \cdot 1\end{array}$ | $2 \cdot 39$ | $\begin{array}{llll}2 & 13 & 52.4 \\ 2 & & \end{array}$ | 2.25 | $\begin{array}{llll}2 & 16 & 3 \cdot 4 \\ 2 & 11 & 30.9\end{array}$ | $2 \cdot 12$ | $\begin{array}{rrr}2 & 18 & 6 \cdot 5\end{array}$ | 1.99 | 2 20 $2 \cdot 1$ <br> 2 1  | 1.87 | $\begin{array}{llll}2 & 21 & 50.5 \\ 2 & 17 & 27.2\end{array}$ | I•75 |
| 54 | $2 \quad 6 \quad 52 \cdot 2$ | $2 \cdot 46$ | $2 \quad 9 \quad 15.9$ | $2 \cdot 32$ | 2 II 30*9 | 2•18 |  | 2.04 | 215 36.I | I'91 | 217127.2 | I•79 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ}$ A. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | s. | s. | s. |
| 0 | --00 | $-4.20$ | +.08 | -4.21 | $\pm \cdot 15$ | -4.21 | + 23 | -4.21 | + 31 | -4.22 | + 38 | $-4.22$ |
| 2 | -05 | $4 \cdot 21$ | +.03 | $4 \cdot 21$ | 11 | 4.21 | 18 | $4 \cdot 21$ | -26 | $4 \cdot 21$ | -34 | 4.22 |
| 4 | -09 | $4 \cdot 21$ | - 02 | $4 \cdot 20$ | -06 | $4 \cdot 21$ | -14 | 4.21 | -21 | $4 \cdot 21$ | -29 | $4 \cdot 22$ |
| 6 | -14 | $4 \cdot 21$ | -06 | $4 \cdot 21$ | + OI | 4.21 | -09 | 4.21 | -17 | $4 \cdot 21$ | - $\cdot 25$ | 4.21 |
| 8 | -19 | 4.2I | -II | $4 \cdot 21$ | - .03 | 4.20 | + 04 | 4.20 | -12 | 4.21 | - 20 | $4 \cdot 21$ |
| 10 | - $\cdot 24$ | $4 \cdot 21$ | - .16 | $4 \cdot 21$ | -.08 | 4.21 | - 01 | $4 \cdot 21$ | + .07 | $4 \cdot 21$ | + 15 | $4 \cdot 21$ |
| 12 | -29 | 4.21 | -21 | $4 \cdot 21$ | -13 | $4 \cdot 21$ | . 05 | 4.21 | + . 02 | $4 \cdot 20$ | -10 | $4 \cdot 21$ |
| 14 | -34 | $4 \cdot 22$ | -26 | $4 \cdot 21$ | -18 | 4.21 | -10 | $4 \cdot 21$ | - 02 | $4 \cdot 20$ | .05 | $4 \cdot 21$ |
| 16 | - 39 | 4.22 | -31 | $4 \cdot 22$ | -23 | 4.2 I | -15 | 4.2 I | $\cdot 07$ | $4 \cdot 20$ | + OI | 4.20 |
| 18 | -45 | 4.23 | $\cdot 36$ | $4 \cdot 22$ | -28 | 4.2I | $\cdot 20$ | $4 \cdot 21$ | -12 | $4 \cdot 2 \mathrm{I}$ | -. 04 | $4 \cdot 20$ |
| 20 | - . 50 | $4 \cdot 23$ | - 42 | $4 \cdot 22$ | - 33 | $4 \cdot 22$ | - 25 | 4.21 | - 17 | 4.21 | -.09 | $4 \cdot 20$ |
| 22 | - 56 | $4 \cdot 24$ | $\cdot 47$ | $4 \cdot 23$ | $\cdot 39$ | $4 \cdot 22$ | -30 | $4 \cdot 2 \mathrm{I}$ | $\cdot 22$ | $4 \cdot 21$ | -13 | $4 \cdot 21$ |
| 24 | -6I | 4.25 | -53 | $4 \cdot 24$ | -44 | $4 \cdot 23$ | $\cdot 36$ | $4 \cdot 22$ | $\cdot 27$ | $4 \cdot 21$ | -19 | 4.21 |
| 26 | -67 | 4.26 | -59 | $4 \cdot 24$ | -50 | $4 \cdot 23$ | -4I | $4 \cdot 22$ | $\cdot 32$ | $4 \cdot 22$ | -24 | 4.21 |
| 28 | $\cdot 74$ | $4 \cdot 27$ | . 65 | $4 \cdot 25$ | -56 | 4.24 | -47 | $4 \cdot 23$ | $\cdot 38$ | $4 \cdot 22$ | -29 | $4 \cdot 21$ |
| 30 | -.80 | $4 \cdot 28$ | - 71 | $4 \cdot 26$ | - 62 | $4{ }^{2} 5$ | -. 52 | $4 \cdot 24$ | - 43 | $4 \cdot 23$ | - 34 | 4.22 |
| 32 | -87 | $4 \cdot 29$ | -77 | $4 \cdot 27$ | -68 | $4 \cdot 26$ | -59 | $4 \cdot 25$ | -49 | $4 \cdot 23$ | -40 | $4 \cdot 22$ |
| 34 | -94 | 4.31 | -84 | 4.29 | -75 | $4 \cdot 27$ | . 65 | $4 \cdot 25$ | $\cdot 55$ | $4 \cdot 24$ | -46 | $4 \cdot 23$ |
| 36 | I. 02 | 4.33 | -92 | $4 \cdot 30$ | -82 | $4 \cdot 28$ | $\cdot 72$ | $4 \cdot 27$ | -62 | $4 \cdot 25$ | -52 | $4 \cdot 24$ |
| 38 | I•IO | 4.35 | 1.00 | $4 \cdot 32$ | -89 | $4 \cdot 30$ | $\cdot 79$ | $4 \cdot 28$ | -68 | $4 \cdot 26$ | -58 | $4 \cdot 25$ |
| 40 | -I'19 | $4 \cdot 37$ | - I. 08 | $4 \cdot 34$ | -.97 | 4.31 | -. 86 | 4.29 | -.76 | $4 \cdot 27$ | -.65 | $4 \cdot 25$ |
| 42 | I. 29 | $4 \cdot 39$ | I-17 | $4 \cdot 36$ | 1.05 | $4 \cdot 33$ | -94 | 4.31 | -83 | $4 \cdot 28$ | -72 | $4 \cdot 27$ |
| 44 | I.39 | $4 \cdot 43$ | 1.27 | $4 \cdot 39$ | I-I5 | $4 \cdot 36$ | 1.03 | $4 \cdot 33$ | -91 | $4 \cdot 30$ | . 80 | $4 \cdot 28$ |
| 46 | I. 50 | 4.47 | 1.37 | 4.42 | r. 24 | $4 \cdot 39$ | I'12 | $4 \cdot 35$ | 1.00 | $4 \cdot 32$ | -88 | $4 \cdot 30$ |
| 48 | I. 63 | $4 \cdot 51$ | 1.49 | $4 \cdot 46$ | I. 35 | $4 \cdot 42$ | $1 \cdot 22$ | $4 \cdot 38$ | I'09 | $4 \cdot 35$ | -97 | $4 \cdot 32$ |
| 50 | - 1.77 | $4 \cdot 56$ | - I 62 | 4.51 | - 1.47 | $4 \cdot 46$ | -I.33 | 4.41 | -I.19 | $4 \cdot 37$ | - I.06 | $4 \cdot 34$ |
| 52 | I.92 | $4 \cdot 62$ | I•76 | 4.56 | I 60 | $4 \cdot 50$ | I.45 | 4.45 | I 31 | 4.40 | 1.17 <br> 1.28 | $4 \cdot 36$ |
| 54 | 2.II | $4 \cdot 70$ | I 92 | $4 \cdot 63$ | 1*75 | $4 \cdot 55$ | 1-59 | $4 \cdot 50$ | I 43 | $4 \cdot 44$ | I. 28 | $4 \cdot 40$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. <br> Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{lrr} \text { H. M. } & \text { S } \\ 6 & 7 & 49 \end{array}$ | + | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 9 & 8.8 \end{array}$ | S +1.32 | $\begin{array}{lcc} \text { H. м. S. } \\ 6 & \text { Io } & 28 \cdot 1 \end{array}$ | $1+$ | $\begin{array}{ll} \text { H. M. S. } \\ 6 & \text { II } \\ 48 \cdot 0 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 33 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { s. } \\ 6 & 13 & 8 \cdot 3 \end{array}$ | S. | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { I4 } & 29 \cdot 1 \end{array}$ | S. $\cdot 35$ |
| 10 | $\begin{array}{llll}5 & 25 & 37 \cdot 4\end{array}$ | I-25 | 526 52.I | 1-24 | $\begin{array}{llll}5 & 28 & 6 \cdot 4\end{array}$ | 1.23 | $\begin{array}{llll}5 & 29 & 20 \cdot 2\end{array}$ | 1.23 | $53033 \cdot 5$ | I 22 | $53146 \cdot 5$ | . 21 |
| 12 | 51712.0 | 1.24 | $\begin{array}{llll}5 & 18 & 26 \cdot 2\end{array}$ | 1.23 | $\begin{array}{llll}5 & 19 & 39 \cdot 7\end{array}$ | I. 22 | $\begin{array}{lllll}5 & 20 & 52 \cdot 7\end{array}$ | I 21 | $\begin{array}{llll}5 & 22 & 5\end{array}$ | . 20 | $\begin{array}{llll}5 & 23 & 16 \cdot 7\end{array}$ | 9 |
| I | $\begin{array}{llll}5 & 8 & 47 \cdot 0\end{array}$ | 1.24 | 5 10 0.7 | 1.22 | 5 II 13.7 | I.2I | $\begin{array}{llll}5 & 12 & 25 \cdot 7\end{array}$ | I'19 | $\begin{array}{lllll}5 & 13 & 37 \cdot 1\end{array}$ | I•18 | 5 I4 47.6 | 7 |
| 16 | $5022 \cdot 1$ | $1 \cdot 23$ | 5 I $35 \cdot 5$ | . 21 | $5 \quad 2 \quad 47 \cdot 9$ | I | $\begin{array}{llll}5 & 3 & 59 & 3\end{array}$ | I•18 | $\begin{array}{llll}5 & 5 & 9 \cdot 7\end{array}$ | I•16 | $5 \quad 6 \quad 19.1$ | I•15 |
| 18 | $45157 \cdot 3$ | +I.23 | 45310 | +I.2I | $45422 \cdot 5$ | +I.I | $45533 \cdot 2$ | +1.17 | $45642 \cdot 9$ | +I.I5 | 45751.4 | +I•13 |
| 20 | $44332 \cdot 6$ | I 23 | $444 \quad 45 \cdot 7$ | 1.20 | $\begin{array}{llll}4 & 45 & 57 \cdot 3\end{array}$ | I-18 | $447 \quad 7 \cdot 6$ | I.I6 | $4 \begin{array}{llll}4 & 48 & 16 \cdot 5\end{array}$ | I. 14 | 449 24.I | 12 |
| 22 | $435 \quad 7 \cdot 9$ | I-23 | $436 \quad 20 \cdot 9$ | I.20 | $43732 \cdot 3$ | I•8 | $43842 \cdot 2$ | 15 | $43950 \cdot 5$ | I-12 | $4 \quad 40 \quad 57 \cdot 3$ | I-10 |
| 24 | $42643 \cdot \mathrm{I}$ | 1.23 | 42756.2 | -20 | $\begin{array}{llll}4 & 29 & 7 \cdot 5\end{array}$ | 7 | $43017 \cdot 0$ | I.I4 | 43124.9 | I•I2 | $43231 \cdot 0$ | I.09 |
| 26 | 4 I8 I8.2 | I. 24 | 4 I9 3I.5 | I. 20 | $42042 \cdot 8$ | I•I7 | $42152 \cdot 1$ | I•I4 | $42259 \cdot 6$ | $1 \cdot 11$ | $4 \begin{array}{lll}4 & 24 & 5 \cdot 1\end{array}$ |  |
| 28 | $4 \quad 953 \cdot 0$ | +1.25 | 4 II 6.6 | +I.2I | 412 I8.I | +I•I | 4 I3 27.3 | +I.I | 4 I4 34.5 | + I•IO | 4 I5 39.5 | +1.07 |
| 3 | 4 I $27 \cdot 5$ | I. 25 | $4 \quad 241 \cdot 7$ | 1.2 | 435 | I•I7 | $\begin{array}{llll}4 & 5 & 2 \cdot 6\end{array}$ | I-13 | $\begin{array}{lll}4 & 6 & 9.6\end{array}$ | I-10 | 4714 | I.06 |
| 32 | $3 \begin{array}{lll}3 & 53 & I \cdot 7\end{array}$ | I-27 | $\begin{array}{llll}3 & 54 & 16 \cdot 4\end{array}$ | 22 | $35528 \cdot 5$ |  | $3 \begin{array}{llll}3 & 56 & 37 \cdot 9\end{array}$ | I-13 | $\begin{array}{lllll}3 & 57 & 44 \cdot 8\end{array}$ | 9 | $358849 \cdot 0$ | . 05 |
| 3 | $34^{3} 4848 \cdot 6$ | I. 27 | $\begin{array}{llll}3 & 50 & 3 & 7\end{array}$ | 3 | 35116 | I•18 | $35225 \cdot 5$ | 4 | $3 \begin{array}{llll}3 & 53 & 32 \cdot 4\end{array}$ | 9 | $35436 \cdot 6$ | I.05 |
| 34 | $34435 \cdot 4$ | I. 28 | $3 \begin{array}{llll}3 & 45 & 50 \cdot 9\end{array}$ | I. 23 | $347 \quad 3.5$ | I•18 | $34^{3} \quad 1313$ | I.I4 | $34920 \cdot 0$ | I.09 | $35024 \cdot 1$ | I. 05 |
| 35 | 34022.0 | +I.29 | 341579 | +1.24 |  | +1.19 | $\begin{array}{lll}3 & 44 & 0 \cdot 7\end{array}$ | +I.14 | $\begin{array}{llll}3 & 45 & 7 \cdot 7\end{array}$ | + I.09 | $34^{3} 17177$ | +I.04 |
| 3 | $\begin{array}{llll}3 & 36 & 8 \cdot 5\end{array}$ | I 30 | $\begin{array}{llllllll}3 & 37 & 24.9\end{array}$ | I-25 | $33^{88} 38$ | I-I9 | $33948 \cdot 3$ | I-I4 | $34055 \cdot 3$ | I | 3 4I 59.4 | . 04 |
| 3 | 3 31 54.7 | I-3I | 33311.7 | I. 25 | $\begin{array}{lllll}3 & 34 & 25 \cdot 3\end{array}$ | 20 | $33535 \cdot 7$ | I. 15 | $\begin{array}{llll}3 & 36 & 43 \cdot 0\end{array}$ | 9 | $\begin{array}{llll}3 & 37 & 47 \cdot 0\end{array}$ | 04 |
| 38 | $\begin{array}{llll}3 & 27 & 40 \cdot 8\end{array}$ | I. 32 |  | 6 | 33012.5 | 1.21 | 3 3I 23.2 | I.I5 | $\begin{array}{llll}3 & 32 & 30 \cdot 5\end{array}$ | 9 | 333134.7 | . 04 |
| 39 | $\begin{array}{llll}3 & 23 & 26 \cdot 7\end{array}$ | I•33 | $\begin{array}{llllll}3 & 24 & 44.9\end{array}$ | I. 27 | 32559.5 | I. 21 | $\begin{array}{llll}3 & 27 & 10 \cdot 5\end{array}$ | I'I5 | 328 I8•I |  | $32922 \cdot 3$ | 1.04 |
| 40 | 3 I9 I2.3 | +1.35 | $32031 \cdot 2$ | +1.28 | 32146 | +1.22 | $32257 \cdot 8$ | +I•16 | $\begin{array}{lll}3 & 24 & 5 \cdot 6\end{array}$ | +I.IO | $325 \quad 9.9$ | +I.04 |
| 41 | $31457 \cdot 7$ | I. 36 | 3 I6 17.3 | I-29 | 31733. | I. 23 | 3 I8 $45^{\circ} \mathrm{O}$ | I•17 | 3 I9 53.1 | I-IO | $3 \begin{array}{llll}3 & 20 & 57 \cdot 6\end{array}$ | I.04 |
| 42 | 3 IO $42 \cdot 8$ | I. 37 | $\begin{array}{llll}3 & 12 & 3 \cdot 3\end{array}$ | I-3I |  | I. 24 | 3 I4 $32 \cdot 0$ | I.I7 | $3 \begin{array}{llll}3 & \text { I } & 40 \cdot 5\end{array}$ | I-II | $31645 \cdot 2$ | 4 |
| 43 | 3 $36627 \cdot 7$ | I-39 | $\begin{array}{lllll}3 & 7 & 48 \cdot 9\end{array}$ | I. 32 | 3960 | 2 | 31019.0 | I-I8 | 3 II 27.9 | [1I | $\begin{array}{llll}3 & 12 & 32 \cdot 7\end{array}$ | I.05 |
| 44 | $3 \quad 2 \mathrm{I} 2 \cdot \mathrm{I}$ | I.4I | $3 \quad 3 \quad 344$ | I•33 | $\begin{array}{llll}3 & 4 & 52 \cdot 2\end{array}$ | I.26 | $\begin{array}{lll}3 & 6 & 5 \cdot 8\end{array}$ | I.19 | $3715 \cdot 1$ | I'I2 | $3 \begin{array}{llll}3 & 8 & 20 \cdot 2\end{array}$ | I.05 |
| 45 | $25756 \cdot 3$ | +1.43 | 25919.5 | + 1.35 | $3 \quad 0$ | +1.27 | 3 I 52.4 | +I.20 |  | +I.13 | $\begin{array}{llll}3 & 4 & 7 \cdot 8\end{array}$ | + I.06 |
| 46 | $25340 \cdot 0$ | I. 45 | $2 \begin{array}{lll}55 & 4 \cdot 4\end{array}$ | ェ.37 | 25624 | 1.29 | $25738 \cdot 9$ | 1 | $2{ }_{2} 58849.3$ | I.I3 | $25955 \cdot \mathrm{I}$ | I.06 |
| 47 | 24923.3 | I.47 | $250 \quad 48 \cdot 9$ | 1.38 | 2529.5 | 1.30 | $25325 \cdot 2$ | I 22 | $25436 \cdot 2$ | I.14 | $25542 \cdot 5$ | 07 |
|  | $245 \quad 6 \cdot 2$ | I.49 | 24633 | 1.40 | 24754. | 1 | 249 II•3 | I. 23 | $25022 \cdot 9$ |  | 25129.7 | 07 |
| 49 | $24048 \cdot 6$ | I. 52 | $242 \begin{array}{llll} & 16 & 8\end{array}$ | I 42 | $24339 \cdot 6$ | 1.34 | 244 57-1 | I. 25 | $246 \quad 9 \cdot 5$ | I.I6 | 24716.8 | 8 |
| 5 | $23630 \cdot$ | +154 | 23800 | +I.45 | 23924.2 | +1.35 | $24042 \cdot 7$ | + I 26 | $24 \mathrm{I} 55^{\circ} 9$ | +1.18 | $243 \quad 3 \cdot 8$ | +1.09 |
| 5 | 2321 | I. 57 | $2 \begin{array}{llll}2 & 33 & 42.9\end{array}$ | I.47 | 235083 | 1.38 | $23^{2} \quad 28 \cdot 0$ | I 28 | $23742 \cdot 1$ | I. 19 | $2 \begin{array}{lllll}28 & 50 \cdot 5\end{array}$ | o |
| 52 | 22752.2 | r.60 | $2 \begin{array}{lll}29 & 25^{\circ} 2\end{array}$ | I.50 | $23052 \cdot 1$ | 1.40 | $\begin{array}{lllll}2 & 32 & 13.0\end{array}$ | I. 30 | $233128 \cdot 0$ | 1.20 | $23437 \cdot 4$ | I |
| 53 | 223 32.I | - 6 | $225 \quad 6 \cdot 9$ | I.53 | $22635 \cdot 4$ | 1.42 | 227576 | 1.32 | $\begin{array}{llll}2 & 29 & 13.8\end{array}$ | I 22 | $230 \quad 23 \cdot 9$ | I-12 |
| 54 | 2 I9 II.I | r.6 | $22048 \cdot 0$ | I.56 | $22218 \cdot 2$ | 1.45 | 223 4199 | I.34 | 22459.2 | 1.24 | $22610 \cdot 2$ | I.I3 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. $+\quad .46$ | s. -4.23 | $\begin{gathered} \mathrm{s} . \\ +\quad \cdot 54 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 24 \end{gathered}$ | s. $+\quad .62$ | s. -4.25 | $\begin{aligned} & \mathrm{s} . \\ & +70 \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 26 \end{gathered}$ | s. $+\quad .78$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 28 \end{gathered}$ |  | S. 86 | s. |
| 2 | -42 | 4.23 | . 50 | $4 \cdot 24$ | - 57 | 4.24 | . 65 | $4 \cdot 26$ | . 73 | $4 \cdot 27$ |  | . 81 | $4 \cdot 28$ |
| 4 | $\cdot 37$ | $4 \cdot 22$ | $\cdot 45$ | $4 \cdot 23$ | - 52 | $4 \cdot 24$ | . 60 | $4 \cdot 25$ | . 68 | $4 \cdot 26$ |  | $\cdot 76$ | 4.27 |
| 6 | $\cdot 32$ | 4.22 | - 40 | $4 \cdot 22$ | -48 | $4 \cdot 23$ | $\cdot 56$ | $4 \cdot 24$ | -63 | $4 \cdot 26$ |  | $\cdot 71$ | 4.27 |
| 8 | - 27 | $4 \cdot 2 \mathrm{I}$ | -35 | $4 \cdot 22$ | -43 | $4 \cdot 23$ | -51 | $4 \cdot 23$ | $\cdot 59$ | 4.25 |  | . 67 | 4.26 |
| IO | + 23 | $4 \cdot 2 \mathrm{I}$ | + 3 I | $4 \cdot 22$ | $+\cdot 38$ | 4.22 | + 46 | 4.23 | + 54 | $4 \cdot 24$ |  | . 62 | 4.25 |
| 12 | -18 | 4.21 | - 26 | 4.21 | - 34 | $4 \cdot 22$ | $\cdot 42$ | 4.23 | $\cdot 50$ | $4 \cdot 23$ |  | $\cdot 58$ | 4.24 |
| 14 | -13 | $4 \cdot 21$ | -21 | 4.21 | -29 | $4 \cdot 21$ | -37 | 4.22 | -45 | 4.23 |  | $\cdot 53$ | $4 \cdot 24$ |
| 16 | -09 | $4 \cdot 21$ | -17 | 4.21 | - 25 | 4.21 | -33 | 4.22 | -4I | $4 \cdot 22$ |  | -49 | $4 \cdot 23$ |
| 18 | +.04 | $4 \cdot 20$ | -12 | 4.21 | -20 | $4 \cdot 21$ | $\cdot 28$ | 4.21 | $\cdot 36$ | $4 \cdot 22$ |  | $\cdot 44$ | 4.23 |
| 20 | . 00 | $4 \cdot 20$ | + .08 | 4.21 | + .16 | $4 \cdot 21$ | + 24 | 4.21 | + 32 | $4 \cdot 22$ |  | $\cdot 40$ | $4 \cdot 22$ |
| 22 | $\cdot 05$ | $4 \cdot 20$ | + .03 | $4 \cdot 20$ | -1I | 4.21 | -19 | 4.21 | $\cdot 28$ | $4 \cdot 2 \mathrm{I}$ |  | $\cdot 36$ | 4.22 |
| 24 | -10 | 4.21 | - .02 | $4 \cdot 20$ | .06 | 4.21 | -15 | 4.21 | $\cdot 23$ | $4 \cdot 2 \mathrm{I}$ |  | $\cdot 31$ | $4 \cdot 22$ |
| 26 | $\cdot 15$ | 4.21 | - 07 | 4.21 | + .02 | 4.20 | -10 | 4.21 | -19 | 4.21 |  | $\cdot 27$ | 4.21 |
| 28 | -20 | 4.21 | -12 | 4.21 | . 03 | $4 \cdot 20$ | -06 | $4 \cdot 20$ | - 14 | 4.21 |  | - 23 | 4.21 |
| 30 | - . 25 | 4.21 | - .17 | 4.21 | -.08 | 4.21 | + - Or | $4 \cdot 20$ | + 10 | $4 \cdot 2 \mathrm{I}$ |  | $\cdot 18$ | $4 \cdot 21$ |
| 32 | -3I | $4 \cdot 22$ | -22 | $4 \cdot 21$ | . 13 | $4 \cdot 21$ | -.04 | $4 \cdot 20$ | +.05 | $4 \cdot 20$ |  | -14 | 4.21 |
| 34 | $\cdot 36$ | 4.22 | $\cdot 27$ | 4.21 | -18 | 4.21 | -99 | 4.21 | $\cdot 0$ | 4.20 |  | -10 | 4.21 |
| 36 | 42 | $4 \cdot 23$ | -33 | 4.22 | $\cdot 23$ | $4 \cdot 21$ | -I4 | 4.2 I | -. 04 | $4 \cdot 20$ |  | . 05 | 4.21 |
| 38 | $\cdot 48$ | 4.23 | $\cdot 3^{8}$ | 4.22 | -29 | $4 \cdot 21$ | -19 | 4.21 | . 09 | 4.21 |  | .00 | $4 \cdot 20$ |
| 40 | -. 55 | 4.24 | - 44 | $4 \cdot 23$ | - -34 | $4 \cdot 22$ | - . 24 | 4.21 | - . 14 | $4 \cdot 21$ |  | . 04 | $4 \cdot 20$ |
| 42 | . 61 | $4 \cdot 25$ | -5I | $4 \cdot 23$ | -40 | $4 \cdot 22$ | $\cdot 30$ | $4 \cdot 21$ | -20 | $4 \cdot 21$ |  | -09 | $4 \cdot 20$ |
| 44 | - 69 | $4 \cdot 26$ | - 58 | 4.24 | -47 | $4 \cdot 23$ | $\cdot 36$ | 4.22 | $\cdot 25$ | $4 \cdot 21$ |  | -15 | 4.21 |
| 46 | $\cdot 76$ | 4.27 | . 65 | 4.25 | $\cdot 53$ | $4 \cdot 24$ | $\cdot 42$ | 4.23 | -31 | $4 \cdot 22$ |  | - 20 | 4.21 |
| 48 | -84 | 4.29 | $\cdot 72$ | $4 \cdot 27$ | . 60 | $4 \cdot 25$ | -49 | $4 \cdot 23$ | $\cdot 37$ | $4 \cdot 22$ |  | -26 | 4.21 |
| 50 | - 93 | 4.31 | - .80 | 4.28 | - . 68 | $4 \cdot 26$ | -. 56 | 4.24 | - $\cdot 44$ | $4 \cdot 23$ |  |  | 4.22 |
| 52 | I-03 | 4.33 | . 89 | 4.30 | $\cdot 76$ | 4.27 | . 63 | 4.25 | - 51 | $4 \cdot 24$ |  | $\cdot 38$ | 4.22 |
| 54 | I 13 | $4 \cdot 36$ | -99 | $4 \cdot 32$ | . 85 | 4.29 | $\cdot 71$ | 4.27 | $\cdot 58$ | $4 \cdot 25$ |  | $\cdot 45$ | 4.23 |

76 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $18^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{array}{\|l\|} \hline \text { True } \\ \text { Alt. } \end{array}$ | $12^{\circ}$ |  | $13^{\circ}$ |  | $14^{\circ}$ |  | $15^{\circ}$ |  | $16^{\circ}$ | ecl. | $17^{\circ}$ | Dec. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - |  |  | H. M. S. |  |  | . 8 |  |  |  |  |  |  |
| 10 | 32 |  |  |  |  | . 20 |  |  |  |  |  |  |
| 12 | 524 | 1. 18 | 525 | 1.17 | 52648.8 | $1 \cdot 17$ | 527 | 1-16 | 529 | r. 6 | 53017.6 | $1 \cdot 15$ |
| 14 | ${ }_{5}^{5} 15$57 <br> 5 | I.16 | $\begin{array}{llll}5 & 17 & 6.6\end{array}$ | I.15 | 5 18 15.2 <br> 5   | I.14 |  | 1.13 | 5 $52030 \cdot 6$ | 2 | $\begin{array}{llll}5 & 21 & 37.6 \\ 5 & 12 & 58.8\end{array}$ | I.1I |
| 16 | 5727.8 | $1 \cdot 13$ | 5835 | I-12 | $5942 \cdot 5$ |  | 51048.7 |  | 5 II 54.I |  | 51258.8 | 7 |
| 18 | $1 \begin{array}{llll}4 & 58 & 58.8 \\ 4 & 50 \\ 4 & 30.5\end{array}$ | +1.1 | 5-8 $5 \cdot 5$ | $+$ | $5{ }_{5}^{5}$ | +r.08 | ${ }_{5}^{5} 21515$ | +1.06 | $5{ }_{5}^{5} 318.5$ | +1.05 |  |  |
| 22 | $\begin{array}{llll}4 & 50 & 30.5 \\ 4 & 42 & 2.7\end{array}$ |  | [4 51 35.6 <br> 4 43 6 |  | 4 52 $39 \cdot 6$ <br> 4 44  |  | [43312.3 |  |  |  |  | 0 |
|  | $\begin{array}{llll}4 & 42 & 2 \cdot 7 \\ 4 & 33 & 35 \cdot 5\end{array}$ | 1.08 1.06 | $\begin{array}{rrrr}4 & 43 \\ 4 & 34 & 38.7\end{array}$ | $1.05$ | $\begin{array}{lll}4 & 44 & 9 \cdot 3 \\ 4 & 35 & 39 \cdot 6\end{array}$ | r.03 I OI | (4 45  <br> 4 36 $10 \cdot 5$ | 01 |  | $99$ | 4 47  <br> 4 38 $3 \cdot 0$ | ${ }_{9}^{96}$ |
| 2 | $\begin{array}{llll}4 \\ 4 & 25 & 8.7\end{array}$ | 1.04 | ${ }_{4}^{4} 2610.6$ | 1.01 |  | $\cdot 99$ | ${ }_{4}^{4} 289090$ | 96 | ${ }_{4}^{4} 2955$ | .93 | 4   <br> 4 30 0.5 | -90 |
| 28 | $\begin{array}{lll} 4 & 16 & 42 \cdot 4 \\ & 8 \end{array}$ | +1.03 | 4 17 <br> 4  <br> 4  | +1.00 | $\begin{array}{llll}4 & 18 & 42 \cdot 3 \\ 4 & 10 & 14.5\end{array}$ | + 96 | 44 19 39.3 <br> 4 r1  | +.93 | ${ }^{4} 22034 \cdot 31$ | + 98 | 4 2128.274 |  |
| 30 31 | $\left\lvert\, \begin{array}{ccc} 4 & 8 & 16 \cdot 5 \\ 4 & 4 & 3.7 \end{array}\right.$ | 1.02 | 4 9 $16 \cdot 6$ <br> 4 5 3.4 | .98 | 4 10 14.5 <br> 4 6 0.8 | 95 |  |  | [4 12 $3 \cdot 7$ <br> 4 7 $48 \cdot 7$ |  | 4 12 $55 \cdot 1$ <br> 4 8 $39 \cdot 3$ |  |
| 32 | $\begin{array}{lllll}4 & 59 & 50 \cdot 9\end{array}$ | ror | $\bigcirc 50.2$ |  | I $47 \cdot 2$ |  | 2 |  | $4{ }_{4}^{4} 333$ |  | $4 \begin{array}{llll}4 & 4 & 23 \cdot 6\end{array}$ | 81 |
| 33 | 35538.2 | 1.00 | $35637 \cdot 2$ | -96 | $35733 \cdot 6$ | 92 | 5827.6 |  | 359 $19 \cdot 1$ |  | - 8.0 | 79 |
| 34 | $\left\lvert\, \begin{array}{lll} 3 & 51 & 25 \cdot 6 \\ 3 & 47 & 13 \cdot 0 \end{array}\right.$ | +1. | 3 32 | + | 353 | + 91 | 354 | + 88 | 3 350 | + 88 | 33 55 $52 \cdot 6$ <br> 3 51  | + 78 |
| 35 36 36 | $\begin{array}{ll} 47 & 13.0 \\ 43 & 0.4 \end{array}$ | -99 | 3 <br> 3 <br> 3 <br> 3 <br> 48 <br> 48 | 94 |  | 90 | 349 |  |  |  | $\begin{array}{llll}3 & 51 & 37 \cdot 4 \\ 3 & 47 & 22 \cdot 3\end{array}$ |  |
| 37 | 38 48.0 | 星 | 3 $3945 \cdot 8$ | -94 | $34040 \cdot 7$ |  | 341 3 4 3 3 |  | 342 2r-5 |  | 3 43 | 74 |
| 38 | $33435 \cdot 5$ | -99 | 3 35 33.2 | $\cdot 93$ | $33627 \cdot 7$ |  | 337 |  | $3{ }^{38}$ |  | 3 38 52:6 | 73 |
| 39 | $\left\lvert\, \begin{array}{lll} 3 & 30 & 23 \cdot 1 \\ 3 & 26 & 10 \cdot 7 \end{array}\right.$ | + $\quad .98$ | $\left\|\begin{array}{ccc} 3 & 31 & 20 \cdot 6 \\ 3 & 27 & 8 \cdot 1 \end{array}\right\|$ | + 93 | $\begin{array}{lll} 3 & 32 & 14 \cdot 8 \\ 3 & 28 & 2 . \\ \hline \end{array}$ |  |  |  |  |  |  |  |
| $4 \mathrm{I}$ | $\left\lvert\, \begin{array}{lll} 3 & 26 & 107 \\ 3 & 21 & 58 \end{array}\right.$ |  | $\begin{array}{llll}3 & 27 & 8 \cdot 1 \\ 3 & 22 & 55 \cdot 6\end{array}$ | $\begin{aligned} & 93 \\ & \hline 92 \end{aligned}$ | 3 28 <br> 3 28 <br> 3 $2 \cdot$ <br> 49.2  | . 87 | (1) $\begin{array}{llll}3 & 28 \\ 3 & 28 & 52 \cdot 5 \\ 3 & 24 & 39 \cdot 3\end{array}$ | -81 |  |  | 3 30 <br> 3 26.4 <br> 3  |  |
| 42 | 317460 |  | 31843.1 | -92 | 319 $36 \cdot 5$ |  | 3 2026.3 |  | 321 |  | $32154 \cdot 7$ | . 68 |
| 43 | 313 33.7 | -98 | $314 \begin{array}{ll}30 \cdot 7\end{array}$ | .92 | 31523 |  | ${ }_{3}^{3} 1613.3$ | -79 | 316 |  | $31740 \cdot 6$ | . 66 |
| 44 | $3{ }^{3} 921.4$ | + 98 | 31018.3 | + 92 | $3 \begin{array}{lllllll}311 & 11.4\end{array}$ | + 85 | 3 121204 | + 78 | ${ }_{3}^{3} 124545$ | + 72 |  | $+$ |
| 45 | $\begin{array}{lll}3 & 5 & 9.0 \\ 3 & 0 & 56.6\end{array}$ |  | I 53.6 |  | 3 6 58.8 <br> 3 28.8  | . 85 |  |  | 383 |  | 3 9 $12 \cdot 6$ <br> 3 4  <br> 3 58.  |  |
|  |  |  |  | .91 | $\begin{array}{lcll}3 & 2 & 46 \cdot 4 \\ 2 & 58 \\ & 33.9\end{array}$ |  |  |  | 3 $4 \begin{aligned} & 4 \\ & 3\end{aligned}$ |  |  | 析 |
| 48 | $2{ }^{2} 52317$ | 99 | 25328 | $\cdot 91$ | $25421 \cdot 5$ | 84 | $2 \begin{array}{ll}55 & 9.4\end{array}$ | - | $2{ }^{2} 55$ 52.7 | .68 | $2{ }^{56} 315$ | $61$ |
| 49 | $\begin{array}{lll} 2 & 48 & 19 \cdot 1 \\ 2 & 44 & 6 \cdot 6 \end{array}$ | +1 | 249 |  | 250 | + 84 | 250 |  | $2 \begin{aligned} & 21 \\ & 2 \\ & 2\end{aligned}$ |  | 2 25 |  |
| 5 |  | 1.01 | 24051 | 92 | 24 |  | 242 |  |  |  | 2 2 2 43 4 5 5 |  |
| 5 | ${ }_{2} 354 \mathrm{4} \cdot \mathrm{I}$ | 1.02 | 236 | -92 | $23732 \cdot 0$ | 8 | $\begin{array}{lllll}2 & 38 \\ 19 & 19\end{array}$ | $\cdot 74$ | 2 39 <br>  $1 \cdot 2$ |  | 2 $3937 \cdot 7$ |  |
| 53 | 23128.2 | 1.02 | 23226 | 93 | $2 \begin{array}{lll}33 & 19.7\end{array}$ | . 83 | $2346 \cdot 9$ | $\cdot 74$ | $23448 \cdot 5$ | . 65 | 23524.5 | 55 |
| 54 55 | $\begin{array}{llll}2 & 27 & 15 \cdot 2 \\ 2 & 23 & 2 \cdot 1\end{array}$ | + |  | .93 | $\begin{array}{llll}2 & 29 & 7 \cdot 3 \\ 2 & 24 & 54 \cdot 9\end{array}$ | $+84$ |  | + 74 |  |  |  |  |
| 55 56 |  | 1. |  | 94 | $\begin{array}{llll}2 & 24 & 54.9 \\ 2 & 20 & 42.9\end{array}$ |  |  |  |  |  | $\begin{array}{llll}2 & 26 & 58 \cdot 4 \\ 2 & 22 & 45 \cdot 4 \\ & 28\end{array}$ | $\begin{array}{r}\text { - } 53 \\ .52 \\ \hline\end{array}$ |
| 57 | 214 |  | $21536 \cdot 0$ | .96 | $21630 \cdot 0$ |  | 21717.4 |  | 21758.2 |  | $21832 \cdot 5$ | . 52 |
| 58 | 21021 |  | II 23.0 | . 97 | 21217.5 |  | $2135 \cdot 1$ |  | 21345 |  | 21419.7 | -51 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ATTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ}$ | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | +.94 | -4.31 | +1.02 | $-4.33$ | +I.11 | +4.35 | +1.19 | $-4.37$ | +1.27 | -4.39 | +1.36 | $-4.42$ |
| 4 | - 84 | $4 \cdot 29$ | -92 | $4 \cdot 31$ | I.00 | $4 \cdot 32$ | 1.09 | $4 \cdot 34$ | I•I7 | $4 \cdot 36$ | I. 25 | $4 \cdot 39$ |
| 8 | -75 | $4 \cdot 27$ | -83 | $4 \cdot 28$ | -91 | $4 \cdot 30$ | -99 | $4 \cdot 32$ | 1.07 | $4 \cdot 34$ | I'15 | $4 \cdot 36$ |
| 12 | -66 | $4 \cdot 26$ | -74 | $4 \cdot 27$ | - 82 | $4 \cdot 28$ | -90 | $4 \cdot 30$ | -98 | $4 \cdot 32$ | I.06 | $4 \cdot 34$ |
| 16 | -57 | $4 \cdot 24$ | . 65 | $4 \cdot 26$ | -73 | $4 \cdot 27$ | .81 | $4 \cdot 28$ | . 89 | $4 \cdot 30$ | -98 | $4 \cdot 32$ |
| 20 | + 48 | $4 \cdot 23$ | +.57 | $4 \cdot 24$ | +.65 | $4 \cdot 25$ | + 73 | $4 \cdot 27$ | +.81 | $4 \cdot 28$ | + 90 | 4.30 |
| 22 | . 44 | $4 \cdot 23$ | . 52 | $4 \cdot 24$ | . 61 | $4 \cdot 25$ | . 69 | $4 \cdot 26$ | $\cdot 77$ | $4 \cdot 28$ | . 86 | $4 \cdot 29$ |
| 24 | -40 | $4 \cdot 22$ | -48 | $4 \cdot 23$ | - 57 | $4 \cdot 24$ | -65 | $4 \cdot 25$ | $\cdot 74$ | 4.27 | . 82 | $4 \cdot 28$ |
| 26 | $\cdot 36$ | $4 \cdot 22$ | -44 | $4 \cdot 23$ | $\cdot 53$ | $4 \cdot 24$ | -61 | $4 \cdot 25$ | $\cdot 70$ | $4 \cdot 26$ | $\cdot 78$ | $4 \cdot 28$ |
| 28 | -31 | $4 \cdot 22$ | -40 | $4 \cdot 22$ | -49 | $4 \cdot 23$ | -57 | $4 \cdot 24$ | . 66 | 4.26 | $\cdot 75$ | $4 \cdot 27$ |
| 30 | +.27 | $4 \cdot 22$ | + 36 | $4 \cdot 22$ | + 45 | 4.23 | +.54 | $4 \cdot 24$ | + .62 | 4.25 | +.71 | $4 \cdot 27$ |
| 32 | $\cdot 23$ | $4 \cdot 21$ | $\cdot 32$ | $4 \cdot 22$ | -41 | $4 \cdot 22$ | - 50 | $4 \cdot 23$ | - 59 | $4 \cdot 25$ | . 68 | $4 \cdot 26$ |
| 34 | -19 | $4 \cdot 21$ | - 28 | $4 \cdot 21$ | - 37 | $4 \cdot 22$ | -46 | $4 \cdot 23$ | -55 | $4 \cdot 24$ | -64 | $4 \cdot 26$ |
| 36 | -14 | $4 \cdot 21$ | $\cdot 24$ | $4 \cdot 21$ | -33 | $4 \cdot 22$ | $\cdot 42$ | $4 \cdot 23$ | . 52 | $4 \cdot 24$ | -61 | $4 \cdot 25$ |
| 38 | -10 | $4 \cdot 21$ | -19 | $4 \cdot 21$ | -29 | $4 \cdot 22$ | $\cdot 38$ | $4 \cdot 22$ | -48 | $4 \cdot 23$ | $\cdot 58$ | $4 \cdot 25$ |
| 40 | +.05 | $4 \cdot 20$ | + -15 | 4.21 | + 25 | 4.21 | + 35 | $4 \cdot 22$ | + 45 | $4 \cdot 23$ | + 54 | $4 \cdot 24$ |
| 42 | + .01 | $4 \cdot 20$ | - II | $4 \cdot 20$ | -21 | $4 \cdot 21$ | -31 | $4 \cdot 22$ | -41 | $4 \cdot 22$ | $\cdot 51$ | $4 \cdot 24$ |
| 44 | -04 | $4 \cdot 21$ | -06 | $4 \cdot 21$ | 17 | 4.21 | -27 | $4 \cdot 21$ | $\cdot 38$ | $4 \cdot 22$ | $\cdot 48$ | $4 \cdot 23$ |
| 46 | -09 | $4 \cdot 21$ | + .02 | $4 \cdot 21$ | $\cdot 12$ | 4.21 | $\cdot 23$ | $4 \cdot 21$ | -34 | $4 \cdot 22$ | -45 | $4 \cdot 23$ |
| 48 | -14 | $4 \cdot 21$ | -. 03 | $4 \cdot 21$ | -08 | $4 \cdot 21$ | -19 | $4 \cdot 21$ | -30 | $4 \cdot 22$ | -42 | $4 \cdot 23$ |
| 50 | . 20 | $4 \cdot 2 \mathrm{I}$ | -. 08 | 4:21 | +.03 | $4 \cdot 21$ | +.15 | $4 \cdot 21$ | + 27 | $4 \cdot 21$ | + 38 | $4 \cdot 22$ |
| 52 | -26 | 4.21 | -13 | $4 \cdot 21$ | - .01 | $4 \cdot 20$ | -11 | $4 \cdot 21$ | $\cdot 23$ | $4 \cdot 21$ | -35 | $4 \cdot 22$ |
| 54 | -32 | $4 \cdot 22$ | -19 | $4 \cdot 21$ | -06 | $4 \cdot 21$ | -07 | $4 \cdot 21$ | -19 | 4.21 | -32 | $4 \cdot 22$ |
| 56 | $\cdot 38$ | $4 \cdot 22$ | $\cdot 25$ | $4 \cdot 21$ | $\cdot 11$ | $4 \cdot 21$ | +.02 | $4 \cdot 21$ | -15 | 4.2I | -29 | $4 \cdot 22$ |
| 58 | -45 | $4 \cdot 23$ | -31 | $4 \cdot 22$ | -17 | $4 \cdot 2 \mathrm{I}$ | -. 03 | $4 \cdot 21$ | -II | $4 \cdot 21$ | -25 | $4 \cdot 22$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 77 LATITUDE $18^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | $\left\lvert\, \begin{array}{lc} \mathrm{H} . \mathrm{M} & \mathrm{~S} . \\ 6 & 24 \end{array}\right.$ | +1.44 | $\begin{array}{lll} \text { H. M. } \\ 6 & 25 & \text { SI. } \end{array}$ | +r.46 | $\left\lvert\, \begin{array}{cc} \text { H. M. S. } \\ 6 & 27 \\ \text { 10. } \end{array}\right.$ | $+\mathrm{I} \cdot 48$ | $\begin{cases}\text { H. M. } & \text { S. } \\ 6 & 28 \\ 39\end{cases}$ | $+1.50$ | $\left\|\begin{array}{lll} \text { H. M. } \\ 6 & 30 & \text { s. } \\ \hline \end{array}\right\|$ | $\begin{gathered} \mathrm{S} . \\ \mathrm{I} \cdot 52 \end{gathered}$ | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 3 \text { I } \\ 42.6 \end{array}$ | $55$ |
| ${ }_{10}$ | 540 10.3 | I-19 | $54 \mathrm{I} 2 \mathrm{I} \cdot 8$ | I•19 | $54233 \cdot 3$ | -19 | 54345.0 | I-19 | $54456 \cdot 6$ | $1 \cdot 19$ | $\begin{array}{llll}5 & 46 & 8.5\end{array}$ |  |
| 12 | $53126 \cdot 5$ | r. 15 | 53235.2 | I-14 | $53343 \cdot 7$ | $1 \cdot 14$ | $53452 \cdot 0$ | I• 4 | $\begin{array}{lll}5 & 36 & 0.3\end{array}$ | I-14 | $\begin{array}{lll}5 & 37 & 8.6\end{array}$ | I. 13 |
| 14 | 52244.0 | 10 | $52350 \cdot 0$ | r-10 | $52455 \cdot 6$ | 09 | 52610 | I.08 | $\begin{array}{llll}5 & 27 & 5 \cdot 8\end{array}$ | r.08 | $5 \begin{array}{lll}58 & 10 \cdot 5\end{array}$ | 1.07 |
| 16 | $\begin{array}{llll}5 & 14 & 2.9\end{array}$ | 06 | $\begin{array}{llll}5 & 15 & 6 \cdot 3\end{array}$ | 05 | 5 I6 9•I | I-04 | 5 I7 11.3 | r.03 | 51813.0 | I.02 | 51914.1 | 1.01 |
| 18 | $\begin{array}{\|ccc\|}5 & 5 & 22.9 \\ 4 & 56\end{array}$ | +1.02 | $\begin{array}{llll}5 & 6 & 23 \cdot 8 \\ 4 & 57 & \end{array}$ | +r.or | $\begin{array}{llll}5 & 7 & 23 \cdot 8 \\ 4 & 58\end{array}$ | + 99 | $5 \begin{aligned} & 5 \\ & 4\end{aligned} 23 \cdot 1$ | + 98 | 5 9 $21 \cdot 6$ <br> 5 0  | + 97 | $5 \mathrm{I}_{5} \mathrm{IO} 19.4$ | + 96 |
| 20 | $45644 \cdot \mathrm{I}$ | $\cdot 98$ | $45742 \cdot 5$ | -96 | $4 \quad 5839.9$ | $\cdot 95$ | $4 \begin{array}{llll}4 & 59 & 36.3\end{array}$ |  | $5{ }_{5}^{5}$ | -91 | $\begin{array}{llll}5 & 1 & 26 \cdot 2\end{array}$ |  |
| 22 | 4486.3 | $\cdot 94$ | $4492 \cdot 3$ | $\cdot 92$ | 449 57.1 | -90 | $4 \begin{array}{lll}40 & 50 \cdot 8 \\ 4\end{array}$ | . 88 | $\begin{array}{llllll}4 & 51 & 43.2\end{array}$ | 86 | $\begin{array}{lllll}4 & 52 & 34.4\end{array}$ | . 84 |
| 24 | 43929.5 | $\cdot 91$ | 44023.2 | . 88 | $44115 \cdot 6$ | . 86 | $4426 \cdot 4$ | . 83 | 44255.8 | -81 | $44343 \cdot 8$ | 79 |
| 26 | 43053.6 | $\cdot 87$ | 4 31 $45 \cdot 1$ | - 84 | $43234 \cdot 9$ | 82 | $43323 \cdot 1$ | 79 | $\begin{array}{lll}4 & 34 & 9.6\end{array}$ | $\cdot 76$ | 43454.4 | 73 |
| 28 | 42218.6 | + 84 | $423 \quad 7 \cdot 9$ | + -80 | 2355.3 | + 77 | $42440 \cdot 8$ | + 74 | $425 \quad 24.4$ | + 71 | 426 6.I | +.68 |
| 30 | 41344.4 | -80 | $4 \begin{array}{llllllllll}4 & 31.5\end{array}$ | $\cdot 77$ | $4 \begin{array}{llll}4 & 16 \cdot 5\end{array}$ | $\cdot 73$ | $4 \begin{array}{llll}4 & 15 & 59.4\end{array}$ | $\cdot 70$ | $41640 \cdot 2$ | $\cdot 66$ | $\begin{array}{llllll}4 & 17 & 18.8\end{array}$ | . 62 |
| 31 | $\begin{array}{lllll}4 & 9 & 27 \cdot 6\end{array}$ | $\cdot 79$ | $4 \begin{array}{lllllllll}40 & 13.6\end{array}$ | $\cdot 75$ | 4 10 $57 \cdot 5$ | $\cdot 71$ | 4 II 39.0 | $\cdot 67$ |  | $\cdot 64$ | $41255 \cdot 5$ | 60 |
| 32 | $4 \begin{array}{llll}4 & 5110\end{array}$ | $\cdot 77$ | $4 \quad 5 \quad 56: 0$ | $\cdot 73$ | 638.6 | -69 | $4 \quad 7 \begin{array}{ll}49 \cdot 0\end{array}$ | 65 | $\begin{array}{llll}4 & 7 & 56 \cdot 9\end{array}$ | $\cdot 61$ | $\begin{array}{llll}4 & 8 & 32 \cdot 4\end{array}$ | 57 |
| 33 | 4 - $54 \cdot 5$ | $\cdot 75$ | $4 \begin{array}{llll}4 & \text { I }\end{array}$ | $\cdot 71$ | $220 \cdot 0$ | $\cdot 67$ | 259.0 | $\cdot 63$ | $4 \quad 3 \quad 35 \cdot 5$ | 59 | $\begin{array}{lll}4 & 4 & 9.5\end{array}$ | 54 |
| 34 | $\begin{array}{lllll}3 & 56 & 38 \cdot 2\end{array}$ | + 74 | 35721.2 | + 69 | $\begin{array}{lll}3 & 58 & 1.5\end{array}$ | + 65 | 3 $358839 \cdot 2$ | + 6 I | $3{ }^{3} 5914.4$ | + 56 | $35946 \cdot 9$ | + $\cdot 52$ |
| 35 | 3 52 $22 \cdot 1$ <br> 3 4  | $\cdot 72$ | $\begin{array}{llll}3 & 53 & 4 \cdot 0 \\ 3 & 4 & \end{array}$ | $\cdot 67$ | $35343 \cdot 2$ | -63 | $\left\lvert\, \begin{array}{llll}3 & 54 & 19.7\end{array}\right.$ | . 58 |  | - 54 | 35524.4 | 49 |
| 36 |  | $\cdot 70$ | $34847 \cdot 0$ | . 66 | 349 25.1 | -6r | $\begin{array}{lll}3 & 50 & 0.3\end{array}$ | . 56 | $\begin{array}{ll}3 & 50 \\ 32 \cdot 6\end{array}$ | -51 | 3 5I 2-I | $\cdot 46$ |
| 37 |  | $\cdot 69$ | $\begin{array}{lllllllllllllll}3 & 44 & 30 \cdot 2\end{array}$ | -64 | $\begin{array}{llll}3 & 45 & 7.2\end{array}$ | $\cdot 59$ | 345 4I•r | - 54 | $\begin{array}{llll}3 & 4612 \cdot 0\end{array}$ | - 49 | 3 46 39 | T |
| 38 | 33934 | $\cdot 67$ | 34013.6 | . 62 | 34049.4 | - 57 | 34 I 22. I | -52 | 34151.6 |  | 342 | 4 I |
| 39 | $\left\lvert\, \begin{array}{llll}3 & 35 & 19.1 \\ 3 & 31 & \\ 3\end{array}\right.$ | + 66 |  | + 60 | $\begin{array}{lllll}3 & 36 & 3 \mathrm{r} & 8\end{array}$ | $+.55$ | $\begin{array}{lll}3 & 37 & 3.2\end{array}$ | $+\cdot 50$ |  | + 44 | $33756 \cdot \mathrm{I}$ | + 38 |
| 40 | 331 3.8 | . 64 | $\begin{array}{llll}3 & 31 & 40 \cdot 8\end{array}$ | -59 | $3 \quad 3214.3$ | $\cdot 53$ | $33244 \cdot 5$ | 47 | ${ }^{3} 333 \mathrm{II} \cdot 2$ | -42 | $33334 \cdot 5$ | $\cdot 36$ |
| 4 I | $32648 \cdot 5$ | . 63 |  | $\cdot 57$ | 3 27 $57 \cdot 0$ <br> 3   | -51 | 3 28 $25 \cdot 9$ <br> 3 24  | 45 | $\begin{array}{lllll}3 & 28 & 51 \cdot 2 \\ 3 & 24 & \\ 3\end{array}$ | -39 | $\begin{array}{llll}3 & 29 & 12 \cdot 9\end{array}$ | $\cdot 33$ |
| 42 |  | -61 | $\begin{array}{llll}3 & 23 & 8.5\end{array}$ | . 55 | $\begin{array}{llll}3 & 23 & 39 \cdot 9 \\ 3 & \text { 1 }\end{array}$ | $\cdot 49$ | $\begin{array}{lll}3 & 24 & 7 \cdot 5\end{array}$ | 43 | $\begin{array}{llllll}3 & 24 & 31.4\end{array}$ | $\cdot 3$ | $32451 \cdot 5$ | $\cdot 30$ |
| 43 | $1 \begin{array}{llll}3 & 18 & 19.5\end{array}$ | . 60 | $\begin{array}{llllllllllllllll}3 & 18 & 52\end{array}$ | $\cdot 54$ | 31922 | -47 | 31949.2 | 41 | 320 | - 34 | 32030 | 27 |
| 44 | 3 14 3.6 | + 59 |  | + 52 | $\begin{array}{llll}3 & 15 & 5 \cdot 9\end{array}$ | $+\cdot 45$ | $3 \begin{array}{llll}3 & 15 & 3 \mathrm{r} \cdot \mathrm{I}\end{array}$ | $+\cdot 38$ | 3 15 $52 \cdot r$ <br> 3 15  | $+\cdot 32$ | 31690 | + 25 |
| 45 | 3 9 48.9 <br> 3 5  | $\cdot 57$ | $1021 \cdot 1$ | 5 | 10 49.1 | 43 | 3 II 12.9 | -36 | $\begin{array}{lllll}3 & 11 & 32 \cdot 6\end{array}$ | 29 | 3 II 47.9 | 22 |
| 46 | $\begin{array}{llll}3 & 5 & 34.3\end{array}$ | $\cdot 56$ | $6 \quad 5 \cdot 5$ | 48 | $\begin{array}{ll}6 & 32 \cdot 5\end{array}$ | 41 | $3{ }^{3} 655 \cdot \mathrm{I}$ |  | $\begin{array}{llll}3 & 7 & 13.2\end{array}$ |  | $\begin{array}{llll}3 & 7 & 26.9\end{array}$ | 19 |
| 47 | 3 1 19.8 <br>  5  | -54 | $150 \cdot 1$ | 47 | 215.9 | -39 | $\begin{array}{llll}3 & 2 & 37 \cdot 2\end{array}$ | -32 | 3 2 53.9 | -24 | 3 3 $5 \cdot 9$ | -16 |
| 48 | $\begin{array}{llll}2 & 57 & 5.4\end{array}$ | -53 | $25734 \cdot 8$ | 45 | $5759 \cdot 5$ | $\cdot 37$ | ${ }^{2} 58819.5$ | -29 | 2 58 <br> 8  |  | $25845 \cdot \mathrm{I}$ | 13 |
| 49 | $2525 I \cdot I$ | + 51 | 25319.6 | + $\cdot 43$ | $25343 \cdot 2$ | + 35 | $2 \begin{array}{lll}54 & 1 \cdot 9\end{array}$ | + 27 | $2 \begin{array}{lllllll}2 & 54 & 15.6\end{array}$ | + $\times 19$ | 25424.2 | + .10 |
| 50 | $\begin{array}{llllll}2 & 48 & 37 \cdot 0 \\ 2 & 44 & 22.8\end{array}$ | $\cdot 50$ | 2 49 $4 \cdot 5$ <br> 2 4  | $\cdot 42$ |  | $\cdot 33$ | $2 \begin{array}{llll}2 & 49 & 44 \cdot 3 \\ 2\end{array}$ | $\cdot 25$ | 2 $49 \begin{array}{llll} & 56 \cdot 5 \\ 2 & 45 & 37.5\end{array}$ | - | $\begin{array}{lll}2 & 50 & 3 \cdot 5 \\ 20\end{array}$ | . 07 |
| 51 | 24422.8 | $\cdot 49$ | $24449 \cdot 5$ | 40 | $24510 \cdot 8$ | -35 | $24526 \cdot 9$ | -22 | $24537 \cdot 5$ | - 13 | $24542 \cdot 7$ | -04 |
| 5 | 2 40 8.8 <br> 2   | 47 | ${ }^{2} 403034.6$ | $\cdot 38$ | 24054.8 | 29 | $24 \mathrm{I} \quad 9 \cdot 5$ | - 20 | $\begin{array}{llllll}2 & 41 \\ 2 & 18.6\end{array}$ | -10 | 24122.0 | + -01 |
| 53 | $2 \begin{array}{llll}2 & 35 & 54.8\end{array}$ | 46 | $\begin{array}{llll}2 & 36 & 19.7\end{array}$ | $\cdot 37$ | 23638.8 | $\cdot 27$ | $23652 \cdot 2$ | -17 | $23659 \cdot 7$ | -08 | 237183 | - . 02 |
| 54 |  | + 45 | $\begin{array}{rrrr}2 & 32 & 5 \cdot 0 \\ 2 & 2 & 50\end{array}$ | $+.35$ | $\begin{array}{lllll}2 & 32 & 22.9\end{array}$ | $+25$ | $2 \begin{array}{llll}2 & 32.9 \\ 2\end{array}$ | $+\cdot 15$ | $\begin{array}{llllll}2 & 32 & 40 \cdot 8 \\ 2\end{array}$ | +.05 | $23240 \cdot 5$ | .06 |
| 56 | $\begin{array}{llll}2 & 27 & 27.4 \\ 2 & 23\end{array}$ |  | $22750 \cdot 3$ | -33 | 228 7•1 | $\cdot 23$ | $22817 \cdot 7$ | -12 | $2 \begin{array}{llll}28 & 21.9\end{array}$ | + 02 | $\begin{array}{llll}2 & 28 & 19 \cdot 7\end{array}$ | . 09 |
| 56 | $\begin{array}{llll}2 & 23 & 13.8 \\ 2 & 19 & 8\end{array}$ | + | $\begin{array}{lllll}2 & 23 & 35 \cdot 8\end{array}$ | $\cdot 31$ | 2 23 $51 \cdot 4$ <br> 2   | - 21 | $\begin{array}{lll}2 & 24 & 0.5\end{array}$ | 10 | 224 3.1 |  | 22358.9 | 13 |
| 57 | $\begin{array}{llll}2 & 19 & 0.2 \\ 2 & 19 & 46.7\end{array}$ | 41 | $\begin{array}{llll}2 & 19 & 21 \cdot 3 \\ 2 & 15 & 6 \cdot 3\end{array}$ | -30 | $\begin{array}{llll}2 & 19 & 35 \cdot 8 \\ 2 & 5\end{array}$ | -18 | $\begin{array}{lllll}2 & 19 & 43.4 \\ 2\end{array}$ | $\cdot 07$ | 21944.3 | -0 | $21938 \cdot \mathrm{I}$ | -16 |
| 58 | $21446 \cdot 7$ | 39 | 2156.9 | -28 | 215 20.1 | '16 |  | . 04 | $215 \quad 25.4$ | -08 | $21517 \cdot 1$ | . 20 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. 18 | $8^{\circ}$ A. | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ}$ | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{r} \cdot 44 \end{gathered}$ | $\begin{gathered} s . \\ -4.44 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 53 \end{gathered}$ | $\begin{gathered} s . \\ -4.47 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 62 \end{gathered}$ | $\begin{gathered} s . \\ -4.5 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 7 \mathrm{I} \end{gathered}$ | $\begin{gathered} s . \\ -4.54 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\mathrm{I} \cdot 80 \end{aligned}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 57 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 89 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 6 I \end{gathered}$ |
| 4 | I. 34 | $4 \cdot 41$ | 1.42 | $4 \cdot 44$ | I. 51 | 4.47 | I. 60 | $4 \cdot 50$ | I. 69 | $4 \cdot 53$ | 1.78 | $4 \cdot 56$ |
| 8 | I. 24 | $4 \cdot 38$ | I-32 | $4 \cdot 41$ | I 41 | $4 \cdot 43$ | I. 49 | $4 \cdot 46$ | I. 58 | 4.49 | 1.67 | $4 \cdot 52$ |
| 12 | I'I5 | $4 \cdot 36$ | I 23 | $4 \cdot 38$ | I 31 | $4 \cdot 40$ | I-40 | $4 \cdot 43$ | r 49 | $4 \cdot 46$ | 1.58 | $4 \cdot 49$ |
| 16 | I.06 | $4 \cdot 34$ | I-15 | $4 \cdot 36$ | I. 23 | $4 \cdot 38$ | I 32 | $4 \cdot 41$ | 1.40 | $4 \cdot 43$ | I 49 | $4 \cdot 46$ |
| 20 | + 98 | $4 \cdot 32$ | +1.07 | $4 \cdot 34$ | +I.15 | $4 \cdot 36$ | +1.24 | $4 \cdot 38$ | + $\mathrm{I} \cdot 33$ | 4.41 | +r.4I | $4 \cdot 44$ |
| 22 | $\cdot 94$ | $4 \cdot 31$ | I.03 | $4 \cdot 33$ | I. 12 | $4 \cdot 35$ | I 20 | $4 \cdot 37$ | I. 29 | $4 \cdot 40$ | [.38 | $4 \cdot 43$ |
| 24 | -91 | $4 \cdot 30$ | -99 | $4 \cdot 32$ | r.08 | $4 \cdot 34$ | r-17 | $4 \cdot 36$ | I-26 | $4 \cdot 39$ | I.35 | $4 \cdot 42$ |
| 26 | . 87 | $4 \cdot 29$ | . 96 | $4 \cdot 31$ | I.05 | $4 \cdot 33$ | I-I3 | $4 \cdot 35$ | I. 22 | $4 \cdot 38$ | I•32 | $4 \cdot 4 \mathrm{I}$ |
| 28 | . 84 | 4.29 | $\cdot 92$ | $4 \cdot 31$ | I-OI | $4 \cdot 33$ | I-10 | $4 \cdot 35$ | I•19 | $4 \cdot 37$ | I-29 | $4 \cdot 40$ |
| 30 | $+80$ | $4 \cdot 28$ | +.89 | $4 \cdot 30$ | + 988 | $4 \cdot 32$ | +1.07 | $4 \cdot 34$ | +1.17 | $4 \cdot 36$ | + $\mathrm{I} \cdot 26$ | $4 \cdot 39$ |
| 32 | $\cdot 77$ | $4 \cdot 27$ | -86 | $4 \cdot 29$ | -95 | $4 \cdot 31$ | r. 04 | $4 \cdot 33$ | I-14 | $4 \cdot 36$ | I. 23 | $4 \cdot 38$ |
| 34 | $\cdot 74$ | 4.27 | . 83 | 4.29 | $\cdot 92$ | $4 \cdot 30$ | 1.02 | $4 \cdot 33$ | I•II | $4 \cdot 35$ | I-2I | $4 \cdot 38$ |
| 36 | $\cdot 70$ | $4 \cdot 26$ | -80 | 4.28 | $\cdot 90$ | $4 \cdot 30$ | -99 | $4 \cdot 32$ | 1.09 | $4 \cdot 34$ | r.19 | $4 \cdot 37$ |
| 38 | . 67 | $4 \cdot 26$ | $\cdot 77$ | $4 \cdot 28$ | . 87 | $4 \cdot 30$ | $\cdot 97$ | $4 \cdot 3 \mathrm{I}$ | 1.07 | $4 \cdot 34$ | I'I7 | $4 \cdot 36$ |
| 40 | $+.64$ | $4 \cdot 25$ | + 77 | 4.27 | +.84 | $4 \cdot 29$ | + 95 | 4.31 | + r*05 | 4.33 | +1.15 | $4 \cdot 36$ |
| 42 | . 61 | 4*25 |  | $4 \cdot 27$ | -82 | $4 \cdot 28$ | -92 | $4 \cdot 30$ | 1.03 | $4 \cdot 33$ | I'I3 | $4 \cdot 35$ |
| 44 | -59 | $4 \cdot 25$ | -69 | $4 \cdot 26$ | -80 | 4.28 | -90 | $4 \cdot 30$ | I.OI | $4 \cdot 33$ | I-I2 | $4 \cdot 35$ |
| 46 | $\cdot 56$ | $4 \cdot 24$ | -66 | $4 \cdot 26$ | $\cdot 77$ | 4.28 | . 88 | $4 \cdot 30$ | 1.00 | $4 \cdot 32$ | I•II | $4 \cdot 35$ |
| 48 | $\cdot 53$ | $4 \cdot 24$ | -64 | $4 \cdot 25$ | -75 | $4 \cdot 27$ | $\cdot 87$ | $4 \cdot 29$ | -98 | $4 \cdot 32$ | I•IO | $4 \cdot 35$ |
| 50 | + 50 | $4 \cdot 24$ | +.62 | $4 \cdot 25$ | + 73 | 4.27 | $+.85$ | $4 \cdot 29$ | + 97 | 4.32 | + 1.09 | $4 \cdot 35$ |
| 52 | $\cdot 47$ | $4 \cdot 23$ | -60 | $4 \cdot 25$ | $\cdot 72$ | $4 \cdot 27$ | -84 | $4 \cdot 29$ | $\cdot 97$ | $4 \cdot 31$ | I.09 | $4 \cdot 34$ |
| 54 | -45 | $4 \cdot 23$ | $\cdot 57$ | $4 \cdot 24$ | -70 | 4.26 | -83 | $4 \cdot 29$ | -96 | $4 \cdot 31$ | I.09 | $4 \cdot 35$ |
| 56 | -42 | 4.23 | -55 | $4 \cdot 24$ | . 69 | 4.26 | -82 | $4 \cdot 29$ | -96 | $4 \cdot 31$ | r. 10 | $4 \cdot 35$ |
| 58 | -39 | $4 \cdot 23$ | - 53 | $4 \cdot 24$ | . 67 | $4 \cdot 26$ | -82 | $4 \cdot 29$ | -96 | $4 \cdot 31$ | I•II | $4 \cdot 35$ |

78 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $19^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Secl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | ecl. far. | $3{ }^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $4{ }^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - |  | $38$ |  | . 38 |  | $\mathrm{I} \cdot 38$ |  | $\begin{gathered} \mathrm{s} . \\ \mathrm{r} \cdot \mathbf{B}^{\prime} \end{gathered}$ |  | . 38 | s. | , |
| Io | $5 \mathrm{~F} 740 \cdot 2$ |  |  | I.39 | 5 20268 | 1.37 | 5-2148.7 | r.36 | 523 10.0 | - | $52430 \cdot 7$ | r.34 |
| 12 | $5{ }_{5} 511 \cdot 3$ |  | 55 ro $35 \cdot 5$ | I. 39 | ${ }_{5}^{5}$ II 158.7 |  |  | r. 36 | $5{ }_{5}^{5} 442 \cdot 3$ |  |  | 33 |
| $\xrightarrow{14}$ | ${ }_{4}{ }_{4}{ }^{\text {O }}$ | I.42 | ${ }_{5}^{2}$ | r:40 | $\begin{array}{cccc}5 & 3 & 30 \cdot 6 \\ 4 & 5 & 2.2\end{array}$ |  |  | r. 37 r .37 r | $\begin{array}{lllll}5 & 614.6 \\ 4 & 57 & 46.9\end{array}$ | r.35 r.35 rex | 5 7 $35 \cdot 1$ <br> 4 59 7 | 33 |
| 18 | 443 | +1.46 | 4458.4 | +r.43 | $44633 \cdot 5$ | +1.40 | $44757 \%$ | +r.38 | 4 49. 19.1 | +1.36 | 4 450 | 33 |
| 20 | 435 | I. 8 | 43638.2 | $1 \cdot 45$ | $4384 \cdot \mathrm{r}$ | . 42 | 43928.4 | I. 39 | 440510 | , | 442 12.0 | 34 |
| 22 | 4 | I. 50 | 428 | $1 \cdot 47$ | $4 \begin{aligned} & 4 \\ & 4 \\ & 49\end{aligned}$ | r.43 | 43059.4 | ${ }^{1}$ | 43222.6 |  | 433 44. I | r. 34 |
| 24 | 4185 |  |  |  |  |  | $\begin{array}{llll}4 & 22 & 29.8 \\ 4 & 13 & 59.6\end{array}$ | r. 42 |  |  | $\begin{array}{ll}4 & 25 \\ 4 & 15 \cdot 9 \\ 4 & 16 \\ 4 & 4.3\end{array}$ |  |
| 28 |  |  | 4 II |  | 12 |  | $\left\lvert\, \begin{array}{ccc}4 & 13 & 59 \cdot 6 \\ 4 & 5 & 28 \cdot 7\end{array}\right.$ |  |  |  |  |  |
| 30 | ${ }_{4}^{4} 5$ |  | 4 2 29 <br> 3 5 53 | + r 57 | 4 4  <br> 3 5 $0 \cdot 1$ <br>  $26 \cdot 8$  | r.52 | (1) ${ }_{4}^{4}$ | $+$ |  | +1.41 | 35948 | 37 |
| 32 |  | r.68 |  | - 6 | 3 465 | r 5 | 13 <br> 3 <br> 3 <br> 8 <br> 24.0 | r. 5 | 3 34952.7 | 1 |  | r.41 |
| 33 34 | 3 39  <br> 3 348 $18 \cdot 9$ | ${ }_{\mathrm{I}}^{\mathrm{r}} \cdot 6$ |  | I. 63 <br> r |  | r.57 |  | +52 |  |  | 347 3.2 | 4.42 |
| 35 | 330 | +1.73 | 33219.0 | +r.67 | 33357.4 | +r.6r | 335 |  |  |  |  |  |
| 36 | ${ }_{3} 2615$ 151 |  | 3 27 <br>  58.7 | x 69 | 3 2938.4 | . 63 | 331 | . 5 | $\begin{array}{llll}3 & 32 & 46 \cdot 8\end{array}$ | r.5I | $3415 \cdot 7$ |  |
| 37 | $32152 \cdot 6$ |  | 323 | r.72 | 3 25 1888 | r.65 | 32656.0 | r 59 | 328 | r.53 | 329 |  |
| 38 39 | 3 17 29.4 <br> 3 r3 5 | $\xrightarrow{\mathrm{r}} \mathrm{r}$.81 | 3 19 <br> 3 19 | r. |  | $\mathrm{r} \cdot 6$ | $\|$3 22 37.3 <br> 3 18  | r.6 | 3 24 |  | $\begin{array}{llll}3 & 25 & 42 \cdot 7 \\ 3 & 29 & 25 \cdot 7\end{array}$ | I.48 <br> I .50 |
| 40 | 3840.8 | + x . 88 | 310 | +1.80 | 31216.9 | +1.72 | 31358.3 | +r.65 | 31535.4 | + 1 | 3178.4 | 52 |
| 4 | 3 | I.9x | 67.5 |  | 3 7 $55 \cdot \mathrm{x}$ | 175 | 938.0 | 1 | 3 lr 16.5 |  | $3{ }^{3} 12 \begin{array}{lll}2 & 50 \%\end{array}$ |  |
| 42 | $5522 \cdot 2$ |  | $\begin{array}{ll}3 & 1 \\ 2 \\ 2\end{array}$ | 1.86 r re | 3 3 $32 \cdot 5$ <br> 2 59  | r. | 3 $\begin{array}{lll}3 & 5 & 17 . \\ 3 & 0 & 55 \\ 2 & 5\end{array}$ | r.7 | lllll $\begin{array}{lll}3 & 6 & 57 \\ 3 & 2 & 37 \\ & 5 & 7\end{array}$ |  |  |  |
| 44 | $25052 \cdot 7$ | 2.03 | 25258 -6 | r. 94 | ${ }^{2} 5445 \cdot 2$ | 1.85 | $\begin{array}{lllll}3 & 56 & 35 \cdot 7 \\ 2 & 3\end{array}$ | $\begin{aligned} & 1 \cdot 73 \\ & x .76 \end{aligned}$ |  |  |  | $\begin{aligned} & 1.58 \\ & 1.60 \end{aligned}$ |
| 45 | $\begin{array}{llll}2 & 46 & 22.9 \\ 2 & 41 \\ 51\end{array}$ | $+2$ | 248 | +r.98 | 2 50 $20 \cdot 2$ <br> 2 45  <br> 1   | +r.88 | 252 | +r.79 | 25355 | +r.7 | 55 | +r.62 |
| 46 | ${ }_{37}^{41}$ |  | $\begin{array}{llll}2 & 43 & 5 \cdot 1 \\ 2 & 39 & 26 \cdot 6 \\ 2 & \\ 2\end{array}$ | 2. | 45 | r.96 |  | r | 24933 |  |  | r.65 |
| 48 | $3245 \cdot 6$ | 2.23 | 2 $3455 \cdot 8$ | $2 \cdot 11$ | 23659.4 | 2.01 | 248 286.6 | I. 9 | 24047.8 | - | $4233 \cdot 0$ | r.7r |
| 49 | $2810 \cdot 1$ |  | $23023 \cdot 6$ | $2 \cdot 17$ | $23230 \cdot 3$ |  | $23430 \cdot 1$ | I | $23623 \cdot 5$ | I. 84 | 38 ro.9 | 隹 |
| 50 | $\begin{array}{llll}23 & 32 \cdot 7 \\ 18 \\ 53 \cdot 3\end{array}$ | +2.35 | ${ }_{2}^{2} 22549.8$ | +2.22 | $\begin{array}{ll}2 & 27 \\ 29 & 59 \\ 2 & 23 \\ 27\end{array}$ | +2.10 | $\begin{array}{llll}2 & 30 & 2.3 \\ 2 & 25\end{array}$ | +r.99 | $\begin{array}{llll}2 & 31 & 58.3 \\ 2 & 27 \\ 2\end{array}$ | +r.88 | 3347.9 |  |
| 51 52 | I8 $53 \cdot 3$ |  |  | 2.28 2.35 | 22327.5 | 2.16 2.22 | $\begin{array}{llll}2 & 25 & 25 & 33.4 \\ 2 & \\ 21\end{array}$ | 2.0 | ${ }_{2}^{2} 2738 \cdot 1$ | 1. | ${ }^{2} 22924 \cdot 1$ |  |
| 5 | 14 |  |  |  | (18) |  |  |  |  |  | (1)2 24 $59 \cdot 3$ <br> 2 20 $33 \cdot 4$ |  |
| 54 | $2 \begin{array}{lll}240.8\end{array}$ | $2 \cdot 6$ | $7{ }^{1} 57$ | 2.50 | 2 9 4r-I | $2 \cdot 35$ | $2 \mathrm{Ir} 57 \cdot 7$ | $2 \cdot 21$ | 21460 | $2 \cdot 07$ | $16{ }^{1} 4$ |  |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. 0 | A. | L. 1 | A. | L. 2 | A. | L. 3 | A. | L. 4 | A. | L. | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}^{\circ}$ | $-\stackrel{\text { s. }}{00}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 23 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .08 \end{aligned}$ | $\begin{gathered} \mathrm{s} . \\ -4.23 \end{gathered}$ | $+\stackrel{s}{s} \cdot 15$ | $\begin{gathered} \mathrm{S} \\ -4.23 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +\quad .23 \end{aligned}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 24 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\quad 3 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.24 \end{gathered}$ | S. $+\quad .39$ | $\begin{gathered} s . \\ -4.25 \end{gathered}$ |
| 2 | .05 | 4.23 | +.03 | 4.23 | - 10 | 4.23 4.23 | $\begin{array}{r}+\quad .18 \\ \hline 18\end{array}$ | $\begin{aligned} & 4.24 \\ & 4.24 \end{aligned}$ | +26 | -4.24 4.24 | $\begin{array}{r}+\quad .39 \\ \hline .34\end{array}$ | -4.25 4.25 |
| 4 | -10 | $4 \cdot 23$ | -. 02 | $4 \cdot 23$ | . 05 | 4.23 | -13 | 4.23 | - 21 | $4 \cdot 24$ | -29 | $4 \cdot 24$ |
| 6 | - I5 | $4 \cdot 23$ | -08 | 4.23 | + - Or | 4.23 | -08 | 4.23 | -16 | $4 \cdot 24$ | -24 | $4 \cdot 24$ |
| 8 | - 20 | $4 \cdot 23$ | $\cdot 12$ | $4 \cdot 23$ | - . 05 | 4.23 | +.03 | 4.23 | - II | $4 \cdot 23$ | - 19 | $4 \cdot 23$ |
| 10 | -. 26 | 4.24 | -.18 | 4.23 | - .10 | $4 \cdot 23$ | -. 02 | $4 \cdot 23$ | $+.06$ | $4 \cdot 23$ | + 14 | $4 \cdot 23$ |
| 12 | $\cdot 31$ | $4 \cdot 24$ | $\cdot 23$ | $4 \cdot 24$ | - I5 | $4 \cdot 23$ | -07 | $4 \cdot 23$ | + .or | $4 \cdot 23$ | .09 | $4 \cdot 23$ |
| 14 | -36 | $4 \cdot 24$ | -28 | $4 \cdot 24$ | -20 | $4 \cdot 23$ | -12 | 4.23 | -. 04 | 4.23 | +.04 | $4 \cdot 23$ |
| r6 | $\cdot 42$ | $4 \cdot 25$ | -34 | $4 \cdot 24$ | . 25 | $4 \cdot 24$ | $\cdot 17$ | 4.23 | $\cdot 09$ | 4.23 | - - Or | $4 \cdot 23$ |
| 18 | $\cdot 48$ | $4 \cdot 26$ | -39 | $4 \cdot 25$ | -31 | $4 \cdot 24$ | - 23 | $4 \cdot 23$ | $\cdot 14$ | $4 \cdot 23$ | .06 | $4 \cdot 23$ |
| 20 | - . 53 | $4 \cdot 26$ | - 45 | 4.25 | - 36 | 4.24 | - $\cdot 28$ | 4.24 | - $\cdot 20$ | $4 \cdot 23$ | - 'rI | $4 \cdot 23$ |
| 22 | $\cdot 59$ | $4 \cdot 27$ | $\cdot 51$ | $4 \cdot 26$ | .42 | $4 \cdot 25$ | $\cdot 34$ | $4 \cdot 24$ | -25 | $4 \cdot 24$ | -17 | $4 \cdot 23$ |
| 24 | -66 | $4 \cdot 28$ | $\cdot 57$ | 4.27 | -48 | $4 \cdot 26$ | -39 | -4.25 | -31 | $4 \cdot 24$ | . 22 | 4.23 |
| 26 | $\cdot 72$ | 4.29 | $\cdot 63$ | $4 \cdot 28$ | - 54 | $4 \cdot 26$ | - 45 | $4 \cdot 25$ | $\cdot 36$ | $4 \cdot 24$ | . 28 | $4 \cdot 24$ |
| 28 | -79 | $4 \cdot 30$ | -70 | $4 \cdot 29$ | - 60 | $4 \cdot 27$ | - 51 | $4 \cdot 26$ | -42 | $4 \cdot 25$ | -33 | $4 \cdot 24$ |
| 30 | -.86 | 4.31 | - $\cdot 76$ | $4 \cdot 30$ | -.67 | $4 \cdot 28$ | - $\cdot 57$ | $4 \cdot 27$ | -. 48 | $4 \cdot 25$ | - 39 | $4 \cdot 25$ |
| 32 | $\cdot 93$ | $4 \cdot 33$ | -83 | $4 \cdot 31$ | .74 | $4 \cdot 29$ | .64 | 4*:28 | . 55 | $4 \cdot 26$ | . 45 | 4.25 |
| 34 | I-OI | 4.35 | -91 | $4 \cdot 33$ | .8r | $4 \cdot 31$ | -71 | $4 \cdot 29$ | -61 | $4 \cdot 27$ | - 52 | $4 \cdot 26$ |
| 36 | r.09 | $4 \cdot 37$ | -99 | $4 \cdot 34$ | -88 | $4 \cdot 32$ | -78 | $4 \cdot 30$ | -68 | $4 \cdot 28$ | -58 | 4.27 |
| 38 | r-18 | $4 \cdot 39$ | 1.07 | $4 \cdot 36$ | -96 | $4 \cdot 34$ | -86 | $4 \cdot 32$ | -75 | $4 \cdot 30$ | . 65 | $4 \cdot 28$ |
| 40 | -r.28 | 4.42 | -r.r6 | $4 \cdot 39$ | -I.O5 | $4 \cdot 36$ | -.94 | $4 \cdot 33$ | -. 83 | $4 \cdot 31$ |  | $4 \cdot 29$ |
| 42 | Y.38 | $4 \cdot 45$ | I-26 | $4 \cdot 4 \mathrm{I}$ | $\mathrm{I} \cdot \mathrm{I} 4$ | $4 \cdot 38$ | - 03 | $4 \cdot 35$ | .91 | $4 \cdot 33$ | . 80 | $4 \cdot 30$ |
| 44 | I. 49 | 4.49 | r.36 | 4.45 | r. 24 | $4 \cdot 4 \mathrm{I}$ | I-12 | $4 \cdot 38$ | r.00 | $4 \cdot 35$ | -88 | $4 \cdot 32$ |
| 46 | I.62 | $4 \cdot 53$ | I.48 | 4.48 | I.35 | $4 \cdot 44$ | I.22 | $4 \cdot 40$ | r.09 | $4 \cdot 37$ | -97 | $4 \cdot 34$ |
| 48 | 1.75 | $4 \cdot 58$ | I'6I | $4 \cdot 52$ | I.47 | $4 \cdot 48$ | I.33 | $4 \cdot 43$ | I. 20 | $4 \cdot 40$ | 1.07 | $4 \cdot 36$ |
| 50 | -r.90 | $4 \cdot 64$ | -1.75 | $4 \cdot 58$ | -r.60 | $4 \cdot 52$ | -I.45 | 4.47 | -I.3I | 4.43 | -r•r7 | $4 \cdot 39$ |
| 52 | $2 \cdot 08$ | 4.71 | $1 \cdot 91$ | $4 \cdot 64$ | r 74 | 4.57 | - 59 | $4 \cdot 52$ | I.43 | $4 \cdot 47$ | I. 29 | $4 \cdot 42$ |
| 54 | $2 \cdot 28$ | $4 \cdot 80$ | $2 \cdot 09$ | $4 \cdot 72$ | I.91 | $4 \cdot 64$ | I•74 | $4 \cdot 57$ | r.57 | $4 \cdot 51$ | I.42 | $4 \cdot 46$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 79 LATITUDE $19^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| $\begin{aligned} & \text { True } \\ & \text { Alt. } \end{aligned}$ | $6^{\circ}$ | Decl. Var. | $77^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Dec <br> Var | $9^{\circ}$ |  | $10^{\circ}$ | Decl. <br> Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 8 & \text { Iク. } 8 \end{array}\right\|$ | $+1 \cdot 39$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 9 & 4 \mathrm{I} \cdot 6 \end{array}\right.$ | $\begin{gathered} 5 . \\ +\mathrm{I} \cdot 40 \end{gathered}$ | $\left\|\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { II } & 5 \cdot 7 \end{array}\right\|$ | $\begin{gathered} 5 . \\ +\mathrm{I} \cdot 40 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I2 } & 30 \cdot 3 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 4 \mathrm{I} \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I3 } & 55^{\circ} 4 \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 42 \end{gathered}$ | $\left.\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I5 } & 2 I^{\circ} \mathrm{O} \end{array} \right\rvert\,$ | S. |
| IO | 52550.7 | I.33 | 527 10.2 | I-32 | $\begin{array}{llll}5 & 28 & 29.2\end{array}$ | 1.31 | $\begin{array}{llllll}5 & 29 & 47 \cdot 8\end{array}$ | I. 30 | 5315 | 1.30 | $\begin{array}{llll}5 & 32 & 23 \cdot 6\end{array}$ | r. 29 |
| 12 | 5 I7 $22 \cdot 6$ | I'32 | 5 $51841 \cdot 5$ | I•3I | 5 I9 59 | $1 \cdot 3$ | $512117 \cdot 5$ | I. 29 | $\begin{array}{llll}5 & 22 & 34.5\end{array}$ | $\underline{1}$ | $\begin{array}{lllll}5 & 23 & 51 & 0\end{array}$ | I. 27 |
| 14 |  | 1.32 | 5 10 I3.1 | I 30 | 5 II $30 \cdot 9$ | 9 | $51247 \cdot 7$ | 7 | $\begin{array}{llll}5 & 14 & 3.8\end{array}$ | I 26 | $5{ }_{5}^{5} 1519 \cdot 2$ | I. 25 |
| 16 | $5 \quad 0 \quad 26 \cdot 8$ | I-3I | 5 I 45.0 | I 29 | $\begin{array}{lll}5 & 3 & 2 \cdot 3\end{array}$ | I 28 | $\begin{array}{llll}5 & 4 & 18 \cdot 5\end{array}$ | I. 26 | $\begin{array}{llll}5 & 5 & 33 \cdot 8\end{array}$ | $1 \cdot 24$ | $56648 \cdot 0$ | I-23 |
| 18 | $45 \mathrm{5} 59 \cdot \mathrm{I}$ | +I•3I | $4 \quad 5317 \cdot 2$ | + I. 29 | $45434^{\circ} \mathrm{O}$ | +1.27 | $45549 \cdot 6$ | + I. 25 | 4574.2 | +1.23 | 458 I7. 5 | -1.21 |
| 20 | 443 3I•5 | $\underline{1}$ | 444 | 1.2 | $446 \quad 6 \cdot 0$ | I. 26 | 447 2I'2 | I 24 | $44^{8} 35 \cdot 0$ | $1 \cdot 2$ | $44947 \cdot 6$ | - |
| 22 | $4 \begin{array}{lll}4 & 35 & 3 \cdot 8\end{array}$ | I | 436 | 1.29 | $\begin{array}{lllll}4 & 37 & 38 \cdot 2\end{array}$ | I 26 | 43853.0 | I. 23 | 44063 | 1.21 | 44 I I $8 \cdot \mathrm{I}$ | 8 |
| 24 | $4 \begin{array}{llll}4 & 26 & 35 \cdot 9\end{array}$ | 1 | 4275 | I. 29 | $4 \begin{array}{lllll}4 & 29 & 10 \cdot 5\end{array}$ | I-26 | $430 \quad 25 \cdot 1$ | 1.23 | $43137 \cdot 9$ | I.20 | 432 49'I | 17 |
| 26 | $4 \begin{array}{lll}48 & 7 \cdot 9\end{array}$ | I.32 | 4 I9 26.4 | 1.29 | $42042 \cdot 8$ | I. 26 | $42157 \cdot 3$ | I. 22 | 4239 | I-19 | $42420 \cdot 4$ | 6 |
| 28 | $4 \quad 939.5$ | + I•33 | 4 10 58 | + I | 4 I2 15.1 | +I. 2 | 41329.6 | +1.22 | 4 I4 41.9 | +I.I | 4 I5 52.I | -I'I5 |
| 30 | 4 I Io. | I•34 | 423 | I. 30 | $\begin{array}{llll}4 & 3 & 47 \cdot 3\end{array}$ | I. 26 | $\begin{array}{lll}4 & 5 & 1 \cdot 9\end{array}$ | 2 | 4614 | I. | $\begin{array}{lrrrr}4 & 7 & 24 \cdot 1\end{array}$ | I-I4 |
| 32 | $35241 \cdot 6$ | I.36 | 354 I.8 | I 31 | $\begin{array}{llll}3 & 55 & 19.3\end{array}$ | I 27 | $\begin{array}{llll}3 & 56 & 34 \cdot 2\end{array}$ | 1.22 | $35746 \cdot$ |  | $358856 \cdot 2$ | 4 |
| 33 | 34826 | $1 \cdot 37$ | $34947 \cdot 4$ | I | 3 51 5•3 | I.27 | $35220 \cdot 3$ | I.23 | $353132 \cdot 6$ | 8 | $35442 \cdot 3$ | 4 |
| 34 | 344 I | I.38 | $\begin{array}{llllllllll}3 & 45 & 32 \cdot 9\end{array}$ | $1 \cdot 33$ | $\begin{array}{lllll}3 & 46 & 5 \mathrm{I} \cdot \mathrm{I}\end{array}$ | I. 28 | $\begin{array}{lll}3 & 48 & 6 \cdot 4\end{array}$ | I. 23 | $3 \quad 49$ 18.8 | I•18 | $35028 \cdot 5$ | 4 |
| 3 | $3 \begin{array}{llll}3 & 39 & 56 \cdot 6\end{array}$ | +1.39 | $3 \begin{array}{llll}3 & 41 & 18 \cdot 3\end{array}$ | +1.33 | $\begin{array}{llll}3 & 42 & 36 \cdot 8\end{array}$ | + 1.2 | 34352.4 | +1.23 | $345 \quad 5.0$ | +1.18 |  | +I•14 |
| 36 | 3354 I | 1.40 | $3 \begin{array}{llll}3 & 37 & 3.5\end{array}$ | 1.34 | $\begin{array}{llll}3 & 38 & 22 \cdot 5\end{array}$ | $1 \cdot 2$ | $3 \begin{array}{llll}39 & 38 \cdot 3\end{array}$ | I. 24 | $3405 \mathrm{I} \cdot \mathrm{I}$ | I'19 | 3420.8 | -14 |
| 37 | 3 31 25.7 | I. 41 | $\begin{array}{lllll}3 & 32 & 48 \cdot 5\end{array}$ | I.35 | $\begin{array}{lll}3 & 34 & 8 \cdot 0\end{array}$ | I. 30 | $\begin{array}{lllllllllllll}3 & 35 & 24 \cdot 2\end{array}$ | I. 24 | $\begin{array}{lllll}3 & 36 & 37 \cdot 1\end{array}$ | 9 | 33 37 47 | - 14 |
| 38 | $\begin{array}{llll}3 & 27 & 9.8\end{array}$ | I.42 |  | I.36 | $3 \begin{array}{llll}3 & 29 & 53.4\end{array}$ | I. 30 | 3 3I | I. 25 | $\begin{array}{llll}3 & 32 & 23 \cdot 2\end{array}$ | 9 | 333 33.1 | 4 |
| 39 | $\begin{array}{lllll}3 & 22 & 53 \cdot 7\end{array}$ | I.43 | $32418 \cdot 0$ | I 37 | $32538 \cdot$ | I•3I | 3265 | I. 25 | $\begin{array}{llll}3 & 28 & 9 \cdot 2\end{array}$ | I•I9 | 32919.2 | 14 |
| 40 |  | +1.45 | 320204 | +I.38 | $32123 \cdot 7$ | +1.32 | 32241.2 | +1.26 | 323 55'1 | +1.20 | $325 \quad 5 \cdot 3$ | +1.14 |
| 41 | $31420 \cdot 7$ | I. 46 | $31546 \cdot 6$ | I. 40 | $3 \begin{array}{lll}3 & 17 & 8 \cdot 5\end{array}$ | I 33 | $318126 \cdot 6$ | I 27 | 3 I9 40. | I | $3205 \mathrm{I} \cdot 4$ | -14 |
| 42 | 3 10 $3 \cdot 7$ | I.48 | 3 II $30 \cdot 5$ | 41 | $\begin{array}{llll}3 & 12 & 53.2\end{array}$ | 1 | 314411.9 | I-28 | 315156 | 21 | $3 \begin{array}{llll}3 & 16 & 37.4\end{array}$ | 15 |
| 43 | $35546 \cdot 3$ | I.50 | 3714.1 | I 43 |  | I. 36 | $3 \quad 957 \cdot 0$ | I. 29 | 3 II 12.2 | 22 | $3 \begin{array}{llll}3 & 12 & 23.4\end{array}$ | -15 |
| 4 | $3 \begin{array}{lll}3 & 1 & 28 \cdot 5\end{array}$ | I. 52 | $\begin{array}{llll}3 & 2 & 57 * 4\end{array}$ | 1.44 | $\begin{array}{llll}3 & 4 & 2 I \cdot 8\end{array}$ | 1.37 | $3 \quad 5 \quad 4 \mathrm{I} \cdot 9$ | 1.30 | $3 \quad 6 \quad 57 \cdot 7$ | $1 \cdot 23$ | $\begin{array}{lll}3 & 8 & 9 \cdot 3\end{array}$ | 6 |
|  | $25710 \cdot 3$ | + I. 54 | 25840.4 | +I.46 | $3 \begin{array}{lll}3 & 0 & 5.8\end{array}$ | +1.38 | 3 I $26 \cdot 6$ | +1.3I | $\begin{array}{llll}3 & 2 & 43 \cdot 1\end{array}$ | +1.24 | $3 \quad 355 \cdot 0$ | +I•16 |
| 46 | $2525 \mathrm{I} \cdot 6$ | I.56 | $254 \quad 22 \cdot 9$ | I. 48 | 25549.4 | 1.40 | 257 11.2 | I. 32 | $258 \quad 28 \cdot 2$ | 1.25 | $25940 \cdot 7$ | I.17 |
| 4 | $\begin{array}{lllll}2 & 48 & 32 \cdot 4\end{array}$ |  | 250 | . 50 |  | I. 42 | $2 \begin{array}{llll}2 & 52 & 55.4\end{array}$ | 1.34 | 225413.2 | , | $2 \begin{array}{llll}2 & 55 & 26 \cdot 3\end{array}$ | I.I8 |
| 48 |  | I-6I | $24546 \cdot 8$ | 1.52 | $24715 \%$ | -44 | $2 \begin{array}{llll}2 & 48 & 39\end{array}$ | 1-35 | 249 58.0 | 1.27 | 251 II・ク | I-19 |
| 49 | $23952 \cdot 3$ | I-64 | $24 \mathrm{I} 28 \cdot 0$ | 1.5 | $24258 \cdot 2$ | $1 \cdot$ | $24423 \cdot 0$ | I.37 | $24542 \cdot 6$ | 1-28 | $246 \quad 56 \cdot 9$ | I. 20 |
| 50 | $2353 \mathrm{x} \cdot 3$ | +1.67 | $2378 \cdot 7$ | +1.57 | $23^{8} \quad 40 \cdot 3$ | +1.48 | 24063 | + I. 39 | $2 \begin{array}{llll} & 41 & 26.9\end{array}$ | + $1 \cdot 30$ | 24242.0 | +1.2I |
| 51 | 23189 | $1 \cdot 71$ | $23248 \cdot 8$ | 1.60 | $23422 \cdot 0$ | 1.50 | $23549 \cdot 3$ | I.41 | 23710.9 | 1.31 | $238 \quad 26 \cdot 9$ | I. 22 |
| 52 | $22647 \cdot 0$ | I.74 | $\begin{array}{llll}2 & 28 & 28 \cdot 3\end{array}$ | 1.63 | $23003 \cdot 1$ | I.53 | $\begin{array}{llll}2 & 31 & 31 \cdot 9\end{array}$ | I.43 | $\begin{array}{llll}2 & 32 & 54 \cdot 6\end{array}$ | 1.33 | 2341116 | I. 23 |
| 53 | $22223 \cdot 7$ | r-78 | $\begin{array}{llll}2 & 24 & 7 \cdot 0\end{array}$ | 1.67 | 22543.7 | I.56 | 22714.0 | I 45 | $22838 \cdot 0$ | 1-35 | 22955.9 | I 25 |
| 54 | 21759.3 | 1.82 | 2 I9 44.9 | 1•7 | $22123 \cdot 6$ | I. 59 | $22255 \cdot 6$ | I.48 | 224210 | 1.37 | $22540 \cdot 1$ | 1.27 |

VARIATION TO $x^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ}$ A. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\mathrm{S}_{4}$ | $\begin{gathered} s . \\ -4 \cdot 26 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +: 55 \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 26 \end{gathered}$ | $+\quad .63$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 28 \end{gathered}$ | $+\stackrel{s}{ }+7 \mathrm{I}$ | $\begin{gathered} 5 \\ -4 \cdot 29 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\quad \cdot 79 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 30 \end{gathered}$ | S. $+\quad .87$ | $\begin{gathered} s . \\ -4 \cdot 32 \end{gathered}$ |
| 2 | -42 | $4 \cdot 25$ | . 50 | $4 \cdot 26$ | - 58 | $4 \cdot 27$ | . 66 | $4 \cdot 28$ | -74 | $4 \cdot 29$ | . 82 | $4 \cdot 31$ |
| 4 | -37 | $4 \cdot 24$ | -45 | $4 \cdot 25$ | $\cdot 52$ | $4 \cdot 26$ | -60 | $4 \cdot 27$ | -68 | $4 \cdot 28$ | -77 | $4 \cdot 30$ |
| 6 | $\cdot 32$ | $4 \cdot 24$ | -40 | $4 \cdot 25$ | -48 | $4 \cdot 26$ | $\cdot 56$ | $4 \cdot 27$ | -64 | $4 \cdot 28$ | -72 | $4 \cdot 29$ |
| 8 | -27 | $4 \cdot 24$ | -35 | $4 \cdot 24$ | $\cdot 42$ | 4.25 | -50 | $4 \cdot 26$ | $\cdot 58$ | $4 \cdot 27$ | -66 | $4 \cdot 28$ |
| 10 | + 22 | $4 \cdot 24$ | + 30 | $4 \cdot 24$ | + 38 | $4 \cdot 25$ | + 46 | $4 \cdot 26$ | +.54 | 4.27 | +.62 | $4 \cdot 28$ |
| 12 | -17 | $4 \cdot 23$ | -25 | $4 \cdot 24$ | -33 | $4 \cdot 24$ | -4I | $4 \cdot 25$ | -49 | $4 \cdot 26$ | $\cdot 57$ | $4 \cdot 27$ |
| 14 | -12 | $4 \cdot 23$ | -20 | $4 \cdot 23$ | -28 | $4 \cdot 24$ | -36 | $4 \cdot 24$ | -44 | 4.25 | -52 | $4 \cdot 26$ |
| 16 | -07 | $4 \cdot 23$ | -15 | $4 \cdot 23$ | $\cdot 23$ | $4 \cdot 24$ | -3I | $4 \cdot 24$ | -39 | $4 \cdot 25$ | $\cdot 47$ | $4 \cdot 26$ |
| 18 | +.02 | $4 \cdot 23$ | -10 | $4 \cdot 23$ | - 18 | $4 \cdot 23$ | $\cdot 26$ | $4 \cdot 24$ | -34 | $4 \cdot 24$ | 42 | $4 \cdot 25$ |
| 20 | - .03 | $4 \cdot 23$ | +.05 | 4.23 | + 13 | $4 \cdot 23$ | $+.21$ | $4 \cdot 23$ | + 30 | $4 \cdot 24$ | $+\cdot 38$ | $4 \cdot 25$ |
| 22 | - 08 | $4 \cdot 23$ | -00 | $4 \cdot 23$ | -08 | $4 \cdot 23$ | -17 | $4 \cdot 23$ | $\cdot 25$ | $4 \cdot 24$ | -33 | $4 \cdot 24$ |
| 24 | -14 | 4.23 | -. 05 | $4 \cdot 23$ | +.03 | $4 \cdot 23$ | -12 | $4 \cdot 23$ | -20 | $4 \cdot 23$ | -29 | $4 \cdot 24$ |
| 26 | -19 | $4 \cdot 23$ | -10 | $4 \cdot 23$ | - 02 | $4 \cdot 23$ | $\cdot 07$ | $4 \cdot 23$ | -15 | $4 \cdot 23$ | -24 | $4 \cdot 24$ |
| 28 | $\cdot 24$ | $4 \cdot 24$ | -16 | $4 \cdot 23$ | -07 | $4 \cdot 23$ | +.02 | $4 \cdot 23$ | -10 | $4: 23$ | -19 | $4 \cdot 23$ |
| 30 | - 30 | $4 \cdot 24$ | - 21 | $4 \cdot 23$ | - -12 | $4 \cdot 23$ | - -03 | $4 \cdot 23$ | +.05 | $4 \cdot 23$ | + .14 | $4 \cdot 23$ |
| 32 | $\cdot 36$ | 4.24 | -27 | $4 \cdot 24$ | -18 | 4.23 | - 08 | $4 \cdot 23$ | $\cdot 00$ | 4.23 | -10 | $4 \cdot 23$ |
| 34 | -42 | $4 \cdot 25$ | -33 | $4 \cdot 24$ | -23 | $4 \cdot 24$ | -14 | 4.23 | -. 04 | $4 \cdot 23$ | +.05 | $4 \cdot 23$ |
| 36 | $\cdot 48$ | $4 \cdot 26$ | -39 | $4 \cdot 25$ | -29 | $4 \cdot 24$ | -19 | $4 \cdot 23$ | -10 | $4 \cdot 23$ | -00 | $4 \cdot 23$ |
| 38 | -55 | $4 \cdot 27$ | -45 | $4 \cdot 25$ | $\cdot 35$ | $4 \cdot 24$ | -25 | $4 \cdot 24$ | -15 | $4 \cdot 23$ | -.05 | $4 \cdot 23$ |
| 40 | - .62 | $4 \cdot 27$ | -.5I | $4 \cdot 26$ | . 41 | $4 \cdot 25$ | - 31 | $4 \cdot 24$ | -.21 | $4 \cdot 23$ | - II | $4 \cdot 23$ |
| 42 | -69 | 4.28 | . 58 | $4 \cdot 27$ | -48 | 4.26 | $\cdot 37$ | $4 \cdot 24$ | -27 | $4 \cdot 24$ | -16 | $4 \cdot 23$ |
| 44 | $\cdot 77$ | 4.30 | - 66 | $4 \cdot 28$ | - 55 | $4 \cdot 26$ | -44 | $4 \cdot 25$ | -33 | $4 \cdot 24$ | -22 | $4 \cdot 24$ |
| 46 | -85 | $4 \cdot 32$ | $\cdot 73$ | $4 \cdot 29$ | . 62 | $4 \cdot 28$ | -50 | $4 \cdot 26$ | -39 | $4 \cdot 25$ | - 28 | $4 \cdot 24$ |
| 48 | -94 | $4 \cdot 33$ | -82 | $4 \cdot 31$ | $\cdot 70$ | $4 \cdot 29$ | $\cdot 58$ | $4 \cdot 27$ | -46 | $4 \cdot 25$ | -34 | $4 \cdot 24$ |
| 50 | -I.04 | $4 \cdot 36$ | -.91 | $4 \cdot 33$ | -.78 | $4 \cdot 30$ | -.65 | $4 \cdot 28$ | -. 53 | $4 \cdot 26$ | - $\cdot 41$ | $4 \cdot 25$ |
| 52 | I-15 | $4 \cdot 38$ | I-OI | $4 \cdot 35$ | -87 | $4 \cdot 32$ | -74 | $4 \cdot 29$ | -6I | $4 \cdot 27$ | $\cdot 48$ | $4 \cdot 26$ |
| 54 | I. 26 | 4.41 | I•II | $4 \cdot 37$ | $\cdot 97$ | 4.34 | -83 | 4.31 | -69 | $4 \cdot 29$ | $\cdot 56$ | 4.27 |

80 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT. LATITUDE $19^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { I6 } \end{array}\right.$ | +1.44 | H. M. S. |  | $\left\lvert\, \begin{array}{cc} \text { H. M. } \\ 6 & \text { I9 } \\ 42.0 \end{array}\right.$ | S. +1.47 | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \mathrm{S} . \\ 6 & 2 \mathrm{I} \\ \mathrm{IO} \cdot 5 \end{array}\right.$ | + 5 |  | S. |  |  |
| 10 | 533 41-I | I 29 | $53458 \cdot 3$ | I-28 | $5 \quad 3615.2$ | 1.28 | $53732 \cdot 0$ | 1.28 |  |  |  |  |
| 12 | 525711 | 26 | $\begin{array}{llll}5 & 26 & 22 \cdot 6\end{array}$ | I 25 | $\begin{array}{llllllllll}5 & 27 & 37 \cdot 8\end{array}$ | 25 | $\begin{array}{llll}5 & 28 & 52.5\end{array}$ | $1 \cdot 24$ | $5 \begin{array}{llll}5 & 30 & 7.0\end{array}$ | I. 24 | $5 \begin{array}{lll}5 & 31 & 21.2\end{array}$ |  |
| 14 | $\begin{array}{llllll}5 & 16 & 33.9\end{array}$ | 1.24 | 51748.0 | I 23 | 519 19 | 1.22 | 52014.3 | $1 \cdot 21$ | 52126.6 | 1.20 | 5 $22238 \cdot 6$ | '19 |
| 16 | $\begin{array}{llll}5 & 8 & 1.5\end{array}$ | 1.22 | 5 5 9 I4.I | 1.20 | 5 10 26.0 | I•19 | 5 II 37-I | I. 18 | 51247.5 | I•17 | $\begin{array}{lllll}5 & 13 & 57 \cdot 2\end{array}$ | 16 |
| 18 | 45929.9 | +1.20 | $5{ }^{5}$ | +r.18 | 1 51.5 | +I.16 | . 9 | +1. | $\begin{array}{lll}5 & 4 & 9 \cdot 4\end{array}$ | +I•13 | 17.0 | +1.12 |
| 20 | $45058 \cdot 9$ | x.18 | 4529.0 | 1•16 | $4 \quad 53 \quad 17.9$ | $\underline{1}$ | $5425 \cdot 6$ | I.12 | $45532 \cdot 3$ | I'10 | $45638 \cdot 0$ | r.08 |
| 22 | 44228 | I•I6 | $44337 \cdot 4$ | I.I4 | $44445 \cdot 0$ | I•II | $44551 \cdot 3$ |  | $44656 \cdot 2$ | 1.0 | 44759 | 5 |
| 24 | $1 \begin{array}{llll}4 & 33 & 58 \cdot 7\end{array}$ | 1 | 4356.5 | I.I2 | $4 \begin{array}{lll}46 & 12.9\end{array}$ | $1 \cdot 09$ | 43717.7 | $1 \cdot 07$ | 43821.0 | I. 04 | 43922.9 | 02 |
| 26 | 42529.2 | 13 | $4 \begin{array}{lll}4 & 26 & 36 \cdot 2\end{array}$ |  | $42741 \cdot 4$ | I.07 | $4 \quad 28 \quad 44.9$ | $1 \cdot 04$ | $42946 \cdot 6$ | I.OI | $43046 \cdot 7$ | 99 |
| 28 | $\begin{array}{ccc}4 & 17 & 0.3 \\ 4 & 8 & 3.7\end{array}$ | +1.12 | $\begin{array}{cccc}4 & 18 & 6.4 \\ 4 & 9 & 37 \cdot 1\end{array}$ | +1.08 | $\begin{array}{llll}4 & 19 & 10 \cdot 6\end{array}$ | +r.05 | $4 \begin{array}{llll}4 & 20 & 12.8\end{array}$ | +1.02 | $\begin{array}{llll}4 & 21 & 13.0\end{array}$ | + 99 | 422211.4 | + 96 |
| 30 | ${ }_{4}^{4} 8831 \cdot 7$ | I'II | ${ }_{9} 937 \cdot 1$ | 1.07 | $41040 \cdot 3$ | I.03 | $\begin{array}{lllllll}4 & 11 & 41.3\end{array}$ | 1. | $\begin{array}{ll}4 & 12 \\ 4 & 40 \cdot 1\end{array}$ | $\cdot 9$ | $4 \begin{array}{llll}4 & 13 & 36 \cdot 9\end{array}$ | 93 |
| 31 32 | $\begin{array}{lll}4 & 4 & 17 \cdot 4 \\ 4 & 0 & 3.4\end{array}$ | $\xrightarrow{\text { I-ro }}$ |  | . 06 | $\begin{array}{lll}4 & 6 & 25 \cdot 3 \\ 4 & 2 & 10 \cdot 4\end{array}$ | $\begin{array}{r}1.03 \\ \text { I.02 } \\ \hline\end{array}$ | $\begin{array}{llll}4 & 7 & 25 \cdot 8 \\ 4 & 3 & 10 \cdot 4\end{array}$ | 99 | $\begin{array}{llll}4 & 8 & 24.0 \\ 4 & 4 & 7.9\end{array}$ | $\cdot 95$ | $\begin{array}{llll}4 & 9 & 19 \cdot 9 \\ 4 & 5 & 3 \cdot 5\end{array}$ | 91 |
| 32 | $\begin{array}{lrr}4 & 0 & 3.4 \\ 3 & 55 & \end{array}$ |  | $\begin{array}{llrr}4 & 1 & 8 \cdot 2 \\ 3 & 56 & 53.8\end{array}$ | 1.06 | $\begin{array}{cccc}4 & 2 & 10 \cdot 4 \\ 3 & 57 & \end{array}$ | . 02 | $\begin{array}{lll}3 & 10 \cdot 4\end{array}$ |  | $\begin{array}{llll}4 & 4 & 7.9\end{array}$ | $\cdot 94$ | $4{ }_{4}^{4} 505 \cdot 1$ | 90 |
| 33 | 35549 | rog | $\begin{array}{llll}3 & 56 & 53 \cdot 8\end{array}$ | 1.05 | $35755 \cdot 7$ | r.or | 58 55.1 | -97 | $35952 \cdot 0$ | $\cdot 93$ | - $46 \cdot 5$ | 9 |
| 34 | $\begin{array}{llll}3 & 51 & 35.4 \\ 3 & 47 & 21.4\end{array}$ | +1.09 | $\begin{array}{lll}3 & 52 & 39 \cdot 6 \\ 3 & 48 & 25 \cdot 4\end{array}$ | 1.05 +1.04 |  | $+\mathrm{r} .0$ | 54 <br> 54 <br> 50 <br> 0 | + 9.96 | $\begin{array}{llll}3 & 55 & 36.3 \\ 3 & 51 & 20.7\end{array}$ | + 9.92 | $\begin{array}{llll}3 & 56 & 30 \cdot 0 \\ 3 & 52 & 13.7\end{array}$ | + 88 $+\quad .86$ |
| 3 | 3 47 21.4 <br> 3 43 7.5 | 1.09 | $\begin{array}{llll}3 & 48 & 25 \cdot 4 \\ 3 & 44 & \text { II } & \\ 3\end{array}$ | $\text { I. } 04$ | $\begin{array}{llll}3 & 49 & 26 \cdot 6 \\ 3 & 45 & 12 \cdot 1\end{array}$ | 1.0 | $\begin{array}{llll}3 & 50 & 250 \\ 3 & 46 & 10.1\end{array}$ | -95 | $\begin{array}{cccc}3 & 51 & 20 \cdot 7 \\ 3 & 47 & 5 \cdot 3\end{array}$ |  | $\begin{array}{llll}3 & 52 & 13 \cdot 7 \\ 3 & 47 & 57.6\end{array}$ | 86 |
| 37 |  |  | $\begin{array}{lllllllll} \\ 3 & 39 & 57 \cdot 2\end{array}$ | 1.03 | $34057 \cdot 8$ |  | $34 \mathrm{I} 55^{\circ} 4$ | -93 | $34250 \cdot 0$ |  | 3 <br> 43 <br> 15 | 3 |
| 38 | ${ }_{3}^{3} 34398$ | I.08 | $3 \begin{array}{llll}3 & 35 \cdot 2\end{array}$ | 03 | $\begin{array}{llllllllll}3 & 36 & 43\end{array}$ | $\cdot 98$ | $3 \quad 3740 \cdot 7$ | -93 | $\begin{array}{llll}3 & 38 & 34.8\end{array}$ | 8 | $\begin{array}{lllll}3 & 39 & 25\end{array}$ | 82 |
| 39 | $\begin{array}{llll}3 & 30 & 26.0\end{array}$ | +1.08 | $\begin{array}{llll}3 & 31 & 29.3 \\ 3 & 19\end{array}$ | +1.03 | $\begin{array}{llll}3 & 32 & 29.4\end{array}$ | + 97 | $\begin{array}{llll}3 & 33 & 26 \cdot 2\end{array}$ | + 92 |  | $+.86$ | $\begin{array}{llll}3 & 35 & 10 \cdot 0\end{array}$ | + $8 \mathrm{8r}$ |
| 4 | $\begin{array}{lllll}3 & 26 & 12 \cdot 1 \\ 3 & 21 & 58.3\end{array}$ | I.08 | 2715.4 | 1.02 |  | 97 |  | -91 | $\begin{array}{llll}3 & 30 & 4 \cdot 7\end{array}$ | . 85 | $\begin{array}{lllll}3 & 30 & 54.4\end{array}$ |  |
| 4 I |  | I. 08 | $\begin{array}{llll}3 & 23 & 1.5 \\ 3 & 18 & 4.7\end{array}$ | 1.02 | $\begin{array}{llll}3 & 24 & 1 \cdot 2 \\ 3 & 1 & \end{array}$ | -96 |  | 90 | 3 25 49 |  | 32639 | 79 |
| 42 | $\begin{array}{llllllllllll}3 & 17 & 44.5\end{array}$ | I.08 |  | I. 02 | $\begin{array}{llll}3 & 19 & 47 \cdot 2 \\ 3 & 15 & \end{array}$ | -96 | $\begin{array}{llll}3 & 20 & 43 \cdot 0 \\ 3 & 16 & 28.8\end{array}$ | 90 | $\begin{array}{llll}3 & 21 & 35 \cdot 1 \\ 3 & 17 & 20 \cdot 5\end{array}$ |  | $\begin{array}{llllll}3 & 22 & 23.6\end{array}$ | 8 |
| 43 | $31330 \cdot 6$ |  | 31433.8 |  | $315 \begin{array}{lll}33 & 2\end{array}$ | 6 | 31628.8 |  | $\begin{array}{lllll}3 & 17 & 20 \cdot 5\end{array}$ |  |  | 77 |
| 44 | $\begin{array}{llllllllllllll}3 & 9 & 16.7\end{array}$ | +1.09 |  | $+\mathrm{I} .02$ |  | + 9.95 |  |  |  |  |  | + 76 |
| 45 | $\begin{array}{llll}3 & 5 & 2 \cdot 7 \\ 3 & 0 & 48 \cdot 7 \\ 2 & 56 & \end{array}$ | 1.09 | $\left\lvert\, \begin{array}{llr} 3 & 6 & 6 \cdot 2 \\ 3 & 1 & 52 \cdot 3 \end{array}\right.$ | $\begin{aligned} & \mathrm{I} .02 \\ & \mathrm{I} .02 \end{aligned}$ | $\begin{array}{ccc}3 & 7 & 5 \cdot 5 \\ 3 & 2 & 51 \cdot 6 \\ 2\end{array}$ | -95 | $\begin{array}{rrr} 3 & 8 & 0 \cdot 5 \\ 3 & 3 & 46 \cdot 5 \end{array}$ | . 88 | $\begin{array}{lll} 3 & 8 & 51.4 \\ 2 & 1 & 27 \end{array}$ | .82 | 3 $\begin{array}{llll}3 & 9 & 38 \cdot 4 \\ 3 & 5 & 23 \cdot 5\end{array}$ | 75 |
| 46 | $\begin{array}{rrrr}3 & 0 & 48 \cdot 7 \\ 2 & 56 & 34 \cdot 7 \\ & \end{array}$ | I•10 | $\begin{array}{ccc}3 & 1 & 52.3 \\ 2 & 57 & 38.5 \\ \end{array}$ | $\underline{\mathrm{I} \cdot 02}$ | $\begin{array}{rrrrr}3 & 2 & 51 \cdot 6 \\ 2 & 58 & 37.7\end{array}$ | $\cdot 95$ | 3 3 $46 \cdot 5$ <br> 2 59  | . 88 | 3 4 $37 \cdot 1$ <br> 3 0  |  | 3 5 23.5 <br>  5 8.5 | 74 |
| 4 | $\begin{array}{lllll}2 & 56 & 34.7\end{array}$ | I-10 | $\begin{array}{lllll}2 & 57 & 38 \cdot 5\end{array}$ | 1.02 |  | 95 | $\begin{array}{llllllllll}2 & 59 & 32 \cdot 5\end{array}$ | -88 | $\begin{array}{llll}3 & 0 & 22.8 \\ 2 & 56 & 8.6\end{array}$ | 80 | $\begin{array}{llll}3 & 1 & 8.7\end{array}$ | - |
| 48 | $25220 \cdot 5$ | I•II | 25324.5 | 1.03 | $2 \begin{array}{llll}24 & 23\end{array}$ | -95 | 5518 | 87 | $2 \begin{array}{lll}56 & 8 \cdot 6\end{array}$ | 79 | 25654.0 | 72 |
| 49 50 | $\begin{array}{llr}2 & 48 & 6 \cdot 3 \\ 2 & 43 & 5.9\end{array}$ | +1.11 | $\begin{array}{llll}2 & 49 & 10 \cdot 6 \\ 2 & 44 & 56.7\end{array}$ | + 1.03 | $\begin{array}{llll}2 & 50 & 10 \cdot 1 \\ 2 & 5 & 56 \cdot 2\end{array}$ | + 95 | 2 51 4.7 <br> 2 46  | + 88 | $\begin{array}{lllll}2 & 51 & 54.4 \\ 2 & 47\end{array}$ | $\begin{array}{r} \\ +\quad 79 \\ \hline 78\end{array}$ | $2 \begin{array}{llll}22 & 39 \cdot 4\end{array}$ |  |
| 50 | 2 43 51.9 <br> 2 3  | 12 |  | 1.04 |  | $\cdot 95$ | $\begin{array}{llllllll}2 & 46 & 50 \cdot 8\end{array}$ |  | $\begin{array}{lllll}2 & 47 & 40 \cdot 3\end{array}$ |  | $\begin{array}{lllll}2 & 48 & 24 \cdot 9\end{array}$ |  |
| 51 | $\begin{array}{llll}2 & 39 & 37.4 \\ 2 & 35 & 22.8\end{array}$ | $\xrightarrow{1 \cdot 13}$ | $\begin{array}{llll}2 & 40 & 42 \cdot 6 \\ 2 & 36 & 28 \cdot 4\end{array}$ | $\underline{1.04}$ |  | $\cdot 95$ | $\begin{array}{llll}2 & 42 & 36 \cdot 9 \\ 2 & 38 & 23 \cdot 1 \\ 2 & \end{array}$ |  | $\begin{array}{lllll}2 & 43 & 26 \cdot 3\end{array}$ |  | $\begin{array}{llll}2 & 44 & 10 \cdot 5 \\ 2 & 30 & 56\end{array}$ | 6 |
| 52 |  | $\xrightarrow{1} 1.14$ | $\begin{array}{llll}2 & 36 & 28 \cdot 4\end{array}$ | 05 | $\begin{array}{lllll}2 & 37 & 28 \cdot 5\end{array}$ | $\cdot 96$ | $\begin{array}{lllll}2 & 38 & 23 \cdot 1\end{array}$ | - 86 |  |  | $\begin{array}{lllll}2 & 39 & 56 \cdot I \\ 2\end{array}$ | $\cdot 69$ |
| 53 | 231 | 5 | 23214.2 | I.05 | $\begin{array}{llll}2 & 3314.6\end{array}$ | '96 | $\begin{array}{lll}2 & 34 & 9 \cdot 3\end{array}$ | . 86 | $23458 \cdot 4$ | $\cdot 77$ | $23541 \cdot 9$ | $\cdot 68$ |
| 54 | $\begin{array}{llll}2 & 26 & 53 \cdot 0 \\ 2 & 22\end{array}$ | +1.16 | $\begin{array}{llll}2 & 27 & 59 \cdot 8 \\ 2 & 23\end{array}$ | + 1.06 | $\begin{array}{lll}2 & 29 & 0.6 \\ 2 & 24 & 6.5\end{array}$ | + .96 | $\begin{array}{llll}2 & 29 & 55.4\end{array}$ | + 87 | $\begin{array}{lllll}2 & 30 & 44 \cdot 5\end{array}$ | + 77 | $2 \begin{array}{llllllll}21 & 27 & 7\end{array}$ |  |
| 55 | $\begin{array}{lllll}2 & 22 & 37.8\end{array}$ | 1-18 | $\begin{array}{llll}2 & 23 & 45 \cdot 3\end{array}$ | 1.07 | $\begin{array}{llll}2 & 24 & 46 \cdot 5\end{array}$ | . 97 | $\begin{array}{llll}2 & 25 & 4 \mathrm{I} \cdot 6\end{array}$ | 8 | $\begin{array}{llll}2 & 26 & 30 \cdot 6\end{array}$ | -77 | $\begin{array}{lllll}2 & 27 & 13.5\end{array}$ | 66 |
| 56 | ${ }_{2}^{2} 18$ | 19 | $\begin{array}{llll}2 & 19 & 30 \cdot 6\end{array}$ |  | 2 20 32.4 <br> 2 1  | -98 | $\begin{array}{llll}2 & 21 & 27 \cdot 7 \\ 2\end{array}$ | -87 | $\begin{array}{llll}2 & 22 & 16.8 \\ 2 & 18\end{array}$ | $\cdot 76$ | $\begin{array}{llll}222 & 59.5\end{array}$ | $\cdot 66$ |
| 57 58 | 214 | 1.21 1.23 | $\begin{array}{\|ccc\|}2 & 15 & 15.8 \\ 2 & 11 & 0.7\end{array}$ |  | $2{ }^{2} 1618$ | -98 | $\begin{array}{llll}2 & 17 & 13.8 \\ 2 & \text { I2 } & 59\end{array}$ |  |  | $\cdot 76$ | $1845 \cdot 4$ | 5 |
| 58 | $2950 \cdot 6$ | 1.2 | II 0.7 | $1 \cdot 1$ | 212 | '99 | 21259.9 |  | 13 49•1 |  | 1431 | 65 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $1^{17}{ }^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{aligned} & \mathrm{s} . \\ & +95 \end{aligned}$ | $\begin{gathered} 5 . \\ -4.34 \end{gathered}$ | $\begin{gathered} \text { s. } \\ +1 \circ 04 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 35 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot \mathrm{I}_{2} \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 37 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 20 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 40 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 29 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 42 \end{gathered}$ | $\begin{gathered} \text { s. } \\ +\mathrm{I} \cdot 37 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 45 \end{gathered}$ |
| 4 | .85 | 4.31 | . 93 | 4.33 | . 01 | 4.35 | 1.09 | $4 \cdot 37$ | -18 | 4.39 | 1.26 | $4 \cdot 41$ |
| 8 | $\cdot 74$ | $4 \cdot 30$ | $\cdot 83$ | 4.31 | $\cdot 91$ | $4 \cdot 33$ | $\cdot 99$ | $4 \cdot 34$ | 1.07 | $4 \cdot 36$ | I•16 | $4 \cdot 38$ |
| 12 | -65 | $4 \cdot 28$ | $\cdot 73$ | $4 \cdot 29$ | -81 | $4 \cdot 31$ | -89 | $4 \cdot 32$ | $\cdot 98$ | $4 \cdot 34$ | 1.06 | $4 \cdot 36$ |
| 16 | $\cdot 55$ | 4.27 | . 64 | 4.28 | $\cdot 72$ | $4 \cdot 29$ | -80 | $4 \cdot 30$ | -88 | $4 \cdot 32$ | -97 | $4 \cdot 34$ |
| 20 | + $\cdot 46$ | $4 \cdot 25$ | + 54 | $4 \cdot 26$ | +.63 | $4 \cdot 28$ | +.71 | $4 \cdot 29$ | + 79 | $4 \cdot 30$ | + 88 | $4 \cdot 32$ |
| 22 | -42 | $4 \cdot 25$ | . 50 | $4 \cdot 26$ | $\cdot 58$ | $4 \cdot 27$ | . 67 | $4 \cdot 28$ | . 75 | $4 \cdot 30$ | .84 | 4.31 |
| 24 | $\cdot 37$ | 4.25 | $\cdot 45$ | 4.25 | $\cdot 54$ | 4:26 | $\cdot 62$ | $4 \cdot 28$ | $\cdot 71$ | $4 \cdot 29$ | -80 | 4.30 |
| 26 | $\cdot 32$ | 4.24 | -41 | 4.25 | $\cdot 50$ | $4 \cdot 26$ | $\cdot 58$ | $4 \cdot 27$ | $\cdot 67$ | $4 \cdot 28$ | $\cdot 76$ | $4 \cdot 30$ |
| 28 | $\cdot 28$ | 4.24 | -37 | 4.24 | -45 | 4.25 | -54 | $4 \cdot 26$ | $\cdot 63$ | $4 \cdot 28$ | $\cdot 72$ | 4.29 |
| 30 | + 23 | $4 \cdot 24$ | + 32 | 4.24 | + 41 | $4 \cdot 25$ | + 50 | $4 \cdot 26$ | + 59 | 4.27 | + 68 | 4.29 |
| 32 | -19 | $4 \cdot 23$ | . 28 | 4.24 | $\cdot 37$ | $4 \cdot 25$ | . 46 | $4 \cdot 25$ | - 55 | $4 \cdot 26$ | . 64 | $4 \cdot 28$ |
| 34 | - 14 | 4.23 | $\cdot 23$ | 4.24 | $\cdot 32$ | 4.24 | $\cdot 41$ | 4.25 | -51 | $4 \cdot 26$ | -60 | 4.27 |
| 36 | -09 | $4 \cdot 23$ | -18 | $4 \cdot 23$ | -28 | $4 \cdot 24$ | $\cdot 37$ | 4.25 | -47 | $4 \cdot 25$ | $\cdot 56$ | 4.27 |
| 38 | + 04 | 4.23 | -14 | $4 \cdot 23$ | - 24 | $4 \cdot 24$ | $\cdot 33$ | 4.24 | -43 | 4.25 | -53 | 4.26 |
| 40 | - .or | $4 \cdot 23$ | + 09 | 4.23 | + 19 | 4.23 | + 29 | 4.24 | + 39 | $4 \cdot 25$ | + 49 | $4 \cdot 26$ |
| 42 | -06 | $4 \cdot 23$ | +.04 | 4.23 | $\cdot 14$ | $4 \cdot 23$ | -25 | $4 \cdot 24$ | $\cdot 35$ | $4 \cdot 24$ | $\cdot 45$ | 4.25 |
| 44 | -II | $4 \cdot 23$ | - or | $4 \cdot 23$ | -10 | $4 \cdot 23$ | - 20 | $4 \cdot 24$ | -31 | $4 \cdot 24$ | 4 4 | 4.25 |
| 46 | -17 | $4 \cdot 23$ | -06 | 4.23 | + .05 | 4.23 | -16 | 4.23 | -27 | $4 \cdot 24$ | $\cdot 38$ | 4.25 |
| 48 | -23 | 4.24 | - II | $4 \cdot 23$ | $\cdot 00$ | $4 \cdot 23$ | -II | 4.23 | -22 | 4.24 | $\cdot 34$ | 4.24 |
| 50 | - 29 | 4.24 | - 17 | 4.23 | -.05 | 4.23 | +.06 | 4.23 | + 18 | 4.23 | + 30 | 4.24 |
| 52 | $\cdot 35$ | $4 \cdot 24$ | $\cdot 23$ | 4.24 | - II | $4 \cdot 23$ | + 02 | $4 \cdot 23$ | - 14 | 4.23 | - 26 | 4.24 |
| 54 | 42 | $4 \cdot 25$ | -29 | $4 \cdot 24$ | -16 | 423 | -. 03 | 4.23 | -09 | 4.23 | - 22 | 4.24 |
| 56 | $\cdot 50$ | 4.26 | $\cdot 36$ | $4 \cdot 25$ | -22 | $4 \cdot 24$ | -09 | $4 \cdot 23$ | . 04 | 4.23 | - 18 | 4.23 |
| 58 | -58 | $4 \cdot 27$ | $\cdot 43$ | $4 \cdot 25$ | -29 | 4.24 | $\cdot 15$ | $4 \cdot 23$ | -00 | $4 \cdot 23$ | -14 | 4.23 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Dec <br> Var | $19^{\circ}$ | Dec <br> Var | $20^{\circ}$ | Dec <br> Var | $21^{\circ}$ | $\begin{aligned} & \mathrm{De} \\ & \mathrm{Va} \end{aligned}$ | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. | S | H. M. S. | S. | H. M. S. |  | H. M. S. |  |  |  | M. S. |  |
| 0 | 6254 | +1. | 627 | +1.55 | 28 47. | $+1.57$ | 3022.9 | + I 5 | 3159.2 | + I. 62 | 33 37.0 | + I. 64 |
| 10 | 54121.8 | 1.27 | $54238 \cdot 4$ | I-28 | 543 55.1 | I. 28 | $\begin{array}{lllll}5 & 45 & \mathrm{II} \cdot 8\end{array}$ | I. 28 | $546 \quad 28.8$ | I. 28 | $54746 \cdot 0$ | . 29 |
| 12 | $\begin{array}{llll}5 & 32 & 35 \cdot 2\end{array}$ | 23 | $53349 \cdot 0$ | $1 \cdot 23$ | $535 \quad 2 \cdot 6$ | I-22 | $5{ }_{5}^{56}$ I6•I | I 22 | $53729 \cdot 6$ | 2 | $53843 \cdot 1$ | 22 |
| 14 | $\begin{array}{llll}5 & 23 & 500\end{array}$ | I-19 | $5 \begin{array}{lll}5 & 25 & \text { I I I }\end{array}$ | I.18 | 526 II.9 | I-18 | $\begin{array}{llll}5 & 27 & 22 \cdot 3\end{array}$ | 17 | $5 \quad 28 \quad 32 \cdot 4$ | 7 | 52942.4 | -16 |
| 16 | $\begin{array}{llll}5 & 15 & 6 \cdot 3\end{array}$ | I•I5 | $\begin{array}{llll}5 & 16 & 14.8\end{array}$ | $1 \cdot 14$ | $\begin{array}{llllllllll}5 & 17 & 22.7\end{array}$ | I. 13 | $\begin{array}{lllll}5 & 18 & 30 \cdot 1\end{array}$ | 2 | $\begin{array}{lllllllllll}5 & 19 & 37 \cdot 0\end{array}$ | I•II | 52043.4 | 1-10 |
| 18 | $\begin{array}{llll}5 & 6 & 23 \cdot 8\end{array}$ | + I | $\begin{array}{llll}5 & 7 & 29 \cdot 8\end{array}$ | +1.09 | 5 S 35 | + I.08 | 5939 | +1.07 | 5 10 43.2 | + 5.06 | 5 II $46 \cdot 3$ | + I.04 |
| 2 | $45742 \cdot 5$ | 1.07 | $458 \quad 46 \cdot 0$ | I.05 | $45948 \cdot 6$ | 1.03 | $5 \quad 0 \quad 50 \cdot 2$ | 1.02 | 5 I 50.9 | 1.00 | $5 \quad 2 \quad 50 \cdot 7$ | 99 |
| 22 | $4492 \cdot 3$ | 1.0 | 450 | $\underline{I}$ | 44 51  | -99 | $\begin{array}{lll}4 & 52 & 2.4\end{array}$ | -97 | 453 O.I | -95 | $45356 \cdot 7$ | 93 |
| 26 | $44023 \cdot 2$ |  | 44122.2 | -97 | $\begin{array}{llll}4 & 42 & 19.7\end{array}$ | 5 | $\begin{array}{llll}4 & 43 & 15 \cdot 8\end{array}$ | $\cdot 92$ | $444 \begin{array}{lll}4 & 10.6\end{array}$ | -90 | $445 \quad 4 \cdot 0$ | 8 |
| 26 | 431451 | $\cdot 96$ | 432 41.8 | -93 | $433 \quad 37 \cdot 0$ | -90 | $43430 \cdot 4$ | . 88 | $435 \quad 22 \cdot 3$ | 5 | $43612 \cdot 6$ | 2 |
| 28 | 4237 | + 9.92 | $424 \quad 2 \cdot 5$ | + 89 | $42455 \cdot 2$ | +.86 | 4254 | $+.83$ | $42635 \cdot 2$ | +.80 | 42722.4 | + 77 |
| 30 | 41431.5 |  | 4 I5 24.0 | - 86 | $4 \begin{array}{llll}4 & 16 & 14.5\end{array}$ | 3 | 4 I7 $2 \cdot 8$ | 79 | 4 I7 49 | 75 | 41833.3 | 72 |
| 31 | 4 IO 13.6 | -88 | 4 II 5.2 | -84 | 4 II $54 \cdot 5$ | O | 4 I2 41.6 | 77 | $\begin{array}{llll}4 & 13 & 26 \cdot 5\end{array}$ | 3 | $\begin{array}{llll}4 & 14 & 9 \cdot 2\end{array}$ | 69 |
| 32 | 4556 | 86 | $4 \quad 6 \quad 46 \cdot 5$ | . 82 | $4734^{\circ}$ | - 78 | 482 | $\cdot 74$ | $\begin{array}{lll}4 & 9 & 4 \cdot 1\end{array}$ | $\cdot 71$ | $4 \quad 945.3$ | 67 |
| 33 | 4138 | -84 | $4 \quad 2 \quad 28 \cdot 0$ | -80 | $\begin{array}{llll}4 & 3 & 15 \cdot 1\end{array}$ | $\cdot 76$ | $\begin{array}{llll}4 & 3 & 59.7\end{array}$ | 2 | $4 \quad 4 \quad 4 \mathrm{I} \cdot 9$ | -68 | $4 \quad 5 \quad 21.6$ | 64 |
| 34 | $35721 \cdot 2$ | + .83 | $\begin{array}{llll}3 & 58 & 9 \cdot 7\end{array}$ | + •79 | $35^{3} 5855$ | + 74 | 359 39-I | + 70 | $4020 \cdot 0$ | +.66 | $4 \quad 0 \quad 58 \cdot 2$ | + 6 I |
| 35 | 353 | -81 | $\begin{array}{lllll}3 & 53 & 51 \cdot 6\end{array}$ | 77 | $\begin{array}{llll}3 & 54 & 36 \cdot 5\end{array}$ | $\cdot 72$ | 3551 | 68 | $355 \quad 58 \cdot 2$ | - 63 | $35635 \cdot 0$ | 5 |
| 36 | $34847 \cdot 0$ | - 80 | $34933 \cdot 7$ | -75 | $350017 \cdot 5$ |  | 35058 | - 66 | $35136 \cdot 6$ | -6I | $\begin{array}{llll}3 & 52 & 12.01\end{array}$ | 56 |
| 38 | $\begin{array}{llll}3 & 44 & 30 \cdot 2\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 45 & 15 \cdot 9 \\ 3 & 40 & 58 \cdot 4\end{array}$ | $\cdot 74$ |  | -67 | $\begin{array}{llll}3 & 46 & 38 \cdot 5 \\ 3 & 42 & 7 & \end{array}$ | -64 | $\begin{array}{llllll}3 & 47 & 15 \cdot 3\end{array}$ | - 59 |  | 54 |
| 38 | 34013.6 | 77 | $\begin{array}{lllll}3 & 40 & 58 \cdot 4\end{array}$ | $\cdot 72$ | $34 \mathrm{I} 40 \cdot \mathrm{I}$ | -67 | $\begin{array}{lllllllllll}3 & 42 & 18.7\end{array}$ | -62 | $\begin{array}{llll}3 & 42 & 54 \cdot 2\end{array}$ | $\cdot 56$ | $\begin{array}{llll}3 & 43 & 26 \cdot 5\end{array}$ | 51 |
| 39 | $\begin{array}{llllllllllll}3 & 35 & 57\end{array}$ | + 76 | $\begin{array}{llll}3 & 36 & 41.0\end{array}$ | + 70 | $\begin{array}{llll}3 & 37 & 21.6\end{array}$ | + 65 | $\begin{array}{llll}3 & 37 & 59\end{array}$ | + 60 | $\begin{array}{llll}3 & 38 & 33 \cdot 2\end{array}$ | + . 54 | 339 | + 49 |
| 40 | 33140 | -7 | $\begin{array}{llll}3 & 32 & 23 \cdot 7\end{array}$ | -69 | $\begin{array}{lll}3 & 33 & 3 \cdot 3\end{array}$ | -63 | $\begin{array}{llll}3 & 33 & 39 \cdot 5\end{array}$ | 57 | $\begin{array}{lllll}3 & 34 & 12.4\end{array}$ | -52 | 334 4I•8 | 6 |
| 4 I | 32724.5 | 73 | $\begin{array}{lll}3 & 28 & 6 \cdot 6\end{array}$ |  |  | -61 | $\begin{array}{llll}3 & 29 & 20 \cdot 2\end{array}$ | 5 | $32951 \cdot 8$ | 9 | $\begin{array}{lllllllllllllll}3 & 30 & 19.7\end{array}$ | 43 |
| 42 | $\begin{array}{llr}3 & 23 & 8 \cdot 5 \\ 3 & 18 & 52.6\end{array}$ | $\cdot 72$ | 3 23 $49 \cdot 7$  <br> 3 1   | 6 | 3 24 $27 \cdot 2$ <br> 3 20  | 9 | $\begin{array}{rrrr}3 & 25 & I \cdot I\end{array}$ | . 53 | $3{ }_{3} 25$ 3I•3 | 47 |  | 4 |
| 43 | 31852 |  | $\begin{array}{llll}3 & 19 & 32 \cdot 9\end{array}$ | . 64 | 320 |  | $32042 \cdot 1$ | 5 I | 32110.9 | -45 | $32135 \cdot 9$ |  |
| 44 | $314436 \cdot 8$ | + . 69 | $\begin{array}{llll}3 & 15 & 16 \cdot 3\end{array}$ | + 62 | $315151 \cdot 7$ | + 56 | $\begin{array}{llll}3 & 16 & 23 \cdot 3\end{array}$ | + 49 | 31650.8 | + 42 | 31714.2 | - 36 |
| 45 | $31021 \cdot 1$ | . 68 | $\begin{array}{llll}3 & 10 & 59 \cdot 7\end{array}$ | -61 | 3 II $34^{\circ} 2$ | - 54 | $\begin{array}{llll}3 & 12 & 4 \cdot 6\end{array}$ | $\cdot 47$ | $\begin{array}{llll}3 & 12 & 30 \cdot 8\end{array}$ | -40 | $31252 \cdot 7$ | 33 |
| 46 | $\begin{array}{llr}3 & 6 & 5.5\end{array}$ | . 66 | $\begin{array}{lll}3 & 6 & 43 \cdot 3\end{array}$ |  | $\begin{array}{llll}3 & 7 & 16.9\end{array}$ |  | $\begin{array}{llll}3 & 7 & 46 \cdot 0\end{array}$ | -45 | $\begin{array}{llll}3 & 8 & 10.9 \\ 3 & 3 & 51 .\end{array}$ | $\cdot 38$ | $3{ }^{3} 8631 \cdot 3$ | 30 |
| 47 | 3 I 50.1 | -65 | $\begin{array}{llll}3 & 2 & 27 \cdot 1\end{array}$ | $\cdot 58$ | $\begin{array}{llll}3 & 2 & 59 \cdot 6\end{array}$ | - 50 | $\begin{array}{llll}3 & 3 & 27 \cdot 6\end{array}$ | -43 |  | -35 | $3 \quad 4 \quad 9$ | 28 |
| 48 | 25734.8 | . 64 | 258 II.O | $\cdot 56$ | $\begin{array}{llll}2 & 58 & 42 \cdot 5\end{array}$ |  | $\begin{array}{lll}2 & 59 & 9 \cdot 3\end{array}$ |  | $25931 \cdot 5$ | 33 | $25948 \cdot 8$ | 25 |
| 49 | 25319.6 | + 63 | $\begin{array}{llll}2 & 53 & 54.9\end{array}$ | + 55 | $2 \begin{array}{llll}2 & 54 & 25 \cdot 5\end{array}$ | + 47 | 254 5I•I | + 39 | 255 | + 30 | $25527 \cdot 7$ | $+\cdot 22$ |
| 50 | $2494 \cdot 5$ | . 62 | $24939 \cdot 0$ | -53 | $2 \begin{array}{lll}20 & 8 \cdot 6\end{array}$ | -45 | $25033 \cdot 1$ | $\cdot 36$ | $25052 \cdot 4$ | 28 | 2516. |  |
| 51 | $\begin{array}{lllll}2 & 44 & 49.5\end{array}$ | 61 | $\begin{array}{llll}2 & 45 & 23 \cdot 2\end{array}$ | . 52 | $\begin{array}{llll}2 & 45 & 5 \mathrm{I} \cdot 8 \\ 2\end{array}$ | 3 | $\begin{array}{lllll}2 & 46 & 15 \cdot 1\end{array}$ | $\cdot 34$ | $2{ }_{2} 46$ | 5 | $2{ }^{2} 4645 \cdot 7 \cdot 7$ |  |
| 52 | $24034 \cdot 6$ | . 60 | 24176 | -50 | $24135 \cdot 1$ | 41 | 241573 | -32 | $2 \begin{array}{llll}2 & 42 & 13.8\end{array}$ | 23 | 34224.8 | I3 |
| 53 | 23619.7 | $\cdot 58$ | $2365 x \cdot 9$ | 49 | $2 \quad 37 \quad 18 \cdot 6$ | 40 | 2373 | -30 | 23754.7 | -20 | $\begin{array}{llll}2 & 38 & 4 \cdot 0\end{array}$ | II |
| 54 | $\begin{array}{llll}2 & 32 & 5.0\end{array}$ | $+.57$ | $23236 \cdot 5$ | + 48 | $\begin{array}{lll}2 & 33 & 2 \cdot 1\end{array}$ | + 38 | 233121.8 | + 28 | $23315 \cdot 6$ | + 18 | $23343 \cdot 2$ | + 07 |
| 55 | 22750.3 | $\cdot 56$ | $2282 \mathrm{I} \cdot \mathrm{I}$ | -46 | $\begin{array}{llll}2 & 28 & 45 \cdot 8\end{array}$ | $\cdot 36$ | 229 |  | 22916. | -15 | $\begin{array}{llll}2 & 29 & 22.5\end{array}$ | . 04 |
| 56 | $\begin{array}{llll}2 & 23 & 35 \cdot 8\end{array}$ | -55 | $\begin{array}{llr}2 & 24 & 5 \cdot 8 \\ 2 & 1\end{array}$ | 45 | $\begin{array}{llll}2 & 24 & 29.5\end{array}$ | -34 | $\begin{array}{llll}2 & 24 & 46 \cdot 8 \\ 2 & 20 & 29\end{array}$ | -23 |  | -12 | $\begin{array}{llll}2 & 25 & 1 & 7\end{array}$ | + .01 |
| 57 | $\begin{array}{llll}2 & 19 & 21.3 \\ 2 & 15 & 6 \cdot 3\end{array}$ | -54 | $\begin{array}{llll}2 & 19 & 50 \cdot 7\end{array}$ | -43 | $\begin{array}{lll}2 & 20 & 13.3 \\ 2 & 15 & 57\end{array}$ | -32 | $\begin{array}{llll}2 & 20 & 29.4\end{array}$ | -21 | $22038 \cdot 6$ | -10 | $22041 \cdot 0$ | . 02 |
| 58 | $\begin{array}{llll}2 & 15 & 6 \cdot 9\end{array}$ | - 53 | 21535.5 | 42 | 21557.2 | -30 | 21612. | 19 | 21619.7 | -07 | $216 \quad 20 \cdot 3$ | . 05 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ}$ | - A. | L. $23^{\circ}$ | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $+\mathrm{I} \cdot 46$ | $\begin{gathered} s . \\ -4.47 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 55 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 50 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 64 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 54 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +1 \cdot 73 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4.57 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{r} \cdot 83 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -4.6 \mathrm{I} \end{gathered}$ | S. +1.92 | $\begin{gathered} s . \\ -4 \cdot 64 \end{gathered}$ |
| 4 | 1-35 | 4.44 | 1.43 | 4.47 | 1.52 | 4.50 | 1.61 | 4.53 | 1.70 | $4 \cdot 56$ | 1.79 | 4.59 |
| 8 | 1-24 | $4 \cdot 41$ | I-33 | $4 \cdot 43$ | 1.41 | $4 \cdot 46$ | 1.50 | $4 \cdot 49$ | 1.59 | $4 \cdot 52$ | 1.68 | $4 \cdot 55$ |
| 12 | 1.14 | $4 \cdot 38$ | I-23 | $4 \cdot 40$ | 1-31 | $4 \cdot 43$ | 1.40 | 4.45 | I-49 | $4 \cdot 48$ | I. 58 | $4 \cdot 51$ |
| 16 | 1.05 | $4 \cdot 36$ | I-14 | $4 \cdot 38$ | 1.22 | $4 \cdot 40$ | 1*3I | 443 | 1.40 | $4 \cdot 45$ | 1.48 | $4 \cdot 48$ |
| 20 | + 96 | $4 \cdot 34$ | +1.05 | $4 \cdot 36$ | +1.14 | $4 \cdot 38$ | + 1.22 | $4 \cdot 40$ | +I.3I | $4 \cdot 43$ | +1.40 | 4.45 |
| 22 | -98 | $4 \cdot 33$ | I $\cdot 01$ | $4 \cdot 35$ | I-10 | $4 \cdot 37$ | I-18 | $4 \cdot 39$ | 1.27 | $4 \cdot 42$ | I.36 | $4 \cdot 44$ |
| 24 | . 88 | $4 \cdot 32$ | -97 | $4 \cdot 34$ | I.06 | $4 \cdot 36$ | I'I5 | $4 \cdot 38$ | I. 23 | $4 \cdot 41$ | 1-32 | $4 \cdot 43$ |
| 26 | -84 | $4 \cdot 32$ | -93 | 4.33 | 1.02 | $4 \cdot 35$ | I•II | $4 \cdot 37$ | I-20 | $4 \cdot 40$ | I. 29 | $4 \cdot 42$ |
| 28 | -80 | 4.31 | -89 | $4 \cdot 32$ | $\cdot 98$ | $4 \cdot 34$ | I.07 | $4 \cdot 36$ | I•16 | $4 \cdot 39$ | I. 26 | $4 \cdot 41$ |
| 30 | + 77 | $4 \cdot 30$ | +.86 | $4 \cdot 32$ | + 95 | $4 \cdot 33$ | +1.04 | $4 \cdot 35$ | +I.13 | $4 \cdot 38$ | +1.23 | $4 \cdot 40$ |
| 32 | -73 | $4 \cdot 29$ | . 82 | $4 \cdot 31$ | -91 | $4 \cdot 33$ | I.OI | $4 \cdot 35$ | I-10 | $4 \cdot 37$ | I'20 | $4 \cdot 39$ |
| 34 | -69 | $4 \cdot 29$ | $\cdot 79$ | $4 \cdot 30$ | -88 | $4 \cdot 32$ | -98 | $4 \cdot 34$ | 1.07 | $4 \cdot 36$ | I-17 | $4 \cdot 39$ |
| 36 | -66 | $4 \cdot 28$ | $\cdot 75$ | $4 \cdot 30$ | -85 | $4 \cdot 31$ | -95 | $4 \cdot 33$ | I. 04 | $4 \cdot 36$ | I-14 | $4 \cdot 38$ |
| 38 | -62 | 4.27 | $\cdot 72$ | $4 \cdot 29$ | -82 | $4 \cdot 31$ | $\cdot 92$ | $4 \cdot 33$ | I-02 | $4 \cdot 35$ | I-12 | $4 \cdot 37$ |
| 40 | + 59 | $4 \cdot 27$ | + .69 | 4.29 | + 79 | $4 \cdot 30$ | + 89 | $4 \cdot 32$ | + 99 | $4 \cdot 34$ | + 1.09 | $4 \cdot 37$ |
| 42 | -55 | $4 \cdot 27$ | - 66 | $4 \cdot 28$ | $\cdot 76$ | $4 \cdot 30$ | -86 | $4 \cdot 32$ | -97 | $4 \cdot 34$ | I.07 | $4 \cdot 36$ |
| 44 | -52 | $4 \cdot 26$ | -62 | $4 \cdot 28$ | -73 | $4 \cdot 29$ | -84 | $4 \cdot 31$ | -95 | $4 \cdot 33$ | I.05 | $4 \cdot 36$ |
| 46 | -48 | $4 \cdot 26$ | -59 | $4 \cdot 27$ | -70 | $4 \cdot 29$ | .81 | $4 \cdot 31$ | -93 | $4 \cdot 33$ | I. O 4 | $4 \cdot 36$ |
| 48 | -45 | $4 \cdot 25$ | $\cdot 56$ | $4 \cdot 27$ | -68 | $4 \cdot 28$ | $\cdot 79$ | $4 \cdot 30$ | -91 | $4 \cdot 33$ | I. 02 | $4 \cdot 35$ |
| 50 | + 42 | $4 \cdot 25$ | + 53 | $4 \cdot 26$ | +.65 | $4 \cdot 28$ | + 77 | $4 \cdot 30$ | +.89 | $4 \cdot 32$ | +I.OI | $4 \cdot 35$ |
| 52 | $\cdot 38$ | $4 \cdot 25$ | . 50 | $4 \cdot 26$ | . 63 | $4 \cdot 28$ | . 75 | $4 \cdot 30$ | . 88 | $4 \cdot 32$ | I 100 | $4 \cdot 35$ |
| 54 | -35 | 4.24 | $\cdot 48$ | $4 \cdot 26$ | -60 | $4 \cdot 27$ | -73 | $4 \cdot 29$ | - 86 | $4 \cdot 32$ | 1.00 | $4 \cdot 35$ |
| 56 | $\cdot 31$ | $4 \cdot 24$ | $\cdot 45$ | $4 \cdot 25$ | $\cdot 58$ | $4 \cdot 27$ | $\cdot 72$ | $4 \cdot 29$ | - 85 | $4 \cdot 32$ | -99 | $4 \cdot 35$ |
| 58 | -28 | $4 \cdot 24$ | $\cdot 42$ | $4 \cdot 25$ | $\cdot 56$ | $4 \cdot 27$ | $\cdot 70$ | $4 \cdot 29$ | . 85 | $4 \cdot 3 \mathrm{I}$ | $\cdot 99$ | $4 \cdot 34$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. <br> Var. | $5{ }^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}\right.$ | $\begin{gathered} \mathrm{s} . \\ +1 \cdot 45 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 27 \cdot 3 \end{array}$ | $\begin{gathered} s . \\ +I \cdot 46 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 2 & 54 \cdot 8 \end{array}$ | $\begin{gathered} s . \\ +I \cdot 46 \end{gathered}$ | $\left\|\begin{array}{rrc} \text { H. M. } & \text { S. } \\ 6 & 4 & 22 \cdot 3 \end{array}\right\|$ | $\begin{gathered} \text { s. } \\ +\mathrm{r} \cdot 46 \end{gathered}$ | $\left\|\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 5 & 50 \cdot 0 \end{array}\right\|$ | $\left\|\begin{array}{c} \text { S. } \\ +\mathrm{I} \cdot 46 \end{array}\right\|$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 7 & \text { I } 8 \cdot 0 \end{array}\right\|$ | $\begin{gathered} \text { s. } \\ +\mathrm{I} \cdot 47 \end{gathered}$ |
| Io | $\begin{array}{llll}5 & 17 & 24.2\end{array}$ |  | $\begin{array}{lllllllllllll}5 & 18 & 52 \cdot 7\end{array}$ | I.47 | $52020 \cdot 3$ | I 445 | $52147 \cdot 1$ | 1.44 | $\begin{array}{lllll}5 & 23 & 13 \cdot 2\end{array}$ | I.43 | $\begin{array}{lllllllllllll}5 & 24 & 38 \cdot 7\end{array}$ | 1.42 |
| 12 | $\begin{array}{llll}5 & 8 & 52 \cdot 1\end{array}$ | r.49 | 5 10 21.2 | 1.47 | 5 II 49.2 | 1.46 | $\begin{array}{llll}5 & 13 & 16 \cdot 3\end{array}$ | 4 | $\begin{array}{llllll}5 & 14 & 42 \cdot 4\end{array}$ | r43 | $\begin{array}{llllll}5 & 16 & 7 \cdot 7\end{array}$ | *4I |
| 14 | $5 \quad 0 \quad 19.5$ | I. 5 | 5 I $49 \cdot 3$ | - 49 | $5 \quad 3 \quad 177.8$ | 1.47 | $\begin{array}{llll}5 & 4 & 45 \cdot 3\end{array}$ | r 45 | $\begin{array}{lll}5 & 6 & 11 \cdot 6\end{array}$ | 43 | $5 \begin{array}{llll}5 & 7 & 36 \cdot 9\end{array}$ | 4 I |
| I6 | $45 \mathrm{I} 46 \cdot 2$ | I. 52 | $45316 \cdot 9$ | I-50 | 454 46•1 | I.48 | 456 I4.1 | 1.45 | $45740 \cdot 7$ | I-43 | $4596 \cdot 1$ | 1.41 |
| 18 | 443 I2.2 | + $\mathrm{T} \cdot 5$ | 44443.9 | +1.51 | $4 \begin{array}{llll}46 & 14 \cdot 0\end{array}$ | +I.49 | $44742 \cdot 6$ | +1.46 | $449 \quad 9 \cdot 5$ | +1.44 | $45035 \cdot 2$ | +1.42 |
| 20 | $43437 \cdot 4$ | I. 56 | $436 \quad 10 \cdot 2$ | 1.53 | $43741 \cdot 3$ | I.50 | $43910 \cdot 6$ | I.47 | $44038 \cdot 2$ | 1.45 | $4{ }^{4} 42$  <br> 4  | 1.42 |
| 22 | 426 I-5 | I 59 | $4 \begin{array}{lllll}4 & 27 & 35\end{array}$ | I. 55 | 42978.9 | I. 52 | $43038 \cdot 1$ | I.49 | $\begin{array}{llll}4 & 32 & 6 \cdot 5\end{array}$ | 6 | $43333 \cdot 0$ | . 43 |
| 2 | 4 I7 24.5 | 1 | $4 \begin{array}{lll}4 & 19 & 0.2\end{array}$ | I. 58 | $42033 \cdot 7$ | 1 | $422 \begin{array}{ll}4 \cdot 1\end{array}$ | I.50 | $\begin{array}{llll}4 & 23 & 34 \cdot 2\end{array}$ | 1.47 | $\begin{array}{lll}4 & 25 & 1.4\end{array}$ | 44 |
| 26 | $4846 \cdot 1$ | $\underline{r}$ | 4 10 23.6 |  | 4 II 58.6 | I.56 | 4 I3 31.2 | I•52 | 41515 | 1.48 | 4 16 29.5 | 1.45 |
| 28 | 406 | +r. 6 | 4 I 45.7 | +1.63 | $\begin{array}{llll}4 & 3 & 22.4\end{array}$ | +I. 59 | $4 \begin{array}{lrr}4 & 4 & 56 \cdot 5\end{array}$ | +1.54 | $4 \begin{array}{llll}4 & 6 & 28 \cdot 0\end{array}$ | +1.50 | $4 \quad 757 \cdot 0$ | +1.46 |
| 30 | $35124 \cdot 8$ | 1.72 | $3 \begin{array}{lll}3 & 53 & 6 \cdot 4\end{array}$ | I. 67 | $35445 \cdot 0$ | r 6 |  | I | $\begin{array}{lllllllllll}3 & 57 & 53 \cdot 6\end{array}$ | I. 52 | $3 \begin{array}{llll}3 & 59 & 23.8\end{array}$ | 1.48 |
| 32 | $\begin{array}{lllllllll}3 & 42 & 41\end{array}$ | 1.76 | $3 \begin{array}{llll}3 & 44 & 25 \cdot 4\end{array}$ | I•7 | $346 \quad 6 \cdot 2$ | 1.65 |  | $1 \cdot$ | $\begin{array}{lllll}3 & 49 & 18 \cdot 3\end{array}$ | I. 55 | $35049 \cdot 8$ | . 50 |
| 33 | $\begin{array}{llll}3 & 38 & 18 \cdot 7\end{array}$ |  | $\begin{array}{lll}3 & 40 & 4 \cdot 2\end{array}$ | 1.73 | $\begin{array}{llll}3 & 41 & 46 \cdot 1\end{array}$ | I.67 | $\begin{array}{llll}3 & 43 & 24 \cdot 8\end{array}$ | I. 62 | $\begin{array}{lll}3 & 45 & 0.2 \\ 3 & 40 & 4\end{array}$ | I.56 |  | 1 |
| 34 | $\begin{array}{llll}3 & 33 & 55 \cdot 6\end{array}$ |  | $3 \begin{array}{llll}3 & 3542.4\end{array}$ | 1•75 | $\begin{array}{llll}3 & 37 & 25 \%\end{array}$ | I. 69 | $\begin{array}{llll}3 & 39 & 5 \cdot 4\end{array}$ | I.63 | $34041 \cdot 8$ | I.58 | $3 \begin{array}{lllllll}3 & 14.9\end{array}$ | I. 52 |
| 35 | $329531 \cdot 8$ | +I.84 | $33120 \cdot 1$ | +1.77 | $\begin{array}{lll}3 & 33 & 4 \cdot 7\end{array}$ | +r•7x | $33445 \cdot 7$ | +1.65 | $3 \begin{array}{llll}3 & 36 & 23\end{array}$ | +I.59 | $33757 \cdot 1$ | + I. 54 |
| 36 | $\begin{array}{llll}3 & 25 & 7 \cdot 3\end{array}$ | I. 86 | $\begin{array}{lllll}3 & 26 & 57 \cdot 3\end{array}$ | I.80 | $3{ }^{3} 2843 \cdot 43$ | 1.73 | $\begin{array}{llll}3 & 30 & 25.4\end{array}$ | I 6 | $\begin{array}{llll}3 & 32 & 4 \cdot 0\end{array}$ | I.6I | $\begin{array}{llll}3 & 33 & 38 \cdot 9\end{array}$ | I. 55 |
| 37 | $32042 \cdot 1$ | 1. | $\begin{array}{llll}3 & 22 & 33 \cdot 7\end{array}$ | 1.83 |  | 1 | $\begin{array}{llll}3 & 26 & 4 \cdot 8 \\ 3 & 21 & 4.6\end{array}$ | I | $\begin{array}{lllllllllll}3 & 27 & 44 \cdot 5 \\ 3 & 23 & 4.5\end{array}$ | 3 | $\begin{array}{llll}3 & 29 & 20.4\end{array}$ | r.57 |
| 38 | 31616. | I'9 | $\begin{array}{llll}3 & 18 & 9.5\end{array}$ | I.85 | 3 I 19 58.6 | I•78 | $\begin{array}{lllllllllllll}3 & 21 & 43 \cdot 6\end{array}$ | I•71 | $\begin{array}{llll}3 & 23 & 24 \cdot 5\end{array}$ | I. 65 | $\begin{array}{llr}3 & 25 & 1.6\end{array}$ | I•58 |
| 39 | 3 II 49.3 | I.96 | $\begin{array}{lllll}3 & 13 & 44.6\end{array}$ | I-88 |  | I.8I | 3 I7 21-9 | I'74 | 3 I9 4.I | 1.67 | 32042.4 | 1.60 |
| 40 | $3721$ | +I.99 | $3 \begin{array}{lll}3 & 9 & 18\end{array}$ | +1.91 | 3 II II•5 | +I.84 | 31259.6 | +I.76 | $31443 \cdot 3$ | + $\mathrm{I} \cdot 69$ | $\begin{array}{llll}3 & 16 & 22.7\end{array}$ | +r.62 |
| 41 | $\begin{array}{\|ccc\|}3 & 2 & 52 \cdot 8 \\ 2 & 5 & 5\end{array}$ | 2.03 | $\begin{array}{llll}3 & 4 & 52\end{array}$ | I•95 | $3{ }^{3} 5646 \cdot 8$ | I.87 | 38886.6 |  | 3 Io 2I•9 | I-72 | $\begin{array}{llll}3 & 12 & 2 \cdot 7\end{array}$ | I. 64 |
| 42 | $2 \begin{array}{llll}2 & 58 & 23 \cdot 1\end{array}$ | 2.07 | $3 \quad 0 \quad 24 \cdot 8$ | 1.98 | $\begin{array}{lrrr}3 & 2 & 21.4\end{array}$ | I.90 | $3 \quad 4 \begin{array}{llll}3 & 1 & 0\end{array}$ | 1 | $\begin{array}{llll}3 & 5 & 59.8\end{array}$ | I•74 | $\begin{array}{lllll}3 & 7 & 42 \cdot 1\end{array}$ | 66 |
| 43 | $\begin{array}{llll}2 & 53 & 52 \cdot 1 \\ 2 & 49 & 20 \cdot 0\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}2 & 55 & 56 \cdot 3 \\ 2 & 51 & 26.7\end{array}$ | 2.02 | $\begin{array}{llll}2 & 57 & 55 \cdot 1 \\ 2 & 53 & 27 \cdot 8\end{array}$ | I•94 | $\begin{array}{llll}2 & 59 & 48 \cdot 7 \\ 2 & 55 & 23 \cdot 5\end{array}$ | I. 85 I. 88 | $\begin{array}{rrrr}3 & 1 & 37 \cdot 2 \\ 2 & 57 & 1 & \end{array}$ | $\underline{1.77}$ | $\begin{array}{lrrr}3 & 3 & 21.0 \\ 2 & 58 & 59\end{array}$ | r.69 |
| 44 | $24920 \cdot 0$ | 2•16 | 25126 | 2.06 | $253127 \cdot 8$ | 1.97 | $255 \quad 23 \cdot 5$ | I. 88 | 25713.9 | 1.80 | $2 \begin{array}{lllllll} & 58 & 59\end{array}$ | I•72 |
| 45 | $\begin{array}{lllll}2 & 44 & 46 \cdot 5\end{array}$ | +2.2I | $2 \begin{array}{llll}2 & 46 & 56 \cdot 1\end{array}$ | $+2 \cdot 11$ | $2 \begin{array}{llll}2 & 48 & 59 \cdot 6\end{array}$ | $+2.01$ | 25057.5 | + I 92 | $2 \begin{array}{llll}2 & 52 & 49.9\end{array}$ | +1.83 | $254 \begin{array}{llll}27 & 0\end{array}$ | +1•74 |
| 46 | 240 | $2 \cdot 26$ | $242 \begin{array}{ll}24 \cdot 1\end{array}$ | $2 \cdot 16$ |  | 2.05 |  | I•96 | $\begin{array}{llll}2 & 48 & 25 \cdot 1 \\ 2\end{array}$ | I. 86 | $25014 \cdot 1$ | I•77 |
| 47 | $2 \begin{array}{llll}25 & 34.9\end{array}$ | $2 \cdot 32$ |  | $2 \cdot 2$ | $\begin{array}{lllll}2 & 39 & 59.8\end{array}$ | $2 \cdot$ | $242 \begin{array}{lll}2 & 2.6\end{array}$ | 0 | $\begin{array}{llllll}2 & 43 & 59.4\end{array}$ | -90 | $245 \quad 50 \cdot 4$ | 0 |
| 48 | $23056 \cdot$ | $2 \cdot 38$ | $\begin{array}{llll}2 & 33 & 15 \cdot 8 \\ 2 & 38 & 30.3\end{array}$ | $2 \cdot 2$ | $\begin{array}{llll}2 & 35 & 28 \cdot 0 \\ 2 & 30 & 5 \cdot 7\end{array}$ | $2 \cdot 15$ | $\begin{array}{llll}2 & 37 & 33.5 \\ 2 & 33 & 3.2\end{array}$ | $2 \cdot 04$ | $239 \quad 32 \cdot 7$ | - $\cdot 98$ | $\begin{array}{llll}2 & 41 & 25.8 \\ 2 & 37 & 0.5\end{array}$ | r.84 |
| 49 | $22616 \cdot 5$ | 2.44 | $2 \quad 28 \quad 39 \cdot 3$ | $2 \cdot 32$ | $23054 \cdot 7$ | $2 \cdot 20$ | 233313 | 2.09 | $235 \quad 5 \cdot 0$ | 1.98 | $237 \begin{array}{lll}2 & 3 & 0.5\end{array}$ | r.87 |
| 50 | $22134 \cdot 1$ | +2.5 | $\begin{array}{llll}2 & 24 & 0.9\end{array}$ | +2.38 | $\begin{array}{llll}2 & 26 & 19.9\end{array}$ | +2.2 | 22831.6 | +2.14 | $23036 \cdot 2$ | +2.02 | $23234 \cdot 2$ | +I.9r |
| 51 | $\begin{array}{lllll}2 & 16 & 49 \cdot 5\end{array}$ |  | $2 \begin{array}{llll}2 & 19 & 20 \cdot 5 \\ 2 & 1 & 3\end{array}$ | 2.45 | $2 \begin{array}{llll}2 & 21 & 43.4\end{array}$ | $2 \cdot 3$ | 2 23 $58 \cdot 5$ <br> 2 5  | $2 \cdot 19$ | 2 26 $6 \cdot 2$ <br> 2 21  | $2 \cdot 07$ | 2 28 $6 \cdot 8$ <br> 2 2  | 1.95 |
| 52 | $\begin{array}{rrrr}2 & 12 & 2.2 \\ 2 & 7 & 12.1\end{array}$ | 2.67 | $\begin{array}{rrrr}2 & 14 & 38 \cdot 0\end{array}$ | 2.52 | $\begin{array}{rrr}2 & 17 & 5 \cdot 0 \\ 2 & 12 & 24.5\end{array}$ | 2.38 2.45 | $\begin{array}{llll}2 & 19 & 23 \cdot 8\end{array}$ | 2.25 | 2 21 34.8 <br> 2 17  | $2 \cdot 12$ | $\begin{array}{llll}2 & 23 & 38 \cdot 3 \\ 2 & 1 & 8.6\end{array}$ | 2.00 |
| 53 | $\begin{array}{llll}2 & 7 & 12.1 \\ 2 & 2 & 18.7\end{array}$ | 2.75 | $\begin{array}{llll}2 & 9 & 52.9\end{array}$ | 6 | 12 24.5 | 2.45 | $2 \mathrm{I} 4487 \cdot 3$ | $2 \cdot 31$ | $2 \begin{array}{lll}17 & 1.8\end{array}$ | 2 | $\begin{array}{llllllllllllllll}2 & 19 & 8.6\end{array}$ | 2.05 |
| 54 | 218. | 2.83 | $2 \quad 5 \quad 5 \cdot 2$ | $2 \cdot 69$ | $74 r \cdot 7$ | $2 \cdot 53$ | 210809 | $2 \cdot 38$ | 21227.3 | $2 \cdot 24$ | $1437 \cdot 4$ | $2 \cdot 10$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. 1 | A. | L. $\mathbf{2}^{\circ}$ | A. | L. 3 | A. | L. 4 | A. | L. 5 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{\circ}{\circ}$ | - ${ }_{\text {s. }}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 26 \end{gathered}$ | s. +.08 | $\begin{gathered} \text { s. } \\ -4 \cdot 26 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +{ }_{16} \end{aligned}$ | $\begin{gathered} s . \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} \text { s. } \\ +\quad-24 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\quad{ }_{32} \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 26 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +{ }_{40} \end{gathered}$ | s. $4 \cdot 27$ |
| 2 | . 05 | $4 \cdot 26$ | +.03 | $4 \cdot 26$ | . 10 | $4 \cdot 26$ | -18 | $4 \cdot 26$ | - 26 | $4 \cdot 26$ | $\cdot 34$ | 4.27 |
| 4 | - II | $4 \cdot 26$ | -.03 | $4 \cdot 26$ | +.05 | $4 \cdot 26$ | -13 | $4 \cdot 26$ | -21 | $4 \cdot 26$ | -29 | $4 \cdot 26$ |
| 6 | - 16 | $4 \cdot 26$ | -08 | $4 \cdot 26$ | - . 01 | $4 \cdot 26$ | -08 | $4 \cdot 26$ | ${ }^{1} 5$ | $4 \cdot 26$ | $\cdot 23$ | $4 \cdot 26$ |
| 8 | -22 | $4 \cdot 26$ | -14 | $4 \cdot 26$ | -06 | $4 \cdot 26$ | +.02 | $4 \cdot 26$ | - 10 | $4 \cdot 26$ | -18 | $4 \cdot 26$ |
| 10 | - . 27 | $4 \cdot 27$ | - 19 | $4 \cdot 26$ | -II | 4.26 | -.03 | $4 \cdot 26$ | +.05 | $4 \cdot 26$ | + 13 | $4 \cdot 26$ |
| 12 | -33 | $4 \cdot 27$ | $\cdot 25$ | $4 \cdot 26$ | -17 | $4 \cdot 26$ | -99 | $4 \cdot 26$ | -. 01 | $4 \cdot 26$ | -07 | $4 \cdot 26$ |
| 14 | -39 | 4.27 | -30 | 4.27 | - 22 | $4 \cdot 26$ | - 14 | $4 \cdot 26$ | . 06 | $4 \cdot 26$ | + . 02 | $4 \cdot 26$ |
| 16 | $\cdot 45$ | $4 \cdot 28$ | $\cdot 36$ | 4.27 | $\cdot 28$ | $4 \cdot 26$ | $\cdot 20$ | $4 \cdot 26$ | -II | $4 \cdot 26$ | - .03 | $4 \cdot 26$ |
| 18 | $\cdot 5 \mathrm{I}$ | $4 \cdot 29$ | $\cdot 42$ | $4 \cdot 28$ | $\cdot 34$ | $4 \cdot 27$ | $\cdot 25$ | $4 \cdot 26$ | -17 | $4 \cdot 26$ | . 09 | $4 \cdot 26$ |
| 20 | -. 57 | 4.29 | $-.48$ | $4 \cdot 28$ | - 40 | 4.27 | - 31 | $4 \cdot 27$ | -. 23 | $4 \cdot 26$ | - . 14 | $4 \cdot 26$ |
| 22 | . 63 | $4 \cdot 30$ | $\cdot 54$ | $4 \cdot 29$ | -46 | $4 \cdot 28$ | $\cdot 37$ | $4 \cdot 27$ | $\cdot 28$ | $4 \cdot 26$ | -20 | $4 \cdot 26$ |
| 24 | $\cdot 70$ | 4.31 | -6r | $4 \cdot 30$ | $\cdot 52$ | 4.29 | $\cdot 43$ | $4 \cdot 28$ | $\cdot 34$ | 4.27 | $\cdot 26$ | $4 \cdot 26$ |
| 26 | $\cdot 77$ | $4 \cdot 32$ | $\cdot 67$ | $4 \cdot 31$ | $\cdot 58$ | $4 \cdot 29$ | -49 | $4 \cdot 28$ | $\cdot 41$ | $4 \cdot 27$ | $\cdot 32$ | 4.27 |
| 28 | $\cdot 84$ | $4 \cdot 34$ | $\cdot 74$ | $4 \cdot 32$ | . 65 | $4 \cdot 30$ | $\cdot 56$ | $4 \cdot 29$ | $\cdot 47$ | $4 \cdot 28$ | $\cdot 38$ | $4 \cdot 27$ |
| 30 | - .91 | $4 \cdot 35$ | $-.82$ | $4 \cdot 33$ | - 72 | $4 \cdot 31$ | -. 63 | $4 \cdot 30$ | -. 53 | 4.29 | - $\cdot 44$ | $4 \cdot 28$ |
| 32 | .99 | $4 \cdot 37$ | . 89 | $4 \cdot 35$ | $\cdot 79$ | $4 \cdot 33$ | $\cdot 70$ | $4 \cdot 31$ | . 60 | $4 \cdot 30$ | -5I | $4 \cdot 29$ |
| 34 | r.08 | $4 \cdot 39$ | -97 | $4 \cdot 37$ | . 87 | $4 \cdot 34$ | $\cdot 77$ | $4 \cdot 32$ | . 67 | $4 \cdot 31$ | $\cdot 57$ | $4 \cdot 29$ |
| 36 | I'17 | $4 \cdot 4 \mathrm{I}$ | I.06 | $4 \cdot 39$ | -95 | $4 \cdot 36$ | $\cdot 85$ | $4 \cdot 34$ | $\cdot 75$ | $4 \cdot 32$ | -64 | $4 \cdot 30$ |
| 38 | I 26 | $4 \cdot 44$ | 1.15 | $4 \cdot 4 \mathrm{I}$ | r 04 | $4 \cdot 38$ | -93 | $4 \cdot 36$ | -82 | $4 \cdot 33$ | $\cdot 72$ | $4 \cdot 32$ |
| 40 | - I. 36 | $4 \cdot 47$ | - $\mathrm{I} \cdot 25$ | 4.43 | - I. 13 | $4 \cdot 40$ | -1.02 | $4 \cdot 38$ | -.91 | $4 \cdot 35$ | -.80 | $4 \cdot 33$ |
| 42 | $\underline{1} 48$ | $4 \cdot 50$ | x 35 | $4 \cdot 46$ | 1.23 | $4 \cdot 43$ | $1 \cdot 11$ | $4 \cdot 40$ | I. 00 | $4 \cdot 37$ | $\cdot 88$ | $4 \cdot 34$ |
| 44 | I.60 | $4 \cdot 55$ | $\mathbf{1} 47$ | $4 \cdot 50$ | 1.34 | $4 \cdot 46$ | 1.2I | 4.43 | r.09 | $4 \cdot 39$ | $\cdot 97$ | 4.37 |
| 46 | $\begin{array}{r}\text { 1.73 } \\ \text { - } \\ \hline 8\end{array}$ | 4.60 | I 59 | $4 \cdot 54$ | r.45 | $4 \cdot 50$ | I. 32 | $4 \cdot 46$ | I'19 | $4 \cdot 42$ | x.07 | $4 \cdot 39$ |
| 48 | 1.88 | $4 \cdot 65$ | I•73 | $4 \cdot 59$ | I-58 | $4 \cdot 54$ | 1.44 | $4 \cdot 49$ | 1.3I | $4 \cdot 45$ | I-17 | $4 \cdot 42$ |
| 50 | -2.05 | $4 \cdot 72$ | -r.89 | $4 \cdot 66$ | - 1.73 | $4 \cdot 59$ | -r.58 | $4 \cdot 54$ | - 1.43 | $4 \cdot 49$ | -r.29 | $4 \cdot 45$ |
| 52 | 2.24 2.47 | 4.81 | 2.06 | 4.73 | 1.89 | $4 \cdot 66$ | r.72 | 4.59 | r.57 | 4.54 | r.41 | 4.48 |
| 54 | $2 \cdot 47$ | $4 \cdot 92$ | 2.27 | 4.82 | $2 \cdot 07$ | 4.73 | I. 89 | $4 \cdot 66$ | I•72 | $4 \cdot 59$ | I 56 | $4 \cdot 53$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 83
LATITUDE $20^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \[
\begin{array}{|l|}
\text { True } \\
\text { Alt. }
\end{array}
\] \& \(6^{\circ}\) \& \& \(7{ }^{\circ}\) \& \& \(8^{\circ}\) \& \& 9 \& \& \(10^{\circ}\) \& \& \(1{ }^{\circ}\) \& \\
\hline \& \& \& \& \& \& \& \& \& \& \& \& \\
\hline ro \& \begin{tabular}{ll}
6 \& 8 \\
5 \& 86 \\
\hline
\end{tabular} \& \& \& \&  \& \& 3.2 \& \& \[
\left\{\begin{array}{lll}
6 \& 14 \& 43 \cdot 1 \\
5 \& 31 \& 37 \cdot 8
\end{array}\right.
\] \& \& \& \\
\hline \& 5 I) \& \& 518 \& \& 520 \& \& 5 \& \& \(523 \quad 3 \cdot 5\) \& \& \(52424 \cdot 8\) \& \\
\hline \(\mathrm{r}_{1}\) \& \& \& 5 I0 \(24 \cdot 6\) \& \& \& \& \& \& \& \& \& \\
\hline \& 5 O \(30 \cdot 3\) \& \& \& \& \& \& \& \& \& 1.3 \& 5 \& I.31 \\
\hline 18 \& 45 \& +1.39 \& 45322.5 \& +1.37 \& 4 4 44.2 \& +1.35 \& 8 \& +r.33 \&  \& +r39 \& \({ }^{4} 58842 \cdot 5\) \& \\
\hline \& \& I 40 \& 444 \& \& \({ }_{4}^{4} 48\) \& \&  \& 1.32 \& 4 \& \& 41 \& \\
\hline 24 \& 4 \& \& 42750 \& \& 429 \& \& , \& \& 431 \& \& \& \\
\hline 26 \& \(4 \mathrm{I7}\) \& I 41 \& 419 \& \& 420 \& \& 4220.3 \& \& 423 \& \& 24 \& \\
\hline 28 \& \(4{ }^{4} 23.6\) \& \& \& \& \({ }^{4} 12\) \& \& \begin{tabular}{l}
4 \\
4 \\
4 \\
4 \\
4 \\
\hline
\end{tabular} 59.95 \& +r.3 \&  \& \& \(\begin{array}{llll}4 \& 16 \& 2 \cdot 5\end{array}\) \& +124 \\
\hline \begin{tabular}{l}
30 \\
32 \\
\hline
\end{tabular} \& (rrers \& \& \(4{ }_{3}^{4} 5\) \& \& [4 \& \& \(4{ }_{4}^{4} 5\) \& \& \& \&  \& \\
\hline \& \begin{tabular}{l}
3 \\
48 \\
r \\
\hline
\end{tabular} \& 1.46 \& 34928 I \& \& 5 \& r.37 \& \({ }_{3} 5212\) 12. \& \& \& \& 54 \& \\
\hline 34 \& 34344 \& 1.47 \& 45 \& \& 3 \& r. 3 \& 34756 \& \& \& \& 350 \& r 2 \\
\hline 35 \& 339 \& +1 \& \& \& \(3 \begin{array}{llll}3 \& 19.5\end{array}\) \& + \& \(34340 \cdot 8\) \& +1.3 \& 344 59.1 \& +1.28 \& 346 \& +1.23 \\
\hline \& 35 \& \& 32 \& \& \begin{tabular}{llll}
3 \& 38 \\
3 \& 3.4 \\
3 \& 3 \& 4 \\
\hline
\end{tabular} \& \& \begin{tabular}{llll}
3 \& 39 \& 25.0 \\
3 \& 35 \\
\hline
\end{tabular} \& \& 3 3627 \& \& \& \\
\hline 37 \& \& \& \begin{tabular}{l}
322 \\
28 \\
\hline
\end{tabular} \& \&  \& r 39 \&  \& \& 3 3627 \& \& 3 37 \& \\
\hline 39 \& 322 \& r. 54 \& 323 \& \& 325 \& \& 326 \& \& \begin{tabular}{l}
327 \\
\hline 1
\end{tabular} \& \& 329 \& - \\
\hline 40 \& \(31758 \cdot \mathrm{I}\) \& +r \& 31929.4 \& + \& 320 \& + \& 32220.6 \& + \& 32340.6 \& + \(\mathrm{I} \cdot 3\) \& \(32457 \cdot 0\) \& + 124 \\
\hline 4 I \& I3 \& \& 31511.5 \& \& 31618.8 \& \& \({ }_{3}^{3} 18\) 18-1 \& \& \% \& \& , 6 \& \\
\hline \& \& \&  \& \& \({ }_{3}^{3} 1\) \& \& 3 \& \& \begin{tabular}{lll}
315 \\
3 \& 15 \\
\hline 10 \\
\hline
\end{tabular} \& \& 31619 \& \\
\hline 4 \& 3 - \& r.63 \& \(634 \cdot 6\)
2

5 \& \& $3 \begin{array}{llll}3 & 36.7\end{array}$ \& \& 513.4 \& \&  \& \& 12
3
7 \& <br>
\hline \& 256 \& +r.66 \& $25756 \cdot 1$ \& \& $\begin{array}{llll}2 & 59 & 28.4 \\ 2\end{array}$ \& +1.50 \& $3{ }^{3}$ \& +1.42 \& \& r \& 3 \& <br>

\hline \& 2 21 \& \& 25336.2 \& \&  \& \& $1 \begin{array}{lll}2 & 56 \\ 2 & 52 & 38 \\ 2 & 20\end{array}$ \& \& $$
\begin{array}{ccc}
2 & 58 & 2 \cdot 2 \\
2 & 53 & 45 \cdot 1
\end{array}
$$ \& \& \& <br>

\hline 4 \& \& \& $4454 \cdot 8$ \& \& 246 \& \& 248 \& \& 249 \& \& , \& <br>
\hline 49 \& 238 \& 1.77 \& $24033 \cdot 3$ \& \& 242 II.0 \& \& $24343 \cdot 2$ \& \& 245 \& \& 346 \& ז. 32 <br>
\hline 50 \& 23425 \& \& 236 \& \& $23750 \cdot 5$ \& + r . 6 \& 2392 \& +r.51 \& 4052 \& +1. \& + \& <br>
\hline 51
52
52 \& \& \& \& \& \& \& $4{ }^{\text {+ }}$ \& \& 232 \& \& 23757.2
233
2 \& <br>

\hline 53 \& 22534 \& \& | 27 |
| :--- |
| 224.4 |
| 22988 | \& \&  \& \& | 2 | 30 |
| :--- | :--- |
| 2 | $46 \cdot 3$ |
| 2 | $23 \cdot 5$ | \& \& 232

2
27
2 \& \& 2 3339 \& <br>
\hline 54 \& 163 \& \& 1834 \& \& 2I. \& \& 222 \& \& 223 \& \& 25 \& <br>
\hline
\end{tabular}

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $\mathrm{y}^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | s. $+\quad .48$ | $\begin{gathered} s . \\ -4 \cdot 28 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +\quad .55 \end{aligned}$ | $\begin{gathered} s . \\ -4 \cdot 29 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .64 \end{aligned}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 30 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +\quad .72 \end{aligned}$ | $\begin{gathered} s \\ -4.3 \mathrm{I} \end{gathered}$ | $\begin{gathered} s . \\ +\quad 80 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 33 \end{gathered}$ | S. $+\quad .88$ | $\begin{gathered} s . \\ -4 \cdot 35 \end{gathered}$ |
| 2 | +.42 | 4.28 | +.50 | 4 | $\begin{array}{r}+58 \\ \hline .58\end{array}$ | 4 | . 66 | $4 \cdot 31$ | +.74 | 4.32 | +.83 | 4.34 |
| 4 | -37 | $4 \cdot 27$ | -45 | $4 \cdot 28$ | $\cdot 53$ | $4 \cdot 29$ | -61 | $4 \cdot 30$ | -69 | $4 \cdot 31$ | -77 | $4 \cdot 33$ |
| 6 | -31 | $4 \cdot 27$ | -39 | $4 \cdot 28$ | -47 | $4 \cdot 28$ | $\cdot 55$ | $4 \cdot 29$ | -64 | $4 \cdot 31$ | $\cdot 71$ | $4 \cdot 32$ |
| 8 | - 26 | $4 \cdot 26$ | $\cdot 34$ | $4 \cdot 27$ | -42 | $4 \cdot 28$ | $\cdot 50$ | $4 \cdot 29$ | -58 | $4 \cdot 30$ | -66 | $4 \cdot 31$ |
| 10 | + $\cdot 21$ | $4 \cdot 26$ | + 29 | 4.27 | + 37 | $4 \cdot 27$ | + 45 | $4 \cdot 28$ | + 53 | 4.29 | + 6 rl | $4 \cdot 30$ |
| 12 | $\cdot 15$ | $4 \cdot 26$ | $\cdot 23$ | $4 \cdot 26$ | $\cdot 32$ | $4 \cdot 27$ | -40 | $4 \cdot 27$ | . 48 | $4 \cdot 28$ | $\cdot 56$ | $4 \cdot 29$ |
| 14 | - Io | $4 \cdot 26$ | -18 | $4 \cdot 26$ | - 26 | $4 \cdot 26$ | -34 | $4 \cdot 27$ | -43 | $4 \cdot 28$ | -51 | $4 \cdot 29$ |
| r6 | +.05 | $4 \cdot 26$ | -13 | $4 \cdot 26$ | -21 | $4 \cdot 26$ | -29 | $4 \cdot 27$ | $\cdot 37$ | $4 \cdot 27$ | -46 | $4 \cdot 28$ |
| 18 | - OI | $4 \cdot 26$ | -08 | $4 \cdot 26$ | -16 | $4 \cdot 26$ | - 24 | 4.26 | -32 | $4 \cdot 27$ | -41 | $4 \cdot 27$ |
| 20 | -.06 | $4 \cdot 26$ | +.02 | $4 \cdot 26$ | + - II | $4 \cdot 26$ | + 19 | $4 \cdot 26$ | $+\cdot 27$ | $4 \cdot 26$ | + 36 | $4 \cdot 27$ |
| 22 | -II | $4 \cdot 26$ | - 03 | $4 \cdot 26$ | -05 | $4 \cdot 26$ | -14 | $4 \cdot 26$ | $\cdot 22$ | $4 \cdot 26$ | $\cdot 31$ | $4 \cdot 27$ |
| 24 | -17 | $4 \cdot 26$ | -08 | $4 \cdot 26$ | + 00 | $4 \cdot 26$ | -08 | $4 \cdot 26$ | -17 | $4 \cdot 26$ | - 26 | $4 \cdot 26$ |
| 26 | $\cdot 23$ | $4 \cdot 26$ | -14 | $4 \cdot 26$ | - .05 | $4 \cdot 26$ | +.03 | 4.26 | -12 | $4 \cdot 26$ | -21 | $4 \cdot 26$ |
| 28 | $\cdot 29$ | $4 \cdot 26$ | -20 | $4 \cdot 26$ | - II | $4 \cdot 26$ | -. 02 | $4 \cdot 26$ | -07 | $4 \cdot 26$ | - 15 | $4 \cdot 26$ |
| 30 | - 35 | $4 \cdot 27$ | - .26 | $4 \cdot 26$ | - •16 | $4 \cdot 26$ | -. 08 | $4 \cdot 26$ | + - OI | 4.26 | + -10 | $4 \cdot 26$ |
| 32 | -41 | $4 \cdot 28$ | -32 | $4 \cdot 27$ | $\cdot 22$ | $4 \cdot 26$ | - I3 | $4 \cdot 26$ | - 04 | $4 \cdot 26$ | -05 | $4 \cdot 26$ |
| 34 | -48 | $4 \cdot 28$ | $\cdot 38$ | $4 \cdot 27$ | $\cdot 28$ | $4 \cdot 27$ | -19 | $4 \cdot 26$ | -10 | $4 \cdot 26$ | + .00 | $4 \cdot 26$ |
| 36 | $\cdot 54$ | $4 \cdot 29$ | -44 | $4 \cdot 28$ | -35 | $4 \cdot 27$ | $\cdot 25$ | $4 \cdot 26$ | -15 | $4 \cdot 26$ | - .06 | $4 \cdot 26$ |
| 38 | . 61 | $4 \cdot 30$ | -5I | $4 \cdot 29$ | -41 | $4 \cdot 27$ | -31 | $4 \cdot 27$ | -2I | $4 \cdot 26$ | - II | $4 \cdot 26$ |
| 40 | -. 69 | $4 \cdot 31$ | -. 58 | $4 \cdot 30$ | - $\cdot 48$ | $4 \cdot 28$ | $-38$ | $4 \cdot 27$ | - .27 | $4 \cdot 26$ | - -17 | $4 \cdot 26$ |
| 42 | $\cdot 77$ | $4 \cdot 32$ | -66 | 4.31 | -55 | $4 \cdot 29$ | -44 | $4 \cdot 28$ | -34 | $4 \cdot 27$ | - 23 | $4 \cdot 26$ |
| 44 | $\cdot 85$ | $4 \cdot 34$ | $\cdot 74$ | 4.32 | -63 | $4 \cdot 30$ | $\cdot 51$ | $4 \cdot 29$ | $\cdot 40$ | $4 \cdot 28$ | -30 | $4 \cdot 27$ |
| 46 | -95 | $4 \cdot 36$ | -82 | $4 \cdot 34$ | -71 | $4 \cdot 31$ | -59 | $4 \cdot 30$ | $\cdot 47$ | $4 \cdot 28$ | -36 | $4 \cdot 27$ |
| 48 | I. 04 | $4 \cdot 38$ | $\cdot 92$ | $4 \cdot 35$ | $\cdot 79$ | $4 \cdot 33$ | -67 | 4.31 | $\cdot 55$ | $4 \cdot 29$ | -43 | $4 \cdot 28$ |
| 50 | -I.I5 | 4.41 | -1.02 | $4 \cdot 38$ | - . 88 | $4 \cdot 35$ | -.76 | $4 \cdot 32$ | - . 63 | $4 \cdot 30$ | - . 51 | $4 \cdot 29$ |
| 52 | I. 27 | $4 \cdot 44$ | 1.12 | $4 \cdot 40$ | $\cdot 98$ | $4 \cdot 37$ | -85 | $4 \cdot 34$ | $\cdot 72$ | $4 \cdot 32$ | - 59 | $4 \cdot 30$ |
| 54 | I. 40 | $4 \cdot 48$ | I 24 | $4 \cdot 43$ | I.09 | $4 \cdot 40$ | -95 | $4 \cdot 36$ | -81 | $4 \cdot 33$ | - 67 | 4.3 I |

## 84 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $20^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True <br> Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 |  | $+$ | $\left\lvert\, \begin{array}{c\|c} \text { H. M. } & \text { S. } \\ \hline & \text { I9 } \end{array}\right.$ |  | $\left\lvert\, \begin{aligned} & \text { H. M. } \\ & 6 \\ & 6 \end{aligned}\right.$ | $+\mathbf{1} \cdot 55$ | $\left\|\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 22 \\ 23.2 \end{array}\right\|$ | $\begin{gathered} \mathrm{s} . \\ +1.57 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } \\ 6 & 23 & 57.7 \end{array}$ | $\frac{\mathrm{S} .}{\mathrm{I} \cdot 58}$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & 25 & 33 \cdot 3 \end{array}$ | $\begin{gathered} \text { S. } \\ 1.60 \end{gathered}$ |
| 10 | 534 | 1.37 | $\begin{array}{lllllllll}5 & 35 & 44\end{array}$ | 1.36 | $\begin{array}{llll}5 & 37 & 6.7\end{array}$ | 1.36 | 5 518828.4 | 1.36 | $539 \begin{array}{ll}50 \cdot 1\end{array}$ | I. 36 | 54 IITr 7 | I.36 |
| 12 | ${ }_{5}^{5} 2545 \cdot 7$ | $1 \cdot 34$ | 5276.2 | I 34 | $52826 \cdot 3$ | I 33 | $52946 \cdot 0$ | 1.33 | 53154 | I. 32 | $\begin{array}{lllll}5 & 32 & 24 \cdot 7\end{array}$ | . 32 |
| 14 | $\begin{array}{llll}5 & 17 & 9.6\end{array}$ | I 32 | $\begin{array}{lllll}5 & 18 & 28 \cdot 6\end{array}$ | $1 \cdot 31$ | $51947 \cdot 0$ | 30 | $\begin{array}{llll}5 & 21 & 4 \\ 5\end{array}$ | 1.29 | $52222 \cdot 2$ | I 28 | 523 39•1 | 1.28 |
| 16 | $\begin{array}{llll}5 & 8 & 34.4\end{array}$ | $1 \cdot 30$ | $5 \quad 9 \quad 5 \mathrm{I} \cdot 9$ |  | 5 II $8 \cdot 7$ | $1 \cdot 27$ | $\begin{array}{llll}5 & 12 & 24.8\end{array}$ |  | $51340 \cdot 1$ | I. 25 | $514 \quad 54.9$ | 4 |
| 18 | $45959 \cdot 8$ | +1.28 | 116.1 | + 1.26 | $\begin{array}{llll}5 & 2 & 31 \cdot 4\end{array}$ | +1.25 | $\begin{array}{llll}5 & 3 & 45 \cdot 8\end{array}$ | +1.23 | 54893 | +1.22 | 612.0 | +1.20 |
| 20 | 4 51 26.0 | I 26 | $45241 \cdot 0$ | I.24 | 45355.0 | $\underline{1} 22$ | $4 \begin{array}{lll}45 & 7 \cdot 8\end{array}$ | 1.20 | $\begin{array}{llll}4 & 56 & 19.5\end{array}$ | I. 19 | $45730 \cdot 2$ | 7 |
| 22 |  | $\mathrm{I} \cdot 24$ | $4446 \cdot 7$ | I. 22 | $\begin{array}{llll}4 & 45 & 19 \cdot 4\end{array}$ | 1.20 | $44630 \cdot 7$ | I-18 | $44740 \cdot 8$ | I.16 | $44849 \cdot 6$ | 4 |
| 24 | $43420 \cdot 0$ | $1 \cdot 23$ | 43533.0 | 1.20 | $43644 \cdot 5$ | I-18 | 43754.5 | I-15 | $439 \quad 2.9$ | I.13 | $44010 \cdot 0$ | I |
| 26 | $42547 \cdot 8$ | 1.22 | 4270.0 | 19 | $42810 \cdot 3$ | I•16 | 429 19.0 | I-I3 | $43026 \cdot 0$ | I-10 | $43 \mathrm{I} 3 \mathrm{I} \cdot 2$ | 7 |
| 28 | 417816.0 | +1.2I | $\begin{array}{llll}4 & 18 & 27.4\end{array}$ | +1 | $4 \begin{array}{llll}49 & 19 & 6.8\end{array}$ | + 1 | 42044.2 | +I.II | $42149 \cdot 8$ | + $\mathrm{I} \cdot 08$ | 42253.5 | 4 |
| 30 | $\begin{array}{llll}4 & 8 & 44.5\end{array}$ | I. 20 | $4 \quad 9 \quad 55.2$ | I.16 | $\begin{array}{llll}4 & \text { II } & 3.8\end{array}$ | I.12 | $4 \begin{array}{lll}4 & 12 & 10 \cdot 1\end{array}$ | 1.09 | $4 \begin{array}{lll}4 & 14.3\end{array}$ | 1.0 | $4 \begin{array}{llllllllll}4 & 16.5\end{array}$ | 2 |
| 31 | 4 | 19 | $39 \cdot 3$ | I.15 | $647 \cdot 4$ | I.12 | $\begin{array}{llll}4 & 7 & 53.3\end{array}$ | -08 | $\begin{array}{lllll}4 & 8 & 56.9\end{array}$ | 4 | $4 \quad 958.3$ | 0 |
| 32 | $\begin{array}{llll}4 & 0 & 13.3 \\ 3 & 5 & 5.8\end{array}$ | 19 |  | I.I5 | 4 2 $31 \cdot 3$ <br> 3 58  | I-II | 4 3 $36 \cdot 6$ <br> 3 5  | . 07 | $\begin{array}{llll}4 & 4 & 39 \cdot 6\end{array}$ | 1.03 | 5 $40 \cdot 3$ | 9 |
| 33 | 3555 | 19 | $3 \begin{array}{lll}37 & 7 \cdot 7\end{array}$ | 1-14 | $\begin{array}{lllll}3 & 58 & 15 \cdot 1\end{array}$ | I•10 | $35920 \cdot 0$ | 1.06 | $4 \quad 0 \quad 22 \cdot 5$ | 1.0 | 122.4 | 8 |
| 34 | $\begin{array}{llll}3 & 51 & 42 \cdot 3 \\ 3 & 47 & 26.8\end{array}$ | 1.18 +1.18 | 3 52 $52 \cdot 0$ <br> 3 48  | +r.14 | 3 53 $59 \cdot 1$ <br> 3 49  | +I.10 | 3 55 $3 \cdot 6$ <br> 3 5 $4 \cdot 3$ | $+\mathrm{I} .05$ | $\begin{array}{llll}3 & 56 & 5 \cdot 5\end{array}$ | +r.0r | $\begin{array}{llll}3 & 57 & 4 \cdot 8 \\ 3 & 52 & 47.3\end{array}$ | '97 |
| 35 | 34726 | I.18 | $\begin{array}{llll}3 & 48 & 36 \cdot 4\end{array}$ | $1 \cdot 14$ | $\begin{array}{llllllllllll}3 & 49 & 43 \cdot 2\end{array}$ |  | $3{ }^{3} 5047 \cdot 3$ | I. 04 | $35148 \cdot 6$ | -00 | $\begin{array}{lllllllll}3 & 52 & 47 \cdot 3\end{array}$ | '95 |
| 36 | 343 | I. 18 | 3 44 $20 \cdot 9$ | I.13 | ${ }_{3}^{3} 455$ | $\underline{1.08}$ | 3 46 $3 I \cdot I$ | . 04 | $\begin{array}{llll}3 & 47 & 31.9\end{array}$ | -99 | $\begin{array}{llll}3 & 48 & 29.9\end{array}$ | 4 |
| 37 | $\begin{array}{llll}3 & 38 & 56 \cdot 0\end{array}$ | I. 18 | $\begin{array}{llll}3 & 40 & 5 \cdot 4\end{array}$ | I.13 | 3411117 | I. 0 | 34215.0 | 1.03 | $3 \begin{array}{llll}3 & 15 \cdot 4\end{array}$ |  | 344412.7 | 93 |
| 38 | $33440 \cdot 6$ | I-18 | $33550 \cdot 0$ | I•13 | $\begin{array}{llll}3 & 36 & 56 \cdot 0\end{array}$ | 1.07 | $33759 \cdot 0$ | 1.02 | $\begin{array}{lllll}38 & 58 \cdot 9\end{array}$ | -97 | $33955 \cdot 7$ | 92 |
| 39 | $\begin{array}{lllll}3 & 30 & 25.2\end{array}$ | +1.18 |  | +1:13 | $\begin{array}{llllllllllllllll}3 & 32 & 40 \cdot 5\end{array}$ | + I | $\begin{array}{lllll}3 & 33 & 43 \cdot 1\end{array}$ | +1.02 | $\begin{array}{llll}3 & 34 & 42 \cdot 6\end{array}$ | + 96 | $\begin{array}{llllllllllll}3 & 35 & 38 \cdot 8\end{array}$ | + 9 OI |
| 40 | $\begin{array}{llll}3 & 26 & 9 \cdot 8 \\ 3 & 21\end{array}$ | I-18 | $\begin{array}{llll}3 & 27 & 19.0 \\ 3 & 23 & \end{array}$ | i.12 | $\begin{array}{llll}3 & 28 & 24.9\end{array}$ |  | $\begin{array}{llll}3 & 29 & 27 \cdot 3 \\ 3 & 25 & \text { II }\end{array}$ | Or | $\begin{array}{llll}3 & 30 & 26 \cdot 3 \\ 3 & 26 & 10 \cdot 2\end{array}$ | .95 | 3 31 22.0 <br> 3 2  | - |
| 4 I | $\begin{array}{llll}3 & 2154 \\ 3 & 17 & 78\end{array}$ | I9 | $\begin{array}{llll}3 & 23 & 3.6 \\ 3 & 18 & 48.2\end{array}$ | 12 | $\begin{array}{cccc}3 & 24 & 9 \cdot 4 \\ 3 & 19 & 54 \cdot 0\end{array}$ | I. 06 1.06 | $\begin{array}{llll}3 & 25 & \text { II } 6 \\ 3 & 20 & 55\end{array}$ | . 01 | $\begin{array}{llll}3 & 26 & 10 \cdot 2 \\ 3 & 21 & 54.2\end{array}$ | $\cdot 95$ | $\begin{array}{llll}3 & 27 & 5.4 \\ 3 & 22 & 48.8\end{array}$ |  |
| 42 | $\begin{array}{llll}3 & 17 & 38: 8 \\ 3 & 13 & 23 \cdot 3\end{array}$ | I.19 | $\begin{array}{llll}3 & 18 & 48 \cdot 2 \\ 3 & 14 & 32.9\end{array}$ | I.13 I-13 | $\begin{array}{llll}3 & 19 & 54 \cdot 0 \\ 3 & 15 & 38 \cdot 5\end{array}$ | I.06 | $\begin{array}{llll}3 & 20 & 55 \cdot 9 \\ 3 & 16 & 40 \cdot 3\end{array}$ | I 100 1.00 | $\begin{array}{llll}3 & 21 & 54.2 \\ 3 & 17 & 38 \cdot 3\end{array}$ | -94 | $\begin{array}{llll}3 & 22 & 48 \cdot 8 \\ 3 & 18 & 32 \cdot 5\end{array}$ | . 88 |
| 43 | $\begin{array}{cccc}3 & 13 & 23.3 \\ 3 & 9 & 7.7\end{array}$ | 1.19 +1.20 | $\begin{array}{llll}3 & 14 & 32.9 \\ 3 & 10 & 17.4\end{array}$ |  | $\begin{array}{llll}3 & 15 & 38 \cdot 5 \\ 3 & 11 & 23 \cdot 1\end{array}$ |  | $\begin{array}{llll}3 & 16 & 40 \cdot 3 \\ 3 & 12 & 24 \cdot 7\end{array}$ |  | $\begin{array}{llll}3 & 17 & 38 \cdot 3 \\ 3 & 13 & 22.4\end{array}$ | $\cdot 93$ $+\quad .93$ | $\begin{array}{llll}3 & 18 & 32 \cdot 5 \\ 3 & 14 & 16 \cdot 1\end{array}$ |  |
| 44 45 | $\begin{aligned} & 9 \\ & 4 \\ & 4 \\ & \hline \end{aligned}$ | + $\begin{array}{r}\text { I } 20 \\ \mathrm{I} .20\end{array}$ | $\begin{array}{crrr}3 & 10 & 17.4 \\ 3 & 6 & 1.9\end{array}$ | +1.13 1.13 | $\begin{array}{cccc}3 & 11 & 23 \cdot 1 \\ 3 & 7 & 7 \cdot 7 \\ 3 & 7 & \end{array}$ | +I | 3 12 $24 \cdot 7$ <br> 3 8 $9 \cdot 2$ | $\begin{array}{r}+\quad .99 \\ \hline .99\end{array}$ | 3 13 22.4 <br> 3 9 6.6 | $\begin{array}{r} \\ +\quad .93 \\ \hline 92\end{array}$ | $\begin{array}{rrrrr}3 & 14 & 16 \cdot I \\ 3 & 9 & 59 \cdot 9\end{array}$ | 86 |
| 46 | 3 - $36 \cdot 2$ | I.2I | $\begin{array}{llll}3 & 1 & 46 \cdot 4\end{array}$ | -13 | $\begin{array}{llll}3 & 2 & 52 \cdot 3\end{array}$ | I. 06 | $\begin{array}{lllll}3 & 3 & 53 \cdot 8\end{array}$ | -99 | $\begin{array}{lllll}3 & 4 & 510\end{array}$ | $\cdot 92$ | 3544.0 | 5 |
| 47 | ${ }_{2} 25620 \cdot 3$ | I. 21 | $\begin{array}{llll}2 & 57 & 30.9\end{array}$ | 14 | $\begin{array}{llll}2 & 58 & 36 \cdot 9\end{array}$ | I.06 | $\begin{array}{llllllll}2 & 59 & 38 \cdot 3\end{array}$ | -99 | 3 3 $0 \cdot 35 \cdot 3$ | $\cdot 91$ | 3 1 27.9 <br>  5  | 4 |
| 48 | $\begin{array}{llll}2 & 52 & 4 \cdot 3\end{array}$ | 1.22 | $2 \begin{array}{llll}23 & 15 \cdot 2\end{array}$ | I•14 | $2542 \mathrm{I} \cdot 4$ | 1.06 | $2 \begin{array}{llll}55 & 22 \cdot 9\end{array}$ | '99 | $2 \begin{array}{llll} & 56 & 19 \cdot 7\end{array}$ | $\cdot 91$ | 2 57 <br> 19  | 3 |
| 49 | $4748 \cdot 1$ | +1.23 | $\begin{array}{lllll}2 & 48 & 59.5\end{array}$ | +1.15 | $\begin{array}{lll}2 & 50 & 6.0\end{array}$ | +1.0 | $2 \begin{array}{lll}51 & 7.5\end{array}$ | + 98 | $2 \begin{array}{lll}22 & 4.2\end{array}$ | + 90 | $25256 \cdot \mathrm{I}$ |  |
| 5 | $4331 \cdot 7$ | I 24 | 24443.5 | I 5 | $24550 \cdot 3$ | I 07 | $24652 \cdot \mathrm{I}$ | -99 | $24748 \cdot 7$ | $\cdot 90$ | $24840 \cdot 3$ | . 82 |
| 51 | 23915.2 | 1.25 |  | I.16 | $\begin{array}{llllll}3 & 41 & 34.9\end{array}$ | r.07 | $24236 \cdot 4$ | -99 |  | 90 | 24424.6 |  |
| 52 | $23458 \cdot 5$ | 1.27 | $\begin{array}{llllll}2 & 36 & 11 \\ 2 & 31\end{array}$ | I-17 | $\begin{array}{llll}2 & 37 & 19.2 \\ 2 & 73\end{array}$ | 1.08 | $\begin{array}{rrrrr}2 & 38 & 21 & 3 \\ 2 & 34 & 5\end{array}$ | '99 | $2 \begin{array}{lllllll}29 & 39 & 178 \\ 2 & 35 & 2.4\end{array}$ | '90 | $\begin{array}{lll}2 & 40 \\ 2 & 9.0\end{array}$ |  |
| 53 | $23041 \cdot 5$ | I-28 | 23155.4 | I-18 | $\begin{array}{llll}2 & 33 & 3.5\end{array}$ | 1.09 | $2 \begin{array}{lll}34 & 5 \cdot 8\end{array}$ | -99 | 23542 | $\cdot 90$ | $23553 \cdot 4$ |  |
| 54 |  | +r.30 | 22739.0 | +1.19 |  | +1.09 | $2 \begin{array}{llllllllllllll}29 & 50 \cdot 3\end{array}$ | + 99 |  |  |  |  |
| 55 | $\left\lvert\, \begin{array}{lll} 2 & 22 & 6 \cdot 6 \\ 0 & 7 & 8.8 \end{array}\right.$ | I.31 |  | I 21 |  | $1.10$ | $22534 \cdot 7$ | $100$ | $22631 \cdot 6$ | -90 | $\begin{array}{rrrr}2 & 27 & 22.4 \\ 2 & 23 & 6.9\end{array}$ | . 80 |
| 56 57 | $\begin{array}{lll} 2 & 17 & 48 \cdot 8 \\ 2 & 13 & 30 \cdot 5 \end{array}$ | I. 33 r 36 | $\begin{array}{llll}2 & 19 & 5 \cdot 5 \\ 2 & 14 & 48 \cdot 3\end{array}$ | 1.22 I 24 | $\begin{array}{llll}2 & 20 & 15.5 \\ 2 & 15 & 59.3\end{array}$ | -11 | $\begin{array}{lll}2 & 21 & 19 \cdot 1 \\ 2 & 17 & 3.4\end{array}$ |  | $\begin{array}{cccc}2 & 22 & 16.2 \\ 2 & 18 & 0.8\end{array}$ |  | $\begin{array}{cccc}2 & 23 & 6.9 \\ 2 & 18 & 51.5 \\ & 15\end{array}$ | 9 |
| 57 58 | 2 13 $30 \cdot 5$ <br> 2 9 11 |  | $\begin{array}{llll}2 & 14 & 48 \cdot 3 \\ 2 & 10 & 30 \cdot 9\end{array}$ | I 24 I 26 |  | I. 13 I. 14 | $\begin{array}{rrrr}2 & 17 & 3 \cdot 4 \\ 2 & 12 & 47 \cdot 5\end{array}$ | 1.01 1.02 |  | 91 | $\begin{array}{llll}2 & 18 & 51 \cdot 5 \\ 2 & 14 & 36.5\end{array}$ | 9 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS-LATITUDE.


DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. Var. | $4{ }^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 53 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 32 \cdot I \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 53 \end{gathered}$ | $\begin{array}{\|lrl} \text { H. M. } & \text { S. } \\ 6 & 3 & 4 \cdot 3 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 54 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 36 \cdot 7 \end{array}\right.$ | $\left\lvert\, \begin{gathered} s . \\ +\mathrm{I} \cdot 54 \end{gathered}\right.$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 6 & 9 \cdot I \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 54 \end{gathered}$ | $\left\lvert\, \begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 7 & 4 \mathrm{I} \cdot 9 \end{array}\right.$ | S. $I \cdot 55$ |
| 10 | $\begin{array}{llll}5 & 17 & 7 \cdot 3\end{array}$ | 1.56 | $\begin{array}{llllllllllll}5 & 18 & 40 \cdot 6\end{array}$ | 1.55 | $52013 \cdot 1$ | 1.53 | $\begin{array}{lllll}5 & 21 & 44.8\end{array}$ | 1.52 | 52315.7 | 1.51 | $52446 \cdot 0$ | 1.50 |
| 12 | $\begin{array}{llll}5 & 8 & 31 \cdot 7\end{array}$ | I. 57 | 5 10 $5 \cdot 7$ | 1;56 | 5 II $38 \cdot 6$ | 1.54 | $\begin{array}{llll}5 & 13 & 10.5\end{array}$ | 1.52 | 514415 | 1.51 | $51611 \cdot 7$ | $\underline{150}$ |
| 14 | $45955 \cdot 5$ | I. 59 | $\begin{array}{lllll}5 & 1 & 30.2\end{array}$ | I 57 | $\begin{array}{lll}5 & 3 & 3 \cdot 8\end{array}$ | I'55 | $\begin{array}{llll}5 & 4 & 36 \cdot 1\end{array}$ | 1.53 | $\begin{array}{lll}5 & 6 & 7 \cdot 4\end{array}$ | I.5I | $\begin{array}{llll}5 & 7 & 37 \cdot 6\end{array}$ | I. 49 |
| 16 | 45158.6 | I.6I | 45254.3 | I.58 | $4 \quad 54 \quad 28 \cdot 6$ | I.56 | 45615 | I. 54 | 457 33-1 | 1.51 | $4 \begin{array}{lll}4 & 59 & 3.4\end{array}$ | I. 49 |
| 18 | $44240 \cdot 9$ | +I.63 | 444 17・ク | + I•60 | $445 \quad 52 \cdot 8$ | + I 57 | 44726.4 | + I.55 | $44^{48} 58 \cdot 5$ | +I.52 | $45029 \cdot 1$ | +1.50 |
| 20 | $434 \quad 2 \cdot 2$ | I. 65 | $43540 \cdot 2$ | I'62 | 43716.4 | I 59 | $43850 \cdot 9$ | I. 56 | $44023 \cdot 6$ | 1.53 | 44154.7 | $\underline{150}$ |
| 22 | $\begin{array}{llll}4 & 25 & 22.4\end{array}$ | 1.67 | $\begin{array}{lll}4 & 27 & 1.8\end{array}$ | I. 64 | $42839 \cdot 3$ | I.6I | $43014 \cdot 7$ | I.57 | 4 3I $48 \cdot 4$ | I•54 | 433 20.0 | I.5I |
| 24 | 4 I6 4I•2 | $1 \cdot 70$ | $\begin{array}{llllllllllllllll}4 & 18 & 22.4\end{array}$ | 1.67 | 42013 | I. 63 | 42137.9 | I.59 | $\begin{array}{llll}4 & 23 & 12.4\end{array}$ | I. 56 | $42444 \cdot 8$ | 1.52 |
| 26 | 4758.6 | I•74 | $4 \quad 94 \mathrm{I} \cdot 6$ | I•70 | 4 II 22.2 | I.65 | 413002 | 1.6I | $4 \begin{array}{lllll}4 & 14 & 35 \cdot 8\end{array}$ | I.57 | 4169.2 | I.54 |
| 28 | 35914.3 | +r.78 | $4 \quad 0 \quad 59.5$ | +x•73 | $4 \quad 24 \mathrm{I} \cdot 8$ | +x.68 | 4421.4 | +1.64 | $\begin{array}{lllll}4 & 5 & 58 \cdot 4\end{array}$ | + I. 59 | 478732.9 | + $\mathrm{I} \cdot 55$ |
| 30 | $3{ }^{3} 50028 \cdot 1$ | I. 82 | 35215.6 | I'77 | $3540 \cdot 1$ | I•71 | $3554 \mathrm{I} \cdot 5$ | 1.67 | $35720 \cdot 1$ | I. 62 | $\begin{array}{lllllllllllllllll}3 & 58 & 55 \cdot 8\end{array}$ | I. 57 |
| 31 | $\begin{array}{llll}3 & 46 & 4 \cdot 2\end{array}$ | I.84 | 34753.0 | 1.79 | $\begin{array}{llll}3 & 49 & 38 \cdot 6\end{array}$ | I.73 | 3 5I 2I'O | I. 68 | $\begin{array}{lll}3 & 53 & 0 \cdot 5\end{array}$ | I.63 | $\begin{array}{llllllll}3 & 54 & 37 \cdot 0\end{array}$ | I. 58 |
| 32 | $3 \begin{array}{llll}3 & 41 & 39 & 7\end{array}$ | I. 86 | $343 \quad 29 \cdot 9$ | I.8I | $34516 \cdot 7$ | 1-75 | $\begin{array}{lll}3 & 47 & 0.2\end{array}$ | $1 \cdot 70$ | $34840 \cdot 5$ | I. 65 | 35017.8 | I. 60 |
| 33 |  | I.89 | $\begin{array}{llll}3 & 39 & 6 \cdot 2\end{array}$ | 1.83 | $34054 \cdot 3$ | 1.77 | $\begin{array}{llll}3 & 42 & 38 \cdot 9\end{array}$ | $1 \cdot 72$ | 344 20.2 | I. 66 | $345158 \cdot 4$ | 1.61 |
| 34 | $\begin{array}{llll}3 & 32 & 48 \cdot 8\end{array}$ | + I.92 | 334 4I'9 | + 1.85 | $3 \begin{array}{llll}36 & 31.4\end{array}$ | +1.79 | $33^{38} 177 \cdot 3$ | +1.73 | $33959 \cdot 6$ | + 1.68 |  | +1.62 |
| 35 | $\begin{array}{llll}3 & 28 & 22 \cdot 3\end{array}$ | I•94 | 33017.0 | I.88 | $3328 \cdot 0$ | 1.82 | $\begin{array}{llll}3 & 33 & 55 \cdot 1\end{array}$ | 1•75 |  | r•70 |  | I 64 |
| 36 | $\begin{array}{llll}3 & 23 & 55 \cdot 0 \\ 3 & 5 & \end{array}$ | 1.97 | $\begin{array}{llll}3 & 25 & 51.5\end{array}$ | 1.91 | $\begin{array}{llll}3 & 27 & 43 \cdot 9\end{array}$ | I. 84 | 3 29 $32 \cdot 4$ <br> 3 25  | I.78 | $\begin{array}{llll}3 & 31 & 17.2 \\ 3 & 26 & 55 \cdot 3\end{array}$ | I•71 | $\begin{array}{llll}3 & 32 & 58 \cdot 3\end{array}$ | 1.65 |
| 37 | $\begin{array}{llll}3 & 19 & 26 \cdot 9\end{array}$ | $2 \cdot 01$ | 321512.2 | I.94 | $\begin{array}{llll}3 & 23 & 19.3\end{array}$ | I. 87 | $\begin{array}{lll}3 & 25 & 9 \cdot 3\end{array}$ | I.80 | $32655 \cdot 3$ | I'73 |  | 1.67 |
| 38 | $3 \begin{array}{lllllllllll}3 & 14 & 57 \cdot 9\end{array}$ | $2 \cdot 04$ | 3 I6 58.I | I.97 | 3 I8 54.0 | I.89 | $32045 \cdot 5$ | I.82 | $32232 \cdot 9$ | I.76 | $32416 \cdot 3$ | I. 69 |
| 39 | 31027.9 | $+2.08$ | $\begin{array}{llll}3 & 12 & 30.2\end{array}$ | $+2.00$ | 3 I4 27.9 | +1.92 | 3 I6 2I•I | +1.85 | 318 10.0 | $+1 \cdot 78$ | 3 19 54.7 | + I•71 |
| 40 | $\begin{array}{llll}3 & 5 & 56 \cdot 9\end{array}$ | $2 \cdot 12$ | $\begin{array}{lll}3 & 8 & \mathrm{I} 4\end{array}$ | $2 \cdot 03$ | 3 Io 100 | I.95 | 3 II $56 \cdot 0$ | I. 88 | 3131646 | I.80 | $\begin{array}{lllllllllllllllllll}3 & 15 & 3 \cdot 5\end{array}$ | $1 \cdot 73$ |
| 41 | $\begin{array}{rrrr}3 & 1 & 24.8 \\ 2 & 56 & 51.4\end{array}$ | 2.16 | 3 3 31.6 <br> 2 5  | 2.07 | $\begin{array}{lll}3 & 5 & 33.4 \\ 3 & 1 & 4.8\end{array}$ | 1.99 | $\begin{array}{lll}3 & 7 & 30.2 \\ 3 & 3 & 3.6\end{array}$ | 1.91 | $\begin{array}{lll}3 & 9 & 22 \cdot 3\end{array}$ | I.83 | $\begin{array}{lll}3 & \text { II } & 9.9\end{array}$ | 1.75 |
| 42 | $\begin{array}{llll}2 & 56 & 51.4 \\ 2 & 5 & 5\end{array}$ | $2 \cdot 20$ | 2 59 $0 \cdot 8$ <br> 2 5 8 | $2 \cdot 11$ | $\left[\begin{array}{rrr}3 & 1 & 4.8 \\ 2 & 56 & 35.2\end{array}\right.$ | 2.02 | $\begin{array}{rrrr}3 & 3 & 3 \cdot 6 \\ 2 & 5 & 3\end{array}$ | I.94 | $\begin{array}{llll}3 & 4 & 57 \cdot 5\end{array}$ | I.86 | $\begin{array}{llll}3 & 6 & 46 \cdot 7\end{array}$ | I•78 |
| 43 | $2 \begin{array}{llll}2 & 52 & 16 \cdot 8\end{array}$ | $2 \cdot 25$ | 25428.8 | 2.15 | $25635 \cdot 2$ | 2.06 | $\begin{array}{llll}2 & 58 & 36 \cdot 2\end{array}$ | 1.97 | 3 o $32 \cdot 0$ | I.89 | $\begin{array}{llll}3 & 2 & 22 \cdot 8\end{array}$ | I 181 |
| 44 | $2 \begin{array}{llll}2 & 47 & 40 \cdot 8\end{array}$ | +2.30 | $24955 \cdot 6$ | $+2 \cdot 20$ | $\begin{array}{lll}2 & 52 & 4 \\ 2\end{array}$ | +2.10 | $\begin{array}{lll}2 & 54 & 7 \cdot 8\end{array}$ | +2.01 | $2 \begin{array}{lll}26 & 5 \cdot 6\end{array}$ | +1.92 | $2 \begin{array}{lllll}2 & 57 & 58 \cdot 3\end{array}$ | +1.84 |
| 45 | $\begin{array}{lll}2 & 43 & 3 \cdot 2\end{array}$ | $2 \cdot 35$ | 245 2I•I | 2.25 | $\begin{array}{lllll}2 & 47 & 32 \cdot 8\end{array}$ | $2 \cdot 14$ | $24938 \cdot 5$ | $2 \cdot 05$ | 251388 | I•95 | $25333 \cdot 0$ | I. 86 |
| 46 | $\begin{array}{llll}2 & 38 & 23 \cdot 9 \\ 2 & 33 & 42.8\end{array}$ | 2.41 | $\begin{array}{lllll}2 & 40 & 45 \cdot 0 \\ 2 & 36 & 7\end{array}$ | 2.30 | $\begin{array}{llll}2 & 42 & 59.6 \\ 2 & 38 & 25 \cdot 2\end{array}$ | $2 \cdot 19$ | $\begin{array}{lll}2 & 45 & 8 \cdot 0 \\ 2 & 40 & \end{array}$ | 2.09 | $\begin{array}{llllll}2 & 47 & 10 \cdot 3\end{array}$ | I.99 | 249780 | I.90 |
| 47 | $\begin{array}{llll}2 & 33 & 42 \cdot 8 \\ 2 & 28 & 59.7\end{array}$ | 2.47 | $\begin{array}{llll}2 & 36 & 7 \cdot 5 \\ 2 & 31 & 28.1\end{array}$ | 2.35 | $\begin{array}{llll}2 & 38 & 25 \cdot 2 \\ 2 & 3 & \end{array}$ | $2 \cdot 24$ | $2{ }^{2} 40636 \cdot 3$ | $2 \cdot 13$ | $\begin{array}{lllll}2 & 42 & 41 \cdot 2\end{array}$ | 2.03 | 244 40.1 | $\underline{1} 93$ |
| 48 | $2 \begin{array}{llll}2 & 28 & 59.7\end{array}$ | 2.54 | $23128 \cdot 1$ | 2.45 | $23349 \cdot 2$ | 2.29 | $\begin{array}{llll}2 & 36 & 3 \cdot 4\end{array}$ | 2.18 | $23^{8}$ II.O | 2.07 | $2 \begin{array}{lllllll} & 40 & 12.2\end{array}$ | I.97 |
| 49 | $\begin{array}{llll}2 & 24 & 14.4\end{array}$ | $+2 \cdot 6 \mathrm{I}$ | $22646 \cdot 8$ | $+2.48$ | 229 II•6 | +2.35 | 2 3I 2900 | $+2.23$ | 2331395 | +2.12 | 23543.4 | $+2.01$ |
| 50 | $\begin{array}{llll}2 & 19 & 26 \cdot 5\end{array}$ | $2 \cdot 69$ | $\begin{array}{llll}2 & 22 & 3.5\end{array}$ | $2 \cdot 55$ | $22432 \cdot 2$ | $2 \cdot 4 \mathrm{I}$ | $2 \begin{array}{llll}26 & 53 \cdot 1\end{array}$ | $2 \cdot 29$ | 229667 | $2 \cdot 17$ | 23113.3 | $2 \cdot 05$ |
| 51 | $\begin{array}{llll}2 & 1 & 36 \cdot 1\end{array}$ | $2 \cdot 77$ | 2 I 7178.8 | 2.62 | $\begin{array}{llll}2 & 19 & 50 \cdot 7 \\ 2 & 15 & \end{array}$ | 2.48 | $\begin{array}{llll}2 & 22 & 15.5 \\ 2 & 17\end{array}$ | $2 \cdot 35$ | 2 24 $32 \cdot 5$ <br> 2   | $2 \cdot 22$ | $\begin{array}{llll}2 & 26 & 42 \cdot I \\ 2\end{array}$ | $2 \cdot 10$ |
| 52 | $\begin{array}{llll}2 & 9 & 42 \cdot 5 \\ 2 & 4 & 45 \cdot 6\end{array}$ | 2.85 | $\begin{array}{rrrr}2 & 12 & 29.4\end{array}$ | 2.70 | $2 \begin{array}{llr}15 & 7 \cdot 1 \\ 2 & 10 & \end{array}$ | 2.55 | 2 17 $36 \cdot 0$ | 2.41 | $\begin{array}{llll}2 & 19 & 56 \cdot 7\end{array}$ | $2 \cdot 28$ | $\begin{array}{lll}2 & 22 & 9.5 \\ 2 & 7\end{array}$ | 2.15 |
| 53 | $2 \quad 445 \cdot 6$ | 2.95 | $\begin{array}{lllll}2 & 7 & 38 \cdot 3\end{array}$ | $2 \cdot 79$ | $21020 \cdot 9$ | $2 \cdot 63$ | 2 12 54.4 | 2.48 | 15 19.0 | $2 \cdot 34$ | 2 I7 35.4 | $2 \cdot 21$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | - A. | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ}$ | A. | L. | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\stackrel{s}{\mathbf{s}}$ | $\begin{gathered} \text { s. } \\ -4.28 \end{gathered}$ | $\begin{aligned} & \mathrm{s.} \\ & +\quad .08 \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 28 \end{gathered}$ | $\begin{gathered} \mathrm{s.} \\ +\quad{ }^{\prime} 6 \end{gathered}$ | $\begin{gathered} S . \\ -4 \cdot 29 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad \cdot 24 \end{aligned}$ | S. -4.29 | $\begin{gathered} s . \\ +\quad .32 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -4.29 \end{gathered}$ | S. $+\quad .40$ | S. |
| 2 | -06 | 4.29 | +.02 | $4 \cdot 29$ | -10 | 4.29 | -18 | $4 \cdot 29$ | - 26 | 4.29 | +.34 | 4.30 |
| 4 | -II | $4 \cdot 28$ | -.03 | $4 \cdot 28$ | + 004 | $4 \cdot 28$ | -12 | $4 \cdot 29$ | - 20 | $4 \cdot 29$ | -29 | $4 \cdot 29$ |
| 6 | -17 | $4 \cdot 29$ | -09 | $4 \cdot 29$ | - 01 | $4 \cdot 29$ | -07 | 4.29 | - 15 | $4 \cdot 29$ | -23 | $4 \cdot 29$ |
| 8 | $\cdot 23$ | $4 \cdot 29$ | -15 | $4 \cdot 29$ | -07 | $4 \cdot 28$ | + OI | $4 \cdot 28$ | -09 | $4 \cdot 28$ | -17 | 4.29 |
| 10 | - $\cdot 29$ | $4 \cdot 29$ | - 21 | $4 \cdot 29$ | - -13 | $4 \cdot 29$ | - .04 | $4 \cdot 28$ | +.03 | $4 \cdot 28$ | + $\cdot \mathrm{II}$ | $4 \cdot 29$ |
| 12 | $\cdot 35$ | $4 \cdot 30$ | $\cdot 27$ | $4 \cdot 29$ | -18 | $4 \cdot 29$ | -10 | $4 \cdot 28$ | -02 | $4 \cdot 28$ | .06 | $4 \cdot 28$ |
| I4 | -41 | $4 \cdot 30$ | -33 | $4 \cdot 30$ | -24 | $4 \cdot 29$ | -16 | $4 \cdot 29$ | $\cdot 08$ | $4 \cdot 28$ | + .00 | $4 \cdot 28$ |
| 16 | -47 | $4 \cdot 31$ | -39 | $4 \cdot 30$ | -30 | $4 \cdot 29$ | $\cdot 22$ | $4 \cdot 29$ | -14 | $4 \cdot 29$ | - .05 | $4 \cdot 28$ |
| 18 | -54 | $4 \cdot 32$ | -45 | $4 \cdot 31$ | $\cdot 37$ | $4 \cdot 30$ | $\cdot 28$ | $4 \cdot 29$ | -20 | $4 \cdot 29$ | -II | $4 \cdot 28$ |
| 20 | - . 60 | $4 \cdot 33$ | - 52 | $4 \cdot 31$ | - 43 | 4.30 | - 34 | $4 \cdot 30$ | - $\cdot 26$ | $4 \cdot 29$ | - $\cdot 17$ | $4 \cdot 29$ |
| 22 | -67 | $4 \cdot 34$ | -58 | $4 \cdot 32$ | -49 | $4 \cdot 31$ | -41 | $4 \cdot 30$ | $\cdot 32$ | $4 \cdot 29$ | -23 | $4 \cdot 29$ |
| 24 | $\cdot 74$ | $4 \cdot 35$ | -65 | $4 \cdot 33$ | -56 | $4 \cdot 32$ | -47 | $4 \cdot 31$ | $\cdot 38$ | $4 \cdot 30$ | -29 | $4 \cdot 29$ |
| 26 | -82 | $4 \cdot 36$ | $\cdot 72$ | $4 \cdot 34$ | -63 | 4.33 | -54 | $4 \cdot 32$ | -45 | $4 \cdot 31$ | -36 | $4 \cdot 30$ |
| 28 | $\cdot 89$ | $4 \cdot 37$ | -80 | $4 \cdot 36$ | $\cdot 70$ | $4 \cdot 34$ | .61 | 4.33 | -5I | $4 \cdot 32$ | -42 | $4 \cdot 30$ |
| 30 | - 97 | $4 \cdot 39$ | -.87 | $4 \cdot 37$ | -.78 | $4 \cdot 35$ | -. 68 | $4 \cdot 33$ | -. 58 | $4 \cdot 32$ | - $\cdot 49$ | $4 \cdot 31$ |
| 32 | I.06 | $4 \cdot 41$ | . 96 | $4 \cdot 39$ | . 85 | 4.37 | $\cdot 76$ | $4 \cdot 35$ | - 66 | $4 \cdot 33$ | -56 | $4 \cdot 32$ |
| 34 | I• 5 | 4.43 | I'04 | $4 \cdot 41$ | -94 | $4 \cdot 38$ | -83 | $4 \cdot 36$ | -73 | 4.34 | -63 | $4 \cdot 33$ |
| 36 | I. 24 | $4 \cdot 46$ | I'13 | $4 \cdot 43$ | I.02 | $4 \cdot 40$ | $\cdot 92$ | $4 \cdot 38$ | -8I | $4 \cdot 36$ | $\cdot 71$ | $4 \cdot 34$ |
| 38 | 1.35 | $4 \cdot 49$ | I-23 | $4 \cdot 46$ | I•I2 | $4 \cdot 43$ | I•OI | $4 \cdot 40$ | -90 | $4 \cdot 37$ | $\cdot 79$ | $4 \cdot 36$ |
| 40 | -1.46 | $4 \cdot 52$ | - I. 34 | $4 \cdot 49$ | - I. 22 | $4 \cdot 45$ | - I•10 | $4 \cdot 42$ | - 99 | $4 \cdot 39$ | -. 88 | $4 \cdot 37$ |
| 42 | I 58 | $4 \cdot 57$ | 1.45 | $4 \cdot 52$ | I-32 | $4 \cdot 48$ | 1.20 | $4 \cdot 45$ | I.08 | $4 \cdot 42$ | .97 | $4 \cdot 39$ |
| 44 | I•71 | 4.61 | 1.57 | 4.56 | I. 44 | $4 \cdot 52$ | I•31 | $4 \cdot 48$ | I•18 | $4 \cdot 45$ | 1.06 | $4 \cdot 4 \mathrm{I}$ |
| 46 | r.86 | $4 \cdot 67$ | I•71 | $4 \cdot 61$ | I.57 | 4.56 | 1.43 | $4 \cdot 52$ | I. 30 | $4 \cdot 48$ | I'I7 | 4.44 |
| 48 | 2.02 | $4 \cdot 74$ | 1.86 | 4.67 | $1 \cdot 71$ | $4 \cdot 6 \mathrm{I}$ | 1.56 | $4 \cdot 56$ | I. 42 | $4 \cdot 5 \mathrm{I}$ | I-28 | $4 \cdot 47$ |
| 50 | $-2.21$ | $4 \cdot 82$ | $-2.03$ | $-4.74$ | -r.87 | $4 \cdot 67$ | - 1.71 | $4 \cdot 61$ | -I.56 | $4 \cdot 56$ | -I.4I | 4.51 |
| 52 | $2 \cdot 42$ | $4 \cdot 92$ | 2.23 | $4 \cdot 83$ | 2.05 | $4 \cdot 75$ | 1.87 | $4 \cdot 68$ | $1 \cdot 71$ | $4 \cdot 61$ | I. 55 | $4 \cdot 56$ |

LATITUDE $21^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Dec $\operatorname{Var}$ | $8^{\circ}$ | $\begin{aligned} & \text { De } \\ & \text { Va } \end{aligned}$ | $9^{\circ}$ | $\begin{aligned} & \mathrm{De} \\ & \mathrm{Va} \end{aligned}$ | $10^{\circ}$ | $\begin{aligned} & \text { Ded } \\ & \text { Va } \end{aligned}$ | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 9 & \text { I } \end{array}$ | $+1 \cdot 5$ | $\begin{aligned} & \text { H. M. } \\ & 6 \\ & 6 \end{aligned} \text { IO }$ | $+1 \cdot 5$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I2 } & 22 \cdot 2 \end{array}$ | $+1 \cdot 57$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 13 & 56 \cdot 6 \end{array}$ | $+\mathrm{I} \cdot 5$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I5 } & 3 \mathrm{I} \cdot 5 \end{array}\right.$ | $+1 \cdot 59$ | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & \text { I7 } \\ 7.0 \end{array}$ | $+1.60$ |
| 10 | $5 \quad 2615 \cdot 7$ |  | $52744 \cdot 8$ | I. 48 |  | 1.47 | $53041 \cdot 6$ | I 47 | $\begin{array}{llll}5 & 32 & 9 \cdot 5\end{array}$ | I.46 | $\begin{array}{llll}5 & 33 & 36 \cdot 9\end{array}$ | 1.45 |
| 12 | 5 I7 4I'I | I 48 | $\begin{array}{lll}5 & 19 & 9.8\end{array}$ | 1.47 | $52037 \cdot 7$ | 1. | 522 | I.45 | $\begin{array}{llll}5 & 23 & 31 \cdot 8\end{array}$ | I 44 | 524 58-1 | 43 |
|  | $\begin{array}{llll}5 & 9 & 6.8\end{array}$ |  | 5 Io 35.1 |  | $\begin{array}{llll}5 & 12 & 2.5\end{array}$ |  | $\begin{array}{llll}5 & 13 & 29 \cdot 1\end{array}$ |  | 5145 |  | 5 I6 $20 \cdot 2$ | 4 |
| 16 | 5 ○ $32 \cdot 6$ | I | $\begin{array}{llll}5 & 2 & 0.6\end{array}$ | I. 4 | $\begin{array}{llll}5 & 3 & 27 \cdot 7\end{array}$ | 1.44 | $\begin{array}{lllll}5 & 4 & 53.7\end{array}$ | 1.42 | $\begin{array}{llll}5 & 6 & 18.7\end{array}$ | 1.41 | $5743 \cdot 0$ | - 39 |
| 18 | 45158 | +I.4 | 45326 | +1.46 | 45453 | +1.4 | $456 \quad 18 \cdot 7$ | +I.4I | $45743 \cdot \mathrm{I}$ | +1. | $\begin{array}{llll}4 & 59 & 6 \cdot 4\end{array}$ | +1.38 |
| 20 | 4432 |  | 444 | 1.4 | 446 | I.43 | $44744^{\circ} \mathrm{O}$ |  | $449 \quad 7 \cdot 9$ |  | $4 \begin{array}{llll}4 & 50 & 30 \cdot 4\end{array}$ | 6 |
| 22 | 43449 | 1.4 | 436 I | I. | 43744 | -43 | 439396 | I 40 | $44033 \cdot 0$ | I•38 | 44155 | 35 |
| 24 | $\begin{array}{llll}4 & 26 & 15 \cdot 3\end{array}$ |  | $42743 \cdot 8$ |  | 4291 |  | $43035 \cdot 4$ |  | $43158 \cdot 5$ |  | 43319.9 | 4 |
| 26 | 417404 | 1.5 | $4 \begin{array}{lll}49 & 9 \cdot 3\end{array}$ | 1.46 | 42036 | $1 \cdot 43$ | $4 \begin{array}{lll}422 & 1 \cdot 2\end{array}$ |  | $42324 \cdot 2$ | 1.37 | $424 \quad 45 \cdot 2$ | 3 |
| 28 | 49 | +I. 5 | 4 10 34. | +1.4 | 4 I2 I•9 | + | 4 I3 27.0 | + | 4 I4 50.0 | +I. | $41610 \cdot 7$ | + I'33 |
| 30 | 4 - 29.0 | I. 53 | 4 I 5 | 1.4 | $\begin{array}{llll}4 & 3 & 27 & 3\end{array}$ |  | $4 \begin{array}{lll}4 & 4 & 52 \cdot 7\end{array}$ |  | 4615 | 1 | $\begin{array}{llll}4 & 7 & 36 \cdot 4\end{array}$ | -32 |
| 32 | 3 5I 52.2 | $1 \cdot 5$ | $35323 \cdot$ | I 50 | 35452 |  | $3{ }_{3} 56618 \cdot 3$ |  | 357415 | I | $\begin{array}{lll}3 & 59 & 2 \cdot 3\end{array}$ | 32 |
| 33 | $34733 \cdot 5$ | - | $\begin{array}{lll}3 & 49 & 5 \cdot 5\end{array}$ |  | 350 |  | 3523 1 |  | $\begin{array}{llll}3 & 53 & 24 \cdot 5\end{array}$ | $\underline{5} 37$ | 35445 | 2 |
| 34 | $\begin{array}{llll}3 & 43 & 14.5\end{array}$ | r.57 | $\begin{array}{lllll}3 & 44 & 47 \cdot 2\end{array}$ | I. 52 | 346 I | $1 \cdot$ | 34743 | $1 \cdot 42$ | $\begin{array}{llll}3 & 49 & 7 \cdot 2\end{array}$ | 1.37 | 350 | I•32 |
| 35 | $\begin{array}{llll}3 & 38 \\ 58\end{array}$ | +I.5 | 340 | + 1.5 | 3415 | +1.4 | 343125.9 | + 1.42 | $34450 \cdot 0$ | +1. | 346 II.O | + I. 33 |
| 36 | 33435 | I.60 | $33^{36} 1$ |  | 3374 | 1.4 | $\begin{array}{llll}3 & 39 & 8 \cdot 3\end{array}$ | I | $34032 \cdot 6$ |  | 341 | I•33 |
|  | 33016. |  | 3315 |  | 333 |  | $334 \begin{array}{llll}3 & 50 \cdot 5\end{array}$ |  | $\begin{array}{llllll}3 & 36 & 15 \cdot 2\end{array}$ |  | $\begin{array}{lllll}3 & 37 & 36 \cdot 7\end{array}$ | 3 |
| 38 | $\begin{array}{llll}3 & 25 & 55 \cdot \\ 3 & 21 & \end{array}$ |  | $\begin{array}{llll}3 & 27 & 31 \cdot 7 \\ 3 & 23 & 1\end{array}$ |  | $\begin{array}{rrr}3 & 29 & 3 \cdot 8 \\ 3 & 24 & 45.1\end{array}$ |  | $\begin{array}{llll}3 & 30 & 32 \cdot 5\end{array}$ |  | $\begin{array}{llll}3 & 31 & 57.7\end{array}$ |  | $\begin{array}{lllll}3 & 33 & 19.4\end{array}$ | 33 |
| 39 | 3213 |  | $32312 \cdot 1$ | I. 5 | $32445 \cdot \mathrm{I}$ | I. 52 | 32614.3 | 1.46 | $32740 \cdot 0$ | 1.40 | $329 \quad 2 \cdot 1$ | I.34 |
| 40 | 3 I7 14.4 | + I | 3185 | +1.6 | $32026 \cdot 0$ | +1.5 | 3215 | + I. 4 | $\begin{array}{llll}3 & 23 & 22.2\end{array}$ | + I. 4 | 32444.7 | I. 34 |
|  | $\begin{array}{llll}3 & 12 & 53.0\end{array}$ | I.68 | 314 | I.6I | $\begin{array}{llll}3 & 16 & 6 \cdot 6\end{array}$ | 1. | 317 | 1.4 | $\begin{array}{llll}3 & 19 & 4.2 \\ 3 & \end{array}$ |  | $32027 \cdot 2$ | 35 |
| 42 | $3{ }^{3} 8835 \cdot$ |  | 310 |  | 3 II $47 \cdot 0$ |  | 313 |  | 3 I4 $46 \cdot \mathrm{I}$ |  | $\begin{array}{llll}3 & 16 & 9.5\end{array}$ |  |
| 43 | $\begin{array}{lrr}3 & 4 & 8\end{array}$ | $1 \cdot 73$ | 355 | 1 | $\begin{array}{llll}3 & 7 & 27 \cdot 0 \\ 3 & 3 & 6 \cdot 7\end{array}$ |  | $\begin{array}{llll}3 & 8 & 59.5 \\ 3 & 4 & 40.5\end{array}$ |  | 3 10 $27 \cdot 7$ |  | 3 11 $51 \cdot 7$ | 36 |
|  | $25945 \cdot 9$ | I'75 | 3 I 2 |  | $\begin{array}{llll}3 & 3 & 6 \cdot 7\end{array}$ |  | $3 \quad 4 \quad 40 \cdot 1$ | I. 52 | 3669.1 | I. 45 | $3 \quad 7 \begin{array}{llll}3 & 7\end{array}$ | 8 |
|  | $255122 \cdot 3$ | +1.78 | 257 | +1. | 25845 | + | $3 \quad 0$ | +I. | 3 I $500 \cdot 3$ | + 1.4 | $\begin{array}{lrrr}3 & 3 & 15.6\end{array}$ | I.39 |
| 46 | $25058 \cdot$ | - | 2524 |  | $2 \begin{array}{llll}24 & 24.6\end{array}$ |  | 256 | r. 5 | $25731 \cdot 2$ | I | $2 \begin{array}{lllll}2 & 58 & 57 \cdot 3\end{array}$ | I.40 |
|  | $24633 \cdot 2$ | -8 | 248 |  | $\begin{array}{lll}2 & 50 & 2.8\end{array}$ | 66 | 2513 |  | 25311.8 | 49 | $25438 \cdot 7$ |  |
| 48 | $\begin{array}{llll}2 & 42 & 7.4 \\ 2 & 37 & 40.8\end{array}$ | I.87 | 2435 |  | $\begin{array}{llll}2 & 45 & 40 \cdot 6 \\ 2 & 4\end{array}$ | I.68 | $\begin{array}{llllllll}2 & 47 & 18.9\end{array}$ |  | $24852 \cdot 0$ |  | 250 I9.9 | 4 |
| 49 | $23740 \cdot 8$ | I.91 | $23932 \cdot 2$ |  | 24117.7 | r.71 | $24257 \cdot 5$ | I | 244 3I•8 | r.53 | 246 | 1. |
| 50 | $\begin{array}{llll}2 & 33 & 13\end{array}$ | +I.95 | $\begin{array}{lll}2 & 35 & 6.8\end{array}$ | +I. | $2 \begin{array}{llll}26 & 54 \cdot 2\end{array}$ | +I. | $2 \begin{array}{lll}2 & 38 & 35 \cdot 6\end{array}$ | +1. 6 | 2401113 | +1.55 | $24114 \mathrm{l} \cdot 3$ | 1.45 |
| 51 | 2284 | 1.99 | $23040 \cdot 6$ | I.88 | $\begin{array}{llll}2 & 32 & 29.9 \\ 2 & 28 & \end{array}$ |  | 23413. | I. 67 | 235 | I. 57 | $2 \begin{array}{llll} & 3 & 21\end{array}$ | I 47 |
| 52 | 2241 | 2.03 | $\begin{array}{llll}2 & 26 & 13 .\end{array}$ |  | $\begin{array}{lll}2 & 28 & 4 \cdot 9 \\ 2 & 23 & 3\end{array}$ |  | 22950 | I.70 | 23128. | I. 59 | $\begin{array}{llll}2 & 33 & 1 \cdot 3\end{array}$ | 49 |
| 53 | $\begin{array}{llll}2 & 19 & 44^{\circ} \\ 2 & \end{array}$ | $2 \cdot 08$ | $22 I 45 \cdot 0$ | 1 | $\begin{array}{lllll}2 & 23 & 39\end{array}$ |  | $225 \quad 26 \cdot 1$ |  | $2 \begin{array}{lllllllllllll}27 & 6 \cdot 6\end{array}$ |  | $22840 \cdot 7$ | 5 |
| 54 | 215 II.6 | $2 \cdot 1$ | 21715. | $2 \cdot$ | 2 I9 12.2 | I | $21 \quad 1 \cdot 5$ | I.76 | 22243.9 | I. 65 | 22419.6 | I. 54 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $\mathrm{y}^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ}$ A. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{\circ}$ | s. $+\quad .48$ | 5. -4.31 | s. $+\quad .56$ | S. | $\begin{aligned} & \mathrm{s} \\ & +\quad .64 \end{aligned}$ | S. | $\begin{gathered} \mathrm{s} . \\ +\quad 73 \end{gathered}$ | $\begin{gathered} s \\ -4 \cdot 35 \end{gathered}$ | $+\stackrel{s .81}{ }$ | $\begin{gathered} s . \\ -4 \cdot 36 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .89 \end{aligned}$ | $\begin{gathered} s \\ -4 \cdot 37 \end{gathered}$ |
| 2 | . 42 | 4.31 | . 50 | $4 \cdot 32$ | - 59 | $4 \cdot 33$ | . 67 | $4 \cdot 34$ | . 75 | $4 \cdot 35$ | . 74 | $4 \cdot 36$ |
| 4 | -37 | $4 \cdot 30$ | -45 | $4 \cdot 31$ | - 53 | $4 \cdot 32$ | -6I | 4.33 | -69 | $4 \cdot 34$ | $\cdot 77$ | $4 \cdot 35$ |
| 6 | -31 | $4 \cdot 30$ | -39 | $4 \cdot 30$ | -47 | $4 \cdot 31$ | $\cdot 55$ | $4 \cdot 32$ | -63 | $4 \cdot 33$ | $\cdot 72$ | $4 \cdot 34$ |
| 8 | - 25 | $4 \cdot 29$ | -33 | $4 \cdot 30$ | -41 | $4 \cdot 30$ | $\cdot 50$ | $4 \cdot 31$ | $\cdot 58$ | $4 \cdot 32$ | -66 | $4 \cdot 33$ |
| 10 | + 20 | $4 \cdot 29$ | + 28 | $4 \cdot 30$ | +.36 | $4 \cdot 30$ | + 44 | $4 \cdot 31$ | + 52 | $4 \cdot 32$ | + 6.61 | $4 \cdot 33$ |
| 12 | $\cdot 14$ | $4 \cdot 29$ | $\cdot 22$ | $4 \cdot 29$ | -30 | $4 \cdot 29$ | $\cdot 39$ | $4 \cdot 30$ | $\cdot 47$ | $4 \cdot 31$ | - 55 | $4 \cdot 32$ |
| 14 | -08 | $4 \cdot 28$ | -17 | $4 \cdot 29$ | - 25 | $4 \cdot 29$ | -33 | $4 \cdot 30$ | - 4 | $4 \cdot 30$ | - 50 | $4 \cdot 31$ |
| 16 | +.03 | $4 \cdot 28$ | -II | $4 \cdot 28$ | -19 | $4 \cdot 29$ | $\cdot 27$ | $4 \cdot 29$ | $\cdot 36$ | $4 \cdot 30$ | -44 | $4 \cdot 31$ |
| 18 | -. 03 | $4 \cdot 28$ | $+.05$ | $4 \cdot 28$ | - 14 | $4 \cdot 29$ | $\cdot 22$ | 4.29 | -30 | $4 \cdot 29$ | -39 | $4 \cdot 30$ |
| 20 | - . 09 | $4 \cdot 28$ | - .00 | $4 \cdot 28$ | $+.08$ | $4 \cdot 28$ | + .16 | $4 \cdot 29$ | + $\cdot 25$ | $4 \cdot 29$ | +.33 | 4.30 |
| 22 | - 15 | $4 \cdot 28$ | . 06 | $4 \cdot 28$ | +.02 | $4 \cdot 28$ | - II | - 4.29 | -19 | $4 \cdot 29$ | . 28 | $4 \cdot 29$ |
| 24 | - 21 | $4 \cdot 29$ | -12 | $4 \cdot 29$ | -. 03 | $4 \cdot 28$ | .05 | $4 \cdot 28$ | -14 | $4 \cdot 29$ | - 23 | $4 \cdot 29$ |
| 26 | -27 | $4 \cdot 29$ | -18 | $4 \cdot 29$ | -09 | $4 \cdot 28$ | +.00 | 4.28 | . 08 | $4 \cdot 28$ | -17 | $4 \cdot 29$ |
| 28 | $\cdot 33$ | $4 \cdot 30$ | -24 | $4 \cdot 29$ | -15 | $4 \cdot 29$ | -. 06 | $4 \cdot 28$ | $+.03$ | $4 \cdot 28$ | -12 | $4 \cdot 28$ |
| 30 | - .40 | $4 \cdot 30$ | - 30 | $4 \cdot 29$ | - 21 | $4 \cdot 29$ | - 12 | 4.29 | -. 03 | $4 \cdot 28$ | +.06 | $4 \cdot 28$ |
| 32 | -46 | $4 \cdot 31$ | $\cdot 37$ | $4 \cdot 30$ | $\cdot 27$ | $4 \cdot 29$ | -18 | $4 \cdot 29$ | -09 | $4 \cdot 28$ | $\cdot 00$ | $4 \cdot 28$ |
| 34 | - 53 | $4 \cdot 32$ | $\cdot 44$ | $4 \cdot 31$ | $\cdot 34$ | $4 \cdot 30$ | -24 | $4 \cdot 29$ | - 15 | $4 \cdot 29$ | -. 05 | $4 \cdot 28$ |
| 36 | -6I | $4 \cdot 33$ | -51 | $4 \cdot 31$ | -4I | $4 \cdot 30$ | $\cdot 31$ | 4.29 | -21 | $4 \cdot 29$ | $\cdot \mathrm{II}$ | $4 \cdot 28$ |
| 38 | -68 | $4 \cdot 34$ | $\cdot 58$ | $4 \cdot 32$ | $\cdot 48$ | 4.31 | $\cdot 37$ | $4 \cdot 30$ | $\cdot 27$ | $4 \cdot 29$ | -17 | $4 \cdot 29$ |
| 40 | -.76 | $4 \cdot 35$ | -. 66 | $4 \cdot 33$ | -. 55 | 4.32 | - . 44 | 4.31 | - 34 | $4 \cdot 30$ | - . 24 | $4 \cdot 29$ |
| 42 | -85 | $4 \cdot 37$ | -74 | $4 \cdot 35$ | -63 | $4 \cdot 33$ | $\cdot 52$ | $4 \cdot 31$ | -4I | $4 \cdot 30$ | $\cdot 30$ | $4 \cdot 29$ |
| 44 | $\cdot 94$ | $4 \cdot 39$ | -83 | $4 \cdot 36$ | $\cdot 71$ | $4 \cdot 34$ | -60 | $4 \cdot 33$ | -48 | $4 \cdot 31$ | -37 | $4 \cdot 30$ |
| 46 | I.04 | $4 \cdot 41$ | -92 | $4 \cdot 38$ | -80 | $4 \cdot 36$ | -68 | $4 \cdot 34$ | $\cdot 56$ | $4 \cdot 32$ | $\cdot 44$ | $4 \cdot 31$ |
| 48 | I'I5 | $4 \cdot 44$ | 1.02 | $4 \cdot 40$ | -89 | $4 \cdot 38$ | $\cdot 77$ | $4 \cdot 35$ | -64 | $4 \cdot 33$ | -52 | $4 \cdot 32$ |
| 50 | - I. 27 | $4 \cdot 47$ | - I I ${ }^{\text {l }}$ | $4 \cdot 43$ | - .99 | 4.40 | - .86 | $4 \cdot 37$ | - 73 | $4 \cdot 35$ | - . 60 | $4 \cdot 33$ |
| 52 | I. 39 | $4 \cdot 51$ | I-25 | $4 \cdot 46$ | I-IO | $4 \cdot 42$ | -96 | $4 \cdot 39$ | - 83 | $4 \cdot 36$ | -69 | $4 \cdot 34$ |
| 54 | I. 54 | $4 \cdot 55$ | I•38 | $4 \cdot 50$ | I. 23 | $4 \cdot 46$ | I.08 | 4.42 | $\cdot 93$ | $4 \cdot 38$ | $\cdot 79$ | $4 \cdot 36$ |

88 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $21^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ |  | $13^{\circ}$ |  | $14^{\circ}$ |  | $15^{\circ}$ |  | $16^{\circ}$ |  | $17^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\left\lvert\, \begin{array}{lc} \text { H. M. } & \text { S. } \\ 688 & 43 \cdot 2 \end{array}\right.$ | $+\mathrm{x} \cdot 6 \mathrm{I}$ | $\left\lvert\, \begin{array}{lc} \text { H. M. } & \text { S. } \\ 620 & 20 \cdot 2 \end{array}\right.$ | $+1 \cdot 62$ | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 2 \mathrm{II} \\ \hline 8 \end{array}\right.$ | $+1 \cdot 64$ | $\left\|\begin{array}{lll} \text { H. } & \text { M. } & \text { S. } \\ 6 & 36.9 \end{array}\right\|$ | $+\mathrm{x} \cdot 65$ | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 25 \\ 1 \end{array}$ | $+\mathrm{r} \cdot 67$ | $\left\lvert\, \begin{aligned} & \text { H. M. } \\ & 6 . \\ & 6 \end{aligned} \mathbf{5 .}\right. \text {. }$ | $\begin{gathered} \mathrm{S} \cdot \mathbf{x}_{9} \end{gathered}$ |
| 10 | 5354.2 | 1. | $53631 \cdot 2$ | 1.4 | $53758 \cdot 0$ | 1.44 | [ 53924.7 | I. 44 | 540 51.4 | 1.4 | $542 \begin{array}{ll}5 & 18 \cdot 2\end{array}$ | I. 45 |
| 12 | ${ }^{5} 52624.0$ | 1.43 | 5274 | 1 | $5 \begin{array}{llllllll}5 & 29 & 14.4\end{array}$ | 1.41 | [ $513039 \cdot 1$ | 1.41 | $\begin{array}{llll}5 & 32 & 3 \cdot 6\end{array}$ | 141 | 53327.9 | I.40 |
| 14 | 51744.7 |  | 519 |  | $52032 \cdot 0$ |  | $52154 \cdot$ |  | $\begin{array}{lllllll}523 & 17.2\end{array}$ |  | $52439 \cdot 2$ | $1 \cdot 36$ |
| 16 | $\begin{array}{llll}5 & 9 & 6 \cdot 3\end{array}$ | $1 \cdot 38$ | 5 10 |  | 5 II 50 | $1 \cdot 36$ | $51311 \times 7$ | 35 | $5 \quad 14 \quad 32 \cdot 2$ | . 33 | $515 \quad 52 \cdot 0$ | I.32 |
| 18 | 5 | + | 5 I 5 | +1. | 3 | + | $\begin{array}{lllllllllll}5 & 4 & 29 \cdot 7\end{array}$ | + 1.32 | $548 \cdot 3$ | +1.30 |  |  |
| 20 | 4515 |  | 4531 | 1.32 | $45430 \cdot 9$ | 1 | $4 \begin{array}{llll}4 & 55 & 48 \cdot 8\end{array}$ | 1 | $4{ }^{57} 515 \cdot 6$ |  | $4 \begin{array}{llll}48 & 21.5\end{array}$ | 6 |
| 22 | 44315 |  | 444 |  | 4 <br> 45 <br> 4 $52 \cdot 3$ |  | $\begin{array}{llll}4 & 47 & 8 \cdot 8 \\ 4 & 38\end{array}$ | 1.26 | 44824.0 | 1.24 | $44938 \cdot 0$ | I-22 |
| 24 | $43439 \cdot 7$ | $1 \cdot 32$ | $1 \begin{array}{llll}4 & 35 & 57.9\end{array}$ | 129 | 43714.5 |  | 4 $4 \begin{array}{lll}48 & 29 \cdot 6\end{array}$ | 24 | $43943 \cdot 3$ | 21 | 44055.5 |  |
| 26 | $4 \begin{array}{lll}4 & 26 & 4.4\end{array}$ | 1-30 | 42721.7 | 1.27 | $42837 \cdot 4$ | . 24 | 42951.3 | . 22 | 431315 | -19 | $432 \mathrm{I4}$ I |  |
| 28 | 41729 | +1.2 | 418 | +1.2 | $420 \quad 0.9$ | +1.23 | $4 \begin{array}{llll}4 & 21 & 13.7\end{array}$ | +1.20 | 42224.5 | +1 | $42333 \cdot 6$ | +13 |
| 30 | 54 |  | 4 10 | I. 25 | 4 II 24.9 | I. 21 | $\begin{array}{llll}4 & 12 & 36.7\end{array}$ | I-18 | $4 \begin{array}{llll}43 & 46 \cdot 4\end{array}$ | I 14 | 41433.9 | $1 \cdot 11$ |
| 31 | 4 |  | 45 |  | $\begin{array}{llll}4 & 7 & 7 \cdot 1\end{array}$ |  | $\begin{array}{llll}4 & 8 & 18.4\end{array}$ |  | $4 \begin{array}{llll}4 & 9 & 27.5\end{array}$ |  | 4 Io 34.4 |  |
| 32 | $4 \quad 0 \quad 20 \cdot 5$ |  | 4 |  | $4 \quad 249$ |  | $\begin{array}{lll}4 & 4 & 0.3\end{array}$ |  | $\begin{array}{lll}4 & 5 & 8.8\end{array}$ |  | 4615.0 |  |
| 33 | $\begin{array}{llll}3 & 56 & 3.4\end{array}$ |  | 3571 |  | 3583519 | -19 | $35942 \cdot 3$ |  | 4 - 50.3 |  | $5 \cdot 8$ | 1.07 |
|  | $3 \mathrm{~S} 5146 \cdot 3$ | + $\mathrm{I} \cdot 28$ |  | +I |  | + $\mathrm{I} \cdot 1$ |  | +I.15 | $3{ }^{56} \quad 32 \cdot 0$ | +1.10 |  | +1.06 |
| 35 | $\begin{array}{llllllllllllllll}3 & 47 & 29 \cdot 2\end{array}$ | I.28 | $\begin{array}{llllll}3 & 48 & 44 \cdot 5 \\ 3 & 44 & 27.3\end{array}$ | I 23 | $34957 \cdot 0$ | $I$ | $\left[\begin{array}{lll} 3 & 51 & 6 \cdot 7 \end{array}\right.$ | $\begin{array}{r} \mathrm{I} \cdot \mathrm{I} 4 \\ \mathrm{~T} \cdot \mathrm{~T} \end{array}$ | $\begin{array}{lllllll}3 & 52 & 13 \cdot 7\end{array}$ |  | 3 53 $18 \cdot 0$ <br>    <br> 3 48  | 05 |
| 37 | (1)4312.1 | I. 28 | $34427 \cdot 3$ | I. 23 | $\begin{array}{llll}3 & 45 & 39 \cdot 6\end{array}$ | $\underset{T \cdot 18}{I \cdot 18}$ | $\mathrm{llll}_{3}^{3} 4649 \cdot \mathrm{I}$ | $3$ | 34755 | $\underline{1.08}$ | $\begin{array}{llll}3 & 48 \\ 3 & 59.4\end{array}$ | 4 |
| 37 |  |  | $34010 \cdot 2$ |  | $\begin{array}{lll}3 & 41 & 22.4\end{array}$ | I•18 |  |  | 34337 | $1 \cdot 08$ | $34440 \cdot 9$ | 3 |
| 38 | 334 |  | $33553 \cdot 1$ | 1.23 | $\begin{array}{llll}3 & 37 & 5\end{array}$ | 1-17 | $\mathrm{llll}_{3} 3814.0$ |  | 33919 | 1.07 | $34022 \cdot 5$ | 2 |
| 39 | 33020 |  | $33136 \cdot 1$ | $+1$ | 33248.0 | $+$ | $\begin{array}{lllll}3 & 33 & 56 \cdot 7\end{array}$ | +1 | 335 $2 \cdot 1$ | + I.06 | $3364 \cdot 3$ | I.01 |
| 40 | 326 | I. 28 | 32719.0 |  | $\begin{array}{llll}3 & 28 & 30 \cdot 9\end{array}$ | I-17 | $\begin{array}{llll}3 & 29 & 39 \cdot 3\end{array}$ |  | 33044.4 |  | 3 31 $46 \cdot 1$ | 0 |
| 4 I | 321 | 1.29 | 3231 |  | 324 | I•17 | $\begin{array}{llll}3 & 25 & 22 \cdot I \\ 3 & 21\end{array}$ |  | $\begin{array}{llll}3 & 26 & 26 \cdot 9\end{array}$ |  |  |  |
| 42 | $\begin{array}{llll}3 & 17 & 29 \cdot 1 \\ 3 & 19 & 15 \cdot 7\end{array}$ | 1.29 | $\begin{array}{lllll}3 & 18 & 44.8\end{array}$ | 1.23 | $31956 \cdot 7$ | -17 | $\begin{array}{llll}3 & 21 & 4.9 \\ 3 & 16 & 478\end{array}$ |  | $\begin{array}{lll} 3 & 22 & 9 \cdot 4 \end{array}$ |  | $\begin{array}{llll}3 & 23 & 10 \cdot 3 \\ 3 & 18 & 52.5\end{array}$ |  |
| 43 | 313 | $1 \cdot 30$ | $\begin{array}{lllll}3 & 14 & 27.6\end{array}$ |  | 3151597 |  | 316 |  | $31752 \cdot 0$ |  | $318 \quad 52 \cdot 5$ | 8 |
| 44 | 3 | +1.3I | 3 10 10.5 | +1.2 | $\begin{array}{llllllllll}3 & \text { II } & 22 \cdot 6\end{array}$ | +1.17 |  | +1.10 | $\begin{array}{llll}3 & 13 & 34.7 \\ 3 & 9 & 7\end{array}$ | 1.03 +1.03 | $\begin{array}{lllllllllll}3 & 14 & 34 \cdot 8 \\ 3 & 10 & 17.3\end{array}$ | 77 |
| 45 | ${ }^{3}$ | 31 | 3 5 53.1 <br>  1  | I. 24 | $5 \cdot 5$ | 1-17 | $\begin{array}{llll}3 & 8 & 13.6 \\ 3 & 3 & 56.5\end{array}$ | I•10 | $3 \begin{array}{llll}3 & 9 & 17.5\end{array}$ | I•03 | 3 10 17.3 |  |
| 46 | $\begin{array}{llll}3 & 0 & 18.8 \\ 2 & 56\end{array}$ | 32 | 3 |  | - 28 |  | $\begin{array}{llll}3 & 3 & 56 \cdot 5\end{array}$ |  | $\begin{array}{llll}3 & 5 & 0.3 \\ 3 & 0 & 3\end{array}$ | 1.03 | 59.8 | 96 |
| 47 | 256 | 1.33 | $\begin{array}{lllll}2 & 57 & 18 \\ 2 & 53 & 0\end{array}$ |  | $\begin{array}{llll}2 & 58 & 3 \mathrm{IJ} \cdot 2\end{array}$ |  | 2 $515939 \cdot 5$ |  | 3 0 $43 \cdot 1$ <br> 26   | $\underline{1.02}$ | $\begin{array}{llll}3 & 1 & 42 \cdot 4 \\ 2 & 57 & 25 \cdot 1\end{array}$ | 95 |
| 48 | 251 | I•34 | 253 |  | 25413.9 |  | $25522 \cdot 3$ |  | $25626 \cdot 0$ |  | $25725 \cdot 1$ | 5 |
| 49 | $\begin{array}{llllllll}2 & 47 & 24.5\end{array}$ | +1.35 | $\begin{array}{lllll}2 & 48 & 43 \cdot 1\end{array}$ | +1.27 | $24956 \cdot 6$ | +1.18 |  | +1 | $\begin{array}{llll}2 & 52 & 8.9 \\ 2\end{array}$ | +1.02 | 2 53 $7 \cdot 8$ <br> 2 48  |  |
| 50 | 243 248 | 1.3 1.3 | 2 44 <br> 2 $25 \cdot 2$ <br> 2 40 <br> 7  | 1.28 | $2 \begin{array}{lll}2 & 45 & 39 \cdot 2 \\ 2\end{array}$ | I.19 | $\begin{array}{llllll}2 & 46 & 48 \cdot 1 \\ 2 & 42 & 30 \cdot 9\end{array}$ | I•10 | $\begin{array}{llllll}2 & 47 \\ 2 & 51 \\ 2 & 4 \\ 2\end{array}$ | $1.02$ | $24850 \cdot 6$ | .94 |
| 51 52 | $\begin{array}{ll}2 & 38 \\ 2 & 34\end{array}$ | 1.38 | $\begin{array}{rrrr}2 & 40 \\ 2 & 7 \cdot 1 \\ 2 & 38 \cdot 9\end{array}$ | I. 29 I 30 | $\begin{array}{rrrr}2 & 41 & 21 \cdot 7 \\ 2 & 37 & 4 \cdot 7\end{array}$ | . 20 | $1 \begin{array}{ll}2 & 42 \\ 2 & 38 \\ 2\end{array}$ |  | $\begin{array}{llll}2 & 43 & 34 \cdot 8 \\ 2 & 39 & 17 \cdot 7\end{array}$ | 1.02 1.02 | $\begin{array}{llll}2 & 44 & 33.4 \\ 2 & 40 & 16.3\end{array}$ | 93 |
| 53 |  | 1.40 1.41 | $\begin{array}{llll}2 & 35 & 48 \cdot 9 \\ 2 & 31 & 30 \cdot 3\end{array}$ |  | $\begin{array}{cccc}2 & 37 & 4 \cdot 1 \\ 2 & 32 & 46 \cdot 3\end{array}$ | I 21 I 22 | ll $\begin{aligned} & 2 \\ & 2\end{aligned} 38$ |  | $\begin{array}{rrrrr}2 & 39 & 17.7 \\ 2 & 35 & 0.6\end{array}$ | 1.02 | $\begin{array}{llll}2 & 40 & 16 \cdot 3 \\ 2 & 35 & 59.2\end{array}$ | 3 |
| 53 54 | 2 3008086 |  | $\begin{array}{llll}2 & 31 & 30 \cdot 3 \\ 2 & 27 & 11\end{array} 6$ |  | $\begin{array}{llll}2 & 32 & 46 \cdot 3 \\ 2 & 28 & 28 \cdot 3\end{array}$ |  | 2 233156.6 | +1.13 | $\begin{array}{rrrr}2 & 35 & 0.6 \\ 2 & 30 & 43.5\end{array}$ |  | $\begin{array}{llll}2 & 35 & 59 \cdot 2 \\ 2 & 31 & 42 \cdot 1\end{array}$ | .93 $+\quad .93$ |
| 54 55 5 | $\left\lvert\, \begin{array}{llll}2 & 25 & 48 \cdot 8 \\ 2 & 21 & 28 \cdot 5 \\ 2 & \end{array}\right.$ | 1.41 +1.43 1.46 | $\begin{array}{llll}2 & 27 & 11 \cdot 6 \\ 2 & 22 & 52 \cdot 6\end{array}$ | 1.3 +1.33 I .35 | 2 28 $28 \cdot 3$ <br> 2 24 $10 \cdot 1$ <br>    | + 1.2 I 21 |  | +1.13 $\mathrm{I} \cdot 13$ | $\begin{array}{llll}2 & 30 & 43 \cdot 5 \\ 2 & 26 & 26 \cdot 3\end{array}$ | +1.03 | $\begin{array}{llll}2 & 31 & 42 \cdot I \\ 2 & 27 & 25 \cdot 0\end{array}$ | -93 |
| 56 | $\begin{array}{llll}2 & 17 & 7.9\end{array}$ | 1.48 | 21833.2 | I-36 | $21951 \cdot 7$ | I. 25 | $\begin{array}{lll}2 & 21 & 3.6\end{array}$ |  | 222900 | 1.04 | $\begin{array}{llll}2 & 23 & 7 \cdot 9\end{array}$ | 93 |
| 57 |  | $\underline{151}$ | 21413.5 |  | $2 \begin{array}{llll}15 & 33 \cdot 1\end{array}$ | 1.27 | $1 \begin{array}{llll}2 & 16 & 45.8 \\ 2 & 12 & 27.7\end{array}$ |  | $\begin{array}{lllllll}2 & 17 & 51 \\ 2\end{array}$ | 1.04 | $\begin{array}{lllllllll}2 & 18 \\ 2\end{array}$ | 93 |
| 58 | $2 \quad 8 \quad 25.0$ | r.53 | $2 \quad 953.3$ |  | 2 II 14.1) | 1.29 | $1 \begin{array}{llll}2 & 12 & 27.7\end{array}$ | 1.17 | 213 34.2 | 1.05 | $21433 \cdot 7$ | -93 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. $+\quad .98$ | S. -4.39 | $\begin{gathered} s . \\ +r \cdot 06 \end{gathered}$ | s. -4.4 I | S. $+\mathrm{I} \cdot 15$ | s. -4.43 | s. $+\mathrm{r} \cdot 24$ | $\begin{gathered} \text { s. } \\ -4 * 46 \end{gathered}$ | ¢ | s. -4.48 | $\xrightarrow{\text { S. }}$ | S. 4.51 |
| 4 | . 86 | $4 \cdot 37$ | . 94 | 4.39 | 1.03 | 4.40 | I.II | $4 \cdot 42$ | I. 20 | $4 \cdot 45$ | 1.28 | $4 \cdot 47$ |
| 8 | $\cdot 74$ | $4 \cdot 35$ | . 83 | $4 \cdot 36$ | -91 | $4 \cdot 38$ | -99 | 4.40 | 1.08 | $4 \cdot 42$ | I.16 | 4.44 |
| 12 | . 63 | $4 \cdot 33$ | $\cdot 71$ | $4 \cdot 34$ | . 80 | $4 \cdot 36$ | -88 | $4 \cdot 37$ | $\cdot 97$ | $4 \cdot 39$ | 1.05 | $4 \cdot 41$ |
| 16 | $\cdot 52$ | 4.32 | -65 | $4 \cdot 33$ | $\cdot 69$ | $4 \cdot 34$ | $\cdot 77$ | $4 \cdot 35$ | $\cdot 86$ | $4 \cdot 37$ | '95 | $4 \cdot 39$ |
| 20 | + ${ }^{42}$ | 4.30 | + 50 | $4 \cdot 31$ | + 59 | $4 \cdot 32$ | + 67 | $4 \cdot 34$ | + 76 | $4 \cdot 35$ | + 84 | $4 \cdot 37$ |
| 22 | $\cdot 36$ | $4 \cdot 30$ | $\cdot 45$ | $4 \cdot 31$ | $\cdot 54$ | $4 \cdot 32$ | . 62 | $4 \cdot 33$ | . 76 | $4 \cdot 34$ | -80 | $4 \cdot 36$ |
| 24 | $\cdot 31$ | 4.29 | -40 | $4 \cdot 30$ | $\cdot 48$ | $4 \cdot 3 \mathrm{I}$ | $\cdot 57$ | 4.32 | -66 | 4.33 | $\cdot 75$ | 4.35 |
| 26 | - 26 | 4.29 | -35 | $4 \cdot 30$ | 43 | $4 \cdot 31$ | $\cdot 52$ | $4 \cdot 31$ | $\cdot 61$ | 4.33 | $\cdot 70$ | 4.34 |
| 28 | -2I | 4.29 | - 29 | $4 \cdot 29$ | $\cdot 38$ | $4 \cdot 30$ | -47 | $4 \cdot 31$ | $\cdot 56$ | 4.32 | . 65 | $4 \cdot 33$ |
| 30 | + - 15 | 4.29 | + 24 | $4 \cdot 29$ | + 33 | $4 \cdot 30$ | + 42 | $4 \cdot 30$ | + 5 5 | $4 \cdot 31$ | + 60 | $4 \cdot 33$ |
| 32 | -10 | $4 \cdot 28$ | -19 | $4 \cdot 29$ | -28 | $4 \cdot 29$ | $\cdot 37$ | $4 \cdot 30$ | -47 | $4 \cdot 31$ | $\cdot 56$ | $4 \cdot 32$ |
| 34 | +.04 | $4 \cdot 28$ | $\cdot 14$ | 4.29 | - 23 | 4.29 | $\cdot 32$ | $4 \cdot 30$ | $\cdot 42$ | $4 \cdot 30$ | - 51 | 4.31 |
| 36 | - .01 | $4 \cdot 28$ | . 08 | $4 \cdot 28$ | -18 | 4.29 | $\cdot 27$ | $4 \cdot 29$ | $\cdot 37$ | $4 \cdot 30$ | $\cdot 47$ | $4 \cdot 31$ |
| 38 | $\cdot 07$ | $4 \cdot 28$ | +.02 | 4.29 | . 12 | $4 \cdot 29$ | -22 | $4 \cdot 29$ | $\cdot 32$ | $4 \cdot 30$ | -42 | 4.30 |
| 40 | - .13 | $4 \cdot 29$ | -.03 | $4 \cdot 28$ | +.07 | $4 \cdot 28$ | + 17 | $4 \cdot 29$ | + 27 | 4.29 | + 37 | $4 \cdot 30$ |
| 42 | - 20 | $4 \cdot 29$ | . 09 | $4 \cdot 28$ | - .or | 4.28 | -12 | $4 \cdot 29$ | . 22 | 4.29 | -32 | $4 \cdot 30$ |
| 44 | $\cdot 26$ | $4: 29$ | - 15 | $4 \cdot 29$ | . 04 | $4 \cdot 28$ | . 06 | $4 \cdot 28$ | -17 | 4.29 | $\cdot 28$ | 4.29 |
| 46 | 33 | $4 \cdot 30$ | $\cdot 22$ | $4 \cdot 29$ | -10 | $4 \cdot 29$ | + ${ }^{\text {OI }}$ | $4 \cdot 28$ | -12 | 4.29 | $\cdot 23$ | 4.29 |
| 48 | -40 | $4 \cdot 30$ | $\cdot 28$ | $4 \cdot 29$ | -17 | $4 \cdot 29$ | . 05 | 4.29 | -06 | $4 \cdot 28$ | -18 | $4 \cdot 29$ |
| 50 | - 48 | $4 \cdot 31$ | $\cdot 35$ | $4 \cdot 30$ | - 23 | $4 \cdot 29$ | . II | 4.29 | + .01 | 4.28 | + 13 | $4 \cdot 29$ |
| 52 | - 56 | $4 \cdot 32$ | 43 | $4 \cdot 3 \mathrm{I}$ | $\cdot 30$ | $4 \cdot 29$ | $\cdot 18$ | $4 \cdot 29$ | -.05 | $4 \cdot 28$ | - 07 | 4.29 |
| 54 | $\cdot 65$ | $4 \cdot 33$ | $\cdot 51$ | $4 \cdot 31$ | $\cdot 38$ | $4 \cdot 30$ | - 24 | 4.29 | -11 | 4.29 | + 02 | 4.28 |
| 56 | $\cdot 74$ | $4 \cdot 35$ | - 60 | $4 \cdot 33$ | -46 | $4 \cdot 31$ | $\cdot 32$ | 4.30 | - 18 | 4.29 | -. 04 | $4 \cdot 28$ |
| 58 | -85 | $4{ }^{\circ} 37$ | . 69 | $4 \cdot 34$ | $\cdot 54$ | $4 \cdot 32$ | -39 | $4 \cdot 30$ | $\cdot 25$ | 4.29 | -10 | $4 \cdot 29$ |

DECLINATION-SAME NAME AS-LATITUDE.

| $\left\lvert\, \begin{gathered} \text { True } \\ \text { Alt. } \end{gathered}\right.$ | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 28 & 39 \cdot 6 \end{array}\right\|$ | $\left\lvert\, \begin{gathered} S . \\ +I \cdot 7 I \end{gathered}\right.$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 30 \end{array} 22 \cdot 9\right.$ | $+1 \cdot 73$ | $\begin{array}{lll} \text { H. M. } & \text { s. } \\ 6 & 32 & 7.5 \end{array}$ | $+1 \cdot 75$ | $\left\|\begin{array}{\|cc} \text { H. M. } \\ 6 & 33 \\ 53 \cdot 6 \end{array}\right\|$ | $+1.98$ | $\left\lvert\, \begin{aligned} & \text { H. M. } \\ & 63 \end{aligned}\right.$ | $\begin{gathered} \text { S. } \\ \mathrm{I} \cdot 8 \mathrm{I} \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 37 & 30 \cdot 6 \end{array}\right.$ |  |
| 10 | $54345 \%$ | 1-45 | $545 \mathrm{II} \cdot 8$ | I 45 | $54638 \cdot 9$ | 1.45 | $548 \quad 6.2$ | I. 46 | $54933 \cdot 8$ | I. 46 | 55 5 |  |
| 12 | 53452.0 | 1.4 | $53616 \cdot 1$ | I-40 | $53740 \cdot 2$ | 40 | $\begin{array}{llll}5 & 39 & 4 \cdot 2\end{array}$ | 1-40 | $54028 \cdot 3$ | 1.40 | $54152 \cdot 6$ | 0 |
| 14 | $\begin{array}{llll}5 & 26 & 1 \cdot 0\end{array}$ | I 36 | 52722.3 | I. 35 | $5 \begin{array}{llll}5 & 28 & 43.4\end{array}$ | . 35 | $530 \quad 4 \cdot 2$ | I 35 | 53125.0 | $\cdot 34$ | $\begin{array}{llll}5 & 32 & 45 \cdot 7\end{array}$ | 34 |
| 16 | 5 I 7 II 3 | I. | $51830 \cdot 1$ | 1-31 | $51948 \cdot 4$ | 30 | $521 \quad 6 \cdot 2$ | I.29 | 52223.7 | 129 | $52340 \cdot 9$ | -28 |
| 18 | $\begin{array}{llll}5 & 8 & 23 \cdot 1\end{array}$ | +r r 28 | 39.4 | + $1 \cdot 26$ | 5 Io 55.0 | $+\mathrm{r} 25$ | 51210 | +1.24 | 5 I3 24.4 | $+1.23$ | 514438.2 | 2 |
| 20 | $45936 \cdot 3$ | I | - 50.2 | I | 5 5123.3 | 1.21 | $\begin{array}{lllll}5 & 3 & 15 \cdot 4\end{array}$ | I | $\begin{array}{llll}5 & 4 & 26 \cdot 7\end{array}$ | 8 |  | -17 |
| 22 | $45050 \cdot 8$ | 1. 20 | $452 \quad 2.4$ | I•I8 | $4 \begin{array}{llll}4 & 53 & 12.9\end{array}$ | I•17 | $45422 \cdot 4$ | 1-15 | $45530 \cdot 7$ | 3 | $45638 \cdot \mathrm{I}$ | $\underline{19}$ |
| 24 | 4426.4 | I'17 |  | $1 \cdot 15$ | 44424.0 | $1 \cdot 12$ | $44530 \cdot 8$ | 1.10 | $44636 \cdot 3$ | . 08 | $44740 \cdot 6$ | .06 |
| 26 | 43323.1 | I•I3 | $43430 \cdot 4$ | 1-11 | $43536 \cdot 2$ | 1.08 | $43640 \cdot 5$ | 1.06 | $43743 \cdot 3$ | I.03 | $43^{8} 44 \cdot 5$ | 1.01 |
| 28 | $42440 \cdot 8$ | +I.I | $42546 \cdot \mathrm{I}$ | $+1.07$ | $42649 \cdot 7$ | +1.04 | $42751 \cdot 5$ | +r.or | 428 5x.6 | + 99 | $42950 \cdot 0$ | + 96 |
| 30 | 41559.4 | I | $\begin{array}{llll}4 & 17 & 2.8 \\ 4\end{array}$ | 1.04 | $4 \begin{array}{lll}4 & 18 & 4 \cdot 3\end{array}$ | I 01 | $4 \begin{array}{lll}49 & 19 & 3\end{array}$ | -97 | 420 I•I | -94 | 4 4 4 1 56.6 | 91 |
| 3 I | 4 II 3900 | I.06 | 412416 | 1.02 | 413420 | $\cdot 99$ | $41440 \cdot 2$ | 5 | $41536 \cdot 3$ | 92 | $41630 \cdot 4$ | 8 |
| 32 | $4 \quad 719.0$ | r. 04 | $4 \quad 8 \quad 20 \cdot 5$ | 1.01 | $4 \begin{array}{lll}4 & 9 & 19.9\end{array}$ | 97 | 41017.0 | 93 | $4 \mathrm{Ir} \mathrm{II} \cdot 8$ | 90 | 4124.5 | 86 |
| 33 | 425 | r.03 | $4 \begin{array}{lll}4 & 3 & 59\end{array}$ | 99 | $4 \quad 458 \cdot 0$ | 95 | 45 | -91 | $4 \quad 647 \cdot 6$ |  | 4738 | 3 |
| 34 | $\begin{array}{lllll}3 & 58 & 39 \cdot 2\end{array}$ | +r.02 | 3 3 3 59 | + 98 |  | + 93 | 4 | + 8.89 | 4 2 $23 \cdot 6$ <br> 3 57 $50 \cdot 9$ | + 85 | $\begin{array}{rrrrr}4 & 3 & 13.5 \\ 3 & 58 & 48.4\end{array}$ | I |
| 35 |  | 1.00 | 35518 | $\cdot 96$ | 3 56 $15 \cdot 1$ <br> 3 51  | 2 | 357 |  | 3 57 59.9 <br> 3 53  <br> 15.4   |  | 358 |  |
| 36 | -3 50  <br> 3 45 $0 \cdot 3$ | .99 |  | -95 | 3 3 51 53.9 |  |  | - 83 | $\begin{array}{llll}3 & 53 & 36 \cdot 4 \\ 3 & 49 & 13 \cdot 2\end{array}$ | 9 | $\begin{array}{llll}3 & 54 & 23.6 \\ 3 & 49 \\ 59.0\end{array}$ | 4 |
| 38 | $\begin{array}{llll}3 & 45 & 4 \mathrm{I} \cdot \mathrm{I} \\ 3 & 4 \mathrm{I} & 22 \cdot \mathrm{I}\end{array}$ | -97 | $\begin{array}{llll}3 & 46 & 38 \cdot 5 \\ 3 & 42 & 18 \cdot 7\end{array}$ | -93 | $\begin{array}{llll}3 & 47 & 33 \cdot 0 \\ 3 & 43 & 12 \cdot 2\end{array}$ | . 88 | \|rrrr|r| | . 83 | $\begin{array}{llll}3 & 49 & 13.2 \\ 3 & 44 & 50 \cdot 2\end{array}$ | 7 | $\begin{array}{llll}3 & 49 & 59 \\ 3 & 45 & 34\end{array}$ |  |
| 39 | 337 | + 95 | 337 | + 90 | $33^{8}$ 5r-6 | + 85 | 339 | + $\cdot 80$ | $34027 \cdot 4$ | + $\cdot 74$ | $34110 \cdot 5$ | $\cdot 69$ |
| 40 | $3244 \cdot 5$ | 94 | $3 \quad 33 \quad 39 \cdot 5$ | 89 | $3 \quad 343 \mathrm{I} \cdot 3$ | 83 |  | $\cdot 78$ | $\begin{array}{llll}3 & 36 & 4 \cdot 8\end{array}$ | $\cdot 72$ |  | . 67 |
| 4 I | $\begin{array}{lllll}3 & 28 & 25.9\end{array}$ | 93 | $32920 \cdot 2$ | . 88 | 330 II'I | . 82 | $3 \quad 3058 \cdot 5$ | $\cdot 76$ | $33^{31} 42 \cdot 4$ |  | $3 \quad 3222.9$ | 64 |
| 42 | $\begin{array}{llll}3 & 24 & 7 \cdot 5\end{array}$ | -92 | $\begin{array}{lll}3 & 25 & \text { I I I }\end{array}$ | 86 | $32551 \cdot \mathrm{I}$ | -80 | $\begin{array}{llll}3 & 26 & 37 \cdot 5\end{array}$ | $\cdot 74$ | $32720 \cdot 3$ |  | 32759.4 | 62 |
| 43 | 31949.2 | 1 | $32042 \cdot \mathrm{I}$ | 85 | $32131 \cdot 3$ | -79 | 322 | $\cdot 72$ | 32258.3 |  | 323 | 60 |
| 44 | $\begin{array}{lllll}3 & 15 & 31.0\end{array}$ | + 90 |  | + 84 |  | + 77 | $31756 \cdot 0$ | $+\cdot 7 \mathrm{I}$ |  | + 64 | 31913.0 | + 57 |
| 45 | $\begin{array}{llll}3 & 11 & 12.9\end{array}$ |  | $\begin{array}{llll}3 & 12 & 4 \cdot 6\end{array}$ | $\cdot 83$ | 3 12 $52 \cdot \mathrm{I}$ | $\cdot 76$ | $\begin{array}{llll}3 & 13 & 35.6\end{array}$ | . 69 | $\begin{array}{lllllllll}3 & 14 & 14.9\end{array}$ | A | $31450 \cdot 2$ | 55 |
| 46 | $\begin{array}{llll}3 & 6 & 55 \cdot 0\end{array}$ |  | $\begin{array}{llll}3 & 7 & 46 \cdot 0\end{array}$ | . 81 | $\begin{array}{llll}3 & 8 & 32 \cdot 7\end{array}$ | 74 | $\begin{array}{llll}3 & 9 & 15 \cdot 3\end{array}$ | 67 | $\begin{array}{llll}3 & 9 & 53.5\end{array}$ |  | 31027.4 | 53 |
| 47 | $\begin{array}{cccc}3 & 2 & 37 \cdot 2 \\ 2 & 58 & 10.5\end{array}$ | . 88 | $\begin{array}{llllllllllllllll}3 & 3 & 27 \cdot 6\end{array}$ | . 80 | $\begin{array}{llll}3 & 4 & 13.6 \\ 2 & 59 & 54.5\end{array}$ | 73 | $\begin{array}{llll}3 & 4 & 55 \cdot I \\ 3 & \text { P }\end{array}$ | -65 |  | 8 | $\begin{array}{lll}3 & 6 & 4.9 \\ & \end{array}$ | 51 |
| 48 | $12 \begin{array}{lll}28 & 19.5\end{array}$ | 87 | $2 \begin{array}{lll}29 & 9 \cdot 3\end{array}$ | 79 | $25954 \cdot 5$ | - 71 | 3 0 35.I | . 64 | $3 \text { I II•I }$ | 6 | $\begin{array}{llll}3 & 1 & 42 \cdot 4\end{array}$ | 48 |
| 49 | $2 \begin{array}{lll}24 & \mathrm{I} 9\end{array}$ | + 86 | $2545 \mathrm{I} \cdot \mathrm{I}$ | + 78 | $25535 \cdot 6$ | + 70 | $25615 \cdot 3$ | + 62 | $25^{56} 50 \cdot 2$ | + 54 | $25720 \cdot 2$ | + $\cdot 46$ |
| 50 | ${ }_{2}^{2} 4944 \cdot 3$ | 85 | $25033 \cdot \mathrm{I}$ | 77 | 2 51 $16 \cdot 8$ | . 69 | 25155.6 | . 60 | 25229.4 | 52 | $25258 \cdot \mathrm{I}$ | 43 |
| 5 5 | $\begin{array}{lllllllll}2 & 45 & 26 \cdot 9\end{array}$ | 85 | $24615 \cdot 1$ | $\cdot 76$ | $24658 \cdot 2$ | . 67 | $24736 \cdot 1$ | -59 | $\begin{array}{llll}2 & 48 & 8 \cdot 7\end{array}$ | $\cdot 50$ | $24^{8} 36 \cdot 1$ | 41 |
| 52 | $24 \mathrm{I} \quad 9 \cdot 5$ | 84 | 241573 | 75 | $24239 \cdot 6$ | . 66 | 24316.6 | - 57 | $24348 \cdot 2$ | -48 | 24414.3 | 39 |
| 53 | ${ }^{2} 3652 \cdot 2$ | $\cdot 84$ | 23739.5 | 74 | $23^{8} \quad 21 \cdot 2$ |  | $23^{88} 57 \cdot 3$ | -55 | $23927 \cdot 8$ | -46 | 23952 | 36 |
| 54 | 23234.9 |  | $2332 \mathrm{I} \cdot 8$ | + 73 | $234 \begin{array}{ll}3 & 3\end{array}$ |  |  |  | $\begin{array}{lll}2 & 35 & 7 \cdot 6 \\ 2\end{array}$ | + 64 | $23531 \cdot 0$ | + 34 |
| 5 | $\begin{array}{cccc}2 & 28 & 17.7 \\ 2 & 24 & 0.5 \\ 0.5\end{array}$ | .83 | 2 29 4.3 <br> 2 24 46.8 | $\cdot 72$ | 2 29 44.7 <br> 2 25  |  | 2 30 19.2 <br> 2 26  | - 5 | 2 30 $47 \cdot 4$ <br> 2 26  | 42 | 2 31 $9 \cdot 5$ <br> 2 36 8 <br> 8.2   | 32 |
| 56 | $\begin{array}{llll}2 & 24 & 0 \cdot 5 \\ 2 & 1 & \end{array}$ | $\cdot 82$ | $22446 \cdot 8$ | $\cdot 72$ | $22526 \cdot 7$ | 61 | $\begin{array}{llll}2 & 26 & 0.2 \\ 2 & 21 & 1.5\end{array}$ | 51 | $\begin{array}{ll}2 & 2627.4\end{array}$ | 40 | $22648 \cdot 1$ | 29 |
| 57 | $\begin{array}{llllll}2 & 19 & 43.4 \\ 2 & 15 & 26.3\end{array}$ | -82 | 22029.4 | $\cdot 71$ | 2218.6 | -60 | 22141.5 | -49 | $2 \begin{array}{lll}22 & 7 \cdot 5\end{array}$ | . 38 | 22226.9 | 27 |
| 58 | 21526 |  | 161 | $\cdot 70$ | 1650 | - 59 | 21722 |  | 21747 | -36 | 218 | . 24 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} s . \\ +r \cdot 50 \end{gathered}$ | $\begin{gathered} s . \\ -4.54 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 59 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \times 57 \end{gathered}$ | $\begin{gathered} s . \\ +r \cdot 69 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 60 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +1 \cdot 78 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 64 \end{gathered}$ | $\begin{gathered} \mathbf{s} . \\ +\mathbf{r} \cdot 88 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 67 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 97 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 72 \end{gathered}$ |
| 4 | 1.37 | 4.50 | 1.46 | 4.53 | I.55 | $4 \cdot 56$ | I. 64 | $4 \cdot 59$ | I.73 | $4 \cdot 62$ | r. 83 | $4 \cdot 66$ |
| 8 | 1.25 | $4 \cdot 46$ | I•34 | $4 \cdot 49$ | 1-43 | $4 \cdot 52$ | 1.52 | $4 \cdot 54$ | 1.61 | $4 \cdot 58$ | $1 \cdot 70$ | $4 \cdot 6$ I |
| 12 | I. 14 | $4 \cdot 43$ | 1.22 | $4 \cdot 45$ | I-3I | $4: 48$ | I. 40 | $4 \cdot 51$ | 1.49 | $4 \cdot 54$ | 1.58 | $4 \cdot 57$ |
| 16 | I.03 | $4 \cdot 41$ | I.12 | $4 \cdot 43$ | 1.25 | $4 \cdot 45$ | I 29 | $4 \cdot 47$ | I-38 | $4 \cdot 50$ | 1.47 | $4 \cdot 53$ |
| 20 | + 93 | 4.38 | +1.02 | $4 \cdot 40$ | +1.11 | $4 \cdot 42$ | +1.19 | $4 \cdot 45$ | +1.28 | $4 \cdot 47$ | + 1.37 | $4 \cdot 50$ |
| 22 | . 88 | $4 \cdot 37$ | $\cdot 97$ | $4 \cdot 39$ | 1.06 | $4 \cdot 41$ | I. 5 | $4 \cdot 43$ | 1. 24 | $4 \cdot 46$ | 1.33 | $4 \cdot 48$ |
| 24 | -83 | $4 \cdot 36$ | $\cdot 92$ | $4 \cdot 38$ | I.OI | $4 \cdot 40$ | $1 \cdot 10$ | 4.42 | I•I9 | $4 \cdot 45$ | 1.28 | $4 \cdot 47$ |
| 26 | $\cdot 79$ | $4 \cdot 35$ | $\cdot 88$ | $4 \cdot 37$ | -97 | $4 \cdot 39$ | I.06 | $4 \cdot 41$ | I. 5 | 4.44 | I. 24 | $4 \cdot 46$ |
| 28 | 74 | $4 \cdot 35$ | $\cdot 83$ | $4 \cdot 36$ | $\cdot 92$ | $4 \cdot 38$ | 1.01 | $4 \cdot 40$ | I•I | $4 \cdot 42$ | I 20 | $4 \cdot 45$ |
| 30 | + 70 | $4 \cdot 34$ | + 79 | $4 \cdot 35$ | + 88 | $4 \cdot 37$ | + 97 | $4 \cdot 39$ | +1.07 | $4 \cdot 42$ | + I 16 | 4.44 |
| 32 | $\cdot 65$ | $4 \cdot 33$ | $\cdot 74$ | $4 \cdot 35$ | $\cdot 84$ | $4 \cdot 36$ | -93 | $4 \cdot 38$ | 1.03 | $4 \cdot 40$ | I. 12 | $4 \cdot 43$ |
| 34 | -61 | $4 \cdot 33$ | - 70 | $4 \cdot 34$ | $\cdot 80$ | $4 \cdot 36$ | -89 | $4 \cdot 38$ | -99 | $4 \cdot 40$ | I.09 | $4 \cdot 42$ |
| 36 | $\cdot 56$ | $4 \cdot 32$ | -66 | $4 \cdot 33$ | $\cdot 76$ | $4 \cdot 35$ | -85 | $4 \cdot 37$ | -95 | $4 \cdot 39$ | 1.05 | $4 \cdot 41$ |
| - $3^{8}$ | $\cdot 52$ | $4 \cdot 3 \mathrm{I}$ | . 62 | $4 \cdot 33$ | $\cdot 72$ | $4 \cdot 34$ | - 82 | $4 \cdot 36$ | -92 | $4 \cdot 38$ | I.02 | $4 \cdot 40$ |
| 40 | + 47 | $4 \cdot 3 \mathrm{I}$ | + 57 | $4 \cdot 32$ | + 68 | $4 \cdot 34$ | + 78 | $4 \cdot 35$ | +.88 | $4 \cdot 37$ | + 99 | $4 \cdot 39$ |
| 42 | -43 | $4 \cdot 30$ | -53 | $4 \cdot 32$ | - 64 | 4.33 | $\cdot 74$ | $4 \cdot 35$ | $\cdot 85$ | $4 \cdot 37$ | -95 | $4 \cdot 39$ |
| 44 | $\cdot 38$ | $4 \cdot 30$ | 49 | 4.31 | -60 | 4.33 | $\cdot 71$ | $4 \cdot 34$ | $\cdot 82$ | $4 \cdot 36$ | -93 | $4 \cdot 38$ |
| 46 | $\cdot 34$ | $4 \cdot 30$ | -45 | 4.31 | $\cdot 56$ | $4 \cdot 32$ | - 67 | $4 \cdot 34$ | $\cdot 78$ | $4 \cdot 36$ | -90 | $4 \cdot 38$ |
| 48 | - 29 | $4 \cdot 29$ | -41 | $4 \cdot 30$ | $\cdot 52$ | $4 \cdot 32$ | . 64 | $4 \cdot 33$ | $\cdot 75$ | $4 \cdot 35$ | . 87 | $4 \cdot 37$ |
| 50 | + 25 | 4.29 | + 36 | $4 \cdot 30$ | + 48 | 4.31 | + 60 | $4 \cdot 33$ | + 72 | $4 \cdot 35$ | + 88 |  |
| 52 | - 20 | $4 \cdot 29$ | $\cdot 32$ | $4 \cdot 30$ | $\cdot 45$ | 4.31 | $\cdot 57$ | $4 \cdot 32$ | $\cdot 70$ | $4 \cdot 34$ | . 82 | $4 \cdot 36$ |
| 54 | -15 | 4.29 | $\cdot 28$ | 4.29 | $\cdot 4 \mathrm{I}$ | $4 \cdot 30$ | . 54 | 4.32 | $\cdot 67$ | $4 \cdot 34$ | -80 | $4 \cdot 36$ |
| 56 | -10 | 4.29 | $\cdot 23$ | 4.29 | -37 | $4 \cdot 30$ | -5I | 4.31 | . 64 | $4 \cdot 33$ | $\cdot 78$ | 4.35 |
| 58 | -04 | $4 \cdot 28$ | -19 | 4.29 | -33 | $4 \cdot 30$ | -47 | 4.31 | $\cdot 62$ | $4 \cdot 33$ | $\cdot 76$ | 4.35 |

DECLINATION—SAME NAME AS-LATITUDE.

| $\begin{aligned} & \text { True } \\ & \text { Alt. } \end{aligned}$ | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. | $2^{\circ}$ |  | $3{ }^{\circ}$ |  | $4{ }^{\circ}$ |  | $5{ }^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\lvert\, \begin{aligned} & \text { H. M. } \\ & 6 \end{aligned}\right.$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot \mathrm{I} \end{gathered}$ | $\left\|\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & 37.0 \end{array}\right\|$ |  | $\begin{array}{cc} \text { M. } & \text { S. } \\ 3 & 14 \end{array}$ | $+\mathrm{I} \cdot 62$ | $\begin{gathered} \text { M. S. } \\ 45 \mathrm{I} \cdot 2 \end{gathered}$ | $+1 \cdot 62 \mid$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 6 \\ 28 \cdot 5 \end{array}\right\|$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{x} \cdot 62 \end{gathered}$ | $\left\|\begin{array}{\|cc\|} \text { H. M. } & \text { S. } \\ 6 & 6 \cdot 2 \end{array}\right\|$ |  |
| 10 | $1649 \cdot 4$ |  | $1827 \cdot 6$ | I.63 | $520 \quad 50$ | 1.62 | 2141.6 | I. 60 | $\begin{array}{llll}5 & 23 & 17.4\end{array}$ | I. 59 | $52452 \cdot 6$ | 8 |
| 12 | 810.0 |  | $5{ }_{5} 5$ | I. 64 | 5 II 26 | I. 62 | $\begin{array}{llll}5 & 13 & 3.8\end{array}$ | I.61 | $51439 \cdot 7$ | 9 | $\begin{array}{llll}5 & 16 & 14.9\end{array}$ | I. 58 |
| 14 | 59 30•I |  | I 9.8 | I. 65 | $\begin{array}{llll}5 & 2 & 48 \cdot 4\end{array}$ | . 63 | 425.7 | .6I | $\begin{array}{llll}5 & 6 & 2 \cdot 0\end{array}$ |  | $5 \begin{array}{llll}5 & 7 & 37 \cdot 1\end{array}$ | 58 |
| 16 | 5049 |  | 52 30.1 |  | $4 \quad 54 \quad 9 \cdot 4$ | I. 64 | $5547 \cdot 4$ |  | $45724^{\circ}$ |  | 45859.4 | 58 |
| 18 | $42 \quad 7 \cdot 6$ | + 1 • 71 | $44349 \cdot 6$ | +1.68 | $445 \quad 29$. | +1.66 | 44786 | + I | $44845 \cdot 8$ | +r.6r | $45021 \cdot 6$ | + 1.58 |
| 20 | 3324.8 | I. | $4358 \cdot 1$ | I.71 | 4 36849.6 | ェ.67 | $\begin{array}{llll}4 & 38 & 29 \cdot 2\end{array}$ |  | 44078 | 2 | 44143.4 | 59 |
| 22 | 24 40•8 | I.77 | $42625 \cdot 7$ |  | $\begin{array}{llll}4 & 28 & 8.4\end{array}$ | r.69 | 42949.2 |  | 43128.0 |  | $4335^{\circ} \mathrm{O}$ | . 60 |
| 24 | $415 \begin{array}{llll}4 & 5\end{array}$ |  | 4 I7 $42 \cdot 0$ |  | 41926 | 72 | 4218.4 | r.68 | 42248.2 |  | $42426 \cdot 0$ | .61 |
| 26 | $\begin{array}{llll}4 & 7 & 8\end{array}$ |  | 4 | I.79 | 4 10 4 | 5 | $1226 \cdot 5$ | I•70 |  | r.67 | $41546 \cdot 5$ | I.63 |
| 28 | 358 | + | - | +1.82 | $4 \begin{array}{llll}4 & 1 & 58 \cdot 1\end{array}$ | +r.78 | 343 | + 1 | $4 \quad 5 \quad 26 \cdot 1$ | +r.69 | I | +1.65 |
| 30 | $4927 \cdot 9$ | I.92 | 351 | I. 86 | 353 | I.81 | 35459 |  | $35643 \cdot 4$ | I•7 | $\begin{array}{llll}3 & 58 & 24.9\end{array}$ |  |
| 31 | 45154 |  | 46 | 89 | 348 | I.83 | $35036 \cdot 3$ |  | $\begin{array}{llllllll}3 & 52 & 21.5\end{array}$ | 73 | 354 |  |
| 32 | 40 34•I | $1 \cdot 97$ | $\begin{array}{llll}3 & 42 & 30 \cdot 6\end{array}$ | 9 | 344 |  | $\begin{array}{lllll}3 & 46 & 13 \cdot 0\end{array}$ |  | $\begin{array}{lllllllll}3 & 59\end{array}$ | I.74 | $34942 \cdot 5$ | - 1.69 |
| 33 | 336 | $2 \cdot 00$ | $\begin{array}{llll}3 & 38 & 4.3\end{array}$ | I•93 | 339 | 1.87 | $34149 \cdot 4$ |  | 343 | 1.76 | $345 \quad 20 \cdot 9$ | $1 \cdot 71$ |
| 34 | $3137 \cdot 7$ | +2.03 | $\begin{array}{llll}3 & 33 & 37 \cdot 3\end{array}$ | +r.96 |  | +1.90 | $\begin{array}{llll}3 & 37 & 25.2 \\ 3 & 33 & 0.5\end{array}$ |  | $\begin{array}{lllllllllllllllllllll}3 & 39 & 13 \cdot 7 \\ 3 & 34 & 50 \cdot 2\end{array}$ | + +78 | $\begin{array}{llllllllll}3 & 40 \\ 3 & 58 \cdot 9\end{array}$ | +1.72 |
| 35 | 327 | , | $\begin{array}{lllllllllllll}3 & 29 & 9 \cdot 6\end{array}$ | r.99 | 3 3 7 7 | I.92 | $\begin{array}{llll}3 & 33 & 0 \cdot 5 \\ 3\end{array}$ |  | 33450 | - | $\begin{array}{llll}3 & 36 & 36 \cdot 5\end{array}$ |  |
| 3 | $2237 \cdot 9$ | , | $32441 \cdot 2$ |  | $32640 \cdot 2$ |  |  |  | 33026. |  | 33213.7 |  |
| 37 | $\begin{array}{llll}3 & 18 & 6.7\end{array}$ |  | 3201 |  | 322 | r.98 | $\begin{array}{llll}3 & 24 & 9 \cdot 3\end{array}$ |  | 3 26 |  | $32750 \cdot 4$ |  |
|  | 3 13 34.4 |  | 315 |  | 3 I7 |  | 31942.7 | I•93 | 32136.8 | I.87 | $32326 \cdot 7$ |  |
|  | $\begin{array}{llll}3 & 9 & \text { I'I }\end{array}$ | +2 | 3 II $10 \cdot 6$ | $+2.12$ | $\begin{array}{llll}3 & 13 & 15.4\end{array}$ | $+2.04$ | 3151504 | +r.96 |  | + $\mathrm{I} \cdot 89$ |  |  |
| 40 | $426 \cdot 5$ | 2.24 | $\begin{array}{llll}3 & 6 & 38 \cdot 5\end{array}$ | $2 \cdot 16$ |  | 2.07 | $\begin{array}{lllll}3 & 10 & 47 \cdot 4 \\ 3\end{array}$ | r.99 | 3 12 44.7 | I.92 | $31437 \cdot 6$ |  |
| 4 I | $\begin{array}{lllll}2 & 59 & 50 \cdot 7 \\ 2 & 5 & 1 \\ 1\end{array}$ | 29 | $\begin{array}{cccc}3 & 2 & 5 \cdot 2 \\ 2 & 57 & 30.8\end{array}$ | 24 | $\begin{array}{rrrr}3 & 4 & 14.4 \\ 2 & 59 & 42.4\end{array}$ | 2.11 | $\begin{array}{lll}3 & 6 & 18.5 \\ 3 & 1 & 48.7\end{array}$ | . 06 | $\begin{array}{llllllllllll}3 & 8 & 17 \cdot 7 \\ 3 & 3 & 49.8\end{array}$ |  | 3 10 12.2 | 80 |
| 43 | $\begin{array}{llll}2 & 5 & 1 & 13 \cdot 6 \\ 2 & 50 & 34 \cdot 9\end{array}$ | 34 | $\begin{array}{llll}2 & 57 & 30 \cdot 8 \\ 2 & 52 & 55 \cdot 1\end{array}$ | 2.24 2.29 | $\begin{array}{cccc}2 & 59 & 42 \cdot 4 \\ 2 & 55 & 9 \cdot 3\end{array}$ | I | $\begin{array}{ccc}3 & 1 & 48 \cdot 7 \\ 2 & 57 & 17.9\end{array}$ | .06 | rrrrrrr $\begin{array}{rrrr}3 & 49 \cdot 8 \\ 2 & 59 & 2 \mathrm{I} \cdot \mathrm{I}\end{array}$ | 1.98 2.01 | $\begin{array}{lll}3 & 5 & 46 \cdot 1 \\ 3 & 1 & 19 \cdot 2\end{array}$ | 0 |
|  | 24554.6 | +2.44 | 24817.8 | +2.33 | $25034 \cdot 9$ | +2.23 | $25246 \cdot 0$ | +2. | $2545 \mathrm{I} \cdot 5$ | +2. | $2565 \times 6$ | x.96 |
|  | 24112.6 | 2.50 | $243 \quad 39 \cdot 2$ | $2 \cdot 39$ | $245 \quad 59 \cdot 2$ | 2.28 | $\begin{array}{lllll}2 & 48 & 13.0\end{array}$ | 2.18 | $25020 \cdot 9$ | 2.08 | $25223 \cdot 1$ | . 99 |
| 46 | $23628 \cdot 6$ | 2.56 | 23858.8 | 44 | $24122 \cdot 0$ | - 33 | $\begin{array}{lllll}2 & 43 & 38.7\end{array}$ | 2.23 | $24549 \cdot 2$ | $2 \cdot 12$ | $24753 \cdot 7$ | 2.03 |
| 47 | 23142.6 | 2.63 | $23416 \cdot 5$ | 2.51 | $23643 \cdot 3$ | . 39 | $\begin{array}{llll}2 & 39 & 3 \cdot 1\end{array}$ | $2 \cdot 27$ | $24116 \cdot 3$ | $2 \cdot 17$ | 24323.4 | $2 \cdot 07$ |
| 48 | 22654.2 | 2.70 | $22932 \cdot 3$ | 2.57 | $\begin{array}{llll}2 & 32 & 2 \cdot 7\end{array}$ | 2.45 | 23425.9 | $2 \cdot 33$ | $23642 \cdot 2$ | 2.22 |  | 2.11 |
| 49 | $\begin{array}{ll}2 & 22 \\ 2\end{array}$ | + | $\begin{array}{llll}2 & 24 & 45.9 \\ 2\end{array}$ | +2.64 | 227 | +2. | $22947 \cdot 1$ | +2.38 | $\begin{array}{rrrr}2 & 32 & 6 \cdot 6\end{array}$ | +2.27 | 234 I9•I | +2.15 |
| 50 | $\begin{array}{llll}2 & 17 & 9.4\end{array}$ | 86 | 21957.0 | 2.72 | $\begin{array}{llllll}2 & 22 & 35.8\end{array}$ | 2.58 | $2 \begin{array}{lll}25 & 6 \cdot 5\end{array}$ | $2 \cdot 45$ | 2729 | 2.32 | 22945.0 | . 20 |
| 51 | $\begin{array}{llll}2 & 12 & 12.4\end{array}$ |  | 15 | $2 \cdot 80$ | $2 \begin{array}{llll}2 & 17809\end{array}$ | $2 \cdot 65$ | 22023.9 | $2 \cdot 51$ | $22250 \cdot 6$ |  | 2259.6 | 2.25 |
| 52 | 711.9 | 3.05 | 1010.7 | 2.90 | $1259 \cdot 5$ |  | $\begin{array}{llll}2 & 15 & 39.0 \\ 2 & 10 & 51.7\end{array}$ | 2.58 | 28 $9 \cdot 9$ <br> 2  | $2 \cdot 45$ | $\begin{array}{lllll}2 & 20 & 32 \cdot 5 \\ 2 & 15 & 53.6\end{array}$ | 2.31 2.37 |
| 53 | $\begin{array}{llll}2 & 2 & 7 \cdot 4\end{array}$ | $3 \cdot 15$ | $2 \quad 512.6$ |  |  |  | 10 51•7 |  | $1327 \cdot$ | 2.5 | 21553.6 | $2 \cdot 37$ |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | S. | -4.3I | S. | 4.3I | $\stackrel{\text { S. }}{+}$ | -3 | S. | s. | s. | S. | s. | S. |
| $\bigcirc$ | -00 | -4.3I | +.08 | -4.31 | + 16 | $4 \cdot 31$ | + 24 | -4.32 | + 32 | $4 \cdot 32$ | + 41 | 4.33 |
| 2 | .06 | $4 \cdot 32$ | +.02 | $4 \cdot 32$ | -10 | $4 \cdot 32$ | -18 | $4 \cdot 32$ | $\cdot 26$ | $4 \cdot 32$ | $\cdot 34$ | $4 \cdot 33$ |
| 4 | -12 | 4.31 | -. 04 | $4 \cdot 31$ | + 04 | $4 \cdot 31$ | -12 | 4.32 | - 20 | 4.32 | - 28 | 4.32 |
| 6 | -18 | $4 \cdot 32$ | -10 | $4 \cdot 32$ | -.02 | $4 \cdot 32$ | -06 | $4 \cdot 32$ | - 14 | $4 \cdot 32$ | $\cdot 22$ | 4.32 |
| 8 | $\cdot 24$ | $4 \cdot 32$ | -16 | $4 \cdot 32$ | $\cdot 08$ | $4 \cdot 31$ | + 00 | $4 \cdot 3 \mathrm{I}$ | -08 | 4.31 | -16 | $4 \cdot 32$ |
| ro | $\cdot 31$ | $4 \cdot 32$ | $\cdot 22$ | $4 \cdot 32$ | - . 14 | $4 \cdot 32$ | - .06 | $4 \cdot 3 \mathrm{r}$ | +.02 | $4 \cdot 31$ | + 10 | $4 \cdot 31$ |
| 12 | $\cdot 37$ | $4 \cdot 33$ | -29 | $4 \cdot 32$ | - 20 | $4 \cdot 32$ | -12 | $4 \cdot 31$ | -. 04 | $4 \cdot 3 \mathrm{I}$ | +.04 | $4 \cdot 31$ |
| 14 | - 44 | $4 \cdot 34$ | $\cdot 35$ | $4 \cdot 33$ | $\cdot 27$ | $4 \cdot 32$ | -18 | $4 \cdot 32$ | -10 | 4.31 | - .02 | $4 \cdot 31$ |
| 16 | -50 | $4 \cdot 34$ | -42 | $4 \cdot 33$ | $\cdot 33$ | $4 \cdot 32$ | $\cdot 25$ | $4 \cdot 32$ | -16 | $4 \cdot 32$ | . 08 | $4 \cdot 31$ |
| 18 | $\cdot 57$ | $4 \cdot 35$ | -48 | $4 \cdot 34$ | $\cdot 40$ | $4 \cdot 33$ | -31 | $4 \cdot 32$ | -22 | $4 \cdot 32$ | -14 | $4 \cdot 31$ |
| 20 | - . 64 | $4 \cdot 36$ | -. 55 | $4 \cdot 35$ | - $\cdot 46$ | $4 \cdot 34$ | - 38 | $4 \cdot 33$ | - . 29 | $4 \cdot 32$ | - 20 | $4 \cdot 32$ |
| 22 | $\cdot 71$ | $4 \cdot 37$ | . 62 | $4 \cdot 36$ | $\cdot 53$ | $4 \cdot 35$ | - 44 | $4 \cdot 33$ | -36 | $4 \cdot 33$ | $\cdot 27$ | $4 \cdot 32$ |
| 24 | $\cdot 79$ | $4 \cdot 39$ | $\cdot 70$ | 4.37 | . 68 | $4 \cdot 35$ | $\cdot 51$ | 4.34 | -42 | 4.33 | $\cdot 33$ | 4.33 |
| 26 | $\cdot 87$ | $4 \cdot 40$ | $\cdot 77$ | $4 \cdot 38$ | $\cdot 68$ | $4 \cdot 37$ | - 58 | $4 \cdot 35$ | -49 | 4.34 | $\cdot 40$ | 4.33 |
| 28 | $\cdot 95$ | $4 \cdot 42$ | . 85 | $4 \cdot 40$ | $\cdot 75$ | $4 \cdot 38$ | . 66 | $4 \cdot 36$ | $\cdot 56$ | $4 \cdot 35$ | -47 | $4 \cdot 34$ |
| 30 | - 1.03 | 4.44 | -. 93 | 4.41 | -.83 | $4 \cdot 39$ | - .73 | $4 \cdot 37$ | -. 64 | $4 \cdot 36$ | - . 54 | $4 \cdot 34$ |
| 32 | $1 \cdot 12$ | $4 \cdot 46$ | I 02 | $4 \cdot 43$ | $\cdot 92$ | $4 \cdot 4 \mathrm{I}$ | . 82 | $4 \cdot 39$ | .72 | $4 \cdot 37$ | . 62 | $4 \cdot 36$ |
| 34 | 1.22 | $4 \cdot 48$ | I.II | $4 \cdot 45$ | r.or | $4 \cdot 43$ | $\cdot 90$ | 4.41 | . 80 | 439 | $\cdot 69$ | 4.37 |
| 36 38 |  | 4.51 4.55 | I 21 $\mathrm{I} \cdot 32$ | $4 \cdot 48$ 4.51 |  | 4.45 4.48 | $\cdot 99$ $\times 108$ | 4.43 4.45 | . 88 | 4.40 4.42 | .78 | $4 \cdot 38$ $4 \cdot 40$ |
| 40 | - I. 55 | $4 \cdot 59$ | - 1.43 | $4 \cdot 54$ | -1.3I | 4.51 | - I.19 | $4 \cdot 47$ | - 1.07 | $4 \cdot 44$ | - .95 | $4 \cdot 42$ |
| 42 | I. 68 | $4 \cdot 63$ | I. 55 | $4 \cdot 58$ | I-42 | $4 \cdot 54$ | 1.30 | $4 \cdot 50$ | 1.17 | $4 \cdot 47$ | $1 \cdot 05$ | $4 \cdot 44$ |
| 44 | 1.83 | $4 \cdot 69$ | - 69 | $4 \cdot 63$ | I 55 | $4 \cdot 58$ | 1.42 | $4 \cdot 54$ | $1 \cdot 29$ | $4 \cdot 50$ | I•16 | $4 \cdot 47$ |
| 46 | I 99 | $4 \cdot 75$ | r.83 | $4 \cdot 69$ | I. 69 | $4 \cdot 63$ | 1. 55 | $4 \cdot 58$ | 1.41 | $4 \cdot 54$ | I. 27 | $4 \cdot 50$ |
| 48 | $2 \cdot 17$ | $4 \cdot 83$ | 2.00 | $4 \cdot 75$ | I.84 | 4.69 | I. 69 | 4.63 | I. 54 | 4.58 | I. 40 | $4 \cdot 54$ |
| 50 | $-2.37$ | 4.92 | -2.19 | $4 \cdot 84$ | -2.01 | $4 \cdot 76$ | - I .85 | $4 \cdot 69$ | -r.69 | $4 \cdot 63$ | -1.54 | $4 \cdot 58$ |
| 52 | 2.61 | $5 \cdot 04$ | $2 \cdot 40$ | $4 \cdot 94$ | 2.21 | $4 \cdot 85$ | $2 \cdot 03$ | $4 \cdot 77$ | r. 86 | $4 \cdot 70$ | r. 69 | 4.63 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $77^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{lcc} \text { H. M. } & \text { s. } \\ 6 & 9 & 44 \cdot \mathrm{I} \end{array}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{r} \cdot 63 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { II } & 22 \cdot 4 \end{array}\right.$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{r} \cdot 64 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I3 } & \text { I• } \end{array}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 65 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 14 & 40 \cdot 5 \end{array}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} .66 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I6 } & 20 \cdot 6 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{r} \cdot 67 \end{gathered}$ | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & \text { I8 } \end{array}\right.$ | $\begin{gathered} s . \\ +\mathrm{r} .68 \end{gathered}$ |
| 10 | $5 \quad 26 \quad 27 \cdot 2$ | 1.57 | $\begin{array}{lll}5 & 28 & \text { I } 2\end{array}$ | I. 56 | 5 $29234 \cdot 8$ | 1.55 | $\begin{array}{llll}5 & 31 & 7 \cdot 9\end{array}$ | I. 55 | $53240 \cdot 7$ | I 54 | $53413 \cdot 1$ | r.54 |
| 12 | 5 17 49*1 | I. 56 | $\begin{array}{llll}5 & 19 & 22.7\end{array}$ | I 55 | 520 | 1. | $\begin{array}{llll}5 & 22 & 28 \cdot 0\end{array}$ | I. 53 | $\begin{array}{llllllllllll}5 & 23 & 59 \cdot 7\end{array}$ | I. 52 | $\begin{array}{llll}5 & 25 & 30 \cdot 8\end{array}$ | I. 52 |
| 14 | $5 \quad 9 \mathrm{II} \cdot 3$ | x.56 | 5 10 44.6 | r.55 | 51217.0 | I 53 | $\begin{array}{lllll}5 & 13 & 48 \cdot 6\end{array}$ | I. 52 | $\begin{array}{llll}5 & 15 & 19.5\end{array}$ | r. 51 | $\begin{array}{llll}5 & 16 & 49 \cdot 5\end{array}$ | 50 |
| 16 | 5 o 33.6 | 1.56 | $\begin{array}{llll}5 & 2 & 6 \cdot 7\end{array}$ | I. 54 | $\begin{array}{llll}5 & 3 & 38 \cdot 7\end{array}$ | r. 5 | $\begin{array}{llll}5 & 5 & 9 \%\end{array}$ | 1.5 5 | $\begin{array}{lllll}5 & 6 & 39 \cdot 8\end{array}$ | r.49 | 58890 | 1.48 |
| 18 | 45 5 5.9 | +1.56 | $453 \quad 28 \cdot 9$ | + I. 54 | 4550.7 | + 1.52 | $4563 \mathrm{~S} \cdot 3$ | +1.50 | $\begin{array}{lll}4 & 58 & 0.8\end{array}$ | +1.48 | 459 29•I | 1.46 |
| 20 | 443 I8•I | I. 56 | $4445 \mathrm{I} \cdot 2$ | I•54 | $4 \begin{array}{llll}46 & 22 \cdot 9\end{array}$ | 1.52 | $4 \begin{array}{llllllll}4 & 53\end{array}$ | 1.49 | $44922 \cdot 1$ | I.47 | $45049 \cdot 8$ | I. 45 |
| 22 | 434 40.I | I. 57 |  | I. 54 | $43745 \cdot 2$ | I•5I | $4 \begin{array}{llll}4 & 39 & 15 \cdot 3\end{array}$ | 9 | 44043.9 | r 46 | 442110 | 4 |
| 24 | 426 I.8 | I. 58 | $42735 \cdot 5$ | I•55 | $4 \begin{array}{lll}4 & 29 & 7 \cdot 5\end{array}$ | $\cdot 52$ | $43037 \cdot 6$ | r.49 | $4326 \cdot 0$ | r.46 | $433 \begin{array}{lll}42 \cdot 6\end{array}$ | $\cdot 43$ |
| 26 | $4 \begin{array}{llll}4 & 17 & 23\end{array}$ | I 59 | 4 18 57.3 | 1.55 | $420 \quad 29.6$ | $1 \cdot 52$ | 42159.9 | 1.49 | $\begin{array}{llll}4 & 23 & 28 \cdot 2\end{array}$ | 1.45 | $42454 \cdot 5$ | 42 |
| 28 | $4883 \cdot 7$ | + I. 60 | 4 10 18.8 | + $5 \cdot 5$ | 4 Ir 5r.6 | +r.53 | $4 \begin{array}{llll}4 & 13 & 22 \cdot 1\end{array}$ | +1.4 | 4 I4 50.5 | +1.45 | $41616 \cdot 6$ | -1.42 |
| 30 | $4 \quad 0 \cdot 6$ | I. 62 | 4 I 39.7 | I. 58 | $\begin{array}{lll}4 & 3 & 13 \cdot 2\end{array}$ | I. 5 | $\begin{array}{\|ccc\|}4 & 4 & 44 \cdot 2\end{array}$ | 1 | $\begin{array}{llll}4 & 6 & 12.7\end{array}$ | 1.45 | $\begin{array}{lllll}4 & 7 & 38 \cdot 9\end{array}$ | 1.42 |
| 32 | 35122.6 | I. 64 | $\begin{array}{llll}3 & 52 & 59 \cdot 9\end{array}$ | r 6 | $354134 \cdot 3$ | I. 55 | $\begin{array}{llll}3 & 56 & 5 \cdot 9\end{array}$ | $1 \cdot 50$ | 355734.9 | 1.46 | $\begin{array}{llll}3 & 59 & 1 \cdot 2\end{array}$ | - 42 |
| 33 | 347 I.8 | 66 | $\begin{array}{lllll}3 & 48 & 39 \cdot 7\end{array}$ | 6I | $\begin{array}{llll}3 & 50 & 14.6\end{array}$ | 1.56 | $3 \begin{array}{llll}3 & 5 & 46 \cdot 6\end{array}$ | I.51 | $\begin{array}{llll}3 & 53 & 15.9\end{array}$ | I.46 | $\begin{array}{llllllll}3 & 54 & 42 \cdot 3\end{array}$ | 42 |
| 34 | $\begin{array}{lllll}3 & 42 & 40 \cdot 7\end{array}$ | I | 34419.3 | 1.62 | $345 \quad 54 \cdot 8$ | - 57 | $3 \begin{array}{llll}3 & 47 & 27 \cdot 2\end{array}$ | 2 | $34856 \cdot 8$ | 1.47 | $35023 \cdot 4$ | 42 |
| 35 | $\begin{array}{lllllll}3 & 38 & 19.2\end{array}$ | +r.68 | $\begin{array}{llll}3 & 39 & 58 \cdot 6\end{array}$ | +1.63 | $3{ }^{3} 415134 \cdot 8$ | +r.57 | $\begin{array}{llll}3 & 43 & 7.7 \\ 3 & 38 & 7\end{array}$ | + 1.52 | $3{ }^{3} 44437 \cdot 6$ | +r.47 | $\begin{array}{lll}3 & 46 & 4.4\end{array}$ | +1.42 |
| 36 |  | I.70 | $\begin{array}{llll}3 & 35 & 37 \cdot 6\end{array}$ | I. 64 | $\begin{array}{lllll}3 & 37 & 14.5\end{array}$ | I. 5 | $\begin{array}{llll}3 & 38 & 48 \cdot 0\end{array}$ | x.53 | $\begin{array}{llll}3 & 40 & 18 \cdot 3\end{array}$ | I.48 | $3 \mathrm{4I} 45 \cdot 4$ | 43 |
| 3 | $\begin{array}{lllll}3 & 29 & 35 \cdot 2\end{array}$ | 1-72 | $\begin{array}{llll}3 & 31 & 16.4\end{array}$ | -66 | $\begin{array}{llll}3 & 32 & 54 & 0\end{array}$ | I-60 | 3 34 $28 \cdot 1$ <br>    | 1.54 | $\begin{array}{lllll}3 & 35 & 58 \cdot 9\end{array}$ | $\mathbf{1} 48$ | $\begin{array}{llll}3 & 37 & 26 \cdot 3\end{array}$ | - 43 |
| 3 | $\begin{array}{llll}3 & 25 & 12 \cdot 7 \\ 3 & 20 & 49.6\end{array}$ | 1-73 | $\begin{array}{llll}3 & 26 & 54 \cdot 7 \\ 3 & 22 & 32 \cdot 8\end{array}$ | r.67 | $\begin{array}{llll}3 & 28 & 33 \cdot 2 \\ 3 & 24 & 1\end{array}$ | 61 | $\begin{array}{rrrr}3 & 30 & 8 \cdot 0 \\ 3 & 25 & 47 \cdot 7\end{array}$ | I.55 | $\begin{array}{llll}3 & 31 & 39 \cdot 3 \\ 3 & 27 & 19 \cdot 6\end{array}$ | I.49 | $\begin{array}{llll}3 & 33 & 7 \cdot 2 \\ 3 & 28 & 47 \cdot 9\end{array}$ | - 44 |
| 3 | 32049.6 | 1-75 | $32232 \cdot 8$ |  | $32412 \cdot 1$ | r | $32547 \cdot 7$ | 1.56 | 32719.6 | I.50 | $\begin{array}{lllll}3 & 28 & 47 \cdot 9\end{array}$ | I.44 |
| 40 | 3 I6 26.I | + 17 | $\begin{array}{llll}3 & 18 & 10.5\end{array}$ | + I 70 | 3 I9 $50 \cdot 8$ | +1.64 | $321827 \cdot 1$ | +1.57 | $\begin{array}{llll}3 & 22 & 59 \cdot 7\end{array}$ | + $\mathrm{I} \cdot 5 \mathrm{I}$ | $\begin{array}{llll}3 & 24 & 28.4\end{array}$ | +1.45 |
| 41 | $\begin{array}{llll}3 & 12 & 2 \cdot 1\end{array}$ | - 79 | 3 I3 47.7 | I•72 | $\begin{array}{llll}3 & 15 & 29 \cdot 1\end{array}$ | 1.65 | $\begin{array}{lll}3 & 17 & 6 \cdot 3\end{array}$ | - 59 | 3 18 $39 \cdot 5$ | r. 52 | $\begin{array}{llr}3 & 20 & 8 \cdot 9\end{array}$ | x.46 |
| 42 | $\begin{array}{lllll}3 & 7 & 37 \cdot 5\end{array}$ | $1 \cdot 82$ | $\begin{array}{llll}3 & 9 & 24 \cdot 6\end{array}$ | 1.74 | $\begin{array}{lll}3 & 11 & 7 \cdot 0\end{array}$ | r.67 | $\begin{array}{\|crr\|}3 & 12 & 45 \cdot 2\end{array}$ | $1 \cdot 60$ | $\begin{array}{lllll}3 & 14 & 19.2\end{array}$ | I. 53 | $\begin{array}{llll}3 & 15 & 49 \cdot 2\end{array}$ | -47 |
| 43 | $\begin{array}{lrrr}3 & 3 & 12.4 \\ 2 & 58 & 46.5\end{array}$ | 1.85 | $\begin{array}{lll}3 & 5 & 0 \cdot 7 \\ 3 & 0 & 36.4\end{array}$ | $\underline{1.77}$ | $\begin{array}{llll}3 & 6 & 44 \cdot 5 \\ 3 & 2 & 21.5\end{array}$ | I. 69 | 3 8 $23 \cdot 7$ <br> 3 4  | I. 62 | $\begin{array}{llll}3 & 9 & 58 \cdot 6 \\ 3 & 5 & 37.7\end{array}$ | I. 55 | $3 \mathrm{II} 29 \cdot 2$ | -48 |
| 44 | $25846 \cdot 5$ | 1.87 | $3 \quad 0 \quad 36 \cdot 4$ | x•79 | $3 \quad 2 \quad 21.5$ | 「・ク1 | $\begin{array}{llll}3 & 4 & \mathrm{r} & 8\end{array}$ | I. 63 | $3 \quad 5 \quad 37 \cdot 7$ | 1.56 | $\begin{array}{llll}3 & 7 & 9 \cdot 1\end{array}$ | r 49 |
| 45 | 2541909 | +r.90 | $\begin{array}{llll}2 & 56 & \text { II. } 5\end{array}$ | + I .82 | $2 \begin{array}{lllllllll} & 57 & 58 \cdot 0\end{array}$ | +r.73 | $2 \begin{array}{lll}2 & 59 & 39 \cdot 6\end{array}$ | +x.65 | $\begin{array}{\|ccc\|}3 & 1 & 16 \cdot 5\end{array}$ | + $\mathbf{x} \cdot 58$ | $\begin{array}{rrrr}3 & 2 & 48 \cdot 7\end{array}$ | + r .50 |
| 46 | 24952.6 | 1.93 | $\begin{array}{llll}2 & 51 & 45^{\prime} 9\end{array}$ | 1 | $\begin{array}{llllll}2 & 53 & 34 *\end{array}$ | r•76 | $\begin{array}{llll}2 & 55 & 16.9\end{array}$ | r.67 | $2{ }^{2} 56654 \cdot 9$ | $\underline{x} 59$ | $25^{2} 8688 \cdot 0$ | 1.51 |
| 47 | 245124.4 | 1.97 | $\begin{array}{llll}2 & 47 & 19.6\end{array}$ | 1 | 24969 | 8I | $2 \begin{array}{llll}2 & 50 & 53 \cdot 7 \\ 2 & \end{array}$ | r•70 | $25233 \cdot 0$ | 1 | 2544 | I. 53 |
| 48 | $2 \begin{array}{lllll} \\ 2 & 40 & 55 \cdot 2\end{array}$ | $2 \cdot \mathrm{Or}$ | $\begin{array}{llll}2 & 42 & 52 \cdot 5 \\ 2 & 38 & 24.6\end{array}$ | $\underline{191}$ | 22 44 $44 \cdot 1$ | I | $2{ }_{2} 46$ | $1 \cdot 72$ | $\begin{array}{llll}2 & 48 & 10 \cdot 5\end{array}$ | - 6 | $24945 \cdot 8$ | 1.54 |
| 49 | $23625 \cdot 0$ | $2 \cdot 05$ | $\begin{array}{lllll}2 & 38 & 24 \cdot 6\end{array}$ | r.94 | 240 18.1 | r.84 | $\begin{array}{lll}2 & 42 & 5 \cdot 7\end{array}$ | 1.75 |  | $\mathbf{r} 65$ | $245 \quad 24 \cdot 2$ | $\mathbf{1} \cdot 56$ |
| 50 | 23153.7 | +2.09 | $23355 \cdot 7$ | + I.98 | $23551 \cdot 3$ | + 1.88 | $\begin{array}{llll}2 & 37 & 40 \cdot 8\end{array}$ | +1.77 | $\begin{array}{llll}2 & 39 & 24.3\end{array}$ | +1.68 | $2412 \cdot 1$ | + I. 58 |
| 51 | 227 21.2 | $2 \cdot 13$ | $\begin{array}{llll}2 & 29 & 25 \cdot 8 \\ 2 & 24 & 54\end{array}$ | 2.02 |  | 1.91 | $\begin{array}{lll}2 & 33 & 15 \cdot 1 \\ 2 & 28 & 48 \cdot 7\end{array}$ |  | $\begin{array}{rrr}2 & 35 & 0 \cdot 3 \\ 2 & 30 & 35 \cdot 8\end{array}$ | 1.70 | $\begin{array}{llll}2 & 36 & 39 \cdot 6\end{array}$ | 60 |
| 52 | $\begin{array}{llll}2 & 22 & 47 \cdot 3\end{array}$ | $2 \cdot 18$ | $\begin{array}{llll}2 & 24 & 54.7\end{array}$ | $2 \cdot 06$ |  | 1.95 | $\begin{array}{llll}2 & 28 & 48 \cdot 7\end{array}$ | -8 | $2 \begin{array}{llll}20 & 35 \cdot 8\end{array}$ | 1.73 |  | r. 63 |
| 53 | $\begin{array}{llll}2 & 18 & 11 \cdot 9 \\ 2 & 13 & 34.8\end{array}$ | 2.24 | $\begin{array}{llll}2 & 20 & 22.4 \\ 2 & 15 & 48 \cdot 7\end{array}$ | $2 \cdot 11$ | $\begin{array}{llll}2 & 22 & 25 \cdot 5 \\ 2 & 17 & 54.6\end{array}$ | 1.99 | $\begin{array}{llll}2 & 24 & 21 \cdot 4\end{array}$ | r.87 | $\begin{array}{llll}2 & 26 & 10.5 \\ 2 & 21 & 4.4\end{array}$ | r.76 | $2 \begin{array}{lllll}2 & 27 & 52 \cdot 9\end{array}$ | r. 65 |
| 54 | $\left\lvert\, \begin{array}{llll}2 & 13 & 34.8\end{array}\right.$ | $2 \cdot 30$ | $21548 \cdot 7$ | $2 \cdot 16$ | 2 | $2 \cdot 04$ | $21953 \cdot 1$ | 19 | 22 I 44.4 | r. 8 | $223 \quad 28 \cdot 8$ | r.68 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | ${ }^{\circ}$ A. | L. 7 | A. | L. 8 | A. | L. 9 | A. | L. 10 | - A. | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | s. | s. | s. | S. | S. | s. | S. | S. | S. | S. | s. |
| 0 | +.49 | -4.34 | $+\cdot 57$ | $-4.35$ | + 65 | $-4.36$ | + $\cdot 74$ | $-4 \cdot 38$ | +.82 | -4.39 | +.94 | $-4.41$ |
| 2 | -43 | $4 \cdot 33$ | -51 | 4.35 | -59 | $4 \cdot 36$ | -67 | $4 \cdot 37$ | $\cdot 76$ | $4 \cdot 38$ | -84 | 4.40 |
| 4 | -37 | $4 \cdot 33$ | -45 | $4 \cdot 34$ | - 53 | $4 \cdot 35$ | -61 | $4 \cdot 36$ | $\cdot 70$ | $4 \cdot 37$ | $\cdot 78$ | $4 \cdot 38$ |
| 6 | -31 | $4 \cdot 33$ | -39 | $4 \cdot 33$ | -47 | $4 \cdot 34$ | -55 | $4 \cdot 35$ | -63 | $4 \cdot 36$ | $\cdot 72$ | $4 \cdot 38$ |
| 8 | - 25 | $4 \cdot 32$ | $\cdot 33$ | 4.33 | -41 | $4 \cdot 33$ | -49 | $4 \cdot 34$ | $\cdot 57$ | $4 \cdot 35$ | -66 | $4 \cdot 36$ |
| 10 | + .19 | $4 \cdot 32$ | + 27 | $4 \cdot 32$ | + 35 | $4 \cdot 33$ | +.43 | $4 \cdot 34$ | +.52 | $4 \cdot 35$ | +.60 | $4 \cdot 36$ |
| 12 | -13 | $4 \cdot 31$ | -21 | $4 \cdot 32$ | - 29 | $4 \cdot 32$ | $\cdot 37$ | $4 \cdot 33$ | $\cdot 46$ | $4 \cdot 34$ | $\cdot 54$ | $4 \cdot 35$ |
| 14 | . 07 | $4 \cdot 31$ | -15 | $4 \cdot 32$ | - 23 | $4 \cdot 32$ | $\cdot 31$ | $4 \cdot 32$ | -40 | $4 \cdot 33$ | $\cdot 48$ | $4 \cdot 34$ |
| I6 | + .00 | $4 \cdot 31$ | -09 | $4 \cdot 31$ | -17 | $4 \cdot 32$ | $\cdot 26$ | $4 \cdot 32$ | $\cdot 34$ | $4 \cdot 33$ | $\cdot 42$ | $4 \cdot 33$ |
| 18 | -.05 | $4 \cdot 31$ | +.03 | 4.31 | $\cdot \mathrm{rr}$ | $4 \cdot 31$ | -20 | $4 \cdot 32$ | $\cdot 28$ | $4 \cdot 32$ | - 37 | $4 \cdot 33$ |
| 20 | - . 12 | $4 \cdot 31$ | - .03 | 4.31 | +.05 | $4 \cdot 31$ | +.14 | $4 \cdot 32$ | + $\cdot 22$ | $4 \cdot 32$ | + 3 r | $4 \cdot 32$ |
| 22 | -18 | $4 \cdot 32$ | -09 | $4 \cdot 31$ | - - Or | $4 \cdot 31$ | .08 | $4 \cdot 3 \mathrm{r}$ | $\cdot 17$ | $4 \cdot 32$ | $\cdot 25$ | $4 \cdot 32$ |
| 24 | -24 | $4 \cdot 32$ | -15 | $4 \cdot 32$ | -07 | $4 \cdot 3 \mathrm{r}$ | + . 02 | $4 \cdot 31$ | $\cdot \mathrm{II}$ | $4 \cdot 31$ | -19 | $4 \cdot 32$ |
| 26 | -31 | $4 \cdot 32$ | $\cdot 22$ | $4 \cdot 32$ | - 13 | $4 \cdot 31$ | - 04 | 4.31 | + 05 | $4 \cdot 31$ | -14 | $4 \cdot 32$ |
| 28 | $\cdot 38$ | $4 \cdot 33$ | $\cdot 28$ | $4 \cdot 32$ | -19 | $4 \cdot 32$ | - 10 | $4 \cdot 31$ | - 01 | $4 \cdot 31$ | -08 | 4.31 |
| 30 | - . 45 | $4 \cdot 34$ | - 35 | $4 \cdot 33$ | - .26 | $4 \cdot 32$ | - 16 | . $4 \cdot 32$ | - 07 | 4.31 | +.02 | $4 \cdot 31$ |
| 32 | - 52 | $4 \cdot 34$ | -42 | $4 \cdot 33$ | -33 | $4 \cdot 33$ | -23 | $4 \cdot 32$ | $\cdot 14$ | 4.31 | -. 04 | $4 \cdot 31$ |
| 34 | -59 | $4 \cdot 35$ | -49 | $4 \cdot 34$ | -40 | $4 \cdot 33$ | -30 | $4 \cdot 32$ | -20 | $4 \cdot 32$ | -10 | $4 \cdot 31$ |
| 36 | -67 | $4 \cdot 37$ | $\cdot 57$ | $4 \cdot 35$ | -47 | $4 \cdot 34$ | $\cdot 37$ | $4 \cdot 33$ | -27 | $4 \cdot 32$ | $\cdot 17$ | $4 \cdot 32$ |
| 38 | $\cdot 75$ | $4 \cdot 38$ | -65 | $4 \cdot 36$ | $\cdot 54$ | $4 \cdot 35$ | -44 | $4 \cdot 34$ | -34 | $4 \cdot 33$ | -23 | $4 \cdot 32$ |
| 40 | - . 84 | $4 \cdot 39$ | - •73 | $4 \cdot 37$ | -. 62 | $4 \cdot 36$ | -. 52 | $4 \cdot 34$ | - 4 4 | $4 \cdot 33$ | - 30 | $4 \cdot 32$ |
| 42 | -94 | $4 \cdot 4 \mathrm{r}$ | -82 | $4 \cdot 39$ | -71 | $4 \cdot 37$ | - 59 | $4 \cdot 35$ | -48 | $4 \cdot 34$ | -37 | $4 \cdot 33$ |
| 44 | $1 \cdot 04$ | 4.44 | -91 | 4.41 | -80 | $4 \cdot 39$ | - 68 | $4 \cdot 37$ | - 56 | $4 \cdot 35$ | -45 | $4 \cdot 34$ |
| 46 | $\mathbf{x} \cdot 14$ | $4 \cdot 46$ | $\mathrm{r} \cdot \mathrm{O2}$ | $4 \cdot 43$ | -89 | $4 \cdot 40$ | $\cdot 77$ | $4 \cdot 38$ | . 65 | $4 \cdot 36$ | - 53 | 4.35 |
| 48 | 1.26 | $4 \cdot 49$ | 1-12 | $4 \cdot 46$ | -99 | $4 \cdot 43$ | -86 | $4 \cdot 40$ | $\cdot 74$ | $4 \cdot 38$ | . 62 | $4 \cdot 36$ |
| 50 | -1.39 | $4 \cdot 53$ | -r.24 | $4 \cdot 49$ | -r.ro | 4.45 |  | 4.42 | -. 84 | $4 \cdot 39$ |  | $4 \cdot 37$ |
| 52 | 1.53 | $4 \cdot 58$ | r.38 | $4 \cdot 53$ | I. 23 | $4 \cdot 48$ | I.08 | $4 \cdot 45$ | .94 | $4 \cdot 41$ | . 80 | $4 \cdot 39$ |
| 54 | x.69 | $4 \cdot 63$ | 1.52 | $4 \cdot 57$ | 1.36 | $4 \cdot 52$ | I-2I | $4 \cdot 48$ | r.05 | $4 \cdot 44$ | -91 | $4 \cdot 41$ |

## 92 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $22^{\circ}$.

DECLINATION—SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ |  | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ |  | $16^{\circ}$ |  | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I9 } & 42 \cdot 4 \end{array}$ | $1+$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 21 & 24 \cdot 5 \end{array}$ | $+1 \cdot 71$ | $\begin{array}{ll} \text { H. м. } & \text { s. } \\ 6 & 23 \\ \hline \end{array}$ | $+1 \div 72$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 24 & \text { 5I• } 6 \end{array}$ | $+1 \cdot 74$ | $\left\lvert\, \begin{array}{cc} \text { н. м. } & \text { s. } \\ 6 & 26 \\ 36 \cdot 6 \end{array}\right.$ | $\begin{array}{r} \mathrm{s} . \\ +\mathrm{r} \cdot 76 \end{array}$ | $\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 28 \\ 22 \cdot 9 \end{array}$ |  |
| 10 | $\begin{array}{llll}5 & 35 & 45 \cdot 3\end{array}$ | 1.53 |  | 1.53 | 5. $38 \quad 49 \cdot 2$ | I. 53 | 54021.0 | I•53 | $54152 \cdot 8$ | $1 \cdot 53$ | $54324 \cdot 6$ | 1.53 |
| 12 | 27 | 1 | $52832 \cdot 1$ | 1.50 | $5302 \cdot 1$ | 50 | $53132 \cdot 0$ | 1.49 | $\begin{array}{llll}5 & 33 & 1.5\end{array}$ | 9 | $3431 \cdot 0$ | . 49 |
| 14 | 18 | 1-49 | 51948.0 | 1.4 | 52116.4 | 47 | $52244 \cdot 3$ | I 46 | $524 \mathrm{II} \cdot 8$ | 45 | 25 39.0 | 45 |
| 16 | $\begin{array}{llll}5 & 9 & 37 \cdot 3\end{array}$ | 1.47 | 5 II $5^{\circ} \mathrm{O}$ | $1 \cdot 45$ | $\begin{array}{llllll}5 & 12 & 318\end{array}$ | 1.44 | $\begin{array}{lllllllll}5 & 13 & 57.9\end{array}$ | I-43 | $515 \quad 23 \cdot 5$ | $1 \cdot 42$ | $51648 \cdot 5$ | 1 |
| 18 | 5 ¢ 056.4 | +1.45 | 222.8 | +1.43 | $\begin{array}{lllll}5 & 3 & 48\end{array}$ | +1.42 | $\begin{array}{lllllllll}5 & 5 & 12.8\end{array}$ | +1. | $\begin{array}{llll}5 & 6 & 36 \cdot 5\end{array}$ | +1.39 | 5 7 59.4 | +1.38 |
| 20 | $4 \begin{array}{ll}42 & 16 \cdot 2\end{array}$ | 43 | $45341 \cdot 5$ | $1 \cdot 41$ | $4{ }^{55} 5056$ | I•39 | $45628 \cdot 6$ | 1.3 | $45750 \cdot 6$ | $1 \cdot 36$ | 459 İ•7 | $1 \cdot 34$ |
| 22 | $44336 \cdot 6$ | 1.41 | $4 \begin{array}{lll}45 & 0.9\end{array}$ | 1.39 | $\begin{array}{llll}4 & 46 & 23.8\end{array}$ | $1 \cdot 37$ | 44745.5 | I | $4495 \cdot 9$ | $1 \cdot 33$ | $45025 \cdot 1$ | 31 |
| 24 | $43457 \cdot 6$ | I.40 | $43621 \cdot 0$ |  | $43742 \cdot 8$ | $1 \cdot 35$ | $\begin{array}{lll}4 & 39 & 3.2\end{array}$ | 1.33 | $44022 \cdot 1$ | I. 30 | 44139.7 | . 28 |
| 26 | 42619.0 | I-39 | 427417 | 1.36 | 42926 | $1 \cdot 33$ | 43021.8 | 1.30 | 431393 | I 28 | 43255 | I.25 |
| 28 | 174 | + $1 \cdot 38$ | $4 \begin{array}{lll}49 & 2 \cdot 8\end{array}$ | +1. | 42022.9 | +1 | $4214 \mathrm{I} \cdot \mathrm{I}$ | +1 | $42257 \cdot 3$ | +1 | 424 | 1.22 |
| 30 | $\begin{array}{llll}4 & 9 & 2 \cdot 7\end{array}$ | 1.38 | 1024.4 | I 34 | 4 II $43 \cdot 8$ | 1.30 | $4 \begin{array}{lll}13 & 10\end{array}$ | r 27 | $\mathrm{llll}_{4}^{14} 1 \mathrm{I} 6 \cdot \mathrm{I}$ | r 23 | $415 \quad 29^{\circ} 2$ | 2 |
| 31 | $43 \cdot 8$ | I-38 | $65 \cdot 3$ | I-34 | $4 \quad 724.3$ | -30 | $484 \mathrm{I} \cdot 2$ |  | $4 \begin{array}{llll}4 & 9 & 55.8\end{array}$ | . 22 | 4 II 8.2 | -19 |
| 32 | $25^{\circ}$ | -37 | I $46 \cdot 2$ | I. 33 | $\begin{array}{lrrr}4 & 3 & 5 \cdot 1 \\ & 5 & \end{array}$ | 29 | $\begin{array}{llll}4 & 4 & 21.5\end{array}$ | 25 | $4 \begin{array}{llll}4 & 5 & 35 \cdot 6\end{array}$ | .2I | $647 \cdot$ | -18 |
| 33 | 356 | -37 | $35727 \cdot 3$ | $1 \cdot 33$ | $35845 \cdot 9$ | 29 | 4 - 2.0 | . 25 | $4 \begin{array}{llll}4 & 1 & 15.5\end{array}$ |  | 226 |  |
| 34 |  | +1.37 | 353 | +r- | $35426 \cdot 8$ | + | $35542 \cdot 5$ | +1.24 | $3 \begin{array}{llll}3 & 56 & 55\end{array}$ | +1.20 | $\begin{array}{llll}3 & 58 & 6 \cdot 3\end{array}$ | I•15 |
| 35 |  | $1 \cdot 37$ | 3 48 | $1 \cdot 3$ | 350 | I. 28 | 35123.2 | I 23 | 35236 |  | 35346 | 1.14 |
| 3 | 3439 |  | 3443 | I-33 | $34548 \cdot 7$ |  | $3474{ }^{\circ} \mathrm{O}$ | . 23 | 348 |  | 34925 | 1.14 |
| 37 | 3385 | 1.38 | 340 II• 7 | 1.32 | 3412908 | 2 | $34244 \cdot 8$ | . 22 | 343 | $1 \cdot 17$ | $345 \quad 5 \cdot 9$ | .12 |
| 38 | 3343 | -38 | 33552.9 | $1 \cdot 33$ | $3 \begin{array}{lllll}37 & 10.9\end{array}$ | 127 |  | 122 | $\begin{array}{llll}3 & 39 & 37 \cdot 4\end{array}$ | $1 \cdot 17$ | $34046 \cdot 1$ |  |
| 39 |  | +1.38 | 3 31 34.0 <br> 3 27  | 1 +1.33 I | $\begin{array}{llll}3 & 32 & 52 \cdot 0 \\ 3 & 28 & 33 \cdot 2\end{array}$ | +1.27 | $\begin{array}{ccrr}3 & 34 & 6 \cdot 7 \\ 3 & 29 & 478\end{array}$ | +1.22 | $\begin{array}{lllll}3 & 35 & 18 \cdot 2 \\ 3 & 30 & 58 \cdot 9\end{array}$ | +1.16 | $\begin{array}{llll}3 & 36 & 26 \cdot 3 \\ 3 & 32 & 6.8\end{array}$ | I |
| 40 |  | I•39 | $\begin{array}{llll}3 & 27 & 15 \cdot 1\end{array}$ | $\pm 33$ | $\begin{array}{llllllllllll}3 & 28 & 33 \cdot 2\end{array}$ | I | $\begin{array}{llll}3 & 29 & 47 \cdot 8 \\ 3\end{array}$ |  | $\begin{array}{llll}3 & 30 & 58 \\ 3\end{array}$ |  | 332 |  |
| 41 | 32134 | 1.39 | $\begin{array}{lllllllllllllllll}3 & 22 & 56 \cdot 2\end{array}$ | 1.33 | $\begin{array}{llllllll}3 & 24 & 14.3\end{array}$ |  | $\begin{array}{llll}3 & 25 & 28.8 \\ 3\end{array}$ | 21 | $\begin{array}{lll}3 & 26 & 39 \\ 3\end{array}$ |  | $\begin{array}{llll}3 & 27 & 47 \\ \\ 3\end{array}$ |  |
| 42 | 317 |  | $31837 \cdot 2$ |  | 3195 |  | $32110 \cdot 0$ |  | $\begin{array}{llll}3 & 22 & 20 \cdot 8 \\ 3 & 18\end{array}$ |  | 323 |  |
| 43 | $31255 \cdot 7$ |  | 14 | I. 34 | 315 |  | 316 |  | $\begin{array}{llll}3 & 18 & 1.8\end{array}$ |  | 319 |  |
| 44 | 38 | +1 | $\begin{array}{llll}3 & 9 & 59.0\end{array}$ | + I |  | +1.28 | $\begin{array}{llll}3 & 12 & 32.3\end{array}$ | +1.21 | $\begin{array}{llll}3 & 13 & 42 \cdot 8\end{array}$ | $+\mathrm{I} \cdot 14$ | 31449.4 | + 1.08 |
| 45 | 34 | 1. |  | I.35 | $\begin{array}{llllllllllll}3 & 6 & 58 \cdot 7\end{array}$ | I 28 | $\begin{array}{lll}3 & 8 & 13.4 \\ \\ 3 & 3 & 5.5\end{array}$ | I | $\begin{array}{lll}3 & 9 & 23.9 \\ 3 & 5 & 5\end{array}$ | $1 \cdot 14$ | $31030 \cdot 3$ | 7 |
| 46 | $\begin{array}{lllll}2 & 59 & 56 \cdot 5 \\ 2 & 5 & 5\end{array}$ | 1.44 | $\begin{array}{llll}3 & 1 & 20.3\end{array}$ | 1.36 | 3 2 $39 \cdot 7$ <br> 2 58 20.5 |  |  | I.2I |  |  | $\begin{array}{lll}3 & 6 & 11.3 \\ 3 & 1 & 52.3\end{array}$ |  |
| 47 | $\begin{array}{lll}2 & 55 & 36 \cdot 4 \\ 2 & 51 & 16 \cdot 0\end{array}$ | 1.45 1.46 | $\begin{array}{ccc}2 & 57 & 0 \cdot 8 \\ 2 & 52 & 4 \mathrm{I} \cdot \mathrm{I}\end{array}$ | 1.37 1.38 | $\begin{array}{ccc}2 & 58 & 20 \cdot 5 \\ 2 & 54 & \mathrm{I} \cdot 3\end{array}$ | 1.29 I 30 | $\begin{array}{llll}2 & 59 & 35 \cdot 7 \\ 2 & 55 & 16 \cdot 7\end{array}$ | 1.21 1.22 | (1) $\begin{array}{ccc}3 & 0 & 46 \cdot 2 \\ 2 & 56 & 27 \cdot 4\end{array}$ |  | $\begin{array}{lrrr}3 & 1 & 52 \cdot 3 \\ 2 & 57 & 33 \cdot 4\end{array}$ |  |
|  | 246 | +r. | 2482 | +1.39 | 249 41•9 | +1.30 | 250 | +1 | 528.5 | $+1$ |  |  |
| 50 | 242 | 1.49 | 244 I.O | - 4 | 24522.4 | . 31 | $24638 \cdot 6$ | I. 23 | $24749 \cdot 6$ | I-14 | 24855.6 | , |
| 51 | 238 |  | 23940 |  | $2412 \cdot 7$ | $1 \cdot 32$ | 24219.2 | 1.23 | 243 30.7 |  | $24436 \cdot 8$ |  |
| 52 | 233 51.2 |  | $23520 \cdot 0$ |  | $23642 \cdot 8$ | 33 | $\begin{array}{llll}2 & 38 & 0.1\end{array}$ | . 24 | 239 II•7 | 15 | 24017.9 |  |
| 53 | $2 \begin{aligned} & 29 \\ & 29\end{aligned}$ 9-1 | 1.5 | 23058.9 | I.45 | $\begin{array}{llll}2 & 32 & 22.8\end{array}$ | 35 | $23340 \%$ | -25 | $23452 \cdot 7$ | I•15 | 23559.0 |  |
| 54 | $2 \begin{array}{llll}25 & 6 \cdot 4\end{array}$ | +1.57 | $22637 \cdot 6$ | +1.47 | $\begin{array}{lll}2 & 28 & 2.4\end{array}$ | +1.36 | 22921.0 | +1.26 | $23033 \cdot 6$ | +1.16 | $23140 \cdot 2$ |  |
| 55 | $22043 \cdot 3$ | 1.60 | $\begin{array}{llll}2 & 22 & 15.8\end{array}$ | I 49 | 22341.7 | 1.38 | $2251 \cdot 2$ | 1. | $\begin{array}{lllll}2 & 26 & 14.4\end{array}$ |  | $\begin{array}{llll}2 & 27 & 21.2\end{array}$ | 1.06 |
| 56 | $\begin{array}{llll}2 & 16 & 19.4\end{array}$ |  |  | I. 51 | $\begin{array}{llll}2 & 19 & 20 \cdot\end{array}$ | 40 | 22041 | $1 \cdot 28$ | $\begin{array}{llll}2 & 2154.9 \\ 2 & 1 & 35.5\end{array}$ | 18 | $\begin{array}{llll}2 & 23 & 2 \cdot 3\end{array}$ | 1.07 |
| 57 | 2 II 55.I |  | 1330 | I. 54 | 21459.5 | I. 42 | $21620 \cdot 9$ | 30 | 21735 | 1 | $\begin{array}{lllllllllllll}2 & 18 & 43\end{array}$ | $1 \cdot 07$ |
| 58 | 729.9 | 1.69 | 2976 | 1.56 | 210 | 1.44 | 2120.4 | $1 \cdot 32$ | 13 |  | 21424.1 |  |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ 。 |  | $21^{\circ}$ |  | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } \\ 6 & 30 & \text { ro } \\ \hline \end{array}\right.$ | $+1 \cdot 80$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 3 \text { I } & 59 \cdot 2 \end{array}$ | $+\mathrm{r} \cdot 83$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 33 & 49 \cdot 5 \end{array}$ | $\begin{array}{r} \mathrm{s} . \\ +\mathrm{r} \cdot \mathrm{~B}_{5} \end{array}$ | $\left\{\begin{array}{lc} \text { H. M. } & \text { s. } \\ 6 & 35 \\ 4 \mathrm{r} \cdot 3 \end{array}\right.$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 88 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 37 & 34 \cdot 7 \end{array}\right\|$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 90 \end{gathered}$ | H. M. S. | 4 |
| 10 | $54456 \cdot 6$ | I. 53 | 54628.8 | I-54 | 548 I-1 | 1.54 | $54933 \cdot 8$ | I.55 | $\begin{array}{llll}5 & 51 & 6.9\end{array}$ | I-55 | $5 \quad 5240 \cdot 4$ | I. 56 |
| 12 | $\begin{array}{llll}5 & 36 & 0.3\end{array}$ | $1 \cdot 49$ | $53729 \cdot 6$ | 49 | 558 38  | $1 \cdot 49$ | $54028 \cdot 3$ | 1.49 | 54157.9 | 1.49 | 54327.6 | 1.50 |
| 14 | $\begin{array}{llll}5 & 27 & 5 \cdot 8\end{array}$ | 1.44 | $52832 \cdot 4$ | I. 44 | $52958 \cdot 8$ | 1.44 | 53125.0 | $1 \cdot 44$ | $\begin{array}{lllll}5 & 32 & 51 \cdot 2\end{array}$ | 1.43 | $5 \begin{array}{llll}54 & 17 \cdot 3\end{array}$ | 43 |
| 16 | $5_{5}^{5} 1813.0$ | 1.40 | $51937 \cdot 0$ | I.40 | 5210.5 | 1-39 | $52223 \cdot 7$ | I.3 | $52346 \cdot 6$ | I.38 | $\begin{array}{lll}525 & 9.2\end{array}$ | r.37 |
| 18 | 5 9 21.6 <br> 5 0  | +r.36 | 5 10 43.2 | +1.35 | 12 | +r.34 | $\begin{array}{llll}5 & 13 & 24.4\end{array}$ | +1.33 | ${ }_{5}^{5} 14444.1$ | +r.32 | $\begin{array}{llll}5 & 16 & 3.4\end{array}$ | +r.32 |
| 20 | 5 O 31.7 | I.33 | 5 I 50.9 | $1 \cdot 31$ | $\begin{array}{ll}3 & 9 \cdot 2\end{array}$ | I. 30 | $5426 \cdot 7$ | I. 28 | $\begin{array}{llll}5 & 5 & 43.4\end{array}$ | $1 \cdot 27$ | $\begin{array}{llll}5 & 6 & 59.4\end{array}$ | 1.26 |
| 22 | 45143.2 | 1.29 | 453 O.I | 27 | 454 16.0 | I 25 | $45530 \cdot 7$ | I-24 | $45644 \cdot 6$ | 1.22 | $45757 \cdot 4$ | 0 |
| 24 | $44255 \cdot 8$ | I. 26 | $4 \begin{array}{lll}4 & 40 & 10 \cdot 6\end{array}$ | 23 | 445 24. ${ }^{\text {r }}$ | I. 21 | $44636 \cdot 3$ | I-19 | $\begin{array}{lllllllll}4 & 47 \\ 4\end{array}$ | 7 | $44857 \cdot 1$ | . 15 |
| 26 | $434 \begin{array}{ll}4 & 9 \cdot 6\end{array}$ | 1.22 | $43522 \cdot 3$ | I. 20 | $43633 \cdot 5$ | I•17 | $43743 \cdot 3$ | I•15 | 43851.5 | I-12 | $43958 \cdot 4$ | \% |
| 28 | 42524.4 | +1.19 | $42635 \cdot 2$ | + 1 | $42744 \cdot 3$ | +I.1 | 42851.6 | +1.II | $42957 \cdot 2$ | +r.08 | 4 31 1•2 | r.05 |
| 30 | $41640 \cdot 2$ | $1 \cdot 17$ | 417 49.1 | 1.13 | $4{ }_{4} 1856 \cdot 1$ | I.10 | 420119 | 1.07 | 4214.2 | 1.03 | $422 \begin{array}{lll}4 & 2 & 5\end{array}$ | 1.00 |
| 35 |  | I.15 | 41326.5 | 12 | 4 $14 \begin{array}{llll}42 \cdot 5\end{array}$ | r.08 | $\begin{array}{llll}4 & 15 & 36 \cdot 3\end{array}$ | 1.05 |  | 1.01 | $41737 \cdot 9$ | 8 |
| 32 | $4 \quad 756 \cdot 9$ | I. 14 | 4981 I | I•IO | 4 10 9.1 | . 06 | 4 II II.8 | . 03 | $\begin{array}{llll}4 & 12 & 12.4\end{array}$ | -99 | 41310.8 | 95 |
| 33 | $4 \quad 3 \quad 35 \cdot 5$ | I•I2 | $4 \quad 441.9$ | I.09 | $4546 \cdot 0$ | I.05 | $4 \quad 6 \quad 47 \cdot 6$ | 1.01 | $4747 \cdot 0$ | 7 | 4844.0 | 3 |
| 34 | 59 | + | 4 O | +r.07 | $\begin{array}{llll}4 & 1 & 23.0 \\ 3 & 5 & \end{array}$ | $+1.03$ | $\begin{array}{\|ccc\|}4 & 2 & 23.6\end{array}$ | + 99 | $\begin{array}{llll}4 & 3 & 21.8 \\ 3 & 5\end{array}$ | + 95 |  | .91 |
| 35 | 5453.4 | I-10 | $\begin{array}{llllllllllllll}3 & 55 & 58.2\end{array}$ | I 06 | $\begin{array}{llll}3 & 57 & 0.3\end{array}$ | I.or | $\begin{array}{llll}3 & 57 & 59.9\end{array}$ | '97 | $\begin{array}{llll}3 & 58 & 56.9\end{array}$ | $\cdot 93$ | $3595 \mathrm{I} \cdot 3$ |  |
| 36 | $\begin{array}{lllll}3 & 50 & 32 \cdot 6\end{array}$ | r.09 |  | $\underline{1} 04$ | $\begin{array}{lllll}3 & 52 & 37.9\end{array}$ | - 00 | $353136 \cdot 4$ | .95 |  | -91 | $355 \quad 25 \cdot 3$ | . 86 |
| 37 | 34612 |  |  |  | $\begin{array}{lllll}3 & 48 & 15 \cdot 7\end{array}$ | $\bullet 98$ | $\begin{array}{llllllllllll}3 & 49 & 13.2\end{array}$ | 93 | 3 50 $7 \cdot 8$ <br>  45 $43 \cdot 7$ |  | $35059 \cdot 7$ | 4 |
| 38 | 3415 | 1.07 | $34254 \cdot 2$ | 1.02 | $34353 \cdot 7$ | $\cdot 97$ | $344 \quad 50 \cdot 2$ | -92 | 34543.7 | . 87 | 34634.2 | 2 |
| 39 | 373 | +1.06 | $\begin{array}{lllll}3 & 38 & 33.2 \\ 3 & 34 & \text { I2.4 }\end{array}$ | +1.0 | 3 39 $3 \mathrm{I} \cdot 8$ <br> 3 3 $\mathbf{1}$ | + 95 |  | +90 $+\quad .88$ |  | + 8.85 | 3 42 $9 \cdot \mathrm{I}$ | $\cdot 79$ |
| 40 | 33 1112 | 1.05 | $\begin{array}{llll}34 & 12.4 \\ & \text { 2 }\end{array}$ | -99 | 3 35 10.2 <br> 3 30  | 94 | 3 36 $4 \cdot 8$ | . 88 | $\begin{array}{lllll}3 & 36 & 56 \cdot 1\end{array}$ | $\cdot 83$ | $33744 \cdot 1$ | 77 |
| 41 | $2851 \cdot 2$ | 1.04 | 3 29 $51 \cdot 8$ <br> 3 25  | $\cdot 98$ | $33048 \cdot 8$ | 92 | $33142 \cdot 4$ | . 86 |  | -81 | 33319.4 | 75 |
| 42 | $\begin{array}{llll}3 & 24 & 31 \cdot 4\end{array}$ | 1.03 | $\begin{array}{llllllll}3 & 25 & 31\end{array}$ | -97 | $\begin{array}{llll}3 & 26 & 27 \cdot 6 \\ 3 & 22 & 6 \cdot 5\end{array}$ | 91 | $\begin{array}{llll}3 & 27 & 20 \cdot 3 \\ 3 & 22 & 58 \cdot 3\end{array}$ |  |  | $\cdot 79$ | $\begin{array}{lllll}3 & 28 & 55 \cdot 0 \\ 3 & 24 & \end{array}$ | 73 |
| 43 | 3201177 | 2 | $\begin{array}{llll}3 & 21 & 10.9\end{array}$ |  | $\begin{array}{lll} 3 & 22 & 6.5 \end{array}$ |  | $32258 \cdot 3$ |  | 32346.4 |  | $32430 \cdot 7$ |  |
| 44 | 33 15 $52 \cdot 1$ | +1.01 | $\begin{array}{llll}3 & 16 & 50 \cdot 8 \\ 3 & 5 & 30.8\end{array}$ | + 95 | $\begin{array}{llll}3 & 17 & 45 \cdot 6\end{array}$ | + 88 | $3 \begin{array}{llll}3 & 18 & 36 \cdot 5\end{array}$ | + 8.82 | $\begin{array}{llll}3 & 19 & 23.6\end{array}$ | + 75 | $\begin{array}{llr}3 & 20 & 6.7\end{array}$ | +.68 |
| 46 | 11 <br> 1 <br> 7 <br> 132.6 | 1.00 | $\begin{array}{cccc}3 & 12 & 30 \cdot 8 \\ 3 & 8 & 10 \cdot 9\end{array}$ | . 94 | $\begin{array}{llll}3 & 13 & 24.9 \\ 3 & 0 & 4 \cdot 3\end{array}$ | . 87 | $\begin{array}{lllllll}3 & 14 & 14.9 \\ 3 & 9 & 53.5\end{array}$ | . 78 | $3 \begin{array}{lll}3 & 15 \\ 3 & 10\end{array}$ | $\cdot 73$ | $31542 \cdot 8$ | . 66 |
| 47 | 713.2 | 1.00 | $\begin{array}{llll}3 & 8 & 10 \cdot 9 \\ 3 & 3 & 5 \mathrm{I} \cdot \mathrm{I}\end{array}$ | -93 | 3. | 85 | 953 | $\cdot 78$ | $\begin{array}{llll}3 & 10 & 38.4\end{array}$ | 7 | 31119.1 | 64 |
| 47 | 3 2 53.9 <br>  58  | 99 | 3 3 $5 I \cdot I$ | $\cdot 92$ | $\begin{array}{llll}3 & 4 & 43 \cdot 9\end{array}$ | 84 | 5 | $\cdot 77$ | $\begin{array}{llll}3 & 6 & 16 \cdot 2\end{array}$ | $\cdot 70$ | 655.7 | 62 |
| 48 | 228 <br> 84 | 8 | $25931 \cdot 5$ | 91 | 6 |  | 3 I II•I | -75 | 3 I 54.0 |  | $\begin{array}{llll}3 & 2 & 32 \cdot 4\end{array}$ |  |
| 49 |  | + 98 | $\begin{array}{llllll}2 & 55 & 11.9 \\ 2 & 50 & 52.4\end{array}$ | + 9.90 | $\begin{array}{lll}2 & 56 & 3.4 \\ 2 & 51\end{array}$ |  | $25650 \cdot 2$ |  | $\begin{array}{lllll}2 & 57 & 32 \cdot 1 \\ 2 & 5\end{array}$ |  | $\begin{array}{lll}2 & 58 & 9 \cdot 3\end{array}$ | + 58 |
| 50 | $\begin{array}{lllllllllll}2 & 49 & 56.5 \\ 2 & 45 & 37.5\end{array}$ | $\cdot 97$ | $\begin{array}{lllll}2 & 50 & 52 \cdot 4 \\ 2 & 46 & 33 \cdot 1\end{array}$ | . 89 | $\begin{array}{lllll}2 & 51 & 43.4 \\ 2 & 47 & 23.5\end{array}$ | .81 | $\begin{array}{llll}2 & 52 & 29.4 \\ 2 & 48 & 8.7\end{array}$ | $\cdot 72$ | 2 53 $10 \cdot 4$ <br> 2 48  | . 64 |  | $\cdot 56$ |
| 51 | 4537.5 | 97 | 2 46 $33 \cdot 1$ <br> 2 4  | . 88 | $2 \begin{array}{llllll}2 & 47 & 23.5\end{array}$ |  | 2 48 $8 \cdot 7$ <br> 2 4  | $\cdot 71$ |  | $\cdot 62$ | 24923.5 | 54 |
| 52 | 24118.6 | -97 | 22 43 13 | -88 | $2 \begin{array}{lll}2 & 43 & 3\end{array}$ |  | $24348 \cdot 2$ | - 78 | 24427.3 | $\cdot 61$ | $2 \begin{array}{lll}45 & 0.9\end{array}$ | 1 |
| 53 | $23659 \cdot 7$ | .96 | 23754.7 | . 87 | $2 \begin{array}{llll}28 & 44 \cdot \mathrm{I}\end{array}$ | 78 | $23927 \cdot 8$ | . 68 | $2 \begin{array}{lll}20 & 59\end{array}$ | -59 | 24038.4 |  |
| 54 | $23240 \cdot 8$ | + 96 | 23335.6 | + 86 | 23424.5 | + 77 | $\begin{array}{lll}2 & 35 & 7 \cdot 6\end{array}$ | $+67$ | $23544 \cdot 8$ | + 57 | 236 16.I |  |
| 56 | 2821.9 | '96 | $\begin{array}{llllllllllll}2 & 29 & 16.5\end{array}$ | . 86 | $\begin{array}{llll}2 & 30 & 50\end{array}$ | 76 | $23047 \cdot 4$ | 6 | $\begin{array}{llll}2 & 31 & 23.8\end{array}$ | -55 | 23153.9 | 45 |
| 56 | $\begin{array}{ll}24 & 3 \cdot 1\end{array}$ | -96 | $\begin{array}{llllll}2 & 24 & 57.5 \\ 2 & 20\end{array}$ | . 85 | 2 25 45 | 75 | $\begin{array}{llll}2 & 26 & 27 \cdot 4\end{array}$ | 64 | $\begin{array}{llll}2 & 27 & 2 \cdot 8 \\ 2 & 2 & \end{array}$ | 54 | 22731.8 | 43 |
| 58 | 2 19 44.3 <br> 2 15  | 6 | $2 \begin{array}{llll}2 & 20 & 38 \cdot 6\end{array}$ | $\cdot 85$ | $\begin{array}{llll}2 & 21 & 26 \cdot 4\end{array}$ | 74 | $\begin{array}{lll}2 & 22 & 7 \cdot 5\end{array}$ | . 6 | $22242 \cdot 1$ | -52 | $2 \begin{array}{llll}23 & 9 \cdot 9\end{array}$ | 41 |
| 58 | $215 \quad 25.4$ | $\cdot 96$ | 21619.7 | . 85 | 21787 | 73 | 217479 | . 62 | 21821.4 | -50 | 1848 | 39 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\xrightarrow{\text { s. }}$ | s. -4.57 | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 62 \end{gathered}$ | $\begin{gathered} s . \\ -4.61 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 7 \mathrm{I} \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 64 \end{gathered}$ | $\begin{gathered} s .8 I \\ +r \cdot 8 I \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 6 \end{gathered}$ | $\begin{gathered} \mathrm{s} .90 \\ +1 \cdot 90 \end{gathered}$ | S. -4.71 | ¢ ${ }_{\text {S }}$ | s. |
| 4 | I. 38 | 4.53 | 1.48 | $4 \cdot 56$ | 1.57 | 4.59 | 1.66 | $4 \cdot 62$ | I.75 | 4.66 | 1.85 | 4.69 |
| 8 | I. 26 | 4.49 | I 35 | 4.52 | 1.43 | $4 \cdot 55$ | I.53 | $4 \cdot 58$ | 1.62 | 4.61 | 1.75 | $4 \cdot 64$ |
| 12 | I. 14 | $4 \cdot 46$ | I. 22 | 4.48 | I-31 | $4 \cdot 51$ | 1.40 | $4 \cdot 54$ | 1.49 | $4 \cdot 56$ | 1.58 | $4 \cdot 59$ |
| 16 | 1.02 | $4 \cdot 43$ | I•I | $4 \cdot 45$ | 1. 20 | $4 \cdot 48$ | $1 \cdot 29$ | $4 \cdot 50$ | 1.38 | 4.53 | 1.47 | $4 \cdot 56$ |
| 20 | + .91 | 4.41 | +1.00 | 4.43 | +1.09 | 4.45 | +1.18 | $4 \cdot 47$ | +1.27 | 4.50 | +1.36 | 4.52 |
| 22 | . 86 | $4 \cdot 40$ | $\cdot 95$ | $4 \cdot 42$ | I. 04 | 4.44 | 1.13 | $4 \cdot 46$ | 1.22 | 4.48 | 1.35 | 4.51 |
| 24 | -81 | $4 \cdot 39$ | $\cdot 90$ | $4 \cdot 41$ | $\cdot 99$ | $4 \cdot 43$ | I.08 | 4.45 | $1 \cdot 17$ | $4 \cdot 47$ | I 26 | $4 \times 49$ |
| 26 | $\cdot 76$ | $4 \cdot 38$ | . 85 | $4 \cdot 40$ | $\cdot 94$ | $4 \cdot 41$ | I.03 | 4.44 | $1 \cdot 12$ | 4.46 | $1 \cdot 22$ | $4 \cdot 48$ |
| 28 | $\cdot 71$ | $4 \cdot 37$ | -80 | $4 \cdot 39$ | -89 | $4 \cdot 40$ | -99 | $4 \cdot 42$ | 1.08 | $4 \cdot 45$ | 1-17 | $4 \cdot 47$ |
| 30 | + 66 | $4 \cdot 36$ | + 75 | $4 \cdot 38$ | +.85 | $4 \cdot 40$ | + 94 | $4 \cdot 42$ | +1.03 | 4.44 | +1.13 | 4.46 |
| 32 | . 61 | $4 \cdot 36$ | . 71 | $4 \cdot 37$ | .80 | $4 \cdot 39$ | .90 | $4 \cdot 40$ | . 99 | 4.43 | I. 09 | $4 \cdot 45$ |
| 34 | $\cdot 56$ | $4 \cdot 35$ | . 66 | $4 \cdot 36$ | $\cdot 75$ | $4 \cdot 38$ | . 85 | $4 \cdot 40$ | $\cdot 95$ | 4.42 | $\underline{105}$ | $4 \cdot 44$ |
| 36 | $\cdot 51$ | $4 \cdot 34$ | -6r | $4 \cdot 36$ | -75 | $4 \cdot 37$ | -81 | $4 \cdot 39$ | $\cdot 9 \mathrm{x}$ | $4 \cdot 45$ | $1 \cdot \mathrm{Or}$ | $4 \times 43$ |
| 38 | $\cdot 46$ | $4 \cdot 34$ | $\cdot 56$ | $4 \cdot 35$ | . 66 | $4 \cdot 36$ | $\cdot 77$ | $4 \cdot 38$ | - 87 | $4 \cdot 40$ | -97 | $4 \cdot 42$ |
| 40 | + 42 | $4 \cdot 33$ | + 52 | $4 \cdot 34$ | + 62 | $4 \cdot 36$ | +.72 | $4 \cdot 37$ | +.83 | $4 \cdot 39$ | + 93 | 4.41 |
| 42 | $\cdot 37$ | 4.33 | $\cdot 47$ | $4 \cdot 34$ | $\cdot 58$ | $4 \cdot 35$ | . 68 | $4 \cdot 37$ | $\cdot 79$ | $4 \cdot 39$ | . 89 | $4 \cdot 40$ |
| 44 | $\cdot 32$ | $4 \cdot 33$ | -42 | $4 \cdot 33$ | -53 | $4 \cdot 35$ | . 64 | $4 \cdot 36$ | $\cdot 75$ | $4 \cdot 38$ | -86 | $4 \cdot 40$ |
| 46 | - 26 | $4 \cdot 32$ | $\cdot 38$ | $4 \cdot 33$ | -49 | $4 \cdot 34$ | . 60 | $4 \cdot 36$ | -71 | $4 \cdot 37$ | . 83 | $4 \cdot 39$ |
| 48 | 21 | $4 \cdot 32$ | $\cdot 33$ | $4 \cdot 33$ | -44 | $4 \cdot 34$ | $\cdot 56$ | $4 \cdot 35$ | . 68 | $4 \cdot 37$ | $\cdot 79$ | $4 \cdot 39$ |
| 50 | + . 56 | $4 \cdot 32$ | +.28 | $4 \cdot 32$ | + 40 | $4 \cdot 33$ | + 52 | $4 \cdot 35$ | + 64 | $4 \cdot 36$ | + 76 | $4 \cdot 38$ |
| 52 | -10 | $4 \cdot 31$ | . 23 | $4 \cdot 32$ | $\cdot 35$ | $4 \cdot 33$ | -48 | $4 \cdot 34$ | . 61 | $4 \cdot 36$ | $\cdot 73$ | $4 \cdot 38$ |
| 54 | +.05 | 4.3 I | -18 | $4 \cdot 32$ | -35 | 4.33 | 44 | $4 \cdot 34$ | $\cdot 57$ | 4.35 | $\cdot 70$ | $4 \cdot 37$ |
| 56 | -. 01 | $4 \cdot 31$ | $\cdot 12$ | $4 \cdot 32$ | - 26 | $4 \cdot 32$ | -40 | $4 \cdot 33$ | . 54 | $4 \cdot 35$ | . 67 | $4 \cdot 37$ |
| 58 | . 08 | $4 \cdot 31$ | . 07 | $4 \cdot 31$ | -21 | $4 \cdot 32$ | $\cdot 36$ | $4 \cdot 33$ | . 50 | 4.34 | . 65 | $4 \cdot 36$ |

## 94 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

LATITUDE $23^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 0.0 \end{array}$ | $\begin{gathered} s . \\ +1 \cdot 70 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 41 \cdot 9 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{r} \cdot 70 \end{gathered}$ | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 3 & 23.9 \end{array}$ | $\left\lvert\, \begin{gathered} \mathrm{S} . \\ +\mathrm{r} \cdot 70 \end{gathered}\right.$ | $\begin{array}{\|rrl} \text { H. } & \text { M. } & \text { S. } \\ 6 & 5 & 5.9 \end{array}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 70 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 48 \cdot 2 \end{array}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 7 \mathrm{I} \end{gathered}$ | $\begin{array}{\|cccc} \text { H. M. } & \text { S. } \\ 6 & 8 & 30 \cdot 8 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot \mathrm{I} \end{gathered}$ |
| 10 | $\begin{array}{llll}5 & 16 & 30 \cdot 3\end{array}$ | I.73 | $\begin{array}{llll}5 & 18 & 13 \cdot 6\end{array}$ | x•7I | 5 I9 56.0 | r.70 | $\begin{array}{llll}5 & 21 & 37 \cdot 6\end{array}$ | r-69 | $\begin{array}{llll}5 & 23 & 18.4\end{array}$ | 1.67 | $\begin{array}{lllllllllllllll}5 & 24 & 58 \cdot 5\end{array}$ | I•66 |
| 12 | $5747 \cdot 1$ | 1.74 | $5 \quad 931 \cdot 1$ | I•72 | 5 II 14.0 | I•7I | $51256 \cdot 0$ | 1. 69 | $\begin{array}{lll}5 & 14 & 36 \cdot 9\end{array}$ | r. 67 | $\begin{array}{llll}5 & 16 & 17 \cdot 0\end{array}$ | r. 66 |
| 14 | 4593 3.1 | I• 76 | 5 ¢ 5 48.0 | $1 \cdot 74$ | $\begin{array}{llll}5 & 2 & 31\end{array}$ | I•72 | $\begin{array}{llll}5 & 4 & 14.0\end{array}$ | 1.70 | $\begin{array}{lll}5 & 5 & 55 \cdot 5\end{array}$ | r 68 | $\begin{array}{llll}5 & 7 & 35 \cdot 6\end{array}$ | I. 66 |
| 16 | $450 \times 8 \cdot 2$ | I•78 | $\begin{array}{llll}4 & 52 & 4.2\end{array}$ | 1•75 | $45348 \cdot 7$ | I•73 | $4553 x \cdot 8$ | 1-71 | 45713.6 | r.68 | $45854{ }^{\circ}$ | 1.66 |
| 18 | 44132.3 | +1.80 | 443 19.6 | +1.77 | $445 \quad 5 \cdot 1$ | +r•74 | $44649 \cdot x$ | +1•72 | 44831.4 | + x -69 | 45012.3 | +x.67 |
| 20 | $43245 \cdot 2$ | r.83 | $43433 \cdot 9$ | I•79 | $43620 \cdot 7$ | r•76 | $4 \begin{array}{llll}4 & 38\end{array}$ | 1.73 | $43948 \cdot 8$ | I•70 | $44^{4} 1230 \cdot 3$ | r. 68 |
| 22 | $42356 \cdot 7$ | I.86 | $4 \begin{array}{llll}4 & 25 & 47 \cdot 1\end{array}$ | I.82 | $4 \begin{array}{llllll}4 & 27 & 35\end{array}$ | x•99 | $42921 \cdot 5$ | I•75 | 4 31 $5 \cdot 6$ | I•72 | 4324 47 | . 69 |
| 24 | 4156.5 | r.89 | 416658 | x.85 | $41888 \cdot 8$ | I.81 | $420 \quad 36 \cdot 3$ | r 77 | $422 \quad 216$ | I•74 | $\begin{array}{lll}4 & 24 & 4.9\end{array}$ | 1.70 |
| 26 | $\begin{array}{lllll}4 & 6 & 14.5\end{array}$ | I.93 | $\begin{array}{lll}4 & 8 & 9 \cdot 0\end{array}$ | 1.88 | 4100.8 | r.84 | 4 II 50\%0 | r.80 | $4 \begin{array}{lllll}4 & 36 \cdot 8\end{array}$ | r.76 | 4 I5 2I•I | I•72 |
| 28 | $35720 \cdot 4$ | +1.97 | 359 I7* 4 | +1.92 | 4 I II•3 | +1.87 | $\begin{array}{llll}4 & 3 & 2.4\end{array}$ | +1.83 | $4450 \cdot 7$ | +x•78 | $\begin{array}{llll}4 & 6 & 36 \cdot 4\end{array}$ | + I•74 |
| 29 | $\begin{array}{llllllllllllll}3 & 52 & 52 \cdot 5\end{array}$ | $2 \cdot 00$ | $3 \begin{array}{lll}3 & 54 & 50 \cdot 7\end{array}$ | 1.94 | $35645 \cdot 9$ | I.89 | $\begin{array}{lllll}3 & 58 & 38 \cdot 0\end{array}$ | r. 84 | 4 0 27.3 | 1.80 | $\begin{array}{lllll}4 & 2 & 13.8\end{array}$ | x 75 |
| 30 | 34823.9 | $2 \cdot 0$ | 350 | r.97 | $35220 \cdot 0$ | I.91 | 35413.2 | r 86 | $\begin{array}{lll}3 & 56 & 3.4\end{array}$ | r.8I | 35750.7 | -76 |
| 31 | $34354 \cdot 6$ | $2 \cdot 05$ |  | I 99 | 34753.5 | I 93 | $34948 \cdot 0$ | I. 88 | $\begin{array}{llllllllll}3 & 51 & 39.2\end{array}$ | I.83 | $35327 \cdot 4$ | r 78 |
| 32 | 3 <br> 39 <br> $24 \cdot 6$ | $2 \cdot 07$ | $34127 \cdot 3$ | $2 \cdot 01$ | $343 \quad 26 \cdot 5$ | I.96 | $345 \quad 22 \cdot 2$ | I'90 | $\begin{array}{lllllll}3 & 47 & 14.5\end{array}$ | r.84 | $349 \quad 377$ | I•79 |
| 33 | $\begin{array}{llll}3 & 34 & 53 \cdot 8\end{array}$ | $+2 \cdot 10$ | $3 \begin{array}{lllllllll}3 & 56\end{array}$ | $+2.04$ | $\begin{array}{lllll}3 & 38 & 58 \cdot 9\end{array}$ | +x•98 | 34055.9 | + 1.92 | 34249.5 | +x.86 | $34439 \cdot 7$ | + 1.81 |
| 34 | $33^{30} 22 \cdot 1$ | $2 \cdot 14$ | $\begin{array}{llll}3 & 32 & 28 \cdot 3\end{array}$ | 2.07 | $\begin{array}{llllllllllllllll}3 & 34 & 30 \cdot 6\end{array}$ | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}3 & 36 & 29 \cdot 1\end{array}$ | r 94 | $\begin{array}{llll}3 & 38 & 23 \cdot 9\end{array}$ | x.88 | $340 \begin{array}{lll}3 & 40\end{array}$ | I.83 |
| 35 | $\begin{array}{llll}3 & 2549.5\end{array}$ | $2 \cdot 17$ |  | $2 \cdot 10$ | 33015 | 2.03 | $\begin{array}{llll}3 & 32 & \mathrm{r} & 6\end{array}$ | I 97 | $\begin{array}{lllll}3 & 33 & 57 \cdot 8\end{array}$ | r 90 | $\begin{array}{llll}3 & 35 & 50 \cdot 3\end{array}$ | I.84 |
| 36 | $32116 \cdot 0$ | $2 \cdot 20$ |  | $2 \cdot 13$ | 325 31.9 | $2 \cdot 06$ |  | r 99 | 32931 | r 93 | 3 31 $255^{\circ} 0$ | I.86 |
| 37 | 3 I6 4I•3 | $2 \cdot 24$ | 3 I8 53.6 | 2.17 | $\begin{array}{lll}3 & 21 & 1 \cdot 3\end{array}$ | 2.09 | $\begin{array}{llll}3 & 23 & 4 \cdot 7\end{array}$ | $2 \cdot 02$ | $\begin{array}{llll}3 & 25 & 3.9\end{array}$ | I.95 | 32659.0 | 9 |
| 38 | 3125.5 | +2.28 | $3 \mathrm{I} 420 \cdot \mathrm{I}$ | $+2.20$ | $31629 \cdot 9$ | $+2 \cdot 12$ | 318185.2 | +2.05 | $32036 \cdot 0$ | +1.98 | $32232 \cdot 6$ | + I.91 |
| 39 | $\begin{array}{llll}3 & 7 & 28 \cdot 5\end{array}$ | $2 \cdot 32$ | $3 \begin{array}{lll}3 & 9 & 45 \cdot 6\end{array}$ | $2 \cdot 24$ | 3 II $57 \cdot 6$ | $2 \cdot 16$ | $\begin{array}{lllll}3 & 14 & 4 \cdot 7\end{array}$ | 2.08 | $\begin{array}{lll}3 & 16 & 7 \cdot 3\end{array}$ | $2 \cdot 00$ | $\begin{array}{llll}3 & 18 & 5 \cdot 5\end{array}$ | I.93 |
| 4 | $\begin{array}{llll}3 & 2 & 50 \cdot 2\end{array}$ | $2 \cdot 37$ | $\begin{array}{lll}3 & 5 & 9 \cdot 8 \\ 3 & 0 & 38\end{array}$ | $2 \cdot 28$ | $\begin{array}{llll}3 & 7 & 24 \cdot 2\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}3 & 9 & 33 \cdot 5\end{array}$ | $2 \cdot$ | 3 II $38 \cdot 0$ | 2.03 |  | I.96 |
| 41 | 25810.5 | $2 \cdot 42$ | $\begin{array}{llll}3 & 0 & 32 \cdot 8\end{array}$ | $2 \cdot 33$ | $\begin{array}{lrrr}3 & 2 & 49 & 7\end{array}$ | $2 \cdot 24$ | $\begin{array}{lll}3 & 5 & I \cdot 2\end{array}$ | $2 \cdot 15$ | $\begin{array}{llll}3 & 7 & 7 \cdot 7\end{array}$ | 2.07 | $\begin{array}{lll}3 & 9 & 9 \cdot 3\end{array}$ | x'99 |
| 42 | 253 29.I | $2 \cdot 47$ | $2 \begin{array}{lllllllll}2 & 55 & 54.5\end{array}$ | $2 \cdot 37$ | 25814.0 | $2 \cdot 28$ | $3 \begin{array}{llll}3 & 0 & 27 \cdot 9\end{array}$ | $2 \cdot 19$ | $\begin{array}{llll}3 & 2 & 36 \cdot 5\end{array}$ | $2 \cdot 10$ | $3440 \cdot 1$ | $2 \cdot 02$ |
| 43 | $24846 \cdot 1$ | +2.53 | $2 \begin{array}{llllllll} & 51 & 1 & 6\end{array}$ | $+2.42$ | $253137 \cdot 0$ | +2.32 | $2 \begin{array}{lllll}2 & 55 & 53.5\end{array}$ | +2.23 | $\begin{array}{llll}2 & 58 & 4 \cdot 5\end{array}$ | +2.14 | 3 O IO. 1 | $+2.05$ |
| 44 | 244183 | 2.59 | $24633 \cdot 2$ | 2.48 | $24858 \cdot 6$ | $2 \cdot 37$ | $251177 \cdot 9$ | $2 \cdot 27$ | $253131 \cdot 3$ | $2 \cdot 18$ | 255 39-I | 2.08 |
| 45 | 239114.4 | $2 \cdot 65$ | 2 41 $49 \cdot 9$ | 2.54 | $2{ }^{2} 4448 \cdot 18.7$ | 2.42 | $24640 \cdot 9$ | $2 \cdot 32$ | $24857 \cdot 0$ | $2 \cdot 22$ | $2517 \cdot 1$ | $2 \cdot 12$ |
| 46 | $23425 \cdot 3$ | $2 \cdot 72$ | $2 \begin{array}{lll}2 & 37 & 4 \cdot 8\end{array}$ | $2 \cdot 60$ | 239 37-1 | 2.48 | $242 \begin{array}{lll}2 & 42\end{array}$ | $2 \cdot 37$ | 24421.4 | $2 \cdot 26$ | $24634 \cdot 1$ | $2 \cdot 16$ |
| 47 | $22933 \cdot 8$ | $2 \cdot 80$ | 23217.5 | $2 \cdot 66$ | 23453.6 | $2 \cdot 54$ | 23722.5 | $2 \cdot 42$ | 23944.4 | $2 \cdot 31$ | 24159.9 | 2.21 |
| 48 | $22439 \cdot 6$ | +2.88 | 22727.9 | $+2 \cdot 74$ | 23086 | +2.61 | $23240 \cdot 7$ | $+2.48$ | $\begin{array}{lll}2 & 35 & 6 \cdot 0\end{array}$ | $+2 \cdot 36$ | 237424 | $+2.25$ |
| 49 | 2 I9 42.4 | $2 \cdot 96$ | $22235 \%$ | 2.82 | $225 \quad 20 \cdot 5$ | 2.68 | $22757 \cdot 0$ | $2 \cdot 54$ | $23025 \cdot 9$ | 2.42 | $23247 \cdot 5$ | $2 \cdot 30$ |
| 50 | 21441.9 | 3.05 | 2 I7 40.7 | 2.90 | $22030 \cdot 4$ | 2.75 | 223 II.2 | $2 \cdot 61$ | $22544{ }^{\circ} \mathrm{O}$ | 2.48 | 228190 | $2 \cdot 36$ |
| 51 | $2 \begin{array}{lllll} \\ 2 & 9 & 37 \cdot 7\end{array}$ | $3 \cdot 14$ | 21242.6 | 3.00 |  | $2 \cdot 84$ | $2 \begin{array}{lll}2 & 18 & 23 \cdot 1\end{array}$ | $2 \cdot 69$ | 221000 | $2 \cdot 55$ | $\begin{array}{llll}2 & 23 & 28 \cdot 8\end{array}$ | $2 \cdot 4 \mathrm{I}$ |
| 52 | 429.4 | $3 \cdot 24$ | $740 \cdot 9$ | $3 \cdot 10$ | $21041 \cdot 6$ | $2 \cdot 93$ | $2 \begin{array}{llll} & \text { I3 } & 32.4\end{array}$ | 2.77 |  | 2.62 |  | $2 \cdot 48$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. 0 | A. | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ}$ | A. | L. 3 | A. | L. 4 | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. | s. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | -00 | $-4.34$ | + 08 | $-4.34$ | + .16 | $-4.35$ | + 25 | $-4.35$ | + 33 | $-4.36$ | + $4 \mathrm{4I}$ | $-4 \cdot 36$ |
| 2 | -06 | $4 \cdot 35$ | + . 02 | $4 \cdot 34$ | -10 | $4 \cdot 35$ | -18 | $4 \cdot 35$ |  | $4 \cdot 35$ | -35 | $4 \cdot 36$ |
| 4 | -13 | $4 \cdot 35$ | -. 05 | $4 \cdot 34$ | +.04 | $4 \cdot 34$ | -II | $4 \cdot 35$ | - 20 | $4 \cdot 35$ | - 28 | $4 \cdot 35$ |
| 6 | -19 | $4 \cdot 35$ | - II | $4 \cdot 35$ | -.03 | $4 \cdot 34$ | +.05 | 4.35 | -14 | $4 \cdot 35$ | -22 | $4 \cdot 35$ |
| 8 | $\cdot 26$ | $4 \cdot 35$ | - 18 | $4 \cdot 35$ | .09 | $4 \cdot 34$ | - . 01 | $4 \cdot 34$ | -07 | $4 \cdot 35$ | - 15 | $4 \cdot 35$ |
| 10 | - 32 | $4 \cdot 36$ | - $\cdot 24$ | $4 \cdot 35$ | - .16 | $4 \cdot 35$ | -.07 | $4 \cdot 34$ | +.00 | $4 \cdot 34$ | + .09 | $4 \cdot 35$ |
| 12 | $\cdot 39$ | $4 \cdot 36$ | 3I | $4 \cdot 36$ | - 22 | $4 \cdot 35$ | -14 | $4 \cdot 35$ | - .05 | $4 \cdot 34$ | +.03 | $4 \cdot 34$ |
| 14 | $\cdot 46$ | 4.37 | $\cdot 38$ | $4 \cdot 36$ | -29 | 4.35 | - 21 | $4 \cdot 35$ | -12 | $4 \cdot 35$ | -. 03 | $4 \cdot 34$ |
| 16 | -53 | $4 \cdot 38$ | $\cdot 45$ | $4 \cdot 37$ | $\cdot 35$ | $4 \cdot 36$ | -27 | $4 \cdot 35$ | -19 | 435 | -10 | $4 \cdot 34$ |
| 18 | -60 | $4 \cdot 39$ | -52 | $4 \cdot 38$ | $\cdot 42$ | $4 \cdot 36$ | -34 | 4.36 | $\cdot 25$ | $4 \cdot 35$ | -17 | $4 \cdot 35$ |
| 20 | - . 68 | 4.40 | - 60 | $4 \cdot 38$ | - 49 | $4 \cdot 37$ | - 40 | $4 \cdot 36$ | - 33 | $4 \cdot 35$ | - 23 | $4 \cdot 35$ |
| 22 | $\cdot 76$ | 4.4 I | -66 | $4 \cdot 39$ | $\cdot 58$ | $4 \cdot 38$ | -48 | $4 \cdot 37$ | $\cdot 39$ | $4 \cdot 36$ | -30 | $4 \cdot 35$ |
| 24 | -84 | $4 \cdot 42$ | $\cdot 74$ | 4.41 | -65 | 4.39 | -55 | $4 \cdot 38$ | -47 | $4 \cdot 37$ | 37 | $4 \cdot 36$ |
| 26 | -91 | $4 \cdot 44$ | -83 | $4 \cdot 42$ | $\cdot 73$ | $4 \cdot 4 \mathrm{I}$ | -63 | $4 \cdot 39$ | -54 | $4 \cdot 38$ | -44 | $4 \cdot 37$ |
| 28 | I.OI | $4 \cdot 46$ | $\cdot 90$ | $4 \cdot 44$ | . 81 | $4 \cdot 42$ | $\cdot 71$ | $4 \cdot 40$ | $\cdot 62$ | $4 \cdot 39$ | -52 | $4 \cdot 37$ |
| 30 | -x.10 | $4 \cdot 48$ | - 1.00 | 4.45 | -.89 | $4 \cdot 43$ | - •79 | 4.41 | - 70 | $4 \cdot 40$ | - . 59 | $4 \cdot 38$ |
| 32 | I-19 | $4 \cdot 50$ | r.09 | $4 \cdot 48$ | -99 | $4 \cdot 45$ | -89 | $4 \cdot 43$ | $\cdot 77$ | $4 \cdot 41$ | . 67 | $4 \cdot 40$ |
| 34 | 1.30 | 4.53 | 1.29 | $4 \cdot 50$ | $\mathrm{x} \cdot 07$ | $4 \cdot 48$ | $\cdot 96$ | $4 \cdot 45$ | . 87 | $4 \cdot 43$ | $\cdot 76$ | 4.41 |
| 36 | I.41 | $4 \cdot 57$ | 1:29 | $4 \cdot 53$ | I•18 | $4 \cdot 50$ | r.06 | $4 \cdot 47$ | $\cdot 95$ | $4 \cdot 45$ | $\cdot 85$ | $4 \cdot 43$ |
| 38 | 1.53 | $4 \cdot 60$ | r 40 | $4 \cdot 56$ | I. 28 | $4 \cdot 53$ | I•Iク | 4.50 | 1.05 | $4 \cdot 47$ | . 94 | $4 \cdot 44$ |
| 40 | - 1.66 | $4 \cdot 65$ | -r.53 | $4 \cdot 61$ | - 1.40 | $4 \cdot 56$ | -x.28 | $4 \cdot 53$ | -r.r6 | 4.49 | -I. 04 | 4.47 |
| 42 | r 80 | $4 \cdot 70$ | I. 66 | $4 \cdot 65$ | I.52 | $4 \cdot 60$ | I. 39 | $4 \cdot 56$ | I. 27 | $4 \cdot 52$ | I-14 | $4 \cdot 49$ |
| 44 | 1.95 | 4.76 | I.8I | $4 \cdot 71$ | I.66 | $4 \cdot 65$ | I.52 | $4 \cdot 60$ | - 39 | $4 \cdot 56$ | I. 26 | $4 \cdot 52$ |
| 46 | 2.13 2.32 | $4 \cdot 84$ | 1.97 | 4.77 | r.81 | $4 \cdot 71$ | I. 66 | $4 \cdot 65$ | I. 52 | $4 \cdot 60$ | I.38 | $4 \cdot 56$ |
| 48 | $2 \cdot 32$ | 4.93 | 2.15 | $4 \cdot 85$ | r.98 | $4 \cdot 78$ | I.82 | $4 \cdot 71$ | r.67 | $4 \cdot 65$ | I.52 | $4 \cdot 60$ |
| 50 | $-2.55$ | 5.04 | $-2 \cdot 36$ | $4 \cdot 94$ | $-2.17$ | $4 \cdot 86$ | $-2.00$ | $4 \cdot 78$ | $-\mathrm{x} \cdot 83$ | $4 \cdot 72$ | -r.67 | $4 \cdot 66$ |
| 52 | $2 \cdot 81$ | 5.18 | $2 \cdot 60$ | $5 \cdot 06$ | $2 \cdot 39$ | $4 \cdot 96$ | $2 \cdot 20$ | $4 \cdot 87$ | 2.01 | $4 \cdot 79$ | I. 84 | $4 \cdot 72$ |

DECLINATION-SAME NAME AS-LATITUDE.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline True Alt. \& \(6^{\circ}\) \& Decl. Var. \& \(7{ }^{\circ}\) \& Decl. Var. \& \(8^{\circ}\) \& Decl. Var. \& \(9^{\circ}\) \& Decl. Var. \& \(10^{\circ}\) \& Decl. Var. \& \(11^{\circ}\) \& Decl. Var. \\
\hline \(\bigcirc\) \& \& \& H. M. S. \& \[
+1 .
\] \&  \& \(\stackrel{\text { S. }}{\text { I.73 }}\) \& H. M. S. \& S. \& H. M. S. \& \& H. M. S. \& \\
\hline ıо \& \(52638 \cdot\) I \& 1.65 \& \(\left\lvert\, \begin{array}{llll}5 \& 28 \& 17 \cdot 1\end{array}\right.\) \& r.65 \& 52955.7 \& I•64 \& \(53133 \cdot 7\) \& 1.63 \&  \& 1.63 \& 34 48.9 \& \\
\hline 12 \& 5 17 56.3 \& 1. 65 \& 5 19 34.9 \& I. 64 \& \(\begin{array}{llllllllllllll}5 \& 21 \& 12.8\end{array}\) \& 63 \& \(52250 \cdot \mathrm{I}\) \& I. 62 \& \(52426 \cdot 9\) \& I \& \(\begin{array}{lllll}5 \& 26 \& 3\end{array}\) \& \\
\hline 14 \& 51914.8 \& 64 \& 5 10 53.1 \& I.63 \& \(1230 \cdot 5\) \& 1.62 \&  \& 1.60 \& \(51543 \cdot 0\) \& \& 17 18.2 \& \\
\hline 16 \& \(5033 \cdot 3\) \& 1.64 \& \(5 \quad 21115\) \& I.63 \& \(5 \quad 3 \quad 48 \cdot 6\) \& I.6I \& \(\begin{array}{llll}5 \& 5 \& 24.6\end{array}\) \& 1.59 \& 5 \(61 \begin{array}{ll}59 \& 8\end{array}\) \& 1.58 \& 5834.0 \& 1.56 \\
\hline 18 \& \(45151 \cdot 9\) \& +1.65 \& \(45330 \cdot 0\) \& \(+\mathrm{r} \cdot 62\) \& 4556.9 \& \(+\mathrm{I} .60\) \& \(45642 \cdot 6\) \& +1.58 \& \(4 \begin{array}{llll}48 \& 17 \cdot 2\end{array}\) \& +1.57 \& \(5950 \cdot 6\) \& + 1.55 \\
\hline 20 \& \(44310 \cdot 2\) \& 1.6 \& \(44448 \cdot 5\) \& 1.63 \& 44625.4 \& r.60 \& \(44^{48} 0.8\) \& I.58 \& \(44935 \cdot 0\) \& 1.56 \& 4517.7 \& 1.54 \\
\hline 22 \& 43428.3 \& 1.66 \& 43670 \& r. 63 \& 43743.9 \& I. 60 \& \(43919 \cdot 3\) \& 1.58 \& \(44053 \cdot 1\) \& I. 55 \& 44225.4 \& 1.53 \\
\hline 24 \& \(42546 \cdot 0\) \& 67 \& \(4 \begin{array}{lll}4 \& 27 \& 25\end{array}\) \& I. 64 \& 429294 \& I. 60 \& \(43037 \cdot 8\) \& -57 \& 4321144 \& I.55 \& 3343 \& \(1 \cdot 52\) \\
\hline 26 \& 41783.2 \& I.68 \& 4 I8 43.0 \& I. 64 \& \(42020 \cdot 7\) \& I.6I \& \(42156 \cdot 4\) \& 1.5 \& \(42330 \cdot 0\) \& I.54 \& 42519 \& 51 \\
\hline 28 \& \(4{ }_{4}^{4} 819.6\) \& +1.70 \& \(410 \quad 0.4\) \& + r .66 \& 4 II \(38 \cdot 7\) \& +r.62 \&  \& +1.58 \& 41448.5 \& + \(\mathrm{I} \cdot 54\) \& \(41620 \cdot 1\) \& +1.5I \\
\hline 30 \& \(35935 \cdot 2\) \& \(1 \cdot 72\) \& 4 \begin{tabular}{llll}
1 \& 17 \\
\hline
\end{tabular} \& 1.67 \& \(56 \cdot 2\) \& r.63 \& \(\begin{array}{llll}4 \& 4 \& 32 \cdot 8 \\ 3 \& 5\end{array}\) \& \(\underline{1} 59\) \& \({ }^{4} 865780\) \& r 55 \& \(4 \begin{array}{llll}4 \& 7 \& 38.7\end{array}\) \& 1.51 \\
\hline 32 \& \(35049 \cdot 8\) \& I. 74 \& \(\begin{array}{lllll}3 \& 52 \& 32.9\end{array}\) \& I. 69 \& \(5413 \cdot \mathrm{I}\) \& I.65 \& \(\begin{array}{llll}3 \& 55 \& 50 \cdot 5\end{array}\) \& 1.60 \& \(\begin{array}{llll}3 \& 57 \& 25.2\end{array}\) \& I. 56 \&  \& .5I \\
\hline 33 \& \(34626 \cdot 7\) \& 1.76 \&  \& \(1 \cdot 70\) \& \(34951 \cdot 3\) \& I. 65 \& \(35129 \cdot 1\) \& \(1 \cdot\) \& \begin{tabular}{llll}
3 \& 53 \& \(4 \cdot \mathrm{I}\) \\
\hline
\end{tabular} \& I. 56 \& \(35436 \cdot 4\) \& 1.51 \\
\hline 34 \& 342 3-I \& 1.77 \& \(\left\lvert\, \begin{array}{llll}3 \& 43 \& 47 \cdot 8\end{array}\right.\) \& \(1 \cdot 72\) \& \(345 \quad 29 \cdot 2\) \& 1.66 \& \(347 \quad 7 \cdot 6\) \& I.6I \& \(\begin{array}{lllll}3 \& 48 \& 43 \cdot 1\end{array}\) \& I.56 \& \(35015 \cdot 5\) \& I. 52 \\
\hline 35 \& \(\begin{array}{lllll}3 \& 37 \& 39 \cdot 3\end{array}\) \& + \(1 \cdot 79\) \& \(\begin{array}{lllll}3 \& 39 \& 24.8\end{array}\) \& +1.73 \& 3415 \& +r.68 \& \(34246 \cdot 0\) \& + r .62 \& \(\begin{array}{lllllll}3 \& 44 \& 21.8\end{array}\) \& +1.57 \& \(34554 \cdot 6\) \& +1.52 \\
\hline 36 \& \begin{tabular}{llll}
3 \& 33 \& \(15 \cdot 0\) \\
\hline
\end{tabular} \& I.80 \& \(\begin{array}{llll}3 \& 35 \& 1.5\end{array}\) \& \(1 \cdot 74\) \& \(\begin{array}{llll}3 \& 36 \& 44 \cdot 5\end{array}\) \& I.69 \& \(\begin{array}{llllllllllllll}3 \& 38 \& 24 \cdot 1\end{array}\) \& I.63 \& \begin{tabular}{llll}
3 \& 40 \& \(0 \cdot 4\) \\
3 \& 35 \& \\
\hline
\end{tabular} \& r.58 \&  \& I.53 \\
\hline 37 \& \(32850 \cdot 3\) \& I. 82 \& \(\begin{array}{lllll}3 \& 30 \& 37 \cdot 8\end{array}\) \& \(1 \cdot 76\) \& \(3 \begin{array}{llll}32 \& 21 \cdot 7\end{array}\) \& r 70 \& \(\begin{array}{llll}3 \& 34 \& 2 \cdot 0\end{array}\) \& 4 \&  \& I•59 \& \(\begin{array}{lllll}3 \& 37 \& 12.4\end{array}\) \& I.53 \\
\hline 38 \& \(32425 \cdot \mathrm{I}\) \& I. 84 \&  \& r 78 \& \(32758 \cdot 5\) \& I•71 \& \(\begin{array}{llll}3 \& 29 \& 39 \cdot 6\end{array}\) \& I.6 \& \(\begin{array}{llll}3 \& 31 \& 77 \cdot 1\end{array}\) \& I.60 \& \(3251 \cdot 2\) \& 54 \\
\hline 39 \& 31959.4 \& I.86 \& \(32149 \cdot 2\) \& 1.80 \& 323 35.0 \& -73 \& 32517.0 \& I.6 \& \(32655 \cdot 2\) \& I•61 \& \(\begin{array}{llll}3 \& 28 \& 29 \cdot 7\end{array}\) \& \(1 \cdot 55\) \\
\hline 40 \& 315 33.I \& +1.89 \& 317824.2 \& +1.82 \& 319 II•I \& + \(\mathrm{I} \cdot 75\) \& 32054.0 \& +r.68 \& 32233.0 \& +1.62 \& 3248 11 \& +1.55 \\
\hline 41 \& 3 II \(6 \cdot 3\) \& \(1 \cdot 91\) \& \(\begin{array}{lllll}3 \& 12 \& 58.7\end{array}\) \& 1.84 \&  \& r 77 \& \(\begin{array}{lllllllllll}3 \& 16 \& 30 \cdot 7\end{array}\) \& 1.70 \& \(\begin{array}{llll}3 \& 18 \& 10.5\end{array}\) \& 1.63 \& \(\begin{array}{lllll}3 \& 19 \& 46 \cdot 3\end{array}\) \& 1.56 \\
\hline 42 \& \(\begin{array}{llll}3 \& 6 \& 38 \cdot 8\end{array}\) \& 94 \& \(\begin{array}{llll}3 \& 8 \& 32 \cdot 7 \\ 3 \& 4 \& 6 \cdot 1\end{array}\) \& I.86 \& \(\begin{array}{llll}3 \& 10 \& 22 \cdot 1 \\ 3 \& 5 \& 56 \cdot 8\end{array}\) \& \(\pm .79\) \& \(\begin{array}{llll}3 \& 12 \& 7 \cdot 1\end{array}\) \& 1.71 \& \(\begin{array}{lllll}3 \& 13 \& 478 \\ 3 \& 9\end{array}\) \& I. 64 \& \(\begin{array}{lllll}3 \& 15 \& 24.3\end{array}\) \& 1.57 \\
\hline 43 \& \(\begin{array}{llll}3 \& 2 \& 10 \cdot 5\end{array}\) \& 素 \& \begin{tabular}{|ccc}
3 \& 4 \& \(6 \cdot 1\) \\
2 \& 5 \& 38
\end{tabular} \& I.89 \& \(\begin{array}{llll}3 \& 5 \& 56 \cdot 8 \\ 3 \& \text { I }\end{array}\) \& I.8I \& \(\begin{array}{llll}3 \& 7 \& 43.0\end{array}\) \& I•73 \& \(3 \begin{array}{llll}3 \& 9 \& 24 \cdot 7\end{array}\) \& \& \(\begin{array}{llll}3 \& 11 \& 2 \cdot 1\end{array}\) \& 59 \\
\hline 44 \& \(25741 \cdot 5\) \& 2.00 \& \(2 \begin{array}{lll}2 \& 59 \& 38\end{array}\) \& 1.91 \& 3 I 31.0 \& \& \(\begin{array}{llll}3 \& 3 \& 18.5\end{array}\) \& 1.75 \& \(\begin{array}{|ccc|}3 \& 5 \& 1.3\end{array}\) \& \& \(\begin{array}{llll}3 \& 6 \& 39 \cdot 6\end{array}\) \& \\
\hline 45 \&  \& +2.03 \& \(2{ }_{2} 5510.8\) \& +r.94 \& \(\begin{array}{llll}2 \& 57 \& 4.6 \\ 2 \& 5 \& 4\end{array}\) \& +1.86 \& \(\begin{array}{llll}2 \& 58 \& 53.5 \\ 2 \& 54 \& 28.0\end{array}\) \& +r.77 \& \(\begin{array}{llll}3 \& 0 \& 37.5\end{array}\) \& + \(\mathrm{I} \cdot 69\) \&  \& + I .62 \\
\hline 46 \& \begin{tabular}{ll}
2 \& 48 \\
2 \& \(40 \cdot 9\) \\
\hline \& \(9 \cdot 9\)
\end{tabular} \& \(2 \cdot 10\) \& 2 \(\begin{array}{llll}2 \& 50 \& 42 \cdot 0 \\ 2 \& 46 \& 12.3 \\ 2 \& 4 \& \end{array}\) \& 1.97
2.01 \& \(\begin{array}{llll}2 \& 52 \& 37 \cdot 6 \\ 2 \& 48 \& 9.8 \\ 2 \& 4 \& \end{array}\) \& 1.91 \& \(\begin{array}{rrrr}2 \& 54 \& 28 \cdot 0 \\ 2 \& 50 \& 1.8 \\ \text { rer }\end{array}\) \& I. 82 \&  \& I• 7 \& \(\begin{array}{llll}2 \& 57 \& 53.5 \\ 2 \& 53 \& 30.0\end{array}\) \& r.63

r 65 <br>

\hline 48 \& $23936 \cdot 2$ \& I4 \& | 2 | 41 |
| :--- | :--- |
| 2 | 41 | \& 2.04 \& $\begin{array}{llll}2 & 43 & 4 \mathrm{I} \cdot 3\end{array}$ \& I.94 \& $\begin{array}{lllll}2 & 45 & 35 \cdot 0\end{array}$ \& I.8 \& 24723.2 \& 1.76 \& | 2 |
| :--- |
| 2 |
| 29 |
| 49 | \& r 65

r .67 <br>
\hline 49 \& $235 \quad 2 \cdot \mathrm{I}$ \& 19 \& $2 \begin{array}{llll}2 & 3 & 10.2\end{array}$ \& 2.08 \& 23911.9 \& 1.9 \& 24178 \& I.88 \& $24257 \cdot 4$ \& I. $\%$ \& 244 41.5 \& I.69 <br>
\hline 50 \& $23026 \cdot 7$ \& +2.24 \& $23237 \cdot 4$ \& +2.12 \& $2344 \mathrm{I} \cdot 6$ \& +2.01 \& 23639.3 \& +1.91 \& $\begin{array}{llll}2 & 38 & 30.9\end{array}$ \& $+\mathrm{I} .8 \mathrm{I}$ \& $24016 \cdot 6$ \& +r• 1 <br>

\hline 51 \& 22549.8 \& 29 \& 2283.5 \& 2.17 \& $23010 \cdot 2$ \& 2.0 \& $\begin{array}{llll}2 & 32 & 10.2\end{array}$ \& 1 \& | 2 | 34 | 3.8 |
| :--- | :--- | :--- | :--- | \& 1.8 \& $23551 \cdot 1$ \& 1.74 <br>

\hline 52 \& 22111.4 \& $2 \cdot 35$ \& 22388.2 \& 22 \&  \& $2 \cdot 10$ \& $22740 \cdot 1$ \& I.98 \& $\begin{array}{lllll}2 & 29 & 35 \cdot 8\end{array}$ \& I. 87 \& $23 \mathrm{I} 25^{\circ} \mathrm{O}$ \& 1.77 <br>

\hline 53 \& $21631 \cdot \mathrm{I}$ \& 2.41 \& 2 I 815 l 4 \& $2 \cdot 27$ \& | 2 | 21 | 3.9 |
| :--- | :--- | :--- | :--- |
| 2 | 16 |  | \& 2.15 \& 223900 \& 2.03 \& $\begin{array}{llll}2 & 25 & 7 \cdot 0 \\ 2 & 20 & 3\end{array}$ \& 1.91 \&  \& 1.80 <br>


\hline 54 \& 2 II 48.9 \& 2.47 \& 21412.9 \& $2 \cdot 33$ \& 21628.8 \& 2.20 \& 2 |  |  |
| :--- | :--- | :--- | :--- |
| 8 | 36.7 | \& $2 \cdot 0$ \& $22037 \cdot 3$ \& I.95 \& $22230 \cdot 5$ \& I. 83 <br>

\hline
\end{tabular}

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ}$ | A. | L. 8 | A. | L. $9^{\circ}$ | A. | L. 1 | $0^{\circ} \mathrm{A}$. | L. 11 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ |  |  | $\begin{array}{cc}\text { s. } & \text { S. } \\ +\quad .58 & -4.38\end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ +\because 66 & -4.39 \end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ +\quad \cdot 75 & -4 \cdot 4 \mathrm{I} \end{array}$ |  | s. |  | S. S. |  |
| 2 | . 43 | 4.37 | . 51 |  | . $60-4.39$ |  | +68 4.40 |  | $\begin{array}{rr} +.83 & -4.42 \\ .77 & 4.4 \mathrm{I} \end{array}$ |  | +.92 -8.4 .44 |  |
| 4 | $\cdot 37$ | $4 \cdot 36$ | -45 4.37 |  | -53 4.38 |  | - 62 |  | .70 4.40 |  | $\begin{array}{ll}.85 & 4.43 \\ \cdot 78 & 4.45\end{array}$ |  |
| 6 | $\cdot 30$ | $4 \cdot 36$ | - 38 4.36 |  | -47 4.37 |  | $\cdot 554 \cdot 38$ |  | . $63 \quad 4.39$ |  | $\cdot 724.40$ |  |
| 8 | -24 | $4 \cdot 35$ | -32 | $4 \cdot 36$ | -40 | 4.36 | -49 | $4 \cdot 37$ | $\cdot 57$ | 4.38 | . 66 | $4 \cdot 39$ |
| 10 | + 17 | $4 \cdot 35$ |  | $4 \cdot 35$ | + 34 | 4.364.35 | + 43 | $4 \cdot 37$ | +.51 4.38 | $4 \cdot 38$ | + .60 . 4.39 |  |
| 12 | $\cdot \mathrm{II}$ | $4 \cdot 35$ | - 20 | $4 \cdot 35$ | $\cdot 28$.22 |  | . 36 | $4 \cdot 36$ | . 454.37 |  | $\begin{array}{r}+53 \\ \hline .53\end{array}$ |  |
| 14 | +.05 | 4.34 | -13 4.35 |  |  | 4.35 | -30 | $4 \cdot 35$ | $\cdot 38.4 .36$ |  | $\cdot 474.37$ |  |
| 16 | $\cdot 02$ | 4.34 | $\begin{array}{r}.07 \\ +\quad .00 \\ \hline .0645 \\ \hline\end{array}$ |  | -15 4.35 |  | $\cdot 24 \quad 4.35$ |  | $\cdot 32$ | $4 \cdot 36$ | -41 4.36 |  |
| 18 | -08 | $4 \cdot 34$ |  |  |  | $4 \cdot 35$ | -18 | 4.35 | $\cdot 26$ | 4.35 | -35 | $4 \cdot 36$ |
| 20 | -15 | $4 \cdot 35$ | -.06 4.34 |  | +.03 4.34 |  | + Ir 4.35 |  | + .20 4.35 |  | + 294.35 |  |
| 22 | -2I | 4.35 | -12 | $4 \cdot 34$ | - .03 4.34 |  | +.05 4.34 |  | -14 4.35 |  | $\begin{array}{ll}.23 & 4.35 \\ .16 & 4.35\end{array}$ |  |
| 24 | -28 | $4 \cdot 35$ | -19 | $4 \cdot 35$ | -10 4.34 |  | - or 4.34 | $4 \cdot 34$ | . 074.35 |  |  |  |
| 26 | $\cdot 35$ | $4 \cdot 36$ | -26 | $4 \cdot 35$ | -17 4.35 |  | .08 4.34 |  | + 0 OI 4.34 |  | -10 4.35$+\quad .044 .34$ |  |
| 28 | -42 | $4 \cdot 36$ | $\cdot 33$ | $4 \cdot 36$ | . 23 | $4 \cdot 35$ | -I4 | $4 \cdot 35$ | .05 | $4 \cdot 34$ | +.04 | $4 \cdot 34$ |
| 30 | -.50 4.37 |  | - . 40 4.36 |  | - 31 | $4 \cdot 35$ | - 2 II 4.35 |  | - .12 4.34 |  | -. 024.34 |  |
| 32 | . 58 | $4 \cdot 38$ | -48 | $4 \cdot 37$ | $\cdot 38$ | $4 \cdot 36$ | . 28 | $4 \cdot 35$ | -18 | $4 \cdot 35$ | -09 | $4 \cdot 34$ |
| 34 | $\cdot 66$ | 4.39 | $\cdot 55$ | $4 \cdot 38$ | $\cdot 45$ | $4 \cdot 37$ | $\cdot 35$ | $4 \cdot 36$ | $\cdot 25$ | $4 \cdot 35$ | - I5 | $4 \cdot 35$ |
| 36 | $\cdot 74$ | 4.41 | $\cdot 63$ | 4.39 | . 53 | 4.38 | 43 | 4.37 | $\cdot 33$ | $4 \cdot 36$ | -22 | $4 \cdot 35$ |
| 38 | -83 | $4 \cdot 42$ | $\cdot 72$ | $4 \cdot 40$ | . 61 | 4.39 | 5r | 4.37 | $\cdot 40$ | $4 \cdot 36$ | $\cdot 30$ | $4 \cdot 35$ |
| 40 | -. 92 | $4 \cdot 44$ | - 8184.42 |  | - 70 4.40 |  | -.59 <br> .67 <br> .77 <br> .86 <br> .97 | $\begin{aligned} & 4 \cdot 38 \\ & 4 \cdot 40 \\ & 4 \cdot 4 \mathrm{I} \\ & 4 \cdot 43 \\ & 4 \cdot 45 \end{aligned}$ | $\begin{array}{r} -.48 \\ -.56 \\ .65 \\ .74 \\ .84 \end{array}$ | $\begin{aligned} & 4 \cdot 37 \\ & 4 \cdot 38 \\ & 4 \cdot 39 \\ & 4 \cdot 4 \mathrm{I} \\ & 4 \cdot 43 \end{aligned}$ | $\begin{array}{r} -.37 \\ -45 \\ .53 \\ .62 \\ .71 \end{array}$ | 4.364.374.384.394.40 |
| 42 | I. 02 | $4 \cdot 46$ | -9I | $4 \cdot 44$ | $\checkmark 79$ | 4.41 |  |  |  |  |  |  |
| 44 | I.13 | 4.49 | I-OI | 4.46 | -89 | 4.43 |  |  |  |  |  |  |
| 46 | I 25 | 4.52 | I'12 | $4 \cdot 49$ | -99 | $4 \cdot 46$ |  |  |  |  |  |  |
| 48 | I. $3^{8}$ | $4 \cdot 56$ | I 24 | $4 \cdot 52$ | -1 | $4 \cdot 48$ |  |  |  |  |  |  |
| 50 | -r.52 | $4 \cdot 60$ | $\begin{array}{r} \mathrm{I} .37 \\ \mathrm{I} .51 \\ 1.67 \end{array}$ | 4.56 | $\begin{array}{r} -\mathbf{I} \cdot \mathbf{2 2} \\ \mathbf{I} \cdot 36 \\ \mathbf{I} \cdot 50 \end{array}$ | $4 \cdot 51$ | $\begin{array}{r} -\mathrm{I} .08 \\ \mathrm{I} \cdot 2 \mathrm{I} \\ \mathrm{I} .34 \end{array}$ | $\begin{aligned} & 4.48 \\ & 4.5 I \\ & 4.55 \end{aligned}$ | $\begin{array}{r} -94 \\ \mathbf{1 . 0 6} \\ \mathrm{x} \cdot 19 \end{array}$ | $\begin{aligned} & 4.45 \\ & 4.47 \\ & 4.50 \end{aligned}$ | $\begin{array}{r} -8 \mathrm{I} \\ .92 \\ \mathrm{r} .04 \end{array}$ | $\begin{aligned} & 4.42 \\ & 4.44 \\ & 4.47 \end{aligned}$ |
| 52 | I 67 r .85 | 4.66 |  | 4.60 |  | 4.55 |  |  |  |  |  |  |
| 54 | I.85 | $4 \cdot 72$ |  | $4 \cdot 66$ |  | $4 \cdot 60$ |  |  |  |  |  |  |

## LATITUDE $23^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl | $14^{\circ}$ |  | $15^{\circ}$ | ecl. Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | $\begin{gathered} \mathrm{s} \cdot 78 \end{gathered}$ | $\begin{array}{ll}\text { H. M. } & \text { S. } \\ 6 & 22 \\ 29.7\end{array}$ | $\begin{gathered} \text { S. } \\ +1.80 \end{gathered}$ |  | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 8 \mathrm{I} \end{gathered}$ | $\begin{aligned} & \text { H. M. } \\ & 6 \\ & \hline 26 \end{aligned}$ |  |  |  | H. M. S. |  |
| 10 | $\begin{array}{llll}5 & 36 & 26 \cdot 2\end{array}$ | r. 62 | 5383.2 | I.62 | 5 $3940 \cdot 4$ | I.6I | $541 \begin{array}{llll}517 \cdot 2\end{array}$ | 1.61 | 5 |  |  |  |
| 12 | $52739 \cdot 0$ | I. 59 | $\begin{array}{llllll}5 & 29 & 14.4\end{array}$ | 1.59 | $53049 \cdot 6$ | I. 58 | $53224 \cdot 5$ | I.58 | 5331593 | I.58 | 5 |  |
| 14 | $1852 \cdot 8$ | 1.57 | 5 5 $2026 \cdot 8$ | . 56 | 220.2 | . 55 | $52333 \cdot 3$ | +55 | $525 \quad 6.0$ | I. 54 | ${ }_{5} 26383$ |  |
| 16 | 5 10 $7 \cdot 5$ | 1.55 | 5 II 4 | I. 54 |  | I.53 | $51443 \cdot 5$ | I. 52 | 51614.2 | I-5 | 51744.4 | . 5 |
| 18 | 5 I 23.1 | +1.53 | $5 \quad 2 \quad 54 \cdot 6$ | +1.52 | 425.1 | +1.50 | 554.8 | +1.49 | 723.8 | +1.47 | 852.0 | +1.46 |
| 20 | 45239.3 | I. 52 | $4 \begin{array}{lll}54 & 9.8\end{array}$ | I 5 | 455 39.I | 1.48 | $457 \quad 7 \cdot 3$ | 1.46 | $45834 \cdot 6$ | $1 \cdot 44$ | $\begin{array}{llll}5 & 0 & 0.9\end{array}$ | 43 |
| 22 | 44356 | I.50 | $445 \quad 25 \cdot 8$ | 1.48 | 44654.0 | $1 \cdot 46$ | $44^{48} 20 \cdot 8$ | I•44 | $44946 \cdot 5$ | 1 | 451110 | \% |
| 24 | $4 \begin{array}{lll}4 & 35 & 13.7\end{array}$ |  | $43642 \cdot 4$ | 46 | $438 \quad 9.5$ | 44 | $43935 \cdot 2$ | I.4I | 44059.4 | I.39 | 44222.3 | 37 |
| 26 | 426 |  | 42759.6 | 1.45 | $4 \quad 2925.9$ | I 42 | $43050 \cdot 4$ | I.39 | $43213 \cdot 3$ | 1.37 | $43334 \cdot 6$ | 3 |
| 28 | 417 | + 1 | $1 \begin{array}{llll}4 & 19 & 17.2\end{array}$ | +1.44 | $420042 \cdot 8$ | + $\mathrm{I} \cdot 4 \mathrm{I}$ | 4226.4 | +1.38 | $4 \begin{array}{llll}4 & 23 & 28 \cdot 1\end{array}$ | +1.35 | $42448 \cdot 0$ | +1.31 |
| 30 | $\begin{array}{llll}4 & 9 & 8.1\end{array}$ | r 47 | $41035 \cdot 3$ | I 43 | 412 | I 40 | 41323.0 | 1.3 | 41443.6 | $\pm .3$ | $4 \begin{array}{lll}4 & 16 & 2.3\end{array}$ | 29 |
| 31 | 47.4 | 1.47 | 46154.4 | I. 43 | $4 \begin{array}{llll}4 & 7 & 39 \\ 4 & \text { I }\end{array}$ | I 39 | $4 \begin{array}{lll}4 & 1 & 5\end{array}$ | I. 35 | 41021.7 | I 32 | $\begin{array}{lllll}4 & 11 & 39 \cdot 7\end{array}$ | 28 |
| 32 | O 26.7 | 7 | 153.6 | I 43 | $4 \begin{array}{llll}4 & 3 & 18 \cdot 1\end{array}$ | I. 39 | 4 40'I | I. 3 | $4 \begin{array}{llll}4 & 59.8\end{array}$ | .31 | $4 \quad 7 \quad 17.3$ | 1.27 |
| 33 | $356 \quad 6 \cdot 0$ | 1.47 | $\begin{array}{llllllllll}3 & 57 & 32 \cdot 8\end{array}$ | I-43 | $\begin{array}{lllll}3 & 58 & 57 \cdot 1\end{array}$ | I. 38 | 4 - 18.9 | I. 34 | 4 1 388.2 | I 3 | $4 \quad 2 \begin{array}{lll}4 & 2 & \text { I }\end{array}$ | 1.26 |
| 34 | 5145.2 | +r ${ }^{4} 4$ | $\begin{array}{llll}3 & 53 & 12 \cdot 1 \\ 3 & 18\end{array}$ | + $\mathrm{I} \cdot 42$ | 3 $354 \begin{array}{lll}36 \cdot 3\end{array}$ | +1.38 |  | +1.34 | $357516 \cdot 7$ | +r.29 | $\begin{array}{lllll}3 & 58 & 33 \cdot 0\end{array}$ | +1.25 |
| 35 | 4724.4 | 1.47 | $\begin{array}{llllllllll}3 & 48 & 51.4\end{array}$ | $1 \cdot 42$ | $\begin{array}{llllll}3 & 50 & 15.4\end{array}$ | I. 38 |  | I. 33 | $35255 \cdot 3$ |  | 35411.2 | $1 \cdot 24$ |
| 36 | $\begin{array}{lllll}3 & 43 \\ 3\end{array}$ | 1.47 | $34430 \cdot 6$ | 1.42 | 3 45 54.6 | I•38 | 34715.7 | + 33 | $34^{3} 834 \cdot 0$ | I.28 | 34949 | 1.23 |
| 37 |  | I.48 | $\begin{array}{lll}3 & 40 & 9 \cdot 8 \\ 3 & \end{array}$ | 1.42 | $3 \begin{array}{llll}3 & 41 & 33.9\end{array}$ | $1 \cdot 37$ | 34254.9 | r 32 |  | 127 | $\begin{array}{lllllllllll}3 & 45 & 27 \cdot 8\end{array}$ | $1 \cdot 22$ |
| 38 | 33421 |  | 3 35 49 | I.43 | $\begin{array}{llll}3 & 37 & 13 \cdot 1\end{array}$ | $1 \cdot 37$ | $33^{8} 34.0$ | $1 \cdot 32$ | 3 395 5I•7 | 1.27 | $\begin{array}{llll}3 & 4 \mathrm{I} & 6.4\end{array}$ | . 22 |
| 39 | $\begin{array}{llll}3 & 30 & 0.8\end{array}$ | +r.49 | $\begin{array}{llll}3 & 31 & 28.3\end{array}$ | +1.43 |  | +1.37 |  | +1.32 |  | +r 26 |  | +I.2I |
| 40 | 3 25 $39 \cdot 6$ <br> 3 2 1 | I.49 | $\begin{array}{llll}3 & 27 & 7 \cdot 4 \\ 3 & 22 & 46 \cdot 5\end{array}$ | 1.43 |  | 1.37 | $\begin{array}{llll}3 & 29 & 52 \cdot 5 \\ 3 & 5 & 5\end{array}$ | I.32 | $\mathrm{llll}_{3}^{3} 3 \mathrm{I}$ | I 26 | ${ }_{3}^{3}$ | . 20 |
| 41 | $\begin{array}{cccc}3 & 21 & 18 \cdot 3 \\ 3 & 16 & 56.9\end{array}$ | 5 | 3122 $\begin{array}{lll}3 & 22 & 46 \cdot 5 \\ 3 & 18 & 25 \cdot 4\end{array}$ | 44 | $\begin{array}{llll}3 & 24 & 10 \cdot 9 \\ 3 & 19 & 50 \cdot 1\end{array}$ | $\begin{array}{r}1.38 \\ \mathbf{1} 38 \\ \hline 1\end{array}$ | 3 25 31.7 <br> 3 21 11 | 1.32 $\mathrm{I} \cdot 32$ | $\begin{array}{llll}3 & 26 & 49 \cdot 0 \\ 3 & 22 & 28.2\end{array}$ | I 26 | $\begin{array}{cccc}3 & 28 & 2 \cdot 7 \\ 3 & 23 & 4.6\end{array}$ | . 20 |
| 4 | $\begin{array}{llll}3 & 16 & 56 \cdot 9 \\ 3 & 12 & 35 \cdot 3\end{array}$ | 5 | $\begin{array}{llll}3 & 18 & 25.4 \\ 3 & 14 & 4.3\end{array}$ | 1.44 1.45 | $\begin{array}{llll}3 & 19 & 50 \cdot 1 \\ 3 & 15 & 29 \cdot 3\end{array}$ | - 38 | $\begin{array}{llll}3 & 21 & 11.0 \\ 3 & 16 & 50.3\end{array}$ | I. 32 | 3 22 28.2 <br> 3 18 7.4 | I. 25 I .25 | (1) $\begin{array}{ccc}3 & 23 & 41 \cdot 6 \\ 3 & 19 & 20.7\end{array}$ | 19 |
| 43 | 31235 | I.52 | 314 | $\underline{1} 45$ | 31529 | I-38 | 316 | I 32 | $3 \begin{array}{llll}3 & 18 & 74\end{array}$ |  | $\begin{array}{llllll}3 & 19 & 20 \cdot 7\end{array}$ | 9 |
| 44 | $\begin{array}{llll}3 & 8 & 13.4\end{array}$ | +1.53 | 43.0 | +r.46 | $\begin{array}{llll}3 & \text { II } & 8 \cdot 3\end{array}$ | +1.39 | $\begin{array}{llll}3 & 12 & 29.5 \\ 3 & 8 & 8.5\end{array}$ | +1.32 | $3 \begin{array}{llll}3 & 13 & 46 \cdot 6\end{array}$ | +1.25 | $\begin{array}{lllllllllllllllllll}3 & 14 & 59 \cdot 8\end{array}$ | -19 |
| 45 | ${ }^{3}$ | $1 \cdot 5$ | $3{ }^{5}$ | 1 | $\begin{array}{llll}3 & 6 & 47 \cdot 3\end{array}$ | I 39 | $\begin{array}{lll}3 & 8 & 8 \cdot 7\end{array}$ | I 32 | $\begin{array}{llll}3 & 9 & 25.9 \\ 3 & 5 & 5\end{array}$ | 25 | $3 \begin{array}{llll}3 & 10 & 38.9\end{array}$ | 18 |
| 46 | 2 59 $29 \cdot I$ <br> 2 59  | 1.55 |  | 1.48 |  | $1 \cdot 40$ | $\begin{array}{lllllllll}3 & 3 & 47.9\end{array}$ | I 33 | 3 3 5 $5 \cdot 5 \cdot 2$ | . 25 | 3 $61 \begin{array}{lll}3 & 18 \cdot 2 \\ 3 & 1\end{array}$ | 8 |
| 47 | $\begin{array}{llll}2 & 55 & 6 \cdot 5\end{array}$ | 5 | $\begin{array}{llll}2 & 56 & 38 \cdot 1 \\ 2 & 52 & 16.0\end{array}$ | 49 | 2 58 <br> 2 4.8 | 41 | $\begin{array}{llll}2 & 59 & 27.0 \\ 2 & 5 & 6\end{array}$ | I.33 | $\begin{array}{llll}3 & 0 & 44 \cdot 5 \\ 2 & 56\end{array}$ | I.25 | [ $\begin{array}{ccc}3 & 1 & 57.4 \\ 2 & 57 & 36.7\end{array}$ | 8 |
| 48 | $25043 \cdot 5$ | 1.58 | 252 | 50 | $25343 \cdot 4$ | 1.42 | 255 | I.34 | 256123.7 | I 26 | $2 \begin{array}{llll} \\ 2 & 56 & 36\end{array}$ | I.18 |
| 49 | $\begin{array}{llll}2 & 46 & 20 \cdot 3 \\ 2\end{array}$ | +1.60 |  | +1.51 | 22 49 21.8 <br> 2 4  | +1.43 | $\begin{array}{lllll}2 & 50 & 44 \cdot 8\end{array}$ | + $\mathrm{I} \cdot 34$ | 2 52 2.9 <br> 2 4  | +1.26 | $\begin{array}{lllll}2 & 53 & 16.0\end{array}$ | +r.18 |
| 50 | $\begin{array}{llllll}2 & 41 & 56.6 \\ 2 & 37 & 32.8\end{array}$ | I•62 | 2 43 $35^{\circ} \mathrm{O}$ <br> 2   | I. 53 | 2 2 $44 \begin{aligned} & 59 \\ & 2\end{aligned}$ | I. 44 | 2 46 23.5 <br> 2 42  | I.35 | $\begin{array}{llll}2 & 47 & 42 \cdot 0 \\ 2 & 43 \\ 20\end{array}$ | 26 | $\begin{array}{llllllll}2 & 48 & 55 \cdot 2 \\ 2 & 44 & 31.5\end{array}$ | 8 |
| 5 | 23732.8 |  | 23980 | I. 54 | $24037 \cdot 8$ | I 45 | $2 \begin{array}{lll}2 & 42 & 2 \cdot 1\end{array}$ | $\pm 36$ | $2 \begin{array}{llll}2 & 43 & 20 \cdot 9\end{array}$ | 1.27 | $\begin{array}{llll}2 & 44 & 34 \cdot 5\end{array}$ | 8 |
| 52 | 33 79 <br> 8  |  | $\begin{array}{ll}2 & 34 \\ 2 & 44.6\end{array}$ | I. 56 | $\begin{array}{llll}2 & 36 & 15.5 \\ 2 & 35 & 5\end{array}$ | 1 | $\begin{array}{lllll}2 & 37 & 40 \cdot 5\end{array}$ | I 37 | $\begin{array}{llllll}2 & 38 & 59.9 \\ 2\end{array}$ | $1 \cdot 28$ | $\begin{array}{llllll}2 & 40 & 13.7 \\ 2 & 35 & 5\end{array}$ | 8 |
| 53 | $22842 \cdot 7$ | 1.69 | 230,20 | I.58 | $23152 \cdot 8$ | I.4 | $\begin{array}{llllllllllll}2 & 33 & 18.7\end{array}$ | 1 | $23438 \cdot 7$ |  | $23552 \cdot 8$ | I-19 |
| 54 |  | +1.72 | $225 \quad 56 \cdot 6$ | + $\mathrm{I} \cdot 6 \mathrm{r}$ | $\begin{array}{llllll}2 & 27 & 29.8\end{array}$ | +I.50 | 22856.6 | +1.40 | 230173 | +1.29 | 23131.9 | I•19 |
| 55 | $\begin{array}{lllll}2 & 19 & 50 \cdot 5\end{array}$ | 75 | 22131.8 | I. 63 | $\begin{array}{llll}2 & 23 & 6.4\end{array}$ | I.52 | $\begin{array}{lllll}2 & 24 & 34 \\ 2 & 3\end{array}$ | 1.41 | $\begin{array}{llll}2 & 25 & 55 \cdot 7 \\ 2\end{array}$ | $1 \cdot 30$ | $\begin{array}{llll}2 & 27 & 10.9\end{array}$ | 120 |
| 56 | $2 \begin{array}{llll}2 & 15 & 23\end{array}$ | $1 \cdot 78$ | $\begin{array}{lllll}2 & 17 & 6.4\end{array}$ | I.66 | $2 \mathrm{I} 842 \cdot 5$ | I.54 | 22011.6 | I.43 | 22133.9 | I 32 | $\begin{array}{llllll}2 & 22 & 49 & 7\end{array}$ | 21 |
| 57 | 2 10 55.2 | I. 82 | $2 \begin{array}{lllll}2 & 1240 \cdot 4\end{array}$ | 69 | 21418.2 | 1.57 | $\begin{array}{lllllll}2 & 15 & 48.6\end{array}$ | I 45 | 2 I7 119 | 1.33 | $2 \begin{array}{lllll}2 & 18 & 28.3\end{array}$ | . 22 |
| 58 | 2626.2 |  | 813. | 1.72 | 953 | I.60 | 2 II 25 | 1.47 |  | 1.35 | 214 | I. 23 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 00 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 * 46 \end{gathered}$ | $\begin{gathered} s . \\ +1 \backsim 08 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.48 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot \mathrm{I} 8 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.50 \end{gathered}$ | $\begin{gathered} \text { s. } \\ +1 \cdot 27 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 53 \end{gathered}$ | $\begin{gathered} s . \\ +\mathbf{r} \cdot 36 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \times 55 \end{gathered}$ | $\xrightarrow{\text { s. }}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 58 \end{gathered}$ |
| 4 | . 87 | $4 \cdot 43$ | $\cdot 96$ | $4 \cdot 45$ | 1.04 | 4.47 | $1 \cdot 13$ | 4.49 | I 22 | 4.51 | $1 \cdot 31$ | 4.54 |
| 8 | $\cdot 74$ | $4 \cdot 41$ | $\cdot 82$ | $4 \cdot 42$ | -91 | $4 \cdot 44$ | I.00 | $4 \cdot 46$ | I-08 | $4 \cdot 48$ | 1.17 | 4.50 |
| 12 | . 62 | $4 \cdot 39$ | $\cdot 70$ | 4.40 | $\cdot 79$ | $4 \cdot 42$ | $\cdot 87$ | $4 \cdot 43$ | -96 | $4 \cdot 45$ | 1.05 | 4.47 |
| 16 | -49 | $4 \cdot 37$ | $\cdot 58$ | $4 \cdot 38$ | $\cdot 66$ | $4 \cdot 39$ | $\cdot 75$ | 4.41 | $\cdot 84$ | $4 \cdot 42$ | $\cdot 92$ | $4 \cdot 44$ |
| 20 | + 37 | $4 \cdot 36$ | + 46 | $4 \cdot 37$ | + 55 | $-4.38$ | + 63 | $4 \cdot 39$ | + 72 | $4 \cdot 40$ | + 8 81 | 4.42 |
| 22 | -31 | $4 \cdot 35$ | + 40 | $4 \cdot 36$ | -49 | $4 \cdot 37$ | $\cdot 57$ | $4 \cdot 38$ | . 66 | $4 \cdot 39$ | $\cdot 75$ | $4 \cdot 41$ |
| 24 | - 25 | $4 \cdot 35$ | $\cdot 34$ | $4 \cdot 36$ | -43 | $4 \cdot 37$ | -52 | $4 \cdot 37$ | -61 | $4 \cdot 39$ | $\cdot 70$ | $4 \cdot 40$ |
| 26 | -19 | $4 \cdot 35$ | -28 | $4 \cdot 35$ | $\cdot 37$ | $4 \cdot 36$ | -46 | $4 \cdot 37$ | -55 | $4 \cdot 38$ | -64 | $4 \cdot 39$ |
| 28 | -13 | 4.35 | -22 | $4 \cdot 35$ | $\cdot 31$ | $4 \cdot 36$ | -40 | $4 \cdot 36$ | -49 | $4 \cdot 37$ | -59 | $4 \cdot 38$ |
| 30 | +.07 | $4 \cdot 35$ | + ${ }^{16}$ | 4.35 | + 25 | $4 \cdot 35$ | + 35 | $4 \cdot 36$ | + $44{ }^{\text {. }}$ | 4.37 | + 53 | $4 \cdot 38$ |
| 32 | + 00 | $4 \cdot 34$ | -10 | $4 \cdot 35$ | -19 | $4 \cdot 35$ | $\cdot 29$ | $4 \cdot 35$ | $\cdot 38$ | $4 \cdot 36$ | $\cdot 48$ | $4 \cdot 37$ |
| 34 | -.06 | $4 \cdot 34$ | + .04 | $4 \cdot 34$ | -13 | $4 \cdot 35$ | -23 | $4 \cdot 35$ | -33 | $4 \cdot 36$ | -42 | $4 \cdot 37$ |
| 36 | -13 | $4 \cdot 35$ | - .02 | $4 \cdot 34$ | -07 | $4 \cdot 35$ | -17 | $4 \cdot 35$ | $\cdot 27$ | $4 \cdot 35$ | $\cdot 37$ | $4 \cdot 36$ |
| 38 | -19 | $4 \cdot 35$ | .09 | $4 \cdot 35$ | + .01 | $4 \cdot 35$ | - II | $4 \cdot 35$ | . 21 | $4 \cdot 35$ | -31 | $4 \cdot 36$ |
| 40 | - $\cdot 26$ | $4 \cdot 35$ | - . 16 | $4 \cdot 35$ | -.05 | $4 \cdot 34$ | +.05 | $4 \cdot 34$ | + 15 | $4 \cdot 35$ | + 25 | 4.35 |
| 42 | $\cdot 34$ | $4 \cdot 36$ | $\cdot 23$ | $4 \cdot 35$ | -12 | $4 \cdot 34$ | - . 01 | $4 \cdot 34$ | . 09 | $4 \cdot 35$ | $\cdot 20$ | $4 \cdot 35$ |
| 44 | $\cdot 42$ | $4 \cdot 37$ | -31 | $4 \cdot 36$ | -19 | $4 \cdot 35$ | . 08 | $4 \cdot 35$ | +.03 | 4.35 | . 14 | $4 \cdot 35$ |
| 46 | -50 | 4.37 | $\cdot 38$ | $4 \cdot 36$ | $\cdot 27$ | $4 \cdot 35$ | - 15 | $4 \cdot 35$ | -. 04 | $4 \cdot 35$ | + 08 | $4 \cdot 35$ |
| 48 | . 59 | $4 \cdot 38$ | -46 | $4 \cdot 37$ | -34 | $4 \cdot 36$ | - 22 | $4 \cdot 35$ | -10 | $4 \cdot 35$ | . 01 | $4 \cdot 35$ |
| 50 | -. 68 | $4 \cdot 40$ | -. 55 | $4 \cdot 38$ | - $\cdot 42$ | $4 \cdot 37$ | - 30 | $4 \cdot 36$ | - . 17 | $4 \cdot 35$ | -. 05 |  |
| 52 | $\cdot 78$ | $4 \cdot 42$ | . 64 | $4 \cdot 39$ | . 51 | $4 \cdot 37$ | $\cdot 38$ | $4 \cdot 36$ | - 25 | $4 \cdot 35$ | -12 | 4.35 |
| 54 | . 89 | $4 \cdot 43$ | $\cdot 74$ | 4.41 | . 60 | $4 \cdot 39$ | -46 | $4 \cdot 37$ | $\cdot 33$ | $4 \cdot 36$ | $\cdot 19$ | $4 \cdot 35$ |
| 56 | 1.00 | $4 \cdot 46$ | . 85 | 4.43 | $\cdot 70$ | 4.40 | -55 | $4 \cdot 38$ | $4{ }^{41}$ | $4 \cdot 36$ | $\cdot 27$ | $4 \cdot 35$ |
| 58 | I-14 | $4 \cdot 48$ | -97 | $4 \cdot 45$ | .81 | $4 \cdot 42$ | . 65 | $4 \cdot 39$ | $\cdot 50$ | $4 \cdot 37$ | $\cdot 35$ | $4 \cdot 36$ |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 97 LATITUDE $23^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | $\begin{aligned} & \text { Ded } \\ & \text { Va } \end{aligned}$ | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 3 I & 42 \cdot 6 \end{array}$ | + |  |  | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 35 \\ 33 \cdot 0 \end{array}$ |  | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 37 \\ 30 \cdot 6 \end{array}\right\|$ |  | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 39 \\ 30 \cdot 0 \end{array}$ | $+2 \cdot 00$ | H. M. S. <br> 6413 I. 3 | $\begin{gathered} 5 . \\ +2 \cdot 04 \end{gathered}$ |
| 10 | 54688 | I. 62 | $54746 \cdot 0$ | $\mathrm{I} \cdot 63$ | $54923 \cdot 8$ | r.63 | $\begin{array}{llll}5 & 51 & \text { I-8 }\end{array}$ | I. 6 | $55240 \cdot 4$ | 1.65 | $\begin{array}{llll}5 & 54 & 19 & 5\end{array}$ | 66 |
| 12 | $\begin{array}{llll}5 & 37 & 8 \cdot 6\end{array}$ | x. 58 | $53843 \cdot 1$ | I. 58 | 540 I7.8 | I.58 | $54 \mathrm{~L} 52 \cdot 6$ | -58 | $543 \quad 27 \cdot 6$ | 1.58 | $\begin{array}{llll}5 & 45 & 2 \cdot 9\end{array}$ | 59 |
|  | 52810.5 | 53 | 52942.4 | I-53 | 5 31 14. ${ }^{\text {I }}$ | I 53 | $53245 \%$ | . 53 | 53417.3 | I.53 | $53548 \cdot 9$ | 3 |
| 16 | $51914 \cdot 1$ |  | $52043 \cdot 4$ | 8 | $522 \times 2$ | r.48 | $\begin{array}{llll}5 & 23 & 40 \cdot 9\end{array}$ | -47 | $\begin{array}{lll}5 & 25 & 9 \cdot 2\end{array}$ | 1.47 | $\begin{array}{llll}5 & 26 & 37 \cdot 4\end{array}$ | I.47 |
| 18 | 51019.4 | +1.45 | 5 II $46 \cdot 3$ | +I. 4 | 51312.5 | +I.4 | $\begin{array}{llll}5 & 14 & 38 \cdot 2\end{array}$ | +1.42 | 516 | +r.4I | 5 17 28.1 | +r.4 |
| 20 | 5 I $26 \cdot 2$ | I-4I | $\begin{array}{llll}5 & 2 & 50 \cdot 7\end{array}$ | 1.4 | $\begin{array}{llll}5 & 4 & 14.4\end{array}$ | I- | $\begin{array}{llll}5 & 5 & 37 \cdot 3\end{array}$ | 1.37 | $\begin{array}{llll}5 & 6 & 59 \cdot 4\end{array}$ | r.36 | $5821 \cdot 0$ | I 35 |
| 22 | $45234^{\circ}$ | . 38 | $45356 \cdot 7$ | I.36 | $45517 \cdot 9$ | 1-34 | 45638 | r 33 | $45757^{\circ}$ | I•31 | 45915.8 | 30 |
| 24 | $44343 \cdot 8$ | 35 | $445 \quad 4.0$ | I-32 | $44622 \cdot 9$ | -30 | $44740 \cdot 6$ | 1.28 | $44857 \cdot 1$ | 6 | 45012.4 | 25 |
| 26 | 43454.4 | I | 43612.6 | I. 29 | $43729 * 3$ | I | 438.44 .5 | r.24 | 43958.4 | 1.22 | $44110 \cdot 8$ | 9 |
| 28 | 426 | +I.29 | 4272 | + r | 4283 | +I.2 | 429 | + | 4 3I I•2 | +I. | $4.32 \quad 10 \cdot 7$ | I• 14 |
| 30 | 417818.8 | I. 26 | $418 \quad 33 \cdot 3$ | 23 | 4 I9 46 | I. | $42056 \cdot 6$ | r-16 | $4225 \cdot 3$ | 3 | $4 \quad 2312.2$ | -10 |
| 31 | $41255 \cdot 5$ | $1 \cdot 24$ | 414 | I-2I | 415 |  | 41630 |  | 4 17 $37 \cdot 9$ | II | $4 \begin{array}{lll}4 & 18 & 43 \cdot 4\end{array}$ | .07 |
| 32 | $\begin{array}{llll}4 & 8 & 32 \cdot 4\end{array}$ | 1.23 | $4 \quad 945 \cdot 3$ |  | 4 10 $56 \cdot 0$ |  | 4124.5 |  | 41310.8 |  | 4 I4 15.0 | 5 |
| 33 | 449.5 | I-22 | $4 \quad 5 \quad 2 x \cdot 6$ | I•I8 | 463 |  | $47738 \cdot 8$ |  | $4844^{\circ} \mathrm{O}$ | I.07 | $4 \quad 9 \quad 46 \cdot 9$ | . 03 |
| 3 | $35946 \cdot 9$ | +I.2 | 4 0 $58 \cdot 2$ | +r. | 42 | + | $4 \quad 31$ |  | $\begin{array}{llll}4 & 4 & \text { r7. }\end{array}$ | r.05 | $4519 \cdot 1$ | r.or |
| 35 | $\begin{array}{lllll}3 & 55 & 24.4\end{array}$ | I-20 | $35635 \cdot 0$ | I-I | 35743.0 |  | $35^{88} 48$ |  | $35951 \cdot 3$ | I.03 | 4 0 51.7 | 8 |
| 36 | $3512 \cdot 1$ | I•I | 352 |  | 3 53.19 |  | 354 |  | $35525 \cdot 3$ | - 01 | $3 \begin{array}{llll}3 & 56 & 24.4\end{array}$ | 96 |
| 37 | 34639 |  | 347 49•1 | r.13 | $34^{3} 865 \cdot 5$ |  | $34959 \cdot 0$ | 3 | $35059 \cdot 7$ | $\mathbf{r} \cdot 99$ | $35157 \cdot 5$ | 94 |
| 38 | 342 I | I'I7 | $34326 \cdot 5$ | I•I2 | $34432 \cdot r$ | 1 | 34534 | 1.02 | $34634 \cdot 2$ | -97 | 347 30.9 | 92 |
| 39 | $33756 \cdot 1$ | + 1 | $3394 \cdot 1$ | +I | $\begin{array}{lll}3 & 40 & 8 \cdot 8\end{array}$ | + 1 | 341 | 1.00 | 342 9•I | + 95 |  |  |
| 40 | $\begin{array}{llll}3 & 33 & 34 \cdot 5\end{array}$ | - | $3{ }^{3} 34$ 4x.8 |  | $\begin{array}{llll}3 & 35 & 45 \cdot 8\end{array}$ |  | $3 \quad 364$ | - | $33744 \cdot 1$ | -93 | $\begin{array}{llll}3 & 38 & 38 \cdot 4\end{array}$ |  |
| 41 | $\begin{array}{llll}3 & 29 & 12.9\end{array}$ |  | 330 I9 |  | $3 \mathrm{3I} 23.0$ |  | $\begin{array}{llll}3 & 32 & 22\end{array}$ | 97 | 3331 | -91 | $\begin{array}{lllllllllllllllllll}3 & 34 & 12.6\end{array}$ | 86 |
| 42 | $32451 \cdot 5$ | I•I3 | $32557 \cdot 7$ |  | 327 | $1 \cdot 01$ | $\begin{array}{llll}3 & 27 & 59.4\end{array}$ | -95 | $32855 \cdot 0$ |  | $32946 \cdot 9$ |  |
| 43 | $32030 \cdot 2$ | I- | 3213 | I.06 | 3223 | $1 \cdot 0$ | 323 36.2 | -94 | $32430 \cdot 7$ |  | $325 \quad 2 \mathrm{I} \cdot 5$ |  |
| 44 | $3 \mathrm{I} 6 \quad 9.0$ | +1 | 317714.2 | + 1.0 | $\begin{array}{llll}3 & 18 & 15.6\end{array}$ | + 99 | 3 I9 13.0 | + 933 | $3206 \cdot 7$ | +.86 | $32056 \cdot 4$ |  |
| 45 | 3 II 47.9 |  |  | 1.05 | $\begin{array}{llll}3 & 13 & 53.4\end{array}$ | -98 | 3 I4 50.2 | 9 I | $31542 \cdot 8$ |  | 3 16 3I*4 |  |
| 4 | $\begin{array}{llll}3 & 7 & 26 \cdot 9\end{array}$ |  | $38831 \cdot 3$ |  | $\begin{array}{llll}3 & 9 & 31 \cdot 5\end{array}$ |  | 3 10 $27 \cdot 4$ |  | 311519 | . 8 | $3126 \cdot 7$ |  |
| 47 | $\begin{array}{llll}3 & 3 & 5 \cdot 9\end{array}$ |  | $\begin{array}{llll}3 & 4 & 9 \cdot 9\end{array}$ |  | $\begin{array}{lll}3 & 5 & 9.6\end{array}$ | -96 | $\begin{array}{llll}3 & 6 & 4.9\end{array}$ | - 88 | $\begin{array}{llll}3 & 6 & 55 \cdot 7\end{array}$ |  | $3 \quad 7$3 42 |  |
| 48 | $25^{8} 45^{\prime} \mathrm{I}$ |  | $25948 \cdot 8$ | I | $3 \quad 0 \quad 47 \cdot 9$ | -95 | 3 I 42.4 | -87 | $\begin{array}{llll}3 & 2 & 32.4\end{array}$ | -79 | $3 \quad 3 \begin{array}{llll} & 17\end{array}$ |  |
|  | 25424.2 | + x | $255 \quad 27 \cdot 7$ | +1. | $2 \begin{array}{llll}26 & 26 \cdot 3\end{array}$ | + 94 | 257 | + 86 | $2 \begin{array}{lll}28 & 9 \cdot 3\end{array}$ | + 78 | 25853.6 |  |
| 50 | 250 |  | 25156 |  | $2 \begin{array}{lll}2 & 52 & 4.8\end{array}$ | 93 | 25258 |  | $25346 \cdot 3$ | -76 | 25429.6 |  |
| 51 | $24542 \cdot \%$ |  | $24645 \cdot$ |  | 24743.5 | 92 | $24^{8} 36 \cdot \mathrm{r}$ |  | $24923 \cdot 5$ | 75 | 2505 |  |
| 52 | 24 I 22.0 |  | 24224.8 |  | $243 \quad 22 \cdot 2$ | -91 | 24414.3 | - 82 | 245009 | 73 | $24542 \cdot 2$ |  |
| 5 | $2 \begin{array}{llll}27 & 1 & 3\end{array}$ | 1.09 | $23^{8} \quad 4{ }^{\circ} 0$ | 1.00 | 239 I•I | -90 | 23952.6 | -81 | 24038 | $\cdot 72$ |  |  |
| 54 | $23240 \cdot 5$ | + $\mathrm{x} \cdot 09$ | 23343.2 | + I.00 | $23440 \cdot 0$ | + 90 | $2353 \mathrm{r} \cdot \mathrm{O}$ | + 80 | $23616 \cdot 1$ | + 70 | $2 \begin{array}{lllll}2 & 36 & 55 \cdot 3\end{array}$ | + 6 |
| 55 | 22819.7 | r | 22922.5 | -99 | $230 \times 9.0$ | -89 | 2319.5 | -79 | 23153.9 | -69 | $23232 \cdot 2$ | - 59 |
| 5 | $22358 \cdot 9$ | r.10 | 22511.7 | -99 | 225 58.1 |  | $22648 \cdot 2$ |  | 22731.8 |  | $228 \quad 9 \cdot 2$ | . 57 |
|  | 2 I9 $3^{8}$ | II | $22041 \cdot 0$ | -99 | $22137 \cdot 3$ | 88 | $22226 \cdot 9$ | $\cdot 77$ | $\begin{array}{llll}2 & 23 & 9 \cdot 9\end{array}$ |  | $22346 \cdot 3$ | 55 |
| 58 | $21517 \cdot$ | I•I | 2 I6 20.3 | -99 | 2 17 16.5 | -88 | 2 I8 5.7 | $\cdot 76$ | 2 I8 48-I |  | 21923.6 | -53 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21{ }^{\circ} \mathrm{A}$. |  | L. 22 | $\bigcirc$ A. | L. 23 | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | $\begin{gathered} s . \\ +1 \cdot 54 \end{gathered}$ | $\begin{gathered} s \\ -4.6 \mathrm{r} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathbf{1} \cdot 64 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4.64 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 74 \end{gathered}$ | $\begin{gathered} s . \\ -4.68 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 84 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 72 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 94 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 75 \end{gathered}$ | $\begin{gathered} s . \\ +2 \cdot 04 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 80 \end{gathered}$ |
| 4 | I. 40 | $4 \cdot 56$ | x.49 | 4.59 | 1.58 | $4 \cdot 62$ | I. 68 | 4.66 | 1.77 | 4.69 | 1.8\% | $4 \cdot 73$ |
| 8 | $\mathrm{x} \cdot 26$ | $4 \cdot 52$ | x 35 | $4 \cdot 55$ | I.44 | $4 \cdot 58$ | 1.54 | $4 \cdot 61$ | I. 63 | $4 \cdot 64$ | $1 \cdot 72$ | $4 \cdot 67$ |
| 12 | I•I3 | 4.49 | 1.22 | 4.51 | I-3I | $4 \cdot 54$ | 1.40 | $4 \cdot 57$ | r.50 | 4.59 | r.59 | $4 \cdot 62$ |
| r6 | I.OI | $4 \cdot 46$ | 1.10 | $4 \cdot 48$ | I.19 | 4.51 | 1.28 | $4 \cdot 53$ | I.37 | $4 \cdot 56$ | I.47 | $4 \cdot 58$ |
| 20 | + 90 | $4 \cdot 44$ | + 99 | 4.45 | +1.08 | 4.48 | +1.17 | 4.50 | +I.26 | $4 \cdot 52$ | + $\times 135$ | 4.55 |
| 22 | . 84 | $4 \cdot 43$ | -93 | $4 \cdot 45$ | x.02 | $4 \cdot 46$ | I•12 | $4 \cdot 48$ | I. 20 | 4.51 | I. 30 | $4 \cdot 53$ |
| 24 | $\cdot 79$ | $4 \cdot 42$ | -88 | $4 \cdot 43$ | -97 | $4 \cdot 45$ | I.06 | 4.47 | I'I5 | $4 \cdot 49$ | I 25 | $4 \cdot 52$ |
| 26 | $\cdot 74$ | 4.41 | -82 | $4 \cdot 42$ | $\cdot 92$ | 4.44 | reor | $4 \cdot 46$ | I'IO | $4 \cdot 48$ | I-19 | $4 \cdot 5 \mathrm{I}$ |
| 28 | . 68 | $4 \cdot 40$ | $\cdot 77$ | $4 \cdot 4 \mathrm{I}$ | . 86 | $4 \cdot 43$ | -96 | $4 \cdot 45$ | I. 05 | $4 \cdot 47$ | I.I4 | $4 \cdot 49$ |
| 30 | +.63 | $4 \cdot 39$ | $+\cdot 72$ | 4.41 | +.80 | 4.42 | +.91 | 4.44 | +1.00 | $4 \cdot 46$ | +rio | $4 \cdot 48$ |
| 32 | - 57 | $4 \cdot 38$ | . 67 | $4 \cdot 39$ | $\cdot 76$ | $4 \cdot 4 \mathrm{I}$ | . 86 | $4 \cdot 43$ | -95 | 4.45 | $x \cdot 05$ | 4.47 |
| 34 | $\cdot 52$ | $4 \cdot 38$ | -62 | $4 \cdot 39$ | -75 | $4 \cdot 40$ | -8r | 4.42 | -91 | 4.44 | r-or | 4.46 |
| 36 | $\cdot 46$ | $4 \cdot 37$ | - 56 | $4 \cdot 38$ | -66 | $4 \cdot 39$ | $\cdot 76$ | $4 \cdot 4 \mathrm{r}$ | -86 | $4 \cdot 43$ | -96 | $4 \cdot 45$ |
| 38 | -41 | $4 \cdot 36$ | -51 | $4 \cdot 37$ | -6I | $4 \cdot 39$ | -71 | $4 \cdot 40$ | -82 | $4 \cdot 42$ | $\cdot 92$ | $4 \cdot 44$ |
| 40 | + 36 | $4 \cdot 36$ | + $\cdot 46$ | 4.37 | $+.57$ | $4 \cdot 38$ | + 67 | 4.39 | +.77 | 4.41 | +.88 | 4.43 |
| 42 | $\cdot 30$ | $4 \cdot 35$ | . 41 | $4 \cdot 36$ | -5I | $4 \cdot 37$ | -62 | $4 \cdot 39$ | -73 | 4.40 | .83 | $4 \cdot 42$ |
| 44 | - 25 | $4 \cdot 35$ | -36 | $4 \cdot 36$ | -46 | $4 \cdot 37$ | -57 | $4 \cdot 38$ | - 68 | 4.40 | - 80 | 4.42 |
| 46 | -19 | $4 \cdot 35$ | -30 | $4 \cdot 36$ | $\cdot 42$ | $4 \cdot 36$ | -53 | $4 \cdot 38$ | -64 | $4 \cdot 39$ | $\cdot 76$ | $4 \cdot 41$ |
| 48 | - 13 | $4 \cdot 35$ | -25 | $4 \cdot 35$ | $\cdot 36$ | $4 \cdot 36$ | -48 | $4 \cdot 37$ | - 60 | $4 \cdot 39$ | $\cdot 72$ | $4 \cdot 40$ |
| 50 | +.07 | $4 \cdot 35$ | + -19 | 4.35 | + 31 | $4 \cdot 36$ | + 43 | $4 \cdot 37$ | +.56 | $4 \cdot 38$ | +.68 | $4 \cdot 40$ |
| 52 | + .01 | $4 \cdot 35$ | - I3 | $4 \cdot 35$ | - 26 | $4 \cdot 35$ | -39 | $4 \cdot 36$ | . 51 | $4 \cdot 38$ | -64 | $4 \cdot 39$ |
| 54 | -.06 | $4 \cdot 35$ | - 07 | $4 \cdot 35$ | -21 | $4 \cdot 35$ | -34 | $4 \cdot 36$ | -47 | $4 \cdot 37$ | -60 | $4 \cdot 39$ |
| 56 | -13 | 4.35 | + .01 | 4.35 | - 5 | $4 \cdot 35$ | -29 | $4 \cdot 35$ | -43 | $4 \cdot 37$ | - 57 | $4 \cdot 38$ |
| 58 | - 20 | $4 \cdot 35$ | -.05 | $4 \cdot 35$ | -09 | $4 \cdot 35$ | - 24 | $4 \cdot 35$ | -39 | $4 \cdot 36$ | -53 | $4 \cdot 38$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{lcl} \text { H. M. } & \text { S. } \\ 6 & 0 & 0.0 \end{array}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 78 \end{gathered}$ | $\left.\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 46 \cdot 9 \end{array} \right\rvert\,$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 78 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 33 \cdot 8 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 79 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & 20 \cdot 9 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 79 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 7 & 8 \cdot 2 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 80 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 8 & 55 \cdot 8 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 8 \mathrm{o} \end{gathered}$ |
| 10 | 51610.2 | I.81 | 5 17 58.6 | I.80 | 5 19 46.I | I•78 | $512132 \cdot 7$ | 1.77 |  | I.76 | $\begin{array}{llll}5 & 25 & 3.7\end{array}$ | I.75 |
| 12 | $\begin{array}{llll}5 & 7 & 22.8\end{array}$ | I.83 | $5 \quad 912.0$ | I.8I | 5 II 0.0 | I•79 | $51247 \cdot 0$ | I•78 | 5 I4 $33 \cdot 1$ | $1 \cdot 76$ | $\begin{array}{llll}5 & 16 & 18.3\end{array}$ | 1.75 |
| 14 | $4{ }_{4} 4834.5$ | 85 | $\begin{array}{rrrr}5 & 0 & 24 \cdot 7\end{array}$ | I.83 | 5 2 13.5 | I.80 | $5{ }^{5}$ | ェ・78 | 5 | 1.77 | 5rrrrr | 74 |
| 16 | $44945 \cdot 3$ | 1.87 | $4515136 \cdot 6$ | 1.84 | $\begin{array}{llll}4 & 53 & 26 \cdot 4\end{array}$ | 2 | $45514 \cdot 7$ | I•79 | 45751.6 | ェ・77 | $458 \quad 47 \cdot 3$ | I.75 |
| 18 | $44055 \cdot 0$ | + I.89 | $44247 \cdot 6$ | +1.86 | 44438.5 | + 1.83 | $44627 \cdot 7$ | +1.81 | $4 \begin{array}{llll}48 & 15.4\end{array}$ | +1•78 | $450 \quad 1.5$ | +1.76 |
| 20 | $4 \begin{array}{lll}4 & 32 & 3\end{array}$ | I.92 | $433 \quad 57 \cdot 4$ | 1.89 | $43549 \cdot 7$ | I. 85 | $43740 \cdot 0$ | I. 82 | $43928 \cdot 5$ | I•79 | $4 \begin{array}{llll}4 & 4 & 15\end{array}$ | $1 \cdot 77$ |
| 22 | $42310 \cdot 0$ | I•95 | $425 \quad 6.0$ | I-91 | $42659 \cdot 8$ | I.88 |  | I.84 | $43041 \cdot 0$ | I.8I | $\begin{array}{llll}4 & 32 & 28 \cdot 7\end{array}$ | 8 |
| 24 | 41414.9 | 9 | 4 16 13.0 | I•95 | $4 \begin{array}{lll}48 & 8 \cdot 5\end{array}$ | I.90 | $4201 \cdot 7$ | I.87 | $42152 \cdot 6$ | I.83 | $4234 \mathrm{I} \cdot 3$ | 0 |
| 26 | 45157.8 | $2 \cdot 03$ | $4718 \cdot 1$ | I.98 | $4 \quad 9 \quad 15 \cdot 7$ | $1 \cdot 94$ |  | I•90 | $4 \begin{array}{lll}4 & 3 \cdot 1\end{array}$ | I.85 | $4 \begin{array}{llll}4 & 14 & 53\end{array}$ | 1 |
| 28 | $356 \quad 18 \cdot 2$ | -2.08 | $35821 \cdot 2$ | $+2.02$ | $4 \quad 0 \quad 21.2$ | +1.97 | $4 \quad 2 \begin{array}{lllll}4 & 18.2\end{array}$ | +I•93 | $\begin{array}{llll}4 & 4 & 12.4\end{array}$ | +1.88 | $4 \quad 6 \quad 3 \cdot 9$ | +1.84 |
| 29 | 351547.5 | 2 | $35351 \times 9$ | $2 \cdot 05$ | $355153 \cdot 1$ | I•99 | $35751 \cdot 3$ | I•94 | $35946 \cdot 4$ | I.90 | 4 I 38.8 | 85 |
| 30 | $34716 \cdot 0$ | $2 \cdot 13$ | $34922 \cdot 0$ | 2.07 | $\begin{array}{lllll}3 & 51 & 24 \cdot 6\end{array}$ | 2.01 | $\begin{array}{llll}3 & 53 & 23 \cdot 9\end{array}$ | 1.96 | 3 55 $20 \cdot 1$ | 1.91 | $\begin{array}{llll}3 & 57 & 13.4 \\ 3 & 52 & 4\end{array}$ | 86 |
| 31 | $34243 \cdot 8$ | $2 \cdot 1$ | $34451 \cdot 3$ | 2.09 | $34655 \cdot 3$ | 2.03 | $34856 \cdot 0$ | 1.98 | 35053.3 | I•93 | $35247 \cdot 6$ | 8 |
| 32 | $\begin{array}{llll}3 & 38 & 10 \cdot 7\end{array}$ | 2.19 | $34020 \cdot 0$ | $2 \cdot 12$ | $\begin{array}{lllll}3 & 42 & 25 \cdot 5\end{array}$ | 2 | $\begin{array}{lllllllllll}3 & 44 & 27 \cdot 5\end{array}$ | 2 | $34626 \cdot 1$ | -95 | $\begin{array}{llllllllllllll}3 & 48 & 21.4\end{array}$ | 0 |
| 33 | $33336 \cdot 7$ | $+2.22$ | 35 47•8 | $+2 \cdot 15$ | 33755.0 | $+2.08$ | $\begin{array}{lllllllllllllll}3 & 39 & 58 & 5\end{array}$ | +2.03 | 34158.4 | +1.97 | $3 \begin{array}{llll}3 & 43 & 54 \cdot 8\end{array}$ | +I.91 |
| 34 | $\begin{array}{llll}3 & 29 & 1.8\end{array}$ | 2.25 | $3 \mathrm{3I} 14 \cdot 8$ | $2 \cdot 18$ | $\begin{array}{llll}3 & 33 & 23 \cdot 8 \\ 3 & 2 & 5\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}3 & 35 & 28 \cdot 8\end{array}$ | 2.05 | $\begin{array}{lllll}3 & 37 & 30 \cdot 0\end{array}$ | 1.99 | $\begin{array}{llll}3 & 39 & 27 \cdot 7\end{array}$ | $1 \cdot 93$ |
| 35 | $32425 \cdot 9$ | $2 \cdot 29$ |  | $2 \cdot 22$ | $\begin{array}{lllllllllllllllll}3 & 28 & 51.7\end{array}$ | $2 \cdot 14$ | 3303 38 | $2 \cdot 08$ | $\begin{array}{llll}3 & 33 & 1 \cdot 1\end{array}$ | 2.02 | 3 35 $0 \cdot 1$ | -95 |
| 36 | $\begin{array}{llll}3 & 19 & 48 \cdot 8\end{array}$ | $2 \cdot 33$ | $\begin{array}{llll}3 & 22 & 6 \cdot 1\end{array}$ | 2.25 | $\begin{array}{llllllllllllllll}3 & 24 & 18.8\end{array}$ | $2 \cdot 18$ | $\begin{array}{lllll}3 & 26 & 27 \cdot 3\end{array}$ | $2 \cdot 10$ | 328 31.6 | $2 \cdot 04$ | $\begin{array}{llll}3 & 30 & 32 \cdot 0\end{array}$ | 1.97 |
| 37 | $31510 \cdot 6$ | $2 \cdot 37$ |  | $2 \cdot 28$ | 3 I9 45.0 | 2.21 | $32155 \cdot 3$ | $2 \cdot 14$ | $\begin{array}{llll}3 & 24 & 1 & 3\end{array}$ | 2.07 | $\begin{array}{llll}3 & 26 & 3 \cdot 2\end{array}$ | $2 \cdot 00$ |
| 38 | 31031.0 | $+2.41$ | $3 \begin{array}{lll}3 & 12 & 53 \cdot 1\end{array}$ | $+2.32$ | 31510.2 | +2.24 | 3 I7 22.5 | +2.17 | $31930 \cdot 3$ | $+2.09$ | $3 \begin{array}{llll}3 & 21 & 33.8\end{array}$ | $+2.02$ |
| 39 | $3{ }^{3} 5150 \cdot 1$ | 2.46 | $\begin{array}{llll}3 & 8 & 14 \cdot 8\end{array}$ | $2 \cdot 37$ | 3 Io $34 \cdot 3$ | $2 \cdot 28$ | $\begin{array}{llll}3 & 12 & 48 \cdot 8\end{array}$ | $2 \cdot 20$ | 3 I4 58.5 | $2 \cdot 13$ | $\begin{array}{llll}3 & 17 & 3.7\end{array}$ | 2.05 |
| 40 | $\begin{array}{llll}3 & 1 & 7 \cdot 7\end{array}$ | $2 \cdot$ | 3 3 $35 \cdot 1$ <br> 2 5  | 2.41 | 3 5 57.2  <br> 3 1 1  | $2 \cdot 32$ | $\begin{array}{llll}3 & 8 & 14.0 \\ 3 & 3 & 38.0\end{array}$ | $2 \cdot 24$ | $\begin{array}{rrrr}3 & 10 & 25.8 \\ 3 & 5 & 5 \cdot 1\end{array}$ | 2.16 | $\begin{array}{rrrr}3 & 12 & 32 \cdot 8 \\ 3 & 8 & 1.2\end{array}$ | - |
| 4 I | $\begin{array}{llll}2 & 56 & 23.6\end{array}$ | $2 \cdot 56$ |  | 2.46 | $\begin{array}{lllll}3 & 1 & 18.9\end{array}$ | $2 \cdot 37$ | $\begin{array}{llll}3 & 3 & 38 \cdot 2\end{array}$ | $2 \cdot 27$ | $3 \begin{array}{llll}3 & 5 & 52 \cdot 2\end{array}$ | $2 \cdot 19$ | $\begin{array}{llr}3 & 8 & \mathbf{1} \cdot 2 \\ 3 & 3 & 28.6\end{array}$ | $2 \cdot 11$ |
| 42 | $25137 \cdot 8$ | 2.62 | 254 II•6 | 2.51 | $2 \begin{array}{lllll}26 & 39 & 3\end{array}$ | 2.41 | 259 I. 2 | $2 \cdot 32$ | 3 I 17.5 | $2 \cdot 23$ | 33 | $2 \cdot 14$ |
| 4 | $24650 \cdot 0$ | +2.68 | $249 \quad 27 \cdot 3$ | +2.57 | 2 5I 58.I | $+2.46$ | $2 \begin{array}{llll}2 & 54 & 22 \cdot 8\end{array}$ | +2.36 | $25641 \cdot 7$ | +2.27 | 258550 | $+2 \cdot 18$ |
| 44 | 242001 | 2.7 | 244 4I•I | $2 \cdot 63$ | $2 \begin{array}{lllllll}2 & 47 & 15\end{array}$ | 2.52 | 249 43.1 | 2.41 | $2{ }_{2} 524 \cdot 4 \cdot 7$ | $2 \cdot 31$ | $25420 \cdot 4$ | $2 \cdot 22$ |
| 45 | 23780 | $2 \cdot 8$ | $23953 \cdot 0$ | $2 \cdot 69$ | $\begin{array}{llll}2 & 42 & 30 \cdot 8\end{array}$ | 2.57 | $245 \begin{array}{lll}2 & 45 \\ 2\end{array}$ | 2.46 | $\begin{array}{llll}2 & 47 & 26 \cdot 3\end{array}$ | 2.36 | $\begin{array}{lllll}2 & 49 & 44 \cdot 7\end{array}$ | $2 \cdot 26$ |
| 46 | $\begin{array}{llll}2 & 32 & 13.3\end{array}$ | 2.89 | $\begin{array}{llll}2 & 35 & 2 \cdot 6 \\ 2 & 30 & 9 \cdot 9\end{array}$ | 2.76 | $\begin{array}{lllll}2 & 37 & 44.3 \\ 2 & 32 & 55.8\end{array}$ | 2.63 | $\begin{array}{llllllllll}2 & 40 & 18.8\end{array}$ | $2 \cdot 52$ | $\begin{array}{llll}2 & 42 & 46 \cdot 5\end{array}$ | 2.41 | $\begin{array}{lllll}2 & 45 & 7 \cdot 7\end{array}$ | 2.30 |
| 47 | 22715.8 | $2 \cdot 97$ | 2330 | 2.83 | $23255 \cdot 8$ | $2 \cdot 70$ | 235 34.I | $2 \cdot 58$ | $\begin{array}{lllll}2 & 3^{8} & 5 \cdot 1\end{array}$ | $2 \cdot 46$ | $240 \quad 29 \cdot 3$ | $2 \cdot 35$ |
| 48 | $2 \begin{array}{llll}222 & 15.2\end{array}$ | $+3.06$ | $2 \begin{array}{lll}2 & 25 & 14.4\end{array}$ | +2.91 | $\begin{array}{lll}2 & 28 & 4 \cdot 9\end{array}$ | +2.77 | $23047 \cdot 3$ | +2.64 | $23322 \cdot 0$ | +2.52 | 23549.4 | $+2.40$ |
| 49 | 217 II.2 | 3.16 | 22015.9 | 3.00 | 223 II.4 | $2 \cdot 85$ | $22558 \cdot 2$ | $2 \cdot 71$ | $2 \begin{array}{llll}28 & 36 \cdot 9\end{array}$ | 2.58 | 231789 | $2 \cdot 46$ |
| 50 | $\begin{array}{llr}2 & 12 & 3 \cdot 3\end{array}$ | $3 \cdot 26$ | $\begin{array}{lllll}2 & 15 & 14.2 \\ 2\end{array}$ | $3 \cdot 10$ | $2 \mathrm{I}^{2} 815 \cdot 1$ | 2.94 | 2 21 $6 \cdot 8$ <br> 2 16  | $2 \cdot 79$ | 2 23 $49 \cdot 8$ <br> 2 1  | $2 \cdot 65$ | $\begin{array}{llll}2 & 26 & 24 \cdot 6 \\ 2 & 21 & 39 \cdot 3\end{array}$ | 2.52 2.58 |
| 51 | 2651.1 | $3 \cdot 37$ | 2110807 | $3 \cdot 20$ | $\begin{array}{llllllllllllllll}2 & 13 & 15.6\end{array}$ | 3.03 | $\begin{array}{llll}2 & 16 & 12.6\end{array}$ | 2.87 | 19 $0 \cdot 3$ <br>   | $2 \cdot 72$ 2.80 | $\begin{array}{lll}2 & 21 & 39.3 \\ 2 & 16 & 5 \mathrm{I} \cdot 7\end{array}$ | 2.58 2.65 |
| 52 | 2 I 34.I | 3.48 | 2489.1 | $3 \cdot 32$ | $2 \quad 8 \quad 12 \cdot 6$ | $3 \cdot 13$ | 2 II 15.2 | $2 \cdot 96$ | $2 \mathrm{I} 4 \quad 8 \cdot \mathrm{I}$ | $2 \cdot 80$ | 2 I6 5I*7 | $2 \cdot 65$ |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. 2 | A. | L. 3 | A. | L. 4 | A. | L. 5 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | s. | s. | s. | s. |
| 0 | 00 | $-4 \cdot 38$ | +.08 | $-4.38$ | + 16 | $-4 \cdot 38$ | + 25 | $-4 \cdot 38$ | + 34 | $-4.39$ | $+.42$ | $-4.40$ |
| 2 | . 07 | $4 \cdot 38$ | + . OI | $4 \cdot 38$ | -10 | $4 \cdot 38$ | 18 | $4 \cdot 38$ | -27 | $4 \cdot 39$ | -35 | $4 \cdot 39$ |
| 4 | -14 | $4 \cdot 38$ | - 05 | $4 \cdot 38$ | + . 03 | $4 \cdot 38$ | - II | $4 \cdot 38$ | - 20 | 4.38 | -28 | $4 \cdot 39$ |
| 6 | $\cdot 21$ | $4 \cdot 38$ | -12 | $4 \cdot 38$ | -. 04 | $4 \cdot 38$ | $+.05$ | $4 \cdot 38$ | -13 | $4 \cdot 38$ | - 22 | $4 \cdot 39$ |
| 8 | $\cdot 28$ | $4 \cdot 38$ | -19 | $4 \cdot 38$ | - II | $4 \cdot 38$ | -.02 | $4 \cdot 38$ | + .06 | $4 \cdot 38$ | -15 | $4 \cdot 38$ |
| 10 | - 34 | $4 \cdot 39$ | - 26 | $4 \cdot 38$ | - 18 | $4 \cdot 38$ | - -09 | $4 \cdot 38$ | - OI | $4 \cdot 38$ | $+.08$ | $4 \cdot 38$ |
| 12 | $\cdot 42$ | $4 \cdot 40$ | -33 | 4.39 | $\cdot 24$ | $4 \cdot 38$ | -16 | $4 \cdot 38$ | - 07 | 4.38 | + . OI | $4 \cdot 38$ |
| 14 | -49 | $4 \cdot 40$ | -40 | 4.40 | $\cdot 31$ | 4.39 | - 23 | $4 \cdot 38$ | -14 | $4 \cdot 38$ | -.06 | $4 \cdot 38$ |
| I6 | - 56 | 4.41 | -47 | $4 \cdot 40$ | -38 | $4 \cdot 39$ | $\cdot 30$ | 4.39 | -21 | $4 \cdot 38$ | -12 | 4.38 |
| 18 | . 64 | $4 \cdot 42$ | -55 | $4 \cdot 4 \mathrm{I}$ | $\cdot 46$ | 4.40 | $\cdot 37$ | $4 \cdot 39$ | $\cdot 28$ | $4 \cdot 38$ | -19 | $4 \cdot 38$ |
| 20 | - 72 | 4.44 | -. 63 | 4.42 | -. 53 | 4.41 | - 44 | $4 \cdot 40$ | - 36 | $4 \cdot 39$ | -. 27 | $4 \cdot 39$ |
| 22 | -80 | $4 \cdot 45$ | $\cdot 70$ | 4.43 | . 61 | $4 \cdot 42$ | -52 | 4.41 | *43 | $4 \cdot 40$ | -34 | $4 \cdot 39$ |
| 24 | - 89 | 4.47 | -79 | $4 \cdot 45$ | $\cdot 70$ | $4 \cdot 43$ | -60 | 4.42 | $\cdot 51$ | $4 \cdot 4 \mathrm{I}$ | -41 | 4.40 |
| 26 | -98 | $4 \cdot 48$ | . 88 | $4 \cdot 46$ | $\cdot 78$ | 4.45 | -68 | $4 \cdot 43$ | - 58 | $4 \cdot 42$ | -49 | $4 \cdot 40$ |
| 28 | 1.07 | $4 \cdot 51$ | $\cdot 96$ | $4 \cdot 48$ | -86 | $4 \cdot 46$ | $\cdot 76$ | 4.44 | -67 | $4 \cdot 43$ | -57 | $4 \cdot 41$ |
| 30 | - I'17 | 4.53 | - I.06 | $4 \cdot 50$ | - .96 | $4 \cdot 48$ | -.85 | 4.46 | - 75 | 4.44 | -. 65 | 4.42 |
| 32 | 1.27 | $4 \cdot 56$ | I•16 | $4 \cdot 53$ | 1.05 | $4 \cdot 50$ | -94 | $4 \cdot 48$ | -84 | $4 \cdot 46$ | $\cdot 73$ | 4.44 |
| 34 | I 38 | 4.59 | I. 26 | 4.55 | 1.15 | $4 \cdot 53$ | I. 04 | $4 \cdot 50$ | -93 | $4 \cdot 48$ | -83 | 4.45 |
| 36 | I 50 | 4.63 | I. 38 | 4.59 | 1-26 | $4 \cdot 55$ | I.14 | $4 \cdot 52$ | I.O3 | $4 \cdot 50$ | -92 | $4 \cdot 47$ |
| 38 | I. 62 | $4 \cdot 67$ | I. 50 | $4 \cdot 63$ | 1.37 | $4 \cdot 59$ | 1.25 | $4 \cdot 55$ | I•13 | $4 \cdot 52$ | 1.02 | $4 \cdot 49$ |
| 40 | - I.76 | $4 \cdot 72$ | - I.63 | 4.67 | - I. 50 | $4 \cdot 63$ | - 1.37 | 4.59 | -I.25 | $4 \cdot 55$ | -I'I3 | $4 \cdot 52$ |
| 42 | I.92 | $4 \cdot 78$ | I'77 | $4 \cdot 72$ | 1.63 | $4 \cdot 68$ | I. 50 | 4.63 | I 37 | 4.59 | I. 24 | $4 \cdot 55$ |
| 44 | 2.09 | $4 \cdot 85$ | I.93 | $-4.79$ | I.78 | $4 \cdot 73$ | 1.64 | $4 \cdot 67$ | 1.50 | $4 \cdot 63$ | I•36 | $4 \cdot 59$ |
| 46 | $2 \cdot 28$ | 4.93 | $2 \cdot 11$ | 4.86 | I.94 | $4 \cdot 79$ | 1.79 | $4 \cdot 73$ | I. 64 | $4 \cdot 68$ | I. 50 | $4 \cdot 63$ |
| 48 | $2 \cdot 49$ | $5 \cdot 04$ | $2 \cdot 31$ | 4.95 | $2 \cdot 13$ | $4 \cdot 87$ | I.96 | $4 \cdot 80$ | I.80 | $4 \cdot 73$ | I.65 | $4 \cdot 68$ |
| 50 | $-2.74$ | 5•17 | $-2.54$ | $5 \cdot 06$ | $-2.34$ | 4.96 | $-2 \cdot 16$ | 4.88 | - I.98 | 4.80 | - $\mathrm{I} \cdot 8 \mathrm{I}$ | $4 \cdot 74$ |
| 52 | 3.04 | $5 \cdot 33$ | 2.80 | 5.19 | $2 \cdot 58$ | $5 \cdot 08$ | $2 \cdot 38$ | 4.98 | 2-18 | $4 \cdot 89$ | 2.00 | 4.81 |

## LATITUDE $24^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { IO } & 43 \cdot 8 \end{array}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 8 \mathrm{o} \end{gathered}$ | $\begin{aligned} & \text { H. M. S. } \\ & 6 \mathrm{IL} \\ & \hline \end{aligned}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 8 \mathrm{I} \end{gathered}$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & \text { I4 } & 2 \mathrm{I} \cdot \mathrm{O} \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 8_{2} \end{gathered}$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { I6 } & 10.5 \end{array}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 83 \end{gathered}$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I } 8 & 0.6 \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I}: 84 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I9 } & \text { 5I• } \end{array}\right\|$ | $\begin{gathered} s . \\ +r \cdot 86 \end{gathered}$ |
| 10 | $52648 \cdot 3$ | 1.74 | $5 \quad 28 \quad 32 \cdot 4$ | I.73 | 53016.0 | 1.72 | $53159 \cdot 1$ | 1.72 | $53342 \cdot 0$ | I.71 | 535124.5 | I•71 |
| 12 | $\begin{array}{lll}5 & 18 & 2.6\end{array}$ | $1 \cdot 73$ | 5 I9 46.3 | I.72 | 52129.2 | 1.71 | 523 II.6 | 1.70 | $52453 \cdot 5$ | I-69 | $52634 \cdot 8$ | I. 69 |
| 14 | $\begin{array}{lllll}5 & 9 & \text { I } 7 \cdot I\end{array}$ | I•73 | 5 II 0.6 | $1 \cdot 72$ | $51243 \cdot 1$ | $1 \cdot 70$ | $\begin{array}{llll}5 & 14 & 24 \cdot 8\end{array}$ | I. 69 | $\begin{array}{llll}5 & 16 & 5 \cdot 8\end{array}$ | I. 68 | 5 I7 $46 \cdot 1$ | I. 67 |
| 16 | 5 0-31.7 | I•73 | $5 \quad 2 \quad 15.0$ | I-71 | $\begin{array}{lllll}5 & 3 & 57 \cdot 2\end{array}$ | 1.70 | $5 \begin{array}{llll}5 & 5 & 38 \cdot 5\end{array}$ | I.68 | $\begin{array}{llll}5 & 7 & 18.8\end{array}$ | I. 66 | $\begin{array}{llll}5 & 8 & 58 \cdot 2\end{array}$ | I. 65 |
| 18 | 4 5I $46 \cdot 2$ | + 1.73 | $45329 \cdot 6$ | +1.71 | 45511.6 | +1.69 | $45652 \cdot 6$ | +1.67 | $4 \quad 58 \quad 32 \cdot 3$ | + I. 65 | 5 O II.O | +1.64 |
| 20 | $4 \begin{array}{lll}4 & 43 & 0.5\end{array}$ | I•74 | $44444 \cdot 1$ | I•72 | $4 \begin{array}{llll}4 & 46 & 26 \cdot 2\end{array}$ | I. 69 | $4 \begin{array}{lll}48 & 6 \cdot 9\end{array}$ | 1. 66 | $44946 \cdot 3$ | I. 64 | $45124 \cdot 3$ | I. 62 |
| 22 | 43414.5 | I 75 | $435 \quad 58 \cdot 5$ | I•72 | $43740 \cdot 8$ | 1.69 | $43921 \cdot 5$ | 1.66 | 4410.6 | I. 64 | $44238 \cdot \mathrm{I}$ | I.6I |
| 24 | $\begin{array}{llll}4 & 25 & 28 \cdot 0\end{array}$ | I.76 | 42712.5 | I.73 | $428 \quad 55 \cdot 2$ | I. 69 | $43036 \cdot 0$ | 1.66 | $\begin{array}{llll}4 & 32 & 15 \cdot 0\end{array}$ | I. 64 | $43352 \cdot 3$ | I.6I |
| 26 | $41640 \cdot 8$ | 1.78 | 418 26.1 | 1.74 | $420 \quad 9.4$ | 1-70 | $42150 \cdot 5$ | 1.67 | 42329.6 | I 64 | 4256.8 | 1.60 |
| 28 | $\begin{array}{llll}4 & 7 & 52.8\end{array}$ | +1.79 | $4 \quad 9 \quad 39 \cdot 2$ | +1.75 | 4 II 23-1 | +1.71 | $\begin{array}{llll}4 & 13 & 4 \cdot 8\end{array}$ | +1.67 | 4 I4 44* ${ }^{\text {I }}$ | +1.64 | $\begin{array}{llll}4 & 16 & 2 I & 3\end{array}$ | + $\mathrm{I} \cdot 60$ |
| 30 | $\begin{array}{llll}3 & 59 & 3.8\end{array}$ | 1.82 | $4 \quad 051 \cdot 3$ | $1 \cdot 77$ | $\begin{array}{lll}4 & 2 & 36 \cdot 3\end{array}$ | 1.73 | $\begin{array}{llll}4 & 4 & \text { I8.6 }\end{array}$ | 1.68 | $\begin{array}{llll}4 & 5 & 58 \cdot 5\end{array}$ | I. 64 | $47835 \cdot 9$ | I. 60 |
| 32 | 35013.6 | I. 84 | $\begin{array}{lll}3 & 52 & 2.6\end{array}$ | $1 \cdot 79$ | $353148 \cdot 7$ | I•75 | $355132 \cdot 0$ | $1 \cdot 70$ | $\begin{array}{lllll}3 & 57 & 12.5\end{array}$ | I. 65 | $\begin{array}{llll}3 & 58 & 50 \cdot 3\end{array}$ | I.6I |
| 33 | $34548 \cdot 0$ | I. 85 |  | 80 | $3 \begin{array}{lll}3 & 49 & 24 \cdot 6\end{array}$ | I.75 | 35188 | I•7I | $\begin{array}{llll}3 & 52 & 49 & 3\end{array}$ | I. 66 | $\begin{array}{llll}3 & 54 & 27 \cdot 4\end{array}$ | I.6I |
| 34 | 3 41 2I'9 | I.87 |  | I-82 | $\begin{array}{llll}3 & 45 & 0.2\end{array}$ | r.76 | $3 \begin{array}{llll}3 & 46 & 6\end{array}$ | I•71 | $3 \begin{array}{llll}3 & 48 & 26 \cdot 0\end{array}$ | I. 66 | $\begin{array}{llll}3 & 50 & 4.4\end{array}$ | 1 |
| 35 | $\begin{array}{lllll}3 & 36 & 55 \cdot 4\end{array}$ | + 1.89 | $\begin{array}{llllllll}3 & 3^{8} & 47 \cdot 2\end{array}$ | + I .83 | $34035 \cdot 6$ | +1.78 | $34220 \cdot 7$ | +1•72 | $\begin{array}{lll}3 & 44 & 2 \cdot 6\end{array}$ | +I.67 | 3454 I 4 | +1.62 |
| 36 | $\begin{array}{llll}3 & 32 & 28 \cdot 5\end{array}$ | I.91 | $\begin{array}{llll}3 & 34 & 21.3\end{array}$ | I. 85 | $\begin{array}{llll}3 & 36 & 10 \cdot 6\end{array}$ | I.79 | $3 \begin{array}{lllll}3 & 37 & 56 \cdot 4\end{array}$ | 1.73 | $\begin{array}{llll}3 & 39 & 39 \cdot 0\end{array}$ | I. 68 | $\begin{array}{llll}3 & 41 & 18 \cdot 2\end{array}$ | I. 63 |
| 37 | $\begin{array}{llll}3 & 28 & 1 \cdot 0\end{array}$ | I•93 | 329 55:0 | I.87 |  | I.8I | 333 31.9 | I.75 | 3 35 15 | I. 69 | $\begin{array}{llll}3 & 36 & 54.8\end{array}$ | I. 63 |
| 38 | $\begin{array}{lllll}3 & 23 & 33 \cdot 0\end{array}$ | I-95 | $325128 \cdot 2$ | I.89 | $\begin{array}{llllll}3 & 27 & 19.6\end{array}$ | I.82 | $\begin{array}{llll}3 & 29 & 7 \cdot 1\end{array}$ | 1.76 | $33051 \cdot 0$ | I.70 | $3 \begin{array}{llll}3 & 32 & 3 I \cdot 3\end{array}$ | I. 64 |
| 39 | $\begin{array}{llll}3 & 19 & 4.5\end{array}$ | I.98 | 32110 | I.91 | $\begin{array}{llll}3 & 22 & 53.4\end{array}$ | I. 84 | $32442 \cdot 0$ | 1.77 | $\begin{array}{llll}3 & 26 & 26 \cdot 6\end{array}$ | I'71 | $\begin{array}{llll}3 & 28 & 7 \cdot 6\end{array}$ | I.65 |
| 40 | $3 \begin{array}{lll}3 & 14 & 35 \cdot 2\end{array}$ | $+2.01$ | 31633.2 | +1.93 | 33 I8  | + 1.86 | 32016.4 | + I.79 | $\begin{array}{lll}3 & 22 & 2.0\end{array}$ | +1.73 | 32343.6 | + 1.66 |
| 41 | $3105 \cdot 3$ | 2.03 | $\begin{array}{llll}3 & 12 & 4.8\end{array}$ | I.95 | 3131390 | 1.88 | $315 \quad 50 \cdot 5$ | I.8I | $317737 \cdot 0$ | I.74 | $3 \begin{array}{llll}3 & 19 & 19.4\end{array}$ | 1.68 |
| 42 | $\begin{array}{llll}3 & 5 & 34 \cdot 6\end{array}$ | 2.06 | $\begin{array}{llll}3 & 7 & 35.7\end{array}$ | I.98 | $\begin{array}{lll}3 & 9 & 32 \cdot 2\end{array}$ | I.90 | 3 II $24 \cdot 1$ | I.83 | 3 13 11 | 1.76 | $\begin{array}{llll}3 & 14 & 55^{\circ}\end{array}$ | I. 69 |
| 43 | $\begin{array}{lll}3 & 1 & 3 \cdot 1\end{array}$ | 2.09 | $\begin{array}{llll}3 & 3 & 5 \cdot 9\end{array}$ | $2 \cdot 01$ | $\begin{array}{llll}3 & 5 & 4.0\end{array}$ | I.93 | $36657 \cdot 3$ | I. 85 | $3846 \cdot 0$ | $1 \cdot 77$ | 3 IO 30.2 | 1-70 |
|  | $2 \begin{array}{llll}2 & 56 & 30 \cdot 6\end{array}$ | $2 \cdot 12$ | $\begin{array}{lllll}2 & 58 & 35 \cdot 4\end{array}$ | 2.04 | 3 0 35.1 | I•95 | $\begin{array}{llll}3 & 2 & 29 \cdot 8\end{array}$ | 1.87 | $\begin{array}{llll}3 & 4 & 19.8\end{array}$ | I.79 | $\begin{array}{llll}3 & 6 & 5 \cdot 1\end{array}$ | I•72 |
| 45 | $25157 \cdot 2$ | $+2 \cdot 16$ | 254 4.I | $+2.07$ | $2 \begin{array}{lll}26 & 5 \cdot 6\end{array}$ | + I.98 | $2 \begin{array}{lll}58 & 1.9\end{array}$ | + I.90 | 25953.2 | + $\mathrm{I} \cdot 8 \mathrm{I}$ | 3 I 39.5 | +1.73 |
| 46 | $24722 \cdot 7$ | $2 \cdot 20$ | $2493 \mathrm{~F} \cdot 8$ | $2 \cdot 10$ | $25135 \cdot 2$ | $2 \cdot 01$ | $253133 \cdot 2$ | 1.92 | $255 \quad 26 \cdot 0$ | I. 84 | 25713.6 | I•75 |
| 47 | $\begin{array}{lllll}2 & 42 & 47 \cdot 0\end{array}$ | $2 \cdot 24$ |  | $2 \cdot 14$ | $2 \begin{array}{lll}2 & 47 & 4 \cdot 1\end{array}$ | 2.04 | $\begin{array}{llrr}2 & 49 & 3 \cdot 9\end{array}$ | 1.95 | $\begin{array}{lllll}2 & 50 & 58 \cdot 2\end{array}$ | 1.86 | $\begin{array}{lllllll}2 & 52 & 47 \cdot 2\end{array}$ | 1.77 |
| 48 | 2 38 $10 \cdot 1$ <br> 2 33  | $2 \cdot 29$ | $\begin{array}{llll}2 & 40 & 24 \cdot 1\end{array}$ | $2 \cdot 18$ | $2 \begin{array}{llll}2 & 42 & 31.9\end{array}$ | $2 \cdot 08$ | $\begin{array}{llllllllllllll}2 & 44 & 33 \cdot 8\end{array}$ | I.98 | $\begin{array}{llll}2 & 46 & 29 \cdot 8\end{array}$ | I.89 | $\begin{array}{llll}2 & 48 & 20 \cdot 3\end{array}$ | I.80 |
| 49 | $23331 \cdot 7$ | $2 \cdot 34$ | $23548 \cdot 5$ | 2.23 | 23758.8 | $2 \cdot 12$ | $240 \quad 2 \cdot 8$ | 2.02 | $2 \begin{array}{lll}2 & 42 & 0.8\end{array}$ | 1.92 | $24352 \cdot 8$ | I.82 |
| 50 | 228 5I.8 | $+2 \cdot 39$ | $23111 \cdot 6$ | +2.27 | 23324.6 | $+2 \cdot 16$ | $23530 \cdot 9$ | +2.05 | $23730 \cdot 9$ | + $\mathrm{r} \cdot 95$ | 23924.7 | +1.85 |
| 51 | $2 \begin{array}{llll}2 & 24 & 10 \cdot 2\end{array}$ | $2 \cdot 45$ | $2 \begin{array}{lllll}26 & 26 & 3\end{array}$ | $2 \cdot 32$ | $22849 \cdot 1$ | 2.21 | $23058 \cdot 0$ | 2.09 | 233002 | I.98 | $23456 \cdot 0$ | I. 88 |
| 52 | $21926 \cdot 7$ | 2.51 | 2 2I 53.4 | $2 \cdot 38$ | $2 \begin{array}{llll}24 & 12.3\end{array}$ | $2 \cdot 25$ | $2 \begin{array}{llll}26 & 23.9\end{array}$ | $2 \cdot 13$ | $2 \begin{array}{llll}28 & 28 \cdot 5\end{array}$ | 2.02 | $230 \quad 26 \cdot 3$ | I.91 |
| 53 | 2144 I | $2 \cdot 56$ | 21711.6 | $2 \cdot 44$ | 2 I9 $34^{\circ} \mathrm{O}$ | $2 \cdot 31$ | $22148 \cdot 8$ | $2 \cdot 18$ | $\begin{array}{lllll}2 & 23 & 55.8\end{array}$ | $2 \cdot 06$ | $2 \begin{array}{lllll}2 & 25 & 55 \cdot 9\end{array}$ | I.94 |
| 54 | $2953 \cdot 1$ | 2.62 | 21227.9 | 2.51 | 2 I4 54.I | $2 \cdot 37$ | 21711.9 | $2 \cdot 23$ | 21922.0 | 2.10 | $22124 \cdot 5$ | I.98 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | s. $+\quad .51$ | S. -4.40 | s. $+\quad .59$ | S. -4.42 | S. $+\quad .68$ | s. -4.43 | s. $+\quad .76$ | s. -4.44 | s. <br> + <br> .85 | $\begin{gathered} \text { s. } \\ -4.46 \end{gathered}$ | s. $+\quad .93$ | S. $4 \cdot 48$ |
| 2 | . 43 | $4 \cdot 40$ | . 52 | $4 \cdot 41$ | . 61 | 4.42 | - 69 | $4 \cdot 43$ | . 78 | $4 \cdot 45$ | -.86 | $4 \cdot 46$ |
| 4 | $\cdot 37$ | 4.39 | -45 | $4 \cdot 40$ | $\cdot 54$ | 4.41 | -62 | $4 \cdot 42$ | $\cdot 71$ | $4 \cdot 44$ | $\cdot 79$ | 4.45 |
| 6 | $\cdot 30$ | $4 \cdot 39$ | -38 | $4 \cdot 39$ | $\cdot 47$ | $4 \cdot 40$ | $\cdot 55$ | $4 \cdot 4 \mathrm{I}$ | . 64 | $4 \cdot 43$ | $\cdot 72$ | $4 \cdot 44$ |
|  | - 23 | $4 \cdot 38$ | $\cdot 32$ | $4 \cdot 39$ | -40 | 4.40 | -49 | 4.45 | $\cdot 57$ | $4 \cdot 42$ | . 66 | $4 \cdot 43$ |
| 10 | + 16 | $4 \cdot 38$ | + 25 | $4 \cdot 38$ | + 33 | $4 \cdot 39$ | + 42 | $4 \cdot 40$ | + 50 | 4.41 | + 59 | 4.42 |
| 12 | -10 | $4 \cdot 38$ | -18 | $4 \cdot 38$ | . 27 | $4 \cdot 39$ | $\cdot 35$ | $4 \cdot 39$ | $\cdot 44$ | $4 \cdot 40$ | -. 52 | $4 \cdot 41$ |
| 14 | +.03 | $4 \cdot 38$ | -12 | 4.38 | - 20 | $4 \cdot 38$ | -29 | $4 \cdot 39$ | $\cdot 37$ | $4 \cdot 40$ | -46 | $4 \cdot 40$ |
| 16 | -. 04 | $4 \cdot 38$ | +.05 | $4 \cdot 38$ | -13 | $4 \cdot 38$ | -22 | $4 \cdot 38$ | $\cdot 31$ | $4 \cdot 39$ | -39 | 4.40 |
| 18 | - II | $4 \cdot 38$ | - .02 | $4 \cdot 38$ | $\cdot 07$ | $4 \cdot 38$ | -16 | $4 \cdot 38$ | $\cdot 24$ | $4 \cdot 39$ | 33 | $4 \cdot 39$ |
| 20 | - .18 | $4 \cdot 38$ | -.09 | $4 \cdot 38$ | + 00 | $4 \cdot 38$ | + .09 | $4 \cdot 38$ | + -18 | $4 \cdot 38$ | + ${ }^{26}$ | $4 \cdot 39$ |
| 22 | $\cdot 25$ | $4 \cdot 39$ | -16 | $4 \cdot 38$ | $-.07$ | $4 \cdot 38$ | + .02 | $4 \cdot 38$ |  | $4 \cdot 38$ | . 20 | $4 \cdot 38$ |
| 24 | $\cdot 32$ | 4.39 | $\cdot 23$ | 4.38 | $\cdot 14$ | $4 \cdot 38$ | - .05 | 4.38 | + 04 | 4.38 | -13 | $4 \cdot 38$ |
| 26 | -39 | 4.40 | -30 | 4.39 | -21 | $4 \cdot 38$ | - 12 | $4 \cdot 38$ | -.03 | $4 \cdot 38$ | +.07 | 4.38 |
| 28 | -47 | $4 \cdot 40$ | $\cdot 38$ | 4.39 | -28 | $4 \cdot 39$ | -19 | $4 \cdot 38$ | -09 | 4.38 | . 00 | $4 \cdot 38$ |
| 30 | - 55 | 4.41 | - 45 | $4 \cdot 40$ | - 36 | 4.39 | - . 26 | $4 \cdot 39$ | $-17$ | $4 \cdot 38$ | -. 07 | $4 \cdot 38$ |
| 32 | $\cdot 63$ | $4 \cdot 42$ | . 53 | 4.41 | - 43 | $4 \cdot 40$ | $\cdot 33$ | 4.39 | $\cdot 24$ | $4 \cdot 38$ | -14 | $4 \cdot 38$ |
| 34 | $\cdot 72$ | $4 \cdot 44$ | -62 | $4 \cdot 42$ | $\cdot 51$ | $4 \cdot 4 \mathrm{I}$ | -41 | $4 \cdot 40$ | $\cdot 31$ | $4 \cdot 39$ | -21 | $4 \cdot 38$ |
| 36 | -8r | $4 \cdot 45$ | $\cdot 70$ | $4 \cdot 43$ | . 60 | $4 \cdot 42$ | -49 | $4 \cdot 4 \mathrm{I}$ | -39 | 4.40 | -29 | $4 \cdot 39$ |
| 38 | -91 | $4 \cdot 47$ | $\cdot 79$ | 4.45 | -68 | $4 \cdot 43$ | -57 | $4 \cdot 42$ | -47 | $4 \cdot 40$ | -36 | 4.39 |
| 40 | - I .01 | $4 \cdot 49$ | - . 89 | $4 \cdot 47$ | - 78 | 4.45 | -. 66 | $4 \cdot 43$ | - . 55 | 4.4 r | - 44 | $4 \cdot 40$ |
| 42 | I•II | $4 \cdot 52$ | -99 | 4.49 | . 87 | 4.47 | $\cdot 76$ | 4.45 | . 64 | $4 \cdot 42$ | - 53 | 4.41 |
| 44 | $1 \cdot 23$ | 4.55 | I.10 | 4.51 | -98 | 4.49 | - 86 | 4.46 | $\cdot 74$ | $4 \cdot 44$ | . 62 | 4.42 |
| 46 | 1.36 | $4 \cdot 58$ | -1.22 | $4 \cdot 55$ | $\mathrm{I} \cdot 09$ | $4 \cdot 51$ | -96 | $4 \cdot 48$ | $\cdot 84$ | $4 \cdot 46$ | $\cdot 71$ | $4 \cdot 44$ |
| 48 | 1.50 | 4.63 | ${ }^{\text {a }}$ - 35 | 4.58 | I-2I | $4 \cdot 54$ | I.08 | $4 \cdot 51$ | -94 | $4 \cdot 48$ | -81 | 4.45 |
| 50 | -r.65 | $4 \cdot 68$ | -1.50 | 4.63 | - I. 35 | $4 \cdot 58$ | - I 20 |  | - I.06 | $4 \cdot 50$ | -.92 |  |
| 52 | I. 82 | $4 \cdot 74$ | 1.65 | $4 \cdot 68$ | 1.49 | 4.63 | 1-34 | $4 \cdot 58$ | I•19 | $4 \cdot 54$ | 1.04 | $4 \cdot 50$ |
| 54 | 2.02 | $4 \cdot 82$ | r. 83 | $4 \cdot 75$ | r.66 | $4 \cdot 68$ | $\mathbf{r} 49$ | 4.62 | I. 32 | 4.58 | I•17 | $4 \cdot 54$ |

## 100 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $24^{\circ}$.

DECLINATION—SAME NAME AS—LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 2 I & 43.4 \end{array}$ | $\begin{gathered} s . \\ +1.87 \end{gathered}$ | $\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & 23 \end{array} \quad 36 \cdot 0$ | $\begin{gathered} \text { s. } \\ +\mathbf{r} \cdot 88 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 25 & 29 \cdot 6 \end{array}$ | $\begin{gathered} 5 . \\ +I \cdot 90 \end{gathered}$ | $\left\lvert\, \begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 27 & 24 \cdot 4 \end{array}\right.$ | S. | H. M. S. $6 \quad 29 \quad 20 \cdot 4$ | S. | H. M. S. | S. - 06 |
| 10 | $\begin{array}{llll}5 & 37 & 6.9\end{array}$ | I.70 | $53849 \cdot 1$ | I.70 | $54031 \cdot 2$ | 1.70 | $\begin{array}{lllll}5 & 42 & 13 & 4\end{array}$ | 1.70 | (1) $\begin{array}{ccc}5 & 43 & 55 \cdot 6\end{array}$ | I.70 | $\begin{array}{llll}5 & 45 & 38 \cdot 0\end{array}$ | I.71 |
| 12 | $\begin{array}{llll}5 & 28 & 15.8\end{array}$ | r. 68 | $\begin{array}{llll}5 & 29 & 56 \cdot 4\end{array}$ | 1.67 | $\begin{array}{llll}5 & 31 & 36 \cdot 7\end{array}$ | I. 67 | $\begin{array}{lllll}5 & 33 & 16 \cdot 9\end{array}$ | r 67 | 5 $344 \begin{array}{lll}56 \cdot 8\end{array}$ | 1.67 | $53636 \cdot 8$ | I. 66 |
| 14 | 5 I9 25.8 | I. 66 | 5 2I 5.0 | I. 65 |  | I. 64 | $\begin{array}{llll}5 & 24 & 21 \cdot 9\end{array}$ | r. 63 | 5 $225 \begin{array}{llll}59 & 8\end{array}$ | 1.63 | $5 \quad 27 \quad 37 \cdot 4$ | 1.62 |
| 16 | $51036 \cdot 8$ | I. 64 | 51214.6 | I. 63 | 5 13 5 | I.6I | $\begin{array}{llll}5 & 15 & 28 \cdot 4\end{array}$ | I-60 | $\begin{array}{lll}5 & 17 & 4.3\end{array}$ | 1.60 | $\begin{array}{lllllllllllll}5 & 18 & 39.8\end{array}$ | I. 59 |
| 18 | 5 I $48 \cdot 6$ | +1.62 | $\begin{array}{llll}5 & 3 & 25 \cdot 3\end{array}$ | + $\mathrm{I} \cdot 60$ | $5 \quad 5 \mathrm{I} \cdot \mathrm{I}$ | +I.59 | $56636 \cdot 0$ | +1.57 | $\begin{array}{llll}5 & 8 & 10.2\end{array}$ | + I.56 | 943.7 | +I. 55 |
| 20 | $4 \begin{array}{lll}4 & 53 & 1 \cdot 2\end{array}$ | 1.60 | $45436 \cdot 8$ | I. 58 | 456 Ix. 4 | I. 57 | $4 \begin{array}{llll}4 & 57 & 44.9\end{array}$ | I 55 | 459174 | I. 53 | $5 \quad 0 \quad 49 \cdot 0$ | I. 52 |
| 22 | 44414.3 | 5 | $44549 \cdot 1$ | 1.57 | $44722 \cdot 6$ | I. 55 | $44854 \cdot 8$ | I 53 | $45025 \cdot 8$ | I. 50 | 4 5I 55.7 | I 49 |
| 24 | $435 \quad 28 \cdot 0$ | . 58 | $43782 \cdot 1$ | I.56 | $43834 \cdot 5$ | I.53 | $440 \quad 5 \cdot 6$ | I. 50 | 4413512 | I. 48 | $\begin{array}{llll}4 & 43 & 3 \cdot 5\end{array}$ | I.46 |
| 26 | $42642 \cdot 1$ | r.57 | 428 I5.5 | I.55 | $42947 \cdot 3$ | I•5I | 4 3I I7.3 | I 49 | $4 \quad 32 \quad 45 \cdot 6$ | I.46 | $\begin{array}{llll}4 & 34 & 12.4\end{array}$ | I.43 |
| 28 | $4 \begin{array}{llll}4 & 7 & 56 \cdot 4\end{array}$ | + 1.57 | 41929.5 | + I. 53 | 4210.5 | + I.50 | $\begin{array}{llll}4 & 22 & 29 \cdot 6\end{array}$ | +1.47 | $\begin{array}{llll}4 & 23 & 56 \cdot 9\end{array}$ | + I. 44 | $425 \quad 22 \cdot 3$ | +I.4I |
| 30 | 49 Ir.O | I. 56 | 4 10 $43 \cdot 7$ | r.52 | 412143 | I. 49 | $4 \begin{array}{llll}4 & 13 & 42 \cdot 6\end{array}$ | r 45 | $\begin{array}{llll}4 & 15 & 8 \cdot 9\end{array}$ | I. 42 | $4 \begin{array}{lll}46 & 33 \cdot 1\end{array}$ | I 39 |
| 31 | $4 \quad 4 \quad 48 \cdot 3$ | r.56 | $4 \quad 6 \quad 20 \cdot 9$ | I. 52 | $4751 \cdot 3$ | I.48 | $4 \begin{array}{lll}4 & 9 & 19.3\end{array}$ | I 45 | 4 10 $45 \cdot 1$ | I-41 | $\begin{array}{llll}4 & \text { I2 } & 8.8\end{array}$ | -38 |
| 32 | $4 \quad 0 \quad 25 \cdot 5$ | . 57 | 4 I $58 \cdot 2$ | I. 52 | $\begin{array}{lll}4 & 3 & 28 \cdot 4\end{array}$ | I.48 | $4 \quad 4 \quad 56 \cdot 2$ | 4 | $46621 \cdot 6$ | O | $\begin{array}{lllll}4 & 7 & 44 \%\end{array}$ | I. 37 |
| 33 | $\begin{array}{llll}3 & 56 & 2 \cdot 8\end{array}$ | r.57 | $35735 \cdot 5$ | I. 52 | $\begin{array}{llll}3 & 59 & 5 \cdot 5\end{array}$ | I.48 | $4033 \cdot 1$ | $1 \cdot 44$ | 4 I 58.2 | I.40 | $\begin{array}{llll}4 & 3 & 20 \cdot 8\end{array}$ | I 35 |
| 34 | $35140 \cdot 0$ | +1.57 | $\begin{array}{lllll}3 & 53 & 12.7\end{array}$ | +1.52 | $\begin{array}{llllllllllll}3 & 54 & 42 \cdot 8\end{array}$ | +1.48 | $35610 \cdot \mathrm{I}$ | +1.44 | 35754.8 | + I-39 | $3 \begin{array}{lll} & 58 & 57 \cdot 0\end{array}$ | +I.35 |
| 35 | 347 17.2 | I 57 | $34850 \cdot 0$ | 1.52 | $35020 \cdot 0$ | 1.48 | 3 5I 47.2 | I 43 | 35311.6 | r.38 | 35433.4 | I 34 |
| 3 | $\begin{array}{lllll}3 & 42 & 54.3\end{array}$ | I 57 | $34427 \cdot 3$ | r. 52 | $345 \quad 57 \cdot 3$ | I.48 | 34724.4 | 1. | $\begin{array}{lllllllll}3 & 48 & 48 \cdot 6\end{array}$ | I. 38 | 350 ro.0 | I•33 |
| 37 | $\begin{array}{lllll}3 & 38 & 31 \cdot 3\end{array}$ | I.58 | $\begin{array}{llll}3 & 40 & 4 \cdot 5\end{array}$ | I.53 |  | I.47 | $\begin{array}{llll}3 & 43 & \mathrm{r} \cdot 6\end{array}$ | I.42 | $\begin{array}{llll}3 & 44 & 25 \cdot 6\end{array}$ | I.37 | $34546 \cdot 6$ | I. 33 |
| 38 | $\begin{array}{llll}3 & 34 & 8 \cdot 2\end{array}$ | I.58 | $33541 \cdot 6$ | I. 53 | 337 II.8 | I 47 | $\begin{array}{llll}3 & 38 & 38 \cdot 8\end{array}$ | I•42 | $\begin{array}{llll}3 & 40 & 2.7\end{array}$ | I•37 | 34 I 23.4 | I.32 |
| 39 | $\begin{array}{llll}3 & 29 & 45 \cdot 0\end{array}$ | +1.59 | 3 31 18.7 | + I. 53 | $\begin{array}{llll}3 & 32 & 49 \cdot 1\end{array}$ | +I.47 | $\begin{array}{llll}3 & 34 & 16 \cdot 1\end{array}$ | + I. 42 | 3 3135 | +1.37 | $\begin{array}{lll}3 & 37 & 0 \cdot 3\end{array}$ | +I.3I |
| 4 |  | I. 60 | $\begin{array}{llll}3 & 26 & 55 \cdot 7\end{array}$ | I. 54 | $\begin{array}{llll}3 & 28 & 26 \cdot 3\end{array}$ | 1.48 | $\begin{array}{lllll}3 & 29 & 53.4\end{array}$ | I. 42 | $\begin{array}{llll}3 & 31 & 17.0\end{array}$ | 1.37 | $\begin{array}{llll}3 & 32 & 37 \cdot 3\end{array}$ | I.3I |
| 4 | $32058 \cdot 0$ | -6I | $\begin{array}{llll}3 & 22 & 32 \cdot 6\end{array}$ | I. 55 | $\begin{array}{llll}3 & 24 & 3 \cdot 5\end{array}$ | I.48 |  | 1.42 | $\begin{array}{llll}3 & 26 & 54 \cdot 3\end{array}$ | I 36 | 32814.3 | I.30 |
| 42 | $\begin{array}{llll}3 & 16 & 34 \cdot 2\end{array}$ | 62 | $\begin{array}{llll}3 & 18 & 9: 3\end{array}$ | I. 55 | $31940 \cdot 5$ | I.49 | $\begin{array}{llr}3 & 21 & 8 \cdot 0\end{array}$ | I. 42 | $\begin{array}{llll}3 & 22 & 3 I \cdot 5\end{array}$ | I. 36 | $\begin{array}{llll}3 & 23 & 51 \cdot 5\end{array}$ | I.30 |
| 43 | $\begin{array}{lllll}3 & 12 & 10.2\end{array}$ | I. 63 | $\begin{array}{lllllllll}3 & 13 & 45\end{array}$ | I. 56 |  | I. 49 | 3 I6 $45 \cdot \mathrm{I}$ | 1.43 | $\begin{array}{lllll}3 & 18 & 8 \cdot 9\end{array}$ | I.36 | $3 \begin{array}{llll}3 & 19 & 28 \cdot 7\end{array}$ | I. 30 |
| 44 | $3 \begin{array}{llll}3 & 7 & 45.9\end{array}$ | +1.64 | 31922.3 | + I.57 | 3 IO 54.4 | +1.50 | $\begin{array}{llll}3 & 12 & 22 \cdot 3\end{array}$ | + I.43 | $3 \begin{array}{llll}3 & 13 & 46 \cdot 1\end{array}$ | +1.36 | $315 \quad 5 \cdot 9$ | + 1.30 |
| 45 | $\begin{array}{lrrr}3 & 3 & 21 \cdot 3 \\ 2 & 58 & 56\end{array}$ | r.66 | 3 4 $58 \cdot 4$ <br>    | I. 58 | $3{ }^{3} 6631 \cdot I$ | I.5I | 3 7 $59 \cdot 4$ <br>    | I 44 | $\begin{array}{lll}3 & 9 & 23.4\end{array}$ | I. 36 | 3 10 $43 \cdot 2$ | I. 29 |
| 4 |  | 1.67 | 3 O $34 \cdot 3$ | r. 59 | $\begin{array}{llll}3 & 2 & 7 \cdot 6\end{array}$ | I.52 | $\begin{array}{llll}3 & 3 & 36 \cdot 4\end{array}$ | I•44 | $\begin{array}{llll}3 & 5 & 0.6\end{array}$ | 1.37 | $\begin{array}{llll}3 & 6 & 20 \cdot 5\end{array}$ | I-29 |
| 47 | $2543 \mathrm{I} \cdot \mathrm{I}$ | 1.69 | $25610 \cdot 0$ | I.6I | 25744.0 | I. 53 | $2 \begin{array}{llll}2 & 59 & 13 \cdot 2\end{array}$ | I. 45 | $3 \begin{array}{lll}3 & 0 & 37.8\end{array}$ | I. 37 | $\begin{array}{lllll}3 & 1 & 57 \cdot 7\end{array}$ | r. 29 |
| 4 | $\begin{array}{llll}2 & 50 & 5 \cdot 4\end{array}$ | I.71 | $25145 \cdot 3$ | I. 62 | 253 20.1 | I.54 | $25449 \cdot 9$ | I.46 | $2 \begin{array}{llll}26 & 14.9\end{array}$ | I.38 | $25735 \cdot 0$ | I 30 |
| 49 | $24539 \cdot 3$ | +1.73 | $24720 \cdot 3$ | +1.6 | $24856 \cdot 0$ | +1.55 | $2 \begin{array}{llll}2 & 50 & 26 \cdot 4\end{array}$ | +r.46 | $2 \begin{array}{llll}2 & 51 & 5 \cdot 8\end{array}$ | +I.38 | $2 \begin{array}{llll}23 & 12 \cdot 3\end{array}$ | +1.30 |
| 5 | $\begin{array}{llll}2 & 41 & 12.7\end{array}$ | 1.75 | $\begin{array}{llll}2 & 42 & 54.9\end{array}$ | I. 66 | $2 \begin{array}{llll}2 & 44 & 31.5\end{array}$ | r.57 | $\begin{array}{lll}2 & 46 & 2 \cdot 8 \\ 2 & 41\end{array}$ | 1.48 | $\begin{array}{llll}2 & 47 & 28 \cdot 7\end{array}$ | r.39 | $2 \begin{array}{llll}2 & 48 & 49 \cdot 4\end{array}$ | I.30 |
| 51 | $23645 \cdot 5$ | 1.77 | $238 \quad 29 \cdot 0$ | 1.68 | 24068 | I•58 | 24138.9 | I.49 | $\begin{array}{lll}2 & 43 & 5 \cdot 4\end{array}$ | 1.40 | $244 \quad 26 \cdot 6$ | I.31 |
| 52 | 22 32 17 | .80 | $\begin{array}{llll}2 & 34 & 2 \cdot 7\end{array}$ | $1 \cdot 70$ | $23541 \cdot 7$ | 60 | $\begin{array}{llllll}2 & 37 & 14.7\end{array}$ | I. 50 | $\begin{array}{lllll}2 & 38 & 42 \cdot 0\end{array}$ | 1.41 | 240 | $1 \cdot 31$ |
| 53 | 22749.2 | I.83 | $22935 \cdot 8$ | I*72 | $23116 \cdot 2$ | I.62 | $2 \begin{array}{llll}2 & 32 & 50 \cdot 3\end{array}$ | I.52 | $2 \begin{array}{llll}2 & 34 & 18 \cdot 3\end{array}$ | I. 42 | $23540 \cdot 5$ | I. 32 |
| 54 | 223 I9.9 | +1.87 | $\begin{array}{llll}2 & 25 & 8 \cdot 4\end{array}$ | + $1 \cdot 75$ | $22650 \cdot 2$ | +1.64 | $\begin{array}{llll}2 & 28 & 25.4\end{array}$ | + I. 53 | 22954.4 | + I. 43 | 23117.2 | + I. 33 |
| 55 | $\begin{array}{llll}2 & 18 & 49.4 \\ 2 & 18\end{array}$ | I 90 | $22040 \cdot 2$ | I•79 | $\begin{array}{llll}2 & 22 & 23 \cdot 7\end{array}$ | 1.67 | $\begin{array}{lll}2 & 24 & 0 \cdot 3 \\ 2 & \end{array}$ | I. 55 | $\begin{array}{llll}2 & 25 & 30 \cdot 2\end{array}$ | I. 45 | $2 \begin{array}{llll}26 & 53 \cdot 8\end{array}$ | I•34 |
| 56 | 2 14 18.8 <br> 2   | I.94 | 2 I6 II•3 | I.8I | 2 I7 56.5 | I. 69 | $21934 \cdot 7$ | I. 58 | $2 \begin{array}{lll}21 & 518\end{array}$ | I. 46 | $22230 \cdot 2$ | $1 \cdot 35$ |
| 57 58 | $\begin{array}{llll}2 & 9 & 46 \cdot 7\end{array}$ | I•99 | 2 II $4 \mathrm{I} \cdot 6$ | 1.85 | $2 \begin{array}{llll}2 & 13 & 28 \cdot 8\end{array}$ | $1 \cdot 72$ | $\begin{array}{llll}2 & 15 & 8 \cdot 5\end{array}$ | 1.60 | 2 I6 4I'0 | 1.48 | $2 \begin{array}{lll}2 & 18 & 6 \cdot 3\end{array}$ | r.36 |
| 58 | $\begin{array}{llll}2 & 5 & 13.4\end{array}$ | 2.03 | 27 II.O | r.89 | $\begin{array}{lll}2 & 9 & 0.3\end{array}$ | r.76 | $21041 \cdot 9$ | r.63 | $21215 \% 7$ | 1.50 | $21342 \cdot 2$ | I•38 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.


DECLINATION-SAME NAME AS-LATITUDE.


DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{\circ}{\circ}$ | $\begin{array}{ccc} \text { H. } & \text { M. } & \text { s. } \\ 6 & 0 & 0.0 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{r} .86 \end{gathered}$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 5 \mathrm{I} \cdot 9 \end{array}$ | $\begin{gathered} s . \\ +\mathrm{r} \cdot 87 \end{gathered}$ | $\begin{array}{\|lrc} \text { H. M. } & \text { S. } \\ 6 & 3 & 43 \cdot 9 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} .87 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 5 & 36 \cdot I \mid \end{array}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} .87 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. } & \text { M. } & \text { S. } \\ 6 & 7 & 28 \cdot 4 \end{array}\right.$ | $\begin{gathered} 5 \\ +\mathbf{r} .88 \end{gathered}$ | $\begin{array}{\|lrc} \text { H. M. } & \text { S. } \\ 6 & 9 & 2 I \cdot 2 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 88 \end{gathered}$ |
| 10 | $51549 \cdot 0$ | I-90 |  | I. 88 | 5 r9 $35 \cdot 1$ | 1.87 | $\begin{array}{llll}5 & 21 & 26.9\end{array}$ | I.85 | $\begin{array}{lllll}5 & 23 & 17 & 9\end{array}$ | I. 84 | $\begin{array}{llll}5 & 25 & 8 \cdot 2\end{array}$ | I. 83 |
| 12 | $\begin{array}{llll}5 & 6 & 57 \cdot 1\end{array}$ | I 92 | $\begin{array}{llll}5 & 8 & 51 \cdot 5\end{array}$ | I.90 | 5 Io 44.8 | I. 88 | $51237 \cdot 0$ | 1.86 | $\begin{array}{lllll}5 & 14 & 28 \cdot 2\end{array}$ | I. 84 | 5 I6 18.5 | I. 83 |
| 14 | $\begin{array}{llll}4 & 58 & 4.4\end{array}$ | I 93 | $45959 \cdot 8$ | I.91 | 5 I 53.9 | I.89 | $\begin{array}{llll}5 & 3 & 46 \cdot 7\end{array}$ | 1.87 | $5{ }_{5}^{5} 5$ | I. 85 |  | I. 83 |
| 16 | 449 10.6 | I.96 | $4 \begin{array}{llll} & 51 & 7 \cdot 2\end{array}$ | 1.93 | $\begin{array}{llll}4 & 53 & 2 \cdot 3\end{array}$ | I.90 | $45456 \cdot 0$ | I. 88 | $4 \begin{array}{llll}4 & 56 & 48 \cdot 2\end{array}$ | I.86 | $4 \begin{array}{llll} & 58 & 39 \cdot 1\end{array}$ | I. 84 |
| 18 | 440 I5.5 | + I.98 | 442 I3.5 | +1.95 | $444 \quad 9 \cdot 9$ | + I.92 | 4464.5 | +1.89 | $44757 \cdot 5$ | +1.87 | 449 49*0 | I.84 |
| 20 | $43118 \cdot 9$ | 2.01 | 43318.6 | I. 98 | $\begin{array}{llll}4 & 35 & 16.4\end{array}$ | I. 94 | 43712.2 | I.91 | 43962 | I. 89 | 44058.4 | I. 85 |
| 22 | $42220 \cdot 5$ | $2 \cdot 05$ | $42422 \cdot 3$ | 2. | $42621 \cdot 7$ | I.97 | 42819.0 | I.93 | 430 I4.I | I.90 | $\begin{array}{llll}4 & 32 & 7 \cdot 3\end{array}$ | x.87 |
| 24 | $413 \quad 20 \cdot 2$ | $2 \cdot 09$ | 4 I5 24.1 | $2 \cdot 04$ | 4 17 25.5 | 2.00 | $4 \begin{array}{lll}4 & 19 & 24.4\end{array}$ | I.96 | $42121 \cdot 0$ | I.92 | $\begin{array}{lll}4 & 23 & 15 \cdot 3\end{array}$ | r.89 |
| 26 | $4 \begin{array}{llll}4 & 4 & 17 \cdot 6\end{array}$ | $2 \cdot 13$ | $4 \quad 6 \quad 24.0$ | $2 \cdot 08$ | 48827.5 | $2 \cdot 04$ | 4 10 $28 \cdot 4$ | I. 99 | $4 \begin{array}{llll}4 & 12 & 26 \cdot 6\end{array}$ | 1.95 | $\begin{array}{llll}4 & 14 & 22.4\end{array}$ | I.91 |
| 27 | $35945 \cdot 3$ | $+2 \cdot 16$ | 4 I 53.1 | $+2 \cdot 10$ | $4 \quad 3 \quad 57.9$ | $+2.06$ | $\begin{array}{llll}4 & 5 & 59 \cdot 8\end{array}$ | +2.01 | $4759{ }^{\circ}$ | +1.96 | $4 \quad 9 \quad 55.5$ | I•92 |
| 28 | $355512 \cdot 3$ | 2.18 | 35721.6 | $2 \cdot 13$ | $\begin{array}{llll}3 & 59 & 27 \cdot 6\end{array}$ | 2.07 | 4 I $30 \cdot 7$ | $2 \cdot 02$ | $4 \quad 3 \quad 30 \cdot 8$ | 1.98 | $4 \quad 5 \quad 28 \cdot 2$ | I.93 |
| 29 | $355038 \cdot 6$ | $2 \cdot 21$ | 352494 | $2 \cdot 15$ | $\begin{array}{llll}3 & 54 & 56.8\end{array}$ | O | 3 57 $\mathrm{I} \cdot \mathrm{I}$ | $2 \cdot 05$ | $\begin{array}{lrrr}3 & 59 & 2 \cdot 3\end{array}$ | $2 \cdot 00$ | 1 1 0.7 <br>  56 32.7 | r.95 |
| 30 | $\begin{array}{llll}3 & 46 & 4 \cdot 1\end{array}$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 48 & 16 \cdot 4\end{array}$ | 2.18 | 35025.4 | $2 \cdot 12$ | $3523 \mathrm{I} \cdot \mathrm{o}$ | $2 \cdot 07$ | $\begin{array}{lllll}3 & 54 & 33 \cdot 3\end{array}$ | 2.01 | $35632 \cdot 7$ | r.96 |
| 3 | $34128 \cdot 7$ | $2 \cdot 2$ | $\begin{array}{lllll}3 & 43 & 42 \cdot 8\end{array}$ | $2 \cdot 20$ | $\begin{array}{lllll}3 & 45 & 53\end{array}$ | $2 \cdot 13$ | $\begin{array}{llll}3 & 48 & 0.2\end{array}$ | 2.08 | 350 | $2 \cdot 03$ | $\begin{array}{llll}3 & 52 & 4 * 3\end{array}$ | I•98 |
| 32 | $3{ }_{3}^{3} 3652 \cdot 3$ | +2.30 | $\begin{array}{llll}3 & 39 & 8 \cdot 3\end{array}$ | +2.23 | $34120 \cdot 4$ | +2.17 | $\begin{array}{llll}3 & 43 & 28 \cdot 9\end{array}$ | +2.II | $3 \begin{array}{llll}3 & 45 & 33 \cdot 8\end{array}$ | $+2.05$ | 34735.4 | $+2.00$ |
| 33 | $33^{32} 15 \cdot 0$ | $2 \cdot 33$ | $\begin{array}{llll}3 & 34 & 32 \cdot 9\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}3 & 36 & 46 \cdot 8\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}3 & 38 & 56 \cdot 9\end{array}$ | $2 \cdot 13$ | 34103.2 | $2 \cdot 07$ | $\begin{array}{llll}3 & 43 & 6 \cdot 0\end{array}$ | $2 \cdot 02$ |
| 34 | $\begin{array}{llll}3 & 27 & 36 \cdot 6\end{array}$ | $2 \cdot 37$ | $\begin{array}{llll}3 & 29 & 56 \cdot 6\end{array}$ | $2 \cdot 30$ | $\begin{array}{lll}3 & 32 & 12.4\end{array}$ | $2 \cdot 23$ | 3 34 $24 \cdot 1$ | $2 \cdot 16$ | $\begin{array}{llll}3 & 36 & 32 \cdot 0\end{array}$ | $2 \cdot 10$ | 3 $33^{8}$ 36-1 | $2 \cdot 04$ |
| 35 | $\begin{array}{lllll}3 & 22 & 57 \cdot 0\end{array}$ | 2.41 | 32519.3 | $2 \cdot 33$ | $\begin{array}{llllll}3 & 27 & 37 \cdot 1\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}3 & 29 & 50 \cdot 6\end{array}$ | $2 \cdot 19$ | $\begin{array}{lll}3 & 32 & 0 \cdot 1\end{array}$ | $2 \cdot 13$ | $\begin{array}{lll}3 & 34 & 5 \cdot 6\end{array}$ | 2.06 |
| 36 | 318 16.2 | 2.45 | $32040 \cdot 8$ | $2 \cdot 37$ | $\begin{array}{lll}3 & 23 & 0.8\end{array}$ | 2.29 | $\begin{array}{llll}3 & 25 & 16 \cdot 2\end{array}$ | $2 \cdot 22$ | $3 \begin{array}{llll}3 & 27 & 27 \cdot 4\end{array}$ | 2.15 | $32934 \cdot 5$ | 2.08 |
| 37 | $\begin{array}{llll}3 & 13 & 34 \cdot 1\end{array}$ | +2.49 | $\begin{array}{lll}3 & 16 & 1 \cdot 2\end{array}$ | +2.41 | $\begin{array}{llll}3 & 18 & 23 \cdot 4\end{array}$ | $+2 \cdot 33$ | $32041 \cdot 0$ | +2.25 | $32254{ }^{\circ} \mathrm{O}$ | +2.18 | $\begin{array}{llll}3 & 25 & 2 \cdot 7\end{array}$ | $+2.11$ |
| 38 | $\begin{array}{llll}3 & 8 & 50 \cdot 5\end{array}$ | $2 \cdot 54$ | 3 II $20 \cdot 3$ | 2.45 | $31345 \cdot 0$ | $2 \cdot 37$ | $\begin{array}{llll}3 & 16 & 4 \cdot \%\end{array}$ | $2 \cdot 29$ | $\begin{array}{llll}3 & 18 & 19.7\end{array}$ | $2 \cdot 21$ | $32030 \cdot 1$ | $2 \cdot 14$ |
| 39 | $\begin{array}{llll}3 & 4 & 5 \cdot 3\end{array}$ | 2.59 | $\begin{array}{llll}3 & 6 & 38 \cdot 0\end{array}$ | $2 \cdot 50$ | $\begin{array}{lll}3 & 9 & 5 \cdot 3\end{array}$ | 2.41 | 3 II $27 \cdot 3$ | $2 \cdot 33$ | $\begin{array}{llll}3 & 13 & 44.4\end{array}$ | 2.24 | $\begin{array}{llll}3 & 15 & 56 \cdot 8\end{array}$ | $2 \cdot 17$ |
| 4 I | $\begin{array}{llll}2 & 59 & 18 \cdot 5 \\ 2 & 54 & 29.8\end{array}$ | 2.64 | $\begin{array}{lrrr}3 & 1 & 54.3\end{array}$ | 2.55 | 3 $31424 \cdot 3$ | 2.46 | $\left\lvert\, \begin{array}{lll}3 & 6 & 48 \cdot 8\end{array}\right.$ | $2 \cdot 36$ | $\begin{array}{llr}3 & 9 & 8 \cdot 2\end{array}$ | $2 \cdot 28$ | 3 II 22.6 | $2 \cdot 20$ |
| 41 | $25429 \cdot 8$ | $2 \cdot 70$ | $2 \begin{array}{llll}2 & 57 & 8 \cdot 9\end{array}$ | 2.60 | $25941 \cdot 9$ | 2.50 | $\begin{array}{llll}3 & 2 & 9 \cdot 1\end{array}$ | 2.41 | $\begin{array}{llll}3 & 4 & 30 \cdot 9\end{array}$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 6 & 47 \cdot 4\end{array}$ | $2 \cdot 23$ |
| 42 | $2 \begin{array}{lll}2 & 49 & 39 \cdot 1\end{array}$ | $+2 \cdot 76$ | $25221 \cdot y$ | $+2.66$ | $\begin{array}{lllll}2 & 54 & 57 \cdot 9\end{array}$ | +2.55 | $\begin{array}{llll}2 & 57 & 28 \cdot 0\end{array}$ | +2.45 | $25952 \cdot 3$ | $+2 \cdot 36$ | $\begin{array}{\|ccc\|}3 & 2 & I X \cdot 2\end{array}$ | $+2.27$ |
| 43 | $24446 \cdot 2$ | 2.83 | 24732.6 | $2 \cdot 72$ | $25012 \cdot 2$ | 2.61 | $25245 \cdot 5$ | 2.50 | 25512.6 | $2 \cdot 40$ | 25733.9 | $2 \cdot 3 \mathrm{I}$ |
| 44 | $\begin{array}{llll}2 & 39 & 50 \cdot 9\end{array}$ | 2.91 | 24241.4 | $2 \cdot 78$ | 245124.7 | 2.66 | $\begin{array}{llll}2 & 48 & 1 \cdot 2\end{array}$ | 2.56 | 25031.4 | 2.45 | $\begin{array}{lllll}2 & 52 & 55 \cdot 4\end{array}$ | $2 \cdot 35$ |
| 45 | $1 \begin{array}{llll}2 & 34 & 52 \cdot 9\end{array}$ | 2.98 | 23747.8 | 2.85 | 240 | $2 \cdot 73$ | $\begin{array}{llll}2 & 43 & 15.3\end{array}$ | 2.6 I | $2 \begin{array}{llllll}2 & 45 & 48 \cdot 6\end{array}$ | 2.50 | $\begin{array}{lllll}2 & 48 & 15 \cdot 5\end{array}$ | 2.40 |
| 46 | $22952 \cdot 1$ | 3.07 | $23251 \cdot 8$ | 2.93 | $23543 \cdot 4$ | 2.80 | $\begin{array}{lllll}2 & 38 & 27 \cdot 4\end{array}$ | 2.67 | 24104 | $2 \cdot 56$ | 243 34.2 | 2.45 |
| 47 | 2244840 | $+3 \cdot 16$ | 22753.0 | $+3.01$ | 23049.3 | +2.87 | $23337 \cdot 4$ | +2.74 | $23618 \cdot 0$ | $+2.62$ | $23^{88} 515$ | +2.50 |
| 48 | 2194040 | $3 \cdot 26$ | $22251 \cdot 0$ | $3 \cdot 10$ | 22552.4 | 2.95 | $22845 \cdot 1$ | 2.81 | 2318129 | $2 \cdot 68$ | $2346 \cdot 7$ | $2 \cdot 56$ |
| 49 | $\begin{array}{llll}214 & 14 & 28 \cdot 7\end{array}$ | $3 \cdot 36$ | 2 I7 45.6 | 3.20 | 22052.6 | 3.04 | $\begin{array}{llll}2 & 23 & 50 \cdot 2\end{array}$ | $2 \cdot 89$ | $\begin{array}{llll}2 & 26 & 39 \cdot 2\end{array}$ | 2.75 | $2 \begin{array}{llll}2 & 29 & 20 \cdot 1\end{array}$ | 2.62 |
| 50 | $\begin{array}{llll}2 & 9 & 12 \cdot 7\end{array}$ | 3.48 | 2 I2 $236 \cdot 4$ | $3 \cdot 31$ | $215549: 4$ | $3 \cdot 13$ | $\begin{array}{llll}2 & 18 & 52 \cdot 5\end{array}$ | 2.97 | $2 \begin{array}{lll}2 & 21 & 46 \cdot 3\end{array}$ | 2.82 | $\begin{array}{llll}2 & 24 & 31 \cdot 5\end{array}$ | $2 \cdot 69$ |
| 51 | $2351 \cdot 5$ | $3 \cdot 60$ | 2722.9 | $3 \cdot 43$ | $21042 \cdot 6$ | $3 \cdot 24$ | $21351 \cdot 6$ | 3.07 | 2 I6 50.6 | $2 \cdot 9 \mathrm{I}$ | $21940 \cdot 5$ | $2 \cdot 76$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | $1^{\circ}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. 5 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | oo | $\stackrel{\text { S. }}{4.4 \mathrm{I}}$ | ${ }_{+}^{\text {s.o8 }}$ |  | $+^{\text {S. }}$ + ${ }_{7}$ |  | + ${ }^{\text {S. }}$. ${ }^{\text {¢ }}$ | $\stackrel{\text { s. }}{4.42}$ | + ${ }_{\text {s. }} \times$ |  | + ${ }^{\text {s. }}$ | $\stackrel{\text { s. }}{4 \cdot 43}$ |
| 4 |  | +4.42 | + 06 | ${ }_{\text {4.41 }}^{4.4}$ | $\begin{array}{r}\text { + } 10 \\ +.03 \\ \hline\end{array}$ | ${ }_{4}^{4.4 \mathrm{I}^{4}}$ |  | ${ }_{4 \cdot 41}^{4.42}$ | - 27 | ${ }_{4 \cdot 42}^{4.42}$ | . 38 | +4.43 |
| ¢ | . 21 | ${ }_{4 \cdot 42}^{4.42}$ | - ${ }^{-13}$ | ${ }_{4}^{4.42}$ | + 0.05 | ${ }_{44}^{4.41}$ | $\begin{array}{r}\text {.11 } \\ +\quad 04 \\ \hline\end{array}$ | ${ }_{4}^{4} 4.4 \mathrm{Tr}$ | + +13 | ${ }_{4 \cdot 4 \mathrm{ta}}^{4.42}$ | . 21 | ${ }_{4 \cdot 42}^{4.42}$ |
|  | $\cdot 29$ | $4 \cdot 42$ |  | 4.42 |  | $4{ }^{41}$ | - 03 | $4 \cdot 4 \mathrm{I}$ | + 05 | ${ }^{4 \cdot 4 \mathrm{I}}$ | I4 | ${ }^{4 \cdot 42}$ |
| 10 | - ${ }^{36}$ | ${ }_{4.44}^{4.43}$ | $\begin{array}{r}\text { - } 28 \\ -35 \\ \hline\end{array}$ | ${ }_{4.43}^{4.42}$ | - $\begin{array}{r}\text { - } 29 \\ -26\end{array}$ | ${ }_{4 \cdot 42}^{4.42}$ | - ${ }_{\text {- } 18}$ | ${ }_{4 \cdot 42}^{4.42}$ | - 0.02 | ${ }_{4 \cdot 4 \mathrm{II}}^{4}$ | + +0 | ${ }_{4 \cdot 4 \mathrm{~s}}^{4 \cdot 4 \mathrm{~L}}$ |
| 148 | . 52 | ${ }_{4}^{4.44}$ | \% .45 .58 | 4.4.3 | $\begin{array}{r}34 \\ .42 \\ \hline 4\end{array}$ | ${ }_{4}^{4.43}$ | .25 | ${ }_{4 \cdot 43}^{4.42}$ | ${ }_{\cdot} \cdot 16$ | ${ }_{4 \cdot 42}^{4.42}$ |  | ${ }_{4}^{4} 4.42$ |
| ${ }_{18}$ | -68 | ${ }_{446}^{445}$ | . 58 | ${ }_{4}^{4.45}$ | 42 <br> .49 | ${ }_{4}^{444}$ | .33 40 | ${ }_{4}^{443}$ | - ${ }^{24}$ | ${ }_{4}^{4} 42$ | 15 22 | ${ }_{4 \cdot 42}^{4 \cdot 42}$ |
| 20 22 2 | - ${ }^{76}$ | ${ }_{4}^{4.48}$ | - 67 | ${ }_{4}^{4.46}$ | -. 67 | ${ }_{4 \cdot 45}^{4.45}$ | - ${ }^{.48}$ | ${ }_{4}^{4} 4.45$ | - 39 | ${ }_{4 \cdot 44}^{4.43}$ | $\begin{array}{r}\text { - } \\ -\quad 30 \\ \hline\end{array}$ | ${ }_{4}^{4.42}$ |
| 22 24 26 26 | - 94 | ${ }_{4.55}^{4.49}$ | . 84 | ${ }_{4}^{4.49}$ | . 78 | ${ }_{4}^{448}$ | . 64 | ${ }_{4}^{4446}$ | . 55 | ${ }_{4}^{445}$ | - 36 | ${ }_{4}^{4.44}$ |
| 26 <br> 28 <br> 28 |  | ${ }_{4 \cdot 56}^{4.53}$ |  | ${ }_{4.53}^{4.51}$ | .83 .92 | ${ }_{4}^{4.49}$ | $\begin{array}{r}73 \\ .8 \\ \hline\end{array}$ | ${ }_{4}^{4} 49$ | . 72 | ${ }_{4}^{4} 474$ | . 54 | ${ }_{4}^{4 \cdot 45}$ |
| 30 32 32 | ${ }_{-}^{1} \mathrm{I} \cdot 23$ | ${ }_{4}^{4.58}$ | -r.13 | 4.55 | -1.02 | 4.55 | r.9x | ${ }_{4}^{4.50}$ | -. 82 | ${ }_{4}^{4.48}$ | - 8 Fr | ${ }_{4}^{4.48}$ |
| ( 32 | IT46 | ${ }_{4}^{4 \cdot 65}$ |  | + 4.65 | (1.23 | 4.58 4.51 4.65 | ¢ | 4.53 <br> 4.58 <br> 4.85 | $\xrightarrow{\text { r.ood }}$ | + 4.53 | . 89 | ${ }_{4}^{4.50}$ |
| -36 ${ }_{38}$ | I. 1.59 | ${ }_{4}^{4.69}$ |  | ${ }_{4 \cdot 69}^{4.65}$ |  | ${ }_{4}^{4.65}$ | ${ }^{1} 34$ | ${ }_{4.58}^{4.58}$ | ${ }_{1}^{\text {I. } 22}$ | ${ }_{4.58}^{4.55}$ | r. 9.9 | ${ }_{4.55}^{4.52}$ |
| ${ }_{4}^{40}$ | ${ }_{-1.88}$ | 4.80 | ${ }_{-1}^{1.73}$ |  | $\xrightarrow{\text { r. }} 1.75$ | 4.69 | -1.47 | ${ }_{4}^{4.65}$ | ${ }_{\text {r }}$ | ${ }_{4}^{4.65}$ | -1.22 | ${ }_{4}^{4.58}$ |
| ${ }_{44}^{42}$ | ${ }^{2.04}$ | ${ }_{4.94}^{4.86}$ | ${ }_{\text {I }}^{1.89}$ | ${ }_{4.87}^{4.80}$ | $\underset{\mathrm{r}}{1.75}$ | ${ }_{4 \cdot 81}^{4.75}$ | ${ }_{\substack{1.78 \\ 1.76}}$ |  | +1.47 | ${ }_{4}^{4} 760$ | (1.34 | ${ }_{4} \cdot 65$ |
| ${ }_{48}^{46}$ | 2.44 |  | ${ }^{2 \cdot 26}$ | ${ }_{5}^{4.96}$ | - | ${ }^{4.88}$ | \% | ${ }_{4}^{4.82}$ | $\xrightarrow{1.77}$ | ${ }_{4}^{4} 82$ |  | ${ }_{4}^{4.760}$ |
| ${ }_{50}$ | 2.95 | ${ }_{5 \cdot 31}$ | ${ }^{2.73}$ | ${ }_{5 \cdot 19}$ | $2 \cdot 29$ | ${ }_{5.98}^{4}$ | ${ }_{2 \cdot 33}$ | ${ }_{4}^{4.99}$ | r-94 | 4.90 | r.96 | ${ }_{4} \cdot 83$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 103 LATITUDE $25^{\circ}$.

DECLINATION—SAME NAME AS—LATITUDE.

| True Alt. | 6 | Decl. Var. | $7^{\circ}$ | Decl. | $8^{\circ}$ |  | $9^{\circ}$ |  | $10^{\circ}$ | Decl. | $11^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. M. <br> 6 II I | $+r \cdot 8$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I3 } & 7.8 \end{array}$ | $+1 \cdot 90$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I5 } & \text { I. } 8 \end{array}\right.$ | $+\mathbf{I} \cdot 9$ | $\left\lvert\, \begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & \text { I } 6 & 56 \cdot 5 \end{array}\right.$ | $+1 \cdot 92$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I8 } & 5 \mathrm{I} \cdot 9 \end{array}$ | $3$ | $\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & 20 \end{array} 4_{8 \cdot I}$ |  |
| Io | 5265 | I. 82 | $52347 \cdot 0$ | I.81 | $53035 \cdot 7$ | I.8 | $532 \quad 24 \cdot 0$ | I.8 | $\begin{array}{lllll}5 & 34 & 12.0\end{array}$ | 1.80 | $5 \quad 35 \quad 59 \cdot 7$ | 79 |
| 12 | 518 | 82 | $\begin{array}{llll}5 & 19 & 56.8\end{array}$ | I | 521450 |  | 52332 | 79 | 5251 |  | 52760 | 77 |
|  | $5 \quad 918$. | 82 | 5 II $7 \cdot 0$ | \% | 51254.7 |  | $51441 \cdot 6$ |  | 5 16 27.8 | 6 | $\begin{array}{lllll}5 & 18 & 13.2\end{array}$ | 4 |
|  | $5 \quad 0 \quad 28 \cdot 8$ |  | $\begin{array}{llll}5 & 2 & 1773\end{array}$ |  | $\begin{array}{llll}5 & 4 & 4 \cdot 7\end{array}$ | 1.78 | $\begin{array}{llll}5 & 5 & 5 I \cdot 2\end{array}$ | I' | $\begin{array}{llll}5 & 7 & 36 \cdot 7\end{array}$ | 1.75 | $\begin{array}{llll}5 & 9 & 21 \cdot 3\end{array}$ | 74 |
|  | $45 \mathrm{I} 39 \cdot 0$ | + | $4 \quad 53 \quad 27 \cdot 7$ | + 1 | 45515.0 | +1 | 457 I.2 | +ェ・ク | $458 \quad 46 \cdot 2$ | +1.74 | 5 O 30.1 | + $\mathrm{I} \cdot 72$ |
|  | 442 |  | 44438 | I.80 | 4462 | I•78 | 448 II. 4 |  | 449 56•I |  | $45139 \cdot 4$ | I |
| 22 | 43358 |  | $43548 \cdot 0$ |  | 43735 |  | 439 | I•75 | 44 I ¢ 3 | - 73 | $44249 \cdot 2$ | O |
|  | $\begin{array}{llll}4 & 25 & 7 \cdot 5\end{array}$ | x.85 | $\begin{array}{llll}4 & 26 & 57 \cdot 6\end{array}$ | 82 | $42845 \cdot 8$ | 8 | 430 |  | $43216 \cdot 6$ |  | 433 59. |  |
| 26 | $4 \begin{array}{llll}4 & 15 \cdot 7\end{array}$ |  | $4 \begin{array}{lll}48 & 6 \cdot 7\end{array}$ |  | $4 \begin{array}{llllllll}4 & 55\end{array}$ | I' | $42142 \cdot 3$ | r 76 | 42327.0 | I•73 | $425 \quad 9 \cdot 7$ |  |
|  | 472 | + | 9 I |  | 4 II $4 \cdot 8$ | + I | $41252 \cdot 2$ | + I. | $4 \begin{array}{llll}4 & 37 \cdot 2\end{array}$ | + I.73 | $41620 \cdot 0$ | -69 |
|  | $3 \quad 58$ |  | 402 | 8 | 421 | I. | 44 |  | 45 | I•74 | 47 | . 69 |
| 32 | $3 \begin{array}{llll}3 & 49 & 33\end{array}$ |  | $\begin{array}{lllllllllllllll}3 & 51 & 28 \cdot 9\end{array}$ |  | 353 |  | $\begin{array}{llll}3 & 55 & 10 \cdot 3\end{array}$ |  | 3565 |  | $35840 \cdot 4$ | 71 |
| 33 | 3455 |  | $\begin{array}{llll}3 & 47 & 1 & 5\end{array}$ | I'91 | 348 | -86 | 3504 | . 81 | 352 |  | $\begin{array}{llll}3 & 54 & 15\end{array}$ | 1 |
| 34 | 34036 |  | 34233 | r.92 | 344 | I.87 | 346 |  | 348 | r•76 | $34950 \cdot 0$ | 72 |
|  | 336 | $+2.00$ | $\begin{array}{llll}3 & 3^{8} & 5 \cdot 6\end{array}$ | + $\mathrm{I} \cdot 9$ | 340 | + | 34 I 51•7 | +r | $\begin{array}{llll}3 & 43 & 39.8\end{array}$ | +r.77 | 34524.7 | 2 |
| 36 | $\begin{array}{lllll}3 & 31 & 37 \cdot 7\end{array}$ | 2.02 | $\begin{array}{llll}3 & 33 & 37 \cdot 0\end{array}$ |  | $\begin{array}{llll}3 & 35 & 32 \cdot 7\end{array}$ | I.90 | 337 |  | $\begin{array}{llll}3 & 39 & 13 \cdot 7\end{array}$ | r.7 | 34059 | 73 |
| 3 | $\begin{array}{llll}3 & 27 & 7 \cdot 3\end{array}$ |  | $\begin{array}{llll}3 & 29 & 7 \cdot 9\end{array}$ |  | $\begin{array}{llll}3 & 31 & 4 * 7\end{array}$ |  | 332 |  | 334 |  | $\begin{array}{lllll}3 & 36 & 33.4\end{array}$ | 74 |
| 3 | $\begin{array}{llll}3 & 22 & 36 \cdot 3\end{array}$ | $2 \cdot 07$ | $\begin{array}{llll}3 & 24 & 38 \cdot 3\end{array}$ |  | $\begin{array}{\|lll\|}3 & 26 & 36 \cdot 3\end{array}$ | -93 | $\begin{array}{llll}3 & 28 & 30 \cdot 3\end{array}$ |  | 330 |  | $\begin{array}{llll}3 & 32 & 7 \cdot 5\end{array}$ | 6 |
| 3 | 3 I 84 | $2 \cdot$ | $3208 \cdot 1$ |  | $\begin{array}{llll}3 & 22 & 7 \cdot 3\end{array}$ | I.95 | $\begin{array}{llll}3 & 24 & 2 \cdot 5\end{array}$ |  | 325 |  | 327 4I•3 |  |
|  | 3133 | $+2.12$ | $3 \begin{array}{llll}3 & 15 & 37 \cdot 2\end{array}$ | $+2.0$ | $31787 \cdot 8$ | +r.9 | 3 I9 34.2 | + I | 321 | +1 |  |  |
| 41 | $\begin{array}{llll}3 & 8 & 59\end{array}$ | 2 | 3 II 5.6 | $2 \cdot 0$ | $\begin{array}{llll}3 & 13 & 7 \cdot 8\end{array}$ | $2 \cdot 00$ | $\begin{array}{lll}3 & 15 & 5.4\end{array}$ |  | 3 r 6 |  | $31848 \cdot 0$ |  |
| 42 | $3 \begin{array}{lll}3 & 4 & 2\end{array}$ | $2 \cdot 18$ | $\begin{array}{lll}3 & 6 & 33 \cdot 3\end{array}$ |  | $\begin{array}{llll}3 & 8 & 37 \cdot 1\end{array}$ |  | 3 ro $36 \cdot 2$ |  | $\begin{array}{llll}3 & 12 & 30 \cdot 7\end{array}$ |  | $\begin{array}{lllllllllll}3 & 14 & 20.9\end{array}$ |  |
| 43 | 2594 | $2 \cdot 22$ | 3 2 0.2 <br> 2 5  |  | $\begin{array}{llll}3 & 4 & 5 \cdot 7\end{array}$ | 2.0 | $\begin{array}{lll}3 & 6 & 6 \cdot 2\end{array}$ |  | $\begin{array}{lll}3 & 8 & 2 \cdot 1\end{array}$ |  | $\begin{array}{llll}3 & 9 & 53.4\end{array}$ |  |
| 44 | 255 I | 2 | 25726 | $2 \cdot$ | $2 \begin{array}{llll}2 & 59 & 33 \cdot 5\end{array}$ |  | 3 I $135 \cdot 6$ |  | $3 \quad 3 \quad 33 \cdot 0$ |  | $\begin{array}{llll}3 & 5 & 25.4\end{array}$ |  |
|  | $25036 \cdot 3$ | +2.30 | 2525 | +2. | 255 | +2 | 2574.5 | +2 | 2593 - | +I |  | 6 |
| 46 | 245 57.7 |  | 248 I |  | $25026 \cdot$ |  | $25232 \cdot 5$ |  | $25432 \cdot 9$ |  | $256128 \cdot 1$ |  |
|  | 2415 |  | $\begin{array}{llll}2 & 43 & 37\end{array}$ | $2 \cdot 28$ | $2455 \mathrm{I} \cdot 7$ |  | 24759. |  | 250 |  | 25158.6 | - |
| 48 | $\begin{array}{llll}2 & 36 & 36 \cdot 4\end{array}$ | . | $\begin{array}{lll}2 & 38 & 59 \cdot 3 \\ 2 & 34 & \end{array}$ |  | $\begin{array}{lllll}2 & 41 & 15.7\end{array}$ | 2.22 | $\begin{array}{llll}2 & 43 & 25.9\end{array}$ |  | 24530 |  |  |  |
| 49 | 23153.4 | $2 \cdot 4$ | $\begin{array}{llll}2 & 34 & 19.4\end{array}$ | $2 \cdot 38$ | $2 \begin{array}{llll}26 & 38 \cdot 5\end{array}$ | $2 \cdot 2$ | 238 5I•I | $2 \cdot 1$ | 24057 | 2; |  |  |
| 50 | $\begin{array}{llll}2 & 27 & 8.6\end{array}$ | +2 | $2 \begin{array}{lll}2 & 29 & 3\end{array}$ | $+2.43$ | 232000 | +2.3 | 23415.2 | +2.2 | $236 \quad 23 \cdot 8$ | +2.0 | $\begin{array}{llll}2 & 38 & 26 \cdot 1\end{array}$ | + I.99 |
| 5 | $22221 \cdot 7$ | 2 | $22454{ }^{\circ}$ | $2 \cdot 49$ | 2272 | $2 \cdot 36$ | $22938 \cdot 2$ |  | $23149 \cdot 3$ | 2.13 | $2 \begin{array}{lllll}2 & 33 & 53.7\end{array}$ | 02 |
| 5 | $\begin{array}{llll}2 & 17 & 32 \cdot 6 \\ 2 & 17 & 4\end{array}$ | $2 \cdot 69$ | $\begin{array}{rrr}2 & 20 & 9.7 \\ 2 & 1 & 22.5\end{array}$ | 2.55 | $\begin{array}{llll}2 & 22 & 38 \cdot 6 \\ 2 & 1 & 5 & 5 \cdot 3\end{array}$ | 2.42 | $\begin{array}{llll}2 & 24 & 59 \\ 2 & \end{array}$ |  | $\begin{array}{llll}2 & 27 & 1 & 3.5\end{array}$ |  | $\begin{array}{llll}2 & 29 & 20 \cdot 3\end{array}$ | 2.06 |
| 53 54 | $\begin{array}{rrrr}2 & 12 & 4 \mathrm{I} \cdot \mathrm{I} \\ 2 & 7 & 46 \cdot 8\end{array}$ |  | $\begin{array}{llll}2 & 15 & 22.5 \\ 2 & 10 & 33.0\end{array}$ | 2 | $\begin{array}{llll}2 & 17 & 55 \cdot 3 \\ 2 & 13 & 10 \cdot 0\end{array}$ | 2.54 | $\begin{array}{llll}2 & 20 & 19.8\end{array}$ | $2 \cdot 34$ | $22236 \cdot 6$ | . 22 | $\begin{array}{llll}2 & 24 & 46 \cdot 0\end{array}$ | $2 \cdot 10$ |
| 5 | $2746 \cdot 8$ | $2 \cdot 85$ | 2 IO $33 \cdot 0$ | $2 \cdot 69$ | 21310.0 | $2 \cdot 54$ | 2 I5 $38 \cdot 2$ | $2 \cdot 40$ | 21758.2 | $2 \cdot 27$ | 22010.4 | $2 \cdot 1$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. 7 | A. | L. 8 | A. | L. 9 | A. | L. 10 | A. | L. 11 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | s. +.51 | S. -4.44 | $\begin{array}{r} \mathrm{s} . \\ +\quad .60 \end{array}$ | $\begin{gathered} s . \\ -4 \cdot 46 \end{gathered}$ | $\begin{gathered} s . \\ +\quad .69 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.47 \end{gathered}$ | $\begin{array}{r} \mathrm{s} \\ +\quad .77 \end{array}$ | $\begin{gathered} \text { S. } \\ -4 \cdot 48 \end{gathered}$ | $\begin{array}{r} s .8 \\ +\quad .86 \end{array}$ | $\begin{gathered} s . \\ -4.50 \end{gathered}$ | $\begin{aligned} & \text { S. } \\ &+\quad .95\end{aligned}$ | $\begin{gathered} \mathrm{s} . \\ -4.5 \mathrm{I} \end{gathered}$ |
| 0 | +.51 .44 | -4.44 4.43 | + 60 .53 | -4.46 4.44 | $\begin{array}{r}+69 \\ \hline .61\end{array}$ | -4.47 4.46 | +77 $+\quad 70$ | -4.48 4.47 | $\begin{array}{r}+\quad .86 \\ \hline .79\end{array}$ | -4.50 4.48 | $+\quad .95$ .88 | -4.51 4.50 |
| 4 | $\cdot 37$ | $4 \cdot 43$ | $\cdot 45$ | 4.43 | - 54 | 4.45 | -63 | $4 \cdot 46$ | -71 | $4 \cdot 47$ | -80 | $4 \cdot 48$ |
| 6 | $\cdot 30$ | $4 \cdot 42$ | -38 | 4.42 | - 47 | 4.44 | $\cdot 55$ | $4 \cdot 45$ | -64 | $4 \cdot 46$ | $\cdot 73$ | 4.47 |
| 8 | $\cdot 23$ | $4 \cdot 42$ | $\cdot 31$ | 4.42 | -40 | 4.43 | $\cdot 48$ | $4 \cdot 44$ | -57 | 4.45 | -66 | $4 \cdot 46$ |
| 10 | + 15 | $4 \cdot 42$ | + 24 | 4.42 | + 33 | $4 \cdot 43$ | + 41 | 4.43 | $+.50$ | $4 \cdot 44$ | + . 59 | 4.45 |
| 12 | -08 | 4.41 | -17 | $4 \cdot 42$ | - 26 | $4 \cdot 42$ | $\cdot 34$ | 4.43 | -43 | $4 \cdot 43$ | $\cdot 52$ | $4 \cdot 44$ |
| 14 | + -0I | $4 \cdot 41$ | -10 | $4 \cdot 41$ | -18 | 4.42 | -27 | 4.42 | $\cdot 36$ | $4 \cdot 43$ | -45 | $4 \cdot 44$ |
| 16 | -.06 | $4 \cdot 41$ | +.03 | $4 \cdot 4 \mathrm{I}$ | - II | $4 \cdot 42$ | -20 | 4.42 | -29 | $4 \cdot 42$ | $\cdot 38$ | $4 \cdot 43$ |
| 18 | -13 | $4 \cdot 42$ | -. 04 | 4.41 | +.04 | 4.41 | -13 | 4.42 | -22 | $4 \cdot 42$ | -31 | $4 \cdot 42$ |
| 20 | - 21 | $4 \cdot 42$ | - -12 | 4.42 | - .03 | 4.41 | +.06 | $4 \cdot 41$ | + .15 | $4 \cdot 42$ | + 24 | 4.42 |
| 22 | $\cdot 28$ | 4.42 | -19 | $4 \cdot 42$ | -ro | $4 \cdot 4 \mathrm{I}$ | - Or | $4 \cdot 41$ | .08 | $4 \cdot 4 \mathrm{I}$ | -17 | $4 \cdot 42$ |
| 24 | $\cdot 36$ | $4 \cdot 43$ | -27 | $4 \cdot 42$ | -17 | $4 \cdot 42$ | -08 | $4 \cdot 41$ | + - OI | $4 \cdot 4 \mathrm{I}$ | -10 | $4 \cdot 4 \mathrm{I}$ |
| 26 | -44 | 4.44 | -35 | 4.43 | $\cdot 25$ | $4 \cdot 42$ | -16 | $4 \cdot 42$ | -.06 | $4 \cdot 41$ | +.03 | 4.41 |
| 28 | -52 | 4.45 | -43 | 4.43 | -33 | $4 \cdot 43$ | $\cdot 23$ | $4 \cdot 42$ | -14 | $4 \cdot 42$ | -. 04 | 4.41 |
| 30 | - . 60 | $4 * 45$ | - . 51 | 4.44 | - $\cdot 41$ | $4 \cdot 43$ | - 31 | $4 \cdot 42$ | - $\cdot 2 \mathrm{I}$ | 4.42 | - 12 | $4 \cdot 42$ |
| 32 | -69 | $4 \cdot 47$ | $\cdot 59$ | 4.45 | - 49 | $4 \cdot 44$ | $\cdot 39$ | $4 \cdot 43$ | - 29 | 4.42 | -19 | $4 \cdot 42$ |
| 34 | -79 | 4.48 | -68 | $4 \cdot 46$ | - 58 | $4 \cdot 45$ | -47 | $4 \cdot 44$ | -37 | 4.43 | - 27 | $4 \cdot 42$ |
| 36 | -88 | 4.50 | $\cdot 77$ | $4 \cdot 48$ | - 66 | 4.46 | $\cdot 56$ | 4.45 | -45 | 4.44 | $\cdot 35$ | $4 \cdot 43$ |
| 38 | -99 | $4 \cdot 52$ | . 87 | $4 \cdot 50$ | $\cdot 76$ | $4 \cdot 48$ | -65 | $4 \cdot 46$ | -54 | $4 \cdot 45$ | -43 | $4 \cdot 44$ |
| 40 | - I•IO | 4.55 | -. 98 | $4 \cdot 52$ | -. 86 | $4 \cdot 50$ | - $\cdot 74$ | 4.47 | -. 63 | $4 \cdot 46$ | -. 52 | $4 \cdot 44$ |
| 42 | I. 21 | $4 \cdot 58$ | $\underline{109}$ | $4 \cdot 54$ | -96 | $4 \cdot 52$ | - 84 | 4.49 | $\cdot 72$ | $4 \cdot 47$ | -61 | $4 \cdot 45$ |
| 44 | I.34 | $4 \cdot 61$ | I-20 | $4 \cdot 37$ | r.08 | $4 \cdot 54$ | -95 | 4.51 | -83 | 4.49 | -70 | $4 \cdot 47$ |
| 46 | 1.47. | $4 \cdot 65$ | I. 33 | $4 \cdot 61$ | I-20 | 4.57 | I.06 | $4 \cdot 54$ | -93 | $4 \cdot 51$ | -81 | $4 \cdot 49$ |
| 48 | 1.63 | 4.70 | I. 48 | $4 \cdot 65$ | 1-33 | $4 \cdot 6 \mathrm{r}$ | I•19 | $4 \cdot 57$ | I.05 | 4.54 | $\cdot 92$ | $4 \cdot 5 \mathrm{I}$ |
| 50 | - I•79 | 4.76 | -r.63 | $4 \cdot 70$ | - I. 47 | $4 \cdot 65$ | - $1 \cdot 32$ | 4.6 I | -I.I8 | 4.57 | -r.03 | $4 \cdot 53$ |
| 52 | I.98 | 4.84 | I.81 | $4 \cdot 77$ | I. 64 | $4 \cdot 71$ | I. 47 | $4 \cdot 65$ | I. 32 | $4 \cdot 6 \mathrm{r}$ | I•16 | 4.56 |
| 54 | $2 \cdot 20$ | 4.93 | 2.00 | $4 \cdot 84$ | I. 82 | $4 \cdot 77$ | 1.65 | $4 \cdot 71$ | I 47 | $4 \cdot 66$ | 1.3I | $4 \cdot 60$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $12^{\circ}$ | Dec <br> Var | $13^{\circ}$ | $\begin{aligned} & \text { Dec } \\ & \text { Var } \end{aligned}$ | $14^{\circ}$ | $\begin{aligned} & \mathrm{De} \\ & \mathrm{Va} \end{aligned}$ | $15^{\circ}$ |  | $16^{\circ}$ |  | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 22 & 45 \end{array}$ | +1.9 | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 24 & 43 \cdot 3 \end{array}$ | $+1 \cdot 9$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 26 & 42.4 \end{array}$ |  | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 28 & 42 \cdot 6 \end{array}$ |  | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 30 & 44^{2} 2 \end{array}\right\|$ | $+2.04$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 32 & 47 \cdot I \end{array}$ |  |
| 10 | $53747 \cdot 3$ | I•79 | $53934 \cdot 7$ | $1 \cdot 79$ | $54122 \cdot 2$ | I•79 | $\begin{array}{llll}5 & 43 & 9.6\end{array}$ | I.7 | $5 \quad 44$ 57-1 | 1.79 | 54644.9 | 1.80 |
| 12 | 528 52. | 76 | $53038 \cdot 0$ | 6 | $\begin{array}{llll}5 & 32 & 23.6\end{array}$ | 6 | 534980 | I |  | 75 | $\begin{array}{llll}5 & 37 & 39 \cdot 6\end{array}$ | 75 |
|  | 51958 | 73 | $\begin{array}{lllllllllllll}5 & 21 & 42\end{array}$ | 3 | $\begin{array}{lllll}5 & 23 & 26 \cdot 5\end{array}$ |  | 525 10. |  | $\begin{array}{llllllllllllll}5 & 26 & 53 \cdot 2\end{array}$ | 2 | $\begin{array}{lllllllllll}5 & 28 & 36 \cdot 2\end{array}$ | 1 |
| 16 | 5 II 5 |  | $51248 \cdot 2$ |  | 5 I4 $30 \cdot 7$ | I.70 | 5 16 I2 | I. 68 | 5 17 53.8 | 68 | $\begin{array}{lllll}5 & 19 & 34 \cdot 6\end{array}$ | 68 |
| 18 | 521 | $+$ | 355.0 | + I | 5536 | +1 | $\begin{array}{llll}5 & 7 & 16 \cdot 3\end{array}$ | + 1.66 | $5 \quad 8 \quad 8 \quad 55 \cdot 8$ | + 1.65 | 5 IO 34.7 | 4 |
| 20 | $45321 \cdot 6$ |  | $455 \quad 2 \cdot 6$ | 1. 67 | 4564 |  |  |  | $4 \begin{array}{llll}4 & 59 & 59.2\end{array}$ | I-62 | $5 \quad 1 \quad 36 \cdot 2$ | I |
| 22 | 4443 | 68 | $446 \quad 10 \cdot 9$ | I. 66 | 4474 | I. 64 | $44927 \cdot 4$ | 2 | 4 51 3.8 | 60 | 45239 | 5 |
| 24 | 4354 |  | $43720 \cdot 0$ |  | $43858 \cdot 0$ |  | 44034.4 | I 60 | $442 \quad 9 \cdot 4$ | $1 \cdot 57$ | 44343 I | 55 |
| 26 | 4265 | . 66 | 42829.5 | I.63 | 43067 | I. 60 | $43142 \cdot 2$ | I. 58 | 433 16.1 | I. 55 | $43448 \cdot 4$ | 52 |
| 28 | $\begin{array}{lll}4 & \text { I8 } & 0.8\end{array}$ | + 1.66 | 4 I9 39. | +1.62 | 42116.0 | + I | 4225 | +1.56 | 424 | +1.53 | $425 \quad 54 \cdot 6$ | I.50 |
| 30 | 49 II•I | 5 | 4 10 $49 \cdot 6$ |  | $412 \quad 25.8$ | $\underline{1} 5$ | 4 I3 59.9 | $\underline{1}$ | 41531.8 | I'51 | 4 17 1.7 | 48 |
| 31 | 4446 | 66 | $4 \quad 6 \quad 24.8$ | 62 | $\begin{array}{lll}4 & 8 & 0.8\end{array}$ | 1.5 | $4 \quad 934 \cdot 7$ |  | 4 II $6 \cdot 2$ | 1.51 | $41235 \cdot 6$ | 47 |
| 32 | $4021 \cdot 5$ |  | $4 \quad 20.0$ |  | $4 \quad 3 \quad 36 \cdot 0$ |  | $\begin{array}{llll}4 & 5 & 9.5\end{array}$ |  | $4 \quad 6 \quad 40 \cdot 7$ |  | $\begin{array}{llll}4 & 8 & 9 \cdot 6\end{array}$ | . 46 |
| 33 | $35556 \cdot 6$ | . 66 | 357 35-2 | I. 62 | 359 II'I | I. 58 | $4 \quad 044 \cdot 5$ | I•53 | $\begin{array}{llll}4 & 2 & 15.4\end{array}$ | 1-49 | $\begin{array}{llll}4 & 3 & 43.9\end{array}$ | -45 |
| 34 | 35131.6 | + $1 \cdot 6$ | $35310 \cdot 3$ | + 1 | $35446 \cdot 3$ | + $\mathrm{I} \cdot 5$ | 356 I | + I. 53 | 357 50.1 | +I | 35918.2 | 44 |
| 35 | 347 | I. 67 | $34845 \cdot 4$ |  | 35021.4 | I 5 | $35154 \cdot 6$ | I.53 | 353250 | 1. | $35452 \cdot 7$ | 44 |
| 36 | 34241 | 68 | $34420 \cdot 5$ | I. 63 | $34556 \cdot$ | I 5 | 34729.7 | I.53 | $349 \quad 0.0$ |  | $350 \quad 27 \cdot 4$ | . 43 |
| 37 | $33^{38} 16$ | I. 68 | $\begin{array}{lllll}3 & 39 & 55 \cdot 5\end{array}$ |  | $34 \mathrm{I} 3 \mathrm{I} \cdot 8$ | 1 | $\begin{array}{llll}3 & 43 & 4 \cdot 9\end{array}$ | I•53 | $34435 \cdot 0$ | 1.48 | $\begin{array}{llll}3 & 46 & 2 \cdot 2\end{array}$ | 43 |
| 38 | 3335 | I. 69 | $\begin{array}{llll}3 & 35 & 30 \cdot 5\end{array}$ | 6 | $\begin{array}{llll}3 & 37 & 6 \cdot 9\end{array}$ | I.58 | $\begin{array}{llll}3 & 3^{8} & 40 \cdot 1\end{array}$ | I.53 | 340 10.1 | I.47 | $34137 \cdot 0$ | I. 42 |
| 39 | 32925 | + $1 \cdot 7$ | 33150 | $+$ | 324 | + 1 | 33415 | + I. 5 | $313545 \cdot 3$ | +1.47 | 33712.0 | 2 |
| 40 | 32459 |  | $32640 \cdot 0$ |  | 328 1 |  | $\begin{array}{llll}3 & 29 & 50\end{array}$ | 1 | $\begin{array}{lllll}3 & 31 & 20.5\end{array}$ | 1.47 | $\begin{array}{llll}3 & 32 & 47 \cdot 0\end{array}$ | I.41 |
| 41 | 32033 | $1 \cdot 72$ | 322 I |  | 3235 |  | $\begin{array}{llll}3 & 25 & 25 \cdot 6\end{array}$ | I. 53 | $32655 \cdot 6$ | 47 | $3 \begin{array}{llll}38 & 28 & 22.1\end{array}$ | - |
| 42 | $\begin{array}{llll}3 & 16 & 6 \cdot 9\end{array}$ |  | $\begin{array}{llll}3 & 17 & 48 \cdot 7\end{array}$ |  | $\begin{array}{llll}3 & 19 & 26 \cdot 6\end{array}$ |  | $\begin{array}{rrr}3 & 21 & 0.6 \\ 3 & 16 & 35.6\end{array}$ |  | $\begin{array}{llll}3 & 22 & 30 \cdot 8\end{array}$ | 47 | $\begin{array}{lllll}3 & 23 & 57 \cdot 3\end{array}$ |  |
| 4 | 3 II 40.3 | 1.75 | 3 I3 22.9 |  | $\begin{array}{llll}3 & \text { I5 } & \text { I } 3\end{array}$ |  | 3 I6 35.6 | I•54 | 3 I8 6.0 | $1 \cdot 47$ | 3 I9 $32 \cdot 5$ | I.4I |
|  | 3713 | +1.76 | $3 \begin{array}{llll}3 & 8 & 56 \cdot 7\end{array}$ | +1.69 | $31035 \%$ | +1 | 31210 | + I. 54 | 3134 | +1. | $\begin{array}{lll} 3 & 15 & 7 \cdot 6 \end{array}$ | +I.4I |
|  | $3 \quad 246 \cdot$ |  | $\begin{array}{lllll}3 & 4 & 30 \cdot 3\end{array}$ |  | $3610 \cdot 0$ | I. 62 | 3745 |  | $3 \quad 916.2$ |  | 3 IO $42 \cdot 8$ | 4 |
|  | $2 \begin{array}{lll}28 & 18 \cdot 3\end{array}$ |  | $\begin{array}{lll}3 & 0 & 3 \cdot 5\end{array}$ |  | 3 I 44. |  | $\begin{array}{llll}3 & 3 & 19\end{array}$ |  | $\begin{array}{llll}3 & 4 & 5 I \cdot I\end{array}$ | 8 | $3 \quad 618.0$ | 41 |
|  | 2535 |  | 25536.4 |  | $2{ }^{2} 57717.8$ |  | 25854 | 7 | $\begin{array}{lrrr}3 & 0 & 26.0\end{array}$ | 4 | $\begin{array}{llll}3 & 1 & 53 \cdot 1\end{array}$ | 4 I |
| 48 | 24921 |  | 2518.9 | I• | $25251 \cdot 2$ |  | 2542 | I.58 | $\begin{array}{llll}2 & 56 & 0.7\end{array}$ |  | $257128 \cdot 2$ | 42 |
| 49 | 2445 | + 1.86 | 246 | +1. | $2 \begin{array}{llll}2 & 48 & 24.3\end{array}$ | + I 68 | $2{ }^{2} 50 \quad 2.4$ | + I 59 | $251135 \cdot 3$ | +1.5 | $2 \begin{array}{llll}2 & 53 & 3.2\end{array}$ | +I.42 |
|  | 2402 | 咗 | 242 I |  | 2435 | I. | $24536 \cdot 1$ | I. 60 | 2479 | 1.5 | $248 \quad 38 \cdot 0$ | 43 |
| 5 | 23551 | .91 | $23743 \cdot 5$ | I | 23929.4 |  | 241595 |  | $24243 \cdot 8$ |  | 24412.8 | - |
| 52 | 23120 |  | 2331 | I. 84 | 2351012 |  | $\begin{array}{lllll}2 & 36 & 42.4\end{array}$ | 64 | $2 \begin{array}{llllll}2 & 3 & \text { I7.8 }\end{array}$ |  | $23947 \cdot 3$ | 44 |
| 53 | 2264 | I.98 | $2 \begin{array}{lllll}28 & 43 \cdot 7\end{array}$ | 1 | $23032 \cdot 6$ | I•76 | $2 \begin{array}{lllll} & 32 & 15 & 1\end{array}$ | I. 6 | 233515 | I 55 |  | I 46 |
|  | 22215 | $+2.02$ | 22412.6 | +1.90 | 226134 | +I•79 | $22747 \cdot 2$ | +1.68 | 22924.7 | +1.57 | 23055.9 | +1.47 |
| 55 | 217410 | 2.06 | 2 I9 40 | I.94 | $22133 \cdot 3$ | 1 | $2 \begin{array}{llll}23 & 18.9\end{array}$ | - |  |  | $226 \quad 29.7$ | 8 |
| 5 | $2 \begin{array}{llll}2 & 13 & 5 \cdot 7\end{array}$ | $2 \cdot 10$ | 2 I | I•97 | 2 I7 2.6 | I.85 | $2 \begin{array}{llll}2 & 18 & 50\end{array}$ | I•73 | $22030 \cdot 1$ | . 61 | 2223.4 | . 50 |
|  | 2829 | $2 \cdot 15$ | 2 IO 34 | 22 | $21231 \cdot 1$ | I.89 | $\begin{array}{lllll}2 & 14 & 20.4\end{array}$ |  | $2162 \cdot \mathrm{I}$ |  | $2 \begin{array}{lllllllllllllllll}26.6\end{array}$ | 1.52 |
| 58 | $35 \mathrm{I} \cdot 0$ | $2 \cdot 2$ | 5 59.I |  | $758 \cdot 7$ | I.92 | $2950 \cdot I$ | ェ・7 | 2 II 33. | I. 6 | 2 I3 9.5 | 1.54 |

VARIATION TO I' OF LATITUDE AND ALTITÚDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ}$ A. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot \mathrm{O} 4 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 53 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 13 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 56 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 22 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -4 \cdot 58 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +1 \cdot 32 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4.60 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 4 \mathrm{I} \end{gathered}$ | $\begin{gathered} s \\ -4.63 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 50 \end{gathered}$ | $\begin{gathered} \text { S. } \\ -4.66 \end{gathered}$ |
| 4 | . 89 | $4 \cdot 50$ | $\cdot 98$ | $4 \cdot 52$ | 1.07 | $4 \cdot 54$ | 1-16 | $4 \cdot 56$ | I. 25 | 4.59 | I•34 | $4 \cdot 61$ |
| 8 | $\cdot 74$ | 4.48 | -83 | $4 \cdot 49$ | -92 | 4.51 | $1 \cdot 00$ | $4 \cdot 53$ | I-IO | $4 \cdot 55$ | I•I9 | $4 \cdot 57$ |
| 12 | -60 | $4 \cdot 46$ | -69 | 4.47 | $\cdot 78$ | $4 \cdot 48$ | -87 | $4 \cdot 50$ | -96 | $4 \cdot 52$ | 1.05 | $4 \cdot 54$ |
| I6 | $\cdot 47$ | $4 \cdot 44$ | -55 | 4.45 | -64 | $4 \cdot 46$ | $\cdot 73$ | $4 \cdot 47$ | - 82 | $4 \cdot 49$ | $\cdot 91$ | $4 \cdot 5$ I |
| 20 | + 33 | 4.43 | + 42 | 4.43 | +.51 | $4 \cdot 44$ | +.60 | 4.45 | + 69 | 4.47 | +.78 | 4.48 |
| 22 | - 26 | $4 \cdot 42$ | $\cdot 35$ | 4.43 | - 44 | $4 \cdot 43$ | -53 | $4 \cdot 45$ | -62 | $4 \cdot 46$ | $\cdot 71$ | 4.47 |
| 24 | -19 | 4.42 | - 28 | 4.42 | -37 | 4.43 | -47 | 4.44 | - 56 | 4.45 | . 65 | 4.46 |
| 26 | -12 | 4.42 | - 22 | 4.42 | $\cdot 31$ | 4.42 | -40 | 4.43 | -49 | $4 \cdot 44$ | $\cdot 59$ | $4 \cdot 45$ |
| 28 | $+.05$ | 4.41 | -15 | 4.42 | - 24 | $4 \cdot 42$ | -33 | 4.43 | -43 | $4 \cdot 43$ | . 52 | 4.45 |
| 30 | - 02 | 4.41 | +.08 | 4.41 | $+\cdot 17$ | $4 \cdot 42$ | + 27 | 4.42 | + 36 | $4 \cdot 43$ | + 46 | 4.44 |
| 32 | -09 | 4.41 | + 01 | 4.41 | -10 | $4 \cdot 41$ | -20 | 4.42 | $\cdot 30$ | $4 \cdot 42$ | -39 | 4.43 |
| 34 | -17 | $4 \cdot 42$ | -. 07 | 4.41 | +.03 | 4.41 | -13 | 4.42 | -23 | $4 \cdot 42$ | -33 | 4.43 |
| 36 | -24 | 4.42 | -14 | 4.42 | -. 04 | 4.41 | +.06 | 4.41 | - 16 | 4.42 | -26 | 4.42 |
| 38 | -32 | $4 \cdot 43$ | - 22 | 4.42 | - II | 4.41 | . OI | 4.41 | -10 | 4.41 | -20 | 4.42 |
| 40 | - 4 II | 4.43 | $\cdot 30$ | 4.42 | - .19 | 4.42 | - .08 | 4.41 | +.03 | 4.41 | $+13$ | 4.4 I |
| 42 | -49 | 4.44 | $\cdot 38$ | 4.43 | -27 | 4.42 | -16 | $4 \cdot 42$ | -.05 | $4 \cdot 4 \mathrm{I}$ | +.06 | 4.41 |
| 44 | . 59 | 4.45 | - 47 | 4.44 | $\cdot 35$ | $4 \cdot 43$ | $\cdot 24$ | 4.42 | - 12 | 4.41 | -.01 | 4.4 I |
| 46 | -68 | 4.47 | -56 | $4 \cdot 45$ | $\cdot 44$ | 4.43 | $\cdot 32$ | $4 \cdot 43$ | - 20 | 4.42 | -08 | $4 \cdot 41$ |
| 48 | $\cdot 78$ | $4 \cdot 48$ | . 66 | $4 \cdot 46$ | -53 | 4.45 | $\cdot 40$ | 4.43 | $\cdot 28$ | $4 \cdot 42$ | $\cdot 16$ | 4.42 |
| 50 | - 90 | 4.50 | -.76 | 4.48 | -. 63 | 4.46 | - 50 | 4.44 | - 37 | 4.43 | - $\cdot 24$ | $4 \cdot 42$ |
| 52 | 1.02 | $4 \cdot 53$ | -87 | 4.50 | $\cdot 73$ | 4.47 | -59 | $4 \cdot 45$ | -46 | $4 \cdot 44$ | $\cdot 32$ | $4 \cdot 43$ |
| 54 | I•5 | $4 \cdot 56$ | -99 | $4 \cdot 52$ | -84 | $4 \cdot 49$ | -70 | $4 \cdot 47$ | $\cdot 55$ | 4.45 | -41 | 4.43 |
| 56 | I. 29 | $4 \cdot 60$ | I•13 | 4.56 | -97 | $4 \cdot 52$ | -81 | 4.49 | -66 | $4 \cdot 46$ | $\cdot 51$ | 4.44 |
| 58 | 1*44 | $4 \cdot 65$ | I. 28 | 4.60 | I-10 | 4.55 | $\cdot 94$ | $4 \cdot 5 \mathrm{I}$ | $\cdot 77$ | $4 \cdot 48$ | -6I | $4 \cdot 46$ | Latitude $25^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True <br> Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. |  | H. M. S. <br> $6 \quad 36 \quad 57.5$ |  | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 39 \\ 5.2 \end{array}\right\|$ |  |  | $17$ | $\left\lvert\, \begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 43 & 26 \cdot 2 \end{array}\right.$ | $\begin{gathered} 5.21 \\ +2 \cdot 21 \end{gathered}$ | H. M. S. | $24$ |
| 10 | $\begin{array}{llll}5 & 48 & 32 \cdot 9\end{array}$ | I.80 | $55021 \cdot 2$ | I.81 | 552 10\% | I.8I | 5 $53359 \cdot 2$ | 1.82 | $55549 \cdot \mathrm{I}$ | I.84 | $\begin{array}{llll}5 & 57 & 39.6\end{array}$ |  |
| 12 | 53924.9 | 1.76 | $54110 \cdot 3$ | $1 \cdot 76$ | 4255.9 | $1 \cdot 76$ | $4441 \cdot 7$ | 1.77 | 54627.9 | $1 \cdot 77$ | 54814.5 | 78 |
| 14 | 53019.0 | 1.71 | $\begin{array}{llll}5 & 32 & 1 \cdot 6\end{array}$ | 71 | $3344 \cdot 2$ | I.7I | $535 \quad 26 \cdot 8$ | 1•71 | $\begin{array}{llll}5 & 37 & 9.6\end{array}$ | 1 | 3852.4 | 1 |
| 16 | 52115.0 | 1.67 | $52255 \cdot 1$ |  | 2434.9 |  | $\begin{array}{llll}5 & 26 & 14.4\end{array}$ |  | 52753.8 |  | $52933 \cdot 1$ | 6 |
| 18 | 512 | $+\mathrm{r} \cdot 63$ | 513 50.5 | $+\mathrm{r} .62$ | 1527.6 | +1.61 | 5 I7 4.2 | +1.61 | $51840 \cdot 5$ | +1.60 | 52016.4 | + 1.60 |
| 20 | 312.3 | 1.59 | $\begin{array}{llll}5 & 4 & 47.6\end{array}$ | I. 58 | $\begin{array}{ll}6 & 22 \cdot 2\end{array}$ | I.57 | $5{ }_{5}^{5} 786 \cdot 1$ | I. 56 | $5{ }_{5}^{5} 929293$ | I 55 | 5 II 2.0 | 54 |
| 22 | $4 \begin{array}{llllllll}4 & 13.2\end{array}$ | - 56 | $45546 \cdot 4$ | I. 54 | $45718 \cdot 6$ | I.53 | $4 \begin{array}{llll} & 58 \\ 49\end{array}$ | 1.51 | 5 ¢ 0203 | I. 50 | $5{ }_{5} 1149$ | 48 |
| 24 | 44515.6 | I.53 | $44646 \cdot 7$ | 1.51 | $44^{48} 16 \cdot 6$ | $1 \cdot 49$ | $44945 \cdot 4$ | $1 \cdot 47$ | $45113 \cdot 1$ | 45 | $\begin{array}{lllll}4 & 52 & 39 \cdot 7\end{array}$ | 33 |
| 26 | $43619 \cdot 1$ | 1.50 | $43748 \cdot 4$ | 47 | 3916 | 45 | $44042 \cdot 6$ | 1.42 | $442 \quad 7 \cdot 7$ | 141 | $44331 \cdot 5$ | 8 |
| 28 | 42723.8 | +1.4 | $42851 \cdot 3$ | +I. 44 | 43017.2 | +1.4 | $43 \mathrm{I} 4 \cdot 4$ | +1 | $4334^{\circ} \mathrm{O}$ | +I.36 | $1 \begin{array}{lll}4 & 34 & 25.1\end{array}$ | +I.34 |
| 30 | $4 \begin{array}{ll}48 & 29.6\end{array}$ | I 45 | $4 \begin{array}{lll}4955\end{array}$ | 4 | 42119.5 | I 38 | $4224 \mathrm{I} \cdot 6$ | I.35 | $4 \begin{array}{llll}43 & 1.8\end{array}$ | I.32 | $42520 \cdot 2$ | 1.29 |
| 31 | $414 \begin{array}{lll}4.8\end{array}$ | 1.43 | 4151580 | 140 | 16 51.0. | 1.37 | $4{ }_{4} 1812 \cdot 1$ | I.33 | $41931 \cdot 2$ | 30 | 42048.4 | 1.26 |
| 32 | $4 \quad 936 \cdot 3$ | 1.42 | $\begin{array}{llll}4 & 11 & 0.7\end{array}$ | I. 38 | 1222.9 | I.35 | 413 43.0 | 1.31 | 4151.0 | 1.28 | 41617.0 | 5 |
| 33 | $\begin{array}{llll}4 & 5 & 9.9\end{array}$ | 1.41 | $\begin{array}{llll}4 & 6 & 33.6\end{array}$ | 37 | $755^{\circ}$ | 3 | $4 \quad 9 \quad 14.2$ | $1 \cdot 30$ | 4 10 3I'I | I. 26 | 4 II 45.9 | 23 |
| 34 | $4 \quad 0 \quad 43 \cdot 8$ | +1.4 | $\begin{array}{llll}4 & 2 & 6.8\end{array}$ | +1.36 | 327.5 | +1.32 | 45'7 | +1.28 | 6 I.6 | 1 | $4715 \cdot 1$ | +1.21 |
| 3 | $\begin{array}{lllllllllll}3 & 56 & 17.8\end{array}$ | 1.40 | 35740 | I•35 | 59 | I 31 | - 17.5 | 1.27 | 4 I $32 \cdot 3$ | I 23 | 44 <br> 4 | 19 |
| 36 | $\begin{array}{llll}3 & 51 & 52 \cdot 0\end{array}$ | I.39 | $1 \begin{array}{llll}3 & 53 & 13.8\end{array}$ | I.34 | $5433 \cdot$ | 30 | $35549 \cdot 5$ | 1.25 | $\begin{array}{lll}3 & 57 & 3\end{array}$ | $\underline{121}$ |  | 16 |
| 37 |  | 38 |  | 33 | 50 | I 28 | 3 5I $2 \mathrm{I} \cdot 8$ | 1.24 | $3{ }^{3} 5234 \cdot 7$ | I-19 | $35344 \cdot 8$ | I-14 |
| 38 | $\begin{array}{lll}3 & 43 & 0.9\end{array}$ | $1 \cdot 37$ | $34421 \cdot 6$ | 32 | $34539 \cdot 4$ | I 27 | $34654 \cdot 3$ | 1.22 | $\begin{array}{llll}3 & 48 & 6 \cdot 3\end{array}$ | I-I7 | $\begin{array}{llll}3 & 49 & 15 & 3\end{array}$ | I.13 |
| 39 | $\begin{array}{llll}3 & 38 & 35.5 \\ 3 & 34 & 10.2\end{array}$ | +1.36 | $\begin{array}{llll}3 & 39 & 55 \cdot 8 \\ 3 & 35\end{array}$ | +1.31 | $\begin{array}{llllll}3 & 41 & 13.0 \\ 3 & 36 & 46 \cdot 7\end{array}$ | +1.26 |  | +1.21 |  | +I.16 | $\begin{array}{llll}3 & 44 & 46 \cdot 1 \\ 3\end{array}$ | +I.11 |
| 40 |  | 1 |  | I. 30 | $\begin{array}{llll}3 & 36 & 46 \cdot 7\end{array}$ | 1.25 | $33^{8}$ |  | $\begin{array}{llll}3 & 39 & 10 \cdot 2\end{array}$ |  |  |  |
| 41 | $\begin{array}{lllll}3 & 29 & 45 \cdot 1\end{array}$ | 1.35 | $\begin{array}{llll}3 & 31 & 4 \cdot 6\end{array}$ | I 29 | $3220 \cdot 6$ | I 24 | $333133 \cdot 3$ |  | $33442 \cdot 6$ | I'12 | $\begin{array}{llll}3 & 35 & 48 \cdot 5\end{array}$ | 8 |
| 42 | 32520.0 | 35 | $\begin{array}{llll}3 & 26 & 39 & 1\end{array}$ | 1.29 | $32754 \cdot 7$ | I. 23 | $\begin{array}{lll}3 & 29 & 6 \cdot 7\end{array}$ | I. 17 | $33015 \cdot 1$ |  | 3 31 20.1 | 6 |
| 43 | $32055 \cdot \mathrm{I}$ | $1 \cdot 34$ | $\begin{array}{lllll}3 & 22 & 13.9\end{array}$ | 1.2 | 323 29•1 | 1-22 | $32440 \cdot 3$ | I.16 | 32548.0 | $1 \cdot 10$ | $\begin{array}{llll}3 & 26 & 52.0\end{array}$ | 1-04 |
| 45 | $\begin{array}{llll}3 & 16 & 30 \cdot 1\end{array}$ | +1.34 | $\begin{array}{lllll}3 & 17 & 48.7\end{array}$ | +1.28 | 3 19 3.3 <br> 3 19 3 | +1.21 | 3 20 $14 \cdot 1$ | $+\mathrm{I} \cdot 15$ | $32121 \cdot 0$ | + 1.08 | $\begin{array}{lll}3 & 22 & 24.0\end{array}$ | +1.02 |
| 45 | $\begin{array}{cccc}3 & 12 & 5.3 \\ 3 & 7 & 4\end{array}$ | $1 \cdot 34$ | $\begin{array}{cccc}3 & 13 & 23.6 \\ 3 & 8 & 58.6\end{array}$ | 1.27 1.27 | $\begin{array}{llll}3 & 14 & 37 \cdot 8 \\ 3 & 10 & 12.5\end{array}$ | I 220 <br> I 20 <br> 1 | $\begin{array}{llll}3 & 15 & 48 \cdot 0 \\ 3 & 11 & \end{array}$ | I.14 I. 13 | $\begin{array}{llll}3 & 16 & 54 \cdot 2 \\ 3 & 12 & 27 \cdot 6\end{array}$ | 1.07 +06 | $\begin{array}{llll}3 & 17 & 56.4 \\ 3 & 13 & 28.9\end{array}$ | O1 |
| 46 | $\begin{array}{llll}3 & 7 & 40 \cdot 4\end{array}$ | r.34 | $\begin{array}{lllllllllllll}3 & 8 & 58 \cdot 6\end{array}$ | 1.27 | $\begin{array}{llll}3 & 10 & 12.5\end{array}$ | I-20 | $31122 \cdot 1$ | . 13 | $\begin{array}{llll}3 & 12 & 27.6\end{array}$ | 6 | 313 | 99 |
| 47 | 3 3 15 <br>  58 50 | 4 | 3 | I. 26 | 47.3 | I-19 | $\begin{array}{llll}3 & 6 & 56 \cdot 4 \\ 3 & 2 & 30.8\end{array}$ | I•12 | $\begin{array}{lll}3 & 8 & 1 \cdot 2 \\ 3 & 3 & \end{array}$ | $\underline{1.04}$ | $3{ }^{3} \mathrm{9}$ I ${ }^{\text {d }}$ | 97 |
| 48 | $2{ }^{2} 5850.9$ | 1.34 | 3 |  | $3 \begin{array}{lll}3 & 1 & 22 \cdot 1\end{array}$ |  | $3 \quad 230$ |  | $3 \quad 3350$ |  | 434 | 95 |
| 49 | $25426 \cdot 0$ | +1.34 | $25544 \cdot 0$ | +r.26 | $25^{56} 57 \cdot \mathrm{I}$ | +1.18 | $\begin{array}{lll}2 & 58 & 5.4\end{array}$ | +1 | 259 9.0 | $+1.02$ | $3 \quad 1087$ |  |
| 50 | 22 50 <br> 2 1.1 <br>  45 | I.34 | $\begin{array}{llll}2 & 51 & 19 \cdot 1 \\ 2 & 46 & 5\end{array}$ | I. 26 | $\begin{array}{llll}2 & 52 & 32 \cdot 1 \\ 2 & 48 & \\ 7\end{array}$ | I.17 | $25340 \cdot 0$ |  | $2544^{\circ}{ }^{\circ}$ | 1.01 | $25541 \cdot 0$ | 93 |
| 51 | $24536 \cdot 2$ | I. 35 | 24654.3 | 26 | $\begin{array}{llll}2 & 48 & 7 \cdot 2\end{array}$ | $1 \cdot 17$ | $\begin{array}{llllllll}2 & 49 & 14.8\end{array}$ | I-08 | $25017 \cdot 3$ | -00 | 25114.5 | 91 |
| 52 | 24 IIIP | I. 35 | $\begin{array}{lllll}2 & 42 & 29.5\end{array}$ | I. 26 | $\begin{array}{lllllll}2 & 43 & 42 \cdot 3\end{array}$ | I'17 | 24449.7 | 1.08 | 24551.6 | $\cdot 99$ | $24648 \cdot 2$ | 90 |
| 53 | ${ }^{2} 3646 \cdot 1$ | 1.36 | 238 | 1.26 | 23917.5 | $1 \cdot 17$ | 24024.5 | 1.07 | 241 | 98 | $24222 \cdot \mathrm{I}$ | 89 |
| 54 | $23220 \cdot 9$ | + I 36 | 23339.7 | +1.26 | $23452 \cdot 7$ | +1.17 |  | +1.07 | $\begin{array}{lll}2 & 37 & 0.8 \\ 2\end{array}$ |  | $23756 \cdot 1$ |  |
| 55 | 2 2755.4 | $1 \cdot 37$ |  | 127 | $2 \begin{array}{llll}2 & 30 & 27 \cdot 9\end{array}$ | $1 \cdot 17$ | $\begin{array}{lllllllllll}2 & 31 & 34 \cdot 8\end{array}$ | I.06 | $\begin{array}{llll}2 & 32 & 35 \cdot 6 \\ 2\end{array}$ | -96 | $23330 \cdot 2$ |  |
| 56 | $\begin{array}{lll}2 & 23 & 29.8 \\ 2\end{array}$ | 1.39 |  |  | $\begin{array}{llr}2 & 26 & 3.0 \\ 2 & 21 & 38.2\end{array}$ | $1 \cdot 17$ $1 \cdot 17$ | $\begin{array}{rrrr}2 & 27 & 9 \cdot 9 \\ 2 & 22 & 45 \cdot 1\end{array}$ |  | $\begin{array}{llll}2 & 28 & 10 \cdot 4 \\ 2 & 23 & 45 \cdot 3\end{array}$ | 5 | $\begin{array}{lll}2 & 29 & 4.5 \\ 2 & 24 & 39.0\end{array}$ | 85 |
| 57 58 | \|rrrr | 40 | $\left\lvert\, \begin{array}{llll}2 & 20 & 24.5 \\ 2 & 15 & 59.2\end{array}\right.$ | 8 | $\begin{array}{llll}2 & 21 & 38 \cdot 2 \\ 2 & 17 & 13.2\end{array}$ | $1 \cdot 17$ | $\begin{array}{llll}2 & 22 & 45^{\prime} 1 \\ 2 & 18 & 20 \cdot 3\end{array}$ | 1.06 |  |  | 2 24  <br> 2 20 $39 \cdot$ <br>    | 84 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{\circ}{\circ}$ | $\begin{gathered} s . \\ +1.60 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 70 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +\mathrm{I} \cdot 70 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 73 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +1 \cdot 80 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 76 \end{gathered}$ | $\begin{gathered} s . \\ +1.90 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -4.80 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +2 \cdot 00 \end{gathered}$ | $\stackrel{\mathrm{s}}{-4.85}$ | $\begin{gathered} s . \\ +2 \cdot I I \end{gathered}$ | $\stackrel{s}{-4.89}$ |
| 4 | I.44 | 4.64 | 1.53 | 4.67 | 1.63 | 4.70 | 1.72 | 4.74 | 1.82 | $4 \cdot 78$ | 1.92 | 4.82 |
| 8 | I. 28 | 4.60 | $1 \cdot 37$ | 4.62 | 1.47 | 4.65 | 1.56 | 4.68 | I. 66 | $4 \cdot 71$ | I-76 | $4 \cdot 75$ |
| 12 | I. 14 | $4 \cdot 56$ | 1-23 | $4 \cdot 58$ | $1 \cdot 32$ | $4 \cdot 61$ | 1.41 | $4 \cdot 63$ | I 51 | $4 \cdot 66$ | I. 60 | $4 \cdot 69$ |
| 16 | 1.00 | $4 \cdot 52$ | 1.09 | $4 \cdot 55$ | 1-18 | $4 \cdot 57$ | I. 28 | $4 \cdot 59$ | I. 37 | $4 \cdot 62$ | 1.46 | $4 \cdot 65$ |
| 20 | +.87 | 4.50 | + .96 | 4.52 | +1.05 | 4.54 | +1.15 | $4 \cdot 56$ | +1.24 | $4 \cdot 58$ | +x.33 | $4 \cdot 61$ |
| 22 | -80 | $4 \cdot 49$ | -90 | $4 \cdot 50$ | -99 | $4 \cdot 52$ | I. 08 | $4 \cdot 54$ | I.18 | $4 \cdot 57$ | 1.27 | $4 \cdot 59$ |
| 24 | $\cdot 74$ | $4 \cdot 48$ | -83 | $4 \cdot 49$ | -93 | 4.51 | 1.02 | 4.53 | I-II | $4 \cdot 55$ | I-2I | $4 \cdot 57$ |
| 26 | . 68 | 4.47 | $\cdot 77$ | 4.48 | - 86 | 4.50 | -96 | 4.52 | I.05 | 4.54 | I-I5 | $4 \cdot 56$ |
| 28 | -62 | 4.46 | $\cdot 71$ | 4.47 | -80 | 4.49 | -90 | $4 \cdot 50$ | I 00 | $4 \cdot 52$ | I.09 | $4 \cdot 55$ |
| 30 | + 55 | 4.45 | +.65 | 4.46 | + 74 | $4 \cdot 48$ | +.84 | 4.49 | + 94 | $4 \cdot 51$ | +1.04 | $4 \cdot 54$ |
| 32 | -49 | 4.44 | -59 | $4 \cdot 45$ | - 69 | 4.47 | $\cdot 78$ | 4.48 | . 88 | 4.50 | -98 | $4 \cdot 52$ |
| 34 | -43 | 4.43 | -53 | 4.44 | -63 | $4 \cdot 46$ | -73 | 4.47 | -83 | 4.49 | -93 | $4 \cdot 5 \mathrm{I}$ |
| 36 | -37 | 4.43 | -47 | 4.44 | -57 | 4.45 | -67 | 4.46 | $\cdot 77$ | 4.48 | -87 | $4 \cdot 50$ |
| 38 | -30 | $4 \cdot 42$ | -41 | $4 \cdot 43$ | -51 | 4.44 | -6I | 4.45 | -72 | 4.47 | -82 | 4.49 |
| 40 | +.24 | $4 \cdot 42$ | + 34 | $4 \cdot 43$ | + $\cdot 45$ | 4.44 | +.56 | 4.45 | +.66 | $4 \cdot 46$ | + 77 | 4.48 |
| 42 | -17 | 4.41 | -28 | $4 \cdot 42$ | -39 | $4 \cdot 43$ | $\cdot 50$ | 4.44 | -61 | 4.45 | $\cdot 72$ | $4 \cdot 47$ |
| 44 | -10 | 4.41 | -22 | $4 \cdot 42$ | -33 | $4 \cdot 43$ | -44 | 4.44 | - 55 | 4.45 | -66 | $4 \cdot 46$ |
| 46 | +.03 | $4 \cdot 4 \mathrm{I}$ | - 15 | $4 \cdot 42$ | $\cdot 27$ | $4 \cdot 42$ | -38 | 4.43 | - 50 | 4.44 | -6I | $4 \cdot 46$ |
| 48 | -. 04 | 4.41 | -08 | $4 \cdot 41$ | $\cdot 20$ | $4 \cdot 42$ | -32 | $4 \cdot 42$ | -44 | 4.43 | $\cdot 56$ | 4.45 |
| 50 | - II | 4.41 | +.01 | 4.41 | + 14 | 4.42 | +.26 | $4 \cdot 42$ | + 39 | 4.43 | +.5I | 4.44 |
| 52 | -19 | 4.42 | -.06 | 4.41 | +.07 | $4{ }^{*} 4$ | -20 | 4.42 | -33 | 4.43 | $\cdot 46$ | $4 \cdot 44$ |
| 54 | $\cdot 27$ | 4.42 | -14 | 4.42 | -00 | 4.41 | '14 | 4.41 | -27 | 4.42 | -41 | $4 \cdot 43$ |
| 56 | $\cdot 36$ | $4 \cdot 43$ | - 22 | $4 \cdot 42$ | - .07 | 4.41 | +.07 | 4.41 | - 21 | 4.42 | $\cdot 35$ | 4.43 |
| 58 | $\cdot 46$ | $4 \cdot 44$ | -30 | $4 \cdot 43$ | - I5 | 4.41 | - 00 | 4.41 | -15 | 4.41 | $\cdot 30$ | $4 \cdot 42$ |

## LATITUDE $26^{\circ}$ ．

DECLINATION－SAME NAME AS－LATITUDE．

| True Alt． | $0^{\circ}$ | Decl． <br> Var． | $1^{\circ}$ | Decl． Var． | $2^{\circ}$ | Decl． <br> Var． | $3^{\circ}$ | Decl． <br> Var． | $4^{\circ}$ | Decl． <br> Var． | $5^{\circ}$ | Decl． Var． |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{\|ccc\|} \hline \text { H. M. } & \text { S. } \\ 6 & \text { o } & 0 \cdot 0 \end{array}$ | S． +1.95 | $\left\lvert\, \begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { I } & 57 \cdot I \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 95 \end{gathered}$ | $\left.\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 3 & 54^{\prime 2} \end{array} \right\rvert\,$ | $\begin{array}{r} \mathrm{S} \\ +\mathrm{I} \cdot 95 \end{array}$ | $\left.\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 5 & 5 \mathrm{I} \cdot 5 \end{array} \right\rvert\,$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 96 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. } & \text { M. } & \text { S. } \\ 6 & 7 & 49 \cdot 1 \end{array}\right.$ | $\begin{gathered} \text { S. } \\ +\mathrm{r} \cdot 96 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 9 & 47 \cdot 0 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{r} \cdot 97 \end{gathered}$ |
| 10 | $\begin{array}{llll}5 & 15 & 26 \cdot 5\end{array}$ | I． 99 | $517 \quad 25.3$ | 1.97 | $\begin{array}{llll}5 & 19 & 23.2\end{array}$ | 1．96 | $521 \cdot 20 \cdot 1$ | I．94 | $\begin{array}{llll}5 & 23 & 16.4\end{array}$ | 1.93 | $\begin{array}{lllll}5 & 25 & \text { II } 9\end{array}$ | I．92 |
| 12 | $\begin{array}{llll}5 & 6 & 30.0\end{array}$ | $2 \cdot 00$ | $\begin{array}{llll}5 & 8 & 29 \cdot 7\end{array}$ | I 98 | 5 10 $28 \cdot 3$ | I－97 | $\begin{array}{llll}5 & 12 & 25 \cdot 8\end{array}$ | I．95 | $\begin{array}{llll}5 & 14 & 22 \cdot 2\end{array}$ | I．93 | $\begin{array}{lllll}5 & 16 & 17 \cdot 9\end{array}$ | 1．92 |
| 14 | $45732 \cdot 6$ | 2.02 | $45933 \cdot 3$ | 2.00 | $\begin{array}{llll}5 & 1 & 32 \cdot 8\end{array}$ | $\underline{1} 98$ | $\begin{array}{llll}5 & 3 & 31 \cdot 0\end{array}$ | I．96 | $\begin{array}{lllll}5 & 5 & 27 \cdot 9\end{array}$ | I．94 | $\begin{array}{llll}5 & 7 & 23.7\end{array}$ | I．92 |
| 16 | $44^{48} 33 \cdot 8$ | 2.05 | $45036 \cdot 0$ | 2.0 | $45236 \cdot 5$ | $2 \cdot 00$ | $45435 \cdot 6$ | I．97 | $4 \begin{array}{llll}4 & 56 & 33 \cdot 2\end{array}$ | I．95 | $\begin{array}{llll}4 & 58 & 29.4\end{array}$ | I．92 |
| 18 | $43933 \cdot 7$ | $+2.08$ | $44137 \cdot 5$ | $+2.04$ | 443393 | $+2.02$ | 445394 | ＋I．99 | $44737 \cdot 8$ | ＋1．96 | $44934 \cdot 8$ | ＋I．93 |
| 20 | $43032 \cdot 0$ | $2 \cdot 11$ | $43237 \cdot 5$ | $2 \cdot 07$ | $\begin{array}{lllll}4 & 34 & 40 \cdot 9\end{array}$ | $2 \cdot 04$ | $43642 \cdot 3$ | 2.01 | $438 \quad 4 \mathrm{I} \cdot 8$ | I．98 | $4 \quad 4039.6$ | I．95 |
| 22 | $42128 \cdot 3$ | $2 \cdot 15$ | $423 \quad 35 \cdot 9$ | 2．II | $42541 \cdot 1$ | 2.07 | $42744^{\circ} \mathrm{O}$ | 2. | $42944 \cdot 8$ | I•99 | 43143.6 | －96 |
| 24 | 41222.4 | $2 \cdot 19$ | $4 \begin{array}{llll}4 & 14 & 32 \cdot 3\end{array}$ | $2 \cdot 14$ | 41639.6 | $2 \cdot 10$ | $4 \begin{array}{llll}4 & 184\end{array}$ | 2. | $42046 \cdot 7$ | 2 | $42246 \cdot 8$ | r．98 |
| 26 | 4314.0 | $2 \cdot 23$ | $4 \quad 5 \quad 26 \cdot 6$ | $2 \cdot 1$ | $47736 \cdot 2$ | $2 \cdot 13$ | $4943 \cdot 0$ | 2.09 | 4 II 47•2 | $2 \cdot 04$ | $4 \begin{array}{llll}4 & 13 & 48\end{array}$ | $2 \cdot 00$ |
| 27 | $3 \begin{array}{lllll}3 & 58 & 38 \cdot 7\end{array}$ | $+2 \cdot 26$ | $4 \quad 0 \quad 52.7$ | ＋2．21 | $\begin{array}{llll}4 & 3 & 3 \cdot 7\end{array}$ | $+2 \cdot 16$ | 4511.7 | ＋2．12 | 4 7 エ7・ク | ＋2．06 | $\begin{array}{lll}4 & 9 & 19.4\end{array}$ | ＋2．01 |
| 28 | $\begin{array}{llll}3 & 54 & 2 \cdot 6\end{array}$ | 2.29 | $35618 \cdot 2$ | $2 \cdot 23$ | 3 $358830 \cdot 6$ | 2．18 | $\begin{array}{rrrr}4 & 0 & 39 \cdot 8\end{array}$ | $2 \cdot 13$ | $4 \begin{array}{lrr} \\ 4 & 2 & 46 \cdot 1\end{array}$ | $2 \cdot 08$ | $\begin{array}{llll}4 & 4 & 49 \cdot 5\end{array}$ | 2.03 |
| 29 | $\begin{array}{lllll}3 & 49 & 25 \cdot 7\end{array}$ | $2 \cdot 32$ | 35143.0 | $2 \cdot 26$ | $\begin{array}{llll}3 & 53 & 56 \cdot 8\end{array}$ | 2.20 | $\begin{array}{llll}3 & 56 & 7 \cdot 4\end{array}$ | $2 \cdot 15$ | $\begin{array}{llll}3 & 58 & 14.8\end{array}$ | O | $\begin{array}{lrrr}4 & 0 & 19.2 \\ 3 & 55 & 48.5\end{array}$ | 2.05 |
| 30 | 33 44  | $2 \cdot 35$ | 3476.9 | $2 \cdot 29$ | $34922 \cdot 3$ | $2 \cdot 23$ | $3 \mathrm{5I} 34 \cdot 3$ | $2 \cdot 17$ | $\begin{array}{lllllllllllllll}3 & 53 & 43\end{array}$ | 2 | $\begin{array}{lllllllllll}3 & 55 & 48\end{array}$ | $2 \cdot 06$ |
| 31 | 340 9•I | $2 \cdot 38$ | $34230 \cdot 0$ | $2 \cdot 31$ | 344 47＇I | 2.25 | $\begin{array}{lll}3 & 47 & 0.6\end{array}$ | 2．19 | $3 \begin{array}{llll}3 & 49 & 10 \cdot 6\end{array}$ | 2．14 | $35117 \cdot 3$ | 8 |
| 32 | $335 \quad 29 \cdot 3$ | $+2.41$ | 33752.2 | $+2 \cdot 35$ | 340 II•I | ＋2．28 | $\begin{array}{llll}3 & 42 & 26 \cdot 2\end{array}$ | $+2 \cdot 22$ | $34437 \cdot 6$ | $+2 \cdot 16$ | $34645 \cdot 6$ | ＋2．10 |
| 33 | $33048 \cdot 4$ | $2 \cdot 45$ | $\begin{array}{lllll}3 & 33 & 13 \cdot 3\end{array}$ | $2 \cdot 38$ | $\begin{array}{lllll}3 & 35 & 34 \cdot 2\end{array}$ | $2 \cdot 31$ | $\begin{array}{llll}3 & 37 & 51 \cdot 0\end{array}$ | $2 \cdot 25$ | 34040 | $2 \cdot 18$ | $3 \begin{array}{llll}3 & 42 & 13\end{array}$ | $2 \cdot 12$ |
| 3 | $\begin{array}{llll}3 & 26 & 6 \cdot 2\end{array}$ | $2 \cdot 49$ | $\begin{array}{llll}3 & 28 & 33 \cdot 5\end{array}$ | 2.41 | $\begin{array}{llll}3 & 30 & 56 \cdot 3 \\ 3 & 26 & \end{array}$ | $2 \cdot 34$ | 3 33 15 <br> 3 18  | 2.27 | $\begin{array}{llll}3 & 35 & 29 \cdot 6 \\ 3 & 30 & 5 \cdot 5\end{array}$ | $2 \cdot$ | $\begin{array}{llll}3 & 37 & 40.4 \\ 3 & 3 & 6.8\end{array}$ | $2 \cdot 15$ |
| 35 | $\begin{array}{llll}3 & 21 & 22 \cdot 8\end{array}$ | 2.53 | $\begin{array}{llll}3 & 23 & 52.4\end{array}$ | 2.45 | $\begin{array}{lllll}3 & 26 & 17.5\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}3 & 28 & 38 \cdot 1\end{array}$ | $2 \cdot 31$ | $330054 \cdot 5$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 33 & 6.8\end{array}$ | $2 \cdot 17$ |
| 36 | 3 I6 $38 \cdot 0$ | $2 \cdot 58$ | $\begin{array}{llll}3 & 19 & 10.2\end{array}$ | $2 \cdot 50$ | $32137 \cdot 5$ | 2.41 | $\begin{array}{lll}3 & 24 & 0.2\end{array}$ | $2 \cdot 34$ | $3 \quad 2618.5$ | $2 \cdot 27$ | $328 \quad 32 \cdot 5$ | $2 \cdot 20$ |
|  | 3 II 51「7 | ＋2．63 | $314466 \cdot 6$ | ＋2．54 | $3 \mathrm{I} 6156 \cdot 4$ | $+2.45$ | $\begin{array}{lll}3 & 19 & 2 I \cdot 3\end{array}$ | $+2 \cdot 37$ | $3 \mathrm{2I} 4 \mathrm{4} \cdot 6$ | ＋2．30 | $\begin{array}{llll}3 & 23 & 57 \cdot 4\end{array}$ | ＋2．23 |
| 38 | $\begin{array}{lll}3 & 7 & 3.7\end{array}$ | 2.68 | $3{ }^{3}$ | 2.58 | $\begin{array}{rrrr}3 & 12 & 14.0\end{array}$ | 2.50 | $\begin{array}{llll}3 & 14 & 41 \cdot 3\end{array}$ | 2.41 | 3 I7 $3 \cdot 7$ | $2 \cdot 33$ | $\begin{array}{lllll}3 & 19 & 21 \cdot 5\end{array}$ | $2 \cdot 26$ |
| 39 | 3 2 14.0 | 2.73 | $\begin{array}{llll}3 & 4 & 55.0\end{array}$ | 2.63 | $\begin{array}{llll}3 & 7 & 30 \cdot 3\end{array}$ | 2.54 2.54 | $\begin{array}{lrr}3 & 10 & 0 \cdot 1 \\ 3 & 5 & 17.6\end{array}$ | 2.45 2.50 | $\begin{array}{rrrr}3 & 12 & 24 \cdot 8 \\ 3 & 7 & 44 \cdot 8\end{array}$ | $2 \cdot 37$ | $\begin{array}{llllll}3 & 14 & 44 \cdot 6 \\ 3 & 10 & 6.8\end{array}$ | 2.29 |
| 40 | $\begin{array}{llll}2 & 57 & 22.4\end{array}$ | 2.79 | $\begin{array}{lrrr}3 & 0 & 6 \cdot 7 \\ 2 & 55 & 6 \cdot 6\end{array}$ | 2.69 | 3 2 $45 \cdot 0$  <br> 2 5 5  | 2.59 | $\begin{array}{llll}3 & 5 & 17.6 \\ 3 & 0 & 33.7\end{array}$ | $2 \cdot 50$ | $\begin{array}{llll}3 & 7 & 44 \cdot 8 \\ 3 & 3 & 3 \cdot 5\end{array}$ | 2.41 | $\begin{array}{rrr}3 & 10 & 6.8 \\ 3 & 5 & 27.8\end{array}$ | $2 \cdot 32$ |
| 41 | $25228 \cdot 6$ | 2.85 | $25516 \cdot 6$ | $2 \cdot 74$ | $25758 \cdot \mathrm{I}$ | $2 \cdot 64$ | $3 \quad 0 \quad 33.7$ | $2 \cdot 54$ | $\begin{array}{llll}3 & 3 & 3 \cdot 5\end{array}$ | $2 \cdot 45$ | $\begin{array}{llll}3 & 5 & 27 \cdot 8\end{array}$ | $2 \cdot 36$ |
| 42 | $24732 \cdot 6$ | $+2.92$ | 25024.4 | ＋2．81 | 25319.5 | ＋2．70 | $2 \begin{array}{llll}25 & 48 \cdot 2\end{array}$ | ＋2．59 | $25820 \cdot 8$ | ＋2．49 | $3 \quad 0 \quad 47 \cdot 7$ | $+2.40$ |
| 43 | $24234 \cdot 1$ | 3.00 | $24530 \cdot 1$ | 2.87 | 248 I9．0 | $2 \cdot 76$ | 25 I I•O | $2 \cdot 65$ | $2 \begin{array}{llll}2 & 53 & 36 \cdot 7\end{array}$ | $2 \cdot 54$ | $2 \begin{array}{lll}26 & 6 \cdot 3\end{array}$ | $2 \cdot 45$ |
| 44 | $\begin{array}{lllll}2 & 37 & 32 \cdot 9\end{array}$ | 3.08 | $\begin{array}{llll}2 & 40 & 33.4\end{array}$ | $2 \cdot 94$ | $\begin{array}{llll}2 & 43 & 26 \cdot 3\end{array}$ | 2.82 | $2 \begin{array}{llll}2 & 46 & 12 \cdot 0\end{array}$ | $2 \cdot 70$ | $\begin{array}{lllll}2 & 48 & 50 \cdot 9\end{array}$ | $2 \cdot 60$ | $2 \begin{array}{llll}21 & 23.5\end{array}$ | 2.49 |
| 45 | $2 \begin{array}{llll}2 & 32 & 28 \cdot 6\end{array}$ | $3 \cdot 16$ | 2 35 $34^{\circ}$ | 3.02 | $\begin{array}{llll}2 & 38 & 31 \cdot 3\end{array}$ | $2 \cdot 89$ | $\begin{array}{llll}2 & 41 & 21 \cdot 0 \\ 2 & 36 & 27\end{array}$ | $2 \cdot 77$ | $\begin{array}{lll}2 & 44 & 3 \cdot 5 \\ 2 & 39 & \end{array}$ | $2 \cdot 65$ | $\begin{array}{lllll}2 & 46 & 39 \cdot 2\end{array}$ | $2 \cdot 54$ |
| 46 | 22721.0 | $3 \cdot 26$ | $23031 \cdot 7$ | $3 \cdot 11$ | $23333 \cdot 8$ | $2 \cdot 97$ | $236 \quad 27 \cdot 7$ | $2 \cdot 84$ | 239 14．I | $2 \cdot 71$ | $2 \begin{array}{lllllll}2 & 41 & 53.3\end{array}$ | － |
| 47 | 22297 | $+3 \cdot 36$ | $225 \quad 26 \cdot 2$ | ＋3．20 | $\begin{array}{llll}2 & 28 & 33.4\end{array}$ | $+3.05$ | $23132 \cdot 0$ | ＋2．91 | $234 \begin{array}{lll}22.5\end{array}$ | $+2.78$ | 237504 | ＋2．65 |
| 48 | 21654.3 | 3.46 | $220 \mathrm{I} 7 \cdot \mathrm{I}$ | $3 \cdot 30$ | $22330 \cdot 0$ | $3 \cdot 14$ | $2 \begin{array}{llllll}26 & 33 \cdot 7\end{array}$ | $2 \cdot 99$ | $\begin{array}{lllll}2 & 29 & 28 \cdot 7\end{array}$ | $2 \cdot 85$ | $\begin{array}{llll}2 & 32 & 15.6\end{array}$ | $2 \cdot 72$ |
| 49 | 2 II 34.2 | $3 \cdot 58$ | $2 \begin{array}{lll}15 & 4 \cdot 1\end{array}$ | 3.41 | $\begin{array}{llll}2 & 18 & 23.2\end{array}$ | 3.23 |  | 3. | $\begin{array}{llll}2 & 24 & 32 \cdot 3\end{array}$ | $2 \cdot 93$ | $\begin{array}{lllll}2 & 27 & 23 \cdot 5\end{array}$ | $2 \cdot 79$ |
| 50 | $\begin{array}{llll}2 & 6 & 8.8\end{array}$ | $3 \cdot 70$ | $\begin{array}{llll}2 & 9 & 46 \cdot 5\end{array}$ | 3.53 | $\begin{array}{llll}2 & 13 & 12.4 \\ 2 & 7 & 574\end{array}$ | $3 \cdot 34$ | $\begin{array}{lllll}2 & 16 & 27 \cdot 7 \\ 2 & 11 & \end{array}$ | $3 \cdot 17$ | $\begin{array}{llll}2 & 19 & 33.0\end{array}$ | 3.01 | 2 22 $29 \cdot 1$ | $2 \cdot 86$ |
| 51 | $2 \quad 0 \quad 37 \cdot 6$ | $3 \cdot 84$ | $2 \quad 4 \quad 23.8$ | 3.66 | 27574.4 | 3.46 | 2 II I9．3 | $3 \cdot 28$ | $21430 \cdot 5$ | $3 \cdot 10$ | 2 I7 3I•8 | $2 \cdot 94$ |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE．

| Alt． | L． $0^{\circ} \mathrm{A}$ ． |  | L． $1^{\circ} \mathrm{A}$ ． |  | L． $2^{\circ} \mathrm{A}$ ． |  | L． $3^{\circ} \mathrm{A}$ ． |  | L． $4^{\circ} \mathrm{A}$ ． |  | L． $5^{\circ} \mathrm{A}$ ． |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s． | S． | S． $+\quad .09$ | S． | $\stackrel{\mathrm{s} .}{17}$ | 45 | s． $+\quad .26$ | s． -4.46 | s． $+\quad .35$ | $\begin{gathered} \text { s. } \\ -4 \cdot 46 \end{gathered}$ | s． | s． |
| 2 | －．00 | -4.45 4.45 | $+\quad .09$ $+\quad 01$ | -4.45 4.45 | ＋ | 4.45 | ．18 | $4 \cdot 45$ | ＋ 27 | $4 \cdot 46$ | －． 36 | 4.46 |
| 4 | － 15 | $4 \cdot 45$ | －．06 | $4 \cdot 45$ | ＋．02 | $4 \cdot 45$ | －II | $4 \cdot 45$ | － 20 | 4.45 | －28 | $4 \cdot 46$ |
| 6 | ． 22 | $4 \cdot 46$ | ． 14 | $4 \cdot 45$ | －．06 | $4 \cdot 45$ | ＋．03 | $4 \cdot 45$ | $\cdot 12$ | 4.45 | －21 | $4 \cdot 45$ |
| 8 | －31 | $4 \cdot 46$ | ． 22 | $4 \cdot 45$ | －13 | 4.45 | －． 04 | $4 \cdot 45$ | ＋．04 | 4.45 | －13 | 4.45 |
| 10 | － 39 | $4 \cdot 47$ | － 30 | $4 \cdot 46$ | $\cdot 20$ | 4.45 | $\cdot 12$ | 4.45 | －．03 | 4.45 | ＋．06 | $4 \cdot 45$ |
| 12 | $\cdot 46$ | $4 \cdot 47$ | $\cdot 37$ | $4 \cdot 46$ | $\cdot 28$ | 4.46 | － 20 | 4.45 | $\cdot \mathrm{II}$ | 4.45 | －． 02 | 4.45 |
| 14 | －54 | $4 \cdot 48$ | －45 | 4.47 | $\cdot 36$ | $4 \cdot 46$ | $\cdot 28$ | 4.46 | －19 | 4.45 | －10 | 4.45 |
| 16 | ． 63 | $4 \cdot 49$ | $\cdot 54$ | $4 \cdot 48$ | ${ }^{-45}$ | 4.47 | $\cdot 35$ | $4 \cdot 46$ | －26 | $4 \cdot 46$ | －18 | 4.45 |
| 18 | $\cdot 72$ | $4 \cdot 51$ | ． 62 | $4 \cdot 49$ | $\cdot 53$ | $4 \cdot 48$ | $\cdot 43$ | $4 \cdot 47$ | $\cdot 34$ | $4 \cdot 46$ | －25 | $4 \cdot 46$ |
| 20 | －． 80 | $4 \cdot 52$ | － 71 | $4 \cdot 5 \mathrm{I}$ | － 6 I | 4.49 | － 52 | $4 \cdot 48$ | －$\cdot 43$ | 4.47 | －33 | 4.46 |
| 22 | ． 89 | 4.54 | $\cdot 79$ | $4 \cdot 52$ | $\cdot 70$ | $4 \cdot 50$ | ． 60 | $4 \cdot 49$ | $\cdot 51$ | $4 \cdot 48$ | －41 | $4 \cdot 47$ |
| 24 | －99 | 4.56 | ． 88 | 4.54 | $\cdot 79$ | 4.52 | $\cdot 69$ | $4 \cdot 50$ | ． 60 | $44 \cdot 9$ | $\cdot 50$ | 4.48 |
| 26 | I－09 | 4.58 | $\cdot 98$ | $4 \cdot 56$ | ． 88 | $4 \cdot 54$ | $\cdot 78$ | 4.52 | $\cdot 68$ | $4 \cdot 50$ | $\cdot 58$ | 4.49 |
| 28 | I•19 | $4 \cdot 61$ | $1 \cdot 09$ | $4 \cdot 58$ | $\cdot 98$ | 4.56 | － 88 | $4 \cdot 54$ | $\cdot 78$ | $4 \cdot 52$ | ． 67 | $4 \cdot 50$ |
| 30 | －1．3I | 4.63 | －I．19 | 4.60 | －r．08 | $4 \cdot 58$ | －． 98 | 4：55 | －．88 | $4 \cdot 53$ | －．77 | 4.51 |
| 32 | 1.42 | 4.67 | 1.30 | 4.64 | I．19 | 4.61 | I． 08 | 4.58 | $\cdot 97$ $\times .08$ | 4.55 |  | 4.53 |
| 34 | $\begin{array}{r}1.55 \\ \mathbf{r} \\ \hline\end{array}$ | 4.71 | 1.42 $\mathbf{r} 56$ | $4 \cdot 67$ | 1.31 1.43 | 4.64 4.67 | 1.19 1．31 | 4.61 4.64 | 1.08 1．19 | 4.58 4.6 r | $\cdot 97$ $\mathrm{r} \cdot 07$ | 4.55 4.58 |
| 36 | $\begin{array}{r}\text { r } \\ \mathbf{1} .68 \\ \hline 18\end{array}$ | 4.76 4.81 | 1.56 r .70 | $4 \cdot 71$ $4 \cdot 76$ | 1.43 1.57 | 4.67 4.72 | 1.35 I .44 | 4.64 4.68 | $1 \cdot 19$ 1.31 | 4.61 4.64 | r．07 r．19 | 4.58 4.61 |
| 38 | 1．83 | $4 \cdot 8 \mathrm{I}$ | I•70 | $4 \cdot 76$ | 1．57 | $4 \cdot 72$ | I 44 | $4 \cdot 68$ | $1 \cdot 31$ | $4 \cdot 64$ | 1．19 | 4.61 |
| 40 | －1．99 | 4.88 | －1．85 | 4.82 | －I．71 | $4 \cdot 77$ | － $\mathrm{I} \cdot 58$ | $4 \cdot 72$ | －1．44 | $4 \cdot 68$ | － 1.31 | 4.64 |
| 42 | $2 \cdot 17$ | 4.95 | 2.02 | $4 \cdot 89$ | 1．87 | 4.83 | I．72 | 4.77 | I 58 | 4.73 | I． 44 | $4 \cdot 68$ |
| 44 | 2.38 | 5.05 | 2.21 | 4.97 | 2.04 | 4.90 | 1.89 2.07 | 4.83 | 1．74 | 4.78 4.84 | 1.59 <br> r <br> r | 4.73 4.78 |
| 46 48 | 2.61 2.87 | $5 \cdot 16$ 5.30 | 2.42 2.66 | $5 \cdot 06$ $5 \cdot 18$ | 2.24 2.46 | 4.08 5.08 | 2.07 2.27 | 4.91 5.00 | 1.91 2.09 | 4.84 4.92 | 1.75 r .92 | 4.78 4.85 |
| 50 | 3.18 | $5 \cdot 47$ | $2 \cdot 94$ | $5 \cdot 34$ | 2.72 | $5 \cdot 21$ | 2.51 | $5 \cdot 11$ | $2 \cdot 3 \mathrm{I}$ | $5 \cdot \mathrm{OI}$ | $2 \cdot 12$ | $4 \cdot 93$ |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 107

 LATITUDE $26^{\circ}$.DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & \text { II } \end{array}$ | $+1.97$ | $\begin{array}{lcc} \text { H. м. } & \text { s. } \\ 6 & \text { r3 } & 44^{\circ} \mathrm{O} \end{array}$ | $\begin{gathered} s . \\ +r \cdot 98 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { 15 } & 43 \cdot 3 \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{I} \cdot 99 \end{gathered}$ | $\begin{array}{llc} \text { H. M. } & \text { s. } \\ 6 & \text { I7 } & 43 \cdot 3 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +2.00 \end{gathered}$ | $\begin{array}{llc} \text { H. M. S. } \\ 6 & \text { I9 } & 44 \cdot 1 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +2 \cdot 02 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. s. } & \text { S. } \\ 6 & 2 I & 45^{\circ} 6 \end{array}\right.$ | S. $2 \cdot 03$ |
| 10 | $\begin{array}{llll}5 & 27 & 6.8\end{array}$ | I.91 | $\begin{array}{lll}5 & 29 & 1.2\end{array}$ | I.90 | $53055 \cdot \mathrm{I}$ | I.89 | $53248 \cdot 6$ | I.89 | $5344 \mathrm{I} \cdot 8$ | I.88 | $53634 \cdot 8$ | I. 88 |
| 12 |  | 90 | 5206.6 | 1.89 | 5220.0 | r. 88 | $5 \quad 23 \quad 52 \cdot 7$ | r. 88 | $52545 \cdot 0$ | 1.87 | $5 \quad 2736 \cdot 7$ | I. 86 |
| 14 | $\begin{array}{llll}5 & 9 & 18 \cdot 5\end{array}$ | I 90 | 5 II 12.4 | I.89 | $\begin{array}{llll}5 & 13 & 5 \cdot 3\end{array}$ | I. 87 | $\begin{array}{llllllllllllllllll}5 & 14 & 57.5\end{array}$ | I.86 | $5{ }_{5} 1649.0$ | I. 85 | $\begin{array}{lllllllllllllllllll}5 & 18 & 39 \cdot 7\end{array}$ | r. 84 |
| 16 | $5 \quad 0 \quad 24.4$ | I.9r | $\begin{array}{llll}5 & 2 & 18 \cdot 3\end{array}$ | I.89 | 54110 | 1.87 | $\begin{array}{lll}5 & 6 & 2 \cdot 8\end{array}$ | I.85 | $\begin{array}{lllll}5 & 7 & 53.6\end{array}$ | I. 84 | $\begin{array}{lllll}5 & 9 & 43 \cdot 5\end{array}$ | I.82 |
| 18 | $45130 \cdot 2$ | +I.9I | 45324.2 | + 1.89 | 455 17.0 | + 1.87 | 45788.4 | + r .85 | $45858 \cdot 8$ | +1.83 | $5 \quad 0 \quad 48 \cdot 0$ | + I.8I |
| 20 | $4 \begin{array}{llll}4 & 42 & 35 \cdot 6\end{array}$ | I.92 | $4 \begin{array}{llll}4 & 44 & 30 \cdot 0\end{array}$ | I. 89 | 446122.9 | I.87 | $44^{48} \begin{array}{lll}14.3\end{array}$ | I.85 | 450 | I.82 | 45153.1 | I.80 |
| 22 | $43340 \cdot 5$ | I.93 | $435 \quad 35 \cdot 5$ | I.90 | $\begin{array}{llll}4 & 37 & 28 \cdot 7\end{array}$ | I. 87 | $43920 \cdot 2$ | 1.85 | $44110 \cdot 2$ | I. 82 | $44258 \cdot 6$ | I.80 |
| 24 | $42444 \cdot 7$ | 5 | $\begin{array}{lllll}4 & 26 & 40 \cdot 4\end{array}$ | I.91 | $\begin{array}{llll}4 & 28 & 34 \cdot 2\end{array}$ | I. 88 | $43026 \cdot 1$ | r.85 | $432 \begin{array}{llll} & 16 \cdot 2\end{array}$ | I.82 | $434 \begin{array}{lll}4 & 4\end{array}$ | 1.79 |
| 26 | $41548 \cdot 0$ | I.96 | 4 I7 $44 \cdot 8$ | I.92 | $41939 \cdot 3$ | I.89 | $42131 \cdot 7$ | I. 85 | $42322 \cdot 0$ | I.82 | $\begin{array}{llll}4 & 25 & 10.4\end{array}$ | 1.79 |
| 28 | $4 \begin{array}{lll}4 & 6 & 50 \cdot 2\end{array}$ | +1.99 | $48848 \cdot 2$ | +r.95 | 4 ro $43 \cdot 8$ | +I.91 | $41237 \cdot 0$ | +r.87 | $4 \begin{array}{llll}4 & 14 & 27 \cdot 7\end{array}$ | + $\mathrm{I} \cdot 82$ | 4 16 16.3 | +1.78 |
| 30 | $35751 \cdot 0$ | $2 \cdot 01$ | $\begin{array}{llll}3 & 59 & 50 \cdot 6\end{array}$ | 1.97 | $\begin{array}{rrrr}4 & 1 & 47 \cdot 4\end{array}$ | I-91 | $4 \begin{array}{lll}4 & 3 & 41 \cdot 5\end{array}$ | I.88 | $4 \quad 5 \quad 33 \cdot 0$ | I. 84 | $47822 \cdot 0$ | I.80 |
| 32 | $34^{3} 4850 \cdot 2$ | 2.05 | $35051 \cdot 6$ | $2 \cdot 00$ | $\begin{array}{llll}3 & 52 & 50 \cdot 0\end{array}$ | I.94 | $35445 \cdot 2$ | I.90 | $356137 \cdot 7$ | I.85 | $\begin{array}{lllll}3 & 58 & 27.4\end{array}$ | I.81 |
| 33 | $\begin{array}{llll}3 & 44 & \text { I9•I }\end{array}$ | 2.07 | $3{ }^{3} 4621 \cdot 5$ | 2.01 | $\begin{array}{llll}3 & 48 & 20 \cdot 7\end{array}$ | I.96 | $35016 \cdot 7$ | I.91 | $\begin{array}{llll}3 & 52 & 9.8\end{array}$ | I. 86 | $\begin{array}{lllll}3 & 53 & 59 \cdot 9\end{array}$ | I.81 |
| 34 | $3 \begin{array}{llll}3 & 39 & 47 \cdot 4\end{array}$ | $2 \cdot 08$ | $3415 \mathrm{I} \cdot \mathrm{O}$ | 2.03 | 343 5I•I | r.97 | $34548 \cdot 0$ | I.92 | 347 4I'7 | I.87 | 349 32.3 | I. 82 |
| 35 | $3{ }^{3} 3515 \cdot 3$ | $+2 \cdot \mathrm{II}$ | $313720 \cdot 0$ | $+2.05$ | $3 \begin{array}{lll}3 & 39 & \mathbf{2 I} \cdot 2\end{array}$ | + I.99 | $341518 \cdot 9$ | +1.93 | 34313.3 | +I.88 | $345 \quad 4.4$ | +I.82 |
| 36 | $3{ }^{3} 3042.4$ | $2 \cdot 13$ | $313248 \cdot 5$ | $2 \cdot 07$ | $3 \begin{array}{llll}3 & 34 & 50 \cdot 7\end{array}$ | $2 \cdot 01$ |  | 1.95 | $\begin{array}{lllllllllllll}3 & 38 & 44 \cdot 6\end{array}$ | I. 89 | 340 | I. 83 |
| 37 | $\begin{array}{llll}3 & 26 & 9 \cdot 0\end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}3 & 28 & 16 \cdot 3\end{array}$ | $2 \cdot 09$ | 33019.9 | 2.03 |  | I.96 | $\begin{array}{llll}3 & 34 & 15.6\end{array}$ | 1.90 | $3 \begin{array}{llll}36 & 8 \cdot 1\end{array}$ | I. 84 |
| 38 | $3 \begin{array}{llll}3 & 21 & 34.7\end{array}$ | 2 | $\begin{array}{llll}3 & 23 & 43 \cdot 6\end{array}$ | $2 \cdot 11$ | $\begin{array}{lllll}3 & 25 & 48 \cdot 4\end{array}$ | 2.05 |  | I.98 | $\begin{array}{llllllllllll}3 & 29 & 46 \cdot 3\end{array}$ | I.92 |  | I. 86 |
| 39 |  | 2.21 | $31910 \cdot 2$ | $2 \cdot 14$ | $3 \begin{array}{lll}3 & 216 \cdot 5\end{array}$ | 2.07 | $\begin{array}{llll}3 & 23 & 18.5\end{array}$ | $2 \cdot 00$ | 32516.5 | I.93 | $3 \quad 27107$ | I. 87 |
| 4 | $\begin{array}{llll}3 & 12 & 23.8\end{array}$ | $+2.24$ | $3 \mathrm{I} 4{ }^{36 \cdot 1}$ | +2.17 | $\begin{array}{lll}3 & 16 & 43 \cdot 8\end{array}$ | +2.09 | $\begin{array}{lllll}3 & 18 & 47 \cdot 2\end{array}$ | $+2.02$ | $32046 \cdot 4$ | +r.95 | $32241 \cdot 5$ | + I. 88 |
| 41 | 37747.0 | $2 \cdot 28$ | 3 Io I•I | $2 \cdot 19$ | $\begin{array}{llll}3 & 12 & 10 \cdot 5\end{array}$ | $2 \cdot 12$ | 314150 | $2 \cdot 04$ | 31615.8 | I•97 | 3 18 II.9 | I.90 |
| 42 | 3 3 $9 \cdot 1$  <br>  5 9  | $2 \cdot 31$ | $\begin{array}{llll}3 & 5 & 25 \cdot 3\end{array}$ | 2.23 | $\begin{array}{lll}3 & 7 & 36 \cdot 5\end{array}$ | $2 \cdot 15$ | $\begin{array}{lllll}3 & 9 & 42.9\end{array}$ | 2.07 | 3 II 44.6 | I.99 | 31341.9 | I.92 |
| 43 | $\begin{array}{llll}2 & 58 & 30 \cdot 2\end{array}$ | $2 \cdot 35$ | 3 O 0 | $2 \cdot 26$ | $\begin{array}{llll}3 & 3 & 1 & 7\end{array}$ | $2 \cdot 18$ | $\begin{array}{llll}3 & 5 & 9 & 7\end{array}$ | $2 \cdot 09$ | 37513.0 | - | $3{ }^{3} 9711.4$ | I•94 |
| 4 | 253 50•I | $2 \cdot 39$ | 2561 | $2 \cdot 30$ | $\begin{array}{llll}2 & 58 & 25 \cdot 9\end{array}$ | 2.21 | 3 0 35.8 | $2 \cdot 12$ | $\begin{array}{llll}3 & 2 & 40 \cdot 6\end{array}$ | 2.04 | $\begin{array}{lllll}3 & 4 & 40 \cdot 5\end{array}$ | I.96 |
| 45 | 2 4 498.6 | +2.44 | $2513 \mathrm{I} \cdot 8$ | +2.34 | $25349 \cdot 2$ | +2.24 | $256 \quad \mathrm{I} \cdot \mathrm{I}$ | $+2 \cdot 15$ | $\begin{array}{llll}2 & 58 & 7 \cdot 6\end{array}$ | $+2.07$ | $3 \quad 0 \quad 9 \cdot 0$ | +r.98 |
| 46 | 24425.7 | 2.49 | $2465 \mathrm{I} \cdot 6$ | $2 \cdot 38$ | 249 II•5 | $2 \cdot 28$ | $25125 \cdot 5$ | $2 \cdot 19$ | 253333.8 | 2.09 | $25536 \cdot 8$ | 2.01 |
| 4 | 239415 | $2 \cdot 54$ | 242 IO. I | 2.43 | $\begin{array}{llll}2 & 44 & 32 \cdot 5\end{array}$ | $2 \cdot 32$ | $\begin{array}{lllllllllll}2 & 46 & 48.8\end{array}$ | $2 \cdot 22$ | $\begin{array}{lllll}2 & 48 & 59 \cdot 2\end{array}$ | $2 \cdot 13$ | $2 \begin{array}{lll}2 & 51 & 3.9\end{array}$ | 2.03 |
| 48 | 23454.9 | 2.59 | $\begin{array}{llll}2 & 37 & 27.0\end{array}$ | 2.48 | $\begin{array}{lllll}2 & 39 & 52 \cdot 3\end{array}$ | $2 \cdot 37$ | 242 IIII | $2 \cdot 26$ | $\begin{array}{lllll}2 & 44 & 23.7\end{array}$ | $2 \cdot 16$ | $246 \quad 30 \cdot 3$ | 2.06 |
| 4 | 2306.8 | $2 \cdot 66$ | $23242 \cdot 3$ | 2.53 | $\begin{array}{lllll}2 & 35 & 10.7\end{array}$ | 2.42 | 23732.2 | $2 \cdot 30$ | 239 47:2 | $2 \cdot 20$ | 24155.9 | 2.09 |
| 50 | $\begin{array}{llll}2 & 25 & 16.5\end{array}$ | $+2.72$ | 22755.9 | $+2.59$ | $2 \begin{array}{llll}2 & 30 & 27 \cdot 6\end{array}$ | $+2.47$ | $23252 \cdot 0$ | $+2.35$ | $2350 \cdot 6$ | +2.24 | $23720 \cdot 5$ | $+2 \cdot 13$ |
| 51 | $\begin{array}{llll}2 & 20 & 23.9\end{array}$ | 2.80 |  | 2.66 | $\begin{array}{llll}2 & 25 & 42 \cdot 7 \\ 2 & 20 & 55 \cdot 9\end{array}$ | 2.52 | $\begin{array}{llll}2 & 28 & 10 \cdot 3\end{array}$ | 2.40 | $\begin{array}{llll}2 & 30 & 30 \cdot 7\end{array}$ | 2.28 | $23244 \cdot 1$ | 2.17 |
| 52 | $\begin{array}{llll}2 & 15 & 28 \cdot 7 \\ 2 & 1 & 3 & 306\end{array}$ | 2.88 | $\begin{array}{llll}2 & 18 & 16.6\end{array}$ | 2.73 | $22_{20} 2055 \cdot 9$ | 2.59 | $\begin{array}{llll}2 & 23 & 27 \cdot 1 \\ 2 & 18\end{array}$ | 2.45 | $\begin{array}{llll}2 & 25 & 50 \cdot 5\end{array}$ | $2 \cdot 33$ | $\begin{array}{lll}2 & 28 & 6 \cdot 6\end{array}$ | $2 \cdot 21$ |
| 53 | $2 \begin{array}{rrr}2 & 10 & 30 \cdot 6 \\ 2 & 5 & 20 \cdot 0\end{array}$ | 2.96 |  | 2.81 | $216 \quad 7 \cdot 3$ | $2 \cdot 66$ | $2 \mathrm{I} 812 \cdot \mathrm{I}$ | $2 \cdot 51$ | $\begin{array}{lll}2 & 21 & 8 \cdot 9\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}2 & 23 & 27.9\end{array}$ | 2.25 |
| 54 | $2 \begin{array}{lll}2 & 5 & 29 \%\end{array}$ | 3.05 | $2 \quad 8 \quad 27 \cdot 5$ | 2.89 | 2 II 15.9 | $2 \cdot 73$ | 21355.0 | $2 \cdot 58$ | $2 \begin{array}{llll}2 & 16 & 25.5\end{array}$ | 2.44 |  | $2 \cdot 31$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $\mathbf{6}^{\circ} \mathrm{A}$. |  | L. $\mathrm{y}^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .52 \end{aligned}$ | $\begin{gathered} s . \\ -4.48 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\quad .6 \mathrm{I} \end{gathered}$ | S. -4.49 | $+\stackrel{s .}{70}$ | $\begin{gathered} s . \\ -4 \cdot 50 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad 79 \end{aligned}$ | $\begin{gathered} \mathrm{S} \\ -4.52 \end{gathered}$ | $\begin{gathered} s . \\ +\quad .88 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.53 \end{gathered}$ | S. $+\quad .97$ | $\begin{gathered} s . \\ -4 \cdot 55 \end{gathered}$ |
| 2 | - 44 | 4.47 | - 53 | 448 | . 62 | 4.49 | -7x | 4.50 | +.80 | 4.52 | . 89 | 4 |
| 4 | $\cdot 37$ | $4 \cdot 46$ | - 46 | $4 \cdot 47$ | -54 | $4 \cdot 48$ | . 63 | $4 \cdot 49$ | $\cdot 72$ | 4.51 | .81 | 4.52 |
| 6 | $\cdot 29$ | $4 \cdot 46$ | $\cdot 38$ | $4 \cdot 47$ | -47 | 4.47 | $\cdot 56$ | $4 \cdot 48$ | -64 | $4 \cdot 50$ | $\cdot 73$ | 4.51 |
| 8 | -22 | $4 \cdot 45$ | -31 | $4 \cdot 46$ | -39 | $4 \cdot 47$ | $\cdot 48$ | $4 \cdot 47$ | $\cdot 57$ | $4 \cdot 49$ | -66 | $4 \cdot 50$ |
| 10 | + 14 | 4.45 | +.23 | 4.46 | + 32 | 4.46 | + 4 r | $4 \cdot 47$ | + 49 | $4 \cdot 48$ | + 58 | $4 \cdot 49$ |
| 12 | +.07 | 4.45 | -16 | $4 \cdot 45$ | $\cdot 24$ | $4 \cdot 46$ | -33 | $4 \cdot 46$ | -42 | 4.47 | -51 | $4 \cdot 48$ |
| 14 | - .01 | $4 \cdot 45$ | -08 | $4 \cdot 45$ | -17 | $4 \cdot 45$ | $\cdot 26$ | $4 * 46$ | -35 | $4 \cdot 46$ | -43 | $4 \cdot 47$ |
| 16 | $\cdot 09$ | $4 \cdot 45$ | +.00 | $4 \cdot 45$ | -10 | 4.45 | -18 | $4 \cdot 45$ | $\cdot 27$ | $4 \cdot 46$ | -36 | $4 \cdot 46$ |
| 18 | -16 | 4.45 | - .07 | $4 \cdot 45$ | +.02 | $4 \cdot 45$ | - I I | $4 \cdot 45$ | - 20 | 4.45 | -29 | $4 \cdot 46$ |
| 20 | - $\cdot 24$ | 4.46 | - •15 | 4.45 | - .06 | 4.45 | +.03 | 4.45 | +.13 | 4.45 | + 21 | $4 \cdot 45$ |
| 22 | $\cdot 32$ | $4 \cdot 46$ | -23 | $4 \cdot 46$ | -13 | 4.45 | - .04 | $4 \cdot 45$ | + .05 | $4 \cdot 45$ | $\cdot 14$ | $4 \cdot 45$ |
| 24 | -40 | $4 \cdot 47$ | $\cdot 31$ | $4 \cdot 46$ | - 21 | 4.45 | -12 | $4 \cdot 45$ | - . 03 | $4 \cdot 45$ | + .07 | $4 \cdot 45$ |
| 26 | -49 | $4 \cdot 48$ | -39 | 4.47 | -29 | $4 \cdot 46$ | - 20 | $4 \cdot 45$ | -10 | $4 \cdot 45$ | - or | $4 \cdot 45$ |
| 28 | -58 | $4 \cdot 49$ | $\cdot 47$ | 4.47 | -38 | 4.47 | -28 | 4.46 | -18 | $4 \cdot 45$ | $\cdot 08$ | $4 \cdot 45$ |
| 30 | -. 66 | $4 \cdot 50$ | -. 56 | $4 \cdot 48$ | -. 46 | 4.47 | - 36 | $4 \cdot 46$ | - .26 | $4 \cdot 46$ | - 16 | 4.45 |
| 32 | $\cdot 76$ | 4.51 | -65 | $4 \cdot 50$ | -55 | $4 \cdot 48$ | -45 | 4.47 | -34 | $4 \cdot 46$ | - 24 | $4 \cdot 46$ |
| 34 | - 86 | 4.53 | $\cdot 75$ | $4 \cdot 51$ | - 64 | $4 \cdot 49$ | - 53 | $4 \cdot 48$ | -43 | $4 \cdot 47$ | -33 | $4 \cdot 46$ |
| 36 | -95 | $4 \cdot 55$ | . 85 | 4.53 | $\cdot 74$ | $4 \cdot 51$ | -63 | $4 \cdot 49$ | $\cdot 52$ | $4 \cdot 48$ | - 41 | $4 \cdot 47$ |
| 38 | 1.07 | $4 \cdot 57$ | -95 | $4 \cdot 55$ | -84 | 4.53 | $\cdot 72$ | $4 \cdot 5 \mathrm{I}$ | .61 | 4.49 | -50 | $4 \cdot 48$ |
| 40 | -I'19 | $4 \cdot 60$ | - I.06 | $4 \cdot 57$ | - 94 | $4 \cdot 55$ | . 82 | $4 \cdot 52$ | - $\cdot 71$ | $4 \cdot 51$ | - . 59 | $4 * 49$ |
| 42 | 1.31 | $4 \cdot 64$ | I•18 | 4.60 | r.06 | $4 \cdot 57$ | -93 | $4 \cdot 55$ | -8I | $4 \cdot 52$ | -69 | $4 \cdot 51$ |
| 44 | 1.45 | $4 \cdot 68$ | I.3I | $4 \cdot 64$ | I•18 | $4 \cdot 60$ | 1.05 | $4 \cdot 57$ | -92 | $4 \cdot 54$ | -79 | $4 \cdot 52$ |
| 46 | I 60 | $4 \times 73$ | I. 45 | $4 \cdot 68$ | 1.31 | $4 \cdot 64$ | 1.17 | $4 \cdot 60$ | I. 04 | $4 \cdot 57$ | -91 | 4.54 |
| 48 | I•76 | $4 \cdot 79$ | I.6I | 4.73 | I.45 | $4 \cdot 68$ | I-31 | $4 \cdot 64$ | I•16 | $4 \cdot 60$ | I.03 | $4 \times 57$ |
| 50 | - I.95 | $4 \cdot 86$ | - I 77 | $4 \cdot 79$ | - $\mathrm{I} \cdot 6 \mathrm{I}$ | 4.73 | - I. 45 | $4 \cdot 68$ | - I.30 | $4 \cdot 64$ | - I.15 | $4 \cdot 60$ |
| 52 | $2 \cdot 15$ | 4.94 | 1.97 | $4 \cdot 87$ | I•79 | $4 \cdot 79$ | I. 62 | $4 \times 73$ | I. 45 | $4 \cdot 67$ | I. 30 | $4 \cdot 63$ |
| 54 | 2.40 | $5 \cdot 05$ | $2 \cdot 19$ | 4.94 | I.99 | $4 \cdot 87$ | I.80 | $4 \cdot 79$ | I. 62 | 4.72 | I. 45 | $4 \cdot 67$ |

DECLINATION－SAME NAME AS－LATITUDE．

| True Alt． | $12^{\circ}$ | Decl． Var． | $13^{\circ}$ | Decl | $14^{\circ}$ | Decl． Var． | $15^{\circ}$ |  | $16^{\circ}$ | Decl． Var． | $17^{\circ}$ | Decl． Var． |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H．M． <br> 62348 | ＋2．05 | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 25 \\ \hline \text { I } \cdot 7 \end{array}\right.$ | $+2.07$ | $\left.\begin{array}{ccc} \text { H. м. } & \text { s. } \\ 6 & 27 & 56 \cdot 5 \end{array} \right\rvert\,$ | $+2.09$ | $\begin{array}{lll} \text { н. м. } & \text { s. } \\ 6 & 30 & 2 \cdot 3 \end{array}$ | $+2 \cdot I I$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 32 \end{array}\right.$ | ${ }^{2} x_{3}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 34 \\ \text { I } 8 \cdot 2 \end{array}\right.$ |  |
| 10 | $53827 \cdot 6$ | 1．88 | $540 \quad 20 \cdot 3$ | I． 88 | $542 \mathrm{I} 3 \cdot \mathrm{I}$ | 1.88 | $\begin{array}{llll}5 & 44 & 5.9\end{array}$ | 1．88 | $545 \quad 58 \cdot 8$ | I． 88 | $54752 \cdot 0$ | 89 |
| 12 | 2928.2 | 1．85 | 53119.3 | 1．85 |  | 1.8 | 531510 | 1．85 | $53651 \cdot 7$ | I．84 | $\begin{array}{llll}5 & 38 & 42 \cdot 4\end{array}$ | 8 |
| 14 | 2029.9 |  | 5 22219.6 | I． 82 | $\begin{array}{lll}5 & 24 & 8.8\end{array}$ | I． 82 | 525 57．8 | I．81 | $52746 \cdot 4$ | I．80 | 529347 | 1．80 |
| 16 | $\begin{array}{lllllllllllllllll}5 & 11 & 3 \cdot 7\end{array}$ | I．81 | 513 2I•I | I．80 | $\begin{array}{llll}5 & 15 & 8.9\end{array}$ | 9 | $51656 \cdot 0$ | $1 \cdot 78$ | $5 \mathrm{I} 842 \cdot 7$ | I•77 | $52029 \cdot 0$ | 7 |
| 18 | $5 \quad 236$ |  | 54 | ＋ | 5610 | ＋1．77 | 5785.7 | ＋1．75 | 6 | ＋1 | 5 II 24.9 | 3 |
| 20 | $45340 \cdot 7$ |  | $455 \quad 27 \cdot 1$ | I．76 | 45712.4 | I．74 | $45856 \cdot 6$ | ェ・73 | $5 \quad 0 \quad 39 \cdot 9$ | I•7 | $\begin{array}{lll}5 & 2 & 22.4\end{array}$ | 0 |
| 22 | $4445 \cdot 6$ | ェ．76 | $44631 \cdot 2$ | I．75 | $\begin{array}{lllllllllll}4 & 48 & 15.5\end{array}$ | ェ・73 | $44958 \cdot 6$ | I＇71 | $45140 \cdot 5$ | ． 69 | $\begin{array}{llll}4 & 53 & 2 \mathrm{I} \cdot 2\end{array}$ | 7 |
| 24 | 3551.0 | I． 76 | $43736 \cdot 1$ | $1 \cdot 73$ | 43919.5 | I．71 | $4 \begin{array}{lll}415\end{array}$ |  | 4 42 $42 \cdot \mathrm{I}$ |  | 44421 | 4 |
| 26 | $2656 \cdot 8$ | I．76 | $42841 \cdot 4$ | 1．73 | 43024.2 | I•\％ | $432 \quad 5: 3$ | ． 67 | $43344 \cdot 7$ |  | 43522.6 | 62 |
| 28 | 18 | ＋I． | $1947 \cdot 0$ | ＋1．72 | 42129.3 | ＋1． | 423197 | ＋x．66 | $42448 \cdot 2$ | ＋1． | $1 \begin{array}{lll}4 & 26 & 24.9\end{array}$ | 6 |
| 30 |  | I• | 41052.9 | $1 \cdot 72$ | 412350 | I．68 | $4 \begin{array}{llll}4 & 14.7\end{array}$ | 5 |  |  | $\begin{array}{llll}4 & 17 & 28 \cdot 1\end{array}$ | 58 |
| 31 | 441 | －$\cdot 76$ | $4 \quad 6 \quad 25.9$ | I－71 | $\begin{array}{lll}4 & 8 & 7.8\end{array}$ | I． 68 | $4 \quad 9 \quad 47 \cdot 4$ | I． 64 | 4 II 24. |  | 413 | 57 |
| 32 | $4{ }^{4} \mathrm{O} 14.4$ | I．76 | 4 I | 1．72 |  |  | $\begin{array}{lll}4 & 5 & 20 \cdot 2\end{array}$ |  | $\begin{array}{lllllll}4 & 6 & 57.2\end{array}$ |  | $4 \quad 832 \cdot 0$ | 5 |
| 33 | $35547 \cdot 2$ |  | 357 | 1．7 | 35913.7 | ． 67 | 4 o 53.0 | I． 63 | $\begin{array}{llll}4 & 2 & 29.8\end{array}$ | I．59 | $4 \quad 4 \quad 4 \cdot 2$ | 55 |
| 34 | $35120 \cdot 0$ | ＋1．77 | $\begin{array}{lll}3 & 53 & 4 \cdot 7\end{array}$ | ＋1．72 | $35446 \cdot 7$ | $+\mathrm{r} .68$ | $35626 \cdot 0$ | ＋1．63 | $\begin{array}{lll}3 & 58 & 2 \cdot 6\end{array}$ | ＋I． 59 | $35936 \cdot 6$ | ＋1．55 |
| 35 | $34652 \cdot 5$ | 1 |  | I．72 | $3 \begin{array}{lll}3 & 50 & 19.6\end{array}$ | 67 | 351588 |  |  |  | $\begin{array}{lll}3 & 55 & 9 \cdot 1\end{array}$ | ． 54 |
| 36 | $\begin{array}{lllll}3 & 42 & 25.0\end{array}$ | I•78 |  |  | $3 \begin{array}{llllllll}3 & 45 & 52 \cdot 6\end{array}$ | 68 | $\begin{array}{llllll}3 & 47 & 31 \cdot 9\end{array}$ | ． 63 | $\begin{array}{llll}3 & 49 & 8 \cdot 2\end{array}$ |  | $35041 \cdot 7$ | －5 |
| 37 | $3 \begin{array}{llll}3 & 57 \cdot 2\end{array}$ | I•79 | $\begin{array}{llll}3 & 39 & 43\end{array}$ | I•73 | $\begin{array}{llll}3 & 41 & 25 \cdot 5\end{array}$ | I． 68 | $3{ }^{3} 434{ }^{\text {a }}$ | ． 63 | 344 41－1 |  | $\begin{array}{llll}3 & 4614.4\end{array}$ | 1.53 |
| 38 | $\begin{array}{llll}3 & 33 & 29 \cdot 3\end{array}$ |  | $\begin{array}{lllllll}3 & 35 & 15.4\end{array}$ | 1•74 | $\begin{array}{llllllllllll}3 & 36 & 5 \cdot 3\end{array}$ |  | $\begin{array}{llll}3 & 38 & 37\end{array}$ |  | $34014 \cdot \mathrm{I}$ | I．58 | 3 $41 \begin{array}{ll}17 & 3\end{array}$ | 1．52 |
| 39 | 29 | ＋1 | $33047 \cdot 8$ | ＋I | 3 $32231 \cdot 0$ | ＋r．69 |  | ＋1．63 | 335 | ＋r．58 | $3 \begin{array}{llll}37 & 20 \cdot 1\end{array}$ | 2 |
| 40 | $\begin{array}{llllllllllll}3 & 24 & 32 \cdot 7\end{array}$ | 1.8 | 3 $26620 \cdot 0$ |  | $\begin{array}{llll}3 & 28 & 3 \cdot 6 \\ 3 & 2\end{array}$ |  |  | 63 | 3 31 $20 \cdot 1$ <br>  16  | 8 | 3 $32253 \cdot 1$ | 52 |
| 4 I | 204.0 |  | $\begin{array}{lllll}3 & 21 & 51 \cdot 9\end{array}$ | $1 \cdot 77$ － 8 | $\begin{array}{llll}3 & 23 & 36 \cdot 0 \\ 3 & 19 & 8 \cdot 3\end{array}$ | $\pm 70$ | $\begin{array}{llll}3 & 25 & 16 \cdot 4 \\ 3 & 20 & 49 \cdot 0\end{array}$ | I．64 | 32653.0 | I． | $\begin{array}{llll}3 & 28 & 26 \cdot 0 \\ 3 & 23 & 59\end{array}$ | 52 |
| 42 |  |  | $\begin{array}{llll}3 & 17 & 23 \cdot 6 \\ 3 & 12 & 55 \cdot 0\end{array}$ | $1 \cdot 78$ | $\begin{array}{ccc}3 & 19 & 8 \cdot 3 \\ 3 & 14 & 40 \cdot 4\end{array}$ | －75 | $\begin{array}{llll}3 & 20 & 49 \\ 3 & 16\end{array}$ |  | 322 |  | $\begin{array}{llll}3 & 23 & 59.0\end{array}$ | \％ 52 |
| 43 | 3 II 5.4 <br> 3 6 35.6 |  | 3125 | ＋ | $31440 \cdot 4$ |  | 316 |  | 317 |  | 319 32．0 |  |
| 44 | $\begin{array}{lllll}3 & 6 & 35 \cdot 6\end{array}$ | ＋ I ． | $\begin{array}{lll}3 & 8 & 26 \cdot 2 \\ 3 & 3 & 56 \cdot 8\end{array}$ | $\begin{array}{r}\text {＋} \\ +1.80 \\ \mathrm{I} \\ \mathrm{r} \\ \hline 8\end{array}$ |  | ＋1．73 |  | $\left\|\begin{array}{r} 1.66 \\ 1.67 \end{array}\right\|$ | $\begin{array}{lllll}3 & 13 & 31.5\end{array}$ | 1.59 +1.60 | $\begin{array}{rrrr}3 & 15 & 4 \cdot 9 \\ 3 & 10 & 37.8\end{array}$ | $\begin{array}{r}1.52 \\ +1.52 \\ 1.53 \\ \hline\end{array}$ |
| 46 | $\begin{array}{cccc}3 & 2 & 5 \cdot 3 \\ 2 & 5 & 3\end{array}$ | 1 | $\begin{array}{rrrr}3 & 3 & 56 \cdot 8 \\ 2 & 59 & 27.3 \\ & 54 & \end{array}$ | r r .82 ． 81 |  | $\mathrm{I} \cdot 74$ $\mathrm{I} \cdot 76$ 7 | $\begin{array}{llll}3 & 7 & 26 \cdot 2 \\ 3 & 2 & 58 \cdot 2\end{array}$ | 1.67 1.68 | $\begin{array}{rrrr}3 & 9 & 4 \cdot 2 \\ 3 & 4 & 36 \cdot 7 \\ \end{array}$ | $\mathrm{r} \cdot 60$ <br> r <br> 60 | 3 10 37.8 <br> 3 6 10.6 | ＋53 |
| 46 | $\begin{array}{llll}2 & 57 & 34 \cdot 5 \\ 2 & 53 & 3 \cdot 2\end{array}$ | 1．92 | （1） $\begin{array}{lll}2 & 59 & 27 \cdot 3 \\ 2 & 54 & 57 \cdot 1 \\ 2 & 5 & 26 \cdot 6\end{array}$ | 1.8 | （rrrr | 1．76 |  | I 68 I 69 | 3 4 $36 \cdot 7$ <br> 3 0 $9 \cdot 0$ <br>    | I．60 <br> I .6 r <br> r | $3{ }^{3} 1010 \cdot 6$ |  |
| 48 | $24831 \cdot 2$ | I•97 | 25026.6 | I． 88 | $\begin{array}{lll}2 & 52 & 16 \cdot 6\end{array}$ | I．79 | $\begin{array}{lll}2 & 54 & 1.4\end{array}$ | I．70 | $2554 \mathrm{I} \cdot 2$ | 1．62 | 257 | 54 |
| 49 | 24358.5 | $+2.0$ | $\begin{array}{lllllll}2 & 45 & 55.4\end{array}$ | ＋r．90 | $24746 \cdot 7$ | ＋ I .8 I |  | ＋1．72 | $25^{516} 13 \cdot \mathrm{I}$ | ＋1．63 |  | ＋1．55 |
| 50 |  | 2. |  | 1．93 | $\begin{array}{llll}2 & 43 & 16 \cdot 3 \\ 2 & 38 & 45.4\end{array}$ | I．83 I .85 | $\begin{array}{llll}2 & 45 & 3 \cdot 3 \\ 2 & 40 & 33 \cdot 6\end{array}$ | I•74 | 2 46 <br> 2 $44 \cdot 8$ <br> 2 42 | 1．65 |  | 56 |
| 51 | $\begin{array}{llllll}2 & 34 & 50 \cdot 9\end{array}$ | 2.06 | $1 \begin{array}{llll}2651 \cdot 2\end{array}$ | 1．95 |  | I． 85 | ${ }_{2}^{2} 40633 \cdot 6$ | $1 \cdot 76$ | $24216 \cdot 1$ | 1．66 | 24353.0 | 57 |
| 52 | $\begin{array}{llllll}2 & 30 & 15 \cdot 7 \\ 2 & 25 & 39.5\end{array}$ | 2.10 | $\begin{array}{lllll}2 & 32 & 18 \cdot I \\ 2 & 27\end{array}$ | I． 98 | 2 34 13.9 <br> 2 20  | I．88 | $\begin{array}{llll}2 & 36 & 3.6 \\ 2 & 31\end{array}$ | $\pm 78$ | $23747 \cdot 0$ | I 68 | $\begin{array}{lllll}2 & 39 & 24.8 \\ 2\end{array}$ | 1．58 |
| 53 | 22539.5 | $2 \cdot 13$ | $22744{ }^{\circ}$ | 2.02 | $2294 \mathrm{I} \cdot 7$ | I＇9， 1 | $23 \mathrm{I} 32 \cdot 9$ |  | 23317.8 | I＇\％o | $23.456 \cdot 4$ | 1．59 |
| 5 | $\begin{array}{llll}2 & 21 & 2.2\end{array}$ | ＋2．18 | $\begin{array}{llll}2 & 23 & 9 \cdot 1\end{array}$ | ＋2．05 |  | ＋I．94 | 22719 | ＋1．83 | $22847 \cdot 9$ | ＋ $\mathrm{I} \cdot 72$ | $\begin{array}{llll}2 & 30 & 27 \cdot 7\end{array}$ | I 61 1．63 1 |
|  |  | 2.23 | $\begin{array}{lllll}2 & 18 & 33 \cdot 1\end{array}$ | 2.10 2.14 | $\left\|\begin{array}{ccc} 2 & 20 & 35 \cdot 1 \\ 2 & 16 & 0 \cdot 4 \end{array}\right\|$ | $\begin{aligned} & 1.97 \\ & 0.07 \end{aligned}$ | $\begin{array}{lll} 2 & 22 & 29.8 \\ 2 & 12 & 57.0 \end{array}$ | I．85 | $\begin{array}{llll}2 & 24 & 17.6 \\ 2 & 19 & 46.7\end{array}$ | $\begin{array}{r}1.74 \\ \mathbf{I} 77 \\ \hline\end{array}$ | $\begin{array}{llll}2 & 25 & 58 \cdot 6 \\ 2 & 21 & 29 \cdot 1\end{array}$ | $\begin{array}{r}163 \\ \\ \hline 165\end{array}$ |
| 57 | 211143.5 | 2.28 2.36 | $\begin{array}{llll}2 & 13 & 56 \cdot 0 \\ 2 & 9 & 17.5\end{array}$ | $\begin{aligned} & 2.14 \\ & 2.19 \end{aligned}$ | $\begin{array}{lll} 2 & \text { I6 } & 0 \cdot 4 \\ 2 & \text { II } & 24 \cdot 7 \end{array}$ | $\begin{aligned} & 2.01 \\ & 2.05 \end{aligned}$ | $\begin{array}{llll} 2 & 1 & 57 & 57 \cdot 2 \\ 2 & 13 & 23 \cdot 8 \end{array}$ | $\begin{aligned} & \mathrm{I} \cdot 89 \\ & \mathrm{I} \cdot 92 \end{aligned}$ | $\begin{array}{lll} 2 & 19 & 46 \cdot 7 \\ 2 & 15 & 15 \cdot 2 \end{array}$ | $\begin{aligned} & \mathbf{I} \cdot 77 \\ & 1 \cdot 79 \end{aligned}$ | $\begin{array}{lll} 2 & 2 \mathrm{I} & 29 \cdot 1 \\ 2 & 16 & 59 \cdot \mathrm{I} \end{array}$ | 1.65 1.67 |
| 57 <br> 58 | $\begin{array}{cccc}2 & 7 & 1.5 \\ 2 & 2 & 18.4\end{array}$ | 2.36 2.42 | $\begin{array}{llll}2 & 9 & 17 \cdot 5 \\ 2 & 4 & 37.6\end{array}$ | 2.19 2.24 | $\begin{array}{cccc}2 & 11 & 24 \cdot 7 \\ 2 & 6 & 47 \cdot 7\end{array}$ | 2.05 $2 \cdot 10$ | $\begin{array}{rrrr}2 & 13 & 23 \\ 2 & 8 & 49\end{array}$ | 1.92 | $\begin{array}{lllll}2 & 15 & 15 \cdot 2 \\ 2 & \text { 10 } & 43.0\end{array}$ | 1.79 1.83 | $\begin{array}{lll}2 & 16 & 5 \\ 2 & 12 & 28\end{array}$ | －7 |

VARIATION TO I＇OF LATITUDE AND ALTITUDE．

| Alt． | L． $12^{\circ} \mathrm{A}$ ． |  | L． $13^{\circ} \mathrm{A}$ ． |  | L． $14^{\circ} \mathrm{A}$ ． |  | L． $15^{\circ} \mathrm{A}$ ． |  | L． $16^{\circ} \mathrm{A}$ ． |  | L． $17^{17} \mathrm{~A}$ ． |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\begin{gathered} \text { s. } \\ +\mathrm{r} \cdot 06 \end{gathered}$ | $\begin{gathered} s \\ -4.57 \end{gathered}$ | $\stackrel{s .}{\substack{ \\+15}}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 60 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 24 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 62 \end{gathered}$ | $\begin{gathered} \text { s. } \\ +1 \cdot 34 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.65 \end{gathered}$ | S． | $\begin{gathered} \text { s. } \\ -4.67 \end{gathered}$ | $\stackrel{\text { s．}}{+}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 70 \end{gathered}$ |
| 4 | －90 | 4.54 | ． 99 | 4.56 | I． 08 | 4.58 | 1．17 | 4.60 | I． 26 | $4 \cdot 63$ | ＋．36 | 4.65 |
| 8 | $\cdot 75$ | $4 \cdot 51$ | ． 83 | 4.53 | ． 92 | $4 \cdot 54$ | 1.01 | $4 \cdot 56$ | I．II | 4.58 | $1 \cdot 20$ | 4.60 |
| 12 | ． 60 | $4 \cdot 49$ | ． 69 | 4.50 | $\cdot 77$ | $4 \cdot 52$ | ． 87 | 4.53 | －96 | $4 \cdot 55$ | $1 \cdot 05$ | $4 \cdot 57$ |
| 16 | －45 | $4 \cdot 47$ | $\cdot 54$ | 4.48 | ． 63 | $4 \cdot 49$ | $\cdot 72$ | $4 \cdot 5 \mathrm{I}$ | －8I | $4 \cdot 52$ | －90 | $4 \cdot 54$ |
| 20 | ＋ 31 | $4 \cdot 46$ | ＋ 40 | 4.47 | ＋${ }^{49}$ | $4 \cdot 48$ | ＋ 58 | $4 \cdot 49$ | ＋．67 | $4 \cdot 50$ | ＋．76 | 4.51 |
| 22 | $\cdot 23$ | 4.45 | $\cdot 33$ | 4.46 | $\cdot 42$ | $4 \cdot 47$ | ． 51 | $4 \cdot 48$ | －60 | 4.49 | －69 | 4.50 |
| 24 | －16 | $4 \cdot 45$ | － 25 | 4.46 | －35 | 4.46 | $\cdot 44$ | 4.47 | $\cdot 53$ | $4 \cdot 48$ | $\cdot 62$ | 4.49 |
| 26 | －09 | $4 \cdot 45$ | － 18 | 4.45 | －28 | $4 \cdot 46$ | $\cdot 37$ | $4 \cdot 46$ | $\cdot 46$ | 4.47 | $\cdot 56$ | 4.48 |
| 28 | ＋ 0 I | 4.45 | －II | 4.45 | －20 | $4 \cdot 45$ | $\cdot 30$ | $4 \cdot 46$ | －39 | $4 \cdot 47$ | －49 | $4 \cdot 48$ |
| 30 | －．06 | 4.45 | ＋．03 | $4 \cdot 45$ | ＋ 13 | 4.45 | ＋ 23 | $4 \cdot 46$ | ＋ 32 | $4 \cdot 46$ | ＋ 42 | $4 \cdot 47$ |
| 32 | － 14 | $4 \cdot 45$ | －． 04 | $4 \cdot 45$ | ＋．06 | 4.45 | －16 | 4.45 | $\cdot 25$ | 4.46 | $\cdot 35$ | $4 \cdot 46$ |
| 34 | － 22 | 4.46 | －12 | $4 \cdot 45$ | － 02 | $4 \cdot 45$ | ．08 | $4 \cdot 45$ | －18 | $4 \cdot 45$ | － 28 | $4 \cdot 46$ |
| 36 | $\cdot 30$ | $4 \cdot 46$ | － 20 | 4.45 | －10 | $4 \cdot 45$ | ＋ 01 | $4 \cdot 45$ | －II | $4 \cdot 45$ | －21 | $4 \cdot 45$ |
| 38 | －39 | $4 \cdot 47$ | －28 | $4 \cdot 46$ | －18 | $4 \cdot 45$ | －．07 | $4 \cdot 45$ | ＋ 04 | $4 \cdot 45$ | －14 | $4 * 45$ |
| 40 | － 48 | 4.47 | － 37 | $4 \cdot 46$ | －． 26 | $4 \cdot 46$ | －．15 | $4 \cdot 45$ | －． 04 | 4.45 | ＋．07 | $4 \cdot 45$ |
| 42 | $\cdot 57$ | $4 \cdot 48$ | －46 | $4 \cdot 47$ | $\cdot 34$ | $4 \cdot 46$ | － 23 | $4 \cdot 46$ | －12 | $4 \cdot 45$ | － 01 | $4 \cdot 45$ |
| 44 | $\cdot 67$ | $4 \cdot 50$ | $\cdot 55$ | 4.48 | － 43 | $4 \cdot 47$ | $\cdot 32$ | $4 \cdot 46$ | $\cdot 20$ | 4.45 | $\cdot 08$ | 4.45 |
| 46 | $\cdot 78$ | $4 \cdot 52$ | $\cdot 65$ | $4 \cdot 50$ | － 53 | $4 \cdot 48$ | $\cdot 40$ | $4 \cdot 47$ | －28 | $4 \cdot 46$ | －16 | $4 \cdot 45$ |
| 48 | ． 89 | 4.54 | －76 | $4 \cdot 5 \mathrm{I}$ | $\cdot 63$ | 4.49 | $\cdot 50$ | $4 \cdot 48$ | －37 | $4 \cdot 47$ | $\cdot 25$ | $4 \cdot 46$ |
| 50 | －I． OI | $4 \cdot 56$ | －．87 | $4 \cdot 53$ | －．73 | 4.51 | － 60 | $4 \cdot 49$ | － 47 | $4 \cdot 47$ | － 34 | $4 \cdot 46$ |
| 52 | I•I4 | $4 \cdot 59$ | ． 99 | $4 \cdot 56$ | $\cdot 85$ | 4.53 | $\cdot 7 \mathrm{I}$ | $4 \cdot 51$ | $\cdot 57$ | $4 \cdot 49$ | $\cdot 43$ | $4 \cdot 47$ |
| 54 | $1 \cdot 29$ | $4 \cdot 63$ | $1 \cdot 13$ | $4 \cdot 59$ | $\cdot 97$ | 4.55 | ． 82 | $4 \cdot 53$ | －67 | $4 \cdot 50$ | $\cdot 53$ | $4 \cdot 48$ |
| 56 | 1.45 | $4 \cdot 68$ | I． 28 | 4.63 | I．II | 4.59 | －95 | 4.55 | $\cdot 79$ | 4.52 | $\cdot 64$ | 4.50 |
| 58 | I． 63 | $4 \cdot 74$ | 1．44 | $4 \cdot 68$ | I 26 | $4 \cdot 63$ | I． 09 | $4 \cdot 60$ | $\cdot 92$ | 4.54 | $\cdot 75$ | $4 \cdot 52$ |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 109 LATITUDE $26^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.


## 110 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

LATITUDE $27^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}$ | $\begin{array}{r} \mathrm{S} \\ +2.0 \end{array}$ | $\begin{array}{\|lrl} \text { H. M. } & \text { S. } \\ 6 & 2 & 2 \cdot 3 \end{array}$ | $\begin{gathered} 5 . \\ +2 \cdot 04 \end{gathered}$ | $\begin{array}{\|rrl} \text { H. M. } & \text { S. } \\ 6 & 4 & 4 \cdot 7 \end{array}$ | $\begin{gathered} s . \\ +2.04 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 6 & 7 \cdot 2 \end{array}$ | $\begin{gathered} 5 . \\ +2 \cdot 04 \end{gathered}$ | $\begin{array}{llc} \text { H. M. S. } \\ 6 & 8 & 10 \cdot 0 \end{array}$ | $\begin{gathered} \mathrm{s} . \\ +2 \cdot 05 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 10 & 13 \cdot 2 \end{array}$ | $\begin{gathered} \text { S. } \\ +2.06 \end{gathered}$ |
| 10 | $\begin{array}{llll}5 & 15 & 2 \cdot 8\end{array}$ | 2.08 | $517 \quad 7 \cdot 0$ | $2 \cdot 06$ | 5 I9 10.2 | 2.04 | 52112.5 | 2.03 | $5 \quad 2314.0$ | $2 \cdot 02$ | $\begin{array}{llllllll}5 & 25 & 14.9\end{array}$ | 2.01 |
| 12 | $\begin{array}{llll}5 & 6 & 1 \cdot 4\end{array}$ | 2.09 | $\begin{array}{llll}5 & 8 & 6 \cdot 5\end{array}$ | $2 \cdot 07$ | 51010.5 | 2.06 | $\begin{array}{llll}5 & 12 & 13.4\end{array}$ | O |  | O2 | $51616 \cdot 1$ | I |
| 14 | $4 \begin{array}{llll}46 & 58 \cdot 9\end{array}$ | $2 \cdot$ | 45950 | $2 \cdot 09$ | 5 I 10.1 | 2.07 | $\begin{array}{llll}5 & 3 & 13.7\end{array}$ | 5 | $5 \quad 5 \quad 16 \cdot 1$ | 2.03 | $5 \quad 7173$ | $2 \cdot \mathrm{OI}$ |
| 16 | $44755 \cdot 1$ | $2 \cdot 1$ | $450 \quad 2.8$ | $2 \cdot 11$ | $452 \quad 9 \cdot 0$ | $2 \cdot$ | $4 \quad 5413.5$ | 2.06 | 456 16*5 | 2.04 | $45^{48} \quad 18 \cdot 2$ | 02 |
| 18 | $43^{8} 49 \cdot 7$ | +2.17 | $44059 \cdot 1$ | +2.1 | $4436 \cdot 6$ | +2.11 | $44512 \cdot 3$ | +2.08 | 447 I6.3 | +2.05 | $449 \quad 18 \cdot 7$ | $+2.03$ |
| 20 | $42942 \cdot 5$ | $2 \cdot 2$ | $43153 \cdot 8$ | $2 \cdot 17$ | $434 \quad 3 \cdot 0$ | $2 \cdot 13$ | 436 10.I | $2 \cdot 10$ | $4 \begin{array}{llll}4 & 38 & 15\end{array}$ | 2.07 | $440 \times 18.6$ | 2.04 |
| 22 | $42033 \cdot 2$ | $2 \cdot 24$ | $412246 \cdot 7$ | $2 \cdot 20$ | $424 \begin{array}{llll}4 & 57 \\ 4\end{array}$ | 2. | $4276 \cdot 5$ | $2 \cdot 13$ | 429 13.2 | $2 \cdot 09$ | $43117 \cdot 7$ | 6 |
| 24 | 14 II 21.4 | $2 \cdot$ | $\begin{array}{llll}4 & 13 & 37 \cdot 4\end{array}$ | $2 \cdot 24$ | $41550 \cdot 7$ | $2 \cdot 20$ | $418 \quad 1 \cdot 5$ | $2 \cdot 16$ | 422093 | $2 \cdot 12$ | $\begin{array}{lllll}4 & 22 & 15.6\end{array}$ | 8 |
| 26 | $\begin{array}{llll}4 & 2 & 6 \cdot 8\end{array}$ | $2 \cdot 34$ | $4 \quad 4 \quad 25 \cdot 7$ | $2 \cdot 29$ | $4641 \cdot 5$ | $2 \cdot$ | $\begin{array}{llll}4 & 8 & 54.5\end{array}$ | $2 \cdot 19$ | 4 II $4 \cdot 7$ | $2 \cdot 15$ | $\begin{array}{lllll}4 & 13 & 12.3\end{array}$ |  |
| 27 | $3 \begin{array}{llll}3 & 57 & 28 \cdot 3\end{array}$ | +2.37 | $359548 \cdot 7$ | $+2 \cdot 3$ | $4 \quad 26.0$ | +2 | $420 \cdot 2$ | +2.21 | $4631 \cdot 6$ | +2.17 | $4 \quad 8 \quad 40 \cdot 1$ | $+2 \cdot 12$ |
| 28 | $3 \begin{array}{lllll}3 & 52 & 48 \cdot 9\end{array}$ | 2.40 | $35511 \cdot 0$ | $2 \cdot 34$ | $\begin{array}{lllll}3 & 57 & 29.8\end{array}$ | $2 \cdot 29$ | $35945 \cdot 4$ | 2 | 4 I 57•9 | $2 \cdot 18$ | $\begin{array}{llll}4 & 4 & 7 \cdot 5\end{array}$ | 3 |
| 29 | $\begin{array}{rrrr}3 & 48 & 8 \cdot 6\end{array}$ | 2.43 | $\begin{array}{llll}3 & 50 & 32 \cdot 5\end{array}$ | $2 \cdot 37$ | $\begin{array}{llll}3 & 52 & 52 \cdot 9\end{array}$ | 3 I | 35509.9 | $2 \cdot 26$ | $\begin{array}{llll}3 & 57 & 23.6\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}3 & 59 & 34 \cdot 4\end{array}$ | -15 |
| 30 | $\begin{array}{llll}3 & 43 & 27 \cdot 3\end{array}$ | $2 \cdot 46$ | $\begin{array}{lllll}3 & 45 & 53 \cdot 1\end{array}$ | 2.40 | $\begin{array}{lllllll}3 & 48 & 15 \cdot 2\end{array}$ | - 34 | 350 | $2 \cdot 28$ | $\begin{array}{lllll}3 & 52 & 48 \cdot 8\end{array}$ | $2 \cdot 22$ | $355 \quad 0 \cdot 7$ | -17 |
| 31 | $\begin{array}{lllll}3 & 38 & 44 \cdot 9\end{array}$ | $2 \cdot 5$ | $34^{3} 112 \cdot 7$ | 2.43 | 3433 | $2 \cdot 37$ | $34556 \cdot 8$ | $2 \cdot 30$ | $\begin{array}{llll}3 & 48 & 13.4\end{array}$ | $2 \cdot 25$ | $35026 \cdot 5$ | 2.19 |
| 32 | 334154 | +2.53 | $3 \begin{array}{llll}3 & 36 & 3 & r \cdot 3\end{array}$ | +2.46 | $\begin{array}{llll}3 & 38 & 57 \cdot 2\end{array}$ | +2.40 | 341 I9.I | +2.33 | 343 37-2 | +2.27 | 345 51•7 | +2.21 |
| 33 | $32916 \cdot 6$ | $2 \cdot 57$ | $\begin{array}{lllllllll}3 & 31 & 48 \cdot 8\end{array}$ | $2 \cdot 50$ | 3 313416.8 | $2 \cdot 4$ | $3 \begin{array}{llll}36 & 40 \cdot 5\end{array}$ | $2 \cdot 36$ | $\begin{array}{llll}3 & 39 & 0 \cdot 3\end{array}$ | $2 \cdot 30$ | $34116 \cdot 3$ | 24 |
| 3 | $32430 \cdot 5$ | $2 \cdot 62$ | $\begin{array}{llll}3 & 27 & 5.2\end{array}$ | $2 \cdot 5$ | 32935 | $2 \cdot 46$ | 332 1.0 | $2 \cdot 39$ | $\begin{array}{llll}3 & 34 & 22 \cdot 6\end{array}$ | $2 \cdot 33$ | $\begin{array}{lllllllllllllll}3 & 36 & 40 \cdot 2\end{array}$ | -26 |
| 3 | $\begin{array}{lllll}3 & 19 & 42 \cdot 9\end{array}$ | $2 \cdot 66$ | $\begin{array}{llll}3 & 22 & 20 \cdot 2\end{array}$ | $2 \cdot 58$ | $\begin{array}{lllll}3 & 24 & 52 \cdot 6\end{array}$ | $2 \cdot 50$ | $\begin{array}{llll}3 & 27 & 20.5\end{array}$ | 2.43 | 3 29 44 | $2 \cdot 36$ | $\begin{array}{llll}3 & 32 & 3 & 3\end{array}$ | $2 \cdot 29$ |
| 3 |  | $2 \cdot 71$ | 3 17 33.8 | $2 \cdot 62$ | $\begin{array}{llll}3 & 20 & 8.8\end{array}$ | 2.54 | $32239 \cdot 0$ | $2 \cdot 46$ | $\begin{array}{llll}3 & 25 & 4.5\end{array}$ | $2 \cdot 39$ | $32725 \cdot 6$ | $2 \cdot 32$ |
| 37 | 3 10 $2 \cdot 9$ | $+2 \cdot 76$ | 3 I2 $46 \cdot 0$ | +2.67 | 315123.7 | +2.5 | 3 r7 56.2 | +2.50 | 32023.9 | +2.42 | $32247 \cdot 0$ | $+2.35$ |
| 3 | $\begin{array}{llll}3 & 5 & 10.3\end{array}$ | 2.8 | $\begin{array}{llll}3 & 7 & 56 \cdot 5\end{array}$ | $2 \cdot 72$ | 3 10 $37 \cdot 0$ | 2.63 | 3 I 312.2 | $2 \cdot 54$ | $\begin{array}{llll}3 & 15 & 42 \cdot 3\end{array}$ | $2 \cdot 46$ | $\begin{array}{lll}3 & 18 & 7 \cdot 5\end{array}$ | $2 \cdot 38$ |
| 39 | $3 \begin{array}{llll}3 & 0 & 15.6\end{array}$ | $2 \cdot 88$ | $\begin{array}{rrrr}3 & 3 & 5 \cdot 3\end{array}$ | 2.78 | $3{ }^{3}$ | 2.68 | $\begin{array}{llll}3 & 8 & 26 \cdot 8\end{array}$ | 2.59 | 3 10 59.4 | $2 \cdot 50$ | $313136 \cdot 9$ | 2.42 |
| 40 | $\begin{array}{llllll}2 & 55 & 18.8\end{array}$ | 2.94 | 258 I2.I | 2.83 | $3 \quad 0 \quad 59 \cdot 0$ | 73 | $\begin{array}{llll}3 & 3 & 40 \cdot 0\end{array}$ | 2.63 | $3 \begin{array}{llll}3 & 6 & 15 \cdot 2\end{array}$ | $2 \cdot 54$ | $38845 \cdot 1$ | $2 \cdot 45$ |
| 41 | $2 \begin{array}{llllllll}2 & 50 & 19.6\end{array}$ | 3.01 | 25316.8 | 2.90 | $\begin{array}{llll}2 & 56 & 7 \cdot 4\end{array}$ | $2 \cdot 79$ | $25851 \cdot 5$ | $2 \cdot 68$ | 3 I 29.6 | 9 | $\begin{array}{llll}3 & 4 & 2 \cdot 1\end{array}$ | $2 \cdot 50$ |
| 42 | 24517.8 | $+3.09$ | $2 \begin{array}{llll}2 & 48 & 19.3\end{array}$ | $+2.96$ | 25113.6 | +2.85 | $254 \quad \mathrm{I} 3$ | $+2 \cdot 7$ | $25642 \cdot 5$ | $+2.64$ | 259 17.8 | $+2.54$ |
| 43 | $2{ }_{2} 4013.2$ | $3 \cdot 17$ | $2 \begin{array}{llllll}2 & 43 & 19 \cdot 3\end{array}$ | 3.04 | $24617 \cdot 8$ | $2 \cdot 91$ | 249 9•1 | 2.80 | 25153.7 | $2 \cdot 69$ | $25432 \cdot 0$ | $2 \cdot 59$ |
| 44 | $\begin{array}{lll}2 & 35 & 5 \cdot 5\end{array}$ | 3.26 | $\begin{array}{llll}2 & 38 & 16.6 \\ 2 & 33 & \end{array}$ | 3 | $2 \begin{array}{llll}2 & 41 & 19.5\end{array}$ | 2.99 | $2 \begin{array}{llll}24 & 14.9\end{array}$ | 2.86 | $2 \begin{array}{lll}2 & 47 & 3 \cdot 1\end{array}$ | 2.75 | 24944.6 | $2 \cdot 64$ |
| 45 | $\begin{array}{llll}2 & 29 & 54 \cdot 3\end{array}$ | 3.35 | $\begin{array}{llll}2 & 33 & 10 \cdot 8\end{array}$ | 3.20 | $\begin{array}{llllll}2 & 36 & 18 \cdot 6\end{array}$ | 3.06 | $2{ }_{2} 3918 \cdot 3$ | 2.93 | 242 IO. 4 | $2 \cdot 81$ | $2 \begin{array}{llll}2 & 44 & 55.4\end{array}$ | $2 \cdot 69$ |
| 46 | $22439 \cdot 3$ | 3.46 | $\begin{array}{llll}2 & 28 & 1\end{array} 7$ | 3.29 | $\begin{array}{llllllllll}2 & 31 & 14.7\end{array}$ | 3.15 | $2 \begin{array}{llll}2 & 34 & 19.2\end{array}$ | 3.01 |  | 2.88 | 2404.4 | $2 \cdot 75$ |
| 47 | 2 I9 $20 \cdot 0$ | $+3.57$ | $2 \begin{array}{llll}2 & 22 & 48 \cdot 8\end{array}$ | $+3.40$ | $226 \quad 7 \cdot 7$ | $+3 \cdot 24$ | $2 \quad 29$ I7•3 | $+3.09$ | $2 \quad 3218 \cdot 3$ | +2.95 | 235 II•2 | $2 \cdot 82$ |
| 48 | $\begin{array}{llll}2 & 13 & 55.9\end{array}$ | 3.69 | 2 I7 $3 \mathrm{I} \cdot 8$ | 3.51 | $22057 \cdot 0$ | 3.34 | $2 \begin{array}{llll}2 & 24 & 12.3\end{array}$ | $3 \cdot 18$ | $2 \begin{array}{lllll}2 & 27 & 18 \cdot 3\end{array}$ | 3.03 | $23015 \cdot 7$ | $2 \cdot 89$ |
| 49 | $\begin{array}{llll}2 & 8 & 26 \cdot 4 \\ 2 & 2 & 50 \cdot 7\end{array}$ | 3.82 | 2 I2 10.2 | 3.63 | 2 I 542.4 | 3.45 | $\begin{array}{llll}2 & 19 & 3 \cdot 8\end{array}$ | 3.27 | $\begin{array}{lll}2 & 22 & 15.3\end{array}$ | $3 \cdot \mathrm{II}$ | 22517.6 | $2 \cdot 97$ |
| 50 | 2 2 $50 \cdot 7$ <br> 7 5  | 3.97 | $2 \quad 6 \quad 43 \cdot 3$ | 3.77 | 2 10 23.2 | 3.57 | $2 \begin{array}{llll}2 & 13 & 51 \cdot 5\end{array}$ | $3 \cdot 38$ | 217900 | 3.21 | $\begin{array}{llll}2 & 20 & 16.6\end{array}$ | $3 \cdot 05$ |
| 51 | I 5780 | $4 \cdot 12$ | 2 I 10.5 | 3.92 | 2459.0 | $3 \cdot 70$ | 2834.8 | $3 \cdot 50$ | 2 II 59.0 | $3 \cdot 31$ |  | $3 \cdot 14$ |

VARIATION TO $x^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ}$ A. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ}$ A. |  | L. $5^{\circ}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | S. | S. | S. | S. | s. | s. | s. | s. | s. | s. | s. |
| 0 | - 00 | $-4.49$ | +.09 | $-4.49$ | + 17 | $-4.49$ | + 26 | $-4.49$ | + 35 | -4.50 | + 44 | -4.5I |
| 2 | -08 | $4 \cdot 49$ | + or | 4.49 | -09 | $4 \cdot 49$ | 18 | 4.49 | -27 | 4.50 | $\cdot 36$ | $4 \cdot 50$ |
| 4 | -16 | 4.49 | -.07 | 4.49 | +.02 | $4 \cdot 49$ | -10 | 4.49 | -19 | 4.49 | -28 | 4.50 |
| 6 | -24 | $4 \cdot 49$ | -15 | 4.49 | -. 06 | 4.49 | +.02 | 4.49 | -II | $4 \cdot 49$ | - 20 | $4 \cdot 49$ |
| 8 | -32 | $4 \cdot 50$ | - 23 | 4.49 | -14 | $4 \cdot 49$ | -.05 | $4 \cdot 49$ | $+.03$ | $4 \cdot 49$ | -12 | $4 \cdot 49$ |
| 10 | - $\cdot 40$ | $4 \cdot 51$ | - 31 | $4 \cdot 50$ | - $\cdot 22$ | 4.49 | - - 13 | 4.49 | -. 05 | 4.49 | +.04 | $4 \cdot 49$ |
| 12 | -49 | 4.51 | $\cdot 40$ | $4 \cdot 50$ | $\cdot 31$ | 4.50 | - 22 | $4 \cdot 49$ | -13 | 4.49 | - 04 | 4.49 |
| 14 | $\cdot 57$ | 4.52 | -48 | $4 \cdot 5 \mathrm{I}$ | -39 | 4.50 | -30 | $4 \cdot 50$ | -2I | 4.49 | - 12 | $4 \cdot 49$ |
| 16 | -66 | $4 \cdot 54$ | -57 | $4 \cdot 52$ | -47 | 4.51 | $\cdot 38$ | $4 \cdot 50$ | -29 | $4 \cdot 50$ | - 20 | $4 \cdot 49$ |
| 18 | $\cdot 75$ | $4 \cdot 55$ | -66 | $4 \cdot 54$ | $\cdot 56$ | 4.52 | -47 | 4.51 | $\cdot 37$ | $4 \cdot 50$ | $\cdot 28$ | $4 \cdot 50$ |
| 20 | -.85 | 4.57 | - 75 | $4 \cdot 55$ | - 65 | $4 \cdot 53$ | -. 55 | $4 \cdot 52$ | - . 46 | 4.51 | - 37 | $4 \cdot 50$ |
| 22 | -94 | $4 \cdot 59$ | $\cdot 84$ | $4 \cdot 57$ | $\cdot 74$ | $4 \cdot 55$ | . 65 | 4.53 | - 55 | $4 \cdot 52$ | - 45 | $4 \cdot 51$ |
| 24 | I. 05 | $4 \cdot 61$ | $\cdot 94$ | $4 \cdot 59$ | - 84 | $4 \cdot 57$ | $\cdot 74$ | $4 \cdot 55$ | -64 | $4 \cdot 53$ | -54 | $4 \cdot 52$ |
| 26 | I. 15 | 4.63 | $1 \cdot 04$ | $4 \cdot 61$ | $\cdot 94$ | 4.59 | -83 | 4.57 | $\cdot 73$ | $4 \cdot 55$ | . 63 | $4 \cdot 53$ |
| 28 | 1.26 | $4 \cdot 66$ | 1.15 | 4.63 | 1.04 | $4 \cdot 61$ | . 94 | 4.59 | -83 | 4.56 | -73 | 4.55 |
| 30 | - I. 38 | $4 \cdot 69$ | -I.27 | $4 \cdot 66$ | - I.15 | $4 \cdot 63$ | - I. 04 | $4 \cdot 61$ | - 93 | $4 \cdot 58$ | -.83 | $4 \cdot 56$ |
| 32 | 1.51 | $4 \cdot 73$ | I.39 | $4 \cdot 70$ | I. 27 | $4 \cdot 66$ | I. 15 | $4 \cdot 63$ | I. 04 | 4.61 | . 93 | $4 \cdot 58$ |
| 34 | I. 64 | $4 \cdot 78$ | 1.52 | $4 \cdot 74$ | 1-39 | $4 \cdot 70$ | I. 27 | $4 \cdot 66$ | I.15 | - 4.63 | $\underline{1} \cdot 04$ | 4.61 |
| 36 | I.79 | $4 \cdot 83$ | I. 66 | $4 \cdot 78$ | 1.53 | $4 \cdot 74$ | I. 40 | $4 \cdot 70$ | I. 28 | $4 \cdot 67$ | I.15 | 4.63 |
| 38 | I 95 | 4.89 | I•8 | $4 \cdot 84$ | 1.67 | $4 \cdot 79$ | I.53 | $4 \cdot 74$ | 1.40 | $4 \cdot 70$ | I. 28 | $4 \cdot 67$ |
| 40 | $-2.12$ | 4.96 | -I.97 | 4.90 | - I. 82 | $4 \cdot 84$ | - I. 68 | 4•79 | - 1.54 | $4 \cdot 75$ | - I. 41 | 4.71 |
| 42 | $2 \cdot 32$ | $5 \cdot 05$ | $2 \cdot 15$ | $4 \cdot 98$ | 1.99 | 4.91 | I. 84 | $4 \cdot 85$ | I. 69 | $4 \cdot 80$ | I. 55 | 4.75 |
| 44 | $2 \cdot 54$ | 5.16 | $2 \cdot 36$ | $5 \cdot 07$ | 2.19 | $4 \cdot 99$ | 2.02 | 4.92 | I.86 | $4 \cdot 86$ | I•71 | 4.80 |
| 46 | $2 \cdot 79$ | $5 \cdot 29$ | $2 \cdot 59$ | $5 \cdot 18$ | 2.40 | 5.09 | $2 \cdot 22$ | $5 \cdot 01$ | 2.05 | 4.93 | I. 88 | $4 \cdot 87$ |
| 48 | 3.08 | $5 \cdot 45$ | 2.86 | $5 \cdot 32$ | $2 \cdot 65$ | $5 \cdot 21$ | 2.45 | 5.11 | $2 \cdot 26$ | $5 \cdot 02$ | $2 \cdot 08$ | $4 \cdot 95$ |
| 50 | 3.43 | $5 \cdot 65$ | $3 \cdot 17$ | $5 \cdot 50$ | 2.93 | $5 \cdot 36$ | $2 \cdot 71$ | $5 \cdot 24$ | 2.50 | $5 \cdot 14$ | $2 \cdot 30$ | 5.04 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ |  | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & \text { I2 } \end{array}\right.$ | $\begin{array}{r} \text { S. } \\ +2.06 \end{array}$ | $\begin{array}{llc} \text { H. M. S. } \\ 6 & 14 & 20.8 \end{array}$ | $+2.07$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & \text { r6 } \\ 25 \cdot 5 \end{array}\right.$ | $\begin{array}{r} \mathrm{s} . \\ +2 \cdot 08 \end{array}$ | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & \text { I8 } \\ 30 \cdot 9 \end{array}\right.$ | $\begin{gathered} \mathrm{s} \cdot \mathrm{IO} \end{gathered}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 20 \end{array} 37 \cdot 2\right.$ | $\frac{s \cdot 1}{2 \cdot I}$ | $\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & 22 \end{array}$ | $12$ |
| 10 | 52715.0 | 2.00 | 52914.7 | I•99 | 53113.9 | I. 98 | $53312 \cdot 7$ | I•98 | 35 In-3 | 1.97 | $537 \quad 9.5$ | 1.97 |
| 12 | 518816.2 | I.99 | 52015.5 | r. 98 |  | I.97 | $\begin{array}{lllllllll}5 & 24 & 12 \cdot 3\end{array}$ | I. 96 | $\begin{array}{lll}5 & 26 & 9 \cdot 8\end{array}$ | r.95 | 528870 | I.95 |
| 14 | $5 \quad 917.5$ | 99 | 5 Ir 16.6 | 98 | $\begin{array}{lllll}5 & 13 & 15.0\end{array}$ | I.96 | $51512 \cdot 5$ | I 95 | $\begin{array}{lll}5 & 17 & 9 \cdot 3\end{array}$ | 4 | $\begin{array}{llll}5 & 19 & 5 \cdot 4\end{array}$ | 93 |
| 16 | 5 O-18.7 | oo | $5 \quad 2 \begin{array}{llll}5 & 17.9\end{array}$ | I. 98 | $\begin{array}{llll}5 & 4 & \text { 16.I }\end{array}$ | I.96 | $\begin{array}{llll}5 & 6 & 13.2\end{array}$ | I.94 | $\begin{array}{llll}5 & 8 & 9 \cdot 4\end{array}$ | 1•93 | 5 10 4.7 | I |
| 18 | 45119.7 | $+2$ | 45319.2 | +r.98 | $4 \begin{array}{llllllll} & 55 & 17\end{array}$ | +1.96 | 4  <br> 1 14.3 | +1•94 | $45910 \cdot 1$ | +1.92 |  | +1.90 |
| 22 | 4422 | 2.01 | $44420 \cdot 2$ | r.98 | $\begin{array}{lllllll}4 & 46 & 18 \cdot 6\end{array}$ | r.96 | $4 \begin{array}{ll}48 & 15 \cdot 5\end{array}$ | r.94 | $450 \mathrm{II} \cdot \mathrm{I}$ | r.91 | $\begin{array}{llll}4 & 52 & 5 \cdot 3\end{array}$ | r. 89 |
| 22 | $\begin{array}{llll}4 & 33 & 20 \cdot 2 \\ 4 & 21 & 10 \cdot 3\end{array}$ | $2 \cdot 02$ | $43520 \cdot 8$ | r.99 | $\begin{array}{llll}4 & 37 & 19 \cdot 6 \\ 4 & 28 & 20 \cdot 3\end{array}$ | r.97 | 439916.8 | I.94 | $\begin{array}{llll}4 & 4 \mathrm{I} & 12.3 \\ 4 & 32\end{array}$ | r.9 | $\begin{array}{llll}4 & 43 & 6 \cdot 3 \\ 4 & 34 & 7.5\end{array}$ | 8 |
| 24 26 | $\begin{array}{llll}4 & 24 & 19 \cdot 3 \\ 4 & 15 & 17.4\end{array}$ | 2.04 2.06 | $42620 \cdot 9$ | 2.01 2.02 | $42820 \cdot 3$ | $1 \cdot 97$ | $\begin{array}{llll}4 & 30 & 17.9 \\ 4 & 21 & 18.6\end{array}$ | r. 94 <br> r <br> 1 | 43213.6 | 1.9 | $434 \quad 7 \cdot 5$ | 888 |
| 28 | 461 | +2.09 | $4 \begin{array}{llll}4 & 18.3\end{array}$ | +2. | 4 10 19.8 | +2.00 | 41218.8 | +1.96 | $1415 \cdot 5$ | +1.92 | 4 16 10.0 |  |
| 30 | 3579.5 | $2 \cdot 12$ | $359 \times 5 \cdot 2$ | 2.07 | $4{ }_{4} 1188.1$ | 2.02 | $\begin{array}{llll}4 & 3 & 18.3\end{array}$ | I-98 | $4 \begin{array}{llll}4 & 5 & 15.9\end{array}$ | I. 94 | $4{ }_{4} 710 \cdot 8$ | I. 89 |
| 32 | $\begin{array}{llll}3 & 48 & 2 \cdot 9\end{array}$ | $2 \cdot 16$ | 350 10.6 | $2 \cdot 10$ |  | 2.05 | $35416 \cdot 8$ | 2.00 | $3 \quad 5615.5$ | I•95 | 358 II 2 | I.91 |
| 33 | 3 $3828 \cdot 7$ | $2 \cdot 18$ | $34537 \cdot 6$ | $2 \cdot 12$ |  |  | $34945 \cdot 6$ | 2.01 | 35144.9 | r.96 | $3534 \mathrm{I} \cdot 2$ | I .9 r |
| 34 | $33^{88} 54.0$ | $2 \cdot 20$ | 34 I 4-1 | $2 \cdot 14$ | $34310 \cdot 8$ | $2 \cdot 08$ | 34514.1 | 2.03 | $34714 \cdot 1$ | I.97 | $349 \mathrm{II} \cdot$ | I. 92 |
| 35 | 3341 | +2 | $\begin{array}{llll}3 & 36 & 30 \cdot 1\end{array}$ | +2 |  | +2.10 | $34042 \cdot \mathrm{I}$ | +2. | $\begin{array}{llll}3 & 42 & 43.0\end{array}$ | +r.99 | $34440 \cdot 5$ | $+\mathrm{I} \cdot 93$ |
| 36 | $\begin{array}{llllllllllll}3 & 29 & 42 \cdot 5\end{array}$ | 2.25 | $33155 \cdot 4$ | $2 \cdot 18$ | $\begin{array}{llll}3 & 34 & 4 \cdot 5\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}3 & 36 & 9 \cdot 8\end{array}$ |  | $\begin{array}{llll}3 & 38 & 115\end{array}$ | $2 \cdot 00$ | 3409.8 | r. 94 |
| 37 |  | $2 \cdot 27$ | 3 27 <br> 3 $20 \cdot 1$ | 2.21 | $\begin{array}{llll}3 & 29 & 30 \cdot 5\end{array}$ |  | $\begin{array}{llll}3 & 31 & 37.0\end{array}$ | $2 \cdot 08$ | $\begin{array}{lllll}3 & 33 & 39 \cdot 7\end{array}$ | 2.01 | $\begin{array}{lllll}3 & 35 & 38 \cdot 7\end{array}$ | I.95 |
| 38 | $\begin{array}{llll}3 & 20 & 28 \cdot 0 \\ 3 & 15 & 49.4\end{array}$ | 30 | $\begin{array}{llll}3 & 22 & 44 \cdot 1 \\ 3 & 18 & \end{array}$ | 2.23 | $\begin{array}{llll}3 & 24 & 55.9 \\ 3 & 20\end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}3 & 27 & 3.6 \\ 3 & 22 & 30.8\end{array}$ | $2 \cdot 10$ | $\begin{array}{llll}3 & 29 & 7 \cdot 4 \\ 3 & 24\end{array}$ | 2.03 | $\begin{array}{llll}3 & 31 & 7 \cdot 4\end{array}$ | .97 |
| 39 | 31549.4 | $2 \cdot 34$ | 318 7*3 | 2.26 | $32020 \cdot 7$ | 2.19 | $\begin{array}{llll}3 & 22 & 29.8\end{array}$ | $2 \cdot 12$ | $32434 \cdot 7$ | 2.05 | $\begin{array}{llll}3 & 26 & 35 \cdot 7\end{array}$ | 98 |
| 40 | $\begin{array}{llll}3 & 11 & 9\end{array}$ | +2.37 | $\begin{array}{llll}3 & 13 & 29 \cdot 6\end{array}$ | +2.29 | $\begin{array}{lllll}3 & 15 & 44.7\end{array}$ | +2.21 |  | +2.14 | $\begin{array}{llll}3 & 20 & 1.5\end{array}$ | $+2.07$ | $\begin{array}{llll}3 & 22 & 3 \cdot 5\end{array}$ | $+2.00$ |
| 4 I | $\begin{array}{lllll}3 & 6 & 29 \cdot 2\end{array}$ | 2.41 | $85 \mathrm{r} \cdot 0$ | $2{ }^{2}$ | $\begin{array}{llll}3 & 11 & 7.9\end{array}$ | 27 | $\begin{array}{lllll}3 & 13 & 20.1\end{array}$ | 2re |  | 2. | 31731.0 | 2 |
| 42 | $\begin{array}{llll}3 & 1 & 47 \cdot 3\end{array}$ | 2.45 | II•4 | $2 \cdot 36$ | $\begin{array}{llll}3 & 6 & 30 \cdot 3 \\ 3 & 15\end{array}$ | $2 \cdot 27$ | $\begin{array}{lllll}3 & 8 & 44.2\end{array}$ | $2 \cdot 19$ | 3 IO 53.4 | 1 | $\begin{array}{lllll}3 & 12 & 57.9\end{array}$ |  |
| 43 | $\begin{array}{llll}2 & 57 & 4.2 \\ 2 & 52 & 10.7\end{array}$ | $2 \cdot 49$ | $\begin{array}{lllllllllll}2 & 59 & 30 \cdot 7 \\ 2 & 5 & 48 \cdot 8\end{array}$ | $2 \cdot 40$ |  | $2 \cdot 31$ | $\begin{array}{llll}3 & 4 & 7 \cdot 5\end{array}$ | . 22 | $\begin{array}{lll}3 & 6 & 18 \cdot 3\end{array}$ | 4 | $\begin{array}{llll}3 & 8 & 24.2\end{array}$ | 2.06 |
| 44 | $\begin{array}{llll}2 & 52 & 19.7\end{array}$ | 2.53 | $25448 \cdot 8$ | 2.44 | $25712 \cdot \mathrm{I}$ | $2 \cdot 34$ | $2{ }^{2} 5929.9$ | 2.25 | 3 I 42.5 | $2 \cdot 17$ | $\begin{array}{llll}3 & 3 & 49.9\end{array}$ | 2.08 |
| 45 | 24733.7 | $+2.58$ | $\begin{array}{llll}2 & 50 & 5 \cdot 6\end{array}$ | $+2.48$ | $\begin{array}{lllllll}2 & 52 & 31\end{array}$ | +2.38 | $2 \begin{array}{lllll}2 & 54 & 51\end{array}$ | +2.29 | $\begin{array}{llll}2 & 57 & 5.9 \\ 2 & 5\end{array}$ | $+2.20$ | $25915 \%$ | +2.11 |
| 46 | $\begin{array}{llll}2 & 42 & 46 \cdot 0 \\ 2 & 37 & 56 \cdot 5\end{array}$ | 2. | $\begin{array}{llll}2 & 45 & 20 \cdot 9 \\ 2 & 40 & 34.7\end{array}$ | $2 \cdot 5$ | $\begin{array}{lllll}2 & 47 & 49 \cdot 4 \\ 2 & 43 & 6 \cdot 1\end{array}$ | 2.42 | 2 50  <br> 2 45 II $\cdot 8$ | $2 \cdot 32$ | $\begin{array}{llll}2 & 52 & 28 \cdot 4 \\ 2 & 47 & 49.9\end{array}$ | 2.23 | $\begin{array}{llllll}2 & 54 & 3.3 \\ 2 & 50\end{array}$ | -14 |
| 48 | $\begin{array}{llll}2 & 37 & 56.5 \\ 2 & 33 & 5.0 \\ 2 & 28\end{array}$ |  | $24034 \cdot 7$ |  |  |  |  |  |  |  | 250 |  |
| 49 | $\begin{array}{llll}2 & 28 \\ \text { II }\end{array}$ | 2.83 | $23056 \cdot 9$ | $2 \cdot 7$ | $\begin{array}{lllll}2 & 33 & 34 \cdot 8\end{array}$ | 2.57 | $\begin{array}{llll}2 & 36 & 5.6\end{array}$ | $2 \cdot 46$ | $\begin{array}{ll}2 & 38 \\ 29 & 29\end{array}$ | $2 \cdot 34$ | $24047 \cdot 0$ | 2.24 |
| 50 | 22315.1 | $+2.90$ | 2264.9 | $+2.76$ | $22846 \cdot 6$ | +2.63 | $23120 \cdot 7$ | +2.51 | $23347 \cdot 6$ | +2.39 | $2 \begin{array}{lll}26 & 7 \cdot 5\end{array}$ | +2.28 |
| 51 |  | 2.98 | $\begin{array}{llll}2 & 21 & 10 \cdot 5\end{array}$ | 2.83 |  | $2 \cdot 70$ | 22634.0 | 2.56 | $\begin{array}{llll}2 & 29 & 4 \cdot 1\end{array}$ | 2.44 | $23126 \cdot 8$ | $2 \cdot 32$ |
| 52 | 213 | 3.07 | $\begin{array}{llllllllllll}2 & 16 & 13 \cdot 6\end{array}$ | 2.91 | $\begin{array}{llll}2 & 19 & 3.9\end{array}$ | $2 \cdot 77$ | 22145.5 | 2.63 | $\begin{array}{llll}2 & 24 & 19\end{array}$ | 2.49 | $22644 \cdot 7$ | $2 \cdot 37$ |
| 53 | $\begin{array}{llll}2 & 8 & 8 \cdot 7\end{array}$ | $3 \cdot 16$ | II 13.7 | 3.00 | $\begin{array}{llll}2 & 14 & 8.9\end{array}$ | $2 \cdot 84$ | 21654.8 | 2.69 | $21932 \cdot \mathrm{I}$ |  | 2221.2 | 2.42 |
| 54 | 259 | 3.27 | $2 \quad 610 \cdot 5$ | $3 \cdot 10$ | II'I | $2 \cdot 93$ | 12 | $2 \cdot 77$ | 21443.3 | $2 \cdot 62$ | 217 | 2.4 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. 7 | A. | L. 8 | A. | L. | A. | L. 10 | - A. | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | $\begin{gathered} s . \\ +\quad .53 \end{gathered}$ | $\begin{gathered} s \\ -4.52 \end{gathered}$ | $\begin{aligned} & \text { s. } \\ & +\quad .62 \end{aligned}$ | $\begin{gathered} s . \\ -4.53 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad \cdot 7 I \end{aligned}$ | $\begin{gathered} s . \\ -4.54 \end{gathered}$ | S. $+\quad .80$ | $\begin{gathered} s . \\ -4.56 \end{gathered}$ | S. $+\quad .89$ | S. -4.58 | s. $+\quad .98$ | S. |
| 2 | . 45 | 4.51 | . 54 | 4.52 | . 63 | 4.53 | . 72 | -4.55 | +.89 | 4.56 4.5 | $+\quad .98$ .90 | 4.58 |
| 4 | -37 | 4.50 | -46 | 4.51 | $\cdot 55$ | $4 \cdot 52$ | -64 | $4 \cdot 53$ | $\cdot 72$ | 4.55 | . 82 | $4 \cdot 56$ |
| 6 | -29 | $4 \cdot 50$ | $\cdot 38$ | $4 \cdot 50$ | -46 | 4.51 | $\cdot 55$ | $4 \cdot 52$ | -64 | 4.53 | $\cdot 73$ | $4 \cdot 55$ |
| 8 | -21 | 4.49 | $\cdot 30$ | $4 \cdot 50$ | -39 | 4.50 | $\cdot 4^{8}$ | 4.51 | -56 | $4 \cdot 52$ | -66 | $4 \cdot 54$ |
| 10 | + 13 | $4 \cdot 49$ | + 22 | $4 \cdot 49$ | + 31 | 4.50 | + 40 | 4.51 | + 49 | 4.51 | + 58 | 4.53 |
| 12 | +.05 | $4 * 49$ | -14 | $4 \cdot 49$ | $\cdot 23$ | 4.49 | $\cdot 32$ | $4 \cdot 50$ | -41 | $4 \cdot 5 \mathrm{I}$ | $\cdot 50$ | $4 \cdot 52$ |
| 14 | - 03 | $4 \cdot 49$ | + .06 | $4 \cdot 49$ | -15 | 4.49 | -24 | 4.49 | $\cdot 33$ | $4 \cdot 50$ | -42 | $4 \cdot 51$ |
| 16 | - II | $4 \cdot 49$ | -. 02 | $4 \cdot 49$ | +.07 | 4.49 | -16 | $4 \cdot 49$ | $\cdot 25$ | $4 \cdot 50$ | -34 | $4 \cdot 50$ |
| 18 | -19 | $4 \cdot 49$ | -ro | $4 \cdot 49$ | - . 01 | 4.49 | +.08 | $4 \cdot 49$ | - 8 | $4 \cdot 49$ | $\cdot 27$ | $4 \cdot 50$ |
| 20 | - $\cdot 27$ | $4 \cdot 50$ | - .18 | $4 * 49$ | - .09 | 4.49 | - 00 | $4 * 49$ | + 10 | $4 \cdot 49$ | + 19 | $4 \cdot 49$ |
| 22 | $\cdot 36$ | 4.50 | $\cdot 26$ | $4 \cdot 50$ | -17 | 4.49 | -07 | $4 \cdot 49$ | +.02 | $4 \cdot 49$ | -Ir | $4 \cdot 49$ |
| 24 | $\cdot 44$ | 4.51 | -35 | $4 \cdot 50$ | $\cdot 25$ | 4.49 | -15 | 4.49 | -.06 | $4 \cdot 49$ | +.03 | 4.49 |
| 26 | - 53 | $4 \cdot 52$ | - 43 | $4 \cdot 51$ | -34 | $4 \cdot 50$ | - 24 | $4 \cdot 49$ | $\cdot 14$ | 4.49 | -. 05 | 4.49 |
| 28 | - 62 | $4 \cdot 53$ | -52 | $4 \cdot 52$ | -42 | 4.51 | $\cdot 32$ | $4 \cdot 50$ | -23 | 4.49 | - 13 | $4 \cdot 49$ |
| 30 | - 72 | 4.54 | -. 62 | 4.53 | -.51 | $4 \cdot 52$ | - 41 | 4.51 | - 31 | 4.50 | - 21 | 4.49 |
| 32 | . 82 | 4.56 | $\cdot 71$ | $4 \cdot 54$ | -6I | $4 \cdot 53$ | - 50 | $4 \cdot 52$ | - 40 | 4.51 | -30 | 4.50 |
| 34 | -93 | 4.58 | -81 | $4 \cdot 56$ | -70 | 4.54 | -60 | $4 \cdot 53$ | -49 | 4.51 | -38 | $4 \cdot 50$ |
| 36 | I. 04 | 4.61 | - 92 | $4 \cdot 58$ | .8I | $4 \cdot 56$ | -69 | $4 \cdot 54$ | -58 | $4 \cdot 53$ | -48 | $4 \cdot 51$ |
| 38 | I•15 | $4 \cdot 63$ | I. 03 | $4 \cdot 6 \mathrm{I}$ | $\cdot 92$ | 4.58 | -80 | $4 \cdot 56$ | -68 | $4 \cdot 54$ | -57 | $4 \cdot 52$ |
| 40 | - I. 28 | $4 \cdot 67$ | -I.I5 | $4 \cdot 63$ | -r.03 | 4.60 | - 91 | $4 \cdot 58$ | - . 79 | $4 \cdot 56$ | - . 67 | $4 \cdot 54$ |
| 42 | I 42 | $4 \cdot 71$ | I. 28 | $4 \cdot 67$ | I-15 | 4.63 | 1.02 | $4 \cdot 60$ | $\cdot 90$ | $4 \cdot 58$ | - 78 | $4 \cdot 56$ |
| 44 | I 56 | 4.75 | I-42 | 4.71 | I. 28 | $4 \cdot 67$ | I•15 | $4 \cdot 63$ | 1.02 | $4 \cdot 60$ | -89 | $4 \cdot 58$ |
| 46 | I•73 | 4.81 | I. 57 | $4 \cdot 76$ | 1.43 | $4 \cdot 71$ | r.28 | 4.67 | 1.15 | 4.63 | I.Or | $4 \cdot 60$ |
| 48 | I.91 | 4.88 | I•74 | $4 \cdot 81$ | 1.58 | $4 \cdot 76$ | I.43 | $4 \cdot 71$ | 1-28 | 4.67 | 1.14 | $4 \cdot 63$ |
| 50 | $-2.11$ | 4.96 | - I.93 | $4 \cdot 89$ | - $\mathrm{I} \cdot 76$ | 4.82 | - I. 59 | $4 \cdot 76$ | - 1.43 | 4•1 | - $\mathrm{I} \cdot 28$ | 4.67 |
| 52 | $2 \cdot 34$ | 5.06 | $2 \cdot 14$ | 4.97 | I 95 | 4.89 | $1 \cdot 77$ | 4.83 | 1. 60 | $4 \cdot 77$ | 1.44 | $4 \cdot 71$ |
| 54 | $2 \cdot 61$ | 5•19 | $2 \cdot 38$ | $5 \cdot 07$ | 2.17 | 4.98 | I•98 | 4.90 | 1.79 | 4.83 | I.6I | $4 \cdot 77$ |

## 112 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $27^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \& \& \& \& \& \& \& \& \& \& \& \& \\
\hline \& \& \& \& \& \& \& \& \& \& \& \& \\
\hline ro \& \& \& \& \& \& \& \& \& \& \& \& \\
\hline 12 \& \& \& \& \& \({ }_{5}^{5} 3356.6\) \& \& 5 \& \& \& \& \({ }^{5} 3945 \cdot 2\) \& \\
\hline \& \& \& 52256.0 \& \& \& \& \& \& \& \& 53033. \& \\
\hline 16 \& 5 II \(59 \cdot 3\) \& \& \(1353 \cdot 1\) \& \& 515 \& \& 5 I7 \& \& 19 \& \& 21 \& \\
\hline 18 \& 5 \& +r.89 \& \(5 \quad 45 \mathrm{I} \cdot 2\) \& +r.87 \& \({ }^{6}\) \& + 1.86 \& \(5 \quad 834 \cdot 2\) \& +1.85 \& 510 \& +r.83 \& 5 I \& I.82 \\
\hline \& 4 \& \& \(45550 \cdot 2\) \& \& 4 \& \& 4 \& \& 5-1 \& \& 5 \& \\
\hline \& \& \& 46 \& \& \({ }^{4} 488398\) \& \& 450 \& \& 4 5215.8 \& \& 4 \& \\
\hline 24
26 \& \({ }_{4}^{4} 325\) \& \& \({ }_{4}^{4} 28\) \& \& 430 \& \& \({ }_{4}^{4} 42\) \& \& + 44 \& 1.74 \& 4 \& \\
\hline 28 \& \(\begin{array}{llll}4 \& 18 \& 2\end{array}\) \& +1.85 \& \(41952 \cdot 3\) \& +r.82 \& 421 \& +1.78 \& \(42326 \cdot 5\) \& \& 4510 \& \& 2 \& \\
\hline 30 \& \(4 \begin{array}{lll}4 \& 3\end{array}\) \& \& 4 10 53.5 \& \& 12 \& \& 14 \& \& 416 10\% \& \& 52-I \& \\
\hline 3 I \& \& \& \(4 \quad 6 \quad 24.2\) \& \& 4812 \& \& \& \& \& \& \& \\
\hline 32 \& \(4{ }^{4}\) \& \& \& \& \(4{ }^{4} 3{ }^{3} 42 \cdot 7\) \& \& \& \& \& \& 4851 \& \\
\hline 33 \& 355 \& \& 357 \& \& 35 \& \& \& \& 42415 \& \& 44219 \& \\
\hline 34 \& 9 \& \(+1\) \& \begin{tabular}{l}
3 \\
3 \\
3 \\
3 \\
48 \\
\hline
\end{tabular} \& +r.82 \& \({ }^{3} 54444.0\) \& 78 \& \begin{tabular}{lllll}
3 \& 56 \& 29.3 \\
3 \& 52 \& \\
\hline
\end{tabular} \& + r 174 \& \begin{tabular}{llll}
3 \& 58 \\
\hline 12 \& 12 \\
\hline
\end{tabular} \& \& \& \\
\hline \[
\begin{aligned}
\& 35 \\
\& 36
\end{aligned}
\] \& [ \begin{tabular}{rrrr}
3 \& 46 \& \(34 \cdot 9\) \\
3 \& 42 \& \(4 \cdot 7\) \\
\hline
\end{tabular} \& \& 3
3
3
4
48 \& \& 3 \begin{tabular}{l}
3 \\
3 \\
\hline
\end{tabular} \& \& 3 \(\begin{array}{rrrr} \& 52 \& 0.0 \\ 3 \& 47 \& 30 \cdot 6\end{array}\) \& \& 3534 \& \& \begin{tabular}{ll}
3 \& 55 \\
3 \& 22.5 \\
\hline \& 50 \\
\(52 \cdot 9\)
\end{tabular} \& \\
\hline \& 33 \& \& \& \& \& \& \& \& \(34443{ }^{\circ}\) \& \& 346 \& \\
\hline 38 \& 33 \& I.91 \& 3
34
56 \& \& \& - 79 \& 3 \& -74 \& 34014 \& \& 4 \& . 6 \\
\hline 39 \& 32 \& +r. \& 330 \& +1 \& 3 \& 1 \& 33 \& +r.74 \& 3 \& \& \(33724 \cdot 6\) \& \\
\hline \& \& \& 3 \& \& \& \& - \& \& \& \& \& \\
\hline 42 \& \& \& \begin{tabular}{llll}
3 \& 21 \\
3 \& 16 \\
\hline
\end{tabular} \& \& \({ }_{3} 3\) \& \& - \(\begin{aligned} \& 3 \\ \& 3 \\ \& 3\end{aligned}\) \& \& \(\left\lvert\, \begin{array}{llll}3 \& 26 \& 46 \cdot 2 \\ 3 \& 22 \& 16 \cdot 6\end{array}\right.\) \& \& 328 \& \\
\hline 43 \& 3 10 \& r.98 \& 312 \& I.91 \& 314 \& \& \(\begin{array}{llll}316 \& 2 \cdot 9\end{array}\) \& -7 \& 317470 \& 1.70 \& 1927 \& \\
\hline \& \& \& 37 \& \& \& \& \(31132 \cdot 6\) \& +1.78 \& 3 \& \& 6 \& \\
\hline \[
\begin{aligned}
\& 45 \\
\& 46
\end{aligned}
\] \& \& \& \begin{tabular}{ll}
3 \& 3 \\
2 \& 5 \\
\hline
\end{tabular} \& \& \& \& \& \& 3 \& \& \& \\
\hline 47 \& 2 \& \& 254 \& \& 256 \& \& 258 \& \& \(25946 \%\) \& 崖 \& \& \\
\hline 48 \& 247 \& \& 249 \& \& 251 \& I.92 \& 253 \& \& 255 \& \& 256 \& \\
\hline \& 242 \& \& 45 \& \& 247 \& \& 248 \& +1 \& 250 \& \& 25 \& \\
\hline \& \& \& 24 \& 2.07 \& 242 \& I.97
2.00 \& 244 \& 1.87
+8
189 \& 246 \& \& 2 \& \\
\hline \& \& \& 2
2
3

1
1 \& \& \& \& \& - 1 \& 243 ${ }^{2}$ \& I. 8 \& 2 385 \& <br>
\hline 53 \& $22422 \cdot 6$ \& \& 226 \& $2 \cdot 17$ \& $22843 \cdot 4$ \& \& 2 30 \& 1.95 \& $23237 \cdot 1$ \& \& 234 \& 析 <br>
\hline \& $2 \begin{array}{llll}2 & 19 & 406 \\ 2\end{array}$ \& \& $2 \begin{array}{lll}21 & 57.3 \\ 2 & 17 \\ 1\end{array}$ \& \& $\begin{array}{lllll}2 & 24 & 6 \cdot 5 \\ 2\end{array}$ \& +2.09 \& $\begin{array}{llll}2 & 26 & 8.6 \\ 2 & 21\end{array}$ \& + I .98 \& $\begin{array}{llll}2 & 28 & 3 & 3 \\ 2 & 23\end{array}$ \& \& $\begin{array}{llll}2 & 29 & 52.4 \\ 2 & 25 & \end{array}$ \& <br>
\hline  \&  \& \& $\begin{array}{lllll}2 & 17 & 16 \cdot 7 \\ 2 & 12 & 36.7\end{array}$ \& \& $\begin{array}{llll}2 & 19 & 28 \cdot 5 \\ 2 & 14 & 49.4\end{array}$ \& \& $\begin{array}{llll}2 & 21 & 32 \cdot 8 \\ 1 & 16 & 56 \cdot 2\end{array}$ \& \& $\begin{array}{llll}2 & 23 & 29 \\ 2 & \\ 2\end{array}$ \& \& 225
220 \& <br>
\hline \& $\begin{array}{llll}2 & 5 & 24\end{array}$ \& \& $2 \quad 751.2$ \& \& 2 IO \& \& \& \& 4 \& \& 1 2613 \& <br>
\hline 58 \& 2035 \& \& 23 \& \& 2527 \& \& 739 \& \& 943 \& \& 2 II 39 \& <br>
\hline
\end{tabular}

VARIATION TO $x^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. +I .08 | $\begin{gathered} \mathrm{s} . \\ -4.62 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 17 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 64 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathbf{i} \cdot 26 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.66 \end{gathered}$ | $\begin{gathered} s . \\ +r \cdot 36 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.69 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 46 \end{gathered}$ | $\underset{-4 \cdot 72}{\mathrm{~s}_{2}}$ | $\begin{gathered} s . \\ +1 \cdot 56 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.75 \end{gathered}$ |
| 4 | .91 | 4.58 | 1.00 | 4.60 | + 1.09 | 4.62 | T.19 | $4 \cdot 64$ | I.28 | 4.67 | +1.38 | 4.69 |
| 8 | $\cdot 75$ | $4 \cdot 55$ | . 84 | $4 \cdot 57$ | $\cdot 93$ | $4 \cdot 58$ | I.02 | $4 \cdot 60$ | I.II | $4 \cdot 62$ | I-21 | 4.65 |
| 12 | -59 | 4.53 | -68 | $4 \cdot 54$ | $\cdot 77$ | $4 \cdot 55$ | $\cdot 86$ | $4 \cdot 57$ | -95 | $4 \cdot 59$ | 1.05 | $4 \cdot 6$ I |
| 16 | -43 | 4.51 | $\cdot 53$ | $4 \cdot 52$ | -62 | 4.53 | $\cdot 71$ | $4 \cdot 54$ | $\cdot 80$ | 4.56 | $\cdot 89$ | $4 \cdot 58$ |
| 20 | + 28 | $4 \cdot 50$ | + 37 | $4 \cdot 50$ | + 47 | $4 \cdot 51$ | + 56 | 4.52 | + 65 | $4 \cdot 54$ | +.74 | $4 \cdot 55$ |
| 22 | -20 | 4.49 | $\cdot 30$ | $4 \cdot 50$ | -39 | 4.51 | $\cdot 48$ | $4 \cdot 51$ | $\cdot 58$ | 4.53 | . 67 | $4 \cdot 54$ |
| 24 | .13 +.05 | $4 \cdot 49$ | - 22 | 4.49 | $\cdot 32$ | $4 \cdot 50$ | $\cdot 41$ | 4.51 | $\cdot 50$ | 4.52 | -60 | $4 \cdot 53$ |
| 26 | +.05 | $4 \cdot 49$ | -14 | $4 \cdot 49$ | - 24 | 4.49 | $\cdot 33$ | $4 \cdot 50$ | $\cdot 43$ | 4.51 | $\cdot 52$ | 4.52 |
| 28 | . 03 | 4.49 | -07 | 4.49 | -16 | 4.49 | -26 | $4 \cdot 50$ | $\cdot 36$ | 4.50 | -45 | 4.5 I |
| 30 | - II | $4 \cdot 49$ | + or | 4.49 | +.08 | $4 \cdot 49$ | + .18 | $4 \cdot 49$ | + 28 | 4.50 | + 38 | $4 \cdot 50$ |
| 32 | -19 | $4 \cdot 49$ | -.09 | $4 \cdot 49$ | + ${ }^{\text {Or }}$ | $4 \cdot 49$ | - II | $4 \cdot 49$ | -21 | 4.49 | -31 | $4 \cdot 50$ |
| 34 | $\cdot 28$ | 4.50 | - 17 | 4.49 | -. 07 | 4.49 | +.03 | $4 \cdot 49$ | -13 | $4 \cdot 49$ | . 23 | 4.49 |
| 36 | -37 | 4.50 | -26 | $4 \cdot 50$ | - 15 | $4 \cdot 49$ | -. 05 | $4 \cdot 49$ | + 05 | $4 \cdot 49$ | -16 | $4 \cdot 49$ |
| 38 | $\cdot 46$ | 4.51 | -35 | 4.50 | - 24 | $4 \cdot 50$ | -13 | $4 \cdot 49$ | -. 02 | $4 \cdot 49$ | + .08 | $4 \cdot 49$ |
| 40 | -. 56 | 4.52 | - 44 | 4.51 | - 33 | 4.50 | - 22 | 4.49 | - 11 | $4 \cdot 49$ | - . 00 | $4 \cdot 49$ |
| 42 | - 66 | $4 \cdot 53$ | $\cdot 54$ | 4.52 | $\cdot 42$ | 4.51 | $\cdot 30$ | $4 \cdot 50$ | $\cdot 19$ | 4.49 | .08 | 4.49 |
| 44 | $\cdot 76$ | 4.55 | $\cdot 64$ | 4.53 |  | 4.51 | $\cdot 40$ | 4.51 | - 28 | $4 \cdot 50$ | - 16 | 4.49 |
| 46 | . 88 | 4.57 | $\cdot 75$ | 4.55 | -62 | 4.53 | $\cdot 49$ | 4.52 | $\cdot 37$ | 4.51 | $\cdot 25$ | $4 \cdot 50$ |
| 48 | I.00 | $4 \cdot 60$ | -86 | 4.57 | -73 | 4.55 | -60 | $4 \cdot 53$ | -47 | 4.51 | -34 | $4 \cdot 50$ |
| 50 | -r.13 | $4 \cdot 63$ | -.99 | 4.60 | - 84 | $4 \cdot 57$ | - 71 | $4 \cdot 54$ | -. 57 | 4.52 | - 44 | 4.51 |
| 52 | I 28 | $4 \cdot 67$ | r12 | $4 \cdot 63$ | $\cdot 97$ | 4.59 | $\cdot 82$ | $4 \cdot 56$ | . 68 | 4.54 | - 54 | $4 \cdot 52$ |
| 54 | 1.43 | $4 \cdot 71$ | $1 \cdot 27$ | $4 \cdot 66$ | r.17 | 4.62 | $\cdot 95$ | 4.59 | -80 | $4 \cdot 56$ | $\cdot 65$ | 4.54 |
| 56 58 | $\begin{array}{r}\text { r } \\ \mathrm{I} .61 \\ \hline 182\end{array}$ | 4.77 4.85 | 1.43 r .62 | $4 \cdot 7 \mathrm{I}$ 4.77 | I 26 I 43 | 4.66 4.71 | 1.09 I. 25 | 4.62 4.66 | 933 $\times 107$ | 4.58 4.62 | -77 | 4.55 4.58 | LATITUDE $27^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True <br> Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\left\lvert\, \begin{array}{ll} \text { H. M. } \\ 6 & 38 \end{array}\right.$ |  | $\left\lvert\, \begin{array}{lll} \text { H. M. } \\ 640 & 25 \end{array}\right.$ | $\begin{gathered} 5 . \\ +2 \cdot 3 I \end{gathered}$ | ${ }_{6}^{\mathrm{H} .}$ | $2 \cdot$ | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 645 & 7.0 \end{array}$ | $+2 \cdot 38$ | $\left\|\begin{array}{ll} \text { H. M. } & \text { S. } \\ \hline & 47 \\ 3 \mathrm{I} \cdot 2 \end{array}\right\|$ | $+2 \cdot 42$ | $\left\|\begin{array}{cc} \text { H. м. } & \text { s. } \\ 6 & 49 \\ 57.7 \end{array}\right\|$ | $2 \cdot 46$ |
| 10 | 55058.6 | I-99 | $558258 \cdot 1$ | $2 \cdot 00$ | $554 \quad 58 \cdot 2$ | 2.01 | $5 \begin{array}{lllll}56 & 58.9\end{array}$ | $2 \cdot 02$ | ${ }_{5}^{5} 590$ | 2.03 | 6 Y $2 \cdot 7$ | 2.04 |
| 12 | 41415 | I.94 | 54338.0 | I•94 | 54534.9 | I.95 | $54732 \cdot 1$ | 1.96 | 5 54929.9 | I.96 | 5 51 28.1 | 1.97 |
| 14 | 53226.8 |  | $53420 \cdot 6$ | 90 | 53614.4 | $1 \cdot 90$ | $\begin{array}{llll}5 & 38 & 8 \cdot 3\end{array}$ | -90 | 540 | \% | 54156.9 | I.91 |
| 16 | $\begin{array}{llllllllll}5 & 23 & 14.3\end{array}$ |  | $\begin{array}{llll}5 & 25 & 54\end{array}$ | 85 | $52656 \cdot 3$ | 1.85 | $5 \quad 28 \quad 47 \cdot 2$ | + 85 | $53038 \cdot 0$ | 1.85 | $\begin{array}{llll}5 & 32 & 28 \cdot 8\end{array}$ | I. 85 |
| 18 | 14 | + I .8 I | 15 52.3 | 1.8 | 5 I7 $40 \cdot 6$ | +1.80 | 51928.5 | +1.79 | $52116 \cdot 1$ | $+1.79$ | 5 23313.5 | + 1.79 |
| 20 | $54 \cdot 7$ | 1.78 | $4 \mathrm{I} \cdot 2$ | 1.77 | 5827.0 | I 76 | 5 10 12.1 | 1.75 | 5 II $56 \cdot 7$ | 1.74 | $51340 \cdot 9$ | 3 |
| 22 | $5547 \cdot 5$ | I.75 | 45731.8 | I.73 | $45915 \cdot 2$ | I.72 | 5 - $57 \cdot 8$ | I• 70 | 5 51239.6 | I. 69 | 5 5420.7 | 88 |
| 24 | $44641 \cdot 7$ | I.72 | 44824.1 | 1.70 | $450 \quad 5 \cdot 3$ | r. 68 | $45145 \cdot 5$ | 1.66 | $4 \quad 5324.6$ | I. 64 | $\begin{array}{lll}4 & 55 & 2.8\end{array}$ | . 63 |
| 26 | $43737 \cdot 2$ | 1.69 | 439 x 78 | I.66 | 44057 | I. 64 | 44234.9 |  | 444 II.6 |  | $44547 \cdot 0$ | 8 |
| 28 | 28 | $+\mathrm{I} \cdot 66$ | 3012.9 | +1.64 | 431 | I. | 43326.0 | +1.58 | $4 \begin{array}{lll}4 & 35 & 0.3\end{array}$ | +1.56 | 43633.0 | +1.53 |
| 30 | 1931.6 | I. 64 | 219 | I.61 | 42244.8 | 1.58 | $42418 \cdot 6$ | I.55 | $\left\lvert\, \begin{array}{llll}4 & 25 & 50 \cdot 7\end{array}\right.$ | 1.52 | ${ }_{4}^{4} 27 \begin{array}{ll} & 20 \cdot 9\end{array}$ | $1 \cdot 49$ |
| 31 | $\begin{array}{lll}15 & 0.9\end{array}$ | 1.63 | $4{ }^{4} 1637 \cdot 7$ | I.60 | $\begin{array}{\|ccc\|}4 & 18 & 12.5\end{array}$ | I.56 | $\begin{array}{llll}4 & 19 & 45.4\end{array}$ | I.53 | ${ }^{4} 221516.4$ | 1.5 |  | 1.47 |
| 32 | 4 10 $30 \cdot 3$ |  | $4 \begin{array}{llll}42 & 6.5\end{array}$ | 1.58 | $4 \begin{array}{lllllllll}4 & 40 \cdot 6\end{array}$ | I. 5 | $4 \begin{array}{lll}45 & 12.6\end{array}$ | 1.5 | $4 \begin{array}{llll}4 & 16 & 42 \cdot 5\end{array}$ | I. 48 | $\begin{array}{llllll}4 & 18 & 10.5\end{array}$ | 1.45 |
| 33 | $4 \quad 5 \quad 59 \cdot 9$ | 1.6 | $4 \quad 7 \quad 35 \cdot 6$ | 57 | $\begin{array}{llll}4 & 9 & 8 \cdot 9\end{array}$ | I. 54 | $41040 \cdot 0$ | $1 \cdot 50$ | 4129.0 | 1.4 | 41335 | 1.43 |
| 34 | 1 5697 59.7 | $+1$ | $5834 \cdot 3$ | +1.56 | $\begin{array}{llll}4 & 4 & 37.5 \\ 4 & 0 & 6.3\end{array}$ | +I.52 | 7.8 | +1.48 | $\begin{array}{llll}4 & 7 & 35.8 \\ 4 & 3 & 2.9\end{array}$ | +1.45 | 427.6 | +1.41 |
|  | $5659 \cdot 7$ | r 60 | $\begin{array}{lllllllll}3 & 58 & 34.3\end{array}$ | $1 \cdot 55$ | ${ }_{4}^{4}$ | 1.51 | 135.9 | 1.47 | 4 3 2.9 <br>  58 30.4 | 143 | $\begin{array}{llll}4 & 4 & 27 \cdot 6\end{array}$ | I.39 |
| 36 | 5229.8 | I 59 | $\begin{array}{llll}3 & 54 & 3 & 3\end{array}$ | I.55 | 3 $355135 \cdot 4$ | 1.50 | 3574.2 | 1.46 | $3{ }^{58} 30 \cdot 4$ | I.4I | 35954.0 | 39 |
| 37 | $3{ }^{3} 48$ 0.0 | r. 59 | $\begin{array}{lllll}3 & 49 & 33 \cdot 7\end{array}$ | 54 | $\begin{array}{llll}3 & 51 & 4 \cdot 6\end{array}$ | $1 \cdot 49$ | 3 52 $32 \cdot 7$ <br> 3 48  | 1.44 | $35358 \cdot 1$ |  | $\begin{array}{llll}3 & 55 & 20 \cdot 7 \\ 3 & 50 & 47\end{array}$ | I.35 |
| 38 | $34330 \cdot 4$ | 1.5 | $\begin{array}{lllll}3 & 45 & 3.7\end{array}$ | 1.53 | 346 34-I | 1.48 | $\begin{array}{llll}3 & 48 & 1.5\end{array}$ | I-43 | 349 | 1.38 | $35047 \cdot 8$ | 34 |
| 39 | 3 39 0.8 <br> 3 34  | +1.58 | $\begin{array}{llllll}3 & 40 & 33 \cdot 9 \\ 3 & 36 & 4 \cdot 1\end{array}$ | +I.52 |  | +1.47 | 3 43 $30 \cdot 6$ <br> 3 38 59.8 | +1.42 | $\begin{array}{llll}3 & 44 & 54 \cdot 3 \\ 3 & 40 & 22 \cdot 9\end{array}$ | 1.38 +1.36 1.3 | 3 46 $15 \cdot 1$ <br> 3 41 $42 \cdot 8$ | 1.32 +1.30 |
| 40 | 33431.3 | 1 | 3 36 $4 \cdot 1$ | 152 | 3 37733.6 | I. 46 | $\begin{array}{llll}3 & 38 & 59 \cdot 8\end{array}$ | 1 | $34022 \cdot 9$ | 1.36 | 3 41 $42 \cdot 8$ | . 30 |
| 4 | 3301.9 | r 5 | 33134.5 | 1.51 | $\begin{array}{llll}3 & 33 & 3.6\end{array}$ | 146 | $\begin{array}{llll}3 & 34 & 29 \cdot 3\end{array}$ | - 40 | $33551 \cdot 6$ |  | $\begin{array}{lllllllllll}3 & 37 & 10 \cdot 7\end{array}$ | I 29 |
| 42 | $\begin{array}{lllll}3 & 25 & 32 \cdot 5\end{array}$ |  | $\begin{array}{llll}3 & 27 & 5.0\end{array}$ | 1.5I | $\begin{array}{lllll}3 & 28 & 33.7\end{array}$ | 45 | $\begin{array}{llll}3 & 29 & 58.9\end{array}$ | 9 | $331520 \cdot 6$ | 33 | $\begin{array}{llll}3 & 32 & 38 \cdot 8 \\ 3\end{array}$ | . 27 |
| 43 | 3213.2 | 1 | $32235 \cdot 5$ | I•51 | $13244 \cdot 0$ | 1.44 | $325 \quad 28 \cdot 7$ |  | $32649 \cdot 8$ |  |  |  |
| 44 | $\begin{array}{llll}3 & 16 & 33.9\end{array}$ | +1.57 | $\begin{array}{llll}3 & 18 & 6 \cdot 1\end{array}$ | +1.50 | 31954.3 | +1.44 |  | + $\mathrm{I} \cdot 37$ |  | +1.3I |  | +1.25 |
| 45 | $\begin{array}{llll}3 & 12 & 4.5\end{array}$ | 1.57 | $\begin{array}{lllll}3 & 13 & 36 \cdot 7\end{array}$ | I. 50 | $\begin{array}{llll}3 & 15 & 4.9\end{array}$ | 1.43 | 315688 | 1.37 | $\begin{array}{llll}3 & 17 & 48.8\end{array}$ | I.30 | 3 19 4.8 | 1.23 |
| 46 | $\begin{array}{llll}3 & 7 & 35.0 \\ 3 & 3 & 5.5\end{array}$ | 1.5 | $\begin{array}{llll}3 & 9 & 7 \cdot 4 \\ 3 & 4 & 38.0\end{array}$ | I. 50 | $\begin{array}{crrr}3 & 10 & 35 \cdot 3 \\ 3 & 6 & 5 \cdot 9\end{array}$ | 1.4 | 311590 | $\begin{array}{r}\text { I. } 36 \\ \text { I. } 35 \\ \hline\end{array}$ | $\begin{array}{crrrr}3 & 13 & 18.5 \\ 3 & 8 & 48.4\end{array}$ | 1.29 <br> 1.28 | $\begin{array}{llll}3 & 14 & 33 \cdot 8 \\ 3 & 10 & 3 \cdot 1\end{array}$ | . 22 |
| 48 | $\begin{array}{llll}3 & 3 & 5 \cdot 5 \\ 2 & 58 & 5 \cdot 5\end{array}$ | I. 58 | $\begin{array}{llll}3 & 4 & 38 \cdot 0\end{array}$ | I. 50 | 3 6 5.9  <br> 3 1 3  | $1 \cdot 43$ | 3729 | I.35 | $\begin{array}{llll}3 & 8 & 48 \cdot 4\end{array}$ | I | 3 10 $3 \cdot 1$ | 1.21 |
| 48 | 25835.9 | 1.58 | 3 | 1.50 | $\begin{array}{llll}3 & 1 & 36.5\end{array}$ | 1.43 | 325 | 1.35 | $3 \quad 418 \cdot 5$ | $1 \cdot 27$ | $532 \cdot 6$ | 1.20 |
| 49 | $\begin{array}{llll}2 & 54 & 6 \cdot 2\end{array}$ | + 1.59 | $2 \begin{array}{llll}25 & 39 \cdot 1\end{array}$ | +1.51 | $\begin{array}{llll}2 & 57 & 7 \cdot 1 \\ 2 & 5 & 7\end{array}$ | +1.43 | $2 \begin{array}{llllllllllllll} & 58 & 30 \cdot 3\end{array}$ | +I.35 | $2 \begin{array}{lllll}29 & 48 \cdot 6\end{array}$ | +1.27 | $\begin{array}{lrrr}3 & 1 & 2.2 \\ & 56 & 32 .\end{array}$ | -19 |
| 50 | $24936 \cdot 3$ | $\mathrm{I} \cdot$ | 251 | 1.51 | $\begin{array}{lllll}2 & 52 & 37.8 \\ 2\end{array}$ | $1 \cdot 43$ | $2 \begin{array}{lll}54 & 0.9\end{array}$ | I. 34 | $2 \begin{array}{llll}25 & 18.9\end{array}$ | $1 \cdot 26$ | $\begin{array}{llll}2 & 56 & 32 \cdot 0\end{array}$ | .18 |
| 51 | $245 \quad 6 \cdot 2$ | 61 | $24640 \cdot 0$ | ${ }^{1} 5.5$ | 2 48 | 1.43 | $2 \begin{array}{llll}29 & 31.5\end{array}$ | I.34 |  | $1 \cdot 25$ | 2 52 $2 \cdot 0$ <br> 2 4  | \% |
| 52 |  | 1.62 | $\begin{array}{llll}2 & 42 & 10 \cdot 3 \\ 2\end{array}$ | . 53 | ${ }^{2} 443$ 39*0 | 43 | 2 45 $2 \cdot 1$ | I•34 | $2 \begin{array}{llll} \\ 46 & 19 \cdot 8\end{array}$ | 125 | $24732 \cdot 1$ | r6 |
| 53 | $\begin{array}{llll}2 & 36 & 5 \cdot 3\end{array}$ | 1.63 | $23740 \cdot 3$ | . 53 | $1 \begin{array}{lll}2 & 39 & 9 \cdot 4\end{array}$ | 1.44 | $24032 \cdot 7$ | I 34 | $24150 \cdot 4$ | 1.25 | 24313.3 | - 15 |
| 54 | $\begin{array}{llll}2 & 31 & 34 \cdot 6 \\ 2 & 27 & 3 \cdot 2\end{array}$ | +1. 6 | 2 33 $10 \cdot 2$ <br> 2 28  | +1.5 | 2 34 $39 \cdot 8$ <br> 2 30  | +1.44 | $\begin{array}{llll}2 & 36 & 3 \cdot 4\end{array}$ | +1.34 | 23721.0 | +1.24 | $\begin{array}{llllllllllllll}2 & 38 & 32 \cdot 6\end{array}$ | +r.14 |
| 55 | $\begin{array}{llll}2 & 27 & 3.2 \\ 2 & 22 & 3\end{array}$ | . 67 | 2 28 2 | 1.56 | $23010 \cdot 1$ | 1.45 | $23134^{\circ} \mathrm{O}$ | I 35 | $23251 \cdot 6$ | 1.24 | 2343 3.0 | . 14 |
| 56 | $\begin{array}{llll}2 & 22 & 3 \mathrm{I} \cdot 6 \\ 2 & 17 & 50.5\end{array}$ | r. 69 | $2 \begin{array}{lll}2 & 24 & 9.3\end{array}$ | $1 \cdot 57$ | $2 \begin{array}{llll}25 & 40 \cdot 2\end{array}$ | $1 \cdot 46$ | $\begin{array}{llll}2 & 27 & 4.5\end{array}$ | r.35 | $2 \begin{array}{ll}28 & 22 \cdot 2 \\ 2\end{array}$ | 1.24 | $22933 \cdot 5$ | $1 \cdot 14$ |
|  | $\begin{array}{llll}2 & 17 & 59 \\ 2 & 13 & 26\end{array}$ | 1.7 | $\begin{array}{llll}2 & 19 & 38 \cdot 4 \\ 2 & 15 & 7.0\end{array}$ | 1.59 I. 61 | $\begin{array}{llll}2 & 21 & 10 \cdot 1 \\ 2 & 16 & 39 \cdot 7\end{array}$ | 1. | (2)22 34.9 | I. | $\begin{array}{llll}2 & 23 & 52.9 \\ 2 & 19 & 23.5\end{array}$ | I. | 2 25 4.7 <br> 2 20  | I.13 |
| 58 | 2132 | I• | $15 \quad 70$ |  | 21639.7 |  | 218 | 1.36 | 21923.5 | I. 2 | 2034.7 | I'I3 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. 19 | - A. | L. $20^{\circ}$ | ${ }^{\circ} \mathrm{A}$. | L. 21 | - A. | L. 2 | A. | L. 28 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 66 \end{gathered}$ | $\begin{gathered} s . \\ -4 \cdot 78 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 76 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4 \cdot 82 \end{gathered}$ | $\begin{gathered} \text { s. } \\ +\mathbf{1} .87 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.86 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 97 \end{gathered}$ | $\begin{gathered} s . \\ -4.90 \end{gathered}$ | $\begin{gathered} s . \\ +2 \cdot 08 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -4.94 \end{gathered}$ | $\begin{gathered} s . \\ +2 \cdot 19 \end{gathered}$ | $\begin{gathered} s . \\ -5 \cdot 00 \end{gathered}$ |
| 4 | 1.47 | $4 \cdot 72$ | 1.57 | 4.75 | 1.67 | $4 \cdot 79$ | 1.77 | 4.83 | I. 88 | $4 \cdot 86$ | 1.98 | 4.91 |
| 8 | I 30 | $4 \cdot 67$ | I 40 | $4 \cdot 70$ | 1.49 | $4 \cdot 73$ | I.59 | $4 \cdot 76$ | 1. 69 | $4 \cdot 80$ | 1.79 | $4 \cdot 83$ |
| 12 | 1-14 | 4.63 | I 23 | $4 \cdot 65$ | $1 \cdot 33$ | $4 \cdot 68$ | 1.43 | $4 \cdot 71$ | 1.52 | $4 \cdot 74$ | 1.62 | $4 \cdot 77$ |
| 16 | -99 | $4 \cdot 60$ | 1.08 | $4 \cdot 62$ | 1-17 | $4 \cdot 64$ | I. 27 | $4 \cdot 66$ | I. 37 | $4 \cdot 69$ | 1.46 | $4 \cdot 72$ |
| 20 | +.84 | $4 \cdot 57$ | +.93 | $4 \cdot 58$ | $+1.03$ | $4 \cdot 60$ | +1.12 | $4 \cdot 63$ | $+1.22$ | $4 \cdot 65$ | +1.31 | $4 \cdot 68$ |
| 22 | -76 | $4 \cdot 55$ | . 86 | 4.57 | . 95 | $4 \cdot 59$ | 1.05 | $4 \cdot 61$ | I-15 | $4 \cdot 63$ | 1.24 | 4.66 |
| 24 | -69 | $4 \cdot 54$ | $\cdot 79$ | $4 \cdot 56$ | -88 | $4 \cdot 57$ | -98 | 4.59 | 1.08 | 4.62 | $1 \cdot 17$ | $4 \cdot 64$ |
| 26 | . 62 | 4.53 | - 72 | 4.54 | -81 | $4 \cdot 56$ | -91 | $4 \cdot 58$ | I.OI | $4 \cdot 60$ | I III | 4.62 |
| 28 | -55 | $4 \cdot 52$ | . 65 | $4 \cdot 53$ | $\cdot 74$ | 4.55 | . 84 | $4 \cdot 57$ | . 94 | $4 \cdot 59$ | 1.04 | $4 \cdot 61$ |
| 30 | + 48 | 4.51 | + 58 | 4.53 | +.68 | $4 \cdot 54$ | + 77 | $4 \cdot 55$ | +.87 | $4 \cdot 57$ | + .97 | 4.59 |
| 32 | -41 | $4 \cdot 51$ | -51 | $4 \cdot 52$ | . 61 | 4.53 | $\cdot 71$ | 4.54 | -81 | $4 \cdot 56$ | -91 | $4 \cdot 58$ |
| 34 | -33 | $4 \cdot 50$ | -44 | $4 \cdot 51$ | -54 | $4 \cdot 52$ | -64 | $4 \cdot 53$ | $\cdot 74$ | 4.55 | - 85 | 4.57 |
| 36 | - 26 | $4 \cdot 50$ | -37 | 4.51 | -47 | 4.51 | $\cdot 57$ | $4 \cdot 52$ | -68 | $4 \cdot 54$ | $\cdot 78$ | $4 \cdot 56$ |
| 38 | -19 | $4 \cdot 49$ | - 29 | $4 \cdot 50$ | -40 | 4.51 | $\cdot 51$ | $4 \cdot 52$ | -6I | $4 \cdot 53$ | $\cdot 72$ | $4 \cdot 54$ |
| 40 | $+\cdot 11$ | $4 \cdot 49$ | +.22 | 4.49 | + 33 | $4 \cdot 50$ | + 44 | $4 \cdot 51$ | +.55 | $4 \cdot 52$ | +.66 | 4.54 |
| 42 | $+.03$ | $4 \cdot 49$ | -15 | 4.49 | -26 | $4 \cdot 50$ | - 37 | $4 \cdot 51$ | . 48 | $4 \cdot 52$ | . 59 | $4 \cdot 53$ |
| 44 | -.04 | 4.49 | +.07 | 4.49 | -19 | 4.49 | -30 | 4.50 | -42 | $4 \cdot 51$ | -53 | $4 \cdot 52$ |
| 46 | -13 | $4 \cdot 49$ | - .OI | 4.49 | - II | $4 \cdot 49$ | - 23 | 4.49 | -35 | $4 \cdot 50$ | -47 | 4.51 |
| 48 | -21 | 4.49 | -09 | 4.49 | +.03 | $4 \cdot 49$ | -16 | 4.49 | - 28 | $4 \cdot 50$ | -40 | $4 \cdot 51$ |
| 50 | - 30 | $4 \cdot 50$ | -17 | 4.49 | -.05 | $4 \cdot 49$ | +.08 | 4.49 | + 21 | $4 \cdot 49$ | + 34 | 4.50 |
| 52 | -40 | $4 \cdot 51$ | -26 | $4 \cdot 50$ | -13 | $4 \cdot 49$ | -00 | 4.49 | -14 | $4 \cdot 49$ | $\cdot 27$ | $4 \cdot 50$ |
| 54 | - 50 | $4 \cdot 52$ | $\cdot 36$ | $4 \cdot 50$ | - 22 | $4 \cdot 49$ | -. 08 | 4.49 | +.06 | $4 \cdot 49$ | - 20 | 4.49 |
| 56 | -61 | 4.53 | $\cdot 46$ | 4.51 | -31 | $4 \cdot 50$ | -16 | 4.49 | -. 02 | $4 \cdot 49$ | -13 | 4.49 |
| 58 | $\cdot 73$ | 4.55 | $\cdot 57$ | 4.53 | $\cdot 42$ | 4.5 I | $\cdot 25$ | $4 \cdot 50$ | -10 | $4 \cdot 49$ | $\cdot \mathrm{O}$ | $4 \cdot 49$ |

## 114 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $\mathbf{2 8}^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\begin{array}{\|ccl\|} \text { H. M. } & \text { S. } \\ 6 & \text { O } & 0 \circ \mathrm{O} \end{array}$ | $\begin{gathered} s . \\ +2 \cdot I_{3} \end{gathered}$ | $\begin{array}{\|rrl} \text { H. } & \text { M. } & \text { S. } \\ 6 & 2 & 7 \cdot 6 \end{array}$ | $\begin{gathered} s . \\ +2 \cdot I_{3} \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 4 & 15 \cdot 3 \end{array}\right\|$ | $\begin{gathered} s . \\ +2 \cdot 13 \end{gathered}$ | $\left.\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 6 & 23 \cdot 3 \end{array} \right\rvert\,$ | $\begin{gathered} \mathrm{S} \\ +2 \cdot \mathrm{I}_{3} \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 8 & 3 \mathrm{I} \cdot 4 \end{array}\right\|$ | $\begin{gathered} \text { S. } \\ +2 \cdot 14 \end{gathered}$ | $\begin{array}{lcc\|} \text { H. M. } & \text { S. } \\ 6 & \text { IO } & 39 \cdot 9 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +2 \cdot 14 \end{gathered}$ |
| 10 | $\begin{array}{lllll}5 & 14 & 37 \cdot 9\end{array}$ | $2 \cdot 17$ | $51647 \cdot 5$ | $2 \cdot 15$ | $\begin{array}{lllll}5 & 18 & 56 \cdot 2\end{array}$ | $2 \cdot 14$ | $\begin{array}{llll}5 & 21 & 3.9\end{array}$ | 2.12 | $\begin{array}{llll}5 & 23 & 10 \%\end{array}$ | $2 \cdot 11$ | 15 25 17  | $2 \cdot 10$ |
| 12 | $\begin{array}{llll}5 & 5 & 3 I \cdot 3\end{array}$ | $2 \cdot 19$ | $\begin{array}{lrrrr}5 & 7 & 42 \cdot 0\end{array}$ | $2 \cdot 17$ | $\begin{array}{llll}5 & 9 & 51.4\end{array}$ | $2 \cdot 15$ | 5 II 597 | $2 \cdot 13$ | $\begin{array}{llll}5 & 14 & 7 \cdot 0\end{array}$ | 1 | $\begin{array}{llll}5 & 16 & 13.4\end{array}$ | 10 |
| 14 | $45623 \cdot 5$ | $2 \cdot 2$ | $\begin{array}{llll}4 & 58 & 35 \cdot 4\end{array}$ | $2 \cdot 19$ | $\begin{array}{rrrr}5 & 0 & 45 \cdot 9\end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}5 & 2 & 55^{\circ} 0\end{array}$ | $2 \cdot 14$ | $\begin{array}{lll}5 & 5 & 2.9\end{array}$ | $2 \cdot 12$ | $\begin{array}{\|ccc\|}5 & 7 & 9 \cdot 6\end{array}$ | $2 \cdot 10$ |
| 16 | 44714.3 | $2 \cdot 2$ | $4 \quad 49 \quad 27.7$ | $2 \cdot 21$ | $45139 \cdot 4$ | 2.18 | $453 \quad 49 \cdot 6$ | $2 \cdot 15$ | $4 \quad 55 \quad 58 \cdot 2$ | $2 \cdot 13$ | $4 \begin{array}{lll}4 & 58 & 5 \cdot 5\end{array}$ | 2.II |
| 18 | $43883 \cdot 3$ | $+2.27$ | 44018.5 | +2.24 | $4 \begin{array}{llll}4 & 42 & 31.8\end{array}$ | +2.20 | $44443 \cdot 2$ | +2.17 | $4 \quad 46$ | $+2 \cdot 15$ | $449 \quad 0 \cdot 9$ | $+2 \cdot 12$ |
| 20 | $428850 \cdot 3$ | $2 \cdot 3$ | 43178 | 2.27 | $4 \begin{array}{lll}4 & 33 & 22 \cdot 6\end{array}$ | 2.23 | $43535 \cdot 6$ | $2 \cdot 20$ | $\begin{array}{llll}4 & 37 & 46 \cdot 5\end{array}$ | $2 \cdot 17$ | $\begin{array}{llll}4 & 39 & 55 \cdot 6\end{array}$ | $2 \cdot 14$ |
| 22 | 4 I9 35.0 | $2 \cdot 35$ | 4 2I 54.6 | $2 \cdot 30$ | $42411 \cdot 7$ | $2 \cdot 26$ | $\begin{array}{llll}4 & 26 & 26 \cdot 4\end{array}$ | $2 \cdot 23$ | $4 \begin{array}{llll}4 & 28 & 38 \cdot 9\end{array}$ | $2 \cdot 19$ | $43049 \cdot 3$ | $2 \cdot 15$ |
| 24 | 4 10 16.9 | $2 \cdot$ | $\begin{array}{llll}4 & 12 & 39 \cdot 2\end{array}$ | $2 \cdot 35$ | $4 \begin{array}{llll}4 & 14 & 58 \cdot 7\end{array}$ | $2 \cdot 30$ | 4 17 15.6 | $2 \cdot 26$ | $\begin{array}{llll}4 & 19 & 29.9\end{array}$ | $2 \cdot 22$ | $412141 \cdot 8$ | $2 \cdot 18$ |
| 25 | $4 \begin{array}{lll}4 & 56 \cdot 8\end{array}$ | 2.42 | $\begin{array}{llll}4 & 8 & 0.5\end{array}$ | $2 \cdot 37$ | 41021.4 | $2 \cdot 32$ | $41239 \cdot 4$ | $2 \cdot 28$ | $4 \begin{array}{llll}4 & 54 \cdot 8\end{array}$ | $2 \cdot 23$ | $\begin{array}{llll}4 & 17 & 7.5\end{array}$ | $2 \cdot 19$ |
| 26 | $4005{ }^{\circ}$ | $+2.4$ | $\begin{array}{llll}4 & 3 & 2 I \cdot I\end{array}$ | $+2.40$ | $4 \quad 5 \quad 43.4$ | +2.35 | $\begin{array}{lll}4 & 8 & 2 \cdot 7\end{array}$ | +2.30 | 4 10 19.I | +2.25 | $\begin{array}{llll}4 & 12 & 32 \cdot 8\end{array}$ | $+2.21$ |
| 27 | $\begin{array}{llllllll}3 & 56 & 13 \cdot 8\end{array}$ | 2.48 | $\begin{array}{llll}3 & 58 & 40.9\end{array}$ | 2.42 | $\begin{array}{llll}4 & 1 & 4.7\end{array}$ | $2 \cdot 37$ | $\begin{array}{llll}4 & 3 & 25 \cdot 3\end{array}$ | $2 \cdot 32$ | $4 \quad 5 \quad 42 \cdot 8$ | $2 \cdot 27$ | $4 \begin{array}{llll}4 & 7 & 57 \cdot 7\end{array}$ | 2.22 |
| 28 | $35131 \cdot 0$ | $2 \cdot 5 \mathrm{I}$ | $\begin{array}{llll}3 & 53 & 59 \cdot 8\end{array}$ | 2.45 | $\begin{array}{llll}3 & 56 & 25 \cdot 2\end{array}$ | $2 \cdot 39$ | $\begin{array}{lllllllll}3 & 58 & 47\end{array}$ | $2 \cdot 34$ | 4 1 $6 \cdot 2$ <br>  5  | $2 \cdot 29$ | $\begin{array}{llll}4 & 3 & 22.0\end{array}$ | $2 \cdot 24$ |
| 29 | $34647 \cdot 0$ | $2 \cdot 55$ | $\begin{array}{lllllllll}3 & 49 & 17.8\end{array}$ | $2 \cdot 48$ | $3 \mathrm{51} 45^{\circ} \mathrm{O}$ | 2.42 | $\begin{array}{llll}3 & 54 & 8 \cdot 6\end{array}$ | $2 \cdot 36$ | $\begin{array}{llll}3 & 56 & 28 \cdot 8 \\ 3 & 51 & 50 \cdot 8\end{array}$ | $2 \cdot 31$ | $\begin{array}{llll}3 & 58 & 46 \cdot 0\end{array}$ | $2 \cdot 26$ |
| 30 | $\begin{array}{llll}3 & 42 & 2 \cdot 0\end{array}$ | $2 \cdot 58$ | $\begin{array}{lllll}3 & 44 & 34 \cdot 8\end{array}$ | 2.51 | $\begin{array}{llll}3 & 47 & 3.8\end{array}$ | $2 \cdot 45$ | 34929.0 | $2 \cdot 39$ | $\begin{array}{lllllllllllllll}3 & 51 & 50 \cdot 8\end{array}$ | $2 \cdot 33$ | $\begin{array}{lll}3 & 54 & 9 \cdot 2\end{array}$ | $2 \cdot 28$ |
| 31 | $3 \quad 3715.8$ | +2.62 | $3 \begin{array}{llll}3 & 39 & 50.8\end{array}$ | +2.55 | 34221.7 | $+2.48$ | $344 \begin{array}{llll}3 & 4 & 7\end{array}$ | +2.42 | 34712.0 | $+2 \cdot 36$ | $34931 \cdot 8$ | +2.30 |
| 32 | $\begin{array}{llll}3 & 32 & 28 \cdot 3\end{array}$ | $2 \cdot 66$ | $\begin{array}{llll}3 & 35 & 5 \cdot 6\end{array}$ | 2.58 | $\begin{array}{lllll}3 & 37 & 38 \cdot 6\end{array}$ | $2 \cdot 5 \mathrm{I}$ | $3 \quad 40$ | 2.45 | $\begin{array}{llllllllllllll}3 & 42 & 32 \cdot 5\end{array}$ | $2 \cdot 38$ | $\begin{array}{lllll}3 & 44 & 53.8\end{array}$ | $2 \cdot 32$ |
| 33 | 32739.4 | $2 \cdot 70$ | $\begin{array}{llll}3 & 30 & 19.2\end{array}$ | $2 \cdot 62$ | $\begin{array}{lllll}3 & 32 & 54.4\end{array}$ | $2 \cdot 55$ | $\begin{array}{lllll}3 & 35 & 25.4\end{array}$ | 2.48 | $\begin{array}{llll}3 & 37 & 52 \cdot I \\ \\ 3 & 33 & 10\end{array}$ | $2 \cdot 4 \mathrm{I}$ | 34015.0 | $2 \cdot 35$ |
| 34 | 322490 | $2 \cdot 75$ | 325 3I•4 | $2 \cdot 67$ | $\begin{array}{lll}3 & 28 & 9 \cdot 0\end{array}$ | $2 \cdot 59$ |  | 2.51 | $\begin{array}{llll}3 & 33 & 10 \cdot 8\end{array}$ | 2.44 | $\begin{array}{llll}3 & 35 & 35 \cdot 5\end{array}$ | $2 \cdot 38$ |
| 35 | $\begin{array}{lllll}3 & 17 & 57\end{array}$ | 2.80 | $32042 \cdot 2$ | $2 \cdot 71$ | $\begin{array}{llll}3 & 23 & 22.4\end{array}$ | 2.63 | $325 \quad 57 \cdot 8$ | $2 \cdot 55$ | $3 \quad 28 \quad 28 \cdot 6$ | 2.48 | $33055 \cdot 1$ | 2.41 |
| 36 | $\begin{array}{lll}3 & 13 & 3.2\end{array}$ | +2.85 | 315514 | $+2.76$ | 318184.3 | +2.67 | 32112.2 | +2.59 |  | +2.51 | 32613.7 | +2.44 |
| 37 | $\begin{array}{llll}3 & 8 & 7 \cdot 5\end{array}$ | 2.91 | 3 IO 59.0 | 86 | $\begin{array}{llll}3 & 13 & 44 \cdot 8 \\ 3 & 8 & 53\end{array}$ | $2 \cdot 72$ | $\begin{array}{llll}3 & 16 & 25 \cdot 3\end{array}$ | $2 \cdot 63$ | $\begin{array}{lll}3 & 19 & 0.8\end{array}$ | 2.55 | $\begin{array}{llll}3 & 21 & 31 \cdot 4\end{array}$ | 2.47 |
| 38 | $\left[\begin{array}{rrrr}3 & 3 & 9.8\end{array}\right.$ | 2.97 | $\begin{array}{lll}3 & 6 & 47\end{array}$ | $2 \cdot 86$ | $\begin{array}{llll}3 & 8 & 53.7\end{array}$ | $2 \cdot 77$ | 3 II $37 \cdot 0$ | $2 \cdot 6$ | $\begin{array}{llll}3 & 14 & 15.0\end{array}$ | 2.59 | $\begin{array}{llllll}3 & 16 & 47.9 \\ 3 & 12 & \end{array}$ | 2.51 |
| 39 | 2 58 $9 \cdot 8$ <br> 2 5  | 3.03 | $\begin{array}{llrr}3 & 1 & 8 \cdot 5\end{array}$ | 2.92 | $\begin{array}{lrr}3 & 4 & 0 \cdot 8 \\ 2 & 50 & 6 \cdot 0\end{array}$ | $2 \cdot 82$ | $3 \begin{array}{llllllll}3 & 6 & 47 \cdot 2\end{array}$ | $2 \cdot 72$ | $\begin{array}{llll}3 & 9 & 27 \cdot 9\end{array}$ | $2 \cdot 63$ | $\begin{array}{llll}3 & 12 & 3 \cdot 3\end{array}$ | 2.55 |
| 40 | $\begin{array}{llll}2 & 53 & 7 \cdot 4\end{array}$ | 3.10 | $25610 \cdot 0$ | 2.99 | $259 \quad 6 \cdot 0$ | 2.88 | $3 \quad 155.6$ | $2 \cdot 78$ | $\begin{array}{lllll}3 & 4 & 39 \cdot 3\end{array}$ | $2 \cdot 68$ | $\begin{array}{lllllllll} & 7 & 1773\end{array}$ | 2.59 |
| 41 | $\begin{array}{llll}2 & 48 & 2 \cdot 3\end{array}$ | $+3 \cdot 18$ | 25193 | $+3.06$ | 254 9•I | $+2.94$ | $\begin{array}{lll}2 & 57 & 2 \cdot 3\end{array}$ | +2.83 | $25949 \cdot 1$ | +2.73 | $3 \begin{array}{lrr}3 & 2 & 30 \cdot 0\end{array}$ | +2.63 |
| 42 | $\begin{array}{llll}2 & 42 & 54 \cdot 3\end{array}$ | $3 \cdot 26$ | $\begin{array}{llll}2 & 46 & 5 \cdot 9\end{array}$ | $3 \cdot 13$ | 2491000 | 3.01 | $\begin{array}{lll}2 & 52 & 6 \cdot 9\end{array}$ | 2.89 | $2 \begin{array}{llllll} & 54 & 57 \cdot 1\end{array}$ | $2 \cdot 78$ | $2{ }^{2} 5741 \mathrm{I} \cdot \mathrm{I}$ | 68 |
| 43 | $\begin{array}{lllll}2 & 37 & 43 \cdot 0\end{array}$ | $3 \cdot 35$ | $2 \begin{array}{lllll}2 & 40 & 59 \cdot 6\end{array}$ | 3.21 | $\begin{array}{lll}2 & 44 & 8 \cdot 3\end{array}$ | 3.08 | $\begin{array}{lll}2 & 47 & 9 \cdot 3\end{array}$ | 2.96 | $2 \begin{array}{lll}2 & 50 & 3 \cdot 3\end{array}$ | $2 \cdot 84$ | $\begin{array}{lllll}2 & 52 & 50 \cdot 5\end{array}$ | $2 \cdot 73$ |
| 44 | $\begin{array}{llll}2 & 32 & 28 \cdot 1\end{array}$ | 3.45 | 23550.3 | 3.30 | $\begin{array}{llrr}2 & 39 & 3 \cdot 9\end{array}$ | $3 \cdot 16$ | $\begin{array}{lll}2 & 42 & 9 \cdot 4 \\ 2\end{array}$ | 3.03 | $245 \begin{array}{lll}2 & 75 \\ 2\end{array}$ | 2.91 | $\begin{array}{lllll}2 & 47 & 58 \cdot 1 \\ 2 & 43 & 3.7\end{array}$ | 2.79 2.85 |
| 45 | $\begin{array}{llll}2 & 27 & 9 \cdot 3\end{array}$ | $3 \cdot 55$ | $23037 \cdot 5$ | $3 \cdot 39$ | $23356 \cdot 5$ | $3 \cdot 24$ | 23767 | 3.10 | $240 \quad 9 \cdot 0$ | 2.97 | 24313.7 | $2 \cdot 85$ |
| 46 | $\begin{array}{llll}2 & 21 & 46 \cdot 1\end{array}$ | +3.67 | $225 \quad 20 \cdot 9$ | $+3.50$ | $22845 \cdot 7$ | $+3.34$ | $2 \begin{array}{lll}2 & 32 & 1 \cdot 3\end{array}$ | +3.19 | $\begin{array}{llll}2 & 35 & 8 \cdot 2\end{array}$ | $+3.05$ | $\begin{array}{llll}2 & 38 & 7 \cdot 1\end{array}$ | $+2.92$ |
| 47 | 216179 | 3.79 | $2 \begin{array}{llll}2 & 19 & 59.9\end{array}$ | $3 \cdot 61$ | $\begin{array}{llll}2 & 23 & 31 \cdot 2\end{array}$ | $3 \cdot 44$ | $\begin{array}{lllll}2 & 26 & 52 \cdot 5\end{array}$ | $3 \cdot 28$ | $\begin{array}{llll}2 & 30 & 4.6 \\ 2 & 4.6\end{array}$ | $3 \cdot 13$ | $\begin{array}{llll}2 & 33 & 8 \cdot 0\end{array}$ | 2.99 |
| 48 | 21040 | 3.93 | 2 I4 $43^{3} \cdot 2$ | 3.7 | $\begin{array}{lllll}2 & 18 & 12.5 \\ 2 & 12 & 49.2\end{array}$ |  | $\begin{array}{llll}2 & 21 & 40 \cdot 2 \\ 2 & 16 & 23.8\end{array}$ | $3 \cdot 38$ | 2 24 57.8 <br> 2 1  <br> 7.6   | 3.22 3.35 | $\begin{array}{llll}2 & 28 & 6 \cdot 3 \\ 2 & 23 & 1.6\end{array}$ | 3.07 3.16 |
| 49 | $\begin{array}{rrr}2 & 5 & 4.0 \\ 1 & 59 & 16.6\end{array}$ | 4.08 | $\begin{array}{rrrr}2 & 9 & 3 \cdot 0 \\ 2 & 3 & 25.7\end{array}$ | 3.88 4.03 | $\begin{array}{rrrr}2 & 12 & 49 \cdot 2 \\ 2 & 7 & 20 \cdot 7\end{array}$ | 3.8 r | $\begin{array}{rrrr}2 & 16 & 23 \cdot 8 \\ 2 & 11 & 2 \cdot 9\end{array}$ | 3.49 3.61 | $\begin{array}{llll}2 & 19 & 47 \cdot 6 \\ 2 & 14 & 33 \cdot 5\end{array}$ | $3 \cdot 3 \mathrm{I}$ $3 \cdot 42$ | $\begin{array}{rrrr}2 & 23 & 1.6 \\ 2 & 1 & 7 & 53.5\end{array}$ | 3.16 3.25 |
| 50 | $1 \begin{array}{llll}1 & 59 & 16.6\end{array}$ | $4 \cdot 24$ | $2 \quad 3 \quad 25 \%$ | 4.03 | $720 \cdot 7$ | $3 \cdot 8 \mathrm{I}$ | 2 II 2.9 | 3.61 | $21433 \cdot 5$ | 3.42 |  | $3 \cdot 25$ |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. 1 | A. | L. 2 | A. | L. 3 | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{0}^{0}$ | S. | $\begin{gathered} s . \\ -4.53 \end{gathered}$ | S. $+\quad .09$ | $\begin{gathered} s . \\ -4 \cdot 53 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .18 \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4.53 \end{gathered}$ | 5. $+\quad .27$ | S. -4.54 | s. $+\quad .36$ | $s$. -4.54 | S. $+\quad .45$ | $\begin{gathered} \mathrm{s} \\ -4.55 \end{gathered}$ |
| 2 | . 08 | 4.53 | . 00 | 4.53 | +.09 | 4.53 | -18 | 4.53 | - 27 | 4 | - 36 | 4.54 |
| 4 | -17 | 4.53 | -.08 | 4.53 | + .0r | 4.53 | -10 | $4 \cdot 53$ | -19 | 4.53 | - 28 | $4 \cdot 54$ |
| 6 | . 25 | 4.54 | - 16 | $4 \cdot 53$ | - 07 | 4.53 | +.02 | 4.53 | - II | 4.53 | -20 | $4 \cdot 53$ |
| 8 | -34 | 4.54 | -25 | 4.54 | -16 | $4 \cdot 53$ | - 0.07 | 4.53 | +.02 | 4.53 | $\cdot \mathrm{II}$ | 4.53 |
| 10 | - 43 | $4 \cdot 55$ | - 33 | $4 \cdot 54$ | - $\cdot 24$ | $4 \cdot 54$ | - .15 | 4.53 | -.06 | $4 \cdot 53$ | +.03 | $4 \cdot 53$ |
| 12 | $\cdot 51$ | $4 \cdot 56$ | -42 | $4 \cdot 55$ | $\cdot 33$ | $4 \cdot 54$ | - 24 | $4 \cdot 54$ | - 15 | $4 \cdot 53$ | -.05 | $4 \cdot 53$ |
| 14 | -60 | 4.57 | -51 | $4 \cdot 56$ | $\cdot 42$ | 4.55 | $\cdot 32$ | $4 \cdot 54$ | $\cdot 23$ | $4 \cdot 53$ | -14 | 4.53 |
| 16 | -70 | $4 \cdot 58$ | -60 | $4 \cdot 57$ | -51 | $4 \cdot 56$ | -41 | $4 \cdot 55$ | $\cdot 32$ | $4 \cdot 54$ | -22 | $4 \cdot 53$ |
| 18 | -79 | $4 \cdot 60$ | $\cdot 70$ | $4 \cdot 58$ | . 60 | $4 \cdot 57$ | -50 | $4 \cdot 56$ | $\cdot 41$ | $4 \cdot 55$ | -31 | $4 \cdot 54$ |
| 20 | -.89 | $4 \cdot 62$ | - 79 | $4 \cdot 60$ | -. 69 | 4.58 | - 60 | 4.57 | - 50 | $4 \cdot 56$ | - 40 | 4.55 |
| 22 | 1.00 | $4 \cdot 64$ | . 89 | $4 \cdot 62$ | $\cdot 79$ | 4.60 | . 69 | $4 \cdot 58$ | - 59 | $4 \cdot 57$ | - 49 | $4 \cdot 56$ |
| 24 | I-10 | $4 \cdot 66$ | I. 00 | $4 \cdot 64$ | -89 | $4 \cdot 62$ | -79 | $4 \cdot 60$ | -69 | $4 \cdot 58$ | - 59 | 4.57 |
| 26 | 1. 22 | $4 \cdot 69$ | I•II | $4 \cdot 66$ | I-00 | 4.64 | -89 | $4 \cdot 62$ | $\cdot 79$ | $4 \cdot 60$ | -68 | 4.58 |
| 28 | 1.33 | $4 \cdot 72$ | I 22 | $4 \cdot 69$ | I'II | $4 \cdot 66$ | 1.00 | $4 \cdot 64$ | -89 | $4 \cdot 62$ | $\cdot 79$ | $4 \cdot 60$ |
| 30 | - I.46 | $4 \cdot 76$ | - I 34 | $4 \cdot 72$ | -1.23 | 4.69 | - ifir | $4 \cdot 66$ | - I.OO | $4 \cdot 64$ | -. 89 | $4 \cdot 62$ |
| 32 | I. 60 | 4.80 | 1.47 | 4.76 | I.35 | $4 \cdot 73$ | 1.23 | $4 \cdot 69$ | I•II | $4 \cdot 66$ | I. 00 | $4 \cdot 64$ |
| 34 | 1.74 | $4 \cdot 85$ | I.6I | $4 \cdot 8 \mathrm{I}$ | I.48 | $4 \cdot 77$ | 1.36 | $4 \cdot 73$ | 1.24 | $4 \cdot 69$ | I•12 | $4 \cdot 66$ |
| 36 | 1.90 | $4 \cdot 91$ | I 76 | $4 \cdot 86$ | I 62 | $4 \cdot 8 \mathrm{I}$ | 1.49 | $4 \cdot 77$ | $1 \cdot 37$ | $4 \cdot 73$ | I. 24 | $4 \cdot 70$ |
| 38 | 2.07 | 4.98 | $1 \cdot 92$ | 4.92 | I•78 | $4 \cdot 87$ | I. 64 | $4 \cdot 82$ | I 50 | 4.77 | I-37 | 4.73 |
| 40 | -2.26 | 5.06 | $-2.10$ | $4 \cdot 99$ | - I.94 | 4.93 | - 1.80 | $4 \cdot 87$ | - 1.65 | 4.82 | -1.52 | $4 \cdot 78$ |
| 42 | 2.47 | 5.16 | $2 \cdot 30$ | $5 \cdot 08$ | $2 \cdot 13$ | $5 \cdot \mathrm{Or}$ | 1.97 | 4.94 | 1.82 | $4 \cdot 88$ | 1.67 | $4 \cdot 83$ |
| 44 | $2 \cdot 71$ | 5.28 | $2 \cdot 52$ | $5 \cdot 18$ | $2 \cdot 34$ | $5 \cdot 10$ | 2.16 | $5 \cdot \mathrm{O} 2$ | $2 \cdot 00$ | 4.95 | I. 84 | $4 \cdot 89$ |
| 46 | $2 \cdot 99$ | $5 \cdot 43$ | $2 \cdot 78$ | $5 \cdot 31$ | $2 \cdot 57$ | $5 \cdot 21$ | $2 \cdot 38$ | $5 \cdot 12$ | 2.20 | $5 \cdot 04$ | 2.03 | 4.96 |
| 48 | $3 \cdot 32$ | $5 \cdot 62$ | 3.07 | $5 \cdot 47$ | $2 \cdot 84$ | $5 \cdot 36$ | $2 \cdot 63$ | $5 \cdot 24$ | 2.43 | 5.14 | 2.24 | $5 \cdot 05$ |
| 50 | $3 \cdot 72$ | $5 \cdot 84$ | 3.43 | $5 \cdot 68$ | $3 \cdot 16$ | $5 \cdot 53$ | $2 \cdot 91$ | $5 \cdot 39$ | $2 \cdot 69$ | $5 \cdot 27$ | $2 \cdot 48$ | $5 \cdot 17$ |

DECLINATION-SAME NAME AS—LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { I2 } & 4^{8 \cdot 9} \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +2 \cdot 15 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I4 } & 58.4 \end{array}$ | $\begin{gathered} s . \\ +2 \cdot 16 \end{gathered}$ | $\begin{array}{\|ll} \text { H. M. } & \text { S. } \\ 6 & \text { I7 } \\ 8 \cdot 5 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +2 \cdot \mathrm{I} 7 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { 19 } & 19.4 \end{array}\right.$ | $\begin{gathered} s . \\ +2 \cdot 19 \end{gathered}$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & 2 I & 3 I \cdot I \end{array}$ | $\begin{gathered} 5 . \\ +2.20 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 23 & 43 \cdot 8 \end{array}$ | $\begin{gathered} 5 . \\ +2.22 \end{gathered}$ |
| 10 | $\begin{array}{llll}5 & 27 & 22.6\end{array}$ | 2.09 | $\begin{array}{llllllllllll}5 & 29 & 27 \cdot 6\end{array}$ | 2.08 | $\begin{array}{lllllllllllllll}5 & 31 & 32 \cdot 2\end{array}$ | 2.07 | $533136 \cdot 4$ | 2.07 | $\begin{array}{llllllllllllllllll}5 & 35 & 40 \cdot 4\end{array}$ | 2.06 | $53744 \cdot 1$ | 2.06 |
| 12 | $\begin{array}{lllll}5 & 18 & 18 \cdot 9\end{array}$ | 2.08 | $52023 \cdot 6$ | 2.07 | 52227.7 | 2.06 | $52431 \cdot 2$ | $2 \cdot 05$ | $52634 \cdot 2$ | $2 \cdot 04$ | $\begin{array}{llll}5 & 28 & 36 \cdot 7\end{array}$ | $2 \cdot 04$ |
| 14 | $\begin{array}{llll}5 & 9 & 15 \cdot 2\end{array}$ | $2 \cdot 08$ | 5 II I9.9 | 2.07 | $\begin{array}{llll}5 & 13 & 23 \cdot 6\end{array}$ | $2 \cdot 05$ | $\begin{array}{llll}5 & 15 & 26 \cdot 6\end{array}$ | $2 \cdot 04$ | 5 I7 28.8 | 2.03 | $\begin{array}{lllll}5 & 19 & 30 \cdot 4\end{array}$ | 2.02 |
| 16 | 5 O II'5 | 2.09 | $\begin{array}{lllll}5 & 2 & 16.2\end{array}$ | 2.07 | $\begin{array}{llll}5 & 4 & 19.8\end{array}$ | 2.05 | $\begin{array}{llll}5 & 6 & 22 \cdot 5\end{array}$ | $2 \cdot 03$ | $5 \quad 8 \quad 24 \cdot 1$ | 2.02 | 51025.0 | $2 \cdot \mathrm{O}$ |
| 18 | 4 5I 7.4 | +2.10 | $4 \quad 5312 \cdot 5$ | +2.07 | $455 \quad 16 \cdot 2$ | +2.05 | $4 \begin{array}{lll}4 & 57 & 18 \cdot 7\end{array}$ | $+2.03$ | $45920 \cdot 0$ | +2.01 | 5 I 20.2 | + I.99 |
| 20 | $4 \begin{array}{lll}4 & 2 & 2 \cdot 9\end{array}$ | $2 \cdot 11$ | $444 \quad 8 \cdot 5$ | 2.08 | 446 I2.5 | 2.05 | $44^{48}$ I5.0 | $2 \cdot 03$ | 450 16.2 | 2.01 | 452 16.0 | I.99 |
| 22 | $1 \begin{array}{llll}4 & 32 & 57 \cdot 6\end{array}$ | $2 \cdot 12$ | $435 \quad 400$ | 2.09 | 43785 | $2 \cdot 06$ | 4391114 | 2.03 | 44112.5 | 2.00 | 443 I2.I | I 98 |
| 24 | $4 \begin{array}{llll}4 & 23 & 5 I \cdot 3\end{array}$ | $2 \cdot 14$ |  | $2 \cdot 10$ | $\begin{array}{llll}4 & 28 & 4 \cdot 1\end{array}$ | 2.07 | 430074 | $2 \cdot 04$ | $\begin{array}{llll}4 & 32 & 8 \cdot 8\end{array}$ | 2.01 | $434 \quad 8 \cdot 5$ | I.98 |
| 26 | 41443.9 | $2 \cdot 16$ | $416 \quad 52 \cdot 6$ | 2:12 | $\begin{array}{lllll}4 & 18 & 58 \cdot 9\end{array}$ | 2.09 | $4213 \cdot 0$ | 2.05 | $423 \quad 5 \cdot 0$ | 2.01 | $\begin{array}{lll}4 & 25 & 4.8\end{array}$ | I.98 |
| 28 | $4535 \cdot 0$ | +2.19 | $4 \quad 745 \cdot 3$ | $+2.15$ | $4 \begin{array}{lll}4 & 9 & 52.9\end{array}$ | +2.10 | 4 II 57.9 | +2.06 | $\begin{array}{lll}4 & 14 & 0.6\end{array}$ | +2.02 | 4 I6 1.0 | +1.99 |
| 30 | $35624 \cdot 3$ | $2 \cdot 23$ | $3 \begin{array}{llll}3 & 58 & 36 \cdot 4\end{array}$ | $2 \cdot 18$ | $4 \quad 0 \quad 45 \cdot 6$ | $2 \cdot 13$ | $\begin{array}{llll}4 & 2 & 52 \cdot 0\end{array}$ | 2.08 | $4455 \cdot 7$ | $2 \cdot 04$ | $4 \quad 6 \quad 56 \cdot 7$ | $2 \cdot 00$ |
| 32 |  | 2.27 | $\begin{array}{llll}3 & 49 & 25 \cdot 8\end{array}$ | 2.21 | $\begin{array}{llll}3 & 51 & 36 \cdot 9\end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}3 & 53 & 44 \cdot 8\end{array}$ | 2 |  | 2.06 | $35751 \cdot 8$ | $2 \cdot 01$ |
| 33 | $\begin{array}{llllllll}3 & 42 & 34 \cdot 2\end{array}$ | $2 \cdot 29$ | 34449.7 | 2.23 | $\begin{array}{llll}3 & 47 & 1 & 9\end{array}$ | $2 \cdot 17$ |  | $2 \cdot 12$ |  | 2.07 | $35319 \cdot 1$ | 2.02 |
| 34 | $\begin{array}{lllll}3 & 37 & 56 \cdot 2\end{array}$ | $2 \cdot 31$ |  | $2 \cdot 25$ | $\begin{array}{llll}3 & 42 & 26 \cdot 4\end{array}$ | 2.19 | $34436 \cdot 2$ | 2. | $\begin{array}{lllll}3 & 46 & 42 \cdot 8\end{array}$ | $2 \cdot 08$ | $\begin{array}{lllll}3 & 48 & 46 \cdot I\end{array}$ | 2.03 |
| 35 | $\begin{array}{lllll}3 & 33 & 17.4\end{array}$ | +2.34 | $\begin{array}{llll}3 & 35 & 35 \cdot 8\end{array}$ | +2.27 | $\begin{array}{llll}3 & 37 & 50.4\end{array}$ | +2.21 | $\begin{array}{lll}3 & 40 & 1 \\ 3 & 3\end{array}$ | +2.15 | $\begin{array}{llll}3 & 42 & 8 \cdot 7\end{array}$ | $+2.09$ | $\begin{array}{lllllllllll}3 & 44 & 12\end{array}$ | +2.04 |
| 36 | $\begin{array}{llll}3 & 28 & 37 \cdot 9\end{array}$ | $2 \cdot 37$ | $3{ }^{3} 30157 \cdot 8$ | 2.30 | $\begin{array}{llll}3 & 33 & 13.7\end{array}$ | $2 \cdot 23$ | $\begin{array}{llll}3 & 35 & 25 \cdot 9\end{array}$ | $2 \cdot 17$ | $\begin{array}{lllll}3 & 37 & 34 \cdot 3\end{array}$ | $2 \cdot 11$ | $\begin{array}{llll}3 & 39 & 39 \cdot 2\end{array}$ | 2.05 |
| 37 | $\begin{array}{llll}3 & 23 & 57 \cdot 4\end{array}$ | $2 \cdot 40$ | $\begin{array}{llll}3 & 26 & 19.0\end{array}$ | 2.32 | $\begin{array}{llll}3 & 28 & 36 \cdot 5\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}3 & 30 & 49 \cdot 9\end{array}$ | $2 \cdot 19$ | 3 32 $59 \cdot 4$ <br> 3 28 24 | 2.13 | $\begin{array}{llll}3 & 35 & 5 \cdot 2\end{array}$ | 2.07 |
| 38 | $\begin{array}{llll}3 & 19 & 16 \cdot 0\end{array}$ | 2.43 | $\begin{array}{llll}3 & 21 & 39 \cdot 5\end{array}$ | $2 \cdot 35$ | $\begin{array}{llll}3 & 23 & 58 \cdot 5\end{array}$ | $2 \cdot 28$ | $\begin{array}{llll}3 & 26 & 13.3\end{array}$ | 2.21 | $\begin{array}{llll}3 & 28 & 24 \cdot 1 \\ 3 & 23 & \end{array}$ | $2 \cdot 15$ | $3{ }^{3} 30 \begin{array}{lll}30.9\end{array}$ | 2.08 |
| 39 | $\begin{array}{lllll}3 & 14 & 33 \cdot 6\end{array}$ | $2 \cdot 46$ | 3 16 59\% | $2 \cdot 38$ | $\begin{array}{llllll}3 & 19 & 19.7\end{array}$ | $2 \cdot 31$ | 3 21 $36 \cdot 1$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 23 & 48 \cdot 1\end{array}$ | $2 \cdot 17$ | 325 56•I | $2 \cdot 10$ |
| 40 | $\begin{array}{llll}3 & 9 & 50 \cdot 0\end{array}$ | $+2.50$ | $\begin{array}{lllll}3 & 12 & 17 & 5\end{array}$ | +2.42 | 3 I4 40.2 | +2.34 | 3 I6 58.I | +2.26 | 3 I9 II• 6 | +2.19 | $32120 \cdot 8$ | $+2 \cdot 12$ |
| 41 | $\begin{array}{llll}3 & 5 & 5 \cdot 2\end{array}$ | $2 \cdot 54$ | $\begin{array}{llll}3 & 7 & 35^{\circ} \\ \\ 3\end{array}$ | 2.45 | $\begin{array}{llll}3 & 9 & 59.7\end{array}$ | $2 \cdot 37$ | 312219.4 | $2 \cdot 29$ | 314434.5 | 2.21 | 3 16 $45 \cdot 0$ | $2 \cdot 14$ |
| 42 | 3 0 19.0 <br> 2 55  | 2.58 | $\begin{array}{lrrr}3 & 2 & 51 \cdot 3\end{array}$ | $2 \cdot 49$ | $\begin{array}{llll}3 & 5 & 18 & 18 \\ 3 & 0\end{array}$ | $2 \cdot 40$ | $\begin{array}{llll}3 & 7 & 39 \cdot 8\end{array}$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 9 & 56 \cdot 6\end{array}$ | $2 \cdot 24$ | 3 I 288.6 | $2 \cdot 16$ |
| 43 | $\begin{array}{llll}2 & 55 & 31 \cdot 5\end{array}$ | 2.63 | $\begin{array}{lll}2 & 58 & 6 \cdot 4\end{array}$ | 2.53 | $\begin{array}{rrrr}3 & 0 & 35 \cdot 6\end{array}$ | $2 \cdot 44$ | $\begin{array}{lrrr}3 & 2 & 59 \cdot 3 \\ 2 & 5 & \end{array}$ | $2 \cdot 35$ | 3 5 $18 \cdot 0$ | $2 \cdot 27$ | $\begin{array}{llll}3 & 7 & 31.5\end{array}$ | $2 \cdot 19$ |
| 44 | $25042 \cdot 31$ | 2.68 | $25320 \cdot 0$ | $2 \cdot 58$ | $25551 \cdot 8$ | $2 \cdot 48$ | $2 \begin{array}{llllllll}2 & 58 & 17 \cdot 8\end{array}$ | $2 \cdot 39$ | $3 \quad 0 \quad 38 \cdot 4$ | $2 \cdot 30$ | $3 \quad 2 \begin{array}{llll}3 & 53.6\end{array}$ | $2 \cdot 21$ |
| 45 | $\begin{array}{llllllll}2 & 45 & 51\end{array}$ | +2.74 | $\begin{array}{lllll}2 & 48 & 32 \cdot 2\end{array}$ | +2.63 | $2 \begin{array}{lll}2 & 51 & 6.7\end{array}$ | +2.52 | $2 \begin{array}{lll}2 & 53 & 35 \cdot 2\end{array}$ | +2.43 | $2 \begin{array}{lllll}2 & 55 & 57 \cdot 9\end{array}$ | +2.33 | 25815.0 | $+2.24$ |
| 46 | $2 \begin{array}{lllllllll} & 40 & 58 \cdot 4\end{array}$ | $2 \cdot 80$ | 24312.7 | $2 \cdot 68$ |  | $2 \cdot 57$ | $24851 \cdot 3$ | 2.47 | 2515163 | $2 \cdot 37$ | 2531506 | $2 \cdot 27$ |
| 47 | $\begin{array}{llll}2 & 36 & 3 \cdot 5 \\ 2 & 31 & 6.2\end{array}$ | 2.86 | $\begin{array}{llll}2 & 38 & 5 \mathrm{I} \cdot 3 \\ 2 & 33 & 58 \cdot 0\end{array}$ | 2.74 | $\begin{array}{llll}2 & 41 & 32 \cdot 1\end{array}$ | $2 \cdot 62$ | $\begin{array}{llll}2 & 44 & 6 \cdot 1\end{array}$ | 2.51 | $2 \begin{array}{lllll}2 & 46 & 33 \cdot 6\end{array}$ | 2.41 | 248 55.I | $2 \cdot 31$ |
| 48 | $\begin{array}{lll}2 & 31 & 6 \cdot 2\end{array}$ | 2.93 | $\begin{array}{llll}2 & 33 & 58 \cdot 0\end{array}$ | 2.80 | $2 \begin{array}{lllll}2 & 36 & 42 \cdot 3\end{array}$ | $2 \cdot 68$ | $\begin{array}{llll}2 & 39 & 19.4\end{array}$ | $2 \cdot 56$ | $2 \begin{array}{llllllll} & 41 & 49.7\end{array}$ | $2 \cdot 45$ | $\begin{array}{llll}2 & 44 & 13.6 \\ 2 & \end{array}$ | $2 \cdot 35$ |
| 49 | 2266.3 | 3.01 | $\begin{array}{llll}2 & 29 & 2.4\end{array}$ | 2.87 | $23150 \cdot 5$ | $2 \cdot 74$ | 234 3I•0 | 2.61 | 23743 | 2.50 | $23930 \cdot 8$ | $2 \cdot 39$ |
| 50 | $\begin{array}{lll}2 & 21 & 3 \cdot 5\end{array}$ | +3.09 | $\begin{array}{lll}2 & 24 & 4 \cdot 4\end{array}$ | +2.94 | $\begin{array}{llll}2 & 26 & 56 \cdot 7\end{array}$ | +2.80 | $\begin{array}{lll}2 & 29 & 40 \cdot 8\end{array}$ | +2.67 | 2321775 | +2.55 | $23446 \cdot 8$ | +2.43 |
| 51 | 2 I5 57.6 | $3 \cdot 18$ | $\begin{array}{lllr}2 & 19 & 3.6 \\ 2 & 13 & 59.8\end{array}$ | 3.02 | $\begin{array}{lll}2 & 22 & 0.5\end{array}$ | $2 \cdot 88$ | $\begin{array}{llll}2 & 24 & 48 \cdot 7\end{array}$ | $2 \cdot 73$ | $\begin{array}{lllll}2 & 27 & 28.7\end{array}$ | 2.61 | 230 | $2 \cdot 48$ |
| 52 | $\begin{array}{rrrr}2 & 10 & 48 \cdot 1 \\ 2 & 5 & 34 \cdot 5\end{array}$ | $3 \cdot 28$ 3.40 | $\begin{array}{rrrr}2 & 13 & 59 \cdot 8 \\ 2 & 8 & 52.5\end{array}$ | 3.11 | $\begin{array}{llll}2 & 17 & 1.6 \\ 2 & 12 & 0.0\end{array}$ | 2.95 | $\begin{array}{lll}2 & 19 & 54.4 \\ 2 & 14 & 57.5\end{array}$ | 2.81 2.88 | $\begin{array}{llll}2 & 22 & 38 \cdot 4 \\ 2 & 1 & 7 & 45 \cdot 8\end{array}$ | 2.67 | $\begin{array}{llll}2 & 25 & 14.3 \\ 2 & 20 & 25 \cdot 3\end{array}$ | 2.53 |
| 53 54 | $\begin{array}{llll}2 & 5 & 34.5 \\ 2 & 0 & 16.3\end{array}$ | 3.40 3.52 | $\begin{array}{llll}2 & 8 & 52 \cdot 5 \\ 2 & 3 & 4 \mathrm{I} \cdot 4\end{array}$ | 3.21 3.32 | $\begin{array}{rrrr}2 & 12 & 0.0 \\ 2 & 6 & 54.0\end{array}$ | 3.04 3.15 | $\begin{array}{rrrr}2 & 14 & 57.5 \\ 2 & 9 & 57.8\end{array}$ | 2.88 | $\begin{array}{llll}2 & 17 & 45 \cdot 8 \\ 2 & 12 & 50.9\end{array}$ | 2.73 | $\begin{array}{llll}2 & 20 & 25 \cdot 3 \\ 2 & 15 & 34\end{array}$ | 2.59 |
| 54 | $2016 \cdot 3$ | $3 \cdot 52$ | 2341.4 | $3 \cdot 32$ | $2 \begin{array}{llll}2 & 6 & 54.9\end{array}$ | $3 \cdot 14$ | $2 \begin{array}{llll}2 & 9 & 57.8\end{array}$ | $2 \cdot 97$ | $21250 \cdot 9$ | $2 \cdot 8 \mathrm{I}$ | 21534.7 | $2 \cdot 66$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $\mathrm{y}^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ}$ |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{\circ}$ | $\begin{aligned} & \mathrm{s} . \\ & +{ }_{54} \end{aligned}$ | $\begin{gathered} s . \\ -4 \cdot 56 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +\quad \cdot_{33} \end{aligned}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 57 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \cdot 72 \end{aligned}$ | $\begin{gathered} \mathrm{s} . \\ -4.59 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +{ }^{\mathbf{8 I I}} \end{aligned}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 60 \end{gathered}$ | $\begin{aligned} & s \\ & +\quad g_{1} \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 62 \end{gathered}$ | $\begin{gathered} \mathrm{s} .0 \\ +\mathrm{r} \cdot 0 \end{gathered}$ | $\begin{gathered} s .{ }_{-4} \end{gathered}$ |
| 2 | - 45 | $4 \cdot 55$ | - 54 | 4.56 | - 64 | 4.57 |  | $4 \cdot 59$ | $\begin{array}{r}\text { + } \\ +81 \\ \hline .82\end{array}$ | -4.60 | $\begin{array}{r}+1.00 \\ \hline .91\end{array}$ | -4.64 |
| 4 | $\cdot 37$ | 4.54 | $\cdot 46$ | 4.55 | $\cdot 55$ | 4.56 | - 64 | $4 \cdot 57$ | $\cdot 73$ | $4 \cdot 59$ | $\cdot 83$ | $4 \cdot 60$ |
| 6 | -29 | 4.54 | $\cdot 38$ | 4.54 | -47 | 4.55 | $\cdot 56$ | $4 \cdot 56$ | -65 | 4.58 | $\cdot 74$ | $4 \cdot 59$ |
| 8 | -20 | 4.53 | $\cdot 29$ | $4 \cdot 54$ | -38 | 4.55 | -47 | $4 \cdot 55$ | $\cdot 56$ | 4.56 | . 66 | $4 \cdot 58$ |
| 10 | + 12 | 4.53 | + 21 | 4.53 | + 30 | 4.54 | + 39 | $4 \cdot 55$ | + 48 | $4 \cdot 55$ | + 57 | 4.57 |
| 12 | + .03 | 4.53 | -13 | 4.53 | - 22 | 4.53 | -31 | 4.54 | . 40 | 4.55 | -49 | $4 \cdot 56$ |
| 14 | - 05 | 4.53 | + 04 | 4.53 | -13 | 4.53 | $\cdot 23$ | 4.53 | $\cdot 32$ | $4 \cdot 54$ | -41 | $4 \cdot 55$ |
| 16 | -13 | 4.53 | - 04 | 4.53 | + 05 | 4.53 | -14 | 4.53 | - 24 | 4.54 | -33 | $4 \cdot 54$ |
| 18 | $\cdot 22$ | 4.53 | -12 | $4 \cdot 53$ | -.03 | 4.53 | +.06 | 4.53 | -15 | $4 \cdot 53$ | - 25 | $4 \cdot 54$ |
| 20 | - 31 | $4 \cdot 54$ | - 21 | $4 \cdot 53$ | - 12 | $4 \cdot 53$ | -. 02 | $4 \cdot 53$ | +.07 | $4 \cdot 53$ | + $\cdot 16$ | $4 \cdot 53$ |
| 22 | -40 | $4 \cdot 55$ | $\cdot 30$ | $4 \cdot 54$ | - 20 | 4.53 | - If | $4 \cdot 53$ | $-.01$ | 4.53 | + 08 | 4.53 |
| 24 | $\cdot 49$ | 4.56 | -39 | 4.55 | - 29 | 4.54 | -19 | 4.53 | -10 | 4.53 | -00 | $4 \cdot 53$ |
| 26 | -58 | $4 \cdot 57$ | $\cdot 48$ | $4 \cdot 55$ | $\cdot 38$ | $4 \cdot 54$ | - 28 | $4 \cdot 54$ | -18 | $4 \cdot 53$ | - .08 | $4 \cdot 53$ |
| 28 | . 68 | 4.58 | $\cdot 58$ | $4 \cdot 56$ | -47 | 4.55 | $\cdot 37$ | $4 \cdot 54$ | -27 | $4 \cdot 54$ | -17 | $4 \cdot 53$ |
|  |  | 4.60 | -. 68 | $4 \cdot 58$ |  | $4 \cdot 56$ | - 47 | 4.55 | -. 36 | 4.54 | -. 26 | $4 \cdot 54$ |
| 32 | . 89 | $4 \cdot 61$ | $\cdot 78$ | $4 \cdot 60$ | . 67 | 4.58 |  |  | - 46 | 4.55 | -35 | $4 \cdot 54$ |
| 34 | I.OO | $4 \cdot 64$ | -89 | 4.61 | $\cdot 77$ | 4.59 | $\cdot 66$ | $4 \cdot 58$ | $\cdot 55$ |  | -45 | $4 \cdot 55$ |
| 36 | I.12 | 4.67 | I.OO | 4.64 | . 88 | 4.61 | $\cdot 77$ | 4.59 | -65 | 4.58 | - 54 | 4.56 |
| 38 | I. 25 | $4 \cdot 70$ | 1.12 | $4 \cdot 67$ | 1.00 | $4 \cdot 64$ | . 88 | $4 \cdot 6 \mathrm{I}$ | $\cdot 76$ | $4 \cdot 59$ | -65 | $4 \cdot 57$ |
| 40 | -1.38 | 4.74 | - 1.25 | $4 \cdot 70$ | -1.12 | $4 \cdot 67$ | - $\mathrm{I} \cdot 00$ | $4 \cdot 64$ | -.87 | 4.61 | - 75 | $4 \cdot 59$ |
| 42 | I. 53 | $4 \cdot 78$ | I.39 | $4 \cdot 74$ | 1.25 | $4 \cdot 70$ | I'12 | 4.67 | $\cdot 99$ | $4 \cdot 64$ | . 87 | $4 \cdot 61$ |
| 44 | I. 69 | 4.83 | $1 \cdot 54$ | 4.78 | 1.40 | $4 \cdot 74$ | I 26 | $4 \cdot 70$ | $1 \cdot 12$ | $4 \cdot 67$ | $\cdot 99$ | $4 \cdot 64$ |
| 46 | I. 86 | 4.90 | $1 \cdot 70$ | 4.84 | r.55 | 4.79 | I. 40 | $4 \cdot 74$ | I-26 | $4 \cdot 70$ | I.12 | $4 \cdot 67$ |
| 48 | 2.06 | $4 \cdot 98$ | 1.89 | 4.91 | $1 \cdot 72$ | 4.85 | I. 56 | $4 \cdot 79$ | 1.41 | $4 \cdot 74$ | I. 26 | 4.70 |
| 50 | -2.28 | 5.07 | -2.09 | $4 \cdot 99$ | -1.91 | $4 \cdot 92$ | - 1 「 74 | $4 \cdot 85$ | -1.57 | $4 \cdot 80$ | -1.41 | $4 \cdot 74$ |
| 52 | 2.54 | $5 \cdot 19$ | $2 \cdot 33$ | $5 \cdot 09$ | 2.13 | $5 \cdot 00$ | r.94 | 4.93 | 1.76 | $4 \cdot 86$ | I. 58 | $4 \cdot 80$ |
| 54 | $2 \cdot 84$ | $5 \cdot 34$ | 2.60 | $5 \cdot 22$ | $2 \cdot 37$ | $5 \cdot 10$ | $2 \cdot 15$ | $5 \cdot 01$ | r.96 | 4.93 | I• 78 | 4.87 |

## 116 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATTTUDE $28^{\circ}$.

DECLINATION-SAME NAME $A S$-LATITUDE.

| $\begin{aligned} & \text { True } \\ & \text { Alt. } \end{aligned}$ | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | $\begin{aligned} & \text { Dec } \\ & \text { Var } \end{aligned}$ | $14^{\circ}$ |  | $15^{\circ}$ |  | $16^{\circ}$ | Decl. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 25 \end{array} 57.5$ | $+2$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. S. } & \text { S. } \\ 6 & 28 & \text { I2. } \end{array}\right.$ | +2.2 | $\left\lvert\, \begin{array}{cc} \text { H. M. S. } \\ 6 & 30 \\ 28 \cdot 3 \end{array}\right.$ | $+2.28$ | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 32 \end{array}$ | +2.30 | $\begin{array}{ccc}\text { H. M. } & \text { S. } \\ 6 & 35 & 4.8\end{array}$ | +2.33 | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 37 & 25 \cdot 3 \end{array}\right\|$ | $2 \cdot 36$ |
| 10 | $53947 \cdot 7$ | $2 \cdot 0$ | $54151 \cdot 3$ | $2 \cdot 06$ | $54355 \cdot 0$ | $2 \cdot 06$ | 5 $545 \quad 58.8$ | 2.06 | $548 \quad 2 \cdot 8$ | 2.07 | $\begin{array}{llll}5 & 50 & 7 \cdot 2\end{array}$ | $2 \cdot 07$ |
| 12 | $53039 \cdot 0$ | $2 \cdot 03$ | $53240 \cdot 9$ | $2 \cdot 03$ | $\begin{array}{llll}5 & 34 & 42 \cdot 8\end{array}$ | $2 \cdot 03$ | 5 26 44.5 | , | $\begin{array}{llllllllllll}5 & 38 & 46 \cdot 2\end{array}$ | 2.03 | $54048 \cdot \mathrm{I}$ | . 03 |
| 14 | 5 21 31.4 | 2.01 | $5 \quad 2332$ | 2.01 | $525 \begin{array}{llll}5 & 25\end{array}$ | $2 \cdot 00$ | $512732 \cdot 0$ | I.99 | $52931 \cdot 6$ | 99 | 53131 | 99 |
| 16 | 5 I2 25 | $1 \cdot$ | 5 I4 2 | 1 | 51623 | I.97 | 5 I8 21.2 | I.96 |  | I.96 | $522216 \cdot 2$ | 95 |
| I8 | 5319 | +I | 5 5 5 I7.7 | - | 57 I5•1 | + | 5 9 1 I -8 | +1 | 5 II $7 \cdot 8$ | + | 5 I3 3.2 | 2 |
| 20 | 45414.6 | I 9 | $45612 \cdot 0$ | 1.95 | $\begin{array}{llll}4 & 58 & 8 \cdot 4\end{array}$ | I'93 | $\begin{array}{lll}5 & 0 & 8 \\ 5\end{array}$ | I'91 | $5 \quad 1 \begin{array}{lll}5 & 1 & 8.2\end{array}$ |  | $5 \quad 3 \quad 5 \mathrm{I} \cdot 8$ | 9 |
| 22 | $44510 \cdot 3$ |  | 447 |  | $\begin{array}{llr}4 & 49 & 2 \cdot 6\end{array}$ |  | 450568 |  | 45249.9 |  | $4544 \mathrm{I} \cdot 9$ | . 86 |
| 24 | $436 \quad 6 \cdot 4$ | I.95 | $\begin{array}{llll}4 & 38 & 2 \cdot 7\end{array}$ | 3 | $4 \begin{array}{llll}4 & 39 & 57 \cdot 5\end{array}$ | -90 | $44150 \cdot 8$ | I.88 | $44342 \cdot 7$ | I. 85 | $44533 \cdot 3$ | 3 |
| 26 | $\begin{array}{lll}4 & 27 & 2 \cdot 7\end{array}$ | I'95 | $4 \begin{array}{llll}488 & 58\end{array}$ |  | $43053 \cdot 1$ |  | $4 \begin{array}{llll}4 & 32 & 46\end{array}$ |  | $434 \quad 36 \cdot 5$ |  | $4 \begin{array}{llll}4 & 36 & 25\end{array}$ |  |
| 28 | 41759 | + I.95 | 4 I9 55. | +1. | 4 2I 49'I | +1 | $42341 \cdot 0$ | +1.8 | 425 3I•I | + 1.82 | 427 19.4 | +1.79 |
| 30 | 4855 | I.96 | 41051. | I'92 | $41245 \cdot 3$ | I. 88 | 4 I4 37.0 | I. 84 | 41626.4 |  | $4 \begin{array}{llll}4 & 18 & 13.9\end{array}$ | 77 |
| 31 | $\begin{array}{llll}4 & 4 & 23 \cdot 2\end{array}$ |  | $4 \quad 619.6$ |  | $\begin{array}{llll}4 & 8 & 13.5\end{array}$ |  | 4 IO 5 |  | 4 II 54.3 |  | 4 I 34 I 4 |  |
| 32 | 35951.1 | 96 | 4 1 47 | I.92 | $\begin{array}{llll}4 & 3 & 4 I \cdot 7\end{array}$ |  | $\begin{array}{llll}4 & 5 & 33 \cdot 2\end{array}$ | 4 | $4 \quad 7 \quad 22 \cdot 3$ |  | $4 \begin{array}{lll}4 & 9 & 9 \cdot 0\end{array}$ | 1.76 |
| 33 | 3551 | $1 \cdot 9$ | $35715 \%$ | I'93 | $\begin{array}{lll}3 & 59 & 9 \cdot 8\end{array}$ |  | $\begin{array}{llll}4 & \text { I } & \text { 1.3 }\end{array}$ |  | $\begin{array}{lllll}4 & 2 & 50 \cdot 3\end{array}$ | 79 | $\begin{array}{llll}4 & 4 & 36 \cdot 8\end{array}$ | I'75 |
| 34 | 3504 | +1.98 | $35243 \cdot 6$ | + I.93 | $35438 \cdot 0$ | +1.8 | $3 \begin{array}{llll}3 & 56 & 29 \cdot 5\end{array}$ | + I .8 | $\begin{array}{llllllll}3 & 58 & 18.4\end{array}$ | + I•79 | $4 \quad 0 \quad 4 \%$ | +1.75 |
| 35 | 3461 | $\mathbf{1} \cdot 9$ | $34^{3} 48 \mathrm{II} 3$ | I.94 | 35060 | r.8 | 3 5 1157.7 | I.8 | $353546 \cdot 6$ | I•79 | $\begin{array}{llll}3 & 55 & 32 \cdot 7\end{array}$ | I'75 |
| 36 | $3 \mathrm{4} 1140 \cdot 7$ |  | $\begin{array}{lllll}3 & 43 & 38 \cdot 9\end{array}$ |  | $\begin{array}{llll}3 & 45 & 33.9\end{array}$ | I.89 | $\begin{array}{lllll}3 & 47 & 25 \cdot 8\end{array}$ |  | $\begin{array}{llllll}3 & 49 & 14.8\end{array}$ | I•79 | 351 |  |
| 37 | $\begin{array}{llll}3 & 37 & 7 \cdot 5\end{array}$ |  | $\begin{array}{llll}3 & 39 & 6 \cdot 3\end{array}$ | I'95 | 34151 |  | $\begin{array}{llllllllllllll}3 & 42 & 53.9\end{array}$ |  | 34443.0 |  | $\begin{array}{lllll}3 & 46 & 28 \cdot 9\end{array}$ |  |
| $3^{8}$ | $33234 * 0$ | $2 \cdot 02$ | $\begin{array}{lllll}3 & 34 & 33.4\end{array}$ |  | $\begin{array}{lllll}3 & 36 & 29.4\end{array}$ |  | $\begin{array}{llll}3 & 38 & 2 I \cdot 9\end{array}$ |  | 340 II•I | 9 | 33 41 57 |  |
| 39 | 3280 | $+2.0$ | $3 \begin{array}{lll}30 & 0 \cdot 3\end{array}$ | +1.97 | $33156 \cdot 8$ | +I.91 | $\begin{array}{llll}3 & 33 & 49 \cdot 8\end{array}$ | +1.85 | 335139.2 | + I•79 | $\begin{array}{llll}3 & 37 & 25 \cdot 3\end{array}$ | +1.74 |
| 40 | 32325 | 2. | $\begin{array}{lllll}3 & 25 & 26 \cdot 9\end{array}$ | I. 0 | $\begin{array}{lllllll}3 & 27 & 24 \cdot 1\end{array}$ | I.92 |  | I | 313172 | I.80 | $\begin{array}{lllll}3 & 32 & 53.4\end{array}$ | I.74 |
| 41 | 3185 | 2 | $32053 \cdot 1$ |  | 322 | $\underline{193}$ | $\begin{array}{lllllllll}3 & 24 & 45\end{array}$ | 1 |  | I.80 | $\begin{array}{llll}3 & 28 & 21.6\end{array}$ | 1.74 |
| 42 | 3 I4 I | $2 \cdot 09$ | 3 I6 I |  | 3 I8 I | 4 | $\begin{array}{lllll}3 & 20 & 12 & 3\end{array}$ |  | $\begin{array}{lll}3 & 22 & 2.9\end{array}$ |  | $\begin{array}{llllllllllllllll}3 & 23 & 49 & 6\end{array}$ | 1.75 |
| 43 | 394 |  | 3 II 4 |  | 3 I3 4 | I.96 | $\begin{array}{lllll}3 & 15 & 39 \cdot 4\end{array}$ |  | 3 I7 $30 \cdot 6$ |  |  | 1.75 |
|  | 351 | $+2 \cdot 1$ | $\begin{array}{lll}3 & 7 & 9 \cdot 3\end{array}$ | $+2$ | $\begin{array}{llll}3 & 9 & 10 \cdot 0\end{array}$ | +1.97 | $3 \mathrm{II} \quad 6 \cdot 2$ | + I-90 | 31258.0 | +1. | $31445 \cdot 5$ |  |
| 45 | $3 \begin{array}{llll}3 & 0 & 27 \cdot 0\end{array}$ | $2 \cdot 1$ | $\begin{array}{llll}3 & 2 & 33 \cdot 7\end{array}$ |  | $\left[\begin{array}{lll}3 & 4 & 35 \cdot 6\end{array}\right.$ | I.99 | $3 \begin{array}{llll}3 & 6 & 32 \cdot 7\end{array}$ |  | $\begin{array}{llll}3 & 8 & 25.2\end{array}$ |  | 3101013.2 | 76 |
| 46 | 2554 | $2 \cdot 1$ | $25757 \cdot$ | $2 \cdot$ | $\begin{array}{lll}3 & 0 & 0.6\end{array}$ | $2 \cdot 01$ | $\begin{array}{lrrrr}3 & 1 & 58.8\end{array}$ |  |  |  | $\begin{array}{llll}3 & 5 & 40 \cdot 8\end{array}$ | 1.77 |
| 47 | 251 I | 2.21 | $\begin{array}{lllllllllllll}2 & 53 & 20 \cdot 6\end{array}$ |  | $\begin{array}{llll}2 & 55 & 25 \cdot 2\end{array}$ |  | $2 \begin{array}{llll}2 & 57 & 24.5\end{array}$ | 95 | $\begin{array}{lllll}2 & 59 & 18 \cdot 7\end{array}$ | I.86 | $\begin{array}{lrrr}3 & 1 & 8 \cdot 1\end{array}$ |  |
| 48 | 2463 | $2 \cdot$ | 24843 | $2 \cdot 15$ | $25049 \cdot 1$ | 2. | $25249 \cdot 7$ | 1.97 | $25445 \%$ | I. 88 | $25635 \cdot 2$ | $1 \cdot 79$ |
| 5 | 2415009 | $+2 \cdot 28$ | $\begin{array}{lll}2 & 44 & 4 \cdot 6\end{array}$ | $+2.1$ | 2461 | $+2$ | 248 | +I.99 | 25010.9 | + 1.90 | $252 \begin{array}{lll}2.0\end{array}$ | +I.8I |
| 50 | $\begin{array}{llll}2 & 37 & 9 \cdot 3\end{array}$ | $2 \cdot 32$ | $2 \begin{array}{llll}2 & 39 & 25 \cdot 3\end{array}$ | $2 \cdot 21$ | 24134 |  | $\begin{array}{lllllllllllllllll}2 & 43 & 38 \cdot 5\end{array}$ | $2 \cdot 01$ | $2{ }_{2} 45 \begin{array}{lll}36 \cdot 3\end{array}$ | I.92 | $247128 \cdot 4$ |  |
| 51 | 23226 | $2 \cdot 36$ | 234450 | $2 \cdot 25$ | 2365 |  | $\begin{array}{llll}2 & 39 & 2 \cdot 0\end{array}$ | $2 \cdot 04$ | 2415 |  | $\begin{array}{lllll}2 & 42 & 54.4\end{array}$ | . 84 |
| 52 | 2274 | 2.41 | $\begin{array}{lll}2 & 30 & 3 \cdot 5\end{array}$ |  |  |  |  | - | $\begin{array}{lllll}2 & 36 & 25 \cdot 5\end{array}$ | 9 | $\begin{array}{llll}2 & 38 & 20 \cdot 0\end{array}$ |  |
| 53 | 2225 | 2.4 | $22520 \cdot$ | $2 \cdot 3$ | 227 37*2 | 2 | $22946 \cdot 5$ |  | $23149 \cdot 1$ | I'99 | $233345 \cdot 2$ |  |
| 55 | $2 \begin{array}{lll}2 & 18\end{array}$ | $+2.52$ | $2 \begin{array}{llll}2 & 20 & 36 \cdot 8\end{array}$ | +2.38 | 22255 | +2.26 | $\begin{array}{lll}2 & 25 & 7 \cdot 5 \\ 2 & 20 & 27\end{array}$ | +2.13 | 227 12.I | $+2.02$ | $\begin{array}{llll}2 & 29 & 9 \cdot 7\end{array}$ | + I 90 |
| 55 | $\begin{array}{llll}2 & 13 & 20.8\end{array}$ | $2 \cdot 58$ | $2 \begin{array}{lllllll}2 & 15 & 51 \cdot 2\end{array}$ | $2 \cdot 44$ | $\begin{array}{lllll}2 & 18 & 13.3\end{array}$ | 2.30 | $\begin{array}{lllll}2 & 20 & 27 \cdot 5\end{array}$ | $2 \cdot 17$ | $2 \begin{array}{llll}2 & 22 & 34.2\end{array}$ | 2.05 | $2 \begin{array}{lllll}24 & 3 & 33.6\end{array}$ | -93 |
| 56 | $28129^{\circ}$ | 2.64 | $\begin{array}{rrrr}2 & 11 & 3.9 \\ 2 & 6 & \end{array}$ |  | $\begin{array}{llll}2 & 13 & 29 \cdot 3 \\ 2 & 8 & 4\end{array}$ | $2 \cdot 35$ | $\begin{array}{llll}2 & 15 & 46 \cdot 3 \\ 2 & 1 & 4.8\end{array}$ | $2 \cdot$ | $\begin{array}{llll}2 & 17 & 55.4 \\ 2 & 1 & 5 & \end{array}$ | 2.09 | $2 \begin{array}{llll}2 & 19 & 56 \cdot 8 \\ 2 & 15 & 19 \cdot 2\end{array}$ | 190 |
| 58 | $\begin{array}{rrrr}2 & 3 & 36 \cdot 3 \\ \text { I } & 5 & 8 & 40 \cdot 2\end{array}$ | 2.71 | $\begin{array}{lll}2 & 6 & 14.6 \\ 2 & 1 & 23.2\end{array}$ | $2 \cdot 56$ | $2 \times$ 8 <br> 2 $43 \cdot 7$ <br> 2 3 | 2.41 | 2 II 3.8 <br> 2 6  | $2 \cdot 26$ | $\begin{array}{llll}2 & 13 & 15.5\end{array}$ | $2 \cdot 13$ | $\begin{array}{llll}2 & 15 & 19.2 \\ 2 & 10 & 40.7\end{array}$ | 2.00 |
| 58 | I $58 \quad 40 \cdot 2$ | $2 \cdot 7$ | 2 I 23.2 | 2.63 | $356 \cdot 3$ | 2.47 | $2 \begin{array}{llll}2 & 6 & 19.8\end{array}$ | $2 \cdot 32$ | 28134.5 | $2 \cdot 17$ | $21040 \cdot 7$ | 2.03 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 1 | ${ }^{\circ} \mathrm{A}$. | L. 13 | $3^{\circ}$ A. | L. 14 | ${ }^{\circ}$ A. | L. 15 | ${ }^{\circ} \mathrm{A}$. | L. 16 | ${ }^{\circ}$ A. | L. 1 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | $\begin{gathered} s . \\ +\mathrm{I} \cdot 10 \end{gathered}$ | $\begin{gathered} s \\ -4.66 \end{gathered}$ | $\begin{gathered} s . \\ +I \cdot I 9 \end{gathered}$ | $\begin{gathered} s \\ -4.68 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot 29 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 7 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ +\mathrm{I} \cdot 39 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 74 \end{gathered}$ | $\begin{gathered} \text { S. } \\ +\mathbf{I} \cdot 49 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 77 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 59 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4 \cdot 8 \mathrm{o} \end{gathered}$ |
| 4 | $\cdot 92$ | 4.62 | I'OI | 4.64 | I•II | 4.66 | I 20 | 4.69 | 1.30 | 4.71 | 1.40 | $4 \cdot 74$ |
| 8 | $\cdot 75$ | $4 \cdot 59$ | -84 | $4 \cdot 61$ | -93 | $4 \cdot 62$ | 1.03 | $4 \cdot 64$ | 1-12 | 4.67 | 1.22 | 4.69 |
| 12 | $\cdot 58$ | $4 \cdot 57$ | - 67 | $4 \cdot 58$ | $\cdot 77$ | 4.59 | -86 | $4 \cdot 6 \mathrm{I}$ | -95 | 4.63 | 1.05 | $4 \cdot 65$ |
| 16 | - 42 | $4 \cdot 55$ | -5I | $4 \cdot 56$ | -60 | $4 \cdot 57$ | -70 | $4 \cdot 58$ | $\cdot 79$ | $4 \cdot 60$ | -88 | $4 \cdot 61$ |
| 20 | +.26 | 4.54 | + 35 | $4 \cdot 54$ | + 44 | $4 \cdot 55$ | + 54 | $4 \cdot 56$ | +.63 | $4 \cdot 57$ | +.73 | $4 \cdot 59$ |
| 22 | -18 | 4.53 | - 27 | $4 \cdot 54$ | $\cdot 37$ | $4 \cdot 54$ | . 46 | $4 \cdot 55$ | - 56 | 4.56 | . 65 | $4 \cdot 58$ |
| 24 | -09 | $4 \cdot 53$ | -19 | 4.53 | - 29 | $4 \cdot 54$ | -38 | $4 \cdot 55$ | $\cdot 48$ | $4 \cdot 55$ | . 57 | 4.57 |
| 26 | + $\cdot$ OI | $4 \cdot 53$ | - II | $4 \cdot 53$ | - 20 | $4 \cdot 53$ | $\cdot 30$ | 4.54 | $\cdot 40$ | $4 \cdot 55$ | - 50 | $4 \cdot 56$ |
| 28 | - 07 | $4 \cdot 53$ | $+.02$ | $4 \cdot 53$ | -12 | 4.53 | -22 | $4 \cdot 54$ | $\cdot 32$ | $4 \cdot 54$ | -42 | $4 \cdot 55$ |
| 30 | - •16 | 4.53 | -.06 | $4 \cdot 53$ | +.04 | 4.53 | + 114 | $4 \cdot 53$ | +.24 | $4 \cdot 54$ | + 34 | $4 \cdot 54$ |
| 32 | - 25 | $4 \cdot 54$ | -14 | $4 \cdot 53$ | -.04 | $4 \cdot 53$ | + .06 | $4 \cdot 53$ | -16 | 4.53 | -26 | $4 \cdot 54$ |
| 34 | -34 | $4 \cdot 54$ | - 23 | $4 \cdot 54$ | -13 | 4.53 | - 02 | $4 \cdot 53$ | +.08 | 4.53 | -18 | $4 \cdot 53$ |
| 36 | -43 | $4 \cdot 55$ | -32 | $4 \cdot 54$ | -2I | 4.53 | - II | $4 \cdot 53$ | -00 | $4 \cdot 53$ | -10 | $4 \cdot 53$ |
| 38 | -53 | $4 \cdot 56$ | $\cdot 42$ | $4 \cdot 55$ | -3I | 4.54 | -20 | $4 \cdot 53$ | - .09 | $4 \cdot 53$ | + 02 | $4 \cdot 53$ |
| 40 | -. 63 | $4 \cdot 57$ | - . 52 | $4 \cdot 56$ | - 40 | $4 \cdot 55$ | - 29 | $4 \cdot 54$ | - 17 | $4 \cdot 53$ | -.06 | $4 \cdot 53$ |
| 42 | $\cdot 74$ | $4 \cdot 59$ | . 62 | $4 \cdot 57$ | - 50 | $4 \cdot 56$ | -38 | $4 \cdot 55$ | $\cdot 26$ | $4 \cdot 53$ | -15 | $4 \cdot 53$ |
| 44 | -86 | 4.61 | -73 | 4.59 | -61 | 4.57 | -48 | $4 \cdot 56$ | $\cdot 36$ | $4 \cdot 54$ | - 24 | $4 \cdot 54$ |
| 46 | $\cdot 98$ | $4 \cdot 64$ | . 85 | 4.61 | $\cdot 72$ | 4.59 | - 59 | 4.57 | $\cdot 46$ | 4.55 | $\cdot 34$ | $4 \cdot 54$ |
| 48 | I•II | $4 \cdot 66$ | -97 | $4 \cdot 63$ | . 83 | 4.61 | -70 | $4 \cdot 58$ | *57 | $4 \cdot 56$ | $\cdot 44$ | $4 \cdot 55$ |
| 50 | - $\mathrm{I} \cdot 26$ | $4 \cdot 70$ | -I'II | 4.66 | -. 96 | $4 \cdot 63$ | -.82 | 4.60 | -.68 | $4 \cdot 58$ |  | 4.56 |
| 52 | 1.42 | 4.75 | I 25 | $4 \cdot 70$ | I.10 | 4.66 | -95 | 4.63 | -80 | 4.60 | . 65 | $4 \cdot 58$ |
| 54 | I. 59 | 4.80 | 1.42 | 4.75 | I. 25 | $4 \cdot 70$ | I.09 | 4.66 | -93 | 4.62 | $\cdot 78$ | $4 \cdot 60$ |
| 56 | I.79 | 4.87 | I. 60 | 4.80 | I. 42 | 4.75 | I. 24 | $4 \cdot 70$ | 1.07 | $4 \cdot 66$ | $\cdot 91$ | 4.62 |
| 58 | $2 \cdot 01$ | 4.94 | I.8I | 4.87 | I.61 | $4 \cdot 80$ | I.4I | $4 \cdot 75$ | I. 23 | $4 \cdot 70$ | I.05 | $4 \cdot 65$ |

DECLINATION-SAME NAME AS—LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{llc}\text { H. M. } & \text { S. } \\ 6 & 39 & 47.6\end{array}$ | +2.39 | $\begin{array}{lc} \text { H. M. } & \text { S. } \\ 6 & 42 \\ \text { II. } 8 \end{array}$ | +2.42 | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 44 \\ 38 \cdot \mathrm{I} \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +2.45 \end{gathered}$ | $\begin{array}{lll} \text { H. m. } & \text { s. } \\ 6 & 47 & 6.5 \end{array}$ | $+2.49$ | $\left.\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & 49 & 37 \cdot 2 \end{array} \right\rvert\,$ | $\begin{gathered} \mathrm{S} . \\ +2.53 \end{gathered}$ | $\begin{array}{ll} \text { H. M. S. } \\ 6 & 52 \\ \hline \end{array}$ | $\begin{gathered} 5 . \\ +2.58 \end{gathered}$ |
| 0 | $\begin{array}{llll}6 & 39 & 47 \\ 5 & 52 & 12.0\end{array}$ | +2.39 2.08 | $\begin{array}{lllll}5 & 54 & 17 & 17\end{array}$ | 2.09 | $\begin{array}{llll}5 & 56 & 23 \cdot 2\end{array}$ | $2 \cdot 10$ | $\begin{array}{llll}5 & 58 & 29.8\end{array}$ | $2 \cdot 12$ | 6 0 $37 \cdot 2$ | $2 \cdot 13$ | $\begin{array}{llll}6 & 2 & 45 \cdot 6\end{array}$ | 2.15 |
| 12 | $\begin{array}{llll}5 & 42 & 50 \cdot 1\end{array}$ | 2.03 | $544 \quad 52 \cdot 3$ | $2 \cdot 04$ | $546 \quad 54 \cdot 9$ | $2 \cdot 05$ | $548158 \cdot 0$ | $2 \cdot 05$ | 5 51 I•6 | $2 \cdot 06$ | $\begin{array}{llll}5 & 53 & 5 \cdot 9\end{array}$ | 2.07 |
| 14 | $\begin{array}{llll}5 & 33 & 30 \cdot 5\end{array}$ | I.99 | $53530 \cdot 0$ | I-99 | $53729 \cdot 5$ | I•99 | $\begin{array}{llll}5 & 39 & 29 \cdot 3\end{array}$ | $2 \cdot$ | $54129 \cdot 3$ | $2 \cdot 00$ | $\begin{array}{llll}5 & 43 & 29 \cdot 6\end{array}$ | 2.01 |
| 16 | $\begin{array}{llll}5 & 24 & 13\end{array}$ | I•95 | $\begin{array}{llll}5 & 26 & 10 \cdot 1\end{array}$ | $1 \cdot 94$ | $\begin{array}{llll}5 & 28 & 6 \cdot 7\end{array}$ | I.94 | 53033 | 1.94 | 532000 | I'94 | $\begin{array}{lllll}5 & 33 & 56 \cdot 7\end{array}$ | I.95 |
| 18 | $\begin{array}{lllll}5 & 14 & 58 \cdot 0\end{array}$ | +1.9I | 51652.4 | + I.90 | 5 I8 $46 \cdot 4$ | + 1.90 | $52040 \cdot \mathrm{I}$ | + 1.89 | 52233.5 | + $\mathbf{1} \cdot 89$ | $\begin{array}{llll}5 & 24 & 26 \cdot 8\end{array}$ | + I .89 |
| 20 | $5 \quad 544 \cdot 6$ | I. 87 | 578736 | I.86 | $\begin{array}{llll}5 & 9 & 28 \cdot 2\end{array}$ | I.85 | 5 II 19.I | 1.84 | $\begin{array}{llll}5 & 13 & 9 \cdot 6\end{array}$ | I.84 |  | I. 83 |
| 22 | $4 \begin{array}{llll}46 & 32 \cdot 9\end{array}$ | I. 84 | $4 \begin{array}{llll}48 & 22 \cdot 9\end{array}$ | I.83 | $5 \quad 0 \quad 12 \cdot 1$ | I.8I | $\begin{array}{llll}5 & 2 & 0.4\end{array}$ | 0 | $\begin{array}{lllll}5 & 3 & 48 \cdot 0\end{array}$ | 1.79 | $\begin{array}{llll}5 & 5 & 35\end{array}$ | 1.73 |
| 24 | $44722 \cdot 6$ | I.8I | 449 10.8 | I'79 | $45057 \cdot 8$ | I.77 | $\begin{array}{llll}4 & 52 & 43 \cdot 8\end{array}$ | r.76 | $4 \begin{array}{llll}4 & 54 & 28 \cdot 7\end{array}$ | I.74 | $4 \begin{array}{lll}4 & 56 & 12 \cdot 8\end{array}$ | 1.73 |
| 26 | 43813.7 | I.78 | $440 \quad 0 \cdot 1$ | I'76 | $44 \mathrm{I} 4{ }^{\text {\% }}$ | I'74 | $\begin{array}{llll}4 & 43 & 28 \cdot 9\end{array}$ | 1-72 | $44511 \cdot 4$ | I•70 | $4 \quad 46 \quad 52 \cdot 7$ | 68 |
| 28 | 42960 | + I.76 | $43050 \cdot 8$ | + I.73 | $43234 \cdot 1$ | +1.71 | $434 \begin{array}{llll}4 & 15 & 8\end{array}$ | +1.68 | $435 \quad 56 \cdot 0$ | + I 66 | $43734 * 7$ | +1.63 |
| 30 | 4 I9 59.3 | I•74 | $42142 \cdot 8$ | I'71 | $423 \quad 24.4$ | I. 68 | $\begin{array}{llll}4 & 25 & 4 \cdot 1\end{array}$ | I. 65 | $42642 \cdot 2$ | I. 62 |  | I. 59 |
| 31 | $\begin{array}{llll}4 & 15 & 26 \cdot 3\end{array}$ | I'73 | $\begin{array}{llll}4 & 17 & 9.2\end{array}$ | I'70 | $41850 \cdot 0$ | I 66 | $4 \quad 20 \quad 28 \cdot 9$ | I.63 | $\begin{array}{llll}4 & 22 & 5 \cdot 9\end{array}$ | I. 60 | 423 4I'I | 1.57 |
| 32 | 4 IO $53 \cdot 5$ | I'72 | $4 \begin{array}{llll}4 & 12 & 35.8\end{array}$ | I. 69 | $4 \begin{array}{llll}4 & 14 & 15.9\end{array}$ | I. 65 | 41554.0 | I.62 | 4 I7 $30 \cdot 0$ | 1.58 | $419 \quad 4 \cdot 0$ | 1.55 |
| 33 | $4 \quad 620 \cdot 9$ | I•I | $\begin{array}{lll}4 & 8 & 2.6\end{array}$ | . 68 | $4 \quad 9 \quad 42 \cdot 1$ | I. 64 | 4 II 1903 | I.60 | 41254.4 | I.57 | $4 \begin{array}{llll}4 & 14 & 27 \cdot 4\end{array}$ | I.53 |
| 34 | 4 I $48 \cdot 5$ | +I.71 | $\begin{array}{llll}4 & 3 & 29.7\end{array}$ | + I .67 | $\begin{array}{lll}4 & 5 & 8 \cdot 5\end{array}$ | +1.63 | $4645 \cdot 0$ | + 1.59 | $4 \quad 8 \quad 19.2$ | +I.55 | $4 \quad 951 \cdot 1$ | I.51 |
| 3 | 35716.2 | I'70 | $358 \quad 57 \cdot 0$ | I. 66 | $4 \quad 0 \quad 35 \cdot 2$ | I 62 | 4 2 $11 \cdot 0$ | 1.57 | $\begin{array}{lrrr}4 & 3 & 44 \cdot 3\end{array}$ | r.53 | 4 5 $15 \cdot 2$ <br> 4   | 1.49 |
| 36 | $35244{ }^{\circ}$ | I• 70 | 35424.4 | I. 65 | 356 | I | $35737 \cdot 2$ | I.56 | $\begin{array}{lll}3 & 59 & 97\end{array}$ | - 52 | $4 \quad 0 \quad 39 \cdot 6$ | I. 48 |
| 37 |  | I. 69 | $34952 \cdot 0$ | I. 64 | $\begin{array}{llll}3 & 51 & 29 \cdot 2\end{array}$ | I. 60 | $\begin{array}{llll}3 & 53 & 3 \cdot 7 \\ 3 & 48 & 30.4\end{array}$ | 1.55 | $\begin{array}{llll}3 & 54 & 35 \cdot 4\end{array}$ | 1.50 | $\begin{array}{lll}3 & 56 & 4.4\end{array}$ | I.46 |
| 38 | $34340 \cdot 0$ | I.69 |  | I. 64 |  | I.59 | $\begin{array}{lllll}3 & 48 & 30 \cdot 4\end{array}$ | I.54 | 3501.4 | I.49 | 35129.5 | I•44 |
| 39 | $\begin{array}{lll}3 & 39 & 8 \cdot \mathrm{I}\end{array}$ | +1.68 | $34047 \cdot 6$ | + 1.63 | 34224.0 | + I 58 | $\begin{array}{llll}3 & 43 & 57 \cdot 3\end{array}$ | +1.53 | $3 \begin{array}{llll}3 & 45 & 27.6\end{array}$ | +1.48 | 34654.9 | + $\mathrm{I} \cdot 43$ |
| 40 | $33436 \cdot 2$ | I. 68 | $\begin{array}{llll}3 & 36 & 15.6\end{array}$ | I. 63 | $3 \begin{array}{lllll}37 & 51\end{array}$ | I.57 | $\begin{array}{llll}3 & 39 & 24.4\end{array}$ | I.52 | $34^{30} 544^{\circ}$ | I.47 | $\begin{array}{llll}3 & 42 & 20 \cdot 5\end{array}$ | 1.4I |
| 41 | $\begin{array}{llll}3 & 30 & 4.4\end{array}$ | I. 68 | $33143 \cdot 6$ | I. 62 | $\begin{array}{lllll}3 & 33 & 19.4\end{array}$ | 1.57 | $\begin{array}{llll}3 & 34 & 51 \cdot 7\end{array}$ | 1.51 | $\begin{array}{llll}3 & 36 & 20 \cdot 8\end{array}$ | 1.45 | $\begin{array}{llllllllllllll}3 & 37 & 46 \cdot 5\end{array}$ | - 40 |
| 42 | $\begin{array}{lllllllllllllllllll}3 & 25 & 32 \cdot 6\end{array}$ | I. 68 | 327 II•7 | I. 62 |  | 1.56 | $\begin{array}{llll}3 & 30 & 19.3\end{array}$ | 1.50 | $3 \mathrm{3I}$ | I.44 |  | 1-39 |
| 43 | 32100.7 | I 69 | $\begin{array}{llll}3 & 22 & 39.9\end{array}$ | -62 | $\begin{array}{llll}3 & 24 & 15 \cdot 3\end{array}$ | I.56 | $32546 \cdot 9$ | I•50 | $\begin{array}{llllllllllllll}3 & 27 & 14.8\end{array}$ | I.43 | 328 39'I | 1.37 |
| 44 | $31628 \cdot 9$ | + $\mathrm{I} \cdot 69$ | 3 I8 8-I | +1.62 | 3 I9 43.4 | +1.55 | $3 \mathrm{2I} \mathrm{14.6}$ | + I 49 | $32242 \cdot 1$ | + 1.43 | $\begin{array}{lll}3 & 24 & 5 \cdot 7\end{array}$ | I.36 |
| 45 | 3 II 56.9 | I. 69 | 313136 | I. 62 | 3151515 | 1.55 | $\begin{array}{llllllllllllll}3 & 16 & 42.6\end{array}$ | I. 48 | $\begin{array}{llll}3 & 18 & 9 \cdot 6\end{array}$ | I 42 | $\begin{array}{lllllllllllllllll}3 & 19 & 32 \cdot 6\end{array}$ | I. 35 |
| 46 | $\begin{array}{lllllllllll}3 & 7 & 24 \cdot 8\end{array}$ | I•70 | $\begin{array}{llll}3 & 9 & 4.4\end{array}$ | 62 | 3 10 $39 \cdot 6$ | I.55 | $\begin{array}{llll}3 & 12 & 10 \cdot 5\end{array}$ | I. 48 | $\begin{array}{lllll}3 & 13 & 37.2\end{array}$ | 1.41 |  | I•34 |
| 47 | $\begin{array}{lllll}3 & 2 & 52 \cdot 6\end{array}$ | r 70 | $\begin{array}{llll}3 & 4 & 32 \cdot 5\end{array}$ | I.63 | $\begin{array}{llll}3 & 6 & 7 \cdot 8\end{array}$ | I. 55 | $\begin{array}{llll}3 & 7 & 38 \cdot 6 \\ 3 & 3 & 6.8\end{array}$ | I. 48 | 3 9 $5 \cdot 0$ | 1.40 | 3 10 27.0 | I. 33 |
| 48 | $25^{2} 820 \cdot 3$ | I'71 | $3 \quad 0 \quad 0.5$ | I.63 | 3 I $36 \cdot 0$ | I•55 | $\begin{array}{llll}3 & 3 & 6 \cdot 8\end{array}$ | 1.47 | $\begin{array}{llll}3 & 4 & 32 \cdot 8\end{array}$ | I-40 | $\begin{array}{lllll}3 & 5 & 54.3\end{array}$ | I. 32 |
| 49 | $2 \begin{array}{lllllllll}2 & 53 & 47\end{array}$ | +1.72 | $2 \begin{array}{llll}25 & 28 \cdot 5\end{array}$ | +1.64 | $2574 \cdot 1$ | + $1 \cdot 55$ | $\begin{array}{lllll}2 & 58 & 34.9\end{array}$ | +1.47 | $\begin{array}{lll}3 & 0 & 0.8 \\ & 5 & \end{array}$ | + $1 \cdot 39$ | 3 I 2I'9 | + $\mathrm{I} \cdot 31$ |
| 50 | 24915.0 | I'73 | $25056 \cdot 2$ | I. 64 | $25232 \cdot 2$ | I. 56 | $2 \begin{array}{llll}2 & 54 & 3 \cdot 1\end{array}$ | I. 47 | $\begin{array}{llll}2 & 55 & 28.9\end{array}$ | I.39 | $\begin{array}{llllllllllllllllll}2 & 56 & 49 \cdot 6\end{array}$ | I. 30 |
| 51 | $24442 \cdot 0$ | I'74 | $\begin{array}{llllllllllllllll}2 & 46 & 23 \cdot 8\end{array}$ | I.65 | $\begin{array}{llll}2 & 48 & 0 \cdot 2\end{array}$ | r 56 | 249 3I-2 | 1.47 | 25057.0 | I 39 | $\begin{array}{lllllllllll}2 & 52 & 17 & \end{array}$ | I. 29 |
| 52 | $\begin{array}{llll}2 & 40 & 8 \cdot 6\end{array}$ | I•76 | 24151.2 | - 66 | $\begin{array}{lllll}2 & 43 & 28 \cdot 1\end{array}$ | 1.57 | 24459.4 | 1.47 | $2{ }_{2} 46 \quad 25 \cdot 1$ | I. 38 | 24745.4 | I-29 |
| 53 | $23534 \cdot 8$ | I'78 | 23718.4 | I. 68 | $2 \begin{array}{lllll}28 & 58 & 5\end{array}$ | 1.58 | $240 \quad 27 \cdot 5$ | I.48 | $241533 \cdot 3$ | I.38 | $2 \begin{array}{llll}2 & 43 & 13.4\end{array}$ | I. 28 |
| 5 | $2 \begin{array}{lll}21 & 0.7\end{array}$ | + 1.8 | $23245 \cdot 2$ | + 1.69 | $23423 \cdot 5$ | +1.58 | $2 \begin{array}{llll}25 & 35.4\end{array}$ | + 1.48 | 23721.5 | +1.38 | $23841 \cdot 5$ | + 1.28 |
| 55 | $22626 \cdot 1$ | 1.82 | 228 II.7 | I•70 | $22950 \cdot 7$ | 1.60 | 23153.4 | 1.49 | 2322496 | I.39 | $\begin{array}{llll}2 & 34 & 9.7\end{array}$ | I. 27 |
| 56 | 22150.9 | I. 84 | $223 \begin{array}{llll}27 & 8\end{array}$ | I*72 |  | I.6I | 226 5I•I | 1.50 | $2 \begin{array}{lllll}2 & 28 & 17.8\end{array}$ | r 39 |  | $1 \cdot 27$ |
| 57 | 2 I7 I5.I | $\underline{5} 87$ | $2 \begin{array}{lll}2 & 19 & 3 \cdot 5\end{array}$ | I•75 | 22044.6 | I.63 | $\begin{array}{llll}2 & 22 & 18 \cdot 7\end{array}$ | I.5I | $\begin{array}{lllll}2 & 23 & 45 \cdot 8\end{array}$ | I 39 | 22560 | 1.27 |
| 58 | 2 I2 38.6 | I.90 |  | I.77 | 2 16 1100 | I. 64 | $21746 \cdot 0$ | I.52 | 21913.7 | $1 \cdot 40$ | $22034 \cdot 2$ | I-28 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| \% | \% ${ }_{+}^{\text {S }}$. 69 | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 83 \end{gathered}$ | $\begin{gathered} 5 . \\ +r \cdot 80 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.87 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 90 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.9 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ +2 \cdot 01 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 96 \end{gathered}$ | $\begin{gathered} s . \\ +2 \cdot 12 \end{gathered}$ | $\begin{gathered} s . \\ -5.00 \end{gathered}$ | $\begin{gathered} s . \\ +2 \cdot 24 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -5 \cdot 05 \end{gathered}$ |
| 4 | I. 50 | $4 \cdot 77$ | 1.60 | $4 \cdot 80$ | 1.\%0 | $4 \cdot 84$ | I. 80 | 4.87 | 1.91 | 4.92 | $2 . \mathrm{OI}$ | 4.96 |
| 8 | I-3I | $4 \cdot 72$ | 1.41 | $4 \cdot 74$ | 1-5I | $4 \cdot 77$ | I.61 | $4 \cdot 81$ | I.71 | $4 \cdot 84$ | I. 82 | $4 \cdot 88$ |
| 12 | $1 \cdot 14$ | 4.67 | 1.24 | 4.69 | $1 \cdot 34$ | $4 \cdot 72$ | 1.43 | $4 \cdot 75$ | I.53 | 4.78 | I. 63 | $4 \cdot 8$ I |
| 16 | -98 | 4.63 | 1.07 | 4.66 | $1 \cdot 17$ | $4 \cdot 68$ | 1.27 | $4 \cdot 70$ | I.37 | $4 \cdot 73$ | I.46 | $4 \cdot 76$ |
| 20 | +.82 | $4 \cdot 60$ | + 92 | $4 \cdot 62$ | +r.01 | $4 \cdot 64$ | +III | $4 \cdot 66$ | +1.2I | $4 \cdot 69$ | +r.31 | $4 \cdot 71$ |
| 22 | $\cdot 75$ | $4 \cdot 59$ | - 84 | $4 \cdot 61$ | -94 | $4 \cdot 62$ | I. 04 | $4 \cdot 65$ | 1.13 | $4 \cdot 67$ | 1.23 | $4 \cdot 69$ |
| 24 | . 67 | 4.58 | $\cdot 77$ | $4 \cdot 59$ | -86 | $4 \cdot 61$ | $\cdot 96$ | 4.63 | 1.06 | $4 \cdot 65$ | $\pm 16$ | 4.67 |
| 26 | -59 | $4 \cdot 57$ | -69 | $4 \cdot 58$ | -79 | 4.60 | $\cdot 89$ | $4 \cdot 62$ | -98 | 4.63 | 1.08 | $4 \cdot 66$ |
| 28 | $\cdot 52$ | 4.56 | -62 | $4 \cdot 57$ | $\cdot 71$ | $4 \cdot 58$ | -8I | $4 \cdot 60$ | -91 | $4 \cdot 62$ | $1 \cdot 01$ | $4 \cdot 64$ |
| 30 | + 44 | $4 \cdot 55$ | + 54 | $4 \cdot 56$ | + 64 | $4 \cdot 57$ | +.74 | $4 \cdot 59$ | + 84 | $4 \cdot 61$ | + 94 | $4 \cdot 63$ |
| 32 | - 36 | $4 \cdot 54$ | $\cdot 46$ | $4 \cdot 55$ | $\cdot 57$ | $4 \cdot 56$ | . 67 | $4 \cdot 58$ | $\cdot 77$ | $4 \cdot 59$ | . 87 | $4 \cdot 61$ |
| 34 | -29 | $4 \cdot 54$ | -39 | $4 \cdot 55$ | -49 | $4 \cdot 56$ | -60 | 4.57 | $\cdot 70$ | $4 \cdot 58$ | -80 | $4 \cdot 60$ |
| 36 | -2I | $4 \cdot 53$ | $\cdot 31$ | $4 \cdot 54$ | -42 | $4 \cdot 55$ | $\cdot 52$ | $4 \cdot 56$ | -63 | 4.57 | -74 | $4 \cdot 59$ |
| 38 | -13 | 4.53 | -24 | $4 \cdot 54$ | -34 | 4.54 | -45 | 4.55 | $\cdot 56$ | $4 \cdot 56$ | . 67 | 4.58 |
| 40 | + .05 | $4 \cdot 53$ | + .r6 | 4.53 | + 27 | $4 \cdot 54$ | +. 38 | $4 \cdot 54$ | + 49 | $4 \cdot 56$ | + 60 | 4.57 |
| 42 | - .03 | $4 \cdot 53$ | + .03 | 4.53 | -19 | $4 \cdot 53$ | $\cdot 30$ | $4 \cdot 54$ | $\cdot 42$ | $4 \cdot 55$ | -53 | $4 \cdot 56$ |
| 44 | - 12 | $4 \cdot 53$ | - Or | 4.53 | -11 | 4.53 | -23 | $4 \cdot 54$ | $\cdot 35$ | $4 \cdot 54$ | -46 | 4.55 |
| 46 | -21 | $4 \cdot 54$ | -10 | $4 \cdot 53$ | +.03 | $4 \cdot 53$ | -15 | 4.53 | -27 | $4 \cdot 54$ | $\cdot 39$ | $4 \cdot 55$ |
| 48 | $\cdot 31$ | $4 \cdot 54$ | -18 | 4.53 | $-.05$ | $4 \cdot 53$ | +.07 | $4 \times 53$ | -20 | $4 \cdot 53$ | $\cdot 32$ | $4 \cdot 54$ |
| 50 | $-41$ | 4.55 | $-.27$ | $4 \cdot 54$ | -. 14 | $4 \cdot 53$ | - or | $4 \cdot 53$ | + 12 | 4.53 | + 25 | 4.54 |
| 52 | $\cdot 31$ | $4 \cdot 56$ | $\cdot 37$ | $4 \cdot 54$ | $\cdot 23$ | 4.54 | - 10 | 4.53 | +.04 | $4 \cdot 53$ | $\cdot 17$ | $4 \cdot 53$ |
| 54 | $\cdot 63$ | 4.57 | $\cdot 48$ | 4.55 | $\cdot 33$ | 4.54 | -19 | 4.53 | -.05 | 4.53 | .09 $+\quad .01$ | 4.53 |
| 56 | $\cdot 75$ | 4.59 | $\cdot 59$ | $4 \cdot 57$ | -44 | $4 \cdot 55$ | $\cdot 28$ | 4.54 | $\cdot 13$ | 4.53 | $\pm .01$ | 4.53 |
| 58 | . 88 | $4 \cdot 61$ | $\cdot 71$ | $4 \cdot 59$ | $\cdot 55$ | $4 \cdot 56$ | -39 | $4 \cdot 55$ | -23 | $4 \cdot 54$ | -.07 | 4.53 |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & \text { o } & 0: 0 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +2.22 \end{gathered}$ | $\begin{array}{crc} \text { H. M. } & \text { S. } \\ 6 & 2 & \text { I3.I } \end{array}$ | $\begin{gathered} 5 . \\ +2.22 \end{gathered}$ | $\begin{array}{lrc} \text { H. M. S. } \\ 6 & 4 & 26 \cdot 2 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +2 \cdot 22 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 6 & 39 \cdot 5 \end{array}$ | $\begin{gathered} 5 . \\ +2.22 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 8 & 53 \cdot 2 \end{array}$ | $\begin{gathered} s . \\ +2 \cdot 23 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & \text { II } & 7 \cdot I \end{array}$ | $\begin{gathered} S . \\ -2 \cdot 24 \end{gathered}$ |
| 10 | $5 \begin{array}{llll}5 & 14 & 11.5\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}5 & 16 & 26 \cdot 8\end{array}$ | $2 \cdot 24$ | 5 18 41.0 | $2 \cdot 23$ | $52054 \cdot 3$ | 2.21 | $\begin{array}{lllll}5 & 23 & 6 \cdot 7\end{array}$ | 2.20 | $\begin{array}{llll}5 & 25 & 18.4\end{array}$ | 2.19 |
| 12 | $\begin{array}{llll}5 & 4 & 59.6\end{array}$ | 28 | $\begin{array}{lllll}5 & 7 & 15.9\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}5 & 9 & 30.9\end{array}$ | 2.24 | 5 II 44.8 | 22 | $\begin{array}{lllll}5 & 13 & 57 \cdot 6\end{array}$ | 1 | $\begin{array}{lll}5 & 16 & 9 \cdot 5\end{array}$ | 19 |
| 14 | $45546 \cdot 2$ | 31 | $\begin{array}{lrrr}4 & 58 & 3.8\end{array}$ | $2 \cdot$ | $5 \quad 0 \quad 20 \cdot 0$ | 26 | $\begin{array}{rrrr}5 & 2 & 34 \cdot 8\end{array}$ | $2 \cdot 23$ | $\begin{array}{llll}5 & 4 & 48 \cdot 2\end{array}$ | 21 | $\begin{array}{llll}5 & 7 & 0.5\end{array}$ | 20 |
| 16 | $44631 \cdot 2$ | $2 \cdot$ | $44^{4} \quad 50 \cdot 5$ | $2 \cdot$ | 4 5I | $2 \cdot 28$ | $4 \quad 53 \quad 23.9$ | 2.25 | $\begin{array}{llll}4 & 55 & 38 \cdot 2\end{array}$ | $2 \cdot 23$ | $4575 \mathrm{I} \cdot \mathrm{I}$ | 20 |
| 18 | 43714.3 | +2.37 | $43935 \cdot 5$ | $+2 \cdot 34$ | 44 I 54.7 | $+2 \cdot 30$ | 444119 | $+2.27$ | $4 \begin{array}{llll}46 & 27 & 4\end{array}$ | +2.24 | 448 4I'I | +2.22 |
| 20 | $4 \begin{array}{llll}4 & 27 & 55 \cdot 2\end{array}$ | 2.41 | 430 | $2 \cdot 37$ | $43239 \cdot 6$ | $2 \cdot 33$ | $434 \quad 58 \cdot 5$ | $2 \cdot 30$ |  | $2 \cdot 26$ | $43930 \cdot 3$ | $\cdot 23$ |
| 22 | $4 \begin{array}{lllll}4 & 18 & 33.5\end{array}$ | 2.45 | $420 \quad 59.4$ | $2 \cdot 4 \mathrm{I}$ | $42322 \cdot 7$ | $2 \cdot 37$ | $42543 \cdot 5$ | $2 \cdot 33$ | $428 \quad 2 \cdot 1$ | $2 \cdot 29$ | 430180.4 | 25 |
| 24 | 4 9 8.9 <br> 4 4 25.3 | 2.50 | $4 \begin{array}{llll}4 & 11 & 37 \cdot 6 \\ 4\end{array}$ | 2.45 | $\begin{array}{llll}4 & 14 & 3 \cdot 5\end{array}$ |  | $41626 \cdot 6$ | $2 \cdot 36$ | $41847 \cdot 1$ | $2 \cdot 32$ | $\begin{array}{llr}4 & 21 & 5 \cdot 1 \\ 4 & 16 & 2\end{array}$ | 8 |
| 25 | $\begin{array}{llll}4 & 4 & 25 \cdot 3\end{array}$ | $2 \cdot 53$ | $4 \quad 6 \quad 55 \cdot 6$ | $2 \cdot 48$ | $4 \quad 922 \cdot 9$ | 2.43 | 4 II 47.3 | $2 \cdot 38$ | $4 \begin{array}{llll}4 & 14 & 8 \cdot 9\end{array}$ | $2 \cdot 34$ | $416127 \cdot 8$ | $2 \cdot 29$ |
| 26 | $3 \begin{array}{lll}3 & 59 & 40 \cdot 7\end{array}$ | $+2.56$ | $4 \quad 2 \quad 12.8$ | +2.51 | $4 \quad 4 \quad 4 \mathrm{I} \cdot 6$ | +2.4 | $\begin{array}{lll}4 & 7 & 7 \cdot 3\end{array}$ | $+2 \cdot 40$ | $4 \quad 930 \cdot 1$ | $+2 \cdot 36$ | 4 II 50.1 | $+2.31$ |
| 27 | $\begin{array}{llll}3 & 54 & 55 \cdot 2\end{array}$ | 2.59 | $35729 \cdot 1$ | $2 \cdot 54$ | 3595 | $2 \cdot$ | $\begin{array}{lrrr}4 & 2 & 26 \cdot 7\end{array}$ | $2 \cdot 4$ | $\begin{array}{llll}4 & 4 & 50 \cdot 7\end{array}$ | $2 \cdot 38$ | 47119 | -33 |
| 28 | $\begin{array}{lll}3 & 50 & 8.6 \\ 3 & 45 & \end{array}$ | 2.6 | 3515244.4 | 2.57 | 35516.6 | 2.51 | $\begin{array}{lllll}3 & 57 & 45 \cdot 3\end{array}$ | 2.45 | $\begin{array}{rrrr}4 & 0 & 10.8\end{array}$ | 2.40 | $\begin{array}{lrrr}4 & 2 & 33 \cdot \mathrm{I}\end{array}$ | $2 \cdot 35$ |
| 29 | $\begin{array}{llll}3 & 45 & 20 \cdot 8 \\ 3 & 40 & \end{array}$ | 66 |  | $2 \cdot 60$ | 350 | $2 \cdot$ | $\begin{array}{llll}3 & 53 & 3 \cdot 2\end{array}$ | $2 \cdot 48$ | $355130 \cdot 1$ | 2.42 |  | $2 \cdot 37$ |
| 30 | $3 \begin{array}{llll}3 & 40 & 3 I \cdot 9\end{array}$ | $2 \cdot 70$ | 343119 | . 6 | $34548 \cdot 0$ | 2.57 | $34^{3} 4^{8} \quad 20 \cdot 1$ | $2 \cdot 50$ | $35048 \cdot 6$ | $2 \cdot 45$ |  | $2 \cdot 39$ |
| 32 | $\begin{array}{llll}3 & 35 & 4 \mathrm{I} \cdot 5\end{array}$ | +2.7 | $\begin{array}{llll}3 & 38 & 23.9\end{array}$ | +2.67 |  | $+2.60$ | $3{ }^{3} 43136 \cdot 2$ | +253 | $\begin{array}{llll}3 & 46 & 6 \cdot 4\end{array}$ | +2.47 | 34883.0 | $+2.41$ |
| 32 | $\begin{array}{llll}3 & 30 & 49 \cdot 8\end{array}$ |  | 3 33 $34 \cdot 7$ <br>    | $2 \cdot 71$ | $\begin{array}{llll}3 & 36 & 15\end{array}$ | 2. | $\begin{array}{llll}3 & 38 & 5 \mathrm{I} \cdot 2 \\ 3 & 34 & \end{array}$ | $2 \cdot 5$ | $\begin{array}{llll}3 & 41 & 23 \cdot 3\end{array}$ | 2.50 | 343 5I•5 | $2 \cdot 44$ |
| 33 | $\begin{array}{llll}3 & 25 & 56 \cdot 5\end{array}$ | 2.83 | $\begin{array}{llll}3 & 28 & 44^{\circ} 0\end{array}$ | $2 \cdot$ | $\begin{array}{llll}3 & 31 & 26 \cdot 9\end{array}$ | $2 \cdot 68$ | 3 34 $5 \cdot 2$ <br> 3 29  | $2 \cdot 6$ | $\begin{array}{llll}3 & 36 & 39 \cdot 2\end{array}$ | 2.53 | $\begin{array}{llll}3 & 39 & 9 \cdot 2\end{array}$ | . 47 |
| 34 | $\begin{array}{lll}3 & 21 & 1.5 \\ 3 & 16 & 4.7\end{array}$ |  | $\begin{array}{lll}3 & 23 & 51.9 \\ 3 & 18 & 58\end{array}$ | 80 | $\begin{array}{lllll}3 & 26 & 37 \cdot 3\end{array}$ | $2 \cdot 72$ | $\begin{array}{llll}3 & 29 & 18 \cdot 0 \\ 3 & 24 & 29.5\end{array}$ | $2 \cdot 64$ | $3 \mathrm{3I} 54 \cdot \mathrm{I}$ | $2 \cdot 57$ | $\begin{array}{llll}3 & 34 & 26 \cdot 0\end{array}$ | $2 \cdot 50$ |
| 3 | $\begin{array}{llll}3 & 16 & 4 \cdot 7\end{array}$ | $2 \cdot 94$ | $318188 \cdot 2$ | $2 \cdot 85$ | $32146 \cdot 4$ | 2.76 | $\begin{array}{llll}3 & 24 & 29.5\end{array}$ | $2 \cdot 68$ | $\begin{array}{llll}3 & 27 & 7 \cdot 9\end{array}$ | $2 \cdot 60$ | 329 4I•8 | 2.53 |
| 36 | 3 II 6.0 | +2.99 | $\begin{array}{llll}3 & 14 & 2 \cdot 7\end{array}$ | +2.90 | 31653.8 | $+2.81$ | $\begin{array}{llll}3 & 19 & 39 \cdot 7\end{array}$ | +2.72 | $32220 \cdot 5$ | +2.6 | $32456 \cdot 6$ | +2.56 |
|  |  | 3.06 | $\begin{array}{llll}3 & 9 & 5 \cdot 3\end{array}$ | 2.95 | 3 II 59.6 | . 86 | $\begin{array}{llll}3 & 14 & 48 \cdot 4\end{array}$ | $2 \cdot 77$ | 3 I7 3I•8 | $2 \cdot 68$ |  | 60 |
| 3 | $\begin{array}{lrrr}3 & 1 & 1.8\end{array}$ | 3 | $\begin{array}{lll}3 & 4 & 5.9\end{array}$ | I | $\begin{array}{llll}3 & 7 & 3.6 \\ & & \end{array}$ | 2.91 | $\begin{array}{llll}3 & 9 & 55.4\end{array}$ | 2.8 | $31241 \cdot 6$ | $2 \cdot 72$ | $\begin{array}{llll}3 & 15 & 22 \cdot 5\end{array}$ | 4 |
| 3 | $\begin{array}{lll}2 & 55 & 56 \cdot 1 \\ 2 & 50 & 47 \cdot 6\end{array}$ | 3.19 | $\begin{array}{lll}2 & 59 & 4 \cdot 2 \\ 2 & 54 & 0 \cdot 1\end{array}$ | 3.08 | $\begin{array}{lrr}3 & 2 & 5 \cdot 6 \\ 2 & 57 & 5 \cdot 5\end{array}$ | $2 \cdot 97$ | $\begin{array}{lll}3 & 5 & 0.8 \\ 3 & 0 & 4.8\end{array}$ | 2.87 | $\begin{array}{llll}3 & 7 & 50 \cdot 0 \\ 3 & 2 & 56.6\end{array}$ | $2 \cdot 77$ | $31033 \cdot 6$ | 68 |
| 4 | $25047 \cdot 6$ | $3 \cdot 27$ | 254 O.I | $3 \cdot 1$ | 2575 | - | $\begin{array}{llll}3 & 0 & 4.2\end{array}$ | 92 | $\begin{array}{llll}3 & 2 & 56 \cdot 6\end{array}$ | 2.82 | $3 \begin{array}{llll}3 & 5 & 43 \cdot 1\end{array}$ | $2 \cdot 73$ |
| 41 | $24536 \cdot 1$ | $+3.35$ | $24853 \cdot 3$ | $+3.22$ | 2523.0 | +3.10 | $\begin{array}{lll}2 & 55 & 5 \cdot 5\end{array}$ | +2.99 | 258184 | +2.88 | $3051 \cdot 0$ | $+2.78$ |
| 42 | $24021 \cdot 2$ | 3.44 | $24343 \cdot 5$ | $3 \cdot 30$ | $24657 \cdot 8$ | $3 \cdot 17$ | 25046 | 3.05 | $2 \begin{array}{lll}2 & 53 & 4.2\end{array}$ | $2 \cdot 94$ | $255 \quad 57 \cdot 2$ | $2 \cdot 83$ |
| 43 | $\begin{array}{lll}2 & 35 & 2 \cdot 7 \\ 2 & 29 & \end{array}$ | 3.54 | $\begin{array}{llll}2 & 38 & 30 \cdot 5\end{array}$ | $3 \cdot 39$ | 2 41 $49 \cdot 9$ <br> 2 36  | $3 \cdot 25$ | $\begin{array}{llr}2 & 45 & \text { I } 17\end{array}$ | $3 \cdot 12$ | $\begin{array}{llll}2 & 48 & 4 \cdot 9\end{array}$ | 3.00 | 251515 | $2 \cdot 89$ |
| 44 | $22940 \cdot 0$ | 3.64 | 233314.0 | $3 \cdot 49$ | $2 \begin{array}{llll}2 & 36 & 38 \cdot 8\end{array}$ | $3 \cdot 34$ | $\begin{array}{lllll}2 & 39 & 55\end{array}$ | 20 | $\begin{array}{llll}2 & 43 & 3 \cdot 1 \\ 2 & 3 & 5\end{array}$ | 3.07 | $\begin{array}{llll}2 & 46 & 3 \cdot 7\end{array}$ | $2 \cdot 95$ |
| 4 | 22412.7 | 3.77 | $22753 \cdot 5$ | $3 \cdot 60$ | 23124.2 | $3 \cdot 44$ | $23445 \cdot 8$ | $3 \cdot 29$ | $23758 \cdot 6$ | $3 \cdot 15$ | 24103.6 | 3.02 |
| 46 | $2 \begin{array}{llll}2 & 18 & 40.4\end{array}$ | $+3.90$ | 22228.5 | $+3 \cdot 71$ | $\begin{array}{lll}2 & 26 & 5 \cdot 8\end{array}$ | $+3.54$ | $\begin{array}{lll}2 & 29 & 33.2\end{array}$ | $+3 \cdot 38$ | $23251 \cdot 3$ | $+3.23$ | 23600.9 | $+3.09$ |
| 47 | $\begin{array}{lll}2 & 13 & 2.3\end{array}$ | 4.04 | $\begin{array}{llllllllllll}2 & 16 & 58.6\end{array}$ | $3 \cdot 84$ | $220043 \cdot 1$ | $3 \cdot 65$ | $\begin{array}{llll}2 & 24 & 16.9\end{array}$ | 3.48 | $2 \begin{array}{llll}2 & 27 & 40 \cdot 7\end{array}$ | 3.32 | 23055.4 | $3 \cdot 17$ |
| 48 | $\begin{array}{llll}2 & 7 & 17.6 \\ 2 & 1 & 25.5\end{array}$ | 4.21 | $2 \begin{array}{rrrr} \\ 2 & 11 & 23.0\end{array}$ | $3 \cdot 98$ | $\begin{array}{rrrr}2 & 15 & 15 \cdot 6 \\ 2 & 9 & 4\end{array}$ | 3.78 | $\begin{array}{llll}2 & 18 & 56 \cdot 5\end{array}$ | 3.59 | $\begin{array}{llll}2 & 22 & 26 \cdot 6 \\ 2 & 1 & 8 \cdot 4\end{array}$ | 3.42 | $\begin{array}{lllll}2 & 25 & 46 \cdot 8 \\ 2 & 20 & 3.8\end{array}$ | . 26 |
| 49 | 2 1 25.5 <br>  5 24. | $4 \cdot 39$ | $2 \begin{array}{lrr}5 & 41 \cdot 1\end{array}$ | $4 \cdot 14$ | $\begin{array}{lllllllllll}2 & 9 & 42 \cdot 7\end{array}$ | 3.92 | $2 \begin{array}{llll}2 & 13 & 31 \cdot 3\end{array}$ | 3.71 | $\begin{array}{lll}2 & 17 & 8.4\end{array}$ | 3.53 | $\begin{array}{lllllllll}2 & 20 & 34.8 \\ 2 & 1 & 5 & 18\end{array}$ | $3 \cdot 36$ |
| 50 | I 5524.7 | $4 \cdot 61$ | 59 52.0 | $4 \cdot 32$ | $\begin{array}{llll}2 & 4 & 3.5\end{array}$ | 4.07 | 288009 | $3 \cdot 85$ | 2 II $45 \cdot 7$ | 3.65 | 21518.8 | $3 \cdot 46$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | - A. | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ}$ A. |  | L. $3^{\circ}$ A. |  | L. $4^{\circ}$ | A. | L. 5 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | s. | S. | S. | s. | S. | S. | S. | S. | S. | S. |
| 0 | -00 | -4.57 | + 09 | $-4.57$ | + -18 | $-4.58$ | + 27 | $-4.58$ | + 36 | -4.59 | + 46 | $-4.59$ |
| 2 | -09 | 4.57 | -00 | $4 \cdot 57$ | + .09 | 4.57 | -18 | $4 \cdot 58$ | -28 | $4 \cdot 58$ | $\cdot 37$ | 4.59 |
| 4 | -18 | $4 \cdot 58$ | -. 08 | $4 \cdot 57$ | -00 | $4 \cdot 57$ | -10 | $4 \cdot 57$ | -19 | $4 \cdot 58$ | -28 | 4.58 |
| 6 | $\cdot 27$ | $4 \cdot 58$ | $\cdot 17$ | $4 \cdot 58$ | - .08 | 4.57 | + OI | $4 \cdot 57$ | -10 | $4 \cdot 57$ | -19 | 4.58 |
| 8 | $\cdot 36$ | 4.59 | -26 | $4 \cdot 58$ | -17 | 4.58 | -. 08 | $4 \cdot 57$ | + OI | $4 \cdot 57$ | -10 | 4.57 |
| 10 | - .45 | $4 \cdot 59$ | - 36 | 4.59 | - $\cdot 26$ | $4 \cdot 58$ | - •17 | $4 \cdot 57$ | - 07 | $4 \cdot 57$ | + . OI | $4 \cdot 57$ |
| 12 | . 54 | $4 \cdot 60$ | . 45 | 4.59 | -35 | $4 \cdot 59$ | - 26 | $4 \cdot 58$ | -16 | $4 \cdot 58$ | - 07 | 4.57 |
| 14 | -64 | 4.62 | $\cdot 54$ | $4 \cdot 60$ | -44 | 4.59 | $\cdot 35$ | 4.59 | -26 | $4 \cdot 58$ | -16 | $4 \cdot 58$ |
| 16 | $\cdot 74$ | 4.63 | -64 | $4 \cdot 62$ | - 54 | $4 \cdot 60$ | - 44 | $4 \cdot 59$ | -35 | 4.58 | -25 | $4 \cdot 58$ |
| 18 | -84 | $4 \cdot 65$ | $\cdot 74$ | $4 \cdot 63$ | -64 | $4 \cdot 62$ | - 54 | 4.60 | . 44 | $4 \cdot 59$ | -34 | $4 \cdot 58$ |
| 20 | - 94 | 4.67 | - .84 | $4 \cdot 65$ | -.74 | 4.63 | $-.64$ | $4 \cdot 62$ | -. 54 | $4 \cdot 60$ | - . 44 | $4 \cdot 59$ |
| 22 | I. 05 | $4 \cdot 69$ | -94 | $4 \cdot 67$ | . 84 | 4.65 | . 74 | 4.63 | . 64 | $4 \cdot 62$ | $\cdot 54$ | $4 \cdot 60$ |
| 24 | I.16 | $4 \cdot 72$ | 1.05 | $4 \cdot 69$ | -95 | $4 \cdot 67$ | . 84 | 4.65 | -74 | 4.63 | . 64 | 4.62 |
| 26 | 1.28 | $4 \cdot 75$ | I-17 | $4 \cdot 72$ | I. 06 | 4.69 | $\cdot 95$ | 4.67 | . 84 | 4.65 | $\cdot 74$ | 4.63 |
| 28 | 1.41 | $4 \cdot 78$ | I. 29 | 4.75 | I-18 | $4 \cdot 72$ | 1.07 | 4.69 | $\cdot 95$ | 4.67 | . 84 | 4.65 |
| 30 | - I. 54 | $4 \cdot 82$ | - I. 42 | $4 \cdot 79$ | - I. 30 | 4*75 | -I.I8 | $4 \cdot 72$ | - I. 07 | $4 \cdot 70$ | -.96 | $4 \cdot 67$ |
| 32 | I. 69 | $4 \cdot 87$ | 1.56 | 4.83 | 1.43 | 4.79 | I.3I | $4 \cdot 76$ | I.19 | $4 \cdot 73$ | 1.07 | $4 \cdot 70$ |
| 34 | I. 84 | 4*93 | 1-71 | 4.88 | I. 58 | 4.84 | 1.45 | $4 \cdot 80$ | I. 32 | $4 \cdot 76$ | I 20 | $4 \cdot 73$ |
| 36 | 2.01 | 5.00 | 1.87 | 4.94 | 1-73 | 4.89 | I. 59 | $4 \cdot 84$ | I.46 | 4.80 | I. 33 | 4.76 |
| 38 | $2 \cdot 20$ | $5 \cdot 07$ | 2.04 | $5 \cdot 01$ | 1.89 | $4 \cdot 95$ | 1.75 | 4.90 | 1.61 | $4 \cdot 85$ | 1.47 | 4.80 |
| 40 | $-2.40$ | $5 \cdot 17$ | $-2.24$ | $5 \cdot 09$ | $-2.07$ | $5 \cdot 02$ | - I.92 | $4 \cdot 96$ | - 1.77 | $4 \cdot 90$ | $-\mathrm{I} \cdot 63$ | $4 \cdot 85$ |
| 42 | 2.64 | $5 \cdot 28$ | 2.45 | 5.19 | 2.28 | $5 \cdot 11$ | $2 \cdot 11$ | $5 \cdot 03$ | 1.95 | $4 \cdot 97$ | 1.79 | 4.91 |
| 44 | $2 \cdot 90$ | $5 \cdot 42$ | 2.70 | $5 \cdot 31$ | 2.50 | $5 \cdot 21$ | $2 \cdot 32$ | 5.13 | $2 \cdot 15$ | $5 \cdot 05$ | 1-98 | $4 \cdot 98$ |
| 46 | $3 \cdot 21$ | $5 \cdot 59$ | $2 \cdot 98$ | $5 \cdot 46$ | $2 \cdot 76$ | $5 \cdot 34$ | $2 \cdot 56$ | $5 \cdot 24$ | $2 \cdot 37$ | $5 \cdot 15$ | 2.18 | $5 \cdot 07$ |
| 48 | $3 \cdot 58$ | $5 \cdot 81$ | $3 \cdot 31$ | $5 \cdot 65$ | $3 \cdot 06$ | $5 \cdot 50$ | 2.83 | $5 \cdot 38$ | 2.62 | $5 \cdot 27$ | 2.42 | 5.17 |
| 50 | $4^{\circ} \mathrm{O} 3$ | 6.08 | 3.71 | $5 \cdot 89$ | $3 \cdot 42$ | $5 \cdot 71$ | 3.16 | $5 \cdot 56$ | 2.91 | 5.42 | $2 \cdot 68$ | $5 \cdot 30$ |

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{0}{0}$ | $\begin{array}{lc} \text { H. M. S. } \\ 6 & \text { I3 } \\ \hline \end{array}$ | S. $+2 \cdot 24$ | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 15 \\ 36.6 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +2.25 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I7 } & 52 \cdot 3 \end{array}$ | $\begin{gathered} 5 . \\ +2.27 \end{gathered}$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 20 & 8.8 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +2.28 \end{gathered}$ | $\begin{array}{\|ccc\|} \hline H . & \text { M. } & \text { S. } \\ 6 & 22 & 26 \cdot 2 \end{array}$ | $\begin{gathered} 5 . \\ +2 \cdot 30 \end{gathered}$ | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 6 & 24 \end{array} 44^{\prime} 5$ | $\begin{gathered} \mathrm{s} \\ +2 \cdot 3 \mathrm{I} \end{gathered}$ |
| 10 | 512729.4 | $2 \cdot 18$ | $5 \quad 2940 \cdot 0$ | $2 \cdot 17$ | $53150 \cdot 0$ | $2 \cdot 16$ | $533 \quad 59 \cdot 7$ | $2 \cdot 16$ | $\begin{array}{lll}5 & 36 & 9 \cdot 2\end{array}$ | $2 \cdot 15$ | $\begin{array}{lllll}5 & 38 & 18.4\end{array}$ | 2.15 |
| 12 | $\begin{array}{lllll}5 & 18 & 20 \cdot 6\end{array}$ | $2 \cdot 18$ | $5 \quad 2030 \cdot 8$ | $2 \cdot 16$ | $522240 \cdot 4$ | $2 \cdot 15$ | $\begin{array}{lllllllllll}5 & 24 & 49 \cdot 4\end{array}$ | $2 \cdot 14$ | $\begin{array}{lllll}5 & 26 & 57.9\end{array}$ | $2 \cdot 14$ | 52960 | $2 \cdot 13$ |
| 14 | 5 5 9 II'7 | $2 \cdot 18$ | 5 II 22.0 | $2 \cdot 16$ | 5 I3 3I-2 | $2 \cdot 15$ |  | $2 \cdot 13$ | $51747 \cdot 5$ | 2 | 519454 | -II |
| 16 | $\begin{array}{llll}5 & 0 & 2 \cdot 7\end{array}$ | $2 \cdot 18$ | $\begin{array}{llll}5 & 2 & 13\end{array}$ | $2 \cdot 16$ | $\begin{array}{lllll}5 & 4 & 22 \cdot 3\end{array}$ | $2 \cdot 14$ | $\begin{array}{lllll}5 & 6 & 30 \cdot 5\end{array}$ | $2 \cdot 13$ | $\begin{array}{llll}5 & 8 & 37 \cdot 8\end{array}$ | $2 \cdot 1$ | 5 Io 44.I | $2 \cdot 10$ |
| 18 | $45053 \cdot 4$ | +2.19 | 453 4.I | +2.17 | $45513 \cdot 5$ | +2.14 | 45721.6 | +2.12 | $45928 \cdot 5$ | +2.11 | 5 I 34.4 | +2.09 |
| 20 | $44143 \cdot 4$ | $2 \cdot 20$ | $\begin{array}{llllllllllll}4 & 43 & 54\end{array}$ | $2 \cdot 18$ | $446 \quad 4.6$ | $2 \cdot 15$ | 448 12.8 | $2 \cdot 12$ | 45019.6 | 2 | $45225 \cdot 1$ | $2 \cdot 08$ |
| 22 | $43232 \cdot 6$ | $2 \cdot 22$ | 43444.9 | $2 \cdot 19$ | $436 \quad 55 \cdot 2$ | $2 \cdot 16$ | $\begin{array}{llll}4 & 39 & 3 \cdot 9\end{array}$ | $2 \cdot 13$ | $44110 \cdot 8$ | 2.10 | $44316 \cdot 2$ | . 08 |
| 24 | $42320 \cdot 7$ | $2 \cdot 24$ | $42534 \cdot 1$ | $\cdot 20$ | $4 \quad 2745 \cdot 4$ | $2 \cdot 17$ | $42954 \cdot 6$ | $2 \cdot 14$ | $432 \begin{array}{lll}4 & 1\end{array}$ | $2 \cdot 11$ | $\begin{array}{llll}4 & 34 & 7 \cdot 4\end{array}$ | . 8 |
| 26 | $\begin{array}{llll}4 & 14 & 7 \cdot 4\end{array}$ | $2 \cdot 27$ | $4 \quad 16 \quad 22 \cdot 2$ | $2 \cdot 23$ | $418 \quad 34^{4} 6$ | $2 \cdot 19$ | $42044 \cdot 7$ | $2 \cdot 15$ | $42252 \cdot 7$ | $2 \cdot 11$ | $42458 \cdot 5$ | 08 |
| 28 | $4 \quad 4 \quad 52 \cdot 5$ | +2.30 | $4 \quad 7 \quad 90$ | +2.25 | $4 \begin{array}{lll}4 & 9 & 22 \cdot 8\end{array}$ | +2.21 | 4 II 34.I | +2.17 | 4 I3 42.9 | +2.13 | $41549 \cdot 3$ | $+2.09$ |
| 30 | $35515 \cdot 5$ | $2 \cdot 34$ | $35754 \cdot 1$ | $2 \cdot 28$ | $4 \quad 0 \quad 9 \cdot 6$ | 2.23 | $\begin{array}{lrrr}4 & 2 & 22 \cdot 3\end{array}$ | $2 \cdot 19$ | $\begin{array}{llll}4 & 4 & 32 \cdot 3\end{array}$ | $2 \cdot 14$ | $4 \quad 6 \quad 39 \cdot 5$ | $2 \cdot 10$ |
| 32 | 346 16•1 | $2 \cdot 38$ | $\begin{array}{llllll}3 & 48 & 37 \cdot 1\end{array}$ | $2 \cdot 32$ |  | $2 \cdot 27$ | 3 53 $9 \cdot 2$ | 2.21 | $\begin{array}{llll}3 & 55 & 20 \cdot 6\end{array}$ | $2 \cdot 16$ | 35729.0 | $2 \cdot 12$ |
| 33 | $341135 \cdot 3$ | $2 \cdot 40$ | 343 57•7 | $2 \cdot 34$ | 34616.5 | $2 \cdot 28$ | $348 \quad 32 \cdot 0$ | 2.23 | $35044 \cdot 3$ | $2 \cdot 18$ | $\begin{array}{llll}3 & 52 & 53 \cdot 4\end{array}$ | 2-13 |
| 34 | $\begin{array}{lllll}3 & 36 & 53 \cdot 8\end{array}$ | 2.43 |  | $2 \cdot 37$ | $\begin{array}{llll}3 & 41 & 37 \cdot 8\end{array}$ | $2 \cdot 30$ | 34354.4 | 2.25 | $\begin{array}{lll}3 & 46 & 7 \cdot 6\end{array}$ | $2 \cdot 19$ | $3 \begin{array}{lllll}3 & 48 & 17 \cdot 4\end{array}$ | 4 |
| 35 | 3 32 II.4 | +2.46 | $\begin{array}{llll}3 & 34 & 36 \cdot 9\end{array}$ | +2.39 | $\begin{array}{llll}3 & 36 & 58 \cdot 4\end{array}$ | $+2.33$ | $33916 \cdot 2$ | +2.27 | $34130 \cdot 4$ | $+2.21$ | $3434 \mathrm{I} \cdot 2$ | +2.15 |
| 36 | $32728 \cdot 1$ | 2.49 | 32955.3 | $2 \cdot 42$ | $\begin{array}{llll}3 & 32 & 18 \cdot 3\end{array}$ | $2 \cdot 35$ |  | $2 \cdot 29$ | $\begin{array}{llll}3 & 36 & 52 \cdot 8\end{array}$ | 2.22 | $\begin{array}{llll}3 & 39 & 4 \cdot 5\end{array}$ | $2 \cdot 16$ |
| 37 | $\begin{array}{llll}3 & 22 & 43 \cdot 8\end{array}$ | $2 \cdot 52$ | $\begin{array}{llll}3 & 25 & 12.8\end{array}$ | 2.45 | $\begin{array}{llll}3 & 27 & 37 \cdot 5\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}3 & 29 & 58 \cdot 1 \\ 3 & 25 & 18\end{array}$ | $2 \cdot 31$ | $\begin{array}{llll}3 & 32 & 14 \cdot 7\end{array}$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 34 & 27 \cdot 4\end{array}$ | -18 |
| 8 | $\begin{array}{llllllllllllll}3 & 17 & 58.4\end{array}$ | $2 \cdot 56$ | 32029.4 | $2 \cdot 48$ | $\begin{array}{llll}3 & 22 & 56 \cdot 0\end{array}$ | 40 | $\begin{array}{llll}3 & 25 & 18 \cdot 0\end{array}$ | $2 \cdot 33$ | $\begin{array}{llll}3 & 27 & 36 \cdot 0\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}3 & 29 & 49 \cdot 8\end{array}$ | $2 \cdot 20$ |
| 39 | 31311.8 | $2 \cdot 59$ | $31545 \cdot 0$ | $2 \cdot 51$ | $\begin{array}{lllll}3 & 18 & 13.4\end{array}$ | $2 \cdot 43$ | $32037 \cdot 2$ | $2 \cdot 36$ | $32256 \cdot 6$ | $2 \cdot 29$ | 325 II.8 | 2.22 |
| 40 | $3{ }^{3} 8824.0$ | +2.64 | 31059.5 | +2.55 | 313300 | $+2.47$ | $31555 \cdot 6$ | $+2.39$ | $31816 \cdot 6$ | +2.3I | $32033 \cdot 1$ | $+2.24$ |
| 41 | $\begin{array}{llll}3 & 3 & 34.7\end{array}$ | $2 \cdot 68$ | $3 \quad 612 \cdot 8$ | 2.59 | $\begin{array}{llll}3 & 8 & 45 \cdot 4\end{array}$ | $2 \cdot 50$ | 3 II 13.1 | 2.42 | $\begin{array}{lllll}3 & 13 & 35 \%\end{array}$ | $2 \cdot 34$ |  | $2 \cdot 26$ |
| 42 | $25^{28} 44^{\circ} 0$ | $2 \cdot 73$ | 3 I 24.7 | 2.63 | $\begin{array}{llll}3 & 3 & 59.8\end{array}$ | $2 \cdot 54$ | $\begin{array}{llll}3 & 6 & 29.5\end{array}$ | 2.45 | $3{ }^{3}$ | $2 \cdot 37$ | 3 II 13.8 | $2 \cdot 29$ |
| 43 | $2535 \mathrm{I} \cdot 5$ | $2 \cdot 78$ | $25635 \cdot 2$ | $2 \cdot 68$ | $\begin{array}{llll}2 & 59 & 12.9\end{array}$ | $2 \cdot 58$ | $3 \begin{array}{lll}3 & 1 & 44.9\end{array}$ | 2.49 | $3 \begin{array}{llll}3 & 4 & 11.6\end{array}$ | $2 \cdot 40$ | $3633{ }^{\circ} \mathrm{O}$ | $2 \cdot 32$ |
| 4 | $24857 \cdot 2$ | $2 \cdot 84$ | $25144 \cdot 1$ | $2 \cdot 73$ | $\begin{array}{llll}2 & 54 & 24 \cdot 6\end{array}$ | $2 \cdot 62$ | $25659 \cdot 1$ | $2 \cdot 53$ | $2 \begin{array}{llll}2 & 59 & 27.9\end{array}$ | 2.43 | $\begin{array}{llll}3 & 1 & 51 \cdot 3\end{array}$ | $2 \cdot 35$ |
| 45 | $\begin{array}{lll}2 & 44 & 0.9\end{array}$ | $+2.90$ | $2465 \mathrm{I} \cdot 2$ | $+2.78$ | $2 \begin{array}{lll}2 & 49 & 34 \cdot 8\end{array}$ | $+2.67$ | $\begin{array}{llll}2 & 52 & 12 \cdot 0\end{array}$ | $+2.57$ | $25443 \cdot 3$ | $+2.47$ | $\begin{array}{llll}2 & 57 & 8 \cdot 7\end{array}$ | $+2 \cdot 38$ |
| 46 | $\begin{array}{lll}2 & 39 & 2.4\end{array}$ | $2 \cdot 96$ | 241566 | 2.84 | $\begin{array}{llll}2 & 44 & 43 \cdot 3\end{array}$ | 2.73 | $\begin{array}{llll}2 & 47 & 23.5\end{array}$ | 2.62 | $2 \begin{array}{llllllll} & 49 & 57 \cdot 3\end{array}$ | 2.51 | $2{ }^{2} 5225 \cdot 1$ | 2.41 |
| 47 | 2 34 $1 \cdot 5$ <br> 2 28  | 3.03 | $\begin{array}{llll}2 & 36 & 59 \cdot 5 \\ 2 & 32 & \end{array}$ | 2.90 | $\begin{array}{llll}2 & 39 & 50 \cdot 0 \\ 2 & 34 & 54 .\end{array}$ | $2 \cdot 78$ | $\begin{array}{llll}2 & 42 & 33.4 \\ 2 & 37 & 41\end{array}$ | 2.67 | $\begin{array}{lllllll}2 & 45 & 10 \cdot 1 \\ 2 & 40 & 21.3\end{array}$ | $2 \cdot 56$ | $\begin{array}{llllllllllll}2 & 47 & 40 \cdot 3\end{array}$ | 2.45 |
| 48 | $\begin{array}{llll}2 & 28 & 57 \cdot 8\end{array}$ | $3 \cdot 11$ | $\begin{array}{llr}2 & 32 & 0 \cdot 3 \\ 2 & 26 & 58.5\end{array}$ | 2.97 | $\begin{array}{llll}2 & 34 & 54.7 \\ 2 & 29 & 57\end{array}$ | $2 \cdot 84$ | $\begin{array}{lllll}2 & 37 & 41 \cdot 6\end{array}$ | $2 \cdot 72$ |  | $2 \cdot 61$ | $\begin{array}{lllll}2 & 42 & 54 \cdot 3\end{array}$ | $2 \cdot 50$ |
| 49 | $22351 \cdot 2$ | $3 \cdot 20$ | $22658 \cdot 5$ | $3 \cdot 05$ | $\begin{array}{lllllllll}2 & 29 & 57 \cdot 2\end{array}$ | 2.91 | $\begin{array}{lllll}2 & 32 & 47.9\end{array}$ | $2 \cdot 78$ | 23531.0 | $2 \cdot 66$ | $2 \begin{array}{lll}28 & 6 \cdot 9\end{array}$ | $2 \cdot 54$ |
| 50 | 2 I8 4 4I.2 | $+3.29$ | $\begin{array}{llll}2 & 21 & 53.8\end{array}$ | $+3 \cdot 13$ | $\begin{array}{llll}2 & 24 & 57.2\end{array}$ | +2.98 | $\begin{array}{llll}2 & 27 & 52 \cdot 0\end{array}$ | $+2 \cdot 85$ | $2 \begin{array}{llll}2 & 30 & 38 \cdot 8\end{array}$ | $+2 \cdot 72$ | $2 \begin{array}{llll}2 & 33 & 18 \cdot 0\end{array}$ | $+2.59$ |
| 51 | $\begin{array}{lllll}2 & 13 & 27.5\end{array}$ | 3.40 | 2 16 $46 \cdot 0$ | $3 \cdot 22$ | 21954.5 | 3.07 | $\begin{array}{llll}2 & 22 & 53 \cdot 9\end{array}$ | $2 \cdot 92$ | 22544.6 | $2 \cdot 78$ | $2 \begin{array}{llll}2 & 28 & 27 & 3\end{array}$ | $2 \cdot 65$ |
| 52 | $\begin{array}{llll}2 & 8 & 9.6 \\ 2 & 2 & 46.9\end{array}$ | 3.51 | $2 \begin{array}{rrrr} \\ 2 & 11 & 34.5\end{array}$ | $3 \cdot 33$ | $\begin{array}{llll}2 & 14 & 48 \cdot 7\end{array}$ | $3 \cdot 15$ | $2 \mathrm{I} 7{ }^{2} 53 \cdot 1$ | $3 \cdot 00$ | $220048 \cdot 3$ | $2 \cdot 85$ | $\begin{array}{llll}2 & 23 & 34 \cdot 8\end{array}$ | $2 \cdot 71$ |
| 53 | 2 2 $46 \cdot 9$ <br>  57  | 3.64 | $\begin{array}{llll}2 & 6 & 19.0 \\ 2 & 0 & 58.8\end{array}$ | 3.44 | $\begin{array}{llll}2 & 9 & 39.4\end{array}$ | 3.25 | $\begin{array}{rrrr}2 & 12 & 49 \cdot 3 \\ 2 & 7 & 4\end{array}$ | 3.08 | $2 \begin{array}{lllll}2 & 15 & 49.4 \\ 2\end{array}$ | $2 \cdot 92$ | $\begin{array}{llll}2 & 18 & 40 \cdot 2\end{array}$ | 2.77 |
| 54 | 11 57 | 3.77 | $2 \quad 0 \quad 58.8$ | $3 \cdot 56$ | $2 \quad 4 \quad 26 \cdot 3$ | $3 \cdot 36$ | $2742 \cdot 3$ | 3.18 | 2 Io 47.7 | 3.01 | 21343.2 | $2 \cdot 85$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ}$ A. |  | L. $9^{\circ}$ A. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{aligned} & \mathrm{s} \\ & +\quad .55 \end{aligned}$ | $\begin{gathered} \mathrm{s} \\ -4.60 \end{gathered}$ | $\begin{aligned} & \text { s. } \\ & +\quad .64 \end{aligned}$ | $\begin{gathered} \mathrm{s} \\ -4.62 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .74 \end{aligned}$ | $\begin{gathered} s . \\ -4 \cdot 63 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\quad .83 \end{gathered}$ | $\begin{gathered} \mathrm{s} \\ -4.65 \end{gathered}$ | $\begin{gathered} s . \\ +\quad .93 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 66 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{I} \cdot \mathrm{O} 2 \end{gathered}$ | s. $4 \cdot 68$ |
| 2 | - 46 | 4.59 | +.55 | $4 \cdot 61$ | + 64 | 4.62 | +.74 | $4 \cdot 63$ | .83 | 4.65 | . 93 | 4.67 |
| 4 | $\cdot 37$ | $4 \cdot 59$ | $\cdot 46$ | $4 \cdot 60$ | $\cdot 56$ | 4.61 | -65 | $4 \cdot 62$ | $\cdot 74$ | $4 \cdot 63$ | . 84 | 4.65 |
| 6 | -28 | $4 \cdot 58$ | -37 | 4.59 | $\cdot 47$ | $4 \cdot 60$ | -56 | 4.61 | - 65 | 4.62 | $\cdot 75$ | 4.63 |
| 8 | -19 | $4 \cdot 58$ | -29 | $4 \cdot 58$ | -38 | 4.59 | -47 | $4 \cdot 60$ | $\cdot 56$ | $4 \cdot 61$ | -66 | 4.62 |
| 10 | + - II | $4 \cdot 57$ | + 20 | $4 \cdot 58$ | + 29 | $4 \cdot 58$ | $+.38$ | 4.59 | + $\cdot 48$ | 4.60 | + 57 | $4 \cdot 61$ |
| 12 | + 02 | $4 \cdot 57$ | - II | $4 \cdot 57$ | -20 | $4 \cdot 58$ | -30 | $4 \cdot 58$ | -39 | 4.59 | + 48 | $4 \cdot 60$ |
| 14 | - .07 | $4 \cdot 57$ | +.02 | 4.57 | -12 | $4 \cdot 57$ | -21 | $4 \cdot 58$ | -30 | $4 \cdot 58$ | -40 | $4 \cdot 59$ |
| I6 | - I6 | $4 \cdot 58$ | -. 06 | 4.57 | +.03 | $4 \cdot 57$ | -12 | $4 \cdot 57$ | $\cdot 22$ | $4 \cdot 58$ | -31 | $4 \cdot 58$ |
| 18 | $\cdot 25$ | $4 \cdot 58$ | -15 | $4 \cdot 58$ | -.06 | $4 \cdot 57$ | +.03 | $4 \cdot 57$ | -13 | $4 \cdot 57$ | - 22 | $4 \cdot 58$ |
| 20 | - 34 | $4 \cdot 58$ | - . 24 | $4 \cdot 58$ | - •15 | $4 \cdot 57$ | - .05 | $4 \cdot 57$ | +.04 | $4 \cdot 57$ | + 14 | $4 \cdot 57$ |
| 22 | - 44 | 4.59 | - 34 | $4 \cdot 58$ | - 24 | $4 \cdot 58$ | -14 | $4 \cdot 57$ | - 04 | 4.57 | + .05 | 4.57 |
| 24 | -53 | $4 \cdot 60$ | -43 | 4.59 | -33 | $4 \cdot 58$ | -23 | $4 \cdot 58$ | -13 | $4 \cdot 57$ | - 04 | $4 \cdot 57$ |
| 26 | -63 | $4 \cdot 62$ | -53 | $4 \cdot 60$ | $\cdot 43$ | $4 \cdot 59$ | -33 | $4 \cdot 58$ | $\cdot 23$ | $4 \cdot 58$ | -12 | 4.57 |
| 28 | $\cdot 74$ | $4 \cdot 63$ | . 63 | $4 \cdot 62$ | -53 | $4 \cdot 60$ | $\cdot 42$ | $4 \cdot 59$ | $\cdot 32$ | 4.58 | - 22 | 4.58 |
| 30 | -. 85 | $4 \cdot 65$ | - $\cdot 74$ | $4 \cdot 63$ | -. 63 | $4 \cdot 62$ | - 52 | $4 \cdot 60$ | - 42 | $4 \cdot 59$ | - 3I | $4 \cdot 58$ |
| 32 | -96 | $4 \cdot 67$ | - 85 | $4 \cdot 65$ | $\cdot 73$ | $4 \cdot 63$ | . 62 | $4 \cdot 62$ | - 52 | $4 \cdot 60$ | . 41 | 4.59 |
| 34 | I.08 | 4.70 | -96 | $4 \cdot 67$ | . 85 | $4 \cdot 65$ | $\cdot 73$ | $4 \cdot 63$ | -62 | $4 \cdot 61$ | -51 | 4.60 |
| 36 | I 21 | $4 \cdot 73$ | I-08 | $4 \cdot 70$ | -96 | $4 \cdot 67$ | -84 | $4 \cdot 65$ | $\cdot 73$ | 4.63 | . 61 | $4 \cdot 61$ |
| 38 | I.34 | $4 \cdot 66$ | I-2I | $4 \cdot 73$ | I.09 | $4 \cdot 70$ | -96 | $4 \cdot 67$ | -84 | $4 \cdot 65$ | $\cdot 72$ | $4 \cdot 63$ |
| 40 | - I. 49 | 4.81 | - I. 35 | $4 \cdot 77$ | - I. 22 | $4 \cdot 73$ | - 1.09 | $4 \cdot 70$ | -.96 | 4.67 | -.84 | $4 \cdot 65$ |
| 42 | I. 64 | $4 \cdot 86$ | I.50 | 4.81 | 1.36 | $4 \cdot 77$ | I. 22 | $4 \cdot 74$ | 1-09 | $4 \cdot 70$ | $\cdot 96$ | $4 \cdot 67$ |
| 44 | r.82 | 4.92 | I. 66 | 4.87 | 1.51 | $4 \cdot 82$ | 1.37 | 4.77 | 1.23 | $4 \cdot 74$ | 1.09 | $4 \cdot 70$ |
| 46 | $2 \cdot \mathrm{OI}$ | $4 \cdot 99$ | I. 84 | 4.93 | I. 68 | $4 \cdot 87$ | 1.53 | 4.82 | I.38 | $4 \cdot 78$ | I. 23 | $4 \cdot 74$ |
| 48 | $2 \cdot 22$ | 5.09 | 2.04 | 5.01 | 1.87 | $4 \cdot 94$ | 1.70 | 4.88 | 1.54 | $4 \cdot 83$ | 1.38 | 4.78 |
| 50 | $-2.47$ | $5 \cdot 20$ | $-2.27$ | $5 \cdot 10$ | $-2.08$ | 5.02 | - 1.89 | 4.95 | - I 72 | $4 \cdot 89$ | - I. 55 | $4 \cdot 83$ |
| 52 | $2 \cdot 75$ | $5 \cdot 34$ | 2.53 | $5 \cdot 22$ | $2 \cdot 32$ | $5 \cdot 13$ | 2.11 | $5 \cdot 04$ | 1-92 | $4 \cdot 96$ | 1.74 | $4 \cdot 89$ |
| 54 | $3 \cdot 09$ | $5 \cdot 52$ | 2.83 | $5 \cdot 38$ | 2.59 | 5.26 | $2 \cdot 36$ | $5 \cdot 15$ | $2 \cdot 15$ | $5 \cdot 05$ | $1 \cdot 95$ | 4.96 |

## 120 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $29^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True | $12^{\circ}$ |  | $13^{\circ}$ | ecl. ar. | $14^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $17^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ |  |  |  | . 35 |  | $\begin{array}{r} 5 . \\ +2 \cdot 38 \end{array}$ |  | S. | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 36 \end{array}$ |  | $\underset{\mathrm{I} \cdot \mathrm{p}}{ }$ | . 46 |
| 10 | $54027 \cdot 6$ | +23 | $5 \begin{array}{ll}542 & 36.8\end{array}$ |  | ${ }_{5} 4446 \cdot \mathrm{I}$ | 2.15 | 5 $4655 \cdot 5$ | 2.16 | 5495.2 | 16 | $5 \begin{array}{lllllllll}515\end{array}$ | $2 \cdot 17$ |
| 12 | $\begin{array}{llllllllllll}5 & 31 & 13.8\end{array}$ |  | ${ }_{5}^{5} 332121.3$ |  | 53528.7 | $2 \cdot$ | 53736. | $2 \cdot 1$ | $53943 \cdot 5$ | $2 \cdot 12$ | 54151.1 | 2.13 |
| 1 |  | 2.11 2.09 | (1)24$5 \cdot 4$ <br> 5 <br> 5 | 2.10 2.08 | $\begin{array}{ccc}5 & 26 & 13 \cdot 1 \\ 5 & 16 & 59.0\end{array}$ | 2.09 2.07 | ( $\begin{array}{ccc}5 & 28 \\ 5 & 18 \\ 5 & 18.6 \\ 2.8\end{array}$ | 2.09 2.06 | $\begin{array}{ccc}5 & 30 & 23.9 \\ 5 & 21 & 6.9\end{array}$ | 2.09 2.05 | 5 32 <br> 5 23 <br> 5 29.1 | 2.08 <br> 2.05 |
| 18 | $\begin{array}{llll}5 & 3 & 39 \cdot 3\end{array}$ | + | - | 2. | $746 \cdot 2$ | +2.05 | $948 \cdot 5$ | +2.03 | 5 II $50 \cdot 2$ | +2.02 | $51351 \cdot 3$ | 2.01 |
| 20 | 454 | 2.06 | 456 |  | $45834 \cdot 5$ |  | O 35.6 | 2.01 | $5{ }_{5} 2$ |  | $5435{ }^{\circ}$ | r.98 |
| 22 | ${ }^{4}$45 <br> 4 <br> 4 <br> 4 | 2. | [47322.6 | 2. | $\begin{array}{\|ccc\|}4 & 49 & 23.8 \\ 4 \\ 4 \\ 4 \\ \text { I }\end{array}$ | 2.01 | ${ }^{4} 515123.8$ | r. 99 | 45322 | r. 97 | 45520.2 | 5 |
| 24 26 |  | 2. | [rrrer $\begin{array}{rrr}4 & 38 & 13 \cdot 3 \\ 4 & 29 & 4 \cdot 2\end{array}$ | ${ }_{2}^{2.02}$ | 4 40 $13 \cdot 8$ <br> 4 3 I $4 \cdot 4$ | 2.00 | [ $\begin{array}{rrr}4 & 42 & 12 \cdot 9 \\ 4 & 33 & 2.8 \\ 4\end{array}$ | I.96 | 4 44 <br> 4 10 <br> $10 \cdot 6$  <br> 59  | 93 | 4 4 4 46 | r. ${ }_{\text {r }}^{1} \mathrm{Pr}$ |
| 28 | 41753.4 | +2 | $4 \mathrm{r9} 5$ | -2. | $4 \begin{array}{llll}4 & 55 \cdot 4\end{array}$ | +1.9 | $42353 \cdot 3$ | +1.9 | $42549 \cdot 4$ | +1.92 | $42743 \cdot 6$ |  |
| 30 | 4844.3 |  | 4 10 46 |  | 41246.5 | I. 98 | 4 I 444.2 | 1.94 | 4 I6 39.8 | 1.91 | 41833.2 |  |
| 31 | 49.5 |  | $4 \quad 612.0$ |  | 4  <br> 4 8 <br> 4 $12 \cdot 1$ <br>  $37 \cdot 7$ |  | 4 10 0.8 | - | 412 |  | 4135 |  |
| 32 33 |  | 2.08 | ${ }^{4} \begin{array}{llll}4 & 1 & 37.4 \\ 3 & 57 & 2.7 \\ 3\end{array}$ | 2.03 | ${ }^{4}$4 <br> 3 $59 \begin{array}{ll}3 & 3 \\ 3 & 3 \cdot 2\end{array}$ | $\stackrel{1}{1} \mathrm{r} 9$ | ${ }^{4}$ | r. r 194 | ${ }_{4}^{4}$7 <br> 4 | $\underset{\text { r }}{ }$ | 4 <br> 4 <br> 4 <br> 4 |  |
| 34 | 350 | +2 | $35227 \cdot 9$ | +2.04 | 35428.6 | + r .99 | $35626 \cdot 5$ | $+1$ | 35821.7 | +1.90 | $4 \quad 0 \quad 14.3$ | 5 |
| 35 | 34548 | ${ }_{\text {2.11 }}$ |  | 2.04 2.05 | 3 41953.9 |  | 3 315152.1 |  | 3 53478 | 90 | $\begin{array}{lllll}3 & 55 & 39.8 \\ 3 & 5\end{array}$ |  |
| 37 | $\begin{array}{llll}3 & 41 & 12 \cdot 7 \\ 3 & 36 & 36.5\end{array}$ | ${ }_{2}^{2 \cdot 12}$ |  | 2.05 | l $\begin{aligned} & 3 \\ & 3 \\ & 3 \\ & 40\end{aligned}$ | 2.00 |  |  | 3 $44 \begin{aligned} & \text { 3 } \\ & 3\end{aligned}$ | I 19 | (1) |  |
| 38 |  | $2 \cdot 14$ | 334 |  | 3 |  | 3 | r.96 | 34040 |  | $34156 \cdot 6$ | 85 |
| 39 | (3)27 22.8 | +2.15 | ${ }^{3} 2293030 \cdot 0$ | +2.09 | $\begin{array}{llll}3 & 31 & 33 \cdot 4 \\ 3 & 26 & 5\end{array}$ | 2.03 +2.04 2 | 3 38 $33 \cdot 1$ <br> 3 28 58.0 | +r.97 |  | +r.9r |  |  |
| 4 |  |  |  | 2.10 2.12 | ( $\begin{array}{llll}3 & 26 & 57 \cdot 7 \\ 3 & 22 & 21 \cdot 6\end{array}$ | $2 \cdot$ | 3 28 <br> 3 28 | 1.98 | 3 30 $54 \cdot 6$ <br> 3 26  <br> 19 7  | r 1.92 | \|llll |  |
| 42 | 1328.7 |  | 3 $315 \begin{array}{ll}59 \cdot 7\end{array}$ |  | ${ }^{3} 1717451$ |  | 3 1946.9 | 2.00 | $32144 \cdot 6$ | - | 32338.4 |  |
| 43 | $849 \cdot 5$ | 2.23 | 3 II 1.2 |  | 3 13 8 |  | 31511.0 |  | $\begin{array}{llll}317 & 9\end{array}$ |  | $\begin{array}{llll}3 & 19 & 3.6\end{array}$ | 1.87 |
| 44 | 3 4 9 <br> 2 59  <br>  28.5  | 2. | (1) $\begin{gathered}3 \\ 3 \\ 3\end{gathered} \mathrm{I}$ | +2.18 | $\begin{array}{lllll}3 & 8 & 310 \\ 3 & 3 & \\ 2\end{array}$ | +2.10 | $\begin{array}{llll}3 & 10 & 34.6 \\ 3 & 5\end{array}$ | $2 \cdot 02$ | $\begin{array}{cccc}3 & 12 & 33.8 \\ 3 & 7 & 58.0\end{array}$ | + $\mathrm{I} \cdot 95$ | 31428.6 | I 188 I .89 |
| 4 |  | 2.29 2.32 |  |  |  |  | 3 5 57 <br> 3 1  |  | 37 | r. 9 | 3 9 53.4 <br> 3 5  | 90 |
| 47 | ${ }^{2} 5504 \cdot 5$ | 2 | 2 5222.9 |  | 25435.6 | $2 \cdot 17$ | $25643 \cdot 6$ | 2. | $25845 \cdot \mathrm{I}$ |  | 3 O $42 \cdot 2$ | r 91 |
| 48 | 24520.9 | 2.39 | $24741 \cdot 3$ | $2 \cdot 29$ | $24955 \cdot 8$ | $2 \cdot 19$ | $2524 \cdot 6$ | $2 \cdot 10$ | 25480 | $2 \cdot \mathrm{Or}$ | 2566.1 | ז.92 |
| 49 | $2{ }^{2} 4036 \cdot \mathrm{I}$ |  | $2{ }_{2} 4258.7$ | $+$ | $2 \begin{array}{llllll}2 & 15.2\end{array}$ | $+$ | 24725.7 | $+2.13$ | $24930 \cdot 4$ | . 3 |  |  |
| 50 |  | 2.48 2.52 | 2-3815.I | 2.36 |  | 2.26 2.29 | 2 <br> 2 <br> 2 <br> 38 | ${ }_{2}^{2 \cdot}$ |  |  |  | r $\begin{array}{r}1.96 \\ \mathrm{r} \\ \hline 1\end{array}$ |
| 52 | $1{ }^{2}$ | 2 | 2 28 44-I | 2 | 2 <br> 215 | $2 \cdot 3$ | $\begin{array}{ll}2 & 33 \\ 24 \cdot 1\end{array}$ | $2 \cdot 2$ | 23533.9 | 2.1 | 23737.3 | 2.00 |
| 53 | $2 \mathrm{~L} 2122 \cdot 4$ |  | $22356 \cdot 4$ |  | $22682 \cdot 7$ |  | 22841.7 | $2 \cdot 26$ | $23053 \cdot 6$ | $2 \cdot 14$ | 23258 |  |
| 54 | 21629.5 | +2 | 21975 | +2.56 | $22136 \cdot 5$ |  | $22358 \cdot \mathrm{I}$ | +2.30 | $22612 \cdot 3$ | +2.18 | $2 \begin{aligned} & 28 \\ & 19 \\ & 19\end{aligned}$ | ${ }^{\circ} \mathrm{0} 6$ |
| 55 56 | 2 11 34.4 <br> 2 6 36.8 <br>  36  | 2.77 2.85 | 214 |  | 216 |  |  |  | 1646.6 |  | $22339 \cdot 2$ | 9 |
| 57 |  |  | $427 \cdot 2$ |  | 2780 |  |  |  | 2 r 2 r 9 |  | 214 |  |
| 58 | 56 | 3.03 | 5929.0 | 2.85 | 214.4 | 2.6 | 449.8 | 2.51 | 2715.8 | $2 \cdot 36$ | 932 | $2 \cdot 21$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot \mathrm{I} 2 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4.7 \mathrm{I} \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 22 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 73 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 32 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 76 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ +\mathrm{r} \cdot 42 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 78 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 52 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.82 \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 62 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 85 \end{gathered}$ |
| 4 | $\cdot 93$ | 4.67 | I.03 | 4.69 | 1.12 | $4 \cdot 7 \mathrm{I}$ | 1.22 | 4.73 | $1 \cdot 32$ | $4 \cdot 76$ | 1.42 | $4 \cdot 79$ |
| 8 | $\cdot 75$ | $4 \cdot 63$ | - 84 | $4 \cdot 65$ | -94 | $4 \cdot 67$ | 1.03 | $4 \cdot 69$ | $1 \cdot 13$ | $4 \cdot 71$ | $1 \cdot 23$ | $4 \cdot 73$ |
| 12 | $\cdot 58$ | $4 \cdot 61$ | $\cdot 67$ | $4 \cdot 62$ | $\cdot 76$ | $4 \cdot 64$ | $\cdot 86$ | $4 \cdot 65$ | -95 | 4.67 | I.05 | $4 \cdot 69$ |
| 16 | -40 | $4 \cdot 59$ | -50 | $4 \cdot 60$ | -59 | $4 \cdot 61$ | $\cdot 69$ | $4 \cdot 62$ | $\cdot 78$ | $4 \cdot 64$ | . 88 | $4 \cdot 66$ |
| 20 | + 23 | $4 \cdot 58$ | + 33 | $4 \cdot 58$ | + ${ }^{42}$ | $4 \cdot 59$ | + 52 | $4 \cdot 60$ | + 62 | $4 \cdot 61$ | + 71 | $4 \cdot 63$ |
| 22 | -15 | $4 \cdot 57$ | - 24 | $4 \cdot 58$ | -34 | $4 \cdot 59$ | -44 | $4 \cdot 59$ | $\cdot 53$ | $4 \cdot 60$ | . 63 | $4 \cdot 62$ |
| 24 | + .06 | $4 \cdot 57$ | -16 | $4 \cdot 58$ | -26 | $4 \cdot 58$ | -35 | 4.59 | $\cdot 45$ | 4.59 | $\cdot 55$ | $4 \cdot 60$ |
| 26 | -.03 | 4.57 | + 07 | 4.57 | -17 | 4.57 | - 27 | $4 \cdot 58$ | -37 | $4 \cdot 59$ | $\cdot 47$ | $4 \cdot 60$ |
| 28 | $\cdot 12$ | 4.57 | - Or | $4 \cdot 57$ | -08 | $4 \cdot 57$ | -18 | $4 \cdot 57$ | -28 | $4 \cdot 58$ | $\cdot 38$ | $4 \cdot 59$ |
| 30 | - $\cdot 2 \mathrm{I}$ | $4 \cdot 58$ | - .10 | $4 \cdot 57$ | + 00 | 4.57 | + 10 | $4 \cdot 57$ | + 20 | $4 \cdot 58$ | + 30 | $4 \cdot 58$ |
| 32 | $\cdot 30$ | $4 \cdot 58$ | $\cdot 20$ | $4 \cdot 58$ | - -09 | $4 \cdot 57$ | + .01 | $4 \cdot 57$ | -11 | 4.57 | $\cdot 22$ | $4 \cdot 58$ |
| 34 | -40 | $4 \cdot 59$ | -29 | $4 \cdot 58$ | - 18 | 4.58 | -. 08 | $4 \cdot 57$ | + .03 | $4 \cdot 57$ | -13 | $4 \cdot 57$ |
| 36 | - 50 | $4 \cdot 60$ | -39 | $4 \cdot 59$ | -28 | $4 \cdot 58$ | $\cdot 17$ | 4.58 | -. 06 | 4.57 | +.05 | $4 \cdot 57$ |
| 38 | .61 | $4 \cdot 61$ | -49 | $4 \cdot 60$ | $\cdot 38$ | $4 \cdot 59$ | -26 | $4 \cdot 58$ | -15 | 4.57 | $-.04$ | 4.57 |
| 40 | - 72 | $4 \cdot 63$ | - . 60 | $4 \cdot 61$ | - $\cdot 48$ | $4 \cdot 60$ | - . 36 | $4 \cdot 59$ | - . 24 | $4 \cdot 58$ | - .13 | $4 \cdot 57$ |
| 42 | . 83 | $4 \cdot 65$ | $\cdot 71$ | $4 \cdot 63$ | $\cdot 58$ | $4 \cdot 61$ | - 46 | $4 \cdot 6$ | $\cdot 34$ | $4 \cdot 58$ | - 22 | $4 \cdot 58$ |
| 44 | $\cdot 96$ | 4.67 | -83 | $4 \cdot 65$ | $\cdot 70$ | $4 \cdot 63$ | $\cdot 57$ | 4.61 | -45 | $4 \cdot 59$ | $\cdot 32$ | 4.58 |
| 46 | I.09 | $4 \cdot 70$ | $\cdot 95$ | $4 \cdot 67$ | . 82 | $4 \cdot 65$ | -68 | $4 \cdot 62$ | -55 | $4 \cdot 61$ | -43 | 4.59 |
| 48 | I. 23 | $4 \cdot 74$ | 1.09 | $4 \cdot 70$ | -95 | $4 \cdot 67$ | -81 | $4 \cdot 64$ | -67 | $4 \cdot 62$ | -53 | 4.60 |
| 50 | - I. 39 | $4 \cdot 78$ | -1.23 | $4 \cdot 74$ | - 1.08 | $4 \cdot 70$ | -.93 | $4 \cdot 67$ | - 79 | $4 \cdot 64$ | - 65 | 4.62 |
| 52 | $\pm .56$ | 4.83 | 1.40 | $4 \cdot 78$ | 1.23 | $4 \cdot 74$ | $\underline{1.08}$ | 4.70 | $\cdot 92$ | $4 \cdot 66$ | $\cdot 77$ | 4.64 |
| 54 | r 76 | 4.90 | I-58 | $4 \cdot 84$ | 1.40 | +78 | 1.23 | $4 \cdot 73$ | $\underline{1.07}$ | $4 \cdot 70$ | $\cdot 91$ | $4 \cdot 66$ |
| 56 58 | 1.98 2.23 | 4.97 5.08 | I.78 $2 \cdot 01$ | 4.91 4.99 | 1.59 $\mathbf{1} \cdot 80$ | 4.84 4.91 | I.40 $\mathrm{I} \cdot 59$ | 4.78 4.84 | 1.22 1.40 | $4 \cdot 73$ $4 \cdot 78$ | I.05 $\mathrm{I} \cdot 2 \mathrm{I}$ | $4 \cdot 69$ $4 \cdot 73$ |
| 58 | 2.23 | 5.08 | 2.01 | 4.99 | 1.80 | 4.91 | 1'59 | $4 \cdot 84$ | 1.40 | $4 \cdot 78$ | 1.21 | 4.73 |

DECLINATION-SAME NAME AS-LATITUDE.


## LATITUDE $30^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $0{ }^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2{ }^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}$ | S. +2.31 | $\begin{array}{\|ccc\|} \text { H. M. } & \text { S. } \\ 6 & 2 & \text { I } 8 \cdot 5 \end{array}$ | S. $+2 \cdot 31$ | $\begin{array}{lrc} \text { H. M. } & \text { S. } \\ 6 & 4 & 37 \cdot 2 \end{array}$ | $\begin{gathered} \mathrm{S} \\ +2 \cdot 3 \mathrm{I} \end{gathered}$ | $\begin{array}{\|ccc\|} \hline \text { H. M. } & \text { S. } \\ 6 & 6 & 56 \cdot I \end{array}$ | $\begin{gathered} \mathrm{S} \\ +2 \cdot 32 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 9 & 15 \cdot 3 \end{array}$ | $\begin{gathered} 5 \\ +2 \cdot 32 \end{gathered}$ | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 6 & \text { II } & 34^{\circ} 9 \end{array}$ | S. +2.33 |
| 10 | 5 I3 44.0 | $2 \cdot 36$ | $\begin{array}{llll}5 & 16 & 4 \cdot 7\end{array}$ | $2 \cdot 34$ | $\begin{array}{llllllllllllll}5 & 18 & 24.6\end{array}$ | $2 \cdot 32$ | $5 \quad 2043 \cdot 5$ | $2 \cdot 31$ | $\left\lvert\, \begin{array}{lll}5 & 23 & 1.6\end{array}\right.$ | $2 \cdot 29$ | $\begin{array}{llllllllllll}5 & 25 & 18\end{array}$ | $2 \cdot 28$ |
| 12 | $\begin{array}{llll}5 & 4 & 26 \cdot 1\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}5 & 6 & 48 \cdot 2\end{array}$ | $2 \cdot 36$ | $\begin{array}{lll}5 & 9 & 9\end{array}$ | $2 \cdot 34$ | 5 II 28.6 | $2 \cdot 32$ | 5 13 $47 \cdot 0$ | $2 \cdot 30$ | $\begin{array}{llll}5 & 16 & 4 \cdot 6\end{array}$ | $2 \cdot 28$ |
| 14 | $\begin{array}{llll}4 & 55 & 6 \cdot 9\end{array}$ | $2 \cdot 40$ | $4 \begin{array}{llll}4 & 57 & 30 \cdot 4\end{array}$ | $2 \cdot 38$ | $4 \begin{array}{llll}4 & 59 & 52 \cdot 3\end{array}$ | $2 \cdot 35$ | $\begin{array}{llll}5 & 2 & 12.9\end{array}$ | $2 \cdot 33$ | [ $51432 \cdot 1$ | $2 \cdot 31$ | $5 \quad 6 \quad 50 \cdot 0$ | $2 \cdot 29$ |
| 16 | $44545 \%$ | $2 \cdot 43$ | $44^{81 \mathrm{II} \cdot \mathrm{I}}$ | $2 \cdot 40$ | $45034 \cdot 5$ | $2 \cdot 38$ | $4 \begin{array}{llll}4 & 52 & 56\end{array}$ | $2 \cdot 35$ | 45516.4 | $2 \cdot 32$ | $45735 \cdot 1$ | $2 \cdot 30$ |
| I8 | $43622 \cdot 8$ | $+2.47$ | 438 50.0 | $+2.43$ | 44115.2 | $+2.40$ | $44338 \cdot 4$ | +2.37 | $4 \begin{array}{lll}4 & 45 & 59 \cdot 8\end{array}$ | +2.34 | $4 \begin{array}{llll}48 & \text { I } 9.4\end{array}$ | +2.31 |
| 20 | 42657.2 | $2 \cdot 51$ | $\begin{array}{llll}4 & 29 & 26 \cdot 8\end{array}$ | 2.47 | 4 3I 54*O | 2.43 | 434190 | $2 \cdot 40$ | $4364 r \cdot 8$ | $2 \cdot 36$ | $\begin{array}{lll}4 & 39 & 2.8\end{array}$ | $2 \cdot 33$ |
| 22 | 41728.8 | $2 \cdot 56$ | $420 \quad 1 \cdot I$ | $2 \cdot 51$ | $42230 \%$ | $2 \cdot 47$ | $4 \begin{array}{llll}4 & 24 & 57 \cdot 8\end{array}$ | $2 \cdot 43$ | 42722.4 | $2 \cdot 39$ | $4 \quad 2944.9$ | $2 \cdot 35$ |
| 24 | 4.757.1 | $2 \cdot 62$ | $41032 \cdot 5$ | $2 \cdot 56$ | $\begin{array}{llll}4 & 13 & 4.8\end{array}$ | $2 \cdot 51$ | 4 I5 $34 \cdot 3$ | $2 \cdot 47$ | $\begin{array}{lll}4 & 18 & 1 \cdot 2\end{array}$ | 2.42 | $4 \quad 20 \begin{array}{llll}4 & 25\end{array}$ | $2 \cdot 38$ |
| 25 | $\begin{array}{llll}4 & 3 & 9.8\end{array}$ | $2 \cdot 65$ | $4 \quad 5 \quad 46 \cdot 9$ | $2 \cdot 59$ | $\begin{array}{llll}4 & 8 & 20 \cdot 8\end{array}$ | $2 \cdot 54$ | 4 10 $51 \cdot 7$ | $2 \cdot 49$ | 4133197 | 2.44 | 4 I5 $45^{\circ} \mathrm{O}$ | $2 \cdot 40$ |
| 26 | $35^{3} 821.5$ | +2.68 | 4 I 0.5 | $+2 \cdot 62$ | $4 \quad 3 \quad 36 \cdot 0$ | $+2 \cdot 56$ | $\begin{array}{llll}4 & 6 & 8 \cdot 4\end{array}$ | +2.51 | $4 \begin{array}{lll}4 & 8 & 37 \cdot 6\end{array}$ | +2.46 | 4 II 4.1 | $+2.42$ |
| 27 | $\begin{array}{llll}3 & 53 & 32 \cdot 2\end{array}$ | 2.71 | $3{ }_{3} 5613 \cdot 0$ | 2.65 | $\begin{array}{lllll}3 & 58 & 50 & 3\end{array}$ | $2 \cdot 59$ | 1 1 $24 \cdot 2$ | $2 \cdot 54$ | 4 3 54.9 <br> 3 5  | 2.49 | $4 \quad 6 \quad 22.6$ | $\cdot 44$ |
| 28 | 3 48 <br> $1 \times 6$  | $2 \cdot 75$ | $3{ }^{3} 5124 \cdot 5$ | $2 \cdot 68$ | $\begin{array}{llll}3 & 54 & 3 \cdot 7\end{array}$ | 2.62 | $\begin{array}{llll}3 & 56 & 39 \cdot 3\end{array}$ | $2 \cdot 56$ | 359 II.5 | $2 \cdot 51$ | 4 I $40 \cdot 5$ | $2 \cdot 46$ |
| 29 | $\begin{array}{llll}3 & 43 & 49 \cdot 8\end{array}$ | $2 \cdot 79$ | $3{ }^{3} 46634 \cdot 9$ | 2.72 | 349 16.I | $2 \cdot 65$ | 3 51 53.5  <br> 3 4   | 2.59 | $\begin{array}{llll}3 & 54 & 27 \cdot 3\end{array}$ | 2.53 | $\begin{array}{llll}3 & 56 & 57 \cdot 7\end{array}$ | 2.48 |
| 30 | $\begin{array}{llll}3 & 3^{8} & 56 \cdot 5\end{array}$ | 2.83 | 3 4I 44-I | $2 \cdot 76$ |  | 2.69 | $\begin{array}{llll}3 & 47 & 6 \cdot 7\end{array}$ | $2 \cdot 62$ | $34942 \cdot 2$ | 2.56 | 35214.2 | $2 \cdot 50$ |
| 3 I | 334 I.8 | +2.87 | 3 36 $5 I \cdot 9$ | +2.80 | 339 37.5 | $+2 \cdot 72$ | $\begin{array}{lllll}3 & 42 & 18 \cdot 9\end{array}$ | +2.66 | $34456 \cdot 3$ | +2.59 | 34729.9 | $+2.53$ |
| 32 | $\begin{array}{llll}3 & 29 & 5 \cdot 5\end{array}$ | 2.92 | $\begin{array}{llll}3 & 31 & 58 \cdot 3\end{array}$ | 2.84 | $3 \begin{array}{llll}3 & 34 & 46 \cdot 3\end{array}$ | $2 \cdot 76$ | $\begin{array}{llll}3 & 37 & 30 \cdot 0\end{array}$ | $2 \cdot 69$ | $\begin{array}{lll}3 & 40 & 9 \cdot 3\end{array}$ | $2 \cdot 62$ | $\begin{array}{lllll}3 & 42 & 44 \cdot 7\end{array}$ | 2.56 |
| 33 | $\begin{array}{llll}3 & 24 & 7 \cdot 5\end{array}$ | $2 \cdot 97$ | $\begin{array}{llll}3 & 27 & 3 \cdot 2\end{array}$ | $2 \cdot 89$ | $\begin{array}{llll}3 & 29 & 53.8\end{array}$ | 2.80 | $\begin{array}{llll}3 & 32 & 39 \cdot 8\end{array}$ | $2 \cdot 73$ | $\begin{array}{llll}3 & 35 & 21 \cdot 3\end{array}$ | $2 \cdot 66$ | $\begin{array}{lllll}3 & 37 & 58 \cdot 6\end{array}$ | $2 \cdot 59$ |
| 34 | $\begin{array}{llll}3 & 19 & 7 \cdot 6\end{array}$ | 3.02 | $\begin{array}{lll}3 & 22 & 6 \cdot 3\end{array}$ | 2.93 | $\begin{array}{llll}3 & 24 & 59 \cdot 8\end{array}$ | $2 \cdot 85$ | $\begin{array}{llll}3 & 27 & 48 \cdot 4 \\ 3 & 22 & 55 \cdot 5\end{array}$ | 2.77 | $\begin{array}{llll}3 & 30 & 32 \cdot 1 \\ 3 & 25 & 41 \cdot 7\end{array}$ | 2.69 | $\begin{array}{llll}3 & 33 & \text { II.5 }\end{array}$ | 2.62 |
| 35 | $\begin{array}{lllll}3 & 14 & 5 \cdot 7\end{array}$ | $3 \cdot 08$ | $\begin{array}{llll}3 & 17 & 7 \cdot 7\end{array}$ | $2 \cdot 99$ | $\begin{array}{llll}3 & 20 & 4 \cdot 2\end{array}$ | 2.90 | $\begin{array}{llll}3 & 22 & 55 \cdot 5\end{array}$ | 2.81 | $32541 \cdot 7$ | 2.73 | $\begin{array}{llll}3 & 28 & 23 \cdot 2\end{array}$ | $2 \cdot 65$ |
| 36 | $\begin{array}{lll}3 & 9 & 1.6\end{array}$ | $+3.14$ | $\begin{array}{lll}3 & 12 & 7 \cdot 2\end{array}$ | $+3.04$ | $\begin{array}{llll}3 & 15 & 6 \cdot 9\end{array}$ | $+2.95$ | 3 I 8 I.O | +2.86 | 32049.9 | $+2.77$ | $323 \begin{array}{lll}3 & 33.9\end{array}$ | +2.69 |
| 37 | $\begin{array}{llll}3 & 3 & 55 \cdot 1\end{array}$ | $3 \cdot 21$ | $\begin{array}{lll}3 & 7 & 4.5\end{array}$ | $3 \cdot 10$ | 310 | 3.00 | $\begin{array}{llll}3 & 13 & 5 \%\end{array}$ | 2.91 |  | 2.82 | $3 \begin{array}{llll}3 & 18 & 43 \cdot 1\end{array}$ | $2 \cdot 73$ |
| 38 | $25846 \cdot 0$ | $3 \cdot 28$ | $\begin{array}{llll}3 & 1 & 59.5\end{array}$ | $3 \cdot 17$ | $\begin{array}{lll}3 & 5 & 6.4\end{array}$ | 3.06 | $\begin{array}{lll}3 & 8 & 7 \cdot 1\end{array}$ | $2 \cdot 96$ | $\begin{array}{lll}3 & 11 & \text { I } 8\end{array}$ | 2.86 | $31351 \cdot 0$ | 2.78 |
| 39 | 25334.0 | $3 \cdot 36$ | $\begin{array}{llll}2 & 56 & 52 \cdot 0 \\ 2 & 51 & 416\end{array}$ | 3.24 | $\begin{array}{lrrr}3 & 0 & 2 \cdot 9 \\ 2 & 54 & 5 & \end{array}$ | $3 \cdot 13$ | $\begin{array}{rrrr} \\ 3 & 3 & 7 \cdot 2 \\ 2 & 58 & 5 \cdot 1\end{array}$ | 3.02 | 3 6 $5 \cdot 2$ <br> 3 1 $6 \cdot 7$ | 2.92 | $\begin{array}{llll}3 & 8 & 57 \cdot 4\end{array}$ | 2.82 2.87 |
| 40 | $24818 \cdot 8$ | 3.45 | 2 5I 4I•6 | $3 \cdot 32$ | $25456 \cdot 9$ | 3.19 | $25^{2} 58$ 5•1 | $3 \cdot 08$ | 3 I 6•7 | $2 \cdot 97$ | $3 \quad 4 \quad 2 \cdot 0$ | $2 \cdot 87$ |
| 41 | 243003 | $+3.54$ | $2 \begin{array}{llll}2 & 46 & 28 \cdot 3\end{array}$ | $+3.40$ | $24948 \cdot 3$ | $+3.27$ | $2 \begin{array}{llll}2 & 53 & 0.7\end{array}$ | +3.15 | $2{ }^{2} 5666 \cdot 1$ | +3.03 | $2 \begin{array}{lll}2 & 59 & 4.9\end{array}$ | +2.93 |
| 42 | $23737 \cdot 9$ | $3 \cdot 64$ | $2 \mathrm{LII}_{1} \mathrm{II} \cdot 6$ | 3.49 | $\begin{array}{lllll}2 & 44 & 36 \cdot 7\end{array}$ | $3 \cdot 35$ | $\begin{array}{lllll}2 & 47 & 53.8 \\ 2 & 42 & 43.9\end{array}$ | 3.22 | $\begin{array}{rrrr}2 & 51 & 3 \cdot 3 \\ 2 & 45 & 58 \cdot 0\end{array}$ | $3 \cdot 10$ | $\begin{array}{lll}2 & 54 & 5 \cdot 8 \\ 2 & 49 & 4 \cdot 4\end{array}$ | 2.98 |
| 43 | $2 \begin{array}{llll} & 32 & 11.3\end{array}$ | $3 \cdot 74$ | $2 \begin{array}{llll}2 & 35 & 51 \cdot 2\end{array}$ | 3.59 | $2 \begin{array}{llll}2 & 39 & \mathbf{2 r} \cdot 9\end{array}$ | $3 \cdot 44$ | $2 \begin{array}{llll}2 & 42 & 43 \cdot 9\end{array}$ | $3 \cdot 30$ | $\begin{array}{llll}2 & 45 & 58 \cdot 0 \\ 2 & 40 & 49\end{array}$ | $3 \cdot 17$ | $\begin{array}{lll}2 & 49 & 4.4\end{array}$ | 3.05 |
| 44 | $22640 \cdot 0$ | 3.86 | $\begin{array}{lll}2 & 30 & 26 \cdot 8\end{array}$ | 3.70 | $\begin{array}{llll}2 & 34 & 3 \cdot 5 \\ 2 & 28 & 4\end{array}$ | 3.53 | $\begin{array}{lllll}2 & 37 & 31 \cdot 0 \\ 2 & 3 & 1\end{array}$ | 3.39 | $\begin{array}{lllll}2 & 40 & 49 \cdot 8 \\ 2 & 35 & 38 \cdot 7\end{array}$ | 3.25 | $\begin{array}{rrrr}2 & 44 & 0 \cdot 7 \\ 2 & 38 & 5 \cdot 3\end{array}$ | 3.12 |
| 45 | 2213.5 | $4 \cdot 00$ | $22457 \cdot 7$ | $3 \cdot 81$ | 228 4I•I | 3.64 | 23214.5 | 3.48 | $23538 \cdot 7$ | $3 \cdot 33$ | 23854.3 | 3.19 |
| 46 | 21521.0 | +4.14 | 21923.5 | +3.94 | $2 \begin{array}{lll}2 & 23 & 14.3\end{array}$ | +3.76 | $\begin{array}{llllllll}2 & 26 & 54.2\end{array}$ | +3.58 | 2301243 | +3.42 | $233145 \cdot 1$ | +3.27 |
| 47 | $2931 \cdot 7$ | 4.31 | $\begin{array}{llll}2 & 13 & 43.5\end{array}$ | 4.09 | $21742 \cdot 5$ | 3.88 | $2 \begin{array}{llll}21 & 21 & 29.6\end{array}$ | $3 \cdot 70$ | 22560 | $3 \cdot 52$ |  | $3 \cdot 37$ |
| 48 | 2 $\quad 3 \quad 34 \cdot 8$ | 4.50 | 27857.0 | $4 \cdot 25$ | 21250 | 4.03 | $\begin{array}{lll}2 & 16 & 0.2\end{array}$ | 3.82 | $\begin{array}{lllllllllll}2 & 19 & 43.7\end{array}$ | 3.63 | $2 \begin{array}{llll}2 & 23 & 16.4\end{array}$ | 3.46 |
| 49 | I 5729.0 | $4 \cdot 71$ | 2. 2 $3 \cdot 0$ <br> 1.5 0.3  | 4.43 | $2{ }^{2} \quad 6 \quad 21 \cdot 2$ | $4 \cdot 19$ | 2 10 $25 \cdot 3$ | 3.96 | $\begin{array}{rrrr}2 & 14 & 16 \cdot 6 \\ 2 & 8 & 44 \cdot 2\end{array}$ | 3.76 3.8 | $\begin{array}{llll}2 & 17 & 56 \cdot 2 \\ 2 & 12 & 31.4\end{array}$ | 3.57 3.69 |
| 50 | I 5112.8 | 4.95 | $\begin{array}{lll}\text { I } & 56 & 0.3\end{array}$ | $4 \cdot 64$ | $2030 \cdot 1$ | $4 \cdot 37$ | $2 \quad 4 \quad 44 \cdot 2$ | 4.12 | 2844.2 | $3 \cdot 89$ | 212314 | 3.69 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | - A. | L. 1 | A. | L. 2 | A. | L. 3 | A. | L. $4^{\circ}$ | A. | L. $5{ }^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S.00 | S. | S. +.09 | 5. -4.62 | S. ${ }^{\text {S }}$ | 5. -4.62 | S. $+\quad .28$ | S. | S. $+\quad .37$ | S. | S. $+\quad .46$ | S. |
| 0 | -00 | $-4 \cdot 62$ | + 09 | $-4.62$ | + 18 | -4.62 | +.28 | -4.62 | +.37 | $-4.63$ | + 46 | 4.64 |
| 2 | -09 | $4 \cdot 62$ | $\cdot 00$ | $4 \cdot 62$ | +.09 | 4.62 | 18 $+\quad .09$ | $4 \cdot 62$ | - 28 | 4.63 | $\cdot 37$ | $4 \cdot 63$ |
| 4 | -19 | $4 \cdot 62$ | -.09 | $4 \cdot 62$ | -00 | 4.62 | + 09 | $4 \cdot 62$ | -18 | 4.62 | -28 | 4.63 |
| 6 | $\cdot 28$ | $4 \cdot 62$ | -19 | $4 \cdot 62$ | - . 09 | $4 \cdot 62$ | -00 | $4 \cdot 62$ | +.09 | $4 \cdot 62$ | 19 $+\quad .09$ | $4 \cdot 62$ |
| 8 | $\cdot 37$ | 4.63 | -28 | $4 \cdot 63$ | -19 | $4 \cdot 62$ | - 09 | $4 \cdot 62$ | -00 | $4 \cdot 62$ | +.09 | $4 \cdot 62$ |
| 10 | - 47 | $4 \cdot 64$ | -. 38 | $4 \cdot 63$ | - . 28 | 4.63 | - 19 | $4 \cdot 62$ | - . 09 | $4 \cdot 62$ | -00 | 4.62 |
| 12 | . 57 | 4.65 | . 47 | 4.64 | $\cdot 38$ | 4.63 | $\cdot 28$ | $4 \cdot 63$ | -19 | $4 \cdot 62$ | - .09 | $4 \cdot 62$ |
| 14 | . 67 | 4.67 | . 57 | 4.65 | -47 | $4 \cdot 64$ | $\cdot 38$ | $4 \cdot 63$ | - 28 | $4 \cdot 63$ | -18 | $4 \cdot 62$ |
| 16 | $\cdot 78$ | 4.68 | -67 | 4.67 | $\cdot 57$ | $4 \cdot 65$ | -47 | $4 \cdot 64$ | $\cdot 38$ | $4 \cdot 63$ | -28 | 4.63 |
| 18 | -88 | 4.70 | $\cdot 78$ | 4.68 | -68 | $4 \cdot 67$ | $\cdot 58$ | $4 \cdot 65$ | $\cdot 48$ | $4 \cdot 64$ | $\cdot 38$ | $4 \cdot 63$ |
| 20 | - 99 | 4.72 | -.89 | $4 \cdot 70$ | - . 78 | 4.68 | -. 68 | 4.67 | -. 58 | $4 \cdot 65$ | -. 48 | $4 \cdot 64$ |
| 22 | I-II | $4 \cdot 75$ | I.00 | $4 \cdot 72$ | . 89 | $4 \cdot 70$ | $\cdot 79$ | $4 \cdot 68$ | -68 | $4 \cdot 67$ | $\cdot 58$ | 4.65 |
| 24 | I. 23 | $4 \cdot 78$ | I•II | 4.75 | 1.00 | $4 \cdot 73$ | -90 | 4.70 | -79 | $4 \cdot 68$ | -69 | 4.67 |
| 26 | I 36 | 4.81 | I 24 | 4.78 | I 12 | $4 \cdot 75$ | I.OI | $4 \cdot 73$ | -90 | 470 | -79 | $4 \cdot 69$ |
| 28 | 1.49 | $4 \cdot 85$ | 1-37 | 4.82 | 1.25 | $4 \cdot 78$ | I'I3 | $4 \cdot 75$ | I 02 | 4.73 | -91 | 4.71 |
| 30 | - I. 63 | $4 \cdot 90$ | - I.50 | 4.86 | - I.38 | $4 \cdot 82$ | - I. 26 | $4 \cdot 79$ | -I'I4 | $4 \cdot 76$ | -I.03 | 4•73 |
| 32 | 1.79 | $4 \cdot 95$ | 1. 65 | 4.90 | 1.42 | $4 \cdot 86$ | 1.40 | $4 \cdot 83$ | I. 27 | 4.79 | I•5 | 4.76 |
| 34 | I 95 | $5 \cdot \mathrm{OI}$ | I.8I | $4 \cdot 96$ | 1.67 | 4.91 | 1.54 | $4 \cdot 87$ | I.4I | 4.83 | I-28 | $4 \cdot 79$ |
| 36 | $2 \cdot 13$ | 5.09 | I.98 | $5 \cdot 03$ | I. 84 | $4 \cdot 97$ | r.70 | 4.92 | I.56 | $4 \cdot 87$ | $1 \cdot 43$ | 4.83 |
| 38 | $2 \cdot 33$ | 5.17 | $2 \cdot 17$ | 5.10 | 2.01 | $5 \cdot 04$ | I.86 | 4.98 | I•72 | $4 \cdot 93$ | 1.58 | 4.88 |
| 40 | $-2.56$ | $5 \cdot 28$ | $-2.38$ | $5 \cdot 20$ | $-2.21$ | $5 \cdot 12$ | $-2.05$ | $5 \cdot 05$ | $-\mathrm{r} \cdot 89$ | 4.99 | -I.74 | 4.94 |
| 42 | 2.81 | 5.41 | 2.62 | $5 \cdot 31$ | 2.43 | $5 \cdot 22$ | $2 \cdot 25$ | 5.14 | $2 \cdot 09$ | $5 \cdot 06$ | 1.92 | 5.00 |
| 44 | $3 \cdot 11$ | $5 \cdot 56$ | $2 \cdot 88$ | $5 \cdot 45$ | $2 \cdot 68$ | $5 \cdot 34$ | 2.49 | $5 \cdot 24$ | 2.30 | $5 \cdot 16$ | $2 \cdot 12$ | $5 \cdot 08$ |
| 46 | 3.45 | $5 \cdot 76$ | $3 \cdot 20$ | $5 \cdot 62$ | $2 \cdot 96$ | $5 \cdot 49$ | $2 \cdot 75$ | $5 \cdot 37$ | $2 \cdot 54$ | $5 \cdot 27$ | $2 \cdot 35$ | $5 \cdot 18$ |
| 48 | 3.86 | $6 \cdot 02$ | $3 \cdot 57$ | $5 \cdot 84$ | 3.30 | $5 \cdot 68$ | 3.05 | $5 \cdot 54$ | 2.82 3.15 | 5.41 5.59 | 2.60 2.91 | $5 \cdot 30$ 5.45 |
| 50 | $4 \cdot 38$ | $6 \cdot 35$ | 4.02 | $6 \cdot 13$ | $3 \cdot 71$ | $5 \cdot 92$ | 3.41 | $5 \cdot 74$ | $3 \cdot 15$ | $5 \cdot 59$ | $2 \cdot 91$ | $5 \cdot 45$ |

## LATITUDE $30^{\circ}$.

DECLINATION-SAME NAME AS—LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7^{\circ}$ | $\begin{aligned} & \text { Dec } \\ & \text { Var } \end{aligned}$ | $8^{\circ}$ | Ded | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{lll} \mathrm{H} . & \text { M. } & \mathrm{S} \\ 6 & \text { I3 } & 54 \end{array}$ |  | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & \text { 16 } & \text { 15. } \end{array}$ | $+2 \cdot 3$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { I8 } & 37 \cdot 0 \end{array}$ | $+2 \cdot 36$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 20 & 59 \cdot 2 \end{array}\right.$ | $+2 \cdot 38$ | $\begin{array}{cc} \mathrm{H} . \mathrm{M} . & \mathrm{S} . \\ 6 & 23 \\ 22 \cdot 3 \end{array}$ | $+2 \cdot 39$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 6 & 25 & 46 \cdot 4 \end{array}$ | $+2.4 \mathrm{I}$ |
| Io | $\begin{array}{lllll}5 & 27 & 35 \cdot 5\end{array}$ | $2 \cdot 2$ | $\begin{array}{llllllllllllll}5 & 29 & 5 \times\end{array}$ | 2.26 | $\begin{array}{lllll}5 & 32 & 7 \cdot 3\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}5 & 34 & 22 \cdot 6\end{array}$ | $2 \cdot 25$ | $5 \begin{array}{llll}5 & 36 & 37 \cdot 7\end{array}$ | $2 \cdot 25$ | $\begin{array}{lllll}5 & 38 & 52 \cdot 6\end{array}$ | 2.25 |
| 12 | $\begin{array}{llll}5 & 18 & 21.3\end{array}$ | $2 \cdot 27$ | $\begin{array}{lllllllllllllll}5 & 20 & 37 \cdot 1\end{array}$ | $2 \cdot 26$ | $\begin{array}{lllll}5 & 22 & 52 \cdot 3\end{array}$ | $2 \cdot 25$ | $\begin{array}{llll}5 & 25 & 7 \cdot 0\end{array}$ | 4 | $52721 \cdot 0$ | 3 | $5 \quad 2934 \cdot 8$ | 23 |
| 14 | $5 \quad 9 \quad 7 \cdot 0$ | $2 \cdot 27$ | 5 II 22.8 | $2 \cdot 26$ | $5 \begin{array}{llll}5 & 13 & 37\end{array}$ | $2 \cdot 24$ | 5 15 5I.9 | 23 | $\begin{array}{llll}5 & 18 & 5 \cdot 3\end{array}$ | 2 | $52018 \cdot 1$ | 1 |
| 16 | $45952 \cdot 4$ | $2 \cdot 28$ | $\begin{array}{llll}5 & 2 & 8 \cdot 5\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}5 & 4 & 23.4\end{array}$ | $2 \cdot 24$ | $\begin{array}{llll}5 & 6 & 37 \cdot 3\end{array}$ | $2 \cdot 22$ | $\begin{array}{lllll}5 & 8 & 50 \cdot 3\end{array}$ | $2 \cdot 21$ | 5 II $2 \cdot 3$ | $2 \cdot 19$ |
| 18 | $45037 \cdot 5$ | +2.29 | 45254.0 | +2.26 | 455092 | $+2.2$ | 457 | +2.22 | $45935 \cdot 7$ | $+2.20$ | $5 \quad 1 \begin{array}{lll}5 & 47 \\ 4\end{array}$ | 8 |
| 20 | $44 \mathrm{I} 2 \mathrm{I} \cdot 8$ | $2 \cdot 3$ | 4433 | 2.27 | $445 \quad 54 \cdot 6$ | $2 \cdot 25$ | 448 8.8 | 22 | 45021.4 | $2 \cdot 20$ | $4 \quad 5232 \cdot 7$ | -18 |
| 22 | 4324 1 | $2 \cdot 32$ | 43423.4 | 9 | $43639 \cdot 7$ | $2 \cdot 26$ | $43^{48} 54.3$ | 3 | 44171 | $2 \cdot 20$ | 44318.4 | 17 |
| 24 | 422 47* | $2 \cdot 34$ | $425 \quad 6 \cdot 7$ | $2 \cdot 31$ | 427 24-1 | 7 | 42939 | . 24 | $43152 \cdot 6$ | $2 \cdot 20$ | $\begin{array}{lll}4 & 34 & 4 \cdot I\end{array}$ | I8 |
| 26 | $41327 \cdot 8$ | $2 \cdot 37$ | $4 \begin{array}{llllllllll}4 & 188\end{array}$ | $2 \cdot$ | 418874 | 2.29 | $42023 \cdot 7$ | $2 \cdot 25$ | $4 \begin{array}{lllll}4 & 22 & 377\end{array}$ | $2 \cdot 22$ | $42449 \cdot 6$ |  |
| 28 | 446 | $+2.41$ | $\begin{array}{llll}4 & 6 & 29.4\end{array}$ | $+2.36$ | $4 \quad 8 \quad 49 \cdot 5$ | $+2.31$ | 4 II 7-1 | $+2.27$ | $4 \begin{array}{llll}4 & 22.2\end{array}$ | $+2.23$ | 4 I5 $34 \cdot 7$ | 9 |
| 3 | $35442 \cdot 7$ | 2.45 | $\begin{array}{llll}3 & 57 & 7 \cdot 9\end{array}$ | $2 \cdot 39$ | 35930 | $2 \cdot 34$ | 4 I 49 | 9 | $\begin{array}{lll}4 & 4 & 5 \cdot 6\end{array}$ | 5 | $4 \begin{array}{llll}4 & 6 & 19.2\end{array}$ | 20 |
| 32 | $\begin{array}{llll}3 & 45 & 16 \cdot 2\end{array}$ | $2 \cdot 49$ | 33 47  | 2.43 | 35086 | $2 \cdot 3$ | $\begin{array}{llll}3 & 52 & 29 \cdot 7\end{array}$ | 33 | 354177.7 | $2 \cdot 27$ | $\begin{array}{llll}3 & 57 & 2.6\end{array}$ | $2 \cdot 22$ |
| 33 | 34031 | $2 \cdot 52$ | 343 1-3 | 6 | $345 \quad 27 \cdot 0$ | 40 | 34749 | $2 \cdot 34$ | $3 \begin{array}{lll}30 & 8 \cdot 2\end{array}$ | $2 \cdot 29$ | 35224.0 | 23 |
| 34 | 33546 | $2 \cdot 55$ |  | $2 \cdot 48$ | 34044 | $2 \cdot 42$ | $\begin{array}{lll}3 & 43 & 8 \cdot 3\end{array}$ | $2 \cdot 36$ | $\begin{array}{lllllllllllllllll}3 & 45 & 28 \cdot 3\end{array}$ | $2 \cdot 30$ | 34744.9 | $2 \cdot 25$ |
| 35 | 3 3I 0.3 | $+2.5$ | $3 \begin{array}{lll}33 & 33 \cdot 1\end{array}$ | +2.51 | $\begin{array}{llll}3 & 36 & 1.8\end{array}$ | +2.45 | $\begin{array}{llll}3 & 38 & 26 \cdot 7\end{array}$ | +2.38 | $34047 \cdot 8$ | +2.32 | $\begin{array}{lll}3 & 43 & 5.4\end{array}$ | 26 |
| 36 | 32613.0 |  | $\begin{array}{llll}3 & 28 & 47 \cdot 7\end{array}$ | $2 \cdot 54$ | 3 31 18.1 | 2.47 | $\begin{array}{llll}3 & 33 & 44.4\end{array}$ | $2 \cdot 40$ | $3 \begin{array}{lll}36 & 6 \cdot 8\end{array}$ | $2 \cdot 34$ | $\begin{array}{llll}3 & 38 & 25 \cdot 5\end{array}$ | 8 |
| 37 | $\begin{array}{llll}3 & 21 & 24.6\end{array}$ | $2 \cdot 65$ | $\begin{array}{llll}3 & 24 & I \cdot 3\end{array}$ |  | $\begin{array}{llll}3 & 26 & 3\end{array}$ |  | $\begin{array}{llll}3 & 29 & 1.4\end{array}$ |  | $\begin{array}{llll}3 & 31 & 25 \cdot 2\end{array}$ | $2 \cdot$ | $\begin{array}{lllll}3 & 33 & 45^{\circ}\end{array}$ | 30 |
| 38 | 316350 |  | 31913.9 |  | 3214 | $2 \cdot 53$ | $\begin{array}{lllllllllllllllll}3 & 24 & 17\end{array}$ |  | 32642.9 | $2 \cdot 39$ | $\begin{array}{llll}3 & 29 & 4^{\circ} 0\end{array}$ | 32 |
| 39 | 3 II 44.0 | $2 \cdot 73$ | 3 I4 25.2 |  | 31715 |  | 3 19 33.0 |  | 32159.9 | 2.41 | 32422.4 | 34 |
| 40 | 3651.5 | +2.7 | $3 \quad 9 \quad 35 \cdot 3$ | $+2.69$ | 31213.9 | $+2 \cdot 60$ | 3 I4 47*4 | +2.52 | 31716.0 | $+2.4$ | 3 I9 40.I | +2.36 |
| 41 | 3 I 57.4 |  | $3444^{\circ} 0$ |  | $3725^{\circ} 0$ | 2.6 | 3100.7 | 2.55 | $31231 \cdot 3$ | $2 \cdot 47$ | 3 I4 57.1 | $\cdot 39$ |
| 42 | 257 | $2 \cdot 88$ | $2595 \mathrm{I} \cdot 2$ |  | $\begin{array}{llll}3 & 2 & 34 \cdot 9\end{array}$ | $2 \cdot 68$ | $\begin{array}{llll}3 & 5 & 12.9\end{array}$ |  | 374 | $2 \cdot 5$ | $3 \begin{array}{llll}3 & 10 & 13.2\end{array}$ | 42 |
| 43 | 252 |  | $25456 \cdot 7$ |  | $25743 \cdot 3$ |  | $3 \begin{array}{llll}3 & 0 & 23.9\end{array}$ |  | $3 \quad 25$ |  | $\begin{array}{llll}3 & 5 & 28 \cdot 4\end{array}$ | -45 |
| 44 | 247 | 3 | 2500.4 |  | $25^{2} 5250 \cdot 1$ | $2 \cdot 7$ | 25533.5 | $2 \cdot 67$ | $2 \begin{array}{llll}28 & 10 \cdot 9\end{array}$ | $2 \cdot 58$ | $3 \quad 0 \quad 42.6$ |  |
| 45 | $242 \quad 2 \cdot 0$ | $+3.06$ | $245 \quad 2 \cdot 1$ | +2.94 | 247 | +2.83 | 25041.6 | $+2.72$ | 253121.7 | +2.62 | $2 \begin{array}{llll}2 & 55 & 55 \cdot 8\end{array}$ | $+2.52$ |
| 46 | $23657 \cdot 3$ | $3 \cdot 1$ | $240 \quad 1.6$ | 3.01 | $2 \begin{array}{llllllll}2 & 42 & 58\end{array}$ | 2.89 | $24548 \cdot 0$ | 2.77 | $24831 \cdot 0$ | 2.66 | 251177 | 56 |
| 47 | 23149 | $3 \cdot 22$ | $23458 \cdot 6$ | 3.08 |  | $2 \cdot 95$ | $24052 \cdot 6$ | 2.83 | $243188 \cdot 8$ | 2.71 | $2 \begin{array}{llllllll}2 & 46 & 18\end{array}$ | . 60 |
| 48 | 22639.3 | 3 | $22953 \cdot 0$ | $3 \cdot 16$ | $\begin{array}{llll}2 & 32 & 58 \cdot 1\end{array}$ | 2 |  | 2.89 | $\begin{array}{lllllllll}2 & 38 & 44\end{array}$ |  |  | . 65 |
| 49 | $22125 \cdot 2$ | 3.40 | $22444 \cdot 3$ | $3 \cdot 24$ | 22754.3 | 3.09 | $23055 \cdot 7$ | $2 \cdot 96$ | $23349 \cdot 0$ | $2 \cdot 83$ | 23634.8 | 2.70 |
| 50 | 2 I6 763 | +3.5 | 219 | +3.33 | 2224 | $+3 \cdot 18$ | 22553 | +3.03 | 228 | +2.89 | $23140 \cdot 5$ |  |
| 51 | 2 IO 45\% | 3.62 |  | 3.44 |  | 3.27 | $22048 \cdot 8$ | $3 \cdot 11$ |  | -2.96 | 22644.2 | . 82 |
| 52 | 251776 | 3.75 | 28856.6 | 5 | $21224{ }^{\circ}$ | $3 \cdot 37$ | $21540 \cdot 8$ | 3.20 | $2 \begin{array}{lllll}2 & 18 & 47 \cdot 9\end{array}$ | $3 \cdot 04$ | $22145 \%$ | 89 |
| 53 | I $5944 \%$ | 3.90 | $\begin{array}{llll}2 & 3 & 3 \mathrm{I} \cdot 8\end{array}$ | 3.6 | $\begin{array}{lll}2 & 7 & 6.4\end{array}$ | 3.48 | 2 10 29.5 | $3 \cdot 30$ | $\begin{array}{llllllllll}2 & 13 & 420\end{array}$ | $3 \cdot 13$ | 2 I6 44.6 | 2.97 |
| 54 | I $54 \quad 5 \cdot 2$ | 4.06 | $\begin{array}{llll}1 & 58 & \text { I } 6\end{array}$ |  | I 44.2 | $3 \cdot 61$ | $2 \quad 5 \quad 14.3$ | 3.40 | $832 \cdot 8$ | $3 \cdot 22$ | 2 II $40 \cdot 8$ | 3.05 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. | A. | L. 8 | A. | L. | A. | L. 1 | - A. | L. 11 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $+\quad .56$ | $\begin{gathered} s . \\ -4.65 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +.65 \end{aligned}$ | $\begin{gathered} \text { s. } \\ -4.66 \end{gathered}$ | $\begin{aligned} & \mathrm{s} \\ & +\quad 75 \end{aligned}$ | $\begin{gathered} s . \\ -4.68 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .85 \end{aligned}$ | $\begin{gathered} \mathrm{S} \\ -4.69 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & +\quad .94 \end{aligned}$ | $\begin{gathered} s . \\ -4 \cdot 7 I \end{gathered}$ | $\begin{gathered} s . \\ +1 \cdot 04 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 73 \end{gathered}$ |
| 2 | - 46 | 4.64 | -.56 | 4.65 | . 65 | $4 \cdot 66$ | .75 | $4 \cdot 68$ | . 85 | $4 \cdot 70$ | . 94 | 4.71 |
| 4 | -37 | $4 \cdot 63$ | $\cdot 46$ | 4.64 | $\cdot 56$ | $4 \cdot 65$ | -65 | $4 \cdot 66$ | $\cdot 75$ | $4 \cdot 68$ | . 85 | $4 \cdot 70$ |
| 6 | -28 | 4.63 | -37 | $4 \cdot 63$ | - 47 | $4 \cdot 64$ | - 56 | $4 \cdot 65$ | . 65 | 4.66 | $\cdot 75$ | 4.68 |
| 8 | -19 | $4 \cdot 62$ | -28 | $4 \cdot 63$ | -37 | $4 \cdot 63$ | -47 | $4 \cdot 64$ | -56 | $4 \cdot 65$ | -66 | $4 \cdot 66$ |
| 10 | $+.09$ | $4 \cdot 62$ | + .19 | $4 \cdot 62$ | + 28 | $4 \cdot 63$ | + 38 | $4 \cdot 63$ | + 47 | $4 \cdot 64$ | + 56 | $4 \cdot 65$ |
| 12 | .00 | 4.62 | + 10 | $4 \cdot 62$ | -19 | 4.62 | -28 | $4 \cdot 63$ | -38 | 4.63 | + 47 | $4 \cdot 64$ |
| 14 | - .09 | $4 \cdot 62$ | -00 | $4 \cdot 62$ | -10 | $4 \cdot 62$ | -19 | 4.62 | -29 | $4 \cdot 63$ | -38 | $4 \cdot 63$ |
| 16 | - 18 | $4 \cdot 62$ | - .09 | $4 \cdot 62$ | + 01 | $4 \cdot 62$ | -10 | $4 \cdot 62$ | -20 | $4 \cdot 62$ | -29 | $4 \cdot 63$ |
| 18 | $\cdot 28$ | $4 \cdot 62$ | -18 | $4 \cdot 62$ | -.08 | 4.62 | + 01 | 4.62 | -II | $4 \cdot 62$ | -20 | $4 \cdot 62$ |
| 20 | -.38 | $4 \cdot 63$ | - . 28 | $4 \cdot 63$ | - . 18 | $4 \cdot 62$ | -.08 | 4.62 | + .OI | $4 \cdot 62$ | + 111 | 4.62 |
| 22 | - 48 | $4 \cdot 64$ | $\cdot 38$ | 4.63 | -28 | $4 \cdot 63$ | -18 | $4 \cdot 62$ | - .08 | $4 \cdot 62$ | +.02 | $4 \cdot 62$ |
| 24 | -58 | $4 \cdot 65$ | -48 | $4 \cdot 64$ | $\cdot 37$ | $4 \cdot 63$ | -27 | $4 \cdot 63$ | -17 | $4 \cdot 62$ | -.07 | $4 \cdot 62$ |
| 26 | . 69 | $4 \cdot 67$ | - 58 | $4 \cdot 65$ | -48 | $4 \cdot 64$ | -37 | $4 \cdot 63$ | -27 | $4 \cdot 62$ | -17 | $4 \cdot 62$ |
| 28 | -80 | $4 \cdot 69$ | . 69 | 4.67 | - 58 | $4 \cdot 65$ | -47 | $4 \cdot 64$ | -37 | 4.63 | $\cdot 26$ | $4 \cdot 62$ |
| 30 | - 91 | 4.71 | -.80 | $4 \cdot 69$ | -. 69 | $4 \cdot 67$ | -. 58 | $4 \cdot 65$ | - 47 | $4 \cdot 64$ | -.36 | $4 \cdot 63$ |
| 32 | 1.03 | $4 \cdot 73$ | -92 | $4 \cdot 71$ | -80 | 4.69 | -69 | $4 \cdot 67$ | - 58 | $4 \cdot 65$ | $\cdot 47$ | $4 \cdot 64$ |
| 34 | I•I6 | $4 \cdot 76$ | $1 \cdot 04$ | $4 \cdot 73$ | -92 | $4 \cdot 71$ | -80 | $4 \cdot 69$ | -69 | $4 \cdot 67$ | -57 | $4 \cdot 65$ |
| 36 | I 30 | $4 \cdot 80$ | I'I7 | $4 \cdot 76$ | I. 05 | $4 \cdot 73$ | -92 | $4 \cdot 71$ | -80 | $4 \cdot 69$ | -69 | $4 \cdot 67$ |
| 38 | I.44 | $4 \cdot 84$ | I-3I | $4 \cdot 80$ | I•I8 | $4 \cdot 77$ | I.05 | $4 \cdot 74$ | -93 | $4 \cdot 71$ | -80 | $4 \cdot 69$ |
| 40 | - I. 60 | 4.89 | -1.46 | $4 \cdot 84$ | - I. 32 | 4.80 | - I. 19 | $4 \cdot 77$ | - I.06 | 4.74 | - 93 | 4.71 |
| 42 | 1.77 | 4.94 | I 62 | 4.90 | 1.47 | 4.85 | I.33 | $4 \cdot 80$ | I•19 | 4.77 | I.06 | $4 \cdot 74$ |
| 44 | I.96 | $5 \cdot 02$ | I.80 | 4.95 | I. 64 | 4.90 | I.49 | 4.85 | I 34 | $4 \cdot 8 \mathrm{I}$ | I. 20 | $4 \cdot 77$ |
| 46 | 2.17 | 5.10 | 1.99 | 5.03 | I.81 | 4.96 | I. 66 | 4.91 | I-50 | $4 \cdot 86$ | I 35 | 4.81 |
| 48 | 2.40 | $5 \cdot 21$ | $2 \cdot 20$ | $5 \cdot 12$ | 2.01 | $5 \cdot 04$ | I. 85 | $4 \cdot 97$ | I. 68 | 4.91 | I 52 | 4.86 |
| 50 | $-2.67$ | $5 \cdot 33$ | $-2.45$ | $5 \cdot 23$ | $-2.34$ | $5 \cdot 14$ | $-2.06$ | 5.06 | - 1.88 | 4.98 | - I•70 | $4 \cdot 92$ |
| 52 | 2.99 | $5 \cdot 50$ | $2 \cdot 74$ | $5 \cdot 37$ | $2 \cdot 61$ | $5 \cdot 26$ | $2 \cdot 30$ | 5.16 | $2 \cdot 10$ | $5 \cdot 07$ | 1.90 | $5 \cdot 00$ |
| 54 | $3 \cdot 37$ | 5•71 | 3.19 | $5 \cdot 55$ | $2 \cdot 91$ | $5 \cdot 4 \mathrm{I}$ | $2 \cdot 57$ | $5 \cdot 30$ | $2 \cdot 35$ | 5.18 | $2 \cdot 13$ | $5 \cdot 09$ |

## 124 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. Latitude $30^{\circ}$.

DECLINATION-SAME NAME AS-LATITUDE.

|  | $12{ }^{\circ}$ |  | $13^{\circ}$ |  | $14^{\circ}$ |  | $15^{\circ}$ |  | $16^{\circ}$ |  | 1 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| İ |  |  |  |  |  |  |  |  |  |  |  |  |
| I2 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 5223 |  | 52 |  | 52 |  | 529 |  | 531 |  | 6 |  |
|  | 5 |  | 51 |  | 517 |  | 519 |  | 521 |  |  |  |
| 18 | 5 | +2.17 | + 56 | 2.15 | +5859 | +2.14 | 5 | +2.13 | 512 | +2.12 | 51438.6 | +2.1 |
| 20 | 454 |  | 456 |  | 4585 |  |  |  | 5 |  |  |  |
|  | 4 <br> 4 <br> 4 <br> 4 6 |  | 4 4 4 4 4 |  | 449 |  | 451493 |  | 45353 |  | 45557 |  |
| 26 | ${ }_{4}^{4} 26$ |  | 429 |  | $4{ }_{4}^{4}$ | 2.09 | 433 |  | $43520 \cdot$ | 2.03 | $4372 x \cdot$ |  |
| 28 | $41745 \cdot 1$ | $+2.15$ | 419 | +2.12 | 42159.2 |  | 4 | +2.05 | $\begin{array}{llll}4 & 26 & 5.3 \\ 4 & \\ 4 & 50.5\end{array}$ |  |  |  |
|  |  |  |  |  | ${ }^{4} 12$ |  | 414 |  | $4 \begin{array}{llll}16 & 50.5\end{array}$ |  | 418 |  |
|  | 4 3 3 3 |  | 46 |  | 4 |  |  |  | 4 I 2 |  | 4 |  |
| 33 | 354 | $2 \cdot 19$ | $\begin{array}{llll}4 & 56 & 46.3\end{array}$ | 2.14 | 4 | 2.09 | 4 | . 05 | 4 |  |  | r.9 |
|  |  |  | $\begin{array}{llll}32 & 8.5\end{array}$ |  | 35415.8 |  | 3 |  | 3 |  |  |  |
|  |  |  |  |  | 34 |  | 35142.9 |  | 353447 |  |  |  |
|  |  |  |  |  | 45 |  |  |  | 3 <br> 3 <br> 3 <br> 3 7.5 | 2.01 |  |  |
| $\begin{aligned} & 37 \\ & 38 \end{aligned}$ | $\begin{array}{llll} 3 & 36 & 1 \\ 3 & 31 & 21 \end{array}$ | 2.24 2.25 | 3 3 | 2.18 | 33 |  | 3 |  | 30.2 |  | 34629 |  |
| 39 | 3 | + | 328 |  | 3 |  | $\begin{array}{llll}3 & 38 \\ 3 & 12.2\end{array}$ | +2 | 335 |  |  |  |
|  | 3 |  | 324 |  |  |  |  |  |  |  | 3 28.1 |  |
| $\begin{aligned} & 4 \mathrm{I} \\ & 42 \end{aligned}$ |  |  | $\begin{array}{ll}3 & 19 \\ 3 & 19\end{array}$ |  | 3 3 3 3 3 |  | 31 |  | 3 |  | $\begin{array}{ccc}3 & 28 & 0 \cdot 1 \\ 3 & 23 & 22 \cdot 5\end{array}$ |  |
| 43 | $\begin{array}{lllll}3 & 7 & 52 \cdot 9\end{array}$ | 2.37 | 3 I |  | 31 |  | 314 | I3 | 3 1643 <br> 1  |  | 31844 |  |
|  |  |  | I 1 |  |  |  |  | +2.15 |  |  |  |  |
| 45 | $2$ |  | 256 |  |  |  | $\begin{array}{llll}3 & 5 & 17 \\ 3 & \text { O } & 36\end{array}$ |  | $\begin{array}{llll}3 & 725.2\end{array}$ |  | 3 |  |
| 4 | $2{ }_{2} 4851.3$ |  | 251 |  |  | $2 \cdot 31$ | $25555^{\circ}$ |  | 258 |  | $\bigcirc 10$ |  |
| 48 | 44 |  |  | $2 \cdot 44$ |  | $2 \cdot 34$ | 251 |  | 53 |  |  |  |
|  | $\begin{array}{lllll}2 & 39 & 13.5\end{array}$ |  |  | +2 |  |  | 246 |  | 2 | +2.17 |  | +2.08 |
|  |  |  | 2 |  | 234 |  | $1{ }^{2} 41$ |  | 24 |  | 24 |  |
|  |  |  | 227 |  | 229 |  | $\begin{array}{llll}2 & 3 \\ 2 & 32 & 15 \cdot 5\end{array}$ | $2 \cdot 3$ | 2 3434 |  | 246 <br> 2 <br> 47 |  |
| 53 |  |  | 2 |  | $\begin{array}{llll}2 & 24 & 59 \cdot 5\end{array}$ | 2.55 | 227 |  | 2.2950 |  | $2{ }^{2}$ |  |
|  | 2 |  | 21727.7 |  |  |  | 222 |  | $2254 \cdot 1$ |  | 2 |  |
|  | $\begin{array}{llll}2 & 9 & 37 \cdot 0 \\ 2 & 4 & 32 \cdot 2\end{array}$ |  | 2 12 <br> 2 7 <br>  30.4 |  | $\begin{array}{llll}2 & 15 & 14.5 \\ 2 & \text { IO } & 10.0\end{array}$ |  | 2 |  | 2 20 <br> 2 15 | 2.39 2.44 | $\begin{array}{llll}2 & 22 & 36 \cdot 3 \\ 2 & 17 & 50 \cdot 5\end{array}$ |  |
| 57 | 5924 | $3 \cdot 15$ | 228.0 |  | 212 |  |  |  |  |  |  |  |
| 58 | 54 |  | 57 |  | $2020 \%$ |  | 238 |  | 246 |  | 28 |  |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\underset{+\mathrm{r} \cdot \mathrm{I}_{4}}{\mathrm{~s}}$ | $\begin{gathered} \mathrm{s} . \\ -4.75 \end{gathered}$ | $\begin{array}{r} 1 \cdot 24 \\ +1 \cdot 20 \end{array}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 78 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ +\mathrm{r} \cdot 34 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 8 \mathrm{I} \end{gathered}$ | $\begin{aligned} & 1.45 \\ & +1.45 \end{aligned}$ | $-4.84$ | $+1.55$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 87 \end{gathered}$ | $\stackrel{\mathrm{s} .}{+\mathrm{r} \cdot 65}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 90 \end{gathered}$ |
| 4 | -94 | 4.71 | I. 04 | 4.73 | I.14 | $4 \cdot 76$ | I 24 | 4.78 | ${ }_{1} 1.34$ | $4 \cdot 81$ | 1.44 | 4.84 |
| 8 | .75 | 4.68 | . 85 |  | . 94 | 4.71 | r. 8.4 | 4.73 | r.14 | 4.76 | I. 24 | 4.78 |
| ${ }^{12}$ | -57 | 4.65 4.63 | .66 | $4 \cdot 66$ $4 \cdot 64$ | . 78 | 4.68 4.65 | . 868 | 4.70 4.67 | . 95 | 4.72 4.68 | $\begin{array}{r}1.05 \\ \hline .87\end{array}$ | 4.74 4.70 4.6 |
| ${ }^{16}$ | -39 | 4.63 | 48 | $4 \cdot 64$ | . 58 |  |  | $4 \cdot 67$ | '77 |  | . 87 | 4.70 |
| 20 | + 21 | $4 \cdot 62$ | + 31 | 4.63 | + 40 | 4.64 | + 50 | $4 \cdot 64$ | + 60 | 4.66 | + 69 | 4.67 |
| 22 | -12 | $4 \cdot 62$ | . 22 | $4 \cdot 62$ | 31 | 4:63 | 41 | $4 \cdot 64$ | . 51 | $4 \cdot 65$ | . 61 | $4 \cdot 66$ |
| 24 | + 03 | $4 \cdot 62$ | I3 | $4 \cdot 62$ | $\cdot 22$ | 4:62 | $\cdot 32$ | $4 \cdot 63$ | 42 | $4 \cdot 64$ | 52 | $4 \cdot 65$ |
| 26 | -. 06 | $4 \cdot 62$ | +.03 | $4 \cdot 62$ | . 13 | $4 \cdot 62$ | -23 | $4 \cdot 62$ | 33 | 4.63 | $\cdot 44$ | $4 \cdot 64$ |
| 28 | . 16 | $4 \cdot 62$ | -. 06 | $4 \cdot 62$ | + .04 | $4 \cdot 62$ | -14 | $4 \cdot 62$ | 25 | $4 \cdot 62$ | $\cdot 35$ | 4.63 |
| 30 | - $\cdot 26$ | $4 \cdot 62$ | $\cdot 15$ | $4 \cdot 62$ | -.05 | $4 \cdot 62$ | + 05 | $4 \cdot 62$ | + 16 | $4 \cdot 62$ | + 26 | $4 \cdot 62$ |
| 32 | $\cdot 36$ | $4 \cdot 63$ | . 25 | $4 \cdot 62$ | 14 | $4 \cdot 62$ | - . 04 | 4.62 | +.07 | $4 \cdot 62$ |  | 4.62 |
| 34 36 36 | 46 | 4.64 4.65 | . 35 | 4.63 | 24 | 4.62 4.63 | . 13 | ${ }_{4}^{4} 622$ | - . T 2 | ${ }_{4}^{4.62}$ | + .08 | 4.62 4.62 |
| 36 | . 58 | $4 \cdot 65$ | - 46 | 4.64 | 5 | 4.63 | 23 | 4.62 | . 12 | 4.62 | --01 | 4.62 |
| 38 | 68 | $4 \cdot 67$ | . 56 | $4 \cdot 65$ | 45 | $4 \cdot 64$ | 33 | 4.63 | $\cdot 22$ | $4 \cdot 62$ | $\cdot 10$ | $4 \cdot 62$ |
| 40 | - 80 | $4 \cdot 69$ | . 68 | $4 \cdot 67$ | . 56 | $4 \cdot 65$ | $\cdot 44$ |  | $-{ }^{-32}$ | $4 \cdot 63$ | - . 20 | 4.62 |
| 42 | .93 | 4.71 | . 80 | 4.69 | $\cdot 67$ | $4 \cdot 67$ | . 55 | $4 \cdot 65$ | 42 | $4 \cdot 64$ | $\cdot 30$ | $4 \cdot 62$ |
| 44 | r.o6 | 4.74 | 93 | 4.71 | 79 | $4 \cdot 69$ | . 68 |  | -53 | 4.65 | -41 |  |
| 46 48 | r.2r | 4.77 4.81 | I. ${ }_{\text {1.21 }}$ | 4.74 4.77 | .92 $\mathbf{r} .06$ | 4.71 4.74 | .78 | 4.69 4.7 | . 67 | 4.66 | . 52 | 4.65 4.66 |
| 50 | -1.53 | 4.87 | -1.37 | $4 \cdot 82$ | -1.2I |  | - $1 \cdot 06$ | 4.74 | -91 | $4 \cdot 71$ | -. 76 | 4.68 |
| 52 | $1 \cdot 72$ | $4 \cdot 93$ | I. 54 | 4.87 | $1 \cdot 37$ |  | $1 \cdot 2 \mathrm{I}$ | $4 \cdot 77$ | 1.05 | 4.74 | . 89 | 4.75 |
| 54 | 1.92 | $5 \cdot 1$ | 1.74 | 4.94 | ${ }^{\text {r }}$ | $4 \cdot 87$ | I. ${ }^{\text {P }}$ | 4.82 | r 212 | 4.77 | r.04 | 4.73 |
| 56 | 2.18 | $5 \cdot 11$ | 1.97 | 5.02 | 1.76 |  | 1.57 | $4 \cdot 88$ | 1.38 | 4.82 | 1.20 | 4.77 |
| 58 | $2 \cdot 46$ | $5 \cdot 23$ | $2 \cdot 22$ | $5 \cdot 12$ | $2 \cdot 00$ | $5 \cdot 03$ | $1 \cdot 78$ | 4.95 | 1.58 | $4 \cdot 88$ | r.39 | $4 \cdot 82$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 125 LATITUDE $30^{\circ}$.
DECLINATION-SAME NAME AS-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 6 & 43 & 15 \circ \end{array}$ | $\begin{gathered} \mathrm{S} \\ +2 \cdot 60 \end{gathered}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 6 & 45 & 52 \cdot 0 \end{array}$ | $\begin{gathered} s . \\ +2 \cdot 63 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 48 & 3 \mathrm{I} \cdot 3 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ +2 \cdot 67 \end{gathered}$ | $\begin{array}{llc} \text { H. M. } \\ 6 & 5 \mathrm{I} & \text { I } 3 \cdot \end{array}$ | S. +2.72 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & 53 & 57 \cdot 4 \end{array}$ | S. $+2 \cdot 76$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 56 & 44^{\circ} 6 \end{array}$ | 5. +2.81 |
| 10 | $55440 \cdot 4$ | $2 \cdot 28$ | $\begin{array}{llllllllllll}5 & 56 & 57\end{array}$ | 2.29 | 559 I5.4 | $2 \cdot 30$ | 6 I 34.1 | $2 \cdot 32$ | $\begin{array}{lrr}6 & 3 & 53 \cdot 8\end{array}$ | $2 \cdot 34$ | $\begin{array}{lllll}6 & 614.7\end{array}$ | $2 \cdot 36$ |
| 12 | $\begin{array}{llllllllll}5 & 45 & 7.8\end{array}$ | $2 \cdot 23$ | $5 \quad 4721 \cdot 8$ | $2 \cdot 24$ | $54936 \cdot 2$ | $2 \cdot 24$ | 5 5I 5I•3 | $2 \cdot 26$ | $5 \begin{array}{lll}5 & 54 & 7 \cdot 0\end{array}$ | 2.27 | $55623 \cdot 6$ | $2 \cdot 28$ |
| 14 | $\begin{array}{llll}5 & 35 & 37 \cdot 8\end{array}$ | $2 \cdot 18$ | $\begin{array}{lllllllllll}5 & 37 & 48 \cdot 9\end{array}$ | $2 \cdot 18$ | 540002 | $2 \cdot 19$ | $\begin{array}{llll}5 & 42 & \text { II } \cdot 8\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}5 & 44 & 23 \cdot 9\end{array}$ | $2 \cdot 20$ | $54636 \cdot 5$ | $2 \cdot 2 \mathrm{I}$ |
| 16 | $512610 \cdot 3$ | $2 \cdot 14$ | $5 \quad 28$ 18-7 | $2 \cdot 14$ | $\begin{array}{llll}5 & 30 & 27 \cdot 2\end{array}$ | $2 \cdot 14$ | $\begin{array}{llll}5 & 32 & 35 \cdot 6\end{array}$ | 2.I4 | $53444 \cdot 2$ | $2 \cdot 14$ | $53653 \cdot 0$ | $2 \cdot 15$ |
| 18 | $51645{ }^{\circ} \mathrm{O}$ | $+2.10$ | 5 18 51.0 | $+2 \cdot 10$ |  | $+2.09$ | $\begin{array}{lll}5 & 23 & 2 \cdot 2\end{array}$ | +2.09 | $\begin{array}{llll}5 & 25 & 7.5\end{array}$ | $+2.09$ | 52712.9 | $+2.09$ |
| 20 | $57821 \cdot 7$ | 2.07 | $\begin{array}{llll}5 & 9 & 25.5\end{array}$ | 2.06 | $\begin{array}{llll}5 & \text { II } & 28 \cdot 7\end{array}$ | 2.05 | 5 I3 3 I.4 | 2.04 | $\begin{array}{lllll}5 & 15 & 33 \cdot 7 \\ 5 & 6 & 2.5\end{array}$ | 2.04 | $\begin{array}{llllll}5 & 17 & 35 \cdot 8 \\ 5 & 8 & 1.5\end{array}$ | 2.03 |
| 22 | 458 0.1 | 2.03 | $5 \quad 0 \quad 1 \cdot 9$ | $2 \cdot 02$ | $\left[\begin{array}{lll}5 & 2 & 2.8\end{array}\right.$ | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}5 & 4 & 30\end{array}$ | $2 \cdot 00$ | $\begin{array}{llll}5 & 6 & 2 \cdot 5\end{array}$ | I-99 | $\begin{array}{llll}5 & 8 & 1.5\end{array}$ | I. 98 |
| 24 | $44840 \cdot 2$ | 2.01 | $45040 \cdot \mathrm{I}$ | I.99 | $\begin{array}{llll}4 & 52 & 38 \cdot 9\end{array}$ | I.97 | $\begin{array}{llll}4 & 54 & 36 \cdot 8\end{array}$ | I.96 | $\begin{array}{lllll}4 & 56 & 33.7\end{array}$ | I.94 | $\begin{array}{llll}4 & 58 & 29.8\end{array}$ | I.93 |
| 26 | 43921.6 | I.98 | 44 I I9.8 | 1.96 | $44316 \cdot 8$ | I 94 | $\begin{array}{llll}4 & 45 & 12.5\end{array}$ | I.92 | $447 \quad 7 \cdot 0$ | I.90 | $449 \quad 0.5$ | I.85 |
| 28 | 43043 | + 1.96 | 432 I.0 | + I.93 | $43356 \cdot 3$ | +1.91 | 435 50.0 | + I. 88 | 43742.4 | + I. 86 | 43933.3 | +1.84 |
| 30 | $42047 \cdot 7$ | I•94 | 42243.4 | I-91 | $42437 \cdot 2$ | 1.88 | $4 \begin{array}{llll}4 & 26 & 29 \cdot 2\end{array}$ | I. 85 | $4 \begin{array}{lll}4 & 28 & 19\end{array}$ | I.82 | $4308 \cdot 1$ | I-80 |
| 32 | 4 II 32.I | I.93 | $4 \begin{array}{lll}4 & 26 \cdot 8\end{array}$ | I.89 | $4 \begin{array}{llll}45 & 19 \cdot 3\end{array}$ | I. 86 | 417797 | I. 82 | $4 \begin{array}{lllll}48 & 58 \cdot 2\end{array}$ | I•79 | 42044.7 | ェ・76 |
| 34 | $\begin{array}{llll}4 & 2 & 17.2\end{array}$ | I.92 | $4411 \cdot 0$ | I.88 | $4 \begin{array}{lll}4 & 6 & 2.4\end{array}$ | I. 84 | 4751.5 | I.80 | $4 \begin{array}{llll}4 & 9 & 38 \cdot 3\end{array}$ | 1.76 | 4 II 22.9 | 1・フ2 |
| 35 | $\begin{array}{lllll}3 & 57 & 39.8\end{array}$ | I.91 | $35933 \cdot 4$ | 87 | $4 \quad 124.4$ | I.83 | $\begin{array}{llll}4 & 3 & 12.8\end{array}$ | I.79 | $\begin{array}{lllll}4 & 4 & 58 \cdot 9\end{array}$ | I•75 | $4 \quad 6 \quad 42 \cdot 5$ | I'ti |
| 36 | $\begin{array}{lll}3 & 53 & 2.6\end{array}$ | +1.91 | $35455 \cdot 9$ | + 1.86 | $35646 \cdot 5$ | +1.82 | $\begin{array}{llll}3 & 58 & 34.4\end{array}$ | +1.78 | $4 \quad 0 \quad 19.8$ | + I•73 | $\begin{array}{lll}4 & 2 & 2.6\end{array}$ | +1.69 |
| 37 | $3{ }_{3} \quad 4825 \cdot 4$ | I.9I | $35018 \cdot 6$ | I. 86 | $\begin{array}{llll}3 & 52 & 8 \cdot 8\end{array}$ | I.8I | $35356 \cdot 2$ | I•77 | $35540 \cdot 9$ | $1 \cdot 72$ | $\begin{array}{lllll}3 & 57 & 22.9\end{array}$ | 1.68 |
| 38 | $\begin{array}{llll}3 & 43 & 48 \cdot 3\end{array}$ | I.9I | 34541.3 | I.86 | $\begin{array}{llll}3 & 47 & 31 \cdot 2\end{array}$ | I.8I | $\begin{array}{lllll}3 & 49 & 18 \cdot 2\end{array}$ | I•76 | $3 \begin{array}{lll}3 & 51 & 2 \cdot 3\end{array}$ | I•71 | $\begin{array}{lllll}3 & 52 & 43 \cdot 6\end{array}$ | I. 66 |
| 39 | 339 II•2 | I•9r | 341411 | I. 85 | 34253.8 | 1.80 | $34440 \cdot 4$ | $1 \cdot 75$ | 34624.0 | 1.70 | $\begin{array}{llll}3 & 48 & 4.5\end{array}$ | I. 65 |
| 40 | 33434.0 | I.91 | $33^{3} \quad 27 \cdot 0$ | I.85 | $\begin{array}{llllll}3 & 38 & 16 \cdot 5\end{array}$ | I.80 | $3 \begin{array}{lll}30 & 2.8\end{array}$ | $1 \cdot 74$ | $34145 \cdot 8$ | 1.69 | $34325 \cdot 7$ | I 64 |
| 41 | $3 \begin{array}{llll}3 & 29 & 56 \cdot 8\end{array}$ | +1.91 | 3 31 49•8 | +1.85 | $3 \begin{array}{llll}33 & 39 \cdot 3\end{array}$ | +1.79 | $335 \quad 25.3$ | + $1 \cdot 74$ | $3 \begin{array}{lll}3 & 37 & 7 \cdot 9\end{array}$ | + 1.68 | $33^{38} 477 \cdot 2$ | +1.63 |
| 42 | $\begin{array}{lllllll}3 & 25 & 19.5\end{array}$ | I.92 | 32712.7 | I.85 | 329 2.1 | I•79 | $33047 \cdot 9$ | I•73 | $3 \begin{array}{lll}32 & 30 \cdot 2\end{array}$ | 1.67 | $\begin{array}{llll}3 & 34 & 8 \cdot 9\end{array}$ | 1. 62 |
| 43 | ${ }_{3} 32042 \cdot 1$ | I.92 | $\begin{array}{llll}3 & 22 & 35 \cdot 5\end{array}$ | I. 86 | 324250 | I'79 | 3 26 $10 \%$ | I.73 | $32752 \cdot 6$ | I. 67 | $\begin{array}{llll}3 & 29 & 30 \cdot 8\end{array}$ | I. 61 |
| 44 | $\begin{array}{llll}3 & 16 & 4.6\end{array}$ | I.93 |  | I. 86 | 3 I9 $47 \cdot 9$ | I.79 | 3 L I 33.5 | I'73 |  | I 66 | $32453 \cdot 0$ | I 60 |
| 45 | 3 II 26.8 | I'94 | $\begin{array}{llll}3 & 13 & 20 \cdot 7\end{array}$ | 1.87 | 31510.8 | I.80 | 3 I6 56.3 | I•72 | $\begin{array}{lllll}3 & 18 & 37.8\end{array}$ | I 66 | 32015.2 | I-59 |
| 46 | $3 \begin{array}{llll}3 & 6 & 48 \cdot 8\end{array}$ | +I.95 | 38843.4 | +1.87 | 3 10 33.5 | +1.80 | $\begin{array}{llll}3 & 12 & 19.2\end{array}$ | + $1 \cdot 72$ | $\begin{array}{llll}3 & 14 & 0.5\end{array}$ | +1.65 | $315 \begin{array}{llll}37 & 7\end{array}$ | + I. 59 |
| 47 | $\begin{array}{lrrr}3 & 2 & 10.5\end{array}$ | I.96 | $\begin{array}{lrrr}3 & 4 & 5 \cdot 8 \\ 2 & 5 & \end{array}$ | 1.88 | $3 \quad 5 \quad 56 \cdot 1$ | I.80 | $3{ }^{3} 72420$ | I•73 | $\begin{array}{llll}3 & 9 & 23.4\end{array}$ | I. 65 | 3 II 0.2 | 1.57 |
| 48 | $\begin{array}{llll}2 & 57 & 32 \cdot 0\end{array}$ | I.97 | $\begin{array}{llll}2 & 59 & 27 \cdot 9\end{array}$ | I. 89 | $\begin{array}{rrrr}3 & 1 & 18 \cdot 8\end{array}$ | I.8I | $\begin{array}{llll}3 & 3 & 4.9\end{array}$ | 1.73 | $\begin{array}{llll}3 & 4 & 46 \cdot 2\end{array}$ | I. 65 | $\begin{array}{lll}3 & 6 & 22.9\end{array}$ | 1.57 |
| 49 | $\begin{array}{lllll} & 5 & 52 & 53 \cdot 0\end{array}$ | I'99 | $25449 \cdot 7$ | I.90 | $\begin{array}{llllllllll}2 & 56 & 41 \cdot 2\end{array}$ | I. 82 |  | I•73 | 3 O 0 9'I | I. 65 | 3 I 45.6 | I. 57 |
| 50 | $\begin{array}{lllllllllll}2 & 48 & 13.6\end{array}$ | $2 \cdot 01$ | 250 II*3 | 1.92 | $\begin{array}{llll}2 & 52 & 3 \cdot 5\end{array}$ | I.82 | $25350 \cdot 3$ | 1.74 | $255 \quad 32 \cdot 0$ | 1.65 | 2578.5 | I 57 |
| 51 | $\begin{array}{llll}2 & 43 & 33 \cdot 8 \\ 2 & 38 & 53 \cdot 4\end{array}$ | $+2.03$ | $245 \begin{array}{lll}22.5\end{array}$ | +1.93 | $\begin{array}{lllll}2 & 47 & 25 \cdot 5\end{array}$ | +1.84 | $2 \begin{array}{lllll}2 & 49 & 12.8\end{array}$ | +r.74 | $2 \begin{array}{lllll}2 & 50 & 54.8\end{array}$ | + 1.65 | 25231.4 | +1.57 |
| 52 | $\begin{array}{lllll}2 & 38 & 53 \cdot 4\end{array}$ | 2.05 | $2 \begin{array}{llllllll} & 40 & 53 \cdot 2\end{array}$ | I.95 | $24247 \cdot 1$ | I. 85 | $24435 \cdot 2$ | I'75 | 24617.5 | I 66 | 24754.2 | I. 57 |
| 53 | $\begin{array}{lll}2 & 34 & 12.3 \\ 2 & 29 & 30.6\end{array}$ | 2.08 | $\begin{array}{llll}2 & 36 & 13.6\end{array}$ | 1.97 | $\begin{array}{llrr}2 & 38 & 8 \cdot 5\end{array}$ | I.86 | $2 \begin{array}{llll}2 & 39 & 57 \cdot 3\end{array}$ | I'76 | $241140 \cdot 1$ | I. 66 | 243 I7•1 | 1.57 |
| 54 | $\begin{array}{llll}2 & 29 & 30 \cdot 6\end{array}$ | $2 \cdot 10$ | $\begin{array}{llll}2 & 31 & 33.4\end{array}$ | I.99 | $\begin{array}{llll}2 & 33 & 29.5\end{array}$ | I. 88 | $\begin{array}{lllll}2 & 35 & 19.2\end{array}$ | I'78 | $\begin{array}{llll}2 & 37 & 2 \cdot 6\end{array}$ | I. 67 | $\begin{array}{llll}2 & 38 & 39 \cdot 8\end{array}$ | I.57 |
| 55 | $22448 \cdot 0$ | $2 \cdot 13$ | 22652.5 | $2 \cdot 02$ | 22850.0 | I'90 | $23040 \cdot 8$ | 1•79 | $232 \quad 24.9$ | 1.68 | 2342.6 | I.57 |
| 56 | 22004.6 | $+2 \cdot 17$ | 222 II•O | $+2.04$ | $22410 \cdot 0$ | +I.92 | $2 \begin{array}{lll}26 & 1.9\end{array}$ | +I.81 | $22747 \cdot 0$ | + $\mathrm{I} \cdot 69$ | 22925.2 | +r.58 |
| 57 | $2 \begin{array}{lll}2 & 15 & 20 \cdot 1\end{array}$ | 2.21 | 2 I7 28.6 | 2.08 | $2 \mathrm{l} \mathrm{lll}^{29} 29.4$ | I.95 | $\begin{array}{llll}2 & 21 & 22 \cdot 7\end{array}$ | I.83 | $\begin{array}{llll}2 & 23 & 8.7\end{array}$ | I•71 | $22447 \cdot 7$ | I. 59 |
| 58 | 21034.4 | $2 \cdot 25$ | $\begin{array}{lllll}2 & 12 & 45.4\end{array}$ | $2 \cdot 11$ | $2 \mathrm{I} 44^{48} \mathrm{I}$ | I.98 | $21643 \cdot 0$ | 1.85 | $2 \begin{array}{llll}2 & 18 & 30 \cdot 2\end{array}$ | 1.72 | 22099 | 1.60 |
| 59 | $\begin{array}{lllll}2 & 5 & 47 \cdot 5 \\ 2 & 0 & 59.1\end{array}$ | $2 \cdot 30$ | $\begin{array}{llll}2 & 8 & 1 \cdot I\end{array}$ | $2 \cdot 15$ | 2 10 6.1 | 2.01 | $\begin{array}{rrrr}2 & 12 & 2 \cdot 7 \\ 2 & 7 & 21.9\end{array}$ | I 88 | $2 \begin{array}{llll}2 & 13 & 5 I \cdot 2\end{array}$ | $1 \cdot 74$ | $2 \mathrm{I} 5 \times 3 \mathrm{I} \cdot 9$ | x.6r |
| 60 | $2 \quad 50 \cdot 1$ | $2 \cdot 36$ | $\begin{array}{lllll}2 & 3 & 15 \cdot 7\end{array}$ | $2 \cdot 20$ | $25123 \cdot 1$ | 2.05 | 2721.9 | 1.91 | 29 II 8 | 1.76 | 2 10 53.6 | I. 62 |
| VARIATION TO I' OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. $18^{\circ}$ | A. | L. $19^{\circ}$ | - A. | L. $20^{\circ}$ | - A. | L. $21^{\circ}$ |  | L. $22^{\circ}$ | A. | L. $28^{\circ}$ | ${ }^{\circ} \mathrm{A}$. |
| $\stackrel{0}{0}$ | $\begin{array}{cc} \mathrm{s} . & \mathrm{s} . \\ +\mathrm{x} \cdot 76 & -4.94 \end{array}$ |  | $\begin{array}{cc} \mathrm{s} . & \mathrm{s} . \\ +\mathrm{I} .87 & -4.98 \end{array}$ |  | $\begin{array}{cc} \text { s. } & \mathrm{s} . \\ +\mathrm{I} \cdot 98 & -5 \cdot 02 \end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { S. } \\ +2.10 & -5.07 \end{array}$ |  | $\begin{array}{cc} \mathrm{S} . & \mathrm{S} . \\ +2 \cdot 2 \mathrm{I} & -5 \cdot 12 \end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ +2.33 & -5 . \mathrm{I}_{7} \end{array}$ |  |
| 4 | I. 54 | 4.87 | 1.654 .90 |  | 1.75 4.94 |  | $+2.10-5.07$ |  | $\begin{array}{rr}+2.21 & -5.12 \\ 1.98 & 5.02\end{array}$ |  | $\begin{array}{ll}2.09 & 5.07 \\ 1.86 & 4.98\end{array}$ |  |
| 8 | I-34 | $4 \cdot 81$ | I. 44 |  | 1.554 .87 |  | I.65 4.90 |  | I. $76 \quad 4.94$ |  |  |  |
| 12 | 1-15 | $4 \cdot 76$ | I. 254.78 |  | 1.354 .81 |  | 1.454 |  | 1.564 .87 |  | 1.664 .91 |  |
| 16 | -97 | $4 \cdot 72$ | 1.074 .74 |  | I.17 4.76 |  | $1 \cdot 274$ |  | 1.37 | $4 \cdot 82$ | 1.47 | $4 \cdot 85$ |
| 20 | + 79 | $4 \cdot 69$ | $+.894 .70$ |  | + 6.99 4.72 |  | +1.09 4.75 |  |  |  | +1.29 4.80 |  |
| 24 | - 62 | $4 \cdot 66$ | -72 4.67 |  | .82 4.69 |  | -92 |  | $\begin{array}{rr} +1 \cdot 19 & 4.77 \\ 1.02 & 4.73 \end{array}$ |  | I.13 4.75 |  |
| 26 | -54 | 4.65 | - 63 | $4 \cdot 66$ | . 734.68 |  | .84 4.69 |  | $\begin{array}{rr}1.02 & 4.73 \\ .94 & 4.71\end{array}$ |  | 1.044 .73 |  |
| 28 | -45 | 4.64 | $\cdot 55$ | 4.65 | . 65 | $4 \cdot 66$ | $\cdot 754.68$ |  | . $86 \quad 4.70$ |  | .96 4.72 |  |
| 30 | $\cdot 36$ | 4.63 | -47 | $4 \cdot 64$ | $\cdot 57$ | $4 \cdot 65$ | . 67 | $4 \cdot 67$ | $\cdot 78$ | $4 \cdot 68$ | . 88 4.70 |  |
| 32 | + 28 | 4.63 | +38$+\quad .29$$\cdot 21$$\cdot 12$ | 4.63 | r$+\quad .49$.40.32.23 | $4 \cdot 64$ | r$+\quad .59$.51.43.34 | $4 \cdot 66$ | $+$ | 4.67 | $+$ | $\begin{aligned} & 4.69 \\ & 4 \cdot 67 \\ & 4.66 \\ & 4.65 \\ & 4.64 \end{aligned}$ |
| 34 | -19 | $4 \cdot 62$ |  | $4 \cdot 63$ |  | 4.63 |  | $4 \cdot 65$ |  | $4 \cdot 66$ |  |  |
| 36 | -10 | 4.62 |  | 4.62 |  | 4.63 |  | 4.64 |  | 4.65 |  |  |
| 38 | + . OI | $4 \cdot 62$ |  | $4 \cdot 62$ |  | $4 \cdot 62$ |  | $4 \cdot 63$ |  | 4.64 |  |  |
| 40 | -.08 | $4 \cdot 62$ | +.03 | $4 \cdot 62$ |  | $4 \cdot 62$ |  | $4 \cdot 62$ |  | 4.63 |  |  |
| 42 | -.18 | 4.62 | - | $4 \cdot 62$ | +.05 | 4.62 | +.17+.08 | $4 \cdot 62$ | .29$+\quad .20$ | $4 \cdot 63$ | + 40 | 4.64 |
| 44 | - 28 | 4.63 |  | 4.62 | - 04 | 4.62 |  | 4.62 |  | 4.62 | -32 | 4.634.62 |
| 46 | -39 | 4.64 |  | $4 \cdot 62$ |  | 4.62 | +.08 | 4.62 | - 20 $\cdot 11$ | 4.62 | -24 |  |
| 48 | - 50 | 4.65 |  | $4 \cdot 63$ | $\cdot 24$ | $4 \cdot 62$ | - II | $4 \cdot 62$ | + 02 | $4 \cdot 62$ | -15 | $\begin{aligned} & 4.62 \\ & 4.62 \end{aligned}$ |
| 50 | . 62 | $4 \cdot 66$ |  | $4 \cdot 64$ | -34 | 4.63 | - 21 | $4 \cdot 62$ | - 07 | 4.62 | +.06 |  |
| 52 | - 75 | $4 \cdot 68$ | - 60 | $4 \cdot 66$ | .57.70.84.99 | 4.64 | - 31 | $4 \cdot 63$ | -17 | $4 \cdot 62$ | -. 03 | 4.62 |
| 54 | . 88 | 4.70 | .72.86 | 4.68 |  | $4 \cdot 65$ | - 42 | $4 \cdot 64$ | . 274.63 |  | -13 | 4.62 |
| 56 | 1.03 | $4 \cdot 73$ |  | 4.70 |  | $4 \cdot 67$ | $\begin{array}{r} .54 \\ .67 \end{array}$ | $4 \cdot 65$ | -38 4.63 |  | -23 4.62 |  |
| 58 | I. 20 | 4.77 | I 102 | 4.73 |  | $4 \cdot 69$ |  | $4 \cdot 67$ | .62 4.66 |  | . 344.63 |  |
| 60 | 1.39 | 4.82 | I 24 | $4 \cdot 77$ |  | .99 4.72 | -80 | $4 \cdot 69$ |  |  | $\cdot 45$ |  |

## 126 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $1^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. S. | s. | H. M. S | S. | H. M. S. | s. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $6 \quad 0 \quad 0 \cdot 0$ | - . 07 | $\begin{array}{llll}5 & 59 & 55.8\end{array}$ | - 07 | 559 51.6 | - . 07 | $55947 \cdot 4$ | - .07 | $5 \quad 5943 \cdot 2$ | - . 07 | $55939 \cdot 0$ | - 07 |
| 10 | $\begin{array}{lllll}5 & 19 & 59 \cdot 6\end{array}$ | . 07 | 5 19 55.0 | -08 | $\begin{array}{lllll}5 & 19 & 49 \%\end{array}$ | -10 | $\begin{array}{llll}5 & 19 & 43 \cdot 5\end{array}$ |  | $\begin{array}{lllll}5 & 19 & 36 \cdot 6\end{array}$ | -12 | 5 I9 29.0 | -13 |
| 12 | 5 II 59.6 | - 07 | 5 II 54.8 | -09 | 5 II 49.2 | -10 | 5 II $42 \cdot 7$ |  | 5 II $35 \cdot 2$ | -13 | 5 II 26.9 | - I5 |
| 14 | $\begin{array}{llll}5 & 3 & 59.5\end{array}$ | -07 | $\begin{array}{llll}5 & 3 & 54.6\end{array}$ | -09 | $\begin{array}{llll}5 & 3 & 48 \cdot 8\end{array}$ | - II | 5 3 41 |  | $\begin{array}{llll}5 & 3 & 33 \cdot 8\end{array}$ | -14 | $\begin{array}{llll}5 & 3 & 24.7\end{array}$ | -16 |
| 16 | $4 \begin{array}{llll}4 & 55 & 59 \cdot 4\end{array}$ | -07 | 45554.4 | -09 | $45548 \cdot 3$ | - II | $45540 \cdot 9$ |  | $455 \quad 32 \cdot 3$ | -15 | $455 \quad 22 \cdot 5$ | -17 |
| 18 | $44759 \cdot 3$ | . 07 | 44754.2 | -10 | $44747 \cdot 8$ | - 12 | $44740 \cdot 0$ |  | $44730 \cdot 7$ | -16 | $44720 \cdot 2$ | -19 |
| 20 | 43959.2 | -07 | 43954.0 | -10 | $43947 \cdot 3$ |  | $43939 \cdot 0$ |  | 439 29•1 | -18 | 439177 | $\cdot 20$ |
| 22 | 4 31 59.1 | -07 |  | -10 | $43146 \cdot 7$ |  | $43138 \cdot 0$ |  | $43127 \cdot 5$ | 19 | 4 3I 15.2 | - 22 |
| 24 | 42359.0 | -08 | $\begin{array}{llll}4 & 23 & 53 \cdot 5\end{array}$ | $\cdot \mathrm{II}$ | 423 46•I |  | $4 \quad 2336 \cdot 9$ |  | $\begin{array}{llll}4 & 23 & 25 \cdot 7\end{array}$ | - 20 | $4 \begin{array}{llll}4 & 23 & 12 \cdot 7\end{array}$ | -23 |
| 26 | 4 I5 59*0 | - 08 | 4 I5 $53 \cdot 3$ | -II | $41545 \cdot 6$ | -15 | $41535 \cdot 8$ |  | 4 I5 23.9 | -22 | $415 \quad 9.9$ | $\cdot 25$ |
| 28 | $\begin{array}{llll}4 & 7 & 58 \cdot 9\end{array}$ | - 08 | 4753.0 | -12 | 4744.9 | - 15 | $\begin{array}{llll}4 & 7 & 34 \cdot 6\end{array}$ |  | $4722 \cdot 0$ | -23 | $\begin{array}{lll}4 & 7 & 7 \cdot 1\end{array}$ | $\cdot 27$ |
| 30 | $35958 \cdot 8$ | -08 |  | -12 | $35944 \cdot 3$ | -16 | $\begin{array}{llll}3 & 59 & 33 \cdot 4\end{array}$ |  | $35920 \cdot 0$ | -24 | $\begin{array}{llll}3 & 59 & 4.2\end{array}$ | -28 |
| 32 | $35158 \cdot 7$ | -08 | $\begin{array}{llll}3 & 51 & 52.4\end{array}$ | -13 | $35143 \cdot 6$ |  | 3 5I $32 \cdot 0$ |  | 3 51 17.9 | -26 | 351510 | -30 |
| 33 | $34758 \cdot 6$ | -08 | $\begin{array}{llll}3 & 47 & 52 \cdot 3\end{array}$ | - 13 | $34743 \cdot 2$ | -17 | $\begin{array}{lllll}3 & 47 & 31.4\end{array}$ |  | $3 \begin{array}{llll}3 & 47 & 16 \cdot 7\end{array}$ | $\cdot 27$ |  | -31 |
| 34 | $34358 \cdot 6$ | -08 | $34352 \cdot 1$ | - I3 | $34342 \cdot 8$ | -18 | $\begin{array}{llll}3 & 43 & 30 \cdot 7\end{array}$ |  | $\begin{array}{llll}3 & 43 & 15 \cdot 6\end{array}$ | -27 | $34257 \cdot 7$ | $\cdot 32$ |
| 35 | $\begin{array}{llll}3 & 39 & 58 \cdot 5\end{array}$ | -09 | 3 39 51 | -13 | $\begin{array}{llll}3 & 39 & 42.4\end{array}$ | -18 | $\begin{array}{llll}3 & 39 & 29.9\end{array}$ |  | $\begin{array}{llll}3 & 39 & 14.5\end{array}$ | - 28 | $\begin{array}{llll}3 & 38 & 56 \cdot 0\end{array}$ | -33 |
| 36 | $33558 \cdot 5$ | -09 | $3 \begin{array}{llllll}3 & 351 & 8\end{array}$ | -14 | $33542 \cdot 0$ |  | $\begin{array}{llll}3 & 35 & 29 \cdot 2\end{array}$ |  |  | -29 | $3{ }^{3} 3454 \cdot 2$ | $\cdot 34$ |
| 37 | $33158 \cdot 4$ | -09 | 3 3I 5I•6 | -14 | 3 31 4I'6 | -19 | $\begin{array}{llll}3 & 31 & 28.4\end{array}$ |  | $\begin{array}{llll}3 & 31 & 12 \cdot 0\end{array}$ | - 30 | $\begin{array}{llll}3 & 30 & 52 \cdot 4\end{array}$ | $\cdot 35$ |
| 38 | $32758 \cdot 4$ | -09 | $3275 \mathrm{I} \cdot 4$ | - I5 | $32741 \cdot 2$ |  | $\left\lvert\, \begin{array}{llll}3 & 27 & 27.6\end{array}\right.$ |  |  | -31 | $32650 \cdot 5$ | $\cdot 36$ |
| 39 | $\begin{array}{llll}3 & 23 & 58 \cdot 3\end{array}$ | -09 | $3235 \mathrm{I} \cdot 2$ | - 15 | $32340 \cdot 7$ | - 20 | 3 23 $26 \cdot 8$ |  | $\begin{array}{lll}3 & 23 & 9.4\end{array}$ | $\cdot 32$ | $32248 \cdot 6$ | -38 |
| 40 | $\begin{array}{llll}3 & 19 & 58 \cdot 2\end{array}$ |  | $3195 \mathrm{I} \cdot 0$ | - 15 | $31940 \cdot 2$ |  | 31925.9 |  | 3 I9 8.I | -33 | $\begin{array}{llll}3 & 18 & 46 \cdot 6\end{array}$ | -39 |
| 41 | 3 I5 58.2 |  | 3 I5 $50 \cdot 8$ | - 15 | $\begin{array}{llllllllllll}3 & 15 & 39.8\end{array}$ |  | 315151 |  | $\begin{array}{llll}3 & 15 & 6 \cdot 6\end{array}$ | -34 | $31444 \cdot 5$ | - 40 |
| 42 | 3 II 58.I | -09 | 3 II $50 \cdot 6$ | -16 | 3 II 39.3 |  | 3 II 24.2 |  | 3 II $5 \cdot 2$ | -35 | $31042 \cdot 4$ | -41 |
| 43 | $\begin{array}{llll}3 & 7 & 58 \cdot 0\end{array}$ | -09 | $\begin{array}{llll}3 & 7 & 50 \cdot 4\end{array}$ | -16 | $\begin{array}{llll}3 & 7 & 38 \cdot 8\end{array}$ | -23 | $\begin{array}{llll}3 & 7 & 23 \cdot 2\end{array}$ |  | $\begin{array}{lll}3 & 7 & 3 \cdot 7\end{array}$ | -36 | $\begin{array}{llll}3 & 6 & 40 \cdot 1\end{array}$ | -43 |
| 44 | $3 \quad 358 \cdot 0$ | - 10 | $3 \quad 350 \cdot 1$ | -16 | $3 \begin{array}{llll}3 & 3 & 38 \cdot 2\end{array}$ | -23 | $\begin{array}{llll}3 & 3 & 22 \cdot 2\end{array}$ |  | $\begin{array}{llll}3 & 3 & 2 \cdot 1\end{array}$ | $\cdot 37$ | $\begin{array}{llll}3 & 2 & 37 \cdot 8\end{array}$ | $\cdot 44$ |
| 45 | $2 \begin{array}{llll}2 & 59 & 57 \cdot 9\end{array}$ | $\cdot 10$ | 25949.9 | -17 | $25937 \cdot 6$ |  | $2 \begin{array}{lll}2 & 59 & 2 \mathrm{I} \cdot 2\end{array}$ |  | $\begin{array}{lll}2 & 59 & 0.4\end{array}$ | -38 | $\begin{array}{llll}2 & 58 & 35 \cdot 4\end{array}$ | $\cdot 45$ |
| 46 | $255157 \cdot 8$ | $\cdot 10$ | $25549 \cdot 6$ | -17 | $25537 \cdot 0$ |  | $2{ }^{2} 555{ }^{20 \cdot 1}$ |  | $25458 \cdot 7$ | -39 | $2 \begin{array}{llll}2 & 54 & 32 \cdot 9\end{array}$ | $\cdot 47$ |
| 47 | $2 \mathrm{l}_{2} 5157 \cdot 7$ |  | $251549 \cdot 3$ | - 18 | $2515136 \cdot 5$ |  | $\begin{array}{llll}2 & 51 & 19.0\end{array}$ |  | $25056 \cdot 9$ | -41 | $250030 \cdot 3$ | $\cdot 48$ |
| 48 | $\begin{array}{lllll}2 & 47 & 57 \cdot 7 \\ 2 & 43 & 57 \cdot 6\end{array}$ |  | $24749 \cdot 1$ | -18 | $2{ }^{2} 47 \begin{array}{llll} & 35\end{array}$ |  | $\begin{array}{llllllll}2 & 47 & 17.8\end{array}$ |  | $2 \begin{array}{llll}2 & 465 \cdot 1\end{array}$ | $\cdot 42$ |  | $\cdot 50$ |
| 49 | $24357 \cdot 6$ |  | $24348 \cdot 8$ | -19 | $24335 \cdot 1$ |  | $\begin{array}{llll}2 & 43 & 16 \cdot 6\end{array}$ |  | $\begin{array}{lllll}2 & 42 & 53.2\end{array}$ | -43 | $2 \begin{array}{llll}2 & 42 & 24.8\end{array}$ | $\cdot 52$ |
| 50 | $2 \begin{array}{llll}2 & 39 & 57 \cdot 5\end{array}$ |  | $2 \begin{array}{llll}2 & 39 & 48 \cdot 5\end{array}$ | -19 | 23934.4 |  | $2 \begin{array}{lll}2 & 39 & 15 \cdot 3\end{array}$ |  | $23^{8} 5151 \cdot 2$ | -45 | $2 \begin{array}{llll}2 & 38 & 21.8\end{array}$ | - 53 |
| 5 I | $235 \begin{array}{llll} \\ 2 & 57\end{array}$ |  | $23548 \cdot 1$ | -20 | $23533 \cdot 7$ |  | 23514.0 |  | $23449^{\circ} \mathrm{O}$ | - 46 | $\begin{array}{llll}2 & 34 & 18 \cdot 7\end{array}$ | $\cdot 55$ |
| 52 | $23157 \cdot 3$ |  | $2{ }^{2}$ 31 47.8 | -20 | $23132 \cdot 9$ |  | $2 \begin{array}{lll}21 & 31 & 12.6\end{array}$ |  | $23046 \cdot 8$ | -48 | 230015.5 | $\cdot 57$ |
| 53 | $\begin{array}{llll}2 & 27 & 57 \cdot 2\end{array}$ | -12 | $2 \begin{array}{lllllll} \\ 2 & 27 & 47.5\end{array}$ | -21 | $22732 \cdot 1$ |  | 2 27 11.2 <br> 2 23  |  | $\begin{array}{llll}2 & 26 & 44.5\end{array}$ | -49 | $\begin{array}{llll}2 & 26 & 12.0\end{array}$ | -59 |
| 54 | $22357 \cdot 1$ |  | 223 47.1 | 21 | $2233^{1 \cdot 3}$ |  | 22319.6 |  | $22242 \cdot 0$ | - 51 | 2228.5 | -61 |
| VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. | A. | L. $1^{\circ}$ | A. | L. $\mathbf{2}^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| $\stackrel{\circ}{\circ}$ | s. -00 | $\begin{gathered} \mathrm{S} . \\ -4.00 \end{gathered}$ | S. | $\begin{gathered} s . \\ -4 \cdot 00 \end{gathered}$ | S. ${ }_{\text {S4 }}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 00 \end{gathered}$ | $\begin{aligned} & \mathrm{s} . \\ & -.2 I \end{aligned}$ | $\begin{gathered} s \\ -4 \cdot 01 \end{gathered}$ | S. 8 | $\begin{gathered} s . \\ -4 \circ O I \end{gathered}$ | s. $\cdot 35$ | $\begin{gathered} \mathrm{S} \\ 4 \cdot 02 \end{gathered}$ |
| 4 | -00 | 4.00 | . 07 | 4.00 | -14 | 4.00 | - 22 | 4.01 | - 29 | $4 \cdot \mathrm{Or}$ | -36 | 4.02 |
| 8 | - 01 | 4.00 | -08 | $4 \cdot 00$ | -15 | 4.00 | -22 | 4.01 | -29 | $4 \cdot 01$ | -37 | $4 \cdot 02$ |
| 12 | -OI | $4 \cdot 00$ | -09 | 4.00 | -16 | 4.00 | -23 | 4.01 | -30 | 4.01 | -37 | 4.02 |
| 14 | $\cdot 02$ | 4.00 | -09 | 4.00 | -16 | 4.00 | $\cdot 23$ | 4 - OI | -31 | 4.01 | -38 | 4.02 |
| 16 | - 02 | 4.00 | . 09 | 4.00 | -17 | 4.00 | -24 | 4.01 | $\cdot 31$ | 4.01 | $\cdot 39$ | 4.02 |
| 18 | -02 | 4.00 | -10 | 4.00 | -17 | 4.00 | -24 | 4.01 | $\cdot 32$ | 4.01 | $\cdot 39$ | $4 \cdot 02$ |
| 20 | $\cdot 02$ | 4.00 | -10 | $4 \cdot 00$ | -17 | $4 \cdot 00$ | -25 | 4.01 | -32 | 4.01 | $\cdot 40$ | $4 \cdot 02$ |
| 22 | . 03 | 4.00 | -10 | 4.00 | -18 | $4 \cdot 00$ | -25 | 4.01 | -33 | 4.01 | $\cdot 41$ | $4 \cdot 02$ |
| 24 | . 03 | 4.00 | - I I | 4.00 | -18 | $4 \cdot 00$ | $\cdot 26$ | 4.01 | -34 | 4.01 | -41 | $4 \cdot 02$ |
| 26 | . 03 | 4.00 | -II | 4.00 | -19 | 4.01 | -27 | 4.01 | $\cdot 35$ | 4.02 | -42 | 4.02 |
| 28 | . 04 | $4 \cdot 00$ | -12 | $4 \cdot 00$ | -20 | 4.01 | $\cdot 27$ | 4.01 | -35 | $4 \cdot 02$ | -43 | $4 \cdot 02$ |
| 30 | . 04 | $4 \cdot 00$ | -12 | $4 \cdot 00$ | $\cdot 20$ | $4 \cdot \mathrm{OI}$ | -28 | 4.01 | -36 | $4 \cdot 02$ | -45 | 4.03 |
| 32 | -04 | $4 \cdot 00$ | -13 | $4 \cdot 00$ | $\cdot 21$ | 4.01 | -29 | 4.01 | $\cdot 37$ | 4.02 | -46 | $4 \cdot 03$ |
| 34 | -05 | 4.00 | -13 | $4 \cdot 00$ | -2I | 4.0 I | -30 | 4.01 | $\cdot 3^{8}$ | 4.02 | $\cdot 47$ | 4.03 |
| 36 | -05 | 4.00 | -14 | 4.00 | -22 | 4.01 | -31 | 4.01 | -40 | 4.02 | -49 | 4.03 |
| 38 | . 05 | 4.00 | -14 | $4 \cdot 00$ | $\cdot 23$ | 4.01 | -32 | 4.01 | -41 | 4.02 | - 50 | $4 \cdot 03$ |
| 40 | -06 | $4 \cdot 00$ | -15 | 4.00 | $\cdot 24$ | 4.01 | -33 | 4.01 | $\cdot 42$ | 4.02 | $\cdot 52$ | $4 \cdot 03$ |
| 42 | -06 | $4 \cdot 00$ | -16 | $4 \cdot 00$ | - 25 | 4.01 | $\cdot 35$ | 4.01 | -44 | 4.02 | $\cdot 54$ | 4.04 |
| 44 | $\cdot 07$ | 4.00 | -16 | $4 \cdot 00$ | -26 | $4 \cdot 01$ | $\cdot 36$ | 4.02 | -46 | 4.03 | $\cdot 56$ | 4.04 |
| 46 | -07 | 4.00 | -17 | $4 \cdot 00$ | -27 | 4.01 | -38 | $4 \cdot 02$ | -48 | 4.03 | . 58 | 4.04 |
| 48 | -08 | 4.00 | -18 | 4.00 | $\cdot 29$ | 4.01 | -39 | 4.02 | -50 | 4.03 | -6I | 4.05 |
| 50 | -08 | 4.00 | -19 | 4.00 | $\cdot 30$ | 4.01 | -4 | 4.02 | $\cdot 52$ | 4.03 | -63 | 4.05 |
| 52 | -09 | 4.00 | - 20 | 4.00 | - 32 | 4.01 | -43 | 4.02 | $\cdot 55$ | 4.04 | -66 | 4.06 |
| 54 | -10 | 4.00 | -22 | 4.00 | $\cdot 33$ | 4.01 | . 46 | 4.03 | $\cdot 58$ | $4 \cdot 04$ | $\cdot 70$ | 4.06 |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | 7 ${ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | s. | H. M. S. | s. | H. M. S. | s. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $\begin{array}{llll}5 & 59 & 34 \cdot 8\end{array}$ | - 07 | $55930 \cdot 6$ | - ${ }^{\circ} 07$ | $515926 \cdot 3$ | - 07 | $55922 \cdot 0$ | $\cdot 07$ | $\begin{array}{lllll}5 & 59 & 17 \cdot 7\end{array}$ | -07 | 55913.4 | -07 |
| 10 | $\begin{array}{llll}5 & 19 & 20 \cdot 6\end{array}$ | -15 | 5 I9 II.5 | -16 | 51915 | -17 | 5 I8 $50 \cdot 8$ | -19 | 518189.2 | -20 | $518126 \cdot 8$ | -21 |
| 12 | 5 II 17.6 | -16 | 5 II 7.4 | -18 | 5 10 56.3 | -19 | 5 Io 44.2 | -21 | 5 10 3I•I | -23 | 5 10 17.0 | 24 |
| 14 | $\begin{array}{llll}5 & 3 & 14.6\end{array}$ | -18 | $\begin{array}{llll}5 & 3 & 3 \cdot 3\end{array}$ | - 20 | $\begin{array}{llll}5 & 2 & 50 \cdot 9\end{array}$ | - 21 | $\begin{array}{llll}5 & 2 & 37 \cdot 5\end{array}$ | -23 | $\begin{array}{llll}5 & 2 & 22 \cdot 9\end{array}$ | -25 | $\begin{array}{llll}5 & 2 & 7 \cdot 1\end{array}$ | -27 |
| 16 | 45515 | -19 | 454 59•1 | -22 | $454 \quad 45 \cdot 5$ | -24 | $45430 \cdot 6$ | -26 | 45414.4 | -28 | $45356 \cdot 8$ | $\cdot 30$ |
| 18 | $4478 \cdot 2$ | -21 | $44654 \cdot 7$ | '24 | $44639 \cdot 8$ | -26 | $44623 \cdot 5$ | -28 | $4 \quad 46 \quad 5 \cdot 7$ | -3I | $44546 \cdot 4$ | 33 |
| 20 | 4394.8 | $\cdot 23$ | $43^{38} \quad 50 \cdot 2$ | -26 | $43^{8} 344^{\circ}$ | -28 | $43816 \cdot 2$ | -31 | $437 \quad 56 \cdot 8$ | -34 | $43735 \cdot 6$ | $\cdot 37$ |
| 22 | 431513 | $\cdot 25$ | $43045 \cdot 5$ | $\cdot 28$ | $43028 \cdot 0$ | -31 | $430 \quad 8 \cdot 7$ | -34 | $42947 \cdot 5$ | -37 | 42924.4 | -40 |
| 24 | $42257 \cdot 7$ | -27 | $4 \quad 22 \begin{array}{llll}40 \cdot 7\end{array}$ | -30 | $4 \quad 22 \quad 21 \cdot 8$ | -33 | 422009 | -36 | $42138 \cdot 0$ | -40 | 42112.9 | -43 |
| 26 | 41453.9 | $\cdot 28$ | $41435 \cdot 7$ | $\cdot 32$ | $1 \begin{array}{llll}4 & 14 & 15 \cdot 3\end{array}$ | $\cdot 36$ | $\begin{array}{llll}4 & \text { I3 } & 52 \cdot 8\end{array}$ | -39 | 4 I3 28.0 | -43 | $\begin{array}{lll}4 & 13 & 0.9\end{array}$ | . 47 |
| 28 | 4 6 $49 \cdot 9$ | $\cdot 31$ | $4 \begin{array}{lll}4 & 6 & 30 \cdot 4\end{array}$ | -34 | $\begin{array}{\|ccc\|}4 & 6 & 8 \cdot 5\end{array}$ | $\cdot 38$ | $4 \quad 5 \quad 44 \cdot 3$ | -42 | $\begin{array}{llll}4 & 5 & 17.6\end{array}$ | -47 | $\begin{array}{llll}4 & 4 & 48.4\end{array}$ | -5I |
| 30 | $35845 \cdot 8$ | -33 | $\begin{array}{llll}3 & 58 & 24.9\end{array}$ | -37 | $\begin{array}{lll}3 & 58 & 1 \cdot 5\end{array}$ | -4 | $357 \quad 35 \cdot 5$ | -46 | $\begin{array}{lll}3 & 57 & 6.8\end{array}$ | -50 | $3 \begin{array}{llll}3 & 56 & 35\end{array}$ | -55 |
| 32 | $35041 \cdot 5$ | -35 |  | -39 | $\begin{array}{lllll}3 & 49 & 54 \cdot \mathrm{I}\end{array}$ | -44 | $34926 \cdot 2$ | -49 | $\begin{array}{llll}3 & 48 & 55.4\end{array}$ | - 54 |  | -59 |
| 33 | $34639 \cdot 2$ | -36 | $\begin{array}{lllllllllll}3 & 46 & 16 \cdot 2\end{array}$ | -4 | $345 \begin{array}{llll}3 & 50 \cdot 2\end{array}$ | -46 | 34521.4 | -51 | $34449 \cdot 5$ | -56 | 34414.6 | .6I |
| 34 | $\begin{array}{llll}3 & 42 & 36 \cdot 9\end{array}$ | $\cdot 37$ | $\begin{array}{llll}3 & 42 & 13 \cdot 1\end{array}$ | -42 | $34 \mathrm{I} 46 \cdot 3$ | -47 |  | -52 | $34043 \cdot 5$ | -58 | $3 \begin{array}{lll}30 & 7 \cdot 3\end{array}$ | . 63 |
| 35 | $\begin{array}{llll}3 & 38 & 34 \cdot 5\end{array}$ | $\cdot 38$ | $\begin{array}{llll}3 & 38 & 9 \cdot 9\end{array}$ | -44 | $3 \begin{array}{llll}3 & 32 \cdot 2\end{array}$ | -49 | 337 II'4 | - 54 | $\begin{array}{llll}3 & 36 & 37 \cdot 3\end{array}$ | -60 | $3 \begin{array}{lll}3 & 35 & 59 \cdot 8\end{array}$ | . 65 |
| 36 | $\begin{array}{lllll}3 & 34 & 32 \cdot 1\end{array}$ | -40 | $\begin{array}{llll}3 & 34 & 6 \cdot 7\end{array}$ | -45 | $\begin{array}{llll}3 & 33 & 38 \cdot 0\end{array}$ | -50 | $\begin{array}{lll}3 & 33 & 6 \cdot I\end{array}$ | - 56 | $\begin{array}{lll}3 & 32 & 30 \cdot 8\end{array}$ | . 62 | $3 \begin{array}{llll}3 & 31 & 52 \cdot 1\end{array}$ | . 67 |
| 37 | $33029 \cdot 5$ | -41 | $\begin{array}{llll}3 & 30 & 3 \cdot 3\end{array}$ | $\cdot 46$ | $\begin{array}{llll}3 & 29 & 33 \cdot 7\end{array}$ | -52 | $\begin{array}{llll}3 & 29 & 0.7\end{array}$ | - 58 | $\begin{array}{llll}3 & 28 & 24.3\end{array}$ | -64 | $32744 \cdot 2$ | -70 |
| 38 | $\begin{array}{llll}3 & 26 & 26 \cdot 9\end{array}$ | - 42 | $\begin{array}{llll}3 & 25 & 59.8\end{array}$ | -48 |  | -54 | $\begin{array}{llll}3 & 24 & 55 \cdot 2\end{array}$ | -60 | $\begin{array}{lllllllllllllllll}3 & 24 & 17 \cdot 5\end{array}$ | -66 | 323 36.0 | $\cdot 72$ |
| 39 | $32224 \cdot 2$ | -44 | $32156 \cdot 3$ | -50 | $32124 \cdot 7$ | -56 | $32049 \cdot 5$ | -62 | 32010.5 | -68 | $\begin{array}{llllllllllll}3 & 19 & 27.6\end{array}$ | $\cdot 75$ |
| 40 | 318821.4 | -45 | 31752.6 | -51 | 317200 | -57 | $31643 \cdot 6$ | - 64 | $\begin{array}{llll}3 & 16 & 3.2\end{array}$ | -71 |  | 77 |
| 4 I | $\begin{array}{llll}3 & 14 & 18 \cdot 6\end{array}$ | -46 | $\begin{array}{llll}3 & 13 & 48 \cdot 8\end{array}$ | -53 | 31315.1 | -59 | $\begin{array}{llll}3 & 12 & 37 \cdot 5\end{array}$ | - 66 | 3 II $55 \cdot 8$ | $\cdot 73$ | 3 II 9.9 | -80 |
| 42 | 3 IO 15.6 | $\cdot 48$ | $\begin{array}{llll}3 & 9 & 44 \cdot 8\end{array}$ | -55 |  | -6r | $3 \begin{array}{llll}3 & 8 & 31.2\end{array}$ | -68 | $37848 \cdot 0$ | $\cdot 75$ | $\begin{array}{llll}3 & 7 & 0.6\end{array}$ | . 83 |
| 43 | $3 \quad 612.5$ | -49 | $\begin{array}{lll}3 & 5 & 40.8\end{array}$ | -56 | $\begin{array}{lll}3 & 5 & 4 \cdot 8\end{array}$ | -63 | $\begin{array}{llll}3 & 4 & 24 \cdot 6\end{array}$ | $\cdot 71$ | $\begin{array}{llll}3 & 3 & 40 \cdot 0\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 2 & 50 \cdot 9\end{array}$ | -86 |
| 44 | $\begin{array}{llll}3 & 2 & 9 \cdot 3\end{array}$ | $\cdot 51$ | 3 I $36 \cdot 5$ | -58 | $3 \begin{array}{llll}3 & 0 & 59.4\end{array}$ | -66 | $3 \quad 0 \begin{array}{lll}3 & 178\end{array}$ | -73 | $25931 \cdot 7$ | -81 | $2 \begin{array}{llll}28 & 40 \cdot 9\end{array}$ | -89 |
| 45 | $258 \quad 6 \cdot 0$ | - 53 | $25732 \cdot 1$ | -60 | $25653 \cdot 8$ | -68 | $\begin{array}{llll}2 & 56 & 10 \cdot 8\end{array}$ | $\cdot 76$ | $255123 \cdot 1$ | - 84 | $25430 \cdot 5$ | -92 |
| 46 | $\begin{array}{llll}2 & 54 & 2 \cdot 5\end{array}$ | . 54 | $\begin{array}{lllll}2 & 53 & 27 \cdot 5\end{array}$ |  | $\begin{array}{llll}2 & 52 & 47 \cdot 9\end{array}$ | $\cdot 70$ | $\begin{array}{lll}2 & 52 & 3.4\end{array}$ | $\cdot 78$ | $2 \mathrm{l}^{2} \mathrm{I}$ I $4 \cdot \mathrm{I}$ | -86 | $25019 \cdot 7$ | $\cdot 95$ |
| 47 | $\begin{array}{lllll}2 & 49 & 58 \cdot 9\end{array}$ | $\cdot 56$ | 2 49 $22 \cdot 8$ <br> 2 45  |  | $2 \begin{array}{lllll}2 & 48 & 4 \\ \text { •8 }\end{array}$ | $\cdot 72$ | 24755.8 | -8I | $\begin{array}{lll}2 & 47 & 4 \cdot 8\end{array}$ | -89 | $2 \begin{array}{lll}2 & 46 & 8 \cdot 4\end{array}$ | $\cdot 98$ |
| 48 | $24555 \cdot 2$ | $\cdot 58$ | $\begin{array}{llllllll}2 & 45 & 17 & 8\end{array}$ |  | $24435 \cdot 4$ | $\cdot 75$ | $\begin{array}{lllllllll}2 & 43 & 47 \cdot 9\end{array}$ | $\cdot 84$ | $\begin{array}{llll}2 & 42 & 55\end{array}$ | -93 | 24156.7 | I. 02 |
| 49 | 241513 | -60 | $2 \begin{array}{lllll}212 & 7\end{array}$ | -69 | $2 \quad 40 \quad 28 \cdot 8$ | $\cdot 78$ | $23939 \cdot 6$ | $\cdot 87$ | $23^{2} 844.8$ | $\cdot 96$ | 23744.4 | I.06 |
| 50 | $23747 \cdot 2$ | -62 | 23773 | $\cdot 7 \mathrm{I}$ | $2 \begin{array}{llll}26 & 21 \cdot 9\end{array}$ | -80 | $235 \quad 30 \cdot 9$ | -90 | $23434 \cdot 2$ | -99 | 233 31.5 | 1.09 |
| 51 | $233142 \cdot 9$ | -64 | 23331.6 | $\cdot 74$ | 23214.6 | -83 | 23121.8 | -93 | 23023.0 | I.03 | 229 18.1 | [14 |
| 52 | 229388.4 | - 67 | $\begin{array}{lllll}2 & 28 & 55 \cdot 6\end{array}$ | $\cdot 76$ | 228 7-0 | -86 |  | -96 | 22611.3 | 1.07 | $\begin{array}{llll}2 & 25 & 3.9\end{array}$ | I*I8 |
| 53 | $22533 \cdot 7$ | -69 | $22449 \cdot 4$ |  | $2 \begin{array}{llllllll}2 & 58 \cdot 9\end{array}$ | -89 | $\begin{array}{lll}2 & 23 & 2 \cdot 2\end{array}$ | 1.00 | 22159.0 | I.II | 220 49•I | 1. 22 |
| 54 | 22128.8 | $\cdot 71$ | $22042 \cdot 9$ | . 82 | $\left\lvert\, \begin{array}{llll}2 & 19 & 50 \cdot 6\end{array}\right.$ | -93 | 2 18 51*7 | $1 \cdot 04$ | 2 I7 46.1 | I'15 | 21633.4 | 1.27 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $7^{\circ}$ | A. | L. 8 | A. | L. $9^{\circ}$ | A. | L. $10^{\circ}$ | A. | L. 11 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. $-\quad .42$ | S. | S. | S. | ${ }^{\text {S }} \cdot 5$ | s. | S. | s. | S. | s. | s. | s. |
| 4 | $\cdot 43$ | $4 \cdot 02$ | . 50 | -4.03 | -. 58 | -4.04 | - .63 | 4.05 | .70 | 4.06 | .78 .79 | 4.408 |
| 8 | -44 | 4.02 | - 51 | 4.03 | $\cdot 58$ | $4 \cdot 04$ | . 65 | 4.05 | $\cdot 73$ | $4 \cdot 07$ | . 80 | 4.08 |
| 12 | $\cdot 44$ | 4.02 | - 52 | 4.03 | -59 | 4.04 | -66 | 4.06 | $\cdot 74$ | 4.07 | .81 | $4 \cdot 08$ |
| 14 | $\cdot 45$ | $4 \cdot 03$ | -52 | $4 \cdot 03$ | . 60 | $4 \cdot 05$ | $\cdot 67$ | 4.06 | $\cdot 75$ | $4 \cdot 07$ | $=82$ | 4.08 |
| 16 | $\cdot 46$ | 4.03 | -53 | 4.04 | .61 | 4.05 | . 68 | 4.06 | $\cdot 76$ | 4.07 | . 83 | 4.09 |
| 18 | -47 | 4.03 | -54 | $4 \cdot 04$ | -62 | 4.05 | -69 | 4.06 | $\cdot 77$ | $4 \cdot 07$ | . 84 | 4.09 |
| 20 | -47 | 4.03 | - 55 | 4.04 | -63 | 4.05 | $\cdot 70$ | 4.06 | $\cdot 78$ | 4.08 | -86 | 4.09 |
| 22 | -48 | $4 \cdot 03$ | -56 | 4.04 | -64 | 4.05 | $\cdot 71$ | 4.06 | $\cdot 79$ | 4.08 | $\cdot 87$ | $4 \cdot 09$ |
| 24 | -49 | 4.03 | -57 | 4.04 | -65 | 4.05 | $\cdot 73$ | $4 \cdot 07$ | .85 | 4.08 | $\cdot 89$ | 4.10 |
| 26 | $\cdot 50$ | $4 \cdot 03$ | $\cdot 58$ | $4 \cdot 04$ | -66 | 4.05 | $\cdot 74$ | 4.07 | . 82 | 4.08 | '91 | 4.10 |
| 28 | -51 | 4.03 | . 60 | 4.04 | -68 | 4.06 | $\cdot 76$ | 4.07 | . 84 | 4.09 | -93 | $4 \cdot 11$ |
| 30 | -53 | 4.03 | -61 | 4.05 | $\cdot 69$ | 4.06 | $\cdot 78$ | 4.07 | . 86 | $4 \cdot 09$ | -95 | $4 \cdot 11$ |
| 32 | -54 | $4 \cdot 04$ | $\cdot 63$ | 4.05 | $\cdot 71$ | 4.06 | . 80 | 4.08 | -88 | $4 \cdot 10$ | -97 | $4 \cdot 12$ |
| 34 | -56 | $4 \cdot 04$ | -64 | 4.05 | $\cdot 77$ | 4.07 | . 82 | 4.08 | -91 | 4.10 | 1.00 | $4^{\cdot 12}$ |
| 36 | $\cdot 57$ | $4 \cdot 04$ | . 66 | 4.05 |  | 4.07 | . 84 | 4.09 | -93 | $4 \cdot 11$ | r.03 | $4 \cdot 13$ |
| 38 | . 59 | $4 \cdot 04$ | -68 | $4 \cdot 06$ | $\cdot 78$ | 4.07 | $\cdot 87$ | $4 \cdot 09$ | -96 | $4 \cdot 11$ | I.06 | $4 \cdot 14$ |
| 40 | . 61 | 4.05 | $\cdot 71$ | 4.06 | .80 | 4.08 | -90 | $4 \cdot 10$ | -99 | $4 \cdot 12$ | 1.09 | $4 \cdot 15$ |
| 42 | . 63 | $4 \cdot 05$ | $\cdot 73$ | 4.07 | . 83 | 4.09 | -93 | $4 \cdot 11$ | 1.03 | $4 \cdot 13$ | I. 13 | 4.16 |
| 44 | -66 | $4 \cdot 05$ | $\cdot 76$ | 4.07 | -86 | 4.09 | -96 | $4 \cdot 12$ | r.07 | 4.14 | I-18 | 4.17 |
| 46 | $\cdot 68$ | 4.06 | . 80 | 4.08 | -90 | 4.10 | 1.00 | 4.13 | I•II | $4 \cdot 15$ | I. 22 | 4-18 |
| 48 | $\cdot 71$ | 4.06 | . 82 | $4 \cdot 08$ | -94 | $4 \cdot 11$ | 1.05 | 4.14 | I•16 | $4 \cdot 17$ | $1 \cdot 28$ | $4 \cdot 20$ |
| 50 | $\cdot 75$ | 4.07 | -86 | 4.09 | -98 | $4 \cdot 12$ | r.10 | $4 \cdot 15$ | 1.22 | 4-18 | 1.34 | 4.22 |
| 52 | .78 | $4 \cdot 08$ | -90 | $4 \cdot 10$ | 1.03 | $4 \cdot 13$ | I'15 | $4 \cdot 15$ | 1.28 | 4.20 | 1.41 | 4.24 |
| 54 | -82 | 4.08 | '95 | 4.1I | r.08 | $4 \cdot 14$ | I-21 | 4-18 | 1.35 | 4.22 | 1.49 | $4: 27$ |

## LATITUDE $1^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| $\begin{array}{\|c} \text { True } \\ \text { Alt. } \end{array}$ | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ |  | . 07 |  |  |  |  |  |  |  |  |  |  |
| Io | $\begin{array}{lllll}5 & 18 & 13.6\end{array}$ | $\cdot 23$ | $\begin{array}{llll}5 & 59 & 4 \cdot 5 \\ 5 & 17 & 59.5\end{array}$ | . 24 | $\begin{array}{llll}5 & 59 & 0.2 \\ 5 & 17 & 44.5 \\ 5\end{array}$ | . 26 | [54858.7 | $\cdot 27$ |  | - 28 |  | \% |
| 12 | 5 10 2.0 |  | 59459 | 28 | $5 \begin{array}{llll}5 & 9 & 28.7\end{array}$ | $\cdot 30$ | $5 \quad 910 \cdot 4$ | $\cdot 3$ | 58 5r-I |  | $830 \cdot 6$ |  |
| 14 | $5{ }_{5}^{11} 50 \cdot 1$ |  | I $3 \mathrm{r} \cdot 9$ | -31 | 5 I 12 | $\cdot 33$ | 5 0 $51 \cdot 9$ <br>  5  | -36 | $\begin{array}{lll}5 & 0 & 29.9\end{array}$ |  | - 6.6 |  |
| 16 | 45338.0 | $\cdot 33$ | $45317 \%$ | 35 | $45256 \cdot \mathrm{I}$ | 37 | $45232 \cdot 9$ | $\cdot 40$ | $4{ }_{42}{ }^{2} 8 \cdot 3$ | 42 | $45142 \cdot 2$ | 45 |
| 18 | 4 |  |  |  | 4 |  | 4 |  | 4 |  | 4 |  |
| 20 | 437 | 40 | 436 | 43 | $43621 \cdot 7$ | 46 | 43553.4 |  | 43523.2 |  | 434 51-1 |  |
| 22 | 4 <br> 4 <br> 4 <br> 4 <br> 28 | $\stackrel{43}{ }$ |  |  | ${ }^{4} 2883.7$ | 50 | ${ }^{4} 22733 \cdot 7$ |  |  |  | [426 24.4 |  |
| 24 26 | $\begin{array}{cccc}4 & 20 & 45 \cdot 8 \\ 4 & 12 & 31.6\end{array}$ | $.$ | $\begin{array}{lll}4 & 20 & 16.5 \\ 4 & \text { II } & 59.8\end{array}$ | -51 |  | 54 <br> 59 |  | - 63 |  | $\cdot 67$ |  | 72 |
| 28 | $4 \quad 416.8$ |  |  |  |  |  |  | 68 | 143 |  |  |  |
| 29 | 5 | . 57 | 35933.5 |  | $35855 \cdot 1$ |  | $3{ }^{3} 58813.9$ | 7 7 | 35729 | 76 | $35642 \cdot 7$ |  |
| 30 | 36 $1 \cdot 3$ <br> 3 51 |  | 3 35524.3 | . 64 | 3 $5444 \cdot 5$ | -69 |  | 74 | 3 5315 | . 89 |  |  |
| 31 32 | $\begin{array}{llll}3 & 51 & 53.3 \\ 3 & 47 \\ 45\end{array}$ | $\cdot 64$ |  | . 69 |  | 7 | 349 <br> 3 <br> 3 | . 87 |  | 85 | $\begin{array}{llll}3 & 48 & 10 \cdot 6 \\ 3 & 43 & 54.0\end{array}$ | 91 |
| 33 | 34336.6 | . 66 | 342554 | 71 | $34210 \cdot 9$ |  | 34123 |  | 340 | . 88 | 339370 |  |
| 34 | 28.0 | . 68 | $3{ }^{3} 845 \cdot 3$ | 74 | 3 $37 \begin{aligned} & \text { 59.2 }\end{aligned}$ | . 80 | 337 |  | $3 \begin{array}{llll}36 & 16 \cdot 3\end{array}$ |  | $\begin{array}{ll}3 & 3519.5\end{array}$ |  |
| 5 | 35 19.1 | 71 | $3 \quad 34$ 34.8 | 77 | 33347 | . 83 | $3 \quad 3255.6$ | 89 | $\begin{array}{llll}3 & 32 & 0.5\end{array}$ | 95 | 3 31 14 |  |
| 36 37 |  | -73 |  | 8 | (1) $\begin{array}{llll}3 & 29 & 34 \cdot 6 \\ 3 & 25 & 21.8\end{array}$ | 89 |  | 92 9 | (1) $\begin{array}{lll}3 & 27 & 44 \cdot 1 \\ 3 & 23 & 27 \cdot 3\end{array}$ |  |  |  |
| 38 | $32250 \cdot 8$ |  | $\begin{array}{ll}322 & 17\end{array}$ | . 85 | 32 I |  | 320 |  | 319 |  | 318 |  |
| 39 | ${ }^{3} 18840.8$ |  | 3 17 50.0 | . 88 | $\begin{array}{llll}3 & 16 & 55 \%\end{array}$ | 95 | 31555 | -03 |  | $1 \cdot 10$ | $31343{ }^{3}$ |  |
| $4{ }_{4}^{40}$ |  |  |  | -91 |  |  |  |  |  |  |  |  |
| 42 | 3 10 19.8 <br> 3 6 8.7 | -87 | $\begin{array}{llll}3 & 9 & 25 \cdot 3 \\ 3 & 5 & 12 & 3\end{array}$ | -98 | 3 8 $26 \cdot 3$  <br> 3 4 11  |  | ( ${ }^{3}$ | $1 \cdot 1$ | ( |  | $\begin{array}{llll}3 & 5 & 0.7 \\ 3 & 0 & 38.0\end{array}$ |  |
| 43 | ${ }_{3} 1$ |  | 3 | 1.01 | 2 25955.5 | 10 | $2584 \% \cdot 2$ | 18 | 2 5733.6 | 1.27 | 25614.5 |  |
| 44 | $\begin{array}{lllll}2 & 57 & 45 \cdot 4 \\ 2 & 53 \\ 2\end{array}$ | - | 2 25644.9 | 1.05 | $\begin{array}{llll}2 & 55 & 39.3 \\ 2 & 51 \\ 29\end{array}$ | I. 14 | 2 2 5428.4 | 1.23 | 2 $53512 \cdot \mathrm{I}$ | 1.32 | 25150.1 | 1.42 |
| 45 | 2 2 53333.0 | I. I .00 | $\begin{array}{llll}2 & 52 & 30.4 \\ 2 & 48 & 15.2\end{array}$ | I. 1.1 | $\begin{array}{llll}2 & 51 & 22.4 \\ 2 & 47 \\ 2 & 4.8\end{array}$ | 1.22 | $\begin{array}{lllll}2 & 50 & 8.9 \\ 2 & 45 & 48.6\end{array}$ | 1.32 |  |  | 2 4724.6 | I. 4.5 |
| 47 | 245 245 |  | 24359.5 | $1 \cdot 17$ | $2{ }^{2} 42464$ | 1.27 | ${ }_{2}^{2} 4 \mathrm{41} 27 \cdot 4$ | $1 \cdot 37$ | 240 2.1 | 1.48 | $23830 \cdot 2$ |  |
| 48 | 52. | I.11 |  |  | $2 \begin{aligned} & 2 \\ & 38 \\ & 2 \\ & 2\end{aligned}$ |  | $\begin{array}{llll}2 & 37 & 5.2\end{array}$ |  |  | 1.53 | 234 | . 65 |
| 49 | 22 32$22 \cdot 8$ | 1.15 1.20 | 2 35 <br>  315 <br>   |  |  | 142 |  |  |  |  |  |  |
| 51 | 2286 |  | 22648.8 | I. 36 | 22524.0 | 1.47 | $2 \begin{array}{ll}231519\end{array}$ |  | $22212 \cdot 4$ |  | 22024.8 | I.86 |
| 52 | 22349.9 |  | 22228.9 |  | 210.7 | 1.53 | $121925{ }^{\circ}$ | I.66 | 17 | 1.80 | 1549 | $1 \cdot 94$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.


## LATITUDE $1^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 58 \\ 42 \cdot \end{array}$ | . 08 | $\begin{array}{cc} \text { H. M. S. } \\ 5 & 58 \\ 37 \cdot 3 \end{array}$ | s. | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 58 & 32.6 \end{array}\right.$ | $\begin{aligned} & \text { S. } \\ & .08 \end{aligned}$ | $\left\lvert\, \begin{array}{ccc} \text { н. м. } & \text { s. } \\ 5 & 58 & 27 \cdot 9 \end{array}\right.$ | . 08 | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 5 & 58 \\ 23.0 \end{array}\right.$ | $\begin{gathered} \mathrm{s} . \\ -\quad .08 \end{gathered}$ | $\begin{aligned} & \text { н. м. s. } \\ & 5 \mathrm{~S} .58 \text { If. } \end{aligned}$ |  |
| ro | $\begin{array}{lllll}5 & 16 & 35.4\end{array}$ | $\cdot 32$ | $\begin{array}{llllll}5 & 16 & 15.6\end{array}$ | $\cdot 34$ | $\begin{array}{lllll}5 & 15 & 54.9\end{array}$ | - 35 | 51533.0 | . 37 | $\begin{array}{llll}5 & 15 & \text { IO.1 }\end{array}$ | - 39 | $\begin{array}{llll}5 & \text { I4 } & 46 \cdot \mathrm{I}\end{array}$ | .41 |
| 12 | 58890 | -37 | $5746 \cdot 1$ | -39 | $5 \quad 722.0$ | $\cdot 4 \mathrm{r}$ | $5 \begin{array}{llll}5 & 6 & 56.6\end{array}$ | 43 | $5 \quad 629 \cdot 9$ | 46 | $\begin{array}{llll}5 & 6 & 1.9\end{array}$ | -48 |
| 14 | $45942 \cdot 0$ | -42 | 45915.9 | -45 | $45848 \cdot 4$ | -47 | 45819.5 | -50 | $45748 \cdot 9$ | -52 | 45716.8 | $\cdot 55$ |
| 16 | 45114.5 | -48 | $45045 \cdot \mathrm{I}$ | $\cdot 50$ | $45014 \cdot 1$ | -53 | 449 414 | $\cdot 56$ | 4496.9 | 59 | $44^{88} 30 \cdot 6$ | 62 |
| 18 | $44246 \cdot 2$ | -53 | 44213.5 | $\cdot 56$ | 44138.9 | -59 | 44182 | -62 | 44023.9 | 66 | 43943.2 | 69 |
| 20 | 43417.0 | - 58 | $43340 \cdot 9$ | . 62 | 433 | . 66 | $43222 \cdot 2$ | -69 | $43139 \cdot 5$ | $\cdot 73$ | 43054.4 | $\cdot 77$ |
| 22 | $42547 \cdot 0$ | -64 | $425 \quad 7 \cdot 3$ | -68 | $42425 \cdot 2$ | $\cdot 72$ | $42340 \cdot 7$ | $\cdot 76$ | 42253.6 | 81 | $4224^{\circ} 0$ | . 85 |
| 24 | 41715.9 | $\cdot 70$ | 41632.4 | $\cdot 75$ | $41546 \cdot 4$ | $\cdot 79$ | $41457 \cdot 6$ | - 84 | 414 6.1 | -88 | $\begin{array}{llll}4 & 13 & 117\end{array}$ | -93 |
| 25 | $4 \quad 12 \quad 59.9$ | $\cdot 73$ |  | $\cdot 78$ | 4 II 26.5 | $\cdot 83$ | 4 10 35.5 | $\cdot 87$ | $4 \quad 9$ 4I•6 | $\cdot 92$ | 4844.8 | -97 |
| 26 | $\begin{array}{llll}4 & 8 & 43.6\end{array}$ | $\cdot 76$ | $4 \quad 7 \quad 56 \cdot 3$ | -81 | $\begin{array}{llll}4 & 7 & 6 \cdot 1\end{array}$ | -86 | $\begin{array}{llll}4 & 6 & 12.9\end{array}$ | $\cdot 91$ | $\begin{array}{llll}4 & 5 & 16.7\end{array}$ | -96 | $\begin{array}{llll}4 & 4 & 17.3\end{array}$ | 02 |
| 27 | $\begin{array}{llll}4 & 4 & 26.9\end{array}$ | -80 | $4 \quad 3 \quad 37 \cdot 6$ | - 85 | $4 \begin{array}{lll}4 & 2 & 45\end{array}$ | -90 | $4 \begin{array}{llll}4 & 49.9\end{array}$ | $\cdot 95$ | $4051 \cdot 2$ | I-OI | $35949 \cdot 2$ | 1.06 |
| 28 | $\begin{array}{llll}4 & 0 & 9.9\end{array}$ | -83 | $35918 \cdot 5$ | -88 | $\begin{array}{lllll}3 & 58 & 24 \cdot 1\end{array}$ | -93 | $\begin{array}{llll}3 & 57 & 26 \cdot 3\end{array}$ | - | $35625 \cdot 1$ | I 05 | $35520 \cdot 4$ | 11 |
| 29 | $355 \quad 52 \cdot 5$ | -86 | $35459 \cdot 0$ | -92 | $\begin{array}{lll}3 & 54 & 2 \cdot 3\end{array}$ | -97 | $\begin{array}{llll}3 & 53 & 2 \cdot 1\end{array}$ | I.03 | 3 51 58.4 | 1.0 | $35051 \cdot 0$ | 16 |
| 30 | $35134 \cdot 6$ | -90 | $35039 \cdot 1$ | -96 | $34939 \cdot 9$ | 1.01 | 3 48 <br> 87  | I.07 | 347 3rıI | I.I4 | $34620 \cdot 8$ | 1.2 |
| 31 | $\begin{array}{lllll}3 & 47 & 16 \cdot 4 \\ 3 & 42 & 57 \cdot 6\end{array}$ | -93 |  | $\cdot 99$ +.03 |  | 05 | 3 44 12.0 <br> 3 39  | I.12 | $\begin{array}{llll}3 & 43 & 3 \cdot 0\end{array}$ | 8 | $\begin{array}{llllllll}3 & 41 & 49.9 \\ 3 & 37\end{array}$ | I. 25 |
| 32 |  | 97 | $\begin{array}{lllllllllll}3 & 41 & 57.6 \\ 3 & 7 & 36.0\end{array}$ | I.03 | 3 40 $53 \cdot 8$ | I•IO | 3 39 46 | I•16 | $33^{38} 34 \cdot 2$ | 23 | $\begin{array}{lllll}3 & 37 & 18.1\end{array}$ | I.3I |
| 33 | $\begin{array}{lllll}3 & 38 & 38.4 \\ 3 & 34 & 18.6\end{array}$ | I. OI | $\begin{array}{llll}3 & 7 & 36 \cdot 0 \\ 3 & 33 & 13.9\end{array}$ | I.07 | 3 36 $29 \cdot 7$ <br> 3 32  | 14 | 3 313519.3 | I 21 | [3444.6 | 8 |  | I. 36 |
| 34 | $\begin{array}{lllllllllllllllll}3 & 34 & 18 \cdot 6 \\ 3 & 29 & 58 \cdot 3\end{array}$ | $\begin{array}{r}1.05 \\ \text { I } \\ \hline 1\end{array}$ | $\begin{array}{llll}3 & 33 & 13.9 \\ 3 & 28 & 51.9\end{array}$ | I•II | $\begin{array}{llll}3 & 32 & 5 \cdot 0 \\ 3 & 27 & 39.5\end{array}$ | I.18 | 3 30 51.8 <br> 3 26  | I. 26 | 3 29 $34 \cdot 1$ | 1.3 | $\begin{array}{llll}3 & 28 \\ \text { Ir }\end{array}$ | 1.41 |
| 35 | $32958 \cdot 3$ | I.09 | $3285 \mathrm{I} \cdot \mathrm{I}$ | 16 | $\begin{array}{llll}3 & 27 & 39.5\end{array}$ | 1 | $3 \quad 2623.5$ | $1 \cdot 31$ | $\begin{array}{llll}3 & 25 & 29\end{array}$ | r.39 | $\begin{array}{lllllllllll}3 & 23 & 37 \cdot 1\end{array}$ | 47 |
| 36 |  | I.13 | $32427 \cdot 6$ | 1.20 | $\begin{array}{llll}3 & 23 & 13.3\end{array}$ | I.28 | $32154 \cdot 3$ | I. 36 | $32030 \cdot 3$ | 1.44 | $3 \mathrm{I} 91 \cdot 3$ | 5 |
| 37 | $\begin{array}{llll}3 & 21 & 15 \cdot 8 \\ 3 & 1 & 5\end{array}$ | 17 | $\begin{array}{llll}3 & 20 & 3.4\end{array}$ | I 25 | 3 1846.2 | 1.33 | $\begin{array}{lllll}3 & 17 & 24 \cdot 1\end{array}$ | 1.45 | $\begin{array}{lllll}3 & 15 & 56 \cdot 9\end{array}$ | I.50 |  | . 59 |
| 38 |  |  |  | I29 |  | r38 | $\begin{array}{llllllllll}3 & 12 & 52.9\end{array}$ | I.47 | 3 II $22 \cdot 3$ | 1.56 | 3 9 46.0 | 1.65 |
| 39 |  | I 26 | 3 II 12.5 | I•34 | $\begin{array}{llll}3 & 9 & 49\end{array}$ | 1.43 | $\begin{array}{llll}3 & 8 & 20.7\end{array}$ | r | $\begin{array}{llll}3 & 6 & 46 \cdot 4\end{array}$ | . 62 | $\begin{array}{llll}3 & 5 & 6 \cdot 3\end{array}$ | I. 72 |
| 40 | $\begin{array}{llll}3 & 8 & 6 \cdot 7\end{array}$ | $1 \cdot 31$ | $3 \quad 645 \%$ | I. 39 | $\begin{array}{llll}3 & 5 & 19.3\end{array}$ | I 49 | $\begin{array}{llll}3 & 3 & 47 \cdot 3\end{array}$ | I.58 | $\begin{array}{llll}3 & 2 & 9 \cdot 3\end{array}$ | I.68 | 3 O $25 \cdot \mathrm{I}$ | I•79 |
| 41 | $\begin{array}{llll}3 & 3 & 42 \cdot 0\end{array}$ | I.36 | $\begin{array}{llll}3 & 2 & 17.9\end{array}$ | I. 45 | 3 O | I. 54 | 25912.6 | ェ. 65 | $25730 \cdot 7$ | I.75 | $25542 \cdot 3$ | 1.86 |
| 42 | $\begin{array}{lllll}2 & 59 & 16.4\end{array}$ | 1 | $25749 \cdot 0$ | r | $\begin{array}{lllll}2 & 56 & 15.9\end{array}$ | I.60 | $25436 \cdot 5$ | 1.7 | $25250 \cdot 5$ | I. 82 | $25057 \cdot 7$ | 1.94 |
| 43 | ${ }_{2}^{2} 54449 \cdot 8$ | 1.46 | $125319 \cdot 1$ | r 56 | $\begin{array}{llllll}2 & 51 & 42 \cdot 3\end{array}$ | I.67 | $\begin{array}{llll}2 & 49 & 58.9\end{array}$ | 178 | 2488.6 | 190 | $246 \mathrm{II} \cdot \mathrm{I}$ | 2.02 |
| 44 | 2 50 <br> 2 $22 \cdot 1$ <br> 2 4 | r.52 | $\begin{array}{llllll}2 & 48 \\ 2 & 47.9\end{array}$ | 62 | $\begin{array}{lllllllll}2 & 47 & 7 \\ 2 & 42 & 30.7\end{array}$ | r.73 | 2 45 $19 \cdot 7$ <br> 2 40  | r.85 | $\begin{array}{llll}2 & 43 \\ 24.9\end{array}$ | r.98 | 24122.5 | $2 \cdot 11$ |
| 45 | $24553 \cdot 3$ | r.58 | 24415.4 | I. 69 | $24230 \cdot 7$ | I.81 | 24038.7 | I'93 | 238839.2 | 2.06 | ${ }^{2} 3631 \cdot 6$ | $2 \cdot 20$ |
| 46 | $4123 \cdot \mathrm{I}$ | r. 64 | $23941 \cdot 3$ | r.76 | 23752.4 | I.88 | 23555.9 | 2.01 | 23351.2 | $2 \cdot 15$ | $23{ }^{15} 38 \cdot 1$ | $2 \cdot 30$ |
| 47 | $\begin{array}{lllllll}2 & 36 & 51 \\ 2 & 6\end{array}$ | 1.70 | $23505 \cdot 7$ | I. 83 | $\begin{array}{lllll}2 & 33 & 12.3\end{array}$ | I.96 | $\begin{array}{llll}2 & 35 & 10.9\end{array}$ | 2.09 | $\begin{array}{lll}2 & 29 & 0.9\end{array}$ | 2.24 | $\begin{array}{llll}2 & 26 & 41 \cdot 8\end{array}$ | 2.40 |
| 48 | $\begin{array}{lllll}2 & 32 & 18 \cdot 5\end{array}$ | $\begin{array}{r}1 \\ \hline\end{array} 7$ | $23028 \cdot 4$ | 1.90 | $\begin{array}{lllllll}2 & 28 & 30 \cdot 2\end{array}$ | 2.04 |  | $2 \cdot 19$ | $\begin{array}{llll}2 & 24 & 7.8\end{array}$ | $2 \cdot 34$ | $22142 \cdot 5$ | $2 \cdot 50$ |
| 49 |  | I.85 | 2 25 <br> 2 49 | I.98 | $\begin{array}{ll}2 & 23 \\ 2 & 45.9\end{array}$ | 2.13 | $\begin{array}{lllll}2 & 21 & 33.6 \\ 2 & 16 & \end{array}$ | $2 \cdot 28$ | $\begin{array}{llll}2 & 19 & \text { II. } 8 \\ 2\end{array}$ | 2.45 | $\begin{array}{llll}2 & 16 & 39.7\end{array}$ | 2.62 |
| 50 | 2237 | 1.92 | 2177 | $2 \cdot 07$ | 2  <br> 18 59 | $2 \cdot 22$ | 21640.9 | $2 \cdot 39$ | 121412.5 | $2 \cdot 57$ | 2 II $33^{\circ}$ | $2 \cdot 74$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21{ }^{\circ}$ | - A. | L. $22{ }^{\circ}$ | - A. | L. $23^{\circ}$ | ${ }^{\circ}$ A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | - I.30 | -4.2I | - I.38 | $-4.23$ | -I.46 | $-4 \cdot 26$ | - I. 54 | $-4.28$ | - I. 62 | $-4.31$ | -1.70 | $-4.35$ |
| 4 | I.31 | $4 \cdot 21$ | I.39 | $4 \cdot 23$ | 1.47 | $4 \cdot 26$ | I. 55 | $4 \cdot 29$ | 1.63 | $4 \cdot 32$ | 1-71 | $4 \cdot 35$ |
| 6 | I•32 | $4 \cdot 21$ | 1.40 | $4 \cdot 24$ | I.48 | $4 \cdot 26$ | 1.56 | $4 \cdot 29$ | I. 64 | $4 \cdot 32$ | $1 \cdot 72$ | $4 \cdot 35$ |
| 8 | I-33 | $4 \cdot 21$ | 1.41 | $4 \cdot 24$ | I-49 | $4 \cdot 27$ | I.57 | $4 \cdot 30$ | 1. 65 | $4 \cdot 33$ | I•73 | $4 \cdot 36$ |
| 10 | I.34 | 4.22 | I. 42 | $4 \cdot 24$ | I. 50 | $4 \cdot 27$ | I.58 | 4.30 | I. 66 | $4 \cdot 33$ | I•74 | $4 \cdot 37$ |
| 12 | I.35 | 4.22 | I.43 | $4 \cdot 25$ | I•5 | $4 \cdot 28$ | I•59 | $4 \cdot 31$ | 1. 68 | $4 \cdot 34$ | ェ・76 | $4 \cdot 37$ |
| 14 | I.36 | $4 \cdot 23$ | 1.45 | 4.25 | I. 53 | $4 \cdot 28$ | Y.61 | $4 \cdot 31$ | 1.70 | $4 \cdot 35$ | I.78 | $4 \cdot 38$ |
| 16 | I. 38 | $4: 23$ | 1.46 | $4 \cdot 26$ | I. 55 | $4 \cdot 29$ | r.63 | $4 \cdot 32$ | 1.72 | 4.35 | I.8I | $4 \cdot 39$ |
| 18 | 1.40 | $4 \cdot 24$ | 1.48 | 4.27 | 1.57 | 4.30 | I. 66 | $4 \cdot 33$ | I.74 | $4 \cdot 36$ | r.83 | $4 \cdot 40$ |
| 20 | 1.42 | $4 \cdot 25$ | I.5I | $4 \cdot 28$ | I. 59 | $4 \cdot 31$ | I. 68 | $4 \cdot 34$ | 1.77 | $4 \cdot 38$ | I. 86 | $4 \cdot 41$ |
| 22 | I.45 | $4 \cdot 25$ | I 53 | $4 \cdot 29$ | I. 62 | $4 \cdot 32$ | I•71 | $4 \cdot 35$ | 1.80 | $4 \cdot 39$ | I•90 | $4 \cdot 43$ |
| 24 | 1.48 | $4 \cdot 26$ | r.56 | $4 \cdot 30$ | 1.65 | $4 \cdot 33$ | I•75 | $4 \cdot 36$ | I.84 | $4 \cdot 40$ | I•94 | $4 \cdot 44$ |
| 26 | I. 51 | $4 \cdot 27$ | I. 60 | $4 \cdot 31$ | r. 69 | $4 \cdot 34$ | I•78 | $4 \cdot 38$ | 1.88 | $4 \cdot 42$ | I.98 | $4 \cdot 46$ |
| 28 | I-54 | $4 \cdot 29$ | I. 63 | $4 \cdot 32$ | 1.73 | $4 \cdot 36$ | I.83 | $4 \cdot 40$ | I•93 | $4 \cdot 44$ | 2.03 | $4 \cdot 48$ |
| 30 | I.58 | $4 \cdot 30$ | r. 67 | $4 \cdot 34$ | 1.77 | $4 \cdot 37$ | r.87 | $4 \cdot 42$ | I.98 | $4 \cdot 46$ | 2.08 | $4 \cdot 51$ |
| 32 | 1.62 | $4 \cdot 32$ | I*72 | 4.35 | 1.82 | $4 \cdot 40$ | I.92 | $4 \cdot 44$ | 2.03 | $4 \cdot 49$ | 2.14 | 4*54 |
| 34 | 1.67 | $4 \cdot 33$ | 1.77 | $4 \cdot 37$ | I. 88 | 4.42 | I.98 | $4 \cdot 46$ | 2.09 | $4 \cdot 52$ | $2 \cdot 21$ | $4 \cdot 57$ |
| 36 | 1.72 | $4 \cdot 35$ | I. 83 | $4 \cdot 40$ | 1.94 | $4 \cdot 44$ | $2 \cdot 05$ | 4.49 | 2.16 | $4 \cdot 55$ | $2 \cdot 28$ | $4 \cdot 61$ |
| 38 | 1.78 | $4 \cdot 38$ | - 89 | $4 \cdot 42$ | $2 \cdot 00$ | 4.47 | $2 \cdot 12$ | 4.53 | $2 \cdot 24$ | 4.59 | $2 \cdot 37$ | 4.65 |
| 40 | I. 84 | 4.40 | I.96 | $4 \cdot 45$ | $2 \cdot 08$ | $4 \cdot 51$ | $2 \cdot 20$ | 4.57 | 2.33 | 4.63 | 2.47 | 4.70 |
| 42 | I.91 | 4.43 | $2 \cdot 04$ | 4.49 | $2 \cdot 17$ | 4.55 | $2 \cdot 30$ | $4 \cdot 61$ | $2 \cdot 44$ | $4 \cdot 68$ | $2 \cdot 58$ | 4.76 |
| 44 | $2 \cdot 00$ | $4 \cdot 47$ | $2 \cdot 13$ | $4 \cdot 53$ | $2 \cdot 26$ | 4.60 | $2 \cdot 41$ | $4 \cdot 67$ | $2 \cdot 55$ | $4 \cdot 74$ | 2.71 | 4.83 |
| 46 | 2.09 | $4 \cdot 51$ | 2.23 | $4 \cdot 58$ | $2 \cdot 38$ | $4 \cdot 65$ | 2.53 | $4 \cdot 73$ | 2.69 | 4.82 | 2.86 | 4.91 |
| 48 | $2 \cdot 20$ | 4.56 | $2 \cdot 35$ | 4.64 | 2.51 | $4 \cdot 72$ | 2.67 | $4 \cdot 81$ | 2.84 | 4.91 | 3.03 | $5 \cdot 02$ |
| 50 | $2 \cdot 32$ | $4 \cdot 62$ | $2 \cdot 48$ | $4 \cdot 71$ | 2.65 | 4.80 | 2.84 | $4 \cdot 90$ | 3.03 | 5.01 | 3.23 | $5 \cdot 15$ |

## 130 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT.

## LATITUDE $2^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. S. | s. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $\begin{array}{rrr}6 & 0 & 0.0 \\ 5 & 5 & 58\end{array}$ | -14 | 5 59 $51 \cdot 6$ | - '14 | $\begin{array}{llll}5 & 59 & 43 \cdot 2\end{array}$ | - -14 | $\begin{array}{llll}5 & 59 & 34 \cdot 8\end{array}$ | -14 | $\begin{array}{llll}5 & 59 & 26 \cdot 4\end{array}$ | -14 | 559 I8.0 | -14 |
| 10 | 5 I9 $58 \cdot 5$ | -14 | 5 I9 49*7 | -15 | $51940 \cdot 0$ | -17 | 5193129.6 | -18 | 5 19 18.5 | -19 | $\begin{array}{lllll}5 & \text { I9 } & 6.6\end{array}$ | - 20 |
| 12 | 5 II 58.2 | -14 | 5 II $49 \cdot 2$ | - 16 | $\begin{array}{llll}5 & \text { II } & 39\end{array}$ |  | 5 II 28.5 | -19 | 5 II 16.7 | -20 | 5 II 4.1 | $\cdot 22$ |
| 14 | $4 \quad 3 \quad 57 \cdot 9$ | -14 | $\begin{array}{llll}5 & 3 & 48 \cdot 8\end{array}$ | -16 | $\begin{array}{llll}5 & 3 & 38 \cdot 5\end{array}$ | -18 | $\begin{array}{llll}5 & 3 & 27 \cdot 3\end{array}$ | - 20 | $\begin{array}{llll}5 & 3 & 14.9\end{array}$ | -2I | $\begin{array}{llll}5 & 3 & 1 & 5\end{array}$ | - 23 |
| 16 | $45557 \cdot 6$ | -14 | $\begin{array}{lllll}4 & 55 & 48 \cdot 3\end{array}$ | -17 | $45537 \cdot 7$ | -19 | $455 \quad 26 \cdot 0$ | -21 | $45513 \cdot 0$ | -23 | $4 \quad 5458.8$ | -25 |
| 18 | $44757 \cdot 3$ | -15 | $44747 \cdot 8$ | -17 | $44737 \cdot 0$ | -19 | $44724^{\prime 7}$ | -22 | 447 II•O | -24 | $44656 \cdot 0$ | - 26 |
| 20 | $43957 \cdot 0$ | -15 | $43947 \cdot 3$ | -17 | $43936 \cdot 1$ | - 20 | $43923 \cdot 3$ | -23 | $43399 \cdot 0$ | -25 | $43853 \cdot 1$ | -28 |
| 22 | $43156 \cdot 6$ | -15 | 4 3I 46•7 | -18 | $43135 \cdot 1$ |  | 4 3I 21.8 | -24 | 43168 | - 26 | $43050 \cdot 0$ | -29 |
| 24 | $42356 \cdot 3$ | -15 | $\begin{array}{llll}4 & 23 & 46 \cdot 1\end{array}$ | -18 | $42334 \cdot 2$ |  | $423 \quad 20 \cdot 3$ | -25 | $\begin{array}{llll}4 & 23 & 4.5\end{array}$ | -28 | $42246 \cdot 8$ | -3I |
| 26 | $41555 \cdot 9$ | -15 | 4 I5 $45 \cdot 6$ | -19 | 4 I5 $33 \cdot 2$ | $\cdot 22$ | 415 18.7 | -26 | 4 I5 2•I | -29 | $41443 \cdot 5$ | $\cdot 33$ |
| 28 | $4755 \cdot 6$ | -16 | 47449 | -20 | $4732 \cdot 1$ | -23 | 4717.0 | - 27 | $\begin{array}{rrrr}4 & 6 & 59.6\end{array}$ | -31 | $4 \quad 6 \quad 39 \cdot 9$ | -35 |
| 30 | $35955 \cdot 2$ | -16 | $35944 \cdot 3$ | -20 | $35931 \cdot 0$ | -24 | 35915.2 | -28 | $\begin{array}{lllllllllll}3 & 58 & 56 \cdot 9\end{array}$ | $\cdot 32$ | $\begin{array}{lllll}3 & 58 & 36 \cdot 2\end{array}$ | -37 |
| 32 | 3 51 54.8 | -16 | 3 51 43.6 | -21 | 3 51 29.7 | -25 | $3{ }^{3} 5118.2$ | -30 | $35054 \cdot \mathrm{I}$ | $\cdot 34$ | $35032 \cdot 2$ | -39 |
| 33 | $34754 \cdot 6$ | -17 | $3 \begin{array}{llll}3 & 47 & 43\end{array}$ | -2I | $3 \begin{array}{llll}3 & 47 & 29 \cdot 1\end{array}$ | -26 | 34712.2 | -30 | $34652 \cdot 6$ | - 35 | $34630 \cdot 1$ | - 40 |
| 34 | $34354 \cdot 3$ | -17 | $34342 \cdot 8$ | $\cdot 21$ | $343 \quad 28 \cdot 5$ | -26 | 343 II•2 | -31 | 342 5I•I | $\cdot 36$ | $34228 \cdot 0$ | -41 |
| 35 | $33954 \cdot 1$ | -17 | 33942.4 | -22 | $\begin{array}{llll}3 & 39 & 27 \cdot 8\end{array}$ | $\cdot 27$ | 339 10.1 | $\cdot 32$ | $\begin{array}{llll}3 & 38 & 49 \cdot 5\end{array}$ | $\cdot 37$ | $\begin{array}{llll}3 & 38 & 25 \cdot 8\end{array}$ | $\cdot 42$ |
| 36 | $\begin{array}{lllll}3 & 35 & 53.9\end{array}$ | -17 | $\begin{array}{llll}3 & 35 & 42 \cdot 0\end{array}$ | - 22 | $\begin{array}{llll}3 & 35 & 27 \cdot 1\end{array}$ | -27 | $\begin{array}{llll}3 & 35 & 9 \cdot 0\end{array}$ | -33 | $3{ }^{3} 34447 \cdot 8$ | $\cdot 38$ |  | -43 |
| 37 | 3 31 53.7 | -17 | 3 3I 4I•6 | -23 | 3 31 26.3 | $\cdot 28$ | 3 31 $7 \cdot 9$ | -33 | $33046 \cdot 2$ | -39 | $33021 \cdot 2$ | -44 |
| 38 | $\begin{array}{llll}3 & 27 & 53 \cdot 5\end{array}$ | -18 | $\begin{array}{llll}3 & 27 & 41 \cdot 2 \\ 3 & 23 & 40 \cdot 7\end{array}$ | $\cdot 23$ | $\begin{array}{llll}3 & 27 & 25 \cdot 6\end{array}$ | -29 | $\begin{array}{llll}3 & 27 & 6 \cdot 7 \\ 3 & 23 & 5 \cdot 4\end{array}$ | $\cdot 34$ | $\begin{array}{llll}3 & 26 & 44.4\end{array}$ | -40 | $\begin{array}{llll}3 & 26 & 18 \cdot 8\end{array}$ | $\bullet 46$ |
| 39 | $\begin{array}{llll}3 & 23 & 53 \cdot 2\end{array}$ | -18 | $32340 \cdot 7$ | -24 | $323 \begin{array}{llll}3 & 24 \cdot 8\end{array}$ | -29 | $\begin{array}{llll}3 & 23 & 5 \cdot 4\end{array}$ | $\cdot 35$ | $32242 \cdot 6$ | -41 | 322163 | $\cdot 47$ |
| 40 | 31953.0 | -18 | 3 I9 40.2 | -24 | 319240 | -30 | 3 I9 4.2 | -36 | $31840 \cdot 8$ | $\bullet 42$ | $\begin{array}{llll}3 & 18 & 13.7\end{array}$ | -48 |
| 41 |  | -18 | 3 I5 $39 \cdot 8$ | - 25 | 3 I5 23.2 | -3I | $\begin{array}{llll}3 & 15 & 2 \cdot 7\end{array}$ | $\cdot 37$ | $\begin{array}{llll}3 & 14 & 38 \cdot 8\end{array}$ | -43 | 314 II 0 | - 50 |
| 42 | 3 II $52 \cdot 4$ | -19 | $\begin{array}{llll}3 & \text { II } & 39 \cdot 3\end{array}$ | -25 | 3 II 22.3 | -3I | 3 II 1.5 | -38 | 3 10 $36 \cdot 8$ | -44 | 31088 | -51 |
| 43 | $\begin{array}{lllll}3 & 7 & 52 \cdot 2\end{array}$ | -19 | $\begin{array}{llll}3 & 7 & 38 \cdot 8\end{array}$ | -26 | $\begin{array}{llll}3 & 7 & 21.4\end{array}$ | -32 | $3 \quad 7 \quad 0 \cdot 1$ | -39 | $3 \quad 6 \quad 34 \cdot 7$ | $\cdot 46$ | $\begin{array}{lll}3 & 6 & 5 \cdot 3\end{array}$ | -52 |
| 44 | $3 \quad 3 \quad 51 \cdot 9$ | -19 | $\begin{array}{llll}3 & 3 & 38 \cdot 2\end{array}$ | - 26 | $\begin{array}{llll}3 & 3 & 20 \cdot 5\end{array}$ | $\cdot 33$ | $\begin{array}{llll}3 & 2 & 58 \cdot 5\end{array}$ | -40 | $\begin{array}{llll}3 & 2 & 32 \cdot 5\end{array}$ | -47 | $\begin{array}{llll}3 & 2 & 2 \cdot 2\end{array}$ | -54 |
| 45 | $25951 \cdot 6$ | -20 | $25937 \cdot 6$ | -27 | 25919.5 |  | $25857 \cdot 0$ | -4I |  | - 48 | $25759 \cdot 1$ | . 56 |
| 46 | $25551 \cdot 3$ | - 20 | $25537 \cdot 0$ | $\cdot 27$ | $2 \begin{array}{llll}255 & 18 \cdot 5\end{array}$ |  | $25455 \cdot 4$ | -42 | $2 \begin{array}{lllll}2 & 54 & 27 \cdot 9\end{array}$ | $\cdot 50$ | $25355 \cdot 8$ | $\cdot 57$ |
| 47 | $2515 \mathrm{I} \cdot \mathrm{O}$ | $\cdot 20$ | $25136 \cdot 5$ | $\cdot 28$ | $25117 \cdot 4$ | -36 | $25053 \cdot 7$ | -43 | $25025 \cdot 4$ | $\cdot 51$ | $24952 \cdot 3$ | -59 |
| 48 | $24750 \cdot 7$ | $\cdot 2 \mathrm{I}$ | $2{ }^{2}$ | -29 |  |  | $2 \begin{array}{lllllll}2 & 46 & 519\end{array}$ | -44 | $\begin{array}{lllll}2 & 46 & 22 \cdot 8\end{array}$ | - 53 | $24548 \cdot 8$ | -61 |
| 49 | $24350 \cdot 3$ | -21 | $24335 \cdot 1$ | -29 | 243 I5-1 | -37 | $24250 \cdot \mathrm{I}$ | $\cdot 46$ | 242 20.1 | -54 | 24 I 45 I | . 63 |
| 50 | $23950 \cdot 0$ | -22 | 23934.4 | -30 | $\begin{array}{llll}2 & 39 & 13.8\end{array}$ |  | 22 38 48 | $\cdot 47$ | $\begin{array}{lllll}2 & 38 & 17 & 3\end{array}$ | $\cdot 56$ | $2374 \mathrm{I} \cdot 2$ | . 65 |
| 51 | $23549 \cdot 6$ | $\cdot 22$ | $23533 \cdot 7$ |  | 23512.5 |  | 234 46•I | -48 | 234414.3 | - 57 | 233 37•1 | -67 |
| 52 | 2 31 49.3 | . 23 | 231132.9 | $\cdot 32$ | 2 3I II•2 | $\cdot 41$ | 23044.0 | -50 | 230 III.2 | - 59 | $\begin{array}{llll}2 & 29 & 32 \cdot 7\end{array}$ | -69 |
| 53 | $22748 \cdot 9$ | - 23 | $22732 \cdot 1$ | -33 |  |  | $22641 \cdot 7$ | -5I | $\begin{array}{llll}2 & 26 & 7 \cdot 9\end{array}$ | . 61 | $22528 \cdot 2$ | $\cdot 71$ |
| 54 | $22348 \cdot 5$ | -24 | 223 3I.3 | $\cdot 33$ | $\begin{array}{llll}2 & 23 & 8 \cdot 3\end{array}$ | -43 | $22239 \cdot 3$ | . 53 | 22244 | . 63 | 22523.4 | $\bullet 73$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | s. | s. | S. | s. | s. | s. | S. | S. | S. |
| 0 | -00 | -4.00 | -.07 | $-4.00$ | - 14 | -4.00 | - $\cdot 21$ | $-4.01$ | - $\cdot 28$ | $-4.01$ | - 35 | $-4.02$ |
| 4 | -OI | 4.00 | -08 | 4.00 | -15 | 4.01 | - 22 | 4.01 | -29 | 4.01 | -36 | 4.02 |
| 8 | -02 | 4.00 | -09 | $4 \cdot 00$ | -16 | 4.01 | $\cdot 23$ | 4.01 | -30 | 4.01 | -37 | 4.02 |
| 12 | -03 | 4.00 | -10 | 4.00 | -17 | 4.01 | -24 | 4.01 | $\cdot 32$ | 4.01 | -39 | 4.02 |
| 14 | -03 | $4 \cdot 00$ | -II | $4 \cdot 00$ | -18 | 4.01 | -25 | 4.01 | $\cdot 32$ | 4.02 | $\cdot 39$ | 4.02 |
| 16 | -04 | $4 \cdot 00$ | - II | 4.00 | -19 | $4^{\circ} \mathrm{OI}$ | - 26 | 4.01 | -33 | $4 \cdot 02$ | -40 | 4.02 |
| 18 | -04 | 4.00 | -12 | 4.00 | -19 | 4.01 | -27 | $4 \cdot 01$ | $\cdot 34$ | $4 \cdot 02$ | -41 | $4 \cdot 02$ |
| 20 | . 05 | $4 \cdot 00$ | -12 | 4.00 | $\cdot 20$ | 4.01 | -27 | $4 \cdot 01$ | -35 | 4.02 ' | -42 | 4.02 |
| 22 | . 05 | 4.00 | -13 | $4 \cdot 00$ | -21 | $4^{\circ} \mathrm{OI}$ | -28 | $4 \cdot \mathrm{OI}$ | $\cdot 36$ | 4.02 | $\cdot 43$ | $4 \cdot 03$ |
| 24 | . 06 | $4 \cdot 00$ | -14 | $4 \cdot 00$ | - 21 | 4.01 | -29 | 4.01 | $\cdot 37$ | 4.02 | -45 | $4 \cdot 03$ |
| 26 | -07 | $4 \cdot 00$ | -15 | 4.01 | -22 | 4.01 | -30 | 4.01 | $\cdot 38$ | 4.02 | -46 | $4 \cdot 03$ |
| 28 | $\cdot 07$ | 4.00 | -15 | $4 \cdot 01$ | $\cdot 23$ | 4.01 | -31 | $4 \cdot 01$ | -39 | 4.02 | $\cdot 47$ | $4 \cdot 03$ |
| 30 | -08 | 4.00 | -16 | 4.01 | -24 | 4.01 | $\cdot 32$ | 4.02 | $\cdot 41$ | $4 \cdot 02$ | -49 | 4.03 |
| 32 | -09 | $4 \cdot 00$ | -17 | $4 \cdot \mathrm{OI}$ | -25 | 4.01 | -33 | $4 \cdot 02$ | $\cdot 42$ | 4.02 | $\cdot 50$ | 4.03 |
| 34 | $\cdot 09$ | $4 \cdot 00$ | -18 | $4 \cdot 01$ | -26 | $4 \cdot 01$ | -35 | 4.02 | $\cdot 43$ | 4.03 | $\cdot 52$ | 4.04 |
| 36 | -10 | 4.00 | -19 | 4.01 | $\cdot 27$ | 4.01 | -36 | 4.02 | $\bullet 45$ | 4.03 | $\cdot 54$ | 4.04 |
| $3^{8}$ | -II | 4.00 | - 20 | 4.01 | - 29 | 4.01 | -38 | 4.02 | -47 | 4.03 | $\cdot 56$ | 4.04 |
| 40 | -12 | $4 \cdot 00$ | $\cdot 21$ | 4.01 | $\cdot 30$ | 4.01 | -39 | 4.02 | -49 | 4.03 | $\cdot 58$ | 4.04 |
| 42 | -12 | 4.00 | -22 | $4 . \mathrm{OI}$ | -31 | 4.01 | -41 | 4.02 | -5I | 4.03 | -60 | 4.05 |
| 44 | -14 | 4.00 | -23 | 4.01 | $\cdot 33$ | $4 \cdot 02$ | -43 | $4 \cdot 03$ | -53 | 4.04 | -63 | 4.05 |
| 46 | -14 | 4.00 | -25 | 4.01 | -35 | 4.02 | -45 | $4 \cdot 03$ | -55 | 4.04 | -66 | 4.06 |
| 48 | -16 | 4.00 | - 26 | 4.01 | $\cdot 37$ | 4.02 | -47 | 4.03 | - 58 | 4.04 | -69 | 4.06 |
| 50 | - 17 | 4.01 | -28 | 4.01 | -39 | 4.02 | -50 | $4 \cdot 03$ | -61 | 4.05 | $\cdot 72$ | $4 \cdot 07$ |
| 52 | -18 | 4.01 | -29 | 4.01 | -41 | 4.02 | $\cdot 52$ | $4 \cdot 04$ | -64 | 4.05 | $\cdot 76$ | $4 \cdot 07$ |
| 54 | -19 | 4.01 | $\cdot 31$ | $4 \cdot 01$ | $\cdot 43$ | 4.02 | $\cdot 55$ | 4.04 | -68 | 4.06 | -80 | 4.08 |

## LATITUDE $2^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | н. м. |  | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 5 & 59 & \mathrm{I} \cdot \mathrm{O} \end{array}\right.$ | S. | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \mathrm{S} . \\ 5 & 58 \end{array} \mathbf{5 2}^{2 \cdot 5}\right.$ |  | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 58 & 44^{\circ} \mathrm{O} \end{array}\right.$ |  | н. м. s. $55835 \cdot 4$ | , 14 | $\begin{array}{ccc} \text { H. м. } \\ 5 & 58 & \text { S. } \\ \hline \end{array}$ | 15 |
| 10 | $\begin{array}{llll}5 & 59 & 9 \\ 5 & 53\end{array}$ | $\cdot 22$ | $\begin{array}{llll}5 & 18 & 40 \cdot 4\end{array}$ | - 23 | ${ }_{5} 18$ I $26 \cdot 1$ | - 24 |  | - $\cdot 26$ | $\begin{array}{llll}5 & \text { I7 } & 55 \cdot 1\end{array}$ | $\cdot 27$ | $\begin{array}{llll}5 & 17 & 38 \cdot 2\end{array}$ | $\cdot 29$ |
| 12 | 5 10 $50 \cdot 5$ | -23 | 5 10 36.0 | - 25 | $51020 \cdot 4$ | -27 | 5 10 3.9 | - 28 | $5 \quad 946 \cdot 4$ | $\cdot 30$ | $\begin{array}{llll}5 & 9 & 27.9\end{array}$ | $\cdot 32$ |
| 14 | $5247 \%$ | -25 | $\begin{array}{llll}5 & 2 & 3 I & 3\end{array}$ | -27 | $\begin{array}{llll}5 & 2 & 14.5\end{array}$ | -29 | 5 I $56 \cdot 6$ | -31 | 5 I $37 \cdot 6$ | 33 | $\begin{array}{lllllll}5 & 1 & 17.3\end{array}$ | $\cdot 35$ |
| 16 | $45443 \cdot 3$ | 27 | $4 \quad 54 \quad 26 \cdot 5$ | -29 | $\begin{array}{lll}4 & 54 & 8.5\end{array}$ | -3I | $45349 \cdot 1$ | -33 | $45328 \cdot 4$ | 36 | $4 \begin{array}{lll}43 & 6 \cdot 3\end{array}$ | 38 |
| 18 | $4639 \cdot 5$ | 29 | 44621.6 | 31 | $446 \quad 2 \cdot 2$ | 33 | $44541 \cdot 4$ | $\cdot 36$ | 44519.0 | 39 | 44 55.0 | 4 I |
| 20 | $43835 \cdot 6$ | 31 | 43816.4 | $\cdot 33$ | $43755 \cdot 7$ | $\cdot 36$ | $43733 \cdot 3$ | -39 | $437 \quad 9.2$ | 42 | 43643.4 | 44 |
| 22 | $4303 \mathrm{I} \cdot 5$ | $\cdot 32$ | $430 \mathrm{II} \cdot \mathrm{I}$ | -35 | $42949 \cdot 0$ | $\cdot 38$ | 42925.0 | $\cdot 42$ | 428 59-I | 45 | $42831 \cdot 2$ | 48 |
| 24 | $42227 \cdot 1$ | $\cdot 34$ | 4225.5 | -38 | 421419 | 41 | 42116.2 | 44 | $42048 \cdot 5$ | 48 | 42018.6 | 52 |
| 26 | 41422.7 | 36 | $4 \begin{array}{llll}4 & 59 \cdot 7\end{array}$ | 40 | 4 I3 34.5 | 44 | $\begin{array}{llll}4 & 13 & 7 \cdot 1\end{array}$ | 47 | $41237 \cdot 5$ | 51 | $4 \begin{array}{lll}4 & 5 \cdot 5\end{array}$ | 55 |
| 28 | $\begin{array}{llll}4 & 6 & 17.9\end{array}$ | $\cdot 39$ | $4 \quad 5 \quad 53.5$ | 43 | $4 \begin{array}{lll}4 & 56.8\end{array}$ | 47 | $4 \quad 4 \quad 57 \cdot 6$ | 51 | $4 \quad 425.9$ | 5 | $4 \quad 3 \quad 5 \times 7$ | 59 |
| 30 | $3 \begin{array}{llllllll}3 & 58 & 12.9\end{array}$ | 41 | $35747 \cdot 0$ | 45 | 357818.6 | 50 | $35647 \cdot 5$ | . 54 | 35613.7 | 59 | $355 \quad 37 \cdot 2$ | 63 |
| 32 | 350 | -43 | $34940 \cdot 2$ | 48 | $34910 \cdot 0$ | -53 | $34837 \cdot 0$ | -57 | 348 I•O | . 62 | $34722 \cdot 0$ | $\cdot 67$ |
| 33 | 3464.8 | 45 | $34536 \cdot 6$ | -49 | 345 5.5 | $\cdot 54$ | 344 31.5 | -59 | $34354 \cdot 3$ | -64 | $34314 \cdot 1$ | $\cdot 70$ |
| 34 | $342 \quad 2 \cdot 0$ | 46 | 34133.0 | 51 | 34 l I 10 | $\cdot 56$ | $340 \quad 25 \cdot 8$ | $\cdot 61$ | $33947 \cdot 5$ | -67 | $\begin{array}{lll}3 & 39 & 5.9\end{array}$ | 72 |
| 35 | $33759 \cdot \mathrm{I}$ | 47 | $\begin{array}{llll}3 & 37 & 29.2\end{array}$ | 52 | $\begin{array}{lllll}3 & 36 & 56 \cdot 2\end{array}$ | $\cdot 58$ | $33620 \cdot 0$ | 63 | $33540 \cdot 4$ | . 69 | $33457 \cdot 5$ | 74 |
| 36 | $33356 \cdot \mathrm{I}$ | 48 | $\begin{array}{llll}3 & 33 & 25 \cdot 3\end{array}$ | $\cdot 54$ | $3325 \mathrm{I} \cdot 3$ | $\cdot 59$ | $\begin{array}{llll}3 & 32 & 14.0\end{array}$ | 65 | $33133 \cdot 2$ | $\cdot 71$ | $3 \begin{array}{llll}3 & 30 & 48 \cdot 8\end{array}$ | 77 |
| 37 | 32953.0 | $\cdot 50$ | $3292 \mathrm{I} \cdot 3$ | -56 | $\begin{array}{llll}3 & 28 & 46 \cdot 2\end{array}$ | -61 | $\begin{array}{llll}3 & 28 & 7 \cdot 7\end{array}$ | -67 | $32725 \cdot 7$ | $\cdot 73$ | $\begin{array}{llll}3 & 26 & 39 \cdot 9\end{array}$ | 79 |
| 38 | $\begin{array}{llllllll}3 & 25 & 49 \cdot 7\end{array}$ | $\cdot 51$ |  | . 57 | $\begin{array}{lllll}3 & 24 & 41 \cdot 0\end{array}$ | . 63 | $\begin{array}{llll}3 & 24 & 1 \cdot 3\end{array}$ | -69 | $\begin{array}{llllllllllll}3 & 23 & 17.9\end{array}$ | $\cdot 75$ | $\begin{array}{llll}3 & 22 & 30 \cdot 7 \\ 3 & 18 & \end{array}$ | 82 |
| 39 | $32146 \cdot 4$ | $\cdot 53$ | 32112.8 | -59 | $32035 \cdot 6$ | $\cdot 65$ | $31954 \cdot 7$ | $\cdot 71$ | $\begin{array}{lll}3 & 19 & 9.9\end{array}$ | 8 | $\begin{array}{lllll}3 & 18 & 2 I \cdot I\end{array}$ | 85 |
| 40 | 31742.9 | -54 | $\begin{array}{llll}3 & 17 & 8.4\end{array}$ | . 61 | $31630 \cdot 1$ | $\cdot 67$ | $31547 \cdot 8$ | $\cdot 74$ | $\begin{array}{lll}3 & 15 & 1.6\end{array}$ | . 80 | 314 II.3 | . 87 |
| 4 I | 31339  | $\cdot 56$ | $\begin{array}{llll}3 & 13 & 3.8\end{array}$ | . 62 | $\begin{array}{lllll}3 & 12 & 24.3\end{array}$ | -69 | 3 II $40 \cdot 7$ | $\cdot 76$ | 3 10 53.0 | . 83 | 310 1.0 | -90 |
| 42 |  | $\cdot 58$ | $\begin{array}{llll}3 & 8 & 59 \cdot 0\end{array}$ | -64 | $\begin{array}{llll}3 & 8 & 18.3\end{array}$ | $\cdot 71$ | $\begin{array}{llll}3 & 7 & 33.3\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 6 & 44 \cdot \mathrm{I}\end{array}$ | . 86 | $\begin{array}{lllll}3 & 5 & 50 \cdot 5\end{array}$ | . 93 |
| 43 | $\begin{array}{llll}3 & 5 & 31 \cdot 8 \\ & \text { 1 }\end{array}$ | $\cdot 59$ | $\begin{array}{llll}3 & 4 & 54.0\end{array}$ | . 66 | $\begin{array}{llll}3 & 4 & 12 \cdot 0\end{array}$ | 74 | $\begin{array}{llll}3 & 3 & 25 \cdot 7\end{array}$ | . | $\begin{array}{llllllllll}3 & 2 & 34 \cdot 8\end{array}$ | . 8 | $\begin{array}{llll}3 & 1 & 39 \cdot 4\end{array}$ | 96 |
| 44 | 31827.7 | I | $3 \quad 0 \quad 48 \cdot 9$ | $\cdot 68$ | 3 ○ $5 \cdot 5$ |  | $25917 \cdot 7$ | . 83 | $2 \begin{array}{llll}58 & 25 \cdot 3\end{array}$ | $\cdot 91$ | $25728 \cdot 0$ | 99 |
| 45 | $\begin{array}{llll}2 & 57 & 23.5\end{array}$ | . 63 | $2 \begin{array}{llll}26 & 43 \cdot 5\end{array}$ | $\cdot 71$ | $2 \begin{array}{lllllll}2 & 55 & 58\end{array}$ | $\cdot 78$ | $\begin{array}{lll}2 & 55 & 9.5\end{array}$ | . 86 | $25415 \cdot 3$ | -94 | 253 16.1 | 1.03 |
| 46 | $\begin{array}{llllll}2 & 53 & 19.2\end{array}$ |  | $25237 \cdot 9$ | 73 | 25151.8 | .81 | 2510.8 | 89 | $2{ }^{2} 504.8$ | $\cdot 98$ | $249 \quad 3 \cdot 7$ | 1.06 |
| 47 | $24914 \cdot 7$ | . 67 | $\begin{array}{llllll}2 & 48 & 32 \cdot I \\ 2\end{array}$ | $\cdot 75$ | 2 47 44 | . 84 | $\begin{array}{lllll}2 & 46 & 51.8\end{array}$ | '92 | $24554^{\circ}$ | $1 \cdot 01$ | 244 50•7 | \% |
| 48 | $24510 \cdot 0$ | $\cdot 69$ |  | $\cdot 78$ | $\begin{array}{lllll}2 & 43 & 36 \cdot 8\end{array}$ |  | $\begin{array}{lllll}2 & 42 & 42.4 \\ 2 & 38 & 42.6\end{array}$ | -95 | $\begin{array}{llll}2 & 41 & 42 \cdot 6 \\ 2\end{array}$ | I. 04 | $24037 \cdot 2$ | 1.14 |
| 49 | 24150 | $\cdot 71$ | 24019.6 | -80 | 23928.8 | $\cdot 89$ | $2 \begin{array}{llll}28 & 32 \cdot 6\end{array}$ | -98 | $23730 \cdot 7$ | I.08 | $236 \quad 23 \cdot 0$ | 1-18 |
| 50 | $23659 \cdot 7$ | 74 | 23612.9 | . 83 | $23520 \cdot 5$ | '92 | $23422 \cdot 3$ | 1.0 |  | $1 \cdot 12$ | $2328 \cdot 1$ | 1.22 |
| 5 5 | 2 32 $54 \cdot 3$ <br> 2 28  | $\cdot 76$ | $\begin{array}{llll}232 & 5 \cdot 9\end{array}$ | . 88 | 2311197 | 95 |  | 05 | $\begin{array}{llll}2 & 29 & 5 \cdot 2\end{array}$ | I•16 | 22752.5 | 1.27 |
| 52 | $\begin{array}{lllll}2 & 28 & 48 \cdot 6\end{array}$ | $\cdot 78$ | 22758.5 | . 88 | $227 \quad 2.4$ | -99 | $\begin{array}{lll}2 & 26 & \text { O.I }\end{array}$ | I.09 | 224 51.5 | 1.20 | 223 36.I | 1.31 |
| 53 | $22442 \cdot 6$ | -81 | $22350 \cdot 8$ | -92 | $22252 \cdot 7$ | 1.02 | 22148.2 | $1 \cdot 13$ | $22037 \cdot 0$ | 1.24 | $\begin{array}{llll}2 & 19 & 18.8\end{array}$ | I. 36 |
| 54 | $22036 \cdot 2$ |  | 21942.6 | $\cdot 95$ | $21842 \cdot 4$ | 1.06 | 2 I7 35.6 | $1 \cdot 17$ | 21621.7 | I. 29 | 2150.5 | 2 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ}$ A. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. 11 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $-\quad .42$ | s. -4.02 | S. | S. | S. ${ }^{\text {- }}$ | 5. -4.04 | S. 6 | S. | S. | S. | S. ${ }^{\text {8 }} 8^{\circ}$ | S. |
| 4 | -42 .43 | -4.02 4.03 | .49 .51 | -4.03 4.03 | -.56 .58 | -4.04 4.04 | -.63 .65 | -4.05 4.05 | .71 .72 | -4.07 4.07 | .78 .79 | 4.08 4.08 |
| 8 | -45 | 4.03 | -52 | 4.04 | - 59 | 4.05 | . 66 | 4.06 | $\cdot 74$ | 4.07 | .8I | 4.08 |
| 12 | -46 | 4.03 | -53 | 4.04 | . 61 | 4.05 | -68 | 4.06 | -75 | 4.07 | - 83 | 4.09 |
| 14 | $\cdot 47$ | 4.03 | . 54 | 4.04 | . 62 | 4.05 | $\cdot 69$ | 4.06 | $\cdot 76$ | 4.07 | . 84 | 4.09 |
| 16 | -48 | 4.03 | -55 | $4 \cdot 04$ | . 63 | 4.05 | $\cdot 70$ | 4.06 | -78 | 4.08 | -85 | 4.09 |
| 18 | -49 | 4.03 | -56 | 4.04 | . 64 | 4.05 | $\cdot 71$ | 4.07 | -79 | 4.08 | $\cdot 87$ | $4 \cdot 10$ |
| 20 | - 50 | 4.03 | -58 | 4.04 | - 65 | 4.05 | -73 | 4.07 | -81 | 4.08 | - 88 | 4.10 |
| 22 | $\cdot 51$ | 4.04 | -59 | $4 \cdot 05$ | . 67 | 4.06 | $\cdot 74$ | 4.07 | -82 | 4.09 | -90 | $4 \cdot 10$ |
| 24 | -53 | 4.04 | -60 | 4.05 | -68 | 4.06 | $\cdot 76$ | 4.07 | -84 | $4 \cdot 09$ | -92 | $4 \cdot 11$ |
| 26 | -54 | $4 \cdot 04$ | . 62 | 4.05 | -70 | 4.06 | $\cdot 78$ | 4.08 | . 86 | 4.09 | -94 | 4-II |
| 28 | $\cdot 55$ | 4.04 | -63 | 4.05 | $\cdot 72$ | 4.07 | . 80 | 4.08 | -88 | $4 \cdot 10$ | - 97 | 4.12 |
| 30 | -57 | 4.04 | -65 | 4.06 | $\cdot 74$ | 4.07 | -82 | 4.09 | -91 | $4 \cdot 10$ | -99 | $4 \cdot 12$ |
| 32 | -59 | 4.05 . | -67 | 4.06 | $\cdot 76$ | 4.07 | - 84 | 4.09 | -93 | $4 \cdot \mathrm{II}$ | I.02 | $4 \cdot 13$ |
| 34 | -6I | 4.05 | -69 | 4.06 | $\cdot 78$ | 4.08 | . 87 | $4 \cdot 10$ | -96 | 4.12 | I.05 | 4-14 |
| 36 | . 63 | 4.05 | $\cdot 72$ | 4.07 | -81 | 4.08 | '90 | 4.10 | -99 | 4.12 | I-08 | $4 \cdot 15$ |
| 38 | - 65 | 4.05 | $\cdot 74$ | 4.07 | -83 | 4.09 | -93 | $4^{\cdot 11}$ | 1.02 | $4 \cdot 13$ | I-12 | 4.16 |
| 40 | -67 | $4 \cdot 06$ | -77 | 4.07 | - 86 | 4.09 | . 96 | $4 \cdot 12$ | I. 06 | 4*14 | I•16 | $4 \cdot 17$ |
| 42 | -70 | $4 \cdot 06$ | -80 | $4 \cdot 08$ | -90 | 4.10 | I. 00 | $4 \cdot 12$ | I-IO | $4 \cdot 15$ | I. 21 | 4-18 |
| 44 | -73 | $4 \cdot 07$ | -83 | 4*09 | -93 | 4.II | I. 04 | $4 \cdot 13$ | I.I5 | 4.16 | I. 26 | 4.19 |
| 46 | $\cdot 76$ | 4.07 | -87 | 4.09 | -97 | $4 \cdot 12$ | I. 08 | $4 \cdot 15$ | I 20 | $4 \cdot 18$ | I•3I | $4 \cdot 21$ |
| 48 | -80 | 4.08 | -91 | $4 \cdot 10$ | 1.02 | $4 \cdot 13$ | I. 13 | 4.16 | I. 25 | 4.19 | I 37 | 4.23 |
| 50 | . 84 | $4 \cdot 09$ | -95 | $4 \cdot 11$ | I.07 | 4.14 | I.19 | 4.18 | I•3I | $4 \cdot 21$ | I. 44 | $4 \cdot 25$ |
| 52 | -88 | $4 \cdot 10$ | 1.00 | $4 \cdot 13$ | I.13 | 4.16 | I. 25 | $4 \cdot 19$ | I. $3^{8}$ | $4 \cdot 23$ | I. 52 | $4 \cdot 28$ |
| 54 | $\cdot 93$ | $4 \cdot 11$ | I. 06 | 4.14 | I.19 | 4-18 | I.33 | $4 \cdot 2 \mathrm{I}$ | I. 47 | $4 \cdot 26$ | I.6I | $4 \cdot 31$ |

## 132 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $2^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S | S. | H. M. S | S. | H. M. S | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $\begin{array}{llllll}5 & 58 & 17 & 9\end{array}$ | - 15 | $\begin{array}{llll}5 & 58 & 9 \cdot 2\end{array}$ | - - I5 | $\begin{array}{llll}5 & 58 & 0 \cdot 3\end{array}$ | - I5 | $5 \quad 5751 \cdot 3$ | - 15 | $5 \quad 5742 \cdot 3$ | - 15 | $\begin{array}{lllll}5 & 57 & 33 \cdot 2\end{array}$ | - 15 |
| 10 | $51720 \cdot 5$ | - 30 | $\begin{array}{llll}5 & 17 & 1.9\end{array}$ | -32 | $51642 \cdot 4$ | -33 | $\begin{array}{lllll}5 & 16 & 22 \cdot 0\end{array}$ | -35 | 5 16 $0 \cdot 5$ | -36 | 5 I5 $38 \cdot 2$ | -38 |
| 12 | $\begin{array}{llll}5 & 9 & 8 \cdot 3\end{array}$ | - 33 | $\begin{array}{lllllllllllllll}5 & 8 & 47 \cdot 7\end{array}$ | -35 | $5826 \cdot 0$ | - 37 | $\begin{array}{lll}5 & 8 & 3 \cdot 1\end{array}$ | - 39 | $\begin{array}{llll}5 & 7 & 39 \cdot 0\end{array}$ | -41 | $\begin{array}{llll}5 & 7 & 13 & 9\end{array}$ | -43 |
| 14 | $\begin{array}{llll}5 & 0 & 55 \cdot 8\end{array}$ | -37 | $5 \quad 0 \quad 33 \cdot 0$ | -39 | 5 - 9.0 | -41 | $45943 \cdot 7$ | -43 | $45917 \cdot 0$ | $\cdot 46$ | $4 \quad 58 \quad 49^{\circ} \mathrm{O}$ | $\cdot 48$ |
| 16 | $45242 \cdot 9$ | $\cdot 40$ | 452 I8.0 | -43 | 4515 I 6 | -45 | $45123 \cdot 7$ | $\cdot 48$ | $450 \quad 54.4$ | $\cdot 50$ | $4 \quad 5023.4$ | -53 |
| 18 | 44429.5 | -44 | 444204 | $\cdot 46$ | $44333 \cdot 7$ | -49 | $443 \quad 3 \cdot 2$ | $\cdot 52$ | $4423 \mathrm{I} \cdot \mathrm{O}$ | $\cdot 55$ | $44157 \cdot 1$ | -58 |
| 20 | $43615 \cdot 8$ | - 47 | $435 \quad 46 \cdot 4$ | -51 | $43515 \cdot 1$ | - 54 | $434{ }^{42} 0$ | $\cdot 57$ | $434 \begin{array}{ll}4 & 6.9\end{array}$ | . 60 | $433 \quad 29 \cdot 8$ | . 63 |
| 22 | $4 \begin{array}{lll}4 & 28 & 1.5\end{array}$ | - 51 | 42729.7 | -55 | $4 \quad 2655 \cdot 9$ | -58 | $42620 \cdot 0$ | - 62 | $42541 \cdot 9$ | -65 | 425 I.61 | -69 |
| 24 | 4 I9 $46 \cdot 6$ | - 55 | 4 19 12.4 | -59 | 4 I8 36.0 | -63 | 4 I7 $57 \cdot 2$ | -67 | 417 16.0 | $\cdot 71$ | $4 \begin{array}{llll}46 & 32 \cdot 3\end{array}$ | $\cdot 75$ |
| 26 | 4 II 3I•I | - 59 | 4 10 54.4 | . 63 | 4 Io $15 \cdot 1$ | - 68 | $4 \quad 9 \quad 33.3$ | $\cdot 72$ | $4 \quad 8 \quad 48 \cdot 9$ | $\cdot 76$ | 48858 | . 8 I |
| 28 | 43150 | -63 | $\begin{array}{llll}4 & 2 & 35 \cdot 5\end{array}$ | -68 | 4 I 53.3 | -73 | $4 \begin{array}{lll}4 & 8.4\end{array}$ | $\cdot 77$ | 4 0 $20 \cdot 6$ | - 82 | 35929.9 | -87 |
| 29 | 3596.5 | - 66 | $\begin{array}{lllll}3 & 58 & 25 \%\end{array}$ | $\cdot 70$ | $35742 \cdot 1$ | $\cdot 75$ | $\begin{array}{llll}3 & 56 & 55 \cdot 5\end{array}$ | -80 | $356 \quad 6 \cdot 0$ | . 85 | $355513 \cdot 3$ | -90 |
| 30 | $35457 \cdot 9$ | -68 | $35415 \cdot 7$ | $\cdot 73$ | $35330 \cdot 5$ | $\cdot 78$ | $\begin{array}{lllllllll}3 & 52 & 42 \cdot 3\end{array}$ | -83 | 35150.9 | -88 | $35056 \cdot 3$ | 94 |
| 31 | $35049 \cdot \mathrm{I}$ | $\cdot 70$ | 350514 | $\cdot 75$ | 34918.6 | . 81 | $\begin{array}{llll}3 & 48 & 28 \cdot 7\end{array}$ | -86 | $34735 \cdot 5$ | -91 | $\begin{array}{lllll}3 & 46 & 38 \cdot 9\end{array}$ | $\cdot 97$ |
| 32 | $34640 \cdot 0$ | $\cdot 73$ | $345 \quad 54 \cdot 8$ | $\cdot 78$ | $\begin{array}{llll}3 & 45 & 6.4\end{array}$ | . 83 | 3441477 | -89 | $\begin{array}{llll}3 & 43 & 19.6\end{array}$ | -95 | 342210 | I.OI |
| 33 | $34230 \cdot 6$ | $\cdot 75$ | $34144{ }^{\circ} \mathrm{O}$ | -81 | 34053.9 | - 86 | 340004 | -92 | $\begin{array}{lll}3 & 39 & 3.4\end{array}$ | -98 | $\begin{array}{lll}3 & 38 & 2.6\end{array}$ | . 04 |
| 34 | 3 38 <br>   <br> $1 \cdot 1$  | - 78 | $\begin{array}{lllll}3 & 37 & 32 \cdot 8\end{array}$ | -83 | $3{ }^{3} 36410$ | -89 | $3{ }^{3} 3545 \cdot 6$ | -95 | $33446 \cdot 6$ | I. 02 | $\begin{array}{lllll}3 & 33 & 43.7\end{array}$ | . 08 |
| 35 | $334 \mathrm{II} \cdot 2$ | -80 |  | -86 | $\begin{array}{llll}3 & 32 & 27 \cdot 7\end{array}$ | -92 | $33130 \cdot 5$ | -99 | $33029 \cdot 3$ | I.05 | $\begin{array}{llll}3 & 29 & 24.2\end{array}$ | I. 12 |
| 36 | 33010 | - 83 | $\begin{array}{lll}3 & 29 & 9 \cdot 4\end{array}$ | -89 | 328 14•1 | -95 | $\begin{array}{llll}3 & 27 & 14.8\end{array}$ | 1.02 | 326 II•5 | I.09 | 32541 I | 16 |
| 37 | 32550.4 | - 86 | $\begin{array}{llll}3 & 24 & 57 \cdot 2\end{array}$ | -92 | $3240 \cdot 0$ | -99 | 322586 | I.06 | $32153 \cdot 1$ | I•I3 | $32043 \cdot 3$ | 20 |
| $3^{8}$ | $32139 \cdot 6$ | -88 | $32044 \cdot 5$ | -95 | 3 I9 45*4 | I.02 | $\begin{array}{llll}3 & 18 & 42 \cdot 0\end{array}$ | I.09 | 3 I7 34.I | I'17 | $\begin{array}{llll}3 & 16 & 21.8\end{array}$ | I•24 |
| 39 | 31728.4 | -91 | 316315 | $\bullet 98$ | 3 I5 $30 \cdot 3$ | I.06 | $3 \begin{array}{llll}3 & 14 & 24 \cdot 7\end{array}$ | I• 13 | $3{ }^{3} 1314.5$ | I.2I | 3 II 59.6 | I. 29 |
| 4 | $\begin{array}{llll}3 & 13 & 16.8\end{array}$ | -94 | 31218.0 | I. 02 | 3 II 14.7 | I.09 | 3 10 6.8 | I-I7 | $3 \quad 8 \quad 54 \cdot 2$ | I. 25 | $\begin{array}{llll}3 & 7 & 36 \cdot 6\end{array}$ | I•34 |
| 41 | $\begin{array}{llll}3 & 9 & 4 \cdot 8\end{array}$ | -97 | $\begin{array}{llll}3 & 8 & 4.0\end{array}$ | I.05 | 3658 | I.I3 | $3 \begin{array}{llll}3 & 5 & 48 \cdot 3\end{array}$ | I.2I | $3 \quad 4 \begin{array}{lll}3 & 3\end{array}$ | I.30 | $\begin{array}{llll}3 & 3 & 12.7\end{array}$ | I. 38 |
| 42 | $\begin{array}{llll}3 & 4 & 52 \cdot 3\end{array}$ | I-OI | $\begin{array}{llll}3 & 3 & 49.4\end{array}$ | I.09 | $3 \quad 241: 7$ | I•I7 | 3 I 1 29:0 | I. 25 | 3 O II•I | 1.34 | $258 \quad 47 \cdot 8$ | I.43 |
| 43 | $3 \begin{array}{lll}3 & 0 & 39 \cdot 3\end{array}$ | $1 \cdot 04$ | $25934 \cdot 3$ | 1*12 | $258124 \cdot 3$ | I. 21 | $25719 \cdot 0$ | I. 30 | $25548 \cdot 4$ | I.39 | $25422 \cdot 0$ | I.49 |
| 44 | $\begin{array}{llll}2 & 56 & 25 \cdot 9\end{array}$ | 1.08 | $25518 \cdot 6$ | I•I6 | $2546 \cdot 1$ | I. 25 | $\begin{array}{lllll}2 & 52 & 48 \cdot 2\end{array}$ | 1.35 | $2515124 \cdot 6$ | I. 44 | $24955 \cdot 1$ | I. 54 |
| 45 | $\begin{array}{llll}2 & 52 & \text { II'9 }\end{array}$ | II | $2 \begin{array}{llr} & 51 & 2 \cdot 3\end{array}$ | I.2I | $24947 \cdot 2$ | I. 30 | $24^{2} 4826 \cdot 5$ | 1.40 | $2 \begin{array}{lllllllll}2 & 46 & 59\end{array}$ | I.50 | $245 \quad 27.0$ | I. 60 |
| 46 | $24757 \cdot 2$ | I•15 | $24645 \cdot 2$ | I. 25 | $245 \quad 27 \cdot 5$ | r.34 | $\begin{array}{lll}2 & 44 & 3 \cdot 8\end{array}$ | I 45 | $24234{ }^{\circ} \mathrm{O}$ | 1.55 | $2 \begin{array}{lllllllll}2 & 40 & 57.6\end{array}$ | I. 66 |
| 47 | $24342 \cdot 0$ | I•I9 | $242 \quad 27 \cdot 4$ | I. 29 | 24 I 6.9 | I. 39 | $23940 \cdot 1$ | I. 50 | 23866 | I.6I | $2 \begin{array}{llll} & 36 & 26.9\end{array}$ | I•73 |
| 48 | $\begin{array}{llll}2 & 39 & 26 \cdot 0\end{array}$ | 1. 24 | $\begin{array}{llll}2 & 38 & 8.7\end{array}$ | I•34 | $2 \begin{array}{llll}26 & 45 \cdot 3\end{array}$ | 1.44 | $23515 \cdot 3$ | I.56 | $233388 \cdot 6$ | 1.67 | $23154 * 7$ | I•79 |
| 49 | $\begin{array}{lll}2 & 35 & 9 \cdot 3\end{array}$ | . 28 | $233149 \cdot 2$ | I-39 | $\begin{array}{lllll}2 & 32 & 22 \cdot 7\end{array}$ | 1.50 | $23049 \cdot 3$ | I. 62 | $2 \begin{array}{lll}2 & 29 & 8.6\end{array}$ | 1.74 | $22720 \cdot 7$ | I.87 |
| 50 | $2305 \mathrm{I} \cdot 7$ | 1.33 |  | 1.44 |  | I. 56 | 22621.9 | I. 68 | $22437 \cdot 4$ | I. 8 I | $22245{ }^{\circ} \mathrm{O}$ | r.94 |
| 51 | $22633 \cdot 3$ | 1.38 | $225 \quad 7 \cdot 2$ | 1.49 | $22333 \cdot 9$ | 1. 62 | $22153 \cdot 1$ | I•75 | 22004.4 | 18 | $\begin{array}{llll}2 & 18 & 7 \cdot 3\end{array}$ | $2 \cdot 03$ |
| 52 | 22213.9 | 1.43 | $22044 \cdot 6$ | I.55 | 21975 | I. 68 | 21722.6 | I. 82 | 215129.4 | I.96 | $2 \begin{array}{llll} & \text { I3 } & 27.4\end{array}$ | -II |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | S. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| 0 | -.85 | -4.09 | $-.92$ | -4.II | -1.00 | -4.13 | -1.07 | -4.14 | $-\mathrm{I} \cdot 15$ | -4.17 | -I. 22 | $4 \cdot 19$ |
| 4 | . 87 | 4.09 | $\cdot 94$ | $4 \cdot 11$ | $1 \cdot 02$ | $4 \cdot 13$ | r.09 | $4 \cdot 15$ | I. 17 | $4 \cdot 17$ | I. 24 | $4 \cdot 19$ |
| 8 | -89 | $4 \cdot 10$ | $\cdot 96$ | $4 \cdot 11$ | I.04 | $4 \cdot 13$ | I.II | $4 \cdot 15$ | I'19 | 4.17 | 1.27 | 4.20 |
| 10 | $\cdot 89$ | $4 \cdot 10$ | $\cdot 97$ | $4 \cdot 12$ | 1.04 | $4 \cdot 14$ | r.12 | $4 \cdot 16$ | I 20 | 4.18 | 1.27 | $4 \cdot 20$ |
| 12 | $\cdot 90$ | $4 \cdot 10$ | $\cdot 98$ | $4 \cdot 12$ | 1.05 | 4-14 | I-13 | 4•16 | I-2 1 | 4•18 | I 29 | $4 \cdot 20$ |
| 14 | -92 | $4 \cdot 11$ | -99 | 4-12 | 1.07 | $4 \cdot 14$ | I. 15 | $4 \cdot 16$ | 1.23 | 4•19 | I.31 | 4.21 |
| 16 | -93 | $4 \cdot 11$ | I-OI | $4 \cdot 13$ | r.09 | $4 \cdot 15$ | I.16 | $4 \cdot 17$ | I 24 | 4•19 | I. 33 | $4 \cdot 22$ |
| 18 | -95 | $4 \cdot 11$ | $\mathrm{I} \cdot \mathrm{O}$ | 4-13 | 1.10 | $4 \cdot 15$ | 1.18 | $4 \cdot 17$ | I 26 | $4 \cdot 20$ | I. 35 | 4.22 |
| 20 | -96 | $4 \cdot 12$ | 1.04 | 4-14 | I•12 | 4.16 | 1.20 | 4.18 | I. 29 | $4 \cdot 20$ | I. 37 | 4.23 |
| 22 | $\cdot 98$ | 4.12 | I.06 | 4-14 | I-15 | 4•16 | I 23 | $4 \cdot 19$ | I 31 | 4.21 | $1 \cdot 40$ | 4.24 |
| 24 | 1.00 | $4 \cdot 13$ | 1.09 | $4 \cdot 15$ | I. 17 | $4 \cdot 17$ | 1.25 | $4 \cdot 19$ | 1.34 | 4.22 | 1.43 | 4.25 |
| 26 | 1.03 | $4 \cdot 13$ | I.II | $4 \cdot 15$ | x 20 | $4 \cdot 18$ | 1.28 | 4.20 | I 37 | 4.23 | I 46 | $4 \cdot 26$ |
| 28 | 1.05 | $4 \cdot 14$ | 1.14 | 4•16 | 1.23 | $4 \cdot 19$ | 1.3I | 4.21 | 1.40 | $4 \cdot 24$ | I. 49 | 4.27 |
| 30 | 1.08 | $4 \cdot 14$ | I 17 | $4 \cdot 17$ | $\pm 26$ | $4 \cdot 20$ | I.35 | 4.22 | 1.44 | 4.25 | I.53 | 4.29 |
| 32 | I-II | 4.15 | I 20 | $4 \cdot 18$ | I 29 | 4.2 I | I. 39 | 4.24 | 1.48 | $4 \cdot 27$ | I. 58 | $4 \cdot 30$ |
| 34 | I. 14 $\mathrm{I} \cdot 18$ | $4 \cdot 16$ $4 \cdot 17$ | I. 24 | $4 \cdot 19$ 4.20 | 1.33 | 4.22 4.23 | 1.43 1.47 | 4.25 4.27 | 1.53 1.58 | $4 \cdot 28$ 4.30 |  | 4.32 4.34 |
| 36 <br> 38 | 1.18 I 22 | $4 \cdot 17$ $4 \cdot 18$ | 1.27 $\mathrm{I} \cdot 32$ | 4.20 4.21 | 1.37 $\mathrm{I} \cdot 42$ | 4.23 4.25 | 1.47 1.52 | 4.27 4.28 |  | 4.30 4.32 | r. 68 r .74 | $4 \cdot 34$ 4.36 |
| 40 | 1.26 | $4 \cdot 20$ | $1 \cdot 37$ | $4 \cdot 23$ | $1 \cdot 47$ | $4 \cdot 26$ | I. 58 | $4 \cdot 30$ | r.69 | $4 \cdot 34$ | I.8I | $4 \cdot 39$ |
| 42 | I 31 | 4.21 | 1.42 | $4 \cdot 25$ | I. 53 | $4 \cdot 28$ | I. 64 | $4 \cdot 33$ | r 76 | $4 \cdot 37$ | r.88 | 4.42 |
|  | 1.37 | 4.23 | $1 \cdot 48$ | $4 \cdot 27$ | 1.60 | $4 \cdot 31$ | 1.71 | $4 \cdot 35$ | I. 84 | 4.40 | 1.96 | $4 \cdot 46$ |
| 46 | $1 \cdot 43$ | $4 \cdot 25$ | I 55 | $4 \cdot 29$ | I. 67 | $4 \cdot 34$ | I•79 | $4 \cdot 39$ | I. 92 | $4 \cdot 44$ | 2.06 | $4 \cdot 50$ |
| 48 | 1.49 | $4 \cdot 27$ | I.62 | 4.32 | r.75 | 4.37 | r. 88 | $4 \cdot 42$ | 2.02 | 4.49 | $2 \cdot 17$ | 4.55 |
| 50 | I. 57 | 4.30 | r.71 | 4.35 | r.84 | 4.41 | x.99 | 4.47 | $2 \cdot 14$ | 4.53 4.58 | 2.29 | 4.61 |
| 52 | I. 66 | $4 \cdot 33$ | I.80 | 4.39 | I.95 | 4.45 | $2 \cdot 10$ | $4 \cdot 51$ | $2 \cdot 27$ | $4 \cdot 58$ | $2 \cdot 43$ | 4.69 |

## LATITUDE $2^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| $\begin{array}{\|c\|c\|} \hline \text { True } \\ \text { Alt. } \end{array}$ | $18^{\circ}$ | $\begin{array}{\|l} \text { Decl. } \\ \text { Var. } \end{array}$ | $19^{\circ}$ | Decl. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. | $22^{\circ}$ | $\left\lvert\, \begin{array}{l\|} \text { Decl. } \\ \text { Var. } \end{array}\right.$ | $23^{\circ}$ | Decl. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | 16 |  | . 16 |  | s. |  | . 16 |  | ${ }^{16}$ |
| 10 | $\begin{array}{llll}5 & 57 & 24.0 \\ 5 & 15 & 14.7\end{array}$ | 15 | $\begin{array}{llllll}5 & 57 & 14 \cdot 7 \\ 5 & 14 & 50 \cdot 2\end{array}$ | 42 |  | 4 |  | ${ }^{-45}$ |  | ${ }_{-47}$ |  | 16 50 |
| 12 | $5 \quad 647$ | 45 | ${ }_{5}^{5} 619.7$ | 47 | 15 | 49 | 520.4 | 52 |  | . 54 | 5.5 | 56 |
| ${ }^{14}$ | 45819 | 5 | $45748 \cdot 6$ | 53 |  | . 55 | -46 | . 58 | [406 6.4 | 61 | 55 $29 . \mathrm{I}$ | 64 |
| 16 | 44950 | 56 | $44916 \cdot 5$ | 59 | 448 | .61 | 4482.7 | $\cdot 65$ | 3.0 |  | 446 41-4 |  |
| 18 | 44121 | -61 | $4{ }^{40} 43 \cdot 5$ |  | $440 \begin{aligned} & 4.8\end{aligned}$ | 68 | ${ }_{4}^{4} 39922.15$ | 71 | (1) $\begin{array}{llll}4 & 38 & 38 \cdot 3 \\ 4 & 29 & 5 \cdot 1\end{array}$ | 82 |  | 8 |
| 20 | 43250.7 | . 67 | ${ }^{4}$32 | .71 | ${ }^{4} 3$ 31 $26.80 \cdot 0$ | 84 |  | 78 |  |  |  |  |
| 22 | 424 | 73 | ${ }^{4} 23234 \cdot 1$ | . 87 | $1{ }^{4} 22$ |  |  | -93 |  |  |  |  |
| 24 25 | 4  <br> 4 15 <br> 4 II <br> 4 29.2 | . 82 |  |  | ${ }_{4}^{4} 19$ | . 92 | ( ${ }^{4}$4 <br> 4 <br> 4 | 97 | 7 48.7 | r. 02 | - | +1.03 |
| 26 |  | 86 | $4619 \cdot 1$ |  | 523 | 95 | 424.5 | ror | 22.5 | 1.06 | 217.1 | 2 |
| 27 | 54 | 89 | 4-159313 | 94 | , |  | $4{ }^{\circ}$ | r. 05 | $\begin{array}{ll}3 & 58 \\ 3 & 55.5\end{array}$ |  | 35747.5 |  |
|  | 3 388 | .92 |  | I. |  |  |  |  |  | $1 \cdot 15$ |  | 1.21 1.26 |
| 29 30 |  | -96 | 3 48 57\% | I. 05 | 3 47 52-I | r.Ir | $34643 \cdot 4$ |  | 3 $45 \begin{aligned} & 30.8\end{aligned}$ | 1.24 | $34414 \cdot 2$ | I.31 |
|  | 345 | I. 03 | 34435.2 | r.09 | 34327.7 | 16 | 342 | I. 22 | 34151.1 | I. 29 | 3 | ${ }^{36}$ |
| 32 <br> 33 |  |  | (14012.7 | I-1 |  | I 24 |  | $1 \cdot 32$ |  |  |  |  |
| 33 <br> 34 |  | ${ }_{\text {I }}^{1} 15$ | 3 35 <br> 3 35 <br> 3 $25 \cdot 8$ | I. 22 | $\begin{array}{ll}3 & 34 \\ 3 & 10.5 \\ & 10\end{array}$ | 24 | $\begin{array}{ll}3 & 28 \\ 3 & 50.8\end{array}$ | r.37 | ${ }_{3} 2726 \cdot 4$ |  | 3 25 57.1 |  |
| 35 | 32814.9 |  | $\begin{array}{lll}3 & 27 & 1.3\end{array}$ |  | $32543 \cdot 2$ | $1 \cdot 34$ | 324 | $1 \cdot 42$ | 32 |  | $32120 \cdot 1$ |  |
| 36 | 3 |  | $32236 \cdot 0$ |  | 321150 | $\cdot 39$ | 319 | 47 | 31818.2 | I. 56 | ${ }_{3}^{3} 16419.9$ | I.65 |
| 37 | 31928 |  | $\begin{array}{llll}3 & 18 & 9.8 \\ 3 & 13 & 92.8\end{array}$ | 1.36 | 3 $\begin{aligned} & 316 \\ & 3 \\ & 12 \\ & 12 \\ & 1\end{aligned}$ | 1.44 1.50 |  | 1.53 | $3 \begin{array}{llll}3 & 13 & 42.3\end{array}$ |  |  |  |
| 39 | 3 15 <br> 3 15 | 1.32 1.3 1 | $\begin{array}{rrrr}3 & 13 & 42 \cdot 8 \\ 3 & 9 & 14 \cdot 8\end{array}$ | ${ }_{1} \mathrm{I} 4$ | 3 12 157 <br> 3 7 $44 \cdot 4$ |  | (1) | 1.6 | $\begin{array}{lll}3 & 9 & 5.2 \\ 3 & 4 & 26.6\end{array}$ | 1.75 | ( | . 86 |
| 40 | $\begin{array}{llll}3 & 6 & 13 & 3\end{array}$ |  | 3 4 | 1.51 | 312.0 |  | $\begin{array}{llll}3 & 1 & 32 \cdot 3\end{array}$ | 1.71 | $25946 \cdot 5$ |  | 2 5754.2 | ז.93 |
| 41 | $46 \cdot 9$ | 1.48 | $3{ }^{3}$ |  | $2{ }^{2} 5838.2$ | 67 | ${ }_{2}^{2} 5654.8$ | . 88 | $\begin{array}{llll}2 & 55 & 4.8 \\ 2 & 50\end{array}$ | 89 |  | I |
| 42 | $\begin{array}{llll}2 & 57 & 19.0 \\ 2 & 52 & 49.8\end{array}$ |  |  |  |  | I.74 | (1) $\begin{array}{llll}2 & 52 & 15 \cdot 6 \\ 2 & 47 & 34 \cdot 8\end{array}$ | I. 8.92 |  |  | $\begin{array}{ll}2 & 48 \\ 2 & 19.8 \\ 2 & 43 \\ 29.4\end{array}$ | 9 |
| 43 | 2 52 <br> 2 48 <br>  $19 \cdot 8$ <br> 19.4  |  | 2 2 2 4 4 | r. r - 76 | $\begin{array}{llll}2 & 49 & 26 \cdot 5 \\ 2 & 44 & 48 \cdot 3\end{array}$ | I.88 | (2) |  | 2 2 20 40 48 48.4 |  | 2 2 2 $3^{8} 369.5$ |  |
| 45 | 243477 | 1.71 | 2421 | I. | 24083 | -95 | $2{ }^{2} 3874$ | 2.08 | $23558 \cdot 5$ |  | 233 | $2 \cdot 37$ |
| 46 | $\begin{array}{lllll}2 & 39 & 14.5\end{array}$ |  | $\begin{array}{ll}2 & 37 \\ 24.2\end{array}$ |  |  | 2.03 |  | $2 \cdot 17$ | $\begin{array}{llll}2 & 31 & 6.2 \\ 2 & 6 & \end{array}$ | $2 \cdot 32$ | ${ }_{2}^{2} 2842.6$ | . 58 |
| 47 | $\begin{array}{llll}2 & 39 & 39.7 \\ 2 & 30 & 3.2\end{array}$ | I.85 |  |  | 2 2 2 25 |  | (1) $\begin{array}{llll}2 & 28 & 31 \cdot 2 \\ 2 & 23 & 39.2\end{array}$ |  | ${ }_{2}^{2} 26111$ |  | $\begin{array}{lll}2 & 23 \\ 2 & 18 \\ 2\end{array}$ |  |
| 49 | 25 24.7 | 2.00 | $\begin{array}{ll} \\ 2 & 23 \\ 20 & 20.4\end{array}$ | $2 \cdot 15$ | $2 \begin{array}{lll}21 & 7 \cdot 1\end{array}$ | $2 \cdot 30$ | ${ }_{2} 1844{ }^{1}$ | $2 \cdot 4$ | ${ }_{2}^{2} 1611 \mathrm{II}$ | $2 \cdot 6$ | $1{ }_{2} 13127$ |  |
| 50 | $22044 \cdot 2$ | $2 \cdot$ | 21834.5 | $2 \cdot 2$ | 21615 | 2.40 | 21346 |  | 2 II 5.6 |  | ${ }_{2} \quad 8 \quad 1$ |  |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | s. | s. | s. | S. | s. | s. | s. | s. | s. | s. |
| 0 | - I. 30 | $-4.2 \mathrm{I}$ | - I.38 | $-4.23$ | - I. 46 | $-4.26$ | - I. 54 | $-4.29$ | - I. 62 | $-4.32$ | -1.70 | $-4.35$ |
| 4 | I.32 | $4 \cdot 21$ | I. 39 | $4 \cdot 24$ | I 47 | $4 \cdot 26$ | I. 55 | $4 \cdot 29$ | I. 63 | $4 \cdot 32$ | I•71 | 4.35 |
| 6 | I 33 | $4 \cdot 22$ | 1.40 | $4 \cdot 24$ | 1.48 | 4.27 | - 56 | $4 \cdot 30$ | I. 65 | $4 \cdot 33$ | 1.73 | $4 \cdot 36$ |
| 8 | I. 35 | $4 \cdot 22$ | 1.42 | 4.25 | I. 50 | 4.27 | 1.58 | $4 \cdot 30$ | I. 66 | $4 \cdot 34$ | 1.74 | $4 \cdot 37$ |
| 10 | I 35 | 4.22 | I-43 | $4 \cdot 25$ | I. 51 | $4 \cdot 28$ | I-59 | $4 \cdot 3 \mathrm{I}$ | I. 68 | $4 \cdot 34$ | I.76 | 4.37 |
| 12 | 1.37 | $4 \cdot 23$ | 1.45 | $4 \cdot 26$ | I•53 | $4 \cdot 28$ | I. 61 | $4 \cdot 32$ | 1・ク0 | 4.35 | $1 \cdot 78$ | $4 \cdot 38$ |
| 14 | I.39 | $4 \cdot 24$ | 1.47 | $4 \cdot 26$ | I. 55 | $4 \cdot 29$ | 1.64 | $4 \cdot 32$ | I•72 | $4 \cdot 36$ | I-81 | $4 \cdot 39$ |
| 16 | 1.41 | $4 \cdot 24$ | 1.49 | $4 \cdot 27$ | I.57 | $4 \cdot 30$ | 1.66 | $4 \cdot 33$ | 1.75 | $4 \cdot 37$ | I.83 | $4 \cdot 40$ |
| 18 | 1.43 | 4.25 | I.5I | 4.28 | I. 60 | 4.31 | 1.69 | $4 \cdot 34$ | ェ・78 | $4 \cdot 38$ | I.86 | $4 \cdot 42$ |
| 20 | I.45 | $4 \cdot 26$ | I.54 | 4.29 | I. 63 | 4.32 | 1.72 | $4 \cdot 35$ | I•8 | $4 \cdot 39$ | I-90 | $4 \cdot 43$ |
| 22 | I.48 | $4 \cdot 27$ | 1.57 | $4 \cdot 30$ | I. 66 | 4.33 | 1.75 | $4 \cdot 37$ | I. 84 | 4.41 | I.94 | 4.45 |
| 24 | 1.5I | $4 \cdot 28$ | 1.60 | $4 \cdot 31$ | I•70 | 4.35 | 1*79 | $4 \cdot 38$ | I. 88 | 4.42 | I-98 | 4.47 |
| 26 | 1.55 | $4 \cdot 29$ | I. 64 | $4 \cdot 33$ | I•74 | $4 \cdot 36$ | I.83 | $4 \cdot 40$ | I.93 | 4.44 | $2 \cdot 03$ | 4.49 |
| 28 | I. 59 | 4.31 | I. 68 | $4 \cdot 34$ | I•78 | $4 \cdot 38$ | 1.88 | $4 \cdot 42$ | $1 \cdot 98$ | $4 \cdot 46$ | $2 \cdot 08$ | 4.51 |
| 30 | I. 63 | 4.32 | I.73 | $4 \cdot 36$ | I.83 | 4.40 | 1.93 | $4 \cdot 44$ | 2.03 | 4.49 | 2.14 | $4 \cdot 54$ |
| 32 | I. 68 | $4 \cdot 34$ | 1.78 | $4 \cdot 38$ | I. 88 | 4.42 | 1.99 | 4.47 | 2-10 | $4 \cdot 52$ | 2.21 | 4.57 |
| 34 | I.73 | $4 \cdot 36$ | I. 83 | $4 \cdot 40$ | $\underline{1.94}$ | 4.45 | $2 \cdot 05$ | $4 \cdot 50$ | 2.16 | $4 \cdot 55$ | $2 \cdot 28$ | $4 \cdot 6 \mathrm{I}$ |
| 36 | 1.79 | $4 \cdot 38$ | 1.90 | 4.43 | $2 \cdot \mathrm{OI}$ | $4 \cdot 48$ | $2 \cdot 12$ | $4 \cdot 53$ | $2 \cdot 24$ | 4.59 | $2 \cdot 37$ | $4 \cdot 65$ |
| 38 | r.85 | 4.41 | 1.97 | $4 \cdot 46$ | $2 \cdot 08$ | 4.51 | $2 \cdot 20$ | $4 \cdot 57$ | $2 \cdot 33$ | $4 \cdot 63$ | $2 \cdot 46$ | $4 \cdot 70$ |
| 40 | I. 92 | $4 \cdot 44$ | 2.04 | 4.49 | $2 \cdot 17$ | 4.55 | $2 \cdot 30$ | $4 \cdot 61$ | 2.43 | $4 \cdot 68$ | 2.57 | $4 \cdot 75$ |
| 42 | $2 \cdot 00$ | 4.48 | 2•I3 | $4 \cdot 53$ | $2 \cdot 26$ | 4.60 | $2 \cdot 40$ | 4.67 | $2 \cdot 54$ | $4 \cdot 74$ | $2 \cdot 69$ | 4.82 |
| 44 | 2.09 | $4 \cdot 52$ | $2 \cdot 23$ | $4 \cdot 58$ | $2 \cdot 37$ | $4 \cdot 65$ | $2 \cdot 52$ | $4 \cdot 73$ | $2 \cdot 67$ | 4.81 | 2.83 | $4 \cdot 90$ |
| 46 | $2 \cdot 20$ | 4.57 | $2 \cdot 34$ | 4.64 | 2.49 | $4 \cdot 72$ | $2 \cdot 65$ | 4.80 | 2.82 | 4.90 | 3.00 | $5 \cdot 00$ |
| 48 | $2 \cdot 32$ | $4 \cdot 62$ | 2.47 | 4.71 | $2 \cdot 64$ | $4 \cdot 79$ | 2.81 | $4 \cdot 89$ | 2.99 | $5 \cdot 00$ | $3 \cdot 19$ | $5 \cdot 12$ |
| 50 | $2 \cdot 46$ | $4 \cdot 69$ | $2 \cdot 62$ | $4 \cdot 79$ | $2 \cdot 80$ | $4 \cdot 89$ | 3.00 | $5 \cdot 00$ | $3 \cdot 20$ | 5.13 | 3.41 | $5 \cdot 27$ |

## 134 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $3^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | H. M. S. | S. 21 | H. M. ${ }_{\text {S. }}$ | S. 21 | H. M. $\mathrm{Sc}^{\text {S. }}$ | S. 21 | H. M. S. | S. | H. M. S. | S. 21 | H. M. S. | S. 21 |
| 10 | 5 I9 $56 \cdot 7$ | . 21 | 5 I9 $43 \cdot 5$ | $\cdot 23$ | $\begin{array}{llll}5 & 19 & 29.6\end{array}$ | -24 | 5 I9 15.0 | $\cdot 25$ | $\begin{array}{llll}5 & 18 & 59 \cdot 6\end{array}$ | . 26 | $\begin{array}{llll}5 & \text { I } & 43.4\end{array}$ | . 28 |
| 12 | 5 II $56 \cdot 0$ |  | 5 II $42 \cdot 7$ | $\cdot 23$ | 5 II $28 \cdot 5$ | -24 | 5 II I3.4 | - 26 | 5 10 57.3 | - 28 | 5 10 40.3 | - 29 |
| 14 | $\begin{array}{llll}5 & 3 & 55.3\end{array}$ |  | $\begin{array}{llll}5 & 3 & 4 \\ 4 & 5 & 8\end{array}$ | - 23 | $\begin{array}{llll}5 & 3 & 27 \cdot 3\end{array}$ | - 25 | $\begin{array}{lllll}5 & 3 & \text { II } 6\end{array}$ | -27 | $\begin{array}{llll}5 & 2 & 55\end{array}$ | -29 | $\begin{array}{llll}5 & 2 & 37 \cdot 2\end{array}$ | - 3 |
| 16 | $45554 \cdot 6$ |  | $45540 \cdot 9$ | -24 | $455 \quad 26 \cdot 0$ | - 26 | $455 \quad 9.9$ | -28 | $4 \quad 54 \quad 52.5$ | $\cdot 30$ | $45433 \cdot 9$ | $\cdot 32$ |
| 18 | 44753.9 |  | $44740 \cdot 0$ | -24 | $44724 \%$ | -27 | $4478 \cdot 0$ | -29 | $44649 \cdot 9$ | -31 | $44630 \cdot 4$ | -34 |
| 20 | 439 53.1 |  | 43939.0 | $\cdot 25$ | 43923.3 | -27 | $439 \quad 6 \cdot 0$ | -30 | $43^{8} \quad 47 \cdot 2$ | -33 | 43826.8 | -35 |
| 22 | 43152.4 |  | $43138 \cdot 0$ | -25 | 43121.8 | $\cdot 28$ | 43140 | -3I | 43044.4 | -34 | 43023.0 | $\cdot 37$ |
| 24 | $42351 \cdot 6$ |  | $4 \begin{array}{llll}4 & 23 & 36 \cdot 9\end{array}$ | $\cdot 26$ | 42320.3 | -29 | 4 23 $I$ | -32 | 422414 | $\cdot 36$ | 42219.0 | -39 |
| 26 | $41550 \cdot 8$ |  | $41535 \cdot 8$ | -27 | $4 \begin{array}{llll}4 & 15 & 18 \cdot 7\end{array}$ | 30 | 41459.5 | $\cdot 34$ | $41438 \cdot 2$ | $\cdot 37$ | $\begin{array}{llll}4 & 14 & 14.8\end{array}$ | -45 |
| 28 | $4750 \cdot 0$ | -24 | $4 \begin{array}{ccc}4 & 7 & 34\end{array}$ | -27 | $4 \quad 7 \begin{array}{lll}17 & 0\end{array}$ | 31 | 4 6 $57 \cdot 1$ | -35 | $\begin{array}{rrrr}4 & 6 & 34.9\end{array}$ | -39 | $\begin{array}{lll}4 & 6 & 10.4\end{array}$ | -43 |
| 30 | $35949 \cdot 1$ |  | $\begin{array}{llll}3 & 59 & 33.4\end{array}$ | $\cdot 28$ | 35915.2 | $\cdot 32$ |  | $\cdot 37$ | $3 \begin{array}{lllll}3 & 58 & 31 \cdot 3\end{array}$ | $\cdot 41$ | $358 \quad 5 \cdot 7$ | -45 |
| 32 | $\begin{array}{llll}3 & 51 & 48 \cdot 2\end{array}$ | -25 | $\begin{array}{llll}3 & 51 & 32 \cdot 0 \\ 3 & 4 & \\ \end{array}$ | $\cdot 29$ | $\begin{array}{llll}3 & 51 & 13.2 \\ 3 & 4 & 12\end{array}$ | $\cdot 33$ | $350515 \cdot 8$ | -38 | $\begin{array}{llll}3 & 50 & 27 \cdot 6\end{array}$ | -43 | $\begin{array}{llll}3 & 50 & 0 \cdot 7\end{array}$ | $\cdot 47$ |
| 33 | $34747 \cdot 7$ | -25 | $3{ }^{3} 4731314$ | -30 | 34712.2 | -34 | $34650 \cdot 3$ | - 39 | $3 \begin{array}{llll}3 & 46 & 25\end{array}$ | -43 | 345 58.I | -48 |
| 34 | $34347 \cdot 3$ | -25 | $\begin{array}{llll}3 & 43 & 30 \cdot 7\end{array}$ | -30 | 343 II•2 | -35 | $34248 \cdot 9$ | -40 | $3 \begin{array}{llll}3 & 42 & 23.6\end{array}$ | -45 | 34155.4 | -49 |
| 35 | $\begin{array}{llll}3 & 39 & 46 \cdot 8\end{array}$ | - 26 | $\begin{array}{llll}3 & 39 & 29.9\end{array}$ | -31 | $\begin{array}{llll}3 & 39 & 10 \cdot 1\end{array}$ | -35 | $\begin{array}{llll}3 & 38 & 47 \cdot 3\end{array}$ | -40 | $\begin{array}{llll}3 & 38 & 2 I \cdot 5\end{array}$ | .46 | $\begin{array}{llll}3 & 37 & 52 \cdot 6\end{array}$ | -51 |
| 36 | $\begin{array}{lllll}3 & 35 & 46 \cdot 3\end{array}$ | -26 | $\begin{array}{llll}3 & 35 & 29 \cdot 2\end{array}$ | -3I | 335190 | $\cdot 36$ | $\begin{array}{llll}3 & 34 & 45 \cdot 7\end{array}$ | -4I | $\left[\begin{array}{lll}3 & 34 & 19 \cdot 3\end{array}\right.$ | $\cdot 47$ | $\begin{array}{llll}3 & 33 & 49 \cdot 7\end{array}$ | $\cdot 52$ |
| 37 | 3 3I 45.8 | $\cdot 26$ | $\begin{array}{llll}3 & 31 & 28 \cdot 4\end{array}$ | -32 | $\begin{array}{llll}3 & 31 & 7.9\end{array}$ | $\cdot 37$ | $\begin{array}{llll}3 & 30 & 44 \cdot 1\end{array}$ | -42 | $33^{30}$ I7.I | $\cdot 48$ | $\begin{array}{llll}3 & 29 & 46 \cdot 7\end{array}$ | $\cdot 53$ |
| 38 | $\begin{array}{lllll}3 & 27 & 45.3\end{array}$ | $\cdot 27$ | $\begin{array}{llll}3 & 27 & 27 \cdot 6 \\ 3 & 23 & 26 \cdot 8\end{array}$ | $\cdot 32$ | $\begin{array}{llll}3 & 27 & 6 \cdot 7\end{array}$ | $\cdot 38$ | $\begin{array}{llll}3 & 26 & 42 \cdot 4\end{array}$ | $\cdot 43$ | $\begin{array}{lllll}3 & 26 & 14.7\end{array}$ | -49 | $\begin{array}{llll}3 & 25 & 43 \cdot 6\end{array}$ | - 55 |
| 39 | $32344 \times 7$ |  | $\begin{array}{llll}3 & 23 & 26 \cdot 8\end{array}$ | -33 | $\begin{array}{llll}3 & 23 & 5 \cdot 4\end{array}$ | $\cdot 38$ | $32240 \cdot 6$ | -44 | 322212.3 | -50 | $32140 \cdot 4$ | -56 |
| 40 | $\begin{array}{lll}3 & \text { I9 } 44.2\end{array}$ | -27 | $\begin{array}{llll}3 & 19 & 25.9\end{array}$ | -33 | $\begin{array}{lll}3 & 19 & 4.2\end{array}$ | -39 | $3 \begin{array}{lll}3 & 18 & 38.8\end{array}$ | -45 | $\begin{array}{llll}3 & 18 & 9 \cdot 8\end{array}$ | $\cdot 51$ | 3 I7 37.1 | $\cdot 58$ |
| 41 | 3 I5 $43 \cdot 6$ |  |  | -34 | $\begin{array}{llll}3 & 15 & 2 \cdot 7\end{array}$ | 40 | $3 \begin{array}{llll}3 & 14 & 36 \cdot 9\end{array}$ | $\cdot 46$ | $\begin{array}{llll}3 & 14 & 7.2\end{array}$ | -53 | $31333 \cdot 6$ | -59 |
| 42 | 3 II $43 \cdot 0$ | -28 | 3 II 24.2 | -35 | 3 II I'5 | , 41 | 3 10 34.9 | -47 | 3 Io $4 \cdot 6$ | - 54 | $3 \quad 9 \quad 30 \cdot 1$ | -6I |
| 43 | $3 \begin{array}{llll}3 & 7 & 42 \cdot 4\end{array}$ | $\cdot 29$ | $\begin{array}{llll}3 & 7 & 23.2\end{array}$ | -35 | $\begin{array}{llll}3 & 7 & 0 \cdot 1\end{array}$ | $\cdot 42$ | $\begin{array}{llll}3 & 6 & 32 \cdot 9\end{array}$ | -49 | $\begin{array}{llll}3 & 6 & 1 * 7\end{array}$ | $\cdot 55$ | $\begin{array}{llll}3 & 5 & 26 \cdot 4\end{array}$ | - 62 |
| 44 | $3 \quad 341.8$ | $\cdot 29$ | $\begin{array}{llll}3 & 3 & 22 \cdot 2\end{array}$ | $\cdot 36$ | $\begin{array}{llll}3 & 2 & 58 \cdot 5\end{array}$ | $\cdot 43$ | $\begin{array}{llll}3 & 2 & 30 \cdot 7\end{array}$ | -50 | 3 I 1 58.7 | $\cdot 57$ | 3 I 22.5 | -64 |
| 45 | $2594 \mathrm{I} \cdot \mathrm{I}$ |  | $\begin{array}{llll}2 & 59 & 21 \cdot 2\end{array}$ | $\cdot 37$ | $2 \begin{array}{llll}28 & 57 \cdot 0\end{array}$ | -44 | 258888 | . 51 |  | $\cdot 58$ | $25718 \cdot 3$ | 66 |
| 46 | $25540 \cdot 5$ |  | $255^{20 \cdot 1}$ | $\cdot 38$ | $2 \begin{array}{lllllll}2 & 54 & 55.4\end{array}$ |  | $2 \begin{array}{llll}254 & 26 \cdot 2\end{array}$ | $\cdot 52$ |  | -60 | $2{ }^{2} 53114.2$ | -68 |
| 47 | $25139^{\circ} 7$ |  | $25119 \cdot 0$ | - 38 | 250 |  | $25023 \cdot 8$ | -54 | $24949 \cdot 1$ | - 62 | $249 \quad 9.8$ | $\cdot 70$ |
| 48 | $24739^{\circ} \mathrm{O}$ |  | $\begin{array}{lllllllll}2 & 47 & 17.8\end{array}$ | -39 | $24651 \cdot 9$ |  | $\begin{array}{lllllllllllllllll}2 & 46 & 21.2\end{array}$ | $\cdot 55$ |  | -63 | $\begin{array}{llll}2 & 45 & 5.2\end{array}$ | $\cdot 72$ |
| 49 | $24338 \cdot 3$ | $\cdot 32$ | $24316 \cdot 6$ | -40 | $24250 \cdot 1$ | $\cdot 48$ | $242 \begin{array}{llll} & 18\end{array}$ | $\cdot 57$ | $24142 \cdot 0$ | -65 | 24 I | $\cdot 74$ |
| 50 | $23937 \cdot 5$ | -33 | 23915.3 | $\cdot 41$ | $2 \begin{array}{llll}28 & 48 \cdot 1\end{array}$ | -50 | $23815 \cdot 7$ | . 58 | $2 \begin{array}{llll} & 37 & 38 \cdot 2\end{array}$ | -67 | $23655 \cdot 3$ | $\cdot 76$ |
| 51 | $23536 \cdot 7$ |  | 23514.0 | -42 | 234 46•I |  | 23412.8 | -60 | 233 34.I | -69 | $23250 \cdot 0$ | -78 |
| 52 | 2 3I $35 \cdot 8$ | $\cdot 34$ | 23112.6 | -43 | $23044 \cdot 0$ | $\cdot 52$ | 230098 | -62 | $\begin{array}{llll}2 & 29 & 29.9\end{array}$ | $\cdot 71$ | $\begin{array}{llll}2 & 28 & 44.3\end{array}$ | -81 |
| 53 | $\begin{array}{lllll}2 & 27 & 34.9\end{array}$ | -35 | 227 II.2 | -44 |  | $\cdot 54$ | $226 \quad 6 \cdot 5$ | -64 | $\begin{array}{lllll}2 & 25 & 25.4\end{array}$ | $\cdot 73$ | $22438 \cdot 4$ | . 83 |
| 54 | $22334{ }^{\circ} \mathrm{O}$ | $\cdot 36$ | $1 \begin{array}{lll}2 & 23 & 9 \cdot 6\end{array}$ | $\cdot 46$ | 222393 | $\cdot 55$ | 222 3.1 | $\cdot 65$ | $22120 \cdot 7$ | $\cdot 76$ | $22032 \cdot 2$ | . 86 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{\circ}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | s. | s. | s. | s. | S. | S. | S. | s. | s. | s. | s. |
| 0 | - 00 | -4.01 | - 07 | -4.01 | - - 14 | -4.01 | - 21 | -4.OI | - 28 | $-4.02$ | - 35 | $-4.02$ |
| 4 | - 01 | $4 \cdot 01$ | $\cdot 09$ | 4.01 | $\cdot 16$ | 4.01 | $\cdot 23$ | 4.01 | 30 | 4.02 | $\cdot 37$ | 4.02 |
| 8 | . 03 | $4 \cdot 1$ | -10 | 4.01 | $\cdot 17$ | 4.01 | $\cdot 24$ | 4.01 | $\cdot 31$ | 4.02 | -39 | 4.02 |
| 12 | . 04 | 4.01 | - 12 | 4.01 | -19 | 4.01 | - 26 | 4.01 | $\cdot 33$ | $4 \cdot 02$ | 40 | $4 \cdot 03$ |
| 14 | . 05 | 4.01 | -12 | 4.01 | -20 | 4.01 | -27 | 4.01 | $\cdot 34$ | $4 \cdot 02$ | 4 I | $4 \cdot 03$ |
| 16 | .06 | 4.01 | -I3 | $4 \cdot 01$ | -21 | 4.01 | -28 | 4.02 | $\cdot 35$ | $4 \cdot 02$ | $\cdot 43$ | $4 \cdot 03$ |
| 18 | -07 | 4.01 | - 14 | 4.01 | -22 | $4 \cdot \mathrm{OI}$ | -29 | 4.02 | -36 | 4.02 | -44 | 4.03 |
| 20 | -08 | 4.01 | - 15 | 4.01 | -23 | 4.01 | $\cdot 30$ | 4.02 | $\cdot 3^{8}$ | 4.02 | $\cdot 45$ | $4 \cdot 03$ |
| 22 | -09 | 4.01 | - 56 | 4.01 | -24 | 4.01 | $\cdot 31$ | 4.02 | $\cdot 39$ | 4.02 | $\cdot 46$ | 4.03 |
| 24 | -10 | 4.01 | -17 | 4.01 | -25 | 4.01 | $\cdot 32$ | 4.02 | $\cdot 40$ | 4.03 | 48 | 4.03 |
| 26 | -10 | 4.01 | -18 | 4.01 | -26 | 4.01 | -34 | 4.02 | $\cdot 42$ | 4.03 | $\cdot 50$ | 4.04 |
| 28 | - II | 4.01 | - 19 | 4.01 | -27 | 4.01 | -35 | 4.02 | $\cdot 43$ | 4.03 | -51 | 4.04 |
| 30 | - 12 | 4.01 | - 20 | 4.01 | -28 | $4 \cdot 02$ | -37 | 4.02 | -45 | 4.03 | $\cdot 53$ | 4.04 |
| 32 | -13 | 4.01 | -21 | 4.01 | -30 | 4.02 | -38 | 4.02 | -46 | 4.03 | $\cdot 55$ | 4.04 |
| 34 | - 14 | 4.01 | $\cdot 23$ | 4.01 | -31 | 4.02 | -40 | $4 \cdot 02$ | $\cdot 48$ | 4.03 | -57 | 4.05 |
| 36 <br> 38 <br> 8 | . 15 | 4.01 4.01 | .24 .25 | 4.01 | -33 | 4.02 4.02 | 41 .43 | 4.03 4.03 | .50 .52 | 4.04 4.04 | .59 .65 | 4.05 4.05 |
| 38 | - 18 | 4.01 | .25 <br> .27 | 4.01 | -34 | 4.02 4.02 | 43 $\cdot 45$ | 4.03 4.03 | -52 | 4.04 4.04 | . 61 | 4.55 4.06 |
| 42 | -19 | 4.01 | -28 | 4.01 | $\cdot 38$ | 4.02 | -47 | 4.03 | $\cdot 57$ | 4.05 | $\cdot 67$ | 4.06 |
| 44 | $\cdot 20$ | 4.01 | $\cdot 30$ | $4 \cdot 02$ | 40 | 4.03 | $\cdot 50$ | 4.04 | . 60 | 4.05 | $\cdot 70$ | 4.07 |
| 46 | -22 | 4.01 | $\cdot 32$ | 4.02 | $\cdot 42$ | 4.03 | $\cdot 52$ | 4.04 | . 63 | 4.05 | $\cdot 73$ | 4.07 |
| 48 | -23 | 4.01 | -34 | 4.02 | -44 | 4.03 | $\cdot 55$ | 4.04 | . 66 | 4.06 | $\cdot 77$ | 4.08 |
| 50 | $\cdot 25$ | 4.01 | $\cdot 36$ | 4.02 | $\cdot 47$ | 4.03 | $\cdot 58$ | $4 \cdot 05$ | $\cdot 70$ | 4.07 | -81 | 4.09 |
| 52 | $\cdot 27$ | 4.01 | $\cdot 38$ | 4.02 | - 50 | 4.04 | . 62 | 4.05 | $\cdot 74$ | 4.07 | -85 | $4 \cdot 10$ |
| 54 | -29 | 4.02 | 4 I | 4.03 | . 53 | 4.04 | $\cdot 66$ | 4.05 | $\cdot 78$ | 4.08 | $\cdot 91$ | 4.10 |

## LATITUDE $3^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $6^{\circ}$ | Decl. Var. | $7^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | н. м. | s. | H. M. S. | s. | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 58 \\ 18.7 \end{array}\right\|$ | S. | H. M. S. | S. 21 | н. м. S. | s. | н. м. s. | , |
| 10 | $\begin{array}{llll}5 & 18 & 26 \cdot 4\end{array}$ | -29 | 5188 | $\cdot 30$ | $\begin{array}{lllllllll}5 & 17 & 49.9\end{array}$ | -32 |  | -33 | 517100 | $\cdot 35$ | 8.7 | .36 |
| 12 | $51022 \cdot 4$ | 31 | 5 10 3.4 | $\cdot 32$ | $5 \quad 943 \cdot 5$ | -34 | $\begin{array}{llll}5 & 9 & 22 \cdot 6\end{array}$ | $\cdot 36$ | $\begin{array}{lll}5 & 9 & 0.7\end{array}$ | $\cdot 37$ | $\begin{array}{llll}5 & 8 & 37 \cdot 7\end{array}$ | $\cdot 39$ |
| 14 |  | 32 | $\begin{array}{llll}5 & 1 & 58.2\end{array}$ | $\cdot 34$ | 5 I 137.0 | -36 | 5 I 114.6 | $\cdot 38$ | 5 O $51 \cdot \mathrm{I}$ | 40 | 5 - 26.3 | $\cdot 42$ |
| 16 | 45414.0 | -34 | $45352 \cdot 7$ | -36 | $45330 \cdot 2$ | -39 | $453 \quad 6 \cdot 3$ | 44 | $4524 \mathrm{I} \cdot \mathrm{I}$ | -43 | 45214.4 | -46 |
| 18 | $4 \begin{array}{lll}46 & 9.4\end{array}$ | $\cdot 36$ | $44547 \cdot 0$ | -39 | $445 \quad 23 \cdot 7$ | 41 | $44457 \cdot 7$ | 44 | $44430 \cdot 7$ | $\cdot 46$ | $444 \begin{array}{ll}4 & 2 \cdot 1\end{array}$ | 49 |
| 20 | $4 \begin{array}{llll}48 & 4 \cdot 7\end{array}$ | $\cdot 38$ | $4374 \mathrm{I} \cdot \mathrm{I}$ | 41 | $43715 \cdot 7$ | 44 | $43648 \cdot 7$ | 46 | $436 \quad 20 \cdot 0$ | 49 | 43549.4 | 52 |
| 22 | $42959 \cdot 8$ | -40 | $42934 \cdot 8$ | -43 | $4298 \cdot 0$ | $\cdot 46$ | $42839 \cdot 3$ | $\cdot 49$ | $4 \begin{array}{lll}4 & 28 & 8 \cdot 7\end{array}$ | 53 | $42736 \cdot 1$ | $\cdot 56$ |
| 24 | 42154.7 | $\cdot 42$ | $\begin{array}{llll}4 & 21 & 28 \cdot 3\end{array}$ | $\cdot 46$ | $\begin{array}{llr}4 & 21 & 0.0 \\ 4 & \text { I } & 51.5\end{array}$ | -49 | $4 \quad 2029 \cdot 5$ | $\cdot 52$ | $41957 \cdot 0$ | $\cdot 56$ | $\begin{array}{llll}4 & 19 & 22.2\end{array}$ | 6 |
| 26 | 41349.2 | -44 | 41321.5 | 48 | 41251.5 | $\cdot 52$ | 44 19  | $\cdot 56$ | 4 II $44 \cdot 7$ |  | 4 II 7.7 | 4 |
| 28 | $4 \quad 543 \cdot 5$ | 47 | $4 \quad 5 \quad 14.2$ | $\cdot 51$ | 442.5 | -55 | $\begin{array}{llll}4 & 4 & 8.4\end{array}$ | 59 | $4331 \cdot 7$ | $\cdot 63$ | $4 \begin{array}{lll}4 & 2 & 5 \cdot 4\end{array}$ | . 68 |
| 30 | $35737 \cdot 4$ | 49 | $\begin{array}{llll}3 & 57 & 6 \cdot 6\end{array}$ | -54 | $35633 \cdot \mathrm{I}$ | . 58 | $35557 \cdot 0$ | -62 |  | $\cdot 67$ | $35436 \cdot 3$ | 72 |
| 32 | $34931 \cdot 0$ | -52 | $34858 \cdot 5$ | $\cdot 56$ |  | -6I | $34744 \cdot 9$ | $\cdot 66$ | $\begin{array}{llll}3 & 47 & 3.6\end{array}$ | $\cdot 71$ |  | $\cdot 76$ |
| 33 |  | -53 | $\begin{array}{lllllllllll}3 & 44 & 54.3\end{array}$ | -58 | $\begin{array}{llllll}3 & 44 & 17.9 \\ 3 & 40 & 12.6\end{array}$ | . 63 | $\begin{array}{lllll}3 & 43 & 38 \cdot 6\end{array}$ | $\cdot 68$ | $3 \begin{array}{llll}3 & 42 & 56 \cdot I\end{array}$ | $\cdot 73$ |  | $\cdot 79$ |
| 34 | 34124.2 | 55 | $34049 \cdot 9$ | . 60 | $34012 \cdot 6$ | -65 | $3 \quad 39$ 32-1 | $\cdot 70$ | $\begin{array}{llll}3 & 38 & 48\end{array}$ | $\cdot 76$ | $\begin{array}{llll}3 & 38 & 1.3\end{array}$ | 8I |
| 35 | $\begin{array}{llll}3 & 37 & 20 \cdot 6\end{array}$ | 56 | $\begin{array}{lllll}3 & 3645 \cdot 4\end{array}$ | -61 | $\begin{array}{llll}3 & 36 & 7 \cdot 0\end{array}$ | . 67 | $3 \begin{array}{llll}3 & 25 \cdot 3\end{array}$ | $\cdot 72$ | $\begin{array}{llll}3 & 34 & 40 \cdot 3\end{array}$ | $\cdot 78$ | $3335 \mathrm{I} \cdot 8$ | 84 |
| 36 | 33316.8 | 57 | $\begin{array}{llll}3 & 32 & 40 \cdot 7\end{array}$ | -63 | $\begin{array}{lll}3 & 32 & 1 \cdot 3\end{array}$ | -69 | $3 \begin{array}{llll}31 & 18.4\end{array}$ | $\cdot 74$ | $3 \quad 30 \quad 32 \cdot 0$ |  | 329 42-1 | 86 |
| 37 | 32913.0 | -59 | $\begin{array}{llll}3 & 28 & 35.9\end{array}$ | -65 | $32755 \cdot 3$ | $\cdot 71$ | 327 II.2 | 76 |  | -8 | $32532 \cdot 0$ | -89 |
| 38 | $\begin{array}{llll}3 & 25 & 9 \cdot 0\end{array}$ | . 61 | $\begin{array}{llll}3 & 24 & 30 \cdot 9\end{array}$ |  | $\begin{array}{lllllllll}3 & 23 & 49 \\ 3 & 1\end{array}$ |  | $\begin{array}{llll}3 & 23 & 3.8 \\ 3 & 8 & 5\end{array}$ |  |  |  |  | -92 |
| 39 | 3214.9 | . 62 | $32025 \cdot 8$ | -68 | $31942 \cdot 9$ | 75 | 318 56-I | -81 | $\begin{array}{llll}3 & 18 & 5.5\end{array}$ |  | 3 17 10.8 | -95 |
| 40 | 317 | 6 | $31620 \cdot 4$ | $\cdot 70$ | 31536.3 | $\cdot 77$ | $3 \mathrm{I} 44^{8 \cdot 1}$ | - 84 | $31356 \cdot 0$ | -90 | 31259.6 | 97 |
| 41 | $\begin{array}{lllllllllll}3 & 12 & 56 \cdot 2\end{array}$ | -6 |  | $\cdot 72$ | 311129.4 | $\cdot 79$ | 3 10 $39 \cdot 9$ | . 86 | $\begin{array}{llll}3 & 9 & 46 \cdot 1 \\ 3 & 5 & \end{array}$ |  | $38848 \cdot 0$ | I.OI |
| 42 | $\begin{array}{lllll}3 & 8 & 51.6\end{array}$ | -67 | $\begin{array}{llll}3 & 8 & 9 \cdot 1\end{array}$ | $\cdot 74$ | $\begin{array}{llll}3 & 7 & 22.3\end{array}$ | -81 | $\begin{array}{llll}3 & 6 & 31 \cdot 3\end{array}$ | 89 | $\begin{array}{llll}3 & 5 & 35.9\end{array}$ | $\cdot 96$ | $\begin{array}{llll}3 & 4 & 35.9\end{array}$ | 1.04 |
| 43 | $\begin{array}{llll}3 & 4 & 46 \cdot 9\end{array}$ | $\cdot 69$ | $\begin{array}{llll}3 & 4 & 3 \cdot \mathrm{I} \\ 2 & 59 & 5\end{array}$ | $\cdot 77$ | $\begin{array}{llll}3 & 3 & 15.0\end{array}$ |  | $\begin{array}{llll}3 & 2 & 22.4 \\ 2 & 58\end{array}$ | -91 | $\begin{array}{llll}3 & 1 & 25.2\end{array}$ | 99 | $\begin{array}{llll}3 & 0 & 23.4\end{array}$ | I.07 |
| 44 | 33 0 41 | $\cdot 71$ | $25956 \cdot 8$ | $\cdot 79$ | $\begin{array}{lll}2 & 59 & 7 \cdot 3\end{array}$ | 86 | $2 \begin{array}{llll} & 58 & 13 \cdot 1\end{array}$ | -94 | ${ }^{2} 57514.2$ | I. | $25610 \% 2$ | 1 |
| 45 | $\begin{array}{lllll}2 & 56 & 36 \cdot 6\end{array}$ | 73 | $\begin{array}{llll}2 & 55 & 50 \cdot 3\end{array}$ | -81 | $25459 \cdot 3$ | $\cdot 89$ | $\begin{array}{llll}2 & 54 & 3 & 4 \\ 2\end{array}$ | 97 | $\begin{array}{lll}2 & 53 & 2.6\end{array}$ | I. 06 | $25156 \cdot 7$ | 1.14 |
| 46 | $25231 \cdot 2$ | $\cdot 76$ | $25143 \cdot 5$ | . 8 | $250 \quad 50 \cdot 9$ | -92 | $24953 \cdot 3$ | 1.00 | $2 \begin{array}{llll}2 & 48 \\ 50\end{array}$ | I.09 | $24742 \cdot 5$ | I-18 |
| 47 | $24^{2} 25 \cdot 6$ | $\cdot 78$ | $24736 \cdot 4$ |  | $24642 \cdot 2$ | -95 | $24542 \cdot 8$ | I.03 | $24438 \cdot 0$ | I. 13 | $24327 \cdot 6$ | I. 22 |
| 48 |  | -8 | $\begin{array}{llll}2 & 43 & 29 \cdot 0 \\ 2 & 30\end{array}$ | $\cdot 89$ |  | - 1 | $\begin{array}{llll}2 & 4 \mathrm{I} & 3 \mathrm{I} \cdot 7 \\ 2 & 3\end{array}$ | -07 | $24024 \cdot 8$ | I'16 | $\begin{array}{lllll}2 & 39 & \text { I2 } 21 \\ 2 & 34 & 5\end{array}$ | I 26 |
| 49 | $2 \begin{array}{llll}20 & 13.4\end{array}$ | . 83 | $23921 \cdot 2$ | $\cdot 92$ | $\begin{array}{llll}2 & 38 & 23.5\end{array}$ | 1.01 | $23720 \cdot \mathrm{I}$ | I 10 | $236 \mathrm{II} \cdot \mathrm{O}$ | 1.20 | $23455 \cdot 8$ | $1 \cdot 31$ |
| 50 | $\begin{array}{lll}2 & 36 & 6 \cdot 9 \\ 2 & 32 & 0.9\end{array}$ |  | $\begin{array}{llll}2 & 35 & 13.0 \\ 2 & 31 & 4.5\end{array}$ |  |  | 1.04 <br> r .08 |  | 1 | $\begin{array}{llll}2 & 31 & 56 \cdot 4 \\ 2 & 27 & 4 \mathrm{I} \cdot 2\end{array}$ |  |  | I. 35 |
| 51 52 | 2 32 $0 \cdot 1$ <br> 2 27 $52 \cdot 9$ | -91 | 2rrrrer $\begin{array}{rrrr}2 & 31 & 4 \cdot 5 \\ 2 & 26 & 55 \cdot 4\end{array}$ | 98 $\mathrm{r} \cdot 01$ | 2 30 $2 \cdot 9$ <br> 2 25 $5 \mathrm{I} \cdot 8$ | I-1. | 2 28 $55 \cdot 2$ <br> 2 24 $4 \mathrm{I} \cdot 7$ | $1 \cdot 1$ | $\begin{array}{llll}2 & 27 & 41 \cdot 2 \\ 2 & 23 & 25 \cdot 1\end{array}$ | I.29 | $\begin{array}{lll}2 & 26 & 20 \cdot 6 \\ 2 & 22 & 1.6\end{array}$ | 1.40 1.45 |
| 53 | $22345 \cdot 3$ | -94 | 22245.9 | I-04 | $22140 \cdot 1$ | $1 \cdot 15$ | 22027.6 | . 27 | $\begin{array}{llll}2 & 19 & 8 \cdot 1\end{array}$ | I.38 | 21741.5 | . 51 |
| 54 | 21937.3 | 97 | $2 \begin{array}{llll} & 18 & 35\end{array}$ |  | 21727.7 | I•19 | 21612.6 | I.31 | $21450 \cdot 2$ | 1.44 |  | I. 56 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ | A. | L. 7 | A. | L. 8 | A. | L. 9 | A. | L. 10 | $0^{\circ} \mathrm{A}$. | L. 11 | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | S. | S. ${ }^{\text {S }}$ | s. -4.03 | - ${ }_{\text {S }}{ }^{\text {r }}$ | s. | - ${ }_{\text {s. }} .64$ | S. -4.06 | S. | S. | - ${ }^{\text {S. }}$ | S. -4.08 |
| 4 | -44 | 4.03 | $\cdot 51$ | 4.04 | $\cdot 58$ | 4.05 | . 66 | 4.06 | . 73 | 4.07 | . 80 | 4.08 |
| 8 | -46 | 4.03 | -53 | 4.04 | . 60 | 4.05 | $\cdot 68$ | 4.06 | $\cdot 75$ | 4.07 | . 82 | 4.09 |
| 12 | $\cdot 48$ | 4.03 | -55 | 4.04 | $\cdot 62$ | 4.05 | $\cdot 70$ | 4.07 | $\cdot 77$ | $4 \cdot 08$ | -85 | 4.09 |
| 14 | $\cdot 49$ | 4.03 | -56 | $4 \cdot 04$ | $\cdot 64$ | 4.06 | $\cdot 71$ | 4.07 | $\cdot 78$ | 4.08 | -86 | 4-10 |
| 16 | $\cdot 50$ | $4 \cdot 04$ | -57 | 4.05 | . 65 | 4.06 | $\cdot 72$ | 4.07 | -80 | 4.08 | . 88 | $4 \cdot 10$ |
| 18 | -51 | 4.04 | - 59 | 4.05 | . 66 | 4.06 | $\cdot 74$ | 4.07 | $\cdot 82$ | 4.09 | -89 | 4-10 |
| 20 | -53 | 4.04 | . 60 | 4.05 | - 68 | 4.06 | $\cdot 76$ | 4.08 | $\cdot 84$ | 4.09 | -91 | 4-II |
| 22 | . 54 | $4 \cdot 04$ | $\cdot 62$ | 4.05 | $\cdot 70$ | 4.07 | $\cdot 78$ | 4.08 | . 86 | $4 \cdot 10$ | $\cdot 93$ | $4 \cdot \mathrm{II}$ |
| 24 | -56 | 4.04 | -64 | 4.06 | $\cdot 72$ | 4.07 | -80 | 4.08 | $\cdot 88$ | 4.10 | -96 | $4 \cdot 12$ |
| 26 | $\cdot 57$ | 4.05 | . 66 | 4.06 | $\cdot 74$ | 4.07 | $\cdot 82$ | 4.09 | $\cdot 90$ | 4.II | -98 | $4 \cdot 12$ |
| 28 | . 59 | 4.05 | $\cdot 68$ | 4.06 | $\cdot 76$ | 4.08 | $\cdot 84$ | 4.09 | $\cdot 92$ | $4 \cdot 11$ | I-01 | 4.13 |
| 30 | .61 | 4.05 | $\cdot 70$ | 4.06 | $\cdot 78$ | $4 \cdot 08$ | -87 | 4.10 | -95 | $4 \cdot 12$ | 1.04 | 4.I4 |
| 32 | -63 | 4.06 | $\cdot 72$ | 4.07 | -80 | 4.09 | $\bullet 89$ | $4 \cdot 10$ | -98 | $4 \cdot 12$ | 1.07 | $4 \cdot 15$ |
| 34 | . 66 | 4.06 | $\cdot 74$ | 4.07 | $\cdot 83$ | 4.09 | -92 | 4.11 | $1 \cdot 01$ | $4 \cdot 13$ | $1 \cdot 10$ | 4.16 |
| 36 | . 68 | 4.06 | $\cdot 77$ | 4.08 | - 86 | 4-10 | -95 | $4 \cdot 12$ | I.05 | $4 \cdot 14$ | $1 \cdot 14$ | 4.17 |
| 38 | $\cdot 71$ | 4.07 | . 80 | 4.08 | $\cdot 89$ | $4 \cdot 10$ | -99 | $4 \cdot 13$ | I-09 | $4 \cdot 15$ | I-18 | $4 \cdot 18$ |
| 40 | $\cdot 74$ | 4.07 | -83 | 4.09 | -93 | $4 \cdot 11$ | ro3 | 4.13 | $1 \cdot 13$ | $4 \cdot 16$ | $1 \cdot 23$ | 4.19 |
| 42 | $\cdot 77$ | 4.08 | . 87 | $4 \cdot 10$ | $\cdot 97$ | $4 \cdot 12$ | 1.07 | $4 \cdot 15$ | 1-17 | $4 \cdot 17$ | 1.28 | $4 \cdot 20$ |
| 44 | -80 | 4.09 | -91 | 4.11 | 101 | $4 \cdot 13$ | I•12 | 4.16 | I-22 | 4.19 | I 34 | 4.22 |
| 46 | -84 | 4.09 | -95 | $4 \cdot 12$ | 1.06 | 4.14 | 1.17 | $4 \cdot 17$ | I. 28 | $4 \cdot 21$ | 1.40 | 4.24 |
| 48 | -88 | $4 \cdot 10$ | -99 | $4 \cdot 13$ | $1 \cdot 11$ | $4 \cdot 16$ | 1.22 | $4 \cdot 19$ | $1 \cdot 34$ | $4 \cdot 23$ | 1.47 | $4 \cdot 26$ |
| 50 | -93 | $4 \cdot 11$ | I.05 | $4 \cdot 14$ | $1 \cdot 17$ | $4 \cdot 17$ | I. 29 | 4.21 | 1.41 | 4.25 | $1 \cdot 54$ | 4.29 |
| 52 | -98 | $4 \cdot 12$ | I. 10 | $4 \cdot 15$ | I 23 | 4.19 | $1 \cdot 36$ | 4.23 | I.49 | $4 \cdot 28$ | $\pm .63$ | 4.33 |
| 54 | 1.04 | 4.14 | I•17 | $4 \cdot 17$ | I.30 | 4.21 | I. 44 | 4.25 | I 59 | $4 \cdot 31$ | I.73 | 4.36 |

## LATITUDE $3^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 57 & 26.8 \end{array}$ | S. 22 | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 57 & 13.6 \end{array}\right\|$ | S. 22 | $\begin{array}{ccc} \text { H. м. } & \text { S. } \\ 5 & 57 & 0.3 \end{array}$ | S. 22 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 56 & 46 \cdot 9 \end{array}$ | S. 22 | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 56 & 33 \cdot 3 \end{array}\right\|$ | S. 23 | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 5 & 56 & 19 \cdot 7 \end{array}$ | S. 23 |
| 10 | $\begin{array}{llll}5 & 5 & 26.6\end{array}$ | $\cdot 38$ | $\left\lvert\, \begin{array}{lll}5 & 5 & 16 \\ 5 & 3.5\end{array}\right.$ | - 39 | $\begin{array}{llll}5 & 57 & 15 \\ 5 & 15 & 39.4\end{array}$ | . 41 | $\begin{array}{lllll}5 & 5 & 4 & 14.4\end{array}$ | -43 | $\begin{array}{llll}5 & 14 & 48 \cdot 3\end{array}$ | $\cdot 44$ | $\begin{array}{llll}5 & 14 & 21 \cdot 3\end{array}$ | . 46 |
| 12 | $\begin{array}{llll}5 & 8 & 13.6\end{array}$ | -41 | $\begin{array}{llll}5 & 7 & 48 \cdot 4\end{array}$ | -43 | $5 \begin{array}{llll}5 & 7 & 22 \cdot 1\end{array}$ | -45 | $\begin{array}{llll}5 & 6 & 54.6\end{array}$ | -47 | $\begin{array}{llll}5 & 6 & 25.8\end{array}$ | -49 | $\begin{array}{llll}5 & 5 & 56 \cdot 0\end{array}$ | -51 |
| 14 | $\begin{array}{llll}5 & 0 & 0.2\end{array}$ | -45 | $4 \begin{array}{lll}4 & 59 & 32 \cdot 8\end{array}$ | -47 | $4 \quad 59 \quad 4.2$ | -49 | $4 \begin{array}{llll}4 & 58 & 34 \cdot 2\end{array}$ | -51 | $\begin{array}{lll}4 & 58 & 2.8\end{array}$ | - 53 | $45730 \cdot 0$ | . 56 |
| 16 | 45 I $46 \cdot 4$ | $\cdot 48$ | 4 51 56.8 | -5I | $45045 \cdot 7$ | -53 | $45013 \cdot 1$ | -56 | $4 \quad 49 \quad 39^{\circ} \mathrm{O}$ | - 58 | $4493 \cdot 1$ | 6I |
| 18 | $44332 \cdot 0$ | -52 | $443 \quad 0.2$ | -54 | $4 \quad 42 \quad 26 \cdot 6$ | -57 | 4 4I 5I*4 | -60 | 44114.3 | -63 | 44035.4 | 66 |
| 20 | $43517 \cdot 1$ | -55 | $\begin{array}{llll}4 & 34 & 42.9\end{array}$ | -59 | $434 \quad 6 \cdot 8$ | . 62 | 433188 | . 65 | $432 \begin{array}{llll}4 & 48 \cdot 7\end{array}$ | - 68 | $432 \quad 6 \cdot 6$ | -72 |
| 22 | 427 I.6 | -59 | 42625.0 | -63 | $42546 \cdot 2$ | -66 | $\begin{array}{lll}4 & 25 & 5 \cdot 3\end{array}$ | -70 | $42422 \cdot 1$ | $\cdot 74$ | $42336 \cdot 8$ | $\cdot 78$ |
| 24 | 4 I8 $45 \cdot 3$ | . 63 | $\begin{array}{llll}4 & 18 & 6 \cdot 1\end{array}$ | . 67 | 4 17 24.7 | -71 | $4 \begin{array}{llll}4 & 16 & 40 \cdot 8\end{array}$ | $\cdot 75$ | $\begin{array}{llllllll}4 & 15 & 54.4\end{array}$ | -79 | 41555 | - 84 |
| 26 | $41028 \cdot 4$ | -68 | $4 \quad 946 \cdot 5$ | $\cdot 72$ | $\begin{array}{lll}4 & 9 & 2 \cdot 1\end{array}$ | $\cdot 76$ | $4 \quad 8 \quad 15 \cdot 1$ | . 81 | $4 \quad 7 \quad 25.4$ | -85 | $4633 \cdot 0$ | -90 |
| 28 | $4 \quad 2 \quad 10 \cdot 5$ | $\cdot 72$ | $\begin{array}{llll}4 & 1 & 25.9\end{array}$ | -77 | 4 o 38.5 | -81 | $35948 \cdot 2$ | . 86 | $358 \quad 55 \cdot 0$ | -9I | $\begin{array}{llll}3 & 57 & 58.7\end{array}$ | $\cdot 96$ |
| 29 | $3 \begin{array}{lll}3 & 58 & \mathbf{1} 3\end{array}$ | $\cdot 74$ | $35715 \cdot 2$ | -79 | $\begin{array}{llll}3 & 56 & 26 \cdot 2\end{array}$ | -81 | 355134.2 | -90 | $35439 \cdot 2$ | -94 | $35341 \cdot 0$ | I.00 |
| 30 | $35351 \cdot 7$ | -77 | $\begin{array}{llll}3 & 53 & 4.2\end{array}$ | - 82 | $3 \begin{array}{llll}3 & 52 & 13.6\end{array}$ | - 87 | $\begin{array}{lllll}3 & 51 & 19.9\end{array}$ | -92 | 35023.0 | -98 | $34922 \cdot 7$ | 1.03 |
| 31 | $34942 \cdot 0$ | -79 | $3 \begin{array}{llll}3 & 48 & 52\end{array}$ | -84 | $\begin{array}{lll}3 & 4^{8} & 0.6\end{array}$ | -90 | 347 5.I | -95 | $346 \quad 6 \cdot 3$ | I'OI | $3454{ }^{3} \mathrm{O}$ | 1.07 |
| 32 | 34531.9 | -82 | 344 4I•2 | -87 | $\begin{array}{lllll}3 & 43 & 47 & 3\end{array}$ | -93 | $34250 \cdot 0$ | -98 | 3 4I 49'I | I'04 | $34044 \%$ | II |
| 33 | 34121.5 | . 84 | $3 \begin{array}{llll}30 & 29 \cdot 3\end{array}$ | -90 | $\begin{array}{llll}3 & 39 & 33.6\end{array}$ | -96 | $\begin{array}{llll}3 & 38 & 34 \cdot 3\end{array}$ | I. 02 | $33731 \cdot 5$ | 1.08 | $\begin{array}{llll}3 & 36 & 247\end{array}$ | 14 |
| 34 | $\begin{array}{llll}3 & 37 & 10.9\end{array}$ | -87 | $\begin{array}{lllllllllll}3 & 36 & 17\end{array}$ | -93 |  | -99 |  | 1.05 | $\begin{array}{lllllll}3 & 33 & 13.2\end{array}$ | I-12 | $\begin{array}{llll}3 & 32 & 4 & 3\end{array}$ | 18 |
| 35 | $\begin{array}{llll}3 & 32 & 59 \cdot 8\end{array}$ | -90 | $\begin{array}{llll}3 & 32 & 4 \cdot 2\end{array}$ | -96 | $3 \begin{array}{lll}31 & 4.9\end{array}$ | 1.02 | 3301.6 | I.09 |  | I•I5 | $32743 \cdot 1$ | . 22 |
| 36 |  | -92 | 327 51•1 | -99 | $\begin{array}{lllllllllllll}3 & 26 & 49 \cdot 8\end{array}$ | I.05 | $\begin{array}{lllllllllll}3 & 25 & 44.5\end{array}$ | I•12 | 324350 | I.I9 | $\begin{array}{llll}3 & 23 & 21 \cdot 2\end{array}$ | I. 27 |
| 37 | $322436 \cdot 7$ | -95 |  | 1-02 | $\begin{array}{llll}3 & 22 & 34.2\end{array}$ | I.09 | $\begin{array}{lllll}3 & 21 & 26.7\end{array}$ | 1.16 | $\begin{array}{lllll}3 & 20 & 14.9\end{array}$ | I. 23 | 3 I8 58•7 | I•3I |
| 38 | 32024.5 | $\cdot 98$ | $3 \begin{array}{lll}3 & 19 & 23.4\end{array}$ | I.05 | $\begin{array}{llll}3 & 18 & 18 \cdot 1\end{array}$ | I'I2 | $\begin{array}{llll}3 & 17 & 8.4\end{array}$ | 20 | 315154.2 | I. 28 | $\begin{array}{llll}3 & 14 & 35 \cdot 3\end{array}$ | I.36 |
| 39 | $\begin{array}{llll}3 & 16 & 12 \cdot 0\end{array}$ | I. 02 | 3 I5 $\begin{array}{rrr}8 \cdot 9\end{array}$ | I.09 | 31414 | I•16 | 312494 | I. 24 | 3 II $32 \cdot 6$ | I'32 | 3 10 110 | 1.40 |
| 40 | 3 II 59.0 | 1.05 | 3 10 $53 \cdot 8$ | I'12 | $\begin{array}{llll}3 & 9 & 44 \\ \end{array}$ | 1.20 | $\begin{array}{llll}3 & 8 & 29.7\end{array}$ | 1.28 | $\begin{array}{llll}3 & 7 & 10 \cdot 3\end{array}$ | I 37 | $\begin{array}{lllll}3 & 5 & 45 \cdot 8\end{array}$ | I.45 |
| 41 | $\begin{array}{llll}3 & 7 & 45.4\end{array}$ | 1.08 | $\begin{array}{llll}3 & 6 & 38 \cdot 2\end{array}$ | I•I6 | $\begin{array}{llll}3 & 5 & 26 \cdot 2\end{array}$ | 1.24 | $\begin{array}{llll}3 & 4 & 9 \cdot 2\end{array}$ | 1.33 | $\begin{array}{llll}3 & 2 & 47 \cdot 1\end{array}$ | 1.41 | 3 I 19.6 | I.50 |
| 42 | $3 \begin{array}{lll}3 & 3 & 3\end{array}$ | 1-12 | $\begin{array}{llll}3 & 2 & 21 \cdot 9\end{array}$ | I. 20 | $\begin{array}{llll}3 & 1 & 7.5\end{array}$ | I. 28 | $2 \begin{array}{lllll}2 & 59 & 47 \cdot 9\end{array}$ | 1.37 | $\begin{array}{llll}2 & 58 & 23.0\end{array}$ | I.46 | $25652 \cdot 4$ | I. 56 |
| 43 | $25916 \cdot 7$ | I'I5 | $\begin{array}{llll}2 & 58 & 5 \cdot 0\end{array}$ | 1.24 | $25648 \cdot 1$ | I.33 | $\begin{array}{llll}2 & 55 & 25.8\end{array}$ | 1.42 | 25357.8 | I.5I | 25224.0 | .6I |
| 44 | $\begin{array}{lll}2 & 55 & 1.5\end{array}$ | I'19 | $\begin{array}{llllllll}2 & 53 & 47 \cdot 3\end{array}$ | 1.28 | 22 52 $27 \cdot 8$ | 1.37 | $\begin{array}{llll}2 & 51 & 2.6 \\ 2 & 46 & 38.5\end{array}$ | 1.47 | $24931 \cdot 6$ | 1.57 | $\begin{array}{lllll}2 & 47 & 54.4\end{array}$ | I. 67 |
| 45 | $\begin{array}{lllll}2 & 50 & 45 \cdot 5\end{array}$ | 1.23 | $\begin{array}{llll}2 & 49 & 28 \cdot 9\end{array}$ | $1 \cdot 32$ | $\begin{array}{llll}2 & 48 & 6 \cdot 6\end{array}$ | 1.42 | $\begin{array}{lllll}2 & 46 & 38 \cdot 5\end{array}$ | 1.52 | $\begin{array}{llll}2 & 45 & 4.2\end{array}$ | I.63 | $\begin{array}{llll}2 & 43 & 23 \cdot 4\end{array}$ | I.74 |
| 46 | $\begin{array}{llll}2 & 46 & 29 \cdot 0\end{array}$ | 1.27 | $\begin{array}{lll}2 & 45 & 9 \cdot 7 \\ 2 & 40 & 49\end{array}$ | 1.37 |  | 1.47 |  | I. 58 | $\begin{array}{lllll}2 & 40 & 35.5\end{array}$ | I. 69 | $23^{8} 51 \cdot 0$ | 1.80 |
| 47 | 242 II. 6 | $1 \cdot 32$ | $24049 \cdot 6$ | I 42 | $23921 \cdot 4$ | I 52 | $23746 \cdot 8$ | 1.63 | $\begin{array}{llll}2 & 36 & 5.4\end{array}$ | 1.75 | $23416 \cdot 9$ | I.87 |
| 48 | 23753.4 | I.36 | $2 \begin{array}{llll}2 & 36 & 28 \cdot 5\end{array}$ | 1.47 | $2 \begin{array}{llll}2 & 34 & 57 \cdot 2\end{array}$ | 1.58 | $23319 \cdot 1$ | 1.69 | $23133 \cdot 8$ | 1.82 | 229 4I•I | I. 94 |
| 49 | $233134 \cdot 3$ | 1.41 | $\begin{array}{llll}2 & 32 & 6 \cdot 4\end{array}$ | 1.52 | 23031.7 | 1.64 | 22849.8 | 1.76 |  | I.89 | 22503.4 | . 02 |
| 50 | 22914.3 | I. 46 | 227 43.I | I. 58 | 226449 | $1 \cdot 70$ | $22419 \cdot 1$ | 1.83 | 22225.5 | I.96 | $22023 \cdot 6$ | $2 \cdot 11$ |
| 5 I | $22453 \cdot 2$ | I. 52 |  | I. 64 | $22136 \cdot 6$ | 1.77 | 2 I9 46.7 | 1.90 | 2 17 48.4 | $2 \cdot 04$ | 2 I5 4I.4 | $2 \cdot 19$ |
| 52 | $22031 \cdot 0$ | I.57 | 2 | I•70 | $2 \begin{array}{llll}2 & 17 & 6 \cdot 7\end{array}$ | I.84 | 2 I5 12.3 | I.98 | 21313 | $2 \cdot 13$ | $21056 \cdot 7$ | 2.29 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | S. | S. | S. | S. | s. | S. | s. | S. | S. | S. | s. | S. |
| 0 | -. 85 | -4*09 | - 93 | $-4 \cdot 11$ | -1.00 | $-4 \cdot 13$ | -1.07 | $-4 \cdot 15$ | -I.I5 | $-4 \cdot 17$ | -1.23 | -4.19 |
| 4 | . 87 | $4 \cdot 10$ | -95 | $4 \cdot 12$ | $1 \cdot 02$ | $4 \cdot 13$ | I•10 | $4 \cdot 15$ | I•18 | 4.17 | I 25 | $4 \cdot 20$ |
| 8 | -90 | $4 \cdot 10$ | -97 | 4.12 | $1 \cdot 05$ | $4 \cdot 14$ | I'12 | $4 \cdot 16$ | I 20 | $4 \cdot 18$ | I. 28 | $4 \cdot 20$ |
| 10 | -91 | 4'II | -98 | $4 \cdot 12$ | I.06 | 4•14 | I'I3 | 4•16 | I 21 | $4 \cdot 18$ | I. 29 | 4.21 |
| 12 | '92 | 4•II | I 100 | $4 \cdot 13$ | 1.07 | 4.15 | I.15 | 4•17 | I. 23 | 4•19 | I'3I | $4 \cdot 2 \mathrm{I}$ |
| 14 | -94 | 4.II | I OI | 4.13 | 1.09 | $4 \cdot 15$ | 1•17 | 4.17 | 1. 25 | 4.19 | I 33 | $4 \cdot 22$ |
| 16 | -95 | 4.12 | I.O3 | 4.14 | 1•II | $4 \cdot 16$ | 1-19 | $4 \cdot 18$ | 1.27 | $4 \cdot 20$ | I 35 | $4 \cdot 23$ |
| 18 | -97 | 4-12 | 1.05 | 4.14 | 1-I3 | $4 \cdot 16$ | I.2I | 4.18 | 1.29 | $4 \cdot 21$ | I.38 | $4 \cdot 24$ |
| 20 | -99 | $4 \cdot 13$ | 1.07 | $4 \cdot 15$ | 1.15 | 4-17 | I. 24 | 4.19 | 1.32 | $4 \cdot 22$ | 1.40 | $4 \cdot 24$ |
| 22 | 1.02 | $4 \cdot 13$ | I'IO | 4•15 | I•18 | 4.17 | 1.26 | $4 \cdot 20$ | 1-35 | $4 \cdot 23$ | 1.43 | $4 \cdot 25$ |
| 24 | 1.04 | 4.14 | I•I2 | 4.16 | 1-21 | 4.18 | 1.29 | $4 \cdot 21$ | 1.38 | $4 \cdot 24$ | I. 47 | $4 \cdot 27$ |
| 26 | 1.07 | 4.14 | I•15 | $4 \cdot 17$ | I 24 | 4.19 | I. 32 | $4 \cdot 22$ | 1.41 | $4 \cdot 25$ | 1.50 | $4 \cdot 28$ |
| 28 | I•IO | $4 \cdot 15$ | I'I8 | 4.18 | 1.27 | 4.20 | I. 36 | $4 \cdot 23$ | 1.45 | 4.26 | I.54 | $4 \cdot 29$ |
| 30 | I•13 | 4•16 | I 22 | $4 \cdot 19$ | I•3I | 4.21 | I.40 | $4 \cdot 24$ | 1.49 | $4 \cdot 27$ | I•59 | $4 \cdot 31$ |
| 32 | I•16 | 4.17 | I. 25 | $4 \cdot 20$ | I•34 | $4 \cdot 22$ | I 44 | $4 \cdot 26$ | 1.54 | $4 \cdot 29$ | I. 64 | 4.33 |
| 34 | I 20 | $4 \cdot 18$ | I. 29 | 4.21 | 1.39 | $4 \cdot 24$ | 1.49 | 4.27 | I. 59 | 4.31 | I. 69 | 4.35 |
| 36 | I. 24 | $4 \cdot 19$ | I.34 | $4 \cdot 22$ | I. 44 | $4 \cdot 26$ | I. 54 | $4 \cdot 29$ | I. 64 | $4 \cdot 33$ | I.75 | $4 \cdot 37$ |
| 38 | I 28 | $4 \cdot 21$ | $1 \cdot 38$ | $4 \cdot 24$ | 1.49 | $4 \cdot 27$ | I 59 | 4.31 | 1-70 | $4 \cdot 35$ | I.81 | $4 \cdot 40$ |
| 40 | I.33 | $4 \cdot 22$ | 1.44 | $4 \cdot 26$ | I. 55 | $4 \cdot 29$ | I. 66 | $4 \cdot 33$ | 1.77 | $4 \cdot 38$ | I.89 | $4 \cdot 43$ |
| 42 | I.39 | $4 \cdot 24$ | 1.50 | $4 \cdot 28$ | I.61 | $4 \cdot 32$ | 1.73 | $4 \cdot 36$ | 1.85 | 4.41 | 1.97 | 4.46 |
| 44 | 1.45 | 4.26 | 1.56 | $4 \cdot 30$ | x. 68 | $4 \cdot 34$ | I.81 | 4.39 | 1.93 | 4.45 | 2.06 | 4.50 |
| 46 | I. 52 | $4 \cdot 28$ | 1.64 | $4 \cdot 33$ | I.76 | $4 \cdot 38$ | I.89 | 4.43 | 2.03 | 4.49 | 2.17 | $4 \cdot 55$ |
| 48 | I 59 $\mathbf{I} 68$ | 4.31 | 1.72 1.82 | $4 \cdot 36$ | I. 86 | 4.41 | I.99 | 4.47 | 2.14 2.26 | 4.54 | 2.29 | 4.61 |
| 50 | I. 68 I.78 | 4.34 4.38 | I.82 | 4.40 4.44 | 1.96 2.08 | 4.46 | $2 \cdot 11$ | 4.53 4.59 | 2.26 2.41 | 4.60 4.67 | 2.43 2.59 | 4.68 4.77 |
| 52 | I•78 | $4 \cdot 38$ | 1•93 | 4.44 | 2.08 | 4.51 | 2.24 | $4 \cdot 59$ | 2.41 | 4.67 | $2 \cdot 59$ | 4.77 |

## LATITUDE $3^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. | S. | M. | S | M | S. | M. | S. | M. | S. | M. S. | S. |
| 0 | $\begin{array}{llll}5 & 56 & 5 \cdot 9\end{array}$ | $\cdot 23$ | $\begin{array}{lllll}5 & 55 & 51\end{array} 9$ | - 23 | $\begin{array}{llll}5 & 55 & 37 \cdot 7\end{array}$ | -24 | 555 | -24 | 555 | 24 | $55454 \cdot 1$ | 25 |
| 10 | $\begin{array}{llll}5 & 13 & 53 \cdot 1\end{array}$ | -48 | $\begin{array}{llll}5 & 13 & 23.8\end{array}$ | - 50 | $\begin{array}{llllllll}5 & 12 & 53\end{array}$ | - 52 | $\begin{array}{lllll}5 & 12 & 21 \cdot 6\end{array}$ | $\cdot 54$ | 5 II $48 \cdot 7$ | 56 | 5 II 14.5 | 58 |
| 12 | $\begin{array}{llll}5 & 5 & 24 \cdot 7\end{array}$ | -53 | $\begin{array}{llll}5 & 4 & 52 \cdot 2\end{array}$ | -55 | $\begin{array}{llll}5 & 4 & 18 \cdot 3\end{array}$ | -58 | $\begin{array}{llll}5 & 3 & 42.9\end{array}$ | 60 | $\begin{array}{lll}5 & 3 & 6 \cdot 1\end{array}$ | 3 | $\begin{array}{llll}5 & 2 & 27 \cdot 8\end{array}$ | 65 |
| 14 | $45655 \cdot 6$ | $\cdot 58$ | $\begin{array}{llll}4 & 56 & 19 \cdot 8\end{array}$ | -6I | $\begin{array}{llll}4 & 55 & 42 \cdot 3\end{array}$ | - 64 | 455 | -67 | $\begin{array}{llll}4 & 54 & 22.4\end{array}$ | -69 | $4 \begin{array}{llll}4 & 53 & 39 \cdot 8\end{array}$ | 72 |
| 16 | $44825 \cdot 6$ | . 64 | $44746 \cdot 3$ | -67 | $447 \quad 5 \cdot 2$ | $\cdot 70$ | $44622 \cdot 2$ | $\cdot 73$ | $445 \quad 37 \cdot 4$ | $\cdot 76$ | $44450 \cdot 4$ | 80 |
| 18 | $43954 \cdot 6$ | $\cdot 7$ | 439 II•7 | $\cdot 73$ | $4 \begin{array}{lll}4 & 38 & 26 \cdot 9\end{array}$ | $\cdot 76$ | $43739 \cdot 9$ | -80 | $4 \begin{array}{lll}4 & 36 & 50 \cdot 8\end{array}$ | 84 | 435159.4 | 88 |
| 20 | 43122.4 | $\cdot 76$ | 4 30 35.9 | -79 | $42947 \cdot 2$ | . 83 | 428 56•1 | $\cdot 87$ | $\begin{array}{lll}4 & 28 & 2.6\end{array}$ | 91 | $427 \quad 6 \cdot 5$ | -96 |
| 22 | $42248 \cdot 9$ | . 82 | $42158 \cdot 7$ | -86 | $4 \begin{array}{lll}4 & 21 & 5.9\end{array}$ | -90 | $42010 \cdot 5$ | - 95 | $\begin{array}{llll}4 & 19 & 12.4\end{array}$ | '99 | 41811.4 | I. 04 |
| 24 | 41414.1 | . 88 | $4 \begin{array}{llllll}4 & 13\end{array}$ | -93 | $\begin{array}{lllll}4 & 12 & 22.9\end{array}$ | $\cdot 97$ | 4 II 23.0 | 1.02 | $41020 \cdot 0$ | 1.07 | $4 \quad 914.0$ | I'I3 |
| 25 | 4956.0 | -91 | 4859.8 | -96 | 4 8 0.6 | I-OI | $4 \quad 6 \quad 58 \cdot 4$ | 1.06 | $4 \quad 5 \quad 53 \cdot 0$ | I•12 | 44443 | I'17 |
| 26 | $4 \quad 5 \quad 37 \cdot 6$ | -95 | $4 \quad 439 \cdot$ | 1.00 | $\begin{array}{llll}4 & 3 & 37 \cdot 8\end{array}$ | I.05 | $\begin{array}{rrrr}4 & 2 & 33 \cdot 2\end{array}$ | I 10 | $\begin{array}{llll}4 & 1 & 25\end{array}$ | -16 | $\begin{array}{rrrr}4 & 0 & 13.9 \\ 3 & 5 & \end{array}$ | $\cdot 22$ |
| 2 | 4 I 18.7 | - 98 | $4 \quad 0 \quad 18 \cdot 2$ | $1 \cdot 03$ | $\begin{array}{llll}3 & 59 & 14.5\end{array}$ | I'09 | $\begin{array}{llll}3 & 58 & 7.4\end{array}$ | I. 15 | $\begin{array}{llll}3 & 56 & 56 \cdot 8\end{array}$ | 1 | $35542 \cdot 6$ | I. 27 |
| 28 | $35659 \cdot 3$ | 1.02 | $35556 \cdot 6$ | $1 \cdot 07$ | $35450 \cdot 5$ | I'I3 | $35341 \cdot 0$ | 9 | $3 \begin{array}{llll}3 & 52 & 27 \cdot 7\end{array}$ | I 25 | $35110 \cdot 6$ | -32 |
| 29 | $\begin{array}{llll}3 & 52 & 39.4\end{array}$ | 1.05 | 35134.5 | I•II | $35026 \cdot 0$ | I•17 |  | 1.24 | $34757 \times 7$ | I.30 | 346 37•7 | 1.37 |
| 30 | 34819.0 | 1.09 | 3471197 | I.15 | $346 \quad 0 \cdot 7$ | I 22 | $34445 \cdot 8$ | I. 28 | $343 \quad 27 \cdot 0$ | I-35 | $3423 \cdot 9$ | I 42 |
| 3 | 34358 | I. 13 | 34248 | $1 \cdot$ | $34134 \cdot 7$ | I.26 | 33 40 7 | 3 | $33^{3} 855$ | I 40 | $33729 \cdot 1$ | $1 \cdot 47$ |
| 32 | $33936 \cdot 4$ | I•17 | $\begin{array}{lllll}3 & 38 & 24 \cdot 2\end{array}$ | $1 \cdot 2$ | $\begin{array}{llll}3 & 37 & 8 \cdot 0\end{array}$ | - 31 | $3 \quad 3547 \cdot 5$ | I•38 | $\begin{array}{lllll}3 & 34 & 22 \cdot 7\end{array}$ | I. 45 | $\begin{array}{llll}3 & 32 & 53 \cdot 2\end{array}$ | . 53 |
| 33 | $33514 \cdot 1$ | I'2I | $\begin{array}{llll}3 & 33 & 59\end{array}$ | I | $\begin{array}{llll}3 & 32 & 40 \cdot 4\end{array}$ | I 35 | $33^{31}$ I7•1 | 1.43 | $\begin{array}{llll}3 & 29 & 49 \cdot 1\end{array}$ | I. 51 | $\begin{array}{llll}3 & 28 & 16.2\end{array}$ | 1.59 |
| 34 | $\begin{array}{llll}3 & 30 & 51 \cdot 2\end{array}$ | 1.25 | $\begin{array}{llll}3 & 29 & 33 \cdot 8\end{array}$ | 1.33 | $\begin{array}{llll}3 & 28 & 12 \cdot 0\end{array}$ | I. 40 | $\begin{array}{llll}3 & 26 & 45 \cdot 6\end{array}$ | I.48 | $\begin{array}{llll}3 & 25 & 14.3 \\ 3 & 20 & 4.3\end{array}$ | I. 56 | $\begin{array}{llll}3 & 23 & 38 \cdot 0 \\ 3 & 18 & 58 \cdot 4\end{array}$ | . 65 |
| 35 | $\begin{array}{llll}3 & 26 & 27 \cdot 5\end{array}$ | I. 30 | $\begin{array}{lll}3 & 25 & 7 \cdot 4\end{array}$ | 1.37 | $32342 \cdot 6$ | I 45 | 322 I3.1 | I. 53 | $320 \begin{array}{lll}38 \cdot 4\end{array}$ | I. 62 | 3 I8 $58 \cdot 4$ | I•71 |
| 36 | 32230 | $1 \cdot 34$ | $32040 \cdot 1$ |  | 31912.3 | 151 | $\begin{array}{llll}3 & 17 & 39.4\end{array}$ | $1 \cdot 59$ | 31615 | . 68 | $\begin{array}{llllll}3 & 14 & 17 \% 4\end{array}$ | 78 |
| 37 | $\begin{array}{lllllllllll}3 & 17 & 37.7\end{array}$ | I 39 | $3 \mathrm{I} 6 \mathrm{II} \cdot 8$ | $1 \cdot 47$ | $31440 \cdot 9$ | I. 56 | $\begin{array}{llll}3 & 13 & 4 \cdot 6\end{array}$ | I. 65 | 3 II 22.7 | 1.75 | $3 \quad 935.0$ | -85 |
| 3 | $\begin{array}{llll}3 & 13 & 11.4\end{array}$ | 1.44 | 3 II 42.5 | I. 53 | $\begin{array}{llll}3 & 10 & 8 \cdot 3\end{array}$ | 1.62 | $\begin{array}{llll}3 & 8 & 28 \cdot 4\end{array}$ | I•71 | $\begin{array}{lllll}3 & 6 & 42 \cdot 7\end{array}$ | 1.81 | $\begin{array}{lll}3 & 4 & 50.9\end{array}$ | -92 |
| 39 | $\begin{array}{llll}3 & 8 & 44^{\circ} 2\end{array}$ | I. 49 | $\begin{array}{llll}3 & 7 & 12 \cdot 1\end{array}$ | $\underline{1} 58$ | $\begin{array}{llll}3 & 5 & 34.4\end{array}$ |  | $\begin{array}{lll}3 & 3 & 50 \cdot 9\end{array}$ | I•78 | $\begin{array}{lrrr}3 & 2 & 1 \cdot 2\end{array}$ | $\underline{1.88}$ | $3{ }^{3}$ | 1.99 |
| 40 | $\begin{array}{llll}3 & 4 & 16 .\end{array}$ | 1.5 | $3 \quad 240 \cdot 5$ | I. 64 | $3 \quad 0 \quad 59 \cdot 2$ | I•74 | 259 II•8 | I.84 | $2 \begin{array}{llllll} & 57 & 17.9\end{array}$ | 1.96 | 255 I 7 I | $2 \cdot 07$ |
| 41 | $25946 \cdot 6$ | I. 60 | $\begin{array}{llll}2 & 58 & 7 \cdot 7\end{array}$ | I•70 | 25622. | 80 | $2543 \mathrm{I} \cdot \mathrm{I}$ | -91 | $\begin{array}{llll}2 & 52 & 32.8\end{array}$ | $2 \cdot 03$ | $25027 \cdot 2$ | $2 \cdot 16$ |
| 42 | $25516 \cdot 0$ | 66 | $2 \begin{array}{llll}2 & 53 & 33.4\end{array}$ | I.76 | $2 \mathrm{5I} 44.4$ | 1.87 | $24948 \cdot 6$ | -99 | $2 \begin{array}{llllll}2 & 47 & 45\end{array}$ | II | $24535 \cdot 0$ | 24 |
| 43 | $25044 \cdot \mathrm{I}$ | $1 \cdot 72$ | 248 57•7 | I.83 | $\begin{array}{lllllllllllll}2 & 47 & 4.5\end{array}$ | 1.95 | $\begin{array}{llll}2 & 45 & 4 \cdot 2\end{array}$ | $2 \cdot 07$ |  | O | $\begin{array}{llllllllllll}2 & 40 & 40 \cdot 3\end{array}$ | 2 34 |
| 44 | $\begin{array}{llll}2 & 46 & 10 \cdot 8\end{array}$ | 1.78 | $24420 \cdot 3$ | 1.90 | $\begin{array}{llll}2 & 42 & 22 \cdot 7\end{array}$ | $2 \cdot 02$ | $\begin{array}{llll}2 & 40 & 17.6 \\ 2 & 35 & 28.8\end{array}$ | $2 \cdot 15$ | $\begin{array}{lll}2 & 38 & 4 \cdot 5 \\ 2 & 33 & \end{array}$ | $2 \cdot 29$ | $\begin{array}{lllll}2 & 35 & 42 \cdot 8\end{array}$ | 2.44 |
| 45 | 24135.9 | I.85 | $23941 \cdot 2$ | x.97 | $23739 \cdot 0$ | $2 \cdot 10$ | $23528 \cdot 8$ | $2 \cdot 24$ | 233 IO'I | $2 \cdot 39$ | $23042 \cdot 4$ | $2 \cdot 54$ |
| 46 | 23659.3 | 92 | $2350 \cdot 1$ | $2 \cdot 05$ | 23253.0 | 219 | $23037 \cdot 5$ | $2 \cdot 33$ | 22812.8 | 2.49 | $22538 \cdot 6$ | . 66 |
| 47 | $\begin{array}{llll}2 & 32 & 20 \cdot 9\end{array}$ | $2 \cdot 00$ | 2301770 | $2 \cdot 14$ | $\begin{array}{llll}2 & 28 & 4 \cdot 6\end{array}$ | $2 \cdot 28$ | $2 \begin{array}{lllllllll}25 & 43 \cdot 3\end{array}$ | $2 \cdot 43$ | $\begin{array}{llll}2 & 23 & 12.4\end{array}$ | $2 \cdot 60$ | $2203 \mathrm{I} \cdot 2$ | $2 \cdot 78$ |
| 48 | $22740 \cdot 5$ | $2 \cdot 08$ | 22531.5 | $2 \cdot 22$ | $\begin{array}{llll}2 & 23 & 13.5\end{array}$ | $2 \cdot 38$ | $22046 \cdot 1$ | $2 \cdot 54$ | $\begin{array}{llll}2 & 18 & 8 \cdot 4\end{array}$ | $2 \cdot 72$ | $\begin{array}{llll}2 & 15 & 19.6\end{array}$ | 2.91 |
| 49 | $\begin{array}{llll}2 & 22 & 57 \cdot 8 \\ 2 & 18\end{array}$ | $2 \cdot 17$ | $\begin{array}{lllll}2 & 20 & 43.4\end{array}$ | $2 \cdot 32$ | $2{ }_{2} 1819.5$ | $2 \cdot 48$ |  | $2 \cdot 66$ | $\begin{array}{llll}2 & 13 & 0.4\end{array}$ | 2.85 | 2 10 3.4 | 3.06 |
| 50 | 21812.7 | $2 \cdot 26$ | $215 \quad 52.5$ | $2 \cdot 42$ | 2131322 | $2 \cdot 60$ | $21040 \cdot 9$ | 2.79 | $7 \quad 47 \cdot 9$ | 2.99 | 442.0 | $3 \cdot 21$ |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| $\bigcirc$ | -I.30 | -4.21 | -1.38 | $-4.23$ | -1.46 | -4.26 | - 1.54 | -4.29 | I. 62 | 4.32 | - I'70 | $4 \cdot 35$ |
| 4 | I 33 | $4 \cdot 22$ | 1.41 | $4 \cdot 24$ | 1.48 | $4 \cdot 27$ | 1.56 | $4 \cdot 30$ | I. 64 | $4 \cdot 33$ | $1 \cdot 72$ | $4 \cdot 36$ |
| 6 | I. 34 | 4.22 | 1.42 | 4.25 | $\pm 49$ | $4 \cdot 28$ | I. 57 | $4 \cdot 30$ | I.66 | 4.33 | x.74 | $4 \cdot 37$ |
| 8 | 1.36 | 4.23 | 1.44 | 4.25 | 1.51 | $4 \cdot 28$ | 1.59 | $4 \cdot 3 x$ | I. 68 | $4 \cdot 34$ | 1.76 | $4 \cdot 38$ |
| 10 | I 37 | $4 \cdot 23$ | 145 | $4 \cdot 26$ | $1 \cdot 53$ | $4 \cdot 29$ | 1.61 | $4 \cdot 32$ | 1.70 | $4 \cdot 35$ | 1.78 | $4 \cdot 38$ |
| 12 | 1.39 | 4.24 | 1.47 | 4.27 | I. 55 | 4.30 | r.64 | 4.33 | I 72 1.75 | 4.36 4.37 | x.81 | $4 \cdot 39$ |
| 14 | 1.45 | $4 \cdot 25$ | I-49 | 4.27 | $1 \cdot 58$ | $4 \cdot 30$ | 1.66 | $4 \cdot 34$ | I.75 | $4 \cdot 37$ | 1.83 | $4 \cdot 41$ |
| 16 | $1 \cdot 43$ | $4 \cdot 25$ | I 52 | $4 \cdot 28$ | 1.60 | $4 \cdot 31$ | 1.69 | $4 \cdot 35$ | I'78 | $4 \cdot 38$ | 1.86 | $4 \cdot 42$ |
| 18 | $1 \cdot 46$ | 4.26 | I 55 | 4.29 | I. 63 | 4.32 |  | $4 \cdot 36$ | I.81 | 4.39 | 1.90 | $4 \cdot 43$ |
| 20 | 1-49 | $4 \cdot 27$ | I 58 | $4 \cdot 30$ | I. 66 | $4 \cdot 34$ | I•75 | $4 \cdot 37$ | I.84 | 4.41 | 1.94 | $4 \cdot 45$ |
| 22 | 1.52 | $4 \cdot 28$ | 1.61 | $4 \cdot 32$ | 1.70 | $4 \cdot 35$ | x•9 | $4 \cdot 39$ | 1.88 | 4.43 | 1.98 | $4 \cdot 47$ |
| 24 | 1.56 | $4 \cdot 30$ | I.65 | $4 \cdot 33$ | $1 \cdot 74$ | $4 \cdot 37$ | 1.83 | $4 \cdot 40$ | 1.93 | $4 \cdot 45$ | 2.03 | $4 \cdot 49$ |
| 26 | 1.59 | $4 \cdot 31$ | x.69 | $4 \cdot 35$ | $1 \cdot 78$ | $4 \cdot 38$ | 1.88 | $4 \cdot 42$ | I. 98 | $4 \cdot 47$ | 2.08 | $4 \cdot 51$ |
| 28 | I.64 | $4 \cdot 33$ | $\pm 73$ | 4.36 | 1.83 | $4 \cdot 40$ | $\pm .93$ | 4.45 | 2.03 | 4.49 | 2.14 | 4.54 |
| 30 | 1. 68 | $4 \cdot 35$ | 1.78 | $4 \cdot 38$ | 1.88 | $4 \cdot 43$ | I.99 | $4 \cdot 47$ | 2.09 | $4 \cdot 52$ | 2.20 | $4 \cdot 57$ |
| 32 | $1 \cdot 74$ | $4 \cdot 37$ | x. 84 | 4.41 | 1.94 | 4.45 | 2.05 | $4 \cdot 50$ | $2 \cdot 16$ | $4 \cdot 55$ | 2.28 | $4 \cdot 61$ |
| 34 | 1•79 | $4 \cdot 39$ | $1 \cdot 90$ | 4.43 | 2.01 | $4 \cdot 48$ | $2 \cdot 12$ | 4.53 | $2 \cdot 24$ | $4 \cdot 59$ | $2 \cdot 36$ | $4 \cdot 65$ |
| 36 | 1.86 | 4.41 | I.97 | 4.46 | $2 \cdot 08$ | 4.51 | $2 \cdot 20$ | $4 \cdot 57$ | $2 \cdot 32$ | 4.63 | 2.45 | 4.69 |
| 38 | 1.93 | 4.45 | 2.05 | 4.50 | 2.17 2.26 | 4.55 | 2.29 2.39 | 4.6 I | 2.42 | 4.68 | 2.55 2.67 | 4.75 4.81 |
| 40 | 2.01 | $4 \cdot 48$ | $2 \cdot 13$ | 4.54 | $2 \cdot 26$ | 4.60 | $2 \cdot 39$ | $4 \cdot 66$ | $2 \cdot 53$ | 4.74 | 2.67 | 4.8 I |
| 42 | $2 \cdot 10$ | 4.52 | 2.23 | $4 \cdot 58$ | $2 \cdot 36$ | $4 \cdot 65$ | 2.50 | $4 \cdot 72$ | 2.65 | $4 \cdot 80$ | 2.81 | $4 \cdot 89$ |
| 44 | 2.20 2.31 | 4.57 | 2.34 | $4 \cdot 64$ | 2.48 | $4 \cdot 71$ | 2.63 | 4.79 | $2 \cdot 80$ | $4 \cdot 88$ | 2.96 | 4.98 |
| 46 | $2 \cdot 31$ | $4 \cdot 62$ | $2 \cdot 46$ | 4.70 | 2.62 | 4.79 | $2 \cdot 79$ | $4 \cdot 88$ | 2.96 | $4 \cdot 98$ | 3.15 | $5 \cdot 09$ |
| 48 | 2.44 | $4 \cdot 69$ | 2.61 | $4 \cdot 78$ | $2 \cdot 78$ | 4.88 | 2.96 | $4 \cdot 98$ | 3.16 | $5 \cdot 10$ | $3 \cdot 36$ | $5 \cdot 23$ |
| 50 | 2.60 | $4 \cdot 77$ | $2 \cdot 78$ | 4.87 | $2 \cdot 98$ | 4.99 | 3.17 | $5 \cdot 11$ | 3•39 | $5 \cdot 25$ | 3.62 | $5 \cdot 40$ |

## LATITUDE $4^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4{ }^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0 \\ 0.0 \end{array}$ | $\begin{aligned} & \mathrm{S} . \\ & \cdot 28 \end{aligned}$ | $\begin{array}{cc} \text { H. M. s. } \\ 5 & 59 \\ 43 \cdot 2 \end{array}$ | [ ${ }^{\text {S }}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 59 & 26 \cdot 4 \end{array}\right.$ | - ${ }^{\text {S }}$ | $\left\|\begin{array}{lll} \text { н. м. } & \text { S. } \\ 5 & 59 & 9 \cdot 6 \end{array}\right\|$ | $\begin{aligned} & \text { s. } \\ & \cdot 28 \end{aligned}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 58 \\ 52 \end{array}\right.$ | s. $-28$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 58 \\ 35 \cdot 9 \end{array}\right.$ | S 28 |
| 10 | $51954 \cdot \mathrm{I}$ | $\cdot 28$ | 51936.6 | $\cdot 30$ | $\begin{array}{lllll}5 & 19 & 18.5\end{array}$ | $\cdot 3 \mathrm{I}$ | $\begin{array}{lllll}5 & 18 & 59.6\end{array}$ | $\cdot 32$ | $\begin{array}{lllllllllllll}5 & 18 & 39 \cdot 8\end{array}$ | - 34 | $\begin{array}{llllll}5 & 18 & 19.3\end{array}$ | 35 |
| 12 | 5 II  | -28 | 5 II $35 \cdot 2$ | $\cdot 30$ | 5 II 16.7 | $\cdot 32$ | 5 10 57.3 | $\cdot 33$ | 5 10 $37 \cdot 0$ | -35 | 5 10 15.6 | 36 |
| 14 | $\begin{array}{llll}5 & 3 & 51.6\end{array}$ | $\cdot 29$ | $\begin{array}{llll}5 & 3 & 33 \cdot 8\end{array}$ | $\cdot 31$ | $\begin{array}{llll}5 & 3 & 14.9\end{array}$ | $\cdot 32$ | 5 $2055 \%$ | $\cdot 34$ | $\begin{array}{llll}5 & 2 & 33.9\end{array}$ | $\cdot 36$ | $\begin{array}{lllll}5 & 2 & 11\end{array}$ | -38 |
| 16 | $45550 \cdot 4$ | - 29 | $4 \begin{array}{lllllllll} & 5 & 32 \cdot 3\end{array}$ | $\cdot 31$ | 45513.0 | $\cdot 33$ | $4 \quad 54 \quad 52.5$ | $\cdot 35$ | $45430 \cdot 7$ | $\cdot 37$ | $4 \begin{array}{lll}4 & 7 & 76\end{array}$ | 39 |
| 18 | 447 49•I | -29 | $44730 \cdot 7$ | $\cdot 32$ | $447 \mathrm{II} \cdot 0$ | $\cdot 34$ | $44649 \cdot 9$ | -36 | $44627 \cdot 4$ | -39 | 446304 | 1 |
| 20 | $43947 \cdot 8$ | $\cdot 30$ | 439 29•1 | - 32 | $439 \quad 9.0$ | $\cdot 35$ | $43847 \cdot 2$ | $\cdot 38$ | $438 \quad 23 \cdot 8$ | $\cdot 40$ | $\begin{array}{lllll}4 & 37 & 58\end{array}$ | $\cdot 43$ |
| 22 | $43146 \cdot 5$ | $\cdot 30$ | $43127 \cdot 5$ | -33 | 4316.8 | -36 | 43044.4 | $\cdot 39$ | $43020 \cdot 1$ | -42 | $42954 \cdot 2$ | 45 |
| 24 | $42345 \cdot 0$ | 31 | $42325 \cdot 7$ | 34 | 4234.5 | $\cdot 37$ | 42241.4 | $\cdot 40$ | $\begin{array}{llll}4 & 22 & 16.3\end{array}$ | -43 | 42149.2 | $\cdot 47$ |
| 26 | $41543 \cdot 6$ | 31 | $4 \begin{array}{lllll}15 & 23.9\end{array}$ | 35 | $415 \quad 2 \cdot \mathrm{I}$ | $\cdot 38$ | $41438 \cdot 2$ | $\cdot 42$ | 41212.2 | -45 | 4 I3 44.0 | 49 |
| 28 | $\begin{array}{llll}4 & 742 \cdot 1\end{array}$ | '32 | $4 \quad 722 \cdot 0$ | 35 | $659 \cdot 6$ | -39 | $\begin{array}{llll}4 & 6 & 34.9\end{array}$ | -43 | $\begin{array}{llll}4 & 6 & 7 \cdot 9\end{array}$ | $\cdot 47$ | $\begin{array}{lllll}4 & 5 & 38 \cdot 5\end{array}$ | $\cdot 51$ |
| 30 | $35940 \cdot 6$ | $\cdot 32$ | $35920 \cdot 0$ | -36 | $3 \begin{array}{lll}38 & 56.9\end{array}$ | 4 I | $3 \begin{array}{llll} & 58 & 31 \cdot 3\end{array}$ | 45 | $\begin{array}{llll}3 & 58 & 3 & 3\end{array}$ | $\cdot 49$ | $35732 \cdot 6$ | $\cdot 53$ |
| 32 | 35139.0 | -33 | 35117.9 | -37 | $35054 \cdot \mathrm{I}$ | $\cdot 42$ | $35027 \cdot 6$ | $\cdot 46$ | $\begin{array}{lllllllllllllllll}3 & 49 & 58 \cdot 4\end{array}$ | -51 | 34926.4 | . 56 |
| 33 | $34738 \cdot 2$ | $\cdot 33$ | 34716.7 | -38 | $34652 \cdot 6$ | 4 | 34625.6 | 47 | 34555.8 | -52 | 345 23.I | 57 |
| 34 | 343 37-3 | 34 | 34315.6 | -38 | $34251 \cdot \mathrm{I}$ | 43 | 34223.6 | 48 | $3 \begin{array}{llll} & 41 & 53\end{array}$ | -53 | 34119.8 | $\cdot 58$ |
| 35 | $\begin{array}{llll}3 & 39 & 36 \cdot 5\end{array}$ | 34 | $\begin{array}{llll}3 & 39 & 14.5\end{array}$ | . 39 | $33^{8} 49 \cdot 5$ | 44 | $\begin{array}{llll}3 & 38 & 21.5\end{array}$ | -49 | $\begin{array}{llllllllllll}3 & 37 & 50 \cdot 4\end{array}$ | $\cdot 54$ | 33716.3 | 60 |
| 36 |  | 35 | $\begin{array}{lllll}3 & 35 & 13 & 3\end{array}$ | $\cdot 40$ | $33447 \cdot 8$ | 45 | $\begin{array}{llll}3 & 34 & 19 \cdot 3\end{array}$ | - 50 | $\begin{array}{lllllllllllll}3 & 33 & 47 \cdot 6\end{array}$ | $\cdot 56$ | $\begin{array}{lllllllllll}3 & 33 & 12.6\end{array}$ | 1 |
| 37 |  | 35 | $\begin{array}{llllllllll}3 & 31 & 12.0\end{array}$ | 40 | $33046 \cdot 2$ | 46 | $33017 \cdot \mathrm{I}$ | $\cdot 51$ | $\begin{array}{lllllllllllll}3 & 29 & 44 \cdot 6\end{array}$ | $\cdot 57$ | 3298.9 | 62 |
| 38 |  | $\cdot 36$ | $\begin{array}{llll}3 & 27 & 10.7 \\ 3 & 23 & 0.4\end{array}$ | 41 | $\begin{array}{llll}3 & 26 & 44.4 \\ 3 & 22 & 42.6\end{array}$ | 47 | 3 26 $14 \cdot 7$ <br> 3 22  | -52 |  | $\cdot 58$ | 3255.0 | 64 |
| 39 | $32332 \cdot 8$ | $\cdot 36$ | 323 | 42 | 32242 | 48 | $32212 \cdot 3$ | $\cdot 53$ | 32138.4 |  | 32110 |  |
| 40 | $31931 \cdot 8$ | -37 | 31988 | 42 | $\begin{array}{llll}3 & 18 & 40 \cdot 8\end{array}$ | 49 | $\begin{array}{lll}3 & 18 & 9.8\end{array}$ | -55 | $31735 \cdot 1$ | -61 | 31656.8 | . 67 |
| 41 | $\begin{array}{llllllllll}3 & 15 & 30 \cdot 8\end{array}$ | $\cdot 37$ | 3156.6 | 43 | $\begin{array}{lllllllllllllll}3 & 14 & 38.8\end{array}$ | $\cdot 50$ | $\begin{array}{llll}3 & 14 & 7.2\end{array}$ | $\cdot 56$ | 3 13 317 <br> 17   | $\cdot 62$ | 31252.4 | $\cdot 69$ |
| 42 | 3 II 29.7 | -38 | 3 II 5.2 | -44 | 3 10 $36 \cdot 8$ | 51 | $\left\lvert\, \begin{array}{lll}3 & 10 & 4.6\end{array}\right.$ | -57 | $1 \begin{array}{llll}3 & 9 & 28 \cdot 2\end{array}$ | -64 | $3848 \cdot 0$ | $\cdot 70$ |
| 43 | 37828.6 | $\cdot 38$ | $\begin{array}{llll}3 & 7 & 3 \cdot 7\end{array}$ | 45 | $\begin{array}{llll}3 & 6 & 34 \cdot 7\end{array}$ | . 52 | $\begin{array}{lll}3 & 6 & 1 \cdot 7 \\ 3 & 1 & 58\end{array}$ |  | $\begin{array}{llll}3 & 5 & 24.5\end{array}$ | -65 | $3 \quad 4 \begin{array}{llll}3 & 43\end{array}$ | 72 |
| 44 | $\begin{array}{llll}3 & 3 & 27 \cdot 5\end{array}$ | -39 | $\begin{array}{llll}3 & 3 & 2 \cdot 1\end{array}$ | $\cdot 46$ | $\begin{array}{llll}3 & 2 & 32 \cdot 5\end{array}$ | 53 | 3 I 58.7 | . 60 | 3 I 20.7 | $\cdot 67$ | $3 \quad 038 \cdot 3$ | 74 |
| 45 | $2{ }_{2} 5926 \cdot 4$ | $\cdot 40$ | $\begin{array}{lll}2 & 59 & 0.4\end{array}$ | $\cdot 47$ | $1 \begin{array}{llll}2 & 58 & 30 \cdot 2\end{array}$ | - 54 | 25755.7 | .61 |  | - 69 | $25633 \cdot 2$ | 76 |
| 46 | $25525 \cdot 2$ | $\cdot 40$ | $25458 \cdot 7$ | $\cdot 48$ | $\begin{array}{llll}2 & 54 & 27.9\end{array}$ | 55 | $25352 \cdot 5$ | $\cdot 63$ | $\begin{array}{lllllllllllll}2 & 53 & 12.5\end{array}$ | $\cdot 70$ | $252 \quad 27 \cdot 9$ | 78 |
| 47 | 25123.9 | 41 | $25056 \cdot 9$ | $\cdot 49$ | $\begin{array}{lllll}2 & 50 & 25.4 \\ 2\end{array}$ | $\cdot 56$ | $24949 \cdot 1$ | 64 | $\begin{array}{llll}2 & 49 & 8 \cdot \mathrm{I} \\ 2 & 5 & \end{array}$ | $\cdot 72$ | 24822.3 | 80 |
| 48 | 2 47 2 $22 \cdot 6$ | $\cdot 42$ | 2 46 $55 \cdot \mathrm{I}$ <br> 2 42  | $\cdot 50$ | $\begin{array}{llll}2 & 46 & 22 \cdot 8 \\ 2 & 42 & 20 \cdot 1\end{array}$ | $\cdot 58$ |  |  | $\begin{array}{rrr}2 & 45 & 3.6 \\ 2 & 40 & 58.8\end{array}$ | $\cdot 74$ | $\begin{array}{llll}2 & 44 & 16 \cdot 5\end{array}$ | 83 |
| 49 | 243213 | -43 | 24253.2 | $\cdot 51$ | $24220 \cdot 1$ | 59 | 24142.0 | -68 | 24058.8 |  | $24010 \cdot 3$ |  |
| 50 | $\begin{array}{lll}39 & 19.9\end{array}$ | -44 | 23851.2 | 52 | $\begin{array}{llllll}2 & 38 & 17.3\end{array}$ | 61 | $2 \begin{array}{llll} & 37 & 382\end{array}$ | $\checkmark$ | 23653.7 | $\cdot 78$ | $2364^{\circ} \mathrm{O}$ | 88 |
| 51 | 23518.5 | 45 | $23449 \cdot 0$ | $\cdot 53$ | 2 34414.3 | 62 | $23334 \cdot \mathrm{I}$ | $\cdot 72$ | $\begin{array}{llllll}2 & 32 & 48 \cdot 5\end{array}$ | .81 | $23157 \cdot 2$ | 90 |
| 52 | $\begin{array}{lllll}2 & 31 & 16 \cdot 9\end{array}$ | $\cdot 46$ | $\begin{array}{lllll}2 & 30 & 46 \cdot 8\end{array}$ | $\cdot 55$ | $\begin{array}{lllll}2 & 30 & 11.2 \\ 2 & 26 & 7\end{array}$ | $\cdot 64$ | 22929.9 | $\cdot 74$ | $\begin{array}{llllll}2 & 28 & 42 \cdot 9\end{array}$ | . 83 | $\begin{array}{lllll}2 & 27 & 50 \cdot 1\end{array}$ | 93 |
| 53 | 22715.3 | 47 | 23644.5 | $\cdot 56$ | $2 \begin{array}{lll}26 & 7.9\end{array}$ | . 66 | 22525.4 | 76 | $22437 \cdot 1$ | $\cdot 86$ | $22342 \cdot 6$ | 96 |
| 54 | 22313.7 | 4 | 2242.0 | $\cdot 58$ | 2224.4 |  | $22120 \cdot 7$ | $\cdot 78$ | $22030 \cdot 9$ |  | 2 I9 34.7 | '99 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 0 | A. | L. $1^{\circ}$ A. |  | L. ${ }^{\circ}$ | A. | L. 3 | A. | L. 4 | A. | L. | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | . s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| 0 | 00 | -4.01 | - .07 | -4.01 | - •14 | -4.01 | - 21 | $-4.02$ | - 28 | $-4.02$ | - 35 | -4.03 |
| 4 | . 02 | 4.01 | -09 | 4.01 | -16 | 4.01 | - 23 | 4.02 | -30 | 4.02 | $\cdot 37$ | 4.03 |
| 8 | -04 | 4.01 | -II | 4.01 | -18 | 4.01 | -25 | 4.02 | -32 | 4.02 | -40 | 4.03 |
| 12 | -06 | 4.01 | -13 | 4.01 | -20 | $4 \cdot 01$ | -28 | 4.02 | $\cdot 35$ | 4.02 | -42 | 4.03 |
| 14 | -07 | 4.01 | -14 | 4.01 | -21 | 4.02 | $\cdot 29$ | 4.02 | $\cdot 36$ | 4.03 | -43 | 4.03 |
| 16 | . 08 | 4.01 | -15 | 4.01 | $\cdot 23$ | 4.02 | -30 | 4.02 | -37 | 4.03 | -45 | 4.03 |
| I8 | -09 | $4 . \mathrm{OI}$ | - 16 | $4 \cdot \mathrm{OI}$ | -24 | $4 \cdot 02$ | -31 | 4.02 | -39 | 4.03 | -46 | 4.04 |
| 20 | -ro | 4.01 | -18 | 4.01 | - 25 | 4.02 | -33 | 4.02 | $\cdot 40$ | 4.03 | . 48 | 4.04 |
| 22 | - II | 4.01 | -19 | 4.01 | -26 | 4.02 | -34 | 4.02 | -42 | 4.03 | -49 | 4.04 |
| 24 | -12 | 4.01 | - 20 | 4.01 | -28 | 4.02 | $\cdot 36$ | 4.03 | -43 | 4.03 | -5I | 4.04 |
| 26 | -14 | 4.01 | -21 | 4.02 | -29 | 4.02 | $\cdot 37$ | $4 \cdot 03$ | $\bullet 45$ | 4.03 | -53 | $4 \cdot 04$ |
| 28 | -15 | 4.01 | $\cdot 23$ | 4.02 | -31 | 402 | -39 | 4.03 | -47 | $4 \cdot 04$ | $\cdot 55$ | 4.05 |
| 30 | -16 | 4.01 | -24 | 4.02 | -32 | 4.02 | -41 | 4.03 | -49 | 4.04 | -57 | 4.05 |
| 32 | -17 | 4.01 | -26 | 4.02 | -34 | 4.02 | -43 | 4.03 | -51 | 4.04 | -59 | 4.05 |
| 34 | -I9 | 4.01 | $\cdot 27$ | 4.02 | $\cdot 36$ | 4.03 | -45 | 4.03 | $\cdot 53$ | 4.04 | - 62 | 4.06 |
| 36 | -20 | 4.01 | -29 | 4.02 | -38 | 4.03 | -47 | 4.04 | - 56 | 4.05 | . 64 | 4.06 |
| 38 | -22 | 4.02 | - 3 | 4.02 | -40 | 4.03 | -49 | 4.04 | $\cdot 58$ | 4.05 | -67 | 4.07 |
| 40 | -23 | 4.02 | -33 | $4 \cdot 02$ | -42 | 4.03 | -51 | $4 \cdot 04$ | -61 | 4*06 | $\cdot 70$ | 4.07 |
| 42 | $\cdot 25$ | 4.02 | -35 | 4.02 | -44 | 4.03 | . 54 | 4.05 | -64 | $4 \cdot 06$ | $\cdot 74$ | 4.08 |
| 44 | -27 | 4.02 | -37 | 4.03 | -47 | 4.04 | $\cdot 57$ | 4.05 | -67 | 4.06 | $\cdot 77$ | $4 \cdot 08$ |
| 46 | -29 | $4^{\circ} 02$ | -39 | 4.03 | -50 | 4.04 | -60 | 4.05 | -70 | 4.07 | .81 | 4*09 |
| 48 | -31 | 4.02 | -42 | 4.03 | $\cdot 53$ | 4.04 | . 63 | 4.06 | -74 | 4.08 | -85 | $4 \cdot 10$ |
| 50 | -33 | 4.02 | -45 | 4.03 | $\cdot 56$ | 4.05 | . 67 | 4.07 | $\cdot 78$ | 4.09 | -90 | $4 \cdot 11$ |
| 52 | -36 | 4.03 | -48 | 4.04 | -59 | 4.05 | $\cdot 71$ | 4*07 | -83 | 4.09 | -95 | 4.12 |
| 54 | -39 | $4 \cdot 03$ | - 5 | $4 \cdot 04$ | . 63 | 4.06 | $\cdot 76$ | $4 \cdot 08$ | - 88 | 4.10 | I.OI | 4.13 |

HOUR-ANGLES AND VARIATIONS TO $\mathbf{1}^{\prime}$ OF LAT., DECL., AND ALT. 139
LATITUDE $4^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. м. ${ }_{\text {c }}$ | $\cdot 28$ | H. M. S. |  |  | $\cdot$ | 55727.7 | S. | H. M. S. |  | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 . & 56 & 53 . T \end{array}$ | S. |
| ${ }_{10}$ | $\begin{array}{llll}5 & 58 & 18 \cdot 9 \\ 5 & 17 & 58 \cdot 0\end{array}$ | $\cdot{ }^{28}$ | $\begin{array}{rrrr}5 & 58 & 2.0 \\ 5 & 17 & 35.8\end{array}$ | . 28 | $\begin{array}{llll}5 & 57 & 44.9 \\ 5 & 17 & 12.8\end{array}$ | $\cdot 2$ |  | 29 | $\left\lvert\, \begin{array}{ccc}5 & 57 & 10 \cdot 4 \\ 5 & 16 & 24 \cdot 1\end{array}\right.$ | - 29 | $\begin{array}{llll}5 & 56 & 53 \cdot 1 \\ 5 & 15 & 58 \cdot 4\end{array}$ | 4 |
| 12 | $\begin{array}{llllll}5 & 9 & 53.3\end{array}$ | $\cdot 38$ | $\begin{array}{lllll}5 & 9 & 30 \cdot 0\end{array}$ | 40 | $\begin{array}{llll}5 & 9 & 5 \cdot 7\end{array}$ | $\cdot 4 \mathrm{4}$ | $\begin{array}{lllll}5 & 8 & 40 \cdot 3\end{array}$ | -43 | $\begin{array}{lllll}5 & 8 & 1 & 13.9\end{array}$ | -45 | 5 $7846 \cdot 4$ | 47 |
| 14 | $\begin{array}{llll}5 & 1 & 48 \cdot 4\end{array}$ | 40 | $\begin{array}{llll}5 & 1 & 23.9\end{array}$ | $\cdot 42$ | $5 \begin{array}{llll}5 & 0 & 58\end{array}$ | -44 | $5{ }_{5}^{5}$ | -46 | 5 - $0 \cdot 3 \cdot 4$ | -48 | $45934 \cdot 0$ | 兂 |
| 16 | $45343 \cdot 3$ | 42 | $4 \begin{array}{llll}4 & 53 & 17.6\end{array}$ | 44 | $45250 \cdot 6$ | 46 | $45^{52} 22 \cdot 1$ | $\cdot 48$ | 45152.4 | -5I | 4 51 $21 \cdot 1$ | $\cdot 53$ |
| 18 | $44537 \cdot 9$ | 44 | 445 II•0 | $\cdot 46$ | $44442 \cdot 5$ | -49 | 44412.4 | $\cdot 51$ | $44340 \cdot 9$ | -54 | 4437.7 | 57 |
| 20 | $43732 \cdot 3$ | $\cdot 46$ | 4374.0 | $\cdot 48$ | $43634 \cdot \mathrm{I}$ | 5 s | $436 \quad 2.4$ | -54 | 43529.0 | - 57 | $43453 \cdot 7$ | 60 |
| 22 | 42926.4 | $\cdot 48$ | $42856 \cdot 8$ | $\cdot 51$ | $42825 \cdot 3$ | - 54 | 42751.8 | $\cdot 57$ | $4 \quad 2716.5$ | -6I | $42639 \cdot 0$ | 64 |
| 24 | 42120.2 | $\cdot 50$ | $42049 \cdot 1$ | -53 | $42016 \cdot 0$ | $\cdot 57$ | $41940 \cdot 7$ | -61 | $4 \begin{array}{lll}4 & 19 & 3.3\end{array}$ | - 64 | $\begin{array}{lllll}4 & 18 & 23.7\end{array}$ | 68 |
| 26 |  | $\cdot 52$ | 41241.0 | $\cdot 56$ | $412 \quad 6.2$ | $\cdot 60$ | 4 II 29.0 | $\cdot 64$ | 4 IO 49.5 | . 68 | 4107.6 | $\cdot 72$ |
| 28 | $\begin{array}{llll}4 & 5 & 6.7\end{array}$ | -55 | $\begin{array}{llll}4 & 4 & 32 \cdot 5\end{array}$ | $\cdot 59$ | 355.9 | . 63 | $4 \begin{array}{llll}4 & 16 \cdot 7\end{array}$ | $\cdot 67$ | $\begin{array}{llll}4 & 2 & 35\end{array}$ | $\cdot 72$ | 4 I 50.6 | 6 |
| 30 | 35659.4 | - 58 | 35623.5 | -62 | 35545.0 | $\cdot 67$ |  | $\cdot 71$ | 3 35419.6 | $\cdot 76$ | $\begin{array}{lllllllllllll}3 & 53 & 32\end{array}$ | 81 |
| 32 | $3485 \mathrm{I} \cdot 6$ | -60 | $\begin{array}{llllllll}3 & 48 & 13.9\end{array}$ | -65 | $\begin{array}{llllllllllll}3 & 47\end{array}$ | $\cdot 70$ | $3{ }^{3} 4649 \cdot 8$ | $\cdot 75$ | $\begin{array}{llll}3 & 46 & 3.3\end{array}$ | -80 |  | 5 |
| 33 | $34447 \cdot 5$ | - 62 | $\begin{array}{lll}3 & 44 & 8 \cdot 9\end{array}$ | $\cdot 67$ | $343127 \cdot 3$ | $\cdot 72$ |  | $\cdot 77$ | 33 41 $54 \cdot 7$ <br> 3   | -82 |  | 8 |
| 34 | $34043 \cdot 3$ | $\cdot 63$ | 340377 | . 69 | $33921 \cdot 0$ | $\cdot 74$ | $\begin{array}{llll}3 & 3851\end{array}$ | -79 | $3 \begin{array}{llll}3 & 3745\end{array}$ | $\cdot 85$ |  | 0 |
| 35 |  | . 65 |  | $\cdot 70$ |  | $\cdot 76$ | $33427 \cdot 4$ | . 8 I | $\begin{array}{llll}3 & 33 & 36 \cdot 8\end{array}$ | -87 |  | 93 |
| 36 | 3 32 $34 \cdot 4$ <br> 3 28  | -66 | $\begin{array}{llll}3 & 31 & 52 \cdot 8 \\ 3 & 27\end{array}$ | $\cdot 72$ | $\begin{array}{llll}3 & 31 & 7 \cdot 9 \\ 3 & 27 & 0.9\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 30 & 19.4\end{array}$ | $\cdot 84$ | 3 32929.4 | -90 | 3 28 31.7 <br> 3 2  | .96 |
| 37 | $\begin{array}{llll}3 & 28 & 29.7\end{array}$ | -68 | 3 27 $47 \cdot 1$ | $\cdot 74$ | 327 0.9 | -80 | 326 II-1 | -86 | $\begin{array}{llll}3 & 25 & 17.7 \\ 3 & 21 & 7\end{array}$ | -92 | $\begin{array}{llll}3 & 24 & 20.4\end{array}$ | -99 |
| 38 |  | $\cdot 70$ | 3 23 $4 \mathrm{I} \cdot \mathrm{I}$ | $\cdot 76$ | $\begin{array}{llll}3 & 22 & 53 \cdot 7\end{array}$ | $\cdot 82$ | $\begin{array}{lll}3 & 22 & 2.5\end{array}$ | . 88 | $\begin{array}{llll}3 & 21 & 7 \cdot 6 \\ 3 & 16 & 5\end{array}$ | -95 | $\begin{array}{llll}3 & 20 & 8 \cdot 6 \\ 3 & 15 & 56\end{array}$ | 1.02 |
| 39 | $3 \quad 2019.8$ | $\cdot 72$ | 31935.0 | $\cdot 78$ | $\begin{array}{llllllllllll}3 & 18\end{array}$ | -84 |  | 91 | $\begin{array}{llllll}3 & 16 & 57 \cdot 1\end{array}$ | -98 |  | 05 |
| 40 | 31614.6 | $\cdot 73$ | $\begin{array}{llll}3 & 15 & 28.6\end{array}$ | . 80 |  | -87 | 31344.4 | -93 | $312246 \cdot 3$ | r.OI | 3 II 43.7 | 1.08 |
| 4 I | $\begin{array}{llll}3 & 12 & 9.2\end{array}$ | $\cdot 75$ | 3 II 21.9 | . 82 | $31030 \cdot 5$ | -89 | $3 \begin{array}{llll}3 & 94.9\end{array}$ | $\cdot 96$ | $\begin{array}{llll}3 & 8 & 35 \cdot 0\end{array}$ | 1.04 | $\begin{array}{llll}3 & 7 & 30 \cdot 6\end{array}$ | 11 |
| 42 | $\begin{array}{llll}3 & 8 & 3.6\end{array}$ | -7 | $\begin{array}{lllll}3 & 7 & 15.0\end{array}$ | . 84 | $\begin{array}{llll}3 & 6 & 22.2\end{array}$ | $\cdot 92$ | 3 3 5 24.9 |  | $\begin{array}{llll}3 & 4 & 23.2\end{array}$ | 1.07 | $\begin{array}{llll}3 & 3 & 16.9\end{array}$ | I. 15 |
| 43 |  | . 80 | $\begin{array}{lll}3 & 3 & 7 \cdot 8 \\ 2 & 5 & 0 \cdot 3\end{array}$ |  | 3 2 $13 \cdot 5$ <br>  5  | $\bigcirc 94$ | 3 1 14.5  <br> 2 5 7  | 02 | 3 3 O $111 \cdot 0$ | 1.10 |  | I.18 I. 22 |
| 44 | $25951 \cdot 5$ | $\cdot 82$ | $2590 \cdot 3$ | -89 | 2584 | -97. | $2 \begin{array}{lll}2 & 57 & 3\end{array}$ | $1 \cdot 05$ | 255 58.3 | 13 | $25447 \cdot 7$ | 2 |
| 45 | 25545.2 | . 84 | $25452 \cdot 5$ | -92 | 25355.0 | 00 | $25252 \cdot 5$ | . 08 | $25 \mathrm{I} 45^{\circ} \mathrm{O}$ | 1.17 | $250 \cdot 32.2$ | $\cdot 26$ |
| 46 | $25138 \cdot 5$ | . 86 | $25044 \cdot 3$ | -94 | $24945 \cdot 1$ | 1.03 | $24840 \cdot 7$ | 12 | $24731 \cdot 1$ | 1.21 | $24616 \cdot 0$ | $1 \cdot 30$ |
| 47 | 24731.5 | $\cdot 89$ | $24635 \cdot 7$ | -97 | 24534.7 | 1.06 | 24428.4 | I. 15 | 24316.6 | I 24 | 24159.0 | I•34 |
| 48 | 24324.3 | -91 | $242 \begin{aligned} & 26 \cdot 8\end{aligned}$ | 1.00 | 24123.9 | 1.09 |  | 1.19 | $\begin{array}{lll}2 & 39 & 1 \cdot 3\end{array}$ | $1 \cdot 2$ | 23741.2 | - 39 |
| 49 | 23916.6 | -94 | $2 \begin{array}{llll} & 38 & 17.4\end{array}$ | I.03 | 23712.5 | $1 \cdot 13$ | $2 \begin{array}{lll}36 & 1.9\end{array}$ | 1.23 | $23445 \cdot 3$ | $1 \cdot 33$ | 23322.4 | 3 |
| 50 | $\begin{array}{lll}2 & 35 & 8.6\end{array}$ | 97 | $234 \begin{array}{lll}2 & 7\end{array}$ | 1.07 | 233006 | 1:17 | $23147 \cdot 6$ | 1.27 | $23028 \cdot 5$ | I 37 | $\begin{array}{lll}2 & 29 & 2.8\end{array}$ | 1.48 |
| 51 | 310.1 | 1.00 | $22957 \cdot \mathrm{I}$ | I•10 | $22848 \cdot 0$ | 1.20 | 22732.6 | 1.31 | $2 \begin{array}{llll}26 & 10 \cdot 7\end{array}$ | 1.42 | $22442 \cdot 0$ | I. 54 |
| 52 | $\begin{array}{llll}2 & 2651 \cdot 2\end{array}$ | 1.03 | $\begin{array}{llll}2 & 25 & 46 \cdot 2\end{array}$ | $1 \cdot 14$ | $22434 \cdot 8$ | 1.24 | $\begin{array}{llll}2 & 23 & 16.8 \\ 2\end{array}$ | $1 \cdot 36$ | $\begin{array}{lllll}2 & 21 & 52.1 \\ 2 & 1 & 5\end{array}$ | 1.47 | $22020 \cdot 1$ | $1 \cdot 59$ |
| 53 | $2224 \mathrm{I} \cdot 8$ | 1.07 | 22134.7 | $1 \cdot 17$ | 22020.9 | 1.29 | $2 \begin{array}{lll}2 & 19 & 0.1\end{array}$ | $1 \cdot 40$ | $\begin{array}{llll}2 & 17 & 32.3 \\ 2 & 1\end{array}$ | 1.53 | $2 \begin{array}{llll}15 & 56 \cdot 9\end{array}$ | I•65 |
| 5 | 18 31-9 | I•IO | 1722.5 | $1 \cdot 21$ | $2166 \cdot 1$ | I.33 | $1442 \cdot 5$ | $1 \cdot 46$ | 2131144 | 1.58 | 2 II 32.3 | I•72 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $7^{\circ}$ | A. | L. $8^{\circ}$ | - A. | L. | $9^{\circ}$ A. | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $-\quad .42$ | S. -4.03 | S. | S. -4.04 | S. -.56 | S. | $\stackrel{\text { S. }}{.}$ | S. | S. 71 | S. -4.07 | S. 88 | S. -4.08 |
| 4 | -44 | 4.03 | $\cdot 51$ | 4.04 | -59 | 4.05 | . 66 | 4.06 | $\cdot 73$ | 4.08 | -80 | 4.09 |
| 8 | -47 | $4 \cdot 04$ | $\cdot 54$ | 4.05 | -6I | 4.06 | - 68 | $4 \cdot 07$ | $\cdot 76$ | 4.08 | - 83 | $4 \cdot 09$ |
| 12 | -49 | 4.04 | $\cdot 57$ | 4.05 | - 64 | $4 \cdot 06$ | $\cdot 71$ | 4.07 | $\cdot 79$ | 4.09 | -86 | $4 \cdot 10$ |
| 14 | $\cdot 51$ | 4.04 | -58 | 4.05 | . 65 | 4.06 | $\cdot 73$ | $4 \cdot 08$ | .81 | 4.09 | -88 | $4 \cdot 10$ |
| 16 | $\cdot 52$ | 4.04 | -60 | 4.05 | . 67 | 4.07 | -75 | 4.08 | . 82 | $4 \cdot 09$ | -90 | 4.II |
| 18 | - 54 | 4.05 | -61 | 4.06 | -69 | 4.07 | -77 | 4.08 | -84 | $4 \cdot 10$ | -92 | 4.II |
| 20 | -55 | 4.05 | . 63 | 4.06 | $\cdot 71$ | 4.07 | -79 | 4.09 | -86 | $4 \cdot 10$ | -94 | 4.12 |
| 22 | -57 | 4.05 | . 65 | 4.06 | $\cdot 73$ | 4.07 | -81 | 4.09 | $\cdot 89$ | $4 \cdot 11$ | -97 | $4 \cdot 12$ |
| 24 | -59 | 4.05 | . 67 | 4.07 | $\cdot 75$ | 4.08 | -83 | 4.09 | -91 | 4.II | -99 | $4 \cdot 13$ |
| 26 | -6I | 4.06 | -69 | 4.07 | $\cdot 77$ | 4.08 | . 85 | 4.10 | -94 | $4 \cdot 12$ | 1.02 | 4.14 |
| 28 | -63 | $4 \cdot 06$ | $\cdot 72$ | 4.07 | -80 | 4.09 | -88 | 4-11 | - 97 | $4 \cdot 12$ | I.05 | 4.15 |
| 30 | - 66 | 4.06 | $\cdot 74$ | 4.08 | . .82 | 4.09 | -91 | 4.II | I.00 | $4 \cdot 13$ | I.08 | $4 \cdot 15$ |
| 32 | -68 | 4.07 | -77 | 4.08 | -.85 | $4 \cdot 10$ | -94 | 4.12 | I.03 | 4.14 | I•I2 | 4.16 |
| 34 | -71 | 4.07 | $\cdot 79$ | 4.09 | -88 | 4-11 | -98 | $4 \cdot 13$ | I.07 | 4.15 | I•I6 | $4 \cdot 17$ |
| 36 | -74 | 4.08 | -83 | $4 \cdot 09$ | -92 | 4-11 | $1 \cdot 01$ | 4.14 | I'II | $4 \cdot 16$ | $1 \cdot 20$ | $4 \cdot 19$ |
| 38 | -77 | 4.08 | -86 | $4 \cdot 10$ | -95 | $4 \cdot 12$ | I.05 | $4 \cdot 15$ | I'I5 | 4.17 | 1.25 | $4 \cdot 20$ |
| 40 | -80 | 4.09 | -90 | $4 \cdot 11$ | $1 \cdot 00$ | $4 \cdot 13$ | I.09 | 4.16 | I. 20 | $4 \cdot 18$ | I.30 | $4 \cdot 21$ |
| 42 | . 84 | $4 \cdot 10$ | -94 | $4 \cdot 12$ | I.04 | 4.14 | I-I4 | 4-17 | I. 25 | $4 \cdot 20$ | I. 36 | $4 \cdot 23$ |
| 44 | $\cdot 87$ | 4.10 | $\cdot 98$ | $4 \cdot 13$ | 1.09 | $4 \cdot 15$ | 1.19 | $4 \cdot 18$ | I. 31 | $4 \cdot 22$ | 1.42 | $4 \cdot 25$ |
| 46 | -92 | 4.11 | I.03 | 4•14 | 1-14 | 4•I7 | I. 25 | $4 \cdot 20$ | $1 \cdot 37$ | $4 \cdot 24$ | I 49 | 4.28 |
| 48 | -97 | $4 \cdot 12$ | I.08 | $4 \cdot 15$ | I. 20 | $4 \cdot 18$ | I. 32 | $4 \cdot 22$ | I. 44 | $4 \cdot 26$ | I.57 | $4 \cdot 30$ |
| 50 | 1.02 | $4 \cdot 14$ | I. 14 | $4 \cdot 17$ | I.26 | $4 \cdot 20$ | I•39 | $4 \cdot 24$ | I 52 | 4.29 | I.65 | $4 \cdot 34$ |
| 52 | I. 08 | 4.15 | I. 20 | $4 \cdot 19$ | I.34 | $4 \cdot 23$ | 1.47 | $4 \cdot 27$ | I.6I | $4 \cdot 32$ | I.75 | $4 \cdot 38$ |
| 54 | 1.15 | $4 \cdot 17$ | I. 28 | $4 \cdot 21$ | I 42 | 4.25 | I. 56 | $4 \cdot 30$ | I•7 | $4 \cdot 36$ | I.87 | 4.41 |

DECLINATION—CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. S. | S. | H. M. S. | S. | H. M. | s. | H. M. S. | s. | H. M. S. | s. | H. M. S. | S. |
| 0 | $55635 \cdot 6$ | -29 | $55_{56} 518 \cdot 0$ | - $\cdot 29$ | $5{ }_{5}^{56} \quad 0 \cdot 2$ | - 30 | $5{ }_{5}^{5} 5542 \cdot 3$ | '30 | $55^{5} 5524^{2}$ | -30 | $5556 \cdot 0$ | 30 |
| 10 | $5 \mathrm{I} 5 \mathrm{3I} \cdot 8$ | -45 | $\begin{array}{llll}5 & 15 & 4 \\ 5 & 6 & 1\end{array}$ | $\cdot 47$ |  | -49 | $\begin{array}{llll}5 & 14 & 5 \cdot 8\end{array}$ | -50 | $\begin{array}{lllll}5 & 13 & 35 \cdot 1\end{array}$ | -52 | $\begin{array}{llll}5 & 13 & 3.3\end{array}$ | . 54 |
| 12 | $\begin{array}{lllll}5 & 7 & 17.8\end{array}$ | -49 | $56648 \cdot 1$ | -51 | $5{ }^{5} 6617 \cdot 1$ | -53 | $5 \quad 545 \cdot 0$ | . 55 | $\begin{array}{llll}5 & 5 & 11.5\end{array}$ | $\cdot 57$ | $\begin{array}{llll}5 & 4 & 36 \cdot 8\end{array}$ | - 59 |
| 14 | 45953.4 | - 52 | $4 \quad 5831.4$ | - 54 | $45758 \cdot \mathrm{I}$ | - 57 | 45723.4 | - 59 | $45647 \cdot 2$ | - 62 | $4 \begin{array}{lll}46 & 9.5\end{array}$ | - 64 |
| 16 | $45048 \cdot 4$ | . 56 | 45014.2 | -58 | $44938 \cdot 4$ | -6I | 449 I•O | -64 | $448 \quad 2 I \cdot 9$ | - 66 | $4474 \mathrm{I} \cdot 2$ | -69 |
| 18 | $44232 \cdot 8$ | . 60 | 44156.2 | . 62 | 4 41 17.9 | . 65 | $4 \begin{array}{llll}40 & 37 \cdot 8\end{array}$ | -68 | $43955 \cdot 8$ | $\cdot 72$ | 439 II•9 | 75 |
| 20 | $43416 \cdot 6$ | - 63 | $433 \quad 37 \cdot 6$ | . 67 | $43256 \cdot 6$ | $\cdot 70$ | $4 \begin{array}{lll}4 & 32 & 13.6\end{array}$ | -73 | $43128 \cdot 6$ | $\cdot 77$ | $43041 \cdot 4$ | 80 |
| 22 | $42559 \cdot 6$ | -67 |  | -71 | 42434.4 | $\cdot 75$ |  | $\cdot 78$ | $\begin{array}{lll}4 & 23 & 0.2\end{array}$ | - 82 | 4229.6 | . 86 |
| 24 | 4 17 41.9 | $\cdot 72$ |  | $\cdot 76$ | 416 II•I | -80 | $415 \quad 22 \cdot 0$ | -84 | $41430 \cdot 5$ | - 88 | $4 \begin{array}{llll}4 & 13 & 36\end{array}$ | -92 |
| 26 | $4 \quad 9 \quad 23.2$ | $\cdot 76$ | $4886 \cdot 2$ | -80 | $4746 \cdot 6$ | . 85 | $4 \quad 6 \quad 54 \% 4$ | -89 | $4 \quad 5 \quad 59 \cdot 3$ | -94 | $\begin{array}{lll}4 & 5 & 1 * 4\end{array}$ | -99 |
| 28 | $4 \begin{array}{lll}4 & 1 & 3.5\end{array}$ | -81 | $4 \quad 0 \quad 13.6$ | - 85 | $35920 \cdot 9$ | '90 | $\begin{array}{llll}3 & 58 & 25 \cdot 2\end{array}$ | -95 | $\begin{array}{llll}3 & 57 & 26 \cdot 5\end{array}$ | I.00 | $3 \begin{array}{llll}3 & 56 & 24 \cdot 7\end{array}$ | I.06 |
| 29 | 33 56  | - 83 | $\begin{array}{llll}3 & 56 & 1 \cdot 9\end{array}$ | - 88 | $3 \begin{array}{lll}3 & 55 & 7 \cdot 5\end{array}$ | -93 | $35410 \cdot 1$ | -98 | $\begin{array}{llll}3 & 53 & 9 \cdot 4\end{array}$ | I.04 | $\begin{array}{llll}3 & 52 & 5 \cdot 5\end{array}$ | I'09 |
| 30 | $35242 \cdot 7$ | -86 | 3 5I $49 \cdot 8$ | -91 | 35053.7 | -96 | $34954 \cdot 5$ | I'OI | $\begin{array}{lllll}3 & 48 & 51 \cdot 9\end{array}$ | I.07 | $3 \begin{array}{llllllllllll}3 & 47 & 45\end{array}$ | I•13 |
| 31 | $3{ }_{3} 48 \quad 31 \cdot 9$ | -88 |  | - 94 | 346 39.5 | -99 | $345 \begin{array}{llll}3 & 45 \cdot 4\end{array}$ | I.05 | $\begin{array}{lllllllllllllllll}3 & 44 & 33\end{array}$ | I'II | $\begin{array}{llll}3 & 43 & 25 \cdot 6\end{array}$ | I'I7 |
| 32 | $34420 \cdot 7$ | -91 | $343 \quad 24 \cdot 5$ | - 96 | $342 \quad 25 \cdot 0$ | I 02 | $34121 \cdot 9$ | I.08 | $3 \quad 40 \quad 15 \cdot 2$ | I'I4 | $\begin{array}{llll}3 & 39 & 4 \cdot 7\end{array}$ | I.2I |
| 33 | $\begin{array}{lll}3 & 40 & 9.2\end{array}$ | -94 | 3 39 11.3 | '99 | $\begin{array}{llll}3 & 38 & 9 \cdot 9\end{array}$ | I.05 | $\begin{array}{llll}3 & 37 & 4.8\end{array}$ | I-12 | $\begin{array}{llll}3 & 35 & 56.0\end{array}$ | I-18 | $33443 \cdot 2$ | 1.25 |
| 34 | $\begin{array}{lllll}3 & 35 & 57\end{array}$ | -96 |  | I. 02 | $\begin{array}{lllll}3 & 33 & 54.3\end{array}$ | 1.09 | $\begin{array}{llll}3 & 32 & 47 \cdot 2\end{array}$ | I• 5 | $\begin{array}{llll}3 & 31 & 36 \cdot 1\end{array}$ | I. 22 | $33021 \cdot 0$ | I. 29 |
| 35 | $\begin{array}{lllll}3 & 31 & 45 \%\end{array}$ | -99 | $33043 \cdot 6$ | I.06 | $329 \begin{array}{llll}3 & 38\end{array}$ | 1.12 | 32829.0 | I-19 | $\begin{array}{llll}3 & 27 & 157\end{array}$ | I 26 | 325 58.0 | I.33 |
| 36 | $\begin{array}{lllll}3 & 27 & 32 \cdot 3\end{array}$ | $1 \cdot 02$ | 32629.0 | 1.09 | $325121 \cdot 6$ | I•I6 | $32410 \cdot 2$ | I. 23 | $\begin{array}{lllll}3 & 22 & 54.4\end{array}$ | 1.30 | 32144.3 | I 37 |
| 37 | 323 19•1 | I.05 | $\begin{array}{llllll}3 & 22 & 13.9\end{array}$ | I.12 | 3214.5 | I•19 |  | I. 27 | $\begin{array}{lllll}3 & 18 & 32.5\end{array}$ | I'34 | 3 I7 9.6 | 1.42 |
| 38 | $\begin{array}{llll}3 & 19 & 5.5\end{array}$ | I.09 | 3 17 58.3 | I.16 | $31646 \cdot 7$ | I. 23 | $31530 \cdot 6$ | I•31 | $\begin{array}{lll}3 & 14 & 9.8\end{array}$ | I.39 | 31244.1 | 1.47 |
| 39 | 31451.4 | I-12 | 3 I3 42.1 | I•19 | $312 \begin{array}{lll}3 & 28.2\end{array}$ | 1.27 | 3 II 9.6 | I.35 | $3 \quad 9 \quad 46 \cdot 2$ | 1.43 | $3{ }^{3} 817.6$ | I 52 |
| 40 | 31036.8 | I.15 | $\begin{array}{llll}3 & 9 & 25 \cdot 3\end{array}$ | 1.23 | $\begin{array}{llll}3 & 8 & 90\end{array}$ | 1-31 | $3 \begin{array}{lllllllll}3 & 6 & 47 \cdot 9\end{array}$ | 1.39 | $3 \quad 5 \quad 2 \mathrm{I} \cdot 6$ | 1.48 | $\begin{array}{llll}3 & 3 & 50 \cdot 1\end{array}$ | 1.57 |
| 41 | 3 3 $6121 \cdot 6$ | I.19 | $\begin{array}{llll}3 & 5 & 7.8\end{array}$ | 1.27 | $3{ }^{3}$ | 1-35 | $\begin{array}{llll}3 & 2 & 25.3\end{array}$ | 1.44 | 3 - 56.I | I. 53 | 25921.4 | 1.63 |
| 42 | $\begin{array}{llll}3 & 2 & 5 \cdot 7\end{array}$ | I. 23 | 3 o 49.6 | I•3I | $25928 \cdot 3$ | I.40 | 2581 | $1 \cdot 49$ | 25629.5 | I. 58 | $2545 \mathrm{I} \cdot 5$ | I. 68 |
| 43 | $25749 \cdot 2$ | I.27 | $25630 \cdot 6$ | I.35 | $2556 \cdot 7$ | 1.45 | 253 37-1 | 1.54 | $2 \begin{array}{lll}2 & 52 & 1.8\end{array}$ | I. 64 | $25020 \cdot 3$ | $1 \cdot 74$ |
| 44 | $25332 \cdot 0$ | 1-3I | 2521009 | 1.40 | $25044 \cdot 1$ | I.49 | 249 II•5 | 1.59 | $2 \begin{array}{llll}2 & 47 & 32\end{array}$ | I• 70 | $24547 \cdot 6$ | $\underline{1} 81$ |
| 45 | 24914.0 | 1.35 | 247 50.2 | 1.45 | $246 \quad 20 \cdot 5$ | I. 55 | $24444 \%$ | 1.65 | $\begin{array}{llll}2 & 43 & 2.4\end{array}$ | I•76 | 24113.5 | I. 87 |
| 46 | $24455 \cdot 2$ | 1.39 | $2 \begin{array}{lllll}2 & 43 & 28 \cdot 6\end{array}$ | 1.49 | 24155.9 | 1.60 | $24016 \cdot 5$ | $1 \cdot 71$ | $2 \begin{array}{llll}2 & 38 & 30 \cdot 6\end{array}$ | 1.82 | $\begin{array}{lllll}2 & 36 & 37 \cdot 6\end{array}$ | I.95 |
| 47 | $24035 \cdot 5$ | I. 44 | $\begin{array}{lll}2 & 39 & 5 \cdot 9\end{array}$ | I.55 | 237129.8 | I. 66 | $23547 \cdot 0$ | 1.77 | $23357 \cdot 2$ | 1.89 | 23159.9 | 2.02 |
| 48 | $2 \begin{array}{llll}2 & 36 & 14.8\end{array}$ | 1.49 | $23442 \cdot 1$ | 1.60 | $\begin{array}{lll}2 & 33 & 2 \cdot 6\end{array}$ | I.72 | $23116 \cdot 0$ | 1.84 | $22922 \cdot 0$ | 1.97 | $22720 \cdot 1$ | $2 \cdot 10$ |
| 49 | $23153 \cdot 1$ | $1 \cdot 54$ | 123017 | 1.66 | 22833.9 | 1.78 | $22643 \cdot 3$ | I.9I | 22444.9 | $2 \cdot 04$ | $222 \begin{array}{lll}28 \cdot 2\end{array}$ | $2 \cdot 18$ |
| 50 | $22730 \cdot 3$ | 1.60 | $22550 \cdot 7$ | I•72 |  | I.85 | 222819 | I.98 | 22050 | $2 \cdot 13$ | $2 \begin{array}{lllllllll} & 17 & 53.8\end{array}$ | $2 \cdot 28$ |
| 51 | $\begin{array}{llll}2 & 23 & 6 \cdot 2\end{array}$ | 1.66 | $2 \begin{array}{llll}2 & 21 & 22.9\end{array}$ | 1.79 | $2 \begin{array}{llllllll}19 & 31.8\end{array}$ | I.92 | $\begin{array}{llllll}2 & 17 & 32.4\end{array}$ | $2 \cdot 06$ | $2 \begin{array}{llll}2 & 15 & 24.2\end{array}$ | 2.21 | $2 \begin{array}{llll}2 & 13 & 6.7\end{array}$ | $2 \cdot 37$ |
| 52 | 2 I8 40.7 | 1.72 | $\begin{array}{lllllllllll}2 & 16\end{array}$ | I. 86 | 21457.9 | $2 \cdot 00$ | $21253 \cdot 7$ | $2 \cdot 15$ | $21040 \cdot 1$ | $2 \cdot 31$ | 2816.6 | $2 \cdot 48$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12{ }^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. 17 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. | S. | S. | S. | S. | S. | s. | S. | S. | s. | S. | S. |
| 0 | -. 85 | $-4 \cdot 10$ | - 93 | $-4 \cdot 11$ | -1.00 | $-4 \cdot 13$ | - I. 08 | $-4.15$ | - I 15 | $-4 \cdot 17$ | - I. 23 | $-4 \cdot 19$ |
| 4 | . 88 | $4 \cdot 10$ | -95 | $4 \cdot 12$ | I.03 | $4 \cdot 14$ | I•10 | $4 \cdot 16$ | I.18 | $4 \cdot 18$ | 1.25 | $4 \cdot 20$ |
| 8 | $\cdot 91$ | $4 \cdot 11$ | -98 | $4 \cdot 13$ | I 06 | $4 \cdot 15$ | 1.13 | $4 \cdot 17$ | I. 21 | 4-19 | I. 29 | $4 \cdot 21$ |
| 10 | $\cdot 92$ | 4-11 | 1.00 | $4 \cdot 13$ | I.07 | $4 \cdot 15$ | I. 15 | $4 \cdot 17$ | I 23 | $4 \cdot 19$ | I.3I | $4 \cdot 22$ |
| 12 | $\cdot 94$ | 4.12 | 1.02 | $4 \cdot 14$ | 1.09 | 4.16 | 1.17 | 4.18 | I 25 | $4 \cdot 20$ | I.33 | 4.22 |
| 14 | $\cdot 96$ | 4.12 | I.03 | 4.14 | I•II | 4.16 | I•I9 | 4.18 | 1.27 | 4.21 | I.35 | $4 \cdot 23$ |
| 16 | $\cdot 98$ | 4-13 | I.06 | $4 \cdot 15$ | I-13 | $4 \cdot 17$ | 1.21 | $4 \cdot 19$ | I 30 | $4 \cdot 21$ | I.38 | 4.24 |
| 18 | 1.00 | 4.13 | 1.08 | $4 \cdot 15$ | I-16 | $4 \cdot 17$ | - 1.24 | $4 \cdot 20$ | I.32 | $4 \cdot 22$ | I.4I | 4.25 |
| 20 | 1.02 | $4 \cdot 14$ | I-10 | $4 \cdot 16$ | I.19 | 4.18 | 1.27 | $4 \cdot 21$ | I. 35 | $4 \cdot 23$ | I. 44 | $4 \cdot 26$ |
| 22 | I.05 | 4.14 | I I 3 | 4.17 | I.2I | 4.19 | 1.30 | $4 \cdot 21$ | I.38 | $4 \cdot 24$ | 1.47 | $4 \cdot 27$ |
| 24 | I.08 | $4 \cdot 15$ | I•16 | $4 \cdot 17$ | x.25 | $4 \cdot 20$ | 1.33 | $4 \cdot 22$ | 1.42 | $4 \cdot 25$ | 1.5I | $4 \cdot 28$ |
| 26 | I'II | $4 \cdot 16$ | I.19 | 4.18 | 1.28 | $4 \cdot 21$ | 1.37 | $4 \cdot 24$ | I. 46 | $4 \cdot 27$ | I. 55 | $4 \cdot 30$ |
| 28 | 1.14 | 4.17 | I. 23 | 4.19 | I. 32 | $4 \cdot 22$ | 1.41 | $4 \cdot 25$ | I. 50 | $4 \cdot 28$ | I. 59 | $4 \cdot 31$ |
| 30 | 1-17 | 4-18 | I. 26 | $4 \cdot 20$ | 1-36 | $4 \cdot 23$ | 1.45 | 4.26 | 1.54 | $4 \cdot 30$ | I 64 | $4 \cdot 33$ |
| 32 | I. 21 | $4 \cdot 19$ | I-30 | 4.22 | I. 40 | $4 \cdot 25$ | I. 52 | $4 \cdot 28$ | I. 59 | $4 \cdot 32$ | 1.70 | 4.35 |
| 34 | $1 \cdot 55$ | $4 \cdot 20$ | I.35 | 4.23 | 1.45 | 4.26 | $1 \cdot 55$ | $4 \cdot 30$ | 1.65 | $4 \cdot 34$ | 1•75 | $4 \cdot 38$ |
| 36 | I.30 | $4 \cdot 22$ | 1.40 | $4 \cdot 25$ | I. 50 | $4 \cdot 28$ | r.60 | $4 \cdot 32$ | I•1 | $4 \cdot 36$ | I.82 | 4.40 |
| 38 | I.35 | 4.23 | I. 45 | 4.26 | I. 56 | $4 \cdot 30$ | 1.67 | $4 \cdot 34$ | $\underline{1} \cdot 78$ | $4 \cdot 39$ | I.89 | $4 \cdot 43$ |
| 40 | I.4I | $4 \cdot 25$ | $1 \cdot 51$ | $4 \cdot 29$ | 1.62 | $4 \cdot 33$ | $1 \cdot 74$ | $4 \cdot 37$ | I.85 | 4.42 | 1.97 | $4 \cdot 47$ |
| 42 | 1.47 | $4 \cdot 27$ | r.58 | 4.31 | I•70 | $4 \cdot 35$ | I.81 | 4.40 | 1.94 | 4.45 | $2 \cdot 06$ | $4 \cdot 51$ |
| 44 | 1.53 | 4.29 | 1.65 | $4 \cdot 34$ | I•77 | $4 \cdot 38$ | 1.90 | 4.44 | 2.03 | 4.49 | $2 \cdot 16$ | $4 \cdot 56$ |
| 46 | 1.61 | $4 \cdot 32$ | $1 \cdot 73$ | 4.37 | I. 86 | 4.42 | $2 \cdot 00$ | 4.48 | $2 \cdot 14$ | $4 \cdot 54$ | 2.28 | $4 \cdot 61$ |
| 48 | 1.69 | $4 \cdot 35$ | I.83 | 4.41 | I.97 | 4.47 | $2 \cdot 11$ | $4 \cdot 53$ | 2.26 | $4 \cdot 60$ | 2.41 | $4 \cdot 68$ |
| 50 | $1 \cdot 79$ | $4 \cdot 39$ | 1.93 | 4.45 | $2 \cdot 08$ | $4 \cdot 52$ | $2 \cdot 24$ | 4.59 | 2.40 | 4.67 | 2.57 | 4.76 |
| 52 | I 90 | 4.44 | 2.05 | 4.50 | $2 \cdot 22$ | $4 \cdot 58$ | $2 \cdot 39$ | $4 \cdot 67$ | $2 \cdot 56$ | 4.76 | $2 \cdot 76$ | 4.86 |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 54 & 47 \cdot 6 \end{array}\right.$ | S. 31 | $\begin{array}{lcc} \text { H. M. } & \text { S. } \\ 5 & 54 & 28 \cdot 9 \end{array}$ | - 3.1 | $\left\|\begin{array}{ccc} \text { H. M. M. } & \text { S. } \\ 5 & 54 & \text { IO.O. } \end{array}\right\|$ | S. 32 | $\begin{array}{ccc}\text { H. M. } \\ 5 & 53 & \text { S. } \\ 5008\end{array}$ | S. 32 | $\begin{array}{ccc}\text { H. M. } & \text { S. } \\ 5 & 53 & 3 \mathrm{I} \cdot 4\end{array}$ | .32 | $\begin{array}{ccc}\text { H. M. } & \text { S. } \\ 5 & 53 & \text { II } 8\end{array}$ | S. 3 |
| 10 | $\begin{array}{llll}5 & 12 & 30 \cdot 4\end{array}$ | -56 | 5 II 56.2 | . 58 | 5 II 20.9 | . 60 | 5 Io $44^{\prime 2}$ | $\cdot 62$ | 5 Io 6.2 | . 64 | $\begin{array}{llll}5 & 9 & 26.9\end{array}$ | 67 |
| 12 | $\begin{array}{llll}5 & 4 & 0.8\end{array}$ | -6I | $\begin{array}{lll}5 & 3 & 23.4\end{array}$ | -64 | $\begin{array}{llll}5 & 2 & 44 \cdot 5\end{array}$ | -66 | $\begin{array}{llll}5 & 2 & 4 \cdot 1\end{array}$ | -69 | $\begin{array}{llll}5 & 1 & 22.2\end{array}$ | -71 | 5 0-38.7 | - 74 |
| 14 | $45530 \cdot 3$ | -67 | $454 \quad 49 \cdot 5$ | . 69 | $454 \quad 7 \cdot 0$ | $\cdot 72$ | $4 \begin{array}{lll}4 & 53 & 22 \cdot 8\end{array}$ | $\cdot 75$ | $45236 \cdot 8$ | $\cdot 78$ | 4 51 49.0 | -85 |
| 16 | $44658 \cdot 8$ | $\cdot 72$ | $44^{46} 14.4$ | $\cdot 75$ | $\begin{array}{llll}4 & 45 & 28.2\end{array}$ | $\cdot 79$ | 444 40.I | - 32 | $4 \quad 43 \quad 49 \cdot 9$ | . 85 | $4 \quad 42 \quad 57 \cdot 6$ | -89 |
| 18 | $43^{48} 26 \cdot 0$ | $\cdot 78$ | $43738 \cdot 1$ | . 82 | $43648 \cdot 0$ | -85 | 43555.3 | 9 | $435 \quad$ I•3 | '93 | $434 \quad 4.4$ | 97 |
| 20 | $42952 \cdot 0$ | - 84 | 42900.3 | . 88 | 4286.3 | -92 | $427 \quad 9.8$ | -96 | $4 \quad 2610 \cdot 7$ | I.OI | 4259.0 | I-05 |
| 22 | 42116.6 | -90 | 420210 | -95 | 4 I9 22.7 | -99 | $4 \begin{array}{lll}4 & 18 & 2 I \cdot 8\end{array}$ | I.04 | $41718 \cdot 0$ | I.09 | 4 16 11*3 | I-I4 |
| 24 | $41239 \cdot 5$ | -97 | 4 II $39 \cdot 8$ | I. 02 | 4 10 $37 \cdot 2$ | 1.07 | 4 9 4 3I-6 | 1.12 | $\begin{array}{llll}4 & 8 & 22 \cdot 9\end{array}$ | I-17 | $4 \quad 7 \quad 10.9$ | I. 23 |
| 25 | $4 \quad 8 \quad 20 \cdot 2$ | I.OI | $\begin{array}{llll}4 & 7 & 18.4\end{array}$ | I.05 | $4 \quad 613.6$ | I•II | $\begin{array}{lll}4 & 5 & 5 \cdot 6\end{array}$ | I.16 | $4 \quad 3 \quad 54 \cdot 3$ | I. 22 | $\begin{array}{llll}4 & 2 & 39 \cdot 5\end{array}$ | I. 28 |
| 26 | $4 \begin{array}{lll}4 & 4 & 0 \cdot 5\end{array}$ | I.04 | $4 \quad 2 \quad 56 \cdot 5$ | I.09 | 4 I 49*4 | I.I5 | $4 \quad 0 \quad 38.9$ | 0 | 35925.0 | I. 26 | $\begin{array}{llll}3 & 58 & 7 \cdot 4\end{array}$ | I*32 |
| 27 | $35940 \cdot 3$ | I.08 | 35844 I | I'I3 | $\begin{array}{lllll}3 & 57 & 24 \cdot 5\end{array}$ | I-19 | $3{ }^{3} 56$ II•5 | I-25 | $35454 \cdot 8$ | I•3I | $35334 * 4$ | I.37 |
| 28 | $\begin{array}{llll}3 & 55 & 19.6\end{array}$ | I•II | 354 II•I | I'17 | 3 52 59  | I. 23 | $\begin{array}{lllll}3 & 51 & 43.4\end{array}$ | I. 29 | 35024.0 | I. 36 | $\begin{array}{llr}3 & 49 & 0.5\end{array}$ | I-43 |
| 29 | $35058 \cdot 2$ | I•I5 | $34947 \cdot 4$ | I. 21 |  | I. 27 |  | 1-34 | $3{ }^{3} 45$ 52•1 | I.4I | $\begin{array}{llll}3 & 44 & 25 \cdot 6\end{array}$ | I 48 |
| 30 | $34636 \cdot 3$ | I•19 | 34523.0 | I. 25 | $\begin{array}{lll}3 & 44 & 5 \cdot 9\end{array}$ | I. 32 | 34244.7 | 1-39 | 34159 | I.46 | 33949.7 | I. 53 |
| 31 | 34213.7 | I. 23 | $340 \quad 57 \cdot 9$ | I•30 | $\begin{array}{llll}3 & 39 & 38 \cdot 1\end{array}$ | r.36 | $\begin{array}{llll}3 & 3^{8} & 14 \cdot 1\end{array}$ | 1.44 | $33^{36} 45 \cdot 6$ | I 51 | $33512 \cdot 7$ | 1.59 |
| 32 | $\begin{array}{lllll}3 & 37 & 50 \cdot 4\end{array}$ | I-27 | $\begin{array}{llll}3 & 36 & 32 \cdot 0\end{array}$ | I.34 | $\begin{array}{llll}3 & 35 & 9.4\end{array}$ | 1.41 | $\begin{array}{llll}3 & 33 & 42 \cdot 4\end{array}$ | I-49 | $33210 \cdot 8$ | I. 57 | $33034 \cdot 5$ | 1.65 |
| 33 | $\begin{array}{lllll}3 & 33 & 26.4\end{array}$ | I•32 | $\begin{array}{lll}3 & 32 & 5 \cdot 3\end{array}$ | I•39 | $33039 \cdot 8$ | I.46 | $\begin{array}{lll}3 & 29 & 9 \cdot 8\end{array}$ | 1.54 | $\begin{array}{llllllllllll}3 & 27 & 34.9\end{array}$ | I. 62 | 32555.0 | I•7 |
| 34 | $\begin{array}{llll}3 & 29 & \text { I. } 6\end{array}$ | I. 36 | $\begin{array}{lllllll}3 & 27 & 37 \cdot 8\end{array}$ | I. 44 | $\left\lvert\, \begin{array}{lll}3 & 26 & 9 \cdot 3\end{array}\right.$ | I.5I | $\begin{array}{llll}3 & 24 & 36 \cdot 0\end{array}$ | I. 60 | $\begin{array}{llll}3 & 22 & 57 \cdot 7\end{array}$ | I. 68 | $3{ }_{3} 2114 \cdot 1$ | I.77 |
| 35 | $32436 \cdot 0$ | I-4I | $\begin{array}{llll}3 & 23 & 9.2\end{array}$ | I 49 | $\begin{array}{lllll}3 & 21 & 37 \cdot 7\end{array}$ | 1.57 | $320 \mathrm{I} \cdot \mathrm{I}$ | I. 65 | 3 I8 19.2 | I.74 | $\begin{array}{llllll}3 & 16 & 31.8\end{array}$ | I. 84 |
| 36 | $\begin{array}{lll}3 & 20 & 9.4\end{array}$ | I.45 | $\begin{array}{llll}3 & 18 & 39 \cdot 7\end{array}$ | I. 54 | 3 I7 5*0 | I. 62 | 3 15 24.9 | $1 \cdot 71$ | $\begin{array}{llll}3 & 13 & 39 \cdot 3\end{array}$ | I-8I | 3 II $47 \cdot 8$ | I.91 |
| 37 | 3 I5 4I'9 | I. 50 | $314 \quad 9 \cdot 1$ | I•59 | 31231.0 | I. 68 | 3 10 47.3 | I.78 | $\begin{array}{llll}3 & 8 & 57.8\end{array}$ | I.88 | $\begin{array}{lll}3 & 7 & 2.2\end{array}$ | I.98 |
| 38 | 3 II 13.4 | I.56 | $3 \begin{array}{llll}3 & 9 & 37 \cdot 3\end{array}$ | I. 65 | $\begin{array}{llll}3 & 7 & 55.8\end{array}$ | $1 \cdot 74$ | $\begin{array}{llll}3 & 6 & 8 \cdot 3\end{array}$ | I.84 | $\begin{array}{llll}3 & 4 & 14.8\end{array}$ | I.95 | $\begin{array}{llll}3 & 2 & 14.7\end{array}$ | $2 \cdot 06$ |
| 39 | $\begin{array}{llll}3 & 6 & 43 \cdot 8\end{array}$ | I.6I | $3 \begin{array}{llll}3 & 5 & 4 * 3\end{array}$ | I•71 | $\begin{array}{llll}3 & 3 & 19.1\end{array}$ | I.80 | 318127.7 | I.91 | 25959.9 | 2.02 | 257125.2 | $2 \cdot 14$ |
| 40 | $3 \quad 2 \begin{array}{lll}3 & 12.9\end{array}$ | 1.67 | 3 0 30.0 | 1.77 | $2 \begin{array}{llll}2 & 58 & 40 \cdot 9\end{array}$ | I. 87 | $25645 \cdot 4$ | I.98 | 254 43•I | $2 \cdot 10$ | $25233 \cdot 6$ | $2 \cdot 22$ |
| 41 | $25740 \cdot 8$ | I.73 | 255154.2 | I. 83 | 254 I'I | r.94 | $252 \quad 1 \cdot 2$ | 2.06 | 24954.2 | $2 \cdot 18$ | $24739 \cdot 5$ | $2 \cdot 31$ |
| 42 | $\begin{array}{llll}2 & 53 & 7 \cdot 4\end{array}$ | 1.79 | 25116.8 | I•90 | 24919.5 | 2.01 | 24715.0 | $2 \cdot 14$ | 245 3.0 | $2 \cdot 27$ | $2 \begin{array}{llll}2 & 42 & 42 \cdot 9\end{array}$ | 2.41 |
| 43 | $\begin{array}{llll}2 & 48 & 32.4\end{array}$ | 1-85 |  | I.97 | 244 36.0 | 2.09 | $242 \begin{array}{lll}26 \cdot 7\end{array}$ | $2 \cdot 22$ | $24^{2} 4080.4$ | $2 \cdot 36$ | $23743 \cdot 5$ | $2 \cdot 5 \mathrm{I}$ |
| 44 | $\begin{array}{llll}2 & 43 & 55 \cdot 8\end{array}$ | I.92 |  | $2 \cdot 05$ | $23950 \cdot 3$ | $2 \cdot 17$ |  | $2 \cdot 31$ | $\begin{array}{llll}2 & 35 & 12.9\end{array}$ | $2 \cdot 46$ | $2324 \mathrm{I} \cdot 0$ | $2 \cdot 61$ |
| 45 | 23917.4 | 2.00 | $2 \begin{array}{lllll}27 & 13.8\end{array}$ | $2 \cdot 12$ | 23512.4 | $2 \cdot 26$ | 23242.4 | 2.41 | 23013.5 | $2 \cdot 56$ | 22734.9 | 2.73 |
| 46 | $23437 \cdot 1$ | 2.07 | $232 \begin{array}{lll}28 \cdot 7\end{array}$ | 2.21 | 23011.9 | $2 \cdot 35$ | $22746 \cdot 1$ | 2.51 | 22510.8 | 2.67 | 22225.1 | $2 \cdot 85$ |
| 47 | 22954.7 | 2.16 | 227 41•1 | $2 \cdot 30$ |  | $2 \cdot 45$ | $22246 \cdot 6$ | $2 \cdot 62$ | 22044 | $2 \cdot 80$ | 2 I7 II•I | $2 \cdot 99$ |
| 48 | $\begin{array}{llll}2 & 25 & 9.9\end{array}$ | $2 \cdot 24$ | $22250 \cdot 9$ | $2 \cdot 40$ | 22022.3 | $2 \cdot 56$ | 21743.6 | $2 \cdot 74$ | 215453.9 | $2 \cdot 93$ | 2 II 52.3 | 3.13 |
| 49 | $22022 \cdot 7$ | $2 \cdot 34$ | 21757.6 | $2 \cdot 50$ | 215152.5 | $2 \cdot 68$ | $21236 \cdot 5$ | 2.86 | $2 \begin{array}{llll}2 & 9 & 38.8\end{array}$ | 3.07 | $26128 \cdot 1$ | $3 \cdot 30$ |
| 50 | $21532 \cdot 5$ | $2 \cdot 44$ | 2 I3 I•I | $2 \cdot 61$ | 21019.0 | $2 \cdot 80$ | 2725.1 | 3.00 | $\begin{array}{lllll}2 & 4 & 18.4\end{array}$ | $3 \cdot 23$ | 2057.8 | 3.47 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. |  | S. | S. | S. | S. | s. | s. | S. | S. | S. |
| - | - 1.31 1.33 | -4.22 4.23 |  | -4.24 4.25 | -1.46 I. | -4.27 4.28 | $\begin{array}{r}-1.54 \\ \mathrm{r} \\ \hline 156\end{array}$ | -4.29 4.31 | I I. 62 | -4.32 4.34 | - 1.71 r .73 | 4.36 4.37 |
| ${ }_{6}^{4}$ | I. 35 | 4.23 | I.43 | $4 \cdot 26$ |  | 4.28 4.28 | I.59 | 4.31 4 | r. 67 | 4.34 4.34 | I.75 | 4.38 4.38 |
| 8 | I-37 | $4 \cdot 24$ | I. 45 | $4 \cdot 26$ | I.53 | $4 \cdot 29$ | I.6I | $4 \cdot 32$ | 1. 69 | $4 \cdot 35$ | $1 \cdot 78$ | $4 \cdot 39$ |
| 10 | I-39 | $4 \cdot 24$ | 1.47 | $4 \cdot 27$ | r. 55 | $4 \cdot 30$ | I.63 | $4 \cdot 33$ | $1 \cdot 72$ | $4 \cdot 36$ | 1.80 | $4 \cdot 40$ |
| 12 | 1.41 | $4 \cdot 25$ | 1.49 | $4 \cdot 28$ | 1.57 | $4 \cdot 31$ | I. 66 | $4 \cdot 34$ | 1.74 | $4 \cdot 37$ | r. 83 | 4.41 |
| 14 | 143 | 4.26 | I. 52 | 4.29 | I.60 | $4 \cdot 32$ | I. 69 | $4 \cdot 35$ | r.77 | $4 \cdot 38$ | I. 86 | $4 \cdot 42$ |
| 16 | $1 \cdot 46$ | 4.27 | I.54 | 4.30 | r.63 | $4 \cdot 33$ | I.72 | $4 \cdot 36$ | 1.81 | 4.40 | r.90 | $4 \cdot 43$ |
| 18 | I-49 | $4 \cdot 28$ | r.58 | 4.31 | I.66 | $4 \cdot 34$ | r.75 | 4.38 | I. 84 | 4.41 | r 93 | 4.45 |
| 20 | 1.52 | $4 \cdot 29$ | I.6I | 4.32 | I•70 | $4 \cdot 36$ | r 79 | 4.39 | r-88 | $4 \cdot 43$ | 1.98 | $4 \cdot 47$ |
| 22 | I.56 | $4 \cdot 30$ | r.65 | 4.33 | I.74 | $4 \cdot 38$ | r.83 | 4.41 | 1.93 | 4.45 | $2 \cdot 02$ | $4 \cdot 49$ |
| 24 | r.60 | $4 \cdot 32$ | 1.69 | 4.35 | r.78 | $4 \cdot 39$ | 1.88 | $4 \cdot 43$ | 1.98 | 4.47 | 2.08 | $4 \cdot 52$ |
| 26 | I.64 | $4 \cdot 33$ | r.73 | 4.37 | 1.83 | 4.41 | r.93 | 4.45 | 2.03 | $4 \cdot 50$ | 2.14 | $4 \cdot 54$ |
| 28 | I.69 | $4 \cdot 35$ | I•79 | 4.39 | I 88 | 4.43 | r.99 | 4.47 | 2.09 2.16 | $4 \cdot 52$ | 2.20 | $4 \cdot 57$ |
| 30 | I•74 | $4 \cdot 37$ | I. 84 | 4.41 | I•94 | 4.46 | 2.05 | $4 \cdot 50$ | $2 \cdot 16$ | $4 \cdot 55$ | $2 \cdot 27$ | $4 \cdot 61$ |
| 32 | 1.80 | $4 \cdot 39$ | 1.90 | $4 \cdot 44$ | 2.01 | 4.49 | $2 \cdot 12$ | $4 \cdot 54$ | 2.23 | $4 \cdot 59$ | $2 \cdot 35$ | $4 \cdot 65$ |
| 34 | 1.86 | $4 \cdot 42$ | 1.97 | $4 \cdot 47$ | 2.08 | $4 \cdot 52$ | 2.20 | 4.57 | 2.32 | $4 \cdot 63$ | 2.44 | $4 \cdot 69$ |
| 36 | 1.93 | 4.45 | 2.04 | $4 \cdot 50$ | $2 \cdot 16$ | 4.56 | $2 \cdot 28$ | 4.6 r | 2.41 | $4 \cdot 68$ | 2.54 | 4.75 |
| 38 | 2.01 | 4.48 | $2 \cdot 13$ | 4.54 | $2 \cdot 25$ | $4 \cdot 60$ | $2 \cdot 38$ | $4 \cdot 66$ | 2.51 | 4.73 | 2.65 | 4.81 |
| 40 | $2 \cdot 10$ | $4 \cdot 52$ | $2 \cdot 22$ | $4 \cdot 58$ | $2 \cdot 35$ | 4.65 | $2 \cdot 49$ | $4 \cdot 72$ | 2.63 | $4 \cdot 80$ | $2 \cdot 78$ | $4 \cdot 88$ |
| 42 | 2.19 | 4.57 | 2.33 | 4.64 | 2.47 | 4.71 | $2 \cdot 62$ | 4.79 | 2.77 | 4.87 | 2.93 | 4.97 |
| 44 | 2.30 | 4.62 | 2.45 | $4 \cdot 70$ | $2 \cdot 60$ | $4 \cdot 78$ | $2 \cdot 76$ | 4.87 | 2.93 | 4.97 | 3.10 | 5.07 |
| 46 | 2.43 2.58 | $4 \cdot 69$ | $2 \cdot 59$ | 4.77 4.86 | 2.75 | 4.86 | 2.93 | 4.96 5.08 | 3.11 | 5.08 | 3.31 3.55 | 5.20 5.36 |
| 48 50 | 2.58 2.75 | 4.77 4.86 | 2.75 2.94 | 4.86 4.97 | 2.93 3.14 | 4.97 5.09 | $3 \cdot 13$ $3 \cdot 36$ | 5.08 5.23 | 3.33 3.59 | 5.21 5.39 | 3.55 3.84 | 5.36 5.56 |

## LATITUDE $5^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. Var. | $2{ }^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. Var. | $5{ }^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 6 & 0 \\ 0.0 \end{array}$ | $\begin{aligned} & \mathrm{s} . \\ & .35 \end{aligned}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 59 & 39 \cdot 0 \end{array}\right.$ | $-35$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 59 & 18.0 \end{array}\right.$ | - 35 | $\left\lvert\, \begin{array}{cc} \text { H. м. } & \text { S. } \\ 5 & 58 \\ 57 \cdot 0 \end{array}\right.$ | $-\stackrel{s}{\mathbf{s} .}$ | $\left\|\begin{array}{cc} \text { H. м. } & \text { S. } \\ 5 & 58 \\ 35 \cdot 9 \end{array}\right\|$ | $\|-35\|$ |  | - 35 |
| 10 | 5 19  | $\cdot 36$ | $51929 \cdot 0$ | $\cdot 37$ | $\begin{array}{lllll}5 & 19 & 6.6\end{array}$ | - 38 | $\begin{array}{llllllllll}5 & 18 & 43 \cdot 4\end{array}$ | - 39 | $5 \begin{array}{llll}5 & 18 & 19 \cdot 3\end{array}$ | 4 | 51754.5 | $\cdot 42$ |
| 12 | 5 II 48.9 | -36 | 5 II 26.9 | - 37 | $\begin{array}{llll}5 & \text { II } & 4 \cdot 1 \\ 5 & \end{array}$ | -39 | 5 5 $1040 \cdot 3$ | $4{ }^{4}$ | 5 510 15.6 | 42 | 5 5 9 49.9 | 44 |
| 14 | $\begin{array}{llll}5 & 3 & 46 \cdot 9\end{array}$ | -36 | $\begin{array}{lllll}5 & 3 & 24 \cdot 7\end{array}$ | -38 | 5 3 1 <br> 4 54 5 | 39 | $\begin{array}{ccc}5 & 2 & 37 \cdot 2 \\ 4 & 54 & 33.0\end{array}$ | 41 | $5 \begin{array}{llll}5 & 2 & 11\end{array}$ | 4 | 55 1 $45 \cdot 1$ <br>  53 $40 \cdot 1$ | 5 |
| 16 | $45545 \cdot 0$ | $\cdot 36$ | $45522 \cdot 5$ | $\cdot 38$ | $4 \quad 54 \quad 58 \cdot 8$ | $\cdot 40$ | $4 \quad 5433.9$ | 43 | $4 \begin{array}{lll} & 54 & 76\end{array}$ | 5 | $45340 \cdot \mathrm{I}$ | 47 |
| 18 | $44742 \cdot 9$ | '37 | $44720 \cdot 2$ | $\cdot 39$ | $44656 \cdot 0$ | 41 | $44630 \cdot 4$ | 44 | 446304 | $\cdot 46$ | 44534.9 | 49 |
| 20 | $43940 \cdot 9$ | $\cdot 37$ | 43917.7 | 40 | $\begin{array}{lllll}4 & 38 & 53 \cdot 1\end{array}$ | 42 | $438 \quad 26 \cdot 8$ | 45 | $437 \quad 58 \cdot 9$ | 48 | $437 \quad 29.4$ | 51 |
| 22 | $\begin{array}{llllll}4 & 31 & 38.8\end{array}$ | - 38 | $431 \begin{array}{llll}4 & 3\end{array}$ | - 41 | $43050 \cdot 0$ | 43 | 43023.0 | -46 | $42954 \cdot 2$ | 49 | $42923 \cdot 6$ | 53 |
| 24 | $\begin{array}{llll}4 & 23 & 36 \cdot 6 \\ 4 & 15 & 34 \cdot 4\end{array}$ | -38 | $\begin{array}{llll}4 & 23 & 12.7 \\ 4 & 15 & 0.9\end{array}$ | 41 | $\begin{array}{llll}4 & 22 & 46 \cdot 8 \\ 4 & 14 & 43.5\end{array}$ | -45 | 42219.0 | $\cdot 48$ | 4 21 $49 \cdot 2$ <br> 4   | 5 I | $4 \begin{array}{llll}4 & 21 & 17.5\end{array}$ | 55 |
| 26 | 41534.4 | -39 | $\begin{array}{llll}4 & 15 & 9 \cdot 9\end{array}$ | 4 | $41443 \cdot 5$ | 46 | $4 \begin{array}{llll}4 & 14 & 14.8\end{array}$ | 50 | 41344.0 | 53 | $4{ }^{13}$ II•I | 7 |
| 28 | $\begin{array}{llll}4 & 7 & 32 \cdot 1\end{array}$ | 40 | 47 | 43 | $4 \quad 6 \quad 39.9$ | 47 | $4 \begin{array}{llll}4 & 6 & 10 \cdot 4\end{array}$ | 51 | $\begin{array}{lllll}4 & 5 & 38.5\end{array}$ | -55 | $\begin{array}{llll}4 & 5 & 4 \cdot 2\end{array}$ | 59 |
| 30 | $\begin{array}{llll}3 & 59 & 29 \cdot 7 \\ 3 & 59\end{array}$ | $\cdot 40$ | 3594.2 | 45 | $\begin{array}{lllllllllllllll}3 & 58 & 36 \cdot 2\end{array}$ | 49 | $\begin{array}{llll}3 & 58 & 5 \cdot 7 \\ 3 & 50\end{array}$ | 53 | $35732 \cdot 6$ | $\cdot 57$ | $35657 \cdot 0$ | 62 |
| 32 | 3 51 $27 \cdot 1$ <br> 3 47  | 41 |  | $\cdot 46$ |  | -50 | $\begin{array}{llll}3 & 50 & 0 \cdot 7 \\ 3 & 5 & 58.7\end{array}$ | . 55 | $34926 \cdot 4$ | $\cdot 59$ | $\begin{array}{llllllllllll}3 & 48 & 49 \cdot 3\end{array}$ | 4 |
| 33 | 34725.9 | $\cdot 42$ | $34659 \cdot 4$ | -46 | $34630 \cdot 1$ | -51 | $\begin{array}{llll}3 & 45 & 58 \cdot 1\end{array}$ | -56 | $345 \quad 23 \cdot 1$ | -61 | $34445 \cdot 3$ | -66 |
| 34 | 34324.6 | 42 | 3 42 57 | $\cdot 47$ | 34228.0 | 52 | 34155.4 | $\cdot 57$ | 34119.8 | $\cdot 62$ | $34041 \cdot x$ | 67 |
| 35 | $\begin{array}{llll}3 & 3923.2\end{array}$ | 43 | $33856 \cdot 0$ | 48 | 33825.8 | -53 | $33752 \cdot 6$ | $\cdot 58$ | $3 \begin{array}{llll}3 & 16.3\end{array}$ | 63 |  | . 68 |
| 36 | 33512 l 8 | 43 | $33454 \cdot 2$ | $\cdot 49$ | $\begin{array}{lllll}3 & 34 & 23.5\end{array}$ | . 54 | 333497 | $\cdot 59$ | $3 \begin{array}{llll}33 & 12 \cdot 6\end{array}$ |  | $\begin{array}{llll}3 & 32 & 32 \cdot 3\end{array}$ | $\cdot 70$ |
| 37 | 33120.4 | -44 | 33052.4 | -49 | 33021.2 | 5 | $\begin{array}{lllllll}3 & 29 & 46 \cdot 7\end{array}$ | -60 | $\begin{array}{lll}3 & 29 & 8.9\end{array}$ | -66 | $\begin{array}{ll}3 & 2827.7\end{array}$ | 72 |
| 38 | $\begin{array}{lllll}3 & 27 & 18.9\end{array}$ | 45 | $32650 \cdot 5$ | -50 | $\begin{array}{lllll}3 & 26 & 18.8\end{array}$ | $\cdot 56$ | $\begin{array}{llll}3 & 25 & 43 \cdot 6\end{array}$ | -61 | $\begin{array}{llll}3 & 25 & 5 \cdot 0\end{array}$ | $\cdot 67$ | $\begin{array}{llll}3 & 24 & 22 \cdot 8\end{array}$ | 73 |
| 39 | 32317.4 | 45 | $32248 \cdot 6$ | 51 |  | 57 | $32140 \cdot 4$ | . 63 | 3219 | -69 | 32017.9 | 5 |
| 40 | $\begin{array}{llll}3 & 19 & 15.9\end{array}$ | -46 | $31846 \cdot 6$ | -52 |  | -58 | 3177371 | . 64 | $31656 \cdot 8$ | $\cdot 70$ | $31612 \cdot 7$ | 77 |
| 4 I |  | 46 | $31444 \cdot 5$ | $\cdot 53$ | $\begin{array}{llllll}3 & 14 & 11 \cdot 0\end{array}$ | 59 | $\begin{array}{lllllllllll}3 & 13 & 33.6\end{array}$ | 66 | 3 12 52.4 <br> 3 8  | $\cdot 72$ | $\begin{array}{llll}3 & 12 & 7.3\end{array}$ | 88 |
| 42 |  | $\cdot 47$ | 3 10 42.4 <br> 3 6  | $\cdot 54$ | $\begin{array}{llll}3 & 10 & 8.2 \\ 3 & 6 & 5.3\end{array}$ |  |  |  | $\begin{array}{llll}3 & 8 & 48 \cdot 0\end{array}$ | $\checkmark 74$ | $\begin{array}{llll}3 & 8 & 1 \cdot 7\end{array}$ | I |
| 43 | $\begin{array}{rrrrr}3 & 7 & 10.9 \\ 3 & 3 & 9.2\end{array}$ | $\cdot 48$ | $\begin{array}{lll}3 & 6 & 40 \cdot 1 \\ 3 & 2 & 37 \cdot 8\end{array}$ | . 55 | $\begin{array}{lll}3 & 6 & 5 \cdot 3 \\ 3 & 2 & 2 \cdot 2\end{array}$ | 63 | $\begin{array}{lll}3 & 5 & 26 \cdot 4 \\ 3 & 1 & 22 \cdot 5\end{array}$ | -68 | $\begin{array}{llll}3 & 4 & 43 \cdot 3 \\ 3 & 0 & 38 \cdot 3\end{array}$ | $\cdot 75$ | $\begin{array}{rrrr}3 & 3 & 55 \cdot 9 \\ 2 & 59 & 49.8\end{array}$ |  |
| 44 | $3 \quad 3$ | -49 | $\begin{array}{llll}3 & 2 & 37.8\end{array}$ |  | $\begin{array}{llll}3 & 2 & 2 \cdot 2\end{array}$ | 63 | 3 I 222.5 |  | $3 \quad 0 \quad 38 \cdot 3$ | 77 | $25949 \cdot 8$ |  |
| 45 | $\begin{array}{llll}2 & 59 & 7.4 \\ 2 & 55 & 5.5\end{array}$ | 50 | $2 \begin{array}{llll}58 & 35 \cdot 4\end{array}$ | . 57 | $\begin{array}{llll}2 & 57 & 59 \\ 2 & \text { I }\end{array}$ | $\cdot 64$ |  | $\cdot 72$ | $25633 \cdot 2$ | $\cdot 79$ | 25543.5 | 87 |
| 46 | $2 \begin{array}{lll}2 & 55 & 5 \cdot 5\end{array}$ | 51 | $\begin{array}{lllll}2 & 54 & 32 \cdot 9\end{array}$ | $\cdot 58$ | 25355.8 | . 66 | 25314.2 | $\cdot 73$ | 25227.9 | -8I | 25136.9 | 89 |
| 47 | $\begin{array}{llll}2 & 51 & 3.5\end{array}$ | 52 | $25030 \cdot 3$ | $\cdot 59$ | $24952 \cdot 3$ | $\cdot 67$ | $\begin{array}{lll}2 & 49 & 9.8\end{array}$ | $\cdot 75$ | $24822 \cdot 3$ | $\cdot 83$ | 24729.9 | 91 |
| 48 |  | $\cdot 53$ | $\begin{array}{lllll}2 & 46 & 27 \cdot 6\end{array}$ | -61 |  | $\cdot 69$ | $\begin{array}{lll}2 & 45 & 5.2 \\ 2 & 41 & 0.3\end{array}$ | 77 |  | .85 |  | 94 |
| 49 | 24259.4 | $\cdot 54$ | $2 \begin{array}{lll}2 & 424.8\end{array}$ | 62 | 2414511 | $\bigcirc$ | 24 I | -79 | $24010 \cdot 3$ | -88 | 239 I5•r | 97 |
| 50 | $23857 \cdot 2$ | $\cdot 55$ | 23821.8 | 63 | $23741 \cdot 2$ | $\cdot 72$ | 23655.3 | 8 I | 2364.0 | -90 | $235 \quad 7 \cdot 1$ | 99 |
| 51 | 23454.9 | 56 |  | $\cdot 65$ | $23337 \cdot 1$ | 74 | $23250 \cdot 0$ | . 83 | $23157 \cdot 2$ | 93 | $23058 \cdot 7$ | I. 02 |
| 52 | $23052 \cdot 6$ | 57 |  | $\cdot 67$ |  | $\cdot 76$ | $\begin{array}{llllllll}2 & 28 & 44 \cdot 3\end{array}$ | . 86 | 2 $2750 \cdot 1$ | 5 | $22649 \cdot 8$ | -06 |
| 53 | $\begin{array}{llll}2 & 26 & 50 \cdot \mathrm{I} \\ 2 & 22 & 47 \cdot 4\end{array}$ | . 59 | 22612 |  | 2 $25 \begin{array}{lll}28 \cdot 2\end{array}$ | . 88 | 2 $244 \begin{array}{llll} & 38 \cdot 4 \\ 2 & 20 & 32 \cdot 2\end{array}$ | -88 | $\begin{array}{ll}2 & 23 \\ 2 & 42 \cdot 6\end{array}$ | $\stackrel{98}{\square}$ | $22240 \cdot 5$ | 1.09 |
| 54 | $2247 \cdot 4$ |  | 228 | $\cdot 70$ | 22123.4 | 80 | $22032 \cdot 2$ | 91 | 21934.7 | I.OI | $218 \quad 30 \cdot 6$ | 1.12 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. | s. | s. | S. | S. | S. | S. | S. | S. | s. | S. | S. |
| 0 | - 00 | -4.01 | - 07 | $-4.02$ | $\cdot 14$ | $-4.02$ | - $\cdot 2 \mathrm{I}$ | $-4.02$ | - $\cdot 28$ | $-4.03$ | - 35 | $-4.03$ |
| 4 | . 02 | 4.01 | -09 | 4.02 | -17 | 4.02 | - 24 | 4.02 | -3I | 4.03 | $\cdot 38$ | 4.03 |
| 8 | -05 | 4.02 | - 12 | 4.02 | -19 | 4.02 | -26 | 4.02 | -33 | 4.03 | -41 | 4.04 |
| 12 | -08 | 4.02 | - 15 | 4.02 | $\cdot 22$ | 4.02 | -29 | 4.03 | -36 | 4.03 | -44 | 4.04 |
| 14 | -09 | 4.02 | -16 | $4 \cdot 02$ | $\cdot 23$ | 4.02 | -3r | 4.03 | $\cdot 38$ | 4.03 | $\cdot 45$ | 4.04 |
| 16 | $\cdot 10$ | 4.02 | -17 | 4.02 | $\cdot 25$ | 4.02 | $\cdot 32$ | 4.03 | -39 | 4.03 | -47 | 4.04 |
| 18 | -II | 4.02 | - 19 | 4.02 | $\cdot 26$ | 4.02 | -34 | $4 \cdot 03$ | -41 | $4 \cdot 04$ | -49 | 4.04 |
| 20 | - I3 | 4.02 | -20 | $4 \cdot 02$ | -28 | 4.02 | -35 | $4 \cdot 03$ | -43 | $4 \cdot 04$ | $\cdot 51$ | 4.05 |
| 22 | -14 | 4.02 | - 22 | $4 \cdot 02$ | $\cdot 29$ | 4.03 | -37 | 4.03 | -45 | $4 \cdot 04$ | - 53 | 4.05 |
| 24 | -15 | 4.02 | $\cdot 23$ | $4 \cdot 02$ | $\cdot 31$ | 4.03 | -39 | 4.03 | -47 | 4.04 | - 55 | 4.05 |
| 26 | -17 | 4.02 | - 25 | $4 \cdot 02$ | -33 | 4.03 | -4I | $4 \cdot 04$ | -49 | $4 \cdot 04$ | $\cdot 57$ | 4.05 |
| 28 | -19 | 4.02 | - 27 | $4 \cdot 02$ | $\cdot 35$ | 4.03 | -43 | $4 \cdot 04$ | $\cdot 51$ | 4.05 | - 59 | 4.06 |
| 30 | $\cdot 20$ | 4.02 | -28 | 4.03 | $\cdot 37$ | 4.03 | -45 | 4.04 | - 53 | 4.05 | . 62 | 4.06 |
| 32 | $\cdot 22$ | 4.02 | -30 | 4.03 | $\cdot 39$ | 4.03 | -47 | 4.04 | $\cdot 56$ | 4.05 | -64 | 4.07 |
| 34 | $\cdot 24$ | 4.02 | $\cdot 32$ | $4 \cdot 03$ | $\cdot 41$ | 4.04 | -49 | 4.05 | $\cdot 58$ | 4.06 | $\cdot 67$ | 4.07 |
| 36 | $\cdot 25$ | 4.02 | -34 | 4.03 | $\cdot 43$ | 4.04 | $\cdot 52$ | 4.05 | . 61 | 4.06 | $\cdot 70$ | 4.08 |
| 38 | -27 | 4.02 | -36 | 4.03 | 46 | $4 \cdot 04$ | . 55 | 4.05 | . 64 | 4.07 | $\cdot 73$ | 4.08 |
| 40 | -30 | 4.03 | -39 | 4.03 | $\cdot 48$ | 4.04 | - 58 | 4.06 | -67 | 4.07 | $\cdot 77$ | 4.09 |
| 42. | $\cdot 32$ | 4.03 | -41 | $4 \cdot 04$ | $\cdot 51$ | 4.05 | -61 | 4,06 | $\cdot 70$ | 4.08 | -81 | 4.09 |
| 44 | -34 | 4.03 | -44 | $4 \cdot 04$ | -54 | 4.05 | -64 | 4.07 | $\cdot 74$ | 4.08 | -85 | $4 \cdot 10$ |
| 46 | -37 | 4.03 | -47 | $4 \cdot 04$ | $\cdot 57$ | 4.06 | - 68 | 4.07 | $\cdot 78$ | 4.09 | -89 | 4.II |
| 48 | $\cdot 39$ | 4.03 | . 50 | 4.05 | -61 | 4.06 | $\cdot 72$ | $4 \cdot 08$ | . 83 | $4 \cdot 10$ | $\cdot 94$ | $4 \cdot 12$ |
| 50 | $\cdot 42$ | 4.04 | -53 | 4.05 | -65 | $4 \cdot 07$ | $\cdot 76$ | $4 \cdot 09$ | -88 | $4 \cdot \mathrm{II}$ | -99 | $4 \cdot 14$ |
| 52 | -45 | 4.04 | - 57 | 4.06 | -69 | 4.07 | -81 | $4 \cdot 10$ | -93 | $4 \cdot 12$ | r.06 | 4.15 |
| 54 | $\cdot 49$ | $4 \cdot 04$ | -6I | 4.06 | $\cdot 73$ | 4.08 | . 86 | $4 \cdot 10$ | -99 | $4 \cdot 13$ | I•12 | $4 \cdot 17$ |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 143

 LATITUDE $5^{\circ}$.DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 57 \\ 53.6 \end{array}\right.$ | S. | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \mathrm{S} . \\ 5 & 57 \\ \hline 22 \cdot 3 \end{array}\right.$ | $\begin{array}{r} \text { s. } \\ -\cdot 36 \end{array}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 57 \\ \text { 10. } \end{array}\right.$ | $\begin{aligned} & \text { S. } \\ & \cdot 36 \end{aligned}$ | H. M.   <br> 5 56 S. <br> 59   <br> 9   | $\stackrel{\text { S. }}{ }$ | $\left\lvert\, \begin{array}{ccc} \text { н. м. } & \text { s. } \\ 5 & 56 & 27 \cdot 9 \end{array}\right.$ | - ${ }_{\text {S }}$ | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 5 & 56 \\ \hline \end{array}\right.$ | s. 36 |
| 10 | $\begin{array}{llllll}5 & 17 & 28.8\end{array}$ | $\cdot 43$ | 5178 | $\cdot 45$ | 515634.9 | $\cdot 46$ | $\begin{array}{llll}5 & 16 & 6.5\end{array}$ | $\cdot 48$ | 5 | $\cdot 49$ | $\begin{array}{llll}5 & 15 & 7 \cdot 2\end{array}$ | $\cdot 51$ |
| 12 | $\begin{array}{lllll}5 & 9 & 23 \cdot 2\end{array}$ | -45 | 5885.5 | -47 | $\begin{array}{llll}5 & 8 & 26 \cdot 8\end{array}$ | -49 | 5757.0 | -51 | $5 \quad 726 \cdot \mathrm{I}$ | -52 | $5 \quad 6 \quad 54 \cdot \mathrm{I}$ | 54 |
| 14 | $\begin{array}{llll}5 & \text { I } & 17.4\end{array}$ | -47 | 5 - $48 \cdot 5$ | -49 | $5{ }_{5}^{5}$ | $\cdot 51$ | $45947 \cdot 0$ | . 53 | 45914.4 | -55 | $45840 \cdot 5$ | 58 |
| 16 | 453 II 3 | 49 | $45241 \cdot 1$ | - 51 | $4 \begin{array}{lll}42 & 9.6\end{array}$ | $\cdot 54$ | 45136.6 | $\cdot 56$ | 4512.3 | -58 | $4 \quad 5026 \cdot 4$ | 61 |
| 18 | $45 \quad 4.9$ | 51 | $44433 \cdot 4$ | $\cdot 54$ | $\begin{array}{lll}4 & 44 & 0 \cdot 4\end{array}$ | - 56 | 44325.8 | $\cdot 59$ | 44249.5 | . 62 | $442 \begin{array}{llll}4 & 17\end{array}$ | . 65 |
| 20 | $436 \quad 58 \cdot 2$ | 53 | $436 \quad 25 \cdot 3$ | -56 | $435 \begin{array}{llll}4 & 30 \cdot 7\end{array}$ | $\cdot 59$ | $4 \begin{array}{llll}4 & 35 & 14.4\end{array}$ | . 62 | $43436 \cdot 2$ | $\cdot 65$ | $43356 \cdot 2$ | $\cdot 68$ |
| 22 | $42851 \cdot 1$ | 56 | $42816 \cdot 8$ | -59 | $42740 \cdot 6$ | . 62 | $\begin{array}{lll}4 & 27 & 2.4\end{array}$ | -65 | $4 \quad 2622.2$ | -69 | $42540 \cdot 0$ | $\cdot 72$ |
| 24 | $42043 \cdot 7$ | -58 | $\begin{array}{llll}4 & 20 & 7.9\end{array}$ | . 61 | $4 \begin{array}{lll}4 & 19 & 29.9\end{array}$ | $\cdot 65$ | $\begin{array}{llll}4 & 18 & 49 \cdot 8\end{array}$ | $\cdot 69$ | $\begin{array}{llll}4 & 18 & 7.6\end{array}$ | $\cdot 72$ | $\begin{array}{lllll}4 & 17 & 23.0\end{array}$ | .76 |
| 26 | 41235.9 | . 61 | 4 II 58.4 | -64 | 411188.7 | $\cdot 68$ | 4 10 $36 \cdot 6$ | $\cdot 72$ | $4 \quad 952 \cdot \mathrm{I}$ | $\cdot 76$ | $4 \quad 9 \quad 5 \cdot 1$ | 80 |
| 28 | $\begin{array}{llll}4 & 4 & 27 \cdot 6\end{array}$ | $\cdot 6$ | $4 \begin{array}{lll}4 & 3 & 48 \cdot 4\end{array}$ | $\cdot 67$ | $\begin{array}{llll}4 & 3 & 6.8\end{array}$ | $\cdot 72$ | $\begin{array}{llll}4 & 2 & 22.5\end{array}$ | $\cdot 76$ | 4 I 35.7 | 80 | $48046 \cdot 1$ | 85 |
| 3 | 35618.7 | . 66 | $\begin{array}{lllllllllllll}3 & 55 & 37 \cdot 8\end{array}$ | $\cdot 70$ |  | $\cdot 75$ |  | .80 | 3 515318.4 | . 85 | $\begin{array}{llllllllllllll}3 & 52 & 26 \cdot 1\end{array}$ | $\cdot 90$ |
| 31 |  | -67 | $\begin{array}{llllllllllllll}3 & 51 & 32 \cdot 3\end{array}$ | $\cdot 72$ | $\begin{array}{llllll}3 & 50 & 47 \cdot 5\end{array}$ | $\cdot 77$ | $\begin{array}{lllllllll}3 & 49 & 59\end{array}$ | -82 | $\begin{array}{llll}3 & 49 & 9 \cdot 3\end{array}$ | $\cdot 87$ |  | -92 |
| 32 | $\begin{array}{llll}3 & 48 & 9 \cdot 4 \\ 3 & 44 & 4 \cdot 4\end{array}$ | -69 | $\begin{array}{lllll}3 & 47 & 26 \cdot 5\end{array}$ | $\cdot 74$ | $\begin{array}{lllllllllll}3 & 46 & 40 \cdot 7 \\ 3 & 42 & 33\end{array}$ | -79 | 3 45 51 | -84 | $\begin{array}{llll}3 & 44 & 59 \\ 3 & 9\end{array}$ | -89 | $\begin{array}{llll}3 & 44 & 4.8\end{array}$ | 95 |
| 33 | $\begin{array}{llll}3 & 44 & 4.4\end{array}$ | $\cdot 71$ | $34320 \cdot 6$ | $\cdot 76$ | 34233.6 | . 81 | 3 4143.5 | -86 | $34050 \cdot 2$ | -92 | $\begin{array}{lllll}3 & 39 & 53\end{array}$ | 97 |
| 34 | 3959.3 | $\cdot 72$ | 33914.5 | $\cdot 77$ | $3 \begin{array}{llll}38 & 26 \cdot 4\end{array}$ | . 83 | 33735.0 | . 88 | $\begin{array}{llll}3 & 36 & 40 \cdot 2\end{array}$ | -94 | $\begin{array}{llll}3 & 3542.0\end{array}$ | 1.00 |
| 35 | $33554 \cdot \mathrm{I}$ | $\cdot 74$ | $\begin{array}{llll}3 & 35 & 8 \cdot 1\end{array}$ | $\cdot 79$ | $\begin{array}{llllllllllllll}3 & 34 & 18.8\end{array}$ | $\cdot 85$ |  | -91 | $\begin{array}{llll}3 & 32 & 29.9\end{array}$ | -97 |  | 1.03 |
| 36 | 33148.6 | $\cdot 76$ | $\begin{array}{llll}3 & 31 & 1.6\end{array}$ | .81 | $\begin{array}{llllll}3 & 30 & \mathrm{II} \cdot 0\end{array}$ | $\cdot 87$ | $\begin{array}{llllllll}3 & 29 & 17.0\end{array}$ | -93 | $\begin{array}{llllllllll}3 & 28 & 19.2\end{array}$ | -99 | $\begin{array}{llllll}3 & 27 & 17.7\end{array}$ | I.06 |
| 37 | $\begin{array}{llll}3 & 27 & 43\end{array}$ | $\cdot 77$ |  | . 83 | $\begin{array}{llll}3 & 26 & 3 \cdot 0\end{array}$ | . 89 | $\begin{array}{llll}3 & 25 & 7.4\end{array}$ | -96 | $\begin{array}{llll}3 & 24 & 8.2\end{array}$ | I. 02 | $\begin{array}{llll}3 & 23 & 4 \cdot 9\end{array}$ | I.09 |
| 38 | 323 37.1 | $\cdot 79$ | 32247.7 | -85 | 32154.6 | '92 | 32057.6 | $\cdot 98$ | 3 19 56.6 | 1.05 | $\begin{array}{llllll}3 & 18 & 517\end{array}$ | 1.12 |
| 39 | 31931.0 | .81 | $31840 \cdot 4$ | -88 | 31745.9 | -94 | $31647 \cdot 4$ | OI | $\begin{array}{lllll}3 & 15 & 44.8\end{array}$ | 1.08 | $\begin{array}{llll}3 & 14 & 37.9\end{array}$ | 1.15 |
| 40 | $\begin{array}{llllll}3 & 15 & 24 \cdot 7\end{array}$ | . 83 | 3 144 $32 \cdot 8$ | -90 | $\begin{array}{llllllllllll}3 & 13 & 36 \cdot 8\end{array}$ | $\cdot 97$ |  |  | $\begin{array}{llll}3 & 11 & 32.4\end{array}$ | -II | 3 10 23.6 | I. 18 |
| 4 I | $3 \mathrm{II} 18 \cdot 2$ | -85 | $31024 \cdot 8$ | -92 | $\begin{array}{llll}3 & 9 & 27.5\end{array}$ | -99 | $\begin{array}{llll}3 & 8 & 25 \cdot 7\end{array}$ | 1.07 | $\begin{array}{llll}3 & 7 & 19.5\end{array}$ | I•14 | $\begin{array}{llll}3 & 6 & 8.7\end{array}$ | 1.22 |
| 42 | $\begin{array}{lllll}3 & 7 & 11\end{array}$ | -87 | $\begin{array}{llll}3 & 6 & 16 \cdot 7 \\ & 2 & 8 \cdot 1\end{array}$ | $\cdot 95$ | $\begin{array}{lllll}3 & 5 & 17.7\end{array}$ | I.02 | $\begin{array}{llll}3 & 4 & 14.2\end{array}$ | I-10 | 3 3 $6 \cdot I$ <br> 2 58  | I•18 | $\begin{array}{ccc}3 & 1 & 53 \cdot 1 \\ 2 & 57 & 37.0\end{array}$ | I. 26 |
| 43 | $\begin{array}{llll}3 & 3 & 4.2\end{array}$ | '90 | $3 \quad 28 \cdot 1$ | '97 | 3 I 7.5 | 1.05 | $\begin{array}{lll}3 & 0 & 2.2\end{array}$ | $1 \cdot 13$ | $2{ }^{2} 8852 \cdot \mathrm{I}$ | 1.21 | $25737 \cdot 0$ | 1.29 |
| 44 | $2{ }_{2} 58 \quad 56 \cdot 8$ | -92 | 25759.2 | 1.00 | $\begin{array}{llll}2 & 56 & 56.9\end{array}$ | I. 08 | 25549.7 | -16 | $\begin{array}{llll}2 & 54 & 37.5 \\ 2\end{array}$ | 1.25 | $\begin{array}{llll}2 & 53 & 20 \cdot 1\end{array}$ | 1.33 |
| 45 | $\begin{array}{llllll}2 & 54 & 49 \\ 2\end{array}$ | $\cdot 95$ | $\begin{array}{lllll}2 & 53 & 49 \cdot 9\end{array}$ | I.03 | 2 52 $45 \cdot 8$ <br> 2 48  | I'II | $\begin{array}{lllllllllllll}2 & 51 & 36.6\end{array}$ | 20 | $\begin{array}{llll}2 & 50 & 22.2 \\ 2 & 46 & 6.3\end{array}$ | $1 \cdot 28$ | $\begin{array}{llll}2 & 49 & 2 \cdot 4 \\ 2 & 4\end{array}$ |  |
| 46 | $2504 \mathrm{I} \cdot \mathrm{O}$ | . 97 | 249 49 <br> 2 4 | I. 06 | $\begin{array}{llllllllllllll}2 & 48 & 34 \cdot 2 \\ 2 & 44 & 22 \cdot 0\end{array}$ | I.14 | $\begin{array}{llll}2 & 47 & 23.0 \\ 2 & 43 & 8.6\end{array}$ | 1.23 | $\begin{array}{llll}2 & 46 & 6 \cdot 3 \\ 2\end{array}$ | I.32 | $\begin{array}{llll}2 & 44 & 44 \cdot 0\end{array}$ | 1.42 |
| 47 | $\begin{array}{ll}2 & 46 \\ 2 & 32 \cdot 5\end{array}$ | I.00 | $\begin{array}{lll}2 & 45 & 29.9\end{array}$ | I.09 | $24422 \cdot 0$ | I.18 | $\begin{array}{llll}2 & 43 & 8.6\end{array}$ | 1.27 | $\begin{array}{llll}2 & 41 & 49.6\end{array}$ | I 37 | $2{ }_{2} 4024 \cdot 6$ | 1.47 |
| 48 | 24223.7 | I.03 | 24119.2 | I. 12 | 240 9.3 | I-2I | 23883.6 | $1 \cdot 31$ | $23732 \cdot 0$ | 1.41 | $\begin{array}{llll}2 & 36 & 4.2\end{array}$ | 2 |
| 49 | $\begin{array}{lllll}2 & 38 & 14.3\end{array}$ | . 06 | $\begin{array}{llll}2 & 37 & 8.0\end{array}$ | I. 15 | 23555.9 | 1.25 | $\begin{array}{lllll}2 & 34 & 37 \cdot 8 \\ 2\end{array}$ | 1.35 | $\begin{array}{llll}2 & 33 & 13.6 \\ 2\end{array}$ | I. 46 | $\begin{array}{llll}2 & 31 & 42.9\end{array}$ | 1.57 |
| 50 | $\begin{array}{lll}2 & 34 & 4 \cdot 6\end{array}$ | 1.09 | $\begin{array}{llllllllll}2 & 32 & 56 \cdot 2\end{array}$ | I-19 | 23141.8 | 129 | $23021 \cdot 2$ | 1.40 | $\begin{array}{llllll}2 & 28 & 54 \cdot 2\end{array}$ | I.51 | $\begin{array}{llll}2 & 27 & 20 \cdot 3\end{array}$ | 1.62 |
| 51 | $\begin{array}{llll}2 & 29 & 54.3\end{array}$ | I•I2 | $\begin{array}{llllllllllll}2 & 28 & 43\end{array}$ | I 23 | $2 \begin{array}{llll}2 & 27 & \\ 2\end{array}$ | I.33 | $\begin{array}{llll}2 & 26 & 3.7\end{array}$ | I 44 | $\begin{array}{llll}2 & 24 & 33 \cdot 7\end{array}$ | 1 | $22256 \cdot 5$ | I. 68 |
| 52 |  | I.16 | $1 \begin{array}{llll}2 & 24 & 30 \cdot 8\end{array}$ | 1.27 | 2 23 II.4 <br> 18   | I. | 1221453 | r.49 | $22012 \cdot 0$ | I. 62 | $2 \begin{array}{lllll} & 18 & 314\end{array}$ | I.74 |
| 53 | $22132 \cdot 0$ | I 20 | 22016.9 | 1.31 | 1854.8 | 1.43 | 121725.7 | I.55 | $21549 \cdot 1$ |  | 21447 | I.8I |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | s. | s. | s. | s. | s. | s. | s. | s. |
| 0 | - .42 | $-4.04$ | -.50 | $-4.04$ | - 57 | $-4.05$ | - 64 | $-4.06$ | - $\cdot 71$ | $-4.08$ | -. 78 | $-4.09$ |
| 4 | -45 | 4.04 | $\cdot 52$ | 4.05 | - 59 | 4.06 | $\cdot 67$ | 4.07 | $\cdot 74$ | 4.08 | -81 | $4 \cdot 10$ |
| 8 | -48 | 4.04 | -55 | $4 \cdot 05$ | - 62 | 4.06 | -70 | 4.07 | $\cdot 77$ | $4 \cdot 09$ | -84 | 4.10 |
| 12 | -51 | 4.05 | - 58 | 4.06 | - 66 | 4.07 | $\cdot 73$ | 4.08 | -81 | 4.09 | -88 | 4.11 |
| 14 | . 53 | 4.05 | . 60 | 4.06 | -68 | 4.07 | -75 | 4.08 | . 83 | 4.10 | -90 | 4.11 |
| 16 | -54 | 4.05 | -62 | 4.06 | -69 | 4.07 | -77 | 4.09 | -85 | 4.10 | -92 | $4 \cdot 12$ |
| 18 | -56 | 4.05 | . 64 | 4.07 | $\cdot 71$ | 4.08 | -79 | 4.09 | -87 | 4.II | -95 | $4 \cdot 13$ |
| 20 | - 58 | $4 \cdot 06$ | - 66 | 4.07 | $\cdot 74$ | 4.08 | -81 | $4 \cdot 10$ | -89 | $4 \cdot 11$ | $\cdot 97$ | 4.13 |
| 22 | . 60 | 4.06 | -68 | 4.07 | $\cdot 76$ | 4.09 | -84 | $4 \cdot 10$ | -92 | $4 \cdot 12$ | 1.00 | 4.14 |
| 24 | . 62 | 4.06 | -70 | 4.08 | $\cdot 78$ | 4.09 | $\cdot 87$ | 4.11 | -95 | $4 \cdot 13$ | I. 03 | 4.15 |
| 26 | . 65 | 4.07 | -73 | 4.08 | .81 | $4 \cdot 10$ | - 89 | 4.II | - 98 | 4-13 | 1.06 | $4 \cdot 15$ |
| 28 | $\cdot 67$ | 4.07 | $\cdot 76$ | 4.08 | . 84 | $4 \cdot 10$ | -92 | $4 \cdot 12$ | I. 01 | $4 \cdot 14$ | I.10 | $4 \cdot 16$ |
| 30 | $\cdot 70$ | 4.08 | $\cdot 78$ | 4.09 | . 87 | 4.II | -96 | $4 \cdot 13$ | 1.04 | 4.15 | I.13 | 4.17 |
| 32 | $\cdot 73$ | 4.08 | -81 | $4 \cdot 10$ | $\cdot 90$ | $4 \cdot 12$ | -99 | $4 \cdot 14$ | I. 08 | 4.16 | 1-17 | 4.18 |
| 34 | $\cdot 76$ | 4.09 | -85 | 4.10 | -94 | $4 \cdot 12$ | I.03 | $4 \cdot 14$ | I-12 | $4 \cdot 17$ | I*22 | $4 \cdot 20$ |
| 36 | -79 | $4 \cdot 09$ | - 88 | 4-II | -98 | 4•13 | I.07 | $4 \cdot 15$ | I•I7 | 4.18 | I. 26 | 4*21 |
| 38 | -83 | $4 \cdot 10$ | -92 | $4 \cdot 12$ | I. 02 | $4 \cdot 14$ | I•II | $4 \cdot 17$ | I.2I | $4 \cdot 19$ | I. 32 | $4 \cdot 22$ |
| 40 | -86 | $4 \cdot 11$ | $\cdot 96$ | 4.13 | I.06 | 4*15 | I• 16 | $4 \cdot 18$ | I. 27 | $4 \cdot 21$ | 1-37 | $4 \cdot 24$ |
| 42 | '91 | $4 \cdot 12$ | I ${ }^{\text {OI }}$ | 4.14 | I•II | $4 \cdot 17$ | I 222 | $4 \cdot 20$ | $1 \cdot 32$ | 4.23 | 1.44 | $4 \cdot 26$ |
| 44 | -95 | 4.13 | I.06 | $4 \cdot 15$ | 1*17 | $4 \cdot 18$ | I. 28 | 4.21 | I•39 | $4 \cdot 25$ | I 50 | $4 \cdot 29$ |
| 46 | 1.00 | 4.14 | I-II | $4 \cdot 17$ | I. 22 | $4 \cdot 20$ | I. 34 | $4 \cdot 23$ | I.46 | $4 \cdot 27$ | I. 58 | $4 \cdot 31$ |
| 48 | I.05 | $4 \cdot 15$ | I•I 7 | 4.18 | I-29 | $4 \cdot 22$ | I. 41 | $4 \cdot 26$ | I. 54 | $4 \cdot 30$ | I. 67 | $4 \cdot 35$ |
| 50 | I•II | 4.17 | I-24 | $4 \cdot 20$ | I. 36 | $4 \cdot 24$ | I-49 | $4 \cdot 28$ | I. 63 | $4 \cdot 33$ | I•76 | $4 \cdot 39$ |
| 52 | 1-18 | $4 \cdot 19$ | I.3I | $4 \cdot 22$ | 1.45 | 4.27 | I. 58 | $4 \cdot 32$ | 1.73 | 4.37 | I. 88 | $4 \cdot 43$ |
| 53 | 1.22 | $4 \cdot 20$ | r 35 | $4 \cdot 24$ | I 49 | $4 \cdot 29$ | I. 63 | $4 \cdot 34$ | I-78 | $4 \cdot 39$ | I 94 | $4 \cdot 46$ |

## LATITUDE $5^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M, S | S. | H. M. S. |  | H. M. S. |  | H. M. S. | S. |  |  |  | S. |
| 0 | $55544 \cdot 3$ | $\cdot 37$ | $\begin{array}{llll}5 & 55 & 22.2\end{array}$ | $-.37$ | 555000 | $-37$ | $5{ }_{5}^{54} 373 \cdot 6$ | $\cdot 37$ | $554 \times 5 \cdot 0$ | $-\cdot 38$ | $515352 \cdot 1$ | - 38 |
| 10 | $5{ }_{5}^{5} 12436 \cdot 0$ | - 53 | $\begin{array}{llll}5 & 14 & 3 \cdot 8\end{array}$ | -54 | $5{ }_{5}^{5} 1330 \cdot 6$ | - 56 | $5{ }_{5} 12 \times 56 \cdot 3$ | - 58 | $5 \begin{array}{llll}5 & 12 & 20 \cdot 9\end{array}$ | -60 | 5 II 44.4 | -62 |
| 12 | $\begin{array}{llll}5 & 6 & 20.9\end{array}$ | -56 | $5 \quad 5 \quad 46 \cdot 5$ | -58 | $5 \quad 51110$ | -60 | $\begin{array}{lll}5 & 4 & 34 \cdot 1\end{array}$ | -62 | $5 \quad 3 \quad 56 \cdot 0$ | -65 | $\begin{array}{lll}5 & 3 & 16 \cdot 5\end{array}$ | -67 |
| 14 | $\begin{array}{rrrr}4 & 58 & 5 \cdot 3\end{array}$ | -60 | 457578 |  | $4 \begin{array}{lll}4 & 56 & 50 \cdot 7\end{array}$ | -65 |  | -67 | $\begin{array}{llll}4 & 55 & 30 \cdot 2\end{array}$ | $\cdot 70$ |  | $\cdot 72$ |
| 16 | 44949.0 | -64 | 449 10.1 |  | $4 \quad 48 \quad 29 \cdot 5$ | -69 | $44747 \cdot 3$ | $\cdot 72$ | $4 \begin{array}{lll}4 & 47 & 3\end{array}$ | $\cdot 75$ | 446 I\%.8 | $\cdot 78$ |
| 18 | $44132 \cdot 0$ | . 67 | 440 50.7 | $\cdot 70$ | $440 \quad 7 \cdot 5$ | $\bullet 73$ | $43922 \cdot 5$ | $\cdot 77$ | $43835 \cdot 5$ | -80 | $43746 \cdot 6$ | -83 |
| 20 | 43314.3 | $\cdot 71$ | $43230 \cdot 4$ | $\cdot 75$ | $43144 \cdot 5$ | $\cdot 78$ | $430 \quad 56 \cdot 5$ | - 82 | 43065 | $\cdot 85$ | 429 14.I | -89 |
| 22 | $42455 \cdot 7$ | $\cdot 76$ | $4 \begin{array}{lll}4 & 24 & 9 \cdot 2\end{array}$ | $\cdot 79$ | $4 \begin{array}{llll}4 & 23 & 20 \cdot 5\end{array}$ | -83 | 4322944 | $\cdot 87$ | $42136 \cdot 0$ | -91 | $42040 \cdot 2$ | . 95 |
| 24 | $41636 \cdot 2$ | -80 | $\begin{array}{lllll}4 & 15 & 46 \cdot 9\end{array}$ | - 84 | $4 \begin{array}{llll}4 & 14 & 55 \cdot 2\end{array}$ | -88 | $4 \begin{array}{lll}4 & 14 & \text {-O }\end{array}$ | -93 | $4 \begin{array}{lll}4 & 4 \cdot 1\end{array}$ | -97 | $\begin{array}{llll}4 & 12 & 4.6\end{array}$ | I. 02 |
| 26 | 4885 | -85 | $\begin{array}{llll}4 & 7 & 23.4\end{array}$ | -89 | $4 \quad 6 \quad 28 \cdot 6$ | -94 | $4 \quad 531 \cdot 0$ | -98 | $4 \quad 4 \quad 30 \cdot 5$ | 1.03 | $4 \quad 3 \quad 27 \cdot 1$ | I.08 |
| 28 | $35953 \cdot 8$ | -90 | $\begin{array}{llll}3 & 58 & 58.6\end{array}$ | -94 | $\begin{array}{lll}3 & 58 & 0.5\end{array}$ | -99 | $\begin{array}{llll}3 & 56 & 59 \cdot 4\end{array}$ | I'04 | 3555151.1 | I'IO | $35447 \cdot 6$ | I-I5 |
| 29 | $\begin{array}{lllll}3 & 55 & 42 \cdot 5\end{array}$ | -92 | $\begin{array}{lllll}3 & 54 & 45 \cdot 7\end{array}$ | -97 | $\begin{array}{llll}3 & 53 & 45 \cdot 9\end{array}$ | r.02 |  | I.08 | $\begin{array}{llll}3 & 51 & 36 \cdot 6 \\ 3 & \end{array}$ | I-13 | 350 | r. 19 |
| 30 | $35130 \cdot 8$ | -95 | 35032.4 | 1.00 | $\begin{array}{llll}3 & 49 & 30 \cdot 8\end{array}$ | I.05 | $\begin{array}{llll}3 & 48 & 25 \cdot 9\end{array}$ | I-II | $3 \begin{array}{llllllll}3 & 47 & 17\end{array}$ | $1 \cdot 17$ | $\begin{array}{llll}3 & 46 & 5 \cdot 7\end{array}$ | I. 23 |
| 31 | $\begin{array}{llll}3 & 47 \\ & 18.8\end{array}$ | -97 |  | I.03 | $\begin{array}{llll}3 & 45 & 15 \cdot 3\end{array}$ | I.09 | $\begin{array}{llll}3 & 44 & 8 \cdot 4\end{array}$ | I'14 | $\begin{array}{llll}3 & 42 & 58 \cdot 0\end{array}$ | I. 20 |  | I.27 |
| 32 | $\begin{array}{lll}3 & 43 & 6 \cdot 4\end{array}$ | 1.00 | $\begin{array}{llll}3 & 42 & 4\end{array}$ | 1.06 | $\begin{array}{lllll}3 & 40 & 59 \cdot 3\end{array}$ | I'12 | $3 \begin{array}{lll}3 & 39 & 50 \cdot 4\end{array}$ | I•18 | 3 38 $37 \cdot 7$ | 1.24 | 33721.2 | 1.31 |
| 33 | $\begin{array}{lllll}3 & 38 & 53.6\end{array}$ | r.03 | $3 \begin{array}{llll}37 & 50 & 0\end{array}$ | 1.09 | $\begin{array}{llll}3 & 36 & 42 \cdot 7\end{array}$ | I• 15 | $33531 \cdot 7$ | I 22 | 3 3 34-16.8 | 1.28 | $\begin{array}{lllllllllllllll}3 & 32 & 57 \cdot 9\end{array}$ | 1.35 |
| 34 | $33440 \cdot 3$ | r.06 | $\begin{array}{lllllllll}3 & 33 & 34\end{array}$ | I-I2 | $\left[\begin{array}{llll}3 & 32 & 25 \cdot 6\end{array}\right.$ | I•I9 | 3 31 12.4 | I-25 | $\begin{array}{llll}3 & 29 & 55\end{array}$ | I-32 | $\begin{array}{lllll}3 & 28 & 33 \cdot 8\end{array}$ | 1.39 |
| 35 | $33026 \cdot 6$ | I.09 | $\begin{array}{lllll}3 & 29 & 19.2\end{array}$ | I•16 | $\begin{array}{llll}3 & 28 & 7 \cdot 9\end{array}$ | I-22 | $\begin{array}{llll}3 & 26 & 52 \cdot 5\end{array}$ | I-29 | $\begin{array}{llll}3 & 25 & 32 \cdot 9\end{array}$ | I•36 | 32488.8 | I.44 |
| 36 | $\begin{array}{llll}3 & 26 & 12.4\end{array}$ | I. 12 | $\begin{array}{llll}3 & 25 & 3 \cdot 1\end{array}$ | I•19 | $\begin{array}{lllll}3 & 23 & 49 \cdot 6\end{array}$ | I. 26 | 32231.9 | I 33 | $3 \begin{array}{llll}3 & 21 & 9 \cdot 7\end{array}$ | I-4I | 3 19 $42 \cdot 9$ | I-49 |
| 37 | $\begin{array}{lllllllll}3 & 21 & 57.7\end{array}$ | I'I5 | $32046 \cdot 3$ | 1.23 | 3 19 $30 \cdot 6$ | 1.30 | 31810.5 | I 37 | $\begin{array}{llll}3 & 16 & 45 \cdot 7\end{array}$ | 1.45 | $31516 \cdot 1$ | 1.54 |
| 38 | 3 I7 42.5 | I'19 | 31629.0 | I.26 | 3 I5 1x.0 | 1.34 | $\begin{array}{llll}3 & 13 & 48 \cdot 3\end{array}$ | I. 42 | $\begin{array}{rrrr}3 & 12 & 20 \cdot 8\end{array}$ | r. 50 | 3 ro $48 \cdot 3$ | I 59 |
| 39 | $31326 \cdot 7$ | I. 22 | $\begin{array}{llll}3 & 12 & 10.9\end{array}$ | I.30 | 3 Io 50.5 | I.38 | $\begin{array}{llll}3 & 9 & 25 \cdot 3\end{array}$ | I 46 | $\begin{array}{lllll}3 & 7 & 54.9\end{array}$ | I. 55 | $\begin{array}{llll}3 & 6 & 19 & 3\end{array}$ | 1.64 |
| 40 | $\begin{array}{llll}3 & 9 & 10.2 \\ 3 & 4 & 53.1\end{array}$ | 1.26 | 3 7 52.2  <br>  7   | r 34 | $\begin{array}{llll}3 & 6 & 29 \cdot 3\end{array}$ | 1.42 | $\begin{array}{llr}3 & 5 & 1\end{array}$ | I.51 | $\begin{array}{\|ccc\|}3 & 3 & 28 \cdot 0 \\ 2 & 58 & \end{array}$ | r.60 | 3 I 49'1 | 1.70 |
| 41 | $\begin{array}{llll}3 & 4 & 53 \cdot 1 \\ 3 & 0 & 35 \cdot 3\end{array}$ | 1.30 | $\begin{array}{lrrr}3 & 3 & 32 \cdot 6\end{array}$ | r.38 | $\begin{array}{ccc}3 & 2 & 7 \cdot 1 \\ 2 & 57 & 4 \cdot 0\end{array}$ | 1.47 | $\begin{array}{rrrr}3 & 0 & 36 \cdot 3\end{array}$ | I.56 | 2 58 59.9 <br> 2 54  | 1.65 | $\begin{array}{\|lll\|} \\ 2 & 57 & 17 \cdot 7\end{array}$ | 1.75 |
| 42 | $3 \quad 0 \quad 35 \cdot 3$ | 1.34 | 25912.3 | I.43 | $25744^{\circ} \mathrm{O}$ | I. 52 | $25610 \cdot 2$ | r.6I | $25430 \cdot 6$ | r.71 | 25244.9 | r.81 |
| 43 | $2{ }_{2} 5616 \cdot 7$ | 1.38 | $2545 \mathrm{I} \cdot \mathrm{I}$ | 1.47 | 2531200 | 1.57 | 25143.0 | r 67 | 250 | 1.77 | $\begin{array}{llll}2 & 48 & 10 \cdot 5\end{array}$ | 1.88 |
| 44 | $\begin{array}{lllll}2 & 51 & 57 \cdot 3\end{array}$ | 1.43 | 25029.0 | 1.52 | 2 48 54.8 <br> 2 4  | r.62 | $2{ }^{2} 4714.5$ | 1.72 | $\begin{array}{llll}2 & 45 & 27 \cdot 9 \\ 2 & 40 & 54.3\end{array}$ | r.83 | 22 43 $34 \cdot 6$ <br> 2   | 1.95 |
| 45 | $\begin{array}{llll}2 & 47 & 37 \cdot 0 \\ 2 & 43 & 5\end{array}$ | 1.47 | $\begin{array}{lll}2 & 46 & 5 \cdot 8 \\ 2 & 415\end{array}$ | 1.57 | $\begin{array}{llll}2 & 44 & 28.5\end{array}$ | 1.68 | $\begin{array}{lllll}2 & 42 & 44 \cdot 7\end{array}$ | $1 \cdot 78$ | 2406403 | I.90 | $\begin{array}{llll}2 & 38 & 56.8\end{array}$ | $2 \cdot 02$ |
| 46 | $\begin{array}{llll}2 & 43 & 15 \cdot 7 \\ 2 & 38 & 53.5\end{array}$ | 1.52 I. 57 | $\begin{array}{llll}2 & 41 & 4 \mathrm{I} \cdot 5 \\ 2 & 37 & 16 \cdot 0\end{array}$ | I. 62 | $\begin{array}{rrrr}2 & 40 & 0.8 \\ 2 & 35 & 31.8\end{array}$ | 1.73 | $\begin{array}{llll}2 & 38 & 13.4 \\ 2 & 33 & 40.5\end{array}$ | 1.85 | $\begin{array}{llll}2 & 36 & 19.0 \\ 2 & 31 & \end{array}$ | 1.97 | $\begin{array}{llll}2 & 34 & 17.2 \\ 2 & 20 & 35.4\end{array}$ | 2.10 |
| 47 | $23853 \cdot 5$ | I.57 | $23716 \cdot 0$ | I. 68 | 23531.8 | 1.80 | $23340 \cdot 5$ | I.92 | 23141.9 | 2.04 | $22935 \cdot 4$ | 2.18 |
| 48 | $2 \begin{array}{lll}2 & 34 & 30 \cdot 1\end{array}$ | 1.62 | $23249 \cdot 2$ | 1.74 | 23115 | x.86 | $\begin{array}{lll}2 & 29 & 5.9\end{array}$ | I.99 | $\begin{array}{lll}2 & 27 & 2.8\end{array}$ | $2 \cdot 12$ | 22451.4 | $2 \cdot 26$ |
| 49 | $\begin{array}{llll}2 & 30 & 5.4\end{array}$ | r.68 | $228820 \cdot 9$ | I.80 | $22629 \cdot 1$ | 1.93 | $\begin{array}{llll}2 & 24 & 29.4\end{array}$ | $2 \cdot 06$ | $\begin{array}{llll}2 & 22 & 21.4\end{array}$ | $2 \cdot 21$ | $\begin{array}{llll}2 & 20 & 4.7\end{array}$ | $2 \cdot 36$ |
| 50 | $\begin{array}{llll}2 & 25 & 39 \cdot 4\end{array}$ | 1.74 | 223 5I•I | $\underline{1.87}$ | $\begin{array}{llll}2 & 21 & 55 & 0 \\ 2 & 1 & \end{array}$ | $2 \cdot 00$ | $\begin{array}{lll}2 & 19 & 50 \cdot 7\end{array}$ | $2 \cdot 14$ | 2 17 37.6 <br> 2.   | $2 \cdot 30$ | $\begin{array}{llll}2 & 15 & 15.2\end{array}$ | 2.46 |
| 51 | $\begin{array}{llll}2 & 21 & 11.9 \\ 2 & 16 & 42.9\end{array}$ | r.81 | $\begin{array}{lll}2 & 19 & 19.6 \\ 2 & 14 & 46.2\end{array}$ | 1.94 | 2 17 19.0 <br> 2 I  | $2 \cdot 08$ | $\begin{array}{llll}2 & 15 & 9 \cdot 7\end{array}$ | 2.23 | 2'12 $121 \cdot 1$ | $2 \cdot 39$ | 2 10 22.6 | $2 \cdot 56$ |
| 52 | $21642 \cdot 9$ | I. 88 | $21446 \cdot 2$ | $2 \cdot 02$ | $21240 \cdot 8$ | $2 \cdot 17$ | 2 10 $26 \cdot 2$ | $2 \cdot 33$ | $\begin{array}{lll}2 & 8 & 1.6\end{array}$ | $2 \cdot 50$ | $2 \begin{array}{llll}2 & 5 & 26 \cdot 5\end{array}$ | $2 \cdot 68$ |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12{ }^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | -. 86 | -4.II | - 93 | -4.12 | - I.00 | -4.14 | - 1.08 | $-4 \cdot 16$ | -r.16 | $-4.18$ | -1.23 | $-4.20$ |
| 4 | -88 | $4 \cdot 11$ | -96 | $4 \cdot 13$ | I.03 | $4 \cdot 15$ | 1-1 1 | 4.17 | r.19 | 4.19 | I. 26 | $4 \cdot 21$ |
| 8 | -92 | $4 \cdot 12$ | -99 | $4 \cdot 14$ | 1.07 | 4.16 | 1.15 | 4.18 | 1.22 | $4 \cdot 20$ | I 30 | $4 \cdot 22$ |
| Io | -94 | $4 \cdot 12$ | 1.01 | $4 \cdot 14$ | 1.09 | $4 \cdot 16$ | 1-17 | 4-18 | 1.25 | $4 \cdot 20$ | r-32 | 4.23 |
| 12 | $\cdot 96$ | $4 \cdot 13$ | r.03 | $4 \cdot 15$ | I•II | $4 \cdot 17$ | 1.19 | 4.19 | 1.27 | $4 \cdot 21$ | I'35 | $4 \cdot 24$ |
| 14 | . 98 | 4'13 | 1.06 | $4 \cdot 15$ | r.14 | 4.17 | I-2I | 4.19 | 1.29 | $4 \cdot 22$ | I. 38 | $4 \cdot 24$ |
| 16 | 1.00 | $4 \cdot 14$ | 1.08 | $4 \cdot 16$ | 1-16 | 4.18 | I. 24 | 4.20 | 1.32 | $4 \cdot 23$ | I-4I | $4 \cdot 25$ |
| 18 | $1 \cdot 03$ | $4 \cdot 14$ | I'II | $4 \cdot 17$ | I-19 | 4.19 | I 27 | 4.21 | 1.35 | $4 \cdot 24$ | I. 44 | $4 \cdot 27$ |
| 20 | I 05 | $4 \cdot 15$ | I.I4 | $4 \cdot 17$ | 1.22 | $4 \cdot 20$ | I.30 | 4.22 | 1.39 | 4.25 | I. 47 | 4.28 |
| 22 | I.08 | 4.16 | I-17 | $4 \cdot 18$ | I. 25 | 4.21 | I-33 | $4 \cdot 23$ | 1.42 | $4 \cdot 26$ | I-5I | 4.29 |
| 24 | I'II | 4.17 | 1.20 | $4 \cdot 19$ | I.28 | $4 \cdot 22$ | 1.37 | $4 \cdot 24$ | I.46 | 4.27 | x-55 | 4.30 |
| 26 | I'I5 | 4.18 | 1.23 | $4 \cdot 20$ | 1.32 | $4 \cdot 23$ | 1.41 | $4 \cdot 26$ | I.50 | $4 \cdot 29$ | 1.59 | 4.32 |
| 28 | I-18 | $4 \cdot 19$ | I. 27 | $4 \cdot 21$ | 1.36 | $4 \cdot 24$ | I. 46 | $4 \cdot 27$ | I. 55 | $4 \cdot 30$ | I. 64 | $4 \cdot 34$ |
| 30 | I. 22 | $4 \cdot 20$ | $1 \cdot 31$ | $4 \cdot 22$ | 1.41 | $4 \cdot 25$ | I. 50 | $4 \cdot 29$ | I 60 | $4 \cdot 32$ | I•70 | $4 \cdot 36$ |
| 32 | I-27 | 4.21 | 1.36 | $4 \cdot 24$ | 1.46 | $4 \cdot 27$ | I. 55 | $4 \cdot 3 \mathrm{I}$ | I.65 | $4 \cdot 34$ | 1.76 | $4 \cdot 38$ |
| 34 | I.3I | 4.22 | 1.41 | $4 \cdot 26$ | 1.5I | $4 \cdot 29$ | 1.6I | $4 \cdot 33$ | 1.71 | $4 \cdot 37$ | 1.82 | $4 \cdot 41$ |
| 36 | I.36 | $4 \cdot 24$ | 1.46 | $4 \cdot 27$ | 1.57 | $4 \cdot 31$ | I. 67 | $4 \cdot 35$ | 1.78 | $4 \cdot 39$ | I.89 | $4 \cdot 44$ |
| 38 | 1.42 | 4.26 | 1.52 | $4 \cdot 29$ | 1.63 | $4 \cdot 33$ | I•74 | $4 \cdot 38$ | r. 86 | $4 \cdot 42$ | r.97 | $4 \cdot 47$ |
| 40 | I-48 | $4 \cdot 28$ | 1.59 | $4 \cdot 32$ | 1.70 | 4.36 | I. 82 | $4 \cdot 4 \mathrm{I}$ | I:94 | $4 \cdot 46$ | 2.06 | $4 \cdot 51$ |
| 42 | I-55 | $4 \cdot 30$ | 1.66 | $4 \cdot 35$ | $1 \cdot 78$ | $4 \cdot 39$ | I.90 | 4.44 | $2 \cdot 03$ | $4 \cdot 50$ | 2.16 | $4 \cdot 56$ |
| 44 | 1.62 | 4.33 | $1 \cdot 74$ | $4 \cdot 38$ | 1.87 | 4.43 | 2.00 | 4.49 | $2 \cdot 13$ | 4.55 | 2.27 | $4 \cdot 61$ |
| 46 | 1.71 | $4 \cdot 36$ | 1.84 | $4 \cdot 41$ | 1.97 | $4 \cdot 47$ | $2 \cdot 11$ | $4 \cdot 53$ | $2 \cdot 25$ | $4 \cdot 60$ | 2.40 | $4 \cdot 68$ |
| 48 | 1.80 | 4.40 | 1.94 | $4 \cdot 46$ | 2.08 | $4 \cdot 52$ | 2.23 | $4 \cdot 59$ | $2 \cdot 39$ | $4 \cdot 67$ | $2 \cdot 55$ | $4 \cdot 76$ |
| 50 | 1.91 | $4 \cdot 45$ | 2.06 | 4.51 | $2 \cdot 21$ | $4 \cdot 58$ | $2 \cdot 37$ | $4 \cdot 66$ | $2 \cdot 54$ | 4.75 | $2 \cdot 72$ | $4 \cdot 85$ |
| 52 | $2 \cdot 03$ | $4 \cdot 50$ | 2.19 | 4.57 | $2 \cdot 36$ | 4.65 | $2 \cdot 54$ | $4 \cdot 75$ | $2 \cdot 73$ | $4 \cdot 85$ | $2 \cdot 92$ | 4.96 |

## LATITUDE $5^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. S. | S. | H. M. | S. | M. S. | S. | M. | S. | M. S. | S. | H. M. S. | S. |
| 0 | $55329 \cdot 1$ | -39 | 553 5*7 | -.39 | $55^{52} 42 \cdot 1$ | - 40 | $55^{52}$ I8•I | - 40 | 5 51 53.9 | - 41 | $\begin{array}{llll}5 & 51 & 29.2\end{array}$ | - 41 |
| 8 | $\begin{array}{lllll}5 & 19 & 36 \cdot 6\end{array}$ | - 59 | $\begin{array}{llll}5 & 19 & 0.9\end{array}$ | -60 | $5^{5} 1824^{\circ} \mathrm{I}$ | . 62 | 5 I7 46'1 | -64 | 51770 | -66 | $\begin{array}{llll}5 & 16 & 26 \cdot 6\end{array}$ | -68 |
| 10 | 5 II 6.6 | -64 | 5 10 27.6 | -66 | $\begin{array}{llll}5 & 9 & 47 \cdot 3\end{array}$ | 68 | $\begin{array}{llll}5 & 9 & 5.6\end{array}$ | -71 | $\begin{array}{llll}5 & 8 & 22 \cdot 6\end{array}$ | $\cdot 73$ | $5 \quad 738 \cdot 1$ | 75 |
| 12 | $\begin{array}{llll}5 & 2 & 35 \cdot 6\end{array}$ | -69 | 5 I 53.2 | - 72 | 5 I 9.4 | - 74 | 5 ¢ 023.9 | 77 | $45936 \cdot 9$ | -80 | $45848 \cdot 1$ | 83 |
| 14 | $4 \quad 54 \quad 3 \cdot 5$ | $\cdot 75$ | $45317 \cdot 7$ | $\cdot 78$ | $45230 \cdot \mathrm{I}$ | .8I | $45140 \cdot 8$ | - 84 | $45049 \cdot 6$ | -87 | $44956 \cdot 4$ | -90 |
| 16 | 45 30.2 | -81 | 44 40.9 | - 84 | 443 49*5 | -87 | $44256 \cdot 1$ | -91 | 4420.6 | -94 | 441029 | .98 |
| 18 | $43655 \cdot 6$ | $\cdot 87$ | $\begin{array}{lll}4 & 36 & 2.5\end{array}$ | -90 | $435 \quad 7 \cdot 2$ | $\cdot 94$ | $4 \begin{array}{lll}4 & 34 & 9 \cdot 6\end{array}$ | -98 | $\begin{array}{llll}4 & 33 & 9.6\end{array}$ | I. 02 | $432 \quad 7 \cdot 2$ | I.06 |
| 20 | 428 19.6 | -93 | 42722.6 | -97 | $4 \begin{array}{llll}4 & 26 & 23 \cdot 2\end{array}$ | r - OI | $4 \begin{array}{llll}4 & 25 & 21 \cdot 2\end{array}$ | I.06 | $42416 \cdot 5$ | I-IO | $423 \quad 9 \cdot 1$ | I.15 |
| 22 | 4 I9 4I-8 | -99 | $41840 \cdot 8$ | I $0 \cdot 0$ | 4 17 37*1 | 1.09 | $41630 \cdot 5$ | I-I3 | 415210 | I-18 | $\begin{array}{llll}4 & 14 & 8.4\end{array}$ | 1.24 |
| 23 | 4 I5 22.3 | I.03 | 41419.2 | I.08 | $4 \begin{array}{llll} & 13 & 13.2\end{array}$ | I'12 | 41243 | I-I7 | $410 \quad 52.2$ | I. 23 | $4 \quad 9 \quad 37 \cdot 0$ | 1.28 |
| 24 | 4 II $2 \cdot 2$ | I.06 | $4 \quad 957 \cdot 0$ | II | $4 \begin{array}{llll}4 & 8 & 48.8\end{array}$ | I•16 | 473774 | I 22 | $\begin{array}{lll}4 & 6 & 22.8\end{array}$ | I. 27 | $\begin{array}{llll}4 & 5 & 4 \cdot 7\end{array}$ | 1.33 |
| 25 | $4641 \cdot 7$ | I•10 | $4 \quad 5 \quad 34 \cdot 3$ | 1-15 | $\begin{array}{llll}4 & 4 & 23.7\end{array}$ | 1.20 | 4 3 $9 \cdot 8$ <br>  58 4 | I. 26 | $\begin{array}{llll}4 & 1 & 52.5\end{array}$ | I. 32 | $4 \quad 031 \cdot 7$ | 1.38 |
| 26 | $4220 \cdot 6$ | I•I3 | 4 I II.O | I'I9 | $3 \begin{array}{llll} & 59 & 57.9\end{array}$ | $1 \cdot 25$ | $\begin{array}{llllllllllll}3 & 58 & 41\end{array}$ | I. 30 |  | I.37 | $355 \quad 57 \cdot 6$ | 1.43 |
| 27 | $35759^{\circ} \mathrm{O}$ | I.I7 | $35647 \cdot 0$ | I 23 | $355131 \cdot 5$ | I. 29 | $\begin{array}{lllllllllllllll}3 & 54 & 12.4\end{array}$ | I. 35 | $\begin{array}{llll}3 & 52 & 49 \cdot 5\end{array}$ | I.4I | $\begin{array}{llllllllllllll}3 & 51 & 22 \cdot 7\end{array}$ | 1.48 |
| 28 | 353 36.7 | I-2I | $352 \quad 22 \cdot 3$ | I. 27 | 35143 | $1 \cdot 33$ | $34942 \cdot 4$ | I.40 |  | I.46 | $34646 \cdot 7$ | 1.53 |
| 29 | $3 \begin{array}{llll}3 & 49 & 13.8\end{array}$ | I. 25 | $\begin{array}{lllll}3 & 47 & 56.9\end{array}$ | I.3I | $3 \begin{array}{llll}3 & 46 & 36 \cdot 2\end{array}$ | I.38 | 345 II•6 | I. 45 | $34342 \cdot 8$ | 1.52 | $\begin{array}{lll}3 & 42 & 97\end{array}$ | I 59 |
| 30 | $34450 \cdot 2$ | I. 29 | 3 43 3 | I. 36 | $\begin{array}{llll}3 & 42 & 7 \cdot 4\end{array}$ | 1.42 | 34039.8 | I 50 | $\begin{array}{llll}3 & 39 & 7 \cdot 9\end{array}$ | I. 57 | $3 \begin{array}{llll}37 & 31.5\end{array}$ | I. 65 |
| 31 | $34025 \cdot 8$ | $1 \cdot 33$ | $\begin{array}{llll}3 & 39 & 3 \cdot 8\end{array}$ | I.40 |  | I.47 | $\begin{array}{llll}3 & 36 & 7 \cdot 0\end{array}$ | I. 55 | 334319 | I. 63 | $33252 \cdot 0$ | I.71 |
| 32 | $\begin{array}{llll}3 & 36 & 0.7\end{array}$ | I.38 | $33436 \cdot 0$ | I.45 | $\begin{array}{lll}3 & 33 & 6.8\end{array}$ | I. 52 | 33133.2 | I. 60 | $\begin{array}{llll}3 & 29 & 54 *\end{array}$ | 1.68 | $\begin{array}{llll}3 & 28 & \text { II } 2\end{array}$ | I.77 |
| 33 | 3 31 34,7 | 1.42 | $\begin{array}{lll}3 & 30 & 7 \cdot 2\end{array}$ | I. 50 | $\begin{array}{llll}3 & 28 & 35 \cdot 1\end{array}$ | I.58 | $3 \begin{array}{llll} \\ 3 & 26 & 58 \cdot 1\end{array}$ | I. 66 | $3 \begin{array}{llll}3 & 25 & 16 \cdot 2\end{array}$ | I•74 | 32329.0 | I.83 |
| 34 | $\begin{array}{lll}3 & 27 & 7\end{array}$ | 1.47 | $325 \quad 37 \cdot 4$ | I. 55 | $\begin{array}{lll}3 & 24 & 2 \cdot 2\end{array}$ | I. 63 | 32221.9 | I•72 | $\begin{array}{llll}3 & 20 & 36.4\end{array}$ | I.80 | $\begin{array}{llll}3 & 18 & 45 \cdot 3\end{array}$ | 1.90 |
| 35 | $32240 \cdot 1$ | I 52 | $\begin{array}{lllllllllllllllll}3 & 21 & 6.6\end{array}$ | I. 60 | $\begin{array}{llll}3 & 19 & 28 \cdot 1\end{array}$ | I. 68 | 3 I7 44.4 | I.78 | $3 \mathrm{I} 5 \times 55 \cdot 0$ | I. 87 | 313159.8 | $1 \cdot 97$ |
| 36 | 3 I8 II•3 | I.57 | $31634 \cdot 7$ | I. 65 |  | I.74 | $\begin{array}{llll}3 & 13 & 5 \cdot 3\end{array}$ | I. 84 | 3 II I2.I | I.94 | $\begin{array}{llll}3 & 9 & 12.7\end{array}$ | $2 \cdot 04$ |
| 37 | $31341 \cdot 4$ | I. 62 | 31215 | I• 7 | 3 IO I6.I | I.8I | $\begin{array}{llll}3 & 8 & 24.8\end{array}$ | I'9I | $3 \begin{array}{lll}3 & 6 & 27.4\end{array}$ | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}3 & 4 & 23 \cdot 6\end{array}$ | $2 \cdot 12$ |
| 38 | $\begin{array}{lll}3 & 9 & 10.4\end{array}$ | 1.68 | $3727 \cdot 1$ | 1•77 | $\begin{array}{lllll}3 & 5 & 37 \cdot 9\end{array}$ | I.87 | $\begin{array}{llll}3 & 3 & 42 \cdot 7\end{array}$ | I 97 | 3 I 41.0 | 2.08 | $25932 \cdot 5$ | $2 \cdot 20$ |
| 39 | $3 \begin{array}{llll}3 & 4 & 38 \cdot 1\end{array}$ | I•73 | $\begin{array}{llll}3 & 2 & 5 \mathrm{I} \cdot 2\end{array}$ | I.83 | 3 o $58 \cdot 1$ | I•94 |  | $2 \cdot 05$ | 25652.5 | $2 \cdot 16$ | $25439 \cdot 1$ | $2 \cdot 29$ |
| 40 | 304.5 | 1.79 | $2 \begin{array}{lll}288 & 13 \cdot 8\end{array}$ | 1.90 | $25616 \cdot 6$ | 2.01 | 25412.8 | $2 \cdot 12$ | 2522 I. | $2 \cdot 25$ | $24943 \cdot 2$ | $2 \cdot 38$ |
| 41 | 255129.4 | 1.86 | $253134 \cdot 8$ | I.97 | 25133.4 | $2 \cdot 08$ | 24924.8 | $2 \cdot 20$ | $\begin{array}{llll}2 & 47 & 8.8\end{array}$ | $2 \cdot 33$ | 24444.7 | 2.47 |
| 42 | $25052 \cdot 8$ | 1-92 | 24854.0 | $2 \cdot 04$ | $24648 \cdot 0$ | $2 \cdot 16$ | $\begin{array}{llllllllllllllll}2 & 44 & 34.6\end{array}$ | $2 \cdot 29$ | $\begin{array}{llll}2 & 42 & 13 \cdot 1\end{array}$ | 2.43 | $\begin{array}{lllllllllllll}2 & 39 & 43 \cdot 2\end{array}$ | 2.57 |
| 43 | 24614.4 | I.99 | 244 II•2 | $2 \cdot 12$ | $2420 \cdot 5$ | $2 \cdot 24$ | 239 4I•8 | $2 \cdot 38$ | 23714.7 | $2 \cdot 53$ | $23438 \cdot 5$ | $2 \cdot 68$ |
| 44 | 24134.2 | 2.07 | $23926 \cdot 3$ | $2 \cdot 20$ | 23710.5 | $2 \cdot 33$ | $23446 \cdot 3$ | 2.48 | 232 I3•I | $2 \cdot 63$ | $22930 \cdot 2$ | 2.80 |
| 45 | $23652 \cdot 0$ | $2 \cdot 15$ | $23439 \cdot 2$ | $2 \cdot 28$ | $23218 \cdot 0$ | 2.43 | $22947 \cdot 8$ | $2 \cdot 58$ | 227 8.1 | $2 \cdot 75$ | 224 I8.I | $2 \cdot 93$ |
| 46 | $\begin{array}{llll}2 & 32 & 7.5\end{array}$ | $2 \cdot 23$ | $22949 \cdot 5$ | $2 \cdot 37$ | $\begin{array}{lllll}2 & 27 & 22.5\end{array}$ | $2 \cdot 53$ | $22446 \cdot 0$ | $2 \cdot 69$ | 221593 | 2.87 | $2 \begin{array}{lll}19 & 1.5\end{array}$ | 3.06 |
| 47 | $22720 \cdot 6$ | $2 \cdot 32$ | 224 57.0 | 2.47 | $\begin{array}{llll}2 & 22 & 23.9\end{array}$ | 2.64 | $21940 \cdot 6$ | $2 \cdot 8 \mathrm{I}$ | 2 I6 $46 \cdot 3$ | 3.00 | $21340 \cdot 1$ | $3 \cdot 21$ |
| 48 | 2223 I I | $2 \cdot 42$ | 22014 | $2 \cdot 58$ | 2 I7 21.7 | 2.75 | $21431 \cdot 0$ | $2 \cdot 94$ | 2 II 28.5 | $3 \cdot 15$ | $2813 \cdot 1$ | $3 \cdot 37$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | - I.3I | -4.22 | -I.39 | $-4.25$ | -1.47 | $-4.27$ | -I.55 | $-4.30$ | - 1.63 | $-4.33$ | -1.71 | $-4 \cdot 36$ |
| 2 | I.33 | $4 \cdot 23$ | I 40 | 4.25 | I.48 | $4 \cdot 28$ | I. 56 | $4 \cdot 31$ | I. 65 | $4 \cdot 34$ | 1.73 | $4 \cdot 37$. |
| 4 | I. 34 | 4.23 | I. 42 | $4 \cdot 26$ | I. 50 | $4 \cdot 29$ | I. 58 | $4 \cdot 32$ | I. 67 | $4 \cdot 35$ | I•75 | $4 \cdot 38$ |
| 6 | I-36 | 4.24 | I 44 | 4.27 | I.52 | 4.29 | I. 60 | $4 \cdot 32$ | I. 69 | $4 \cdot 36$ | I•77 | $4 \cdot 39$ |
| 8 | I-38 | 4.25 | I. 46 | 4.27 | I. 54 | $4 \cdot 30$ | I. 63 | $4 \cdot 33$ | I•71 | $4 \cdot 37$ | 1.80 | $4 \cdot 40$ |
| 10 | I.4I | $4 \cdot 25$ | I.49 | $4 \cdot 28$ | 1.57 | 4.31 | I. 65 | $4 \cdot 34$ | 1.74 | $4 \cdot 38$ | I. 82 | 4.41 |
| 12 | 1.43 | $4 \cdot 26$ | I-5I | $4 \cdot 29$ | 1.60 | $4 \cdot 32$ | I. 68 | $4 \cdot 35$ | 1.77 | $4 \cdot 39$ | I.86 | $4 \cdot 42$ |
| 14 | I. 46 | $4 \cdot 27$ | I. 54 | $4 \cdot 30$ | I. 63 | $4 \cdot 33$ | I•71 | 4.36 | I. 80 | 4.40 | I.89 | $4 \cdot 44$ |
| 16 | 1.49 | $4 \cdot 28$ | I 57 | $4 \cdot 31$ | I. 66 | $4 \cdot 34$ | I•75 | $4 \cdot 38$ | I. 84 | $4 \cdot 42$ | $\underline{193}$ | $4 \cdot 45$ |
| 18 | I. 52 | $4 \cdot 29$ | I. 61 | $4 \cdot 33$ | 1-70 | $4 \cdot 36$ | I•79 | $4 \cdot 39$ | I. 88 | 4.43 | 1.97 | 4.47 |
| 20 | I. 56 | 4.31 | I. 65 | 4.34 | 1.74 | $4 \cdot 38$ | 1. 83 | 4.41 | I.92 | 4.45 | 2.02 | 4.49 |
| 22 | 1.60 | $4 \cdot 32$ | I. 69 | $4 \cdot 36$ | 1.78 | $4 \cdot 39$ | I. 88 | 4.43 | 1.97 | 4.47 | 2.07 | $4 \cdot 52$ |
| 24 | I. 64 | $4 \cdot 34$ | 1.74 | $4 \cdot 37$ | 1.83 | 4.41 | I.93 | 4.45 | 2.03 | $4 \cdot 50$ | $2 \cdot 13$ | $4 \cdot 54$ |
| 26 | I. 69 | $4 \cdot 36$ | 1*78 | 4.39 | I. 88 | 4.43 | I.98 | $4 \cdot 48$ | 2.09 | $4 \cdot 53$ | $2 \cdot 19$ | $4 \cdot 57$ |
| 28 | 1.74 | $4 \cdot 38$ | I. 84 | $4 \cdot 42$ | 1.94 | $4 \cdot 46$ | 2.05 | $4 \cdot 51$ | $2 \cdot 15$ | $4 \cdot 56$ | $2 \cdot 26$ | $4 \cdot 61$ |
| 30 | I.80 | 4.40 | I 90 | 4.44 | $2 \cdot 01$ | $4 * 49$ | 2.11 | 4*54 | $2 \cdot 23$ | 4.59 | $2 \cdot 34$ | 4.65 |
| 32 | I 86 | 4.43 | 1-97 | 4.47 | 2.08 | $4 \cdot 52$ | $2 \cdot 19$ | 4.57 | $2 \cdot 31$ | 4.63 | 2.43 | 4.69 |
| 34 | $1 \cdot 93$ | $4 \cdot 46$ | $2 \cdot 04$ | 4.50 | $2 \cdot 16$ | $4 \cdot 56$ | $2 \cdot 27$ | 4.61 | 2.40 | $4 \cdot 68$ | 2.52 | 4.74 |
| 36 | $2 \cdot 01$ | 4.49 | $2 \cdot 12$ | $4 \cdot 54$ | $2 \cdot 25$ | $4 \cdot 60$ | 2.37 | $4 \cdot 66$ | $2 \cdot 50$ | 4.73 | 2.63 | $4 \cdot 80$ |
| 38 | 2.09 | $4 \cdot 53$ | $2 \cdot 22$ | $4 \cdot 59$ | $2 \cdot 34$ | $4 \cdot 65$ | 2.48 | $4^{* 72}$ | 2.61 | 4•79 | $2 \cdot 76$ | $4 \cdot 87$ |
| 40 | 2.19 | $4 \cdot 57$ | $2 \cdot 32$ | $4 \cdot 64$ | $2 \cdot 46$ | $4 \cdot 71$ | $2 \cdot 60$ | $4 \cdot 78$ | $2 \cdot 75$ | 4.86 | 2.90 | 4.95 |
| 42 | $2 \cdot 30$ | 4.62 | 2.44 | 4.70 | $2 \cdot 58$ | $4 \cdot 77$ | $2 \cdot 73$ | 4.86 | 2.90 | $4 \cdot 95$ | $3 \cdot 06$ | $5 \cdot 05$ |
| 44 | $2 \cdot 42$ | $4 \cdot 69$ | $2 \cdot 57$ | $4 \cdot 77$ | $2 \cdot 73$ | 4.85 | 2.89 | 4.95 | 3.07 | $5 \cdot 05$ | $3 \cdot 26$ | $5 \cdot 17$ |
| 46 | $2 \cdot 56$ | $4 \cdot 76$ | 2.72 | 4.85 | 2.89 | 4.95 | $3 \cdot 08$ | $5 \cdot 06$ | $3 \cdot 28$ | $5 \cdot 18$ | 3.48 | $5 \cdot 32$ |
| 48 | $2 \cdot 72$ | $4 \cdot 85$ | 2.90 | 4.95 | 3.09 | $5 \cdot 07$ | $3 \cdot 30$ | $5 \cdot 20$ | $3 \cdot 52$ | $5 \cdot 34$ | $3 \cdot 76$ | $5 \cdot 50$ |

## 146 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

LATITUDE $6^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2{ }^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| O | $\begin{array}{lrl} \text { H. м. } & \text { s. } \\ 6 & \text { o } & \text { o. } \end{array}$ | $\begin{aligned} & \text { S. } \\ & 42 \end{aligned}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 59 & 34 \cdot 8 \end{array}\right.$ | $\cdot 42$ | $\left\lvert\, \begin{array}{cc} \text { H. м. } & \text { s. } \\ 5 & 59 \\ 9 \cdot 6 \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \\ -\mathrm{4} \end{gathered}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 5 & 58 \\ 44 \cdot 3 \end{array}\right.$ | $42$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 5 & 58 & \text { I } 8.9 \end{array}\right.$ | 42 | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { s. } \\ 5 & 57 & 53 \cdot 6 \end{array}\right.$ | 42 |
| 10 | $51946 \cdot 6$ | $\cdot 43$ | 51920.6 | $\cdot 44$ | $\begin{array}{llll}5 & 18 & 53.9\end{array}$ | -45 | $\begin{array}{lllll}5 & 18 & 26.4\end{array}$ | $\cdot 47$ | 5 17 58.0 | 48 | 5 I7 28.8 | 49 |
| 12 | 5 II 43.9 | 43 | 5 II 17.6 | -44 | $51050 \cdot 5$ | $\cdot 46$ | 5 10 $22 \cdot 4$ | $\cdot 48$ | $\begin{array}{lll}5 & 9 & 53.3\end{array}$ | -49 | $\begin{array}{llll}5 & 9 & 23.2\end{array}$ | 51 |
| 14 | $\begin{array}{llll}5 & 3 & 4 \mathrm{I} \cdot \mathrm{I}\end{array}$ | 43 | $\begin{array}{lllll}5 & 3 & 14.6\end{array}$ | 45 | 5 2 47 | - 47 | $\begin{array}{lll}5 & 2 & 18 \cdot 3\end{array}$ | -49 | $\begin{array}{lll}5 & \text { I } & 48 \cdot 4\end{array}$ | $\cdot 51$ | $\begin{array}{lll}5 & 1 & 17 \cdot 4\end{array}$ | 53 |
| 16 | $4 \begin{array}{lllll} & 55 & 38\end{array}$ | 44 | $4 \begin{array}{llll}45 & 114\end{array}$ | 46 | $45443 \cdot 3$ | 48 | 45414.0 | $\cdot 50$ | $45343 \cdot 3$ | $\cdot 52$ | 453 II 3 | -54 |
| 18 | $44735 \cdot 4$ | 44 | 44788 | 47 | $44639 \cdot 5$ | 49 | 446894 | . 51 | $44537 \cdot 9$ | 54 | $4454 \cdot 9$ | 56 |
| 20 | $43932 \cdot 4$ | 45 | $\begin{array}{llll}4 & 39 & 4.8\end{array}$ | 47 | $43835 \cdot 6$ | - 50 | $\begin{array}{llll}4 & 38 & 4.7\end{array}$ | . 53 | 4 $3732 \cdot 3$ | 55 | $\begin{array}{llll}4 & 36 & 58.2\end{array}$ | 58 |
| 22 | 43129.4 | 45 | $431 \begin{array}{lll}4 & 31\end{array}$ | 48 | 43031.5 | $\cdot 51$ | $42959 \cdot 8$ | - 54 | $42926 \cdot 4$ | -57 | $42851 \cdot \mathrm{I}$ | -60 |
| 24 | $423 \quad 26 \cdot 3$ | 46 | $\begin{array}{llll}4 & 22 & 57 \cdot 7\end{array}$ | 49 | $42227 \cdot \mathrm{I}$ | $\cdot 52$ | $42154 \cdot 7$ | $\cdot 5$ | $42120 \cdot 2$ | . 59 | $42043 \cdot 7$ | -63 |
| 26 | $415 \quad 23.0$ | 47 | 41453.9 | $\cdot 50$ | $41422 \cdot 7$ | -54 | $41349 \cdot 2$ | $\cdot 57$ |  | 61 | $4 \quad 12 \quad 35.9$ | 65 |
| 28 | $\begin{array}{llll}4 & 7 & 19.7\end{array}$ | 48 | $\begin{array}{lrrr}4 & 6 & 49.9\end{array}$ | $\cdot 51$ | $4 \quad 6 \quad 17.9$ | -55 | $543 \cdot 5$ | -59 | $\begin{array}{lll}4 & 5 & 6 \cdot 7\end{array}$ | .63 | $4 \quad 427.6$ | 67 |
| 30 | 35916.2 | -49 | $\begin{array}{lllllllllll}3 & 58 & 45 \cdot 8\end{array}$ | 53 | $\begin{array}{llllllll}3 & 58 & 12.9\end{array}$ | 57 | $35737 \cdot 4$ | . 61 | 35659.4 | . 66 | $35618 \cdot 7$ | 70 |
| 32 | $35112 \cdot 6$ | 50 | $35041 \cdot 5$ | 54 | $\begin{array}{llll}3 & 50 & 7.6\end{array}$ | -59 | $3493 \mathrm{I} \cdot \mathrm{O}$ | . 63 | $\begin{array}{llll}3 & 48 & 51 \cdot 6\end{array}$ | -68 | $34^{3} \quad 9{ }^{\prime \prime} 4$ | 73 |
| 33 |  | 50 | $\begin{array}{llllllllll}3 & 46 & 39 \cdot 2\end{array}$ | 55 | $\begin{array}{llll}3 & 46 & 4 \cdot 8\end{array}$ | . 60 | $\begin{array}{lllllll}3 & 45 & 27 \cdot 6\end{array}$ | . 64 | $\begin{array}{llllllllll}3 & 44 & 47 \\ & 4 & 5\end{array}$ | $\cdot 69$ | $\begin{array}{llll}3 & 44 & 4.4\end{array}$ | 74 |
| 34 | 343 | 5 I | $34236 \cdot 9$ | $\cdot 56$ | $342 \quad 2 \cdot 0$ | 61 | 34124.2 | . 66 | $34043 \cdot 3$ | $\cdot 71$ | $3 \quad 3959 \cdot 3$ | 76 |
| 35 | $\begin{array}{lll}3 & 39 & 6.9\end{array}$ | 51 | $\begin{array}{llll}3 & 38 & 34 \cdot 5\end{array}$ | $\cdot 56$ | 33759.1 | 62 | $33720 \cdot 6$ | 7 | $\begin{array}{lllll}3 & 36 & 38 \cdot 9\end{array}$ | $\cdot 72$ | $33554 \cdot \mathrm{I}$ | 77 |
| 36 | 3354.9 | 52 | $33432 \cdot \mathrm{I}$ | 57 | $33356 \cdot 1$ | . 63 | 33316.8 | -68 |  | -73 | $33148 \cdot 6$ | 79 |
| 37 | $\begin{array}{llll}3 & 3 \mathrm{I} & 2.8 \\ 3 & 27 & \\ \end{array}$ | 53 | $\begin{array}{llll}3 & 30 & 29 \cdot 5 \\ 3 & 26\end{array}$ | $\cdot 58$ | $\begin{array}{llll}3 & 29 & 53 \cdot 0 \\ 3 & 25\end{array}$ | -64 | $\begin{array}{llllllllll}3 & 29 & 13.0\end{array}$ | -69 |  | $\cdot 75$ | $\begin{array}{llll}3 & 27 & 43.0\end{array}$ | 81 |
| 38 | $\begin{array}{llll}3 & 27 & 0.7 \\ 3 & 22 & 58.5\end{array}$ | . 54 | $\begin{array}{llll}3 & 26 & 26 \cdot 9\end{array}$ | $\cdot 59$ | $\begin{array}{lllllllllll}3 & 25 & 49 \\ 3 & 21\end{array}$ | -65 | $\begin{array}{llll}3 & 25 & 90 \\ 3 & 0\end{array}$ | 71 | $\begin{array}{llll}3 & 24 & 24.8 \\ 3 & 20\end{array}$ | $\cdot 77$ | $\begin{array}{lllll}3 & 23 & 37 \cdot 1\end{array}$ | 83 |
| 39 | $32258 \cdot 5$ | 54 | 32224.2 | 60 | $32146 \cdot 4$ | -66 | $32 \mathrm{I} \quad 4.9$ | 72 | $\begin{array}{lllll}3 & 20 & 19.8\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 19 & 310\end{array}$ |  |
| 40 | $31856 \cdot 3$ | -55 |  | .6I | 31742.9 | - 67 | $\begin{array}{llll}3 & 17 & 0.7\end{array}$ | $\cdot 74$ | $\begin{array}{llll}3 & 16 & 14.6\end{array}$ | -80 | 315154.7 | 86 |
| 41 | $31454{ }^{\circ}$ | -56 | 31418.6 | -62 | 3131393 | -69 | $3 \begin{array}{llll}3 & 12 & 56 \cdot 2\end{array}$ | $\cdot 75$ | $\begin{array}{llll}3 & 12 & 9.2\end{array}$ | . 82 | 3 II 18.2 | 88 |
| 42 | $31051 \cdot 7$ | $\cdot 57$ | 3 10 15.6 | . 63 | $\begin{array}{llll}3 & 9 & 35 \cdot 6\end{array}$ | $\cdot 70$ | 3 8 51 | $\cdot 77$ | $\begin{array}{llll}3 & 8 & 3.6\end{array}$ | - 84 | $\begin{array}{llll}3 & 7 \\ \text { II }\end{array}$ | -91 |
| 4 | $\begin{array}{lll}3 & 6 & 49 \cdot 2\end{array}$ | -58 | $\begin{array}{llll}3 & 6 & 12.5\end{array}$ | 6 | 3 5 31.8 <br> 3 5  | 7 | $\begin{array}{llll}3 & 4 & 46 \cdot 9\end{array}$ | 8 | $\begin{array}{llll}3 & 3 & 57 \cdot 7\end{array}$ | 86 | $\begin{array}{lll}3 & 3 & 4 \\ 2 & 5\end{array}$ | 3 |
| 44 | $3 \quad 246 \cdot 7$ | -59 | $\begin{array}{llll}3 & 2 & 9.3\end{array}$ | 66 | $\begin{array}{llll}3 & 1 & 27.7\end{array}$ | $\cdot 73$ | 3 3 $04 \mathrm{4I} \cdot 8$ | -80 | $25951 \cdot 5$ | 88 | $\begin{array}{lllll}2 & 58 & 56 \cdot 8\end{array}$ | 5 |
| 45 | $\begin{array}{llllll}2 & 58 & 43.9\end{array}$ | -60 | $\begin{array}{lll}2 & 58 & 6 \cdot 0\end{array}$ | $\cdot 67$ | 25723.5 | $\cdot 74$ | $2 \begin{array}{llll}26 & 36 \cdot 6\end{array}$ | . 82 | $25545 \cdot 2$ | -90 | 254 49•I | 97 |
| 46 | $25441 \cdot 3$ | $\cdot 61$ | $2 \begin{array}{lll}24 & 2 \cdot 5\end{array}$ | $\cdot 68$ | $\begin{array}{llllll}2 & 53 & 19.2\end{array}$ | $\cdot 76$ | $2523 \mathrm{I} \cdot 2$ | 8 | $\begin{array}{llll}2 & 51 & 38 \cdot 5\end{array}$ | -92 | $25041 \cdot 0$ | 00 |
| 47 | $25038 \cdot 5$ | $\cdot 62$ | 24958.9 | $\cdot 70$ |  | $\cdot 78$ | 24825.6 | $\cdot 86$ | 24731.5 | -94 | $\begin{array}{lllll}2 & 46 & 32 \cdot 5\end{array}$ | I.03 |
| 48 | $\begin{array}{lllll}2 & 46 & 35 \cdot 7 \\ 2 & 42 & 32 \cdot 5\end{array}$ | .63 | $\begin{array}{llll}2 & 45 & 55 \cdot 2 \\ 2 & 41 & 51.3\end{array}$ | $\cdot 71$ | $\begin{array}{llll}2 & 45 & 10 \cdot 0 \\ 2 & 41 & 5\end{array}$ | .80 | $2 \begin{array}{llll}2 & 49 \\ 2 & 19\end{array}$ | 88 | $\begin{array}{lllll}2 & 43 & 24.3 \\ 2 & 39 & 16.6\end{array}$ | .97 | $\begin{array}{lllll}2 & 42 & 23.7 \\ 2 & 38\end{array}$ | +05 |
|  | 242325 |  | $24151 \cdot 3$ | - 3 | 24150 |  | 24013.2 | 9 | 23916.6 |  | $\begin{array}{lllll}2 & 38 & 14.3\end{array}$ |  |
| 50 | $\begin{array}{llll}2 & 38 & 29.4\end{array}$ | - 66 | $\begin{array}{llll}2 & 37 & 47.2\end{array}$ | $\cdot 75$ | $\begin{array}{llll}2 & 36 & 59\end{array}$ | 8 | $\begin{array}{lll}2 & 36 & 6.9\end{array}$ | -93 | $\begin{array}{lll}2 & 35 & 8.6 \\ 2\end{array}$ | 1.02 | $\begin{array}{lll}2 & 34 & 4 \cdot 6\end{array}$ | III |
| 51 | $\begin{array}{llll}2 & 34 & 26 \cdot 1\end{array}$ | -67 | $\begin{array}{lllll}2 & 33 & 42 \cdot 9 \\ 2 & 2 & \\ 2\end{array}$ | $\cdot 76$ | $\begin{array}{llll}2 & 32 & 54.3 \\ 2 & 28 & 5\end{array}$ | 86 | 2 32 $0 \cdot 1$ <br> 2   | 95 | 2 3 I $\mathrm{O} \cdot \mathrm{I}$ <br> 2   | 1.05 | $\begin{array}{lllll}2 & 29 & 54.3\end{array}$ | $\begin{array}{r}1.15 \\ 15 \\ \hline 18\end{array}$ |
| 52 | $23022 \cdot 6$ | $\cdot 69$ | $\begin{array}{llll}2 & 29 & 38 \cdot 4 \\ 2 & \\ 2 & 5 & 3\end{array}$ | $\cdot 78$ |  | 88 | $\begin{array}{lllll}2 & 27 & 52.9 \\ 2\end{array}$ | '98 | $\begin{array}{llll}2 & 26 & 51.2\end{array}$ | 1.08 | 2 $25 \begin{array}{lll} & 43 \cdot 4\end{array}$ | I'18 |
| 53 | 2 26 <br> 18.9  | $\cdot 71$ | $\begin{array}{llll}2 & 25 & 33.7\end{array}$ | -80 | $\begin{array}{llllll}2 & 24 & 42 \\ 2\end{array}$ | -90 | $22345 \cdot 3$ | 1.01 | $2 \begin{array}{lll}22 & 4 \mathrm{r} \cdot 8 \\ 2\end{array}$ | I.II | $22132 \cdot 0$ | 1.22 |
| 54 | 22215 | $\cdot 72$ | 2128.8 |  | $22036 \cdot 2$ | -93 | $21937 \cdot 3$ | 1.0 | 12  <br> 8 31.9 | . 15 | 21719.8 | 1.26 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{\circ}$ | - A . | L. $2^{\circ}$ | A. | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | s. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | - 00 | $-4.02$ | - 07 | $-4.02$ | - 144 | $-4.03$ | - 21 | $-4.03$ | - 28 | $-4.03$ | -.35 | $-4.04$ |
| 4 | . 03 | 4.02 | - 10 | 4.02 | -17 | 4.03 | -24 | $4 \cdot 03$ | -31 | $4 \cdot 03$ | $\cdot 38$ | $4 \cdot 04$ |
| 8 | -06 | 4.02 | -13 | $4 \cdot 02$ | - 20 | 4.03 | -27 | 4.03 | $\cdot 35$ | 4.04 | - 42 | 4.04 |
| 12 | -09 | 4.02 | -16 | 4.02 | $\cdot 23$ | 4.03 | $\cdot 31$ | 4.03 | $\cdot 38$ | 4.04 | -45 | 4.05 |
| 14 | -10 | 4.02 | - 18 | 4.03 | -25 | 4.03 | $\cdot 32$ | 4.03 | -40 | 4.04 | $\cdot 47$ | 4.05 |
| 16 | -12 | 4.02 | -19 | 4.03 | -27 | 4.03 | $\cdot 34$ | 4.04 | -42 | 4.04 | -49 | 4.05 |
| 18 | -14 | 4.02 | - 21 | 4.03 | -29 | 4.03 | -36 | 4.04 | -44 | 4.05 | -51 | 4.05 |
| 20 | -15 | 4.02 | -23 | 4.03 | -3I | 4.03 | -38 | 4.04 | -46 | 4.05 | -53 | 4.06 |
| 22 | -17 | 4.02 | $\cdot 25$ | 4.03 | -32 | 4.04 | -40 | 4.04 | $\cdot 48$ | 4.05 | -56 | 4.06 |
| 24 | -19 | 4.03 | $\cdot 27$ | 4.03 | $\cdot 34$ | 4.04 | $\cdot 42$ | $4 \cdot 04$ | $\cdot 50$ | 4.05 | $\cdot 58$ | $4 \cdot 06$ |
| 26 | - 21 | 4.03 | -28 | 4.03 | -36 | 4.04 | -44 | $4 \cdot 05$ | -52 | 4.06 | -61 | 4.07 |
| 28 | - 22 | 4.03 | -31 | 4.03 | $\cdot 39$ | 4.04 | -47 | 4.05 | $\cdot 55$ | 4.06 | . 63 | 4.07 |
| 30 | -24 | 4.03 | $\cdot 33$ | 4.03 | -41 | 4.04 | -49 | 4.05 | - 58 | 4.06 | - 66 | 4.08 |
| 32 | -26 | 4.03 | $\cdot 35$ | 4.04 | -43 | 4.05 | - 52 | 4.06 | -60 | 4.07 | -69 | 4.08 |
| 34 | -28 | 4.03 | $\cdot 37$ | 4.04 | $\cdot 46$ | 4.05 | -55 | $4 \cdot 06$ | -63 | 4.07 | $\cdot 72$ | 4.09 |
| 36 | -31 | $4 \cdot 03$ | $\cdot 40$ | 4.04 | -48 | 4.05 | $\cdot 57$ | $4 \cdot 06$ | -66 | 4.08 | $\cdot 76$ | 4.09 |
| 38 | $\cdot 33$ | 4.03 | $\cdot 42$ | 4.04 | $\cdot 51$ | 4.05 | -61 | 4.07 | $\cdot 70$ | 4.08 | $\cdot 79$ | $4 \cdot 10$ |
| 40 | $\cdot 36$ | 4.04 | $\cdot 45$ | 4.05 | - 54 | 4.06 | -64 | $4 \cdot 07$ | -73 | 4.09 | -83 | $4 \cdot 11$ |
| 42 | $\cdot 38$ | 4.04 | -48 | 4.05 | . 58 | 4.06 | -67 | 4.08 | $\cdot 77$ | $4 \cdot 10$ | -87 | $4 \cdot 12$ |
| 44 | $\cdot 41$ | 4.04 | -51 | $4 \cdot 05$ | -6I | 4.07 | -71 | 4.09 | -82 | $4 \cdot 10$ | $\cdot 92$ | $4 \cdot 13$ |
| 46 | -44 | 4.04 | -54 | 4.06 | -65 | 4.07 | $\cdot 76$ | 4.09 | -86 | $4 \cdot 11$ | -97 | 4.14 |
| 48 | $\cdot 47$ | 4.05 | - 58 | 4.06 | . 69 | 4.08 | -80 | $4 \cdot 10$ | $\cdot 91$ | $4 \cdot 12$ | I.03 | $4 \cdot 15$ |
| 50 | $\cdot 51$ | 4.05 | - 62 | 4.07 | $\cdot 74$ | 4.09 | -85 | $4 \cdot 11$ | $\cdot 97$ | $4 \cdot 14$ | I 09 | $4 \cdot 17$ |
| 52 | $\cdot 55$ | 4.06 | $\cdot 67$ | 4.08 | $\cdot 78$ | $4 \cdot 10$ | $\cdot 91$ | $4 \cdot 12$ | 1.03 | $4 \cdot 15$ | I. 16 | $4 \cdot 19$ |
| 54 | $\cdot 59$ | 4.06 | $\cdot 71$ | 4.08 | $\cdot 84$ | $4 \cdot 11$ | -97 | 4.14 | I•IO | $4 \cdot 17$ | I 24 | $4 \cdot 20$ |

## LATITUDE $6^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. | S. | H. M. S | S. | H. M. | S. | H. | S. | I. | S. | M. S. | S. |
| 0 | $\begin{array}{lllll}5 & 57 & 28 \cdot 1\end{array}$ | - 43 | $\begin{array}{lll}5 & 57 & 2 \cdot 5\end{array}$ | $\cdot 43$ | $\begin{array}{llll}5 & 56 & 36 \cdot 9\end{array}$ | $\cdot 43$ | $55^{56}$ II•I | - 43 | $5 \begin{array}{llll}5 & 55 & 45 \cdot 2\end{array}$ | -43 | $55^{55} 19 \cdot 1$ | -44 |
| 10 | $\begin{array}{lllll}5 & 16 & 58.8\end{array}$ | -51 | $\begin{array}{llll}5 & 16 & 27 \cdot 9\end{array}$ | - 52 | 5 I5 $56 \cdot 0$ | - 54 | $\begin{array}{lllll}5 & 15 & 23.3\end{array}$ | -55 | $\begin{array}{llllll}5 & 14 & 49 \cdot 6\end{array}$ | - 57 | $\begin{array}{lllll}5 & 14 & 14.9\end{array}$ | 58 |
| 12 | $\begin{array}{llll}5 & 8 & 52.2\end{array}$ | -53 | 5820.0 | -54 | $\begin{array}{llll}5 & 7 & 46 \cdot 9\end{array}$ | -56 | $\begin{array}{llllllllllll}5 & 7 & 12.6\end{array}$ | -58 | $5 \quad 6 \quad 37 \cdot 2$ | -60 | $\begin{array}{lll}5 & 6 & 0.6\end{array}$ | 2 |
| 14 | $\begin{array}{llll}5 & 0 & 45^{\circ} 2\end{array}$ | $\cdot 55$ | $\begin{array}{lccl}5 & 0 & 11 \\ 4 & 8\end{array}$ | -57 | $45937 \cdot 2$ | -59 | 45981 | -61 | $45824 \cdot 2$ | - 63 | $45745 \%$ | 65 |
| I6 | $4 \quad 5238 \cdot 0$ | -57 | $4 \quad 52 \quad 3 \cdot 3$ | -59 | $45127 \cdot 2$ | -61 | $45049 \cdot 7$ | -64 | $45010 \cdot 7$ | -66 | $44930 \cdot 2$ | -69 |
| 18 | $44430 \cdot 4$ | -59 | 44354.3 | -6I | $\begin{array}{llll}4 & 43 & 16 \cdot 7\end{array}$ | -64 | $44237 \cdot 4$ | -67 | $44156 \cdot 6$ | $\cdot 70$ | 44153.9 | 72 |
| 20 | 43622.4 | -6I | 43544.9 | -64 | $4 \begin{array}{llll}4 & 35 & 5 \cdot 7\end{array}$ | . 67 | $43424 \cdot 6$ | $\cdot 70$ | 433 4r•7 | $\cdot 73$ | $\begin{array}{llll}4 & 32 & 56 \cdot 8\end{array}$ | 76 |
| 22 | 42814.0 | -63 | $42735^{\circ} \mathrm{O}$ | -67 | 42654.0 | $\cdot 70$ | $426 \mathrm{II} \cdot \mathrm{I}$ | $\cdot 73$ | $425 \quad 26 \cdot 0$ | $\cdot 77$ | $42438 \cdot 9$ | -80 |
| 24 | 420512 | -66 | 41924.5 | -69 | $4 \begin{array}{llll}4 & 4 \mathrm{r} & 8\end{array}$ | $\cdot 73$ | 4 I7 56.8 | $\cdot 77$ | 41779 | -8I | 4 16 20.0 | 85 |
| 26 | 4 II 55.9 | -69 | 41113.5 | $\cdot 73$ | 41028.8 | $\cdot 76$ | $4 \quad 941 \cdot 7$ | -80 | $4 \quad 8 \quad 52 \cdot 2$ | -85 | $\begin{array}{lll}4 & 8 & 0 \cdot 1\end{array}$ | -89 |
| 28 | 43459 | $\cdot 71$ | $4 \begin{array}{lll}4 & 3 & 1.8\end{array}$ | $\cdot 76$ | $\begin{array}{llll}4 & 2 & 15 \cdot 1\end{array}$ | -80 | $\begin{array}{rrrr}4 & 1 & 25 \cdot 8\end{array}$ | . 84 | $4 \begin{array}{rrr}4 & 0 & 33 \cdot 8\end{array}$ | -89 | $\begin{array}{llll}3 & 59 & 39 \cdot 0\end{array}$ | 94 |
| 29 | $\begin{array}{llll}3 & 59 & 40 \cdot 8\end{array}$ | $\cdot 73$ | $\begin{array}{llll}3 & 58 & 55 \cdot 6\end{array}$ | $\cdot 77$ | $\begin{array}{llll}3 & 58 & 7 \cdot 9\end{array}$ | - 82 |  | -86 | $\begin{array}{llll}3 & 56 & 24 \cdot 1\end{array}$ | '91 | $\begin{array}{llllllllllllll}3 & 55 & 28 \cdot 0\end{array}$ | -96 |
| 30 | $\begin{array}{lllll}3 & 55 & 35 \cdot 4\end{array}$ | $\cdot 74$ | 35449.4 | -79 | $\begin{array}{llll}3 & 54 & 0.5\end{array}$ | -84 | 3538 | -89 | 35214.2 | -93 | 35 I 16.6 | -99 |
| 31 | $\begin{array}{lllll}3 & 51 & 29.9\end{array}$ | $\cdot 76$ | $35042 \cdot 8$ | .8I | $34952 \cdot 9$ | -86 | $\begin{array}{lll}3 & 49 & 0.0\end{array}$ | -91 | $\begin{array}{llll}3 & 48 & 4 \cdot 0\end{array}$ | -96 | $\begin{array}{llll}3 & 47 & 4 \cdot 8\end{array}$ | I.OI |
| 32 | 34724.2 | $\cdot 78$ | $34636 \cdot 1$ | -83 | $34545 \%$ | -88 | $34450 \cdot 8$ | -93 | $\begin{array}{llll}3 & 43 & 53 \cdot 4\end{array}$ | -98 | $\begin{array}{llll}3 & 42 & 52 \cdot 7\end{array}$ | $1 \cdot 04$ |
| 33 | $\begin{array}{llll}3 & 43 & 18.4\end{array}$ | $\cdot 79$ | $342 \begin{array}{ll}3 & 29.2\end{array}$ | . 85 | $3 \begin{array}{llll}3 & 41 & 36 \cdot 8\end{array}$ | '90 | $340414^{*}$ | -95 | $33942 \cdot 5$ | I.OI | $\begin{array}{llll}3 & 38 & 40 \cdot 2\end{array}$ | 1.07 |
| 34 | $\begin{array}{lllll}3 & 39 & 12 \cdot 3\end{array}$ | -81 | $\begin{array}{llll}3 & 38 & 22 \cdot 0\end{array}$ | . 87 | $\begin{array}{llll}3 & 37 & 28 \cdot 4\end{array}$ | -92 | $33631 \cdot 5$ | $\cdot 98$ | $33531 \cdot 2$ | 1.03 | $\begin{array}{llll}3 & 34 & 27 \cdot 3\end{array}$ | -ro |
| 35 | $\begin{array}{llll}3 & 35 & 6 \cdot 0\end{array}$ | -83 | 313414.5 | -89 |  | -94 | $3 \begin{array}{llll}32 & 21.4\end{array}$ | I.00 | $\begin{array}{llll}3 & 31 & 19.5\end{array}$ | I 06 | $\begin{array}{llll}3 & 30 & 13.9\end{array}$ | I'I3 |
| 36 | $33059 \cdot 5$ | -85 | $\begin{array}{lll}3 & 30 & 6 \cdot 8\end{array}$ | -91 |  | -97 | $\begin{array}{llll}3 & 28 & 10.9\end{array}$ | 1.03 | $\begin{array}{llll}3 & 27 & 7 \cdot 4\end{array}$ | I.09 | $\begin{array}{lll}3 & 26 & 0 \cdot 0\end{array}$ | 16 |
| 37 | $3265152 \cdot 7$ | . 87 | $\begin{array}{llll}3 & 25 & 58.8\end{array}$ | -93 | $\begin{array}{lll}3 & 25 & 1 \cdot 3\end{array}$ | -99 | $\begin{array}{lll}3 & 24 & 0.0\end{array}$ | 1.05 | $\begin{array}{llll}3 & 22 & 54.8\end{array}$ | I'I2 | $32145 \cdot 6$ | 19 |
| 38 | $32245 \cdot 7$ | -89 | $32150 \cdot 6$ | '95 | 320 5r.6 | I. 02 |  | I. 08 | $3 \mathrm{I} 84 \mathrm{4} \cdot 8$ | I'I5 | $\begin{array}{llll}3 & 17 & 30 \cdot 6\end{array}$ | . 22 |
| 39 | $\begin{array}{llllllllllllllll}3 & 18 & 38 \cdot 5\end{array}$ | $\cdot 91$ | 31772.0 | -97 | $31641 \cdot 5$ | I.04 | $3 \begin{array}{llllllll} & 15 & 370\end{array}$ | I | $\begin{array}{llllll}3 & 14 & 28 \cdot 2\end{array}$ | I•I8 | $\begin{array}{llll}3 & 13 & 15 \cdot 1\end{array}$ | . 26 |
| 40 | $\begin{array}{lllll}3 & 14 & 30.9\end{array}$ | -93 | $\begin{array}{llll}3 & 13 & 33^{\circ} 0\end{array}$ | 1.00 | $3123 \mathrm{I} \cdot 0$ | I.07 | 3 II 24.8 | I.I4 | 31014.2 | I. 21 | 38859.0 | I. 29 |
| 41 | 3 Io 23.1 | -95 | $\begin{array}{llll}3 & 9 & 23.7\end{array}$ | I. 02 | $\begin{array}{llll}3 & 8 & 20 \cdot 1\end{array}$ | I-10 |  | I•I7 | $3 \begin{array}{lllll}3 & 5 & 59.5\end{array}$ | I. 25 | $\begin{array}{lll}3 & 4 & 42 \cdot 2\end{array}$ | I.33 |
| 42 | $\begin{array}{llll}3 & 6 & 14.9\end{array}$ | -98 | 3 5 14.1 | 1.05 | $\begin{array}{llll}3 & 4 & 8.8\end{array}$ | I•I3 | $\begin{array}{lllll}3 & 2 & 58.8\end{array}$ | 1.20 | 3 I 44.2 | I. 28 | $3 \quad 0 \quad 24.6$ | I. 37 |
| 43 | $\begin{array}{llll}3 & 2 & 6.4\end{array}$ | I.00 | 3 I 4\%0 | I.08 | 25956.9 | I• 16 | 22 58 45 | I. 24 | $25728 \cdot 3$ | 1.32 | $2 \begin{array}{lll}26 & 6 \cdot 3\end{array}$ | 1.41 |
| 44 | $\begin{array}{lllllllll}2 & 57 & 57 \cdot 5\end{array}$ | I.03 | $\begin{array}{lllll}2 & 56 & 53.4\end{array}$ | I•II | $25544 \cdot 5$ | I-19 | 254 30.6 | 1.27 | 25311.6 | I 36 | $25147 \cdot 2$ | . 45 |
| 45 | $25348 \cdot 2$ | I.06 | $\begin{array}{lllll}2 & 52 & 42.4\end{array}$ | I.14 | $2513 \mathrm{I} \cdot 6$ | I. 22 | 25015.6 | I•3I | 24854.2 | I. 40 | $24727 \cdot 2$ | 150 |
| 46 | $24938 \cdot 5$ | I.08 | $\begin{array}{llllllllllllll}2 & 48 & 30 \cdot 9\end{array}$ | 1.17 | $2 \begin{array}{llllll}2 & 47 & 18 \cdot 1\end{array}$ | I. 26 |  | I. 35 | $24435 \cdot 9$ | 1.45 | $\begin{array}{llll}2 & 43 & 6 \cdot 2\end{array}$ | 1.56 |
| 47 | 24528.3 | I•II |  | I. 20 | $2 \begin{array}{lll}2 & 43 & 3.9\end{array}$ | 1.30 | $24143 \cdot 3$ | I•39 | $2 \begin{array}{llll} & 40 & 16.8\end{array}$ | I*49 | $23^{8} \quad 44^{2}$ | I-60 |
| 48 | 24117.7 | I.I5 | $2 \begin{array}{lll}2 & 40 & 6 \cdot 2\end{array}$ | I. 24 | $23^{2} 849.0$ | I•34 | 237125.9 | 1.44 | $23556 \cdot 7$ | I•54 | $23421 \cdot 1$ | . 65 |
| 49 | 2376.5 | I.I9 | $2 \begin{array}{llll}25 & 52.9\end{array}$ | I. 28 | $2 \begin{array}{llllll} & 34 & 33\end{array}$ | 1.38 | $23317 \cdot 6$ | 1.48 | $23135 \cdot 5$ | I•59 | $22956 \cdot 7$ | $1 \cdot 75$ |
| 50 | $23254 \cdot 8$ | I.2I | $23138 \cdot 9$ | 1.32 | $2 \begin{array}{lllll}2 & 30 & 16 \cdot 9\end{array}$ | 1.42 | 228484 | I.53 |  | I. 64 | $22531 \cdot 0$ | 1•77 |
| 51 | 22842.4 | 1.25 | $22724 \cdot 2$ | I.36 | $\begin{array}{llllllllllll}2 & 25 & 59 \cdot 5\end{array}$ | 1.47 | $22428 \cdot 1$ | I. 58 | 2224896 | I•70 | $\begin{array}{llll}2 & 21 & 3 \cdot 8\end{array}$ | I.83 |
| 52 | 22429.3 | I-29 | $\begin{array}{lll}2 & 23 & 8 \cdot 6\end{array}$ | 1.40 | $22141 \cdot 2$ | I.52 | 2206.6 | I. 64 | $218184 \%$ | I•76 | 2 I6 $35 \cdot 0$ | I.90 |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. 7 | - A. | L. 8 | A. | L. 9 | A. | L. 10 | A | L. 11 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $-\quad 43$ | 5. -4.04 | $-\stackrel{50}{ }$ | S. | $\stackrel{\text { s. }}{ }$ | S. -4.06 | S. ${ }_{\text {- }}$ | $\begin{gathered} s \\ -4 \circ 07 \end{gathered}$ | s. | $\begin{gathered} s . \\ -4.08 \end{gathered}$ | $\stackrel{\text { S. }}{ }$ | $\begin{gathered} \text { S. } \\ -4 \cdot 10 \end{gathered}$ |
| 4 | . 46 | 4.05 | . 53 | 4.06 | -60 | 4.07 | $\cdot 67$ | 4.08 | $\cdot 75$ | 4.09 | . 82 | $4 \cdot 10$ |
| 8 | -49 | 4.05 | -56 | 4.06 | -64 | 4.07 | $\cdot 71$ | 4.08 | -78 | 4.10 | -86 | 4•II |
| Io | -5I | 4.05 | - 58 | 4.06 | -65 | 4.07 | -73 | 4.09 | -80 | 4.10 | -88 | 4.12 |
| 12 | - 53 | $4 \cdot 06$ | -60 | $4 \cdot 07$ | -67 | 4.08 | $\cdot 75$ | 4.09 | -82 | 4.II | -90 | $4 \cdot 12$ |
| I4 | -55 | 4.06 | . 62 | $4 \cdot 07$ | $\cdot 70$ | 4.08 | -77 | 4.09 | -85 | 4-II | -92 | $4 \cdot 13$ |
| 16 | - 57 | 4.06 | -64 | $4 \cdot 07$ | $\cdot 72$ | 4.08 | -79 | 4.10 | -87 | 4.II | -95 | 4.13 |
| 18 | - 59 | 4.07 | -66 | 4.08 | $\cdot 74$ | $4 \cdot 09$ | . 82 | $4 \cdot 10$ | -90 | $4 \cdot 12$ | -98 | $4 \cdot 14$ |
| 20 | -6I | 4.07 | -69 | 4.08 | $\cdot 77$ | 4.09 | -84 | $4 \cdot 11$ | -92 | $4 \cdot 13$ | $1 \cdot 01$ | $4 \cdot 15$ |
| 22 | -63 | 4.07 | $\cdot 71$ | $4 \cdot 08$ | -79 | 4.10 | -87 | 4.12 | -95 | $4 \cdot 13$ | I.04 | $4 \cdot 15$ |
| 24 | -66 | 4.08 | $\cdot 74$ | 4.09 | $\cdot 82$ | 4.10 | -90 | $4 \cdot 12$ | -99 | $4 \cdot 14$ | I.07 | 4.16 |
| 26 | -69 | 4.08 | $\cdot 77$ | 4.09 | -85 | $4 \cdot 11$ | $\cdot 93$ | $4 \cdot 13$ | I.02 | $4 \cdot 15$ | I.IO | $4 \cdot 17$ |
| 28 | $\cdot 71$ | 4.09 | -80 | $4 \cdot 10$ | -89 | $4 \cdot 12$ | -97 | $4 \cdot 14$ | I.05 | 4-16 | I. 14 | 4.18 |
| 30 | $\cdot 74$ | $4 \cdot 09$ | -83 | $4 \cdot 11$ | -92 | $4 \cdot 12$ | 1.00 | 4.14 | I.09 | $4 \cdot 17$ | I•18 | $4 \cdot 19$ |
| 32 | $\cdot 78$ | 4.10 | -86 | $4 \cdot 11$ | -95 | 4.13 | $1 \cdot 04$ | 4.15 | I•13 | 4-18 | 1.23 | $4 \cdot 20$ |
| 34 | -81 | 4.10 | $\cdot 90$ | $4 \cdot 12$ | -99 | 4.14 | I.09 | 4.17 | I-I8 | 4.19 | 1.28 | 4.22 |
| 36 | -85 | $4 \cdot 11$ | -94 | $4 \cdot 13$ | I. 04 | $4 \cdot 15$ | I-13 | 4.18 | I. 23 | $4 \cdot 21$ | 1.33 | $4 \cdot 24$ |
| 38 | -89 | $4 \cdot 12$ | -98 | $4 \cdot 14$ | 1.08 | $4 \cdot 16$ | I•18 | $4 \cdot 19$ | I. 28 | $4 \cdot 22$ | 1.39 | 4.25 |
| 40 | -93 | $4 \cdot 13$ | 1.03 | $4 \cdot 15$ | I'I3 | $4 \cdot 18$ | 1.23 | $4 \cdot 21$ | I 34 | $4 \cdot 24$ | I. 45 | $4 \cdot 27$ |
| 42 | $\cdot 98$ | 4.14 | 1.08 | $4 \cdot 16$ | I-19 | 4.19 | 1.29 | 4.22 | I 40 | $4 \cdot 26$ | I. 52 | $4 \cdot 30$ |
| 44 | 1.03 | 4.15 | I'14 | 4.18 | I. 25 | 4.21 | 1.36 | 4.25 | 1.47 | $4 \cdot 28$ | I. 59 | 4.33 |
| 46 | I•08 | $4 \cdot 17$ | I. 20 | $4 \cdot 20$ | I.31 | 4.23 | 1.43 | 4.27 | I. 55 | 4.31 | 1.68 | $4 \cdot 36$ |
| 48 | I-15 | 4.18 | I. 26 | $4 \cdot 22$ | 1.39 | $4 \cdot 26$ 4.28 | I.51 | 4.30 4.33 | I. 64 I.74 | 4.34 4.38 | 1.77 1.88 | 4.40 4.44 |
| 50 | I-2I | $4 \cdot 20$ | I. 34 | 4.24 | 1.47 1.56 | $4 \cdot 28$ | 1.60 | $4 \cdot 33$ | I•74 | $4 \cdot 38$ | 1.88 2.01 | 4.44 4.49 |
| 52 | I. 29 | $4 \cdot 22$ | I. 42 | $4 \cdot 27$ | 1.56 | $4 \cdot 31$ | 1•71 | $4 \cdot 37$ | I 85 | 4.43 | $2 \cdot 01$ | $4 \cdot 49$ |

148 HOUR-ANGLES AND VARIATIONS TO 1 ' OF LAT., DECL., AND ALT.
LATITUDE $6^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | ${ }_{5}^{\mathrm{H}}$ | S. |  |  | H. M. S. |  | H. M. S. |  | H. M. S. | s. |  |  |
| 10 | 1339.3 | . 60 | $\begin{array}{llll}5 & 54 & 26 \cdot 3 \\ 5 & 13 & 2 \cdot 5\end{array}$ | . 62 | $\begin{array}{llll}5 & 53 & 59 \\ 5 & 12 & 24 \cdot 7\end{array}$ | . 64 | [15llll | . 66 | $\begin{array}{lll}53 & 5 \cdot 5 \\ 11 & 5.6\end{array}$ | . 48 | $\begin{array}{llll}5 & 52 & 38 \cdot 1 \\ 5 & \text { IO } & 24 \cdot 3\end{array}$ | 70 |
| 12 | $\begin{array}{llll}5 & 5 & 23.0\end{array}$ | . 64 | $\begin{array}{llll}5 & 4 & 43 \cdot 9\end{array}$ | - 66 | $\begin{array}{llll}5 & 4 & 3 \cdot 7\end{array}$ | . 68 | [ $\begin{aligned} & 5 \\ & 5\end{aligned}$ | $\cdot 70$ | 239.2 | 73 | 1 $54 \cdot 9$ | 75 |
| 14 | $\begin{array}{llll}4 & 57 & 5 \cdot 9\end{array}$ | -68 | $5624 \cdot 6$ | $\cdot 70$ | $4554 \mathrm{r} \cdot 8$ | $\cdot 72$ | 45457.6 | $\cdot 75$ | 45411.8 | $\cdot 78$ |  | 80 |
| 16 | $44848 \cdot 1$ | $\cdot 72$ | $48 \quad 4.4$ | $\cdot 74$ | 44719.1 | $\cdot 77$ | $44632 \cdot 0$ | 80 | $44543 \cdot 2$ | $\cdot 83$ | $44452 \cdot 5$ | . 86 |
| 18 | 44029.6 | $\cdot 75$ | 3943.4 | $\cdot 79$ | 43855.3 | 82 | $438 \quad 5 \cdot 4$ | 85 | 3713.4 | 8 | 3619.4 | 2 |
| 20 | 432 10.1 | . 80 | $3121 \cdot 3$ | -83 | $43030 \cdot 4$ | $\cdot 87$ | $42937 \cdot 4$ | -90 | $42842 \cdot 2$ | -94 | $42744 \cdot 8$ | $\cdot 98$ |
| 22 | $42349 \cdot 7$ | . 84 | 22 58.1 | -88 | 4224.3 | 92 | $4218 \cdot 2$ | $\cdot 96$ | 4209.6 | I 00 | $4 \begin{array}{lll}49 & 8.4\end{array}$ | - 04 |
| 24 | 415 28.1 | - 88 | $41433 \cdot 8$ | -93 | $4 \begin{array}{llll}4 & 13 & 36 \cdot 9\end{array}$ | -97 | 41237.4 | I.or | II 35.2 | I 06 | 4 Io 30.2 | I•II |
| 25 | 4 II 16.9 | -91 | 4 IO 2I•I | -95 | $\begin{array}{llll}4 & 9 & 22.6\end{array}$ | 99 | $\begin{array}{llll}4 & 8 & 21.4\end{array}$ | I.04 | $4 \quad 7 \quad 17.3$ | 1.09 | $4 \quad 6 \quad 10 \cdot 4$ | . 14 |
| 26 | 4 | - 9 | 68.0 | $\cdot 98$ | $\begin{array}{lll}4 & 5 & 7.9\end{array}$ | 1.03 | $\begin{array}{lll}4 & 4 & 4 \cdot 9\end{array}$ | . 07 | 259.0 | 2 | I 50.0 | . 18 |
| 27 |  | . 96 | 4 I 54.6 | I 01 | $4 \quad 0 \quad 52 \cdot 8$ | 1.06 | $35948 \cdot 0$ | I•II | $35840 \cdot 1$ | 1.16 | 5729.0 | 21 |
| 28 | $3584 \mathrm{I} \cdot 4$ | -98 | $35740 \cdot 8$ | I.03 | 356 | 1.0 | $355030 \cdot 5$ | I•I4 | $35420 \cdot 6$ | I 19 | $353 \quad 7 \cdot 4$ | 1.25 |
| 29 | 35428.8 | -OI | $35326 \cdot 6$ | I.06 | $35221 \cdot 2$ | I•I2 | $\begin{array}{llll}3 & 51 & 12.6\end{array}$ | I•17 | 3500.6 | I 23 | $34^{8}$ 45•I | 1 |
| 30 | 35015.9 | 04 | 34912.0 | 09 | $\begin{array}{llll}3 & 48 & 47\end{array}$ | I.15 | $34654 \cdot 1$ | 1.21 | 34539.9 | 1.27 | $34422 \cdot \mathrm{I}$ | I•33 |
| 31 | $346 \quad 2.5$ |  | $34456 \cdot 8$ | I•12 | 34347.7 | 8 | $34^{\prime \prime} 35 \cdot 0$ | 124 | 34118.6 | I.30 | $33958 \cdot 4$ | 1.37 |
| 32 | 341888.7 | I•10 | $34041 \cdot 2$ | I•15 | $\begin{array}{lllllll}3 & 39 & 30 \cdot 1\end{array}$ | 1.22 | 3 38815.3 | I 28 | 33656 | I. 34 | 335 34* | 1.41 |
| 33 | $\begin{array}{llll}3 & 37 & 34 \cdot 5\end{array}$ | I•13 | $36 \quad 25 \cdot 1$ | 19 | $\begin{array}{llllll}3 & 35 & 11 & 9\end{array}$ | 1.25 | $\begin{array}{lllll}3 & 33 & 54.9\end{array}$ | I. 32 | $\begin{array}{lllll}3 & 32 & 33.9\end{array}$ | I 39 | 3 31 8.6 | $1 \cdot 46$ |
| 34 |  | I• 16 | $\begin{array}{llll}3 & 32 & 8 \cdot 4\end{array}$ | 22 | 3 30 $53 \cdot 1$ <br>  26 $33 \cdot 7$ | I 29 | $\begin{array}{llll}3 & 29 & 33 \cdot 8 \\ 3 & 25 & \end{array}$ | I.36 | $\begin{array}{lll}3 & 28 & 10 \cdot 3\end{array}$ | 1443 | $\begin{array}{llll}3 & 26 & 42 \cdot 4\end{array}$ | I 50 |
| 35 | $\begin{array}{llll}3 & 29 & 4.5\end{array}$ | 19 | $32751 \cdot 1$ | 26 | $\begin{array}{llll}3 & 26 & 33 \cdot 7\end{array}$ | 33 | $32512 \cdot 0$ | I 40 | $32345 \cdot 9$ | $1 \cdot 47$ | $3 \quad 2215 \cdot 3$ | . 55 |
| 36 | $\begin{array}{llll}3 & 2448 \cdot 6\end{array}$ | 1.22 | $2333 \cdot 2$ | 29 | 32213.5 | 37 | 32049 | 1.44 | 31920.6 | 52 | 17 47.1 | 60 |
| 37 | $\begin{array}{ll}3 & 20 \\ 32 \cdot 2\end{array}$ | 26 | 31914.6 | I 33 | $\begin{array}{lllllllllll}3 & 17 & 52.5\end{array}$ | 1.45 | $\begin{array}{llll}3 & 16 & 25 \cdot 8\end{array}$ | $1 \cdot 48$ | 3 <br> 14 | I. 57 | $313 \begin{array}{ll}17 & 8\end{array}$ | . 65 |
| 38 | $\begin{array}{lllllllllll}3 & 16 & 15.2\end{array}$ | 129 | $31455 \cdot 3$ | $1 \cdot 37$ | $\begin{array}{llllllllll}3 & 13 & 30 \cdot 8\end{array}$ | $1 \cdot 45$ | $\begin{array}{llll}3 & 12 & 1.4\end{array}$ | I.53 | 3 10 27.1 | $1 \cdot 62$ | $3847 \cdot 4$ | 1.75 |
| 39 | 3 II 57.5 | I. 33 | $31035 \cdot 3$ | I.41 | 3 498 | I-49 | $736 \cdot 0$ |  | $\begin{array}{llll}3 & 5 & 58 \cdot 7\end{array}$ | 1.67 | $\begin{array}{lllll}3 & 4 & 15.8\end{array}$ | I.76 |
| 40 | $\begin{array}{lll}3 & 7 & 39 \cdot 1\end{array}$ | $1 \cdot 37$ | $\begin{array}{llll}3 & 614.4\end{array}$ | 1.45 | $\begin{array}{llll}3 & 4 & 44 \cdot 6\end{array}$ | I•54 | $\begin{array}{llll}3 & 3 & 9.6\end{array}$ | 3 | $3 \begin{array}{lll}3 & 1 & 29.0\end{array}$ | r 72 | $25942 \cdot 7$ | I. 82 |
| 41 | $\begin{array}{llll}3 & 3 & 20.0\end{array}$ | 1.41 | 3 I $152 \cdot 6$ | I. 50 | $\begin{array}{lll}3 & 0 & 20 \cdot 1\end{array}$ | . 59 | $\begin{array}{llll}2 & 58 \\ 2 & 42 \cdot 0\end{array}$ | \% 68 | $25658 \cdot \mathrm{I}$ | I•78 | $2 \begin{array}{lll}25 & 8 \cdot 3\end{array}$ | . 88 |
| 42 | $\begin{array}{llll}2 & 59 & 0.0\end{array}$ | 1.45 | $25730 \cdot 0$ | I. 56 | 25554.5 | I. 64 | 25413.2 | r.74 | 25225.9 | 1.84 | $25032 \cdot 2$ | I•95 |
| 43 | 254 39•1 | 1 5 | $2536 \cdot 3$ | 9 | 25127.7 | +69 | $24943 \cdot 1$ | 1.80 | $24752 \cdot \mathrm{I}$ | 1.90 | $24554 \cdot 5$ |  |
| 44 | $\begin{array}{llllll}2 & 50 & 17.2 \\ 2 & 45 & 54.4\end{array}$ | $\underline{1} 55$ | $24841 \cdot 5$ | 1.65 |  | I.75 | $\begin{array}{lllll}2 & 45 & 11 \\ 2\end{array}$ | r.86 |  | I.97 | 24114.9 | 2.09 |
| 45 | 24554.4 | I. 60 | $24415 \cdot 5$ | I.70 | $24230 \cdot 3$ | I. 8 | $24038 \cdot 4$ | I.92 | 23839.5 | 2.04 | $2 \begin{array}{llll} & 36 & 33\end{array}$ | $2 \cdot 17$ |
| 46 | $\begin{array}{lllll}2 & 41 & 30 \cdot 4\end{array}$ | 1.65 | $23948 \cdot 3$ | 1.76 | 23759.5 | 87 | $\begin{array}{llll}2 & 36 & 3.6\end{array}$ | 1.99 | 2340.4 | . 12 | 23 I 49.4 | 2.25 |
| 47 | $\begin{array}{lllllllllllllllll}2 & 37 & 5.2\end{array}$ | I•70 | $\begin{array}{llll}2 & 35 & 19.6\end{array}$ | . 82 | 23327.0 | 194 | $\begin{array}{lllll}2 & 31 & 27.0\end{array}$ | 2.06 | $\begin{array}{llll}2 & 29 & 19.2\end{array}$ | 2.20 | $2 \begin{array}{lll}27 & 3.2\end{array}$ | 2.34 |
| 48 | $\begin{array}{llll}2 & 32 & 388\end{array}$ | r 76 | 23049.5 | I.88 | $\begin{array}{llllll}2 & 28 & 52.8\end{array}$ | 2.01 | $\begin{array}{lllll}2 & 26 & 48 \cdot 3\end{array}$ | 2.14 | $22435 \cdot 7$ | $2 \cdot 28$ |  | 2.44 |
| 49 | $\begin{array}{llll}2 & 28 & 10.8\end{array}$ |  |  | 95 | $22416 \cdot 7$ | 2.08 | $\begin{array}{lll}2 & 22 & 7 \cdot 5\end{array}$ | $2 \cdot 23$ | 21949.6 | $2 \cdot 38$ | 21722.3 | $2 \cdot 54$ |
| 50 | 22341 |  | 22144.0 | 2.02 | 21938.4 | $2 \cdot 16$ | 217124.2 | $2 \cdot 31$ | 2150.6 | $2 \cdot 48$ | 21227.2 | 2.65 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. | S. | S. | s. | S. | s. | S. | S. | s. | S. | S. | s. |
| 0 | -. 86 | $-4 \cdot 11$ | - 93 | $-4 \cdot 13$ | - I.OI | $-4 \cdot 15$ | $\rightarrow$ I.08 | $-4 \cdot 17$ | -I•I6 | $-4 \cdot 18$ | -I. 24 | $-4.21$ |
| 4 | -89 | $4 \cdot 12$ | -97 | 4.14 | I. 04 | $4 \cdot 15$ | 1-12 | $4 \cdot 17$ | I 20 | $4 \cdot 20$ | 1.27 | $4 \cdot 22$ |
| 6 | '91 | $4 \cdot 12$ | -99 | 4.14 | I.06 | 4.16 | 1-14 | 4.18 | I. 22 | $4 \cdot 20$ | 1-30 | $4 \cdot 23$ |
| 8 | -93 | $4 \cdot 13$ | I-OI | 4-15 | I.08 | 4.17 | 1.16 | 4.19 | I 24 | 4.21 | 1.31 | $4 \cdot 23$ |
| 10 | -95 | 4.13 | 1.03 | 4.15 | I•II | $4 \cdot 17$ | I.19 | $4 \cdot 19$ | I. 26 | $4 \cdot 22$ | I.34 | $4 \cdot 24$ |
| 12 | -98 | $4 \cdot 14$ | I.05 | 4.16 | I•I3 | 4•18 | I•2I | 4.20 | I•29 | $4 \cdot 22$ | 1.37 | $4 \cdot 25$ |
| 14 | 1.00 | $4 \cdot 14$ | 1.08 | $4 \cdot 16$ | I.16 | 4-19 | I. 24 | $4 \cdot 21$ | 1.32 | $4 \cdot 23$ | 1.40 | $4 \cdot 26$ |
| 16 | I.03 | $4 \cdot 15$ | I'II | $4 \cdot 17$ | I•I9 | 4•19 | $1 \cdot 27$ | $4 \cdot 22$ | 1.35 | $4 \cdot 24$ | 1.43 | $4 \cdot 27$ |
| 18 | 1.06 | 4.16 | I'I4 | $4 \cdot 18$ | I 22 | $4 \cdot 20$ | 1.30 | $4 \cdot 23$ | I. $3^{8}$ | $4 \cdot 25$ | 1.47 | $4 \cdot 28$ |
| 20 | I.09 | $4 \cdot 17$ | 1.17 | $4 \cdot 19$ | I. 25 | $4 \cdot 21$ | I 34 | $4 \cdot 24$ | 1.42 | $4 \cdot 27$ | I.5I | $4 \cdot 30$ |
| 22 | I-12 | $4 \cdot 18$ | I•20 | 4.20 | I.29 | $4 \cdot 22$ | 1.37 | $4 \cdot 25$ | 1.46 | $4 \cdot 28$ | I. 55 | $4 \cdot 31$ |
| 24 | I•15 | $4 \cdot 18$ | I 24 | $4 \cdot 21$ | I 33 | $4 \cdot 23$ | 1.41 | $4 \cdot 26$ | I. 50 | $4 \cdot 30$ | 1.60 | $4 \cdot 33$ |
| 26 | I'I9 | $4 \cdot 19$ | I-28 | $4 \cdot 22$ | I.37 | $4 \cdot 25$ | 1.46 | $4 \cdot 28$ | I. 55 | $4 \cdot 31$ | I. 64 | $4 \cdot 34$ |
| 28 | I 23 | 4.21 | I 32 | $4 \cdot 23$ | 1.41 | $4 \cdot 26$ | 1.51 | $4 \cdot 29$ | I. 60 | $4 \cdot 33$ | I• 70 | $4 \cdot 37$ |
| 30 | 1.27 | $4 \cdot 22$ | I. 37 | $4 \cdot 25$ | I. 46 | $4 \cdot 28$ | 1.56 | $4 \cdot 31$ | 1.66 | $4 \cdot 35$ | 1.76 | $4 \cdot 39$ |
| 32 | 1.32 | 4.23 | I. 42 | $4 \cdot 26$ | I. 52 | $4 \cdot 30$ | I. 62 | $4 \cdot 33$ | 1.72 | $4 \cdot 37$ | 1. 82 | $4 \cdot 41$ |
| 34 | 1.37 | $4 \cdot 25$ | I 47 | $4 \cdot 28$ | I•57 | $4 \cdot 32$ | I 68 | $4 \cdot 36$ | 1.78 | $4 \cdot 40$ | 1.89 | 4.44 |
| 36 | I.43 | $4 \cdot 27$ | 1. 53 | $4 \cdot 30$ | I 64 | $4 \cdot 34$ | 1.75 | $4 \cdot 38$ | I. 86 | $4 \cdot 43$ | 1.97 | $4 \cdot 48$ |
| 38 | I. 49 | $4 \cdot 29$ | I. 60 | $4 \cdot 33$ | I•7 | $4 \cdot 37$ | 1.82 | 4.41 | 1.94 | $4 \cdot 46$ | $2 \cdot 06$ | $4 \cdot 52$ |
| 40 | I.56 | $4 \cdot 3 \mathrm{I}$ | I. 67 | $4 \cdot 36$ | I• 79 | $4 \cdot 40$ | 1.91 | $4 \cdot 45$ | 2.03 | 4.50 | $2 \cdot 15$ | $4 \cdot 56$ |
| 42 | I. 63 | $4 \cdot 34$ | 1.75 | $4 \cdot 39$ | I. 87 | 4.44 | $2 \cdot 00$ | 4.49 | $2 \cdot 13$ | $4 \cdot 55$ | $2 \cdot 26$ | 4.61 |
| 44 | I.71 | $4 \cdot 37$ | I. 84 | 4.42 | 1.97 | $4 \cdot 48$ | $2 \cdot 10$ | $4 \cdot 54$ | $2 \cdot 24$ | 4.60 | $2 \cdot 39$ | $4 \cdot 68$ |
| 46 | I•8I | $4 \cdot 41$ | 1.94 | 4.47 | $2 \cdot 08$ | 4.53 | $2 \cdot 22$ | 4.59 | $2 \cdot 37$ | 4.67 | 2.53 | $4 \cdot 75$ |
| 48 | 1.91 | 4.45 | 2.05 | 4.52 | $2 \cdot 20$ | 4.59 | $2 \cdot 36$ | 4.66 | $2 \cdot 52$ | 4.75 | 2.69 | 4.84 |
| 50 | 2.03 | $4 \cdot 50$ | 2.18 | $4 \cdot 58$ | $2 \cdot 34$ | $4 \cdot 66$ | $2 \cdot 52$ | 4.74 | $2 \cdot 60$ | 4.84 | $2 \cdot 78$ | 4.95 |

## LATITUDE $6^{\circ}$.

DECLINATION-CONTRARY NAME TO—LATITUDE.


DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. M. S. | S. | H. M. S. | s. | H. M. S | S. | H. M. S. | S. | H. M. | S. | H. M. S. | S. |
| 0 |  | -49 | $\begin{array}{llll}5 & 59 & 30 \cdot 6 \\ 5 & 5\end{array}$ | -49 | $\begin{array}{llll}5 & 59 & \text { I.0 }\end{array}$ | -49 | $\begin{array}{lllll}5 & 58 & 31 & 5\end{array}$ | - $\cdot 49$ | 5 58 $2 \cdot 0$ <br> 5 17  | -49 | $\begin{array}{llll}5 & 57 & 32 \cdot 3\end{array}$ | . 50 |
|  | $5 \begin{array}{lll}5 & 19 & 41 \cdot 8\end{array}$ | - 50 | 5 L I9 11.5 | -51 | $5 \begin{array}{llll}5 & 18 & 40 \cdot 4\end{array}$ | - 52 | 5 I 888.5 | - 54 | $51735 \cdot 8$ | - 55 | 5 I7 $2 \cdot 3$ | - 57 |
| 12 | 5 II 38.0 | -50 | 5 II $7 \cdot 4$ | -52 | $51036 \cdot 0$ | . 53 | $\begin{array}{llll}5 & 10 & 3.4\end{array}$ | -55 | $\begin{array}{llll}5 & 9 & 30 \cdot 0\end{array}$ | $\cdot 57$ | $\begin{array}{llll}5 & 8 & 55 \cdot 5\end{array}$ | - 58 |
| 14 | $5{ }_{5}^{5} 3$ | -51 | $\begin{array}{llll}5 & 3 & 3 \cdot 3\end{array}$ | -52 | $\begin{array}{lllll}5 & 2 & 31 \cdot 3\end{array}$ | -54 | 5 I $58 \cdot 2$ | -56 | $\begin{array}{llll}5 & 1 & 23.9\end{array}$ | - 58 | $5 \quad 0 \quad 48 \cdot 5$ | . 60 |
| I6 | $45530 \cdot 4$ | $\cdot 51$ | $454 \quad 59 \cdot \mathrm{I}$ | -53 | $45426 \cdot 5$ | -55 | $\begin{array}{lllllllllll}4 & 53 & 52 \cdot 7\end{array}$ | -57 | $45317 \cdot 6$ | -60 | $45241 \cdot 1$ | - 62 |
| 18 | $44726 \cdot 5$ | -52 | 44654.7 | - 54 | 44621.6 | . 56 | $44547 \cdot 0$ | -59 | 445 II•O | -6I | $44433 \cdot 4$ | . 64 |
| 20 | 43922.4 | -52 | $438 \quad 50 \cdot 2$ | - 55 | $43816 \cdot 4$ | -58 | $43741 \cdot 1$ | -60 | 43740 | -63 | $43625 \cdot 3$ | . 66 |
| 22 | $43^{41}$ 18.3 | -53 | $43045 \cdot 5$ | -56 | 430 II•I | -59 | $42934 \cdot 8$ | -62 | $42856 \cdot 8$ | -65 | 42816.8 | -68 |
| 24 | 42314.0 | -54 | $42240 \cdot 7$ | $\cdot 57$ | $\begin{array}{llll}4 & 22 & 5 \cdot 5\end{array}$ | -60 | $42128 \cdot 3$ | -64 | $42049 \cdot 1$ | -67 | 42079 | $\cdot 70$ |
| 26 | $4 \begin{array}{lll}4 & 15 & 9.6\end{array}$ | $\cdot 55$ | $41435 \%$ | $\cdot 58$ | 41359.7 | - 62 | 41321.5 | . 66 | 4 I2 4I•O | - 69 | 4 II 58.4 | $\cdot 73$ |
| 28 | $\begin{array}{llll}4 & 7 & 5 \cdot 0\end{array}$ | - 56 | $4 \begin{array}{lll}4 & 6 & 30 \cdot 4\end{array}$ | -60 | $4 \quad 5 \quad 53.5$ | . 63 | $4 \quad 5114.2$ | -67 | $\begin{array}{llll}4 & 4 & 32 \cdot 5\end{array}$ | -71 | $\begin{array}{llll}4 & 3 & 48 \cdot 4\end{array}$ | -76 |
| 30 | $359 \quad 0.3$ | . 57 | $\begin{array}{llllllllll}3 & 58 & 24.9\end{array}$ | -6I | $35747 \cdot 0$ | - 65 | $\begin{array}{llll}3 & 57 & 6.6\end{array}$ | -70 | $\begin{array}{llll}3 & 56 & 23.5\end{array}$ | $\cdot 74$ | $35517 \cdot 8$ | $\cdot 78$ |
| 32 | 35055.4 | -58 | 35019.2 | -63 | $34940 \cdot 2$ | -67 | $\begin{array}{lllll}3 & 48 & 58\end{array}$ | $\cdot 72$ | $\begin{array}{llllllll}3 & 48 & 13.9\end{array}$ | -7ク | $34726 \cdot 5$ | .81 |
| 33 | $34652 \cdot 8$ | - 59 | $\begin{array}{llll}3 & 46 & 16 \cdot 2\end{array}$ | - 63 | $345 \quad 36 \cdot 6$ | -68 | $\begin{array}{llllllllll}3 & 44 & 54.3\end{array}$ | -73 | $\begin{array}{lll}3 & 44 & 8 \cdot 9\end{array}$ | $\cdot 78$ | $34320 \cdot 6$ | -83 |
| 34 | $34250 \cdot 2$ | -59 | $34213 \cdot 1$ | -64 | 34133.0 | -69 | 34049.9 | $\cdot 74$ | $\begin{array}{llll}3 & 40 & 3\end{array}$ | $\cdot 79$ | $3 \quad 3914.5$ | -85 |
| 35 | $\begin{array}{lllllllllll}3 & 38 & 47 \cdot 5\end{array}$ | - 60 | $\begin{array}{lll}3 & 38 & 9.9\end{array}$ | - 65 | 33729.2 | $\cdot 70$ | $\begin{array}{llll}3 & 36454\end{array}$ | $\cdot 76$ | $\begin{array}{llll}3 & 35 & 58 \cdot 3\end{array}$ | -81 | $\begin{array}{lll}3 & 35 & 8 \cdot 1\end{array}$ | . 86 |
| 36 | $33444 \cdot 8$ | . 61 | $\begin{array}{llll}3 & 34 & 6 \cdot 7\end{array}$ | -66 | $\begin{array}{llll}3 & 33 & 25 \cdot 3\end{array}$ | $\cdot 72$ | $33240 \% 7$ | $\cdot 77$ | $\begin{array}{llll}3 & 31 & 52 \cdot 8\end{array}$ | . 83 | $\begin{array}{llll}3 & 31 & 1 \cdot 6\end{array}$ | -88 |
| 37 | $33042 \cdot 0$ | -62 | 330303 | -67 | $32921 \cdot 3$ | -73 | $\begin{array}{lllll}3 & 28 & 35 \cdot 9\end{array}$ | $\cdot 78$ | $\begin{array}{lllll}3 & 27 & 47 \cdot 1\end{array}$ | - 84 | $\begin{array}{llll}3 & 26 & 54 \cdot 8\end{array}$ | -90 |
| 38 | $\begin{array}{llll}3 & 26 & 39 \cdot 1\end{array}$ | . 63 | $\begin{array}{llll}3 & 25 & 59 \cdot 8\end{array}$ | . 68 | $\begin{array}{lllll}3 & 25 & 17 \cdot 1 \\ 3 & 21 & 12\end{array}$ | $\cdot 74$ | $\begin{array}{llll}3 & 24 & 30 \cdot 9\end{array}$ | $\cdot 80$ | $\begin{array}{llll}3 & 23 & 4 \mathrm{I} \cdot 1 \\ 3 & 1\end{array}$ | -86 | $\begin{array}{llll}3 & 22 & 47 \cdot 7\end{array}$ | -92 |
| 39 | $32236 \cdot 1$ | -63 | $32156 \cdot 3$ | -69 | 32112.8 | $\cdot 75$ | $32025 \cdot 8$ | -8I | $31935 \%$ | - 88 |  | -94 |
| 40 | $3 \mathrm{I} 8333 \cdot 1$ | - 64 | $\begin{array}{llll}3 & 17 & 52.6\end{array}$ | $\cdot 71$ | 3 17 8.4 <br>    <br> 15   | $\cdot 77$ | $\begin{array}{llll}3 & 16 & 20 \cdot 4\end{array}$ | .83 | $\begin{array}{llll}3 & 15 & 28 \cdot 6\end{array}$ | -90 | $\begin{array}{llll}3 & 14 & 32.8\end{array}$ | -96 |
| 41 | $3 \mathrm{I} 430 \cdot 0$ | -65 | $\begin{array}{lllllllllllll}3 & 13 & 48.8\end{array}$ | $\cdot 72$ | $\begin{array}{llll}3 & 13 & 3 \cdot 8\end{array}$ | $\cdot 78$ | 31214.8 | -85 | 3 II 2I.9 | -92 | $31024 \cdot 8$ | -98 |
| 42 | $31026 \cdot 7$ | -66 | $\begin{array}{llll}3 & 9 & 44.8\end{array}$ | -73 | $\begin{array}{llll}3 & 8 & 59 \cdot 0\end{array}$ | -80 | $\begin{array}{lll}3 & 8 & 9 \cdot 1\end{array}$ | -87 | 3 7 $715 \cdot 0$ | -94 | $\begin{array}{llll}3 & 6 & 16 \cdot 7\end{array}$ | $1 \cdot \mathrm{OI}$ |
| 43 | $\begin{array}{llll}3 & 6 & 23 \cdot 4\end{array}$ | -68 |  | -74 | $3 \begin{array}{lllll}3 & 4 & 54 & 0\end{array}$ | -8I | $\begin{array}{llll}3 & 4 & 3 \cdot 1\end{array}$ | -89 | $\begin{array}{llll}3 & 3 & 7 \cdot 8\end{array}$ | -96 | $\begin{array}{llll}3 & 2 & 8 \cdot 1\end{array}$ | 1.03 |
| 44 | $\begin{array}{llll}3 & 2 & 19.9\end{array}$ | -69 | 3 I $36 \cdot 5$ | $\cdot 76$ | $3 \begin{array}{llll}3 & 0 & 48 \cdot 9\end{array}$ | -83 | $25956 \cdot 8$ | -91 | $\begin{array}{lll}2 & 59 & 0.3\end{array}$ | -98 | 25759.2 | I. 06 |
| 45 | $2 \begin{array}{lll} & 58 & 16 \cdot 3\end{array}$ | $\cdot 70$ | $25732 \cdot 1$ | $\cdot 77$ | $2 \quad 5643 \cdot 5$ | . 85 | $255150 \cdot 3$ | -93 | $25452 \cdot 5$ | I.00 | 25349.9 | I. 08 |
| 46 | 25412.6 | $\cdot 71$ | $25327 \cdot 5$ | -ク9 | $2 \begin{array}{llll}2 & 52 & 37 \cdot 9\end{array}$ | . 87 | $25143 \cdot 5$ | $\cdot 95$ | 25044.3 | 1.03 | 249 40•1 | I•II |
| 47 | 2508.8 | -73 | $24922 \cdot 8$ | -81 | $24^{2} 313 \cdot 1$ | -89 | $2 \begin{array}{lllll}2 & 47 & 36.4\end{array}$ | -97 | $24635 \cdot 7$ | I. 05 | $\begin{array}{lllll}2 & 45 & 29.9\end{array}$ | I 14 |
| 48 | 2464.8 | $\cdot 74$ | $2 \begin{array}{llllllll} & 45\end{array}$ | - 82 | $24425 \cdot 9$ |  | 24329.0 | -99 | $2 \begin{array}{llll}2 & 42 & 26.8\end{array}$ | I.08 | 24119.2 | I•17 |
| 49 | 2420.6 | $\cdot 76$ | 24112.7 | - 84 | 24019.6 | -93 | $23921 \cdot 2$ | 1.02 | $2 \begin{array}{lllll} & 38 & 17 \cdot 4\end{array}$ | I-II | 23780 | I 20 |
| 50 | $23756 \cdot 3$ | $\cdot 77$ | $\begin{array}{lll}2 & 37 & 7 \cdot 3\end{array}$ | -86 | $\begin{array}{llll}2 & 36 & 12.9\end{array}$ | -95 | 23513.0 | I.04 | 234375 | I•I4 | $23256 \cdot 2$ | I•24 |
| 51 | $23351 \cdot 7$ | $\cdot 79$ | 2331.6 | -88 | $2 \begin{array}{lll}22 & 5 \cdot 9\end{array}$ | - - 98 | 2314.5 | 1.07 | $22957 \cdot 1$ | 1-17 | 22843.8 | 1.27 |
| 52 | $22947 \cdot 0$ | . 81 | $22855 \cdot 6$ |  | 22758.5 | 1.00 |  | I•IO | $22546 \cdot 2$ | 1.20 | $22430 \cdot 8$ | $1 \cdot 31$ |
| 53 | $22542 \cdot 0$ | -83 | 22449.4 |  | $22350 \cdot 8$ | I.03 | $22245 \cdot 9$ | I.I3 | $22134 \%$ | 1.24 | 22016.9 | I 35 |
| 54 | $22136 \cdot 8$ | . 85 | $22042 \cdot 9$ | -95 | 2 I9 42.6 | I $\cdot 06$ | $2 \begin{array}{lllll}2 & 18 & 35\end{array}$ | I.17 | 21722.5 | I.28 | 2 I6 $2 \cdot 2$ | I 40 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{\circ}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | s. -4.03 | s. | S. | s. | s. | s. | s. | s. | s. | s. | s. |
| 4 | .03 | 4.03 | --11 | -4.03 4.03 | - 114 | -4.03 4.03 | $\begin{array}{r}-.21 \\ \hline .25\end{array}$ | 4.03 4.04 | .28 .32 | 4.04 4.04 | $\cdot 36$ $\cdot 39$ | 4.04 4.05 |
| 8 | -07 | 4.03 | -14 | $4 \cdot 03$ | - 21 | 4.04 | $\cdot 28$ | 4.04 | $\cdot 36$ | 4.05 | $\cdot 43$ | 4.05 |
| 12 | -10 | 4.03 | -18 | $4 \cdot 03$ | -25 | 4.04 | $\cdot 32$ | 4.04 | $\cdot 40$ | 4.05 | -47 | $4 \cdot 06$ |
| 14 | -12 | 4.03 | -20 | 4.03 | -27 | 4.04 | $\cdot 34$ | 4.04 | $\cdot 42$ | 4.05 | -49 | 4.06 |
| 16 | - 14 | 4.03 | -22 | 4.04 | -29 | 4.04 | $\cdot 36$ | 4.05 | $\cdot 44$ | $4 \cdot 05$ | -51 | 4.06 |
| 18 | -16 | $4 \cdot 03$ | $\cdot 24$ | $4 \cdot 04$ | $\cdot 31$ | 4.04 | $\cdot 39$ | $4 \cdot 05$ | $\cdot 46$ | 4.06 | $\cdot 54$ | 4.07 |
| 20 | -18 | 4.03 | - 26 | 4.04 | $\cdot 33$ | 4.04 | -41 | 4.05 | $\cdot 48$ | 4.06 | $\cdot 56$ | 4.07 |
| 22 | $\cdot 20$ | 4.03 | $\cdot 28$ | 4.04 | $\cdot 35$ | 4.05 | $\cdot 43$ | 4.05 | . 51 | 4.06 | -59 | 4.07 |
| 24 | -22 | 4.04 | $\cdot 30$ | 4.04 | $\cdot 38$ | $4 \cdot 05$ | -46 | 4.06 | $\cdot 53$ | 4.07 | .6I | 4.08 |
| 26 | $\cdot 24$ | 4.04 | -32 | 4.04 | -40 | 4.05 | $\cdot 48$ | 4.06 | $\cdot 56$ | 4.07 | . 64 | 4.08 |
| 28 | $\cdot 26$ | 4.04 | $\cdot 34$ | 4.04 | $\cdot 43$ | 4.05 | . 51 | 4.06 | - 59 | 4.07 | $\cdot 67$ | 4.08 |
| 30 | -28 | 4.04 | $\cdot 37$ | 4.05 | -45 | 4.06 | - 54 | 4.06 | . 62 | 4.08 | $\cdot 70$ | 4.09 |
| 32 | $\cdot 31$ | 4.04 | -39 | 4.05 | -48 | 4.06 | . 56 | 4.07 | -65 | 4.08 | $\cdot 74$ | $4 \cdot 10$ |
| 34 | -33 | 4.04 | -42 | 4.05 | -51 | $4 \cdot 06$ | . 60 | 4.07 | . 69 | 4.09 | $\cdot 77$ | $4 \cdot 10$ |
| 36 | $\cdot 36$ | 4.04 | 45 | 4.05 | $\cdot 54$ | 4.07 | . 63 | $4 \cdot 08$ | $\cdot 72$ | 4.09 | .81 | $4 \cdot 11$ |
| 38 | -39 | $4 \cdot 05$ | $\cdot 48$ | 4.06 | $\cdot 57$ | 4.07 | . 66 | $4 \cdot 08$ | $\cdot 76$ | $4 \cdot 10$ | . 85 | $4 \cdot 12$ |
| 40 | $\cdot 42$ | 4.05 | $\cdot 51$ | 4.06 | . 61 | 4.07 | . 70 | 4.09 | . 80 | $4 \cdot 11$ | .90 | 4.13 |
| 42 | -45 | 4.05 | $\cdot 55$ | 4.07 | . 64 | 4.08 | $\cdot 74$ | $4 \cdot 10$ | . 84 | $4 \cdot 12$ | -95 | 4.14 |
| 44 | 48 | 4.06 | -58 | 4.07 | . 68 | 4.09 | -79 | 4.11 | . 89 | $4 \cdot 13$ | 1.00 | 4.15 |
| 46 | $\cdot 52$ | 4.06 | . 62 | 4.08 | -73 | 4.09 | . 84 | $4 \cdot 12$ | -94 | 4.14 | 1.06 | $4 \cdot 17$ |
| 48 | $\cdot 56$ | 4.07 | . 66 | 4.08 | $\cdot 78$ | $4 \cdot 10$ | . 89 | 4.13 | $1 \cdot 00$ | $4 \cdot 15$ | I-12 | $4 \cdot 18$ |
| 50 | -60 | 4.07 | $\cdot 71$ | 4.09 | . 83 | $4 \cdot 11$ | . 95 | $4 \cdot 14$ | 1.07 | $4 \cdot 17$ | I•19 | $4 \cdot 20$ |
| 52 | . 64 | 4.08 | .76 | $4 \cdot 10$ | . 88 | $4 \cdot 13$ | 1.01 | $4 \cdot 15$ | $1 \cdot 14$ | $4 \cdot 19$ | 1.27 | 4.22 |
| 54 | -69 | 4.09 | . 82 | $4 \cdot 11$ | -95 | 4.14 | 1.08 | 4.17 | I 21 | 4.21 | $1 \cdot 36$ | $4 \cdot 24$ |

# HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 151 

LATITUDE $7^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{lll} \text { H. M. } & \text { S. } \\ 5 & 57 & 2 \cdot 5 \end{array}$ | S. 50 | $\left\lvert\, \begin{array}{ccc} \text { H. m. } & \text { s. } \\ 5 & 56 & 32 \cdot 7 \end{array}\right.$ | s. $\cdot 50$ | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 5 & 56 \\ 2.7 \end{array}$ | - 5.5 | $\begin{array}{lccc}\text { H. M. } & \text { S. } \\ 5 & 55 & 32 \cdot 5\end{array}$ | S. | $\begin{array}{lll}\text { H. M. } & \text { S. } \\ 5 & 55 & 2 \cdot 3\end{array}$ | S. 51 | $\begin{array}{lcc}\text { H. M. } & \text { S. } \\ 5 & 54 & 3 \mathrm{I} \cdot 8\end{array}$ | S. 51 |
| 10 | $\begin{array}{llll}5 & 16 & 27.9\end{array}$ | . 58 | $\begin{array}{llllllllllllll}5 & 15 & 52 \cdot 5\end{array}$ | . 60 | $\begin{array}{llll}5 & 15 & 16 \cdot 3\end{array}$ | . 61 | $\begin{array}{llll}5 & 14 & 39 \cdot 1\end{array}$ | . 63 | $\begin{array}{lll}5 & 14 & 0.9\end{array}$ | . 64 | $\begin{array}{llll}5 & 13 & 21 \cdot 7\end{array}$ | . 66 |
| 12 | $\begin{array}{llll}5 & 8 & 20 \cdot 0\end{array}$ | -60 | $\begin{array}{llll}5 & 7 & 43.5\end{array}$ | . 62 | $\begin{array}{lll}5 & 7 & 5.8\end{array}$ | -64 | $\begin{array}{llll}5 & 6 & 27 \cdot 1\end{array}$ | . 66 | $\begin{array}{llll}5 & 5 & 47 \cdot 1\end{array}$ | -68 | $\begin{array}{lll}5 & 5 & 6 \cdot 0\end{array}$ | -69 |
| 14 | 5 O II.8 | . 62 | 45934.0 | . 64 | $4 \begin{array}{llll}4 & 58 & 54 \cdot 9\end{array}$ | -66 | 45814.5 | -68 | 45732.7 | -71 | $45649 \cdot 6$ | $\cdot 73$ |
| 16 | 4523.3 | -64 | $45124 \cdot 1$ | -67 | $4 \quad 50 \quad 43 \cdot 4$ | -69 | $450 \quad 1 \cdot 3$ | $\cdot 71$ | 449 17.6 | -74 | $44832 \cdot 4$ | $\cdot 77$ |
| 18 | $443 \quad 54 \cdot 3$ | -66 | $\begin{array}{llll}4 & 43 & 13 \cdot 7\end{array}$ | -69 | $44231 \cdot 4$ | $\cdot 72$ | $44147 \times 5$ | $\cdot 75$ | 44 I I.8 | - 78 | 44014.4 | -80 |
| 20 | $43544 \cdot 9$ | -68 | $435 \quad 2 \cdot 7$ | -72 | $434 \begin{array}{llll}4 & 18 \cdot 8\end{array}$ | $\cdot 75$ | $43333 \cdot 0$ | $\cdot 78$ | $\begin{array}{llll}4 & 32 & 45 \cdot 2\end{array}$ | -81 | 43155.5 | $\cdot 84$ |
| 22 | $42735 \cdot 0$ | $\cdot 71$ | $4 \begin{array}{llll}4 & 26 & 5 \mathrm{I} \cdot 2\end{array}$ | $\cdot 75$ | $\begin{array}{lll}4 & 26 & 5.4\end{array}$ | $\cdot 78$ | $\begin{array}{lllllll}4 & 25 & 17 \cdot 6\end{array}$ | -81 | $4 \begin{array}{llll}4 & 24 & 27 \cdot 8\end{array}$ | - 85 | $42335 \cdot 7$ | -89 |
| 24 | 4 I9 24.5 | $\cdot 74$ | $4 \mathrm{l}^{18} 39 \cdot \mathrm{I}$ | $\cdot 78$ | 4 I7 51.4 | -8I | 417 I.5 | -85 | $\begin{array}{llll}4 & 16 & 9 \cdot 3\end{array}$ | -89 | 415154 | -93 |
| 26 | 4 II 13.5 | $\cdot 77$ | 4 10 $26 \cdot 2$ | -81 | $4 \quad 9 \quad 36 \cdot 6$ | -85 | $4844 \cdot 4$ | -89 | $4 \quad 7 \quad 49 \cdot 8$ | -93 | $4 \quad 6 \quad 52 \cdot 5$ | -98 |
| 28 | $\begin{array}{llll}4 & 3 & \text { I.8 }\end{array}$ | -80 | $\begin{array}{llll}4 & 2 & 12.6\end{array}$ | - 84 | $\begin{array}{llll}4 & 1 & 20 \cdot 8\end{array}$ | -89 | $4 \quad 0 \quad 26 \cdot 3$ | -93 | 33 59 29 <br> 1   | -98 | $\begin{array}{llll}3 & 58 & 29 \cdot 0\end{array}$ | I. 02 |
| 29 | $\begin{array}{llll}3 & 58 & 55 \cdot 6\end{array}$ | -81 | $\begin{array}{llll}3 & 58 & 5 \cdot 5\end{array}$ | - 86 | 35712.6 | -91 | $3{ }_{3} 5616 \cdot 8$ | '95 | $\begin{array}{lllll}3 & 55 & 18 \cdot 3\end{array}$ | 1.00 | $35416 \%$ | I.05 |
| 30 | 35449.4 | . 83 | $\begin{array}{llll}3 & 53 & 58 \cdot 1\end{array}$ | - 88 | $35314 \cdot 1$ | $\cdot 92$ | $\begin{array}{llll}3 & 52 & 7 \cdot 1\end{array}$ | -97 | $3 \begin{array}{lll}3 & 51 & 7 \cdot 1\end{array}$ | 1.02 | $3504 \cdot 1$ | I.08 |
| 31 | $35042 \cdot 8$ | . 85 | $\begin{array}{lllllllllllll}3 & 49 & 50 \cdot 6\end{array}$ | -90 | $\begin{array}{llll}3 & 48 & 55 \cdot 3\end{array}$ | -95 | $\begin{array}{llllllllll}3 & 47 & 57\end{array}$ | I.00 | $\begin{array}{llll}3 & 46 & 55 \cdot 6\end{array}$ | 1.05 | $34^{3} 455 \mathrm{I} \cdot 0$ | I•IO |
| 32 | $34636 \cdot 1$ | -86 | $\begin{array}{llll}3 & 45 & 42 \cdot 7\end{array}$ | -92 | 344 46.2 | -97 | $34346 \cdot 6$ | I.02 | $\left\lvert\, \begin{array}{llll}3 & 42 & 43.7\end{array}\right.$ | r.08 | 3 4I 37.4 | I•13 |
| 33 | $\begin{array}{llll}3 & 42 & 29.2\end{array}$ | - 88 | $34134 \cdot 6$ | -94 | $340 \begin{array}{llll}36 \cdot 9\end{array}$ | -99 | $33935 \cdot 8$ | I.05 | $\begin{array}{llll}3 & 38 & 31.4\end{array}$ | I•IO | 33723.4 | I•I6 |
| 34 | $\begin{array}{llll}3 & 38 & 22 \cdot 0\end{array}$ | -90 | $\begin{array}{llll}3 & 37 & 26 \cdot 2\end{array}$ | -96 | $\begin{array}{lllllllllllllllllll}3 & 36 & 27 \cdot 2\end{array}$ | I.OI | 3 35 $24 * 7$ | I.07 | $\begin{array}{llll}3 & 34 & 18 \cdot 6\end{array}$ | I•13 | $\begin{array}{llll}3 & 33 & 8 \cdot 9\end{array}$ | I•19 |
| 35 | $\begin{array}{llll}3 & 34 & 14.5\end{array}$ | $\cdot 92$ | 3 $33317 \cdot 6$ | $\cdot 98$ | $3 \begin{array}{ll}32 & 17 \cdot 1\end{array}$ | I.03 | $33113 \cdot 1$ | I-10 | $\begin{array}{llll}3 & 30 & 5.4\end{array}$ | I.16 | $\begin{array}{llll}3 & 28 & 53 \cdot 9\end{array}$ | I-22 |
| 36 | $\begin{array}{llll}3 & 30 & 6.8 \\ 3 & 25 & 588\end{array}$ | -94 | $\begin{array}{lll}3 & 29 & 8 \cdot 6\end{array}$ | I.00 | $\begin{array}{llll}3 & 28 & 6 \cdot 7\end{array}$ | I. 06 | $\begin{array}{llll}3 & 27 & 1 \cdot I\end{array}$ | I•12 | $\begin{array}{lllll}3 & 25 & 5 I \cdot 7\end{array}$ | I•IO | $\begin{array}{lllll}3 & 24 & 38 \cdot 3\end{array}$ | I-26 |
| 37 | $325 \begin{array}{llll}3 & 58\end{array}$ | -96 | $3 \quad 24 \quad 59 \cdot 3$ | I. 02 | $32356 \cdot 0$ | I.09 | $\begin{array}{llll}3 & 22 & 48 \cdot 7\end{array}$ | I•15 | 3 21 $37 \cdot 5$ | I. 22 | $3 \quad 20 \quad 22 \cdot 2$ | I.29 |
| 38 | 32150.6 | . 98 | $32049 \cdot 6$ | I'05 | 3 I9 44.7 | I•II | $3 \begin{array}{llll}3 & 18 & 35.8\end{array}$ | I-18 | $\begin{array}{llll}3 & 17 & 22.8\end{array}$ | I. 25 | $\begin{array}{lll}3 & 16 & 5.4\end{array}$ | I.33 |
| 39 | 3 I7 $42 \cdot 0$ | 1.01 | 3 I6 $39 \cdot 6$ | I. 07 | 315 | I-14 | 31422.4 | I. 21 | $3 \begin{array}{lll}3 & 13 & 7 \cdot 4\end{array}$ | I. 29 | 3 II $48 \cdot 0$ | I•36 |
| 40 | 3 I3 $33 \cdot 0$ | 1.03 | 31229.1 | I'10 | 3 II 2I.0 | I•17 | 3 IO $8 \cdot 5$ | I. 25 | $\begin{array}{llll}3 & 8 & 51 \cdot 5\end{array}$ | I. 32 | $\begin{array}{llll}3 & 7 & 29.8\end{array}$ | I.40 |
| 41 | $\begin{array}{llll}3 & 9 & 23 \cdot 7 \\ 3 & 5 & \end{array}$ | I.05 | $\begin{array}{lll}3 & 8 & 18.3\end{array}$ | I.13 | $\begin{array}{llr}3 & 7 & 8.4 \\ 3 & 2 & 5.4\end{array}$ | I. 20 | $\begin{array}{llll}3 & 5 & 54 \cdot 0 \\ 3 & 5 & 38.8\end{array}$ | I. 28 | $\begin{array}{llll}3 & 4 & 34 \cdot 9 \\ 3 & 0 & 17.5\end{array}$ | I.36 | 3 3 $10 \cdot 8$  <br> 2 5 5 51.1 | I. 44 |
| 42 | 35154.1 | r.08 | $\begin{array}{llll}3 & 4 & 6 \cdot 9\end{array}$ | I•I6 | $\begin{array}{llll}3 & 2 & 55 & 3\end{array}$ | I-23 | $\begin{array}{llll}3 & \text { I } & 38 \cdot 8\end{array}$ | 1-3I | $3 \quad 0 \begin{array}{lll} \\ 3 & 17.5\end{array}$ | 1.40 | $25851 \cdot I$ | I-48 |
| 43 | 3 I 4.0 | I.II | $2 \begin{array}{llll}2 & 59 & 55 \cdot 1\end{array}$ | I.19 | $25^{2} 584 \mathrm{4} \cdot 5$ | I. 27 | 25723.0 | I*35 | 25559.4 | 1.44 | $25430 \cdot 5$ | I. 53 |
| 44 |  | I-14 | $25542 \cdot 8$ | I. 22 | $25427 \cdot 2$ | I. 30 | $25316 \cdot 5$ | I.39 | $25140 \cdot 5$ | I. 48 | 25080 | I. 57 |
| 45 | $\begin{array}{lllll}2 & 52 & 42 \cdot 4 \\ 2 & 48 & 30 .\end{array}$ | 1.17 | $2 \mathrm{5I} 29.9$ | I. 25 | 25012.3 | I. 34 | $2{ }^{2} 4849 \cdot 2$ | 1.43 | $24720 \cdot 6$ | I. 52 | $\begin{array}{llll}2 & 45 & 46 \cdot 2\end{array}$ | I. 62 |
| 46 | $\begin{array}{llll}2 & 48 & 30 \cdot 9 \\ 2 & 44 & 18.8\end{array}$ | I.20 | $\begin{array}{rrrr}2 & 47 & 16.4 \\ 2 & 43 & 2.3\end{array}$ | I. 28 | $245156 \cdot 6$ | I•38 | 244 3I•I | 1.47 | $\begin{array}{llllll}2 & 42 & 59 \cdot 9\end{array}$ | 1.57 | $\begin{array}{llll}2 & 41 & 22 \cdot 5\end{array}$ | I. 68 |
| 47 | $24418 \cdot 8$ | I. 23 | $243 \quad 2 \cdot 3$ | I. 32 | $24140 \cdot 1$ | I. 42 | 240 I2.I | 1.52 | $23^{28} \quad 38 \cdot 0$ | 1.62 | $2 \begin{array}{lllll}2 & 36 & 57 \cdot 6\end{array}$ | I•73 |
| 48 | $\begin{array}{llll}2 & 40 & 6 \cdot 2\end{array}$ | I. 26 | $2 \begin{array}{llll}2 & 38 & 47.4\end{array}$ | I. 36 | 23722.8 | I.46 | $23552 \cdot \mathrm{I}$ | I. 56 | $2 \begin{array}{llll}24 & 15 \cdot I\end{array}$ | 1.67 | $23231 \cdot 3$ | I•79 |
| 49 | $\begin{array}{llll}2 & 35 & 52.9\end{array}$ | 1.30 | $2 \begin{array}{llll}24 & 31.9\end{array}$ | I. 40 | 2 33 $4 \cdot 7$ | I. 51 | $23131 \cdot 1$ | 1.62 | $2 \begin{array}{llll}2 & 29 & 50 \cdot 8\end{array}$ | I.73 | $\begin{array}{llll}2 & 28 & 3.6\end{array}$ | I. 85 |
| 50 | $\begin{array}{llll}2 & 31 & 38 \cdot 9\end{array}$ | I. 34 | 230150.4 | I. 44 |  | I. 55 | 22786 | 1.67 | $2 \begin{array}{lllllllll}25 & 25.3\end{array}$ | 1.79 |  | I.91 |
| 5 I | $\begin{array}{llll}2 & 27 & 24.2 \\ 2 & 23 & 8.6\end{array}$ | I•38 | $\begin{array}{lllll}2 & 25 & 58 \cdot 1 \\ 2 & 21 & \end{array}$ | I. 49 | $\begin{array}{llll}2 & 24 & 25 \cdot 3\end{array}$ | I. 60 | $2 \begin{array}{llll}2 & 22 & 45 \cdot 5\end{array}$ | 1.72 | $2 \begin{array}{llllll}20 & 58 \cdot 3\end{array}$ | I.85 | 2 19 3.5 | r.98 |
| 52 | $\begin{array}{llll}2 & 23 & 8 \cdot 6\end{array}$ | 1.42 | $22139 \cdot 8$ | I. 54 | 22030 | I. 66 |  | I•78 | $2 \begin{array}{llll}2 & 16 & 29.8\end{array}$ | I.92 | $21430 \cdot 6$ | 2.06 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ}$ A. |  | L. $9^{\circ}$ A. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | S. | S. | S. | $\stackrel{\text { S. }}{-.57}$ | S. | S. | S. | S. | s. | S. | S. |
| 0 | -43 -46 | -4.05 4.06 | -.50 .54 | -4.06 4.06 | -.57 .61 | -4.07 4.08 | -.64 .68 | -4.08 4.09 | - $\cdot 72$ | -4.09 4.10 | $-\quad .79$ .83 | $\begin{array}{r} -4 \cdot 10 \\ 4 \cdot 1 I \end{array}$ |
| 8 | . 50 | $4 \cdot 06$ | . 58 | 4.07 | -65 | 4.08 | $\cdot 72$ | 4.09 | -80 | $4 \cdot 11$ | . 87 | $4 \cdot 12$ |
| 10 | . 52 | $4 \cdot 06$ | - 60 | 4.07 | -67 | 4.08 | $\cdot 74$ | $4 \cdot 10$ | . 82 | 4.1I | -89 | 4.13 |
| 12 | . 54 | $4 \cdot 07$ | - 62 | $4 \cdot 08$ | -69 | 4.09 | $\cdot 77$ | $4 \cdot 10$ | -84 | $4 \cdot 12$ | -92 | 4-13 |
| 14 | $\cdot 57$ | 4.07 | -64 | 4.08 | $\cdot 72$ | 4.09 | $\cdot 79$ | 4.11 | -87 | $4 \cdot 12$ | -95 | $4 \cdot 14$ |
| 16 | - 59 | 4.07 | - 67 | 4.08 | $\cdot 74$ | $4 \cdot 10$ | -82 | $4 \cdot 11$ | -90 | $4 \cdot 13$ | $\cdot 98$ | $4 \cdot 15$ |
| 18 | -61 | 4.08 | -69 | 4.09 | -77 | $4 \cdot 10$ | -85 | 4.12 | -93 | 4•13 | I-OI | $4 \cdot 15$ |
| 20 | -64 | 4.08 | $\cdot 72$ | 4.09 | -80 | 4•II | -88 | 4•12 | -96 | 4.14 | I.04 | 4.16 |
| 22 | -67 | $4 \cdot 08$ | $\cdot 75$ | $4 \cdot 10$ | -83 | 4.II | -91 | 4.13 | -99 | $4 \cdot 15$ | 1.07 | 4.17 |
| 24 | . 69 | $4 \cdot 09$ | $\cdot 78$ | 4.10 | -86 | 4•12 | -94 | 4.14 | I.02 | 4•16 | I•II | 4.18 |
| 26 | -73 | 4.09 | -81 | 4.11 | -89 | $4 \cdot 13$ | -97 | 4.15 | I.06 | 4.17 | I•15 | $4 \cdot 19$ |
| 28 | $\cdot 76$ | 4.10 | -84 | 4.12 | -93 | $4 \cdot 14$ | I 01 | 4.16 | 1.10 | 4.18 | I-19 | $4 \cdot 20$ |
| 30 | -79 | 4.1I | -88 | $4 \cdot 12$ | $\cdot 96$ | $4 \cdot 14$ | I. 05 | 4-16 | I'I4 | $4 \cdot 19$ | I.23 | $4 \cdot 2 \mathrm{I}$ |
| 32 | . 83 | 4.II | $\cdot 92$ | $4 \cdot 13$ | I 0 I | 4.15 | I. 10 | $4 \cdot 18$ | I.19 | $4 \cdot 20$ | I. 28 | $4 \cdot 23$ |
| 34 | . 87 | 4.12 | -96 | 4.14 | 1.05 | $4 \cdot 16$ | I.I4 | 4.19 | I. 24 | $4 \cdot 22$ | I•34 | $4 \cdot 25$ |
| 36 | -91 | 4.13 | I.00 | $4 \cdot 15$ | I'IO | $4 \cdot 18$ | I'19 | $4 \cdot 20$ | I-29 | 4.23 | I.39 | $4 \cdot 26$ |
| 38 | -95 | 4.14 | I. 05 | 4.16 | I. 15 | $4 \cdot 19$ | I 25 | $4 \cdot 22$ | I. 35 | $4 \cdot 25$ | I.46 | $4 \cdot 28$ |
| 40 | 1.00 | 4.15 | I'IO | 4.18 | I. 20 | 4.21 | I-3I | $4 \cdot 24$ | 1.42 | $4 \cdot 27$ | I 53 | $4 \cdot 31$ |
| 42 | I.05 | 4.16 | I•16 | 4.19 | I-26 | $4 \cdot 22$ | I.37 | 4.26 | I 49 | $4 \cdot 30$ | I. 60 | $4 \cdot 34$ |
| 44 | IPI | 4.18 | I. 22 | $4 \cdot 21$ | I.33 | $4 \cdot 24$ | I.45 | $4 \cdot 28$ | 1.56 | $4 \cdot 32$ | 1.69 | $4 \cdot 37$ |
| 46 | I'I7 | $4 \cdot 20$ | I-29 | $4 \cdot 23$ | 1.40 | $4 \cdot 27$ | I•53 | $4 \cdot 31$ | I. 65 | $4 \cdot 35$ | I.78 | $4 \cdot 40$ |
| 48 | I. 24 | $4 \cdot 22$ | I.36 | $4 \cdot 25$ | I-49 | $4 \cdot 29$ | I.6I | $4 \cdot 34$ | 1.75 | $4 \cdot 39$ | I.89 | 4.45 |
| 50 | I. 32 | $4 \cdot 24$ | I. 44 | $4 \cdot 28$ | I.58 | $4 \cdot 33$ | I•72 | $4 \cdot 38$ | I.86 | 4.44 | 2.01 | $4 \cdot 50$ |
| 52 | 1.40 | $4 \cdot 27$ | I. 54 | 4.31 | I. 68 | $4 \cdot 37$ | I. 83 | 4.43 | I.98 | 4.49 | $2 \cdot 14$ | $4 \cdot 56$ |

## 152 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT.

## LATITUDE $7^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| $\begin{aligned} & \text { True } \\ & \text { Alt. } \end{aligned}$ | $12^{\circ}$ | $\begin{array}{\|l\|} \hline \text { Dect. } \\ \text { Var. } \end{array}$ | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $17^{\circ}$ | Pecl. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{8}^{\circ}$ | ( 520 58.6 | . 51 | $\begin{array}{llll}5 & 53 & 30 \cdot 2 \\ 5 & 20 & 19.4 \\ 5 & \end{array}$ | . 52 |  | . 52 |  | . 53 |  | . 53 | $\begin{array}{lllll}5 & 51 & 23.7 \\ 5 & \text { Y7 } & 330\end{array}$ | 4 |
| Io | 5 512415 | . 68 | 5 I 20.1 | 70 | $5 \begin{array}{lll}511 & 17.7\end{array}$ | 72 | 5 10 3 | $\checkmark 74$ |  |  | 59 <br> 5 | -78 |
| 12 | $\begin{array}{ll}5 & 4 \\ 2 & 23.7\end{array}$ | 72 | 5340.0 | 74 |  | 76 | $\begin{array}{llll}5 & 2 & 8.8\end{array}$ | $\cdot 78$ | 5 I 21.0 | I | 5083 -8 | 83 |
| 14 | 456 <br> 65 | 75 | $4{ }^{5} 55^{19} 9$ |  | 454 3r.6 |  | $45342 \cdot 5$ | . 83 | $4{ }^{52} 51$-8 |  | 45 5 59.4 |  |
| 16 | 447457 | $\cdot 79$ | 44657.2 | -82 | 44670 | 85 | $4{ }^{4} 45{ }^{150}$ | -88 | $44421 \cdot 2$ | I | 44325.6 |  |
| 18 | 4 $43925 \cdot 3$ | . 88 | 43834.2 | . 87 | ${ }_{4}^{4} 3741 \cdot 3$ | 90 | ${ }^{4} 3646 \cdot 3$ | 93 | $43549 \cdot 3$ | $\bigcirc 9$ |  |  |
| 22 |  | $\begin{array}{r} .88 \\ .92 \end{array}$ |  | . 96 | 4 29 T4.3 <br> 4 20 45.9 | 95 |  |  | (4 <br> 4 <br> 4 <br> 4 <br> 18 | $\xrightarrow{1} \mathrm{I} .03$ | 426 | 7 |
| 22 24 |  | -92 |  | 1.01 | ${ }_{4}^{4} \mathrm{I} 285 \cdot \mathrm{I}$ | r.06 | ${ }^{4}$ | 1.04 | (4 18 $40 \cdot 7$ <br> 4 10 3.6 | r. 1.15 1 | 4 <br> 4 <br> 4 <br> 4 | 13 |
| 25 | 4 10 $5 \cdot 4$ |  |  |  | 4880.5 |  | $4 \quad 63.9$ |  | 45 |  |  |  |
| 26 | $4 \quad 5 \quad 52 \cdot 6$ |  | + |  | $4{ }^{4} 34$ |  | $4{ }^{2}$ |  | 4 4 I 24.5 |  | 4 |  |
| 27 28 |  | I. 0 |  | -1.10 | 3 59  <br> 3 59 28.0 <br> 150   | I. 15 | [35817 |  |  |  | 3 55 |  |
| 29 | ${ }^{3} 5531212.2$ |  | 3524.4 |  | $35053 \cdot 5$ | 21 | $34939 \cdot 1$ | $1 \cdot 27$ | 3 $482 \mathrm{zr} \cdot 2$ | r.33 | 34659 | 39 |
| 30 | 48 |  | 347 | . 19 | 346 | 24 | 34518 | I. 30 | 343 |  | $34234 \cdot 9$ | I. 43 |
| 31 32 3 |  |  | $\begin{array}{lllll}3 & 43 & 31 \cdot 6 \\ 3 & 39 & 14 \cdot 6\end{array}$ |  | 3 42 $16 \cdot 7$ <br> 3 37 $57 \cdot 4$ |  |  | 1.38 |  |  |  |  |
| 33 |  | $\xrightarrow{1.19}$ | 3 3 39 14.4 |  |  | $1 \cdot 32$ |  | I. 38 | $\begin{array}{llll}3 & 35 & 11 \cdot 7 \\ 3 & 30 & 46 \cdot 9\end{array}$ | $1 \cdot 4$ | $\begin{array}{llll}3 & 33 & 42 \cdot 7 \\ 3 & 29 & 15 \\ 3 & 4 & 2\end{array}$ |  |
| 34 | ${ }^{3} 315155 \cdot 5$ |  | 330 | I. 32 | 329 | I. 39 | 3 $32751 \cdot 2$ | r. 46 | $32621 \cdot 2$ | . 54 | $\begin{array}{lllll}3 & 24 & 46.7\end{array}$ |  |
| 35 | $\begin{array}{llll}3 & 27 & 38.5\end{array}$ | 1.29 | ${ }_{3} 261900$ | $1 \cdot 36$ | $32455 \cdot 3$ | 143 | 32327.3 | 5 51 | $32154 \cdot 6$ | 58 | 32017 | ז. 66 |
| 36 | I9 | I. 33 | $\begin{array}{lllll}3 & 21 & 59.2 \\ 3\end{array}$ | I.40 | 3 $2033 \cdot 1$ | r.4. |  | . 60 | 3 $\begin{array}{llll}3 & 17 & 27.0 \\ 3 & 12 & 58\end{array}$ | 1.63 | 315 |  |
| 37 38 |  | 1.36 | $\begin{array}{llll}3 & 17 & 38 \cdot 6 \\ 3 & 13 & 17 \cdot 2\end{array}$ | I. |  | I. r |  | I. 65 |  | 1.74 |  |  |
| 39 |  | I | [3 | I 52 | 3721.0 |  | $\begin{array}{lllll}3 & 5 & 4 \mathrm{I} \cdot 8\end{array}$ | 1.70 | $\begin{array}{llll}3 & 3 & 57 \cdot 2\end{array}$ | $1 \cdot 79$ | 26.8 | r. 89 |
| 40 |  | $1 \cdot 48$ | ${ }^{3}$ |  | $3{ }^{3}$ | r 1.66 | 3 3112.6 | $\begin{array}{r}1.75 \\ \text { I. } \\ \text { 1 } \\ \hline\end{array}$ | 259 | 5 | 2573 |  |
| 4 | 3 1 <br> 2 5 |  | $3{ }^{3}$ | ri.62 |  | r 1.71 | $\begin{array}{ll}2 & 56 \\ 2 & 52 \\ 5 & 12 \cdot 2 \\ 10.4\end{array}$ | 1.81 1.87 1 |  | r.91 | $2{ }_{2}^{2} 58$ |  |
| 43 | ${ }_{2} 5256.0$ | 1.62 | 251  <br> 15 8 | 172 | 24929.6 | I. 82 | $24737 \cdot 1$ | 1-93 | 24537.9 | 2.04 | 243 3r.7 | $2 \cdot 1$ |
| 44 | 24831.5 | 1.67 | 246 | 1.78 | $24458 \cdot 4$ | ${ }_{1} .88$ | 243 2.1 | 2.00 | 24058.8 | $2 \cdot 12$ | 23848.1 |  |
|  |  |  | 242 | 1. 83 | $\begin{array}{lllll}2 & 40 & 25.7\end{array}$ | $1 \cdot 95$ | $\begin{array}{ll}2 & 3825.4\end{array}$ | 2.07 | $2 \begin{aligned} & 2617.6\end{aligned}$ | 19 | 234 | 2.33 |
| 46 | (1) $\begin{array}{llll}2 & 39 & 38.8 \\ 2 & 35 & 10.8\end{array}$ | 1.78 | 23748 23316 |  |  |  |  | 2.14 | 23134.4 22648.6 | 2.27 2.36 | 22913 | $2 \cdot 42$ |
| $4{ }_{4}^{47}$ | $\|$2 35 $10 \cdot 5$ <br> 2 30 $40 \cdot 6$ |  | 22812 | 2.0 |  | $2 \cdot 1$ |  | 2.2 | 22648.6 |  | 24 | 2.62 |
| 49 | $\|$  <br> 26 $9 \cdot 1$ | I.9 | 224 |  | $12 \begin{aligned} & 2156.4\end{aligned}$ |  | $21937 \cdot 2$ | $2 \cdot 40$ |  | 2.56 | 2 I 430 |  |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $1^{17^{\circ}}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | S. | s. | S. | s. | s. | S. | S. | s. | s. |
| 0 | - . 86 | -4.12 | - 94 | -4.14 | - I.OI | $-4 \cdot 15$ | -I.09 | $-4 \cdot 17$ | - I'I6 | -4.19 | - I. 24 | $-4.21$ |
| 4 | -90 | 4.13 | -98 | $4 \cdot 15$ | I. 05 | 4.16 | I'I3 | 4•19 | I. 21 | $4 \cdot 21$ | I. 29 | $4 \cdot 23$ |
| 6 | -92 | 4.13 | 1.00 | $4 \cdot 15$ | I.08 | 4.17 | I-15 | 4.19 | I 23 | $4 \cdot 21$ | I•3I | $4 \cdot 24$ |
| 8 | -95 | $4 \cdot 14$ | 1.02 | $4 \cdot 16$ | I•IO | 4•18 | I-18 | $4 \cdot 20$ | I. 26 | $4 \cdot 22$ | I•34 | $4 \cdot 25$ |
| Io | -97 | $4 \cdot 14$ | I. 05 | $4 \cdot 16$ | I.I3 | 4-18 | I. 20 | $4 \cdot 21$ | I. 28 | $4 \cdot 23$ | I. 36 | $4 \cdot 25$ |
| 12 | 1.00 | $4 \cdot 15$ | 1.08 | $4 \cdot 17$ | I-15 | $4 \cdot 19$ | I 23 | $4 \cdot 21$ | I.31 | $4 \cdot 24$ | I. 40 | $4 \cdot 26$ |
| 14 | 1.03 | 4.16 | I-10 | 4.18 | I•18 | $4 \cdot 20$ | I 26 | $4 \cdot 22$ | 1.35 | 4.25 | 1.43 | $4 \cdot 28$ |
| 16 | I.06 | 4.17 | I. 13 | 4.19 | I. 22 | 4.21 | I 30 | $4 \cdot 23$ | 1.38 | $4 \cdot 26$ | I. 46 | $4 \cdot 29$ |
| 18 | I.09 | $4 \cdot 17$ | I•17 | $4 \cdot 20$ | I 25 | $4 \cdot 22$ | I•33 | $4 \cdot 24$ | 1.42 | 4.27 | I 50 | $4 \cdot 30$ |
| 20 | I-12 | $4 \cdot 18$ | I-20 | $4 \cdot 2 \mathrm{I}$ | I. 29 | $4 \cdot 23$ | I.37 | $4 \cdot 26$ | 1.46 | $4 \cdot 29$ | I. 55 | 4.32 |
| 22 | I. 16 | 4.19 | 1. 24 | 4.22 | I. 33 | $4 \cdot 24$ | I.41 | $4 \cdot 27$ | 1.50 | 4.30 | I.59 | 4.33 |
| 24 | I.19 | $4 \cdot 20$ | I. 28 | $4 \cdot 23$ | 1.37 | $4 \cdot 25$ | I.46 | $4 \cdot 29$ | 1.55 | $4 \cdot 32$ | I. 64 | $4 \cdot 35$ |
| 26 | $1 \cdot 23$ | 4.21 | I 32 | $4 \cdot 24$ | I 41 | $4 \cdot 27$ | I. 51 | $4 \cdot 30$ | 1.60 | $4 \cdot 34$ | 1.70 | $4 \cdot 37$ |
| 28 | 1-28 | $4 \cdot 23$ | r 37 | $4 \cdot 26$ | I-46 | $4 \cdot 29$ | I. 56 | $4 \cdot 32$ | I. 65 | $4 \cdot 36$ | - 1.75 | $4 \cdot 39$ |
| 30 | 1.33 | $4 \cdot 24$ | I-42 | 4.27 | I. 52 | 4.31 | I. 62 | $4 \cdot 34$ | 1.71 | $4 \cdot 38$ | I. 82 | $4 \cdot 42$ |
| 32 | 1.38 | 4.26 | I. 48 | 4.29 | I. 58 | $4 \cdot 33$ | I. 68 | $4 \cdot 36$ | I. 78 | 4.41 | 1.89 | 4.45 |
| 34 | 1.44 | $4 \cdot 28$ | I 54 | 4.31 | I. 64 | $4 \cdot 35$ | I.74 | $4 \cdot 39$ | 1.85 | 4.44 | 1.96 | $4 \cdot 48$ |
| 36 | I 50 | $4 \cdot 30$ | 1.60 | 4.34 | 1.71 | 4.38 | I. 82 | 4.42 | 1-93 | 4.47 | $2 \cdot 05$ | $4 \cdot 52$ |
| 38 | I. 56 | $4 \cdot 32$ | I. 67 | $4 \cdot 36$ | I•79 | $4 \cdot 4 \mathrm{I}$ | 1.90 | $4 \cdot 46$ | $2 \cdot 02$ | 4.51 | $2 \cdot 14$ | $4 \cdot 57$ |
| 40 | I. 64 | $4 \cdot 35$ | I•75 | $4 \cdot 39$ | 1.87 | $4 \cdot 44$ | 1.99 | $4 \cdot 50$ | $2 \cdot 12$ | $4 \cdot 55$ | $2 \cdot 25$ | 4.62 |
| 42 | 1.72 | $4 \cdot 38$ | I. 84 | 4.43 | I.97 | 4.48 | 2.10 | 4.54 | $2 \cdot 23$ | 4.61 | $2 \cdot 37$ | 4.68 |
| 44 | I.81 | 4.42 | I. 94 | 4.47 | $2 \cdot 07$ | $4 \cdot 53$ | 2.21 | 4.60 | $2 \cdot 36$ | 4.67 | $2 \cdot 51$ | $4 \cdot 75$ |
| 46 | I.91 | $4 \cdot 46$ | 2.05 | 4.52 | $2 \cdot 19$ | $4 \cdot 59$ | $2 \cdot 34$ | $4 \cdot 66$ | $2 \cdot 50$ | $4 \cdot 74$ | $2 \cdot 66$ | $4 \cdot 83$ |
| 48 | 2.03 | $4 \cdot 51$ | 2.18 | 4.58 | $2 \cdot 33$ | $4 \cdot 66$ | 2.49 | $4 \cdot 74$ | $2 \cdot 66$ | 4.83 | $2 \cdot 85$ | 4.93 |
| 49 | 2.09 | 4.54 | $2 \cdot 25$ | 4.61 | $2 \cdot 4 \mathrm{I}$ | $4 \cdot 69$ | $2 \cdot 58$ | $4 \cdot 78$ | 2.75 | $4 \cdot 88$ | $2 \cdot 95$ | 4.99 |

## HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT. 153

 Latitude $7^{\circ}$.DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Deci. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - |  |  |  |  | H. M. S. |  | S. |  |  |  | м. |  |
| $\bigcirc$ | $\begin{array}{lllll}5 & 50 & 51 \cdot 3 \\ 5 & 25 & 20 \cdot 8\end{array}$ | . 59 | $\begin{array}{llll}5 & 50 & 18.5 \\ 5 & 24 & 38.6\end{array}$ | . 75 |  | . 75 | ${ }_{5}^{5} 489 \mathrm{Ir} \cdot 6$ | .55 |  | 75 | $\begin{array}{rrrr}5 & 48 & 3.0 \\ 5 & 21 & 39.3\end{array}$ |  |
| 8 | $\begin{array}{lllll}5 & 16 & 48 \cdot 7\end{array}$ | $\cdot 75$ | $\begin{array}{lllll}5 & 16 & 3.3\end{array}$ | -77 | $\begin{array}{llllll}5 & 15 & 16.6\end{array}$ | -79 |  | .81 | $\begin{array}{lllll}5 & 13 & 39 \cdot 3\end{array}$ | . 83 |  | 86 |
| 10 | $5 \quad 815.5$ | - 80 | $\begin{array}{llll}5 & 7 & 26 \cdot 7\end{array}$ | . 83 | $5 \begin{array}{lll}5 & 6 & 36 \cdot 4\end{array}$ | -85 | $\begin{array}{llll}5 & 5 & 44 \cdot 6\end{array}$ | -88 | $\begin{array}{llllllllll}5 & 4 & 51\end{array}$ | -90 | $\begin{array}{llll}5 & 3 & 56.4\end{array}$ | 3 |
| 12 | $4594 \mathrm{I} \cdot \mathrm{r}$ | - 86 | $4 \begin{array}{llll}48 & 48\end{array}$ | -89 | $45754 \cdot 8$ | -91 | $45659 \cdot 0$ | '94 | $\begin{array}{lll}4 & 56 & 1.5\end{array}$ | $\cdot 97$ | $455 \quad 2 \cdot \mathrm{I}$ | 1 |
| 14 | $\begin{array}{llll}4 & 51 & 5.2\end{array}$ | 92 | 450 | -95 | 449 II• 4 | -98 | $44^{4} 8 \mathrm{Ir} \cdot 6$ | 1.01 | $\begin{array}{llll}4 & 47 & 9.8\end{array}$ | 1.05 | $4 \begin{array}{lll}4 & 46 & 5 \cdot 8\end{array}$ | 9 |
| 16 | 44227.9 | $\cdot 98$ | 44128.2 | 1.01 | $44026 \cdot 3$ | 1.05 | 43922.3 | 1.09 | $438 \quad 159$ | $1 \cdot 1$ | $437 \quad 7 \cdot 1$ | $1 \cdot 17$ |
| 18 | 43348.9 | . 04 | $43245 \cdot 2$ | 1.08 | 43139.2 | $1 \cdot 12$ | $43030 \cdot 7$ | I•16 | $4 \begin{aligned} & 49 \\ & 19.6\end{aligned}$ | I.2I | 4285.8 | 1.25 |
| 20 | 4258.0 | I•II | 4 24 0.2 <br> 4   | 15 | 4 22 <br> 4 $49 \cdot 8$ | 1.20 | $\begin{array}{llll}4 & 21 & 36 \cdot 6\end{array}$ | I. 24 | $4 \begin{array}{llll}4 & 20 & 20 \cdot 6\end{array}$ | 1.29 | $\begin{array}{llll}4 & 19 & 1 \\ 4 & 14 & 28\end{array}$ | 34 |
| 21 | $42046 \cdot 7$ | I. 14 | $4 \begin{array}{lll}49 & 36.9\end{array}$ | I-19 | $418 \quad 24.2$ | 1.24 | $4 \begin{array}{lll}47 & 8 \cdot 6\end{array}$ |  | $41550 \cdot 0$ | 4 | $4 \begin{array}{llll}4 & 28.2\end{array}$ | 1.30 |
| 22 | 41625.0 |  | 41513 |  | $413 \quad 57$ |  | $\begin{array}{llll}4 & 12 & 39.9\end{array}$ | I.33 | 4 II 18.6 | 1.38 | $4 \quad 954$ | 1.44 |
| 23 | $\begin{array}{llll}4 & 12 & 2.7\end{array}$ | I.21 | 4 IO 48.3 | I. 26 | $4 \quad 93 \mathrm{I} \cdot 0$ | r.32 | 48810.4 | I. 37 | $4 \quad 6 \quad 46 \cdot 4$ | 1.4 | $4 \quad 5 \quad 18$ | 49 |
| 24 | $\begin{array}{llll}4 & 7 & 397\end{array}$ | 25 | $4 \quad 623 \cdot 1$ | 1.30 | $\begin{array}{lll}4 & 5 & 3 \cdot 3 \\ 4 & 5 & 3 \cdot 8\end{array}$ | I. 36 | $\begin{array}{llll}4 & 3 & 40 \cdot 0\end{array}$ | 1.42 | $\begin{array}{lrrr}4 & 2 & 13.3 \\ 3 & 57 & 30.2\end{array}$ | 1.4 | $4{ }^{4}$ | 54 |
| 25 | 4 3 I6.I <br>  58  | I. 29 | $\begin{array}{llll}4 & 1 & 57.1 \\ 3 & 57 & 30.4\end{array}$ | I.34 | $\begin{array}{llll}4 & 0 & 34 \cdot 8 \\ 3 & 56 & & 5 \cdot 4\end{array}$ | I.40 | $\begin{array}{llll}3 & 59 & 8 \cdot 9 \\ 3 & 54 & 36 \cdot 7\end{array}$ | 1.4 | $\begin{array}{llll}3 & 57 & 39 \\ 3 & 53\end{array}$ | $\begin{array}{r}\text { r.53 } \\ \text { r. } 58 \\ \hline\end{array}$ | $\begin{array}{lll}3 & 56 & 5.7\end{array}$ | 1.59 +65 |
| 26 | 35851.8 | 1.33 | $35730 \cdot 4$ | I•39 | $3 \begin{array}{lll}3 & 56 & 5 \cdot 4\end{array}$ | I.45 | $35436 \cdot 7$ | 1.51 | $\begin{array}{lll}3 & 53 & 4 \cdot 1\end{array}$ | 1.5 | $35127 \cdot 5$ | 65 |
| 27 | $35426 \cdot 8$ | $\cdot 37$ | $\begin{array}{llll}3 & 53 & 2.9\end{array}$ | 43 | 35135.2 | . 49 | 350 | -56 | 34828.0 | 1.63 | $34648 \cdot 0$ | 70 |
| 28 | 350 1•1 | $1 \cdot 4$ | $34^{8} 34 \cdot 6$ | 147 | $3474 \cdot 1$ | 54 | $\begin{array}{llll}3 & 45 & 29.5\end{array}$ | 61 | $34350 \cdot 7$ | I. 68 | $\begin{array}{llll}3 & 42 & 7 \cdot 4\end{array}$ | 1.76 |
| 29 |  | 1.45 | $\begin{array}{llll}3 & 44 & 5 & 3\end{array}$ | I 52 | $\begin{array}{lllll}3 & 42 & 32 \cdot 0 \\ & 32 & 58\end{array}$ | 5 | $\begin{array}{llll}3 & 40 & 54 \cdot 3\end{array}$ | . 66 | $\begin{array}{llll}3 & 39 & 12.2\end{array}$ | I.74 | $\begin{array}{lllll}3 & 37 & 25 \cdot 4\end{array}$ | . 82 |
| 30 | 3 4 I $7 \cdot 1$ <br>    | 1.5 | 3 39 $35 \cdot 1$ | $1 \cdot 57$ | $\begin{array}{llll}3 & 3758.8\end{array}$ | r 64 | $\begin{array}{llll}3 & 3618 \cdot 0\end{array}$ | 2 | $\begin{array}{llll}3 & 34 & 32 \cdot 4\end{array}$ |  | $\begin{array}{llll}3 & 32 & 41 \cdot 9\end{array}$ | 1.89 |
| 31 | $\begin{array}{llll}3 & 36 & 38 \cdot 7\end{array}$ | $1 \cdot 55$ | $\begin{array}{lll}3 & 35 & 3\end{array}$ |  | $\begin{array}{llll}3 & 33 & 24.4\end{array}$ | $1 \cdot 70$ | 3 31 <br> $10 \cdot 3$  | $1 \cdot 7$ | $32951 \cdot 2$ | I.86 | $\begin{array}{lllll}3 & 27 & 56 \cdot 9\end{array}$ | 1.95 |
| 32 | $\begin{array}{llll}3 & 32 & 9.4\end{array}$ |  | $\begin{array}{llll}3 & 30 & 31.5\end{array}$ |  | 32848.9 | .75 | $\begin{array}{lll}3 & 27 & 1.4\end{array}$ | $\cdot 84$ | $\begin{array}{llll}3 & 25 & 8.6\end{array}$ | I.93 | $\begin{array}{llll}3 & 23 & 10 \cdot 3\end{array}$ | 2.02 |
| 33 | $32739^{\circ} \mathrm{O}$ |  | $32558 \cdot 1$ | 1.72 | $\begin{array}{ll}3 & 24 \\ 12 & 12\end{array}$ | I.81 | $\begin{array}{llll}3 & 22 & 21.0\end{array}$ | 190 | $\begin{array}{lllll}3 & 20 & 24 \cdot 3\end{array}$ | 199 | $\begin{array}{llll}3 & 18 & 21.9\end{array}$ | 2.09 |
| 34 | 33 23 7 | I. 69 | 32123.3 | r.78 | 31933.9 | 187 | 3 17 $39^{\circ}$ | I.96 |  | $2 \cdot 06$ |  | $2 \cdot 17$ |
| 35 36 | $\begin{array}{ccc}3 & 18 & 34.9 \\ 3 & 14 & 0.9\end{array}$ | r 75 | $\begin{array}{ccrr}3 & 16 & 47 \cdot 3 \\ 3 & 12 & 9.8\end{array}$ | I.84 | $\begin{array}{llll}3 & 14 & 54.2 \\ 3 & 10 & 13.0\end{array}$ | -93 | $\begin{array}{rrrr}3 & 12 & 55.4 \\ 3 & 8 & 10.0\end{array}$ | 2.03 | $\begin{array}{llll}3 & 10 & 50 \cdot 5 \\ 3 & 6 & 0.7\end{array}$ | $2 \cdot 13$ | 3 | 2.24 |
| 36 | 314 |  | 312 |  | 310 |  |  |  |  | 2.21 | 3 | 2.33 |
| 37 | $\begin{array}{llll}3 & 9 & 25.6 \\ 3 & 4 & 4\end{array}$ | 1.7 | $\begin{array}{llll}3 & 7 & 30 \cdot 8 \\ 3\end{array}$ | r.96 | 3 5 $30 \cdot 0$ <br> 3 0  | 2.07 | 3 3 22.8 <br> 2 5  | $2 \cdot 18$ | $\begin{array}{lll}3 & \text { I } & 8.8\end{array}$ | 29 | ${ }_{2}^{2} 58847.6$ | 2.42 |
| 38 | $\begin{array}{lll}3 & 4 & 48 \cdot 8 \\ 3 & 0 & 10 \cdot 4\end{array}$ | I.93 | 3 2 $50 \cdot 1$ <br> 2 58  <br> 8.7   | 2.03 | $\begin{array}{rrrr}3 & 0 & 45 \cdot 1 \\ 2 & 5 & 58.3\end{array}$ | $2 \cdot 14$ | $\begin{array}{llll}2 & 58 & 33.4 \\ 2 & 53 & 4.4\end{array}$ | $2 \cdot 26$ | $2 \begin{array}{lll}2 & 56 & 14.4 \\ 2 & 51\end{array}$ | 2.38 | $25348 \cdot 1$ | 2.51 |
| 40 | $\begin{array}{llllll} \\ 2 & 5 & 5 & 30 \cdot 3\end{array}$ | 2.06 | $\begin{array}{llll}2 & 50 & 7.7 \\ 2 & 53 & 23.3\end{array}$ | $2 \cdot 18$ | $\begin{array}{llll}2 & 55 & 5 \cdot 3 \\ 2 & 51 & 9 \cdot 2\end{array}$ | 2.30 | 2 53 <br> 2 48 | 2.43 | $\begin{array}{lll}2 & 51 & 17.7 \\ 2 & 46 & 18 \cdot 1\end{array}$ | 2.56 |  | . 61 |
| 41 | $25048 \cdot 4$ | $2 \cdot 13$ | $24^{8} \quad 36 \cdot 8$ | $2 \cdot 25$ | $2 \begin{array}{llll}46 & 17 & 8\end{array}$ | $2 \cdot 38$ | $2 \begin{array}{lll}2 & 43 & 50 \cdot 9\end{array}$ | 2.52 | 24 x 15.5 | 2.67 | $\begin{array}{lllll}2 & 38 & 31 \cdot 0\end{array}$ | 2.82 |
| 42 | 46 | I | $243{ }^{2} 8 \cdot \mathrm{I}$ | $2 \cdot 34$ | 24123.8 | 2.47 | 23851.2 | 2.62 | $\begin{array}{llll}2 & 36 & 9.5\end{array}$ | 2.77 | 23318.2 | .94 |
| 43 | 24118.2 | $2 \cdot 29$ | 238 56.8 | 2.43 | $23627 \cdot 0$ | $2 \cdot 57$ | $23348 \cdot 3$ | 2.73 | 23059.9 | 2.89 | $\begin{array}{llll}2 & 28 & 1 \cdot 3\end{array}$ | 3.07 |
| 44 | $\begin{array}{lllll}2 & 36 & 29.6\end{array}$ | $2 \cdot 38$ | $\begin{array}{lll}2 & 34 & 2.8 \\ 2\end{array}$ | 52 | $23127 \cdot 1$ | 2.67 | 22841.8 | 2.84 | $22546 \cdot 3$ | 3.02 | $22239 \cdot 7$ | 3.21 |
| 45 |  | 2.47 | 2 29 5.8 <br> 2   | 2.62 | 22623.7 | $2 \cdot 79$ | 22331.5 | 2.96 | 22028.2 | $3 \cdot 15$ | $2 \begin{array}{llll} & 17 & 12.9\end{array}$ | 3.36 |
| 46 | 22644.4 | 2. | 24 | $2 \cdot 73$ | 22116.6 | 2.91 | 2 IS 16.7 | 3. | 215 | $3 \cdot 30$ | 2 II $40 \cdot 3$ | $3 \cdot 52$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18{ }^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| 0 | -1.32 | -4.24 | $-1.40$ | -4.26 | -1.48 | -4.29 | - I 56 | $-4.32$ | -r.64 | $-4.35$ | -1.73 | $-4.38$ |
| 2 | 1.34 | $4 \cdot 25$ | 1.42 | 4.27 | I. 50 | $4 \cdot 30$ | I. 58 | $4 \cdot 33$ | I. 67 | $4 \cdot 36$ | 1.75 | $4 \cdot 39$ |
| 4 | I. 36 | $4 \cdot 25$ | 1.44 | $4 \cdot 28$ | I.53 | $4 \cdot 31$ | I.61 | $4 \cdot 34$ | I. 69 | 4.37 | 1.78 | 4.40 |
| 6 | I 39 | $4 \cdot 26$ | 1.47 | $4 \cdot 29$ | 1.55 | $4 \cdot 32$ | I. 63 | $4 \cdot 35$ | $1 \cdot 72$ | $4 \cdot 38$ | I.8I | 4.41 |
| 8 | 142 | 4.27 | I.50 | $4 \cdot 30$ | r.58 | 4.33 | r.67 | $4 \cdot 36$ | 1.75 | $4 \cdot 39$ | 1.84 | $4 \cdot 43$ |
| 10 | 1.45 | $4 \cdot 28$ | I.53 | $4 \cdot 31$ | I.61 | $4 \cdot 34$ | I. 70 | $4 \cdot 37$ | 1.78 | 4.41 | 1.87 | $4 \cdot 44$ |
| 12 | 1.48 | $4 \cdot 29$ | I. 56 | $4 \cdot 32$ | 1.65 | $4 \cdot 35$ | 1.73 | $4 \cdot 39$ | I. 82 | $4 \cdot 42$ | 1.91 | $4 \cdot 46$ |
| 14 | I.5I | $4 \cdot 30$ | r.60 | $4 \cdot 33$ | I. 69 | $4 \cdot 37$ | I.77 | $4 \cdot 40$ | I. 86 | $4 \cdot 44$ | 1.95 | $4 \cdot 48$ |
| 16 | r.55 | $4 \cdot 32$ | r. 64 | $4 \cdot 35$ | I.73 | $4 \cdot 38$ | 1.82 | $4 \cdot 42$ | I.91 | $4 \cdot 46$ | 2.00 | $4 \cdot 50$ |
| 18 | I. 59 | $4 \cdot 33$ | r.68 | $4 \cdot 37$ | I.77 | $4 \cdot 40$ | I. 86 | 4.44 | I.96 | $4 \cdot 48$ | 2.05 | 4.52 |
| 20 | 1.64 | $4 \cdot 35$ | 1.73 | $4 \cdot 39$ | r.82 | $4 \cdot 42$ | I.91 | $4 \cdot 46$ | 2.01 | $4 \cdot 50$ | $2 \cdot 11$ | $4 \cdot 55$ |
| 22 | I. 68 | $4 \cdot 37$ | r.78 | 4.41 | I. 87 | 4.44 | r.97 | $4 \cdot 48$ | 2.07 | $4 \cdot 53$ | $2 \cdot 17$ | 4.53 |
| 24 | I.74 | 4.39 | I. 83 | 4.43 | I.93 | $4 \cdot 47$ | 2.03 | 4.51 | $2 \cdot 13$ | 4.56 | 2.24 | 4.61 |
| 26 | $\begin{array}{r}\text { I. } \\ \text { r } \\ \hline\end{array}$ | 4.41 | r.89 | 4.45 | r.99 | 4.50 4.53 | $2 \cdot 10$ | $4 \cdot 54$ | 2.20 | 4.59 | 2.31 | $4 \cdot 65$ |
| 28 | r.85 | $4 \cdot 44$ | I.96 | 4.48 | 2.06 | 4.53 | $2 \cdot 17$ | $4 \cdot 58$ | $2 \cdot 28$ | $4 \cdot 63$ | 2.40 | $4 \cdot 69$ |
| 30 | 1.92 | $4 \cdot 46$ | 2.03 | $4 \cdot 51$ | 2.14 | $4 \cdot 56$ | 2.25 | $4 \cdot 62$ | $2 \cdot 37$ | $4 \cdot 67$ | 2.49 | 4.74 |
| 32 | 2.00 | 4.50 | $2 \cdot 11$ | $4 \cdot 55$ | 2.22 | 4.60 | $2 \cdot 34$ | $4 \cdot 66$ | 2.47 | $4 \cdot 72$ | $2 \cdot 59$ |  |
| 34 | 2.08 | 4.53 | $2 \cdot 20$ | $4 \cdot 59$ | $2 \cdot 32$ | $4 \cdot 65$ | $2 \cdot 44$ | $4 \cdot 71$ | $2 \cdot 57$ | $4 \cdot 78$ | 2.71 | $4 \cdot 86$ |
| 36 38 | 2.17 2.27 | 4.58 4.63 | 2.29 2.40 | 4.64 4.69 | 2.42 2.54 | $4 \cdot 70$ 4.76 | 2.56 2.68 | $4 \cdot 77$ $4 \cdot 84$ | 2.69 2.83 | 4.85 4.93 | 2.84 2.99 | 4.93 5.02 |
| 38 | $2 \cdot 27$ | 4.63 | 2.40 | $4 \cdot 69$ | $2 \cdot 54$ | $4 \cdot 76$ | $2 \cdot 68$ | $4 \cdot 84$ | $2 \cdot 83$ | $4 \cdot 93$ | 2.99 | $5 \cdot 02$ |
| 40 | 2.39 | 4.68 | $2 \cdot 53$ | $4 \cdot 76$ | 2.67 | $4 \cdot 84$ | 2.83 | $4 \cdot 92$ | 2.99 | 5.02 | $3 \cdot 16$ | $5 \cdot 12$ |
| 42 | 2.52 | 4.75 | $2 \cdot 67$ | $4 \cdot 83$ | $2 \cdot 83$ | $4 \cdot 92$ | 3.00 | 5.02 | 3.17 | $5 \cdot 13$ | $3 \cdot 36$ | 5.25 |
| 44 | 2.66 | 4.83 | 2.83 | $4 \cdot 92$ | 3.01 | 5.03 | $3 \cdot 19$ | $5 \cdot 14$ | $3 \cdot 39$ | $5 \cdot 26$ | $3 \cdot 60$ | $5 \cdot 40$ |
| 45 | 2.75 2.8 | 4.88 | 2.92 | $4 \cdot 98$ | $3 \cdot 10$ | $5 \cdot 09$ | $3 \cdot 30$ | $5 \cdot 21$ | $3 \cdot 51$ | $5 \cdot 34$ | 3.73 3.88 | 5.49 |
| 46 | 2.84 | 4.93 | 3.02 | $5 \cdot 03$ | $3 \cdot 21$ | 5•15 | $3 \cdot 42$ | 5:29 | 3.64 | $5 \cdot 43$ | 3.88 | $5 \cdot 60$ |

## LATITUDE $8^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5{ }^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left.\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0 \end{array}\right.\right)$ | $\cdot 56$ | $\begin{array}{cc} \text { н. м. } & \text { s. } \\ 5 & 59 \\ 26 \cdot 3 \end{array}$ | $\cdot 56$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { s. } \\ 5 & 58 & 52 \cdot 5 \end{array}\right.$ | $\cdot 56$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 58 & \text { 18.7 } \end{array}\right\|$ | $\text { s. } 56$ | $\left\|\begin{array}{cc} \text { H. м. } & \text { s. } \\ 5 & 57 \\ 44 \cdot 9 \end{array}\right\|$ | $\cdot 56$ | $\left\lvert\, \begin{array}{ccc} \text { H. м. } & \text { S. } \\ 5 & 57 & \text { ro. } 9 \end{array}\right.$ | 57 |
| 10 | 5 I 19 $36 \cdot 2$ | $\cdot 57$ | $\begin{array}{llll}5 & 19 & 1.5\end{array}$ | $\cdot 58$ | ${ }_{5}^{5} 1826 \cdot 1$ | $\cdot 60$ | ${ }_{5}^{5}$ I7 49.9 | . 61 | $\begin{array}{llll}5 & 17 & 12.8\end{array}$ | . 62 | 51634.9 | 64 |
| 12 | 5 II $31 \cdot 3$ | . 57 | 5 10 $56 \cdot 3$ | -59 | 5 10 $20 \cdot 4$ | -61 | $\begin{array}{lllll}5 & 9 & 43 \cdot 5\end{array}$ | . 62 | $\begin{array}{llll}5 & 9 & 5 \cdot 7\end{array}$ | - 64 | 826.8 | 66 |
| 14 | $\begin{array}{llll}5 & 3 & 26 \cdot 3\end{array}$ | -58 | $\begin{array}{lll}5 & 2 & 50 \cdot 9\end{array}$ | 60 | $\begin{array}{llll}5 & 2 & 14.5\end{array}$ | . 62 | 5 I $37 \cdot 0$ | 63 | 5 5 0 58.3 | . 66 | - 18.4 | . 68 |
| 16 | $4552 \mathrm{I} \cdot 2$ | -58 | $45445 \cdot 5$ | .61 | $4 \begin{array}{lll}44 & 8.5\end{array}$ | $\cdot 63$ | $4 \begin{array}{ll}53 & 30 \cdot 2\end{array}$ | -65 | $45250 \cdot 6$ | $\cdot 67$ | $4 \begin{array}{lll}42 & 9 \cdot 6\end{array}$ | $\cdot 70$ |
| 18 | 4716 | $\cdot 59$ | 44639.8 | $\cdot 62$ | $\begin{array}{lll}4 & 46 & 2 \cdot 2\end{array}$ | . 64 | $445 \quad 23 \cdot 1$ | 66 | $44442 \cdot 5$ | . 69 | 4440.4 | 72 |
| 20 | $43910 \cdot 8$ | - 60 | 43834.0 | $\cdot 63$ | $43755 \cdot 7$ | $\cdot 65$ | $43715 \cdot 7$ | 68 | $43634 \cdot \mathrm{I}$ | $\cdot 71$ | $43550 \cdot 7$ | 4 |
| 22 | 43159 | -61 | 43028.0 | . 64 | $42949 \cdot 0$ | . 67 | $4298 \cdot 0$ | 70 | $\begin{array}{llll}4 & 28 & 25 \cdot 3\end{array}$ | $\cdot 73$ | $42740 \cdot 6$ | 76 |
| 24 | 42259.8 | - 62 | 42221.8 | $\cdot 65$ | $42141 \cdot 9$ | -68 | 42100 | $\cdot 72$ | 42016.0 | $\cdot 75$ | 41929.9 | 8 |
| 26 | 41454.0 | . 63 | $4 \begin{array}{lllll}4 & 15\end{array}$ | . 66 | 41334.5 | $\cdot 70$ | 41251.5 | $\cdot 74$ | 4126.2 | -77 | 4 II 18.7 | I |
| 28 | $4 \quad 6 \quad 48 \cdot 0$ | . 64 | 68.5 | . 68 | $4 \quad 5 \quad 26.8$ | $\cdot 72$ | 4424.5 | $\cdot 76$ | $4 \quad 355 \cdot 9$ | . 80 | $\begin{array}{llll}4 & 3 & 6.8\end{array}$ | 84 |
| 30 | $\begin{array}{lllll}3 & 58 & 41.9\end{array}$ | $\cdot 65$ | $3 \begin{array}{lll}38 & 1 & 5\end{array}$ | $\cdot 69$ | $\begin{array}{llllllllllll}3 & 57 & 18.6\end{array}$ | $\cdot 74$ | $\begin{array}{lllll}3 & 56 & 33 \cdot 1\end{array}$ | $\cdot 78$ | 3 55 45 <br> 0   | . 82 | 3 54 $54 \cdot 1$ | 8 |
| 3 | $35035 \cdot 4$ | $\cdot 67$ | 349 54-I | $\cdot 7 \mathrm{I}$ | $34910 \cdot 0$ | $\cdot 76$ | $348 \quad 23 \cdot 2$ | -80 |  | -85 | $\begin{array}{lllllllllll}3 & 46 & 40 \cdot 7\end{array}$ | 90 |
| 33 | 3 46 $32 \cdot 1$ | . 67 | $345 \quad 50 \cdot 2$ | $\cdot 72$ |  | $\cdot 77$ | $\begin{array}{llll}3 & 44 & 17.9\end{array}$ | $\cdot 82$ |  | . 87 | $\begin{array}{lllllllllllllll}3 & 42 & 33 \cdot 6\end{array}$ | $\cdot 92$ |
| 34 | 34228.6 | -68 | $34146 \cdot 3$ | -73 | $\begin{array}{llll}3 & 41 & 1.0\end{array}$ | 78 | $3 \begin{array}{llll}40 & 12 \cdot 6\end{array}$ | . 83 | 33921.0 | . 88 | $\begin{array}{llllllllllllllll}3 & 38 & 26 \cdot 4\end{array}$ | -94 |
| 35 | $\begin{array}{llll}3 & 38 & 25 \cdot 1\end{array}$ | $\cdot 69$ | $\begin{array}{llll}3 & 37 & 42 \cdot 2 \\ 3 & 33 & \\ \\ 3\end{array}$ | $\cdot 74$ | $\begin{array}{llll}3 & 36 & 56 \cdot 2\end{array}$ | .81 | $\begin{array}{llll}3 & 36 & 7 \cdot 0 \\ 3 & 32 & 1 \cdot 3\end{array}$ | . 85 | 3 35 14.5 <br> 3 351  <br>  7.9  | .90 | $\begin{array}{cccc}3 & 34 & 18 \cdot 8 \\ 3 & 30 & 11 \cdot 0\end{array}$ | 96 |
| 36 | $\begin{array}{llll}3 & 34 & 21.5\end{array}$ | $\cdot 70$ | 333 38.0 | $\cdot 75$ | $1 \begin{array}{llll}3 & 32 & 51 \cdot 3\end{array}$ | $\cdot 81$ | $\begin{array}{lll}3 & 32 & 1 \cdot 3\end{array}$ | . 86 | 3 31717.9 | -92 | 3 30 $11 \cdot 0$ <br> 3   | -98 |
| 37 | $\begin{array}{llllll}3 & 30 & 17.9\end{array}$ | $\cdot 71$ | $\begin{array}{llll}3 & 29 & 33 \cdot 7\end{array}$ | $\cdot 76$ | $\begin{array}{llll}3 & 28 & 46 \cdot 2\end{array}$ | . 82 | 3 27 55 <br>    | -88 | $\begin{array}{lll}3 & 27 & 0.9 \\ 3 & 22 & 53.7\end{array}$ | -94 | $\begin{array}{llll}3 & 26 & 3 \cdot 0 \\ 3 & 21 & 5\end{array}$ | I.00 |
| 38 | $\begin{array}{llllll}3 & 26 & 14 \cdot 1\end{array}$ | $\cdot 72$ | $\begin{array}{llll}3 & 25 & 29.3\end{array}$ | $\cdot 78$ | $\begin{array}{lllllll}3 & 24 & 41 \\ 3 & \text { 1 }\end{array}$ | 83 | $\begin{array}{llll}3 & 23 & 49.2\end{array}$ | $\cdot 89$ | $\begin{array}{llll}3 & 22 & 53 \cdot 7 \\ 3 & 18 & 46 \cdot 3\end{array}$ | . 98 | $\begin{array}{lllll}3 & 21 & 54.6 \\ 3 & 17 & 45.9\end{array}$ | I. O |
| 39 |  | -73 | 32124.7 | '79 | $3 \quad 20 \quad 35 \cdot 6$ | 85 | $\begin{array}{llllllll}3 & 19 & 42.9\end{array}$ | -91 | 3 I8 46 | -98 | $\begin{array}{lllllll}3 & 17 & 45\end{array}$ | I.04 |
| 40 | $\begin{array}{llll}3 & 18 & 6 \cdot 2\end{array}$ | 74 | 317 | . 80 | $\begin{array}{llll}3 & 16 & 30 \cdot 1\end{array}$ | . 86 |  | -93 | $314 \begin{array}{llll}3 & 18.5\end{array}$ | 1.00 | $\begin{array}{llll}3 & 13 & 36 \cdot 8\end{array}$ | . 06 |
| 41 | $\begin{array}{lllll}3 & 14 & 2 \cdot 1\end{array}$ | $\cdot 75$ | 3131515 | .81 | $\begin{array}{lllll}3 & 12 & 24.3\end{array}$ | . 88 | 3 II 29.4 | $\cdot 95$ | 3 10 $30 \cdot 5$ | -02 | $\begin{array}{llll}3 & 9 & 27.5\end{array}$ | . 09 |
| 42 | $\begin{array}{lllll}3 & 9 & 57.8\end{array}$ | $\cdot 76$ | $3{ }^{3} 10 \cdot 1$ | . 83 | $\begin{array}{llll}3 & 8 & 18.3\end{array}$ | '90 | $\begin{array}{llll}3 & 7 & 22 \cdot 3\end{array}$ | 9 | $\begin{array}{llll}3 & 6 & 22.2\end{array}$ | . 0 | $\begin{array}{llll}3 & 5 & 17.7\end{array}$ | 1 |
| 43 | $\begin{array}{llll}3 & 5 & 53.4\end{array}$ | $\cdot 78$ | $\begin{array}{llll}3 & 5 & 4 \cdot 8\end{array}$ | -84 | $\begin{array}{llll}3 & 4 & 12.0\end{array}$ | 91 | $\begin{array}{llll}3 & 3150\end{array}$ | -99 | $3 \begin{array}{llll}3 & 2 & 13.5\end{array}$ | 1.06 | $\begin{array}{llll}3 & 1 & 7.5\end{array}$ | -14 |
| 44 | 3 1 18489 | $\cdot 79$ | $3 \quad 0 \quad 59.4$ | . 86 | $\begin{array}{lll}3 & 0 & 5.5\end{array}$ | 93 | $2 \begin{array}{lll}29 & 7 \cdot 3\end{array}$ | $1 \cdot 01$ | $2{ }^{2} 584$ | 1.0 | $\begin{array}{lllll}2 & 56 & 56.9\end{array}$ | 1.1 |
| 45 | 25744.2 | $\cdot 80$ | 25653.8 | -88 | 25558.8 | -95 | $25459 \cdot 3$ |  | 25355.0 | -II | $25245 \cdot 8$ | -19 |
| 46 | $25339 \cdot 3$ | . 82 | $25247 \cdot 9$ | '90 | $2 \mathrm{5I} 5 \mathrm{5} \cdot 8$ | 97 | $25050 \cdot 9$ | 1.06 | 249 45•1 | -1 | $24834 \cdot 2$ | 1.22 |
| 47 | $24934 \cdot 2$ | . 83 | 24841.8 | 91 | 24744.5 | 1.00 | $24642 \cdot 2$ | I 08 | $24534 \cdot 7$ | $1 \cdot 17$ | $\begin{array}{lllll}2 & 44 & 22.0\end{array}$ | I. 26 |
| 48 | $\begin{array}{llll}2 & 45 & 29.0 \\ 2 & 41 & 23.5\end{array}$ | . 85 | $\begin{array}{llll}2 & 44 & 35.4 \\ 2 & 40 & 28.8\end{array}$ | . 93 | $\begin{array}{llll}2 & 43 & 36.8 \\ 2 & 39 & 28.8\end{array}$ | 1.02 1.04 | $\begin{array}{llll}2 & 42 & 33 \cdot 0 \\ 2 & 38 & 23.5\end{array}$ | I-11 | $\begin{array}{llll}2 & 41 & 23.9 \\ 2 & 37 & 12.5\end{array}$ | 1.20 I 23 | $\begin{array}{llrr}2 & 40 & 9 \cdot 3 \\ 2 & 35 & 55.9\end{array}$ | 1.29 1.33 |
| 49 | 24123.5 | $\cdot 87$ | $24028 \cdot 8$ | .96 | 23928.8 | 1.04 | $23^{88} 23 \cdot 5$ | $1 \cdot 14$ | 23712.5 | 1.23 | 23555.9 | $1 \cdot 3$ |
| 50 | 23717.8 | $\cdot 89$ | 23621.9 | 98 | $\begin{array}{llll}2 & 35 & 20.5\end{array}$ | 07 | $2 \begin{array}{llll}34 & 13.4\end{array}$ | 17 | $\begin{array}{lll}2 & 33 & 0.6 \\ 2\end{array}$ | 26 | 23141.8 | . 36 |
| 51 | 23311.8 | $\cdot 91$ | 23214.6 | - | $\begin{array}{lllll}2 & 31 & 11.7\end{array}$ | O | $23002 \cdot 9$ | I.20 |  | I.30 | $22727 \cdot 0$ | 40 |
| 52 | 22956 | 93 | $2287 \cdot 0$ | 1.03 | 22712.4 | 1.13 | 22551.8 | 1.23 | 22434.8 | I. 34 | $22311 \cdot 4$ | 1.45 |
| 53 | 22459.1 | -95 | 22358.9 | I.05 | $\begin{array}{llll}2 & 22 & 52.7\end{array}$ | -16 | 221401 | 1 | 22020.9 | $1 \cdot 38$ | 218 54.8 | 1.4 |
| 54 | $22052 \cdot 2$ | 97 | $21950 \cdot 6$ | 1.08 | 21842.4 | I•19 | 21787.7 | 1-30 | 216 | 1.42 | $1437 \cdot 3$ | I-54 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | - ${ }^{\text {s. }}$ | S. | S. | S. | $\stackrel{\text { s. }}{ }{ }^{\text {I4 }}$ | S. | S. | S. | s. 29 | s. |  | s. |
| 4 | . 04 | 4.04 | - II | 4.04 | -18 | 4.04 | $\cdot 25$ | 4.05 | . 33 | 4.05 | . 40 | $4 \cdot 06$ |
| 8 | . 08 | $4 \cdot 04$ | - 15 | 4.04 | - 22 | 4.05 | $\cdot 30$ | 4.05 | $\cdot 37$ | 4.06 | -44 | $4 \cdot 06$ |
| 12 | - 12 | 4.04 | -19 | $4 \cdot 04$ | -27 | $4 \cdot 05$ | -34 | 4.05 | -41 | 4.06 | $\cdot 49$ | 4.07 |
| 14 | -14 | 4.04 | -2I | 4.05 | -29 | 4.05 | -36 | 4.06 | -44 | 4.06 | $\cdot 51$ | 4.07 |
| 16 | -16 | 4.04 | - 24 | 4.05 | -31 | 4.05 | $\cdot 39$ | 4.06 | $\cdot 46$ | 4.07 | $\cdot 54$ | 4.07 |
| 18 | $\cdot 18$ | 4.04 | $\cdot 26$ | 4.05 | -33 | 4.05 | 41 | 4.06 | $\cdot 49$ | 4.07 | $\cdot 56$ | 4.08 |
| 20 | -21 | 4.04 | -28 | $4 \cdot 05$ | $\cdot 36$ | 4.05 | $\cdot 44$ | 4.06 | $\cdot 51$ | 4.07 | -59 | 4.08 |
| 22 | -23 | 4.05 | $\cdot 31$ | 4.05 | $\cdot 38$ | 4.06 | $\cdot 46$ | 4.07 | $\cdot 54$ | 4.07 | . 62 | 4.09 |
| 24 | -25 | 4.05 | -33 | 4.05 | 41 | $4 \cdot 06$ | $\cdot 49$ | 4.07 | $\cdot 57$ | 4.08 | . 65 | 4.09 |
| 26 | -28 | 4.05 | -36 | 4.05 | -44 | 4.06 | -52 | 4.07 | . 60 | 4.08 | . 68 | 4.10 |
| 28 | -30 | 4.05 | $\cdot 38$ | 4.06 | $\cdot 47$ | 4.07 | $\cdot 55$ | 4.08 | . 63 | 4.09 | $\cdot 72$ | $4 \cdot 10$ |
| 30 | $\cdot 33$ | 4.05 | -41 | 4.06 | -50 | 4.07 | -58 | 4.08 | . 67 | 4.09 | $\cdot 75$ | $4 \cdot 11$ |
| 32 | -36 | 4.05 | -44 | 4.06 | -53 | 4.07 | -61 | 4.09 | $\cdot 70$ | $4 \cdot 10$ | $\cdot 79$ | $4 \cdot 12$ |
| 34 | -38 | 4.06 | 47 | 4.07 | $\cdot 56$ | 4.08 | $\cdot 65$ | 4.09 | $\cdot 74$ | 4-11 | . 83 | $4 \cdot 12$ |
| 36 | -41 | 4.06 | -50 | 4.07 | $\cdot 59$ | 4.08 | . 69 | $4 \cdot 10$ | $\cdot 78$ | $4 \cdot 11$ | . 87 | $4 \cdot 13$ |
| 38 | $\cdot 45$ | 4.06 | -54 | 4.07 | -63 | 4.09 | $\cdot 73$ | $4 \cdot 10$ | . 82 | $4 \cdot 12$ | -92 | $4 \cdot 14$ |
| 40 | $\cdot 48$ | 4.07 | - 57 | 4.08 | -67 | 4.09 | $\cdot 77$ | $4 \cdot 11$ | -87 | $4 \cdot 13$ | -97 | $4 \cdot 15$ |
| 42 | -51 | 4.07 | . 61 | 4.09 | $\cdot 71$ | $4 \cdot 10$ | -81 | $4 \cdot 12$ | -92 | $4 \cdot 14$ | $1 \cdot 02$ | $4 \cdot 17$ |
| 44 | -55 | 4.08 | $\cdot 66$ | 4.09 | $\cdot 76$ | 4-II | -86 | $4 \cdot 13$ | $\cdot 97$ | 4-15 | 1.08 | 4•18 |
| 46 | . 59 | 4.08 | $\cdot 70$ | 4.10 | .81 | $4 \cdot 12$ | . 92 | 4.14 | 1.03 | $4 \cdot 17$ | I. 14 | 4.20 |
| 48 | - 64 | 4.09 | 75 | $4 \cdot 11$ | $\cdot 86$ | $4 \cdot 13$ | -98 | $4 \cdot 16$ | $1 \cdot 09$ | 4.18 | 1.21 | $4 \cdot 22$ |
| 50 | $\cdot 69$ | $4 \cdot 10$ | . 86 | $4 \cdot 12$ | -92 | 4.14 | $1 \cdot 04$ | $4 \cdot 17$ | 1.17 | 4.20 | $1 \cdot 29$ | 4.24 |
| 52 54 | .74 .80 | 4.11 4.12 |  | 4.13 4.14 | -99 $\mathbf{1} \cdot 06$ | 4.16 4.18 | I•19 I 19 | 4.19 4.21 | 1.24 1.33 | 4.23 4.25 | 1.38 1.48 | 4.27 4.29 |

## LATITUDE $8^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. S. | s. | H. M. S. | S. |  |  |  |  |  |  | H. M. S. |  |
| $\bigcirc$ | $\begin{array}{lllll}566 & 36.9\end{array}$ | $\cdot 57$ | $\begin{array}{llll}5 & 56 & 2 \cdot 7\end{array}$ | $\cdot 57$ | $\begin{array}{lllll}5 & 55 & 28.4\end{array}$ |  | $\begin{array}{lllllllllllll}5 & 54 & 53.9\end{array}$ |  | 5 54419.2 |  |  | 58 |
| 10 | 515 56.0 |  | 51515 16.3 | $\cdot 67$ | $5{ }_{5}^{5} 1435 \cdot 6$ | . 69 | $\begin{array}{lllll}5 & 13 & 53.9 \\ 5 & 5 & 40.4\end{array}$ | $\cdot 70$ | $\begin{array}{lllll}5 & 13 & 11.3\end{array}$ | $\cdot 72$ | $\begin{array}{cccc}5 & 12 & 27.5\end{array}$ | 74 |
| 12 | $5 \quad 746 \cdot 9$ | $\cdot 6$ | $\begin{array}{llll}5 & 7 & 5 \cdot 8 \\ 4 & 58\end{array}$ | -69 |  | $\cdot 71$ | $\begin{array}{llll}5 & 5 & 40 \cdot 4 \\ 4 & 57 & 26.2\end{array}$ | $\cdot 73$ | $\begin{array}{lrrrr}5 & 4 & 55 \cdot 9 \\ 4 & 56 & 30.9\end{array}$ | $\cdot 75$ | [1510.2 | . 77 |
| 14 | 4 $45937 \cdot 2$ | $\cdot 70$ | $4 \begin{array}{llll}4 & 58 & 54.9\end{array}$ | $\cdot 72$ | $\begin{array}{llll}4 & 58 & 11 \cdot 2 \\ 4 & 49 & 58 \cdot \mathrm{I}\end{array}$ | $\cdot 74$ | $\begin{array}{llll}4 & 57 & 26 \cdot 2 \\ 4 & 49 \\ \text { II }\end{array}$ | . 76 | $\begin{array}{llll}4 & 56 & 39 \cdot 9 \\ 4 & 48 & 23 \cdot 1\end{array}$ | . 78 | $\begin{array}{llll}4 & 55 & 52 \cdot \mathrm{I} \\ 4 & 47 & 33 \cdot I\end{array}$ | .81 |
| 16 | $4 \begin{array}{llll}4127.2\end{array}$ | $\cdot 72$ | $45043 \cdot 4$ | $\cdot 74$ | 449 58.I | '77 | 449 II•4 | $\cdot 79$ | $4 \begin{array}{lll}48 & 23 \cdot I\end{array}$ | $\cdot 82$ | $44733 \cdot 1$ | 85 |
| 18 | $44316 \cdot 7$ | $\cdot 74$ | 44231.4 | $\cdot 77$ | $44^{1} 44.4$ | . 80 | $44055 \cdot 8$ | - 82 | 4405.5 | - 86 | $4 \quad 3913.2$ | 89 |
| 20 | $435 \quad 57$ | $\cdot 77$ | 43448.8 | . 80 | $43330 \cdot 0$ | . 83 | 43239.4 | . 86 | $43146 \cdot 9$ | $\cdot 89$ | 43052.3 | 93 |
| 22 | 42654.0 | $\cdot 79$ | 42654 | . 83 | 42514.9 | . 86 | $42422 \cdot 2$ | $\cdot 90$ | $4 \begin{array}{llll}4 & 23 & 27.4\end{array}$ | -93 | $42230 \cdot 3$ | 97 |
| 24 | $41841 \cdot 8$ | - 82 | 417751.4 | . 86 | $41658 \cdot 8$ | -90 | 4163.9 | $\cdot 93$ | 4156 | 97 | $414 \quad 7 \cdot 0$ | 1.01 |
| 26 | 4 10 28.8 | . 85 | $4 \begin{array}{llll}4 & 9 & 36 \cdot 6\end{array}$ | $\cdot 89$ | $\begin{array}{llll}4 & 8 & 41\end{array}$ | $\cdot 93$ | $4 \quad 744 \cdot 7$ | 97 | $4 \quad 644.9$ | 2 | $\begin{array}{llll}4 & 5 & 42 \cdot 4\end{array}$ | I.06 |
|  | $4 \quad 6 \quad 22 \cdot 1$ | 87 |  | '91 | $4 \quad 433 \cdot 0$ | -95 | $334 \cdot 6$ | 1.00 | $233 \cdot 4$ | 4 | 4 I 29.5 | . 09 |
| 28 | $215 \cdot 1$ | . 88 | 120.8 | -93 | - 23.9 | -97 | 5924.2 | 1.02 | $35821 \cdot 7$ | 1.07 | $35716 \cdot 3$ | .12 |
| 29 | $58 \quad 7.9$ | -90 | 35712.6 | -95 | 35614.4 | -99 | 35513.4 | I. 04 | $354 \quad 9 \cdot 5$ | 1.09 | $\begin{array}{lll}3 & 53 & 2 \cdot 6\end{array}$ | I-I4 |
| 30 | 54 | -92 | 3 53 $4 \cdot 1$ <br>  4 $55 \cdot 3$ | -97 | $\begin{array}{lllllllllll}3 & 52 & 4 \cdot 7\end{array}$ | I 01 | 3512.4 | 1.06 | 34957.0 | I'12 |  | I-17 |
| 31 | $\begin{array}{llllllllll}3 & 49 & 52.9\end{array}$ | $\cdot 93$ | $\begin{array}{lllll}3 & 48 & 55 \cdot 3\end{array}$ | -99 | 34754.7 | I•04 | $3465 \mathrm{I} \cdot \mathrm{O}$ | I•09 | 3 4544 <br> 15  | $1 \cdot 14$ | $34433 \cdot 8$ | 1-20 |
| 32 | $34545 \cdot 0$ | -95 | $34446 \cdot 2$ | 1 | $34344 \cdot 3$ |  | 34239.2 |  | $34150 \cdot 7$ | 7 | $34018 \cdot 7$ | 1.23 |
| 33 |  | -97 | $34036 \cdot 9$ | 1.03 | $3 \quad 3933 \cdot 6$ | 88 | $3 \quad 3826.9$ | I-14 | $3 \begin{array}{lll}37 & 16.8\end{array}$ | O | $\begin{array}{llll}3 & 36 & 3 \cdot 1\end{array}$ | I-26 |
| 34 | $\begin{array}{llll}3 & 37 & 28.4\end{array}$ | -99 | $33627 \cdot 2$ | I.05 | $3 \quad 35 \quad 22 \cdot 5$ | I'II | 33414.3 | I•17 | $333 \quad 2 \cdot 5$ | 1.23 | $33146 \cdot 9$ | 1.29 |
| 35 | $\begin{array}{lllll}3 & 33 & 19 \cdot 7 \\ 3 & 2 & 19\end{array}$ | I-01 | $3 \begin{array}{ll}32 & 17 \cdot 1\end{array}$ | 07 | $33111 \cdot 0$ | I•I3 | $\begin{array}{lll}3 & 30 \\ 3 & 1.2\end{array}$ | I.19 |  | I. 26 | 327 30•I | I. 32 |
| 36 | $\begin{array}{lllll}3 & 29 & 10.7\end{array}$ | 1.04 | $\begin{array}{llll}3 & 28 & 6 \cdot 7\end{array}$ | I•Io | $32659 \cdot 1$ |  | $32547 \cdot 6$ | $1 \cdot 22$ | $32432 \cdot 2$ | I. 29 | 32312.7 |  |
| 37 | $\begin{array}{lrr}25 & 1.3 \\ 20 \\ 51.6\end{array}$ | $\underline{1} 06$ | $\begin{array}{llll}3 & 23 & 56.0 \\ 3 & 0\end{array}$ | 1.12 I. 15 | $\begin{array}{llll}3 & 22 & 46 \\ 3 & 18\end{array}$ | I.2I | $\begin{array}{llll}3 & 21 & 33.5 \\ 3 & 17 & 18.0\end{array}$ | 1.25 <br> 129 <br> 1 | $\begin{array}{lllll}3 & 20 & 16 \cdot 2 \\ 3 & 15 & 59.5\end{array}$ | I 32 I 36 | $\begin{array}{llll}3 & 18 & 54.6 \\ 3 & 14 & 35.8\end{array}$ | 9 |
| 39 | $\begin{array}{llll}3 & 20 & 51 \cdot 6 \\ 3 & 16 & 41 \cdot 5\end{array}$ | $\stackrel{1}{1 \cdot 1}$ | $\begin{array}{llll}3 & 19 & 44 \cdot 7 \\ 3 & 15 & 33 \cdot 1\end{array}$ | 17 | 3 18 $33 \cdot 9$ <br> 3 14 $20 \cdot 5$ | 25 | $\begin{array}{llll}3 & 13 & 3.6\end{array}$ | $1 \cdot 32$ | 3 II 42.2 | 1.39 | $\begin{array}{lll}3 \\ 3 & \text { 10 } & 16 \cdot 2\end{array}$ | 143 |
| 40 | $31231 \cdot 0$ | 13 | 3 II 21.0 | I 20 | 3 10 6.6 | 1.28 | $847 \cdot 7$ | - 35 | $3 \quad 724.2$ | 43 | 555.9 | . 51 |
| 41 | $\begin{array}{llll}3 & 8 & 20 \cdot 1\end{array}$ | I•16 | $\begin{array}{lll}3 & 7 & 8.4\end{array}$ | $1 \cdot 23$ | $\begin{array}{llll}3 & 5 & 52 \cdot \mathrm{I}\end{array}$ | 1.31 | $431 \cdot 2$ | I 39 | $\begin{array}{llll}3 & 3 & 5 \cdot 4\end{array}$ | 1.47 | 3 I $34 \cdot 6$ | 1.56 |
| 42 | $\begin{array}{llll}3 & 4 & 8.8\end{array}$ | I•19 | $\begin{array}{lllll}3 & 2 & 55 \cdot 3\end{array}$ | 26 | $3 \quad 1 \begin{array}{lll}37.0\end{array}$ | I.34 | $3 \mathrm{O}^{3} 14^{\circ} \mathrm{O}$ | 1.43 | $25845 \cdot 8$ | 1.51 | $2 \begin{array}{llll}27 & 12.4\end{array}$ | 60 |
| 43 | $25956 \cdot 9$ | 1.22 | $25841 \cdot 5$ | 30 | $25721 \cdot 3$ | I. 38 | $25556 \cdot 0$ | 1.47 | $25425 \cdot 3$ | I. 56 | $25249 \cdot 2$ | . 65 |
| 44 | ${ }^{2} 55544.5$ | 1.25 | $25427 \cdot 2$ | 33 | $2 \begin{array}{lll}2 & 53 & 4.8\end{array}$ | 1.42 | $25137 \cdot 1$ | I.51 | $2 \begin{array}{lll}50 & 3 \cdot 8\end{array}$ | 1 | 24824.9 | 1.70 |
| 45 | ${ }^{2} 515131.6$ | 1.28 | $25012 \cdot 3$ | $1 \cdot 37$ | $\begin{array}{ll}2 & 48 \\ 2 & 47 \cdot 6\end{array}$ | I.46 | 24717.4 | 1.55 | $24541 \cdot 4$ | 1.65 | 24359.4 | -75 |
| 46 | 24718.1 | I.31 | $24556 \cdot 6$ | 1.40 | $24429 \cdot 5$ | 1.50 | $24256 \cdot 7$ |  | 24117.8 | I•70 | $23932 \cdot 6$ |  |
| 47 | 2 43 3.9 <br> 2 38  | . 35 | 2 41 <br> 2 $40 \cdot 1$ |  |  | 1.54 I 60 | $\begin{array}{llll}2 & 38 & 34 \cdot 9 \\ 2 & 34 & 12 \cdot 1\end{array}$ | I.65 | $\begin{array}{llll}2 & 36 & 53 \cdot 0 \\ 2 & 32 & 26 \cdot 9\end{array}$ |  |  | 87 |
| 48 | 2 38  <br> 2 49 49 | $\cdot 39$ | $\begin{array}{llrr}2 & 37 & 22.8 \\ 2 & 33 & 4.7\end{array}$ | 1.49 1.53 | $\begin{array}{llll}2 & 35 & 50 \cdot 6 \\ 2 & 31 & 29 \cdot 7\end{array}$ | I. 60 | $\begin{array}{llll}2 & 34 & 12 \cdot 1 \\ 2 & 29 & 48 \cdot 0\end{array}$ | I 77 | $\begin{array}{llll}2 & 32 & 26 \cdot 9 \\ 2 & 27 & 59 \cdot 3\end{array}$ | 1.81 1.87 | $\begin{array}{llr}2 & 30 & 34.8 \\ 2 & 26 & 3 \cdot 4 \\ 2 & \end{array}$ | 1.93 2.00 |
| 50 | 23016.9 | 47 | 228455 | 58 | $227 \quad 7 \cdot 5$ | I. 69 | $22522 \cdot 5$ | 1.81 | 223 30\%2 | . 93 | $22130 \cdot 3$ | 2.07 |
| 51 | 22559.5 | 1.51 | $22425 \cdot 3$ | 1.63 | $22244 \cdot \mathrm{I}$ | 1.75 | 2055.6 | I.87 | 18 59.4 | $2 \cdot 00$ | 6 | 4 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. 11 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | S. | s. | S. | S. | s. | S. | S. | S. | S. | S. | S. | S. |
| 0 | - 43 | $-4.06$ | - 50 | $-4.07$ | - 57 | -4.08 | - . 65 | -4.09 | - 72 | $-4 \cdot 10$ | - 79 | -4.II |
| 4 | -47 | 4.07 | - 54 | 4.08 | . 62 | 4.08 | -69 | $4 \cdot 10$ | $\cdot 76$ | 4-II | -84 | 4.12 |
| 8 | - 51 | 4.07 | - 59 | 4.08 | - 66 | 4.09 | $\cdot 74$ | 4.II | -81 | $4 \cdot 12$ | -89 | 4-13 |
| 10 | - 54 | 4.07 | -6I | 4.08 | -69 | $4 \cdot 10$ | $\cdot 76$ | $4 \cdot 11$ | -84 | $4 \cdot 12$ | -91 | $4 \cdot 14$ |
| 12 | - 56 | 4.08 | -64 | 4.09 | $\cdot 71$ | 4.10 | $\cdot 79$ | $4 \cdot 12$ | -86 | $4 \cdot 13$ | -94 | $4 \cdot 15$ |
| 14 | -59 | 4.08 | -66 | 4.09 | $\cdot 74$ | 4.II | -82 | $4 \cdot 12$ | -89 | 4.14 | -97 | $4 \cdot 15$ |
| 16 | . 61 | 4.08 | -69 | $4 \cdot 10$ | - 77 | 4-1I | -84 | $4 \cdot 13$ | -92 | $4 \cdot 14$ | 1.00 | 4-16 |
| 18 | -64 | 4.09 | $\cdot 72$ | 4.10 | -80 | $4 \cdot 12$ | -88 | $4 \cdot 13$ | -95 | $4 \cdot 15$ | I.O3 | $4 \cdot 17$ |
| 20 | . 67 | 4.09 | -75 | $4 \cdot 11$ | -83 | $4 \cdot 12$ | $\cdot 91$ | 4.14 | -99 | $4 \cdot 16$ | I.07 | 4-18 |
| 22 | $\cdot 70$ | $4 \cdot 10$ | $\cdot 78$ | $4 \cdot 11$ | . 86 | 4.13 | -94 | $4 \cdot 15$ | I.03 | $4 \cdot 17$ | I•II | 4.19 |
| 24 | $\cdot 73$ | 4.10 | . 81 | 4.12 | -90 | 4*14 | $\cdot 98$ | $4 \cdot 16$ | I.06 | 4.18 | I-15 | 4.20 |
| 26 | -76 | $4 \cdot 11$ | . 85 | $4 \cdot 13$ | -93 | 4.15 | 1.02 | $4 \cdot 17$ | I. 10 | $4 \cdot 19$ | I-19 | $4 \cdot 21$ |
| 28 | -80 | 4-12 | . 89 | $4 \cdot 14$ | -97 | $4 \cdot 15$ | I.06 | $4 \cdot 18$ | I•I5 | $4 \cdot 20$ | I-24 | 4.22 |
| 30 | -84 | 4-12 | -92 | 4.14 | I-OI | $4 \cdot 16$ | I-10 | $4 \cdot 19$ | I-I9 | $4 \cdot 21$ | I-29 | $4 \cdot 24$ |
| 32 | -88 | $4 \cdot 13$ | -97 | $4 \cdot 15$ | 1.06 | $4 \cdot 18$ | I'I5 | $4 \cdot 20$ | I. 25 | $4 \cdot 23$ | I 34 | $4 \cdot 26$ |
| 34 | -92 | 4.14 | I OI | $4 \cdot 16$ | I-II | 4-19 | I. 20 | $4 \cdot 21$ | I. 30 | $4 \cdot 24$ | I.40 | 4.27 |
| 36 | -97 | 4.15 | I.06 | $4 \cdot 18$ | I•I6 | $4 \cdot 20$ | I. 26 | $4 \cdot 23$ | I.36 | $4 \cdot 26$ | I.46 | $4 \cdot 30$ |
| 38 | 1.02 | 4.16 | I•II | $4 \cdot 19$ | I. 21 | $4 \cdot 22$ | I. 32 | $4 \cdot 25$ | I. 42 | $4 \cdot 28$ | I. 53 | $4 \cdot 32$ |
| 40 | I.07 | 4-18 | I.I7 | $4 \cdot 21$ | I. 28 | $4 \cdot 24$ | I. 38 | $4 \cdot 27$ | I. 49 | 4.31 | I. 60 | $4 \cdot 35$ |
| 42 | I-13 | 4.19 | I. 23 | 4.22 | I 34 | $4 \cdot 26$ | I-46 | 4.29 | I.57 | $4 \cdot 33$ | I•69 | $4 \cdot 38$ |
| 44 | I•19 | 4.21 | I.30 | 4.24 | I. 42 | $4 \cdot 28$ | I.54 | $4 \cdot 32$ | I. 66 | $4 \cdot 37$ | 1.78 | 4.415 |
| 46 | I. 26 | 4.23 | 1.38 | $4 \cdot 27$ | I. 50 | $4 \cdot 31$ | I. 62 | $4 \cdot 35$ | I.75 | 4.40 | I. 89 | $4 \cdot 46$ |
| 48 | I•34 | 4.26 | 1.46 | $4 \cdot 29$ | 1.59 | $4 \cdot 34$ | I.72 | $4 \cdot 39$ | I. 86 | 4.45 | 2.00 | $4 \cdot 51$ |
| 50 | I. 42 | 4.28 | I.55 | 4.33 | 1.69 | $4 \cdot 38$ | I.83 | 4.44 | 1.98 | 4.50 | 2.14 | 4.57 |
| 51 | 1.47 | $4 \cdot 30$ | I-6I | $4 \cdot 35$ | I•75 | 4.40 | I. 89 | 4.46 | $2 \cdot 05$ | 4.53 | $2 \cdot 21$ | $4 \cdot 60$ |

156 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $8^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S | S. | M. | S. | H. M. | S. | M. S. | S. | M. S. | S. | H. M. s. | S. |
| 0 | $5 \begin{array}{lll}5 & 53 & 9.2\end{array}$ | $\cdot 59$ | $\begin{array}{llll}5 & 52 & 33 \cdot 8\end{array}$ | -59 | 5 5I 58.I | -60 | 5 5I $22 \cdot 0$ | - 60 | $55045 \cdot 7$ | . 61 | $550 \quad 9 \cdot 0$ | . 62 |
| 8 | $\begin{array}{llll}5 & 20 & 1 \cdot 3\end{array}$ | - 72 | 5 I9 17.6 | $\cdot 74$ | $5 \begin{array}{lllll}5 & \text { I8 } & 32 \cdot 9\end{array}$ | $\cdot 75$ | $51747 \cdot 1$ | $\cdot 77$ | 517003 | -79 | 5 16 12.3 | -81 |
| 10 | 5 II $42 \cdot 7$ | $\cdot 76$ | 5 10 56.7 | $\cdot 78$ | 5 10 $9 \cdot 5$ | -80 | $5 \quad 9 \quad 2 \mathrm{I} \cdot \mathrm{I}$ | - 82 | $5 \quad 8 \quad 31.4$ |  | $5 \quad 7 \quad 40 \cdot 5$ | -86 |
| 12 | $\begin{array}{llll}5 & 3 & 23.2\end{array}$ | -79 | $\begin{array}{lllll}5 & 2 & 34.8\end{array}$ | $\cdot 82$ | 5 I 4 4 4.2 | -84 | $5 \quad 0 \quad 54 \cdot 1$ | -86 | $5 \quad 0 \quad 1 \cdot 5$ | -89 | $4 \begin{array}{lll}4 & 59 & 7 \cdot 4\end{array}$ | $\bullet 92$ |
| 14 | $\begin{array}{lll}4 & 55 & 2 \cdot 8\end{array}$ | -83 | $45412 \cdot 1$ | -86 | 45319.8 |  | $4 \begin{array}{llll}4 & 525 & 25\end{array}$ | -91 | $45130 \cdot 2$ | $\cdot 94$ | $45032 \cdot 8$ | $\bullet 97$ |
| 16 | $446 \quad 4 \mathrm{I} \cdot 6$ | $\cdot 87$ | $\begin{array}{llll}4 & 45 & 48 \cdot 2\end{array}$ | -90 | $44453 \cdot 2$ | -93 | $4 \begin{array}{lll}43 & 56 \cdot 3\end{array}$ | -96 | $44257 \cdot 5$ | I.00 | $44156 \cdot 7$ | I. 03 |
| 18 | 43819.2 | -92 | $4 \begin{array}{llll}4 & 37 & 23 \cdot 3\end{array}$ | -95 | $4 \begin{array}{lll}4 & 36 & 25 \cdot 3\end{array}$ | -98 | $4 \begin{array}{llll}4 & 35 & 25.3\end{array}$ | I. 02 | $43423 \cdot 2$ | I.05 | $43318 \cdot 9$ | I.09 |
| 20 | $43955 \cdot 7$ | $\cdot 96$ | $4 \quad 28 \quad 57 \cdot 0$ | I $\cdot 00$ | $42756 \cdot 0$ | 1.03 | $4 \begin{array}{llll}4 & 26 & 52 \cdot 8\end{array}$ | 1.07 | $42547 \cdot 2$ | I•II | $\begin{array}{llll}4 & 24 & 39 \cdot 2\end{array}$ | I. 15 |
| 22 | $42131 \cdot 0$ | I.OI | $4 \quad 20 \quad 29 \cdot 3$ | 1.05 | $4 \begin{array}{llll}4 & 19 & 25 \cdot 2\end{array}$ | I.09 | $4 \begin{array}{llll}48 & 18.6\end{array}$ | r 13 | $\begin{array}{lll}4 & 17 & 9 \cdot 3\end{array}$ | I•I8 |  | I. 22 |
| 24 | 4 I3 4.9 | I.06 | $\begin{array}{llll}4 & 12 & 0.1\end{array}$ | I•IO | 4 10 52.7 | I'15 | $\begin{array}{llll}4 & 9 & 42.4\end{array}$ | I'I9 | $4 \quad 8 \quad 293$ | 1.24 | $4 \begin{array}{lll}4 & 7 & 13.3\end{array}$ | 1.29 |
| 25 | $4 \quad 8 \quad 5 \mathrm{I} \cdot 2$ | I.08 | $4 \quad 7 \quad 44 \cdot 9$ | I.13 | $\begin{array}{llll}4 & 6 & 35 \cdot 7\end{array}$ | I.18 | $4 \begin{array}{lll}4 & 5 & 23 \cdot 6\end{array}$ | 1.23 | $\begin{array}{lll}4 & 4 & 8 \cdot 5\end{array}$ | I 28 | $\begin{array}{lrr}4 & 2 & 50 * 3\end{array}$ | I•33 |
| 26 | $443137 \cdot 2$ | I•II | $\begin{array}{llll}4 & 3 & 29 \cdot 2\end{array}$ | I.I6 | $\begin{array}{llll}4 & 2 & 18 \cdot 2\end{array}$ | I-2I | $4 \quad 14^{\prime} \mathrm{I}$ | I. 26 | $35947 \cdot 0$ | I.31 | $\begin{array}{llll}3 & 58 & 26 \cdot 5\end{array}$ | I 37 |
| 27 | 4 0 $22 \cdot 7$ | I'I4 | 35913.0 | I•I9 | $\begin{array}{llll}3 & 58 & 0.2\end{array}$ | I. 24 | $315644 \cdot 2$ | I. 29 | 35524.8 | I.35 | $\begin{array}{llll}3 & 54 & 2 \cdot I\end{array}$ | I.4I |
| 28 | $\begin{array}{llllllllllllllll}3 & 56 & 7 \cdot 8\end{array}$ | I•I7 |  | 1. 22 | $3534 \mathrm{I} \cdot 6$ | I. 27 | $\begin{array}{llll}3 & 52 & 23 \cdot 5\end{array}$ | I.33 | 35120 | I.39 | $34936 \cdot 9$ | I.45 |
| 29 | 35152.5 | I. 20 | $35039 \cdot 1$ | I.25 | 34922.4 | I•3I | $\begin{array}{llll}3 & 48 & 2 \cdot 2\end{array}$ | $1 \cdot 37$ | $3 \begin{array}{llll}3 & 46 & 38 \cdot 4\end{array}$ | 1.43 | $3 \quad 45 \quad 10.9$ | I 49 |
| 30 | $34736 \cdot 6$ | I. 22 | 34621.4 | 1.28 | $\begin{array}{lll}3 & 45 & 2 \cdot 6\end{array}$ | I•34 | $\begin{array}{llll}3 & 43 & 40 \cdot 2\end{array}$ | I.40 | 342 I 4 I | I'47 | $34^{\circ} 44^{\circ} 0$ | I. 54 |
| 31 | $3 \quad 43 \quad 20 \cdot 2$ | I. 26 | $\begin{array}{lll}3 & 42 & 3 \cdot 0\end{array}$ | I. 32 | $34042 \cdot 1$ | 1.38 | $\begin{array}{llll}3 & 39 & 17 \cdot 5\end{array}$ | I-44 | $313748 \cdot 9$ | I•5I | $\begin{array}{llll}3 & 36 & 16 \cdot 2\end{array}$ | I. 58 |
| 32 | $\begin{array}{llll}3 & 39 & 3 \cdot 2\end{array}$ | I. 29 | $\begin{array}{lllll}3 & 37 & 44 \cdot 0\end{array}$ | 1.35 | $\begin{array}{llll}3 & 36 & 21 \cdot 0\end{array}$ | 1.42 | $\begin{array}{llll}3 & 34 & 54 & 0\end{array}$ | I. 48 | $\begin{array}{llll}3 & 33 & 22.8\end{array}$ | I. 55 | 3 3I 47-4 | I. 63 |
| 33 | $313445 \cdot 6$ | I 32 | $\begin{array}{llll}3 & 33 & 24 \cdot 3\end{array}$ | I.39 | $33159 \cdot 1$ | 1.46 | $33029 \cdot 6$ | I. 53 | $\begin{array}{llll}3 & 28 & 55 \cdot 9\end{array}$ | I. 60 |  | I.68 |
| 34 | $3 \begin{array}{llll}3 & 30 & 27.4\end{array}$ | I. 36 | $\begin{array}{lll}3 & 29 & 4 \cdot 1\end{array}$ | 1.43 | $\begin{array}{llll}3 & 27 & 36 \cdot 3\end{array}$ | 1.50 | $\begin{array}{llll}3 & 26 & 4.4\end{array}$ | I. 57 | $\begin{array}{llll}3 & 24 & 27 \cdot 8\end{array}$ | I 65 | $\begin{array}{llll}3 & 22 & 46 \cdot 6\end{array}$ | I•73 |
| 35 | $\begin{array}{llll}3 & 26 & 8 \cdot 6\end{array}$ | 1.39 | $\begin{array}{llll}3 & 24 & 42 \cdot 8\end{array}$ | I*46 | $\begin{array}{llll}3 & 23 & 12.8\end{array}$ | 1.54 | $32138 \cdot 1$ | 1. 62 | $\begin{array}{llll}3 & 19 & 58 \cdot 8\end{array}$ | I'70 | $\begin{array}{llll}3 & 18 & 14.5\end{array}$ | I.78 |
| 36 | 3 21 49.0 | 1.43 | $\begin{array}{llll}3 & 20 & 20 \cdot 9\end{array}$ | I. 5 I | $31848 \cdot 3$ | I. 58 | 31710.9 | 1.66 | $\begin{array}{llllllllllllll}3 & 15 & 28 \cdot 6\end{array}$ | I•75 | 313 4I•I | I. 84 |
| 37 | $317728 \cdot 7$ | I. 47 | 33 15 58 | I. 55 | 3 I4 22.8 | I. 63 | $\begin{array}{lllll}3 & 12 & 42 \cdot 6\end{array}$ | 1.71 | 3 10 57.1 | I.80 | 3 9  | I. 89 |
| 38 | $\begin{array}{llll}3 & 13 & 7 \cdot 5\end{array}$ | I. 5 I | 3 II 34.4 | I. 59 | $\begin{array}{llll}3 & 9 & 56 \cdot 3\end{array}$ | I. 68 | $\begin{array}{llll}3 & 8 & 13 \cdot 1\end{array}$ | 1・フ7 | 3624.4 | I.86 | $\begin{array}{llll}3 & 4 & 30 \cdot 0\end{array}$ | I.96 |
| 39 | $\begin{array}{llll}3 & 8 & 45.5\end{array}$ | 1.55 | $\begin{array}{llll}3 & 7 & 9 \cdot 7\end{array}$ | I. 64 | $\begin{array}{llll}3 & 5 & 28 \cdot 8\end{array}$ | I.73 | $\begin{array}{llll}3 & 3 & 42 \cdot 3\end{array}$ | I. 82 | 3 I 50.2 | I.92 | $25952 \cdot 1$ | 2.02 |
| 40 | $\begin{array}{llll}3 & 4 & 22 \cdot 5\end{array}$ | I. 60 | $\begin{array}{rrrr}3 & 2 & 44.0\end{array}$ | I. 69 | $\begin{array}{lrrr}3 & 1 & 0.0\end{array}$ | 1.78 | $2 \begin{array}{llll}2 & 59 & 10.2\end{array}$ | 1.88 | $2 \begin{array}{llll}2 & 57 & 14.6\end{array}$ | I.98 | $\begin{array}{llll}2 & 55 & 12.6\end{array}$ | 2.09 |
| 41 | $2 \begin{array}{llll}2 & 59 & 58 \cdot 6\end{array}$ | I. 65 | $25^{2} 88$ I7•I | 1.74 | $2 \begin{array}{llll}56 & 29.9\end{array}$ | I.84 | $2 \begin{array}{llll}2 & 54 & 36 \cdot 7\end{array}$ | I.94 | 25237.2 | $2 \cdot 05$ | $25031 \cdot 1$ | $2 \cdot 16$ |
| 42 | $25533 \cdot 6$ | I. 69 | $2 \begin{array}{llll}2 & 53 & 49 \cdot 0\end{array}$ | 1.79 | $\begin{array}{lllll}2 & 51 & 58 \cdot 4\end{array}$ | I.90 | $2 \begin{array}{lll}20 & 1 & 5\end{array}$ | $2 \cdot 00$ | $24758 \cdot 1$ | 2.II | $24547 \cdot 7$ | 2.23 |
| 43 | $2 \begin{array}{lll}2 & 51 & 7 \cdot 3\end{array}$ | I.75 | $2 \begin{array}{llll}2 & 49 & 19 & 5\end{array}$ | I.85 | 24725.4 | I.96 | $\begin{array}{lllll}2 & 45 & 24.7\end{array}$ | 2.07 | $\begin{array}{lllllllllll}2 & 43 & 17.0\end{array}$ | $2 \cdot 19$ | 24120 | $2 \cdot 31$ |
| 44 | 24639.9 | I.80 | $24448 \cdot 7$ | I.91 | $24250 \cdot 8$ | 2.02 | $24046 \cdot 0$ | 2.14 | 23833.9 | $2 \cdot 27$ | 23614.0 | $2 \cdot 40$ |
| 45 | 242 II•I | I. 86 | 240 I6.2 | 1.97 | $\begin{array}{llll}2 & 38 & 14.4\end{array}$ | 2.09 | $\begin{array}{llll}2 & 36 & 5 \cdot 3\end{array}$ | 2.22 | 23348.4 | $2 \cdot 35$ | 23 I 23.3 | $2 \cdot 49$ |
| 46 | $\begin{array}{llll}2 & 37 & 40 \cdot 8\end{array}$ | I.92 | $23542 \cdot 1$ | 2.04 | $23336 \cdot 1$ | $2 \cdot 16$ | $\begin{array}{llll}2 & 31 & 22.4\end{array}$ | $2 \cdot 30$ | $\begin{array}{lll}2 & 29 & 0.4\end{array}$ | 2.44 | 226 29  | $2 \cdot 58$ |
| 47 | 23319.0 | I.98 | $\begin{array}{lll}2 & 31 & 6 \cdot 2\end{array}$ | $2 \cdot 11$ |  | $2 \cdot 24$ | $2 \begin{array}{lll}2 & 26 & 37 \cdot 0\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}2 & 24 & 9 & 7\end{array}$ | 2.53 | 22133.0 | $2 \cdot 69$ |
| 48 | $22835 \cdot 3$ | 2.05 | $22628 \cdot 2$ | 2.19 | $2 \begin{array}{llll}24 & 13.0\end{array}$ | $2 \cdot 33$ | 22149.0 | $2 \cdot 48$ | 2 I9 I5.9 | $2 \cdot 64$ | 2 I6 $32 \cdot 7$ | 2.81 |
| 49 | 22359.8 | $2 \cdot 13$ | $22148 \cdot 0$ | $2 \cdot 27$ | $21927 \cdot 7$ | 2.42 | $21658 \cdot 1$ | $2 \cdot 58$ |  | 2.75 | 2 II $28 \cdot 5$ | 2.93 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | S. | S. | S. | S. | S. | s. | S. | S. | S. | S. | s. |
| 0 | -.87 | $-4 \cdot 13$ | - 9.94 | $-4.15$ | -I. 02 | $-4 \cdot 16$ | - I.O9 | $-4 \cdot 18$ | -I.I7 | $-4 \cdot 20$ | - I. 25 | -4.23 |
| 4 | $\cdot 91$ | 4.14 | -99 | $4 \cdot 16$ | r.06 | 4.18 | I'I4 | $4 \cdot 20$ | I. 22 | $4 \cdot 22$ | 1.30 | $4 \cdot 24$ |
| 6 | $\cdot 94$ | $4 \cdot 15$ | I'OI | 4.16 | 1.09 | 4.18 | I'I7 | $4 \cdot 20$ | I. 25 | $4 \cdot 23$ | I.32 | 4.25 |
| 8 | $\cdot 96$ | $4 \cdot 15$ | I'04 | $4 \cdot 17$ | I-12 | $4 \cdot 19$ | I'19 | $4 \cdot 21$ | I 27 | $4 \cdot 24$ | I.35 | $4 \cdot 26$ |
| 10 | -99 | 4.16 | 1.07 | 4.18 | I-15 | 4.20 | I-22 | $4 \cdot 22$ | I•30 | $4 \cdot 24$ | I 39 | 4.27 |
| 12 | 1.02 | 4•I7 | I.IO | 4.19 | I'I8 | 4.21 | I'26 | $4 \cdot 23$ | I•34 | $4 \cdot 25$ | 142 | $4 \cdot 28$ |
| 14 | 1.05 | $4 \cdot 17$ | I'13 | 4.19 | I-2I | 4.22 | I. 29 | $4 \cdot 24$ | I. 37 | $4 \cdot 27$ | I-46 | $4 \cdot 29$ |
| 16 | I.08 | $4 \cdot 18$ | I•16 | $4 \cdot 20$ | I. 24 | $4 \cdot 23$ | 1.33 | $4 \cdot 25$ | I.4I | $4 \cdot 28$ | I.50 | $4 \cdot 31$ |
| 18 | I-12 | $4 \cdot 19$ | I 20 | $4 \cdot 21$ | I. 28 | $4 \cdot 24$ | 1.37 | $4 \cdot 26$ | I. 45 | $4 \cdot 29$ | I. 54 | $4 \cdot 32$ |
| 20 | I•5 | $4 \cdot 20$ | I. 24 | 4.22 | I. 32 | $4 \cdot 25$ | 1.41 | $4 \cdot 28$ | I. 50 | 4.31 | I•59 | $4 \cdot 34$ |
| 22 | I-I9 | 4.21 | 1.28 | $4 \cdot 24$ | I.36 | $4 \cdot 26$ | 1.45 | 4.29 | I.54 | $4 \cdot 32$ | 1.64 | 4.36 |
| 24 | 1.23 | $4 \cdot 22$ | I.32 | 4.25 | I.4I | $4 \cdot 28$ | 1.50 | $4 \cdot 31$ | I. 59 | $4 \cdot 34$ | I. 69 | $4 \cdot 38$ |
| 26 | 1-28 | 4.24 | I 37 | 4.27 | I. 46 | $4 \cdot 30$ | I.56 | 4.33 | I.65 | $4 \cdot 36$ | I.75 | $4 \cdot 40$ |
| 28 | I. 33 | $4 \cdot 25$ | I.42 | 4.28 | I.52 | $4 \cdot 32$ | I.6I | $4 \cdot 35$ | I•7 | 4.39 | I.8I | 4.43 |
| 30 | I. $3^{8}$ | $4 \cdot 27$ | r.48 | $4 \cdot 30$ | I. 58 | $4 \cdot 34$ | I.67 | $4 \cdot 37$ | I.78 | $4 \cdot 4 \mathrm{I}$ | r. 88 | $4 \cdot 46$ |
| 32 | 1.44 | 4.29 | 1.54 | $4 \cdot 32$ | I. 64 | $4 \cdot 36$ | 1.74 | $4 * 40$ | I.85 | 4.44 | I.96 | 4.49 |
| 34 | I 50 | 4.31 | I. 60 | $4 \cdot 35$ | I•7 | $4 \cdot 39$ | r. 82 | $4 \cdot 43$ | I.93 | $4 \cdot 48$ | $2 \cdot 04$ | $4 \cdot 53$ |
| 36 | I. 57 | $4 \cdot 33$ | I. 67 | $4 \cdot 37$ | I.78 | $4 \cdot 42$ | I.90 | $4 \cdot 46$ | $2 \cdot \mathrm{OI}$ | $4 \cdot 51$ | $2 \cdot 13$ | 4.57 |
| 38 | I. 64 | $4 \cdot 36$ | I.75 | $4 \cdot 40$ | I.87 | $4 \cdot 45$ | I.99 | $4 \cdot 50$ | $2 \cdot 11$ | $4 \cdot 56$ | $2 \cdot 24$ | 4.62 |
| 40 | I.72 | $4 \cdot 39$ | I. 84 | $4 \cdot 44$ | I.96 | 4.49 | 2.09 | 4.55 | $2 \cdot 22$ | $4 \cdot 61$ | $2 \cdot 35$ | 4.67 |
| 42 | I. 81 | 4.43 | I.94 | 4.48 | 2.07 | $4 \cdot 54$ | $2 \cdot 20$ | $4 \cdot 60$ | $2 \cdot 34$ | 4.67 | 2.48 | 474 |
| 44 | 1.91 | 4.47 | $2 \cdot 04$ | $4 \cdot 53$ | $2 \cdot 18$ | $4 \cdot 59$ | 2.33 | $4 \cdot 66$ | 2.48 | $4 \cdot 74$ | 2.63 | $4 \cdot 82$ |
| 46 | 2.02 | 4.52 | $2 \cdot 17$ | $4 \cdot 58$ | $2 \cdot 32$ | $4 \cdot 66$ | 2.47 | $4 \cdot 74$ | $2 \cdot 64$ | 4.82 | 2.81 | $4 \cdot 92$ |
| 48 | 2.15 2.22 | 4.58 4.61 | 2.31 2.38 | 4.65 4.69 | 2.47 2.55 | $4 \cdot 73$ $4 \cdot 78$ | 2.64 | 4.82 4.88 | 2.81 | 4.93 | 3.00 | 5.04 |
| 49 | $2 \cdot 22$ | 4.61 | $2 \cdot 38$ | $4 \cdot 69$ | $2 \cdot 55$ | 4.78 | $2 \cdot 73$ | 4.88 | 2.91 | 4.99 | $3 \cdot 11$ | $5 \cdot 11$ |

## LATITUDE $8^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.


## 158 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $9^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $0^{\circ}$ | Decl. <br> Var. | $1^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. M. ${ }_{\text {L }}$ S. |  | H. M. S. | S. | H. M. S. | S. | H. M. S. |  | H. M. S. <br> 5 57 | - 6 | H. M. S. | S. |
| 0 |  | - $\cdot 63$ | [15lll |  | $5 \begin{array}{llll}5 & 58 & 44^{\circ} 0 \\ 5 & 18 & \text { II.0 }\end{array}$ | - . 63 | $\begin{array}{llll}5 & 58 & 5 \cdot 9\end{array}$ | --64 | $\begin{array}{llll}5 & 57 & 27 \cdot 7 \\ 5 & 16 & 4 .\end{array}$ | -64 | $5{ }^{5} 56649 \cdot 4$ | 64 |
| 10 | $5 \mathrm{l}_{5} 1929.8$ | -64 | $5{ }_{5}^{5}$ 18 $50 \cdot 8$ |  | 5 18 II•0 |  | $5{ }_{5}^{5} 17830 \cdot 4$ |  | $5{ }_{5}^{5}$ 16 $48 \cdot 9$ | O | $16 \quad 6 \cdot 5$ | 71 |
| 12 | $\begin{array}{rrrr}5 & 11 & 23.5 \\ 5 & 3 & 17.2\end{array}$ | - 65 | 5 5 10 44.2 |  | $\begin{array}{rrrr}5 & 10 & 3.9\end{array}$ |  | $\begin{array}{llll}5 & 9 & 22 \cdot 6 \\ 5 & 1 & \end{array}$ | $\cdot 70$ | $5 \begin{array}{lll}5 & 8 & 40 \cdot 3 \\ 5 & 0 & 31 \cdot 4\end{array}$ | $\cdots 7$ | $5{ }^{5}$ | 73 |
| 14 | $\begin{array}{llll}5 & 3 & 17.2\end{array}$ | -65 | $\begin{array}{llll}5 & 2 & 37 \cdot 5\end{array}$ | - 67 | 5 I $56 \cdot 6$ |  | $\begin{array}{llllllllllll}5 & 1 & 14.6\end{array}$ | -71 | $5 \quad 0 \quad 3 \mathrm{I} \cdot 4$ | -73 | $45947 \cdot 0$ | 75 |
| 16 | $45510 \cdot 8$ | - 66 | $45430 \cdot 6$ |  | 453 49•1 | $\cdot 70$ | $4 \begin{array}{lll}43 & 6 \cdot 3\end{array}$ | $\cdot 72$ | $45222 \cdot 1$ | -75 | $45 \mathrm{I} 36 \cdot 6$ | $\cdot 77$ |
| 18 | $447 \quad 4.2$ | . 67 | $44623 \cdot 5$ | - 69 | 44541.4 | $\cdot 71$ | $444 \quad 57 \cdot 7$ | $\cdot 74$ | 44412.4 | $\cdot 77$ | $\begin{array}{llll}4 & 43 & 25 \cdot 8\end{array}$ | 79 |
| 20 | $43^{48}$ 57.6 | -68 | $43^{88}$ 16.2 | $\cdot 70$ | $43733 \cdot 3$ |  | $4 \quad 36 \quad 48 \cdot 7$ | $\cdot 76$ | $4 \begin{array}{lll}46 & 2.4\end{array}$ | -79 | 43514.4 | 81 |
| 22 | $43050 \cdot 7$ | -68 | $4308 \cdot 7$ |  | 42925.0 | $\cdot 74$ | $4 \begin{array}{lll}4 & 28 & 39 \cdot 3\end{array}$ | $\cdot 78$ | 427 5I•8 | -81 | $4 \begin{array}{lll}4 & 27 & 2.4\end{array}$ | 84 |
| 24 | $42243 \cdot 6$ | -69 | $\begin{array}{lll}4 & 22 & 0.9\end{array}$ | -73 | $42116 \cdot 2$ | $\cdot 76$ | 42029.5 | -80 | $41940 \%$ | -83 | $4 \begin{array}{llll}4 & 49 \cdot 8\end{array}$ | . 87 |
| 26 | $41436 \cdot 3$ | $\cdot 71$ | $\begin{array}{llll}4 & 13 & 52.8\end{array}$ | $\cdot 74$ | $413 \quad 7 \cdot 1$ | $\cdot 78$ | $41219 \cdot 2$ | . 82 | 4 II 29.0 | -85 | 4 10 $36 \cdot 6$ | . 89 |
| 28 | $\begin{array}{llll}4 & 6 & 28.7\end{array}$ | $\cdot 72$ | $4 \quad 544.3$ | $\cdot 76$ | $\begin{array}{llll}4 & 4 & 57 \cdot 6\end{array}$ | -80 | $\begin{array}{llll}4 & 4 & 8.4\end{array}$ | - 84 | $\begin{array}{llll}4 & 3 & 16 \cdot 7\end{array}$ | - 88 | $\begin{array}{llll}4 & 2 & 22.5\end{array}$ | 92 |
| 30 | $\begin{array}{llll}3 & 58 & 20 \cdot 8\end{array}$ | -73 | $35735 \cdot 5$ | $\cdot 78$ | $3 \begin{array}{llll}3 & 56 & 47 \cdot 5\end{array}$ | -82 | $35557 \cdot 0$ | -87 | $\begin{array}{lll}3 & 55 & 3 \cdot 6\end{array}$ | -9x | 354 7.7 | 96 |
| 32 | 35012.6 | $\cdot 75$ | $34926 \cdot 2$ | -80 | $\begin{array}{lllll}3 & 4^{8} & 37 \cdot 0\end{array}$ | - 84 | $34744 \cdot 9$ | -89 | $3 \begin{array}{lllllllllll}3 & 46\end{array}$ | -94 | 345 51.8 | -99 |
| 33 | $3{ }_{3} 46 \quad 8 \cdot 4$ | $\cdot 76$ | 34521.4 | -81 | $3 \begin{array}{llll}3 & 44 & 3 I \cdot 5\end{array}$ |  | $\begin{array}{llll}3 & 43 & 38 \cdot 6\end{array}$ | -91 | $\begin{array}{llll}3 & 42 & 42 \cdot 6\end{array}$ | -96 | 34143.5 | I'OI |
| 34 | $\begin{array}{llll}3 & 42 & 4 \cdot 1\end{array}$ | $\cdot 77$ | 34116.4 | . 82 | $3 \quad 40 \quad 25 \cdot 8$ | -87 | $\begin{array}{llll}3 & 39 & 32 \cdot 1\end{array}$ | -92 | 3 $33^{8} 35 \cdot 1$ | -98 | $33735 \cdot 0$ | I. 03 |
| 35 | $3 \begin{array}{llll}3 & 37 & 59.6\end{array}$ | $\cdot 78$ | 33711.4 | . 83 | $\begin{array}{llll}3 & 36 & 20 \cdot 0\end{array}$ | - 88 | $33525 \cdot 3$ | -94 | $313427 \cdot 4$ | -99 | $33326 \cdot 1$ | I.05 |
| 36 | $33355 \cdot 0$ | -79 | $\begin{array}{lll}3 & 33 & 6 \cdot 1\end{array}$ | -84 | $\begin{array}{llllllllll}3 & 32 & 14.0\end{array}$ | -90 | $\begin{array}{lllll}3 & 31 & 18.4\end{array}$ | -95 | $3 \quad 3019.4$ | 1.OI | 329 17.0 | I.07 |
| 37 | $32950 \cdot 3$ | -80 | $\begin{array}{llll}3 & 29 & 0.7\end{array}$ | -85 | $\begin{array}{llll}3 & 28 & 7 \cdot 7\end{array}$ |  | $3 \begin{array}{llllll}3 & 27 & \text { II } 2\end{array}$ | -97 | $326 \mathrm{II} \cdot \mathrm{I}$ | I.03 | $\begin{array}{llll}3 & 25 & 7.4\end{array}$ | I.09 |
| 38 | $\begin{array}{lllllllllllll}3 & 25 & 45 \cdot 5\end{array}$ | -81 | $\begin{array}{llll}3 & 24 & 55 \cdot 2\end{array}$ | -87 | $\begin{array}{llll}3 & 24 & 1 & 3\end{array}$ |  | $\begin{array}{llll}3 & 23 & 3 \cdot 8\end{array}$ | -99 | $\begin{array}{llll}3 & 22 & 2.5\end{array}$ | I.05 | $320 \quad 57 \cdot 6$ | I•II |
| 39 | $32140 \cdot 6$ | . 82 | $32049 \cdot 5$ |  | $\begin{array}{lllll}3 & 19 & 54 \%\end{array}$ | -94 | $\begin{array}{llll}3 & 18 & 56 \cdot 1\end{array}$ | I-OI | 3 I7 53.7 | r•07 | $\begin{array}{lllll}3 & 16 & 47 \cdot 4\end{array}$ | I'14 |
| 40 | 3 17 35.5 | . 83 | 3 I6 43.6 | -90 | $3 \begin{array}{llll}3 & 15 & 47 \cdot 8\end{array}$ | -96 | $\begin{array}{llll}3 & 14 & 48 \cdot 1\end{array}$ | I.03 | 3 I3 44*4 | I•09 | $\begin{array}{llll}3 & 12 & 36 \cdot 7\end{array}$ | I'16 |
| 41 | $313130 \cdot 3$ | - 85 | $31237 \cdot 5$ | -91 | 3 II 40.7 | $\cdot 98$ | 31039.9 | I.05 | $\begin{array}{llll}3 & 9 & 34.9\end{array}$ | I•12 | $\begin{array}{llll}3 & 8 & 25 \cdot 7\end{array}$ | 19 |
| 42 | $3 \begin{array}{llll}3 & 9 & 24.9\end{array}$ | -86 | $\begin{array}{llll}3 & 8 & 3 \mathrm{I} \cdot 2\end{array}$ | -93 | $\begin{array}{llll}3 & 7 & 33 \cdot 3\end{array}$ | 1.00 | $\begin{array}{llll}3 & 6 & 3 I \cdot 3\end{array}$ | 1.07 | $\begin{array}{llll}3 & 5 & 24.9\end{array}$ | I-14 | $\begin{array}{llll}3 & 4 & 14.2\end{array}$ | I. 22 |
| 43 | $\begin{array}{llll}3 & 5 & 19 \cdot 3\end{array}$ | -88 | $\begin{array}{llll}3 & 4 & 24 \cdot 6\end{array}$ | -95 | $\begin{array}{llll}3 & 3 & 25 \cdot 7\end{array}$ | 1.02 | 3 2 $22 \cdot 4$ | I.09 | $3 \begin{array}{llll}3 & 1 & 14.5\end{array}$ | I•I7 | $\begin{array}{llll}3 & 0 & 2 \cdot 2\end{array}$ | I. 25 |
| 44 | 3 I 13.5 | -89 | 3 3 017.8 | $\cdot 96$ | $\begin{array}{llllll}2 & 59 & 177\end{array}$ | I 04 | $\begin{array}{llll}2 & 58 & \text { I } 3 \cdot 1\end{array}$ | I-12 | $\begin{array}{llll}2 & 57 & 3.8\end{array}$ | I-I9 | $25549 \%$ | I. 28 |
| 45 | 25778 |  | $2 \begin{array}{lll}2 & 56 & 10.8\end{array}$ | -98 | 2559.5 | I.06 | $2 \begin{array}{lll}2 & 54 & 3\end{array}$ | 1.14 | $\begin{array}{llll}2 & 52 & 52 \cdot 5\end{array}$ | 1.22 | $2 \begin{array}{llll}21 & 36 \cdot 6\end{array}$ | I.3I |
| 46 | $2 \begin{array}{lll}2 & 53 & 1 \cdot 3\end{array}$ | -92 | $\begin{array}{lll}2 & 52 & 3.4\end{array}$ | I.00 | 2510.8 | I. 08 | $24953 \cdot 3$ | 1•17 | $24^{2} 4840 \cdot 7$ | I. 25 | 24723.0 | $1 \cdot 34$ |
| 47 | 24854.9 | -94 | $\begin{array}{llllllllll}2 & 47 & 55 \cdot 8\end{array}$ | 1.03 | $24651 \cdot 8$ | I•II | $24542 \cdot 8$ | I'19 | $244 \begin{array}{llll}28 \cdot 4\end{array}$ | 1.28 | $2 \begin{array}{lll}2 & 43 & 8 \cdot 6\end{array}$ | I-38 |
| 48 | $24448 \cdot 1$ | $\cdot 96$ | $\begin{array}{lllll}2 & 43 & 47 \cdot 9\end{array}$ | I.05 | 24242.4 | 1.13 | $24131 \cdot 7$ | I. 22 |  | 1.32 | $2 \begin{array}{llll}28 & 53.6\end{array}$ | 1.41 |
| 49 | $24041 \cdot 1$ | -98 | 23939.6 | 1.07 | $2 \begin{array}{llll}28 & 32 \cdot 6\end{array}$ | I•16 | $23720 \cdot 1$ | I.26 | $2 \begin{array}{lll} & 36 & 1 \cdot 9\end{array}$ | 1.35 | $2 \begin{array}{llll}2 & 34 & 37.8\end{array}$ | 1.45 |
| 50 | $\begin{array}{llll}2 & 36 & 33.9\end{array}$ | 1.00 | $2 \begin{array}{llll}2 & 35 & 30.9\end{array}$ | I•IO | $23422 \cdot 3$ | 1'19 | $2338 \cdot 0$ | I. 29 | $23147 \cdot 6$ | I•39 | $23021 \cdot 2$ | I 49 |
| 51 | $\begin{array}{llll}2 & 32 & 26 \cdot 3\end{array}$ | 1.03 | 2 3I 2I•8 | I•12 | 230 II• 5 | 1.22 | $22855 \cdot 2$ | 1.32 | $22732 \cdot 6$ | 1.43 | $22613 \cdot 7$ | 1.54 |
| 52 | $2 \begin{array}{llllll}28 & 28 & 18\end{array}$ | I. 05 | $2 \begin{array}{llllllll}2 & 27 & 12.3\end{array}$ | I'I5 | $226 \quad 0 \cdot 1$ | 1.25 | $22441 \cdot 7$ | I. 36 |  | 1.47 | $22145 \cdot 3$ | 1-58 |
| 53 | $\begin{array}{lll}2 & 24 & 9 \cdot 9\end{array}$ | I.08 | $\begin{array}{llr}2 & 23 & 2 \cdot 2 \\ 2 & 1 & 51\end{array}$ | I•18 | $22148 \cdot 2$ | 1.29 | $2 \begin{array}{llll}2 & 20 & 27.6\end{array}$ | 1.40 | $\begin{array}{lll}2 & 19 & 0 \cdot 1\end{array}$ | 1.52 | $2 \begin{array}{llll}2 & 17 & 25.7\end{array}$ | 1.64 |
| 54 | 220 I-2 | I•IO | 2 I8 5I•7 | I. 21 | 21735.6 | I 33 | 2 16 12.6 | I.44 | $\mid 2$ I4 42.5 | 1.56 | $2 \begin{array}{lll}2 & 13 & \end{array}$ | I. 69 |


| Alt. | L. $0^{\circ}$ | A. | L. $1{ }^{\circ}$ | A. | L. 2 | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | - ${ }^{\text {S }}$ | S. -4.05 | - ${ }^{\text {s. }}$ | S. | ${ }_{-} \mathrm{S}$. ${ }^{\text {I4 }}$ | S. | S. $-\quad .21$ | s. -4.06 | S. $-\quad .29$ | S. -4.06 | S. $-\quad .36$ | S. |
| 4 | -04 | 4.05 | -12 | 4.05 | -19 | 4.05 | - 26 | 4.06 | - 33 | 4.06 | . 40 | 4.07 |
| 8 | -09 | 4.05 | -16 | 4.05 | . 23 | 4.06 | -3I | 4.06 | $\cdot 38$ | $4 \cdot 07$ | $\cdot 45$ | $4 \cdot 07$ |
| 12 | - 14 | 4.05 | -21 | 4.06 | $\cdot 28$ | 4.06 | $\cdot 36$ | 4.07 | 43 | 4.07 | -51 | 4.08 |
| 14 | -16 | 4.05 | -23 | 4.06 | $\cdot 31$ | 4-06 | $\cdot 38$ | 4.07 | 46 | $4 \cdot 08$ | -53 | 4.08 |
| 16 | . 18 | 4.05 | -26 | 4.06 | -33 | 4.06 | -41 | 4.07 | -48 | 4.08 | -56 | 4.09 |
| 18 | -21 | 4.05 | $\cdot 28$ | 4.06 | $\cdot 36$ | 4.07 | -44 | 4.07 | -1 | 4.08 | -59 | 4.09 |
| 20 | -23 | 4.06 | -31 | 4.06 | $\cdot 39$ | 4.07 | $\cdot 46$ | 4.08 | -54 | $4 \cdot 09$ | -62 | $4 \cdot 10$ |
| 22 | -26 | 4.06 | -34 | 4.06 | $\cdot 42$ | 4.07 | -49 | 4 C 8 | . 57 | 4.09 | $\cdot 65$ | $4 \cdot 10$ |
| 24 | -29 | 4.06 | -36 | 4.07 | $\cdot 44$ | $4 \cdot 07$ | -52 | 4.08 | .61 | 4.09 | -69 | 4.11 |
| 26 | -31 | 4.06 | -39 | 4.07 | -47 | 4.08 | -56 | 4.09 | . 64 | $4 \cdot 10$ | $\cdot 72$ | 4.11 |
| 28 | -34 | 4.06 | $\cdot 42$ | 4.07 | -51 | 4.08 | . 59 | 4.09 | . 67 | $4 \cdot 11$ | $\cdot 76$ | $4 \cdot 12$ |
| 30 | $\cdot 37$ | 4.07 | -46 | 4.07 | $\cdot 54$ | 4.09 | . 62 | 4.10 | $\cdot 71$ | $4 \cdot 11$ | . 80 | $4 \cdot 13$ |
| 32 | -40 | 4.07 | -49 | $4 \cdot 08$ | $\cdot 57$ | 4.09 | $\cdot 66$ | $4 \cdot 10$ | $\cdot 75$ | $4 \cdot 12$ | .84 | 4.14 |
| 34 | -43 | $4 \cdot 07$ | -52 | $4 \cdot 08$ | -61 | $4 \cdot 10$ | $\cdot 70$ | $4 \cdot 11$ | $\cdot 79$ | $4 \cdot 13$ | -88 | $4 \cdot 14$ |
| 36 | -47 | 4.08 | $\cdot 56$ | 4.09 | -65 | 4. 10 | $\cdot 74$ | 4.12 | $\cdot 84$ | 4. 14 |  | $4 \cdot 15$ |
| 38 | . 50 | 4.08 | . 60 | 4.09 | -69 | $4 \cdot \mathrm{II}$ | $\cdot 79$ | 4.13 | $\cdot 88$ | $4 \cdot 15$ | -98 | $4 \cdot 17$ |
| 40 | -54 | 4.09 | . 64 | $4 \cdot 10$ | $\cdot 74$ | $4 \cdot 12$ | . 84 | $4 \cdot 13$ | -93 | $4 \cdot 16$ | $1 \cdot 04$ | $4 \cdot 18$ |
| 42 | $\cdot 58$ | 4.09 | -68 | $4 \cdot 11$ | $\cdot 78$ | $4 \cdot 12$ | $\cdot 89$ | 4.15 | -99 | $4 \cdot 17$ | 1.10 | $4 \cdot 20$ |
| 44 | $\cdot 63$ | 4.10 | -73 | $4 \cdot 12$ | . 83 | 4.13 | -94 | $4 \cdot 16$ | 1.05 | $4 \cdot 18$ | 1•16 | 4.21 |
| 46 | $\cdot 67$ | 4.10 | $\cdot 78$ | $4 \cdot 13$ | . 89 | $4 \cdot 15$ | 1.00 | $4 \cdot 17$ | 1-12 | $4 \cdot 20$ | 1.23 | 4.23 |
| 48 | $\cdot 72$ | $4 \cdot 111$ | $\cdot 84$ | $4 \cdot 14$ | -95 | $4 \cdot 16$ | $\underline{1} \cdot 07$ | $4 \cdot 19$ | r.19 | 4.22 | 1.31 | 4.26 |
| 50 | $\cdot 78$ | $4 \cdot 12$ | $\cdot 90$ | 4.15 | 1.02 | $4 \cdot 18$ | I. 14 | 4.21 | I. 27 | 4.24 | I.40 | $4 \cdot 28$ |
| 52 | $\cdot 84$ | $4 \cdot 14$ | $\cdot 96$ | $4 \cdot 16$ | r.09 | 4.19 | 1.22 | 4.23 | I. 36 | 427 | I. 49 | 4.32 |
| 54 | -90 | 4.15 | I. 04 | 4-18 | 1.17 | 4.21 | $1 \cdot 31$ | 4.25 | 1.46 | 4.30 | I. 60 | 4.34 |

## LATITUDE $9^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $77^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. <br> Var. | $9{ }^{\circ}$ | Decl. Var. | $10^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $11^{\circ}$ | Dect. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{ccc}\text { H. M. } \\ 5 & \text { S. } \\ 5 & 56 & \text { II I I }\end{array}$ | S. 64 | H. M. S. <br> 5 55 <br> 52  | - ${ }_{\text {S. }}$ | $\begin{array}{lcc}\text { H. M. } & \text { s. } \\ 5 & 54 & 53.9\end{array}$ | S. | $\left\lvert\, \begin{array}{cc} \text { H. м. } & \text { s. } \\ 5 & 54 \end{array}\right.$ | $\begin{aligned} & \mathrm{s} . \\ & .65 \end{aligned}$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 5 & 53 & 35 \cdot 9 \end{array}$ | $\stackrel{\text { S. }}{ }$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 52 & 56.6 \end{array}\right\|$ | 6 |
| ro | $\begin{array}{lllll}5 & 15 & 23.3\end{array}$ | $\cdot 73$ |  | $\cdot 74$ | $\begin{array}{lllll}5 & 13 & 53.9\end{array}$ | $\cdot 76$ | $\begin{array}{lllll}5 & 13 & 7.7\end{array}$ | $\cdot 78$ |  | 80 | 5 $\begin{array}{lll}\text { II } & 32 \cdot 2\end{array}$ | . 81 |
| 12 | $5 \quad 712.6$ | $\cdot 75$ | ${ }_{5}^{5} \quad 6 \quad 27 \cdot 1$ | $\cdot 77$ | $5 \quad 540 \cdot 4$ | $\cdot 79$ | $\begin{array}{llll}5 & 4 & 52 \cdot 5\end{array}$ | -81 | $\begin{array}{llll}5 & 4 & 3.5\end{array}$ | . 83 | $\begin{array}{llll}5 & 3 & 13 \cdot 1\end{array}$ | . 85 |
| 14 | 45914 | $\cdot 77$ | $4 \quad 58 \quad 14.5$ | $\cdot 79$ | $457 \quad 26 \cdot 2$ | 82 | $45636 \cdot 6$ | -8. | $45545 \cdot 6$ | . 86 | $45453 \cdot 1$ | 89 |
| 16 | 45049.7 | $\cdot 79$ | $4 \begin{array}{lll}50 & 1 \cdot 3\end{array}$ | . 82 | 449 II.4 | . 84 | $\begin{array}{llll}4 & 48 & 19.9\end{array}$ | $\cdot 87$ | $44726 \cdot 9$ | -90 | $44632 \cdot 2$ | 93 |
| 18 | 42 | -82 | $44147 \cdot 5$ | $\cdot 85$ | $44055 \cdot 8$ | . 88 | 4402.4 | 90 | 43973 | -93 | 43810.2 | 9 |
| 20 | $43424 \cdot 6$ | $\cdot 84$ | 43333.0 | . 88 | 43239.4 | -91 | 43144.0 | 94 | $43046 \cdot 6$ | 97 | 42947 I | OI |
| 22 | $426 \mathrm{II} \cdot \mathrm{I}$ | $\cdot 87$ | $4 \begin{array}{llll}4 & 25 & 17.6\end{array}$ | -91 | $42422 \cdot 2$ | -94 | $\begin{array}{lllllllllllll}4 & 23 & 24.6\end{array}$ | . 98 | 42224.7 | 1.02 | 42122.7 | 1.05 |
| 24 |  | -90 | $\begin{array}{llll}4 & 17 & 1.5\end{array}$ | $\cdot 94$ | $\begin{array}{llll}4 & 16 & 3.9\end{array}$ | 98 | $\begin{array}{llll}4 & 15 & 4.0\end{array}$ | - | 4 14 $1 \cdot 7$ <br>  5 3 | -06 | 41256 | Io |
| 26 | $4 \quad 941 \cdot 7$ | $\cdot 93$ | $\begin{array}{llll}4 & 8 & 44.4\end{array}$ | -97 | $4 \quad 744.7$ | . 02 | $4 \quad 6 \quad 42 \cdot 3$ | 1.06 | $4 \quad 5 \quad 37 \cdot 3$ | I•II | $\begin{array}{lll}4 & 4 & 29.5\end{array}$ | 15 |
| 27 | 33.9 | 95 | $4 \quad 435 \cdot 5$ | 99 | $\begin{array}{llll}4 & 3 & 34 \cdot 6\end{array}$ |  | $\begin{array}{llll}4 & 2 & 30 \cdot 9\end{array}$ | .08 | $\begin{array}{lll}4 & 1 & 24.5\end{array}$ | I.13 | $4 \bigcirc 15.2$ | $1 \cdot 18$ |
| 28 | $4 \begin{array}{llll}4 & 1 & 25.8\end{array}$ | -97 | $4 \quad 0 \quad 26.3$ | Or | $35924 \cdot 2$ | I.06 | $\begin{array}{lllllllllll}3 & 58 & 19.2\end{array}$ | I•II | $\begin{array}{lllllllll}3 & 57 & 11.3\end{array}$ | I-16 | $\begin{array}{lll}3 & 56 & 0.5\end{array}$ | 125 |
| 29 |  | -99 | $\begin{array}{llll}3 & 56 & 16 \cdot 8\end{array}$ | I.03 | 35513.4 | I.08 | $\begin{array}{llll}3 & 54 & 7 \cdot 1\end{array}$ | $1 \cdot 13$ | $\begin{array}{llllllllllllllllllllllll}3 & 52 & 57\end{array}$ | 1.18 | $35145 \cdot 3$ | 23 |
| 30 | $\begin{array}{lll}3 & 53 & 8 \cdot 8\end{array}$ | 1.00 | $3 \begin{array}{lll}32 & 7 \cdot 1\end{array}$ | I.05 | 351 | I-10 | 34954.6 | I•16 |  | I. | $\begin{array}{llll}3 & 47 & 29.5\end{array}$ | 26 |
| 31 | 349 0.0 | 1.02 | 34757.0 | I.07 | $34651 \cdot 0$ | 13 | 34541.7 | I•18 | 34429.2 | I.24 | $\begin{array}{lllllllll}3 & 43 & 13\end{array}$ | 29 |
| 32 | 3 44 $50 \cdot 8$ <br> 3 40  | $\xrightarrow{1} \mathrm{O}$ | $\begin{array}{llll}3 & 43 & 46 \cdot 6 \\ 3 & 39\end{array}$ | I.10 | $\begin{array}{llll}3 & 42 & 39 \cdot 2 \\ 3 & 38 & 26 \cdot 9\end{array}$ |  | $\begin{array}{llll}3 & 41 & 28.4 \\ 3 & 37 & 14.6\end{array}$ | 1.21 1.23 |  | $1 \cdot 3$ | $\begin{array}{llll}3 & 38 & 56 \cdot 5 \\ 3 & 34 & 39 \cdot 1\end{array}$ | 1.33 <br> r 36 |
| 33 34 | $\begin{array}{llll}3 & 40 & 41 \cdot 4 \\ 3 & 36 & 31 \cdot 5\end{array}$ | I.09 | $\begin{array}{llll}3 & 39 & 35 \cdot 8 \\ 3 & 35 & 24 \cdot 7\end{array}$ | 1.14 | $\begin{array}{llll}3 & 38 & 26 \cdot 9 \\ 3 & 34 & 14 \cdot 3\end{array}$ | 20 | $\begin{array}{cccc}3 & 37 & 14 \cdot 6 \\ 3 & 33 & 0 \cdot 3\end{array}$ | 1.26 | $\begin{array}{llll}3 & 35 & 58 \cdot 7 \\ 3 & 31 & 42 \cdot 6\end{array}$ | I.30 | $\begin{array}{llll}3 & 34 & 39 \cdot 1 \\ 3 & 30 & 2 \mathrm{I} \cdot \mathrm{O}\end{array}$ | I. 36 I 39 |
| 35 | 33221.4 | I•II | 3 31 13.1 | I.17 | $3 \begin{array}{lll}30 & 1.2\end{array}$ | 1.23 | $\begin{array}{llllllllllll}3 & 28 & 45\end{array}$ | I 29 | $\begin{array}{llll}3 & 27 & 25.9\end{array}$ | I. 36 | $\begin{array}{lll}3 & 26 & 2 \cdot 3\end{array}$ | 43 |
| 36 | $\begin{array}{llll}3 & 28 & 10.9\end{array}$ | 13 | 33 7 | I-19 | $32547 \cdot 6$ | I. 26 | $\begin{array}{llll}3 & 24 & 30 \cdot 1\end{array}$ | I. 32 | $\begin{array}{lll}3 & 23 & 8.6\end{array}$ | I.39 | $32142 \cdot 9$ | $1 \cdot 46$ |
| 37 | $\begin{array}{lll}3 & 24 & 0.0\end{array}$ | I•16 | $\begin{array}{lll}3 & 22.48 .7\end{array}$ | I. 22 | 32133.5 | I. 29 | 32014.2 | -36 | $\begin{array}{llll}3 & 18 & 50 \cdot 6\end{array}$ | I.42 | $\begin{array}{llll}3 & 17 & 22.7\end{array}$ | . 50 |
| 38 |  | I-18 | $\begin{array}{llll}3 & 18 & 35 \cdot 8\end{array}$ |  | 31718.9 | 32 | $\begin{array}{llllllllllllll}3 & 15 & 57.6\end{array}$ |  | $\begin{array}{lllll}3 & 14 & 31.9\end{array}$ | 研 | 31315 | . 54 |
| 39 | 31537.0 | I-21 | 31422.4 | 28 | $313 \quad 3.6$ |  | 3 II $40 \cdot 3$ | 咗 | 31012.5 | $1 \cdot 50$ | $\begin{array}{llll}3 & 8 & 39 \cdot 8\end{array}$ | . 59 |
| 40 | 31124.8 | 23 | 3108.5 | 31 | $3{ }^{3} 8847 \cdot 7$ | r 38 | 722.4 | 1.46 | $\begin{array}{llll}3 & 5 & 52.2 \\ 3 & 15\end{array}$ | I.54 |  | I. 63 |
| 4 I | $\begin{array}{llll}3 & 7 & 12 \cdot 1\end{array}$ |  | $3 \quad 554.0$ | . 34 | 3 4 31 | 1.42 | $3 \quad 3 \cdot 6$ | I.50 | 3 1 31.0 | I. 59 | $25953 \cdot 2$ | 1.67 |
| 42 |  | 33 | $\begin{array}{cccc}3 & 1 & 38 \cdot 8 \\ 2 & 57 & 23.0\end{array}$ | 1.37 <br> 1.45 <br> 1 | $\begin{array}{llll}3 & 0 & 14.0 \\ 2 & 55 & 56.0\end{array}$ | 1.46 1.49 | $\begin{array}{llll}2 & 58 & 44 \cdot 0 \\ 2 & 54 & 23 \cdot 6\end{array}$ |  | $\begin{array}{ccc}2 & 57 & 8 \cdot 9 \\ 2 & 52 & 45 \cdot 8 \\ 2 & 48 & 2\end{array}$ | - 6 | $\begin{array}{ccc}2 & 55 & 28 \cdot 3 \\ 2 & 51 & 2 \cdot 2 \\ 2 & 46 & 3 \cdot 0\end{array}$ | 72 .77 |
| 43 44 | 2 58  <br> 2 54 $45 \cdot 1$ | T. 33 I 36 | 2 57 $23 \cdot 0$ <br> 2 53 $6 \cdot 5$ | 1.41 <br>  | $\begin{array}{llll}2 & 55 & 56 \cdot 0 \\ 2 & 51 & 37 \cdot 1\end{array}$ | 1.49 1.54 | $\begin{array}{lll}2 & 54 & 23.6 \\ 2 & 50 & 2.2\end{array}$ |  |  | 1.73 | $\begin{array}{lll}2 & 51 & 2 \cdot 2 \\ 2 & 46 & 35 \cdot 0\end{array}$ | . 87 |
| 45 | 25015.6 | - 39 | $24849 \cdot 2$ | I. 48 | 24717.4 | I 58 | 24539.7 | 1.68 | $24356 \cdot 2$ | $1 \cdot 78$ | 2426.3 | r. 89 |
| 46 | $24559 \cdot 8$ | 43 | 244 3I•I | I. 53 | $24256 \cdot 7$ | I. 62 | $24116 \cdot 2$ | $1 \cdot 73$ | 23929.5 | I. 83 | $23736 \cdot 2$ | I. 95 |
| 47 | 24143.3 | 1.47 | $24012 \cdot 1$ | 1.57 | $\begin{array}{llll}2 & 38 & 34.9\end{array}$ | 1.67 | $\begin{array}{llll}2 & 36 & 51\end{array}$ |  | $2 \begin{array}{lll}35 & 1.4\end{array}$ | I.89 | $\begin{array}{llll}2 & 33 & 4.5\end{array}$ | Or |
| 48 | ${ }_{2} 3725.9$ | I-51 | $23552 \cdot \mathrm{I}$ | I. 61 | $\begin{array}{ll}2 & 34 \\ 12 & 12 \cdot 1\end{array}$ | 1.72 | 23225.4 | I.84 | $23031 \cdot 8$ | 1.95 | 22831.0 | . 08 |
| 4 | $\begin{array}{llll}2 & 33 & 7 \cdot 6\end{array}$ | 56 | $23 \mathrm{I} 3 \mathrm{I} \cdot \mathrm{I}$ | I. 66 | $22948 \cdot 0$ | . 78 | 22757.9 | I. 89 | 2260.6 | 2.02 | 22355.6 | $2 \cdot 15$ |
| 5 | $\begin{array}{lllll}2 & 28 & 48 \cdot 4 \\ 2 & 24 & 28 \cdot 1\end{array}$ | 60 | $\begin{array}{llll}2 & 27 & 8 \cdot 9 \\ 2 & 22 & 45 \cdot 5\end{array}$ | . 72 | $\begin{array}{llll}2 & 25 & 22.5 \\ 2 & 20 & 55.6\end{array}$ | I.83 | 2 23 28.8 <br>    | 1.96 | 22127.5 | 2.09 | $2 \mathrm{I} 918 \cdot \mathrm{I}$ | 2.23 |
| 51 | 22428 | 1.65 | $22245 \cdot 5$ | $1 \cdot 77$ | 22055.6 |  | 18 58-1 | 2.03 | 1652.4 |  | $21438 \cdot 3$ | 2.31 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. 7 | A. | L. 8 | A. | L. 9 | A. | L. 10 | - A. | L. 11 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | S. | S. | S. | S. | S. 6 | S. | S. | S. | S. 80 | S. |
| 0 | -43 | -4.07 | - .50 | -4.08 | $-.58$ | -4.09 | -. 65 | -4.10 | - 72 | -4.11 | -.80 | $-4 \cdot 13$ |
| 4 | -48 | 4.08 | - 55 | 4.09 | . 62 | $4 \cdot 10$ | $\cdot 70$ | $4 \cdot 11$ | .77 | 4.12 | . 85 | 4.14 |
| 8 | -53 | 4.08 | -60 | 4.09 | - 67 | $4 \cdot 11$ | $\cdot 75$ | $4 \cdot 12$ | -83 | 4.13 | -90 | 4*15 |
| 10 | $\cdot 55$ | 4.09 | -63 | $4 \cdot 10$ | $\cdot 70$ | 4.II | $\cdot 78$ | $4 \cdot 13$ | -85 | $4 \cdot 14$ | -93 | $4 \cdot 16$ |
| 12 | $\cdot 58$ | 4.09 | - 66 | 4.10 | $\cdot 73$ | 4.12 | .81 | 4.13 | -88 | 4.15 | $\cdot 96$ | 4•16 |
| 14 | -61 | 4.09 | . 68 | 4-11 | -76 | $4 \cdot 12$ | -84 | 4.14 | -92 | $4 \cdot 15$ | -99 | $4 \cdot 17$ |
| 16 | -64 | $4 \cdot 10$ | -71 | 4.II | -79 | $4 \cdot 13$ | .87 | $4 \cdot 14$ | $\cdot 95$ | 4.16 | 1.03 | $4 \cdot 18$ |
| 18 | -67 | $4 \cdot 10$ | $\cdot 75$ | 4.12 | -82 | 4-13 | -90 | $4 \cdot 15$ | -99 | 4.17 | I.07 | $4 \cdot 19$ |
| 20 | $\cdot 70$ | 4.11 | $\cdot 78$ | $4 \cdot 12$ | - 86 | $4 \cdot 14$ | -94 | $4 \cdot 16$ | 1.02 | 4.18 | I.IO | $4 \cdot 20$ |
| 22 | -73 | 4.12 | -81 | 4.13 | -90 | $4 \cdot 15$ | -98 | $4 \cdot 17$ | I.06 | $4 \cdot 19$ | I•15 | 4.21 |
| 24 | $\cdot 77$ | 4.12 | -35 | $4 \cdot 14$ | -93 | 4.16 | 1.02 | 4.18 | 1-10 | $4 \cdot 20$ | I-19 | $4 \cdot 22$ |
| 26 | -80 | 4.13 | -39 | $4 \cdot 15$ | $\cdot 97$ | $4 \cdot 17$ | 1.06 | $4 \cdot 19$ | I.I5 | $4 \cdot 21$ | I-24 | $4 \cdot 23$ |
| 28 | -84 | $4 \cdot 14$ | -93 | 4.16 | I 02 | 4.18 | I•II | $4 \cdot 20$ | I. 20 | $4 \cdot 22$ | I. 29 | 4.25 |
| 30 | -89 | 4.14 | -97 | 4.16 | I.06 | $4 \cdot 19$ | I•I6 | $4 \cdot 21$ | I. 25 | $4 \cdot 24$ | I. 34 | 4.27 |
| 32 | -93 | $4 \cdot 15$ | I-02 | 4-18 | I•II | $4 \cdot 20$ | I-2I | $4 \cdot 23$ | 1.30 | 4.25 | 1:40 | $4 \cdot 28$ |
| 34 | -98 | $4 \cdot 17$ | 1.07 | 4•19 | I 17 | 4.21 | 1.26 | $4 \cdot 24$ | 1.36 | 4.27 | I.46 | 4.31 |
| 36 | 1.03 | 4•18 | I-12 | $4 \cdot 20$ | 1.22 | 4.23 | 1.32 | $4 \cdot 26$ | 1.43 | $4 \cdot 29$ | I.53 | 4.33 |
| 38 | 1.08 | $4 \cdot 19$ | 1-18 | $4 \cdot 22$ | I. 29 | $4 \cdot 25$ | 1-39 | $4 \cdot 28$ | I. 50 | $4 \cdot 32$ | I.6I | $4 \cdot 36$ |
| 40 | I.14 | $4 \cdot 21$ | I. 25 | $4 \cdot 24$ | 1.35 | $4 \cdot 27$ | 1.46 | $4 \cdot 31$ | 1.57 | $4 \cdot 35$ | - 69 | $4 \cdot 39$ |
| 42 | I 20 | $4 \cdot 22$ | I.3I | $4 \cdot 26$ | I*43 | $4 \cdot 29$ | $1 \cdot 54$ | $4 \cdot 33$ | 1.66 | $4 \cdot 38$ | 1*78 | $4 \cdot 42$ |
| 44 | 1.27 | $4 \cdot 25$ | I.39 | 4.28 | I.5I | $4 \cdot 32$ | I. 63 | $4 \cdot 37$ | I•75 | 4.45 | I. 88 | 4.47 |
| 46 | 1.35 | $4 \cdot 27$ | I.47 | $4 \cdot 31$ | I. 60 | $4 \cdot 35$ | 1.73 | $4 \cdot 40$ | I. 86 | $4 \cdot 46$ | 2.00 | 4.51 |
| 48 | 1.44 | $4 \cdot 30$ | I. 56 | $4 \cdot 34$ | I'70 | $4 \cdot 39$ | I. 84 | $4 \cdot 45$ | I.98 | 4.51 | $2 \cdot 13$ | $4 \cdot 57$ |
| 50 | $1 \cdot 53$ | $4 \cdot 33$ | I. 67 | $4 \cdot 38$ | I.8I | $4 \cdot 44$ | 1.96 | $4 \cdot 50$ | $2 \cdot 11$ | 4.57 | $2 \cdot 27$ | $4 \cdot 64$ |
| 51 | 1.5 ${ }^{8}$ | $4 \cdot 35$ | 1•72 | $4 \cdot 40$ | 1.87 | $4 \cdot 46$ | $2 \cdot 03$ | $4 \cdot 53$ | $2 \cdot 19$ | $4 \cdot 60$ | $2 \cdot 36$ | 4.69 |

DECLINATION—CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | $\begin{array}{cccc}5 & 52 & 17 \cdot 0 \\ 5 & 19 & 3 \cdot 1\end{array}$ | - .66 |  | . 67 | $\begin{array}{llll}5 & 50 & 56 \cdot 8 \\ 5 & 17 & 25 \cdot 4\end{array}$ | . 67 | $\left\lvert\, \begin{array}{lll} 5 & 50 & 16 \cdot 2 \\ 5 & 16 & 34 \cdot 9 \end{array}\right.$ | 88 | $\begin{array}{lllll}5 & 49 & 35 \cdot 3 \\ 5 & 15 & 43 \cdot 3\end{array}$ | . 69 | $\begin{array}{llll}5 & 48 & 53.9 \\ 5 & 14 & 50.5\end{array}$ | . 69 |
| 10 | $\begin{array}{rrrr}5 & 19 & 3 \\ 5 & 10 & 42.7\end{array}$ | . 83 |  | . 85 | $\begin{array}{ccc}5 & 17 & 25 \\ 5 & 9 & 0.2\end{array}$ | $\cdot 87$ | $5{ }^{5} 887 \cdot 0$ | -90 | $\begin{array}{lllll}5 & 7 & 12 \cdot 5\end{array}$ | $\cdot 92$ | $\begin{array}{rrrr}5 \\ 5 & 6 & 16.6\end{array}$ | . 94 |
| 12 | $\begin{array}{llll}5 & 2 & 21.4\end{array}$ | -87 | $\begin{array}{llll}5 & 1 & 28.4\end{array}$ | 90 | 5 0 33.9 | -92 | 45937.9 | 95 | $45840 \cdot 4$ | -97 | 457414 | -00 |
| 14 | $45359 \cdot 2$ | $\cdot 91$ | $4 \begin{array}{lll}53 & 3 \cdot 6\end{array}$ | $\cdot 94$ | 4526.4 | $\cdot 97$ | $4 \begin{array}{llll}41 & 7.6\end{array}$ | I-00 | $4 \begin{array}{lll}50 & 6 \cdot 9\end{array}$ | I.03 | $4494 \cdot 5$ | I.06 |
| 16 | $44535 \cdot 8$ | -95 | $44437 \cdot 6$ | $\cdot 98$ | $44337 \cdot 6$ | 1.02 | $44235 \cdot 7$ | I. 05 | 44131.8 | 1.0 | $44025 \cdot 9$ | 2 |
| 18 | 437 Ir.3 | I.00 | $43610 \cdot 4$ | r.03 | 43574 | -07 | $434 \quad 2 \cdot 3$ | $1 \cdot 10$ | $43255 \cdot 0$ | 1.14 | $43145 \cdot 4$ | I8 |
| 20 | $42845 \cdot 5$ | I.05 | $42741 \cdot 6$ | I.08 | $42635 \cdot 6$ | I•12 | $425 \quad 27.1$ | I•16 | $1 \begin{array}{lll}4 & 24 & 16 \cdot 3\end{array}$ | $1 \cdot 20$ | 42312.7 | . 25 |
| 22 | 42018.2 | $1 \cdot 09$ | 419 II.4 | 13 | 418 2.1 | I•18 | 41650.1 | -22 | 41535.4 | 1.27 | $1 \begin{array}{lllllll}4 & 14 & 17.9\end{array}$ | I.3I |
| 24 | 4 II $49 \cdot 5$ | 1-15 | 4 10 $39 \cdot 4$ | -19 | $4 \quad 9 \quad 26.6$ | 1.24 | 10.9 | 1-29 | $4 \quad 6 \quad 52 \cdot 2$ | 1.34 | $4 \quad 5 \quad 30.5$ | -39 |
| 25 | $4 \quad 734.5$ |  | $\begin{array}{llll}4 & 6 & 22 \cdot 7\end{array}$ |  | 45 | 1.27 | $\begin{array}{llll}4 & 3 & 50 \cdot 4\end{array}$ | I. 32 | $\begin{array}{llll}4 & 2 & 29.6\end{array}$ | I.37 | $4 \begin{array}{llll}4 & 5 & 5\end{array}$ | -43 |
| 26 | $\begin{array}{llll}4 & 3 & 19 \cdot 0\end{array}$ | I 20 | $\begin{array}{llll}4 & 2 & 5 \cdot 5\end{array}$ | r 25 | $4 \quad 0 \quad 49$ | I |  | I•35 | $3{ }^{3} 586.4$ | I 4 | $35640 \cdot 1$ | 47 |
| 27 | 3593.0 | 1.23 | $35747 \cdot 7$ | I 28 | $\begin{array}{lllllllll}3 & 56 & 29\end{array}$ | I.33 | $\begin{array}{lll}3 & 55 & 7 \cdot 6\end{array}$ | I-39 | $35342 \cdot 4$ | I 45 | $3{ }^{52} 1213.7$ | . 51 |
| 28 | $\begin{array}{lllllllllllll}3 & 54 & 46 \cdot 5\end{array}$ |  | 35329.4 | 31 | $\begin{array}{llll}3 & 52 & 9 \cdot 0 \\ 3 & 47 & 48\end{array}$ | I.37 | $\begin{array}{lllll}3 & 50 & 45 \cdot 1 \\ 3 & 46 & \end{array}$ | I.43 | $34917 \cdot 6$ | I.49 | $34746 \cdot 5$ | . 55 |
| 29 | 35029.6 | I. 29 | $34910 \cdot 5$ | . 35 | 34748.0 | I 40 | $\begin{array}{ll}3 & 46 \\ 21.9\end{array}$ | 1.47 | $34452 \cdot \mathrm{I}$ | I.53 | 34318.3 |  |
| 30 | $34612 \cdot 0$ | I. 32 | $34451 \cdot 0$ | 1.38 |  | -44 | 34157.9 | $1 \cdot 51$ | 34025.6 | 1.57 | 33849.2 | 65 |
| 31 | 34153.9 | 35 | $34030 \cdot 8$ | 42 | $\begin{array}{llll}3 & 39 & 3.9\end{array}$ | 1.48 | $\begin{array}{llllll}3 & 37 & 33 \cdot 1\end{array}$ | 5 | $33558 \cdot 2$ | 62 | 33419.1 | . 69 |
| 32 | $33735 \cdot 1$ | - | $\begin{array}{llll}3 & 36 & 9 \cdot 9\end{array}$ | 45 |  | $1 \cdot 52$ | 3 3337 |  | 33129.9 | I.66 | $32947 \cdot 8$ | -74 |
| 33 | 33315.6 | $\mathbf{x} 4$ | $33148 \cdot 2$ | 49 | $\begin{array}{llll}3 & 30 & 16 \cdot 7\end{array}$ | I.56 | $\begin{array}{lll}3 & 28 & 40 \cdot 8\end{array}$ | I.63 | $\begin{array}{lll}3 & 27 & 0.5\end{array}$ | r•7 | $\begin{array}{lll}3 & 25 & 15.5\end{array}$ |  |
| 34 | $3 \quad 2855.5$ | I.46 | $\begin{array}{llll}3 & 27 & 25\end{array}$ | . 53 | $\begin{array}{llll}3 & 2551 \cdot 7\end{array}$ |  | $3 \quad 2413.2$ |  | $32230 \cdot 0$ | I.76 | 32041.8 | 1.85 |
| 35 | 32434 | 1.50 | $\begin{array}{llll}3 & 23 & 2.4\end{array}$ |  | $\begin{array}{llll}3 & 21 & 25\end{array}$ | 5 | $\begin{array}{llll}3 & 19 & 44 \cdot 5\end{array}$ |  | 31758.2 |  | 3166.9 | O |
| 36 | $\begin{array}{llll}3 & 20 & 12.8\end{array}$ |  | $\begin{array}{lllllllllll}3 & 18 & 38.2\end{array}$ |  | $\begin{array}{llll}3 & 16 & 58.9\end{array}$ |  | $\begin{array}{lllllllll}3 & 15 & 14.7\end{array}$ | r.78 | $\begin{array}{llll}3 & 13 & 25.2\end{array}$ | 7 | 3 II $30 \cdot 4$ | . 96 |
| 37 | $\begin{array}{llllllllllllllll}3 & 15 & 50\end{array}$ | 1.58 | 31413.0 | I.66 | $\begin{array}{cccc}3 & 12 & 30.9\end{array}$ | I•74 | 3 IO $43 \cdot 6$ | I.83 | $\begin{array}{llll}3 & 8 & 50.9\end{array}$ | I'93 | $652 \cdot 5$ | . 02 |
| 38 | 31126.7 | ${ }^{1} \cdot 62$ | $\begin{array}{lll}3 & 9 & 46.8\end{array}$ | I• | $\begin{array}{lll}3 & 8 & 1.7\end{array}$ |  |  | I.89 | $3{ }^{3} 15^{\circ} \mathrm{O}$ | -99 | $\begin{array}{lllll}3 & 2 & 12.9 \\ 2 & 5 & \end{array}$ | 2.09 |
| 39 | $\begin{array}{llll}3 & 7 & 2 \cdot 2\end{array}$ | 7 | $\begin{array}{llll}3 & 5 & 19.5\end{array}$ | $1 \cdot 76$ | $\begin{array}{llll}3 & 3 & 31 \cdot 3\end{array}$ | I. | $\begin{array}{llll}3 & 1 & 37.4\end{array}$ | I.95 | $25937 \cdot 6$ | 2.05 | $25731 \cdot 5$ | -16 |
| 4 4 | 3 2 $36 \cdot 6$ <br> 2 58 $10 \cdot 0$ <br> 2 5  | 1.72 1.7. l | $\begin{array}{cccc}3 & 0 & 50 \cdot 9 \\ 206 & 21 \cdot 0\end{array}$ |  | $\begin{array}{llll}2 & 58 & 59.4 \\ 2 & 54 & 26.2\end{array}$ | 1.91 1.97 20, | $\begin{array}{llll}2 & 57 & 2 \cdot 1 \\ 2 & 52 & 25 \cdot 1 \\ 2 & 4 & \end{array}$ |  | $\begin{array}{llll}2 & 54 & 58 \cdot 4 \\ 2 & 50 & 17 \cdot 4 \\ & 4 & \end{array}$ |  |  | 3 |
| 41 42 | $\begin{array}{llll}2 & 58 & 10 \cdot 0 \\ 2 & 53 & 42 \cdot 1\end{array}$ | 82 | $\begin{array}{llll}2 & 56 & 21 \cdot 0 \\ 2 & 51 & 49 \cdot 9\end{array}$ | . 86 | $\begin{array}{llll}2 & 54 & 26.2 \\ 2 & 49 & 51.4\end{array}$ | 1.97 2.03 | $\begin{array}{llll}2 & 52 & 25 \cdot 1 \\ 2 & 47 & 46 \cdot 3\end{array}$ | 2.07 2.14 | $\begin{array}{llll}2 & 50 & 17 \cdot 4 \\ 2 & 45 & 34 \cdot 4\end{array}$ | 2.19 2.26 |  | $2 \cdot 39$ |
| 43 | $2 \begin{array}{ll}2 & 49 \\ 12 & \text { 1 }\end{array}$ | I.88 | $24717 \cdot \mathrm{I}$ | I.98 | $245 \mathrm{I} 4 \cdot 8$ | $2 \cdot 10$ | $\begin{array}{lllll}2 & 43 & 57\end{array}$ | I | $24049 \cdot \mathrm{I}$ | $2 \cdot 34$ | $23^{3} \quad 24 \cdot 9$ | , |
| 44 | $24442 \cdot 1$ | 1.93 | $24242 \cdot 8$ | 2.05 | 24036.4 | $2 \cdot 17$ | $\begin{array}{llllllllll}2 & 38 & 22.8\end{array}$ | 2.29 | $2 \begin{array}{lll}36 & 1 \cdot 5\end{array}$ | 2.42 | 233 3r-9 | $2 \cdot 57$ |
| 45 | $40 \quad 9.9$ | 2.00 | $\begin{array}{lll}2 & 38 & 6.6\end{array}$ | 2.12 | 23556.0 | $2 \cdot 24$ | $\begin{array}{llll}2 & 33 & 37.8\end{array}$ | $2 \cdot 37$ | 23111.3 | 2.51 | 22836.0 | . 66 |
| 46 | $23536 \cdot 0$ | $2 \cdot 06$ | $\begin{array}{llll}2 & 33 & 28 \cdot 6\end{array}$ | $2 \cdot 19$ | $\begin{array}{llll}2 & 31 & 13.4\end{array}$ | 2.32 | $\begin{array}{llll}2 & 28 & 50 \cdot 1 \\ 2 & \end{array}$ | 2.46 | 2 26 | I | $22336 \cdot 8$ | 7 |
| 47 | $\begin{array}{llll}2 & 31 & 0.3\end{array}$ | 2.13 | $\begin{array}{ll}2 & 2848.4\end{array}$ | 2.27 | $\begin{array}{llll}2 & 26 & 28 \cdot 4 \\ 2\end{array}$ | 41 | 2 23 59.7 <br> 2   | 2.56 | 22121.8 | 1 | $2 \begin{array}{llll}2 & 18 & 33.9\end{array}$ | -89 |
| 48 | 22622.5 | 2.2 | $\begin{array}{lll}2 & 24 & 5.9\end{array}$ | -35 | $22140 \cdot 7$ | 2. | $\begin{array}{llll}2 & 19 & 6 \cdot 2 \\ 2\end{array}$ |  | $\begin{array}{lllll}2 & 16 & 21.9\end{array}$ | 2.3 | $\begin{array}{llll}2 & 13 & 26.9\end{array}$ | 3.01 |
| 49 | 22142 | $2 \cdot 2$ | 21920.9 | 2.44 | $1650 \cdot 0$ | 2. | $\begin{array}{llll}2 & 14 & 8.4\end{array}$ | 2.77 | 2 II 18.1 | 2.94 | 2815.5 | 5 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ}$ A. |  | L. $1^{17}{ }^{\circ}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | s. | s. | s. | s. | s. | s. | s. | s. | S. | S. |
| 0 | -.87 | $-4 \cdot 14$ | - 95 | $-4 \cdot 16$ | -I.O2 | -4.17 | -I'IO | -4.19 | -I.18 | $-4.22$ | - I. 25 | $-4.24$ |
| 4 | -92 | $4 \cdot 15$ | I.90 | 4.17 | 1.07 | 4.19 | I•15 | $4 \cdot 21$ | 1.23 | $4 \cdot 23$ | I.3I | $4 \cdot 26$ |
| 6 | -95 | 4.16 | I.03 | $4 \cdot 18$ | I'IO | $4 \cdot 20$ | I-I8 | $4 \cdot 22$ | I. 26 | $4 \cdot 24$ | I•34 | $4 \cdot 27$ |
| 8 | -98 | $4 \cdot 17$ | I.06 | $4 \cdot 19$ | I-I3 | $4 \cdot 21$ | I.2I | 4.23 | I-29 | $4 \cdot 25$ | 1.37 | $4 \cdot 28$ |
| 10 | I'OI | 4•17 | 1.09 | 4.19 | I•I7 | $4 \cdot 2 \mathrm{I}$ | I. 25 | $4 \cdot 24$ | I.33 | $4 \cdot 26$ | I.4I | $4 \cdot 29$ |
| 12 | I. 04 | 4.18 | I'I2 | 4.20 | 1.20 | $4 \cdot 22$ | I. 28 | 4.25 | I. 36 | $4 \cdot 27$ | 1.45 | $4 \cdot 30$ |
| 14 | I.07 | 4.19 | I•15 | $4 \cdot 21$ | I 24 | $4 \cdot 23$ | I.32 | 4.26 | I. 40 | $4 \cdot 29$ | I.49 | $4 \cdot 31$ |
| 16 | I•II | $4 \cdot 20$ | I'19 | $4 \cdot 22$ | I 27 | $4 \cdot 25$ | 1.36 | $4 \cdot 27$ | I.44 | $4 \cdot 30$ | I. 53 | 4.33 |
| 18 | I.15 | $4 \cdot 21$ | I. 23 | 4.23 | I•32 | $4 \cdot 26$ | 1.40 | $4 \cdot 28$ | I. 49 | $4 \cdot 31$ | I. 58 | $4 \cdot 35$ |
| 20 | x. 99 | 4.22 | I 27 | $4 \cdot 25$ | I. 36 | $4 \cdot 27$ | 1.45 | $4 \cdot 30$ | I.56 | $4 \cdot 33$ | 1.63 | $4 \cdot 36$ |
| 22 | I.23 | $4 \cdot 23$ | I. 32 | $4 \cdot 26$ | I*4I | $4 \cdot 29$ | I•50 | $4 \cdot 32$ | I.59 | $4 \cdot 35$ | I. 68 | $4 \cdot 38$ |
| 24 | I•28 | $4 \cdot 24$ | I.37 | $4 \cdot 27$ | I. 46 | $4 \cdot 30$ | I 55 | $4 \cdot 34$ | I. 64 | $4 \cdot 37$ | I•74 | $4 \cdot 41$ |
| 26 | I.33 | 4.26 | I-42 | $4 \cdot 29$ | I 51 | $4 \cdot 32$ | I-6I | $4 \cdot 36$ | I•70 | $4 \cdot 39$ | I.80 | 4.43 |
| 28 | I. ${ }^{8}$ | $4 \cdot 28$ | I. 47 | $4 \cdot 31$ | I. 57 | $4 \cdot 34$ | $1 \cdot 67$ | $4 \cdot 38$ | I•77 | $4 \cdot 42$ | I.87 | $4 \cdot 46$ |
| 30 | I. 44 | $4 \cdot 30$ | I. 54 | $4 \cdot 33$ | I. 63 | $4 \cdot 37$ | 1.74 | 4.41 | I.84 | $4 \cdot 45$ | I.95 | $4 \cdot 49$ |
| 32 | I'50 | $4 \cdot 32$ | I. 60 | $4 \cdot 35$ | 1.70 | $4 \cdot 39$ | I. 8 I | 4.44 | I.92 | 4.48 | $2 \cdot 03$ | $4 \cdot 53$ |
| 34 | I. 57 | $4 \cdot 34$ | I. 67 | $4 \cdot 38$ | I.78 | 4.42 | I. 89 | 4.47 | $2 \cdot 00$ | $4 \cdot 52$ | $2 \cdot 12$ | $4 \cdot 57$ |
| 36 | I. 64 | $4 \cdot 37$ | I•75 | $4 \cdot 4 \mathrm{I}$ | I. 86 | $4 \cdot 46$ | 1.98 | 4.51 | $2 \cdot 10$ | $4 \cdot 56$ | $2 \cdot 22$ | $4 \cdot 62$ |
| 38 | 1•72 | 4.40 | x.84 | $4 \cdot 45$ | 1.95 | $4 \cdot 50$ | $2 \cdot 08$ | $4 \cdot 55$ | $2 \cdot 20$ | 4.61 | $2 \cdot 33$ | $4 \cdot 67$ |
| 40 | I.8I | 4.43 | 1.93 | 4.49 | 2.06 | $4 \cdot 54$ | $2 \cdot 19$ | $4 \cdot 60$ | $2 \cdot 32$ | $4 \cdot 67$ | $2 \cdot 46$ | $4 \cdot 74$ |
| 42 | I.9I | 4.48 | 2.04 | 4.53 | $2 \cdot 17$ | 4.59 | $2 \cdot 31$ | $4 \cdot 66$ | 2.45 | 4•74 | $2 \cdot 61$ | $4 \cdot 82$ |
| 44 | 2.02 | 4.52 | $2 \cdot 15$ | 4.59 | $2 \cdot 30$ | $4 \cdot 66$ | 2.45 | $4 \cdot 73$ | $2 \cdot 61$ | $4 \cdot 81$ | 2.77 | 4.91 |
| 46 | 2.14 | $4 \cdot 58$ | $2 \cdot 29$ | $4 \cdot 65$ | $2 \cdot 44$ | $4 \cdot 73$ | 2.61 | 4.82 | $2 \cdot 78$ | 4.91 | $2 \cdot 96$ | $5 \cdot 02$ |
| 48 | $2 \cdot 28$ | 4.65 | 2.44 | 4.73 | 2.61 | $4 \cdot 82$ | 2.79 | 4.93 | $2 \cdot 98$ | $5 \cdot 03$ | 3.19 | $5 \cdot 15$ |
| 49 | $2 \cdot 36$ | $4 \cdot 69$ | $2 \cdot 53$ | 4.77 | $2 \cdot 71$ | $4 \cdot 87$ | $2 \cdot 90$ | 4.98 | $3 \cdot 10$ | 5.10 | $3 \cdot 31$ | $5 \cdot 23$ |

## HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT. 161

 LATITUDE $9^{\circ}$.DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. S. | S. | H. M. S | S. | H. M. S | S. | H. M. s. | S. | H. M. S. | S. |
| 0 | $54812 \cdot 0$ | - 70 | $54729 \cdot 7$ | - 71 | $5{ }_{5}^{5} 4646 \cdot 8$ | $\cdot 72$ | $\begin{array}{llll}5 & 46 & 3 \cdot 5\end{array}$ | - 73 | 5154519.5 | - 74 | $54434 \cdot 8$ | - 75 |
| 6 | $\begin{array}{llll}5 & 22 & 32 \cdot 2\end{array}$ | -86 | $52140 \cdot 2$ | -87 | $52047 \cdot 2$ | -89 | $\begin{array}{llll}5 & 19 & 52.9\end{array}$ | -92 | 5 I8 $57 \cdot 3$ | -94 | $518 \quad 0.5$ | $\cdot 96$ |
| 8 | $\begin{array}{llllllllllll}5 & 13 & 56 \cdot 5\end{array}$ | -91 | 5 I3 I•I | -93 | 5 I2 4.4 | -96 | 5 II $6 \cdot 3$ | $\cdot 98$ | 5 10 6.7 | I-OI | $\begin{array}{llll}5 & 9 & 5 \cdot 5\end{array}$ | I. 03 |
| 10 | $\begin{array}{llll}5 & 5 & 19.3\end{array}$ | -97 | $\begin{array}{llll}5 & 4 & 20 \cdot 4\end{array}$ | -99 | $5 \quad 3 \quad 20 \cdot 0$ | I. 02 | $\begin{array}{lllll}5 & 2 & 17.9\end{array}$ | 1.05 | $5{ }_{5} 1$ | I.08 | 5 5 $\quad 0 \quad 8 \cdot 5$ | I•II |
| 12 | $45640 \cdot 6$ | 1.03 | $455 \quad 38 \cdot \mathrm{I}$ | I.06 | $45433 \cdot 7$ | I.09 | $4 \quad 53 \quad 27 \cdot 5$ | I-I2 | $4 \quad 52$ 19.3 | I. 15 | 45 I 9.I | I-19 |
| 14 | $44^{48} \quad 0.2$ | 1.09 | 44653.9 | I•I2 | $44545 \cdot 5$ | I.16 | $44435 \cdot 0$ | I'19 | $4 \begin{array}{lll}4 & 43 & 22 \cdot 2\end{array}$ | I. 23 | $442 \quad 7 \cdot 1$ | 1.27 |
| 16 | 439179 | I-15 | $438 \quad 7 \cdot 6$ | I'19 | $43655 \cdot 0$ | I. 23 | $43540 \cdot 0$ | 1.27 | $4 \quad 34 \quad 22 \cdot 5$ | I•3I | $43312 \cdot 3$ | I.36 |
| 18 | $43033 \cdot 5$ | I. 22 | 429 19.0 | I. 26 | $428 \quad 2 \cdot 0$ | I.3I | $42642 \cdot 3$ | I 35 | 4 25 19.8 | I.40 | $423 \quad 54 \cdot 2$ | I.45 |
| 20 | $42146 \cdot 8$ | I-29 | $420 \quad 28.0$ | I. 34 | $4 \begin{array}{lll}4 & 19 & 6 \cdot 3\end{array}$ | I. 39 | 4 I7 4I.6 | I 44 | $4 \begin{array}{lll}4 & \text { I6 } & \text { I }\end{array} 8$ | I. 49 | $41412 \cdot 7$ | 1.55 |
| 21 | 41722.6 | I. 33 | 416154 | I. $3^{8}$ | $4 \begin{array}{llll}4 & 37 \cdot 3\end{array}$ | 1.43 | $4 \begin{array}{lllllllllll}4 & 10.0\end{array}$ | I. $4^{8}$ | 4 II $39 \cdot 4$ | I 54 | 4 10 5.4 | I.60 |
| 22 | $\begin{array}{llll}4 & 12 & 57 \cdot 6\end{array}$ | I. 36 | 4 II $34 \cdot 1$ | 1.42 | 4107.5 | 1.47 | 48837.5 | r 53 | 4784.1 | I 59 | $4 \quad 5 \quad 27 \cdot 1$ | I. 65 |
| 23 | $44_{4}^{4} 831 \cdot 9$ | I.40 | $4 \begin{array}{lll}4 & 7 & 6 \cdot 0\end{array}$ | I.46 | $451536 \cdot 8$ | I.5I | $\begin{array}{llll}4 & 4 & 4.2\end{array}$ | I.57 | $\begin{array}{llll}4 & 2 & 27 \cdot 8\end{array}$ | I. 64 | $4 \quad 0 \quad 47 \cdot 6$ | I• 70 |
| 24 | $\begin{array}{llll}4 & 4 & 5 \cdot 5\end{array}$ | I.45 | $\begin{array}{lrrr}4 & 2 & 37 \cdot 1\end{array}$ | I. 50 | $\begin{array}{lrrr}4 & 1 & 5 \cdot 3\end{array}$ | I.56 | 35929.8 | I. 62 |  | I. 69 | $356 \quad 7 \cdot 0$ | I•76 |
| 25 | 359 38-3 | I*49 | $\begin{array}{llll}3 & 58 & 7 \cdot 3\end{array}$ | I. 55 | $\begin{array}{llll}3 & 56 & 32 \cdot 7\end{array}$ | I.6I | $35454 \cdot 3$ | I. 67 |  | I•74 | 35125.1 | I. 82 |
| 26 | $35510 \cdot 2$ | I.53 | 353136.6 | I. 59 | $3 \begin{array}{lll}3 & 51 & 59 \cdot 2\end{array}$ | I. 66 | $35017 \cdot 7$ | I•73 | $\begin{array}{llll}3 & 48 & 32 \cdot 0\end{array}$ | I.80 | $34641 \cdot 9$ | 1.87 |
| 27 | $35041 \cdot 3$ | 157 | $349 \quad 5 \cdot 0$ | I. 64 | $\begin{array}{llll}3 & 47 & 24 \cdot 6\end{array}$ | 1.71 | $34540 \cdot 0$ | I. 78 | $34350 \cdot 9$ | I 86 | $34157 \cdot 2$ | I.94 |
| 28 | 346 II 4 | I. 62 | $344 \begin{array}{llll}3 & 32 \cdot 2\end{array}$ | I. 69 | $\begin{array}{lllllllllll}3 & 42 & 48 \cdot 8\end{array}$ | $1 \cdot 76$ | 34110 | I. 84 | $\begin{array}{llll}3 & 39 & 8 \cdot 4\end{array}$ | I.92 | 337 II•O | $2 \cdot 00$ |
| 29 | $34 \mathrm{I} 40 \cdot 5$ | 1.67 | $\begin{array}{llll}3 & 39 & 58 \cdot 4\end{array}$ | I•74 | $\begin{array}{llll}3 & 3^{8} & \text { İ-8 }\end{array}$ | I.8I | $\begin{array}{llll}3 & 36 & 20.6\end{array}$ | I.89 | $\begin{array}{llll}3 & 34 & 24.4\end{array}$ | $\underline{1} 98$ | $\begin{array}{llll}3 & 32 & 23 \cdot 1\end{array}$ | $2 \cdot 07$ |
| 30 | $\begin{array}{llll}3 & 37 & 8 \cdot 5\end{array}$ | I・リI | $3 \begin{array}{llll}35 & 23.4\end{array}$ | I•79 | $\begin{array}{lllll}3 & 33 & 33 \cdot 5\end{array}$ | I. 87 | $\begin{array}{llll}3 & 31 & 38 \cdot 8\end{array}$ | I.95 | $32938 \cdot 9$ | $2 \cdot 04$ | $327 \begin{array}{llll}33 & 5\end{array}$ | $2 \cdot 14$ |
| 31 | $\begin{array}{llll}3 & 32 & 35 \cdot 4\end{array}$ | 1.77 | $33047 \cdot 1$ | I.85 | $\begin{array}{lllll}3 & 28 & 53 \cdot 8\end{array}$ | 1.93 | $\begin{array}{lllll}3 & 26 & 55 \cdot 4\end{array}$ | $2 \cdot 02$ | $32451 \cdot 5$ | $2 \cdot 11$ | 322 4I*9 | $2 \cdot 21$ |
| 32 | $\begin{array}{llll}3 & 28 & \text { I }\end{array}$ | I. 82 | $\begin{array}{lll}3 & 26 & 9.5\end{array}$ | I 90 | 32412.6 | 1.99 | $\begin{array}{lll}3 & 22 & 10.4\end{array}$ | $2 \cdot 08$ | 320204 | 2.18 | $31748 \cdot 4$ | $2 \cdot 29$ |
| 33 | $\begin{array}{llll}3 & 23 & 25 \cdot 5\end{array}$ | I.88 | 3215004 | I.96 | $3 \begin{array}{llll}3 & 19 & 29.9\end{array}$ | $2 \cdot 06$ | $\|$3 17 $23 \cdot 6$ | $2 \cdot 15$ | $31511 \cdot 3$ | $2 \cdot 26$ | $\begin{array}{llllll}3 & 12 & 52 \cdot 7\end{array}$ | $2 \cdot 37$ |
| 34 | $\begin{array}{lllll}3 & 18 & 48 \cdot 5\end{array}$ | I 93 | $\begin{array}{llllllllllllll}3 & 16 & 49 \cdot 8\end{array}$ | 2.03 | $\begin{array}{lllll}3 & 14 & 45 \cdot 4\end{array}$ | $2 \cdot 12$ | $\begin{array}{rrrr}3 & 12 & 34.9\end{array}$ | $2 \cdot 23$ | 3 10 18.1 | $2 \cdot 34$ | $\begin{array}{llllllllllllllll}3 & 7 & 54 \cdot 6\end{array}$ | $2 \cdot 45$ |
| 35 | $31410 \cdot 0$ | r.99 | $3 \begin{array}{llll}3 & 12 & 7.5\end{array}$ | $2 \cdot 09$ | $3 \begin{array}{llll}3 & 9 & 59 & 0\end{array}$ | $2 \cdot 19$ | $\begin{array}{llll}3 & 7 & 44 \cdot 2\end{array}$ | $2 \cdot 30$ | $\begin{array}{llll}3 & 5 & 22.6\end{array}$ | 2.42 | $\begin{array}{lllll}3 & 2 & 53.9\end{array}$ | $2 \cdot 54$ |
| 36 | $\begin{array}{llll}3 & 9 & 29.9\end{array}$ | 2.06 | $3 \quad 7 \quad 23 \cdot 5$ | 2.16 | $\begin{array}{llll}3 & 5 & 10.7\end{array}$ | $2 \cdot 27$ | $3 \quad 251 \cdot 2$ | $2 \cdot 38$ | $3 \quad 024.6$ | $2 \cdot 51$ | $25750 \cdot 5$ | $2 \cdot 64$ |
| 37 | $\begin{array}{llll}3 & 4 & 48 \cdot 1\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}3 & 2 & 37 \cdot 5\end{array}$ | $2 \cdot 23$ | $\begin{array}{llll}3 & 0 & 20.2\end{array}$ | $2 \cdot 35$ | 2 5 755.8 | 2.47 | $2 \begin{array}{llll}25 & 23.9\end{array}$ | $2 \cdot 60$ | $25244^{\circ} \mathrm{O}$ | $2 \cdot 74$ |
| 38 | $\begin{array}{\|ccc\|}3 & 0 & 4.5\end{array}$ | $2 \cdot 20$ | 257490.4 | $2 \cdot 31$ |  | 2.43 | $\begin{array}{llll}2 & 52 & 57 \cdot 8\end{array}$ | $2 \cdot 56$ | $25020 \cdot 3$ | $2 \cdot 70$ | $24734 \cdot 2$ | $2 \cdot 84$ |
| 39 | $\begin{array}{llll}2 & 55 & 18.8\end{array}$ | $2 \cdot 27$ | $2 \begin{array}{llll} & 52 & 59 \cdot 1\end{array}$ | $2 \cdot 39$ | 25032.0 | 2.52 | $\begin{array}{lllll}2 & 47 & 56 \cdot 9\end{array}$ | $2 \cdot 65$ | $2 \begin{array}{llllllll} \\ 2 & 45 & 13.4\end{array}$ | $2 \cdot 80$ | $242 \begin{array}{llll}20.9\end{array}$ | $2 \cdot 96$ |
| 40 | $2 \begin{array}{llll}2 & 50 & 31 & 0\end{array}$ | $2 \cdot 35$ | $\begin{array}{llll}2 & 48 & 6 \cdot 3\end{array}$ | $2 \cdot 48$ | 245133.9 | $2 \cdot 61$ |  | $2 \cdot 76$ | $\begin{array}{llll}2 & 40 & 3.0\end{array}$ | 2.91 | $\begin{array}{lll}2 & 37 & 3.4\end{array}$ | 3.08 |
| 41 | $24540 \cdot 8$ | 2.43 | $24310 \cdot 9$ | $2 \cdot 57$ | $24032 \cdot 6$ | 2.71 | $23745 \cdot 5$ | $2 \cdot 86$ | $23448 \cdot 8$ | 3.03 | $23141 \cdot 7$ | $3 \cdot 21$ |
| 42 | $2 \begin{array}{llll}2 & 40 & 47 \cdot 9\end{array}$ | 2.52 | $2 \begin{array}{llll} & 38 & 12.5\end{array}$ | 2.66 | $235 \quad 28 \cdot 2$ | 2.82 | $2 \begin{array}{lll}32 & 34.4\end{array}$ | 2.98 | $22930 \cdot 3$ | 3.16 | 22615.0 | $3 \cdot 36$ |
| 43 | $235152 \cdot 3$ | $2 \cdot 62$ | 233110 | 2.77 | $23020 \cdot 1$ | 2.93 | 227 I9.I | $3 \cdot 11$ | $224 \quad 7 \cdot 0$ | $3 \cdot 30$ | 22042.9 | $3 \cdot 51$ |
| 44 | $\begin{array}{llll}2 & 30 & 53 \cdot 6 \\ 2 & 25 & 51.5\end{array}$ | 2.72 | $\begin{array}{llr}2 & 28 & 5.8 \\ 2 & 22 & 56.8\end{array}$ | 2.88 | $225 \begin{array}{rlr}8 \cdot 0\end{array}$ | 3.06 | 2215159.1 | 3.25 | $\begin{array}{llll}2 & 18 & 38.4\end{array}$ | 3.45 | $\begin{array}{llll}2 & 15 & 4.5\end{array}$ | $3 \cdot 68$ |
| 45 |  | 2.83 | $22256 \cdot 8$ | 3.00 |  | $3 \cdot 19$ | 2 I6 $34{ }^{\circ} \mathrm{O}$ | 3.40 | $\begin{array}{llll}2 & 13 & 3.7\end{array}$ | $3 \cdot 62$ | $\begin{array}{lll}2 & 9 & 19.3 \\ 2 & 3 & 26.1\end{array}$ | 3.87 |
| 46 | $\|22045 \cdot 5\|$ | 2.94 | 217434 | $3 \cdot 13$ | $21429 \cdot 6$ | $3 \cdot 34$ | 2 II $3 \cdot 0$ | $3 \cdot 56$ | 2722.4 | $3 \cdot 81$ | $2326 \cdot 1$ | $4 \cdot 08$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | S. | S. | S. | s. | s. | s. | s. | s. | S. | s. |
| 0 | - I. 33 | $-4 \cdot 26$ | -I.4I | $-4.29$ | -I.49 | $-4 \cdot 31$ | - 1.58 | $-4.35$ | - I. 66 | $-4 \cdot 38$ | - 1.74 | $-4.41$ |
| 2 | 1.36 | $4 \cdot 27$ | 1.44 | $4 \cdot 30$ | I 53 | $4 \cdot 33$ | I.6I | $4 \cdot 36$ | 1.69 | $4 \cdot 39$ | 1.77 | 4.42 |
| 4 | I.39 | $4 \cdot 28$ | I.47 | 4.31 | I•55 | $4 \cdot 34$ | I. 64 | $4 \cdot 37$ | I.72 | $4 \cdot 40$ | I.8I | 4.44 |
| 6 | 1.42 | 4.29 | 1.50 | $4 \cdot 32$ | I. 59 | $4 \cdot 35$ | 1.67 | $4 \cdot 38$ | $1 \cdot 76$ | 4.41 | I. 84 | 4.45 |
| 8 | I.46 | $4 \cdot 30$ | 1.54 | $4 \cdot 33$ | I. 62 | $4 \cdot 36$ | 1.71 | $4 \cdot 39$ | 1.80 | $4 \cdot 43$ | I. 88 | 4.47 |
| 10 | I.49 | 4.32 | 1.58 | $4 \cdot 35$ | I. 66 | $4 \cdot 38$ | I•75 | 4.41 | I. 84 | 4.45 | $1 \cdot 93$ | 4.49 |
| 12 | I 53 | $4 \cdot 33$ | 1.62 | $4 \cdot 36$ | 1.70 | $4 \cdot 39$ | I.79 | $4 \cdot 43$ | I. 88 | 4.47 | I.97 | $4 \cdot 51$ |
| 14 | 1.57 | $4 \cdot 34$ | 1.66 | $4 \cdot 38$ | 1.75 | 4.41 | I. 84 | $4 \cdot 45$ | 1.93 | $4 \cdot 49$ | $2 \cdot 02$ | 4.53 |
| 16 | 1.62 | $4 \cdot 36$ | I-71 | $4 \cdot 39$ | 1.80 | $4 \cdot 43$ | I.89 | 4.47 | I.98 | 4.51 | $2 \cdot 08$ | $4 \cdot 55$ |
| 18 | 1.67 | $4 \cdot 38$ | 1.76 | 4.41 | 1.85 | 4.45 | I.94 | 4.49 | 2.04 | 4.54 | $2 \cdot 14$ | $4 \cdot 58$ |
| 20 | I'72 | 4.40 | I.8I | 4.44 | 1.91 | $4 \cdot 48$ | $2 \cdot 01$ | $4 \cdot 52$ | $2 \cdot 10$ | 4.57 | $2 \cdot 21$ | 4.61 |
| 22 | 1-78 | $4 \cdot 42$ | 1.87 | $4 \cdot 46$ | 1.97 | $4 \cdot 50$ | 2.07 | $4 \cdot 55$ | $2 \cdot 17$ | $4 \cdot 60$ | $2 \cdot 28$ | $4 \cdot 65$ |
| 24 | I. 84 | $4 \cdot 45$ | I. 94 | $4 \cdot 49$ | $2 \cdot 04$ | 4.53 | $2 \cdot 14$ | $4 \cdot 58$ | 2.25 | 4.63 | $2 \cdot 36$ | $4 \cdot 69$ |
| 26 | 1.90 | 4.47 | 2.01 | $4 \cdot 52$ | $2 \cdot 11$ | $4 \cdot 57$ | 2.22 | $4 \cdot 62$ | $2 \cdot 33$ | $4 \cdot 67$ | $2 \cdot 45$ | $4 \cdot 73$ |
| 28 | 1.98 | $4 \cdot 50$ | 2.08 | $4 \cdot 55$ | $2 \cdot 19$ | $4 \cdot 61$ | $2 \cdot 31$ | $4 \cdot 66$ | 2.43 | $4 \cdot 72$ | $2 \cdot 55$ | $4 \cdot 78$ |
| 30 | 2.06 | $4 \cdot 54$ | $2 \cdot 17$ | 4.59 | $2 \cdot 28$ | $4 \cdot 65$ | 2.40 | $4 \cdot 71$ | $2 \cdot 53$ | $4 \cdot 77$ | $2 \cdot 66$ | $4 \cdot 84$ |
| 32 | $2 \cdot 14$ | $4 \cdot 58$ | $2 \cdot 26$ | 4.64 | $2 \cdot 38$ | $4 \cdot 70$ | 2.51 | $4 \cdot 76$ | $2 \cdot 64$ | 4.83 | $2 \cdot 78$ | 4.91 |
| 34 | $2 \cdot 24$ | 4.63 | $2 \cdot 37$ | 4.69 | $2 \cdot 50$ | $4 \cdot 76$ | 2.63 | $4 \cdot 83$ | $2 \cdot 77$ | 4.91 | $2 \cdot 91$ | 4.99 |
| 36 | $2 \cdot 35$ | $4 \cdot 68$ | $2 \cdot 48$ | $4 \cdot 75$ | $2 \cdot 62$ | $4 \cdot 82$ | $2 \cdot 76$ | 4.90 | 2.91 | 4.99 | 3.07 | 5.08 |
| 38 | $2 \cdot 47$ | $4 \cdot 74$ | $2 \cdot 61$ | $4 \cdot 82$ | $2 \cdot 76$ | 4.90 | 2.92 | 4.99 | $3^{\circ} 08$ | $5 \cdot 09$ | $3 \cdot 25$ | 5.19 |
| 40 | $2 \cdot 61$ | $4 \cdot 82$ | $2 \cdot 76$ | $4 \cdot 90$ | 2.92 | 4.99 | 3.09 | $5 \cdot 09$ | 3.27 | 5-20 | 3.46 | $5 \cdot 33$ |
| 42 | $2 \cdot 76$ | 4.90 | $2 \cdot 93$ | 5.00 | 3.11 | 5-10 | 3.29 | $5 \cdot 22$ | $3 \cdot 49$ | $5 \cdot 35$ | $3 \cdot 71$ | $5 \cdot 49$ |
| 44 | $2 \cdot 94$ | $5 \cdot \mathrm{OI}$ | 3-13 | 5-12 | $3 \cdot 32$ | $5 \cdot 24$ | $3 \cdot 53$ | $5 \cdot 38$ | $3 \cdot 76$ | $5 \cdot 53$ | 4.01 | $5 \cdot 70$ |
| 45 | 3.05 | $5 \cdot 07$ | $3 \cdot 24$ | 5.19 | 3.45 | $5 \cdot 32$ | 3.67 3.82 | 5.47 5.57 | $3 \cdot 92$ | $5 \cdot 63$ $5 \cdot 75$ | $4 \cdot 18$ $4 \cdot 37$ | $5 \cdot 82$ $5 \cdot 96$ |
| 46 | $3 \cdot 16$ | $5 \cdot 13$ | $3 \cdot 36$ | 5.26 | $3 \cdot 58$ | $5 \cdot 4 \mathrm{I}$ | $3 \cdot 82$ | $5 \cdot 57$ | 4.09 | $5 \cdot 75$ | $4 \cdot 37$ | $5 \cdot 96$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2{ }^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. Var. | $4{ }^{\circ}$ | Decl. <br> Var. | $5{ }^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| O | $\begin{array}{cc} \text { H. M. } & \text { s. } \\ 6 & 0 \\ 0 & 0.0 \end{array}$ | $\cdot 70$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { s. } \\ 5 & 59 & \text { r7•7 } \end{array}\right\|$ | $\left\|\begin{array}{c} \mathrm{S} . \\ -\mathrm{yo} \end{array}\right\|$ | $\left.\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 58 \\ \hline \end{array}\right.\right)$ | $\frac{\mathrm{s} .}{\cdot \mathrm{I}}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { s. } \\ 5 & 57 \\ 53 \cdot 0 \end{array}\right.$ | $\cdot 7$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 57 & \text { ro } \end{array}\right.$ | $\begin{aligned} & \text { s. } \\ & \hline 1 \end{aligned}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. M. } & \text { S. } \\ 5 & 56 & 27 \cdot 9 \end{array}\right.$ | 71 |
| 10 | 51922.6 | $\cdot 72$ | 5 18 18 $39 \cdot 2$ | $\cdot 73$ | 5 17 55.1 | $\cdot 74$ | 517100 | $\cdot 76$ | ${ }_{5}^{5} 16824 \cdot x$ | $\cdot 77$ | 15 37.3 | $\cdot 79$ |
| 12 | 51114.9 | $\cdot 72$ | 5 10 3i•I | $\cdot 74$ | $59646 \cdot 4$ | $\cdot 75$ | $\begin{array}{llll}5 & 9 & 0.7\end{array}$ | $\cdot 77$ | $\begin{array}{lllllllllllll}5 & 8 & 13.9\end{array}$ | $\cdot 79$ | $5726 \cdot 1$ | . 81 |
| 14 | $\begin{array}{llll}5 & 3 & 7 \cdot 1\end{array}$ | -73 | $\begin{array}{llll}5 & 2 & 22 \cdot 9\end{array}$ | $\cdot 75$ | 5 I 5 I 37.6 | $\cdot 76$ | 5 O 51•I | $\cdot 78$ | $\begin{array}{llll}5 & 0 & 3 \cdot 4\end{array}$ | . 8 r | 45914.4 | 82 |
| 16 | 45459.2 | $\cdot 73$ | $4 \quad 5414.4$ | $\cdot 76$ | 45328.4 | $\cdot 78$ | $4524 \mathrm{I} \cdot \mathrm{I}$ | . 80 | $45 \mathrm{x}=52 \cdot 4$ | 8 | $45 \mathrm{I} \quad 2 \cdot 3$ | 85 |
| 18 | 4465 | 74 | 4465 | 77 | 445 19.0 | 9 | $4430 \cdot 7$ | 82 | $44340 \cdot 9$ | 84 | $44249 \cdot 5$ | $\cdot 87$ |
| 20 | $43842 \cdot 7$ | $\cdot 75$ | $437 \quad 56 \cdot 8$ | $\cdot 78$ | $\begin{array}{llll}4 & 37 & 9 \cdot 2\end{array}$ | . 8 r | $43620 \cdot 0$ | $\cdot 83$ | 43529.0 | . 86 | $434 \quad 36 \cdot 2$ | -89 |
| 22 | 43034.2 | $\cdot 76$ | 42947.5 | $\cdot 79$ | $42859 \cdot 1$ | $\cdot 82$ | 42888 | -85 | $4 \begin{array}{llllll}4 & 27 & 16.5\end{array}$ | $\cdot 89$ | $\begin{array}{llll}4 \quad 26 & 22 \cdot 2\end{array}$ | $\cdot 92$ |
| 24 | $\begin{array}{llll}4 & 22 & 25.4\end{array}$ | $\cdot 77$ | $42138 \cdot 0$ | $\cdot 81$ | 42048.5 | . 8 | 41957.0 | . 88 | $\begin{array}{llll}4 & 19 & 3.3\end{array}$ | -91 | $\begin{array}{llll}4 & 18 & 7.6\end{array}$ | -95 |
| 26 | $4 \begin{array}{llll}4 & 16.4\end{array}$ | $\cdot 79$ | 41328.0 | . 82 | 41237.5 | . 86 | 4 II 44.7 | -90 | 4 10 49.5 | -94 | $\begin{array}{lll}4 & 9 & 52 \cdot 1\end{array}$ | 98 |
| 28 | $\begin{array}{lrrr}4 & 6 & 7 & 0\end{array}$ | $\cdot 80$ | $4 \begin{array}{llll}4 & 5 & 77.6\end{array}$ | $\cdot 84$ | $425 \cdot 9$ | 88 | $331 \cdot 7$ | -92 | $4 \quad 235 \cdot 0$ | . 97 | $\begin{array}{llll}4 & 1 & 35 \cdot 7\end{array}$ | or |
| 3 | $\begin{array}{llllll}3 & 57 & 57.2 \\ & 53\end{array}$ | $\cdot 82$ | $\begin{array}{llll}3 & 57 & 6.8 \\ 3\end{array}$ | $\cdot 86$ |  | -91 | 355 I8•I | $\bullet 95$ | $\begin{array}{llll}3 & 54 & 19.6\end{array}$ | r.00 | 35318.4 | 04 |
| 31 | $\begin{array}{llll}3 & 53 & 52 \cdot 2\end{array}$ | -83 | $\begin{array}{llll}3 & 53 & \text { I } 2\end{array}$ | -87 | $352 \quad 7 \cdot 5$ | -92 | 3 51 Ir $\cdot 0$ | -97 | 350 IT•6 | 1.0 | 349 9*3 | .06 |
| 32 | $\begin{array}{llll}3 & 49 & 47 \cdot 0\end{array}$ | $\cdot 84$ | $\begin{array}{llllll}3 & 48 & 55 \cdot 4\end{array}$ | -88 | 3 48 | -93 |  | 98 | $\begin{array}{llll}3 & 46 & 3 \cdot 3\end{array}$ | r.03 | $34459 \cdot 9$ | 08 |
| 33 | $3454 \mathrm{r} \cdot 8$ |  | $34449 \cdot 5$ | $\cdot 90$ | 34354.3 | -94 | $34256 \cdot \mathrm{I}$ | $\mathrm{r} \cdot \mathrm{O}$ | 34154.7 | $\mathrm{r} \cdot 05$ | $34050 \cdot 2$ | 10 |
| 34 | $\begin{array}{llllll}3 & 41 & 36 \cdot 4\end{array}$ | -86 | 34043.5 | $\cdot 91$ | $33947 \cdot 5$ | -96 | $33848 \cdot 3$ | roi | 33745.9 | 1.07 | $33640 \cdot 2$ | 2 |
| 35 |  | .87 |  | $\cdot 92$ | $3 \quad 3540 \cdot 4$ | -97 |  | 1.03 | 3 3133$36 \cdot 8$  <br> 3  | 1.09 | $\begin{array}{llll}3 & 32 & 29.9\end{array}$ | 14 |
| 36 | $\begin{array}{llllllllllll}3 & 33 & 25 \cdot 2\end{array}$ |  | $33230 \cdot 8$ | $\cdot 93$ |  | -99 | $3 \quad 30 \quad 32 \cdot 0$ | $\underline{1} 05$ | $\begin{array}{llll}3 & 29 & 27.4\end{array}$ | 矿 | 3 28 19.2 | 17 |
| 37 | $\begin{array}{lllll}3 & 29 & 19.4 \\ 3 & 25 & 19.5\end{array}$ | $\cdot 89$ | $\begin{array}{llll}3 & 28 & 24 \cdot 3\end{array}$ | -95 | $\begin{array}{llll}3 & 27 & 25.7 \\ 3 & 23 & 5.9\end{array}$ | I.OI | $\begin{array}{llll}3 & 26 & 23.5\end{array}$ | 1.07 |  |  | $\begin{array}{llll}3 & 24 & 8.2\end{array}$ | 1.19 |
| 38 |  | -90 | $32417 \cdot 5$ | -96 | $\begin{array}{llll}3 & 23 & 17.9\end{array}$ | I. 02 | 32214.6 | $1 \cdot 09$ | $321 \quad 7 \cdot 6$ |  | 3 19 56.6 | 21 |
| 39 | $\begin{array}{llll}3 & 21 & 7.3\end{array}$ | -92 | $32010 \cdot 5$ | $\cdot 98$ | 3199.9 | 04 | $\begin{array}{llll}3 & 18 & 5.5\end{array}$ | I•II | $31657 \cdot 1$ | -17 | 31544.8 | 4 |
| 40 | $\begin{array}{lll}3 & 17 & 1.0\end{array}$ | -93 | $\begin{array}{lll}3 & 16 & 3 \cdot 2\end{array}$ | -99 | $315 \quad 1 \cdot 6$ | I.06 | $31356 \cdot 0$ | r.13 |  | I 20 | 3 II 32.4 | $1 \cdot 27$ |
| 4 I | 1254.5 | -95 | $\begin{array}{lllllllll}3 & \text { II } & 55.8\end{array}$ | r 01 | 31053.0 | I.08 | $\begin{array}{llll}3 & 9 & 46 \cdot 1\end{array}$ | -15 | $\begin{array}{llll}3 & 8 & 35 \cdot 0\end{array}$ | r 22 | 37819.5 | I. 30 |
| 42 | $\begin{array}{llll}3 & 8 & 47 \cdot 8\end{array}$ | 9 | $\begin{array}{llll}3 & 7 & 48 \cdot 0\end{array}$ | ro3 | $\begin{array}{lll}3 & 6 & 44 \cdot \mathrm{I}\end{array}$ | I-10 | $\begin{array}{llll}3 & 5 & 35.9\end{array}$ | I.17 | $\begin{array}{llll}3 & 4 & 23.2\end{array}$ | 125 | $3 \begin{array}{lll}3 & 3 & \text { ¢ }\end{array}$ | I-32 |
| 43 | $\begin{array}{llllllllll}3 & 4 & 40 \cdot 8\end{array}$ | -98 | $\begin{array}{llll}3 & 3 & 40 \cdot 0\end{array}$ | 1.05 | $\begin{array}{llll}3 & 2 & 34.8\end{array}$ | I.12 | $\begin{array}{lll}3 & 1 & 25.2\end{array}$ | 1.20 | 3 0 II.O | I 28 | $25^{8} 52 \cdot \mathrm{I}$ | 6 |
| 44 | $\begin{array}{llll}3 & 0 & 33.7\end{array}$ | 99 | $\begin{array}{llll}2 & 59 & 31 \cdot 7 \\ 2 & 5\end{array}$ | 1.07 | $\begin{array}{llll}2 & 58 & 25.3\end{array}$ | 1.15 | 25714.2 | 22 | 25558.3 | I.3I | $25437 \cdot 5$ | 1-39 |
| 45 | $25626 \cdot 2$ | r.0x | $\begin{array}{lllll}2 & 55 & 23 \cdot 1 \\ 2 & 51\end{array}$ | 09 |  | . 17 | $2532 \cdot 6$ | I. 25 | $25 \mathrm{I} 45 \cdot 0$ | 1134 | $25022 \cdot 2$ | 1.42 |
| 46 | $2 \begin{array}{lllll}2 & 52 & 18 \cdot 5\end{array}$ | r.03 |  | I•II | $\begin{array}{lll}2 & 50 & 4.8\end{array}$ | 1.20 | $24850 \cdot 6$ | r 28 | $24731 \cdot 1$ | 1.37 | $\begin{array}{lll}2 & 46 & 6 \cdot 3\end{array}$ | 1.46 |
| 47 | $\begin{array}{llll}2 & 48 & 10 \cdot 5 \\ 2 & 44 & 2 \cdot 5\end{array}$ | -8 | 2474.8 | $\xrightarrow{1} 1.14$ | $\begin{array}{llll}2 & 45 & 54.0 \\ 2 & 41\end{array}$ | 25 | 2 44 $38 \cdot 0$ <br> 2   | 1 | $\begin{array}{llll}2 & 43 & 16 \cdot 6\end{array}$ | 1 | $\begin{array}{lllllll}2 & 41 & 49.6\end{array}$ | 1.50 |
| 48 | 244 2'r | 1.08 | $24255 \cdot 0$ | 16 | $24142 \cdot 6$ | I 25 | 24024.8 | I.34 | $\begin{array}{llll}2 & 39 & 1 & 3\end{array}$ | r 44 | 23732.0 | $1 \cdot 54$ |
| 49 | 3953.4 | Y.10 | $\begin{array}{llll}2 & 38 & 44.8 \\ 2\end{array}$ | 19 | $\begin{array}{llll}2 & 37 & 30 \cdot 7\end{array}$ | I 28 | $236 \mathrm{II} \cdot \mathrm{O}$ | . 38 | $\begin{array}{lllll}2 & 34 & 45\end{array}$ | 48 | $\begin{array}{llll}2 & 33 & 13.6\end{array}$ | 58 |
| 50 | $23544 \cdot 4$ | r 12 | $23434 \cdot 2$ | 22 | 23318.3 | 1 | $23156 \cdot 4$ | 1.41 | 23028.5 | 1.52 | 228 54.2 | 1.63 |
| 51 | $\begin{array}{lllll}2 & 31 & 34.9\end{array}$ | I.15 | $23023 \cdot 0$ | 1.25 | $\begin{array}{llll}2 & 29 & 5 \cdot 2 \\ 2 & 24 & 5\end{array}$ | I 35 | 2 27 | . 4 | $\begin{array}{llll}2 & 26 & 10 \cdot 7\end{array}$ | . 6 | $22433 \cdot 7$ | -68 |
| 52 | 227250 | 1.18 | $22611 \cdot 3$ | I. 28 | $22451 \cdot 5$ | r 38 | $1 \begin{array}{llll}2 & 23 & 25 \\ 2\end{array}$ | 1.49 | $\begin{array}{llll}2 & 21 & 52 \cdot \mathrm{I} \\ 2 & 17\end{array}$ |  | 22012.0 | 1.73 |
| 53 | 22314.5 | $1 \cdot 21$ | 22159.0 | 1.31 | $22037 \cdot 0$ | 1.42 | $\begin{array}{llll}219 & 8.1\end{array}$ | I.54 | 21732.3 | - 66 | 21549.1 | $1 \cdot 78$ |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | S. ${ }^{\text {- }}$ | $\begin{gathered} s . \\ -4.06 \end{gathered}$ | - ${ }^{\text {s. }} 07$ | s. -4.06 | $-\stackrel{1}{\text { S }}$ | s. | s. -.22 | s. | S. | s. | S. ${ }^{\text {S }} 36$ | s. 4.08 |
| 4 | . 05 | 4.06 | -12 | 4.06 | -19 | 4.07 | $\cdot 27$ | 4.07 | $\cdot 34$ | 4.08 | . 41 | 4.08 |
| 8 | -10 | $4 \cdot 06$ | -17 | 4.07 | - 25 | $4 \cdot 07$ | -32 | 4.07 | -39 | 4.08 | -47 | 4.09 |
| 12 | -15 | 4.06 | . 23 | 4.07 | -30 | 4.07 | $\cdot 37$ | 4.08 | -45 | 4.09 | -52 | 4.09 |
| 14 | -18 | 4.06 | $\cdot 25$ | 4.07 | $\cdot 33$ | 4.07 | -40 | 4.08 | $\cdot 48$ | 4.09 | $\cdot 55$ | $4 \cdot 10$ |
| 16 | - 20 | 4.07 | -28 | 4.07 | -36 | 4.08 | $\cdot 43$ | 4.08 | -51 | 4.09 | - 58 | $4 \cdot 10$ |
| 18 | -23 | 4.07 | -31 | 4.07 | $\cdot 39$ | $4 \cdot 08$ | $\cdot 46$ | 4.09 | -54 | 4.10 | . 62 | $4 \cdot 11$ |
| 20 | - 26 | 4.07 | $\cdot 34$ | 4.08 | -42 | 4.08 | - 49 | 4.09 | $\cdot 57$ | 4.10 | . 65 | $4 \cdot 11$ |
| 22 | -29 | 4.07 | $\cdot 37$ | 4.08 | -45 | 4.09 | - 53 | $4 \cdot 10$ | -61 | $4 \cdot \mathrm{II}$ | -69 | $4 \cdot 12$ |
| 24 | -32 | 4.07 | -40 | 4.08 | -48 | 4.09 | $\cdot 56$ | $4 \cdot 10$ | -64 | 4-11 | $\cdot 72$ | $4 \cdot 13$ |
| 26 | -35 | 4.08 | $\cdot 43$ | 4.08 | -51 | 4.09 | -60 | $4 \cdot 11$ | -68 | $4 \cdot 12$ | $\cdot 76$ | $4 \cdot 13$ |
| 28 | - 38 | $4 \cdot 08$ | $\cdot 47$ | 4.08 | - 55 | 4*10 | -63 | $4 \cdot 11$ | $\cdot 72$ | $4 \cdot 12$ | . 80 | $4 \cdot 14$ |
| 30 | $\cdot 41$ | 4.08 | - 50 | 4.09 | $\cdot 59$ | $4 \cdot 10$ | $\cdot 67$ | $4 \cdot 12$ | $\cdot 76$ | 4-13 | . 85 | $4 \cdot 15$ |
| 32 | -45 | 4.09 | -54 | $4 \cdot 10$ | -62 | $4 \cdot 11$ | $\cdot 71$ | $4 \cdot 12$ | -80 | 4.14 | -89 | $4 \cdot 16$ |
| 34 | -49 | 4.09 | $\cdot 58$ | 4.10 | $\cdot 67$ | 4-12 | $\cdot 76$ | $4 \cdot 13$ | $\cdot 85$ | 4.15 | -94 | $4 \cdot 17$ |
| 36 | - 52 | $4 \cdot 09$ | . 62 | 4.11 | $\cdot 71$ | $4 \cdot 12$ | -80 | 4.14 | -90 | $4 \cdot 16$ | -99 | $4 \cdot 18$ |
| 38 | $\cdot 56$ | $4 \cdot 10$ | -66 | $4 \cdot 11$ | $\cdot 75$ | $4 \cdot 13$ | -85 | $4 \cdot 15$ | -95 | $4 \cdot 17$ | r.05 | $4 \cdot 19$ |
| 40 | -61 | $4 \cdot 11$ | $\cdot 71$ | 4.12 | -80 | $4 \cdot 14$ | -90 | 4.16 | r-OI | 4.18 | I-II | 4.21 |
| 42 | -65 | $4 \cdot 11$ | $\cdot 75$ | $4 \cdot 13$ | -86 | $4 \cdot 15$ | $\cdot 96$ | $4 \cdot 17$ | 1.07 | $4 \cdot 20$ | r.18 | 4.23 |
| 44 | $\cdot 70$ | $4 \cdot 12$ | -81 | $4 \cdot 14$ | $\cdot 91$ | 4*16 | 1.02 | 4.19 | I•I3 | $4 \cdot 22$ | r. 25 | $4 \cdot 25$ |
| 46 | $\cdot 75$ | $4 \cdot 13$ | -86 | 4.15 | -98 | 4.18 | r.09 | 4.21 | I. 21 | $4 \cdot 24$ | 1.32 | $4 \cdot 27$ |
| 48 | -81 | 4.14 | -93 | $4 \cdot 17$ | 1.04 | $4 \cdot 19$ | I.16 | 4.23 | r 28 | $4 \cdot 26$ | 1.41 | $4 \cdot 30$ |
| 50 | -87 | $4 \cdot 15$ | $\cdot 99$ | $4 \cdot 18$ | I-12 | $4 \cdot 21$ | r.24 | $4 \cdot 25$ | 1.37 | $4 \cdot 29$ | 1.51 | $4 \cdot 33$ |
| 52 | -94 | $4 \cdot 17$ | r.07 | $4 \cdot 20$ | I 20 | $4 \cdot 23$ | 1.33 | 4.28 | 1.47 | $4 \cdot 32$ | r.62 | 4.37 |
| 53 | $\cdot 98$ | $4 \cdot 18$ | I•II | 4.2 I | I-24 | $4 \cdot 25$ | r.38 | $4 \cdot 29$ | r 53 | $4 \cdot 34$ | I. 67 | 4.39 |

LATITUDE $10^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE,

| True Alt. | $6^{\circ}$ | Decl. Var. | 7 | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. S. | s. | H. M. S. | s. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $\begin{array}{llll}5 & 55 & 45 \cdot 2\end{array}$ | - '71 | $\begin{array}{llll}5 & 55 & 2 \cdot 3\end{array}$ | $\cdot 72$ | 55419.2 | - 72 | $\begin{array}{llll}5 & 53 & 35 \cdot 9\end{array}$ | -. 72 | $5 \begin{array}{llll}5 & 52 & 52.4\end{array}$ | $\cdot 73$ | $\begin{array}{llll}5 & 52 & 8 \cdot 6\end{array}$ | - 73 |
| 10 | $\begin{array}{lllll}5 & 14 & 49 \cdot 6\end{array}$ | -80 | $\begin{array}{llll}5 & 14 & 0.9\end{array}$ | - 82 | $\begin{array}{llll}5 & 13 & 11.3\end{array}$ | $\cdot 84$ | $\begin{array}{llll}5 & 12 & 20 \cdot 5\end{array}$ | - 85 | 5 II $28 \cdot 7$ | $\cdot 87$ | 5 10 $35 \cdot 8$ | -89 |
| 12 | $\begin{array}{llll}5 & 6 & 37 \cdot 2\end{array}$ | -82 | $\begin{array}{llll}5 & 5 & 47 \cdot 1\end{array}$ | - 84 | $\begin{array}{llll}5 & 4 & 55 \cdot 9\end{array}$ | -86 | $\begin{array}{lll}5 & 4 & 3 \cdot 5\end{array}$ | -88 | $\begin{array}{llll}5 & 3 & 9 \cdot 8\end{array}$ | -91 | 5 2 14.7 | -93 |
| 14 | $4 \begin{array}{llll}4 & 58 & 24.2\end{array}$ | . 85 | $45732 \cdot 7$ | $\cdot 87$ | $45639 \cdot 9$ | -89 | $\begin{array}{llll}4 & 55 & 45 \cdot 6\end{array}$ | -92 | $\begin{array}{llll}4 & 54 & 49.9 \\ 4 & 46 & 29\end{array}$ | $\cdot 94$ | $\begin{array}{llll}4 & 53 & 52 \cdot 7 \\ 4 & 45 & 29\end{array}$ | $\cdot 97$ |
| 16 | $45010 \cdot 7$ | $\cdot 87$ | 449 I7.6 | -90 | $44^{88} 23 \cdot 1$ | $\cdot 92$ | $44726 \cdot 9$ | -95 | $44629 \cdot 1$ | -98 | $445 \quad 29 \cdot 6$ | I'OI |
| 18 | $44156 \cdot 6$ | -90 | 44 I I•8 | -93 | $440 \quad 5 \cdot 5$ | -95 | $439 \quad 7 \cdot 3$ | -99 | $\begin{array}{llll}4 & 38 & 7 \cdot 2\end{array}$ | I. 02 | $\begin{array}{llll}4 & 37 & 5 \cdot 3\end{array}$ | I. 05 |
| 20 | $43341 \cdot 7$ | -92 | $\begin{array}{llll}4 & 32 & 45 \cdot 2\end{array}$ | $\cdot 96$ | $43146 \cdot 9$ | -99 | $43046 \cdot 6$ | I. 02 | $42944 \cdot 2$ | I.06 | $4 \begin{array}{llllllllllll}4 & 28 & 39\end{array}$ | I.09 |
| 22 | $42526 \cdot 0$ | -95 | $4 \begin{array}{llll}4 & 24 & 27 \cdot 8\end{array}$ | -99 | 42327.4 | 1.03 | 42224.7 | 1.06 | 42119.9 | I-10 | $42012 \cdot 7$ | I•I4 |
| 24 | 41779.6 | -99 | 41693 | I 02 | $4 \begin{array}{lll}45 & 6 \cdot 7\end{array}$ | I.06 | $\begin{array}{llll}4 & 14 & 1 \cdot 7\end{array}$ | I-10 | $\begin{array}{llll}4 & 12 & 54.2\end{array}$ | I•I5 | 4 II 44.2 | I.19 |
| 26 | 4852.2 | 1.02 | 4749.8 | I.06 | $4 \quad 6 \quad 44 \cdot 9$ | I-10 | $4 \quad 5 \quad 37 \cdot 3$ | I•15 | $4 \quad 4 \quad 27 \cdot 0$ | r.I9 | $\begin{array}{llll}4 & 3 & 13.9\end{array}$ | I 24 |
| 27 | 44343 | I. 04 | $\begin{array}{llll}4 & 3 & 39 \cdot 6\end{array}$ | I. 08 | $\begin{array}{llll}4 & 2 & 33.4\end{array}$ | I-13 | 4 I 24.5 | I•7 | $\begin{array}{llll}4 & 0 & 12.8\end{array}$ | I. 22 | $\begin{array}{llll}3 & 58 & 58 \cdot 0\end{array}$ | I. 27 |
| 28 | $4033 \cdot 8$ | I.05 | $\begin{array}{llll}3 & 59 & 29 \cdot 1\end{array}$ | I•IO | $35^{58} 21 \cdot 7$ | I'I5 | 3571113 | I. 20 | $3{ }^{3} 555158 \cdot 1$ | I. 25 | $\begin{array}{lllll}3 & 54 & 41 \cdot 7\end{array}$ | I.30 |
| 29 | $35624 \cdot 1$ | I.07 | $\begin{array}{llllllllllllllll}3 & 55 & 18 \cdot 3\end{array}$ | I-12 | 35449.5 | I•I7 | $\begin{array}{llllllllllllllll}3 & 52 & 57 \cdot 8\end{array}$ | I. 22 | $3 \mathrm{5I} 42 \cdot 9$ | I. 27 | $\begin{array}{llll}3 & 50 & 24 \cdot 8\end{array}$ | $1 \cdot 33$ |
| 30 | $\begin{array}{llllll}3 & 52 & 14.2\end{array}$ | I.09 | 3 51 $7 \cdot 1$ | I-14 | 349 57.0 | I•I9 |  | I. 25 | $\begin{array}{llllllllllllllllll}3 & 47 & 27 \cdot 2\end{array}$ | I. 30 | $\begin{array}{llll}3 & 46 & 7 \cdot 4 \\ 3 & 41 & 49\end{array}$ | I.36 |
| 31 | 34840 | I'II | $34655 \cdot 6$ | I•I7 | $34544 \cdot 1$ | I. 22 | $34429 \cdot 2$ | I. 28 | 343 II•O | r.33 | 3 4I 49:3 | I-39 |
| 32 | 34353.4 | I-13 | 34243.7 | I'19 | $3 \begin{array}{llll}3 & 41 & 30 \cdot 7\end{array}$ | I. 25 | 34014.2 | 1.30 | $\begin{array}{llll}3 & 38 & 54.3\end{array}$ | I. 36 | $\begin{array}{llll}3 & 37 & 30 \cdot 7\end{array}$ | 1.43 |
| 33 | $\begin{array}{lllll}3 & 39 & 42 \cdot 5\end{array}$ | I-16 | $\begin{array}{llll}3 & 38 & 31 \cdot 4\end{array}$ | I. 2 I | $\begin{array}{llll}3 & 37 & 16.8\end{array}$ | I 27 | $\begin{array}{llll}3 & 35 & 58 \cdot 7\end{array}$ | 1.33 | $\left\lvert\, \begin{array}{llll}3 & 34 & 36 \cdot 9\end{array}\right.$ | I. 39 | $3{ }^{3} 33151.3$ | I.46 |
| 34 | $33531 \cdot 2$ | I-I8 | $\begin{array}{llll}3 & 34 & 18 \cdot 6\end{array}$ | I 24 | $\begin{array}{lll}3 & 33 & 2 \cdot 5\end{array}$ | $1 \cdot 30$ | 3 31 $42 \cdot 6$ | I.36 | $\begin{array}{llll}3 & 30 & 18 \cdot 9\end{array}$ | I.43 | $3 \begin{array}{lllll}3 & 28 & 51 \cdot 2\end{array}$ | I. 50 |
| 35 | $\begin{array}{llll}3 & 31 & 19.5\end{array}$ | I. 20 | $\begin{array}{llll}3 & 30 & 5.4\end{array}$ | $1 \cdot 27$ | $\begin{array}{llllllllllllll}3 & 28 & 47 \cdot 6\end{array}$ | I•33 | $\begin{array}{llll}3 & 27 & 25.9\end{array}$ | r 39 | $\begin{array}{lll}3 & 26 & 0 \cdot 3\end{array}$ | 1.46 | $\begin{array}{lllll}3 & 24 & 30 \cdot 4\end{array}$ | I.53 |
| 36 | $\begin{array}{llll}3 & 27 & 74\end{array}$ | I. 23 | $\begin{array}{lllll}3 & 25 & 51 \cdot 7\end{array}$ | I-29 | $3 \quad 2432 \cdot 2$ | I.36 | $\begin{array}{lll}3 & 23 & 8.6\end{array}$ | I 43 | $32140 \cdot 9$ | 1.50 | $\begin{array}{lll}3 & 20 & 8 \cdot 8\end{array}$ | 1.57 |
| 37 | $\begin{array}{llll}3 & 22 & 54.8\end{array}$ | I. 26 | $32137 \cdot 5$ | I. 32 | $\begin{array}{lll}3 & 20 & 16 \cdot 2\end{array}$ | I-39 | 3 I 850.6 | 1.46 | $\begin{array}{lll}3 & 17 & 20 \cdot 7 \\ 3 & \text { I } & 50 \cdot 8\end{array}$ | I. 54 | $\begin{array}{llll}3 & 15 & 46 \cdot 3\end{array}$ | r. 61 |
| 38 | $3 \mathrm{I} 84 \mathrm{I} \cdot 8$ | I. 28 | $\begin{array}{llll}3 & 17 & 22.8\end{array}$ | I.35 | $\begin{array}{llll}3 & 15 & 59 \cdot 5\end{array}$ | I 42 | $\begin{array}{llll}3 & 14 & 31 \cdot 9\end{array}$ | 1.50 | $\begin{array}{cccc}3 & 12 & 59 \cdot 8 \\ 3 & 8 & 38 \cdot\end{array}$ | 1.57 | $\begin{array}{rrrr}3 & \text { II } & 22.9 \\ 3 & 6 & 58.5\end{array}$ | I. 66 |
| 39 | $\begin{array}{llll}3 & 14 & 28.2\end{array}$ | I-3I | $\begin{array}{llll}3 & 13 & 7.4\end{array}$ | r. 38 | 3 II $42 \cdot 2$ | 1.46 | 3 10 12.5 | r.53 | $\begin{array}{llll}3 & 8 & 38 \cdot 0\end{array}$ | I. 62 | $\begin{array}{llll}3 & 6 & 58 \cdot 5\end{array}$ | I• 70 |
| 40 | 31014.2 | I. 34 | $\begin{array}{llll}3 & 8 & 5 I \cdot 5\end{array}$ | I. 42 | $3 \begin{array}{llll}3 & 7 & 24.2\end{array}$ | I.49 | $\begin{array}{llll}3 & 5 & 52 \cdot 2\end{array}$ | $\mathbf{1} 57$ | 3 4 $15 \cdot 2$ <br> 2 5  | I. 66 | $\begin{array}{lrrr}3 & 2 & 33 \cdot 0\end{array}$ | $1 \cdot 75$ |
| 41 | $\begin{array}{llll}3 & 5 & 59 \cdot 5\end{array}$ | 1.37 | $\begin{array}{llll}3 & 4 & 34.9\end{array}$ | 1.45 | $\begin{array}{lll}3 & 3 & 5.4\end{array}$ | I.53 | 3 I 31.0 | 1.62 | $25951 \cdot 4$ | 1.70 | $2 \begin{array}{lll}2 & 58 & 6 \cdot 4\end{array}$ | I.80 |
| 42 | 3 I $44^{\circ} 2$ | 1.40 | 3 3 8 177.5 | I.49 | $2 \begin{array}{llll}2 & 58 & 45 \cdot 8\end{array}$ | 1.57 | $\begin{array}{llll}2 & 57 & 8.9\end{array}$ | r. 66 | 255126.6 | 1.75 | 253588.6 | I. 85 |
| 43 | $25728 \cdot 3$ | I 44 | $\begin{array}{llll}2 & 55 & 59.4\end{array}$ | I'52 | $25425 \cdot 3$ | I.6I | $2 \begin{array}{llll}2 & 52 & 45 \cdot 8\end{array}$ | I•71 | 25150.6 | I.80 | 249494 | I.90 |
| 44 | 25311.6 | 1.47 | $25140 \cdot 5$ | I. 56 | $\begin{array}{lll}2 & 50 & 3 \cdot 8\end{array}$ | I. 66 | $24821 \cdot 6$ | 1.75 | $2{ }_{2} 46$ | I. 86 | $24438 \cdot 9$ | I.96 |
| 45 | $24854 \cdot 2$ | 1.5I | $24720 \cdot 6$ | I.6I | $24541 \cdot 4$ | 1•70 | $243 \quad 56 \cdot 2$ | I.80 | $\begin{array}{llll}2 & 42 & 4 \cdot 8\end{array}$ | I.91 | $2 \begin{array}{lll}2 & 40 & 6 \cdot 7\end{array}$ | $2 \cdot 02$ |
| 46 | $24435 \cdot 9$ | 1.55 | 24259.9 | r.65 | 24117.8 | I•75 | 23929.5 | I.86 | 23734.6 | I.97 | $23532 \cdot 9$ | $2 \cdot 09$ |
| 47 | 24016.8 | I. 60 | $23838 \cdot 0$ | I•70 | 23653.0 | 1.80 | $2 \begin{array}{lll}2 & 35 & \text { I. } 4\end{array}$ | I.92 | 23313.0 | 2.03 | $2 \begin{array}{lll}20 & 57 \cdot 3\end{array}$ | $2 \cdot 16$ |
| 48 | $23556 \cdot 7$ | I. 64 | $\begin{array}{llll}2 & 34 & 15 \cdot 1\end{array}$ | 1.75 | 23226.9 | r.86 | 23031.8 | I.98 | $2 \begin{array}{llll}2 & 28 & 29.6\end{array}$ | $2 \cdot 10$ | $2 \begin{array}{lllll}26 & 19.6\end{array}$ | $2 \cdot 23$ |
| 49 | $2 \mathrm{3I} 35 \cdot 5$ | I. 69 | $\begin{array}{llll}2 & 29 & 50 \cdot 8\end{array}$ | I.80 | $\begin{array}{llll}2 & 27 & 59 \cdot 3\end{array}$ | I.92 | $\begin{array}{llr}2 & 26 & 0.6\end{array}$ | $2 \cdot 04$ | 2 23 54.2 <br> 2 5  | $2 \cdot 17$ | $\begin{array}{llll}2 & 21 & 39.7\end{array}$ | 2.31 |
| 50 | $\begin{array}{llll}2 & 27 & 13.2\end{array}$ | I.74 | $\begin{array}{llll}2 & 25 & 25 \cdot 3\end{array}$ | I.86 | $2 \begin{array}{llll}2 & 23 & 30 \cdot 2\end{array}$ | r.93 | $\begin{array}{lllll}2 & 21 & 27.5\end{array}$ | $2 \cdot 11$ | $2 \begin{array}{llll}2 & 19 & 16.8\end{array}$ | 2.25 | $\begin{array}{llll}2 & 16 & 57 \cdot 4\end{array}$ | $2 \cdot 40$ |
| 51 | $22249 \cdot 6$ | 1*79 | $22058 \cdot 3$ | I.92 | 2 I8 59.4 | $2 \cdot 05$ | 21652.4 | 2.19 | $21437 \cdot 0$ | $2 \cdot 33$ | 21212.4 | $2 \cdot 49$ |
| VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. | A. | L. 7 | A. | L. | A. | L. $9^{\circ}$ | A. | L. 10 | A. | L. $11^{\circ}$ | A. |
| $\bigcirc$ | S. | $\begin{gathered} \text { s. } \\ -4.08 \end{gathered}$ | s. $\cdot 5 I$ | $\begin{gathered} s . \\ -4.09 \end{gathered}$ | $\text { s. } 58$ | $\begin{gathered} \text { S. } \\ -4 \cdot 10 \end{gathered}$ | s. | $\begin{gathered} s . \\ 4 \cdot I I \end{gathered}$ | s. $\cdot 73$ | $\frac{s .}{4 \cdot 12}$ | $\text { s. } 80$ | $\stackrel{s .}{4 \cdot 14}$ |
| 4 | -49 | 4.09 | . 56 | $4 \cdot 10$ | . 63 | $4 \cdot 11$ | $\cdot 71$ | $4 \cdot 12$ | -78 | $4 \cdot 14$ | . 86 | $4 \cdot 15$ |
| 8 | - 54 | $4 \cdot 10$ | -61 | 4-II | -69 | $4 \cdot 12$ | $\cdot 76$ | 4.13 | -84 | $4 \cdot 15$ | -92 | $4 \cdot 16$ |
| 10 | $\cdot 57$ | $4 \cdot 10$ | -64 | 4-II | $\cdot 72$ | 4.12 | -80 | 4.14 | -87 | $4 \cdot 15$ | -95 | 4.17 |
| 12 | -60 | 4-II | . 68 | 4-12 | $\cdot 75$ | 4.13 | . 83 | $4 \cdot 15$ | -91 | 4.16 | -98 | 4.18 |
| 14 | . 63 | 4.II | -71 | $4 \cdot 12$ | $\cdot 78$ | 4.14 | . 86 | 4.15 | -94 | $4 \cdot 17$ | I. 02 | 4.19 |
| I6 | -66 | 4.II | -74 | 4-13 | . 82 | 4.14 | -90 | $4 \cdot 16$ | -98 | 4-18 | I.06 | $4 \cdot 20$ |
| 18 | $\cdot 70$ | 4.12 | -78 | 4.13 | - 85 | $4 \cdot 15$ | -93 | $4 \cdot 17$ | $1 \cdot 02$ | $4 \cdot 19$ | I•IO | 4.21 |
| 20 | $\cdot 73$ | 4•13 | .81 | 4.14 | -89 | 4-16 | -97 | 4.18 | I•06 | $4 \cdot 20$ | I•I4 | 4.22 |
| 22 | -77 | 4.13 | . 85 | $4 \cdot 15$ | -93 | 4.17 | I. 02 | 4.19 | I•IO | 4.21 | I'I9 | $4 \cdot 23$ |
| 24 | -81 | 4.14 | . 89 | $4 \cdot 16$ | -97 | 4.18 | I. 06 | $4 \cdot 20$ | I•15 | $4 \cdot 22$ | I. 23 | $4 \cdot 24$ |
| 26 | . 85 | 4.15 | -93 | $4 \cdot 17$ | I-02 | 4.19 | I•II | $4 \cdot 21$ | I•19 | $4 \cdot 23$ | 1.28 | $4 \cdot 26$ |
| 28 | - 89 | 4.16 | -98 | 4.18 | 1.07 | $4 \cdot 20$ | I•16 | $4 \cdot 22$ | I. 25 | $4 \cdot 25$ | I 34 | $4 \cdot 28$ |
| 30 | -93 | $4 \cdot 17$ | I-02 | $4 \cdot 19$ | I'I2 | $4 \cdot 21$ | I'2I | $4 \cdot 24$ | I 30 | 4.27 | I.40 | $4 \cdot 30$ |
| 32 | -98 | $4 \cdot 18$ | I-08 | $4 \cdot 20$ | I•7 | $4 \cdot 23$ | I-27 | $4 \cdot 25$ | I-36 | $4 \cdot 28$ | I-46 | $4 \cdot 32$ |
| 34 | I-03 | 4.19 | 1-13 | $4 \cdot 22$ | I. 23 | $4 \cdot 24$ | I 33 | 4.27 | $1 \cdot 43$ | $4 \cdot 30$ | 1.53 | $4 \cdot 34$ |
| 36 | I.09 | $4 \cdot 21$ | 1-19 | $4 \cdot 23$ | I 29 | $4 \cdot 26$ | I 39 | $4 \cdot 29$ | 1.50 | $4 \cdot 33$ | r.6I | $4 \cdot 37$ |
| 38 | I• 15 | $4 \cdot 22$ | I. 25 | $4 \cdot 25$ | I-36 | $4 \cdot 28$ | I 47 | $4 \cdot 32$ | 1.57 | $4 \cdot 36$ | r.69 | $4 \cdot 40$ |
| 40 | $1 \cdot 21$ | $4 \cdot 24$ | I. 32 | $4 \cdot 27$ | I 43 | $4 \cdot 31$ | I. 54 | $4 \cdot 35$ | I. 66 | 4.39 | 1•78 | $4 \cdot 43$ |
| 42 | I. 28 | $4 \cdot 26$ | I 40 | $4 \cdot 30$ | I-5I | $4 \cdot 33$ | I. 63 | $4 \cdot 38$ | $1 \cdot 75$ | $4 \cdot 42$ | I. 88 | $4 \cdot 47$ |
| 44 | I. 36 | $4 \cdot 28$ | 1.48 | 4.32 | 1.60 | 4.37 | I•73 | 4.41 | 1.86 | $4 \cdot 46$ | I.99 | $4 \times 52$ |
| 46 | I. 45 | $4 \cdot 31$ | I. 57 | $4 \cdot 35$ | I•70 | $4 \cdot 40$ | I. 83 | $4 \cdot 46$ | 1.97 | $4 \cdot 51$ | $2 \cdot 11$ | $4 \cdot 58$ |
| 48 | I. 54 | $4 \cdot 34$ | 1.67 | 4.39 | I 81 | 4.45 | I 95 | $4 \cdot 51$ | $2 \cdot 10$ | $4 \cdot 57$ | $2 \cdot 26$ | $4 \cdot 65$ |
| 50 | I-64 | $4 \cdot 38$ | I•79 | 4.44 | I•93 | $4 \cdot 50$ | $2 \cdot 09$ | $4 \cdot 57$ | $2 \cdot 25$ | $4 \cdot 64$ | $2 \cdot 42$ | $4 \cdot 73$ |
| 51 | 1-70 | $4 \cdot 40$ | I. 85 | $4 \cdot 46$ | $2 \cdot 00$ | $4 \cdot 53$ | $2 \cdot 16$ | $4 \cdot 60$ | $2 \cdot 33$ | 4.68 | $2 \cdot 51$ | 4.77 |

## 164 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $10^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True | $12^{\circ}$ | Decl. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. | $16^{\circ}$ | Dect. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. S. |  | 55 | . 7 | H. м. S. | . 7 |  | S. | H. M. S. | s. | H. M. S. |  |
| $\stackrel{\circ}{8}$ | $\left\lvert\, \begin{array}{lll} 5 & 51 & 24 \cdot 5 \\ 5 & 18 & 4.0 \\ \hline \end{array}\right.$ | -74 | $\begin{array}{llll}5 & 50 & 40.1 \\ 5 & 17 & 10.9\end{array}$ | 74 .89 | 5 49 55.3 <br> 5 16  | .75 | $\left\lvert\, \begin{array}{lll} 5 & 49 & 10 \cdot 1 \\ 5 & 15 & 21 \cdot 6 \end{array}\right.$ | $\cdot 76$ | $\begin{array}{lll} 5 & 48 & 24 \cdot 5 \\ 5 & 14 & 25 \cdot 5 \end{array}$ | .76 | $\left\|\begin{array}{lll} 5 & 47 & 38 \cdot 4 \\ 5 & 13 & 27 \cdot 5 \end{array}\right\|$ | 97 |
| 10 | 5 | 91 | 46.2 | -93 | $5 \quad 749.6$ | . 95 | 5 1.6 |  | 5 52.2 | I. 0 | 4 |  |
| 12 | $\begin{array}{lllll}5 & 1 & 18.3\end{array}$ | -95 | - 20.5 |  | $4{ }^{59} 512$ | I. 0 | $45820 \cdot 3$ |  | 45787.9 | 1.0 | 4 56 13.8 |  |
| 14 | $452^{24} 5{ }^{\circ}$ | 99 | $45153 \cdot 5$ | $\mathrm{I}^{1} 02$ | 450514 | .05 | $44947 \cdot 6$ | r.08 | $44842 \cdot 0$ |  | $44734 \cdot 4$ |  |
| ${ }^{16}$ | 44428.3 | 1.04 | 44325.2 |  | $\begin{array}{llll}4 & 42 & 20.2\end{array}$ |  | $4{ }_{4}^{41} 13.3$ |  | $4{ }^{40} 42$ |  | ${ }_{4}^{4} 3^{88} 53 \cdot \mathrm{I}$ |  |
| 18 |  | I. 08 | ${ }^{4} 34555$ | I•I2 | 4 3347.4 | I-15 | ${ }_{4}^{4} 3237.2$ |  | 4 <br> 4 <br> 4 <br> 4 <br> 4 |  | ${ }^{4} 380$ |  |
| 20 22 |  | I. $\mathrm{r}_{3}$ |  | $1 \cdot 17$ |  | . 27 |  | I.25 | $\begin{array}{lll}4 & 22 & 42.9 \\ 4 & \text { r3 } & 58.8\end{array}$ |  |  |  |
| 24 | 4 10 3r | 1.23 | 4916.0 |  | $4 \quad 757 \cdot 7$ | $1 \cdot 3$ | 4686.5 | 1.38 | 4 4 4 r2-I | I. 43 | ${ }_{4}+3446$ |  |
| 25 | 615.0 | r 26 | 457 |  | 33 | - 36 | 21 |  | $4{ }^{\circ} 47.7$ |  | 315917.8 |  |
| 27 | (rrrrr |  |  | I. 38 | 3 <br> 3 <br> 3 <br> 59 <br> 1 <br> 59 | I.40 | 3 57 <br> 3 51 <br> 3 57 |  | 3 56 <br> 3 $22 \cdot 5$ <br>  51 <br> 56.5  |  |  |  |
| 28 | 3 33 22.2 | $1 \cdot 35$ | 35159 | $1 \cdot 4$ | 35033 | I 47 | 3 49 |  | 3 4729.7 |  | 345 52:3 | I.66 |
| 29 | $\left\lvert\, \begin{array}{lll}3 & 49 & 3\end{array}\right.$ | . 39 | 34738.4 | r 44 | 346 Io'r | r.50 | 344 | ${ }_{1} 57$ | 343 <br> 19 | I. 63 | $34 \mathrm{4I} 2 \mathrm{P} \cdot 9$ |  |
| 30 | $34444^{\circ}$ |  | 3 43 17.1 |  | $\begin{array}{llll}3 & 41 & 46.4\end{array}$ |  | 34011 | . 61 | ${ }_{3}^{3} \begin{array}{lll}38 & 33 \cdot 2\end{array}$ | I. 68 | $3{ }^{3} 36$ |  |
| 31 | 34024 | r.45 | ${ }^{3} 38854.9$ |  | 3 37 21.9 |  | 335 |  | $\begin{array}{llll}3 & 34 & 3\end{array}$ | 1.73 | 332 |  |
| 32 33 |  |  |  | r. r + 50 | 3 32 <br> 3 $285 \cdot 5$ <br>  $30 \cdot 5$ | I.61 | 3 3 3 26 | 1.70 | $\begin{array}{cccc}3 & 29 & 32 \cdot 6 \\ 3 & 25 & 0.6\end{array}$ |  |  |  |
| 34 | 3 32719.4 | $\underline{5}$ | ${ }_{3} 2543 \cdot 3$ | 64 | $\begin{array}{llll}3 & 24 & 2.7\end{array}$ | 1.71 | 3 22 | 1.7 |  |  |  |  |
| 35 | $\begin{array}{ll}3 & 22 \\ 3 & 56 \cdot 3\end{array}$ | ${ }^{1} \cdot 61$ | 3215176 | $\stackrel{r}{1} 68$ | $31934 \cdot 3$ | 76 | 3 17 46. I | I. 85 | 31552.8 | -93 | 313540 |  |
| 36 |  | r.65 | 3 36 | I.73 | 315 |  | 3-1313.4 |  | ${ }_{3} 151516.7$ |  | 3 9 14.4 <br> 3   |  |
| 38 | 4r-1 | 1.7 |  |  | 3 IO <br> 3 63.9 |  |  |  | $3639 \cdot \mathrm{I}$ |  | 4 <br> 493 <br> 59 <br> 49.8 |  |
| 39 | ${ }^{3}$ | I.79 | $323 \cdot 9$ |  | I 28.2 | r. 98 | 25926.7 | 研 | 25758 |  | $25^{2} 54 \cdot 6$ | 2.30 |
| 40 |  | r. 84 | $25852 \cdot 3$ | r.94 | 256 | 204 | 25447 |  | 25236.0 | $2 \cdot 26$ | $25017 \cdot \mathrm{I}$ |  |
| 4 I | $2 \begin{array}{llll} & 56 & 15.8\end{array}$ | r.89 | $25419 \cdot 2$ |  | 2. $5218{ }^{16}$ | $2 \cdot 10$ | $2507 \cdot 1$ | $2 \cdot 21$ | $24750 \cdot 9$ | 33 | 245274 |  |
| 42 | ${ }^{2} 515144.7$ | 1.95 2.01 2.05 |  |  | 2 47 <br> 2 38 <br> 2  <br> 2 5 |  | $\begin{array}{llll}2 & 45 & 24.4 \\ 2 & 40 \\ 20\end{array}$ |  | 3 | 2.41 <br> 2.50 |  |  |
| 4 | $\begin{array}{lll}2 & 47 & 12 \cdot 1 \\ 242 & 37 \cdot 9\end{array}$ | 2.07 |  | 2.19 |  | 2.32 | 2 2 | 2.45 |  | 2.59 | 2-30 41.5 | 2.74 |
| 45 | ${ }_{2}^{2} 38$ |  | $\begin{array}{llll}2 & 35 & 49.9\end{array}$ |  | 2 33 $30 \cdot 1$ <br> 2 18  |  | $\begin{array}{lll}2 & 31 & 2 \cdot 2\end{array}$ |  | 228 | $2 \cdot 69$ | $\begin{array}{lllll}2 & 25 & 39.8 \\ 2 & 30\end{array}$ |  |
| 46 | $\begin{array}{llll}2 & 33 & 24.0 \\ 2 & 28 & 44.0\end{array}$ |  | $\begin{array}{llll}2 & 31 & 7 \cdot 4 \\ 2 & 26 & 22.6\end{array}$ | 2.34 2.43 |  |  |  | 2.63 2.74 | 223 | 2.79 2.91 | 2 2 2 20 |  |
| 47 48 | ${ }^{28} 84{ }^{4.0}$ |  |  |  |  | 2.58 |  |  | 2188 |  |  |  |
| 49 | $\left\lvert\, \begin{array}{lll} \\ 2 & 19 & 16.8\end{array}\right.$ |  | $21644 \cdot 6$ |  | $\begin{array}{llll} & 14 & 2.7\end{array}$ |  | 2 II Io. 3 |  | 8 |  | 450 |  |

VARIATION TO. I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ}$ A. |  | L. 1 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{gathered} \mathrm{s} . \\ -.88 \end{gathered}$ | $s$. $-4 \cdot 15$ | s. 95 | s. $-4 \cdot 17$ | S. $-\mathrm{I} \cdot \mathrm{O}$ | S. $-4 \cdot 19$ | $\underset{-I \cdot I I}{S .}$ | $\begin{gathered} S . \\ -4.2 I \end{gathered}$ | $\underset{-\mathrm{I} \cdot \mathrm{I} 8}{\mathrm{~S}}$ | $\begin{gathered} \text { S. } \\ -4.23 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ -\mathrm{r} \cdot 26 \end{gathered}$ | $\begin{gathered} \text { S. } \\ -4.25 \end{gathered}$ |
| 4 | . 93 | 4.17 | 1-OI | 4.19 | r.09 | -4.2I | I•I6 | 4.21 4.23 | 1. 24 | 4.25 4 | I.29 | 4.27 |
| 6 | -96 | $4 \cdot 17$ | I. 04 | 4.19 | I'I2 | $4 \cdot 21$ | I. 20 | 4.23 | I 28 | $4 \cdot 26$ | I. 36 | $4 \cdot 28$ |
| 8 | -99 | 4-18 | 1.07 | $4 \cdot 20$ | I• 5 | $4 \cdot 22$ | 1.23 | $4 \cdot 24$ | I.31 | 4.27 | I.39 | 4.29 |
| ro | r.03 | 4-19 | I•II | 4.21 | I.I9 | 4.23 | I 27 | $4 \cdot 26$ | 1.35 | $4 \cdot 28$ | I.43 | 4.3 I |
| 12 | I.06 | $4 \cdot 20$ | I•I4 | $4 \cdot 22$ | 1. 22 | $4 \cdot 24$ | 1.3I | 4.27 | I•39 | 4.29 | 1.47 | $4 \cdot 32$ |
| 14 | r.10 | $4 \cdot 21$ | I•8 | $4 \cdot 23$ | I 26 | $4 \cdot 25$ | r.35 | $4 \cdot 28$ | 1.43 | $4 \cdot 31$ | I 52 | $4 \cdot 34$ |
| r6 | I-I4 | $4 \cdot 22$ | 1.22 | $4 \cdot 24$ | I•3I | 4.27 | 1.39 | $4 \cdot 29$ | I.48 | 4.32 | I.56 | $4 \cdot 35$ |
| 18 | rer8 | $4 \cdot 23$ | I 27 | $4 \cdot 25$ | I 35 | $4 \cdot 28$ | 1.44 | $4 \cdot 31$ | I.53 | 4.34 | r.61 | $4 \cdot 37$ |
| 20 | 1-23 | $4 \cdot 24$ | I•3 | $4 \cdot 27$ | I. 40 | 4.30 | I 49 | 4.33 | I'58 | $4 \cdot 36$ | I. 67 | 4.39 |
| 22 | I. 27 | $4 \cdot 26$ | 1.36 | $4 \cdot 28$ | I.45 | 4.31 | I.54 | $4 \cdot 34$ | I. 63 | 4.38 | 1•73 | 4.41 |
| 24 | I•32 | $4 \cdot 27$ | I*4 | $4 \cdot 30$ | I. 51 | $4 \cdot 33$ | I. 60 | $4 \cdot 36$ | 1.69 | 4.40 | r.79 | 4.44 |
| 26 | I.38 | 4.29 | I.47 | $4 \cdot 32$ | r. 56 | $4 \cdot 35$ | I. 66 | $4 \cdot 39$ | I.76 | 4.43 | r.86 | 4.47 |
| 28 | I.43 | 4.31 | I. 53 | $4 \cdot 34$ | I. 63 | $4 \cdot 38$ | I 73 | $4 \cdot 41$ | 1.83 | $4 \cdot 46$ | I.94 | $4 \cdot 50$ |
| 30 | I. 50 | $4 \cdot 33$ | I.60 | $4 \cdot 36$ | 1.70 | $4 * 40$ | I-80 | $4 \cdot 44$ | re9r | 4.49 | 2.02 | $4 \cdot 53$ |
| 32 | 1.56 | 4.35 | 1.67 | 4.39 | 1.77 | 4.43 | 1.88 | 4.48 | 1.99 | 4.52 | $2 \cdot 10$ | $4 \cdot 58$ |
| 34 | I. 64 | $4 \cdot 38$ | I'74 | $4 \cdot 42$ | I. 85 | $4 \cdot 46$ | 1.97 | . $4 \cdot 51$ | $2 \cdot 08$ | $4 \cdot 56$ | $2 \cdot 20$ | $4 \cdot 62$ |
| 36 | I•72 | 4.41 | I. 83 | $4 \cdot 45$ | I.94 | $4 \cdot 50$ | 2.06 | $4 \cdot 56$ | $2 \cdot 19$ | $4 \cdot 61$ | $2 \cdot 31$ | 4.67 |
| 38 | I.80 | $4 \cdot 44$ | I. 92 | $4 \cdot 49$ | $2 \cdot 04$ | $4 \cdot 55$ | $2 \cdot 17$ | $4 \cdot 60$ | $2 \cdot 30$ | 4.67 | 2.44 | $4 \cdot 74$ |
| 40 | I.90 | $4 \cdot 48$ | 2.03 | $4 \cdot 54$ | $2 \cdot 15$ | $4 \cdot 60$ | $2 \cdot 29$ | $4 \cdot 66$ | 2.43 | $4 \cdot 73$ | $2 \cdot 58$ | $4 \cdot 81$ |
| 42 | $2 \cdot \mathrm{OI}$ | 4.53 | 2.14 | 4.59 | $2 \cdot 28$ | 4.66 | 2.42 | 4.73 | $2 \cdot 58$ | 4.81 | $2 \cdot 73$ | 4.90 |
| 44 | $2 \cdot 13$ | $4 \cdot 58$ | $2 \cdot 27$ | $4 \cdot 65$ | $2 \cdot 42$ | $4 \cdot 73$ | $2 \cdot 58$ | $4 \cdot 8 \mathrm{I}$ | $2 \cdot 74$ | 4.90 | $2 \cdot 92$ | $5 \cdot 00$ |
| 46 | 2.26 | $4 \cdot 65$ | 2.42 | $4 \cdot 73$ | $2 \cdot 58$ | $4 \cdot 81$ | $2 \cdot 75$ | 4.91 | $2 \cdot 93$ | $5 \cdot \mathrm{OI}$ | $3 \cdot 13$ | 5.13 |
| 48 | $2 \cdot 42$ | $4 \cdot 73$ | 2.59 | 4.82 | 2.77 | 4.92 | $2 \cdot 96$ | $5 \cdot 03$ | $3 \cdot 17$ | $5 \cdot 15$ | $3 \cdot 38$ | $5 \cdot 28$ |
| 49 | $2 \cdot 50$ | $4 \cdot 77$ | $2 \cdot 68$ | 4.87 | $2 \cdot 87$ | $4 \cdot 98$ | 3.08 | $5 \cdot 09$ | 3.19 | $5 \cdot 23$ | $3 \cdot 52$ | $5 \cdot 38$ |

LATITUDE $10^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 46 & 5 I \cdot 8 \end{array}\right.$ | $\stackrel{5}{ } \cdot 78$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 5 & 46 & 4^{.} 6 \end{array}\right.$ | $\stackrel{\text { S. }}{ } \cdot$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 45 & 16 \cdot 9 \end{array}\right.$ | S. 80 | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 44 & 28 \cdot 5 \end{array}$ | $\begin{gathered} 5 . \\ -\quad .8 \mathrm{I} \end{gathered}$ | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 5 & 43 & 39^{\circ} 5 \end{array}$ | $\begin{aligned} & \mathrm{s} . \\ & -\quad .82 \end{aligned}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 42 & 49 \cdot 8 \end{array}$ | S. -.83 |
| 6 | $\begin{array}{llll}5 & 21 & 6.3\end{array}$ | . 94 | $\begin{array}{llll}5 & 20 & 9.5\end{array}$ | $\cdot 96$ | $\begin{array}{llll}5 & 19 & \text { II } 4\end{array}$ | $\cdot 98$ | $\begin{array}{llll}5 & 18 & 12.0\end{array}$ | I. 00 | 5 I7 II•3 | I-02 | $\begin{array}{llll}5 & 16 & 9 \cdot 2\end{array}$ | I. 05 |
| 8 | $\begin{array}{llll}5 & 12 & 28 \cdot 5\end{array}$ | -99 | 5 II $28 \cdot 1$ | I.02 | 5 10 $26 \cdot 3$ | I. 04 | $\begin{array}{llll}5 & 9 & 23 \cdot 1\end{array}$ | 1.07 | $\begin{array}{llll}5 & 8 & \text { I8 } & 2\end{array}$ | I-09 | $\begin{array}{llll}5 & 7 & 11\end{array}$ | I-12 |
| 10 | $\begin{array}{llll}5 & 3 & 49 \cdot 1\end{array}$ | I. 05 | $\begin{array}{llll}5 & 2 & 45 \cdot 1\end{array}$ | I.08 | 5 I 39.5 | I'II | 5 o $32 \cdot 2$ | I-I4 | 45923.0 | I-17 | $458812 \cdot 0$ | I. 20 |
| 12 | $455 \quad 8 \cdot 0$ | I•II | 454002 | I'I4 | $45250 \cdot 7$ | I'18 | $45139 \cdot 1$ | I-2I | $45025 \cdot 5$ | 1.25 | $449 \quad 9.6$ | I 28 |
| 14 | 44624.9 | I-18 | $\begin{array}{lllll}4 & 45 & 13 & 3\end{array}$ | I. 21 | $44359 \cdot 6$ | I. 25 | $44243 \cdot 6$ | I. 29 | $44125 \cdot 3$ | 1-33 | $440 \quad 4.5$ | I.37 |
| 16 | $43739 \cdot 8$ | I 24 | 436124.1 | I. 28 | 43560 | I. 32 | 43345.4 | I. 36 | $4 \quad 32 \begin{array}{lll}422\end{array}$ | 1.41 | $43056 \cdot 2$ | I. 46 |
| 18 | $\begin{array}{lllll}4 & 28 & 52.4\end{array}$ | $1 \cdot 31$ | 42732.4 | I 35 | $\begin{array}{llll}4 & 26 & 9 \cdot 8\end{array}$ | I-40 | 424443 | I.45 | 43315.9 | I. 50 | 42144.4 | I. 55 |
| 19 | $42427 \cdot 7$ | I. 35 | $\begin{array}{llll}4 & 23 & 5 \cdot 5\end{array}$ | I•39 | 42 I $40 \cdot 5$ | I 44 | 42012.5 | I 49 | 4 I8 4I•4 | I. 55 | 4 I7 $7 \cdot 0$ | I. 60 |
| 20 | 42024 | I. 38 | 4 I8 37.9 | I.43 | 41710.4 | I.48 | $\begin{array}{llllllllllll}4 & 15 & 39\end{array}$ | I 54 | $414 \quad 6 \cdot 0$ | 1.59 | $41228 \cdot 7$ | I 65 |
| 2 I | $4 \begin{array}{llll}4 & 15 & 36.4\end{array}$ | I.42 | $\begin{array}{lll}4 & 14 & 9 \cdot 5\end{array}$ | 1.47 | 4 I2 39.5 | I. 53 | $\begin{array}{llll}4 & 11 & 6.2\end{array}$ | I. 58 | $4 \quad 9 \quad 29 \cdot 5$ | I. 64 | 4749.2 | I.70 |
| 22 | 4 II $9 \cdot 6$ | I.46 | $4 \begin{array}{llll}4 & 9 & 40 \cdot 3\end{array}$ | I 52 | $4 \begin{array}{llll}4 & 8 & 7\end{array}$ | 1.57 | $463 \mathrm{l} \cdot 7$ | I. 63 | $4452 \cdot 0$ | 1. 69 | $\begin{array}{llll}4 & 3 & 8 \cdot 5\end{array}$ | I•76 |
| 23 | $4642 \cdot 1$ | I. 50 | $4 \quad 5 \quad 10 \cdot 3$ | I. 56 | $4335 \cdot 0$ | I. 62 | 4 I 56.I | I. 68 | $4 \quad 0 \quad 13 \cdot 3$ | 1.75 | $\begin{array}{llll}3 & 58 & 26 \cdot 6\end{array}$ | I.81 |
| 24 | $\begin{array}{llll}4 & 2 & 13.7\end{array}$ | I.54 | 4 ○ $39 \cdot 3$ | I. 60 | 359 I•3 | I. 67 | 35719.4 | I.73 | 355 | I.80 |  | 1.87 |
| 25 | 35744.4 | I. 59 | $\begin{array}{llll}3 & 56 & 7 \cdot 4\end{array}$ | I. 65 | $35426 \cdot 5$ | I.71 | $3524 \mathrm{I} \cdot 6$ | r*8 | 35052.4 | I. 86 | $348 \quad 58 \cdot 9$ | I•93 |
| 26 | 35314.2 | I. 63 | 35134.4 | r 70 | $34950 \cdot 6$ | 1.77 | $\begin{array}{llll}3 & 48 \\ & 2 \cdot 5\end{array}$ | I. 84 | 346 10.0 | I•91 | $\begin{array}{llll}3 & 44 & 12.8\end{array}$ | 1.99 |
| 27 | $34^{3} 4843 \cdot 1$ | I. 68 | $\begin{array}{llll}3 & 47 & 0.4\end{array}$ | I•75 |  | I. 82 | $3{ }^{3} 43$ 22.1 | I. 89 | $34126 \cdot 1$ | $1 \cdot 97$ | $\begin{array}{llll}3 & 39 & 25 \cdot 1\end{array}$ | $2 \cdot 06$ |
| 28 | 34410.9 | 1.73 | $\begin{array}{lllll}3 & 42 & 25 \cdot 2\end{array}$ | 1.80 | $34035 \cdot 1$ | I. 87 | $\begin{array}{llll}3 & 38 & 40 \cdot 3\end{array}$ | I.95 | $\begin{array}{lllll}3 & 36 & 40 \cdot 6\end{array}$ | $2 \cdot 04$ | $33435 \cdot 8$ | $2 \cdot 13$ |
| 29 | $\begin{array}{llll}3 & 39 & 37 \cdot 5\end{array}$ | I•78 | $\begin{array}{lllllllllllll}3 & 37 & 48\end{array}$ | I. $5_{5}$ | $3 \quad 3555.3$ | I 93 | $33357 \cdot 0$ | 2.01 | 3 31 53.5 | $2 \cdot 10$ | $32944 \cdot 6$ | $2 \cdot 20$ |
| 30 | $\begin{array}{llll}3 & 35 & 3 \cdot 0\end{array}$ | I. 83 | 333 II•O | I.91 | 3 3I 14*I | I.99 | 329 12.1 | $2 \cdot 08$ | 32747 | 2.17 | $3245 \mathrm{I} \cdot 5$ | $2 \cdot 27$ |
| 31 | $3 \begin{array}{llll}3 & 30 & 27.2\end{array}$ | 1. 88 | $\begin{array}{llll}3 & 28 & 31.9\end{array}$ | I.96 | $\begin{array}{llll}3 & 26 & 31.4\end{array}$ | 2.05 | $\begin{array}{lll}3 & 24 & 25 \cdot 5\end{array}$ | 2.15 | $\begin{array}{llll}3 & 22 & 13.9\end{array}$ | 2.24 | 3 I9 56.3 | $2 \cdot 35$ |
| 32 | 325 50.1 | I.94 | $32351 \cdot 3$ | 2.03 | $32147 \cdot 0$ | $2 \cdot 12$ |  | 2.22 | 3 I7 2I'I | $2 \cdot 32$ | 3 I4 58.8 | 2.43 |
| 33 | 32111.5 | $2 \cdot 00$ | $\begin{array}{llll}3 & 19 & 9^{\circ} 0\end{array}$ | 2.09 | $\begin{array}{llll}3 & 17 & 0.9\end{array}$ | $2 \cdot 19$ | $31446 \cdot 7$ | $2 \cdot 29$ | 31226.2 | 2.40 | $\begin{array}{llll}3 & 9 & 58 \cdot 9\end{array}$ | 2.51 |
| 34 | $31631 \cdot 4$ | $2 \cdot 06$ | $3 \begin{array}{llll}3 & 14 & 25 \cdot 1\end{array}$ | $2 \cdot 15$ | $\begin{array}{llll}3 & 12 & 12.8\end{array}$ | $2 \cdot 26$ | 3 3 9 54.2 | $2 \cdot 37$ | $\begin{array}{llll}3 & 7 & 28.9\end{array}$ | 2.48 |  | $2 \cdot 60$ |
| 35 | 3 II 49.7 | $2 \cdot 12$ | $\begin{array}{llll}3 & 9 & 39 \cdot 3\end{array}$ | $2 \cdot 22$ | $\begin{array}{llll}3 & 7 & 22.7\end{array}$ | $2 \cdot 33$ | $3 \quad 4 \quad 59.3$ | $2 \cdot 45$ | $3 \quad 2 \quad 29.0$ | $2 \cdot 57$ | $2595 \mathrm{I} \cdot 0$ | $2 \cdot 70$ |
| 36 | $3 \begin{array}{lll}3 & 7 & 6 \cdot 1\end{array}$ | 2.19 | $3 \quad 451 \cdot 5$ | $2 \cdot 30$ | $\begin{array}{llll}3 & 2 & 30 \cdot 3\end{array}$ | 2.41 | $3 \quad 0 \quad 2.0$ | 2.53 | $2 \begin{array}{llll}2 & 57 & 26 \cdot 3\end{array}$ | 2.66 | $25442 \cdot 5$ | $2 \cdot 80$ |
| 37 | $\begin{array}{llll}3 & 2 & 20 \cdot 6\end{array}$ | $2 \cdot 26$ | $\begin{array}{lll}3 & 0 & 1.6\end{array}$ | $2 \cdot 37$ | $\begin{array}{lllll}2 & 57 & 35 \cdot 6\end{array}$ | $2 \cdot 50$ | $\begin{array}{lll}2 & 55 & 2 \cdot 0\end{array}$ | $2 \cdot 62$ | $25220 \cdot 6$ | $2 \cdot 76$ | $24930 \cdot 6$ | $2 \cdot 91$ |
| 38 | $25733 \cdot 1$ | 2.34 | $\begin{array}{llll}2 & 55 & 9 \cdot 3\end{array}$ | 2.46 | $25238 \cdot 2$ | $2 \cdot 58$ | 249 59•1 | 2.72 | 247 II.6 | $2 \cdot 87$ | $24415{ }^{\circ} \mathrm{O}$ | $3 \cdot 02$ |
| 39 | $25243 \cdot 2$ | 2.42 | 25014.5 | $2 \cdot 54$ | $2 \begin{array}{llllll}2 & 47 & 37.9\end{array}$ | $2 \cdot 68$ | $2 \begin{array}{llllllll} & 4 & 52 \cdot 9\end{array}$ | $2 \cdot 82$ | 24159.0 | 2.98 | $\begin{array}{llllllllllllll}2 & 38 & 55\end{array}$ | $3 \cdot 15$ |
| 40 | $24751 \cdot 0$ | 2.50 | $245 \quad 16 \cdot 9$ | 2.64 | 24234.6 | $2 \cdot 78$ | $23943 \cdot 3$ | $2 \cdot 94$ | $23642 \cdot 3$ | $3 \cdot 10$ | 23.3 3I•I | $3 \cdot 28$ |
| 41 | $24256 \cdot 0$ | 2.59 | $24016 \cdot 3$ | $2 \cdot 73$ | $2 \begin{array}{llll}2 & 37 & 27 \cdot 8\end{array}$ | 2.89 | 23429.7 | 3.05 | $23121 \cdot 3$ | 3.23 | $\begin{array}{llll}2 & 28 & \text { I. } 8\end{array}$ | 3.43 |
| 42 | $23758 \cdot 1$ | 2.69 | $2 \begin{array}{llll} & 35 & 12.4\end{array}$ | $2 \cdot 84$ |  | 3.00 | $2 \begin{array}{llll}2 & 29 & 119\end{array}$ | $3 \cdot 18$ |  | $3 \cdot 37$ | $\begin{array}{lllll}2 & 22 & 26 \cdot 9\end{array}$ | $3 \cdot 58$ |
| 43 | $23257 \cdot 0$ | $2 \cdot 79$ | 23049 | 2.95 | $\begin{array}{llll}2 & 27 & 2.6\end{array}$ | $3 \cdot 13$ | $22349 \cdot 3$ | $3 \cdot 32$ | $22024 \cdot 1$ | $3 \cdot 53$ | 2 I6 $45 \cdot 8$ | 3.76 |
| 44 | $\begin{array}{lllllllllllll}2 & 27 & 52.4\end{array}$ | 2.90 | $2 \begin{array}{llllll}24 & 53\end{array}$ | 3.08 |  | 3.27 | 2 I 821.4 | 3.47 | $21446 \cdot 6$ | $3 \cdot 70$ | 2 10 57.5 | 3.95 |
| 45 | 22243.9 | 3.02 | 2 I9 37.2 | $3 \cdot 21$ | $\begin{array}{lllllllllllll}2 & 16 & 18.8\end{array}$ | $3 \cdot 4 \mathrm{I}$ | 21247.5 | $3 \cdot 64$ | $292 \cdot 1$ | $3 \cdot 89$ | 25 I'I | $4^{\cdot 16}$ |
| VARIATION TO I' OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. $18^{\circ}$ | A. | L. $19^{\circ}$ | A. | L. $20^{\circ}$ | A. | L. | A. | L. $22^{\circ}$ | A. | L. 23 | A. |
| 0 | S. | S. | S. | S. | S. | S. | S. | s. | S. | S. | S. | S. |
| 0 | I-34 | $4 \cdot 28$ | I.42 | $4 \cdot 30$ | I•50 | $4 \cdot 33$ | I. 59 | $4 \cdot 36$ | - $\mathrm{I} \cdot 67$ | 4.39 | - I.76 | 4.42 4.44 |
| 2 | 1-37 | $4 \cdot 29$ | 1.45 | $4 \cdot 31$ | 1.54 | $4 \cdot 34$ | I. 62 | 4.37 | 1•71 | 4.40 | $\begin{array}{r}1.79 \\ \text { I } \\ \hline\end{array}$ | $4 \cdot 44$ |
| 4 | 1.40 | $4 \cdot 30$ | 1.49 | $4 \cdot 33$ | I.57 | $4 \cdot 35$ | I. 65 | $4 \cdot 39$ | I•74 | 4.42 | 1.83 | 4.45 |
| 6 | I 44 | 4.31 | I 52 | $4 \cdot 34$ | I.61 | 4.37 | I. 69 | $4 \cdot 40$ | I.78 | $4 \cdot 43$ | r.87 | 4.47 |
| 8 | I. 48 | $4 \cdot 32$ | I. 56 | $4 \cdot 35$ | I. 65 | $4 \cdot 38$ | I.73 | $4 \cdot 42$ | I. 82 | $4 \cdot 45$ | 1.91 | 4.49 |
| 10 | I. 52 | 4.33 | I. 60 | $4 \cdot 37$ | I. 69 | $4 \cdot 40$ | I. 78 | 4.43 | 1.87 | 4.47 | I.96 | 4.51 |
| 12 | I 56 | $4 \cdot 35$ | $1 \cdot 65$ | $4 \cdot 38$ | $1 \cdot 73$ | 4.42 | I. 82 | 4.45 | I.91 | 4.49 | $2 \cdot 01$ | 4.53 |
| 14 | I-60 | $4 \cdot 37$ | 1-69 | 4.40 | I•78 | 4.44 | I. 87 | $4 \cdot 47$ | I.97 | 4.51 | 2.06 | 4.56 |
| 16 | I. 65 | 4.39 | $1 \cdot 74$ | $4 \cdot 42$ | 1.84 | 4.46 | I.93 | $4 \cdot 50$ | $2 \cdot 03$ | 4.54 | 2-12 | 4.58 |
| 18 | I.71 | 4.41 | I.80 | $4 \cdot 44$ | 1.89 | $4 \cdot 48$ | I•99 | $4 \cdot 52$ | $2 \cdot 09$ | $4 \cdot 57$ | $2 \cdot 19$ | 4.61 |
| 20 | 1•76 | 4.43 | 1.86 | 4.47 | I•96 | 4.51 | 2.06 | $4 \cdot 55$ | 2.16 | $4 \cdot 60$ | $2 \cdot 26$ | $4 \cdot 65$ |
| 22 | 1.82 | 4.45 | 1-92 | 4.49 | $2 \cdot 02$ | $4 \cdot 54$ | $2 \cdot 13$ | 4*58 | $2 \cdot 23$ | $4 \cdot 63$ | $2 \cdot 34$ | $4 \cdot 69$ |
| 24 | I.89 | 4.48 | I•99 | $4 \cdot 52$ | $2 \cdot 10$ | $4 \cdot 57$ | $2 \cdot 20$ | $4 \cdot 62$ | $2 \cdot 31$ | $4 \cdot 67$ | 2.43 | 4.73 |
| 26 | I.96 | $4 \cdot 5 \mathrm{I}$ | 2.07 | $4 \cdot 56$ | $2 \cdot 18$ | $4 \cdot 61$ | $2 \cdot 29$ | $4 \cdot 66$ | $2 \cdot 40$ | $4 \cdot 72$ | 2.52 | 4.78 |
| 28 | $2 \cdot 04$ | $4 \cdot 55$ | $2 \cdot 15$ | 4.60 | $2 \cdot 27$ | $4 \cdot 65$ | $2 \cdot 38$ | 4.71 | $2 \cdot 50$ | $4 \cdot 77$ | 2.63 | 4.84 |
| 30 | $2 \cdot 13$ | 4.59 | $2 \cdot 24$ | 4.64 | $2 \cdot 36$ | 4.70 | 2.49 | $4 \cdot 76$ | $2 \cdot 61$ * | $4 \cdot 83$ | $2 \cdot 75$ | 4.90 |
| 32 | $2 \cdot 22$ | $4 \cdot 63$ | $2 \cdot 35$ | $4 \cdot 69$ | $2 \cdot 47$ | $4 \cdot 75$ | $2 \cdot 60$ | $4 \cdot 82$ | 2.73 | 4.90 | 2.88 | $4 \cdot 98$ |
| 34 | 2.33 | $4 \cdot 68$ | 2.46 | 4.75 | $2 \cdot 59$ | 4.82 | 2.73 | $4 \cdot 89$ | 2.88 | $4 \cdot 98$ | 3.03 | 5.07 |
| 36 | 2.45 | $4 \cdot 74$ | $2 \cdot 58$ | $4 \cdot 8 \mathrm{I}$ | 2.73 | $4 \cdot 89$ | 2.88 | 4.98 | 3.03 | $5 \cdot 07$ | 3.20 | $5 \cdot 17$ |
| 38 | 2.58 | 4.81 | 2.73 | 4.89 | 2.88 | 4.98 | 3.04 | $5 \cdot 08$ | $3 \cdot 22$ | 5.18 | 3.40 | $5 \cdot 29$ |
| 40 | $2 \cdot 73$ | $4 \cdot 89$ | 2.89 | $4 \cdot 98$ | 3.06 | $5 \cdot 08$ | 3.24 | 5.19 | 3.43 | 5.3I | 3.63 | 5.45 |
| 42 | 2.90 | $4 \cdot 99$ | $3 \cdot 08$ | $5 \cdot 09$ | $3 \cdot 26$ | $5 \cdot 21$ | $3 \cdot 46$ | $5 \cdot 34$ | $3 \cdot 67$ | $5 \cdot 48$ | $3 \cdot 90$ | $5 \cdot 63$ |
| 43 | 3.00 | $5 \cdot 05$ | $3 \cdot 18$ | $5 \cdot 16$ | $3 \cdot 38$ | 5.28 | 3.59 | $5 \cdot 42$ | 3.82 | $5 \cdot 57$ | 4.06 | $5 \cdot 74$ |
| 44 | $3 \cdot 10$ | $5 \cdot 11$ | $3 \cdot 30$ | $5 \cdot 23$ | 3 31 | $5 \cdot 36$ | 3.73 | 5.51 | $3 \cdot 97$ | $5 \cdot 68$ | $4 \cdot 24$ | $5 \cdot 87$ |
| 45 | $3 \cdot 21$ | 5.18 | 3.42 | $5 \cdot 3 \mathrm{I}$ | $3 \cdot 64$ | $5 \cdot 46$ | 3.89 | $5 \cdot 62$ | $4 \cdot 15$ | $5 \cdot 8 \mathrm{I}$ | 4.44 | $6 \cdot 02$ |

## 166 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $11^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{\|ccc\|} \hline \text { H. M. } & \text { S. } \\ 6 & 0 & 0 \cdot 0 \end{array}$ | S. $\cdot 78$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 59 & 13.4 \end{array}$ | S. $\cdot 78$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 58 & 26 \cdot 6 \end{array}$ | S. $\cdot 78$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 57 & 39^{\cdot} 9 \end{array}$ | S. $\cdot 78$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 56 & 53 \cdot I \end{array}\right.$ | S. $.78$ | $\left\lvert\, \begin{array}{lll} \text { H. } & \text { M. } & \text { S. } \\ 5 & 56 & 6 \cdot 2 \end{array}\right.$ | S. |
| 10 | 5 I9 14.6 | $\cdot 79$ | $\begin{array}{llllllllllllllll}5 & 18 & 26 \cdot 8\end{array}$ | . 80 | $\begin{array}{llllll}5 & \text { I7 } & 38 \cdot 2\end{array}$ | - 82 | 5 16 $48 \cdot 7$ | . 83 |  | . 85 | $\begin{array}{llll}5 & \text { I5 } & 7 \cdot 2\end{array}$ | . 86 |
| 1 | 5 II 5.2 | -80 | 5 10 17.0 | -81 | $\begin{array}{llll}5 & 9 & 27 \cdot 9\end{array}$ | $\cdot 83$ | $\begin{array}{llll}5 & 8 & 37 \cdot 7\end{array}$ | - 85 | $\begin{array}{llll}5 & 7 & 46 \cdot 4\end{array}$ | -86 |  | -88 |
| 14 | $\begin{array}{llll}5 & 2 & 55.8\end{array}$ | -80 | $\begin{array}{llll}5 & 2 & 7 \cdot 1\end{array}$ | $\cdot 82$ | 5 I 17.3 | -84 | $5 \quad 0 \quad 26 \cdot 3$ | -86 | $45934{ }^{\circ}$ | -88 | $4 \begin{array}{llll}4 & 58 & 40 \cdot 5\end{array}$ | -90 |
| 16 | 454 46•I |  | $45356 \cdot 8$ | -83 | $4 \quad 53 \quad 6 \cdot 3$ | -85 | $4 \quad 52 \quad 14.4$ | - 88 | 4 5 $2 \mathrm{I} \cdot \mathrm{I}$ | -90 | 45026.4 | $\cdot 92$ |
| 18 | $44646 \cdot 3$ | - 82 | $44546 \cdot 4$ | - 84 | $44455 \cdot 0$ | -87 | $\begin{array}{lll}4 & 44 & 2 \cdot 1\end{array}$ | - 89 | 443 7 47 | -92 | 442 II 6 | '95 |
| 20 | 44 <br> 48 <br> 1 | - 83 | $43735 \cdot 6$ | -86 | $43643 \cdot 4$ | -88 | $435 \quad 49 \cdot 4$ | -91 | $43453 \cdot 7$ | $\cdot 94$ | $43356 \cdot 2$ | $\cdot 97$ |
| 22 | 43015.8 | - 84 | 42924.4 | -87 | $4283 \mathrm{I} \cdot 2$ | -90 | 427 36-1 | -93 | $42639 \cdot 0$ | $\cdot 97$ | $42540 \cdot 0$ | I.00 |
| 24 | $4 \begin{array}{lll}4 & 22 & 5 \cdot 2\end{array}$ | - 85 | $\begin{array}{llllllllllll}4 & 21 & 12.9\end{array}$ | -89 | $42018 \cdot 6$ | -92 | 41922.2 | $\cdot 96$ | 4 I8 $23 \cdot 7$ | -99 | 4 17 23.0 | I.03 |
| 26 | 4 I3 $54 \cdot 2$ | $\cdot 87$ | $\begin{array}{lll}4 & 13 & 0.9\end{array}$ | -91 | $412 \quad 5 \cdot 5$ | -94 | 4 II $7 \cdot 7$ | $\cdot 98$ | 4 10 $7 \cdot 6$ | I. 02 | $4 \begin{array}{lll}4 & 9 & 5 \cdot 1\end{array}$ | I.06 |
| 28 | $\begin{array}{llll}4 & 5 & 42 \cdot 8\end{array}$ | -89 | $\begin{array}{llll}4 & 4 & 48.4\end{array}$ | -93 | $\begin{array}{llll}4 & 3 & 51 & 7\end{array}$ | -97 | $\begin{array}{llll}4 & 2 & 52.4\end{array}$ | I-OI | 4 I $50 \cdot 6$ | I 0.5 | $4046 \cdot 1$ | I.IO |
| 30 | $35730 \cdot 9$ | -90 | $\begin{array}{llll}3 & 56 & 35 \cdot 4\end{array}$ | -95 | $3 \begin{array}{lllllllll}3 & 5 & 37 \cdot 2\end{array}$ | -99 | $3 \begin{array}{llll}3 & 54 & 36 \cdot 3\end{array}$ | I.04 | $35332 \cdot 6$ | I 08 | $35226 \cdot 1$ | I•I3 |
| 31 | $35324 \cdot 8$ | -91 | $\begin{array}{lllll}3 & 52 & 28 \cdot 6\end{array}$ | -96 | 35151297 | 1.00 | $35028 \cdot 0$ | I.05 | $349 \quad 23 \cdot 2$ | I-10 | $348 \times 5 \cdot 6$ | I'15 |
| 32 | 34918.6 | -92 | $34^{8121} 7$ | -97 | $34722 \cdot 0$ | I. 02 | 34619.3 | I.07 | 34513.6 | I•I2 | $\begin{array}{lll}3 & 44 & 4\end{array} 8$ | I.I7 |
| 33 | $34512 \cdot 2$ | -93 | 34414.6 | -98 | 34314.1 | I.03 | $\begin{array}{llll}3 & 42 & 10 \cdot 4\end{array}$ | I.09 | $34 \mathrm{I} 3 \cdot 6$ | I•I4 | $\begin{array}{llllllllll}3 & 39 & 53\end{array}$ | I. 19 |
| 34 | 3415.6 | -95 | $340 \quad 7 \cdot 3$ | I.00 | $\begin{array}{lll}3 & 39 & 5.9\end{array}$ | I. 05 | $\begin{array}{llll}3 & 38 & 1 & 3\end{array}$ | 1-10 | $\begin{array}{llll}3 & 36 & 53 \cdot 3\end{array}$ | I.16 | $33542 \cdot 0$ | I. 22 |
| 35 | $\begin{array}{lllllllllll}3 & 36 & 58 \cdot 9\end{array}$ | $\cdot 96$ | $\begin{array}{llllllllllll}3 & 359\end{array}$ | I-OI | $3 \begin{array}{lllllllllll}3 & 34\end{array}$ | 1.07 | $\begin{array}{llll}3 & 33 & 51 \cdot 8\end{array}$ | I•I2 |  | I-18 | 3 3I 30.1 | I. 24 |
| 36 | $33252 \cdot 1$ | -97 | 3 31 52.I | 1.03 | $33048 \cdot 8$ | I.08 | $\begin{array}{llllllllllllllll}3 & 29 & 42 \cdot 1\end{array}$ | I-14 | $32831 \cdot 7$ | 1.20 | 3271777 | I. 26 |
| 37 | 328450 | -98 | 32744.2 | I. 04 | $\begin{array}{llll}3 & 26 & 39 & 9\end{array}$ | I•IO | $\begin{array}{llllllllllllllll}3 & 25 & 3\end{array}$ | I•16 | $32420 \cdot 4$ | I. 23 | $3 \begin{array}{llll}3 & 23 & 4.9\end{array}$ | I-29 |
| 38 | $32437 \cdot 7$ | I $\cdot 00$ | $32336 \cdot 0$ | I.06 | $\begin{array}{llll}3 & 22 & 30 \cdot 7\end{array}$ | I-I2 | $32121 \cdot 6$ | I-I8 | $3208 \cdot 6$ | I. 25 |  | I. 32 |
| 39 | $320030 \cdot 3$ | I.OI | 31927.6 | 1.08 | 3 I8 2I'I | I-14 | 31710.8 | I. 21 | $\begin{array}{llll}3 & 15 & 56.4\end{array}$ | 1.27 | $\begin{array}{llll}3 & 14 & 37 \cdot 9\end{array}$ | I. 34 |
| 40 | $\begin{array}{lllllllllllllll}3 & 16 & 22.6\end{array}$ | I. 03 | $3 \begin{array}{lllll}3 & 15 & 18\end{array}$ | I.09 | 314410 | I•16 | $31259 \cdot 6$ | 1.23 | 3 II 43.7 | I 30 | 3 10 $23 \cdot 6$ | I 37 |
| 41 |  | I.05 | 3 II 9.9 | I•II | 310 10 | I-I8 | $38848 \cdot 0$ | 1.25 | $3730 \cdot 6$ | $1 \cdot 33$ | $\begin{array}{lll}3 & 6 & 8 \cdot 7\end{array}$ | I 40 |
| 42 | $\begin{array}{lll}3 & 8 & 6.4\end{array}$ | I.06 | $\begin{array}{llll}3 & 7 & 0.6\end{array}$ | I-I3 | $3 \quad 5 \quad 50 \cdot 5$ | I. 21 | $\begin{array}{llll}3 & 4 & 35 \cdot 9\end{array}$ | I.28 | $3 \quad 3 \quad 16.9$ | I.36 | 3 I 53'1 | I. 44 |
| 43 | $\begin{array}{llll}3 & 3 & 57 \cdot 9\end{array}$ | I.08 | $\begin{array}{llll}3 & 2 & 50 \cdot 9\end{array}$ | I-I5 | 3 I 139.4 | I. 23 | $3 \quad 0 \quad 23.4$ | $1 \cdot 31$ | $\begin{array}{lll}2 & 59 & 2 \cdot 6\end{array}$ | I. 39 | $257 \quad 37 \cdot 0$ | I.47 |
| 44 | $25949 \cdot 2$ | I-10 | $2 \begin{array}{llll}2 & 58 & 40 \cdot 9\end{array}$ | I.I8 | 25728.0 | 1.26 | $25610 \cdot 2$ | I•34 | $25447 \cdot 7$ | 1.42 | $25320 \cdot 1$ | -50 |
| 45 | $25540 \cdot 1$ | - I•12 | $25430 \cdot 5$ | I. 20 | $25316 \cdot 1$ | I. 28 | $25156 \cdot 7$ | I.37 | $25032 \cdot 2$ | I-45 | 249204 | I. 54 |
| 46 | $25130 \cdot 7$ | I-I4 | $25019 \cdot 7$ | I. 22 | 249377 | 1.3I | $24742 \cdot 5$ | 1.40 | $24616 \cdot 0$ | 1.49 | $24444^{\circ} \mathrm{O}$ | r.58 |
| 47 | $\begin{array}{lllll}2 & 47 & 20 \cdot 9\end{array}$ | I-17 | $\begin{array}{llr}2 & 46 & 8 \cdot 4\end{array}$ | I. 25 | $\begin{array}{llll}2 & 44 & 50 \cdot 7\end{array}$ | I. 34 | 2 lll 27.6 | I.43 | $2 \mathrm{4I} 59 \cdot 0$ | I. 52 | 24024.6 | I. 62 |
| 48 | $2 \begin{array}{llllllll}2 & 43 & 10.8\end{array}$ | I-19 | $24156 \cdot 7$ | I. 28 | $240 \quad 37 \cdot 2$ | 1.37 | 239 I2.I | I. 47 | $2374 \mathrm{I} \cdot 2$ | 1.57 | $\begin{array}{lll}2 & 36 & 4.2\end{array}$ | I. 67 |
| 49 | 23900.1 | I-22 | 23744.4 | I•3I | $2{ }^{2} 3623.0$ | 1.40 |  | 1.50 | 23322.4 | 1.6I | 23142.9 | 1-71 |
| 50 | 234 49•1 | 1.24 | 23331.5 | I•34 | $23^{2} 328 \cdot 1$ | 1.44 | $23038 \cdot 6$ | I•54 | $\begin{array}{llll}2 & 29 & 2.8\end{array}$ | 1.65 | $22720 \cdot 3$ | 1.76 |
| 51 | $23037 \cdot 5$ | 1.27 | 229 I8•I | 1.37 | 22752.5 | I.48 | $226 \quad 20 \cdot 6$ | I•59 | $22442 \cdot 0$ | I•70 | 22256.5 | I. 82 |
| 52 | $2 \begin{array}{llll}2 & 26 & 25\end{array}$ | I. 30 | $\begin{array}{llll}2 & 25 & 3.9\end{array}$ | 1.41 | $2 \begin{array}{llll}2 & 23 & 36 \cdot 1\end{array}$ | I.52 | 222 I.6 | I. 63 | $22020 \cdot 1$ | 1.75 | 21831.4 | I. 88 |
| 53 | 22212.6 | 1-34 | $22049 \cdot 1$ | I 45 | 21918.8 | I.56 | 2 I7 4I'5 | I. 68 |  | I.8I | 21447 | I.94 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | - A. | L. $1^{\circ}$ | - A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | - ${ }^{\text {S }}$ | s. | - ${ }^{-0}{ }^{\text {a }}$ | s. | - ${ }_{\text {S }}$ | s. -4.08 | S. | s. -4.08 | s. $-\quad .29$ | s. -4.08 |  | s. -4.09 |
| 4 | . 05 | 4.07 | -13 | 4.08 | - 20 | 4.08 | . 27 | 4.08 | $\cdot 35$ | 4.09 | $\cdot 42$ | $4 \cdot 10$ |
| 8 | - II | 4.08 | -18 | 4.08 | -26 | $4 \cdot 08$ | -33 | 4.09 | -4I | $4 \cdot 09$ | -48 | 4.10 |
| 12 | -17 | $4 \cdot 08$ | -24 | 4.08 | -32 | $4 \cdot 09$ | -39 | 4.09 | -47 | $4 \cdot 10$ | -54 | $4 \cdot 11$ |
| 14 | -20 | 4.08 | $\cdot 27$ | 4.08 | -35 | $4 \cdot 09$ | -42 | 4.10 | -50 | 4-10 | -58 | $4 \cdot 11$ |
| 16 | . 23 | 4.08 | $\cdot 30$ | 4.09 | $\cdot 38$ | 4.09 | $\cdot 46$ | $4 \cdot 10$ | -53 | 4-II | .6I | $4 \cdot 12$ |
| 18 | -26 | 4.08 | $\cdot 33$ | 4.09 | $\cdot 41$ | $4 \cdot 10$ | -49 | 4-10 | $\cdot 57$ | $4 \cdot 11$ | $\cdot 65$ | 4.13 |
| 20 | -29 | 4.08 | $\cdot 37$ | 4.09 | -44 | 4.10 | -52 | $4 \cdot \mathrm{II}$ | -60 | $4 \cdot 12$ | -68 | 4.13 |
| 22 | -32 | 4.09 | -40 | 4.09 | -48 | $4 \cdot 10$ | $\cdot 56$ | $4 \cdot 11$ | -64 | $4 \cdot 12$ | $\cdot 72$ | 4.14 |
| 24 | -35 | 4.09 | $\cdot 43$ | 4.10 | $\cdot 52$ | $4 \cdot \mathrm{II}$ | . 60 | 4-12 | $\cdot 68$ | 4.13 | $\cdot 76$ | $4 \cdot 15$ |
| 26 | -39 | 4.09 | -47 | 4.10 | -55 | $4 \cdot 11$ | . 64 | 4•12 | $\cdot 72$ | $4 \cdot 14$ | .80 | $4 \cdot 15$ |
| 28 | $\cdot 42$ | $4 \cdot 10$ | -5I | $4 \cdot 11$ | $\cdot 59$ | $4 \cdot 12$ | $\cdot 68$ | 4•13 | $\cdot 76$ | $4 \cdot 15$ | . 85 | $4 \cdot 16$ |
| 30 | -46 | $4 \cdot 10$ | $\cdot 55$ | $4 \cdot 11$ | . 63 | $4 \cdot 12$ | $\cdot 72$ | 4.14 | -81 | 4.15 | -90 | $4 \cdot 17$ |
| 32 | -50 | $4 \cdot 10$ | $\cdot 59$ | $4 \cdot 12$ | -67 | $4 \cdot 13$ | $\cdot 76$ | $4 \cdot 15$ | -85 | $4 \cdot 16$ | . 95 | 4•18 |
| 34 | -54 | $4 \cdot 11$ | . 63 | $4 \cdot 12$ | $\cdot 72$ | 4-14 | -81 | $4 \cdot 16$ | -90 | 4-17 | $1 \cdot 00$ | 4.20 |
| 36 | . 58 | 4.11 | $\cdot 67$ | $4 \cdot 13$ | .77 | $4 \cdot 15$ 4.16 | - 86 | 4.17 4.18 | .96 | $4 \cdot 19$ | r.06 | 4.21 |
| 40 | . 67 | ${ }_{4} \cdot 13$ | .72 .77 | 4.14 4.15 | .82 | 4.16 4.17 | .92 | $4 \cdot 18$ $4 \cdot 19$ | 1.02 1.08 | 4.20 4.21 | I.12 1. 18 | 4.22 4.24 |
| 42 | $\bullet 72$ | $4 \cdot 14$ | . 83 | $4 \cdot 16$ | -93 | 4-18 | I. 04 | $4 \cdot 20$ | $1 \cdot 15$ | $4 \cdot 23$ | $1 \cdot 26$ | $4 \cdot 26$ |
| 44 | $\cdot 78$ | $4 \cdot 15$ | -89 | $4 \cdot 17$ | -99 | 4-19 | r. If | $4 \cdot 22$ | $1 \cdot 22$ | $4 \cdot 25$ | I. 33 | 4.29 |
| 46 | -84 | $4 \cdot 16$ | -95 | 4.18 | x.06 | $4 \cdot 21$ | 1.18 | $4 \cdot 24$ | 1.30 | $4 \cdot 28$ | 1.42 | $4 \cdot 31$ |
| 48 | -90 | $4 \cdot 17$ | 1.02 | $4 \cdot 20$ | I-14 | $4 \cdot 23$ | 1.26 | $4 \cdot 26$ | $1 \cdot 39$ | $4 \cdot 30$ | $1 \cdot 52$ | $4 \cdot 35$ |
| 50 | -97 | 4.19 | 1.09 | $4 \cdot 22$ | 1.22 | $4 \cdot 25$ | I. 35 | $4 \cdot 29$ | $1 \cdot 48$ | $4 \cdot 34$ | I. 62 | $4 \cdot 39$ |
| 52 | I. 05 | 4.21 | $1 \cdot 18$ | 4.24 | r.31 | $4 \cdot 28$ | r.45 | 4.33 | I. 59 | $4 \cdot 38$ | I. 74 | 4.43 |
| 53 | $1 \cdot 09$ | $4 \cdot 22$ | I. 22 | $4 \cdot 25$ | r. 36 | $4 \cdot 30$ | I.5I | $4 \cdot 34$ | I. 65 | $4 \cdot 40$ | I.81 | $4 \cdot 46$ |

## LATITUDE $11^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True | $8^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9{ }^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 55 \\ \text { I } 9 \cdot I \end{array}\right.$ | - 79 | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 5 & 54 \\ 3 \mathrm{r} \cdot 8 \end{array}\right.$ | $-79$ | $\begin{array}{\|cc\|} \hline \text { H. M. } & \text { S. } \\ 5 & 53 \end{array} 44 \cdot 3$ | $\cdot 79$ | $\left\|\begin{array}{cc} \text { H. M. } \\ 5 & 52 \\ 56 \cdot 6 \end{array}\right\|$ | $\begin{aligned} & \mathrm{s} . \\ & .80 \end{aligned}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 52 \\ 8.6 \end{array}\right.$ | S. | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 5 I \\ 20.3 \end{array}\right.$ | . 8.1 |
| ro | $\begin{array}{llllll}5 & \text { I4 } & 14.9\end{array}$ | . 88 | $\begin{array}{llll}5 & 13 & 21.7\end{array}$ | . 89 | $51227 \cdot 5$ | -9I | 5 II $32 \cdot 2$ | 93 | 5 Io 35.8 | 95 | $938 \cdot \mathrm{I}$ | 97 |
| 12 | $\begin{array}{lll}5 & 6 & 0.6\end{array}$ | '90909090 | $\begin{array}{llll}5 & 5 & 6 \cdot 0\end{array}$ | -92 | 5 5 4 $10 \cdot 2$ | -94 | $\begin{array}{llll}5 & 3 & 13 \cdot 1\end{array}$ | 96 | $\begin{array}{llll}5 & 2 & 14.7\end{array}$ | 98 | 14.9 | 1.01 |
| 14 | $45745 \cdot 7$ | $\cdot 92$ | $45649 \cdot 6$ | -95 | $45552 \cdot \mathrm{I}$ | 97 | $4 \begin{aligned} & 4 \\ & 4\end{aligned} 533 \cdot \mathrm{I}$ | -99 | $45352 \cdot 7$ | I. 02 | $45250 \cdot 6$ | I 05 |
| 16 | $44930 \cdot 2$ | -95 | $44832 \cdot 4$ | $\cdot 98$ | $44733 \cdot 1$ | r.oo | $44632 \cdot 2$ | 3 | 44529.6 | 1.06 | 44425.2 | I.09 |
| 18 | 44 41 | -98 | 44014.4 | 1.01 | 43913.2 | 1.03 | $4 \begin{array}{lll}48 & 10 \cdot 2\end{array}$ | 1.07 | $\begin{array}{lll}4 & 37 & 5\end{array}$ | -10 | 43558.4 | 3 |
| 20 | $43256 \cdot 8$ | r.OI | $43155 \cdot 5$ | I-04 | $43052 \cdot 3$ | I.07 | $42947 \cdot 1$ | -10 | $42889 \cdot 7$ | I.I4 | $42730 \cdot 1$ | 8 |
| 22 | $4 \begin{array}{llll}4 & 24 & 38.9\end{array}$ | I. 04 | 42335.7 | 07 | $42230 \cdot 3$ | II | 42122.7 | $1 \cdot 15$ | 42012.7 | r.19 | $\begin{array}{llll}4 & 19 & 0.4\end{array}$ | 23 |
| 24 | $41620 \cdot 0$ | I | 41514.7 | I•II | $414 \quad 7 \cdot 0$ | I'I5 | $4 \begin{array}{lllll}4 & 12 & 56 \cdot 9\end{array}$ | I.19 | 4 II 44.2 | I. | 4 10 $28 \cdot 8$ | 8 |
| 26 | 48 - |  | $4 \quad 652.5$ | I•I5 | $\begin{array}{llll}4 & 5 & 42 \cdot 4\end{array}$ | 19 | 4429.5 | 1 | 4313.9 | 1. | 15 | I•33 |
| 27 | 49 |  | $4 \quad 24$ |  | 29. | 21 | 15.2 |  | $35858 \cdot 0$ | -31 | $5737 \cdot 8$ | 6 |
| 28 | $35939^{\circ}$ | I•I4 | 35829.0 | 9 | $\begin{array}{llllllllllll}3 & 57 & 16.3\end{array}$ | . 24 | $3 \begin{array}{lll}36 & 0.5\end{array}$ | 129 | 354 4I•7 | I 34 | $\begin{array}{llll}3 & 53 & 19 & 7\end{array}$ | . 39 |
| 29 | $35528 \cdot 0$ | I•16 |  | I.2I | $\begin{array}{llll}3 & 53 & 2 \cdot 6\end{array}$ | 6 | $35145 \cdot 3$ | 131 | $35024 \cdot 8$ | 7 | 349 I.O | -42 |
| 30 | 35116.6 | I•18 | 350 4-I | I.23 | 34848.4 | 29 | 34729.5 | I.34 | 34674 | r.40 | $3444 \mathrm{r} \%$ | 6 |
| 3 I | 3474.8 | I. 20 | 34551.0 | I 26 | $34433 \cdot 8$ | $1 \cdot 31$ | $3 \begin{array}{llll} & 43 & 13\end{array}$ | I 37 | 341493 | r.43 | $34021 \cdot 7$ | 9 |
| 32 | $34252 \cdot 7$ | I. 23 | $34137 \cdot 4$ | 8 | 34018.7 | I.34 |  | I 40 | $33730 \cdot 7$ | 1.46 | $3361 \times 0$ | . 53 |
| 33 | $\begin{array}{llll}3 & 38 & 40 \cdot 2\end{array}$ | 1.25 | 3 37723.4 | 1.31 | $3{ }^{3} 36 \quad 3 \cdot 1$ | r 37 | $\begin{array}{llll}3 & 34 & 39 \cdot 1\end{array}$ | I 43 | $333 \mathrm{II} \cdot 3$ | 1.50 | $\begin{array}{llll}3 & 31 & 39 \cdot 6\end{array}$ | . 56 |
| 34 |  | - | $\begin{array}{lllll}3 & 33 & 8 \cdot 9\end{array}$ | I 34 | $\begin{array}{llll}3 & 31 & 46.9\end{array}$ | 140 | $33^{30} 21 \cdot 0$ | 1.46 | $32851 \cdot 2$ | r.53 |  | . 60 |
| 35 |  | r.30 | $\begin{array}{llllll}3 & 28 & 53.9\end{array}$ | I.36 | 3 27 $30 \cdot 1$ | 1.43 | $\begin{array}{lll}3 & 26 & 2 \cdot 3\end{array}$ | - 50 | $\begin{array}{llllllllllll}3 & 24 & 304\end{array}$ | r 5 | $\begin{array}{llll}3 & 22 & 54.2\end{array}$ | 84 |
| 36 | $\begin{array}{lll}3 & 26 & 0 \cdot 0\end{array}$ | 33 | $\begin{array}{ll}3 & 2438.3\end{array}$ | I.39 | 32312.7 | 146 | 32142.9 | 1.53 | 32088 |  | $\begin{array}{lllllllllll}3 & 18 & 302\end{array}$ |  |
| 37 | $\begin{array}{llll}3 & 21 & 45 \cdot 6\end{array}$ |  | 32022.2 | $1 \cdot 42$ |  | r.50 | $\begin{array}{llll}3 & 17 & 22.7\end{array}$ | 1.57 | $31546 \cdot 3$ |  | $\begin{array}{llll}3 & 14 & 5 \cdot 2\end{array}$ | 73 |
| 38 | $317730 \cdot 6$ | 1 | 316504 | 1 | $31435 \cdot 8$ | 5 | 31313 | I.61 | 311522.9 | 1.69 | $\begin{array}{llll}3 & 9 & 39 \cdot I\end{array}$ | 77 |
| 39 | $\begin{array}{lllll}3 & 13 & 15 \cdot 1\end{array}$ | 1.42 | 3 Ir 48.0 | I.49 | $3{ }^{3} 1016 \cdot 2$ | r.57 | $\begin{array}{llll}3 & 8 & 39 \cdot 8\end{array}$ | I.65 | $3{ }^{3} 658 \cdot 5$ | I.73 | 512.0 |  |
| 40 | $\begin{array}{lll}3 & 8 & 59 \cdot 0\end{array}$ | $\underline{1} 45$ | 3 7 29.8 <br> 3   | I.53 | $\begin{array}{llll}3 & 5 & 55.9 \\ 3 & 1 & 34.6\end{array}$ | I $\mathrm{I} \cdot 60$ | $\begin{array}{rrrr}3 & 4 & 17 \cdot 2 \\ 2 & 59 & 53.2\end{array}$ | r 69 <br> r <br> 73 | $\begin{array}{rrrr}3 & 2 & 33.0 \\ 2 & 58 & 6.4\end{array}$ | 8 |  |  |
| 41 42 | $\begin{array}{lll}3 & 4 & 42 \cdot 2 \\ 3 & 0 & 24 \cdot 6\end{array}$ | 1.48 I. 52 | $\begin{array}{ccc}3 & 3 & 10 \cdot 8 \\ 2 & 58 & 51 \cdot I\end{array}$ |  | [ $\begin{array}{ccc}3 & 1 & 34.6 \\ 2 & 57 & 12.4\end{array}$ | I.65 | $\begin{array}{llll}2 & 59 & 53 \cdot 2 \\ 2 & 55 & 28 \cdot 3\end{array}$ | r 73 r 78 | $\begin{array}{lll}2 & 58 & 6 \cdot 4 \\ 2 & 53 & 38 \cdot 6\end{array}$ | 3 | $\begin{array}{lllll}2 & 56 & 14.0 \\ 2 & 51 & 42.9\end{array}$ | 98 |
| 43 | $\begin{array}{llll}2 & 56 & 6 \cdot 3\end{array}$ | . 55 | $25430 \cdot 5$ | I. 64 | $25249 \cdot 2$ | 1.74 | $2512 \cdot 2$ | r.83 | 2498.4 | -93 | $24710 \cdot 5$ | 2.04 |
| 44 | $25147 \cdot 2$ | I.59 | $\begin{array}{llll}2 & 50 & 8 \cdot 9\end{array}$ | I•69 | $\begin{array}{ll}2 & 48 \\ 2 & 24.9\end{array}$ | 78 | $24635 \cdot 0$ | r. 88 | $24438 \cdot 9$ | -99 | $24236 \cdot 3$ | $2 \cdot 10$ |
| 45 | 24727.2 | r. 63 | $24546 \cdot 2$ | -73 | $\begin{array}{llllllllll}2 & 43 & 59\end{array}$ | 1.83 | $2 \begin{array}{lll}2 & 42 & 6\end{array}$ | r 94 | $2406 \cdot 7$ | 2.05 | $\begin{array}{lll}2 & 38 & 0.3\end{array}$ | 2.17 |
| 46 | $243 \quad 6 \cdot 2$ | I•68 | 24122.5 | 8 | $23932 \cdot 6$ | I.89 | $23736 \cdot 2$ | 2. | $23532 \cdot 9$ | $2 \cdot 11$ | 23322.5 |  |
| 47 | $\begin{array}{llll}2 & 38 & 44.2\end{array}$ | I | $23657 \cdot 6$ | 83 | $\begin{array}{llll}2 & 35 & 4.4\end{array}$ | I.94 | $\begin{array}{llll}2 & 33 & 4.5\end{array}$ | 2.06 | $23057 \cdot 3$ | $2 \cdot 18$ | $\begin{array}{ll}2 & 28 \\ 42 \cdot 5\end{array}$ | $2 \cdot 31$ |
| 48 | $\begin{array}{llll}2 & 34 & 21 \cdot I \\ 2\end{array}$ | I.77 | $23231 \cdot 3$ | - 89 | $\begin{array}{llll}2 & 30 & 34.8\end{array}$ | $2 \cdot 00$ | $\begin{array}{ll}2 & 28 \\ 3 & 310\end{array}$ | $2 \cdot 13$ | 22619.6 | $2 \cdot 26$ | $24 \begin{array}{ll} & 0.2\end{array}$ | 9 |
| 49 |  | 1.83 | $\begin{array}{llll}2 & 28 & 3.6\end{array}$ | . 94 | $\begin{array}{llll}2 & 26 & 3.4 \\ 2 & 21 & \end{array}$ | 2.07 | $22355 \cdot 6$ | $2 \cdot$ |  | $2 \cdot 33$ | $\begin{array}{llll}2 & 19 & 15.4 \\ 2 & 15 & 27.7\end{array}$ | 2.48 |
| 50 | 22531.0 | 1.88 | 22334.4 | 2.01 | $22130 \cdot 3$ | $2 \cdot 14$ | 219181 | 2.27 | $21657 \cdot 4$ | 2.42 | $\begin{array}{llll}2 & 14 & 27.7 \\ 2 & 0 & 36.9\end{array}$ | 2.58 2.68 |
| 5 | 2 I 3.8 | 1.9 | 2 I9 3' | 2.07 | 2 I6 55.I | 2.21 |  | $2 \cdot 36$ | 2 I 212.4 | 2.51 | $936 \cdot 9$ | 68 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ | A. | L. 7 | A. | L. 8 | A. | L. 9 | A. | L. 10 | - A. | L. 11 | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. | S. | S. | S. | S. ${ }_{\text {. }}$ | S. | s. 66 | S. -4.13 | S. 73 |  | S. 81 | S. |
| 0 | .44 | $-4 \cdot 10$ $4 \cdot 10$ | .51 .57 | $-4 \cdot 10$ $4 \cdot 11$ | .58 .64 | $-4 \cdot I I$ 4.12 | .66 .72 | $-4 \cdot 13$ $4 \cdot 14$ | $\cdot 73$ $\cdot 76$ | $-4 \cdot 14$ $4 \cdot 15$ | . 818 | -4.15 4.17 |
| 8 | - 55 | $4 \cdot 11$ | . 63 | $4 \cdot 12$ | $\cdot 71$ | $4 \cdot 13$ | $\cdot 78$ | $4 \cdot 15$ | -86 | $4 \cdot 16$ | $\cdot 93$ | 4.18 |
| 10 | - 59 | $4 \cdot 12$ | - 66 | 4. 13 | $\cdot 74$ | 4.14 | -81 | 4.16 | -89 | $4 \cdot 17$ | -97. | 4.19 |
| 12 | -62 | $4 \cdot 12$ | -69 | $4 \cdot 13$ | $\cdot 77$ | $4 \cdot 15$ | -85 | $4 \cdot 16$ | -93 | $4^{1}$ I8 | I.OI | $4 \cdot 20$ |
| 14 | -65 | 4.13 | $\cdot 73$ | 4-14 | -8I | $4 \cdot 15$ | . 89 | 4.17 | -97 | 4.19 | I.05 | $4 \cdot 21$ |
| 16 | -69 | 4.13 | -77 | $4 \cdot 15$ | -85 | $4 \cdot 16$ | -93 | 4.18 | I-OI | $4 \cdot 20$ | I.09 | $4 \cdot 22$ |
| 18 | -72 | 4.14 | -80 | $4 \cdot 15$ | -89 | $4 \cdot 17$ | -97 | $4 \cdot 19$ | I.05 | $4 \cdot 21$ | I-13 | $4 \cdot 23$ |
| 20 | -76 | 4.15 | -84 | 4.16 | -93 | 4.18 | I. 01 | $4 \cdot 20$ | 1.09 | $4 \cdot 22$ | I-I8 | $4 \cdot 24$ |
| 22 | -80 | $4 \cdot 15$ | . 89 | $4 \cdot 17$ | -97 | 4.19 | I.05 | $4 \cdot 21$ | I'I4 | $4 \cdot 23$ | I. 23 | $4 \cdot 25$ |
| 24 | -85 | 4.16 | -93 | 4.18 | I'OI | 4.20 | r.10 | 4.22 | I'I9 | $4 \cdot 24$ | I. 28 | $4 \cdot 27$ |
| 26 | -89 | 4.17 | -98 | 4.19 | I.06 | $4 \cdot 21$ | I'I5 | $4 \cdot 23$ | I-24 | $4 \cdot 26$ | 1.33 | 4.29 |
| 28 | -94 | 4-18 | 1.02 | 4.20 | I-I2 | $4 \cdot 22$ | I 21 | $4 \cdot 25$ | I-30 | $4 \cdot 28$ | 1•39 | 4.31 |
| 30 | -99 | 4.19 | I. 08 | $4 \cdot 21$ | 1.17 | $4 \cdot 24$ | I-26 | $4 \cdot 27$ | I.36 | $4 \cdot 30$ | I.46 | $4 \cdot 33$ |
| 32 | I. 04 | $4 \cdot 20$ | I-13 | $4 \cdot 23$ | I. 23 | $4 \cdot 26$ | I-33 | $4 \cdot 28$ | I.43 | $4 \cdot 32$ | I.53 | $4 \cdot 35$ |
| 34 | I•IO | $4 \cdot 22$ | I.19 | $4: 25$ | I-29 | $4 \cdot 27$ | I.39 | 4.31 | I.50 | $4 \cdot 34$ | I. 60 | $4 \cdot 38$ |
| 36 | I•16 | $4 \cdot 24$ | 1.26 | $4 \cdot 26$ | I.36 | $4 \cdot 30$ | I.46 | $4 \cdot 33$ | 1.57 | $4 \cdot 37$ | I. 68 | 4.41 |
| 38 | I. 22 | $4 \cdot 25$ | 1.33 | $4 \cdot 28$ | I.43 | $4 \cdot 32$ | I. 54 | $4 \cdot 36$ | I-66 | $4 \cdot 40$ | 1.77 | 4.44 |
| 40 | I-29 | $4 \cdot 27$ | 1.40 | $4 \cdot 31$ | I.5I | $4 \cdot 35$ | I. 63 | $4 \cdot 39$ | I'75 | 4.43 | 1.87 | $4 \cdot 48$ |
| 42 | I 37 | $4 \cdot 30$ | $1 \cdot 48$ | $4 \cdot 34$ | I. 60 | $4 \cdot 38$ | 1.72 | $4 \cdot 42$ | I. 85 | $4 \cdot 47$ | I.98 | $4 \cdot 53$ |
| 44 | I.45 | $4 \cdot 33$ | 1.57 | $4 \cdot 37$ | I•70 | 4.41 | I.83 | $4 \cdot 47$ | I.96 | $4 \cdot 52$ | 2.10 | $4 \cdot 58$ |
| 46 | I. 55 | $4 \cdot 36$ | I. 68 | $4 \cdot 40$ | I-81 | $4 \cdot 46$ | I.95 | $4 \cdot 5 \mathrm{I}$ | $2 \cdot 09$ | $4 \cdot 58$ | $2 \cdot 24$ | $4 \cdot 65$ |
| 48 | I. 65 | $4 \cdot 40$ | I'79 | $4 \cdot 45$ | I.93 | $4 \cdot 51$ | $2 \cdot 08$ | $4 \cdot 57$ | $2 \cdot 23$ | $4 \cdot 65$ | $2 \cdot 39$ | $4 \cdot 73$ |
| 50 | $1 \cdot 77$ | 4.44 | 1.91 | $4 \cdot 50$ | $2 \cdot 07$ | $4 \cdot 57$ | $2 \cdot 22$ | $4 \cdot 64$ | $2 \cdot 40$ | $4 \cdot 73$ | $2 \cdot 58$ | $4 \cdot 82$ |
| 51 | 1.83 | 4.47 | I.98 | $4 \cdot 53$ | $2 \cdot 14$ | $4 \cdot 60$ | $2 \cdot 31$ | 4.69 | $2 \cdot 49$ | $4 \cdot 77$ | 2.68 | $4 \cdot 88$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.


## LATITUDE $11^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 45 & 30 \cdot 9 \end{array}$ | . 86 | $\begin{array}{ccc}\text { H. M. } & \text { S. } \\ 5 & 44 & 38 \cdot 9\end{array}$ | $\cdot 87$ | $\begin{array}{lc} \text { H. M. } & \text { S. } \\ 5 & 43 \end{array} 46 \cdot 3$ | S. | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 42 & 53 \cdot 0 \end{array}$ | $\begin{aligned} & \text { S. } \\ & \cdot 89 \end{aligned}$ | $\left\{\begin{array}{lc} \text { H. M. } & \text { S. } \\ 5 & 4 \mathrm{I} \\ 58 \cdot 9 \end{array}\right.$ | S. | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 5 & 4 \mathrm{I} \\ 4 \cdot \mathrm{I} \end{array}$ | S. |
| O | $\begin{array}{llll}5 & 45 & 30 \cdot 9 \\ 5 & 28 & 18 \cdot 0\end{array}$ | . 97 | ( $514438 \cdot 9$ | . 98 | $\left\lvert\, \begin{array}{lll}5 & 43 & 46 \cdot 3 \\ 5 & 26 & 20 \cdot 0\end{array}\right.$ | 1.00 | [15 $\begin{array}{lll}5 & 42 & 53.0 \\ 5 & 25 & 19.3\end{array}$ | I.02 | $\left\lvert\, \begin{array}{lll}5 & 41 & 58 \cdot 9 \\ 5 & 24 & 17 \cdot 5\end{array}\right.$ | I.04 | $\begin{array}{ccc}5 & 41 & 4 \cdot 1 \\ 5 & 23 & 14.4\end{array}$ | .92 $\times .06$ |
| 6 | 51939.4 | 1.02 | $\begin{array}{lllll}5 & 18 & 37 \cdot 5\end{array}$ | I. 04 | $51734 \cdot 3$ | I.06 | $\begin{array}{llll}5 & 16 & 29 \cdot 8\end{array}$ | I 09 | $\begin{array}{lllll}5 & 15 & 23.9\end{array}$ | I•II | 51416.5 | I•14 |
| 8 | 5 10 59.2 | I. 08 | $\begin{array}{lllll}5 & 9 & 53 \cdot 8\end{array}$ | I-10 | $\begin{array}{llll}5 & 8 & 46 \cdot 9\end{array}$ | I•I3 | $\begin{array}{lllll}5 & 7 & 38 \cdot 4\end{array}$ | 1 | $\begin{array}{lllll}5 & 6 & 28 \cdot 2\end{array}$ | I•18 |  | -2I |
| 10 | $\begin{array}{llll}5 & 2 & 17\end{array}$ | I.I4 | 5 I $\quad 8.2$ | I'17 | $45957 \cdot 4$ | I•I9 | $4 \quad 58 \quad 44 \cdot 8$ | 1.23 | 45730.2 | I 26 | $\begin{array}{lllll}4 & 56 & 13.6\end{array}$ | I-29 |
| 12 | 453 33.5 | 20 | $45220 \cdot 6$ | I.23 | 4 5I 5*7 | I.27 | $44948 \cdot 7$ | $1 \cdot 30$ | 448829.5 | 1•34 | 447 8.1 | 1-38 |
| 14 | 444 47.6 | I. 26 | $44330 \cdot 7$ | I. 30 | $4^{-42} 42 \mathrm{II} 5$ | I-34 | 440 50.0 | 1.38 | $43926 \cdot 0$ | I. 42 | 43759.5 | I. 46 |
| 16 | $435 \quad 59 \cdot 5$ | I. 33 | $4 \begin{array}{llll}4 & 34 & 38 \cdot 3\end{array}$ | $1 \cdot 37$ | 43314.7 | I 42 | $43148 \cdot 4$ | 1.46 | 43019.3 | 1 | $42847 \cdot 4$ | I. 56 |
| 18 | 42787 | I. 40 | $42543 \cdot 2$ | 1.45 | 42414.8 | I 50 | $42243 \cdot 5$ | 1.55 | 4 2I 9*I | I. 60 | 4 I9 3I.5 | I. 65 |
| 19 | $42242 \cdot 4$ | I 44 | 42114.5 | I'49 | $41943 \cdot 6$ | I-54 | $4 \begin{array}{lll}4 & 18 & 9 \cdot 7\end{array}$ | 1.59 | $4 \begin{array}{llll}4 & 16 & 32.5\end{array}$ | I. 65 | $4 \begin{array}{llll}4 & 14 & 51.9\end{array}$ | 1.71 |
| 20 | 4 I8 15.2 | 48 | 4 I6 45*0 | I•53 | $4 \begin{array}{llll}4 & 11\end{array} 6$ | 5 | 4 I3 34.9 | 1.64 | 4 II 54*9 | 1.70 | 410 1I.2 | 76 |
| 21 | 413474 | 1.52 | 41214.7 | I. 57 | 4 10 $38 \cdot 6$ | I. 63 | $4 \quad 8 \quad 59 \cdot 2$ | 1.69 | $4716 \cdot 2$ | 1•75 | $\begin{array}{llll}4 & 5 & 29.4\end{array}$ | I |
| 22 | $\begin{array}{llll}4 & 9 & 18.6\end{array}$ | 1.56 | $\begin{array}{llll}4 & 7 & 43.4\end{array}$ | I. 62 | $\begin{array}{llll}4 & 6 & 4.7\end{array}$ | I. 67 | $4 \quad 4 \quad 22.4$ | 1.74 | $4 \quad 2 \quad 36 \cdot 3$ | I. 80 | $4046 \cdot 3$ | 1.87 |
| 23 | $4449 \cdot 0$ | 60 | $\begin{array}{llll}4 & 3 & 11.2\end{array}$ | I. 66 | $\begin{array}{llll}4 & 1 & 29.7\end{array}$ | I•72 | $35944 \cdot 4$ | $1 \cdot 79$ | $35755 \cdot 2$ | I. 86 | $\begin{array}{llll}3 & 56 & 1 \cdot 7\end{array}$ | I 93 |
| 24 | 4018.6 | I. 65 | $\begin{array}{lllll}3 & 58 & 38 \cdot 0\end{array}$ | I•7I |  | 1.77 | $3 \begin{array}{llll}3 & 55\end{array}$ | I. 84 | 35312.7 | I.91 | 35115.6 | I•99 |
| 25 | $35547 \cdot 1$ | I. 69 | 354 3*7 | 17 | 35216.4 | I. 82 | 35024.9 | 1.90 | $\begin{array}{llll}3 & 48 & 28 \cdot 9\end{array}$ | I.97 | $\begin{array}{llll}3 & 46 & 28 \cdot 3\end{array}$ | $2 \cdot 05$ |
| 6 | 35114.6 | 1.74 | 34928.4 | I.81 | $34737 \cdot 9$ | -88 | $\begin{array}{lllll}3 & 45 & 43 \cdot 1\end{array}$ | I•95 | $\begin{array}{llll}3 & 43 & 43 \cdot 6\end{array}$ | 2.03 | 3413902 | $2 \cdot 12$ |
| 27 | $3{ }^{3} 464 \mathrm{I} \cdot \mathrm{O}$ | I-79 | $\begin{array}{lllllllllll}3 & 44 & \text { 1-8 }\end{array}$ | I.86 | $34258 \cdot \mathrm{I}$ | 1.93 | $\begin{array}{lllll}3 & 40 & 59 \cdot 8\end{array}$ | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}3 & 38 & 56 \cdot 7\end{array}$ | $2 \cdot 10$ | $\begin{array}{lllllllllllll}3 & 36 & 48 \cdot 3\end{array}$ | 18 |
| 28 | $\begin{array}{llll}3 & 42 & 6 \cdot 3\end{array}$ | 1. 84 | $3 \begin{array}{llll}3 & 40 & 13.9\end{array}$ | 1.91 | $\begin{array}{llll}3 & 38 & 16 \cdot 9\end{array}$ | I.99 | $\begin{array}{lllll}3 & 36 & 15 \cdot 0\end{array}$ | 2.07 | $\begin{array}{llll}3 & 34 & 8 \cdot 0\end{array}$ | $2 \cdot 16$ | 3 3I 55.6 | $2 \cdot 25$ |
| 29 | $3 \begin{array}{llll}3 & 3 & 30 \cdot 3\end{array}$ | I. 89 | $33534 \cdot 7$ | I 97 | $3 \begin{array}{llll}3 & 33 & 34\end{array}$ | $2 \cdot 05$ | $3 \begin{array}{llll}3 & 3128 \cdot 6\end{array}$ | 2.14 | 329 17.6 | $2 \cdot 23$ | $327 \quad 0.9$ | 33 |
| 30 | $33253 \cdot 1$ | r.94 | 33054.0 | $2 \cdot 03$ | $\begin{array}{llll}3 & 28 & 49 \cdot 8\end{array}$ | II | $\begin{array}{llll}3 & 2640 \cdot 4\end{array}$ | $2 \cdot 20$ | 32425.2 | $2 \cdot 30$ | $322 \begin{array}{lll}3 & 3.9\end{array}$ | 2.41 |
| 31 | $\begin{array}{llllll}3 & 28 & 14.4\end{array}$ | $2 \cdot 00$ | $3 \begin{array}{lllll}3 & 26 & \text { II } 9\end{array}$ | 2.09 | $\begin{array}{llll}3 & 24 & 3 \cdot 7\end{array}$ | 2-18 | $32150 \cdot 3$ | $2 \cdot 27$ | $31930 \cdot 7$ | $2 \cdot 38$ | $\begin{array}{llll}3 & 17 & 4 & 7\end{array}$ | 2.49 |
| 32 | $\begin{array}{llllll}3 & 23 & 34 \cdot 2\end{array}$ | 2.06 | $\begin{array}{lllllllll}3 & 21 & 27.9\end{array}$ | $2 \cdot 15$ | 3 I9 16.0 | $2 \cdot 25$ | $\begin{array}{lllll}3 & 16 & 58 \cdot 2\end{array}$ | $2 \cdot 35$ | 3 I4 33.9 | $2 \cdot 46$ | $\begin{array}{lllll}3 & 12 & 3.0\end{array}$ | $2 \cdot 57$ |
| 33 | 3 I8 52.4 | $2 \cdot 12$ | 3 I6 $42 \cdot 3$ | $2 \cdot 22$ | 3 I4 $26 \cdot 2$ | $2 \cdot 32$ | $\begin{array}{lll}3 & 12 & 3 \cdot 8\end{array}$ | $2 \cdot 43$ | $\begin{array}{llll}3 & 9 & 34 \cdot 8\end{array}$ | $2 \cdot 54$ | $\begin{array}{llll}3 & 6 & 58 \cdot 6\end{array}$ | $2 \cdot 67$ |
| 34 | $\begin{array}{llll}3 & \text { I4 } & 8 \cdot 9\end{array}$ | 2.19 | 3 II 54.7 | 2.29 | $3 \begin{array}{llll}3 & 9 & 34.3\end{array}$ | 2.40 | $\begin{array}{lll}3 & 7 & 7 \cdot 2\end{array}$ | 2.51 | $\begin{array}{llll}3 & 4 & 32.9\end{array}$ | 2.63 | 3 I 51.2 | 76 |
| 35 | $\begin{array}{lll}3 & 9 & 23.6\end{array}$ | $2 \cdot 26$ | $3 \begin{array}{lll}3 & 7 & 5 \cdot 1\end{array}$ | 2 | $3 \quad 440 \cdot 0$ | $2 \cdot 48$ | $\begin{array}{lll}3 & 2 & 7 \cdot 9\end{array}$ | $2 \cdot 60$ | $25928 \cdot 4$ | $2 \cdot 73$ | $25640 \cdot 7$ | $2 \cdot 87$ |
| 36 | $3 \quad 4 \quad 36 \cdot 3$ | $2 \cdot 33$ | $\begin{array}{llll}3 & 2 & 13.3\end{array}$ | $2 \cdot 44$ | $25943 \cdot 3$ | $2 \cdot 56$ | 25750 | 2.69 | $25420 \cdot 5$ | 2.83 | $25126 \cdot 6$ | 2.97 |
| 37 | $25946 \cdot 7$ | $2 \cdot 40$ | 25719.0 | $2 \cdot 52$ | $25443 \cdot 9$ | $2 \cdot 65$ | $2 \begin{array}{lll}2 & 52 & 0.8\end{array}$ | $2 \cdot 79$ | $249 \quad 9 \cdot 3$ | 2.93 | $2 \begin{array}{llll}2 & 46 & 8 \cdot 7\end{array}$ | $3 \cdot 09$ |
| 38 | 25454.9 | $2 \cdot 48$ | $\begin{array}{lllll}2 & 52 & 22 \cdot 1\end{array}$ | 2.61 | $24941 \cdot 5$ | 2.75 | $246 \quad 52 \cdot 5$ | 2.89 | $2 \begin{array}{llll}2 & 43 & 54.4\end{array}$ | 3.05 | $24046 \cdot 7$ | $3 \cdot 22$ |
| 39 | 2500.5 | 2.57 | 24722.4 | $2 \cdot 70$ | $24435 \cdot 9$ | $2 \cdot 85$ | $24140 \cdot 5$ | 3.00 | $23835 \cdot 4$ | $3 \cdot 17$ | $235 \quad 19 \cdot 9$ | $3 \cdot 35$ |
| 40 | $245 \quad 3.4$ | $2 \cdot 66$ | $\begin{array}{llll}2 & 42 & 19.6\end{array}$ | 2.80 | $23926 \cdot 8$ | $2 \cdot 96$ | 23624.5 | $3 \cdot 12$ | 233 I1.9 | 3.30 | $22948 \cdot 1$ | 3.50 |
| 41 | 240 | $2 \cdot 76$ | $2 \begin{array}{llllllll}2 & 37 & 13.3\end{array}$ | $2 \cdot 91$ | 23413.9 | 3.08 | 23140 | 3.25 |  | 3.45 | $22410 \cdot 5$ | 3.66 |
| 42 | $\begin{array}{llll}2 & 34 & 59 \cdot 8\end{array}$ | $2 \cdot 86$ | $\begin{array}{lll}2 & 32 & 3 \cdot 3\end{array}$ | 3.03 |  | 3.20 | $\begin{array}{llll}2 & 25 & 38 \cdot 9\end{array}$ | $3 \cdot 39$ | $\begin{array}{llll}2 & 22 & 9.3\end{array}$ | $3 \cdot 60$ | $\begin{array}{llll}2 & 18 & 26 \cdot 5\end{array}$ | $3 \cdot 83$ |
| 43 | $2 \begin{array}{lll}2 & 29 & 52 \cdot 7\end{array}$ | $2 \cdot 98$ | $\begin{array}{llll}2 & 26 & 49 \cdot 1\end{array}$ | $3 \cdot 15$ | $\begin{array}{lllll}2 & 23 & 34 \cdot 6\end{array}$ | $3 \cdot 34$ | $\begin{array}{lll}2 & 20 & 8.2\end{array}$ | $3 \cdot 55$ | $\begin{array}{llll}2 & 16 & 28.9\end{array}$ | 3.77 | $\begin{array}{llll}2 & 12 & 35.2 \\ 2 & 6 & 35.6\end{array}$ | 4.03 |
| 44 | $2244 \mathrm{I} \cdot 6$ | 3.10 | $22130 \cdot 3$ | 3.29 | $2 \begin{array}{llll}2 & 18 & 7\end{array}$ | 3.49 | 2 I4 31*4 | $3 \cdot 72$ | 2 10 4I*4 | $3 \cdot 96$ | $2 \quad 6 \quad 35 \cdot 6$ | $4 \cdot 24$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | s. | S. | s. |
| 0 | -I.35 | -4.29 | -1.43 | $-4.32$ | -I.51 | $-4.35$ | -1.60 | $-4.37$ | - I. 68 | $-4.41$ | $-1.77$ | $-4.44$ |
| 2 | 1.38 | $4 \cdot 30$ | 1.47 | $4 \cdot 33$ | 1.55 | $4 \cdot 36$ | 1.63 | 4.39 | I'72 | $4 \cdot 42$ | I.81 | $4 \cdot 46$ |
| 4 | 1.42 | $4 \cdot 32$ | 1.50 | $4 \cdot 34$ | 1.59 | $4 \cdot 37$ | 1.67 | 4.40 | I.76 | 4.44 | 1.85 | 4.47 |
| 6 | $1 \cdot 46$ | $4 \cdot 33$ | I.54 | $4 \cdot 36$ | 1.63 | $4 \cdot 39$ | 1.71 | 4.42 | I. 80 | $4 \cdot 46$ | 1.89 | $4 \cdot 49$ |
| 8 | I. 50 | $4 \cdot 34$ | 1.58 | 4.37 | 1.67 | $4 \cdot 40$ | 1.76 | $4 \cdot 44$ | I. 85 | 4:47 | I.94 | 4.51 |
| 10 | 1-54 | $4 \cdot 36$ | I. 63 | $4 \cdot 39$ | 1-72 | 4.42 | 1.80 | 4.46 | I.90 | 4.49 | I.99 | 4.53 |
| 12 | I 59 | $4 \cdot 37$ | I. 68 | 4.41 | 1.77 | $4 \cdot 44$ | 1.86 | $4 \cdot 48$ | I.95 | $4 \cdot 52$ | $2 \cdot 04$ | $4 \cdot 56$ |
| 14 | I. 64 | $4 \cdot 39$ | 1.73 | $4 \cdot 43$ | 1.82 | $4 \cdot 46$ | I-91 | $4 \cdot 50$ | $2 \cdot 01$ | 4.54 | $2 \cdot 10$ | 4.59 |
| 16 | 1.69 | 4.41 | 1.78 | 4.45 | 1.88 | $4 \cdot 49$ | 1.97 | 4.53 | 2.07 | 4.57 | $2 \cdot 17$ | $4 \cdot 62$ |
| 18 | 1.75 | 4.43 | I. 84 | 4.47 | 1-94 | $4 \cdot 5 \mathrm{I}$ | $2 \cdot 04$ | $4 \cdot 56$ | 2.14 | $4 \cdot 60$ | $2 \cdot 24$ | $4 \cdot 65$ |
| 20 | I.81 | 4.46 | 1.91 | $4 \cdot 50$ | 2.00 | 4.54 | 2.II | 4.59 | 2.21 | $4 \cdot 64$ | $2 \cdot 32$ | $4 \cdot 69$ |
| 22 | I. 88 | 4.49 | I.98 | 4.53 | 2.08 | $4 \cdot 57$ | 2.18 | 4.62 | $2 \cdot 29$ | 4.67 | $2 \cdot 40$ | $4 \cdot 73$ |
| 24 | 1.95 | $4 \cdot 52$ | $2 \cdot 05$ | 4.56 | $2 \cdot 16$ | $4 \cdot 61$ | $2 \cdot 27$ | $4 \cdot 66$ | $2 \cdot 38$ | $4 \cdot 72$ | $2 \cdot 50$ | $4 \cdot 78$ |
| 26 | $2 \cdot 02$ | 4.55 | $2 \cdot 13$ | 4.60 | $2 \cdot 25$ | 4.65 | $2 \cdot 36$ | $4 \cdot 71$ | $2 \cdot 48$ | 4.77 | $2 \cdot 60$ | 4.83 |
| 28 | $2 \cdot 11$ | 4.59 | 2.23 | 4.64 | $2 \cdot 34$ | $4 \cdot 70$ | $2 \cdot 46$ | $4 \cdot 76$ | $2 \cdot 58$ | 4.83 | 2.71 | $4 \cdot 89$ |
| 30 | $2 \cdot 20$ | 4.63 | $2 \cdot 32$ | $4 \cdot 69$ | $2 \cdot 45$ | 4.75 | $2 \cdot 57$ | 4.82 | $2 \cdot 70$ | 4.89 | $2 \cdot 84$ | $4.97{ }^{\prime}$ |
| 32 | $2 \cdot 31$ | $4 \cdot 68$ | $2 \cdot 43$ | 4.75 | $2 \cdot 56$ | $4 \cdot 81$ | $2 \cdot 70$ | $4 \cdot 89$ | $2 \cdot 84$ | $4 \cdot 97$ | $2 \cdot 98$ | $5 \cdot 05$ |
| 34 | 2.42 | $4 \cdot 74$ | $2 \cdot 56$ | $4 \cdot 8 \mathrm{I}$ | 2.69 | $4 \cdot 88$ | $2 \cdot 84$ | 4.97 | $2 \cdot 99$ | $5 \cdot 05$ | $3 \cdot 15$ | $5 \cdot 15$ |
| 36 | 2.55 | $4 \cdot 81$ | $2 \cdot 69$ | $4 \cdot 88$ | $2 \cdot 84$ | 4.97 | 3.00 | $5 \cdot 06$ | $3 \cdot 16$ | $5 \cdot 16$ | $3 \cdot 34$ | $5 \cdot 27$ |
| 38 | 2.69 | $4 \cdot 88$ | $2 \cdot 85$ | 4.97 | 3.01 | 5.07 | $3 \cdot 18$ | $5 \cdot 17$ | $3 \cdot 36$ | $5 \cdot 28$ | $3 \cdot 55$ | $5 \cdot 4 \mathrm{I}$ |
| 40 | 2.86 | 4.98 | 3.03 | $5 \cdot 08$ | $3 \cdot 20$ | 5.18 | $3 \cdot 39$ | $5 \cdot 30$ | $3 \cdot 59$ | $5 \cdot 43$ | $3 \cdot 81$ | $5 \cdot 58$ |
| 41 | $2 \cdot 95$ | $5 \cdot 03$ | 3.13 | $5 \cdot 14$ | $3 \cdot 31$ | $5 \cdot 25$ | $3 \cdot 51$ | $5 \cdot 38$ | $3 \cdot 73$ | $5 \cdot 52$ | $3 \cdot 96$ | $5 \cdot 68$ |
| 42 | 3.05 | 5.09 | 3.23 | $5 \cdot 20$ | 3.43 | $5 \cdot 33$ | $3 \cdot 64$ | $5 \cdot 47$ | 3.87 | $5 \cdot 56$ | $4 \cdot 12$ | $5 \cdot 79$ |
| 43 | $3 \cdot 15$ | $5 \cdot 15$ | $3 \cdot 35$ | $5 \cdot 27$ | 3.56 | $5 \cdot 4 \mathrm{I}$ | 3.79 | $5 \cdot 56$ | $4 \cdot 03$ | $5 \cdot 73$ | 4.30 | $5 \cdot 92$ |
| 44 | 3.27 | $5 \cdot 22$ | $3 \cdot 48$ | $5 \cdot 36$ | $3 \cdot 70$ | $5 \cdot 50$ | $3 \cdot 95$ | $5 \cdot 67$ | 4.21 | 5.86 | $4 \cdot 50$ | $6 \cdot 07$ |

## LATITUDE $12^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. Var. | $2{ }^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. M. S. | s. | H. M. S. | S. | H. M. S. | S. | H. M. S . | s. | H. M. S. | S. | H. M. S. | 86 |
| 0 | $\begin{array}{lll}6 & 0 & 0 \cdot 0\end{array}$ |  | $5159 \quad 9^{\circ} 0$ | $\cdot 85$ | $\begin{array}{llll}5 & 58 & 17 \cdot 9\end{array}$ | -- 85 | $515726 \cdot 8$ | $\cdot 85$ | 556 | - 85 | 55544.3 | $\cdot 86$ |
| 10 | $\begin{array}{llll}5 & 19 & 5.8\end{array}$ | -86 | 51813.6 |  | $\begin{array}{lllllllllll}5 & 17 & 20 \cdot 5\end{array}$ | -89 | $515626 \cdot 6$ | -91 | 5 I5 31.8 | -92 | 5 I4 36.0 | -94 |
| 12 | 5 10 54.7 | -87 | 51020 | -89 | $\begin{array}{lll}5 & 9 & 8 \cdot 3\end{array}$ | -90 | $5{ }_{5}^{5} 818.6$ | $\cdot 92$ | $\begin{array}{llll}5 & 7 & 178\end{array}$ | -94 | $\begin{array}{llll}5 & 6 & 20 \cdot 9\end{array}$ | 96 |
| 14 | $\begin{array}{llll}5 & 2 & 43.4\end{array}$ | -88 | 5 I $50 \cdot 1$ | -90 | $\begin{array}{llll}5 & 0 & 55.8\end{array}$ | -92 | $\begin{array}{lll}5 & 0 & 0.2\end{array}$ | $\cdot 94$ | $4 \begin{array}{lll}4 & 59 & 3.4\end{array}$ | -96 | $4 \begin{array}{lll}4 & 58 & 5 \cdot 3\end{array}$ | 98 |
| r 6 | 45431.8 | -89 | $453 \quad 38 \cdot 0$ | -9r | $4 \quad 52 \quad 42 \cdot 9$ | $\cdot 93$ | 45 I $46 \cdot 4$ | -95 | $450 \quad 48 \cdot 4$ | -98 | $44949 \cdot 0$ | I 00 |
| 18 | 446 20•1 | -90 | $445 \quad 25 \cdot 6$ | -92 | 44429.5 | -95 | $44332 \cdot 0$ | -97 | $\begin{array}{llll}4 & 42 & 32 \cdot 8\end{array}$ | I.00 | 441320 | I.03 |
| 20 | $438 \quad 8 \cdot 0$ | $\cdot 91$ | 43712.8 | -93 | $4 \begin{array}{lll}4 & 36 & 15.8\end{array}$ | -96 | 435 I7.1 | -99 | 434 16.6 | I 02 | 43314.3 | 05 |
| 22 | $42955 \cdot 6$ | -92 | $428 \quad 59.5$ | -95 | $\begin{array}{lll}4 & 28 & 1.5\end{array}$ | -98 | $4 \begin{array}{lll}4 & 27 & 6\end{array}$ | I 02 | $425 \quad 59.6$ | I.05 | $42455 \cdot 7$ | -08 |
| 24 | $42142 \cdot 9$ | $\cdot 93$ | $42045 \cdot 8$ | -97 | 4 I9 $46 \cdot 6$ | roo | $4 \mathrm{l}^{4} 845 \cdot 3$ | I. 04 | 4 17 41.9 | I. 08 | 4 I6 $36 \cdot 2$ | -II |
| 26 | 4 I3 29.8 | -95 | $41231 \cdot 6$ | -99 | 4 II 3I•I | r $\cdot 03$ | 4 10 $28 \cdot 4$ | 1.07 | $4 \quad 9 \quad 23 \cdot 2$ | II | $4 \quad 8 \quad 15 \cdot 6$ | I•I5 |
| 28 | $4 \quad 5 \quad 16 \cdot I$ | -97 | $\begin{array}{llll}4 & 4 & 16 \cdot 8\end{array}$ | I.OI | $\begin{array}{llll}4 & 3 & 15\end{array}$ | I.05 | $\begin{array}{llll}4 & 2 & 10 \cdot 5\end{array}$ | I'IO | $4 \quad 103.5$ | I'14 | $\begin{array}{llll}3 & 59 & 53 \cdot 8\end{array}$ | I•18 |
| 30 | 3575 | -99 | 356 | I.03 | $354 \quad 57 \cdot 9$ | 1.08 | $35351 \cdot 7$ | I•I3 | $35242 \cdot 7$ | I•17 | $\begin{array}{llllllllllllll}3 & 51 & 30 \cdot 8\end{array}$ | 1-22 |
| 31 | $35254 \cdot 7$ | I.00 | 3 5r 53.3 | I. 05 | $35049 \cdot 1$ | I.09 | $34942 \cdot 0$ | I•I4 |  | I•19 | $\begin{array}{llllll}3 & 47 & 18.8\end{array}$ | I-24 |
| 32 |  | I.OI | $34745{ }^{\circ}$ | I.06 | $34640 \cdot 0$ | I•II | $34531 \cdot 9$ | I•I6 | $34420 \cdot 7$ | I.2I | $\begin{array}{lll}3 & 43 & 6.4\end{array}$ | I 27 |
| 33 | $34439 \cdot 6$ | 1.02 | 343 36.6 | 1.07 | $\begin{array}{llll}3 & 42 & 30 \cdot 6\end{array}$ | I'I3 | $34 \mathrm{I} 2 \mathrm{I} \cdot 5$ | I•18 | $340 \quad 9 \cdot 2$ | I. 23 | $\begin{array}{llll}3 & 38 & 53.6\end{array}$ | I. 29 |
| 34 | $3 \begin{array}{lll}3 & 40 & 31 \cdot 7\end{array}$ | I.04 | $\begin{array}{llll}3 & 39 & 28 \cdot 0\end{array}$ | 1.09 | $\begin{array}{llll}3 & 38 \\ \text { 2 } & \text { I I }\end{array}$ | I.I4 | $\begin{array}{llll}3 & 37 & 10.9\end{array}$ | 20 | $\begin{array}{llllllll}3 & 35 & 57 \cdot 3\end{array}$ | I. 26 | $313440 \cdot 3$ | I•3I |
| 35 | $\begin{array}{llll}3 & 36 & 23 \cdot 7\end{array}$ | I.05 | 33519.1 | I•IO | $3{ }^{3} 34$ II•2 | I•16 | $3 \begin{array}{llll}32 & 59 \cdot 8\end{array}$ | I. 22 | $33145{ }^{\circ}$ | I. 28 | $33026 \cdot 6$ | -34 |
| 36 |  | I.06 | $\begin{array}{llll}3 & 31 & 9.9\end{array}$ | I•12 | 33010 | 1-18 | 3 $318848 \cdot 5$ | 4 |  | I. 30 | $\begin{array}{llll}3 & 26 & 12.4\end{array}$ | I. 36 |
| 37 | $\begin{array}{llll}3 & 28 & 7 \cdot 0\end{array}$ | I.08 | $\begin{array}{llll}3 & 27 & 0.5\end{array}$ | I'I4 | $\begin{array}{llll}3 & 25 & 50.4\end{array}$ | I. 20 | $\begin{array}{llll}3 & 24 & 36 \cdot 7\end{array}$ | I.26 | $\begin{array}{llll}3 & 23 & 19.1\end{array}$ | r 32 | $32157 \cdot 7$ | I. 39 |
| 38 | $\begin{array}{llll}3 & 23 & 58 \cdot 3\end{array}$ | I.09 | $\begin{array}{llll}3 & 22 & 50.8\end{array}$ | I• 16 | $32139 \cdot 6$ | I. 22 | 32024.5 | I. 28 | 3195.5 | 1.35 | 3 17 $42 \cdot 5$ | I. 42 |
| 39 | 3 I9 49*4 | 1 | $3 \mathrm{I} 8 \quad 40 \cdot 8$ | 1.17 | 3 17 28.4 | I. 24 | $3 \mathrm{I} 612 \cdot 0$ | I.3I | 31451.4 | r.38 | 3 I3 $26 \cdot 7$ | 1.45 |
| 40 | 3 I5 40.1 | I'I3 | 3 I4 $30 \cdot 5$ | I•19 | $\begin{array}{llllllllllllllll}3 & 13 & 16.8\end{array}$ | I. 26 | 3 II 59.0 | I. 33 | 3 ro $36 \cdot 8$ | 1.41 | $310910 \cdot 2$ | I. 48 |
| 41 | 3 II $30 \cdot 6$ | I-15 | 3 Io 19.8 | I-2I | $\begin{array}{llll}3 & 9 & 4.8\end{array}$ | I-29 | $3 \begin{array}{llll}3 & 7 & 45 \cdot 4\end{array}$ | I.36 | $\begin{array}{llll}3 & 6 & 21.6\end{array}$ | 1.44 | $\begin{array}{llll}3 & 4 & 53 \cdot 1\end{array}$ | I- 51 |
| 42 | $\begin{array}{llll}3 & 7 & 20 \cdot 8\end{array}$ | 1-17 | $\begin{array}{llll}3 & 6 & 8 \cdot 7\end{array}$ | 1.24 | $\begin{array}{llll}3 & 4 & 52 \cdot 3\end{array}$ | I•3I | $\begin{array}{llll}3 & 3 & 31 \cdot 3\end{array}$ | I•39 | $\begin{array}{llll}3 & 2 & 5 \cdot 7\end{array}$ | r.47 | $3 \quad 0 \quad 35 \cdot 3$ | I. 55 |
| 43 | $\begin{array}{lllll}3 & 3 & 10.7\end{array}$ | I.19 | $3 \begin{array}{llll}3 & 1 & 57 & \end{array}$ | 1.26 | $3 \quad 039 \cdot 3$ | I-34 | $25916 \cdot 7$ | 1.42 | $25749 \cdot 2$ | I.50 | $25616 \cdot 7$ | I. 58 |
| 44 | $259 \quad 0 \cdot 2$ | . 21 | $25745 \cdot 4$ | 1.29 | $2 \begin{array}{llll}26 & 25.9\end{array}$ | r 37 | 2551.5 | I 45 | $25332 \cdot 0$ | I.53 | 251573 | 1.62 |
| 45 | 254493 | I. 23 | $253133 \cdot 0$ | 1.3I | 252 II•9 | 1.40 | $25045 \cdot 5$ | I.48 | 24914.0 | I.57 | 24737.0 | r 66 |
| 46 | $2 \begin{array}{lllll}2 & 50 & 37 \cdot 9\end{array}$ | I. 26 | $24930 \cdot 1$ | 1.34 | 2 47  | I. 43 | $24^{2} 4629 \cdot 0$ | 1.52 | $24455 \cdot 2$ | I.6I | $\begin{array}{lll}2 & 43 & 15 \cdot 7\end{array}$ | r•71 |
| 47 | $2 \begin{array}{llll}2 & 46 & 26 \cdot 2\end{array}$ | $\underline{1} 28$ | $\begin{array}{lll}2 & 45 & 6 \cdot 7\end{array}$ | 1.37 | $24342 \cdot 0$ | 1.46 | $2 \begin{array}{llll}2 & 42 & 11\end{array} 6$ | I 55 | $24035 \cdot 5$ | I. 65 | $23^{88} 53 \cdot 5$ | I•75 |
| 48 | $2 \begin{array}{llll}2 & 42 & 13.9\end{array}$ | 1.3I | $240 \quad 52 \cdot 7$ | 1.40 | 23926.0 | 1.49 | $\begin{array}{llll}2 & 37 & 53.4\end{array}$ | I. 59 | 23614.8 | I 69 | $23430 \cdot 1$ | r.80 |
| 49 | $23^{2} 8$ I-2 | I.34 | $23^{2} 3638 \cdot 1$ | I. 43 | $\begin{array}{lll}2 & 35 & 9 \cdot 3\end{array}$ | I.53 | $233134 \cdot 3$ | r. 63 | $23153 \cdot 1$ | 1.74 | 23050 | r.85 |
| 50 | $23347 \cdot 9$ | 1.37 | $2 \begin{array}{lll}22 & 22 \cdot 8\end{array}$ | 1.47 | $2305 \mathrm{I} \cdot 7$ | 1.57 | $2 \begin{array}{lll}2 & 29 & 14.3\end{array}$ | I. 68 | 227 30.3 | I•79 | $225139 \cdot 4$ | I.91 |
| 51 | $2 \begin{array}{llll}2 & 29 & 33.9\end{array}$ | I.40 | 22867 | I.50 | 22633.3 | 1.6I | $\begin{array}{lllllll}2 & 24 & 53 \cdot 2\end{array}$ | I•73 | $223 \quad 6 \cdot 2$ | I. 84 | $22111 \cdot 9$ | I.97 |
| 52 |  | 1.44 | $\begin{array}{lllllllllllll}2 & 23 & 49 \cdot 9\end{array}$ | I. 54 | 222213.9 | 1.66 | $2203 \mathrm{I} \cdot 0$ | r.78 | $2 \mathrm{I} 8140 \cdot 7$ | I.90 | 2 I6 $42 \cdot 9$ | $2 \cdot 03$ |
| 53 | 2213.9 | 1.47 | $\left\lvert\, \begin{array}{llll}2 & 19 & 32 \cdot 2\end{array}\right.$ | 1.59 | 2 I7 53.4 | I•71 | 2 I6 7*4 | I.83 | 215413.7 | r.96 | $21212 \cdot 1$ | $2 \cdot 10$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{0}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. 4 | A. | L. $5^{\circ}$ | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. | s. | s. | S. | s. | s. | s. | S. | s. | s. | s. | s. |
| 0 | - 00 | -4.09 | -07 | -4.09 | - 15 | -4.09 | $\begin{array}{r}\text { - } 22 \\ -.28 \\ \hline\end{array}$ | -4.09 | .29 .35 | 4.10 | $\cdot 37$ | -4.11 |
| $\stackrel{4}{8}$ | . 12 | 4.09 | -13 | 4.09 | -21 | $4 \cdot 09$ | .28 .34 | $4 \cdot 10$ 4.10 | $\cdot 35$ | $4 \cdot 10$ | -43 | 4.11 |
| 12 | -18 | 4.09 | -26 | $4 \cdot 10$ | -33 | 4-10 | 41 | $4 \cdot \mathrm{II}$ | $\cdot 49$ | $4 \cdot 12$ | . 56 | $4 \cdot 13$ |
| 14 | $\cdot 22$ | 4.09 | -29 | $4 \cdot 10$ | $\cdot 37$ | $4 \cdot 11$ | -45 | $4 \cdot 11$ | - 52 | $4 \cdot 12$ | . 60 | 4'13 |
| 16 | . 25 | 4.10 | -33 | $4 \cdot 10$ | $\cdot 40$ | $4 \cdot 11$ | $\cdot 48$ | $4 \cdot 12$ | $\cdot 56$ | $4 \cdot 13$ | . 64 | 4.14 |
| 18 | - 28 | $4 \cdot 10$ | $\cdot 36$ | $4 \cdot 10$ | $\cdot 44$ | $4 \cdot 11$ | $\cdot 52$ | $4 \cdot 12$ | . 60 | 4-13 | . 67 | 4.14 |
| 20 | -32 | $4 \cdot 10$ | -40 | $4 \cdot 11$ | 47 | $4 \cdot 12$ | -55 | $4 \cdot 13$ | . 63 | 4.14 | $\cdot 71$ | 4.15 |
| 22 | -35 | $4 \cdot 10$ | -43 | $4 \cdot 11$ | $\cdot 51$ | 4.12 | -59 | $4 \cdot 13$ | $\cdot 67$ | $4 \cdot 14$ | $\cdot 76$ | $4 \cdot 16$ |
| 24 | -39 | 4•II | -47 | $4 \cdot 12$ | -55 | $4 \cdot 13$ | . 63 | 4.14 | -72 | $4 \cdot 15$ | . 80 | 4.17 |
| 26 | -43 | $4 \cdot 1 \mathrm{I}$ | $\cdot 51$ | $4 \cdot 12$ | -59 | $4 \cdot 13$ | $\cdot 68$ | $4 \cdot 14$ | $\cdot 76$ | $4 \cdot 16$ | . 85 | 4•18 |
| 28 | $\cdot 46$ | $4 \cdot 11$ | -55 | $4 \cdot 12$ | -63 | $4 \cdot 14$ | $\cdot 72$ | $4 \cdot 15$ | .81 | 4.17 | -90 | $4 \cdot 19$ |
| 30 | -50 | $4 \cdot 12$ | - 59 | $4 \cdot 13$ | -68 | 4.14 | $\cdot 77$ | $4 \cdot 16$ | $\cdot 86$ | $4 \cdot 18$ | -95 | $4 \cdot 20$ |
| 32 | $\cdot 55$ | $4 \cdot 13$ | . 64 | $4 \cdot 14$ | $\cdot 73$ | $4 \cdot 15$ | . 82 | $4 \cdot 17$ | $\cdot 91$ | $4 \cdot 19$ | 1.00 | $4 \cdot 21$ |
| 34 | -59 | 4-13 | -68 | 4.15 | $\cdot 78$ | 4-16 | $\cdot 87$ | 4-18 | $\cdot 96$ | $4 \cdot 20$ | r.06 | $4 \cdot 22$ |
| 36 | . 64 | $4 \cdot 14$ 4.14 | -73 | $4 \cdot 15$ $4 \cdot 16$ | .83 | $4 \cdot 17$ $4 \cdot 18$ | .92 | $4 \cdot 19$ 4.21 | 1.02 1.09 | 4.22 4.23 | r.12 <br> I. <br> 1 | 4.24 4.26 |
| 40 | . 74 | $4 \cdot 14$ 4.15 | .79 | $4 \cdot 15$ $4 \cdot 17$ | -84 | 4.18 4.20 | $\cdot 98$ $\times 105$ | 4.21 4.22 | I 09 I 15 | 4.23 4.25 | I-19 I-26 | 4.26 4.28 |
| 42 | -80 | 4.16 | -90 | 4•19 | 1.01 | 4.21 | I•I2 | $4 \cdot 24$ | 1.23 | $4 \cdot 27$ | I•34 | $4 \cdot 30$ |
| 44 | -86 | 4-18 | -97 | $4 \cdot 20$ | 1.08 | 4.23 | I-19 | $4 \cdot 26$ | I•3 | $4 \cdot 29$ | 1.43 | $4 \cdot 33$ |
| 46 | -92 | 4•19 | 1.04 | $4 \cdot 22$ | I•5 | $4 \cdot 25$ | 1.27 | $4 \cdot 28$ | $1 \cdot 39$ | $4 \cdot 32$ | 1.52 | $4 \cdot 36$ |
| 48 | -99 | 4.21 | 1.11 | $4 \cdot 24$ | 1. 24 | $4 \cdot 27$ | 1.36 | $4 \cdot 31$ | $1 \cdot 49$ | $4 \cdot 35$ | 1.62 | $4 \cdot 40$ |
| 50 | $1 \cdot 07$ | $4 \cdot 23$ | r 20 | $4 \cdot 26$ | 1.33 | $4 \cdot 30$ | I 46 | 4.34 | I.60 | $4 \cdot 39$ | I•74 | $4 \cdot 45$ |
| 52 | I•16 | 4.25 | 1.29 | 4.29 | I. 43 | $4 \cdot 33$ | I. 57 | $4 \cdot 38$ | I•72 | $4 \cdot 44$ | 1. 88 | $4 \cdot 50$ |
| 53 | 1. 20 | $4 \cdot 26$ | I 34 | $4 \cdot 30$ | 1.48 | 4.35 | I. 63 | 4.40 | r•79 | $4 \cdot 46$ | I 95 | $4 \cdot 53$ |

## LATITUDE $12^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $6^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{\circ}{\circ}$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 54 & 52 \cdot 8 \end{array}\right.$ | - $\quad .8$ | $\begin{array}{lll} \mathrm{H} . & \mathrm{M} . & \mathrm{S} . \\ 5 & 54 & \mathrm{I} \cdot \mathrm{I} \end{array}$ | $\left\lvert\, \begin{gathered} \text { S. } \\ -.86 \end{gathered}\right.$ | $\left\|\begin{array}{lll} \text { H. M. } & \text { S. } \\ 5 & 53 & 9 \cdot 2 \end{array}\right\|$ | $\begin{gathered} \mathrm{s} . \\ -.87 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 52 & \text { I7.O } \end{array}\right\|$ | $\left\lvert\, \begin{aligned} & \mathrm{s} . \\ & -.87 \\ & \hline \end{aligned}\right.$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 5 \mathrm{I} & 24 \cdot 5 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} . \\ -.88 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 50 & 3 \mathrm{~T} \cdot 7 \end{array}\right\|$ | $\text { s. } 8$ |
| 10 | $\begin{array}{llll}5 & 13 & 39 \cdot 3\end{array}$ | -95 | 5 12 41.5 | $\cdot 97$ | $\begin{array}{lllll}5 & \text { II } & 42 \cdot 7\end{array}$ | -99 | 5 10 $42 \cdot 7$ | I.OI | 5 9 4 <br> 5 $\cdot 6$  | 1.03 |  | I.05 |
| 12 | $\begin{array}{llll}5 & 5 & 23 \cdot 0\end{array}$ | -98 | $5 \quad 4 \quad 23.7$ | 1.00 | $\begin{array}{llll}5 & 3 & 23 \cdot 2\end{array}$ | 1.02 | $\begin{array}{llll}5 & 2 & 21.4\end{array}$ | I. 04 | 5 I I $8 \cdot 3$ | I.06 | $5 \quad 0 \quad 13.8$ | I.09 |
| 14 | $\begin{array}{llll}4 & 57 & 5 \cdot 9\end{array}$ | I.00 | $4 \begin{array}{llr}56 & 5 \cdot 1 \\ 4 & 47 & 45\end{array}$ | I.03 | 4 55 $2 \cdot 8$ <br> 4 46 4 | r.05 | $\begin{array}{llll}4 & 53 & 59 \cdot 2\end{array}$ | I.07 | $45254 \cdot 0$ | rio | $45147 \cdot 0$ | I-I3 |
| 16 | 448 48-I | I.03 | $44745 \cdot 7$ | I.05 | $4464 \mathrm{I} \cdot 6$ | I. 08 | $4 \quad 45 \quad 35 \cdot 8$ | I-II | $44428 \cdot 3$ | I•14 | 44319.0 | I.I7 |
| $\uparrow 8$ | 44029.6 | I.06 | $4 \quad 39 \quad 25 \cdot 3$ | I.09 | $4 \begin{array}{llll}4 & 38 & 19.2\end{array}$ | I'12 | 437 II•3 | I•I5 | $\begin{array}{llll}4 & 36 & \text { I } 4\end{array}$ | I-I8 | $434 \quad 49 \cdot 5$ | T. 22 |
| 20 | 432 IO.I | I.09 | 43515 | I-12 | $4 \begin{array}{llll}4 & 29 & 55 \cdot 7\end{array}$ | I.15 | $4 \quad 28 \quad 45 \cdot 5$ | I.19 | $42733 \cdot 1$ | 1.23 | 42618.4 | 5.26 |
| 22 | $42349 \cdot 7$ | I-12 | $42241 \cdot 4$ | I•I6 | $42131 \cdot 0$ | I.19 | $4 \quad 2018 \cdot 2$ | I. 23 | $4193 \cdot 1$ | I. 27 |  | - $3 \pi$ |
| 24 | $415{ }^{1} 128 \cdot 1$ | I-I5 | $4 \begin{array}{llll}4 & 14 & 17\end{array}$ | I'I9 | $4 \begin{array}{llll}4 & 13 & 4.9\end{array}$ | 1.23 | 4 II $49 \cdot 5$ | I-28 | 4 10 $3 \mathrm{I} \cdot 5$ | I-32 | $\begin{array}{llll}4 & 9 & 10.7\end{array}$ | 5.37 |
| 25 | 4 II 16.9 | I'17 | 4 IO $5 \cdot 4$ | I-2I | $485 \mathrm{I} \cdot 2$ | I. 26 | $4734 \cdot 5$ | I. 30 | $4615 \cdot 0$ | I.35 | $4 \quad 4 \quad 52 \cdot 5$ | 1.40 |
| 26 | $\begin{array}{lll}4 & 7 & 5.4\end{array}$ | I.19 | $\begin{array}{llll}4 & 5 & 52 \cdot 6\end{array}$ | I.23 | $4 \begin{array}{llll}4 & 4 & 37 \cdot 2\end{array}$ | I. 28 | $4 \quad 319.0$ | r.33 | 4 I 5779 | 1.38 | $4 \quad 0 \quad 33 \cdot 8$ | T.43 |
| 27 | $\begin{array}{llll}4 & 2 & 53 \cdot 6\end{array}$ | I. 21 | 4 I 313.6 | I. 26 | $4 \quad 0 \quad 22 \cdot 7$ | 1.30 | $359 \quad 3 \cdot 0$ | I•35 | $35740 \cdot 3$ | 1.40 | $3 \begin{array}{lllllll}3 & 56 & 14.4\end{array}$ | I. 46 |
| 28 | $\begin{array}{llllll}3 & 58 & 4 \mathrm{x} \cdot 4\end{array}$ | 1.23 | $\begin{array}{llll}3 & 57 & 26 \cdot 1\end{array}$ | I. 28 | $\begin{array}{llll}3 & 56 & 7 \cdot 8\end{array}$ | I.33 | $\begin{array}{llll}3 & 54 & 46 \cdot 5\end{array}$ | -38 | $\begin{array}{llll}3 & 53 & 22 \cdot 2\end{array}$ | I.43 | $\begin{array}{llll}3 & \text { II } & 54 \cdot 5\end{array}$ | ז-49 |
| 29 | $\begin{array}{llll}3 & 54 & 28 \cdot 8\end{array}$ | I. 25 | $3 \begin{array}{lllllllll}3 & 53 & 12.2\end{array}$ | 1.30 | $35152 \cdot 5$ | I.35 | 35029.6 | I.4I | $\begin{array}{lll}3 & 49 & 3 \cdot 4\end{array}$ | I.46 |  | T.52 |
| 30 | 35015.9 | I. 27 | $\begin{array}{lllll}3 & 4^{8} & 57 \cdot 8\end{array}$ | 1.33 | $34736 \cdot 6$ | 1.38 | 346 12.0 | I. 44 | $34444 \cdot 0$ | 1.50 | $3 \quad 43$ I2.5 | I. 56 |
| 3 T | 3 46 2.5 | I. 30 | $34443 \cdot 0$ | I. 35 | $\begin{array}{llll}3 & 43 & 20 \cdot 2\end{array}$ | I.4I | $34153 * 9$ | I.47 | $340 \quad 24 \cdot 0$ | I.53 | $3.38 \quad 50.4$ | I. 59 |
| 32 | \| 3 41148.71 | I. 32 | 34027.7 | 1.38 | $\begin{array}{\|lll\|}3 & 39 & 3.2\end{array}$ | I. 44 | $3 \begin{array}{llll}3 & 37 & 35 \cdot 1\end{array}$ | 1.50 | $\begin{array}{llll}3 & 36 & 3 \cdot 2 \\ & 31\end{array}$ | 1.56 | $\begin{array}{lllllllllllllllllll}3 & 34 & 27 \cdot 5\end{array}$ | I. 63 |
| 33 | $\begin{array}{\|llll\|}3 & 37 & 34 \cdot 5\end{array}$ | I. 35 | $\begin{array}{llllll}3 & 36 & I I \cdot 9\end{array}$ | I.4I | $33445 \cdot 6$ | I.47 | $\begin{array}{llll}3 & 33 & 15.6\end{array}$ | I.53 | 3 31 4 $4 \cdot 7$ | 1.60 | $\begin{array}{llll}3 & 30 & 3 \cdot 7\end{array}$ | r.fi |
| 34 |  | 1.37 | $\begin{array}{lllll}3 & 31 & 55 \cdot 5\end{array}$ | I.44 | 33027.4 | I. 50 | $\begin{array}{llllllllllllll}3 & 28 & 55 \cdot 5\end{array}$ | I 57 | 312719.4 | 1. 64 | $\begin{array}{llll}3 & 25 & 39 \cdot 1\end{array}$ | I•7 |
| 35 | $\begin{array}{llll}3 & 29 & 4.5\end{array}$ | I.40 | $\begin{array}{lllll}3 & 27 & 38.5\end{array}$ | 1.47 | $\begin{array}{lll}3 & 26 & 8.6\end{array}$ | I. 53 | $\begin{array}{lllll}3 & 24 & 34 * 5\end{array}$ | I. 60 | $\begin{array}{lllll}3 & 22 & 56 \cdot 3\end{array}$ | I. 67 | 3 2I 13.5 | I.75 |
| 36 | $\begin{array}{llll}3 & 24 & 48 \cdot 6\end{array}$ | I. 43 | $\begin{array}{llll}3 & 23 & 20.9\end{array}$ | I. 50 | 32149.0 | 1.57 | $3 \quad 2012.8$ | I. 64 | $\begin{array}{llll}3 & 18 & 32.2\end{array}$ | I. 72 | $31646 \cdot 9$ | 1.79 |
| 37 | $\begin{array}{llll}3 & 20 & 32 \cdot 2\end{array}$ | I.46 | $\begin{array}{llll}3 & 19 & 2.6\end{array}$ | I. 53 | $\begin{array}{lllll}3 & 17 & 28 \cdot 7\end{array}$ | 1.60 |  | 1.68 | $\begin{array}{lllll}3 & 14 & 7 \cdot 2\end{array}$ | I.76 | $\begin{array}{llll}3 & 12 & 19.2\end{array}$ | I. 84 |
| 38 | $\begin{array}{lllllll}3 & 16 & 15 \cdot 2\end{array}$ | I-49 | 3 I4 43.6 | I. 56 | $\begin{array}{llll}3 & 13 & 7.5\end{array}$ | I. 64 | 3 II $26 \cdot 7$ | 1.72 | 3 9 4I•I | I.80 | $\begin{array}{llll}3 & 7 & 50 \cdot 3\end{array}$ | โ.89 |
| 39 | 3 II 57.5 | I. 52 | 3 10 23.8 | I. 60 |  | I. 68 | $\begin{array}{lll}3 & 7 & 2 \cdot 2\end{array}$ | I.76 | $\begin{array}{lllll}3 & 5 & 13.9\end{array}$ | I. 85 | $\begin{array}{llll}3 & 3 & 20 \cdot 2\end{array}$ | I-94. |
| 40 | $\begin{array}{llll}3 & 7 & 39 \cdot 1\end{array}$ | I. 56 | $\begin{array}{lll}3 & 6 & 3.3\end{array}$ | I. 64 | $\begin{array}{llll}3 & 4 & 22.5\end{array}$ | I.72 | $\begin{array}{llll}3 & 2 & 36 \cdot 6\end{array}$ | I-81 | $3 \quad 0 \quad 45 \cdot 5$ | I.90 | $258 \quad 48 \cdot 7$ | I•99 |
| 41 | $\begin{array}{llll}3 & 3 & 20.0\end{array}$ | I.59 | 3 I 41.8 | -68 | 259588.6 | r•76 | 25810.0 | I.86 | 25615.8 | I 95 | $254 \times 5 \cdot 7$ | $2 \cdot 05$ |
| 42 | $\begin{array}{lll}2 & 59 & 0.0\end{array}$ | 1.63 | $2 \begin{array}{llll}2 & 57 & 19 & 4\end{array}$ | I•72 | $25533 \cdot 6$ | 1.81 | $25342 \cdot 1$ | I.91 | 2 5I 44•7 | 2.01 | 249 4I•2 | $2 \cdot 75$ |
| 43 | $\begin{array}{lllll}2 & 54 & 39 \cdot 1\end{array}$ | 1.67 | 25256 | I.76 | 2515 | I. 86 | $2 \begin{array}{lll}2 & 49 & 12.8\end{array}$ | I.96 | 247 I2 2 T | 2.07 | $\begin{array}{llll}2 & 45 & 4.9\end{array}$ | $2 \cdot 78$ |
| 44 | $2 \begin{array}{lllll}2 & 50 & 17.2\end{array}$ | 1.71 | $24^{2} 4831.5$ | I.81 | $2{ }_{2} 46$ |  | $24442 \cdot x$ | $2 \cdot 02$ | $\begin{array}{lllll}2 & 42 & 37 \cdot 9\end{array}$ |  |  | $2 \cdot 24$ |
| 45 | 24554.4 | 1.76 | $244 \quad 5.8$ | I. 86 | 242 II•I | 1.97 | $240 \quad 9.9$ | $2 \cdot 08$ | $2 \begin{array}{lll}18 & 1\end{array} 9$ | 2.19 | $23546 \cdot 8$ | $2 \cdot 32$ |
| 46 | $24130 \cdot 4$ | I.81 | $2 \begin{array}{llll}2 & 39 & 38 \cdot 8\end{array}$ | I.91 | $23740 \cdot 8$ | 2.02 | $23536 \cdot 0$ | $2 \cdot 14$ | 23324.0 | $2 \cdot 26$ | 23145 | $2 \cdot 39$ |
| 47 | $\begin{array}{llr}2 & 37 & 5.2 \\ 2 & 32 & 38.8\end{array}$ | I.86 | $\begin{array}{llll}2 & 35 & 10.5 \\ 2 & 30 & 40.6\end{array}$ | 1.97 | 2 33 9.0 <br> 2 28 $35 \cdot 3$ | 2.08 | $\begin{array}{rrrr}2 & 31 & 0.3 \\ 2 & 26 & 22.5\end{array}$ | 2.21 | $\begin{array}{lllllll}2 & 28 & 44.0\end{array}$ | $2 \cdot 34$ | $\begin{array}{llll}2 & 26 & 19.7\end{array}$ | 2.48 2.56 |
| 48 | $\begin{array}{llll}2 & 32 & 38 \cdot 8 \\ 2 & 28 & 0.8\end{array}$ | 1.91 | 22 30 $40 \cdot 6$ | 2.03 | $\begin{array}{llll}2 & 28 & 35 \cdot 3 \\ 2 & 23 & 59.8\end{array}$ | $2 \cdot 15$ | $\begin{array}{llll}2 & 26 & 22 \cdot 5 \\ 2 & 21 & 4.5\end{array}$ | 2.28 |  | 2.42 | $\begin{array}{llll}2 & 21 & 32 \cdot 3\end{array}$ | $2 \cdot 56$ |
| 49 | $\begin{array}{llll}2 & 28 & 10.8\end{array}$ | 1.97 | 2 26 $9 \cdot 1$ | 2.09 | $\begin{array}{llll}2 & 23 & 59 \cdot 8 \\ 2 & 1 & \end{array}$ | 2.22 |  | $2 \cdot 36$ | $\begin{array}{lll}2 & 19 & 16.8 \\ 2 & 14 & 20.0\end{array}$ | 2.50 | 2 I6 4I.9 | 2.66 |
| 50 | $22341 \cdot 3$ | 2.03 | $\|22135 \cdot 8\|$ | $2 \cdot 16$ | $\left\lvert\, \begin{array}{llll}2 & 19 & 22.2\end{array}\right.$ | $2 \cdot 30$ | 217 O.I | $2 \cdot 44$ | $2 \mathrm{I} 429^{\circ}$ | $2 \cdot 60$ | 2 II 48.3 | $2 \cdot 76$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ | A. | L. 7 | A. | L. $8^{\circ}$ | A. | L. 9 | A. | L. 10 | - A. | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | s. | S. | S. | S. | S. | S. | S. | S. |
| 0 | 4 | -4.II | -51 | -4.12 | -. 59 | $-4 \cdot 13$ | - 66 | $-4 \cdot 14$ | - 774 | -4.15 | -. 8 I | $-4.17$ |
| 4 | $\cdot 50$ | $4 \cdot 12$ | $\cdot 58$ | $4 \cdot 13$ | . 65 | $4 \cdot 14$ | $\cdot 73$ | $4 \cdot 15$ | -80 | $4 \cdot 17$ | . 88 | $4 \cdot 18$ |
| 6 | -53 | 4-12 | -61 | $4 \cdot 13$ | -69 | $4 \cdot 15$ | -76 | $4 \cdot 16$ | . 84 | $4 \cdot 17$ | -92 | $4 \cdot 9$ |
| 8 | $\cdot 57$ | $4 \cdot 13$ | -64 | 4.14 | $\cdot 72$ | 4-15 | -80 | $4 \cdot 17$ | $\cdot 87$ | 4.18 | -95 | $4 \cdot 20$ |
| 10 | . 60 | 4.13 | . 68 | 4.14 | $\cdot 76$ | 4-16 | . 83 | 4-17 | -91 | 4.19 | -99 | $4 \cdot 21$ |
| 12 | . 64 | $4 \cdot 14$ | $\cdot 72$ | $4 \cdot 15$ | -79 | 4.17 | -87 | $4 \cdot 18$ | -95 | 4.20 | I.03 | $4 \cdot 22$ |
| 14 | . 68 | 4.I4 | $\cdot 75$ | 4.16 | . 83 | $4 \cdot 17$ | -91 | $4 \cdot 19$ | -99 | $4 \cdot 21$ | 1.07 | 4.23 |
| I6 | -71 | 4.15 | - 79 | 4.17 | -87 | $4 \cdot 18$ | $\cdot 95$ | $4 \cdot 20$ | 1.04 | $4 \cdot 22$ | 1-12 | $4 \cdot 2.4$ |
| 18 | -75 | 4.16 | . 83 | $4 \cdot 17$ | -92 | 4.19 | I.00 | $4 \cdot 21$ | 1.08 | $4 \cdot 23$ | I•I7 | $4 \cdot 25$ |
| 20 | -80 | 4.17 | -88 | $4 \cdot 18$ | $\cdot 96$ | $4 \cdot 20$ | I.05 | $4 * 22$, | I•3 | $4 \cdot 24$ | I.2I | $4 \cdot 27$ |
| 22 | -84 | 4-18 | -92 | 4•19 | I.OI | 4.21 | 1.09 | 4.23 | I.I8 | $4 \cdot 26$ | 1.27 | 4.28 |
| 24 | -88 | $4 \cdot 18$ | $\cdot 97$ | $4 \cdot 20$ | I.06 | 4.22 | I'I5 | $4 \cdot 24$ | I. 23 | $4 \cdot 27$ | I. 32 | $4 \cdot 30$ |
| 26 | -93 | 4-19 | 1.02 | $4 \cdot 21$ | I•II | 4.24 | I. 20 | $4 \cdot 26$ | r-29 | 4.29 | $1 \cdot 38$ | $4 \cdot 32$ |
| 28 | -98 | $4 \cdot 21$ | I.07 | $4 \cdot 23$ | I.I7 | $4 \cdot 25$ | I. 26 | $4 \cdot 28$ | I.35 | 4.31 | I. 45 | $4 \cdot 34$ |
| 30 | I-04 | $4 \cdot 22$ | I.13 | $4 \cdot 24$ | I 22 | $4 \cdot 27$ | I. 32 | $4 \cdot 30$ | I. 42 | $4 \cdot 33$ | 1.52 | $4 \cdot 36$ |
| 32 | I-10 | 4.23 | I-19 | 4-26 | I. 29 | $4 \cdot 29$ | I 39 | $4 \cdot 32$ | I. 49 | 4.35 | I. 59 | $4 \cdot 39$ |
| 34 | I•16 | $4 \cdot 25$ | I. 26 | $4 \cdot 28$ | I•36 | $4 \cdot 31$ | I.46 | $4 \cdot 34$ | I.57 | $4 \cdot 38$ | 1.67 | 4.42 |
| 36 | I. 22 | $4 \cdot 27$ | I.33 | $4 \cdot 30$ | I. 43 | 4.33 | I. 54 | $4 \cdot 37$ | I. 65 | 4.41 | 1.76 | 4.45 |
| 38 | I. 29 | $4 \cdot 29$ | I. 40 | 4.32 | I.5I | $4 \cdot 36$ | I. 62 | $4 \cdot 40$ | I.74 | 4.44 | I. 86 | $4 \cdot 49$ |
| 40 | $1 \cdot 37$ | 4.31 | I. 48 | 4.35 | I.60 | $4 \cdot 39$ | I.72 | $4 \cdot 43$ | I. 84 | $4 \cdot 48$ | I.96 | 4*54 |
| 42 | 1.45 | $4 \cdot 34$ | $1 \cdot 57$ | $4 \cdot 38$ | I. 69 | 4.43 | I. 82 | 4.48 | I.95 | $4 \cdot 53$ | 2.08 | $4 \cdot 59$ |
| 44 | I. 55 | $4 \cdot 37$ | 1.67 | $4 \cdot 42$ | I.80 | 4.47 | I.93 | 4.52 | 2.07 | $4 \cdot 58$ | $2 \cdot 22$ | $4 \cdot 65$ |
| 46 | I. 65 | $4 \cdot 4 \mathrm{I}$ | 1•78 | $4 \cdot 46$ | I.92 | $4 \cdot 52$ | 2.06 | $4 \cdot 58$ | 2.21 | $4 \cdot 65$ | $2 \cdot 37$ | 4.73 |
| 48 | r.76 | $4 \cdot 45$ | 1.91 | $4 \cdot 51$ | 2.05 | 4.58 | 2.21 | $4 \cdot 65$ | $2 \cdot 37$ | 4.73 | 2.54 | $4 \cdot 81$ |
| 50 | I.89 | $4 \cdot 50$ | $2 \cdot 04$ | $4 \cdot 57$ | $2 \cdot 20$ | 4.65 | $2 \cdot 37$ | $4 \cdot 73$ | $2 \cdot 55$ | $4 \cdot 82$ | $2 \cdot 74$ | 4.92 |

## 172 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT.

LATITUDE $12^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S | S. | H. M. S | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | I1. M. S. | S. |
| 0 | $54938 \cdot 5$ | - . 89 | 54844.9 | $\cdot 90$ | $547 \quad 50 \cdot 9$ | - 90 | $5 \quad 46 \quad 56 \cdot 4$ | - 91 | $\begin{array}{llll}5 & 46 & 1 \cdot 4\end{array}$ | - 92 | $545 \quad 5 \cdot 8$ | -93 |
| 6 | $\begin{array}{lllll}5 & 24 & 27 \cdot 9\end{array}$ | -99 | $\begin{array}{llll}5 & 23 & 27 \cdot 8\end{array}$ | I-OI | $5 \quad 2226 \cdot 7$ | $1 \cdot 03$ | $52124 \cdot 6$ | 1.04 | $52021 \cdot 3$ | I.06 | 5 19 17\%0 | 1.08 |
| 8 | $\begin{array}{llll}5 & 16 & 2 \cdot 3\end{array}$ | 1.03 | $\begin{array}{lllll}5 & 14 & 59 \cdot 9\end{array}$ | 1.05 | 5 I3 $56 \cdot 3$ | I.07 | 512514 | 1.09 | 5 II 45.2 | I•II | 5 10 37.6 | I•14 |
| 10 | $57735 \cdot 7$ | 1.07 | $\begin{array}{llll}5 & 6 & 30 \%\end{array}$ | I.09 | $\begin{array}{lllll}5 & 5 & 24.4\end{array}$ | I.I2 | $\begin{array}{llll}5 & 4 & 16 \cdot 7\end{array}$ | I'I4 | $\begin{array}{llll}5 & 3 & 7 \cdot 4\end{array}$ | I• 17 | 5 I $56 \cdot 5$ | I-19 |
| 12 | $459 \cdot 7 \cdot 8$ | I'II | $458 \quad 0 \cdot 3$ | I'I4 | $4565 \mathrm{I} \cdot 2$ | I-I7 | $455 \quad 40 \cdot 4$ | I 19 | $4 \quad 54 \quad 27 \cdot 9$ | I 22 | $4 \begin{array}{lll}43 & 13.6\end{array}$ | I 25 |
| 14 | $45038 \cdot 6$ | I.16 | $44928 \cdot 3$ | I'I9 | $44816 \cdot 2$ | 1.22 | $447 \quad 2 \cdot 3$ | I. 25 | $4 \begin{array}{llll}4 & 45 & 46 \cdot 4\end{array}$ | I. 28 | $44428 \cdot 5$ | 1.32 |
| 16 | $4 \begin{array}{llll}4 & 42 & 7.8\end{array}$ | I. 20 | $44054 \cdot 7$ | 1.24 | $43939 \cdot 5$ | 1.27 | $\begin{array}{llll}4 & 38 & 22 \cdot 3\end{array}$ | I.3I | $\begin{array}{llll}4 & 37 & 2.8\end{array}$ | I 34 | $4354 \mathrm{I} \cdot 0$ | $1 \cdot 38$ |
| 18 | $4 \cdot 33 \quad 35 \cdot 5$ | I. 25 | $432 \quad 19 \cdot 3$ | I. 29 | $4310 \cdot 9$ | I 33 | 429 40•I | I.37 | $4 \quad 2816.9$ | 1.41 | $42651 \cdot I$ | I 45 |
| 20 | $1 \begin{array}{lll}4 & 25 & 1.4\end{array}$ | I.30 | $\begin{array}{llll}4 & 23 & 42 \cdot 0\end{array}$ | I 34 | $42220 \cdot 1$ | I.39 | $420 \begin{array}{llll}4 & 55\end{array}$ | I. 43 | $4 \begin{array}{llll}4 & 19 & 28 \cdot 4\end{array}$ | 1.48 | $4 \begin{array}{lllll}4 & 58 \cdot 3\end{array}$ | I.53 |
| 22 | 41625.4 | I.36 | $4 \begin{array}{lll}45 & 2 \cdot 6\end{array}$ | I.40 | $41336 \cdot 9$ | 1.45 | $\begin{array}{llll}4 & 12 & 8 \cdot 5\end{array}$ | I.50 | 4 Io $37 \cdot 0$ | 1.55 | $\begin{array}{lll}4 & 9 & 2 \cdot 4\end{array}$ | I. 60 |
| 23 | $4126 \cdot 6$ | I•39 | 4 10 41.9 | I 43 | $\begin{array}{lll}4 & 9 & 14.4\end{array}$ | I. 48 | 4743.9 | I.53 | $4 \quad 6 \quad 10.2$ | $1 \cdot 59$ | $4 \quad 4 \quad 33 \cdot 2$ | I. 64 |
| 24 | $4747 \cdot 2$ | I-42 | $4620 \cdot 7$ | 1.47 | $4 \begin{array}{llll}4 & 4 & 5 \mathrm{I} \cdot 2\end{array}$ | I. 52 | $\begin{array}{llll}4 & 3 & 18 \cdot 5\end{array}$ | I 57 | $4 \quad 142.5$ | 1.63 | $4{ }^{4} \quad 0 \quad 3 \cdot 1$ | I. 69 |
| 25 | $\begin{array}{llll}4 & 3 & 27 \cdot 2\end{array}$ | 1.45 | 4 I 58.8 | I. 50 | $4 \quad 0 \quad 27 \cdot 3$ | I. 55 | $\begin{array}{llllllllllllllllll}3 & 58 & 52 \cdot 3\end{array}$ | I. 61 | 35713.9 | 1.67 | 35531.9 | I•73 |
| 26 | $\begin{array}{lll}3 & 59 & 6 \cdot 7\end{array}$ | I. 48 | $\begin{array}{llll}3 & 57 & 36 \cdot 2\end{array}$ | I. 53 | $\begin{array}{llll}3 & 56 & 2 \cdot 5\end{array}$ | 1.59 | $\begin{array}{lllll}3 & 54 & 25 \cdot 3\end{array}$ | I. 65 | $3 \begin{array}{llll}3 & 52 & 44.4\end{array}$ | I•71 | 3505059.8 | I•78 |
| 27 | $35445 \cdot 4$ | 1.51 | $\begin{array}{llllll}3 & 53 & 12.9\end{array}$ | I.57 | $35136 \cdot 9$ | I. 63 | $34957 \cdot 4$ | I. 69 | $3 \begin{array}{llll}3 & 48 & 13\end{array}$ | 1.76 | $34626 \cdot 5$ | I. 82 |
| 28 | $3 \begin{array}{lll}3 & 50 & 23.4\end{array}$ | 1.55 | $\begin{array}{llll}3 & 48 & 48 \cdot 9\end{array}$ | I.6I | $34710 \cdot 6$ | 1.67 | $\begin{array}{llll}3 & 45 & 28 \cdot 5\end{array}$ | I•73 | $\begin{array}{llll}3 & 43 & 42.4\end{array}$ | 1.80 | 341582.2 | 1.87 |
| 29 | $3 \begin{array}{lll}3 & 46 & 0 \cdot 7\end{array}$ | I. 58 | $\begin{array}{llllllllllllllll}3 & 44 & 23 \cdot 9\end{array}$ | I. 64 | $34243 \cdot 3$ | エ・クI | 340 | I.78 | $\begin{array}{llll}3 & 39 & 9 \cdot 8\end{array}$ | 1.85 |  | 1.93 |
| 30 | $34137 \cdot 2$ | I. 62 | $\begin{array}{llll}3 & 39 & 58 \cdot 1\end{array}$ | I. 68 | $\begin{array}{lllll}3 & 3^{8} & 15 \cdot 0\end{array}$ | I•75 | $\begin{array}{lllll}3 & 36 & 27 \cdot 7\end{array}$ | I.83 | $\begin{array}{llll}3 & 34 & 35 \cdot 9\end{array}$ | I.90 | $\begin{array}{lllll}3 & 32 & 39 \cdot 6\end{array}$ | I 98 |
| 31 | $\begin{array}{lllllllllll}3 & 37 & 12.9\end{array}$ | I. 66 | $3 \begin{array}{lllll}3 & 35 & 31\end{array}$ | I.73 | $3 \begin{array}{llllllllll} & 3 & 45 \cdot 7\end{array}$ | I. 80 | 3 31 55.5 | I.87 | $3 \begin{array}{lll}30 & 0.7\end{array}$ | 1.95 | $\begin{array}{lll}3 & 28 & 1 \cdot 3\end{array}$ | $2 \cdot 03$ |
| 32 | $1 \begin{array}{llll}3 & 32 & 47 \cdot 7\end{array}$ | 1.70 | 3 31 3.7 | 1.77 |  | I. 85 | $\begin{array}{llll}3 & 27 & 22.2\end{array}$ | I.92 | $325 \quad 24 \cdot 4$ | 2.01 | 32321.4 | $2 \cdot 09$ |
| 33 | $\begin{array}{llll}3 & 28 & 21.6\end{array}$ | I•74 | 32634.9 | I. 82 | $32443 \cdot 7$ | I. 89 | $\begin{array}{llll}3 & 22 & 47 \cdot 6\end{array}$ | 1.98 | $32046 \cdot 4$ | 2.06 | 31840.0 | $2 \cdot 15$ |
| 34 | $\begin{array}{llll}3 & 23 & 54.4\end{array}$ | 1.78 | 3 22 5 | I.86 | $3 \quad 2010 \cdot 9$ | I.94 | 3 I8 II 6 | $2 \cdot 03$ | 3 16 7-0 | $2 \cdot 12$ | $\begin{array}{lllll}3 & 13 & 56.8\end{array}$ | $2 \cdot 22$ |
| 35 | 3 I9 26.2 | 1.83 | 31733.9 | I.91 | $\begin{array}{lllll}3 & 15 & 36 \cdot 7\end{array}$ | $2 \cdot 00$ | $3 \begin{array}{llll}3 & 13 & 34 \cdot 1\end{array}$ | 2.09 | 3 II 25.9 | $2 \cdot 19$ |  | $2 \cdot 29$ |
| 36 | $\begin{array}{llll}3 & \text { I4 } & 56 \cdot 8\end{array}$ | I.88 | $\begin{array}{llll}3 & 13 & 1.6\end{array}$ | r.96 | $\begin{array}{lll}3 & 11 & 1 \cdot 1\end{array}$ | 2.06 | 3 8 54.9 <br> 3 4  | $2 \cdot 15$ | 3643.0 | $2 \cdot 25$ | $\begin{array}{lrr}3 & 4 & 24.9 \\ 2 & 59 & 35.6\end{array}$ | $2 \cdot 36$ |
| 37 | 3 IO $26 \cdot 2$ | I.93 | $\begin{array}{llll}3 & 8 & 27.9\end{array}$ | $2 \cdot 02$ | $\begin{array}{llll}3 & 6 & 23.9\end{array}$ | $2 \cdot 11$ | $3 \quad 4 \mathrm{I} 4 \cdot \mathrm{I}$ | $2 \cdot 21$ | 3 I 58.2 | $2 \cdot 32$ | $25935 \cdot 6$ | $2 \cdot 43$ |
| 38 | $3 \quad 5 \quad 54.3$ | I.98 | $\begin{array}{llll}3 & 3 & 52 \cdot 6\end{array}$ | 2.08 | 3 I 45. 1 | 8 | $25931 \cdot 4$ | $2 \cdot 28$ | 257 II.3 | $2 \cdot 39$ | $25444 \cdot 2$ | 2.52 |
| 39 | $3120 \cdot 9$ | 2.04 | $\begin{array}{llll}2 & 59 & 15 \cdot 8\end{array}$ | $2 \cdot 14$ | 2574.5 | $2 \cdot 24$ | $25446 \cdot 8$ | $2 \cdot 35$ | $25222 \cdot 1$ | 2.47 | $24950 \cdot 1$ | $2 \cdot 60$ |
| 40 | $\begin{array}{llll}2 & 56 & 46 \cdot 1\end{array}$ | 2.09 | $254137 \cdot 3$ | $2 \cdot 20$ | $\begin{array}{llll}2 & 52 & 22 \cdot 0\end{array}$ | $2 \cdot 31$ | $\begin{array}{llll}2 & 49 & 59.9\end{array}$ | 2.43 | $247 \begin{array}{llll} & 40 \cdot 5\end{array}$ | 2.55 | $\begin{array}{lllll}2 & 44 & 53.4\end{array}$ | 2.69 |
| 41 | $\begin{array}{rrrr}2 & 52 & 9 \cdot 6 \\ 2 & 47 & 31.3\end{array}$ | 2.16 | $\begin{array}{llll}2 & 49 & 56 \cdot 9 \\ 2 & 45 & \text { 14.5 }\end{array}$ | 2.27 | $\begin{array}{llllllll}2 & 47 & 37.4 \\ 2 & 47 & 50.5\end{array}$ | 2.39 2.46 | $\begin{array}{llll}2 & 45 & 10.6 \\ 2 & 40 & 18.8\end{array}$ | 2.51 | $\begin{array}{llll}2 & 42 & 36 \cdot 2 \\ 2 & 37 & 38 \cdot 9\end{array}$ | 2.64 | $\begin{array}{llll}2 & 39 & 53.5\end{array}$ | 2.78 2.8 |
| 42 | 24731.3 | $2 \cdot 22$ | 24514.5 | $2 \cdot 34$ | $24250 \cdot 5$ | $2 \cdot 46$ | $2 \begin{array}{lllllll} & 40 & 18.8\end{array}$ | $2 \cdot 60$ | $2 \begin{array}{llll}27 & 38 \cdot 9\end{array}$ | $2 \cdot 74$ | $23450 \cdot 4$ | $2 \cdot 89$ |
| 43 | $2425 \mathrm{I} \cdot \mathrm{O}$ | $2 \cdot 29$ | $240 \quad 29 \cdot 8$ | 2.42 | 238 I•I | $2 \cdot 55$ | $23524 \cdot 1$ | $2 \cdot 69$ | $23238 \cdot 5$ | 2.84 | $22943 \cdot 6$ | $3 \cdot 00$ |
| 44 | $\begin{array}{llll}2 & 38 & 8 \cdot 7\end{array}$ | $2 \cdot 36$ | $\begin{array}{llllllllll}2 & 35 & 42 \cdot 8\end{array}$ | $2 \cdot 50$ | $\begin{array}{llll}2 & 33 & 8 \cdot 9\end{array}$ | $2 \cdot 64$ | $23026 \cdot 4$ | $2 \cdot 79$ | $2 \quad 2734 \cdot 6$ | $2 \cdot 95$ | $22432 \cdot 8$ | $3 \cdot 12$ |
| 45 | $23324^{\circ} \mathrm{O}$ | 2.45 | $230053 \cdot 2$ | $2 \cdot 58$ | $\begin{array}{llll}2 & 28 & 13.8\end{array}$ | 2.73 | $225 \quad 25 \cdot 2$ | 2.89 | $22226 \cdot 7$ | 3.06 | $2 \begin{array}{lllllll} & 19 & 17.5\end{array}$ | $3 \cdot 25$ |
| 46 | $\begin{array}{lllll}2 & 28 & 36 \cdot 8\end{array}$ | $2 \cdot 53$ | $\begin{array}{llll}2 & 26 & 0.7\end{array}$ | $2 \cdot 68$ | $\begin{array}{llll}2 & 23 & 15.4\end{array}$ | $2 \cdot 84$ |  | 3.01 | 2 I 714.5 | $3 \cdot 19$ | $2 \begin{array}{llll}2 & \text { IJ } & 57 \cdot 2\end{array}$ | 3.39 |
| 47 | $22346 \cdot 9$ | $2 \cdot 62$ | $2215 \cdot 0$ | $2 \cdot 78$ | 2 I 813.3 | $2 \cdot 95$ | 2 I5 II.O | $3 \cdot 13$ | 2 II 57.4 | $3 \cdot 33$ | $2831 \cdot 3$ | $3 \cdot 55$ |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ÄLTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | S. $-4 \cdot \mathrm{I} 8$ | S. | 5. -4.20 | $\xrightarrow{\text { S. }}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 22 \end{gathered}$ | $\stackrel{\text { S. }}{\substack{\text { S. } \\ \text { I } \\ \text { 2 }}}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 24 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ \mathbf{I} \cdot 20 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4: 26 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -\mathrm{x} \cdot 28 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 28 \end{gathered}$ |
| 2 | -92 | $4 \cdot 19$ | 1.00 | $4 \cdot 21$ | 1.08 | $4 \cdot 23$ | I•16 | 4.25 | 1.24 | $4 \cdot 27$ | $1 \cdot 32$ | $4 \cdot 30$ |
| 4 | $\cdot 96$ | $4 \cdot 20$ | I.04 | 4.22 | I'II | $4 \cdot 24$ | I•19 | 4.26 | 1.27 | $4 \cdot 28$ | 1.36 | $4 \cdot 31$ |
| 6 | -99 | 4.21 | 1.07 | 4.23 | $1 \cdot 15$ | $4 \cdot 25$ | 1.23 | 4.27 | $1 \cdot 31$ | $4 \cdot 29$ | $1 \cdot 39$ | $4 \cdot 32$ |
| 8 | 1.03 | $4 \cdot 22$ | I•II | $4 \cdot 24$ | 1.19 | $4 \cdot 26$ | 1.27 | $4 \cdot 28$ | $1 \cdot 35$ | $4 \cdot 31$ | 1.44 | $4 \cdot 33$ |
| 10 | 1.07 | 4.23 | I•5 | 4.25 | 1.23 | 4.27 | I.3I | $4 \cdot 30$ | 1.40 | $4 \cdot 32$ | 1.48 | $4 \cdot 35$ |
| 12 | I'II | $4 \cdot 24$ | 1.19 | $4 \cdot 26$ | 1.28 | $4 \cdot 28$ | I 36 | $4 \cdot 31$ | $1 \cdot 45$ | $4 \cdot 34$ | 1.53 | $4 \cdot 37$ |
| 14 | I•16 | 4.25 | 1.24 | 4.27 | $1 \cdot 32$ | $4 \cdot 30$ | 1.41 | $4 \cdot 32$ | I.50 | $4 \cdot 35$ | 1.58 | $4 \cdot 39$ |
| 16 | 1.20 | $4 \cdot 26$ | I. 29 | 4.29 | $1 \cdot 37$ | $4 \cdot 31$ | 1.46 | $4 \cdot 34$ | I. 55 | $4 \cdot 37$ | I. 64 | $4 \cdot 41$ |
| 18 | I 25 | $4 \cdot 28$ | I-34 | $4 \cdot 30$ | 1.42 | $4 \cdot 33$ | 1.51 | $4 \cdot 36$ | 1.60 | 4.39 | $1 \cdot 70$ | $4 \cdot 43$ |
| 20 | I. 30 | 4.29 | I.39 | 4.32 | 1.48 | 4.35 | 1.57 | $4 \cdot 38$ | 1.67 | 4.42 | I•76 | 4.45 |
| 22 | I. 36 | 4.31 | I. 45 | 434 | 1.54 | 4.37 | 1.63 | $4 \cdot 40$ | 1.73 | $4 \cdot 44$ | 1.83 | $4 \cdot 48$ |
| 24 | $1 \cdot 42$ | $4 \cdot 33$ | 1.51 | $4 \cdot 36$ | 1.60 | $4 \cdot 39$ | $1 \cdot 70$ | $4 \cdot 43$ | I.80 | $4 \cdot 47$ | 190 | 4.51 |
| 26 | 1.48 | $4 \cdot 35$ | 1.58 | $4 \cdot 38$ | 1.67 | $4 \cdot 42$ | $1 \cdot 77$ | $4 \cdot 46$ | I. 88 | $4 \cdot 50$ | 1.98 | $4 \cdot 54$ |
| 28 | 1-55 | $4 \cdot 37$ | 1.65 | $4 \cdot 41$ | $1 \cdot 75$ | 4.45 | 1.85 | 4.49 | 1.96 | 4.53 | $2 \cdot 07$ | $4 \cdot 58$ |
| 30 | 1.62 | 4.40 | 1.72 | $4 \cdot 44$ | 1.83 | 4.48 | 1.94 | $4 \cdot 52$ | 2.05 | $4 \cdot 58$ | $2 \cdot 17$ | 4.63 |
| 32 | $1 \cdot 70$ | $4 \cdot 43$ | $\mathbf{1}$.81 | $4 \cdot 47$ | $1 \cdot 92$ | $4 \cdot 52$ | 2.03 | $4 \cdot 57$ | $2 \cdot 15$ | $4 \cdot 62$ | $2 \cdot 27$ | $4 \cdot 68$ |
| 34 | $1 \cdot 78$ | $4 \cdot 46$ | 1.90 | 4.51 | 2.01 | 4.56 | $2 \cdot 13$ | 4.61 | $2 \cdot 26$ | 4.67 | $2 \cdot 39$ | $4 \cdot 73$ |
| 36 | 1.88 | 4.50 | 2.00 | $4 \cdot 55$ | $2 \cdot 12$ | 4.61 | 2.25 | 4.67 | $2 \cdot 38$ | $4 \cdot 73$ | $2 \cdot 52$ | $4 \cdot 80$ |
| 38 | 1.98 | $4 \cdot 54$ | $2 \cdot 11$ | $4 \cdot 60$ | $2 \cdot 24$ | $4 \cdot 66$ | $2 \cdot 37$ | 4.73 | $2 \cdot 51$ | $4 \cdot 80$ | $2 \cdot 66$ | $4 \cdot 88$ |
| 40 | $2 \cdot 09$ | 4.59 | 2.23 | $4 \cdot 66$ | $2 \cdot 37$ | 4.73 | 2.51 | $4 \cdot 80$ | $2 \cdot 67$ | 4.88 | 2.83 | $4 \cdot 97$ |
| 42 | $2 \cdot 22$ | 4.65 | 2.37 | $4 \cdot 73$ | 2.52 | 4.80 | 2.68 | $4 \cdot 89$ | $2 \cdot 84$ | $4 \cdot 98$ | 3.02 | $5 \cdot 08$ |
| 44 | $2 \cdot 37$ | 4.72 | 2.52 | 4.80 | 2.69 | $4 \cdot 89$ | 2.86 | $4 \cdot 99$ | $3 \cdot 05$ | $5 \cdot 10$ | 3.24 | $5 \cdot 22$ |
| 46 | 2.53 | 4.81 | $2 \cdot 70$ | $4 \cdot 90$ | 2.88 | $5 \cdot 00$ | 3.07 | $5 \cdot 12$ | $3 \cdot 29$ | $5 \cdot 24$ | $3 \cdot 50$ | $5 \cdot 38$ |
| 47 | 2.62 | 4.86 | 2.80 | 4.96 | 2.99 | $5 \cdot 07$ | $3 \cdot 19$ | 5•19 | 3.42 | $5 \cdot 33$ | 3.65 | $5 \cdot 48$ |

## LATITUDE $12^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Dec | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | ${ }_{c}^{\mathrm{H} .}$ | - S. |  |  |  | - ${ }^{\text {S }}$ | $\begin{aligned} & \text { H. M. } \\ & 5 . \end{aligned}$ |  | ${ }_{0} . \mathrm{s}_{\mathrm{I} \cdot 6}$ | 9 | H. M. s. |  |
| 0 | $\begin{array}{rrrr}5 & 44 & 9 \cdot 6 \\ 5 & 26 & 52 \cdot 3\end{array}$ | r. 04 |  | r. 95 | $\left\lvert\, \begin{array}{llll}5 & 42 & 15 \cdot 1 \\ 5 & 24 & 44 \cdot 2\end{array}\right.$ | I. 09 | 5 41  <br> 5 23 $16 \cdot 7$ | - 1 -17 | $\begin{array}{llll}5 & 40 & 17 \cdot 6 \\ 5 & 22 & 31.4 \\ 5 & \end{array}$ | -99 r 13 | $\begin{array}{llll}5 & 39 & 17.6 \\ 5 & 21 & 23.0\end{array}$ | I. O |
| 6 | $\begin{array}{llll}5 & 18 & 11 \cdot 3\end{array}$ | I | $\begin{array}{llllll}5 & 17 & 4.4 \\ 5 & 8 & \end{array}$ | I•13 | $\begin{array}{lllll}5 & 15 & 56 \cdot 1\end{array}$ | I. 15 | $51446 \cdot 4$ | I. 17 | $51335 \cdot 2$ | I. 20 | 51222.4 | 1.23 |
| 8 | $5 \begin{array}{llll}5 & 9 & 28 \cdot 6\end{array}$ | I•16 | 5 8 $18 \cdot 1$ <br> 4 59  <br> 1   | I'19 | $\begin{array}{llll}5 & 7 & 5.9\end{array}$ | I. 22 | $\begin{array}{llll}5 & 5 & 52 \cdot 2\end{array}$ | r. 24 | $\begin{array}{llll}5 & 4 & 36 \cdot 6\end{array}$ | 1.2 | $5 \begin{array}{llll}5 & 3 & 19\end{array}$ | I.31 |
| 10 | $5 \quad 0 \quad 44^{\circ} \mathrm{O}$ | I. 22 | $4 \begin{array}{lll}4 & 59 & 29\end{array}$ | 25 | $4 \begin{array}{llll}48 & 13.6\end{array}$ | 1.28 | $45655 \cdot 6$ | I. 32 | $45535 \cdot 5$ | I.35 | $4 \begin{array}{llll}4 & 54 & 13\end{array}$ | I-39 |
| 12 | $45157 \cdot 3$ | 9 | 45039.1 | I. 32 | 44918.8 | 36 | 44756.3 | 39 | $44631 \cdot 6$ | 3 | 4454.4 | 7 |
| 14 | $\begin{array}{llll}4 & 43 & 8.4\end{array}$ | r 35 | $44 \mathrm{I} 46 \cdot 0$ | I.39 | 4402 I 3 | 143 | $43854 \cdot \mathrm{I}$ | r 47 | $\begin{array}{llll}4 & 37 & 24.5\end{array}$ | I. 52 | $435{ }^{2} \cdot 0$ | . 56 |
| 16 | 43416.9 | 1.42 | $43250 \cdot 2$ | r 47 | 43120.9 | 151 | $42948 \cdot 8$ | I. 56 | $4 \begin{array}{llll}4 & 28 & 13.8\end{array}$ | I.6I | $42635 \cdot 9$ | . 66 |
| 18 | 42522.6 | 50 | $4 \begin{array}{llll}4 & 23 & 51\end{array}$ | I 55 | $4_{4} \mathbf{2 2} 1717$ | I. 59 | 42039.9 | 65 | $\begin{array}{lllll}4 & 18 & 59.4\end{array}$ | O | 41715.5 | I.76 |
| 19 | 42054.3 | 54 | $41920 \cdot 7$ | 59 | 4 I7 43.9 | 1.64 | $4 \begin{array}{llll}46 & 3.9\end{array}$ | 9 | $41420 \cdot 6$ | 1.75 | 41233.6 | I |
| 20 | 41625.3 |  | 41449 |  | $\begin{array}{llll}4 & 13 & 9.8\end{array}$ | 68 | 4 II 26.9 | 4 | $4 \quad 940$ | - | $750 \cdot 5$ | 87 |
| 21 | 41155.4 | I. 62 | 4 Io 16.7 | 67 | $4 \begin{array}{llll}4 & 8 & 34\end{array}$ | $1 \cdot 73$ | $4 \quad 6 \quad 48 \cdot 9$ | 1.79 | $4 \quad 4 \quad 59.4$ | I.86 | 36.0 | . 92 |
| 22 | $\begin{array}{lllll}4 & 7 & 24.5\end{array}$ | 66 | $\begin{array}{llll}4 & 5 & 43.2\end{array}$ | $1 \cdot 72$ | $\begin{array}{lllll}4 & 3 & 58 \cdot 3\end{array}$ | . 78 | $\begin{array}{llll}4 & 2 & 9.6\end{array}$ | I.84 | $\begin{array}{llll}4 & 0 & 16.9\end{array}$ | I.91 | 3 58 | I. 98 |
| 23 | $1 \begin{array}{llll}4 & 2 & 52.8\end{array}$ | I•70 | $18 \cdot 7$ | 1.77 | $\begin{array}{lll}3 & 59 & 20 \cdot 9\end{array}$ | . 83 | $3{ }^{5} 57$ 29.1 | 1.90 | 35533.2 | r.97 | $35312 \cdot 8$ | 2.04 |
| 24 | $\begin{array}{llll}3 & 58 & 19.9\end{array}$ | I•75 | $35633 \cdot 1$ | I.81 | $3 \quad 5442 \cdot 3$ | I.88 |  | I 95 | $35047 \cdot 9$ | 2.03 | $\begin{array}{llll}3 & 48 & 43.9\end{array}$ | $2 \cdot 11$ |
| 25 | $35346 \cdot \mathrm{I}$ | I.80 |  | 1-86 | $\begin{array}{llll}3 & 50 & 2.4\end{array}$ | 94 | $34^{88} 4 \cdot 1$ | I | $346 \begin{array}{ll}1 \cdot \mathrm{I}\end{array}$ | . 09 | 343 53.3 | 17 |
| 26 | 349 II.2 | I. 84 |  | I.92 |  | I. 99 | $\begin{array}{llllll}3 & 43 & 19 & 3\end{array}$ | 2.07 |  | 2.15 | $\begin{array}{lll}3 & 39 & 0.9\end{array}$ | $2 \cdot 24$ |
| 27 28 | 3 44 350 <br> 3 39  <br> 7.5   | I.90 | $\begin{array}{llll}3 & 42 & 39.0 \\ 3 & 37 & 58.3\end{array}$ | r.97 |  | 2.05 | $\begin{array}{lllll}3 & 38 & 33^{\circ} \\ 3 & \\ \end{array}$ | 2.13 | $\begin{array}{llll}3 & 36 & 22.5 \\ 3\end{array}$ | 2.22 | 3 $34 \begin{array}{lll}6 \cdot 5\end{array}$ | 2.31 |
| 28 29 | $\begin{array}{llll}3 & 39 & 57 \cdot 5 \\ 3 & 35 & 18.7\end{array}$ | 1.95 | $\begin{array}{llll}3 & 37 & 58 \cdot 3 \\ 3 & 33 & 16 \cdot 0\end{array}$ | 2.03 | $\begin{array}{cccc}3 & 35 & 54 \cdot 2 \\ 3 & 31 & 8 \cdot 3\end{array}$ | $2 \cdot 11$ | $\begin{array}{llll}3 & 33 & 45^{\circ} \\ 3 & 28 & 5.2\end{array}$ | 2.20 2.27 | $\begin{array}{llll}3 & 31 & 30 \cdot 4 \\ 3 & 26 & 36 \cdot 4\end{array}$ | 2.29 2.36 | $\begin{array}{llll}3 & 29 & 10 \cdot 1 \\ 3 & 24 & 11.5\end{array}$ | 2.39 2.47 |
| 29 |  |  |  |  | 331 | $2 \cdot 17$ | 3285 | 2.27 | 32636 |  | 324 II'5 |  |
| 30 | $\begin{array}{llll}3 & 30 & 38 \cdot 5 \\ 3 & 25 & 56 \cdot 7\end{array}$ |  | $\begin{array}{llll}3 & 28 & 32 \cdot 2 \\ 3 & 23 & 46 \cdot 7\end{array}$ | 15 | $\begin{array}{llll}3 & 26 & 20 \cdot 6 \\ 3 & 21 & 31.15\end{array}$ | 2.24 | 3 24 $3 \cdot 2$ <br> 3 19  | $2 \cdot 34$ | 32140.1 | 2.44 | 31910.5 | 2.55 |
| 31 32 | $\begin{array}{llll}3 & 25 & 56 \cdot 7 \\ 3 & 21 & 13.2\end{array}$ | $2 \cdot 18$ | $\begin{array}{llll}3 & 23 & 46 \cdot 7 \\ 3 & 18 & 59 \\ \\ 3 & 1 & 3\end{array}$ | $2 \cdot 28$ | 3 21 $31 \cdot 1$ <br> 3 16 39.5 | 2.38 | $\begin{array}{llll}3 & 19 & 9.5 \\ 3 & 19 & 53\end{array}$ | 2.41 | $\begin{array}{llll}3 & 16 & 41 \cdot 6 \\ 3\end{array}$ | 2.52 | 3 14 6.9 <br> 3 9  | 2.64 |
| 32 33 | $\begin{array}{llll}3 & 21 & 13.2 \\ 3 & 16 & 27.9\end{array}$ | 2.18 2.25 | $\begin{array}{cccc}3 & 18 & 59 \cdot 3 \\ 3 & 14 & 9.9\end{array}$ | 2.28 2.35 | $\begin{array}{llll}3 & 16 & 39 \cdot 5 \\ 3 & \text { II } & 45 \cdot 7\end{array}$ | 2.38 2.46 | $\begin{array}{rrrr}3 & 14 & 13.3 \\ 3 & 9 & 14.7\end{array}$ | 2.49 | $\begin{array}{crrrr}3 & \text { Ir } & 40 \cdot 5 \\ 3 & 6 & 36 \cdot 8\end{array}$ | 2.61 | $\begin{array}{ccc}3 & 9 & 0.6 \\ 3 & 3 & 51.2\end{array}$ | 2.73 2.83 2. |
| 33 34 | 3 if 40.8 | 2.25 2.32 | $\begin{array}{crrr}3 & 18 & 9 & 9 \\ 3 & 9 & 18.4\end{array}$ | 2.35 2.43 | $\begin{array}{rrr}3 & 11 & 45 \cdot 7 \\ 3 & 6 & 49 \cdot 5\end{array}$ | 2.46 2.54 | $\begin{array}{lll}3 & 9 & 14 \cdot 7 \\ 3 & 4 & 13 \cdot 5\end{array}$ | 2.57 2.66 | $\begin{array}{llll}3 & 6 & 36 \cdot 8 \\ 3 & 1 & 30 \cdot 0\end{array}$ | -79 | [rrrer | 2.3 2.93 |
| 35 | $\begin{array}{llll}3 & 6 & 51.6\end{array}$ | 239 | 424.7 |  | $\begin{array}{llll}3 & 1 & 50 \cdot 7\end{array}$ | 2.63 | $\begin{array}{lll}2 & 59 & 9.4\end{array}$ | 2.75 | $\begin{array}{llll}2 & 56 & 20 \cdot 1 \\ 2 & 5\end{array}$ | 2.89 | 25322.4 | 3.04 |
| 36 | $\begin{array}{llll}3 & 2 & 0 \cdot 1\end{array}$ | 2.47 | $\begin{array}{llll}2 & 59 & 28.4\end{array}$ | ¢ | $\begin{array}{llllll}2 & 56 & 49 & 3\end{array}$ | $2 \cdot 72$ | $\begin{array}{lll}2 & 54 & 2 \cdot 3\end{array}$ | 2.5 | $\begin{array}{llll}2 & 51 & 6 \cdot 8 \\ 2 & 45\end{array}$ | 3.00 | $\begin{array}{lll}2 & 48 & 2 \cdot 2 \\ 2 & 42\end{array}$ | 3.16 |
| 37 | $\begin{array}{lll}2 & 57 & 6 \cdot 2 \\ 2 & 57 & \end{array}$ | $2 \cdot 55$ | $\begin{array}{llll}2 & 54 & 29.4\end{array}$ | 2.68 | $\begin{array}{llll}2 & 51 & 44 \cdot 7\end{array}$ | $2 \cdot 81$ | $2{ }_{2} 48$ 51.7 | 2.96 | $\begin{array}{llll}2 & 45 & 49 \cdot 6 \\ 2\end{array}$ | $3 \cdot 12$ |  | $3 \cdot 28$ |
| 38 39 | $\begin{array}{lll}2 & 52 & 9 \cdot 8 \\ 2 & 47 & 10 \cdot 4\end{array}$ | $2 \cdot 64$ | $\begin{array}{lll}2 & 49 & 27.5 \\ 2 & 44 & 22.4\end{array}$ | $2 \cdot 77$ | $\begin{array}{llll}2 & 46 & 36 \cdot 9 \\ 2 & 4 \mathrm{I} & 25 \cdot 5\end{array}$ | 2.92 | $\begin{array}{llll}2 & 43 & 37.4 \\ 2 & 38 & 18.9\end{array}$ | 3.07 | $24028 \cdot 2$ | 3.24 | $\begin{array}{rrrr}2 & 37 & 8 \cdot 6 \\ 2 & 31 & 34.2\end{array}$ | 3.42 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | $\begin{array}{lll}2 & 42 & 7.9\end{array}$ | 2.83 | 3913.7 | 2.98 | 236 10.0 | $3 \cdot 15$ | $23256 \cdot 1$ | $3 \cdot 32$ | $22931 \cdot 0$ | 3.52 | 22553.8 | 373 |
| 41 | $\begin{array}{llll}2 & 37 & 2 \cdot 1\end{array}$ | $2 \cdot 94$ | $\begin{array}{llll}2 & 34 & 1.2\end{array}$ | $3 \cdot 10$ | $23050 \cdot 2$ | 3.27 | $\begin{array}{lllll}2 & 27 & 28.2\end{array}$ | $3 \cdot 47$ | 223 54•1 | 3.68 | 2206.9 | 3.91 |
| 42 | $\begin{array}{llllll}2 & 3152.5\end{array}$ | 3.05 | 22844.5 | 22 | $\begin{array}{llll}2 & 25 & 25.5\end{array}$ | 3.41 | $22154 \cdot 7$ | $3 \cdot 62$ | $2 \begin{array}{llll}2 & 10 & 8\end{array}$ | 3.85 |  | $4 \cdot \mathrm{IO}$ |
| 43 | $\begin{array}{lllll}2 & 26 & 38.7\end{array}$ | $3 \cdot 17$ | $\begin{array}{llll}2 & 23 & 22.9\end{array}$ | $3 \cdot 36$ | $2 \begin{array}{llll}2 & 1954\end{array}$ | 3.57 | $2 \begin{array}{llll}26 & 14.9\end{array}$ | $3 \cdot 79$ | $212 \begin{array}{lll}20 \cdot 2\end{array}$ | 4.04 | 2 2819.8 | $4 \cdot 32$ |
| 44 | $22120 \cdot 3$ | 3.31 | 17 56.I | 3.51 | 2 I 4 Ig I | $3 \cdot 74$ | 2 10 $27 \cdot 1$ | $3 \cdot 98$ | 621.3 | 4.25 | I $57 \cdot 2$ | $4 \cdot 57$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18{ }^{\circ}$ | $8^{\circ} \mathrm{A}$. | L. $19^{\circ}$ | - A. | L. $20^{\circ}$ | $0^{\circ} \mathrm{A}$. | L. $21^{\circ}$ | - A. | L. $22^{\circ}$ | A. | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | s. | S. | s. | S. | s. | S. | s. | s. | s. | S. | S. |
| 0 | - I. 36 | $-4.31$ | - I. 44 | $-4.34$ | - 1.53 | $-4.36$ | - I. 61 | $-4.39$ | - $\mathrm{I}_{1} \cdot 69$ | $-4.43$ | - $1 \cdot 78$ | $-4.46$ |
| 2 | I. 40 | $4 \cdot 32$ | 1.48 | $4 \cdot 35$ | I. 56 | $4 \cdot 38$ | I. 65 | 4.41 | I.73 | $4 \cdot 44$ | I.82 | $4 \cdot 48$ |
| 4 | I. 44 | $4 \cdot 33$ | I. 52 | $4 \cdot 36$ | I.6I | $4 \cdot 39$ | I. 69 | 4.43 | 1.78 | $4 \cdot 46$ | I.87 | $4 \cdot 50$ |
| 6 | I. 48 | $4 \cdot 35$ | r.56 | $4 \cdot 38$ | I. 65 | $4 \cdot 41$ | 1.74 | 4.44 | I. 82 | $4 \cdot 48$ | I.9I | $4 \cdot 52$ |
| 8 | I. 52 | $4 \cdot 36$ | I. 61 | $4 \cdot 39$ | I•70 | 4.43 | 1.78 | 4.46 | 1.87 | $4 \cdot 50$ | I.97 | 4.54 |
| 10 | 1.57 | $4 \cdot 38$ | 1. 66 | 4.41 | 1.75 | 4.45 | I. 84 | $4 \cdot 48$ | I 93 | $4 \cdot 53$ | 2.02 | $4 \cdot 56$ |
| 12 | 1.62 | $4 \cdot 40$ | 1.71 | $4 \cdot 43$ | 1.80 | $4 \cdot 47$ | I.89 | $4 \cdot 51$ | 1.98 | $4 \cdot 55$ | 2.08 | 4.59 |
| 14 | 1.67 | 4.42 | I.76 | 4.45 | 1.86 | 4.49 | I.95 | $4 \cdot 53$ | $2 \cdot 05$ | $4 \cdot 57$ | $2 \cdot 15$ | 4.62 |
| 16 | I•73 | 4.44 | I. 82 | $4 \cdot 48$ | I.92 | $4 \cdot 52$ | 2.02 | 4.56 | 2.II | $4 \cdot 60$ | $2 \cdot 22$ | $4 \cdot 65$ |
| 18 | I*79 | 4.46 | 1.89 | $4 \cdot 50$ | I.99 | $4 \cdot 55$ | 2.09 | $4 \cdot 59$ | 2.19 | $4 \cdot 64$ | 2.29 | $4 \cdot 69$ |
| 20 | I. 86 | 4.49 | I.96 | 4.53 | 2.06 | 4.58 | 2.16 | $4 \cdot 62$ | $2 \cdot 27$ | $4 \cdot 68$ | $2 \cdot 38$ | 4*73 |
| 22 | I.93 | $4 \cdot 52$ | 2.03 | $4 \cdot 57$ | $2 \cdot 14$ | $4 \cdot 61$ | $2 \cdot 24$ | $4 \cdot 66$ | $2 \cdot 35$ | $4 \cdot 72$ | $2 \cdot 47$ | $4 \cdot 78$ |
| 24 | $2 \cdot \mathrm{OI}$ | $4 \cdot 56$ | $2 \cdot 11$ | $4 \cdot 60$ | $2 \cdot 22$ | 4.65 | $2 \cdot 33$ | $4 \cdot 71$ | $2 \cdot 45$ | $4 \cdot 77$ | 2.57 | 4.83 |
| 26 | $2 \cdot 09$ | 4.59 | $2 \cdot 20$ | $4 \cdot 64$ | $2 \cdot 32$ | $4 \cdot 70$ | 2.43 | 4.76 | $2 \cdot 56$ | 4.82 | $2 \cdot 68$ | $4 \cdot 89$ |
| 28 | 2.18 | 4.64 | $2 \cdot 30$ | $4 \cdot 69$ | 2.42 | $4 \cdot 75$ | $2 \cdot 54$ | 4.8 I | 2.67 | $4 \cdot 88$ | 2.80 | 4.96 |
| 30 | $2 \cdot 28$ | $4 \cdot 68$ | 2.41 | $4 \cdot 74$ | $2 \cdot 53$ | 4.81 | 2.66 | 4.88 | $2 \cdot 80$ | 4.96 | $2 \cdot 94$ | 5.04 |
| 32 | $2 \cdot 40$ | $4 \cdot 74$ | 2.52 | 4.81 | $2 \cdot 66$ | 4.88 | $2 \cdot 80$ | 4.96 | $2 \cdot 95$ | 5.04 | $3 \cdot 10$ | 5.13 |
| 34 | 2.52 | 4.80 | $2 \cdot 66$ | 4.88 | 2.80 | 4.96 | 2.95 | $5 \cdot 04$ | $3 \cdot 11$ | 5.14 | $3 \cdot 28$ | $5 \cdot 24$ |
| 36 | 2.66 | $4 \cdot 88$ | 2.8 I | $4 \cdot 96$ | $2 \cdot 96$ | $5 \cdot 05$ | 3.13 | $5 \cdot 15$ | $3 \cdot 30$ | $5 \cdot 25$ | $3 \cdot 48$ | $5 \cdot 37$ |
| 38 | 2.82 | 4.96 | $2 \cdot 98$ | 5.06 | $3 \cdot 15$ | $5 \cdot 16$ | 3.33 | $5 \cdot 27$ | 3.52 | $5 \cdot 39$ | $3 \cdot 72$ | $5 \cdot 53$ |
| 40 | 3.00 | $5 \cdot 07$ | $3 \cdot 17$ | 5.18 | $3 \cdot 36$ | $5 \cdot 29$ | 3.56 | $5 \cdot 42$ | 3.78 | $5 \cdot 57$ | 4.01 | $5 \cdot 73$ |
| 41 | $3 \cdot 10$ | 5.13 | $3 \cdot 28$ | $5 \cdot 24$ | 3.48 | $5 \cdot 37$ | $3 \cdot 70$ | $5 \cdot 51$ | 3.93 | $5 \cdot 67$ | $4 \cdot 17$ | $5 \cdot 84$ |
| 42 | $3 \cdot 20$ | 5•19 | $3 \cdot 40$ | $5 \cdot 32$ | 3.61 | $5 \cdot 46$ | 3.84 | $5 \cdot 61$ | 4.09 | $5 \cdot 78$ | $4 \cdot 35$ | $5 \cdot 98$ |
| 43 | $3 \cdot 32$ | $5 \cdot 27$ | 3.53 | $5 \cdot 40$ | 3.76 | 5.55 | 4.01 | $5 \cdot 73$ | $4 \cdot 26$ | 5.90 | $4 \cdot 54$ | $6 \cdot 13$ |
| 44 | 3.45 | $5 \cdot 35$ | 3.68 | $5 \cdot 50$ | 3.92 | $5 \cdot 66$ | 4.18 | 5.85 | 4.45 | 6.05 | $4 \cdot 76$ | $6 \cdot 30$ |

## LATITUDE $13^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\stackrel{\circ}{\circ}$ | $\begin{array}{lrl} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 0 \cdot 0 \end{array}$ | S. $-92$ | $\begin{array}{ll} \text { H. M. } & \text { S. } \\ 5 & 59 \end{array} 4 \cdot 5$ | S. $\cdot 92$ | $\begin{array}{\|ccc} \text { H. M. } & \text { S. } \\ 5 & 58 & 9 \cdot 2 \end{array}$ | S. $\bullet 92$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 57 & 13 \cdot 6 \end{array}\right.$ | s. $\cdot 93$ | $\left\lvert\, \begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 56 & \text { I } 8 \cdot 0 \end{array}\right.$ | S. $\cdot 93$ | H. M. S. <br> $\begin{array}{lll}5 & 55 & 22 \cdot 2\end{array}$ | S. |
| 10 | $\begin{array}{llll}5 & 18 & 56 \cdot 2\end{array}$ | -94 | $5 \begin{array}{llll}5 & 17 & 59.5\end{array}$ | -95 | $\begin{array}{llll}5 & 17 & 19\end{array}$ | $\cdot 97$ | $\begin{array}{llll}5 & 16 & 3 \cdot 5\end{array}$ | -98 | 5 I5 $4 \cdot 1$ | 1.00 | $\begin{array}{llll}5 & 14 & 3.8\end{array}$ | I'OI |
| 12 | 5 10 43.1 | $\cdot 95$ | $\begin{array}{llll}5 & 9 & 45 \cdot 9\end{array}$ | $\cdot 96$ | $58847 \cdot 7$ | $\cdot 98$ | 57484 | 1.00 | $5 \quad 648 \cdot 1$ | I. 02 | $5 \quad 5 \quad 46 \cdot 5$ | 1.03 |
| 14 | $\begin{array}{llll}5 & 2 & 29 \cdot 7\end{array}$ | $\cdot 95$ | 5 1 1 $31 \cdot 9$ | $\cdot 97$ | 5033.0 | -99 | 45932.8 | I-OI | $\begin{array}{llll}4 & 58 & 31.4\end{array}$ | I.03 | $457128 \cdot 7$ | 1.06 |
| 16 | $454 \quad 16 \cdot 2$ | -96 | 453 I7.7 | -98 | $45218 \cdot 0$ | I.OI | 45156.8 | 1.03 | $4 \quad 5014.2$ | I.06 | 449 10.1 | I.08 |
| 18 | $\begin{array}{llll}4 & 46 & 2 \cdot 3\end{array}$ | -97 | $445 \quad 3 \cdot 1$ | I 00 | $444 \quad 2.4$ | 1.02 | $\begin{array}{lll}4 & 43 & 0.2\end{array}$ | r.05 | $44156 \cdot 2$ | I. 08 | $440 \quad 50 \cdot 7$ | I•II |
| 20 | $43748 \cdot 1$ | -99 | $43648 \cdot 1$ | - 1 | $43546 \cdot 4$ | 1.04 | $434 \begin{array}{llll}4 & 42 \cdot 9\end{array}$ | 1.07 | $43337 \cdot 6$ | I•10 | $43230 \cdot 4$ | I.I4 |
| 22 | $42933 \cdot 5$ | 1.00 | 42832.6 | I'03 | 42729.7 | 1.06 | $\begin{array}{llll}4 & 26 & 25 \cdot 0\end{array}$ | I-10 | $4 \begin{array}{lllllll}4 & 25 & 18 \cdot 1\end{array}$ | I•13 | $424 \quad 9 \cdot 2$ | I.17 |
| 24 | 42118.5 | I-02 | $42016 \cdot 5$ | I.05 | 41912.4 | 1.09 | 448 18 | 1 | 4 16 57•7 | I•16 | $41546 \cdot 9$ | I 20 |
| 26 | $413 \quad 3 \cdot 0$ | 1.03 | 4 II 59.8 | 1.07 | 4 IO 54.4 | I•II | $4 \quad 9 \quad 46 \cdot 5$ | I•15 | $4836 \cdot 2$ | I•I9 | $4 \quad 7 \quad 23.4$ | I 23 |
| 28 | $4 \quad 4 \quad 46 \cdot 9$ | $1 \cdot 05$ | $\begin{array}{llll}4 & 3 & 42 \cdot 5\end{array}$ | I.09 | 4* $2235 \cdot 5$ | I'14 | $4 \begin{array}{lll}4 & 159\end{array}$ | I•18 | 4 O I3.6 | 1.23 | $3 \begin{array}{llll}3 & 58 & 58\end{array}$ | $1 \cdot 27$ |
| 29 | 4 o $38 \cdot 7$ | 1.06 | $\begin{array}{llll}3 & 59 & 33 \cdot 5\end{array}$ | -II | $\begin{array}{lllll}3 & 58 & 25 \cdot 7\end{array}$ | I. 15 | $\begin{array}{llllllll}3 & 57 & 15 \cdot 2\end{array}$ | 1.20 | $\begin{array}{llll}3 & 56 & 19\end{array}$ | I. 25 |  | 1.29 |
| 30 | $3 \begin{array}{llll}3 & 56 & 30 \cdot 3\end{array}$ | 1.08 | $355 \quad 24.3$ | I'12 |  | I 17 | $\begin{array}{llll}3 & 53 & 4.2\end{array}$ | I. 22 | $35149 \cdot 8$ | I. 26 | $35032 \cdot 4$ | I'3I |
| 31 | $35221 \cdot 6$ | I.09 | 35114.9 | I•I3 | $3 \begin{array}{llll}3 & 50 & 5.4\end{array}$ | I•18 | $\begin{array}{lllll}3 & 48 & 52 \cdot 9\end{array}$ | I 23 | $34737 \cdot 3$ | I. 28 |  | I.34 |
| 32 | 348 I2.8 | I•IO | $\begin{array}{lll}3 & 47 & 5\end{array}$ | I• 5 | $34554 \cdot 8$ | I.20 | $3444 \mathrm{I} \cdot 2$ | I 25 | $34324 \cdot 5$ | 1.30 | 3424.6 | I. 36 |
| 33 | $\begin{array}{lll}3 & 44 & 3 \cdot 8\end{array}$ | I•II | $\begin{array}{llll}3 & 42 & 55 \cdot 4\end{array}$ | I•16 | 3 41 44\% | 1.22 | $340 \quad 29 \cdot 3$ | 1.27 | 339 II'3 | 1.33 | $33750 \cdot 0$ | 1.38 |
| 34 | $\begin{array}{llll}3 & 39 & 54 \cdot 5\end{array}$ | I'I3 | $\begin{array}{lllllllllll}3 & 38 & 45\end{array}$ | I.I8 | $\begin{array}{lllll}3 & 37 & 32 \cdot 8\end{array}$ | I. 24 | $33^{3} 617 \times 0$ | 1-29 | $\begin{array}{llll}3 & 34 & 57 \cdot 6\end{array}$ | 1.35 | $\begin{array}{lllll}3 & 33 & 34 \cdot 8\end{array}$ | I.4I |
| 35 | $\begin{array}{lllll}3 & 35 & 45 \cdot 1\end{array}$ | I-I4 | $\begin{array}{lllllllllllllllll}3 & 34 & 34 \cdot 8\end{array}$ | I 20 |  | I. 25 | $\begin{array}{llll}3 & 32 & 4 \cdot 2\end{array}$ | I•3I | $33043 \cdot 6$ | I 37 | $\begin{array}{lllll}3 & 29 & 19.2\end{array}$ | I 44 |
| 36 | $\begin{array}{llll}3 & 31 & 35 \cdot 3\end{array}$ | I•16 | $3 \begin{array}{llll}30 & 24 \cdot 1\end{array}$ | 22 | $\begin{array}{lll}3 & 29 & 9 \cdot 4\end{array}$ | 1.27 | $\begin{array}{lllll}3 & 27 & 51 \cdot I\end{array}$ | 1.34 | 32629.0 | 1.40 | 32503.1 | I.46 |
| 37 | $\begin{array}{llll}3 & 27 & 25 \cdot 3\end{array}$ | I•17 | $3 \begin{array}{lllll}3 & 26 & 13 \cdot 1\end{array}$ | 1.23 | $32457 \cdot 2$ | 1.30 | $\begin{array}{lllll}3 & 23 & 37 \cdot 5\end{array}$ | I. 36 | $\begin{array}{llll}3 & 22 & 13.9\end{array}$ | 1.43 | $32046 \cdot 3$ | I. 49 |
| 38 | $\begin{array}{llll}3 & 23 & 15 \cdot 1\end{array}$ | I'19 | $\begin{array}{lll}3 & 22 & 1.7\end{array}$ | 1.25 | 32044.5 | 1.32 | $\begin{array}{llll}3 & 19 & 23.4\end{array}$ | I.38 | 3 I7 $58 \cdot 3$ | 1.45 | 31629.0 | I. 52 |
| 39 | $\begin{array}{llll}3 & 19 & 4.5\end{array}$ | I | $31750 \cdot 0$ | I. 27 | $\begin{array}{llll}3 & 16 & 31 \cdot 5\end{array}$ | I. 34 | $315 \quad 8 \cdot 9$ | 1.41 | 3 I3 42.I | I.48 | $3 \begin{array}{llll}3 & 12 & 10.9\end{array}$ | I. 56 |
| 40 | $31453 \cdot 6$ | I 23 | $3 \begin{array}{llll}3 & \text { I3 } & 37.8\end{array}$ | $1 \cdot 30$ | $31218 \cdot 0$ | I 37 | $31053 \cdot 8$ | I.44 | $\begin{array}{llll}3 & 9 & 25 \cdot 3\end{array}$ | I.51 | $3 \begin{array}{llll}3 & 7 & 52 \cdot 2\end{array}$ | I.59 |
| 41 | $31042 \cdot 3$ | I. 25 | $\begin{array}{llll}3 & 9 & 25 \cdot 3\end{array}$ | I 32 | $3 \quad 8 \quad 4 \cdot 0$ | I. 39 | $\begin{array}{llll}3 & 6 & 38 \cdot 2\end{array}$ | I. 47 | $\begin{array}{lll}3 & 5 & 7 \cdot 8\end{array}$ | I. 55 | $\begin{array}{llll}3 & 3 & 32 \cdot 6\end{array}$ | I. 63 |
| 42 | $\begin{array}{lllll}3 & 6 & 30 \cdot 7\end{array}$ | I 27 | $\begin{array}{lllll}3 & 5 & 12 \cdot 3\end{array}$ | $1 \cdot 34$ | $\begin{array}{llll}3 & 3 & 49.4\end{array}$ | 1.42 | $\begin{array}{lllll}3 & 2 & 21.9\end{array}$ | I.50 | $3 \quad 0 \quad 49 \cdot 6$ | 1.58 | $2 \begin{array}{llll}2 & 12 \cdot 3\end{array}$ | I. 66 |
| 43 | $\begin{array}{llll}3 & 2 & 18 \cdot 7\end{array}$ | I-29 | $3 \quad 0 \quad 58.8$ | $1 \cdot 37$ | 25934.3 | 1.45 | $25885 \cdot 0$ | 1.53 | $25630 \cdot 6$ | 1. 62 | $25451 \cdot 1$ | I•70 |
| 44 | $\begin{array}{llll}2 & 58 & 6 \cdot 3\end{array}$ | I.32 | $2{ }^{2} 5644 \cdot 9$ | 1.40 | 255186 | 1.48 | $253147 \cdot 3$ | I. 56 | $25210 \cdot 9$ | 1. 65 | 25029.0 | I•74 |
| 45 | $2 \begin{array}{lllll}2 & 53 & 53 \cdot 4\end{array}$ | I. 34 | $25230 \cdot 4$ | 1.43 | $\begin{array}{llll}2 & 51 & 2 \cdot 3\end{array}$ | 1.5I | $24928 \cdot 9$ | 1.60 | $24750 \cdot 2$ | 1.69 | 2465 | I•79 |
| 46 | $24939 \cdot 9$ | 1.37 | $2{ }^{2}$ | I. 46 | $\begin{array}{llllllll}2 & 46 & 45 \cdot 2\end{array}$ | I.55 | $\begin{array}{lll}2 & 45 & 9 \cdot 7\end{array}$ | I. 64 | $\begin{array}{llll}2 & 43 & 28 \cdot 6\end{array}$ | 1.73 | $\begin{array}{llll}2 & 41 & 415 \\ 2 & 37\end{array}$ | I. 84 |
| 47 | $24526 \cdot 0$ | 1.40 | $243 \quad 59 \cdot 5$ | I. 49 | 24227.4 | I. 58 | $24049 \cdot 6$ | I. 68 | $\begin{array}{lll}2 & 39 & 5 \cdot 9\end{array}$ | 1.78 | $23716 \cdot 0$ | I. 89 |
| 48 | 24111.5 | 1.43 | $23943{ }^{\circ} \mathrm{O}$ | 1.52 | $\begin{array}{llll}2 & 38 & 8 \cdot 7\end{array}$ | 1.62 | $2 \begin{array}{llll}2 & 36 & 28 \cdot 5\end{array}$ | 1.72 | $23442 \cdot 1$ | 1.83 | $23249 \cdot 2$ | I.94 |
| 49 | $23656 \cdot 3$ | 1.46 | $235 \quad 25 \cdot 8$ | 1.56 | 23349.2 | 1.66 | $\begin{array}{lll}2 & 32 & 6 \cdot 4\end{array}$ | 1.77 | $23017 \cdot 1$ | I. 88 | $2 \begin{array}{lllll}2 & 28 & 20.9\end{array}$ | $2 \cdot 00$ |
| 50 | $23240 \cdot 5$ | I.49 | $\begin{array}{llll}2 & 31 & 7 \cdot 8 \\ 2 & 26 & 8\end{array}$ | I. 60 | 22928.7 | I•71 | $\begin{array}{lllll}2 & 27 & 43 \cdot 1\end{array}$ | 1.82 |  | 1.93 | $22351 \cdot 1$ | 2.06 |
| 51 | $2 \begin{array}{llll}28 & 23.9\end{array}$ | I.53 | $22648 \cdot 8$ | I. 64 | $\begin{array}{llll}2 & 25 & 7.2\end{array}$ | $1 \cdot 75$ | $\begin{array}{llll}2 & 23 & 18.6\end{array}$ | 1.87 | 22122.9 | 1.99 | $2 \begin{array}{llllllllll} & 19 & 19.6\end{array}$ | $2 \cdot 12$ |
| 52 | 2246.5 | I.57 | $22228 \cdot 9$ | I. 68 | 22044.6 | I.80 | $21852 \cdot 7$ | 1.93 | 2 I6 53.5 | $2 \cdot 05$ | $21446 \cdot 2$ | $2 \cdot 19$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{\circ}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | s. | s. | s. | s. | S. | S. | S. | s. | S. | s. | s. |
| $\bigcirc$ | -00 | $-4 \cdot 10$ | $-.07$ | -4.10 | - . 15 | -4.II | - 22 | -4.11 | - 29 | $-4.11$ | - 37 | $-4.12$ |
| 4 | $\cdot 97$ | $4 \cdot 10$ | -14 | $4 \cdot 11$ | -21 | $4 \cdot 11$ | -29 | $4 \cdot 12$ | $\cdot 36$ | $4 \cdot 12$ | - 44 | $4 \cdot 13$ |
| 8 | - 13 | $4 \cdot 11$ | -21 | 4.II | -28 | 4.11 | $\cdot 36$ | $4 \cdot 12$ | -43 | $4 \cdot 13$ | 51 | 4. I4 |
| 10 | -17 | $4 \cdot 11$ | $\cdot 24$ | 4.11 | $\cdot 32$ | $4 \cdot 12$ | $\cdot 39$ | $4 \cdot 12$ | $\cdot 47$ | $4 \cdot 13$ | $\cdot 54$ | 4.14 |
| 12 | -20 | $4 \cdot 11$ | $\cdot 28$ | $4 \cdot 11$ | -35 | $4 \cdot 12$ | -43 | $4 \cdot 13$ | -5 | $4 \cdot 14$ |  | $4 \cdot 15$ |
| 14 | . 24 | 4.11 | $\cdot 31$ | 4.12 | $\cdot 39$ | 4.12 | . 47 | $4 \cdot 13$ | . 54 | $4 \cdot 14$ $4 \cdot 15$ | .62 .66 | $4 \cdot 15$ 4.16 |
| 18 | $\cdot 31$ | $4 \cdot 11$ 4 | -39 | ${ }_{4}^{4} 122$ | -43 | 4.13 4.13 | . 51 | $4 \cdot 14$ 4.14 | . 58 | $4 \cdot 15$ 4.15 | $\cdot 70$ | 4.16 4.17 |
| 20 | -34 | $4 \cdot 12$ | -43 | $4 \cdot 13$ | -51 | $4 \cdot 14$ | - 59 | $4 \cdot 15$ | $\cdot 67$ | $4 \cdot 16$ | $\cdot 75$ | 4.17 |
| 22 | $\cdot 38$ | $4 \cdot 12$ | -46 | $4 \cdot 13$ | $\cdot 55$ | 4-14 | . 63 | $4 \cdot 15$ | $\cdot 71$ | 4.17 | $\cdot 79$ | 4•18 |
| 24 | -42 | $4 \cdot 13$ | $\cdot 51$ | 4.14 | -59 | $4 \cdot 15$ | . 67 | $4 \cdot 16$ | $\cdot 76$ | $4 \cdot 17$ | -84 | 4•19 |
| 26 | -46 | $4 \cdot 13$ | - 55 | 4.14 | . 63 | $4 \cdot 15$ | $\cdot 72$ | $4 \cdot 17$ | . 80 | $4 \cdot 18$ | . 89 | 4.20 |
| 28 | -51 | 4.13 | -59 | $4 \cdot 15$ | -68 | $4 \cdot 16$ | -77 | $4 \cdot 18$ | . 85 | 4. 19 | -94 | 4.21 |
| 30 | $\cdot 55$ | $4 \cdot 14$ | -64 | $4 \cdot 15$ | $\cdot 73$ | $4 \cdot 17$ | . 82 | $4 \cdot 19$ | -91 | $4 \cdot 20$ | 1.00 | 4.22 |
| 32 | $\cdot 57$ | $4 \cdot 15$ | -69 | 4.16 | $\cdot 78$ | 4.18 | . 87 | $4 \cdot 20$ | -96 | $4 \cdot 22$ | 1.06 | 4.24 |
| 34 | .65 .70 | $4 \cdot 16$ $4 \cdot 16$ | $\cdot 74$ | $4 \cdot 17$ $4 \cdot 18$ |  | 4.19 | . 93 | 4.21 | 1.02 | 4.23 4.25 | I.12 | $4 \cdot 26$ |
| 36 38 | -70 | 4.16 4.17 | .79 | $4 \cdot 18$ 4.19 | . 89 | 4.20 4.21 | .99 $\times 105$ | 4.22 4.24 | 1.09 1 16 | 4.25 4.26 | I.19 1. 26 | 4.27 4.29 |
| 40 | $\cdot 81$ | 4-18 | $\cdot 91$ | $4 \cdot 2 \mathrm{I}$ | $1 \cdot 02$ | 4.23 | I-12 | $4 \cdot 26$ | 1.23 | 4.29 | 1.34 | $4 \cdot 32$ |
| 42 | -87 | 4-19 | -98 | $4 \cdot 22$ | $1 \cdot 09$ | 4.25 | $1 \cdot 20$ | $4 \cdot 28$ | 1.31 | $4 \cdot 31$ | $1 \cdot 43$ | $4 \cdot 35$ |
| 44 | 94 | 4.21 | I. 05 | 4.24 | 1.16 | 4.27 | 1.28 | $4 \cdot 30$ | 1.40 | $4 \cdot 34$ | I. 52 | $4 \cdot 38$ |
| 46 | r - 01 | $4 \cdot 23$ | I.13 | $4 \cdot 26$ | I. 25 | $4 \cdot 29$ | $1 \cdot 37$ | 4.33 | 1-49 | $4 \cdot 37$ | $1 \cdot 62$ | 4.41 |
| 48 | r.09 | $4 \cdot 25$ | I.21 | $4 \cdot 28$ | I-34 | $4 \cdot 32$ | 1.47 | $4 \cdot 36$ | I. 60 | 4.41 | 1.74 | $4 \cdot 46$ |
| 50 | $1 \cdot 17$ | 4.27 | $1 \cdot 31$ | 4.31 | I. 44 | $4 \cdot 35$ | 1.58 | 4.40 | 1.72 | 4.45 | 1.87 | $4 \cdot 51$ |
| 52 | $1 \cdot 27$ | 4.30 | 1.41 | 4.34 | 1.55 | 439 | 1.70 | 4.44 | 1. 86 | $4 \cdot 50$ | 2.02 | $4 \cdot 57$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $8^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. S. | S. | H. M. S. | s. | H. M. S. | s. | H. M. S. | s. | H. M. S. | s. |
| o | $\begin{array}{llll}5 & 54 & 26 \cdot 3\end{array}$ | - 93 | $\begin{array}{llll}5 & 53 & 30 \cdot 2\end{array}$ | - 94 | $515233 \cdot 8$ | - 94 | $55137 \cdot 1$ | - 95 | $55040 \cdot 1$ | - 95 | $\begin{array}{lllll}5 & 49 & 42 \cdot 7\end{array}$ | - .96 |
| 8 | $\begin{array}{llll}5 & 21 & 20 \cdot 4\end{array}$ | I.OI | 512019.4 | I'02 | $\begin{array}{lll}5 & 19 & 17 \cdot 6\end{array}$ | I 04 | $5 \begin{array}{lllll}5 & 18 & 14.7\end{array}$ | I.06 | 5 17 10.9 | 1.07 | $5{ }_{5}^{5} 16$ | I•09 |
| 10 | $\begin{array}{llll}5 & 13 & 2 \cdot 5\end{array}$ | I.03 | 5 I2 0.1 | I.05 | 5 10 $56 \cdot 7$ | I.07 | $\begin{array}{lllll}5 & 9 & 52 \cdot 0\end{array}$ | $1 \cdot 09$ | $\begin{array}{llll}5 & 8 & 46 \cdot 2\end{array}$ | I•II | $57839 \cdot 1$ | I'I3 |
| 12 | $\begin{array}{llll}5 & 4 & 43.9\end{array}$ | I.05 | $\begin{array}{lll}5 & 3 & 40 \cdot 0\end{array}$ | I.08 | $\begin{array}{llll}5 & 2 & 34 \cdot 8\end{array}$ | I'IO | $\begin{array}{llll}5 & 1 & 28.4\end{array}$ | I•I2 | 5 \% $\quad 20 \cdot 5$ | I.14 | 459 II I I | I.17 |
| 14 | $\begin{array}{lllll}4 & 56 & 24 \cdot 6\end{array}$ | I.08 | 455519.1 | 1-10 | $45412 \cdot 1$ | I'I3 | $4 \begin{array}{lll}4 & 53 & 3.6\end{array}$ | I•15 | $45153 \cdot 5$ | I.I8 | $4504 \mathrm{I} \cdot 7$ | I.2I |
| 16 | $4 \begin{array}{lll}4 & 48 & 4 * 4\end{array}$ | I•II | $44657 \cdot 2$ | I•I3 | $44548 \cdot 2$ | I•I6 | $44437 \cdot 6$ | 1•19 | $44325 \cdot 2$ | I*22 | $442 \begin{array}{lll}1009\end{array}$ | I*25 |
| 18 | $439343 * 4$ | I•I4 | $\begin{array}{llll}4 & 38 & 34^{\circ} 2\end{array}$ | I•17 | $\begin{array}{llll}4 & 37 & 23 \cdot 3\end{array}$ | I.20 | $43610 \cdot 4$ | $\underline{1} 23$ | $4{ }^{4} 34555^{\circ} 5$ | I•27 | $4 \begin{array}{llll}4 & 33 & 38 \cdot 5\end{array}$ | I.30 |
| 20 | 4 3I 2I•3 | I•I7 | $43010 \cdot 2$ | I 20 | 428 57•0 | I 24 | 42741.6 | 1.27 | $42624^{\circ} \mathrm{I}$ | I•3I | $4254{ }^{4} 3$ | I•35 |
| 22 | $42258{ }^{4} \mathrm{I}$ | I•20 | $42144^{\circ} 9$ | I. 24 | $42029 \cdot 3$ | I. 28 | 4 I9 II.4 | 1•32 | 4 I7 5I*O | I•36 | $41628 \cdot 1$ | 1.40 |
| 24 | $41433 \cdot 8$ | I•24 | $41318 \cdot 2$ | I.28 | $412 \quad 0 \cdot 1$ | I-32 | 4 Io $39 * 4$ | 1*37 | 4916.0 | I-4I | $4749 \cdot 8$ | I*46 |
| 25 | $4102 I^{\circ} \mathrm{I}$ | I*26 | $4 \quad 9 \quad 4{ }^{4} 3$ | I•30 | $4744^{\circ} 9$ | I•35 | $\begin{array}{llll}4 & 6 & 22 \cdot 7\end{array}$ | r•39 | $4457 \cdot 7$ | I.44 | $\begin{array}{llll}4 & 3 & 29 \cdot 8\end{array}$ | I*49 |
| 26 | $4{ }_{4} 6880$ | I*28 | $4450 \cdot 0$ | I•32 | 4329.2 | $1 \cdot 37$ | $\begin{array}{llll}4 & 2 & 5 \cdot 5\end{array}$ | $1 \cdot 42$ | $4 \quad 038 \cdot 9$ | 1.47 | 3 59 $9 \bullet$ | I. 52 |
| 27 | 4 I $54^{\circ} 6$ | I•30 | $4 \quad 0 \quad 35^{\circ} 2$ | I•35 | $\begin{array}{llll}3 & 59 & 13 \cdot 0\end{array}$ | I.40 | $\begin{array}{lllllllllll}3 & 57 & 47 *\end{array}$ | I.45 | $\begin{array}{llll}3 & 56 & 19.4\end{array}$ | 1.50 | $\begin{array}{llllllllll}3 & 54 & 47 \cdot 8\end{array}$ | I.55 |
| 28 | $35740 \cdot 8$ | 1.32 | $3{ }^{3} 5620 \cdot 1$ | 1.37 | $\begin{array}{llll}3 & 54 & 56 \cdot 3\end{array}$ | I 42 | $\begin{array}{llll}3 & 53 & 29 \cdot 4\end{array}$ | 1.47 | 35159 | $\pm .53$ | $\begin{array}{llll}3 & 50 & 25 \cdot 8\end{array}$ | I. 59 |
| 29 | $35326 \cdot 6$ | I'34 | $\begin{array}{lll}3 & 52 & 4.4\end{array}$ | I.40 | $35039 \cdot 1$ | 1.45 | 349 10.5 | I.5I | $34738 \cdot 4$ | I.56 | 3 46 3 | I-62 |
| 30 | 34912.0 | 1.37 | $3 \quad 4748 \cdot 3$ | 1.42 | 34621.4 | I.48 | $344 \begin{array}{lll}31 \cdot 0\end{array}$ | 1.54 | 343 r7'1 | 1.60 | $34139 * 5$ | x-66 |
| 31 | $34456 \cdot 8$ | I•39 | $34331 \cdot 6$ | I*45 | $3423^{3} 0$ | I.5I | $34030 \cdot 8$ | I. 57 | $\begin{array}{llll}3 & 38 & 54 \%\end{array}$ | I. 63 | 33 3 15 | I•70 |
| 32 | $34041 \cdot 2$ | I. 42 | $\begin{array}{llllllllllll}3 & 39 & 14.4\end{array}$ | 1.48 | $3 \begin{array}{llll}3 & 37 & 44^{\circ}\end{array}$ | 1.54 | $\begin{array}{llll}3 & 36 & 9 \cdot 9\end{array}$ | I. 60 | $3 \begin{array}{lllll}3 & 34 & 319\end{array}$ | I. 67 | $3 \begin{array}{llll}32 & 49 \cdot 9\end{array}$ | I•73 |
| 33 | $\begin{array}{llll}3 & 36 & 25 \cdot 1\end{array}$ | I 44 | $33456 \cdot 6$ | I.51 | $3{ }^{3} 33124 \cdot 3$ | 1.57 | $\begin{array}{llll}3 & 31 & 48 \cdot 2\end{array}$ | 1.64 | 33080 | I•70 | $\begin{array}{llll}3 & 28 & 23.7\end{array}$ | r•78 |
| 34 | $\begin{array}{llll}3 & 32 & 8 \cdot 4\end{array}$ | 1.47 | $33038 \cdot 1$ | I.54 | 3 29 4 | r.60 | 32725.8 | I. 67 | $32543 \cdot 3$ | I.74 | $\begin{array}{lllllllllllll}3 & 23 & 56 \cdot 4\end{array}$ | I. 82 |
| 35 | $3 \begin{array}{lll}3 & 27 & 51 \cdot I\end{array}$ | I. 50 | 32619.0 | 1.57 | $\begin{array}{llll}3 & 24 & 42 \cdot 8\end{array}$ | I. 64 | $\begin{array}{lll}3 & 23 & 2.4 \\ 3 & \end{array}$ | 1.71 | $32117 \cdot 6$ | I. 78 | $3 \begin{array}{lll}3 & 19 & 28 \cdot 2\end{array}$ | I. 86 |
| 36 | $\begin{array}{llll}3 & 23 & 33 \cdot 2\end{array}$ | 1.53 | $\begin{array}{llllllllll}3 & 21 & 59.2\end{array}$ | I. 60 | $\begin{array}{llll}3 & 20 & 20 \cdot 9\end{array}$ | I. 67 | $\begin{array}{llll}3 & 18 & 38 \cdot 2\end{array}$ | I.75 | $\begin{array}{llll}3 & 16 & 50.9\end{array}$ | 1.83 | $3 \mathrm{I} 4{ }^{3} 58 \cdot 8$ | I.91 |
| 37 | 3 I9 14.6 | I. 56 | 3 17  | I. 64 | $31558 \cdot 1$ | I•71 | 31413.0 | I'79 | $\begin{array}{lllll}3 & 12 & 23 \cdot 1\end{array}$ | 1.87 | 3 Io $28 \cdot I$ | I. 96 |
| 38 | $\begin{array}{llll}3 & 14 & 55 \cdot 3\end{array}$ | I. 60 | $31317 \cdot 2$ | I. 67 | 3 II 34.4 | I.75 | $\begin{array}{llll}3 & 9 & 46 \cdot 8\end{array}$ | I. 84 | $\begin{array}{llll}3 & 7 & 54 \cdot 1\end{array}$ | 1.92 | $\begin{array}{llll}3 & 5 & 56 \cdot I\end{array}$ | 2.01 |
| 39 | 3 Io $35 \cdot 3$ | I. 63 | 38854.9 | I•71 | $\begin{array}{lll}3 & 7 & 9.7\end{array}$ | I'79 | $\begin{array}{llll}3 & 5 & 19.5\end{array}$ | I. 88 | $3 \quad 3 \quad 23.9$ | 1.97 | $\begin{array}{llll}3 & 1 & 22.7\end{array}$ | $2 \cdot 07$ |
| 40 | $\begin{array}{llll}3 & 6 & 14.4\end{array}$ | 1.67 | $3431 \times 7$ | I.75 | $3 \quad 244^{\circ} \mathrm{O}$ | I. 84 | $3 \quad 0 \quad 50 \cdot 9$ | I'93 | $2 \begin{array}{llll}2 & 58 & 52 \cdot 3\end{array}$ | 2.03 | 22 56 47 | $2 \cdot 12$ |
| 41 | $\begin{array}{llll}3 & 1 & 52 \cdot 6\end{array}$ | I•71 | 3 lll | I.80 | 25817.1 | I.89 | $2 \begin{array}{lll}26 & 21\end{array}$ | I.98 | 25419.2 | 2.08 | $25^{52}$ 1113 | $2 \cdot 19$ |
| 42 | $25730 \cdot 0$ | 1•75 | $25542 \cdot 3$ | I.84 | $25349{ }^{\circ} \mathrm{O}$ | I.94 | 25149.9 | $2 \cdot 04$ | $24944 \cdot 6$ | $2 \cdot 14$ | 24732.9 | $2 \cdot 25$ |
| 43 | $\begin{array}{llll}2 & 53 & 6 \cdot 3\end{array}$ | I•79 | $251515 \cdot 8$ | I.89 | 24919.5 | I.99 | 2  <br> 2 47 <br> 17  | 2.09 | $24580 \cdot 2$ | $2 \cdot 20$ | $24252 \cdot 6$ | $2 \cdot 32$ |
| 44 | 248415 | I.84 | $24648 \cdot 1$ | I.94 | $2444^{8 \cdot 7}$ | $2 \cdot 04$ | $2 \begin{array}{lll}2 & 42 & 42 \cdot 8\end{array}$ | $2 \cdot 15$ | $24030 \cdot 1$ | $2 \cdot 27$ | 23810.2 | $2 \cdot 39$ |
| 45 | $24415 \cdot 5$ | I. 89 | 242 I9•1 | I•99 | 240 I6.2 | $2 \cdot 10$ | $\begin{array}{lll}2 & 38 & 6 \cdot 6\end{array}$ | $2 \cdot 22$ | $23549 \cdot 9$ | $2 \cdot 34$ | 233350.5 | $2 \cdot 47$ |
| 46 | 239484 | I.94 | $23748 \cdot 6$ | $2 \cdot 05$ | $23542 \cdot 1$ | $2 \cdot 17$ | $2 \begin{array}{llll}2 & 33 & 28 \cdot 6\end{array}$ | $2 \cdot 29$ | $2 \begin{array}{lll}21 & 31\end{array}$ | $2 \cdot 42$ |  | $2 \cdot 56$ |
| 47 | $\begin{array}{llll}2 & 35 & 19 \cdot 6\end{array}$ | $2 \cdot 00$ | $2 \begin{array}{llll}23 & 16 \cdot 5\end{array}$ | $2 \cdot 11$ | $2316 \cdot 2$ | $2 \cdot 23$ | $22848 \cdot 4$ | $2 \cdot 36$ | 22622.6 | $2 \cdot 50$ | $2 \begin{array}{llllllllllllllllll}2 & 23 & 48\end{array}$ | $2 \cdot 65$ |
| 48 | $\begin{array}{lllll}2 & 30 & 49 \cdot 5\end{array}$ | $2 \cdot 05$ | $2 \begin{array}{lllll}2 & 28 & 42.6\end{array}$ | $2 \cdot 18$ | $\begin{array}{llll}2 & 26 & 28 \cdot 2\end{array}$ | $2 \cdot 31$ | $2 \begin{array}{lll}24 & 5 \cdot 9\end{array}$ | 2.44 | $22135 \cdot 1$ | $2 \cdot 59$ | $2 \begin{array}{lllllll}2 & 18 & 5 \cdot 2\end{array}$ | $2 \cdot 74$ |
| 49 | 22617.6 | 2.12 | 2246.8 | $2 \cdot 25$ | $22148 \cdot 0$ | $2 \cdot 38$ | 21920.9 | 2.53 | $21644 \cdot 6$ | 2.68 |  | $2 \cdot 85$ |
| VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | 6 | A. | L. $7^{\circ}$ | A. | L. $8^{\circ}$ | A. | L. $9^{\circ}$ | A. | L. 10 | A. | L. 11 | A. |
| $\bigcirc$ | s. | S. | S. | S. | S. | s. | s. | s. | S. | S. | S. | S. |
| 0 | -44 | $4 \cdot 13$ | 52 | 4.14 | $\cdot 59$ | 4*15 | - 67 | 4.16 | $\cdot 74$ | 4•17 | - 82 | 4.19 |
| 4 | $\cdot 51$ | $4 \cdot 14$ | - 59 | $4 \cdot 15$ | - 66 | $4 \cdot 16$ | $\cdot 74$ | $4 \cdot 17$ | .81 | 4.19 | -89 | $4 \cdot 20$ |
| 6 | $\cdot 55$ | $4 \cdot 14$ | -62 | $4 \cdot 15$ | $\cdot 70$ | $4 \cdot 16$ | $\cdot 78$ | 4.18 | . 85 | $4: 19$ | -93 | 4.21 |
| 8 | -58 | 4.15 | - 66 | 4.16 | $\cdot 74$ | $4 \cdot 17$ | -81 | 4.19 | -89 | $4 \cdot 20$ | -97 | 4.22 |
| 10 | -62 | 4.15 | $\cdot 70$ | 4.16 | $\cdot 78$ | $4 \cdot 18$ | $\cdot 85$ | 4•19 | '93 | $4 \cdot 21$ | r.OI | $4 \cdot 23$ |
| 12 | - 66 | 4.16 | $\cdot 74$ | $4 \cdot 17$ | . 82 | 4.19 | -90 | $4 \cdot 20$ | -98 | 4.22 | 1.06 | $4 \cdot 24$ |
| 14 | -70 | $4 \cdot 16$ | $\cdot 78$ | 4.18 | . 86 | $4 \cdot 19$ | -94 | 4.21 | 1.02 | $4 \cdot 23$ | I-10 | 4.25 |
| 16 | $\cdot 74$ | 4.17 | - 82 | 4.19 | -90 | $4 \cdot 20$ | -98 | $4 \cdot 22$ | 1.07 | $4 \cdot 24$ | I'15 | $4 \cdot 26$ |
| 18 | $\cdot 79$ | 4-18 | $\cdot 87$ | 4.20 | $\cdot 95$ | $4 \cdot 21$ | 1.03 | $4 \cdot 23$ | I'I2 | 4.25 | I. 20 | $4 \cdot 28$ |
| 20 | -83 | $4 \cdot 19$ | -91 | 4.21 | I-00 | $4 \cdot 22$ | I.08 | $4 \cdot 25$ | I•I7 | 4.27 | I. 26 | $4 \cdot 29$ |
| 22 | - 88 | $4 \cdot 20$ | -96 | $4 \cdot 22$ | I.05 | 4.24 | I'I3 | $4 \cdot 26$ | I 22 | 4.28 | I•31 | $4 \cdot 31$ |
| 24 | -93 | $4 \cdot 2 \mathrm{I}$ | I.OI | $4 \cdot 23$ | I'IO | $4 \cdot 25$ | I-19 | $4 \cdot 27$ | I-28 | $4 \cdot 30$ | I.37 | $4 \cdot 33$ |
| 26 | -98 | 4.22 | I.07 | $4 \cdot 24$ | I'16 | $4 \cdot 27$ | I. 25 | $4 \cdot 29$ | I 34 | $4 \cdot 32$ | I.44 | $4 \cdot 35$ |
| 28 | I.03 | $4 \cdot 23$ | I'I3 | $4 \cdot 26$ | I. 22 | $4 \cdot 28$ | I 31 | 4.31 | I.4I | $4 \cdot 34$ | I.5I | $4 \cdot 37$ |
| 30 | I.09 | $4 \cdot 25$ | I'I9 | 4.27 | I-28 | $4 \cdot 30$ | I.38 | $4 \cdot 33$ | I. 48 | $4 \cdot 36$ | I. 58 | 4.40 |
| 32 | I.15 | $4 \cdot 26$ | I. 25 | $4 \cdot 29$ | I 35 | $4 \cdot 32$ | I.45 | $4 \cdot 35$ | I. 56 | $4 \cdot 39$ | I. 66 | $4 \cdot 43$ |
| 34 | I'22 | $4 \cdot 28$ | I•32 | $4 \cdot 31$ | I.43 | 4.35 | I. 53 | $4 \cdot 38$ | I. 64 | $4 \cdot 42$ | I•75 | $4 \cdot 46$ |
| 36 | I 29 | $4 \cdot 30$ | I. 40 | $4 \cdot 34$ | I.5I | $4 \cdot 37$ | I. 62 | $4 \cdot 41$ | I•73 | $4 \cdot 45$ | I. 84 | -4.50 |
| 38 | $1 \cdot 37$ | $4 \cdot 33$ | 1.48 | $4 \cdot 36$ | I. 59 | 4.40 | I•8 | 4.45 | I.83 | $4 \cdot 49$ | I.95 | 4.54 |
| 40 | 1.45 | $4 \cdot 36$ | 1.57 | $4 \cdot 39$ | I. 69 | 4.44 | I.8I | 4.49 | I. 94 | $4 \cdot 54$ | 2.07 | $4 \cdot 59$ |
| 42 | I. 55 | $4 \cdot 39$ | 1. 67 | 4.43 | 1•79 | 4.48 | I.92 | $4 \cdot 53$ | $2 \cdot 06$ | 4.59 | 2.19 | $4 \cdot 66$ |
| 44 | I. 65 | $4 \cdot 42$ | I• 78 | $4 \cdot 47$ | I-91 | $4 \cdot 53$ | $2 \cdot 05$ | $4 \cdot 59$ | $2 \cdot 19$ | $4 \cdot 65$ | $2 \cdot 34$ | $4 \cdot 73$ |
| 46 | I.76 | 4.47 | 1.90 | $4 \cdot 52$ | $2 \cdot 04$ | $4 \cdot 58$ | $2 \cdot 19$ | $4 \cdot 65$ | $2 \cdot 34$ | 4.73 | $2 \cdot 51$ | $4 \cdot 81$ |
| 48 | I. 88 | $4 \cdot 52$ | $2 \cdot 03$ | $4 \cdot 58$ | $2 \cdot 19$ | $4 \cdot 65$ | $2 \cdot 35$ | $4 \cdot 73$ | $2 \cdot 52$ | 4.82 | $2 \cdot 70$ | 4.91 |
| 49 | I 95 | $4 \cdot 55$ | $2 \cdot 11$ | $4 \cdot 61$ | $2 \cdot 27$ | 4.69 | $2 \cdot 44$ | $4 \cdot 77$ | $2 \cdot 62$ | $4 \cdot 87$ | $2 \cdot 8 \mathrm{I}$ | 4.97 |

## 176 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $13^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. S. | s. | H. M. S. | S. | H. M. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $\begin{array}{lllllllll}5 & 48 & 44.9\end{array}$ | - 97 | $54746 \cdot 7$ | - 997 | $54648 \cdot 0$ | - 98 | $\begin{array}{llll}5 & 45 & 48 \cdot 8\end{array}$ | - 99 | $54449 \cdot 0$ | - I.00 | $54348 \cdot 6$ | -I.OI |
| 6 |  | 1.07 | $522 \begin{array}{llll}5 & 23\end{array}$ | r.09 | $52117 \cdot 1$ | I'II | 520 10.1 | I-I3 | 5 I9 $2 \cdot 0$ | I'I5 | 5 I7 52.6 | I'I7 |
| 8 | 5 I4 59.9 | I•II |  | I•I3 | 5124402 | I-I5 | 5 II 34.3 | I•17 | 5 IO $23 \cdot 2$ | I. 20 | $\begin{array}{llll}5 & 9 & 10.6\end{array}$ | I. 22 |
| 10 | $\begin{array}{llll}5 & 6 & 30 \cdot 7\end{array}$ | I-I5 | 5 | I•I7 | $\begin{array}{llll}5 & 4 & 97\end{array}$ | I. 20 | $\begin{array}{llll}5 & 2 & 57 \cdot 0\end{array}$ | I 22 | 5 I $42 \cdot 7$ | I. 25 | 5 5 0 26.7 | I. 28 |
| 12 | $4 \begin{array}{lll}4 & 58 & 0 \cdot 3\end{array}$ | I•19 | $\begin{array}{lllllll}4 & 56 & 47 \cdot 8\end{array}$ | 1.22 | $4 \quad 55 \quad 33 \cdot 7$ | I 25 | 4541779 | I 28 | 4530.2 | I.3I | $45140 \cdot 7$ | I 34 |
| 14 | $449828 \cdot 3$ | I. 24 | 44813.0 | 1.27 | $44655 \cdot 9$ | I.30 | $44536 \cdot 8$ | I'34 | 44415.6 | $1 \cdot 37$ | 44252.4 | 1.41 |
| I6 | $44054 \cdot 7$ | I 29 | $4 \begin{array}{llll}4 & 39 & 36 \cdot 4\end{array}$ | I 32 | $43^{8}$ I6•I | I.36 | $4 \begin{array}{llll}4 & 36 & 53 \cdot 6\end{array}$ | I. 39 | $435 \quad 28 \cdot 7$ | I.43 | $434 \quad 1 \cdot 5$ | I 47 |
| 18 | $432 \begin{array}{llll}4 & 19 & 3\end{array}$ | I 34 | $430 \quad 57 \cdot 9$ | 1.38 | 42934.2 | 1.42 | 428880 | 1.46 | $42639 \cdot 3$ | 1.50 | $\begin{array}{lll}4 & 25 & 7 \cdot 9\end{array}$ | r. 55 |
| 20 | $42342 \cdot 0$ | I•39 | $42217 \cdot 3$ | 1.43 | 42049.9 | I.48 | 4 I9 19.9 | I 52 | 4 I7 47.0 | 1.57 | 4 16 II 2 | I. 62 |
| 21 | 41922.6 | I. 42 | 4 I7 56.1 | I. 46 | $416 \quad 26 \cdot 9$ | I. 51 | 4 I4 54.8 | I.56 | $4 \begin{array}{llll}4 & 19 & 7\end{array}$ | I.6I | 4 II 4I•6 | I. 66 |
| 22 | $4 \begin{array}{lll}4 & 15 & 2 \cdot 6\end{array}$ | I.45 | $4 \begin{array}{lll}43 & 34 & 3\end{array}$ | I 50 | 412311 | I•54 | 4 Io 28.9 | 1.60 | 488516 | 1.65 | 47 II•I | I•70 |
| 23 | 4 IO $41 \cdot 9$ | I. 48 | 4 9 II•7 | 1.53 | $47738 \cdot 6$ | I. 58 | $4 \begin{array}{lll}4 & 6 & 2 \cdot 2\end{array}$ | 1. 63 | $4 \quad 422 \cdot 6$ | I.69 | $\begin{array}{llll}4 & 2 & 39 \cdot 6\end{array}$ | I•75 |
| 24 | $\begin{array}{llll}4 & 6 & 20 \cdot 7\end{array}$ | I.5I | $\begin{array}{llll}4 & 4 & 48 \cdot 6\end{array}$ | I. 56 | $\begin{array}{lrrr}4 & 3 & 13 \cdot 3\end{array}$ | I. 62 | 4 I $434 \cdot 7$ | I. 67 | $\begin{array}{llll}3 & 59 & 52 \cdot 7\end{array}$ | 1.73 | 3 58 $7 \cdot 1$ <br>  5  | I'79 |
| 25 | $\begin{array}{lrrr}4 & 1 & 58 \cdot 8\end{array}$ | I. 54 | $4 \quad 024.7$ | I. 60 |  | I. 65 | $\begin{array}{llll}3 & 57 & 6 \cdot 3\end{array}$ | I•71 | 35521.8 | 1.77 |  | I. 84 |
| 26 | $35736 \cdot 2$ | I. $5^{8}$ | 356 | r.63 | $\begin{array}{llll}3 & 54 & 20 \cdot 3\end{array}$ | I. 69 | $35237 \cdot 0$ | 1.75 | $35049 \cdot 9$ | I. 82 | $3 \begin{array}{llll}3 & 48 & 58 \cdot 9\end{array}$ | I. 88 |
| 27 | $\begin{array}{llll}3 & 53 & 12.9 \\ 3 & 48 & 4.9\end{array}$ | I.6I | $\begin{array}{llll}3 & 51 & 34.5\end{array}$ | I 6 ' | $\begin{array}{llll}3 & 49 & 52.5\end{array}$ | 1•\%3 | $\begin{array}{llll}3 & 48 & 6 \cdot 7\end{array}$ | I.80 | $\begin{array}{llll}3 & 46 & 16.9\end{array}$ | I.86 | $\begin{array}{llll}3 & 44 & 23.0\end{array}$ | I'93 |
| 28 | $\begin{array}{lllllllllllllll}3 & 48 & 48 \cdot 9\end{array}$ | 1.65 | $\begin{array}{llll}3 & 47 & 8 \cdot 2\end{array}$ | I•71 | $\begin{array}{llll}3 & 45 & 23 \cdot 8\end{array}$ | I•7\% | $\begin{array}{llll}3 & 43 & 35 \cdot 3\end{array}$ | I.84 | $3 \mathrm{4I} 42 \cdot 8$ | 1.91 | $\begin{array}{lllllllllllllll}3 & 39 & 45 \cdot 8\end{array}$ | I.99 |
| 29 | $\begin{array}{llll}3 & 44 & 23.9\end{array}$ | I. 68 | $\begin{array}{llll}3 & 42 & 40.9\end{array}$ | r 75 | 340 54.0 | I. 82 | $\begin{array}{llll}3 & 39 & 2 \cdot 9\end{array}$ | I.89 | $\begin{array}{llll}3 & 37 & 7.4\end{array}$ | r.96 | $\begin{array}{llll}3 & 35 & 7 \cdot 3\end{array}$ | 2.04 |
| 30 | $\begin{array}{llll}3 & 39 & 58 \cdot 1\end{array}$ | I•72 | $\begin{array}{llll}3 & 3^{8} & 12 \cdot 7\end{array}$ | I•79 | $\begin{array}{lllll}3 & 36 & 23 \cdot 1\end{array}$ | I. 86 | $\begin{array}{llll}3 & 34 & 29 \cdot 2\end{array}$ | I 94 | $\begin{array}{llll}3 & 32 & 30 \cdot 7\end{array}$ | 2.02 | $\begin{array}{llll}3 & 30 & 27.3\end{array}$ | $2 \cdot 10$ |
| 31 | $\begin{array}{lllll}3 & 35 & 31.4\end{array}$ | I•76 | $\begin{array}{llll}3 & 33 & 43 \cdot 4\end{array}$ | I.84 | 3 3I 5I•I | 191 | $32954 \cdot 2$ | I•99 | $32752 \cdot 5$ | 2.07 | $32545 \cdot 8$ | 2•16 |
| 32 | 3 31 3.7 | I. 81 | 329 I3•1 | I. 88 | 33 27 1 7 | 1 96 | 32517.9 | $2 \cdot 04$ | $\begin{array}{llll}3 & 23 & 12.9\end{array}$ | 2.13 | $\begin{array}{lll}3 & 21 & 2.6\end{array}$ | $2 \cdot 22$ |
| 33 | $\begin{array}{llll}3 & 26 & 34.9\end{array}$ | I.85 | $\begin{array}{llll}3 & 24 & 41 \cdot 6\end{array}$ | 1.93 | $\begin{array}{lllll}3 & 22 & 43 \cdot 4\end{array}$ | $2 \cdot 01$ | $\begin{array}{llll}3 & 20 & 40 \cdot 2\end{array}$ | $2 \cdot 10$ | $\begin{array}{llll}3 & 18 & 31 \cdot & 7\end{array}$ | $2 \cdot 19$ | $\begin{array}{llll}3 & 16 & 17.7\end{array}$ | $2 \cdot 28$ |
| 34 | $\begin{array}{llll}3 & 22 & 5 \cdot 0\end{array}$ | I.90 | $\begin{array}{lll}3 & 20 & 8 \cdot 8 \\ 3 & 1\end{array}$ | r.98 | $\begin{array}{llll}3 & 18 & 7 \cdot 5\end{array}$ | $2 \cdot 07$ | $\begin{array}{llr}3 & \text { 16 } & 0.9\end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}3 & 13 & 48 \cdot 8\end{array}$ | $2 \cdot 25$ | 3 II $30 \cdot 8$ | $2 \cdot 35$ |
| 35 | $\begin{array}{lllll}3 & 17 & 33.9\end{array}$ | I.95 | $\begin{array}{llll}3 & 15 & 34 \cdot 7 \\ 3 & 10 & \end{array}$ | 2.03 | $\begin{array}{llll}3 & 13 & 30 \cdot I\end{array}$ | $2 \cdot 12$ | 3 II 19.9 <br>  6  | 2.22 | $3 \quad 9 \quad 4{ }^{\circ} \mathrm{O}$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 6 & 41.8 \\ 3 & 1 & 50.6\end{array}$ | 2.42 |
| 36 | $\begin{array}{llll}3 & 13 & 1.6\end{array}$ | $2 \cdot 00$ | 3 10 $59 \cdot 1$ | 2.09 | $3815 \mathrm{I} \cdot \mathrm{I}$ | 2'I8 | $3 \begin{array}{llll}3 & 6 & 37 \cdot 2\end{array}$ | $2 \cdot 28$ | $3 \quad \begin{array}{llll}3 & 17.2\end{array}$ | $2 \cdot 39$ | $3 \begin{array}{lll}3 & 1 & 50.6\end{array}$ | $2 \cdot 50$ |
| 37 | $\begin{array}{llll}3 & 8 & 27 \cdot 9\end{array}$ | $2 \cdot 05$ | $3 \begin{array}{lll}3 & 6 & 22 \cdot 0\end{array}$ | $2 \cdot 15$ | $3 \quad 4 \begin{array}{lll} & 10\end{array}$ | $2 \cdot 25$ | 3 I 52.5 | $2 \cdot 35$ | $2 \begin{array}{lll}2 & 59 & 28 \cdot 3\end{array}$ | $2 \cdot 46$ | $25^{56} 57 \cdot 1$ | $2 \cdot 58$ |
| 38 | $\begin{array}{llll}3 & 3 & 52 \cdot 6\end{array}$ | $2 \cdot 11$ | $\begin{array}{llll}3 & 1 & 43 \cdot 3\end{array}$ | $2 \cdot 21$ | $2 \begin{array}{llll}2 & 59 & 27 \cdot 8\end{array}$ | $2 \cdot 31$ | $\begin{array}{llll}2 & 57 & 5 \cdot 8\end{array}$ | $2 \cdot 42$ | 254 37.0 | $2 \cdot 54$ | 25200.9 | $2 \cdot 67$ |
| 39 | 25915.8 | $2 \cdot 17$ | $\begin{array}{llll}2 & 57 & 2 \cdot 7\end{array}$ | 2.27 | $25443 \cdot 2$ | $2 \cdot 38$ | $\begin{array}{llll}2 & 52 & 16.7\end{array}$ | $2 \cdot 50$ | $24943 \cdot 2$ | 2.62 | $247 \quad 1.8$ | $2 \cdot 76$ |
| 40 | $25437 \cdot 3$ | $2 \cdot 23$ | $\begin{array}{llll}2 & 52 & 20 \cdot 3\end{array}$ | $2 \cdot 34$ | $24956 \cdot 4$ | $2 \cdot 46$ | 24725.4 | $2 \cdot 58$ | $24446 \cdot 6$ | 2.71 |  | $2 \cdot 86$ |
| 4 I | $24956 \cdot 9$ | $2 \cdot 30$ | $24735 \cdot 7$ | 2.41 | $245 \quad 7 \cdot 3$ | $2 \cdot 54$ | $2423 \mathrm{I} \cdot 2$ | 2.67 | 23947.0 | 2.8 r | $23654 \cdot \mathrm{I}$ | $2 \cdot 96$ |
| 42 | $\begin{array}{llll}2 & 45 & 14.5\end{array}$ | $2 \cdot 37$ | $\begin{array}{llll}2 & 42 & 48 \cdot 8\end{array}$ | $2 \cdot 49$ | $24015 \cdot 6$ | 2.62 | 23734.2 | $2 \cdot 76$ | 234 44•I | 2.91 | 23144.8 | 3.07 |
| 43 | 24029.8 | $2 \cdot 44$ | $\begin{array}{lllllllllll}2 & 37 & 59 \cdot 5\end{array}$ | $2 \cdot 57$ | 235 2I.0 | 2.71 | $\begin{array}{lllll}2 & 32 & 33 \cdot 9\end{array}$ | $2 \cdot 86$ | $22937 \cdot 6$ | 3.02 | 226 3I•3 | $3 \cdot 19$ |
| 44 | 2 35 $42 \cdot 8$ <br> 2   | 2.52 | $\begin{array}{llll}2 & 33 & 7 \cdot 4\end{array}$ | $2 \cdot 66$ | $\begin{array}{llll}2 & 30 & 23.4\end{array}$ | 2.81 | $\begin{array}{llll}2 & 27 & 30 \cdot 1\end{array}$ | 2.97 | $\begin{array}{llll}2 & 24 & 26 \cdot 9\end{array}$ | $3 \cdot 14$ | $\begin{array}{llll}2 & 21 & 13.2 \\ 2 & 1 & 4 & 40\end{array}$ | $3 \cdot 33$ |
| 45 | 23053.2 | $2 \cdot 61$ | $2 \begin{array}{llll}28 & 12.3\end{array}$ | $2 \cdot 76$ | $2 \begin{array}{lllll}2 & 25 & 22 \cdot 3\end{array}$ | 2.92 | $\begin{array}{llll}2 & 22 & 22.4\end{array}$ | 3.09 | $\begin{array}{lllll}2 & 19 & 11.9\end{array}$ | 3.27 | $\begin{array}{llll}2 & 15 & 49.9\end{array}$ | 3.47 |
| 46 | 226007 | $2 \cdot 70$ | $\begin{array}{lllll}2 & 23 & 13.9\end{array}$ | $2 \cdot 86$ | 2201774 | 3.03 | 2 | 3.21 | 21351.8 | 3.41 | $21020 \cdot 8$ | $3 \cdot 63$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 12 | - A. | L. $13^{\circ}$ A. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | S. | S. | S | s. | S. | S. | s. | S. | S. | S. | S. |
| 0 | - 90 | $-4 \cdot 20$ | -. 97 | $-4.22$ | - I.05 | $-4.23$ | - I-I3 | $-4.25$ | -I.2I | $-4.28$ | - I. 29 | $-4.30$ |
| 2 | -93 | $4 \cdot 2 \mathrm{I}$ | I'OI | $4 \cdot 23$ | r.09 | $4 \cdot 25$ | I•I7 | 4.27 | 1.25 | $4 \cdot 29$ | I 33 | $4 \cdot 32$ |
| 4 | -97 | $4 \cdot 22$ | I.O5 | $4 \cdot 24$ | I-I3 | $4 \cdot 26$ | I. 21 | 4.28 | 1.29 | $4 \cdot 30$ | I 37 | $4 \cdot 33$ |
| 6 | 1.01 | $4 \cdot 23$ | I.09 | $4 \cdot 25$ | I-I7 | $4 \cdot 27$ | I. 25 | 4.29 | I 33 | $4 \cdot 32$ | I-42 | $4 \cdot 34$ |
| 8 | 1.05 | $4 \cdot 24$ | I'I3 | $4 \cdot 26$ | I-2I | $4 \cdot 28$ | I 29 | 4.30 | I. 38 | $4 \cdot 33$ | I. 46 | $4 \cdot 36$ |
| 10 | 1.09 | 4.25 | I•17 | $4 \cdot 27$ | I. 26 | $4 \cdot 29$ | I•34 | $4 \cdot 32$ | I. 42 | $4 \cdot 35$ | I•5 | 4.37 |
| 12 | I-14 | $4 \cdot 26$ | 1.22 | $4 \cdot 28$ | I•3I | $4 \cdot 31$ | I 39 | $4 \cdot 33$ | I. 48 | $4 \cdot 36$ | I. 56 | $4 \cdot 39$ |
| 14 | r-19 | $4 \cdot 27$ | I.27 | $4 \cdot 30$ | I 35 | 4.32 | I 44 | $4 \cdot 35$ | 1.53 | $4 \cdot 38$ | I. 62 | $4 \cdot 41$ |
| 16 | I-24 | $4 \cdot 29$ | I-32 | $4 \cdot 31$ | I.41 | $4 \cdot 34$ | I 50 | $4 \cdot 37$ | 1. 59 | $4 \cdot 40$ | I. 68 | 4.43 |
| 18 | I 29 | $4 \cdot 30$ | I-38 | $4 \cdot 33$ | I. 46 | $4 \cdot 36$ | I. 56 | $4 \cdot 39$ | r.65 | 4.42 | I•74 | 4.46 |
| 20 | 1. 34 | $4 \cdot 32$ | I 43 | $4 \cdot 35$ | I. 52 | $4 \cdot 38$ | 1.62 | 4.41 | 1.71 | 4.45 | 1.81 | 4.49 |
| 22 | I. 40 | $4 \cdot 34$ | I. 50 | $4 \cdot 37$ | I. 59 | $4 \cdot 40$ | 1.69 | $4 \cdot 44$ | I.78 | $4 \cdot 48$ | I. 88 | $4 \cdot 52$ |
| 24 | 1.47 | $4 \cdot 36$ | I. 56 | $4 \cdot 39$ | I. 66 | 4.43 | 1.76 | $4 \cdot 46$ | r. 86 | $4 \cdot 51$ | r.96 | $4 \cdot 55$ |
| 26 | I•53 | $4 \cdot 38$ | I. 63 | $4 \cdot 42$ | I.73 | $4 \cdot 46$ | I. 84 | $4 \cdot 50$ | I.94 | $4 \cdot 54$ | $2 \cdot 05$ | 4.59 |
| 28 | I.6I | 4.45 | 1.71 | 4.45 | I.8I | $4 \cdot 49$ | $\mathbf{1} 92$ | 4.53 | $2 \cdot 03$ | $4 \cdot 58$ | 2.14 | 4.63 |
| 30 | x. 68 | 4.44 | I•79 | $4 \cdot 48$ | 1.90 | 4.52 | $2 \cdot 01$ | $4 \cdot 57$ | $2 \cdot 13$ | 4.62 | $2 \cdot 24$ | 4.68 |
| 32 | r.77 | 4.47 | 1.88 | 4.51 | $2 \cdot 00$ | $4 \cdot 56$ | $2 \cdot 11$ | 4.62 | 2.23 | 4.67 | $2 \cdot 36$ | 4.73 |
| 34 | r. 86 | 4.51 | I.98 | $4 \cdot 56$ | $2 \cdot 10$ | 4.61 | $2 \cdot 22$ | 4.67 | $2 \cdot 35$ | $4 \cdot 73$ | $2 \cdot 48$ | 4.80 |
| 36 | r.96 | 4.55 | $2 \cdot 09$ | 4.61 | $2 \cdot 21$ | $4 \cdot 66$ | $2 \cdot 35$ | 4.73 | $2 \cdot 48$ | 4.80 | 2.63 | 4.87 |
| $3^{8}$ | 2.08 | 4.60 | $2 \cdot 2 \mathrm{I}$ | $4 \cdot 66$ | $2 \cdot 34$ | $4 \cdot 73$ | $2 \cdot 48$ | 4.80 | 2.63 | 4.88 | $2 \cdot 78$ | $4 \cdot 96$ |
| 40 | $2 \cdot 20$ | $4 \cdot 66$ | $2 \cdot 34$ | $4 \cdot 72$ | 2.49 | 4.80 | - 2.64 | 4.88 | $2 \cdot 80$ | 4.97 | 2.97 | $5 \cdot 06$ |
| 42 | $2 \cdot 34$ | $4 \cdot 73$ | 2.49 | 4.80 | $2 \cdot 65$ | 4.89 | 2.81 | 4.98 | $2 \cdot 99$ | $5 \cdot 08$ | 3.18 | 5.19 |
| 44 | $2 \cdot 50$ | 4.80 | $2 \cdot 66$ | 4.89 | 2.84 | 4.99 | 3.02 | $5 \cdot 10$ | 3.21 | $5 \cdot 21$ | 3.42 | $5 \cdot 34$ |
| 45 | 2.58 | $4 \cdot 85$ | 2.76 | 4.95 | $2 \cdot 94$ | $5 \cdot 05$ | $3 \cdot 13$ | 5.16 | $3 \cdot 33$ | $5 \cdot 29$ | $3 \cdot 56$ | $5 \cdot 44$ |
| 46 | $2 \cdot 68$ | 4.90 | $2 \cdot 86$ | $5 \cdot \mathrm{OI}$ | 3.05 | 5.12 | $3 \cdot 26$ | $5 \cdot 24$ | 3.47 | $5 \cdot 38$ | 3.71 | $5 \cdot 54$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. м. | S. | H. M. | S. | H. M. S. | S. | H. м. | . | н. м. s . | s. | H. M. s. | s. |
| 0 | $54247 \cdot 5$ | r. 02 | $54145 \cdot 7$ | I-04 | $54043 \cdot 1$ | -1.05 | $\begin{array}{llll}5 & 39 & 39 & 7\end{array}$ | - I.06 | $5 \begin{array}{llll}5 & 38 & 35 \cdot 5\end{array}$ | I.08 | 5 $\begin{array}{llll}5 & 37 & 30 \cdot 3\end{array}$ | $\underline{1.09}$ |
| 2 | $534 \begin{array}{ll}5 & 7\end{array}$ | 1.08 | $53312 \cdot 3$ | 1.09 | $53156 \cdot 2$ | I•II | $53049 \cdot 0$ | I.13 | $52940 \cdot 9$ | I'15 | $\begin{array}{llll}5 & 28 & 31 \cdot 4\end{array}$ | 1.17 |
| 4 | 52525.5 | I•13 | $52417 \cdot 0$ | I-15 | $\begin{array}{llll}5 & 23 & 74\end{array}$ | 17 |  | $1 \cdot 19$ | $52044 \cdot 1$ | $1 \cdot 22$ | 519303 | 1.24 |
| 6 | $\begin{array}{lllll}5 & 16 & 41.9\end{array}$ | 1-19 |  | 21 | $\begin{array}{llll}5 & 14 & 16 \cdot 5\end{array}$ | 1.24 | $\begin{array}{llll}5 & 13 & 1 \cdot 5\end{array}$ | I. 26 | 5 II $45^{\circ}$ | 1.29 | $5{ }_{5} 1026 \cdot 7$ | I. 32 |
| 8 | $5 \quad 756 \cdot 5$ | 1.25 | $5 \quad 640 \cdot 8$ | 1.28 | $5 \quad 5 \quad 23.4$ | I-30 | $\begin{array}{llll}5 & 4 & 4.3\end{array}$ | I 33 | $5 \quad 243 \cdot 3$ | -37 | 5 I 5120.4 | 1.40 |
| 12 | $\begin{array}{lll}4 & 59 & 9.0 \\ 4 & 50 & 90\end{array}$ |  | 4 <br> 4 <br> 4 <br> 4 <br> 4859.4 | I.4I | $\begin{array}{llll}4 & 56 & 27 \cdot \\ 4 & 47 & 20 \cdot 8\end{array}$ | I.37 | $\begin{array}{lll}4 & 55 & 4.4 \\ 4 & 46 & 1.8\end{array}$ | $1 \cdot 49$ | $\begin{array}{lllll}4 & 53 & 38 \cdot 9 \\ 4 & 44 & 3 r \cdot 3\end{array}$ | 1 | $\begin{array}{llll}42 & 11 \cdot 0\end{array}$ | 7 |
| 12 | $\begin{array}{llll}4 & 50 & 19.2 \\ 4 & 41 & 26.9\end{array}$ | $1 \cdot 38$ | 4 <br> 4 <br> 4 <br> 48 <br> 1595 <br> 59 | I.41 | $\begin{array}{llll}4 & 47 & 29 \cdot 8 \\ 4 & 38 & 28.7\end{array}$ |  | $\begin{array}{cccc}4 & 46 & 1 \cdot 8 \\ 4 & 36 & 55 \cdot 9\end{array}$ | 1.49 1.57 | $\begin{array}{llll}4 & 44 & 38 \cdot 3 \\ 4 & 35 & 20 \cdot 3\end{array}$ | 1.53 1.62 |  | 1.57 1.66 |
| 16 | 4 4 42 | I. 52 | $43059 \cdot 5$ | + r 56 | $\begin{array}{lll}4 & 29 & 24.4\end{array}$ | I.61 | $4 \begin{array}{llll}4 & 27 & 46.5\end{array}$ | - $1 \cdot 6$ | 426505 | 1.71 | $42421 \cdot 4$ | I.76 |
| 18 | 42333.8 | I-59 | $42156 \cdot 7$ | I. 64 | 42016.5 | I• | $418 \quad 33.2$ | I•75 | 4 16 $46 \cdot 5$ | I.81 | $41456 \cdot 3$ | . 87 |
| 19 | $\begin{array}{llll}4 & 19 & 3.5\end{array}$ | r. 63 | 41723.9 | r. 69 | $4154 \mathrm{I} \cdot \mathrm{I}$ | 1.74 | $41354{ }^{\circ} 9$ | I. 80 | 412503 | . 86 | 4 10 Ir.8 | 192 |
| 20 | $41432 \cdot 3$ | I. 67 | $41250 \cdot 2$ | $1 \cdot 73$ | 4 I1 $4 \cdot 7$ | $1 \cdot 79$ | $4 \quad 9 \quad 15.6$ | I.85 | 4722.8 | $1 \cdot 91$ | $4 \quad 526 \cdot 0$ | $1 \cdot 98$ |
| 21 | 4100.2 | 1•72 | 48154 | $1 \cdot 78$ | $\begin{array}{llll}4 & 6 & 27 \cdot 1\end{array}$ | I.84 | $4 \begin{array}{lll}4 & 4 & 34.9\end{array}$ | 1.90 | $\begin{array}{lllll}4 & 2 & 38 \cdot 9\end{array}$ | $1 \cdot 97$ | 4 - 38.8 | 2.04 |
| 22 | $\begin{array}{llll}4 & 5 & 27.1\end{array}$ | 1•76 | $4 \quad 3 \quad 39 \cdot 6$ | 1.82 | $4 \begin{array}{llll}4 & 1 & 48 \cdot 3\end{array}$ | I. 89 | $\begin{array}{llll}3 & 59 & 53 \cdot 1\end{array}$ | I.95 | 35753.7 | 2.03 | $35550 \cdot 0$ | 2.10 |
| 23 | $4 \bigcirc 53 \cdot 0$ | I.81 | $3 \begin{array}{lll}39 & 2 \cdot 6\end{array}$ | 1.87 | $\begin{array}{llll}3 & 57 & 8.3\end{array}$ | I 94 | $\begin{array}{lll}3 & 55 & 9.8\end{array}$ | 2.01 | $353 \quad 70$ |  | 35059.6 | 6 |
| 24 |  |  | 35424.4 | 1.92 | $\begin{array}{llll}3 & 52 & 26 \cdot 9\end{array}$ | 1.99 | $\begin{array}{llll}3 & 50 & 25.2\end{array}$ | 2.07 | 33 48 <br> 8.7  | 2.15 | $\begin{array}{llll}3 & 46 & 75\end{array}$ | 2.23 |
| 25 | $\begin{array}{lllllllll}3 & 51 & 41 \\ 3 & 4 & 3\end{array}$ | r.91 | $34944 \cdot 9$ | 1.98 | 34744.2 | 2.05 | $\begin{array}{llllllllll}3 & 45 & 38.9\end{array}$ | $2 \cdot 13$ | $34328 \cdot 7$ | $2 \cdot 21$ |  | $2 \cdot 30$ |
| 26 |  | I.96 | 345 4.1 | 2.03 | 343000 | 2.11 | $34051 \cdot 0$ | 9 | $\begin{array}{llllll}38 & 36 \cdot 9\end{array}$ | $2 \cdot 28$ | $\begin{array}{lllll}3 & 36 & 17.5\end{array}$ | $2 \cdot 37$ |
| 27 | $\begin{array}{lllllllllllllll}3 & 42 & 24 \cdot 7 \\ 3 & 37 & 4\end{array}$ | 2.01 | 3 40 21.9 <br> 3 35  <br> 8.0   | 9 |  | 2.17 | $\begin{array}{llll}3 & 36 & 1.4 \\ 3 & 31\end{array}$ | 6 | 3 33 | $2 \cdot 35$ | $\begin{array}{lllll}3 & 31 & 19.4 \\ 3 & 26 & 19\end{array}$ | 2.45 |
| 28 | $33744 \cdot 3$ | 2.06 | 33538.0 | $2 \cdot 15$ | $33326 \cdot 6$ | 23 | $\begin{array}{llll}3 & 31 & 9.9\end{array}$ | $2 \cdot 33$ | $32847 \cdot 5$ | 2.42 | $3^{3} 26619 \cdot 1$ | 2.53 |
| 29 30 | 3 33 2.4 <br> 3 28  | $2 \cdot 18$ | $\begin{array}{ccc}3 & 30 & 52 \cdot 5 \\ 3 & 26 & 5 \cdot 3\end{array}$ | 2.21 2.28 | $\begin{array}{llll}3 & 28 & 37 \cdot 3 \\ 3 & 23 & 45 \cdot 9\end{array}$ | 2.30 2.37 | $\begin{array}{llll}3 & 26 & 16.4 \\ 3 & 21 & 20.7\end{array}$ | - 40 | 3 23 $49 \cdot 5$ <br> 3 18  <br> 19.1   | . 50 | $\begin{array}{lll}3 & 21 & 16.3 \\ 3 & 16 & 10.8\end{array}$ | 6r |
| 31 |  | 2.25 | $\begin{array}{llll}3 & 21 & 16 \cdot 1\end{array}$ | 2.34 | $\begin{array}{llll}3 & 18 & 52 \cdot 5\end{array}$ | 2.44 | $\begin{array}{llll}3 & 16 & 22 \cdot 7\end{array}$ | 2.55 | 3 18 <br> 3 I3 <br>  $46 \cdot 1$ | 2.67 | $\begin{array}{rrrr}311610.8 \\ 3 & \text { II } & 2.5\end{array}$ | 2.79 |
| 32 | $\begin{array}{lllllllllll}3 & 18 & 46 \cdot 7\end{array}$ | $2 \cdot 31$ | 31624.9 | 2.42 | 31386 | $2 \cdot 52$ | $\begin{array}{llllllllllll}3 & 11 & 22.2\end{array}$ | $2 \cdot 64$ | $\begin{array}{llll}3 & 8 & 40.4\end{array}$ | $2 \cdot 76$ | 3 5 51 | 2.89 |
| 33 | $31357 \cdot 7$ | $2 \cdot 38$ | 3 II 31.5 | 2.49 | 3 3 8 58.7 | $2 \cdot 60$ | 3 | $2 \cdot 72$ | $\begin{array}{llll}3 & 317\end{array}$ | 2.85 | $3 \quad 036 \cdot 3$ | 2.99 |
| 34 | $\begin{array}{llll}3 & 9 & 6.6\end{array}$ | 2.46 | $\begin{array}{llll}3 & 6 & 35.8\end{array}$ |  | $\begin{array}{llll}3 & 3 & 58 \cdot 0\end{array}$ |  | $\begin{array}{llll}3 & 1 & 12.8\end{array}$ | 2.82 | $2 \begin{array}{llll} & 58 & 19 & 6\end{array}$ | 2.96 | $2 \begin{array}{llll}5 & 17.9\end{array}$ | $3 \cdot 10$ |
| 35 | 3 4 $13 \cdot 1$ | $2 \cdot 54$ | $\begin{array}{llll}3 & 1 & 37.4 \\ 2\end{array}$ | 2.66 | 2 58 54.4 | 78 | $\begin{array}{llll}2 & 56 & 3.4\end{array}$ | 2.92 | 253 4.0 | 3.07 | $24955 \cdot 5$ | 3.22 |
| 36 |  | 2.62 | $25636 \cdot 4$ | 2.75 | 253477 | $2 \cdot 88$ | $25050 \cdot 6$ | 3.03 | $24744 \cdot 5$ | $3 \cdot 18$ | $\begin{array}{lllll}2 & 44 & 28.7\end{array}$ | $3 \cdot 35$ |
| 37 |  | 2. | $25132 \cdot 2$ | 2.84 | $\begin{array}{llllllllllll}2 & 48 & 37 \cdot 6 \\ 2\end{array}$ | .99 |  | $3 \cdot 14$ | $24220 \cdot 7$ | 3.31 | 23856.9 | 3.49 |
| 38 | 249170 | 2. | 24624.8 | $2 \cdot 94$ | 24323.8 | $3 \cdot 10$ | $24013 \cdot 1$ | 3.26 | $23652 \cdot \mathrm{~T}$ | 3.44 | $\begin{array}{llll}2 & 33 & 19.9\end{array}$ |  |
| 39 | $\begin{array}{llllllll}2 & 44 & 12.2\end{array}$ | -90 | $\begin{array}{llll}2 & 41 & 13.8\end{array}$ | 3.05 | $\begin{array}{llll}2 & 38 & 5 \cdot 8\end{array}$ | 3.22 | $23447 \cdot 6$ | $3 \cdot 40$ | 23118.3 | $3 \cdot 59$ | 22736.8 | 80 |
| 40 | $\begin{array}{llll}2 & 39 & 3 \cdot 9\end{array}$ | 3.01 | $\begin{array}{llllll}2 & 35 & 58.8\end{array}$ | $3 \cdot 17$ | $\begin{array}{ll}2 & 32 \\ 2 & 43.4\end{array}$ | 3.35 | $\begin{array}{lllllll}2 & 29 & 17.0\end{array}$ | $3 \cdot 54$ | $22538 \cdot 6$ | $3 \cdot 75$ | $22147 \cdot 0$ | 3.89 |
| 41 | 22 33 51.8 | $3 \cdot$ | ${ }_{2}^{2} 30039.4$ | $3 \cdot 30$ | $22716 \cdot 0$ | 3.49 | $\begin{array}{lllllll}2 & 23 & 40 \cdot 7\end{array}$ | 3.7 | $21952 \cdot 3$ | 3.93 | $21549 \cdot 6$ | $\cdot 18$ |
| 42 43 | $\left\lvert\, \begin{array}{llll}2 & 28 & 35 \cdot 3 \\ 2 & 23 & 14 \cdot 2\end{array}\right.$ | 3.25 3.38 | $\begin{array}{lllll}2 & 25 & 15 \cdot 1 \\ 2 & 19 & 45 \cdot 3\end{array}$ | 3.44 3.59 | $\begin{array}{llll}2 & 21 & 42.9 \\ 2 & 16 & 3.7\end{array}$ | 3.64 3.81 | $\begin{array}{llll}2 & 17 & 57.9 \\ 2 & 1 & 7 & 7.9\end{array}$ | 3.87 | 21358.6 | $4 \cdot 12$ | $943 \cdot 5$ | 4.40 |
| 43 | 22314.2 | $3 \cdot 38$ | 1945.3 | 3.59 | $2 \begin{array}{lll}16 & 3.7\end{array}$ | 3.8 | $212 \quad 7.9$ | 4.06 | $2756 \cdot 5$ | 4.34 | $2 \quad 327.5$ | $4 \cdot 65$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.


178 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## Latitude $14^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1^{\circ}$ | Decl. <br> Var. | $2{ }^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | II. M. | -s. | . | S. |  | S. | H. M. S. | S. | . | S. | . s . | S. |
| 0 | 60 | - 1.00 | 559 | - I.00 | $\begin{array}{lll}5 & 58 & 0 \cdot 3\end{array}$ | -I.OO | $\begin{array}{lll}5 & 57 & 0 \cdot 3\end{array}$ | - I.00 | 556 | - I.00 | $\begin{array}{lll}5 & 55 & 0.0\end{array}$ | - I.OI |
| 10 | $\begin{array}{llll}5 & 18 & 45 \%\end{array}$ | I $\cdot$ OI | $\begin{array}{lllll}5 & 17 & 44 \cdot 5\end{array}$ | $1 \cdot 03$ | $\begin{array}{llll}5 & 16 & 42 \cdot 4\end{array}$ | I | 5 I5 39*4 | I.06 | $51435 \cdot 5$ | I.07 | $\begin{array}{llll}5 & 13 & 30 \cdot 6\end{array}$ | 1.09 |
| 12 | 5 10 30.5 | I. 02 | $\begin{array}{lll}5 & 9 & 28 \cdot 7\end{array}$ | I 04 | $5826 \cdot 0$ | I.05 | $5 \quad 722 \cdot 1$ | $1 \cdot 07$ | $5 \quad 6 \quad 17 \cdot 1$ | 1.0 | $5 \quad 511.0$ | I•II |
| 14 | $\begin{array}{llll}5 & 2 & 14.9\end{array}$ | 1.03 | 5 I 12.6 | I.05 | 5 - $9 \cdot 0$ | I-07 | $4 \begin{array}{lll}4 & 59 & 4.2\end{array}$ | I.09 | 45758 | I•II | $4 \quad 5650 \%$ | I 14 |
| 16 | $45359 \cdot \mathrm{I}$ | 1.04 | $45256 \cdot 1$ | I 06 | 45 I 5I.6 | I. 09 | $4 \quad 50 \quad 45 \cdot 7$ | I•II | $44938 \cdot 4$ | I'I3 | 44829.5 | 6 |
| 18 | $44543 \cdot 0$ | I.05 | $44439 \cdot 1$ | I.08 | $44333 \cdot 7$ | I.IO | $442 \quad 26 \cdot 6$ | I. 13 | 44157.9 | -16 | $440 \quad 7 \cdot 5$ | -19 |
| 20 | $43726 \cdot 5$ | 1.07 | $43621 \cdot 7$ | I.09 | $43515 \cdot 1$ | 1.12 | $434 \quad 6 \cdot 8$ | I. 15 | $4 \begin{array}{llll}4 & 32 & 56 \cdot 6\end{array}$ | I•19 | $43144 \cdot 5$ | 1.22 |
| 22 | $429 \quad 9 \cdot 5$ | I.08 | $4 \quad 2837$ | I•II | $42655 \cdot 9$ | -15 | $\begin{array}{llll}4 & 25 & 46 \cdot 2\end{array}$ | I•18 | $42434 \cdot 4$ | I. 21 | $423 \quad 20 \cdot 5$ | 1.25 |
| 24 | 42052.0 | I'IO | $41945 \%$ | I•13 | $4 \quad 18 \quad 36 \cdot 0$ | I.17 | 4 I\% $24 \cdot 7$ | I. 21 | $416 \mathrm{II} \cdot \mathrm{I}$ | I. 25 | $41455 \cdot 2$ | I 28 |
| 26 | 41233.9 | I•12 | 4 II 25.7 | I•16 | 4 10 15.1 | I 20 | $\begin{array}{lll}4 & 9 & 2 \cdot 1\end{array}$ | I. 24 | $4 \begin{array}{lll}4 & 7 & 46 \cdot 6\end{array}$ | I. 28 | $\begin{array}{llll}4 & 6 & 28 \cdot 6\end{array}$ | I-32 |
| 28 | $\begin{array}{llll}4 & 4 & 15.2\end{array}$ |  | $\begin{array}{llll}4 & 3 & 5 \cdot 6\end{array}$ | I'I8 | 4 I 53.3 | 1.23 | $4 \quad 038 \cdot 5$ | $1 \cdot 27$ | $3 \begin{array}{lll}3 & 59 & 20 \cdot 9\end{array}$ | $1 \cdot 32$ | $\begin{array}{lll}3 & 58 & 0.5\end{array}$ | 36 |
| 29 | $4 \quad 5.6$ | I.15 | $35855 \cdot 1$ | 0 | $\begin{array}{ll}3 & 57 \\ 42 \cdot 1\end{array}$ | I. 24 | $\begin{array}{llll}3 & 56 & 26 \cdot 2\end{array}$ | I. 29 | $\begin{array}{llll}3 & 55 & 7 \cdot 5\end{array}$ | 1.34 | $\begin{array}{lllll}3 & 53 & 45 \cdot 9\end{array}$ | I 39 |
| 30 |  | I•I6 | $35444 \cdot 5$ | I.2I | $\begin{array}{llll}3 & 53 & 30 \cdot 5\end{array}$ | 1.26 | $\begin{array}{llll}3 & 52 & 13 & 6\end{array}$ | I 31 | $3 \quad 50 \quad 53.7$ | I. 36 | $34930 \cdot 8$ | 1.41 |
| 31 | 3 5I $45 \cdot 6$ | I.I8 | $35033 \cdot 6$ | I 22 |  | 1.27 | $\begin{array}{lll}3 & 48 & 0.6 \\ 3 & 43 & \end{array}$ | I.33 | $346 \quad 39 \cdot 5$ | I.38 |  | I*43 |
| 32 | $34735 \cdot 3$ | I'I9 | $34622 \cdot 4$ | I 24 | $\begin{array}{llll}3 & 45 & 6 \cdot 4\end{array}$ | I. 29 | $3 \begin{array}{llll}3 & 43 & 47 \cdot 3\end{array}$ | I. 34 | 342250 | I-40 | $340 \quad 59 \cdot 3$ | I. 46 |
| 33 | $\begin{array}{lll}3 & 43 & 24.8\end{array}$ |  | $3 \quad 42 \quad 10 \cdot 9$ | I. 26 | $34053 \cdot 9$ | I-31 | $33933 \cdot 6$ | 137 | $\begin{array}{llll}3 & 38 & 9 \cdot 9\end{array}$ | 1.42 | $\begin{array}{lllll}3 & 36 & 42 \cdot 7\end{array}$ | 48 |
| 34 | $\begin{array}{lll}3 & 39 & 14.0\end{array}$ | I. 22 | $\begin{array}{llll}3 & 37 & 59\end{array}$ | I. 27 | $33^{36} 44^{x} \cdot 0$ | 1.33 | $3 \begin{array}{llll}3 & 35 & 19.4\end{array}$ | I•39 | $\begin{array}{lllll}3 & 33 & 54 \cdot 3\end{array}$ | I.45 | $\begin{array}{llll}3 & 32 & 25 \cdot 6\end{array}$ | . 51 |
| 35 | $\begin{array}{llll}3 & 35 & 3 \cdot 0\end{array}$ | I. 24 | $\begin{array}{lllll}3 & 33 & 47 \cdot 1\end{array}$ | I. 29 | $1 \begin{array}{lll}3 & 32 & 27 \cdot 7\end{array}$ | 1.35 | $\begin{array}{llll}3 & 31 & 4 \cdot 9\end{array}$ | 1.41 | $\begin{array}{llll}3 & 29 & 38 \cdot 3\end{array}$ | I.47 | $\begin{array}{llll}3 & 28 & 7 \cdot 9\end{array}$ | I. 54 |
| 36 | $33051 \cdot 6$ | 1.25 | $\begin{array}{llll}3 & 29 & 34 \cdot 6\end{array}$ | 1.3I | $3{ }^{3} \mathbf{2 8}$ I4•I | 1.37 | $\begin{array}{lllllllllllll}3 & 26 & 49 \cdot 8\end{array}$ | 1.44 | 325121.6 | I. 50 | $\begin{array}{lllllllllllllll}3 & 23 & 49 \cdot 6\end{array}$ | -57 |
| 37 | 32639.9 | 1.27 | 32521.8 | I.33 | $324 \quad 0.0$ | I. 40 | 32234.2 | 1.46 | 3214.5 | I. 53 | $\begin{array}{lllllllllllllllll}3 & 19 & 30 \cdot 6\end{array}$ | I 60 |
| 38 | $\begin{array}{llll}3 & 22 & 27 \cdot 9\end{array}$ | I. 29 | $\begin{array}{lll}3 & 21 & 8.6\end{array}$ | I.35 | 3 I9 45.4 | I. 42 | $31818 \cdot 1$ | I.49 | 3 I6 $46 \cdot 7$ | I. 56 | 315 11*O | 3 |
| 39 | $\begin{array}{llll}3 & 18 & 15 \cdot 6\end{array}$ | -3I | 3 16 55.0 | I.38 | 3 I5 30.3 | I.45 | 31414 | I. 52 |  | I. 59 | $31050 \cdot 5$ | . 67 |
| 40 | $\begin{array}{llll}3 & 14 & 2 \cdot 8\end{array}$ | I.33 | $31240 \cdot 9$ | 1.40 | 3 II $14 \cdot 7$ | 1.47 | $3 \begin{array}{llll}3 & 9 & 44.1\end{array}$ | I.55 | $\begin{array}{lll}3 & 8 & 9^{\circ} \mathrm{O}\end{array}$ | I. 62 | $\begin{array}{llll}3 & 6 & 29 \cdot 3\end{array}$ | $1 \cdot 70$ |
| 41 | $\begin{array}{llll}3 & 9 & 49.7\end{array}$ | I. 35 | $\begin{array}{llll}3 & 8 & 26 \cdot 3\end{array}$ | 43 | $\begin{array}{llll}3 & 6 & 58 \cdot 5\end{array}$ | I. 50 | $\begin{array}{llll}3 & 5 & 26 \cdot 2\end{array}$ | I. 58 | 33 3 49 | I. 66 | $\begin{array}{llll}3 & 2 & 7 \cdot 1\end{array}$ | $\cdot 74$ |
| 42 | $35136 \cdot 1$ | I.38 | $3 \quad 4 \begin{array}{lll}3 & \text { II•2 }\end{array}$ | I'45 | $\begin{array}{llll}3 & 2 & 41 \cdot 7\end{array}$ | I. 53 | 3 I $\quad 7 \quad 7 \cdot 5$ | I. 61 | $2 \begin{array}{llll}29 & 28 \cdot 3\end{array}$ | I•70 | 25744.0 | I・ク8 |
| 43 | 3 I 22.0 | 1.40 | 25955.5 | 1.48 | $2 \begin{array}{llll}2 & 58 & 24 \cdot 3\end{array}$ | I. 56 | $25648 \cdot 1$ | I. 65 | $\begin{array}{llll}2 & 5.5 & 6 \cdot 7\end{array}$ | 173 | $25320 \cdot 0$ | I. 82 |
| 44 | $\begin{array}{llll}2 & 57 & 7 \cdot 4\end{array}$ | $1 \cdot 43$ | $255139 \cdot 3$ | 1.5I | 254 6.1 | 1.60 | $25227 \cdot 8$ | I. 68 | $25044 \cdot \mathrm{I}$ | $1 \cdot 77$ | $248 \quad 54 \cdot 8$ | I. 87 |
| 45 | $25252 \cdot 3$ | 1.46 | 25122.4 | I. 54 | $24947 \cdot 2$ | I. 63 | $2486 \cdot 6$ | 12 | $24620 \cdot 5$ | I. 82 | $24428 \cdot 5$ | I.92 |
| 46 | $\begin{array}{lllll}2 & 48 & 36 \cdot 6\end{array}$ | I. 49 | $\begin{array}{lll}2 & 47 & 4.8\end{array}$ | I. 58 | $245 \begin{array}{llll}27.5\end{array}$ | I. 67 | $\begin{array}{lllllllllll}2 & 43 & 44.6\end{array}$ | 1.76 | 2 41 55.9 <br> 2 3  | 86 | $\begin{array}{rrr}2 & 40 & 0.8 \\ 2 & 35 & 318\end{array}$ | $1 \cdot 97$ |
| 47 | $24420 \cdot 3$ | I. 52 | $2 \begin{array}{ll}2 & 4246 \cdot 4\end{array}$ | I. 62 | 2416.9 | I'71 | 23921.4 | I.81 | 23729.8 | I.91 | 23531.8 | $2 \cdot 02$ |
| 48 | $240 \quad 3 \cdot 2$ | I•55 | $2 \begin{array}{llll}28 & 37 \cdot 2\end{array}$ | 1.65 | $2 \begin{array}{lllll}26 & 45 \cdot 3\end{array}$ | I•75 | $234 \quad 57 \cdot 2$ | 86 | $\begin{array}{lll}2 & 33 & 2 \cdot 6\end{array}$ | 1.97 | 23113 | $2 \cdot 08$ |
| 49 | 23545.4 | 159 | $234 \begin{array}{ll} & 3 \\ 7\end{array}$ | I. 69 | $2 \begin{array}{llll}2 & 32 & 22.7\end{array}$ | 1.79 | $23031 \cdot 7$ | - 91 | $2 \begin{array}{llll}2 & 28 & 33 \cdot 9\end{array}$ | 2.02 | $2 \begin{array}{llll}26 & 29 \cdot 1\end{array}$ | $2 \cdot 14$ |
| 50 | $23126 \cdot 8$ | I. 63 | $22946 \cdot 1$ | 1.73 | $22758 \cdot 9$ | I.84 | 226409 | 1.96 | $\begin{array}{lll}2 & 24 & 3 \cdot 7\end{array}$ | $2 \cdot 08$ | $22155^{\circ} \mathrm{O}$ | $\cdot 21$ |
| 51 | $\begin{array}{llll}2 & 27 & 7\end{array}$ | I. 67 | 22524.0 | 1.78 | $\begin{array}{llllllllll}2 & 23 & 33 \cdot 9\end{array}$ | I.89 | $22136 \cdot 6$ | 2.02 | 2 I9 3I•8 | $2 \cdot 15$ | 217190 | $2 \cdot 28$ |
| 52 | $22246 \cdot 8$ | I•71 | 2210.7 | I.83 | 219975 | I.95 | 2 17 6.7 | $2 \cdot 08$ | 2 I4 57.9 | $2 \cdot 22$ | $21240 \cdot 8$ | $2 \cdot 36$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. 2 | A. | L. $3^{\circ}$ | - A. | L. 4 | A. | L. 5 | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | S. | s. | s. | S. | S. | S. | S. | S. | S. | S. |
| - | 00 | $-4 \cdot 12$ | - .07 | $-4.12$ | - I5 | $-4.13$ | - 22 | $-4 \cdot 13$ | - 30 | $-4 \cdot 13$ | - 37 | $-4 \cdot 14$ |
| 4 | . 07 | $4 \cdot 12$ | - 15 | $4 \cdot 12$ | - 22 | $4 \cdot 13$ | - 30 | $4 \cdot 13$ | -37 | 4.14 | - 45 | $4 \cdot 15$ |
| 8 | - I4 | 4.12 | - 22 | $4 \cdot 13$ | -29 | 4.13 | $\cdot 37$ | $4 \cdot 14$ | $\cdot 45$ | $4 \cdot 15$ | -52 | $4 \cdot 16$ |
| 10 | -18 | 4.13 | - 26 | $4 \cdot 13$ | -33 | 4.14 | 41 | 4.14 | -49 | $4 \cdot 15$ | - 56 | $4 \cdot 16$ |
| 12 | - 22 | 4.I3 | -30 | $4 \cdot 13$ | -37 | 4.14 | $\cdot 45$ | $4 \cdot 15$ | -53 | 4.16 | - 60 | 4.17 |
| 14 | $-26$ | $4 \cdot 13$ | -33 | $4 \cdot 14$ | -41 | $4 \cdot 14$ | -49 | 4.15 | $\cdot 57$ | $4 \cdot 16$ | -65 | $4 \cdot 17$ |
| 16 | - 29 | $4 \cdot 13$ | -37 | $4 \cdot 14$ | $\cdot 45$ | $4 \cdot 15$ | - 53 | 4.16 | -61 | 4.17 | -69 | $4 \cdot 18$ |
| 18 | -33 | $4 \cdot 14$ | - 41 | $4 \cdot 14$ | -49 | $4 \cdot 15$ | $\cdot 57$ | $4 \cdot 16$ | - 65 | $4 \cdot 17$ | -73 | 4.19 |
| 20 | $\cdot 37$ | $4 \cdot 14$ | $\cdot 46$ | $4 \cdot 15$ | -54 | 4.16 | - 62 | $4 \cdot 17$ | $\cdot 70$ | 4.18 | -78 | $4 \cdot 20$ |
| 22 | $\cdot 42$ | $4 \cdot 14$ | - 50 | $4 \cdot 15$ | -58 | $4 \cdot 16$ | -66 | 4.17 | $\cdot 75$ | 4.19 | - 83 | $4 \cdot 21$ |
| 24 | $\cdot 46$ | 4.15 | $\cdot 54$ | 4.16 | . 63 | $4 \cdot 17$ | $\cdot 71$ | $4 \cdot 18$ | . 80 | 4.20 | -88 | 4.22 |
| 26 | - 50 | $4 \cdot 15$ | . 59 | $4 \cdot 16$ | -68 | $4 \cdot 18$ | $\cdot 76$ | $4 \cdot 19$ | . 85 | 4.21 | -94 | $4 \cdot 23$ |
| 28 | - 55 | 4.16 | - 64 | $4 \cdot 17$ | $\cdot 73$ | $4 \cdot 19$ | -81 | $4 \cdot 20$ | -90 | 4.22 | -99 | $4 \cdot 24$ |
| 30 | . 60 | 4.16 | -69 | $4 \cdot 18$ | $\cdot 78$ | $4 \cdot 20$ | -87 | $4 \cdot 21$ | -96 | 4.23 | I.05 | 4.25 |
| 32 | -65 | $4 \cdot 17$ | $\cdot 74$ | 4.19 | -83 | $4 \cdot 21$ | -93 | $4 \cdot 22$ | I-02 | $4 \cdot 25$ | 1-12 | 4.27 |
| 34 | $\cdot 70$ | $4 \cdot 18$ | -80 | $4 \cdot 20$ | -89 | 4.22 | -99 | 4.24 | 1.09 | $4 \cdot 26$ | I•19 | 4.29 |
| 36 | $\cdot 76$ | 4.19 | -86 | $4 \cdot 21$ | $\cdot 95$ | $4 \cdot 23$ | 1.05 | $4 \cdot 26$ | I-16 | 4.28 | I-26 | $4 \cdot 31$ |
| 38 | -82 | $4 \cdot 20$ | -92 | 4.22 | 1.02 | $4 \cdot 25$ | I'I2 | $4 \cdot 27$ | I. 23 | $4 \cdot 30$ | I-34 | $4 \cdot 33$ |
| 40 | -88 | 4.21 | -99 | $4 \cdot 24$ | I.09 | 4.26 | I. 20 | $4 \cdot 29$ | 1.31 | $4 \cdot 33$ | I.42 | $4 \cdot 36$ |
| 42 | -95 | $4 \cdot 23$ | ェ.06 | 4.26 | I•I7 | $4 \cdot 28$ | 1.28 | $4 \cdot 32$ | I 40 | $4 \cdot 35$ | I. 52 | $4 \cdot 39$ |
| 44 | 1.02 | $4 \cdot 25$ | 1.14 | $4 \cdot 28$ | 1. 25 | $4 \cdot 31$ | 1.37 | $4 \cdot 34$ | 1.49 | $4 \cdot 38$ | 1. 62 | 4.43 |
| 46 | 1.10 | $4 \cdot 27$ | 1.22 | $4 \cdot 30$ | I. 34 | $4 \cdot 34$ | 1.47 | $4 \cdot 38$ | I. 60 | $4 \cdot 42$ | 1.73 | $4 \cdot 47$ |
| 48 | 1.19 | $4 \cdot 29$ | I.3I | $4 \cdot 33$ | 1.44 | $4 \cdot 37$ | I. 58 | $4 \cdot 41$ | 1.72 | $4 \cdot 47$ | I. 86 | 4.52 |
| 50 | I. 28 | $4 \cdot 32$ | 1.42 | $4 \cdot 36$ | 1.56 | $4 \cdot 41$ | I.70 | 4.46 | $\underline{1} 85$ | 4.52 | $2 \cdot 00$ | $4 \cdot 58$ |
| 52 | 1.39 | $4 \cdot 35$ | I. 53 | 4.40 | I. 68 | 4.45 | I. 84 | $4 \cdot 51$ | 2.00 | $4 \cdot 58$ | $2 \cdot 17$ | $4 \cdot 65$ |

## LATITUDE $14^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $77^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. <br> Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. S. | S. | H. M. | S. | H. M. | S. | H. M. S. | S. | I. M. S. | S. |
| 0 | $55359 \cdot 6$ | -I.OI | $5 \quad 52$ 59.0 | - I•OI | 5 51 58.1 | - I.02 | $55056 \cdot 8$ | - 1.02 | $54955 \cdot 3$ | - I. 03 | $548 \quad 53 \cdot 3$ | -1.04 |
| 8 | $52045 \%$ | 1.09 | $\begin{array}{llll}5 & 19 & 39.4\end{array}$ | I'10 | $\begin{array}{llll}5 & 18 & 32 \cdot 9\end{array}$ | $1 \cdot 12$ | $\begin{array}{lllll}5 & 17 & 25.4\end{array}$ | I-13 | $\begin{array}{lllll}5 & 16 & 16 \cdot 8\end{array}$ | I'I5 | $5 \begin{array}{llll}5 & 15 & 7\end{array}$ | I'I7 |
| 10 | $\begin{array}{llll}5 & 12 & 24 \cdot 7\end{array}$ | I-II | 5 I1 17•7 | I•13 | $\begin{array}{llll}5 & 10 & 9.5\end{array}$ | I.15 | $\begin{array}{lll}5 & 9 & 0.2\end{array}$ | 1-17 | 57496 | I'19 | $\begin{array}{llll}5 & 6 & 37 \cdot 7\end{array}$ | I. 21 |
| 12 | $\begin{array}{llll}5 & 4 & 3 & 7\end{array}$ | I.13 | $\begin{array}{llll}5 & 2 & 55 \cdot 1 \\ 4 & 54 & \end{array}$ | I•5 | 5 I 45.2 | I.I8 | 5 - 33.9 | 1.20 | $4 \begin{array}{lll}4 & 59 & 21.2\end{array}$ | I 22 | $\begin{array}{llll}4 & 58 & 6 \cdot 9\end{array}$ | 1.25 |
| 14 | $45541 \cdot 8$ | I.16 | 454 31-6 | I'I8 | 45319.8 | I. 21 | $\begin{array}{lll}4 & 52 & 6 \cdot 4\end{array}$ | I.24 | $4505 \mathrm{I} \cdot 4$ | I. 26 | $44934 \cdot 7$ | I. 29 |
| 16 | $44719 \cdot 1$ | 1.19 | $4 \begin{array}{lll}4 & 46 & 7 \cdot 0\end{array}$ | 1.22 | 44453.2 | 1.24 | $4 \begin{array}{llll}4 & 43 & 37 \cdot 6\end{array}$ | 1.27 | $\begin{array}{llll}4 & 42 & 20 \cdot 2\end{array}$ | I.3I | 441009 | 1.34 |
| 18 | $43^{48} 5 \cdot 5 \cdot 3$ | I. 22 | $43741 \cdot 3$ | I 25 | $4 \begin{array}{lll}4 & 35 \cdot 3\end{array}$ | 1.28 | 43507.4 | 1-32 | $\begin{array}{llll}4 & 33 & 47 \cdot 4\end{array}$ | I.35 | $432 \begin{array}{lll}4 & 25 \cdot 2\end{array}$ | 1-39 |
| 20 | $43030 \cdot 4$ | I. 25 | $4 \begin{array}{llllll}4 & 29 & 14\end{array}$ | I 29 | $42756 \cdot 0$ | I. 32 | $4 \begin{array}{lll}4 & 26 & 35 \cdot 6\end{array}$ | 1.36 | $\begin{array}{llll}4 & 25 & 12 \cdot 9\end{array}$ | 1.40 | $42347 \cdot 7$ | I. 44 |
| 22 | 42243 | I. 29 | $42045 \cdot 9$ | I.33 | 419 25.2 | 1.36 | $\begin{array}{lll}4 & 18 & 2 \cdot 1\end{array}$ | 1.41 | $4 \begin{array}{llll}46 & 36 \cdot 4\end{array}$ | I 45 | 415880 | I. 50 |
| 24 | $413136 \cdot 9$ | I. 33 | 4 I2 I6.I | 1.37 | 4 10 $52 \cdot 7$ | 141 | $4 \quad 9 \quad 26 \cdot 6$ | 1.46 | $4 \quad 7 \quad 57 \cdot 7$ | I 51 | $4 \quad 6 \quad 25 \cdot 9$ | 1.55 |
| 25 | $\begin{array}{llll}4 & 9 & 22.6\end{array}$ | I.35 | $\begin{array}{lll}4 & 8 & 0.5\end{array}$ | I.39 | $\begin{array}{llll}4 & 6 & 35 \cdot 7\end{array}$ | 1.44 | $\begin{array}{lll}4 & 5 & 8 \cdot 1\end{array}$ | 1.48 | $\begin{array}{llll}4 & 3 & 37 \cdot 5\end{array}$ | I. 53 | $\begin{array}{lll}4 & 2 & 3.9\end{array}$ | I. 58 |
| 26 | $\begin{array}{llll}4 & 5 & 7 \cdot 9\end{array}$ | I.37 | $\begin{array}{llll}4 & 3 & 44 \cdot 5\end{array}$ | 1.41 | $4 \quad 218.2$ | 1.46 | 4049.0 | I.51 |  | 1.56 | $35741 \cdot 2$ | I. 62 |
| 27 | 4 O $42 \cdot 8$ | 1.39 | $\begin{array}{llll}3 & 59 & 28 \cdot 0\end{array}$ | 1.44 | $\begin{array}{lll}3 & 58 & 0.2\end{array}$ | 1.49 | $\begin{array}{llll}3 & 56 & 29 \cdot 3\end{array}$ | 1.54 | $3 \begin{array}{lllllllll}3 & 54 & 55\end{array}$ | I. 60 | 33 53 | I. 65 |
| 28 |  | I.4I | $35511 \cdot 0$ | 1.46 | 3 53 41 | 1.52 | $\begin{array}{llll}3 & 52 & 9 \cdot 0\end{array}$ | I. 57 | $35033 \cdot 1$ | I. 63 | $\begin{array}{lllllllllllllllllll}3 & 48 & 53\end{array}$ | I. 69 |
| 29 | $3 \begin{array}{llll}3 & 52 & 21 \cdot 2\end{array}$ | I.44 | 35053.5 | I. 49 | 34922.4 | 1.55 | $34748 \cdot 0$ | 1.60 | 346 10.I | I. 66 | $\begin{array}{llll}3 & 44 & 28 \cdot 6\end{array}$ | I.72 |
| 30 | $\begin{array}{llll}3 & 48 & 4 \cdot 7\end{array}$ | 1.46 | $\begin{array}{llll}3 & 46 & 35.4\end{array}$ | 1.52 | $\begin{array}{llll}3 & 45 & 2.6\end{array}$ | I. 58 | $\begin{array}{llll}3 & 43 & 26 \cdot 3\end{array}$ | I. 63 | 3 4146.4 | I•70 | $340 \quad 2 \cdot 7$ | I.76 |
| 31 | $\begin{array}{llll}3 & 43 & 47 \cdot 7\end{array}$ | I. 49 | $\begin{array}{llll}3 & 42 & 16 \cdot 7\end{array}$ | I.55 | $3{ }^{3} 4042 \cdot 1$ | I.61 | $\begin{array}{lll}3 & 39 & 3 \cdot 9\end{array}$ | I. 67 | $\begin{array}{lllll}3 & 37 & 21.9\end{array}$ | 1.73 | $\begin{array}{llll}3 & 35 & 35 \cdot 8\end{array}$ | 1.80 |
| 32 | $\begin{array}{llll}3 & 39 & 30 \cdot 1\end{array}$ | I. 52 | $\begin{array}{llll}3 & 37 & 57 \cdot 4\end{array}$ | I. 58 | 33621.0 | I. 64 | $\begin{array}{llll}3 & 3440 \cdot 7\end{array}$ | 1.70 | $33256 \cdot 5$ | I.77 | $\begin{array}{llll}3 & 31 & 8 \cdot 0\end{array}$ | I. 84 |
| 33 | $\begin{array}{lllll}3 & 35 & 11 & 9\end{array}$ | I.54 | $\begin{array}{llll}3 & 33 & 37 \cdot 4\end{array}$ | I.6I | 3 31 59 | 1.67 | $\begin{array}{llll}3 & 30 & 16 \cdot 7\end{array}$ | 1.74 | $\begin{array}{llllll}3 & 28 & 30 \cdot 1\end{array}$ | I.8I | $\begin{array}{llll}3 & 26 & 39.2\end{array}$ | I.89 |
| 34 | $33053 \cdot 1$ | I. 57 | $3 \begin{array}{llll}3 & 29 & 16.8\end{array}$ | I. 64 | $32736 \cdot 3$ | 1.71 | $32551 \cdot 7$ | 1.78 | $324 \begin{array}{lll}3 & 2 \cdot 7\end{array}$ | I. 85 | 32292 | 1.93 |
| 35 | $\begin{array}{llll}3 & 26 & 33 \cdot 7 \\ 3 & 22 & \end{array}$ | I. 60 | $\begin{array}{llll}3 & 24 & 55 \cdot 3 \\ 3 & 2\end{array}$ | 1.67 | $\begin{array}{lll}3 & 23 & 12.8 \\ 3 & 18 & 4.3\end{array}$ | I•75 | $3 \begin{array}{lll}3 & 21 & 25 \cdot 8 \\ 3 & 16 & 58 \cdot 9\end{array}$ | I.82 | 3 I9 $34 \cdot 3$ | 1.90 | $\begin{array}{lll}3 & 17 & 37.9\end{array}$ | $\underline{1.98}$ |
| 36 | $\begin{array}{llll}3 & 22 & 13.5\end{array}$ | 1.64 | $\begin{array}{llll}3 & 20 & 33 \cdot 1 \\ 3 & 16 & \end{array}$ |  | $\begin{array}{llll}3 & 18 & 48 \cdot 3\end{array}$ | $1 \cdot 78$ | $\begin{array}{llll}3 & 16 & 58 \cdot 9\end{array}$ | I.86 | $\begin{array}{llll}3 & 15 & 4 \cdot 7 \\ 3\end{array}$ | I.94 | $\begin{array}{lll}3 & 13 & 5 \cdot 5\end{array}$ | 2.03 |
| 37 | $\begin{array}{llllllllll}3 & \text { I7 } & 52.5\end{array}$ | 1.67 | $31610 \cdot 0$ | I.75 | $\begin{array}{llll}3 & 14 & 22 \cdot 8\end{array}$ | I.83 | $\begin{array}{llll}3 & 12 & 30 \cdot 9\end{array}$ | I.91 | 3 Io 33.9 | 1•99 | $3883 \pm \cdot 7$ | 2.08 |
| 38 |  | x.81 | 3 II $46 \cdot 0$ | I.79 | $\begin{array}{llll}3 & 9 & 56 \cdot 3\end{array}$ | I.87 | $\begin{array}{lll}3 & 8 & 1 \cdot 7\end{array}$ | I.95 | $\begin{array}{llll}3 & 6 & 1 \cdot 8 \\ 3 & 1 & 8 & \end{array}$ | $2 \cdot 04$ | $\begin{array}{lrrr}3 & 3 & 56 \cdot 4\end{array}$ | $2 \cdot 14$ |
| 39 | $\begin{array}{llll}3 & 9 & 8 \cdot 2\end{array}$ | I•75 | $3721 \cdot 0$ | 1.83 | $\begin{array}{llll}3 & 5 & 28.8\end{array}$ | I.91 | $\begin{array}{llll}3 & 3 & 3 I \cdot 3\end{array}$ | $2 \cdot 00$ | 3 I 128.2 | $2 \cdot 10$ | 25919.4 | $2 \cdot 20$ |
| 40 | $3444{ }^{3} 6$ | 1.79 | $\begin{array}{llll}3 & 2 & 55\end{array}$ | 1.87 | 3100 | I.96 | $2 \begin{array}{lll}2 & 58 & 59.4\end{array}$ | $2 \cdot 06$ | $2 \begin{array}{llll}26 & 53 \cdot 2\end{array}$ | $2 \cdot 16$ | $25440 \cdot 8$ | $2 \cdot 26$ |
| 41 | $3020 \cdot 1$ | I.83 | $\begin{array}{llll}2 & 58 & 27 \cdot 7\end{array}$ | 1.92 | $\begin{array}{llll}2 & 56 & 29.9\end{array}$ | $2 \cdot \mathrm{OI}$ | $254 \quad 26 \cdot 2$ | $2 \cdot 11$ | $252 \begin{array}{llll}2 & 16 \cdot 5\end{array}$ | $2 \cdot 22$ | 250 | $2 \cdot 33$ |
| 42 | $\begin{array}{llll}2 & 55 & 54 \cdot 5\end{array}$ | 1.87 | $2 \begin{array}{lllllll} & 53 & 59\end{array}$ | 1.97 | $25158 \cdot 4$ | 2.07 | 24951.4 | $2 \cdot 17$ | $24738 \cdot 0$ | $2 \cdot 28$ | $2 \begin{array}{llllllll} & 45 & 17\end{array}$ | 2.40 |
| 43 | $\begin{array}{llll}2 & 51 & 27 \cdot 7\end{array}$ | I.92 | $2 \begin{array}{llll}2 & 49 & 29 \cdot 6\end{array}$ | 2.02 | 24725.4 | $2 \cdot 12$ | $2 \begin{array}{llllllll}2 & 45 & 14.8\end{array}$ | $2 \cdot 23$ | $24257 \cdot 5$ | $2 \cdot 35$ | 240 | 2.47 |
| 44 | $24659 \cdot 7$ | 1.97 | $244 \quad 58 \cdot 4$ | 2.07 | 24250.8 | 2.18 | 24036.4 | 2.30 | $23^{8}$ I5.0 | 2.42 | $23545 \cdot 9$ | 2.55 |
| 45 | $\begin{array}{llll}2 & 42 & 30 \cdot 3\end{array}$ | 2.02 | $2 \begin{array}{llll}2 & 40 & 25.7\end{array}$ | $2 \cdot 13$ | $2 \begin{array}{llll}28 & 14.4\end{array}$ | 2.25 | $23556 \cdot 0$ | 2.37 | 233 30.1 | $2 \cdot 50$ | $23056 \cdot 2$ | $2 \cdot 64$ |
| 46 | $2 \begin{array}{llll}2 & 37 & 59\end{array}$ | $2 \cdot 08$ | $\begin{array}{llll}2 & 35 & 51 & 3\end{array}$ | $2 \cdot 19$ | $23336 \cdot 1$ | $2 \cdot 32$ | $2 \begin{array}{llll}2 & 31 & 13.4\end{array}$ | 2.45 | $\begin{array}{llllllllllllllll}2 & 28 & 42 \cdot 7\end{array}$ | 2.58 | $\begin{array}{llll}2 & 26 & 3 \cdot 6\end{array}$ | $2 \cdot 73$ |
| 47 | 2 33 27.0 <br> 2   | $2 \cdot 14$ | $\begin{array}{llll}2 & 31 & 15 \cdot 1 \\ 2 & 16 & 36 \cdot 8\end{array}$ | $2 \cdot 26$ | $2 \begin{array}{llll}28 & 285 \cdot 7\end{array}$ | $2 \cdot 39$ | $\begin{array}{llll}2 & 26 & 28 \cdot 4\end{array}$ | 2.53 | $\begin{array}{llll}2 & 23 & 52 \cdot 6\end{array}$ | 2.67 | $\begin{array}{llll}2 & 21 & 7.8 \\ 2 & 16 & 8.4\end{array}$ | 2.83 |
| 48 | $\begin{array}{llll}2 & 28 & 52 \cdot 8 \\ 2 & 24 & 5 \cdot 7\end{array}$ | 2.20 | $\begin{array}{llll}2 & 26 & 36 \cdot 8 \\ 2 & 21 & 56.4\end{array}$ | 2.33 | 22413.0 | 2.47 | $\begin{array}{lllllllllllllllll} \\ 2 & 21 & 40 \cdot 7\end{array}$ | 2.61 | $\begin{array}{llll}2 & 18 & 59.4\end{array}$ | 2.77 | $\begin{array}{llll}2 & 16 & 8.4\end{array}$ | 2.94 |
| 49 | $2 \quad 2416 \cdot 7$ | $2 \cdot 27$ | 22156.4 | 2.41 | $21927 \cdot 7$ | $2 \cdot 55$ | $21650 \cdot 0$ | 2.71 | 21842.7 | $2 \cdot 87$ | 2 II 5-1 | 3.05 |
| VARIATION TO I' OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. | A. |  | A. | L. | A. | L. $9^{\circ}$ | A. | L. 10 | A. | L. $11^{\circ}$ | - A. |
| $\bigcirc$ | S. | S. ${ }^{\text {P }}$ | S. | S. | S. | S. | . 67 | S. | S. ${ }^{75}$ | S. | S. 83 | S. |
| 4 | . 45 | $4 \cdot 15$ $4 \cdot 15$ | . 52 | $4 \cdot 15$ $4 \cdot 16$ | . 60 | $4 \cdot 16$ 4.18 |  | $4 \cdot 17$ $4 \cdot 19$ | .75 .83 | $\begin{aligned} & 4 \cdot 19 \\ & 4 \cdot 21 \end{aligned}$ | . 83 | 4.20 4.22 |
| 6 | . 56 | 4.16 | . 64 | $4 \cdot 17$ | . 71 | $4 \cdot 18$ | . 80 | $4 \cdot 20$ | .87 | 4.21 | $\cdot 95$ | $4 \cdot 23$ |
| 8 | . 60 | $4 \cdot 17$ | . 68 | 4.18 | 75 | $4 \cdot 19$ | . 83 | $4 \cdot 21$ | $\cdot 91$ | $4 \cdot 22$ | -99 | $4 \cdot 24$ |
| 10 | -64 | $4 \cdot 17$ | $\cdot 72$ | 4.18 | -80 | $4 \cdot 20$ | . 87 | $4 \cdot 21$ | -95 | $4 \cdot 23$ | I-04 | 4.25 |
| 12 | . 68 | 4-18 | -76 | 4.19 | . 84 | $4 \cdot 2 \mathrm{I}$ | -92 | $4 \cdot 22$ | 1.00 | 4.24 | I. 08 | $4 \cdot 26$ |
| 14 | $\cdot 72$ | 4.19 | . 80 | $4 \cdot 20$ | -89 | $4 \cdot 22$ | -97 | $4 \cdot 23$ | I. 05 | $4 \cdot 25$ | I-13 | 4.27 |
| 16 | $\cdot 77$ | 4.19 | . 85 | $4 \cdot 21$ | -93 | $4 \cdot 23$ | $1 \cdot 02$ | $4 \cdot 25$ | I-10 | $4 \cdot 27$ | I•18 | $4 \cdot 29$ |
| 18 | . 82 | 4.20 | -90 | $4 \cdot 22$ | -98 | 4.24 | $\underline{1.07}$ | $4 \cdot 26$ | I'15 | $4 \cdot 28$ | I. 24 | 4.30 |
| 20 | .87 | 4.21 | -95 | $4 \cdot 23$ | 1.03 | 4.25 | I'12 | $4 \cdot 27$ | I-2I | $4 \cdot 30$ | I. 30 | $4 \cdot 32$ |
| 22 | -92 | $4 \cdot 22$ | 1.00 | 4.24 | I.09 | $4 \cdot 26$ | I. 18 | $4 \cdot 29$ | 1.27 | $4 \cdot 31$ | I. 36 | $4 \cdot 34$ |
| 24 | -97 | $4 \cdot 23$ | r.06 | $4 \cdot 25$ | I-15 | $4 \cdot 28$ | I. 24 | $4 \cdot 30$ | I.33 | $4 \cdot 33$ | 1.42 | 4.36 |
| 26 | I-03 | $4 \cdot 25$ | 1-12 | $4 \cdot 27$ | I-21 | $4 \cdot 30$ | $1 \cdot 30$ | $4 \cdot 32$ | I 40 | $4 \cdot 35$ | I-49 | $4 \cdot 38$ |
| 28 | 1.09 | $4 \cdot 26$ | 1-18 | 4.29 | I 27 | $4 \cdot 32$ | $1 \cdot 37$ | $4 \cdot 34$ | 1.47 | $4 \cdot 38$ | I. 57 | 4.41 |
| 30 | I'I5 | $4 \cdot 28$ | 1.24 | 4.31 | I-34 | 4.34 | 1.44 | $4 \cdot 37$ | 1.54 | $4 \cdot 40$ | I. 65 | 4.44 |
| 32 | 1.22 | $4 \cdot 30$ | $1 \cdot 32$ | $4 \cdot 33$ | 1.42 | $4 \cdot 36$ | 1.52 | $4 \cdot 39$ | 1. 63 | 4.43 | $1 \cdot 73$ | 4.47 |
| 34 | I. 29 | $4 \cdot 32$ | I•39 | $4 \cdot 35$ | I•50 | $4 \cdot 39$ | I. 60 | 4.42 | 1.71 | $4 \cdot 46$ | 1.83 | $4 \cdot 5 \mathrm{I}$ |
| 36 | I. 37 | $4 \cdot 34$ | 1.47 | $4 \cdot 38$ | r. 58 | 4.42 | 1.70 | $4 \cdot 46$ | 1-81 | $4 \cdot 50$ | 1.93 | 4.55 |
| 38 | I. 45 | $4 \cdot 37$ | I. 56 | 4.41 | I. 68 | 4.45 | 1-80 | 4.50 | $1 \cdot 92$ | 4.55 | 2.05 | 4.60 |
| 40 | I. 54 | $4 \cdot 40$ | I. 66 | 4.44 | 1.78 | $4 \cdot 49$ | 1.91 | 4.54 | 2.04 | $4 \cdot 60$ | $2 \cdot 17$ | $4 \cdot 66$ |
| 42 | 1. 64 | 4.44 | 1.77 | 4.48 | I.90 | $4 \cdot 54$ | 2.03 | 4.59 | $2 \cdot 17$ | $4 \cdot 66$ | $2 \cdot 31$ | 4.73 |
| 44 | 1.75 | $4 \cdot 48$ | 1. 88 | $4 \cdot 53$ | $2 \cdot 02$ | $4 \cdot 59$ | $2 \cdot 17$ | $4 \cdot 66$ | $2 \cdot 32$ | $4 \cdot 73$ | 2.47 | 4.81 |
| 46 | 1.87 | $4 \cdot 53$ | 2.02 | 4.59 | 2.16 | $4 \cdot 66$ | 2.32 | $4 \cdot 73$ | 2.48 | 4.81 | 2.66 | 4.90 |
| 48 | 2.01 | 4.59 | $2 \cdot 16$ | 4.66 | $2 \cdot 33$ | $4 \cdot 73$ | $2 \cdot 50$ | $4 \cdot 82$ | 2.68 | 4.92 | 2.87 | $5 \cdot 02$ |
| 49 | 2.08 | 4.63 | 2.25 | $4 \cdot 69$ | 2.42 | $4 \cdot 78$ | $2 \cdot 60$ | 4.87 | $2 \cdot 79$ | $4 \cdot 98$ | 2.99 | $5 \cdot 09$ |

## 180 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $14^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. | S. | H. M. |  | 5 | S. | H. M. | S. | M. | S. |
| 0 | 54750.9 | - 1.04 | $54648 \cdot 0$ | - I.05 | $54544 \cdot 6$ | - I•06 | $5 \begin{array}{lll}5 & 44 & 40 \cdot 6\end{array}$ | - 1.07 | $\begin{array}{llll}5 & 43 & 36 \cdot 1\end{array}$ | - 1.08 | $54230 \cdot 8$ | - I.09 |
| 6 | $\begin{array}{llll}5 & 22 & 26 \cdot 7\end{array}$ | 1.15 | $52117 \cdot 1$ | I•17 | $\begin{array}{llll}5 & 20 & 6.4\end{array}$ | I•19 | $5 \quad 18 \quad 54.5$ | I 21 | 5 17 4I.4 | r. 23 | $51627 \cdot 0$ | I. 25 |
| 8 | $\begin{array}{lllll}5 & 13 & 56 \cdot 3\end{array}$ | I•19 | $\begin{array}{llll}5 & 12 & 44 \cdot 2\end{array}$ | I. 21 | 5 II $30 \cdot 8$ | 1.23 | 5 10 16.0 | 1.26 | $\begin{array}{lll}5 & 8 & 59.8\end{array}$ | I-28 | $\begin{array}{llll}5 & 7 & 42 \cdot 2\end{array}$ | r.3 |
| 10 | $\begin{array}{lllll}5 & 5 & 24.4\end{array}$ | 1.23 | $\begin{array}{llll}5 & 4 & 9 * 7\end{array}$ | I 26 | $\begin{array}{llll}5 & 2 & 53.6\end{array}$ | 1.28 | $5 \quad 1 \quad 35 \cdot 7$ | I.3r | $5 \quad 0 \quad 16.4$ | 1.34 | $45855 \cdot 2$ | r.37 |
| 12 | $4565 \mathrm{I} \cdot 2$ | 1-28 | $45533 \cdot 7$ | 1.30 | 45414.6 | I. 33 | $45253 \cdot 6$ | 1.37 | $45130 \cdot 7$ | I 40 | $4 \quad 50 \quad 5 \cdot 9$ | 1.43 |
| 14 | 448 I6.2 | 1.32 | 44655.9 | I.35 | $\begin{array}{llll}4 & 45 & 33.6\end{array}$ | 1•39 | 444193 | 1.42 | $4 \begin{array}{llll}4 & 42 & 42 \cdot 8\end{array}$ | I. 46 | 4 4r 14.2 | I. 50 |
| 16 | 43939.5 | r.37 | 438 r6•I | I. 41 | $43650 \cdot 5$ | $1 \cdot 45$ | $435 \quad 22 \cdot 6$ | 1.48 | $43352 \cdot 4$ | I. 52 | $43219 \cdot 6$ | 1.57 |
| 18 | 431009 | $1 \cdot 42$ | 42934.2 | I.46 | 428 5.1 | 1.51 | $\begin{array}{llllll}4 & 26 & 33.4\end{array}$ | 1.55 | $424 \begin{array}{llll}4 & 24 \cdot 1\end{array}$ | $\underline{1.59}$ | $4 \begin{array}{llll}4 & 23 & 22 \cdot 1\end{array}$ | I.64 |
| 19 | $42640 \cdot 8$ | I.45 | $\begin{array}{llll}4 & 25 & 12.4\end{array}$ | I.49 | 423141.4 | 1.54 | $\begin{array}{llll}4 & 22 & 7 \cdot 8\end{array}$ | 1.58 | $420031 \cdot 3$ | r.63 | $4 \begin{array}{lll}4 & \text { I } & 52 \cdot 0\end{array}$ | r.68 |
| 20 | $42220 \cdot 1$ | I.48 | $42049 \cdot 9$ | I. 52 | 4 I9 r7. | r 57 | 4 I7 4I.4 | $\mathrm{r} \cdot 62$ | $\begin{array}{llll}4 & 16 & 2 \cdot 8\end{array}$ | r.67 | 4 I4 2I'I | x.72 |
| 21 | 4 エ7 $58 \cdot 9$ | I.51 | $\left\lvert\, \begin{array}{lll}4 & 16 & 26 \cdot 9\end{array}\right.$ | r.56 | $4 \begin{array}{lll}4 & 14 & 52 \cdot 0\end{array}$ | r.6r | $4 \begin{array}{lll}43 & 14.2\end{array}$ | 1.65 | 4 II 33.4 | $\underline{1.71}$ | $4 \begin{array}{lll}4 & 9 & 49 \cdot 3\end{array}$ | 1.76 <br> .81 |
| 22 | 4 I3 $36 \cdot 9$ | I. 54 | $\begin{array}{lll}4 & 12 & 3 \cdot 1\end{array}$ | I.59 | 4 10 $26 \cdot 2$ | I. 64 | $4886 \cdot 2$ | I. 69 | $4 \begin{array}{lll}4 & 7 & 3 \cdot 0\end{array}$ | r.75 | $450516 \cdot 4$ | I.8I |
| 23 | $4 \begin{array}{llll}4 & 9 & 14.4\end{array}$ | 1.57 | $4 \begin{array}{llll}4 & 7 & 38 \cdot 6\end{array}$ | I. 62 | $4 \begin{array}{lll}4 & 5 & 59 \cdot 6\end{array}$ | r $\cdot 68$ | $\begin{array}{lrrr}4 & 4 & 17 \cdot 3\end{array}$ | $1 \cdot 73$ | $\begin{array}{lrrr}4 & 2 & 31 \cdot 7 \\ 3 & 5 & \end{array}$ | r.79 | $\begin{array}{rrrr}4 & 0 & 42 \cdot 5 \\ 3 & 56 & 7.5\end{array}$ | I.85 |
| 24 | 4, 4 5I•2 | 1.60 | $\begin{array}{llll}4 & 3 & 13.3\end{array}$ | r.66 | 4 I 32.I | I'7x | $35947 \cdot 6$ | $1 \cdot 77$ | $\begin{array}{llll}3 & 57 & 59.4\end{array}$ | r.83 | $\begin{array}{llll}3 & 56 & 7 \cdot 5\end{array}$ | I.90 |
| 25 | $4 \quad 0 \quad 27 \cdot 3$ | I. 6 | $\begin{array}{llllllllll}3 & 58 & 47 \cdot 3\end{array}$ | r.70 | 3 57. $3 \cdot 8$ | $1 \cdot 75$ | 35516.8 | r 18 r | $35326 \cdot 0$ | I.88 | 3 5I $31 \cdot 4$ | I•94 |
| 26 | $\begin{array}{lll}3 & 56 & 2.5\end{array}$ | 1.6 | $35420 \cdot 3$ | r 73 | $\begin{array}{llll}3 & 52 & 34.6\end{array}$ | $1 \cdot$ | $35045 \cdot 0$ | I. 86 | $34^{3} \quad 51 \cdot 5$ | I'93 | $\begin{array}{lllll}3 & 46 & 53 \cdot 9\end{array}$ | 2.00 |
| 27 | $\begin{array}{llll}3 & 51 & 36 \cdot 9\end{array}$ | r'71 | $\begin{array}{llll}3 & 49 & 52 \cdot 5\end{array}$ | 1.77 | $\begin{array}{llll}3 & 48 & 4 \cdot 3\end{array}$ | I. 84 | $\begin{array}{lllll}3 & 46 & 12 \cdot 1\end{array}$ | $1 \cdot 90$ | $\begin{array}{llll}3 & 44 & 15 \cdot 8\end{array}$ | r.97 | $\begin{array}{llll}3 & 42 & 15 \cdot 2\end{array}$ | $2 \cdot 05$ |
| 28 | $\begin{array}{llll}3 & 47 & 10 \cdot 6\end{array}$ | I.75 | $\begin{array}{llll}3 & 45 & 23 \cdot 8\end{array}$ | I.81 | $\begin{array}{llll}3 & 43 & 33 \cdot 0\end{array}$ | 1.88 | 3 41 $38 \cdot 1$ <br> 3 3  | I.95 | $\begin{array}{llll}3 & 39 & 38.8 \\ 3 & 35 & 0.5\end{array}$ | 2.02 | $\begin{array}{llll}3 & 37 & 35 \cdot 1 \\ 3 & 32 & 53.4\end{array}$ | $2 \cdot 10$ |
| 29 | $\begin{array}{llll}3 & 42 & 43 \cdot 3\end{array}$ | I•79 | 340 | I.86 | $\begin{array}{llll}3 & 39 & 0 \cdot 6\end{array}$ | 1.93 | $\begin{array}{llll}3 & 37 & 2 \cdot 8 \\ 3 & 32 & \end{array}$ | 2.00 | $\begin{array}{llll}3 & 35 & 0.5\end{array}$ | $2 \cdot 08$ | $\begin{array}{llll}3 & 32 & 53.4\end{array}$ | $2 \cdot 16$ |
| 30 | $33^{88} 150$ | r.83 | $\begin{array}{llll}3 & 3 & 23 \cdot 1\end{array}$ | 1.90 | $\begin{array}{llll}3 & 34 & 26 \cdot 9\end{array}$ | 1.97 | $\begin{array}{llll}3 & 32 & 26 \cdot 2\end{array}$ | 2.05 | $33020 \cdot 7$ | $2 \cdot 13$ | 32810.2 | $2 \cdot 22$ |
| 31 | $33345 \cdot 7$ | 1.87 | 3 3I 5I•I | I.95 | $32952 \cdot 1$ | 2.02 | $32748 \cdot 2$ | 1 | 325139.3 | $2 \cdot 19$ | $\begin{array}{llll}3 & 23 & 25 \cdot 2\end{array}$ | $2 \cdot 28$ |
| 32 | $\begin{array}{lllllllllllll}3 & 29 & 15 \cdot 3\end{array}$ | I.92 | 32717.9 | $2 \cdot 00$ | $\begin{array}{lllll}3 & 25 & 15 & 8\end{array}$ | 2.08 | $\begin{array}{llll}3 & 23 & 8 \cdot 7\end{array}$ | .16 | 320566 | $2 \cdot 25$ | $\begin{array}{llll}3 & 18 & 38 \cdot 4\end{array}$ | $2 \cdot 35$ |
| 33 | $32443 \cdot 7$ | I.96 | 32243.4 | $2 \cdot 05$ | $320 \begin{array}{lllll}3 & 20 \cdot 1\end{array}$ | $2 \cdot 13$ | $\begin{array}{llll}3 & 18 & 27 \cdot 6\end{array}$ | $2 \cdot 22$ | $\begin{array}{llll}3 & 16 & 11.5\end{array}$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 13 & 49 \cdot 6\end{array}$ | 2.42 |
| 34 | $\begin{array}{lll}3 & 20 & 10.9 \\ 3 & 15 & 36.7\end{array}$ | 2.01 | $\begin{array}{llrr}3 & 18 & 7 \cdot 5 \\ 3 & 13 & 30 \cdot 1\end{array}$ | $2 \cdot 10$ | 3 15 $58 \cdot 9$ <br> 3 15  | 2.19 2.25 | $\begin{array}{rrrr}3 & 13 & 44 \cdot 7 \\ 3 & 9 & 0.1\end{array}$ | $2 \cdot 28$ $2 \cdot 35$ | $\begin{array}{rrrr}3 & \text { YI } & 24 \cdot 8 \\ 3 & 6 & 36 \cdot 0\end{array}$ | 2.38 2.45 | $\begin{array}{llrr}3 & 8 & 58 \cdot 7 \\ 3 & 4 & 5 \cdot 5\end{array}$ | 2.49 2.57 |
| 35 | $31536 \cdot 7$ | 2.06 | 313 30.1 | $2 \cdot 16$ | 3 II $18 \cdot 0$ | $2 \cdot 25$ | $\begin{array}{lll}3 & 9 & 0 \cdot 1\end{array}$ | $2 \cdot 35$ | $3636 \cdot 0$ | 2.45 | $\begin{array}{llll}3 & 4 & 5 \cdot 5\end{array}$ | $2 \cdot 57$ |
| 36 | 3 II 1-1 | 2 | $3{ }^{3} 8651 \cdot 1$ | 1 | $\begin{array}{llll}3 & 6 & 35 \cdot 3\end{array}$ | $2 \cdot 31$ | 314314 | 2.42 | 3 1 45.0 | $2 \cdot 53$ | $\begin{array}{lll}2 & 59 & 9 \cdot 8\end{array}$ | $2 \cdot 65$ |
| 37 | $\begin{array}{llll}3 & 6 & 23.9\end{array}$ | $2 \cdot 18$ | $\begin{array}{llll}3 & 4 & 10.4\end{array}$ | $2 \cdot 28$ | 3 I 150.7 | $2 \cdot 38$ | $25924 \cdot 6$ | $2 \cdot 49$ | $2{ }^{2} 56515 \cdot 6$ | 2.61 | $2 \begin{array}{llll} & 54 & \text { II. }\end{array}$ | 2.74 |
| 38 | 3 1 $45 \cdot 1$ <br> 2 5  | 2.24 |  | 2.34 | $\begin{array}{llll}2 & 57 & 4.0 \\ 2 & 52 & 1.1\end{array}$ | 2.45 | $2 \cdot 5433 \cdot 4$ | 2.57 | 25155.6 | 2.69 | $\begin{array}{lll}2 & 49 & 10.0 \\ 2 & 44 & 5.5\end{array}$ | 2.83 |
| 39 | 2 57 4.5 <br> 2 5  | $2 \cdot 30$ | $\begin{array}{llllllll}2 & 54 & 43 \cdot 2\end{array}$ | 2.41 | $\begin{array}{llll}2 & 52 & 15 \cdot 1 \\ 2 & 47 & 23.7\end{array}$ | 2.53 | $24939 \cdot 7$ | 2.65 |  | 2.78 2.88 | $\begin{array}{llr}2 & 44 & 5 \cdot 5 \\ 2 & 38 & 57.4\end{array}$ | 2.93 |
| 40 | $25222 \cdot 0$ | $2 \cdot 37$ | $24956 \cdot 4$ | $2 \cdot 49$ | 24723.7 | $2 \cdot 61$ | $24443 \cdot 3$ | $2 \cdot 74$ | 24154.7 | $2 \cdot 88$ | $238 \quad 57 \cdot 4$ | 3.03 |
| 41 | 24737.4 | 2.44 | $\begin{array}{lll}2 & 45 & 7 \cdot 3\end{array}$ | $2 \cdot 56$ | $\begin{array}{llll}2 & 42 & 29 \cdot 6\end{array}$ | $2 \cdot 70$ | $23943 \cdot 7$ | $2 \cdot 84$ | $23649 \cdot 3$ | 2.98 | $\begin{array}{llll}2 & 33 & 45 \cdot 5\end{array}$ | $3 \cdot 15$ |
| 42 | $\begin{array}{llll}2 & 42 & 50 \cdot 5\end{array}$ | 2.52 | 24015.6 | $2 \cdot 65$ | $\begin{array}{llll}2 & 37 & 32 \cdot 6\end{array}$ | $2 \cdot 79$ | 234410 | 2.94 | $23^{31} 40 \cdot 1$ | $3 \cdot 10$ | $\begin{array}{llll}2 & 28 & 29 \cdot 3 \\ 2 & 23 & 8 \cdot 3\end{array}$ | 3.27 |
| 43 | $\begin{array}{lll}2 & 38 & 1 \cdot 1 \\ 2 & 3 & 8\end{array}$ | $2 \cdot 60$ | $235121 \cdot 0$ | 2.74 | $\begin{array}{llll}2 & 32 & 32.4\end{array}$ | 2.89 | $\begin{array}{llll}2 & 29 & 34 \cdot 5\end{array}$ | 3.05 | $\begin{array}{llll}2 & 26 & 26 \cdot 8\end{array}$ | $3 \cdot 22$ | $\begin{array}{lll}2 & 23 & 8 \cdot 3\end{array}$ | $3 \cdot 40$ |
| 44 | $\begin{array}{rrrr}2 & 33 & 8.9 \\ 2 & 28 & 13.8\end{array}$ | 2.69 2.78 | $\begin{array}{llll}2 & 30 & 23.4 \\ 2 & 25 & 22.3\end{array}$ | $2 \cdot 84$ | $2 \begin{array}{llll}2 & 27 & 28 \cdot 6\end{array}$ | 2.99 | $224 \begin{array}{ll}24 \cdot 1\end{array}$ | $3 \cdot 16$ | $\begin{array}{rrrr}2 & 21 & 8.9 \\ 2 & 15 & 45.8\end{array}$ | 3.35 | $21742 \cdot I$ | $3 \cdot 55$ |
| 45 | $2 \begin{array}{llll}28 & 13.8\end{array}$ | $2 \cdot 78$ | $2 \begin{array}{llll}2 & 25 & 22 \cdot 3\end{array}$ | 2.94 | 22221.0 | 3•II | 2 I9 9•1 | $3 \cdot 29$ | $21545 \cdot 8$ | $3 \cdot 49$ | 21299 | $3 \cdot 71$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | S. | s. | s. | s. | s. | s. | s. | S. | s. | s. | s. |
| 0 | - 90 | -4.22 | - 98 | $-4.23$ | - I. 06 | -4.26 | -1.14 | -4.28 | - 1.22 I .26 | -4.30 4.31 | r -1.30 1.35 | 4.32 4.34 |
| 2 | . 94 | 4.23 4.24 | $\xrightarrow{1.02}$ | 4.25 4.26 | I. 10 I 14 | 4.27 4.28 | $\mathrm{r} \cdot 18$ r .22 | 4.29 4.30 | 1.26 1.31 | 4.31 4.32 | 1.35 $\mathbf{r} 39$ | 4.34 4.35 |
| 6 | r.03 | $4 \cdot 25$ | I-1] | $4 \cdot 27$ | 1.19 | $4 \cdot 29$ | 1.27 | 4.31 | 1.35 | 4.34 | 1.44 | 4.36 |
| 8 | r-07 | $4 \cdot 26$ | 1.15 | $4 \cdot 28$ | 1.23 | $4 \cdot 30$ | $1 \cdot 32$ | $4 \cdot 33$ | 1.40 | $4 \cdot 35$ | r'49 | $4 \cdot 38$ |
| 10 | 1.12 | $4 \cdot 27$ | 1.20 | $4 \cdot 29$ | $1 \cdot 28$ | $4 \cdot 32$ | $1 \cdot 37$ | $4 \cdot 34$ | 1.45 | $4 \cdot 37$ | 1.54 | $4 \cdot 40$ |
| 12 | $1 \cdot 17$ | $4 \cdot 28$ | 1.25 | $4 \cdot 31$ | $1 \cdot 33$ | $4 \cdot 33$ | $1 \cdot 42$ | $4 \cdot 36$ | 1.51 | $4 \cdot 39$ | $\mathrm{r} \cdot 60$ | $4 \cdot 42$ |
| 14 | 1.22 | $4 \cdot 30$ | 1.30 | $4 \cdot 32$ | I.39 | $4 \cdot 35$ | r.48 | $4 \cdot 38$ | r 56 | 4.41 | I.66 | 4.44 |
| 16 | $\underline{1} 27$ | 4.31 | 1.36 | 4.34 | 1.45 | 4.37 | I.54 | 4.40 | $\pm .63$ | 4.43 4.46 |  | 4.47 |
| 18 | $1 \cdot 33$ | $4 \cdot 33$ | $1 \cdot 42$ | $4 \cdot 36$ | $1 \cdot 51$ | $4 \cdot 39$ | 1.60 | $4 \cdot 42$ | צ.69 | $4 \cdot 46$ | 1.79 | 4.49 |
| 20 | 1.39 | 4.35 | 1.48 | $4 \cdot 38$ | 1.57 | 4.41 | 1.67 | 4.45 | r 76 | 4.48 | I. 86 | $4 \cdot 52$ |
| 22 | I-45 | $4 \cdot 37$ | 1.54 | 4.40 | 9.64 | $4 \cdot 44$ | $1 \cdot 74$ | $4 \cdot 47$ | I. 84 | $4 \cdot 51$ | $\underline{194}$ | 4.56 |
| 24 | I 52 | $4 \cdot 39$ | 1.62 | 4.43 | r.71 | 4.46 | r.82 | 4.50 | 1.92 | 4.55 | 2.02 | 4.59 |
| 28 | 1.59 $\mathbf{r} \cdot 67$ | 4.42 4.45 | I 69 $\mathbf{1} \cdot 77$ | $4 \cdot 46$ 4.49 | 1.79 $\mathbf{r} .88$ | 4.50 4.53 | 1.90 $\mathbf{r} 99$ | 4.54 4.58 | $2 \cdot 01$ $2 \cdot 10$ | 4.58 4.63 | 2.12 2.22 | 4.63 4.68 |
| 30 | 1.75 | 4.48 | 1.86 | $4 \cdot 52$ | 1.97 | 4.57 | 2.09 | $4 \cdot 62$ | 2.21 | $4 \cdot 68$ | $2 \cdot 33$ | 4.73 |
| 32 | r. 85 | 4.52 | 1.96 | $4 \cdot 56$ | 2.08 | 4.62 | $2 \cdot 20$ | $4 \cdot 67$ | 2.32 | $4 \cdot 73$ | $2 \cdot 45$ | 4.80 |
| 34 | 1.94 | 4.56 | 2.07 | 4.61 | $2 \cdot 19$ | 4.67 | $2 \cdot 32$ | $4 \cdot 73$ | 2.45 | 4.80 | $2 \cdot 59$ | $4 \cdot 87$ |
| 36 | 2.06 | 4.61 | $2 \cdot 18$ | $4 \cdot 66$ | 2.31 | $4 \cdot 73$ | 2.45 | $4 \cdot 80$ | $2 \cdot 59$ | $4 \cdot 87$ | 2.74 | $4 \cdot 95$ |
| 38 | 2.18 | $4 \cdot 66$ | $2 \cdot 31$ | $4 \cdot 73$ | $2 \cdot 45$ | $4 \cdot 80$ | $2 \cdot 60$ | $4 \cdot 87$ | $2 \cdot 75$ | $4 \cdot 96$ | 2.92 | $5 \cdot 05$ |
| 40 | 2.31 | 4.73 | 2.46 | 4.80 | 2.6 r | 4.88 | 2.77 | 4.97 | 2.94 | $5 \cdot 06$ | 3.19 3.35 | $5 \cdot 17$ |
| 42 | 2.46 | 4.80 | $2 \cdot 62$ | $4 \cdot 89$ | 2.79 | 4.98 | 2.96 | $5 \cdot 08$ | 3.15 | $5 \cdot 19$ | $3 \cdot 35$ | $5 \cdot 31$ |
| 43 | 2.55 | $4 \cdot 85$ | 2.71 | 4.93 | 2.89 | 5.03 | 3.07 | $5 \cdot 14$ | 3.27 | $5 \cdot 26$ | 3.48 | $5 \cdot 39$ |
| 44 | 2.64 | 4.89 | 2.81 | 4.99 | 2.99 3.15 | $5 \cdot 09$ | $3 \cdot 19$ | 5.21 | 3.40 3.54 | $5 \cdot 34$ | 3.62 | $5 \cdot 49$ |
| 45 | 2.73 | $4 \cdot 95$ | $2 \cdot 92$ | 5.05 | $3 \cdot 11$ | $5 \cdot 15$ | $3 \cdot 32$ | $5 \cdot 29$ | $3 \cdot 54$ | $5 \cdot 43$ | 3.78 | 5*59 |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 181

## LATITUDE $14^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H, M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $54124 \cdot 8$ | -I.II | 540 I $8 \cdot 0$ | -1.12 | $\begin{array}{llll}5 & 39 & 10.4\end{array}$ | -I.13 | $\begin{array}{llll}5 & 38 & 1 \cdot 9\end{array}$ | -I'15 | $5 \begin{array}{llll}5 & 36 & 52 \cdot 5\end{array}$ | -I.I7 | $\begin{array}{llll}5 & 35 & 42 \cdot 0\end{array}$ | -I.I8 |
| 2 | $\begin{array}{llll}5 & 32 & 42 \cdot 1\end{array}$ | I.16 | $53132 \cdot 0$ | I.18 | $530 \begin{array}{llll}50 & 20.8\end{array}$ | I-19 | $\begin{array}{lllllllllllll}5 & 29 & 8 \cdot 6\end{array}$ | I.2I | 527 55.1 | I•24 | $52640 \cdot 3$ | I. 26 |
| 4 | $\begin{array}{llll}5 & 23 & 57 \cdot 6\end{array}$ | 1.22 | 52244 I | I. 24 | 52129.2 | I. 26 | 52013.0 | I.28 | 518155.4 | I•3I | $\begin{array}{lllllllllll}5 & 17 & 36 \cdot 3\end{array}$ | I. 33 |
| 6 | $\begin{array}{rrrr}5 & 15 & 11 \cdot 3\end{array}$ | 1.27 | $\begin{array}{llll}5 & 13 & 54.1\end{array}$ | 1.30 | $\begin{array}{rrrr}5 & 12 & 35.4 \\ 5 & 3 & 39.2\end{array}$ | $1 \cdot 32$ | $\begin{array}{ccc}5 & 11 & 15 \cdot 1 \\ 5 & 2 & 14.7\end{array}$ | I.35 | $\begin{array}{llll}5 & 9 & 53.2 \\ 5 & 0 & 48.2\end{array}$ | r.38 | $\begin{array}{rrrr}5 & 8 & 29.4\end{array}$ | 1.41 |
| 8 | $5 \quad 6 \quad 22 \cdot 9$ | I. 34 | $5 \begin{array}{lll}5 & 5 & 1.9\end{array}$ | 1.36 | $5 \quad 3 \quad 39 \cdot 2$ | $1 \cdot 39$ | $\begin{array}{llll}5 & 2 & 14.7\end{array}$ | 1.42 | $5 \quad 0 \quad 48 \cdot 2$ | 1.46 | $4 \quad 59$ I9.6 | I-49 |
| 10 | $4 \begin{array}{lll}4 & 57 & 32 \cdot 2\end{array}$ | 1.40 | $4 \begin{array}{lll}46 & 7 \cdot 3\end{array}$ | 1.43 | $45440 \cdot 4$ | 1.47 | $45311 \cdot 4$ | I. 50 | $45140 \cdot 1$ | I. 54 | $4506 \cdot 5$ | 1.58 |
| 12 | $44839 \cdot 1$ | 1.47 | $44710 \cdot 0$ | 1.50 | $4 \begin{array}{llllllllll}4 & 45 & 38 \cdot 7\end{array}$ | 1.54 | 4444.9 | I.58 | $442 \begin{array}{llll}4 & 28 \cdot 7\end{array}$ | I. 63 | $44049 \cdot 8$ | I. 67 |
| 14 | $43943 \cdot 2$ | $1 \cdot 54$ | 43819 | 1.58 | $4 \begin{array}{llll}4 & 36 & 33 \cdot 7\end{array}$ | r. 62 | $43455^{\circ} \mathrm{O}$ | r.67 | $\begin{array}{llll}4 & 33 & 13 & 5\end{array}$ | $1 \cdot 72$ | 431290 | $1 \cdot 77$ |
| 16 | 43044.3 | I.6I | $4296 \cdot 2$ | I. 66 | $4 \quad 27 \quad 25^{\prime} 2$ | I•71 | $4254 \mathrm{I} \cdot 3$ | I•76 | $4 \begin{array}{lll}4 & 23 & 54.2\end{array}$ | I.81 | $\begin{array}{llll}4 & 22 & 3.8\end{array}$ | 1.87 |
| 17 | 42613.6 | I.65 | $42433 \cdot 1$ | I-70 | $42249 \cdot 6$ | r.75 | $4212 \cdot 9$ | I.81 | 4191212 | 1.86 | 4 17 19,3 | 1.92 |
| 18 | $42142 \cdot 1$ | I. 69 | 4 I9 59.1 | 1•74 | $\begin{array}{llll}4 & 18 & 12.9\end{array}$ | 1.80 | 41623.4 | 1.85 | $41430 \cdot 3$ | I-91 | $\begin{array}{llll}4 & 12 & 33 \cdot 6\end{array}$ | I 988 |
| 19 | $\begin{array}{lll}4 & 17 & 9 \cdot 7\end{array}$ | I'73 | 4 I5 24.I | 1.79 | 413 35.1 | I. 84 | 4 II $42 \cdot 7$ | I-90 | $4 \quad 946 \cdot 5$ | I.97 | $4746 \cdot 4$ | $2 \cdot 04$ |
| 20 | $\begin{array}{llll}4 & 12 & 36 \cdot 2\end{array}$ | 1.78 | 4 10 47.9 | 1.83 | $4^{*} 856 \cdot 2$ | I.89 | $\begin{array}{lll}4 & 7 & 0.7\end{array}$ | 1.96 | $\begin{array}{llll}4 & 5 & 1 \cdot 3\end{array}$ | 2.02 | $\begin{array}{lrrr}4 & 2 & 57 \cdot 7 \\ 3 & 58 & 7 \cdot 5\end{array}$ | 2.09 |
| 21 | $\begin{array}{lll}4 & 8 & \pm .8\end{array}$ | I.82 | $46610 \cdot 8$ | I.88 | $4 \quad 416 \cdot 0$ | I.94 | $\begin{array}{rrrr}4 & 2 & 17 & 7\end{array}$ | $2 \cdot 01$ | $\begin{array}{rrrr}4 & 0 & 14.6\end{array}$ | $2 \cdot 08$ | $\begin{array}{llll}3 & 58 & 7.5\end{array}$ | $2 \cdot 16$ |
| 22 | $\begin{array}{llll}4 & 3 & 26 \cdot 3\end{array}$ | 1.87 | 4 I 32.4 | I'93 | 35934.6 | $2 \cdot 00$ | $35732 \cdot 6$ | $2 \cdot 07$ | 35526.4 | $2 \cdot 14$ | $35315 \cdot 6$ | $2 \cdot 22$ |
| 23 | $3 \begin{array}{llll}3 & 58 & 49 \cdot 6\end{array}$ | I.91 | $\begin{array}{llll}3 & 56 & 52 \cdot 7\end{array}$ | 1.98 | $35451 \cdot 7$ | 2.05 | $\begin{array}{llll}3 & 52 & 46 \cdot 5\end{array}$ | $2 \cdot 13$ | $35036 \cdot 6$ | 2.20 | $\begin{array}{llll}3 & 48 & 21.9\end{array}$ | $2 \cdot 29$ |
| 24 | 3541197 | 1.96 | 35211.8 | 2.03 | 350 | $2 \cdot 11$ | $\begin{array}{lllll}3 & 47 & 58 \cdot 7\end{array}$ | $2 \cdot 19$ | $34545 \%$ | $2 \cdot 27$ | $34326 \cdot 3$ | $2 \cdot 36$ |
| 25 | $34932 \cdot 6$ | $2 \cdot 02$ | 34729.4 | 2.09 | $34521 \cdot 7$ | $2 \cdot 17$ | $\begin{array}{llll}3 & 43 & 9.2\end{array}$ | $2 \cdot 25$ | $3405 \mathrm{I} \cdot 6$ | $2 \cdot 34$ | $\begin{array}{llll}3 & 38 & 28 \cdot 7\end{array}$ | $2 \cdot 43$ |
| 26 | $34452 \cdot 0$ | 2.07 | $\begin{array}{llll}3 & 42 & 45 \cdot 5\end{array}$ | $2 \cdot 15$ | $\begin{array}{lllllll}3 & 40 & 34.2\end{array}$ | $2 \cdot 23$ | $\begin{array}{llll}3 & 38 & 17.9\end{array}$ | $2 \cdot 32$ | $\begin{array}{llllllllllllllll}3 & 35 & 5 \cdot 2\end{array}$ | 2.41 | $\begin{array}{llll}3 & 33 & 28 \cdot 8\end{array}$ | 2.51 |
| 27 | $34010 \cdot 0$ | 2.13 | $\begin{array}{llll}3 & 3^{8} & 0 \cdot 1\end{array}$ | 2.21 | $33545 \%$ | 2.29 | $\begin{array}{llll}3 & 33 & 24.7\end{array}$ | $2 \cdot 39$ | $33058 \cdot 7$ | $2 \cdot 48$ | $\begin{array}{llll}3 & 28 & 26 \cdot 7\end{array}$ | $2 \cdot 59$ |
| 28 | $\begin{array}{llll}3 & 35 & 26 \cdot 5\end{array}$ | 2.18 | $\begin{array}{llll}3 & 33 & 12.9\end{array}$ | $2 \cdot 27$ | $3 \begin{array}{lll}30 & 53.9\end{array}$ | $2 \cdot 36$ | $\begin{array}{lll}3 & 28 & 29.4\end{array}$ | $2 \cdot 46$ | $\begin{array}{llll}3 & 25 & 58 \cdot 9\end{array}$ | 2.56 | $\begin{array}{llll}3 & 23 & 22 \cdot 1\end{array}$ | 2.67 |
| 29 | $33^{3} 1041 \cdot 3$ | $2 \cdot 25$ | $\begin{array}{llll}3 & 28 & 23.9\end{array}$ | $2 \cdot 34$ | $\begin{array}{lll}3 & 26 & 0.9\end{array}$ | $2 \cdot 43$ | $\begin{array}{lllll}3 & 23 & 31.9\end{array}$ | $2 \cdot 54$ | $32056 \cdot 6$ | $2 \cdot 64$ |  | $2 \cdot 76$ |
| 30 | $\begin{array}{llllll}3 & 25 & 54.3\end{array}$ | $2 \cdot 3 \mathrm{I}$ | $\begin{array}{llll}3 & 23 & 32.9\end{array}$ | 2.41 | $\begin{array}{lll}3 & 21 & 5 \cdot 6 \\ & 16 & 8 \cdot 0\end{array}$ | 2.51 | $\begin{array}{llll}3 & 18 & 32 \cdot 0\end{array}$ | $2 \cdot 61$ | $\begin{array}{lllllllll}3 & 15 & 51.8\end{array}$ | $2 \cdot 73$ | $\begin{array}{llll}3 & 13 & 4.4\end{array}$ | 2.85 |
| 31 | $\begin{array}{llll}3 & 21 & 5 \cdot 5\end{array}$ | $2 \cdot 38$ | $\begin{array}{lllllllll}3 & 18 & 39\end{array}$ | $2 \cdot 48$ | $3 \mathrm{I} 68 \cdot 0$ | 2.59 | $\begin{array}{llll}3 & 13 & 29.5\end{array}$ | $2 \cdot 70$ | 310.44 .0 | 2.82 | $\begin{array}{lllll}3 & 7 & 50.9\end{array}$ | 2.95 |
| 32 | 3 16 14.6 | 2.45 | $\begin{array}{llll}3 & 13 & 44.5\end{array}$ | 2.56 | 3 II $7 \cdot 9$ | $2 \cdot 67$ | $\begin{array}{llll}3 & 8 & 24 \cdot 3\end{array}$ | $2 \cdot 79$ | $\begin{array}{llll}3 & 5 & 33.2\end{array}$ | $2 \cdot 92$ | $\begin{array}{llll}3 & 2 & 34 \cdot 1\end{array}$ | 3.06 |
| 33 | 3 Ir 21.5 | $2 \cdot 52$ | $\begin{array}{llll}3 & 8 & 46 \cdot 8\end{array}$ | $2 \cdot 64$ | $3665 \cdot 1$ | 2.76 | $\begin{array}{llll}3 & 3 & 16 \cdot 0\end{array}$ | 2.88 | $3 \quad 0 \quad 18 \cdot 9$ | 3.02 | 25713.4 | $3 \cdot 17$ |
| 34 | $3{ }^{3} 6626 \cdot 0$ | $2 \cdot 60$ |  | $2 \cdot 72$ | $3 \begin{array}{lll}3 & 0 & 59.4\end{array}$ | 2.85 | $\begin{array}{llll}2 & 58 & 4 \cdot 5 \\ 2\end{array}$ | $2 \cdot 99$ | $2 \begin{array}{lll}25 & 1 & 1\end{array}$ | $3 \cdot 13$ | $25148 \cdot 7$ | 3.29 |
| 35 | $\begin{array}{llll}3 & 1 & 27.9\end{array}$ | $2 \cdot 69$ | $2{ }^{2} 5843 \cdot 1$ | 2.81 | $25550 \cdot 5$ | 2.95 | $\begin{array}{llll}2 & 52 & 49 \cdot 4\end{array}$ | 3.09 | $24939 \cdot 2$ | 3.25 | $2 \begin{array}{llll}2 & 46 & 19.4\end{array}$ | $3 \cdot 42$ |
| 36 | $\begin{array}{llllllllllll}2 & 56 & 27 \cdot 2\end{array}$ | 2.77 | 25336 | 2.91 | $25038 \cdot 1$ | $3 \cdot 05$ | $\begin{array}{llll}2 & 47 & 30 \cdot 3\end{array}$ | $3 \cdot 21$ | $\begin{array}{lllllllllll}2 & 44 & 13 & 0\end{array}$ | $3 \cdot 38$ | $24045 \cdot 2$ | $3 \cdot 56$ |
| 37 | 25123.3 | 2.87 | 24827.0 | $3 \cdot 01$ | 24521.8 | $3 \cdot 17$ | $242 \quad 7 \cdot 0$ | $3 \cdot 33$ | $23^{8} 4 \mathrm{4r}$-8 | 3.5 I | $\begin{array}{llll}2 & 35 & 5 \cdot 4\end{array}$ | 3.71 |
| 38 | $24616 \cdot 2$ | 2.97 | $\begin{array}{llll}2 & 43 & 13.6\end{array}$ | 3.12 | $240 \quad 1.4$ | 3.29 | $\begin{array}{llll}2 & 36 & 38 \cdot 9\end{array}$ | 3.47 | $\begin{array}{lll}2 & 33 & 5.4\end{array}$ | 3.66 | 22919.6 | 3.87 |
| 39 | $\begin{array}{lll}2 & 41 & 5 \cdot 5\end{array}$ | 3.08 | $23756 \cdot 0$ | $3 \cdot 24$ | $23436 \cdot 4$ | 3.42 | 2315 | $3 \cdot 61$ | 22722.8 | $3 \cdot 82$ | $22326 \cdot 9$ | 4.05 |
| 40 | 2 35 $50 \cdot 7$ | $3 \cdot 20$ | $2 \begin{array}{lllll}2 & 32 & 33.9\end{array}$ | 3.37 | $2296 \cdot 2$ | 3.56 | $\begin{array}{llll}2 & 25 & 26 \cdot 5\end{array}$ | 3.77 | 221533.6 | $4 \cdot 00$ |  | $4 \cdot 25$ |
| 4 I | $23031 \cdot 7$ | $3 \cdot 32$ | $\begin{array}{lllll}2 & 27 & 6.8\end{array}$ | 3.51 | 223 30.3 | $3 \cdot 72$ | $21940 \cdot 7$ | $3 \cdot 95$ | 215156.8 | $4 \cdot 20$ | 2 II 17.0 | 4.46 |
| 42 | $\begin{array}{llll}2 & 25 & 7.6\end{array}$ | $3 \cdot 46$ | 22134.2 | $3 \cdot 66$ | $21747 \cdot 9$ | 3.89 | 21347.5 | 4.14 | 2 9 3I.4 | 4.42 | $2 \quad 4$ | $4 \cdot 69$ |
| VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. $18^{\circ}$ | A. | L. $19^{\circ}$ | A. | L. $20^{\circ}$ | A. | L. $21^{\circ}$ |  | L. $22^{\circ}$ |  | L. $23^{\circ} \mathrm{A}$. |  |
| $\bigcirc$ | $\begin{array}{cc} \text { S. } & \text { S. } \\ -\mathrm{I} \cdot 38 & -4 \cdot 35 \end{array}$ |  | $\begin{array}{cc}\text { S. } & \text { S. } \\ -\mathrm{I} \cdot 47 & -4.37\end{array}$ |  | $\begin{array}{cc}\text { S. } & \text { S. } \\ -\mathrm{I} \cdot 55 & -4.40\end{array}$ |  | $\begin{array}{cc}\text { S. } & \text { S. } \\ -\mathrm{I} .64 & -4.43\end{array}$ |  | $\begin{array}{cc}\text { S. } & \text { S. } \\ -1.73 & -4.47\end{array}$ |  | $\begin{array}{cc}\text { S. } & \text { S. } \\ -\mathrm{I} .8 \mathrm{I} & -4.50\end{array}$ |  |
| 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 1.434 .36 |  | I-31 4.39 |  | I. $60 \quad 4.42$ |  | I. $68 \quad 4.45$ |  | 1.774 |  | I. $86 \quad 4.52$ |  |
| 4 | 1.474 .38 |  | I.56 4.4I |  | r.65 4.44 |  | I.73 4.47 |  | I 824.51 |  | $\mathrm{I} \cdot 914.54$ |  |
| 6 | $1 \cdot 524.39$ |  | I. 6 r <br> r <br> r |  | 1-70 4.46 |  | I.79 4.49 |  | I. 884.53 |  | 1.974 .57 |  |
| 8 | $1 \cdot 57$ | 4.41 | 1.664 .45 |  | I.75 4.48 |  | $1.84 \quad 4.5 \mathrm{I}$ |  | 1.934 .55 |  | 2.034 .60 |  |
| 10 | 1. 63 | 4.43 | I.72 4.47 |  | I.8I 4.50 |  | $1.90 \quad 4.54$ |  | $2 \cdot 00 \quad 4.58$ |  | $2.09 \quad 4.63$ |  |
| 12 | I. 69 | 4.45 | I.78 4.49 |  | I. $87 \quad 4.53$ |  | 1.974 .57 |  | $2.06 \quad 4.6 \mathrm{I}$ |  | 2.16 $4 \cdot 66$ |  |
| 14 | 1.75 | 4.48 | I. $84 \quad 4.52$ |  | 1.944 .56 |  | 2.044 .60 |  | $2 \cdot 14 \quad 4.64$ |  | $2.24 \quad 4.69$ |  |
| 16 | I.8I | $4 \cdot 50$ | I.9I 4.54 |  | 2.014 .59 |  | $2 \cdot 11 \quad 4.63$ |  | $2 \cdot 214.68$ |  | $2 \cdot 32 \quad 4.73$ |  |
| 18 | $\mathbf{1} .89$ | $4 \cdot 53$ | 1.994 .57 |  | $2.09 \quad 4.62$ |  | $2.19 \quad 4.67$ |  | $2 \cdot 30 \quad 4.72$ |  | $2.41 \quad 4.77$ |  |
| 20 | 1.96 | $4 \cdot 57$ | $2.06 \quad 4.61$ |  | 2.17 4.66 |  | $2.28 \quad 4.71$ |  | $2.39 \quad 4.77$ |  | $2.50 \quad 4.82$ |  |
| 22 | 2.04 | $4 \cdot 60$ | $2 \cdot 15 \quad 4.65$ |  | 2.26 4.70 |  | $2.37 \quad 4.76$ |  | $2.49 \quad 4.82$ |  | 2.614 .88 |  |
| 24 | $2 \cdot 13$ | $4 \cdot 64$ | $2 \cdot 25 \quad 4.69$ |  | $2.36 \quad 4.75$ |  | $2.48 \quad 4.8 \mathrm{I}$ |  | $2.60 \quad 4.87$ |  | $2.73 \quad 4.94$ |  |
| 26 | 2.23 | 4.69 | $\begin{array}{ll}2.35 & 4.74 \\ 2.46 & 4.80\end{array}$ |  | $2.47 \quad 4.80$ |  | $2.59 \quad 4.87$ |  | $\begin{array}{ll}2.72 & 4.94 \\ 2.86 & 5.02\end{array}$ |  | 2.865 .02 |  |
| 28 | $2 \cdot 34 \quad 4.74$ |  |  |  | $2.59 \quad 4.87$ |  | 2.724 .94 |  |  |  | 3.00 5.10 |  |
| 30 | 2.46 | 4.80 | $2.59 \quad 4.87$ |  | $2.72 \quad 4.94$ |  | $2.86 \quad 5.02$ |  | 3.015 .10 |  | 3.17 5.20 |  |
| 32 | 2.59 | $4 \cdot 87$ | 2.73 4.94 |  | $2.87 \quad 5.02$ |  | 3.025 .11 |  | $3 \cdot 18 \quad 5 \cdot 21$ |  | $3.35 \quad 5 \cdot 31$ |  |
| 34 | $2 \cdot 73$ | 4.95 | 2.883.06 | $5 \cdot 03$ | 3.04 5.12 |  | 3.215 |  | $3 \cdot 385.33$ |  | $3 \cdot 56 \quad 5 \cdot 45$ |  |
| 36 | 2.90 | $5 \cdot 04$ |  | 5.13 | $\begin{array}{ll}3.23 & 5.24 \\ 3.34 & 5.31\end{array}$ |  | $3.41 \quad 5.35$ |  | $3 \cdot 6 \mathrm{I} \quad 5.48$ |  | $3.81 \quad 5.62$ |  |
| 37 | $2 \cdot 99$ | $5 \cdot 09$ | 3•16 | 5.19 | 3.34 5.3I |  | $3.53 \quad 5.43$ |  | $3.74 \quad 5.56$ |  | 3.95 5.71 |  |
| 38 | 3.08 | $5 \cdot 15$ | $3 \cdot 26 \quad 5 \cdot 26$ |  | 3.46 5.38 |  | 3.66 5.51 |  | $3.88 \quad 5.66$ |  | $4 \cdot 115$ |  |
| 39 | $3 \cdot 19$ | $5 \cdot 21$ | $3 \cdot 38$ 5.33 |  | $3.58 \quad 5.46$ |  | $3.80 \quad 5 \cdot 60$ |  | 4.03 5.76 |  | $4.28 \quad 5.94$ |  |
| 40 | $3 \cdot 30$ | $5 \cdot 28$ | $\begin{array}{ll}3.50 & 5.41 \\ 3.64 & 5.50\end{array}$ |  | $3.72 \quad 5.55$ |  | $3.95 \quad 5 \cdot 71$ |  | $4.20 \quad 5.88$ |  | 4.47 6.08 |  |
| 41 | 3.42 | $5 \cdot 36$ |  |  | $\begin{array}{ll}3.87 & 5.65 \\ 4.03 & 5.76\end{array}$ |  | $\begin{array}{ll}4 \cdot 11 & 5.83 \\ 4.30 & 5.95\end{array}$ |  | $\begin{array}{ll}4.39 & 6.02 \\ 4.60 & 6.17\end{array}$ |  | $\begin{array}{ll}4.68 & 6.24 \\ 4.91 & 6.42\end{array}$ |  |
| 42 | $3 \cdot 56$ | $5 \cdot 45$ | $\mathbf{3 . 7 9} 5 \cdot 59$ |  |  |  |  |  |  |  |  |  |

182 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT.
LATITUDE $15^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. M. | S. | 558 55. | - I. | H. M. |  | H. M. | $\stackrel{\text { S. }}{ }$ | 555 |  | H. M. S. | S. |
| 10 | - |  | $5{ }^{5} 5855$ | $-1.07$ | 557 | I.12 |  |  | $\begin{array}{rrrr}5 & 55 & 42 \cdot 3 \\ 5 & 14 & 5 \cdot 8\end{array}$ | I5 |  |  |
| 12 | 51016. | I-10 | $5 \quad 9 \begin{array}{lll}5 & 10 \cdot 4\end{array}$ | I'II | $\begin{array}{lll}5 & 8 & 3 \cdot 1\end{array}$ | I-13 | $654 \cdot 6$ | -15 | $\begin{array}{ll}5 & 45 \cdot 0\end{array}$ | 17 | 34 | 19 |
| 14 | $5 \quad 1 \quad 58 \cdot 9$ | I'II | $5 \quad 0 \quad 5 \mathrm{I} \cdot 9$ | $1 \cdot 13$ |  | I-15 | $4{ }^{4} 58834 \cdot 2$ | I-17 | 45723.4 | 1-19 | $4{ }^{5} 56112$ | 2 I |
| 16 | 453 40.7 | I'12 | $4 \begin{array}{llll}42 & 32 \cdot 9\end{array}$ | I'14 | 45123.7 | I.16 | $45013 \cdot 1$ | I•19 | 449 1.0 | 1.2I | 447 47.3 | I 24 |
| 18 | $445 \quad 22 \cdot 1$ |  | 44413.4 | I•16 | 443 3.2 | 1.18 | 44 I 5 I | 1 | $44037 \cdot 8$ | 4 | $43922 \cdot 5$ | . 27 |
| 20 | $437 \quad 3 \cdot 0$ | I.15 | $435 \quad 53 \cdot 4$ | I•17 | $4344^{2 \cdot 0}$ | I.20 | $4 \begin{array}{llll}4 & 33 & 28.8\end{array}$ | $1 \cdot 24$ | 432 13.6 | $1 \cdot 27$ | $430 \quad 56 \cdot 5$ | 1.30 |
| 22 | $4 \quad 28 \quad 43 \cdot 4$ | r. 16 | $42732 \cdot 7$ | 19 | $42620 \cdot 0$ | $1 \cdot 23$ | $425 \quad 5 \cdot 3$ | 1.26 | 423188.4 | I. 30 | 42229.4 | -33 |
| 24 | $420 \quad 23 \cdot 2$ | I.I8 | 4 19 1I•3 | 2 | 4 I7 57.2 | 1.25 | 4 I6 $40 \cdot 8$ | 1.29 | $415 \quad 220$ | I•33 | 414 I.O | 1.37 |
| 26 | 412204 | I 20 | 41049.0 | I. 24 | $4 \begin{array}{lll}4 & 9 & 33 \cdot 3\end{array}$ | 1.28 | 48 IF I | I. 32 | $4 \quad 6 \quad 54: 4$ | I•37 | $4531 \cdot 0$ | I.4 1 |
| 27 | 4751 | I 21 | $4 \quad 6 \quad 37 \cdot 6$ | 26 | $4521 \cdot 0$ | I.30 | $4 \begin{array}{lll}4 & 4 & I \cdot 8\end{array}$ | 34 | $4 \quad 2 \begin{array}{lll}4 & 40 \cdot 0\end{array}$ | 39 | $4 \begin{array}{lll}4 & 1 & 15.4\end{array}$ | 3 |
| 28 | $\begin{array}{llll}4 & 3 & 40 \cdot 8\end{array}$ | I. 23 | $4 \quad 2 \quad 25 \cdot 9$ | I. 27 | $\begin{array}{lll}4 & 1 & 8.4\end{array}$ | I•3I | $35948 \cdot 2$ | I.36 | $\begin{array}{llll}3 & 58 & 25 \cdot 2\end{array}$ | 1.41 | 35659.4 | -46 |
| 29 | 3 35929.6 | $1 \cdot 24$ | $\begin{array}{lllllll}3 & 58 & 13\end{array}$ | I.28 | $35655 \cdot 5$ | 1.33 | 355134.2 | I•38 | 354 IO.I | 1.43 | $\begin{array}{llllll}3 & 52 & 42 \cdot 9\end{array}$ | 1.48 |
| 30 | $35518 \cdot 2$ | I. 25 | 354 I'7 | 1.30 | $\begin{array}{lllll}3 & 52 & 42 \cdot 3\end{array}$ | I.35 | 35119.9 | 1.40 | $34954 \cdot 5$ | 1.45 | $\begin{array}{llllllllllll}3 & 48 & 25.9\end{array}$ | 1.50 |
| 31 | 3516.6 | 1.27 | 349 49•1 | I 32 | $3 \begin{array}{llll}3 & 48 & 28 \cdot 7\end{array}$ | I. 37 | 347 5.1 | 1.42 | $3 \begin{array}{lllllllll}3 & 45 & 3\end{array}$ | 1.47 | $\begin{array}{lll}3 & 44 & 8.4\end{array}$ | I. 53 |
| 32 | 34654 | I 28 | 345 36.3 | 33 | $34414 \times 7$ | I•39 | $34250 \cdot 0$ | 44 | 34121.9 | I. 50 | $\begin{array}{llll}3 & 39 & 50 \cdot 4\end{array}$ | - 55 |
| 33 | $\begin{array}{lllll}3 & 42 & 42 \cdot 6\end{array}$ | I 30 | $34123 \cdot 1$ | 1•35 | $\begin{array}{lll}3 & 40 & 0.4\end{array}$ | 1.41 | $\begin{array}{lllll}3 & 38 & 34\end{array}$ | I.46 | $3 \begin{array}{lll}3 & 37 & 4 \cdot 8\end{array}$ | I. 52 | $33531 \cdot 7$ | - 58 |
| 3 | $\begin{array}{llll}3 & 38 & 30 \cdot 1\end{array}$ | $1 \cdot 31$ | $3 \begin{array}{lll}3 & 37 & 9.6\end{array}$ | $1 \cdot 37$ | $\begin{array}{llll}3 & 3545 \cdot 6\end{array}$ | I. 43 | $\begin{array}{lllll}3 & 34 & 18 \cdot 2\end{array}$ | I 49 | $3 \begin{array}{llll}3 & 32 & 47\end{array}$ | I 55 | 3 31 12.4 | .61 |
| 35 | $\begin{array}{lllll}3 & 34 & 17 \cdot 3\end{array}$ | I.33 | $3 \begin{array}{llll}32 & 55 \cdot 6\end{array}$ | I•39 | $33130 \cdot 5$ | 1.45 | 3301.6 | I.5I | 32829.0 | 1.58 | $\begin{array}{llll}3 & 2652 \cdot 5\end{array}$ | - 64 |
| 36 | $\begin{array}{llll}3 & 30 & 4 \cdot 2\end{array}$ | I 35 | 328 41.3 | 1.41 | $\begin{array}{llll}3 & 27 & 14.8\end{array}$ | I. 47 | $\begin{array}{llll}3 & 25 & 44.5\end{array}$ | I. 54 | 32410.2 | I. 60 | $32231 \cdot 9$ | 7 |
| 37 | $32550 \cdot 7$ | 37 | $32426 \cdot 6$ |  | $\begin{array}{llll}3 & 22 & 58.6\end{array}$ | $1 \cdot 50$ | $3 \begin{array}{lll}3 & 21 & 26 \cdot 7\end{array}$ | I. 57 | $3.1950 \cdot 7$ | I. 63 |  | 71 |
| 38 |  | 39 | 320 II.4 | I. 46 | $\begin{array}{llll}3 & 18 & 42 \cdot 0\end{array}$ | I. 52 | $\begin{array}{llll}3 & 17 & 8 \cdot 4\end{array}$ | I•59 | $\begin{array}{lllll}3 & 15 & 30 \cdot 6\end{array}$ | I. 67 | $3151348 \cdot 3$ | $\cdot 74$ |
| 39 | $\begin{array}{llll}3 & 17 & 22.5\end{array}$ | 4 | $\begin{array}{llllll}3 & 15 & 55 \%\end{array}$ | 1.48 | $\begin{array}{llll}3 & 14 & 24: 7\end{array}$ | I. 55 | $\begin{array}{llll}3 & 12 & 49 \cdot 4\end{array}$ | r.63 | $\begin{array}{lll}3 & 11 & 9 \cdot 6\end{array}$ | I.70 | $\begin{array}{llll}3 & 9 & 25 \cdot 3\end{array}$ | 78 |
| 40 | $\begin{array}{llll}3 & 13 & 7 \cdot 7\end{array}$ | 1.44 | 3 II 39.4 | I.51 | $3106 \cdot 8$ | I 58 | $\begin{array}{llll}3 & 8 & 29 \%\end{array}$ | I 66 | $\begin{array}{llllllll}3 & 6 & 47 \cdot 9\end{array}$ | $1 \cdot 74$ | $\begin{array}{lll}3 & 5 & I \cdot 3\end{array}$ | 82 |
| 41 | $\begin{array}{llll}3 & 8 & 52.5\end{array}$ | 1.46 | $3 \quad 7 \begin{array}{llll} & 722.6\end{array}$ | 1.53 | $\begin{array}{llll}3 & 5 & 48 \cdot 3\end{array}$ | I.61 | $\begin{array}{lll}3 & 4 & 9 \cdot 2\end{array}$ | r.69 | $\begin{array}{llll}3 & 2 & 25 \cdot 3\end{array}$ | I.77 | 3 $30036 \cdot 3$ | . 86 |
| 42 | $\begin{array}{llll}3 & 4 & 36 \cdot 7\end{array}$ | 1.49 | $\begin{array}{lrrr}3 & 3 & 5 \cdot 2 \\ 2 & 5 & 4\end{array}$ | 1 | 3 I I 2900 |  | $2 \begin{array}{lll}2 & 59 & 47\end{array}$ | 1.73 | 2 58 | I.81 | $2 \begin{array}{lll}266 & 10.2\end{array}$ | . 90 |
| 43 | $\begin{array}{llll}3 & 0 & 20.4\end{array}$ | I.5I | 2. $58847 \cdot 2$ | I. 59 | 25790 | 8 | $2 \begin{array}{llll}2 & 55 & 25.8\end{array}$ | I.77 | $2 \begin{array}{llll}2 & 53 & 37 \cdot 1\end{array}$ | I.86 | $25143 \cdot 0$ | - 95 |
| 44 | $\begin{array}{llll}2 & 56 & 3 \cdot 5\end{array}$ | I. 54 | 25428.4 | - 6 | $25248 \cdot 2$ | I•71 | 251 | 1.81 | 249 II•5 | $1 \cdot 90$ | 24714.5 | $2 \cdot 00$ |
| 45 | $2 \begin{array}{llll}2 & 51 & 45.9\end{array}$ | I.57 | $\begin{array}{lll}2 & 50 & 8 \cdot 9 \\ 2 & 45 & 4\end{array}$ | - 66 | $\begin{array}{lllll}2 & 48 & 26 \cdot 5\end{array}$ | 1.75 | $2 \begin{array}{llll}2 & 46 & 38 \cdot 5\end{array}$ | r.85 | $24444 \cdot 7$ | 1•95 | $2 \begin{array}{lllll} \\ 2 & 42 & 44.7\end{array}$ | $2 \cdot 05$ |
| 46 | 24727.7 | 1.6I | $24548 \cdot 6$ | $1 \cdot 70$ | $\begin{array}{llll}2 & 44 & 3\end{array}$ | 1.79 | $\begin{array}{lllll}2 & 42 & 13 & 3\end{array}$ | I.89 | 24016.5 | $2 \cdot 00$ | $2 \begin{array}{llll}28 & 13.4\end{array}$ | $2 \cdot 11$ |
| 47 | $\begin{array}{lll}2 & 43 & 8 \cdot 7\end{array}$ | 4 | $\begin{array}{llll}2 & 41 & 27.4\end{array}$ | 4 | $23940 \cdot 1$ | 8 | $23746 \cdot 8$ | 1.94 | 23547.0 | $2 \cdot 05$ | $2 \begin{array}{llll}2 & 33 & 40 \cdot 5\end{array}$ | $2 \cdot 17$ |
| 48 | $\begin{array}{lllll}2 & 38 & 48 \cdot 8\end{array}$ | 68 | $\begin{array}{lll}2 & 37 & 5 \cdot 2\end{array}$ | $1 \cdot 78$ | $\begin{array}{llll}2 & 35 & 15 \cdot 3\end{array}$ | 88 | $2 \begin{array}{llll}2 & 33 & 19 \cdot 1\end{array}$ | I.99 | 23116.0 | $2 \cdot 11$ | 2 29 $5 \cdot 9$ | 2.23 |
| 49 | $\begin{array}{llll}2 & 34 & 28 \cdot 1\end{array}$ | $1 \cdot 72$ | $\begin{array}{lllll}2 & 32 & 41 \cdot 9\end{array}$ | I.82 | 230493 | I.93 | $\begin{array}{llll}2 & 28 & 49 \cdot 8\end{array}$ | 2.05 | $\begin{array}{llllllllllll}2 & 26 & 43 \cdot 3\end{array}$ | $2 \cdot 17$ | $\begin{array}{llll}2 & 24 & 29.4\end{array}$ | $2 \cdot 30$ |
| 50 | $\begin{array}{llll}2 & 30 & 6 \cdot 5\end{array}$ | I•76 |  | I.87 | $22621 \cdot 9$ | I•99 | $2 \begin{array}{llll}2 & 24 & 19 \cdot 1\end{array}$ | $2 \cdot 11$ | $\begin{array}{lll}2 & 22 & 8 \cdot 9\end{array}$ | $2 \cdot 24$ | $\begin{array}{lllll}2 & 19 & 50 \cdot 7\end{array}$ | $2 \cdot 37$ |
| 5 I | 22543.7 | I.81 | 223 5I•9 | I.92 | 22153.1 | $2 \cdot 04$ | $21946 \cdot 7$ | $2 \cdot 17$ | 21732.4 | $2 \cdot 31$ | 21519.7 | $2 \cdot 45$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{\circ}$ | - A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. 4 | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | s. | S. |
| 0 | - 00 | $-4 \cdot 14$ | - 07 | $-4.14$ | - 15 | $-4 \cdot 14$ | - 222 | $-4 \cdot 15$ | - 30 | $-4 \cdot 15$ | -.37 | $-4 \cdot 16$ |
| 4 | -08 | $4 \cdot 14$ | - 15 | $4 \cdot 14$ | $\cdot 23$ | $4 \cdot 15$ | -30 | $4 \cdot 15$ | $\cdot 38$ | $4 \cdot 16$ | -45 | $4 \cdot 17$ |
| 8 | -15 | $4 \cdot 14$ | $\cdot 23$ | $4 \cdot 15$ | -31 | $4 \cdot 15$ | $\cdot 3^{8}$ | 4.16 | -46 | $4 \cdot 17$ | -54 | $4 \cdot 18$ |
| 10 | -19 | $4 \cdot 14$ | $\cdot 27$ | $4 \cdot 15$ | $\cdot 35$ | 4.16 | -43 | $4 \cdot 16$ | -50 | $4 \cdot 178$ | . 58 | $4 \cdot 18$ |
| 12 | - 24 | 4.15 | $\cdot 31$ | $4 \cdot 15$ | $\cdot 39$ | 4.16 | $\cdot 47$ | 4.17 | $\cdot 55$ | 4-18 | -62 | 4.19 |
| 14 | - 28 | 4.15 | -36 | 4•16 | -43 | 4.16 | $\cdot 51$ | $4 \cdot 17$ | -59 | 4.18 | -67 | 4.19 |
| 16 | -32 | 4.15 | -40 | 4.16 | -48 | $4 \cdot 17$ | $\cdot 56$ | 4.18 | -64 | $4 \cdot 19$ | $\cdot 72$ | $4 \cdot 20$ |
| 18 | -36 | $4 \cdot 16$ | -44 | $4 \cdot 16$ | $\cdot 52$ | $4 \cdot 17$ | - 60 | $4 \cdot 18$ | -68 | 4.20 | $\cdot 77$ | 4.21 |
| 20 | $\cdot 40$ | $4 \cdot 16$ | -49 | $4 \cdot 17$ | $\cdot 57$ | 4.18 | . 65 | $4 \cdot 19$ | $\cdot 73$ | 4.21 | .82 | 4.22 |
| 22 | -45 | 4.16 | $\cdot 53$ | $4 \cdot 17$ | . 62 | $4 \cdot 19$ | -70 | 4.20 | $\cdot 78$ | $4 \cdot 21$ | -87 | 4.23 |
| 24 | $\cdot 50$ | $4 \cdot 17$ | . 58 | 4.18 | . 67 | 4.19 | .75 .85 | 4.21 | . 84 | 4.22 | .93 | $4 \cdot 24$ |
| 26 | . 54 | 4.18 | . 63 | 4.19 | $\cdot 72$ | $4 \cdot 20$ | -81 | 4.22 | -89 | 4.24 | -98 | $4 \cdot 26$ |
| 28 | -60 | $4 \cdot 18$ | -68 | 4.20 | $\cdot 77$ | 4.21 | -86 | 4.23 | -95 | 4.25 | 1.04 | $4 \cdot 27$ |
| 30 | -65 | $4 \cdot 19$ | $\cdot 74$ | 4.21 | . 83 | 4.22 | -92 | 4.24 | I. 01 | 4.26 | I-II | 4.29 |
| 32 | $\cdot 70$ | $4 \cdot 20$ | -80 | $4 \cdot 22$ | -89 | 4.24 | -98 | 4.26 | 1.08 | $4 \cdot 28$ | I-18 | 4.31 |
| 34 | $\cdot 76$ | $4 \cdot 21$ | - 86 | 4.23 | -95 | $4 \cdot 25$ | 1.05 | 4.27 | I-15 | 4.30 | I. 25 | 4.33 |
| 36 | . 82 | $4 \cdot 22$ | -92 | $4 \cdot 24$ | 1.02 | 4.27 | I 12 | 4.29 | 1.23 | $4 \cdot 32$ | I 33 | $4 \cdot 35$ |
| 38 | -89 | $4 \cdot 23$ | -99 | 4.26 | I.09 | $4 \cdot 28$ | I. 20 | $4 \cdot 31$ | $1 \cdot 31$ | 4.34 | I. 42 | $4 \cdot 38$ |
| 40 | '95 | $4 \cdot 25$ | I•06 | $4 \cdot 28$ | I'I7 | $4 \cdot 30$ | I•28 | 4.33 | I.39 | 4.37 | I 51 | 4.41 |
| 42 | 1.03 | $4 \cdot 27$ | I-14 | $4 \cdot 29$ | I. 25 | $4 \cdot 33$ | $1 \cdot 37$ | $4 \cdot 36$ | I-49 | 4.40 | I. 61 | 4.44 |
| 44 | 1-11 | $4 \cdot 29$ | 1. 23 | 4.32 | I.35 | $4 \cdot 35$ | 147 | 4.39 | I 59 | 4.44 | 1.72 1.85 | 4.49 |
| 46 | 1. 20 | $4 \cdot 31$ | I. 32 | $4 \cdot 35$ | I. 45 | $4 \cdot 39$ | I.58 | 4.43 | $1 \cdot 71$ | $4 \cdot 48$ | I.85 | 4.53 |
| 48 | 1.29 | $4 \cdot 34$ | 1.42 | $4 \cdot 38$ | 1.56 | 4.42 | 1.69 | 4.47 | I. 84 | 4.53 | I.99 | 4.59 |
| 50 | 1.40 | $4 \cdot 37$ | I. 54 | $4 \cdot 42$ | 1. 68 | $4 \cdot 47$ | 1.83 | $4 \cdot 53$ | I.98 | 4.59 | $2 \cdot 14$ | $4 \cdot 66$ |
| 51 | 1.45 | $4 \cdot 39$ | I. 60 | 4.44 | I•75 | $4 \cdot 49$ | 1.90 | $4 \cdot 56$ | 2.06 | $4 \cdot 63$ | 2.23 | $4 \cdot 70$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. S. | s. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | M. S. | S. |
| 0 | $\begin{array}{llll}5 & 53 & 32 \cdot 7\end{array}$ | - I•08 | $\begin{array}{llll}5 & 52 & 27 \cdot 5\end{array}$ | - I.09 | 5 51 22.0 | - I.09 | $5 \quad 50$ 16.2 | - I-OI | 549 IO.1 | -I.II | $\begin{array}{llll}5 & 48 & 3.5\end{array}$ | -I•II |
| 8 | $\begin{array}{llll}5 & 20 & 8 \cdot 5\end{array}$ | I-17 | $\begin{array}{llllllllllll}5 & 18 & 58 \cdot 3\end{array}$ | I'18 | $51747 \cdot 1$ | I•19 | 5 16 34.9 | I. 21 | 51521.6 | I. 23 | 514470 | I. 25 |
| 10 | 5 II 45.7 | I•19 | $51034{ }^{\circ} 0$ | 1.20 | $5 \quad 921 \cdot 1$ | 1.22 | $\begin{array}{lll}5 & 8 & 7: 0\end{array}$ | I 25 | 568516 | I. 27 | $\begin{array}{llll}5 & 5 & 34.8\end{array}$ | I. 29 |
| 12 | $\begin{array}{llll}5 & 3 & 22 \cdot 1\end{array}$ | I. 21 |  | I.23 | 5 O 54.I | I. 26 | $4 \begin{array}{llll}4 & 59 & 37.9\end{array}$ | I. 28 | $4 \begin{array}{lll}48 & 20 \cdot 3\end{array}$ | I.3I | 457 I•I | I 33 |
| 14 | $45457 \cdot 6$ | I. 24 | $4 \quad 53 \quad 42 \cdot 5$ | I. 26 | $4 \quad 5225 \cdot 8$ | I. 29 | $45 \mathrm{I} 7 \cdot 6$ | r.32 | $44947 \cdot 6$ | I.35 | $44825 \cdot 9$ | I. 38 |
| 16 | $44632 \cdot 0$ | 1.27 | 44515.0 | I. 30 | $44356 \cdot 3$ | I.33 | $44235 \cdot 7$ | 1.36 | 44113.3 | I.39 | $4 \begin{array}{lll}4 & 39 & 48 \cdot 8\end{array}$ | I 42 |
| 18 | $4 \begin{array}{lll}4 & 38 & 5 \cdot 4\end{array}$ | I. 30 | $4 \begin{array}{lll}4 & 36 & 46 \cdot 3\end{array}$ | $1 \cdot 33$ | $\begin{array}{llll}4 & 35 & 25 \cdot 3\end{array}$ | 1.37 | $\begin{array}{llll}4 & 34 & 2 \cdot 3\end{array}$ | I. 40 | $43237 \cdot 2$ | I. 44 | $4 \begin{array}{llr}41 & 9 \cdot 8 \\ 4 & 22 & 8.6\end{array}$ | I. 48 |
| 20 | $42937 \cdot 4$ | I. 34 | $42816 \cdot 2$ | 1.37 | $42652 \cdot 8$ | I. 41 | $425 \quad 27 \cdot 1$ | 1.45 | 423 59•1 | I 49 | 42228.6 | I. 53 |
| 22 | $42188 \cdot 2$ | 1.37 | $4 \begin{array}{llll}4 & 19 & 44 \cdot 6\end{array}$ | I. 41 | $\begin{array}{llll}4 & 18 & 18 \cdot 6\end{array}$ | I. 45 | $4 \begin{array}{lll}4 & 16 & 50 \cdot 1\end{array}$ | 1.50 |  | I. 54 | $4 \begin{array}{lll}4 & 13 & 45 \\ 4\end{array}$ | I. 59 |
| 23 | 41653.0 | I. 39 | 415 28.I | I. 43 | $\begin{array}{lll}4 & 14 & 0.8\end{array}$ | I.48 | $41230 \cdot 8$ | I. 52 | 4 10 58.0 | I. 57 | $4 \quad 922.4$ | I. 62 |
| 24 | $41237 \cdot 4$ | 1.41 | 4 II.II.2 | 1.46 | $\begin{array}{lll}4 & 9 & 42.4\end{array}$ | I. 50 | $4 \begin{array}{lll}4 & 8 & 10 \cdot 9\end{array}$ | I.55 | $46636 \cdot 5$ | I. 60 | $4 \quad 4 \quad 59.0$ | I. 65 |
| 25 | 48821.4 | 1.44 | 4653.9 | I. 48 | $4 \quad 5 \quad 23 \cdot 6$ | I. 53 | $\begin{array}{lrrr}4 & 3 & 50 \cdot 4 \\ 3 & 5 & 20 \cdot 3\end{array}$ | I. 58 | $\begin{array}{lrrr}4 & 2 & 114.2\end{array}$ | I. 63 | $\begin{array}{rrrr}4 & 0 & 34.9 \\ 3 & 56 & \end{array}$ | I. 68 |
| 26 | $\begin{array}{lll}4 & 4 & 4.9\end{array}$ | I. 46 | $\begin{array}{rrrr}4 & 2 & 36 \cdot 0 \\ 3 & 5 & \end{array}$ | I.5I | $4 \begin{array}{rrr}1 & 4 \cdot I\end{array}$ | 1.56 | $\begin{array}{lll}3 & 59 & 29 \cdot 3\end{array}$ | I. 61 | $\begin{array}{lllll}3 & 57 & 51 & 3\end{array}$ | I. 66 | $\begin{array}{lllll}3 & 56 & 10 \cdot 0\end{array}$ | 1.72 |
| 27 | $359948 \cdot 0$ | I. 48 | $\begin{array}{llll}3 & 58 & 17 \cdot 6\end{array}$ | I. 53 | $\begin{array}{llllll}3 & 56 & 44 \cdot 2\end{array}$ | I. 58 | $\begin{array}{lll}3 & 55 & 7 \cdot 6\end{array}$ | I. 64 | $\begin{array}{llll}3 & 53 & 27 \cdot 7\end{array}$ | I. 69 | 3 51 44.3 | I•75 |
| 28 | $35530 \cdot 5$ | I.51 | $3 \begin{array}{llll}3 & 53 & 58 \cdot 6\end{array}$ | I.56 | $35223 \cdot 5$ | I-61 | $35045 \cdot \mathrm{I}$ | 1.67 | $\begin{array}{lll}3 & 49 & 3 \cdot 2\end{array}$ | 1.73 | $34717 \% 7$ | I.79 |
| 29 | 35112.6 | I. 53 | $34939^{\prime} \mathrm{I}$ | I. 59 | $\begin{array}{llll}3 & 48 & 2 \cdot 2\end{array}$ | I. 64 | $\begin{array}{llll}3 & 46 & 21.9\end{array}$ | I•70 | $344 \begin{array}{lll}38 \cdot 0\end{array}$ | 1.76 | $\begin{array}{llll}3 & 42 & 50.2\end{array}$ | I. 83 |
| 30 | $34654 \cdot 1$ | I. 56 | $\begin{array}{lllll}3 & 45 & 18: 9\end{array}$ | I. 62 | $34340 \cdot 2$ | I. 67 | 33 41 57 | I'74 | 340 II 9 | I. 80 | $\begin{array}{llll}3 & 3^{8} & 21.8\end{array}$ | I. 87 |
| 31 | $34235 \cdot 0$ | I. 59 | $3{ }^{3} 40 \begin{gathered}58 \cdot 1\end{gathered}$ | I. 65 | $\begin{array}{llllllllll}3 & 39 & 17 \cdot 5\end{array}$ | I•71 | $\begin{array}{llll}3 & 37 & 33 \cdot 1\end{array}$ | 1.77 | $\begin{array}{lllll}3 & 35 & 44 \cdot 8\end{array}$ | I. 84 | $\begin{array}{llll}3 & 33 & 52 \cdot 3\end{array}$ | I.91 |
| 32 | $\begin{array}{llllll}3 & 38 & 15\end{array}$ | I 62 | $\begin{array}{llll}3 & 36 & 36 \cdot 5\end{array}$ | I. 68 | $33454{ }^{\circ} \mathrm{O}$ | I'74 | $\begin{array}{llll}3 & 33 & 7.4\end{array}$ | I.81 | $3 \mathrm{3I} 16.8$ | I. 88 | $\begin{array}{llll}3 & 29 & 21.8\end{array}$ | I.95 |
| 33 | $\begin{array}{llll}3 & 33 & 54.9\end{array}$ | I. 64 | $\begin{array}{llll}3 & 32 & 14.3\end{array}$ | I・クI | $3 \quad 30 \quad 29.6$ | I•88 | $328 \quad 40 \cdot 8$ | I.85 | $32647 \cdot 7$ | 1.92 | $32450 \cdot 0$ | $2 \cdot 00$ |
| 34 | $\begin{array}{lll}3 & 29 & 33 \cdot 8\end{array}$ | I. 68 | $32751 \cdot 2$ | I.74 | $\begin{array}{llll}3 & 26 & 4.4\end{array}$ | I. 82 | 32413.2 | I. 89 | 32217.5 | $1 \cdot 97$ | 32017.0 | $2 \cdot 05$ |
| 35 | $\begin{array}{llll}3 & 25 & 12 \cdot 0\end{array}$ | 1.71 | $\begin{array}{llll}3 & 23 & 27 \cdot 3\end{array}$ | 1.78 | $32138 \cdot 1$ | I.86 | $\begin{array}{llll}3 & 19 & 44.5\end{array}$ | 1.93 | $\begin{array}{llll}3 & 17 & 46 \cdot 1\end{array}$ | 2.01 | $31542 \cdot 7$ | $2 \cdot 10$ |
| 36 | $\begin{array}{llll}3 & 20 & 49 \cdot 3\end{array}$ | I.75 | $\begin{array}{lll}3 & 19 & 2.4\end{array}$ | I.82 | 3 I7 10.9 | I 90 | 31514.7 | I.98 | 31313.4 | 2.06 | 3 II $6 \cdot 9$ | $2 \cdot 15$ |
| 37 | $\begin{array}{llll}3 & 16 & 25 \cdot 8 \\ 3 & 12 & \end{array}$ | 1.78 | $\begin{array}{llll}3 & 14 & 36 \cdot 6\end{array}$ | I. 86 | $\begin{array}{lrrr}3 & 12 & 42 \cdot 6\end{array}$ | 1.94 | 3 10 $43 \cdot 6$ | 2.03 | $\begin{array}{llll}3 & 8 & 39 \cdot 3\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}3 & 6 & 29 \cdot 6\end{array}$ | 2.21 |
| 38 | $\begin{array}{llll}3 & 12 & 1.4\end{array}$ | 1.82 | 3 Io $9 \cdot 8$ | I. 90 | $3 \quad 8 \quad 13 \cdot 1$ | I.99 | $3 \quad 6 \mathrm{II} \cdot 2$ | 2.08 | $\begin{array}{llll}3 & 4 & 3 \cdot 8\end{array}$ | $2 \cdot 17$ | 3 I 50.6 | 2.27 |
| 39 | $3 \begin{array}{lll}3 & 7 & 36 \cdot 0\end{array}$ | I 86 | $3 \mathrm{~S} 54 \mathrm{l} \cdot 8$ | I.95 | $\begin{array}{rrr}3 & 3 & 42 \cdot 3\end{array}$ | 2.04 | $\begin{array}{rrrr}3 & \text { I } & 37.4\end{array}$ | $2 \cdot 13$ | $\begin{array}{llll}2 & 59 & 26 \cdot 7\end{array}$ | 2.23 | $\begin{array}{lll}2 & 57 & 9 \cdot 9\end{array}$ | $2 \cdot 33$ |
| 40 | $\begin{array}{rrrr}3 & 3 & 9 \cdot 6 \\ 2 & 5 & 8\end{array}$ | 1.91 | $\begin{array}{rrrr}3 & 1 & 12.6\end{array}$ | I.99 | $\begin{array}{llll}2 & 59 & 10 \cdot 2\end{array}$ | $2 \cdot 09$ | 25751 | $2 \cdot 19$ | $2 \begin{array}{lllllllll}2 & 54 & 47 \cdot 8\end{array}$ | $2 \cdot 29$ | $\begin{array}{llll}2 & 52 & 27 \cdot 2\end{array}$ | 2.40 |
| 41 | $2 \begin{array}{llll}28 & 42 \cdot 0\end{array}$ | I.95 | $2 \begin{array}{llll}2 & 56 & 42 \cdot 2\end{array}$ | $2 \cdot 04$ | $25436 \cdot 7$ | 2.14 | $25225 \cdot 1$ | $2 \cdot 25$ | 250 | $2 \cdot 36$ | 24742.4 | $2 \cdot 47$ |
| 42 | $\begin{array}{llll}2 & 54 & 13.2\end{array}$ | 2.00 | $\begin{array}{llll}2 & 52 & 10 \cdot 4\end{array}$ | $2 \cdot 10$ | 250 | $2 \cdot 20$ | $24746 \cdot 3$ | $2 \cdot 31$ | $\begin{array}{lllll}2 & 45 & 24.4\end{array}$ | $2 \cdot 42$ | 24255.4 | $2 \cdot 55$ |
| 43 | $24943 \cdot 1$ | $2 \cdot 05$ | $24737 \cdot 1$ | $2 \cdot 15$ | $24524 \cdot 7$ | $2 \cdot 26$ | 243157 | $2 \cdot 38$ | $240 \quad 39 \cdot 5$ | $2 \cdot 50$ | $\begin{array}{llll}2 & 38 & 5 \cdot 8\end{array}$ | 2.63 |
| 44 | $\begin{array}{llll}2 & 45 & 11.5\end{array}$ | $2 \cdot 10$ | $\begin{array}{llr}2 & 43 & 2 \cdot 1 \\ 2 & 18 & \end{array}$ | 2.21 | $2{ }_{2} 404646$ | $2 \cdot 33$ | 2 38 $22 \cdot 8$ <br> 2 3  | 2.45 | $\begin{array}{llll}2 & 35 & 52.2\end{array}$ | $2 \cdot 58$ | $\begin{array}{llll}2 & 33 & 13.5\end{array}$ | 2.71 |
| 45 | $\begin{array}{llll}2 & 40 & 38 \cdot 4 \\ 2 & 36 & \end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}2 & 38 & 25 \cdot 4\end{array}$ | $2 \cdot 28$ | $\begin{array}{lll}2 & 36 & 5 \cdot 3\end{array}$ | $2 \cdot 40$ | $2 \begin{array}{llll}2 & 33 & 37 \cdot 8\end{array}$ | 2.53 | $\begin{array}{llll}2 & 31 & 2 \cdot 2 \\ 2 & 26 & \end{array}$ | $2 \cdot 66$ | $2 \begin{array}{lllll}28 & 18 \cdot 2\end{array}$ | 2.81 |
|  | $\begin{array}{lll}2 & 36 & 3 \cdot 6\end{array}$ | 2.22 | $\begin{array}{llll}2 & 33 & 46 \cdot 7\end{array}$ | $2 \cdot 34$ | $\begin{array}{llll}2 & 31 & 22.4 \\ 2 & 26 & 3\end{array}$ | 2.47 | $2 \begin{array}{llll}2 & 28 & 50 \cdot 1\end{array}$ | $2 \cdot 61$ | $\begin{array}{llll}2 & 26 & 9.4\end{array}$ | 2.75 | $\begin{array}{llll}2 & 23 & 19.6\end{array}$ | 2.91 |
| 47 | $\begin{array}{llll}2 & 31 & 27.0 \\ 2 & 26 & 48.3\end{array}$ | 2.29 2.36 | $\begin{array}{lll}2 & 29 & 6 \cdot 0 \\ 2 & 2 & \end{array}$ | 2.42 | $\begin{array}{lllll}2 & 26 & 37 \cdot 0\end{array}$ | 2.55 | $\begin{array}{llll}2 & 23 & 59.7\end{array}$ | 2.70 | $\begin{array}{llll}2 & 21 & 1 & 3.4\end{array}$ | $2 \cdot 85$ | 2 l 8178.4 | 3.02 |
| 48 | $12648 \cdot 3$ | $2 \cdot 36$ | 22422.9 | $2 \cdot 49$ | 22149.0 | $2 \cdot 64$ | 2196.2 | $2 \cdot 79$ |  | $2 \cdot 96$ | 2 I3 IIII | $3 \cdot 14$ |
| VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. | A. | L. | A. | L. | A. | L. $9^{\circ}$ | A. | L. 10 | A. | L. 11 | A. |
| $\bigcirc$ | s. | S. | S. | S. | s. | S. | s. | S. | s. | S. | s. | S. |
| 0 | $\cdot 45$ | $4 \cdot 17$ | -53 | $4 \cdot 17$ | -60 | -4.18 | . 68 | -4.19 | - 76 | $-4.21$ | . 83 | 4.22 |
| 2 | -49 | $4 \cdot 17$ | -57 | $4 \cdot 18$ | -64 | $4 \cdot 19$ | $\cdot 72$ | $4 \cdot 20$ | -80 | $4 \cdot 22$ | -88 | $4 \cdot 23$ |
| 4 | $\cdot 53$ | $4 \cdot 17$ | -61 | 4.19 | -68 | $4 \cdot 20$ | -76 | $4 \cdot 21$ | -84 | $4 \cdot 23$ | -92 | $4 \cdot 24$ |
| 6 | $\cdot 57$ | $4 \cdot 18$ | -65 | $4 \cdot 19$ | $\cdot 73$ | $4 \cdot 20$ | .81 | $4 \cdot 22$ | . 88 | 4.23 | -96 | 4.25 |
| 8 | . 62 | $4 \cdot 19$ | . 69 | $4 \cdot 20$ | $\cdot 77$ | $4 \cdot 21$ | $\cdot 85$ | $4 \cdot 23$ | $\cdot 93$ | $4 \cdot 24$ | I-OI | $4 \cdot 26$ |
| 10 | . 66 | $4 \cdot 19$ | $\cdot 74$ | 4.21 | - 82 | $4 \times 22$ | -90 | $4 \cdot 24$ | . 98 | $4 \cdot 26$ | 1.06 | $4 \cdot 27$ |
| 12 | $\cdot 70$ | $4 \cdot 20$ | -78 | 4.21 | -86 | $4 \cdot 23$ | -95 | $4 \cdot 25$ | I 03 | $4 \cdot 27$ | I•II | $4 \cdot 29$ |
| 14 | $\cdot 75$ | $4 \cdot 2 \mathrm{I}$ | . 83 | $4 \cdot 22$ | -91 | $4 \cdot 24$ | 1.00 | $4 \cdot 26$ | 1.08 | $4 \cdot 28$ | I-16 | $4 \cdot 30$ |
| 16 | .80 | 4.22 | -88 | $4 \cdot 23$ | -96 | $4 \cdot 25$ | I. 05 | $4 \cdot 27$ | I'13 | $4 \cdot 29$ | 1.22 | $4 \cdot 32$ |
| 18 | .85 | $4 \cdot 23$ | $\cdot 93$ | $4 \cdot 24$ | I. 02 | $4 \cdot 26$ | I. 10 | $4 \cdot 28$ | I•19 | $4 \cdot 31$ | I. 28 | 4.33 |
| 20 | -90 | 4.24 | . 99 | 4.26 | 1.07 | $4 \cdot 28$ | I 16 | $4 \cdot 30$ | I. 25 | 4.33 | I•34 | $4 \cdot 35$ |
| 22 | -96 | $4 \cdot 25$ | I. 04 | $4 \cdot 27$ | I. 13 | $4 \cdot 29$ | 1.22 | $4 \cdot 32$ | 1.3I | $4 \cdot 34$ | I. 40 | $4 \cdot 37$ |
| 24 | $\mathbf{I} \cdot \mathbf{1}$ | $4 \cdot 26$ | I•IO | 4.29 | I•19 | $4 \cdot 31$ | I. 29 | $4 \cdot 34$ | 1.38 | $4 \times 36$ | 1.47 | $4 \cdot 40$ |
| 26 | I.07 | 4.28 | I.17 | $4 \cdot 30$ | I. 26 | $4 \cdot 33$ | I. 35 | $4 \cdot 36$ | 1.45 | $4 \cdot 39$ | 1.55 | 4.42 |
| 28 | I. 14 | $4 \cdot 29$ | I. 23 | $4 \cdot 32$ | I. 33 | 4.35 | 1.43 | $4 \cdot 38$ | I. 53 | $4 \cdot 4 \mathrm{I}$ | I. 63 | $4 \cdot 45$ |
| 30 | I-2I | $4 \cdot 31$ | 1.30 | $4 \cdot 34$ | 1.40 | 4.37 | 1.51 | 4.41 | I.6I | $4 \cdot 44$ | $1 \cdot 72$ | 4.48 |
| 32 | I. 28 | $4 \cdot 33$ | I. 38 | $4 \cdot 36$ | I-48 | $4 \cdot 40$ | I. 59 | 4.44 | I•70 | 4.48 | I. 81 | $4 \cdot 52$ |
| 34 | I. 36 | 4.36 | I.46 | $4 \cdot 39$ | I.57 | $4 \cdot 43$ | I. 68 | 4.47 | I•79 | $4 \cdot 51$ | 1.91 | $4 \cdot 56$ |
| 36 | I.44 | $4 \cdot 38$ | I. 55 | $4 \cdot 42$ | I. 66 | - 4.46 | I.78 | 4.51 | I.90 | $4 \cdot 56$ | 2.02 | $4 \cdot 61$ |
| 38 | I•53 | 4.41 | I. 65 | $4 \cdot 46$ | I.77 | 4.50 | 1.89 | $4 \cdot 55$ | 2.02 | $4 \cdot 60$ | $2 \cdot 15$ | $4 \cdot 66$ |
| 40 | 1. 63 | 4.45 | 1.75 | 4.50 | 1. 88 | 4.55 | $2 \cdot \mathrm{OI}$ | $4 \cdot 60$ | 2.14 | $4 \cdot 66$ | 2.28 | 4.73 |
| 42 | I. 74 | 4.49 | 1.87 | 4.54 | $2 \cdot 00$ | $4 \cdot 60$ | $2 \cdot 14$ | $4 \cdot 66$ | $2 \cdot 29$ | $4 \cdot 73$ | $2 \cdot 44$ | $4 \cdot 80$ |
| 44 | I.86 | 4.54 | 2.00 | 4.60 | $2 \cdot 14$ | 4.66 | $2 \cdot 29$ | $4 \cdot 73$ | $2 \cdot 45$ | $4 \cdot 8 \mathrm{I}$ | $2 \cdot 61$ | 4.90 |
| 46 | +99 | 4.59 | $2 \cdot 14$ | $4 \cdot 66$ | $2 \cdot 30$ | $4 \cdot 74$ | 2.46 | 4.82 | 2.63 | $4 \cdot 91$ | 2.81 | $5 \cdot \mathrm{OI}$ |
| 48 | -14 | $4 \cdot 66$ | $2 \cdot 30$ | $4 \cdot 74$ | 2.48 | 4.82 | $2 \cdot 66$ | 4.93 | 2.85 | $5 \cdot 03$ | 3.05 | 5.14 |

184 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT.

## LATITUDE $15^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. | S. | H. M. | S. | H. M. S. | S. | H. M. S. | S. | A. S. | S. | . M. S. | - |
| O | $54656 \cdot$ | I. | $54548 \cdot 8$ | - I.13 | $54440 \cdot 6$ | -I.14 | $154313 \mathrm{~F} \cdot 8$ | - I'15 | 54222.4 | - I•I6 | 54 I 12.2 | - 8 |
| 6 | 52124.6 | I. 23 | 520 IO.I | I. 25 | 518454 | 1.27 | $51737 \cdot 7$ | I. 29 | $5 \begin{array}{llll}5 & 16 & 19.6\end{array}$ | 1.3I | $\begin{array}{lll}5 & 15 & 0 \cdot 1\end{array}$ | r.34 |
| 8 | 51251.4 | I. 27 | 5 II $34 \cdot 3$ | 1.29 | 51016.0 | 1.32 | $\begin{array}{llll}5 & 8 & 56 \cdot 2\end{array}$ | I-34 | $\begin{array}{llll}5 & 7 & 350\end{array}$ | 1.37 | $\begin{array}{llll}5 & 6 & 12 \cdot 1\end{array}$ | 1.39 |
| 10 | $\begin{array}{llll}5 & 4 & 16 \cdot 7\end{array}$ | I•3I | $\begin{array}{lllll}5 & 2 & 57 \cdot 0\end{array}$ | I 34 | $5 \quad 1 \quad 35 \%$ | $1 \cdot 37$ | $5 \begin{array}{lll}5 & 0 & 12.9\end{array}$ | 1-39 | $4 \begin{array}{llll}48 & 48 \cdot 3\end{array}$ | 1.42 | $45721 \cdot 9$ | 1.46 |
| 12 | $45540 \cdot 4$ | I.36 | $454 \begin{array}{llll}4 & 17\end{array}$ | r.39 | 45253.6 | 1.42 | $45127 \cdot 4$ | I. 45 | $4 \quad 49 \quad 59 \cdot 3$ | I. 49 | $4 \quad 48 \quad 29 \cdot 1$ | I. 52 |
| 14 | 4478 | I. 41 | $4 \begin{array}{lll}4 & 45 & 36 \cdot 8\end{array}$ | I.44 | $444 \quad 9 \cdot 3$ | I. 48 | $44239 \cdot 6$ | 1.51 | 44178 | 1455 | $43933 \cdot 7$ | 59 |
| r6 | $4 \begin{array}{llll}4 & 38 & 22 \cdot 3\end{array}$ | I-46 | 43653.6 | I 50 | $\begin{array}{llll}4 & 35 & 22 \cdot 6\end{array}$ | I. 54 | 4331993 | r.58 | 43213.5 | 1.62 | $4 \quad 30 \quad 35 \cdot 2$ | I. 66 |
| 18 | $4 \begin{array}{llll}4 & 29 & 40 \cdot 1\end{array}$ | I. 51 | 428 8.0 | I. 56 | $4 \begin{array}{llll}4 & 26 & 33.4\end{array}$ | I. 60 | $\begin{array}{llll}4 & 24 & 56 \cdot 2\end{array}$ | I. 64 | $\begin{array}{llll}4 & 23 & 16 \cdot 2\end{array}$ | - 69 | 4 21 33.4 | I'74 |
| 19 | $4 \begin{array}{llll}4 & 25 & 18.2\end{array}$ | r.54 | 42344.3 | I.59 | $\begin{array}{lll}4 & 22 & 7 \cdot 8\end{array}$ | I.63 | $42028 \cdot 5$ | I. 68 | $41846 \cdot 3$ | $1 \cdot 73$ | 4178 | 1.78 |
| 20 | $42055 \cdot 6$ | $1 \cdot 57$ | 4 I9 19.9 | I. 62 | 41741.4 | r.67 | 416000 | I'72 | $4 \begin{array}{lll}4 & 15 \cdot 5\end{array}$ | $1 \cdot 77$ | $\begin{array}{lllll}4 & 12 & 27.9\end{array}$ | I-82 |
| 21 | $41632 ; 4$ | I. 60 | $\begin{array}{llll}4 & 14 & 54 & 8\end{array}$ | 1.65 | 4 I3 14.2 | 1.70 | 4 II $30 \cdot 6$ | I•75 | $4 \begin{array}{llll}4 & 9 & 43.8\end{array}$ | 1.81 | $4 \quad 7 \quad 53.6$ | r.87 |
| 22 | 41285 | I. 63 | 4 10 $28 \cdot 9$ | I. 69 | $\begin{array}{llll}4 & 8 & 46 \cdot 2\end{array}$ | r.74 | $\begin{array}{lll}4 & 7 & 0.3\end{array}$ | I'79 | 4 . 5 II•I | 1.85 | $\begin{array}{lllll}4 & 3 & 18 \cdot 3\end{array}$ | I.91 |
| 23 | 4743.9 | 1.67 | $\begin{array}{lll}4 & 6 & 2 \cdot 2\end{array}$ | r 72 | $\begin{array}{lll}4 & 4 & 17.3\end{array}$ | - 78 | 422291 | I.83 | 4 0 37.3 | I.89 | $35^{3}$ 41•7 | r.96 |
| 24 | $\begin{array}{llll}4 & 3 & 18.5\end{array}$ | I.70 | 4 I $34 \cdot 7$ | r.76 |  | I. 82 | $\begin{array}{llll}3 & 57 & 56 \cdot 8\end{array}$ | $\underline{r}$.88 | $\begin{array}{lll}3 & 56 & 2.4\end{array}$ | I.94 | $\begin{array}{lll}3 & 54 & 4 \cdot 1\end{array}$ | $2 \cdot 01$ |
| 25 | $\begin{array}{llll}3 & 58 & 52 \cdot 3\end{array}$ | 1.74 | $3576 \cdot 3$ | 1.80 | 35516.8 | 1.86 | $3 \quad 53 \quad 23 \cdot 5$ | 1.92 | $35126 \cdot 4$ | 1.99 | 349 25.1 | $2 \cdot 06$ |
| 26 | $35425 \cdot 3$ | r 77 | $35237 \cdot 0$ | 1.84 | $35045{ }^{\circ}$ | 1.90 | $34849 \cdot 1$ | I.97 | $3{ }_{3} 4^{6} 49 \cdot 1$ | $2 \cdot 04$ | 344 44*7 | 2.II |
| 27 | 349578 | I.8I | $\begin{array}{llll}3 & 48 & 6 \cdot 7\end{array}$ | I. 88 | $34^{36}$ I2.I | I. 94 |  | $2 \cdot \mathrm{Or}$ |  | $2 \cdot 09$ | $340 \quad 2 \cdot 9$ | $2 \cdot 16$ |
| 28 | $34528 \cdot 5$ | I.85 | $3 \begin{array}{llll}3 & 43 & 35 \cdot 3\end{array}$ | 1.92 | 3 41 $38 \cdot 1$ | 1.99 | $\begin{array}{llll}3 & 39 & 36 \cdot 5\end{array}$ | 2.06 | $\begin{array}{lllll}3 & 37 & 30 \cdot 4\end{array}$ | $2 \cdot 14$ | $\begin{array}{llll}3 & 35 & 19.6\end{array}$ | $2 \cdot 22$ |
| 29 | 34058 | I.89 | $\begin{array}{lll}3 & 39 & 2 \cdot 9\end{array}$ | r.96 | $\begin{array}{lll}3 & 37 & 2.8\end{array}$ | $2 \cdot 04$ | $\begin{array}{lllll}3 & 34 & 58 \cdot 2\end{array}$ | $2 \cdot 12$ | $\begin{array}{lllll}3 & 32 & 48 \cdot 9\end{array}$ | $2 \cdot 20$ |  | $2 \cdot 28$ |
| 30 | $\begin{array}{lllll}3 & 36 & 27 \cdot 7\end{array}$ | I 94 | $\begin{array}{llll}3 & 34 & 29 \cdot 2\end{array}$ | $2 \cdot 01$ | $\begin{array}{llll}3 & 32 & 26 \cdot 2\end{array}$ | $2 \cdot 09$ | $\begin{array}{lllll}3 & 30 & 18 \cdot 4\end{array}$ | $2 \cdot 17$ | $\begin{array}{llll}3 & 28 & 5 \cdot 7\end{array}$ | 2.25 | $3 \begin{array}{llll}3 & 25 & 47 \cdot 8\end{array}$ | $2 \cdot 35$ |
| 31 | $\begin{array}{llll}3 & 3155.5\end{array}$ | 1.98 | 32954.2 | 2.06 | $\begin{array}{llll}3 & 27 & 48 \cdot 2\end{array}$ | 2.14 | $\begin{array}{llll}3 & 25 & 37 \cdot 2\end{array}$ | 2.23 | $\begin{array}{lll}3 & 23 & 20.9\end{array}$ | $2 \cdot 32$ | $32059 \cdot 1$ | $2 \cdot 41$ |
| 32 | 32722.2 | 2.03 | $\begin{array}{llllll}3 & 25 & 17 \cdot 9\end{array}$ | II | $\begin{array}{llll}3 & 23 & 8 \cdot 7\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}3 & 20 & 54 \cdot 2\end{array}$ | $2 \cdot 29$ | $\begin{array}{llll}3 & 18 & 34 \cdot 2\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}3 & 16 & 8.4\end{array}$ | $2 \cdot 48$ |
| 33 | $\begin{array}{llll}3 & 22 & 47 \cdot 6\end{array}$ | $2 \cdot 08$ | $3 \begin{array}{llll}3 & 20 & 40 \cdot 2\end{array}$ | $2 \cdot 17$ | $\begin{array}{llll}3 & 18 & 27 \cdot 6\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}3 & 16 & 9.5\end{array}$ | $2 \cdot 35$ | $\begin{array}{lllll}3 & 13 & 45 \cdot 5\end{array}$ | 2.45 | $3 \begin{array}{llll}3 & 11 & 15.4\end{array}$ | $2 \cdot 56$ |
| 34 | $\begin{array}{lllll}3 & 18 & 11.6\end{array}$ | $2 \cdot 13$ | $\begin{array}{llrr}3 & 16 & 0.9 \\ 3 & 11 & \end{array}$ | $2 \cdot 22$ | $\begin{array}{llll}3 & 13 & 44.7\end{array}$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 11 & 22 \cdot 8\end{array}$ | $2 \cdot 42$ | $\begin{array}{lllll}3 & 8 & 54 \cdot 7\end{array}$ | $2 \cdot 52$ | $3 \quad 6 \quad 20 \cdot 1$ | $2 \cdot 63$ |
| 35 | 313 34.1 | $2 \cdot 19$ | 3 II 19.9 | $2 \cdot 28$ | $\begin{array}{lll}3 & 9 & 0 \cdot 1\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}3 & 6 & 34 \cdot 1\end{array}$ | $2 \cdot 49$ | $\begin{array}{lll}3 & 4 & x\end{array}$ | $2 \cdot 60$ | $3 \quad 122 \cdot 3$ | $2 \cdot 72$ |
| 36 | $3 \mathrm{~B} \quad 854.9$ | $2 \cdot 25$ | $\begin{array}{llll}3 & 6 & 37 \cdot 2\end{array}$ | $2 \cdot 35$ | $\begin{array}{llll}3 & 4 & 13.4\end{array}$ | 2.45 | 3 I $43 \cdot 1$ | $2 \cdot 56$ | 25960 | $2 \cdot 68$ | $25621 \cdot 6$ | $2 \cdot 80$ |
| 37 | $\begin{array}{llll}3 & 4 & 14 \cdot 1\end{array}$ | $2 \cdot 31$ | $\begin{array}{llll}3 & 1 & 52.5\end{array}$ | 2.41 | $\begin{array}{llll}2 & 59 & 24.6\end{array}$ | $2 \cdot 52$ | 2 56 $49 \cdot 8$ <br> 2 5  | $2 \cdot 64$ | $\begin{array}{lll}2 & 54 & 7.8 \\ 2 & 49 & 6.5\end{array}$ | 2.76 | 25 I 18.0 | 2.90 |
| 38 | 25931.4 | $2 \cdot 37$ | $\begin{array}{lll}2 & 57 & 5.8\end{array}$ | $2 \cdot 48$ | $\begin{array}{llll}2 & 54 & 33.4\end{array}$ | $2 \cdot 60$ | 25 I 53.8 | $2 \cdot 72$ | $2496 \cdot 5$ | 2.86 | 246 II*O | 3.00 |
| 39 | $25446 \cdot 8$ | 2.44 | $\begin{array}{llll}2 & 52 & 16 \cdot 7\end{array}$ | $2 \cdot 56$ | $\begin{array}{lllll}2 & 49 & 39 \cdot 7\end{array}$ | $2 \cdot 68$ | $\begin{array}{lllll}2 & 46 & 54.9\end{array}$ | 2.81 | $\begin{array}{llrr}2 & 44 & 2 \cdot 1 \\ 2 & 38 & 54\end{array}$ | 2.95 | 24150.5 | $3 \cdot 10$ |
| 40 | 24959.9 | $2 \cdot 51$ | $24725 \cdot 4$ | 2.64 | $24443 \cdot 3$ | $2 \cdot 77$ | 24153.0 | 2.91 | $\begin{array}{lllll}2 & 38 & 54 \cdot 1\end{array}$ | 3.06 | $23545 \cdot 9$ | $3 \cdot 22$ |
| 41 | $24510 \cdot 6$ | 2.59 | $24231 \cdot 2$ | $2 \cdot 72$ | $23943 \cdot 7$ | 2.86 | $\begin{array}{llll}2 & 36 & 47 \cdot 7\end{array}$ | 3.01 | $2 \begin{array}{lll}2 & 33 & 42 \cdot 3\end{array}$ | 3.17 | $23027 \cdot 0$ | 3.35 |
| 42 | 24018.8 | $2 \cdot 68$ | $23734^{\circ} 2$ | 2.81 | 234 4I•0 | 2.96 | $231138 \cdot 6$ | 3.12 | $2 \begin{array}{llll}2 & 28 & 26 \cdot 2\end{array}$ | 3.29 | 22513.2 | $3 \cdot 48$ |
| 43 | 235 24. 1 | 2.77 | 23233.9 | $2 \cdot 91$ | $2 \begin{array}{llll}2 & 29 & 34 \cdot 5\end{array}$ | 3.07 | $2 \begin{array}{llll}2 & 26 & 25\end{array}$ | $3 \cdot 24$ | $\left\lvert\, \begin{array}{lll}2 & 23 & 5 \cdot 4\end{array}\right.$ | 3.43 | $2 \begin{array}{llll}19 & 33.9\end{array}$ | 3.63 |
| 44 | $\begin{array}{llll}2 & 30 & 26.4\end{array}$ | $2 \cdot 86$ | $\begin{array}{lllllllllllllll}2 & 27 & 30 \cdot 1\end{array}$ | 3.02 | $22424 \cdot \mathrm{I}$ | $3 \cdot 19$ | $2 \begin{array}{lll}21 & 7.4\end{array}$ | $3 \cdot 37$ | $2 \begin{array}{lllll}2 & 17 & 39 \cdot 3\end{array}$ | 3.57 |  | 3.79 |
| 45 | $22525 \cdot 2$ | $2 \cdot 96$ | 22222.4 | $3 \cdot 13$ | 21991 | $3 \cdot 32$ | 21544.4 | $3 \cdot 52$ | $2 \begin{array}{lll}2 & 12 & 7 \cdot 2\end{array}$ | $3 \cdot 73$ | $2 \begin{array}{lll}2 & 8 & 16.3\end{array}$ | $3 \cdot 97$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| 0 | - 91 | $-4.24$ | -.99 | $-4.25$ | -1.07 | $-4.28$ | -I'I5 | $-4.30$ | -I.23 | $-4.32$ | -I. 32 | -4.34 |
| - 2 | '95 | $4 \cdot 25$ | $1 \cdot 03$ | $4 \cdot 27$ | I•II | 4.29 | I. 20 | $4 \cdot 31$ | I. 28 | 4.33 | I. 36 | $4 \cdot 36$ |
| 4 | 1.00 | $4 \cdot 26$ | I.08 | 4.28 | I.16 | $4 \cdot 30$ | I. 24 | $4 \cdot 32$ | 1.33 | 4.35 | I. 41 | $4 \cdot 37$ |
| 6 | I. 04 | $4 \cdot 27$ | 1.13 | $4 \cdot 29$ | I-2I | $4 \cdot 31$ | I. 29 | $4 \cdot 34$ | 1.37 | $4 \cdot 36$ | I 46 | $4 \cdot 39$ |
| 8 | I.09 | $4 \cdot 28$ | 1.17 | 4.30 | I. 26 | 4.33 | 1.34 | $4 \cdot 35$ | I.43 | $4 \cdot 38$ | I. 51 | 4.41 |
| 10 | I-14 | 4.30 | $1 \cdot 22$ | 4.32 | 1.31 | $4 \cdot 34$ | I•39 | $4 \cdot 37$ | 1.48 | 4.40 | 1.57 | 4.43 |
| 12 | 1.19 | $4 \cdot 31$ | 1.28 | $4 \cdot 33$ | I 37 | $4 \cdot 36$ | 1.45 | $4 \cdot 39$ | I. 54 | $4 \cdot 42$ | r 63 | $4 \cdot 45$ |
| 14 | I. 25 | $4 \cdot 32$ | 1.34 | $4 \cdot 35$ | I 42 | $4 \cdot 38$ | I.51 | $4 \cdot 4 \mathrm{I}$ | r 60 | $4 \cdot 44$ | 1.70 | $4 \cdot 47$ |
| 16 | I.3I | $4 \cdot 34$ | 1.39 | $4 \cdot 37$ | I. 48 | $4 \cdot 40$ | I. 58 | $4 \cdot 43$ | I. 67 | $4 \cdot 46$ | I.76 | 4.50 |
| 18 | 1-37 | $4 \cdot 36$ | I. 46 | $4 \cdot 39$ | I. 55 | $4 \cdot 42$ | 1.64 | $4 \cdot 45$ | I•74 | $4 \cdot 49$ | I. 84 | 4.53 |
| 20 | I. 43 | $4 \cdot 38$ | 1.52 | $4 \cdot 41$ | 1.62 | $4 \cdot 45$ | 1.72 | $4 \cdot 48$ | r.8I | 4.52 | 1.91 | $4 \cdot 56$ |
| 22 | I. 50 | $4 \cdot 40$ | 1.60 | 4.44 | I. 69 | $4 \cdot 47$ | 1.79 | $4 \cdot 51$ | I.89 | $4 \cdot 55$ | $2 \cdot 00$ | $4 \cdot 60$ |
| 24 | I. 57 | $4 \cdot 43$ | I. 67 | $4 \cdot 46$ | 1.77 | $4 \cdot 50$ | I. 88 | $4 \cdot 55$ | 1.98 | 4.59 | 2.09 | $4 \cdot 64$ |
| 26 | I. 65 | $4 \cdot 46$ | 1.75 | $4 \cdot 50$ | I. 86 | 4.54 | 1.97 | $4 \cdot 58$ | 2.08 | $4 \cdot 63$ | $2 \cdot 19$ | $4 \cdot 68$ |
| 28 | 1.73 | $4 \cdot 49$ | I.84 | $4 \cdot 53$ | I.95 | $4 \cdot 58$ | $2 \cdot 06$ | 4.63 | 2.18 | 4.68 | $2 \cdot 30$ | $4 \cdot 74$ |
| 30 | 1.83 | $4 \cdot 52$ | I'94 | 4.57 | 2.05 | 4.62 | 2.17 | 4.67 | 2.29 | $4 \cdot 73$ | 2.42 | 4.80 |
| 32 | 1.92 | 4.57 | $2 \cdot 04$ | $4 \cdot 62$ | 2.16 | $4 \cdot 67$ | 2.29 | $4 \cdot 73$ | 2.42 | $4 \cdot 79$ | $2 \cdot 55$ | 4.86 |
| 34 | 2.03 | $4 \cdot 6 \mathrm{I}$ | $2 \cdot 16$ | $4 \cdot 67$ | $2 \cdot 28$ | $4 \cdot 73$ | 2.42 | $4 \cdot 79$ | $2 \cdot 55$ | 4.87 | $2 \cdot 70$ | 4.94 |
| 36 | $2 \cdot 15$ | $4 \cdot 67$ | $2 \cdot 28$ | 4.73 | 2.42 | 4.80 | 256 | 4.87 | $2 \cdot 71$ | 4.95 | 2.87 | $5 \cdot 04$ |
| 38 | $2 \cdot 28$ | 4.73 | 2.42 | 4.80 | $2 \cdot 57$ | 4.87 | $2 \cdot 72$ | 4.96 | 2.89 | $5 \cdot 05$ | 305 | $5 \cdot 15$ |
| 40 | 2.43 | 4.80 | 2.58 | 4.88 | $2 \cdot 74$ | 4.97 | $2 \cdot 91$ | 5.06 | $3 \cdot 09$ | 5.16 | $3 \cdot 27$ | $5 \cdot 28$ |
| 42 | $2 \cdot 60$ | $4 \cdot 89$ | $2 \cdot 76$ | 4.98 | $2 \cdot 94$ | $5 \cdot 08$ | $3 \cdot 12$ | $5 \cdot 19$ | $3 \cdot 32$ | $5 \cdot 31$ | 3.53 | $5 \cdot 44$ |
| 43 | $2 \cdot 69$ | 4.94 | $2 \cdot 86$ | $5 \cdot 03$ | $3 \cdot 05$ | $5 \cdot 14$ | $3 \cdot 24$ | $5 \cdot 26$ | 3.45 | $5 \cdot 39$ | $3 \cdot 68$ | $5 \cdot 54$ |
| 44 | $2 \cdot 79$ | 4.99 | $2 \cdot 97$ | 5-10 | $3 \cdot 16$ | $5 \cdot 21$ | $3 \cdot 37$ | $5 \cdot 34$ | $3 \cdot 60$ | $5 \cdot 48$ | $3 \cdot 84$ | $5 \cdot 65$ |
| 45 | $2 \cdot 89$ | $5 \cdot 05$ | 3.09 | $5 \cdot 16$ | $3 \cdot 29$ | $5 \cdot 29$ | $3 \cdot 52$ | $5 \cdot 43$ | $3 \cdot 76$ | $5 \cdot 59$ | 4.02 | $5 \cdot 77$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 185

## LATITUDE $15^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.


## Latitude $16^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 6 & \text { o } & 0.0 \end{array}$ | $\begin{gathered} \mathrm{S} \\ -\mathrm{I} \cdot \mathrm{I} 5 \end{gathered}$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 58 \\ 5 \mathrm{I} \cdot 2 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} . \\ -\mathrm{I} \cdot \mathrm{I} 5 \end{gathered}$ | $\left\lvert\, \begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 57 \\ 42 \cdot 3 \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \\ -\mathrm{I} \cdot \mathrm{I} 5 \end{gathered}$ | $\begin{array}{ccc} \mathrm{H}, \mathrm{M} . & \mathrm{S} . \\ 5 & 56 & 33 \cdot 3 \end{array}$ | $\underset{-\mathrm{I} \cdot \mathrm{I} 5}{ }$ | $\left\|\begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 55 \\ 24^{\prime 2} \end{array}\right\|$ | $\begin{gathered} \mathrm{S} \\ -\mathrm{I} \cdot \mathrm{I} 5 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 54 & \text { I } 5 \cdot 0 \end{array}\right\|$ | S. ${ }_{\text {S }}$ |
| 10 | $\begin{array}{llll}5 & 18 & 22.2\end{array}$ | $1 \cdot 17$ | 5 17 11.8 | I.18 | $\begin{array}{lll}5 & 16 & 0.5\end{array}$ | 1.20 | 51448 | r. 21 | $\begin{array}{llll}5 & 13 & 35 \cdot 1\end{array}$ | 1.23 | $\begin{array}{llllll}5 & 12 & 20.9\end{array}$ | 1.25 |
| 12 | $5102 \cdot 1$ | 1.18 |  | $1 \cdot 19$ | $5739 \cdot 0$ | 1.21 | $\begin{array}{lll}5 & 6 & 25 \cdot 8\end{array}$ | I. 23 | $\begin{array}{llll}5 & 5 & 11.5\end{array}$ | 1. 25 | $5 \quad 3 \quad 56 \cdot 0$ | 1.27 |
| 14 | 5 I 4I•6 | I'19 | $5 \quad 0 \quad 29.9$ | I. 20 | $45917 \cdot 0$ | 1.23 | $\begin{array}{llll}4 & 58 & 2 \cdot 8\end{array}$ | I. 25 | $4 \quad 56 \quad 47 \cdot 2$ | $1 \cdot 27$ | $4 \begin{array}{llll}4 & 55 & 30 \cdot 2\end{array}$ | I. 29 |
| 16 | $45320 \cdot 8$ | I. 20 | $\begin{array}{lll}4 & 52 & 8 \cdot 3\end{array}$ | 22 | 45054.4 | I 24 | $44939 \cdot 0$ | I 27 | $4 \begin{array}{lll}48 & 21.9\end{array}$ | $1 \cdot 30$ | $4 \begin{array}{lll}47 & 3.4\end{array}$ | I 32 |
| 18 | $44459 \cdot 5$ | 1.2I | $44346 \cdot 1$ | 1.24 | $44231 \cdot 0$ | 1.26 | $4 \begin{array}{llll}41 & 143\end{array}$ | 1.29 | $4 \begin{array}{lllll}4 & 39 & 55 \\ 4\end{array}$ | 1.32 | $43835 \cdot 5$ | r 35 |
| 20 | $43637 \cdot 7$ | I. 23 | $435 \quad 23 \cdot 2$ | I. 26 | $4346 \cdot 9$ | 1.29 | $\begin{array}{llll}4 & 32 & 48 \cdot 7\end{array}$ | I. 32 | $43^{4} 3128 \cdot 6$ | 1.35 | 4306.5 | r.39 |
| 22 | 42815.4 | I. 25 | $4 \begin{array}{lll}4 & 26 & 59 \cdot 6\end{array}$ | I. 28 | $4 \quad 2541 \cdot 9$ | I.3I | $4 \begin{array}{llll}4 & 22 & 22 \cdot 1\end{array}$ | I.35 | $\begin{array}{lll}4 & 23 & 0.2\end{array}$ | I. 38 | $42136 \cdot 0$ | I 42 |
| 24 | $41952 \cdot 3$ | I. 27 | $4 \begin{array}{llll}4 & 18 & 35 \cdot 2\end{array}$ | I. 30 | $41716 \cdot 0$ | I. 34 | $4 \begin{array}{llllllll}4 & 154.4\end{array}$ | $1 \cdot 38$ | $4 \begin{array}{lll}4 & 14 & 30 \cdot 5\end{array}$ | I. 42 | $\begin{array}{llll}4 & 13 & 4 \cdot 1\end{array}$ | I 46 |
| 25 | $41540 \cdot 4$ | 1.28 | 41422.7 | I.3I | $4 \begin{array}{lll}4 & 2.6\end{array}$ | 1.35 | 4 II 40.I | 1.40 | 4 10 15.1 | 1.44 | $4 \quad 8 \quad 47 \cdot 5$ | $1 \cdot 48$ |
| 26 | 4 II 28.4 | 1.29 | 4 IO $9^{*} 9$ | 1.33 | $48848 \cdot 9$ | $1 \cdot 37$ | $\begin{array}{llll}4 & 7 & 25.4\end{array}$ | I.41 | $4 \begin{array}{lll}4 & 5 & 59 \cdot 3\end{array}$ | I.46 | $4 \quad 430 \cdot 5$ | I. 50 |
| 27 | $4715 \cdot 1$ | I 30 | $4 \quad 5 \quad 566$ | I. 34 | $4 \begin{array}{llll}4 & 4 & 34 \cdot 9\end{array}$ | 1.39 | $\begin{array}{llll}4 & 3 & 10.4\end{array}$ | I.43 | $4 \begin{array}{lll}4 & 1 & 43 \cdot 1\end{array}$ | I. 48 | $4 \quad 0 \quad 13.0$ | I. 52 |
| 28 | 4 $\begin{array}{rrr}3 & 3 \cdot 6 \\ 3 & 5 & 5\end{array}$ | I.31 | $\begin{array}{rrrr}4 & 1 & 43.4 \\ 3 & 5\end{array}$ | I. 36 | $4 \quad 0 \quad 20 \cdot 6$ | I. 40 | $\begin{array}{llll}3 & 58 & 55 \cdot 0\end{array}$ | 1.45 | $\begin{array}{llll}3 & 57 & 26 \cdot 5\end{array}$ | 1.50 | 33 55 $55 \cdot 1$ | $1 \cdot 55$ |
| 29 | $\begin{array}{llll}3 & 58 & 50 \cdot 8\end{array}$ | r.33 | $\begin{array}{lllll}3 & 57 & 29.8\end{array}$ | I.37 | $\begin{array}{llll}3 & 56 & 6 \cdot 0\end{array}$ | I. 42 | $\begin{array}{llll}3 & 54 & 39 \cdot 2\end{array}$ | 1.47 | $\begin{array}{lll}3 & 53 & 9 \cdot 4\end{array}$ | I. 52 | $35136 \cdot 6$ | r 57 |
| 30 | $3 \begin{array}{lllll}3 & 54 & 37 \cdot 8\end{array}$ | I. 34 | $\begin{array}{lllllllllll}3 & 53 & 15\end{array}$ | 1.39 | $35150 \cdot 9$ | I.44 | 35023.0 | 1.49 | $34^{3} 85 \mathrm{r} \cdot 9$ | 1.54 | 34717.6 | 1.60 |
| 31 | 35024.5 | I.36 | 349 1.5 | 1.41 | 34735.5 | I. 46 | $\begin{array}{lll}3 & 46 & 6 \cdot 3\end{array}$ | x.51 | 34433.8 | 1.57 | $\begin{array}{llll}3 & 42 & 58 \cdot 0\end{array}$ | 1.63 |
| 32 | $\begin{array}{llll}3 & 46 & 10 \cdot 9\end{array}$ | r.38 | $\begin{array}{llll}3 & 44 & 46 \cdot 8\end{array}$ | 1.43 | $3{ }^{3} 4319.6$ | I. 48 | $\begin{array}{llll}3 & 41 & 49 \cdot 1\end{array}$ | I. 54 | $3{ }^{3} 401515 \cdot 2$ | I. 59 | $\begin{array}{llll}3 & 38 & 37 \cdot 7\end{array}$ | I.65 |
| 33 | $\begin{array}{llll}3 & 41 & 57 \cdot 0\end{array}$ | I.39 | 340 3I•8 | 1.45 | $\begin{array}{llll}3 & 39 & 3.4\end{array}$ | 1.50 | $\begin{array}{llll}3 & 37 & 31 \cdot 5\end{array}$ | 1.56 | $3 \begin{array}{llll}3 & 35 & 56 \cdot 0\end{array}$ | I. 62 | $\begin{array}{llll}3 & 34 & 16.8\end{array}$ | r.68 |
| 34 | $\begin{array}{lllll}3 & 37 & 42 \cdot 7\end{array}$ | 1.41 | $\begin{array}{lllll}3 & 36 & 16 \cdot 3\end{array}$ | 147 | $\begin{array}{lllllllllllllllllll}3 & 34 & 46 \cdot 6\end{array}$ | I. 53 | $3 \begin{array}{lllllllll}3 & 33 & 13.2\end{array}$ | 1.59 | $\begin{array}{lllll}3 & 31 & 36 \cdot 1 \\ 3 & 27 & 15 \cdot 7\end{array}$ | I. 65 | $\begin{array}{llll}3 & 29 & 55 \cdot 2\end{array}$ | $1 \cdot 71$ |
| 35 | $33328 \cdot 0$ | I 43 | $\begin{array}{lll}3 & 32 & 0.5\end{array}$ | I 49 | $\begin{array}{lllll}3 & 30 & 29 \cdot 3\end{array}$ | I.55 | $\begin{array}{llllll}3 & 28 & 54.4\end{array}$ | I. 61 | $3 \begin{array}{lllll}3 & 27 & 15 \cdot 7\end{array}$ | I. 68 | $325 \quad 32 \cdot 9$ | 1.75 |
| 36 | $\begin{array}{lll}3 & 29 & 12.9\end{array}$ | 1.45 | $32744 \cdot 1$ | 1.51 | $32611 \cdot 5$ | 1.58 | 32435.0 | I. 64 | $\begin{array}{llll}3 & 22 & 54.4\end{array}$ | I• 71 | 32199 | 1.78 |
| 37 | $\begin{array}{llll}3 & 24 & 57 \cdot 4\end{array}$ | 1.47 | $\begin{array}{llll}3 & 23 & 27 \cdot 3\end{array}$ | 1.54 | $32153 \cdot 1$ | 1.60 | 320014.9 | 1.67 | $\begin{array}{lllll}3 & 18 & 32 \cdot 5\end{array}$ | I•74 | $31645 \%$ | I. 82 |
| 38 | $32041 \cdot 5$ | I 49 | $\begin{array}{llll}3 & 19 & 9 \cdot 9\end{array}$ | 1.56 | 3 I7 34.I | I. 63 | 315154.2 | $1 \cdot 70$ | $\begin{array}{llll}3 & 14 & 9 \cdot 8\end{array}$ | r.78 | $\begin{array}{llll}3 & 12 & 20 \cdot 8\end{array}$ | r.86 |
| 39 | 3 16 $25 \cdot 1$ <br> 3 1  | I 52 | $\begin{array}{llll}3 & 14 & 51.9\end{array}$ | I.59 | $\begin{array}{llll}3 & 13 & 14.5\end{array}$ | I 66 | $\begin{array}{lllll}3 & 11 & 32 \cdot 6\end{array}$ | $1 \cdot 74$ | $\begin{array}{llll}3 & 9 & 46 \cdot 2\end{array}$ | I.81 | $\begin{array}{llll}3 & 7 & 54.9\end{array}$ | I.90 |
| 40 | $3128 \cdot 1$ | I 54 | 3 10 33.4 | I. 62 | $3 \begin{array}{llll}3 & 8 & 54.2\end{array}$ | I. 69 | $3 \quad 7 \quad 10 \cdot 3$ | 1•77 | $3 \quad 5 \quad 21.6$ | 1.85 | $3 \quad 3 \quad 28 \cdot 0$ | I'94 |
| 41 | $\begin{array}{llll}3 & 7 & 50.6\end{array}$ | 1.57 | $3 \begin{array}{llll}3 & 6 & 14.2\end{array}$ | $1 \cdot 65$ | $34833 \cdot 1$ | 1.73 | $3 \quad 2$3 4 | 1.81 | $3 \quad 0 \quad 56 \cdot 1$ | $\mathbf{1 . 8 9}$ | $2 \begin{array}{llll}2 & 58 & 59.9\end{array}$ | 1.98 |
| 42 | $\begin{array}{llll}3 & 3 & 32 \cdot 5\end{array}$ | I. 60 | 3 I 54.3 | I. 68 | 3 O II'I | I.76 | $\begin{array}{llll}2 & 58 & 23 \cdot 0\end{array}$ | I.85 | $\begin{array}{lllll}2 & 56 & 29.5\end{array}$ | I.94 | $25430 \cdot 6$ | 2.03 |
| 43 | $\begin{array}{llll}2 & 59 & 13 \cdot 7\end{array}$ | I. 63 | $\begin{array}{lllll}2 & 57 & 33 \cdot 6\end{array}$ | 1.71 | $\begin{array}{lllll}2 & 55 & 48 \cdot 4\end{array}$ | 1.80 | $2 \begin{array}{lllll}2 & 53 & 57 \cdot 8\end{array}$ | I.89 | 2 52 1.8 <br> 2 4  | I.98 | 250 | 2.08 |
| 44 | 25454.2 | I. 66 | $2 \begin{array}{llllll} & 53 & 12 \cdot 1\end{array}$ | 1.75 | $25124 \cdot 6$ | I. 84 | 249 3r-6 | 1.93 | $\begin{array}{llllllllllll}2 & 47 & 32 \cdot 8\end{array}$ | $2 \cdot 03$ | $2 \begin{array}{lllll}2 & 45 & 27.9\end{array}$ | $2 \cdot 13$ |
| 45 | 25034.0 | I. 69 | $24849 \cdot 7$ | r.78 | $246 \quad 59.8$ | I. 88 | 2454.2 | 1.98 | $2 \begin{array}{lll}2 & 43 & 2.4\end{array}$ | $2 \cdot 08$ | $240 \quad 54.3$ | $2 \cdot 19$ |
| 46 | $2 \begin{array}{llll} & 46 & 13\end{array}$ | 1.73 | $244 \quad 26 \cdot 4$ | I. 82 | $24234^{\circ} 0$ | I 92 | $24035 \cdot 5$ | 2.03 | $2 \begin{array}{lll}2 & 38 & 30 \cdot 6\end{array}$ | $2 \cdot 14$ | 23619.0 | 2.25 |
| 47 | $2 \begin{array}{lllll} & 4 & \text { I } & \mathrm{I} \cdot \mathrm{I}\end{array}$ | I•77 | 240 | 1.87 | $\begin{array}{llll}2 & 38 & 6 \cdot 9\end{array}$ | 1.97 | $\begin{array}{llll}2 & 36 & 5.4\end{array}$ | 2.08 | $2 \begin{array}{llll}2 & 33 & 57 \cdot 2\end{array}$ | $2 \cdot 20$ | 23141.9 | $2 \cdot 32$ |
| 48 | $\begin{array}{llll}2 & 37 & 28 \cdot 2\end{array}$ | 1.81 | $2 \begin{array}{llll}2 & 35 & 36 \cdot 6\end{array}$ | I.91 | $\begin{array}{llll}2 & 33 & 38 \cdot 6\end{array}$ | 2.02 | $\begin{array}{llll}2 & 31 & 33 \cdot 8\end{array}$ | $2 \cdot 14$ | $\begin{array}{llll}2 & 29 & 22.0\end{array}$ | $2 \cdot 26$ | $\begin{array}{lll}2 & 27 & 2.8 \\ 2 & 22 & 21.4\end{array}$ | 2.39 |
| 49 50 | [rrrr $\begin{array}{rrrr}2 & 33 & 4 & 3 \\ 2 & 28 & 39 \cdot 2\end{array}$ | I.85 | $\begin{array}{llll}2 & 31 & 9 \cdot 9 \\ 2 & 26 & 4.8\end{array}$ | 1.96 | $\begin{array}{llr}2 & 29 & 8.6 \\ 2 & 24 & 37.4\end{array}$ | 2.08 | 2 27 0 <br> 2 2 6 | $2 \cdot 20$ | $\begin{array}{llll}2 & 24 & 44.9 \\ 2 & 20 & 5.8\end{array}$ | 2.33 | $\begin{array}{llll}2 & 22 & 21.4 \\ 2 & 17 & 37.6\end{array}$ | 2.46 |
| 50 | $2 \quad 2839.2$ | I.90 | $2264 \mathrm{~T} \cdot 8$ | $2 \cdot 02$ | $22437 \cdot 4$ | $2 \cdot 14$ | $22225 \cdot 5$ | $2 \cdot 26$ | $\begin{array}{llll}2 & 20 & 5.8\end{array}$ | 2.40 | $21737 \cdot 6$ | 2.54 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND, ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | s. -4.16 | S. | S. -4.16 | S. ${ }_{\text {- }}$ | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 17 \end{gathered}$ | S. | $\begin{gathered} s . \\ -4 \cdot \mathrm{I} 7 \end{gathered}$ | S. | $\begin{gathered} \mathrm{s} \\ -4 \cdot 17 \end{gathered}$ | s. $-\quad .38$ | $\begin{gathered} \text { S. } \\ -4 \cdot 18 \end{gathered}$ |
| 4 | .08 | 4.16 | .16 | 4.16 | . 23 | 4.17 | .31 | 4.17 | . 39 | 4.18 | . 46 | 4.19 |
| 6 | -12 | $4 \cdot 16$ | - 20 | $4 \cdot 16$ | $\cdot 28$ | 4.17 | . 35 | $4 \cdot 18$ | -43 | $4 \cdot 18$ | - 51 | $4 \cdot 19$ |
| 8 | -17 | $4 \cdot 16$ | . 24 | $4 \cdot 17$ | $\cdot 32$ | 4.17 | -40 | $4 \cdot 18$ | -47 | $4 \cdot 19$ | . 55 | $4 \cdot 20$ |
| 10 | -2I | 4.17 | -29 | $4 \cdot 17$ | $\cdot 36$ | 4.18 | -44 | $4 \cdot 18$ | - 52 | 4-19 | - 60 | $4 \cdot 20$ |
| 12 | $\cdot 25$ | $4 \cdot 17$ | -33 | 4.17 | -4I | $4 \cdot 18$ | -49 | 4.19 | -57 | 4.20 | -65 | $4 \cdot 21$ |
| 14 | - 30 | 4.17 | $\cdot 38$ | $4 \cdot 18$ | -46 | $4 \cdot 19$ | - 53 | $4 \cdot 19$ | . 62 | 4.21 | -70 | $4 \cdot 22$ |
| 16 | -34 | $4 \cdot 17$ | - 42 | $4 \cdot 18$ | - 50 | 4-19 | - 58 | $4 \cdot 20$ | - 66 | 4.21 | -75 | $4 \cdot 23$ |
| 18 | -39 | 4-18 | -47 | 4.19 | - 55 | $4 \cdot 20$ | . 63 | $4 \cdot 21$ | $\cdot 72$ | $4 \cdot 22$ | -80 | $4 \cdot 24$ |
| 20 | $\cdot 44$ | 4.18 | - 52 | $4 \cdot 19$ | . 60 | $4 \cdot 20$ | - 68 | $4 \cdot 22$ | $\cdot 77$ | $4 \cdot 23$ | -85 | $4 \cdot 25$ |
| 22 | $\cdot 48$ | 4.19 | -57 | $4 \cdot 20$ | - 65 | $4 \cdot 21$ | -74 | $4 \cdot 23$ | . 82 | 4.24 | -91 | $4 \cdot 26$ |
| 24 | - 53 | 4.19 | . 62 | $4 \cdot 21$ | $\cdot 71$ | $4 \cdot 22$ | -79 | $4 \cdot 24$ | -88 | $4 \cdot 25$ | -97 | $4 \cdot 27$ |
| 26 | - 59 | $4 \cdot 20$ | . 67 | $4 \cdot 21$ | $\cdot 76$ | 4.23 | . 85 | $4 \cdot 25$ | - 94 | $4 \cdot 27$ | I.03 | $4 \cdot 29$ |
| 28 | . 64 | $4 \cdot 21$ | $\cdot 73$ | $4 \cdot 22$ | . 82 | $4 \cdot 24$ | -91 | $4 \cdot 26$ | 1.00 | $4 \cdot 28$ | I 10 | 4.30 |
| 30 | -70 | $4 \cdot 22$ | $\cdot 79$ | $4 \cdot 23$ | -88 | $4 \cdot 25$ | -98 | 4.27 | 1.07 | 4.30 | 1-17 | $4 \cdot 32$ |
| 32 | -76 | 4.23 | . 85 | $4 \cdot 25$ | - 95 | 4.27 | 1.04 | $4 \cdot 29$ | $1 \cdot 14$ | $4 \cdot 32$ | 1. 24 | 4.34 |
| 34 | . 82 | 4.24 | $\cdot 92$ | $4 \cdot 26$ | 1.02 | $4 \cdot 28$ | $1 \cdot 12$ | $4 \cdot 31$ | I. 22 | $4 \cdot 34$ | I 32 | $4 \cdot 37$ |
| 36 | -89 | $4 \cdot 25$ | -99 | $4 \cdot 28$ | I.09 | $4 \cdot 30$ | r.19 | $4 \cdot 33$ | 1.30 | $4 \cdot 36$ | I 41 | $4 \cdot 39$ |
| 38 | -96 | $4 \cdot 27$ | I.06 | 4.29 | I-17 | $4 \cdot 32$ | I. 28 | 4.35 | I. 39 | $4 \cdot 39$ | I. 50 | $4 \cdot 42$ |
| 40 | I.03 | $4 \cdot 29$ | I-14 | 4.31 | I. 25 | $4 \cdot 34$ | I.37 | 4.38 | I. 48 | $4 \cdot 42$ | I. 60 | $4 \cdot 46$ |
| 42 | I•II | 4.31 | I. 23 | $4 \cdot 33$ | I 34 | $4 \cdot 37$ | I.46 | 4.41 | I. 58 | 4.45 | 1.71 | 4.50 |
| 44 | I-20 | $4 \cdot 33$ | I.32 | $4 \cdot 37$ | 1.44 | 4.40 | I.57 | 4.45 | $1 \cdot 70$ | 4.49 | 1.83 | 4.55 |
| 46 | 1.29 | 4.36 | I. 42 | $4 \cdot 40$ | 1.55 | 4.44 | 1.69 | $4 \cdot 49$ | I. 82 | $4 \cdot 54$ | $\underline{1.97}$ | $4 \cdot 60$ |
| 48 | 1.40 | 4.39 | I. 53 | $4 \cdot 43$ | 1.67 | 4.49 | I. 82 | $4 \cdot 54$ | 1.97 | 4.60 | 2.12 | 4.67 |
| 50 | I. 51 | $4 \cdot 43$ | I. 66 | $4 \cdot 47$ | I.8I | $4 \cdot 53$ | I.96 | $4 \cdot 60$ | $2 \cdot 13$ | $4 \cdot 67$ | $2 \cdot 30$ | 4.75 |

## LATITUDE $16^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. | S. | M. S. | S. | H. M. S. | s. | H. M. S. | s. | H. M. S. | S. |
| 0 | $\begin{array}{llll}5 & 53 & 5 \cdot 5\end{array}$ | -I'I6 | 5 51 55\% | -I•I6 | $5 \quad 5045 \cdot 7$ | - I*17 | $\begin{array}{llll}5 & 49 & 35 \cdot 3\end{array}$ | - I•I8 | 5 48824.5 | - I•I8 | $54713 \cdot 1$ | - I'19 |
| 6 | $\begin{array}{lllll}5 & 27 & 55 \cdot 8\end{array}$ | I. 22 | $\begin{array}{lllllllll}5 & 26 & 42 \cdot 3\end{array}$ | I. 23 | $5 \quad 25 \quad 28 \cdot 0$ | I. 25 | $\begin{array}{llll}5 & 24 & 12.8\end{array}$ | I. 26 | $\begin{array}{lllllllllllllll}5 & 22 & 56 \cdot 7\end{array}$ | I. 28 | $52139 \cdot 5$ | I. 29 |
| 8 | 5 I9 3I'I | I. 24 | $51816 \cdot 2$ | I. 26 | $\begin{array}{llll}5 & 17 & 0.3\end{array}$ | I. 27 | $\begin{array}{llll}5 & 15 & 43 \cdot 3\end{array}$ | I 29 | $5{ }_{5}^{5} 14425 \cdot 1$ | I.3I | $\begin{array}{llll}5 & 13 & 5 \cdot 8\end{array}$ | I. 33 |
| 10 | 5 II $5 \cdot 6$ | I. 26 | $\begin{array}{lllll}5 & 9 & 49 \cdot 1\end{array}$ | I. 28 | $\begin{array}{llll}5 & 8 & 31.4\end{array}$ | $1 \cdot 30$ | $5 \quad 712.5$ | I•33 | $5 \quad 5 \quad 5 \quad 52 \cdot 2$ | I•35 | $\begin{array}{llll}5 & 4 & 30 \cdot 5\end{array}$ | $1 \cdot 37$ |
| 12 | $\begin{array}{lll}5 & 2 & 39.2\end{array}$ | I. 29 | 5 I 21.0 | I•3I | $5 \quad 0 \quad 1.5$ | I. 34 | $4 \quad 58 \quad 40 \cdot 4$ | I. 36 | $\begin{array}{lllllll}4 & 57 & 17\end{array}$ | I'39 | $455 \quad 53.7$ | 1.42 |
| 14 | $4 \begin{array}{lll}4 & \text { II•8 }\end{array}$ | I.32 | 4525158 | I.35 | $45130 \cdot 2$ | 1.37 | $4 \quad 50 \quad 6 \cdot 9$ | 1.40 | $44842 \cdot 0$ | I. 43 | 447 15.I | I. 46 |
| 16 | $44543 \cdot 2$ | I•35 | $4 \begin{array}{lll}4 & 44 & 21 \cdot 2\end{array}$ | I. 38 | $44257 \cdot 5$ | I.4 | 4 4I 3I•8 | 1.44 | 44048 | 1.48 | $4 \begin{array}{llll}4 & 38 & 34 \cdot 6\end{array}$ | I• 51 |
| 18 | $4 \begin{array}{llll}4 & 3 & 13.4\end{array}$ | I.38 | $43549 \cdot 3$ | I-42 | $434 \quad 23 \cdot 2$ | I.45 | $43255 \cdot 0$ | I 49 | 4 3I $24 \cdot 6$ | I.53 | $42951 \cdot 9$ | I'56 |
| 20 | $42842 \cdot 2$ | I 42 | $4 \begin{array}{lll}4 & 27 & 15 \cdot 9\end{array}$ | I.46 | $42547 \cdot 2$ | I. 50 | $\begin{array}{llll}4 & 24 & 16 \cdot 3\end{array}$ | I 54 | $\begin{array}{llll}4 & 22 & 42 \cdot 9\end{array}$ | I. 58 | $42150 \cdot 9$ | I.62 |
| 22 | 42096 | I.46 | $4 \begin{array}{llll}4 & 40 \cdot 7\end{array}$ | I. 50 | 41789 | I 54 | 415354 | I'59 | $\begin{array}{lllll}4 & 13 & 58.8\end{array}$ | I. 63 | $\begin{array}{llll}4 & 12 & 19.4\end{array}$ | I. 68 |
| 23 | $\begin{array}{llll}4 & 15 & 52.6\end{array}$ | $1 \cdot 48$ | 4 I4 22.4 | I.52 | $\begin{array}{llll}4 & 12 & 49 \cdot 6\end{array}$ | I.57 | 4 II 14.I | I.6I | $4 \quad 9 \quad 35 \cdot 8$ | I. 66 | $47754 \cdot 5$ | 1.71 |
| 24 | 4 II 35.2 | I.50 | $4103 \cdot 6$ | 1.55 | 48829.3 | I. 59 | $4 \quad 6 \quad 52 \cdot 2$ | I. 64 | $4 \quad 512 \cdot 1$ | I. 69 | $4 \quad 3 \quad 28 \cdot 9$ | I•75 |
| 25 | 47173 | I 53 | $4 \quad 5 \quad 443$ | I. 57 | $\begin{array}{llll}4 & 4 & 8 \cdot 5\end{array}$ | I. 62 | $\begin{array}{rrrr}4 & 2 & 29 \cdot 6\end{array}$ | I. 67 | $4 \quad 0 \quad 47 \cdot 7$ | I.73 | $\begin{array}{lll}3 & 59 & 2 \cdot 5\end{array}$ | I.78 |
| 26 | $4259{ }^{\circ} \mathrm{O}$ | 1.55 | 4 I 24.5 | I. 60 | $35947 \cdot 0$ | I. 65 | $\begin{array}{llll}3 & 58 & 6 \cdot 4\end{array}$ | r 70 | $\begin{array}{llll}3 & 56 & 22 \cdot 5\end{array}$ | I.76 | $35435 \cdot 2$ | I. 82 |
| 27 | $35840 \cdot 1$ | I.57 | 3574.0 | I.63 | $3 \begin{array}{llll}3 & 55 & 24 \cdot 8\end{array}$ | I 68 | 35342.4 | 1.74 | 35 I $56 \cdot 5$ | I'79 | $350 \quad 7 \cdot 1$ | 1.85 |
| 28 | $35420 \cdot 6$ | I. 60 | $\begin{array}{llll}3 & 52 & 43 \cdot 0\end{array}$ | 1. 65 | 351520 | 1.71 | 349 17.6 | 1.77 | $\begin{array}{llll}3 & 47 & 29: 7\end{array}$ | I. 83 | $34538 \cdot 0$ | I. 89 |
| 29 | 3500.6 | I. 63 | $34^{3} 82 \mathrm{II} \cdot 2$ | 1.68 | $346 \begin{array}{llll}3 & 38 \cdot 4\end{array}$ | I•74 | $34452 \cdot 1$ | 1.80 | $\begin{array}{llll}3 & 43 & \text { I } 9\end{array}$ | I. 87 | 34179 | I 93 |
| 30 | $\begin{array}{llll}3 & 45 & 39 \cdot 9\end{array}$ | r. 66 | $\begin{array}{llll}3 & 43 & 58.8\end{array}$ | 1.71 | $34214 \cdot 1$ | I•78 | $34025 \cdot 6$ | I. 84 | $\begin{array}{llll}3 & 3^{8} & 33 \cdot 2\end{array}$ | I.91 | $\begin{array}{llll}3 & 36 & 36 \cdot 7\end{array}$ | I.98 |
| 3 I | 34118.6 | I. 69 | $\begin{array}{llll}3 & 39 & 35 \cdot 6\end{array}$ | 1.75 | $\begin{array}{lllll}3 & 37 & 48 \cdot 9\end{array}$ | I.81 |  | I. 88 | $\begin{array}{llll}3 & 34 & 3.5\end{array}$ | I.95 | $\begin{array}{llll}3 & 32 & 4.4\end{array}$ | $2 \cdot 02$ |
| 32 | $33^{3} 565 \cdot 6$ | $1 \cdot 72$ | $3 \quad 3511 \cdot 7$ | 1.78 | $3 \begin{array}{llll}3 & 33 & 22 \cdot 8\end{array}$ | 1.85 | 3 31 29.9 | I 92 | $32932 \cdot 6$ | I•99 | $32730 \cdot 8$ | 2.07 |
| 33 | $\begin{array}{llll}3 & 32 & 33.9\end{array}$ | I'75 | $33046 \cdot 9$ | 1.82 | $\begin{array}{llll}3 & 28 & 55.9\end{array}$ | 1.89 | $\begin{array}{lll}3 & 27 & 0.5\end{array}$ | I:96 | $\begin{array}{lll}3 & 25 & 0.6\end{array}$ | 2.04 | $\begin{array}{lll}3 & 22 & 56 \%\end{array}$ | $2 \cdot 12$ |
| 34 | $\begin{array}{llll}3 & 28 & 10 \cdot 3\end{array}$ | I.78 | $\begin{array}{llll}3 & 26 & 21 \cdot 2\end{array}$ | I. 85 | $\begin{array}{llll}3 & 24 & 27 \cdot 8\end{array}$ | I 93 | $\begin{array}{llll}3 & 22 & 30 \cdot 0\end{array}$ | $2 \cdot 00$ | $\begin{array}{llll}3 & 20 & 27 \cdot 3\end{array}$ | 2.08 | $\begin{array}{llll}3 & 18 & 19.8\end{array}$ | $2 \cdot 17$ |
| 35 | $\begin{array}{llll}3 & 23 & 45.9\end{array}$ | I. 82 | 3 21 54.6 | 1.89 | $\begin{array}{llll}3 & 19 & 58 \cdot 8\end{array}$ | I.97 | $\begin{array}{lllllllllll}3 & 17 & 58 \cdot 2\end{array}$ | $2 \cdot 05$ | $\begin{array}{lllll}3 & 15 & 52 \cdot 8\end{array}$ | $2 \cdot 13$ | 3 I3 42.0 | 2.22 |
| 36 | 3 I9 $20 \cdot 6$ | I.86 | 3 17 $27 \cdot 0$ | 1.93 |  | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}3 & 13 & 25 \cdot 2\end{array}$ | $2 \cdot 10$ | 3 II $16 \cdot 7$ | $2 \cdot 19$ | $\begin{array}{lll}3 & 9 & 2 \cdot 7\end{array}$ | $2 \cdot 28$ |
| 37 |  | 1.90 | $\begin{array}{llllllllllll}3 & 12 & 58 \cdot 2\end{array}$ | 1.98 | $31057 \cdot 1$ | $2 \cdot 06$ | $\begin{array}{llll}3 & 8 & 50 \cdot 9\end{array}$ | $2 \cdot 15$ | $3639 \cdot 1$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 4 & 2 I \cdot 7\end{array}$ | 2.34 |
| 38 | $31027 \cdot 1$ | I. 94 | $\begin{array}{llll}3 & 8 & 28 \cdot 3\end{array}$ | 2.02 | $3 \begin{array}{lll}3 & 6 & 24.4\end{array}$ | 11 | $\begin{array}{llll}3 & 4 & 15 \% \\ & \end{array}$ | $2 \cdot 20$ | 33 1 59 <br>    | $2 \cdot 30$ | $\begin{array}{llll}2 & 59 & 38 \cdot 8\end{array}$ | $2 \cdot 40$ |
| 39 | $\begin{array}{llll}3 & 5 & 58 \cdot 7\end{array}$ | I 988 | $\begin{array}{llll}3 & 3 & 57 \cdot 2\end{array}$ | 2.07 | $3 \begin{array}{llll}3 & 1 & 50 \cdot 2\end{array}$ | $2 \cdot 16$ |  | $2 \cdot 26$ | $\begin{array}{lllll}2 & 57 & 18.8\end{array}$ | $2 \cdot 36$ | $25453 \cdot 9$ | 2.47 |
| 40 | 3 I 29.0 | 2.03 | $\begin{array}{llll}2 & 59 & 24 \cdot 7\end{array}$ | $2 \cdot 12$ | $\begin{array}{lllll}2 & 57 & 14.6\end{array}$ | 2.22 |  | $2 \cdot 32$ | $\begin{array}{llll}2 & 52 & 36 \cdot 0\end{array}$ | $2 \cdot 43$ | 250607 | 2.55 |
| 41 | $25658 \cdot 1$ | 2.08 | $25450 \cdot 7$ | $2 \cdot 17$ |  | $2 \cdot 28$ | $2 \begin{array}{lllllllll} & 50 & 17\end{array}$ | $2 \cdot 39$ | $\begin{array}{lllll}2 & 47 & 50.9\end{array}$ | $2 \cdot 50$ | $\begin{array}{llllllll}2 & 45 & 17.3\end{array}$ | $2 \cdot 62$ |
| 42 | 252525 | $2 \cdot 13$ | $2 \begin{array}{lllll} & 50 & 15 & 2\end{array}$ | $2 \cdot 23$ | 247 58.I | 2.34 | 24534.4 | $2 \cdot 45$ | 24313.6 | $2 \cdot 58$ | $24025 \cdot 2$ | 2.71 |
| 43 | $24752 \cdot 1$ | 2.18 | $24537 \cdot 9$ | 2.29 | $24317 \cdot 0$ | 2.41 | $24049 \cdot 1$ | $2 \cdot 53$ | $23^{2} 8813.7$ | 2.66 | $23530 \cdot 4$ | $2 \cdot 79$ |
| 44 | $2 \begin{array}{llll}2 & 43 & 16 \cdot 7\end{array}$ | $2 \cdot 24$ | $2 \begin{array}{llll}2 & 40 & 58.8\end{array}$ | $2 \cdot 36$ | $\begin{array}{llll}2 & 38 & 33.9\end{array}$ | $2 \cdot 48$ | $2 \begin{array}{lll}26 & 1.5\end{array}$ | 2.61 | 2331212 | $2 \cdot 74$ | $23030 \cdot 4$ | 2.89 |
| 45 | $\begin{array}{llll}2 & 38 & 39 \cdot 5\end{array}$ | 2.31 | $2 \begin{array}{llll}2 & 36 & 17 \cdot 6\end{array}$ | 2.43 | $233148 \cdot 4$ | $2 \cdot 55$ | $23111 \cdot 3$ | $2 \cdot 69$ | $\begin{array}{llll}2 & 28 & 25 \cdot 6\end{array}$ | 2.84 | 22531.0 | 2.99 |
| 46 | $\begin{array}{lll}2 & 34 & 0.4\end{array}$ | $2 \cdot 37$ | 2 lll 31.4 | $2 \cdot 50$ | $\begin{array}{lll}2 & 29 & 0 \cdot 4\end{array}$ | $2 \cdot 64$ | $22618 \cdot \mathrm{I}$ | 2.78 | $\begin{array}{llll}2 & 23 & 26.8\end{array}$ | 2.93 | 22025.9 | $3 \cdot 10$ |
| 47 | 22919.2 | 2.44 | $22648 \cdot 6$ | $2 \cdot 58$ | $224 \quad 9 \cdot 7$ | $2 \cdot 72$ | 22121.8 | 2.88 | 2 | 3.05 | 21516.4 | $3 \cdot 22$ |
| VARIATION TO I' OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. 6 | A. | yo | A. | L. $8^{\circ}$ | A. | L. $9^{\circ}$ | A. | L. 10 | A. | L. $11^{\circ}$ | A. |
| - | s. | S. | s. | S. | S. | S. | s. | S. | S. | S. | S. | S. |
| 0 | -45 | -4.18 | $\cdot 53$ | -4.19 | . 61 | $4 \cdot 20$ | . 69 | $4 \cdot 22$ | - 76 | $-4.23$ | . 84 | $4 \cdot 24$ |
| 2 | - 50 | 4-19 | . 57 | $4 \cdot 20$ | - 65 | $4 \cdot 21$ | $\cdot 73$ | $4 \cdot 22$ | -81 | $4 \cdot 24$ | -89 | $4 \cdot 25$ |
| 4 | -54 | $4 \cdot 20$ | -62 | $4 \cdot 21$ | -70 | $4 \cdot 22$ | $\cdot 77$ | $4 \cdot 23$ | . 85 | $4 \cdot 25$ | $\cdot 93$ | $4 \cdot 26$ |
| 6 | . 59 | $4 \cdot 20$ | . 66 | 4.21 | - 74 | 4.23 | . 82 | $4 \cdot 24$ | -90 | $4 \cdot 26$ | $\cdot 98$ | $4 \cdot 28$ |
| 8 | . 63 | $4 \cdot 21$ | -71 | $4 \cdot 22$ | -79 | $4 \cdot 24$ | . 87 | $4 \cdot 25$ | -95 | $4 \cdot 27$ | I.O3 | $4 \cdot 29$ |
| 10 | . 68 | $4 \cdot 22$ | $\cdot 76$ | $4 \cdot 23$ | -84 | $4 \cdot 24$ | -92 | $4 \cdot 26$ | I.OO | $4 \cdot 28$ | I.08 | 430 |
| 12 | $\cdot 73$ | $4 \cdot 22$ | -81 | $4 \cdot 24$ | -89 | $4 \cdot 25$ | $\cdot 97$ | $4 \cdot 27$ | I. 05 | $4 \cdot 29$ | I'14 | 4.31 |
| 14 | -78 | $4 \cdot 23$ | -86 | $4 \cdot 25$ | -94 | $4 \cdot 27$ | I-03 | $4 \cdot 29$ | I'II | $4 \cdot 31$ | I 20 | $4 \cdot 33$ |
| 16 | . 83 | $4 \cdot 24$ | -91 | $4 \cdot 26$ | I.00 | $4 \cdot 28$ | 1.08 | $4 \cdot 30$ | $1 \cdot 17$ | $4 \cdot 32$ | I. 25 | $4 \cdot 35$ |
| 18 | . 88 | $4 \cdot 25$ | -97 | $4 \cdot 27$ | I.05 | $4 \cdot 29$ | I'I4 | $4 \cdot 3 \mathrm{I}$ | I. 23 | 4.34 | 1.32 | 4.37 |
| 20 | -94 | $4 \cdot 27$ | I'O3 | $4 \cdot 29$ | I•II | $4 \cdot 31$ | I 20 | $4 \cdot 33$ | I. 29 | $4 \cdot 36$ | 1.38 | 4.39 |
| 22 | I. 00 | $4 \cdot 28$ | 1.09 | $4 \cdot 30$ | I•18 | $4 \cdot 32$ | $1 \cdot 27$ | $4 \cdot 35$ | I.36 | $4 \cdot 38$ | I 45 | 4.41 |
| 24 | -06 | $4 \cdot 30$ | I'15 | $4 \cdot 32$ | I-24 | $4 \cdot 34$ | I 34 | $4 \cdot 37$ | 1.43 | $4 \cdot 40$ | I. 53 | 4.43 |
| 26 | I•I2 | 4.31 | I. 22 | $4 \cdot 34$ | I.3I | $4 \cdot 36$ | 1.45 | $4 \cdot 39$ | I-5I | $4 \cdot 43$ | I-6I | $4 \cdot 46$ |
| 28 | I-19 | $4 \cdot 33$ | I. 29 | $4 \cdot 36$ | I•39 | $4 \cdot 39$ | 1-49 | $4 \cdot 42$ | I. 59 | $4 \cdot 46$ | I•70 | 4.49 |
| 30 | I. 27 | 4.35 | I.37 | $4 \cdot 38$ | 1.47 | 4.41 | I. 57 | 4.45 | I. 68 | $4 \cdot 49$ | 1•79 | $4 \cdot 53$ |
| 32 | I. 34 | $4 \cdot 37$ | 1.45 | 4.41 | I. 55 | 4.44 | I-66 | $4 \cdot 48$ | 1.77 | $4 \cdot 52$ | 1.89 | $4 \cdot 57$ |
| 34 | I.43 | $4 \cdot 40$ | I. 54 | $4 \cdot 44$ | I. 65 | $4 \cdot 48$ | I•76 | $4 \cdot 52$ | I. 88 | $4 \cdot 56$ | 2.00 | $4 \cdot 62$ |
| 36 | I. 52 | $4 \cdot 43$ | I. 63 | 4.47 | I.75 | 4.51 | I.87 | $4 \cdot 56$ | I•99 | $4 \cdot 61$ | $2 \cdot 12$ | $4 \cdot 67$ |
| 38 | I. 62 | 4.46 | 1.74 | 4.51 | I.86 | $4 \cdot 56$ | 1.98 | $4 \cdot 61$ | 2-12 | 4.67 | $2 \cdot 25$ | $4 \cdot 73$ |
| 40 | 1-72 | 4.50 | 1.85 | 4.55 | I. 98 | $4 \cdot 61$ | $2 \cdot 12$ | $4 \cdot 67$ | $2 \cdot 26$ | $4 \cdot 73$ | $2 \cdot 40$ | $4 \cdot 80$ |
| 42 | I. 84 | $4 \cdot 55$ | I'98 | $4 \cdot 61$ | $2 \cdot 11$ | $4 \cdot 67$ | $2 \cdot 26$ | $4 \cdot 74$ | 2.41 | $4 \cdot 81$ | $2 \cdot 57$ | $4 \cdot 89$ |
| 44 | I.97 | 4.60 | $2 \cdot 12$ | 4.67 | 2.27 | $4 \cdot 74$ | 2.42 | $4 \cdot 81$ | $2 \cdot 59$ | 4.90 | $2 \cdot 76$ | $4 \cdot 99$ |
| 46 | $2 \cdot 12$ | $4 \cdot 67$ | $2 \cdot 27$ | $4 \cdot 74$ | 2.44 | 4.82 | $2 \cdot 61$ | 4.91 | $2 \cdot 79$ | $5 \cdot \mathrm{OI}$ | $2 \cdot 98$ | 5.12 |
| 47 | $2 \cdot 20$ | $4 \cdot 71$ | $2 \cdot 36$ | $4 \cdot 78$ | 2.53 | $4 \cdot 87$ | $2 \cdot 71$ | $4 \cdot 97$ | $2 \cdot 91$ | $5 \cdot 08$ | $3 \cdot 11$ | $5 \cdot 20$ |

## 188 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $16^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True | $12^{\circ}$ | Decl. | $13^{\circ}$ | Dec | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $17^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. S | S. | H. M. | S. | 3 |  | 54222.4 | S. | н. м. S. | S. | $5 \quad 3052.9$ |  |
| - | $\begin{array}{llll}5 & 46 & 1 \cdot 4\end{array}$ | I. | $\begin{array}{llll}5 & 44 & 49 \cdot 0\end{array}$ | - 1.21 | $\begin{array}{lllll}5 & 43 & 36 \cdot 1 \\ 5 & 26 & 21.2\end{array}$ | r•31 | $\begin{array}{llll}5 & 42 & 22.4 \\ 5 & 25 & 2.3\end{array}$ | $1 \cdot 33$ | $\left\lvert\, \begin{array}{rlr} 5 & 41 \\ 5 & 23 & 82 \cdot 0 \\ \hline \end{array}\right.$ | - $\mathrm{I} \cdot 25$ | $\begin{array}{llll}5 & 39 & 52.9 \\ 5 & 22 & 20.9\end{array}$ |  |
| 4 | 28 56.0 | 1.27 | $\begin{array}{llll}5 & 27 & 39 \cdot 1\end{array}$ | I.29 | 52621.2 | I.31 | $\begin{array}{llll}5 & 25 & 2.3 \\ 5 & 16 & \end{array}$ | I.33 |  | I.34 | $\begin{array}{llll}5 & 22 & 20 \cdot 9 \\ 5 & 13 & 31.8\end{array}$ | . 36 |
| 6 | $52021 \cdot 3$ | 1.31 | $5 \begin{array}{lll}5 & 19 & 2 \cdot 0\end{array}$ | r.33 | 51741 | I.35 | $\begin{array}{lllll}5 & 16 & 19.6\end{array}$ | 1.37 |  | I.40 | $\begin{array}{cccc}5 & 13 & 31 \cdot 8 \\ 5 & 4 & 4\end{array}$ | I.42 |
| 8 | 5 II $45 \cdot 2$ | I 35 | 5 10 23.2 | I. 38 | $\begin{array}{llll}5 & 8 & 59 \cdot 8\end{array}$ | 1.40 | $5{ }_{5} 7835^{\circ}$ | I | $\begin{array}{llll}5 & 6 & 8 \cdot 5\end{array}$ | I.45 | 5 4 $40 \cdot 5$ <br>  55 4 | $1 \cdot 48$ |
| 10 | $7 \cdot 4$ | 1.40 | 5 I 42.7 | 42 | $5 \quad 0 \quad 16.4$ | $1 \cdot 45$ | $45848 \cdot 3$ |  | 44 57 <br> 18.4  | I•5 | $45546 \cdot 7$ | I•55 |
| 12 | 5427 | . 45 | $4 \begin{array}{ll}53 & 0.2\end{array}$ | 48 | $45130 \cdot \%$ |  | $44959 \cdot 3$ |  | $44^{48} 25 \cdot 8$ |  | $44650 \cdot 2$ | \% |
| 14 | $44546 \cdot 4$ | 1.5 | 44415.6 | I.53 | $44242 \cdot 8$ | 1.56 | 44178 | 1.60 | $43930 \cdot 5$ | 64 | $43750 \cdot 7$ | 68 |
| 16 | 4372 | I. 55 | 43528.7 | I. 59 | 43352.4 | 1.63 | $\begin{array}{llllllllllll}4 & 32 & 13.5\end{array}$ | $1 \cdot 67$ | $\begin{array}{llll}4 & 30 & 32 \cdot 1 \\ 4 & 21 & 30.4\end{array}$ | I•71 | $4{ }_{4} 28$ 48;0 | -76 |
| 18 | $4 \begin{aligned} & 4 \\ & 4 \\ & 4\end{aligned} 2816.9$ | I.60 | $\begin{array}{llll}4 & 26 & 39 \cdot 3\end{array}$ | I. 65 | $\begin{array}{llll}4 & 24 & 59 \cdot I \\ 4\end{array}$ | 1.69 | $\begin{array}{llll}4 & 23 & 16.2\end{array}$ | I•74 | $\begin{array}{llll}4 & 21 & 30 \cdot 4\end{array}$ | 9 |  | 84 |
| 19 | 42353.0 | I.63 | 42213.5 | 1.68 | 42031.3 | I•73 | $41846 \cdot 3$ | I•78 | $41658 \cdot 2$ |  | $\begin{array}{llll}4 & 15 & 7.0\end{array}$ | . 88 |
| 20 | 41928.4 | 67 | $41747 \cdot 0$ | . 71 | $\begin{array}{llll}4 & 16 & 2.8\end{array}$ |  | 41415 |  | 41225 |  | $4103 \mathrm{I} \cdot 3$ | 2 |
| 21 | $415 \quad 3 \cdot 1$ | I 70 | $\begin{array}{llll}4 & 13 & 19.7\end{array}$ | I'75 | 4 II 33.4 | O | $4 \quad 9 \quad 43 \cdot 8$ | I.85 | $\begin{array}{llll}4 & 7 & 50 \cdot 9\end{array}$ | I.91 | $4 \quad 554$ | 97 |
| 22 | 4 10 37.0 | r.73 | $4 \quad 8 \quad 5 \mathrm{I} \cdot 6$ | I.78 | $\begin{array}{llll}4 & 7 & 3.0\end{array}$ | I. 84 | $4 \quad 5 \mathrm{II} \cdot \mathrm{I}$ | I. 89 | $\begin{array}{llll}4 & 3 & 15 \cdot 6\end{array}$ | r.95 | $4{ }^{1} 16$ | 2.02 |
| 23 | 4610 | I•77 | $\begin{array}{lllll}4 & 4 & 22.6 \\ 3 & 5\end{array}$ | I.82 | $\begin{array}{crrr}4 & 2 & 31 \cdot 7 \\ 3 & 5 & 7\end{array}$ | $\underline{1.88}$ | $\begin{array}{llll}4 & 0 & 37.3 \\ 3 & 56 & 2.4\end{array}$ | I.94 | $\begin{array}{cccc}3 & 58 & 39 \cdot 2 \\ 3 & 54 & 1.5\end{array}$ | 2.00 2.05 | $\begin{array}{llllllllllll}3 & 56 & 37.2 \\ 3 & 51 & 56.6\end{array}$ | 07 |
| 24 | 4 I $42 \cdot 5$ | I.80 | $35952 \cdot 7$ | I.86 | 35759.4 | 2 | 3562.4 |  | 3541.5 | 2.05 | 3 5I 56.6 | $2 \cdot 12$ |
| 25 | 357513.9 |  | 3 55 21.8 |  | 3532 |  | 351 |  | $\begin{array}{llll}3 & 49 & 22 \cdot 6\end{array}$ | $2 \cdot 10$ | 34714.6 | 7 |
| 26 | 3 52 $4^{\prime} \cdot 4$ | I. 88 | $35049 \cdot 9$ |  | $\begin{array}{llllll}3 & 48 & 515 \\ 3 & 44 & 15\end{array}$ | 2.01 |  |  | $\begin{array}{lllllll}3 & 44 & 42 \cdot 3 \\ 3 & 40 & 0.6\end{array}$ | 2.15 | $\begin{array}{lllll}3 & 42 & 31 \cdot 1\end{array}$ | 23 |
| 27 | $\begin{array}{llll}3 & 48 & 13.9\end{array}$ | I.92 |  | I. 98 | $\begin{array}{llll}3 & 44 & 15\end{array}$ | 2.05 | $\begin{array}{llllll}3 & 42 & 10 \cdot 4\end{array}$ |  | $\begin{array}{llll}3 & 40 & 0.6 \\ 3 & 35\end{array}$ |  | $\begin{array}{ll}3 & 37 \\ 3\end{array}$ | 2.29 |
| 28 | 3 43 | I.96 | $\begin{array}{llllll}3 & 41 & 42 \cdot 8 \\ 3 & 37 & 7 \cdot 4\end{array}$ | 2.03 | 3 39 38. <br> 3 35  | 2.10 $2 \cdot 15$ | $\begin{array}{lllll}3 & 37 & 304 \\ 3 & 32 & 48.9\end{array}$ |  | $\begin{array}{llll}3 & 35 & 17 \cdot 3 \\ 3 & 30 & 32 \cdot 3\end{array}$ |  | $\begin{array}{ll}3 & 32 \\ 3 & 28\end{array}$ | 35 |
| 29 | 3399 |  | $\begin{array}{llll}3 & 37 & 7 \cdot 4\end{array}$ |  | $\begin{array}{lll}3 & 35 & 0.5\end{array}$ | $2 \cdot 15$ | 32 | 2.23 | 330 |  | 328 |  |
| 3 | 3435 |  | 332 |  | 330 | . 21 | $\begin{array}{llll}3 & 28 & 5 \cdot 7\end{array}$ | 2.29 | $32545 \cdot 6$ |  | $\begin{array}{llll}3 & 23 & 19.9\end{array}$ | 2.48 |
| 31 | 300.7 | $2 \cdot 10$ | $\begin{array}{lllll}3 & 27 & 52 \cdot 5\end{array}$ | $2 \cdot 18$ | $\begin{array}{llllllll}3 & 2593\end{array}$ | $2 \cdot 26$ | $\begin{array}{llllllllll}3 & 23 & 20.9\end{array}$ | $2 \cdot 35$ | $\begin{array}{lllllllllll}3 & 20 & 56.9\end{array}$ | 2.45 | $318827 \cdot 2$ | 2.55 |
| 32 | 2524.4 | $2 \cdot 15$ | $\begin{array}{llll}3 & 23 & 12.9\end{array}$ | 23 | $32056 \cdot 3$ | $2 \cdot 32$ |  | 2 | 3 $16 \begin{array}{ll} \\ 3 & 15\end{array}$ | $2 \cdot 52$ | 31332 | 2 |
| 35 | $32046 \cdot 4$ | $2 \cdot 20$ |  | 2.29 | $\begin{array}{lllll}3 & 16 & 115 \\ 3 & 5\end{array}$ | $2 \cdot 38$ | 31345.5 | 2.48 | 3 II 13.4 | 9 | 3 8 34.8 <br> 3   | $2 \cdot 70$ |
| 34 | $316 \quad 70$ | 2.26 | $\begin{array}{lllll}3 & 13 & 48.8\end{array}$ | $2 \cdot 35$ | 3 II 24.8 | 2.45 | $\begin{array}{lllll}3 & 8 & 54.7\end{array}$ | $2 \cdot 55$ | $3 \quad 618.2$ | $2 \cdot 67$ | $\begin{array}{llll}3 & 3 & 34.8\end{array}$ | 2.78 |
| 35 | 3 II 25.9 | $2 \cdot 32$ | $\begin{array}{llll}3 & 9 & 4.0\end{array}$ | 42 | $\begin{array}{llll}3 & 6 & 36 \cdot 0\end{array}$ | 2.52 |  | 2.63 | 3 I | 5 | $2 \begin{array}{llll}28 & 3 \mathrm{r} & 9\end{array}$ | 87 |
| 36 | $3643{ }^{\circ} \mathrm{O}$ | $2 \cdot 38$ | $\begin{array}{lllll}3 & 4 & 17.2\end{array}$ | 2.48 | 3 1 45 | 2.59 | $\begin{array}{lll}2 & 59 & 6 \cdot 0\end{array}$ | 1 | $2 \begin{array}{lll}26 & 19.8\end{array}$ | $2 \cdot 83$ | $2 \begin{array}{llll}235 \cdot 9\end{array}$ | 97 |
| 37 | $\begin{array}{llll}3 & 1 & 58 \cdot 2\end{array}$ | 2.44 | $\begin{array}{lllll}2 & 59 & 28.3\end{array}$ | $2 \cdot 55$ | 2 56 51 | 2.67 | $\begin{array}{lll}2 & 54 & 78\end{array}$ | $2 \cdot 79$ | $25116 \cdot 2$ | 293 | $2{ }^{2} 4816 \cdot 5$ | 3.07 |
| 38 | $257 \mathrm{II} \cdot 3$ | 2.51 | $\begin{array}{lllll}2 & 54 & 37 \cdot 0 \\ 2 & 49 & 43.2\end{array}$ | 2.63 | $\begin{array}{lllll}2 & 51 & 55 \cdot 6 \\ 2 & 46 \\ 56.7\end{array}$ | 5 | $\begin{array}{llll}2 & 49 & 6 \cdot 5 \\ 2 & 44 & 2 \cdot 1\end{array}$ | 2.98 | $\begin{array}{rrrr}2 & 46 & 9.3 \\ 2 & 40 & 58.8\end{array}$ | 3.03 3.13 | $\begin{array}{llll}2 & 43 & 3.4 \\ 2 & 37 & 46.2\end{array}$ | $3 \cdot 18$ |
| 39 | $25222 \cdot \mathrm{I}$ | $2 \cdot 59$ | $24943 \cdot 2$ | 2.71 | $24656 \cdot 7$ | 2.84 | 244 2•I | $2 \cdot 98$ | 24058.8 | 3.13 | $23746 \cdot 2$ | 3.29 |
| 40 | 2473 | 2.67 | $\begin{array}{lll}2 & 44 & 46 \cdot 6\end{array}$ |  | 24 I 54.7 | $2 \cdot 94$ | $\begin{array}{llll}2 & 38 & 54 \cdot\end{array}$ | 3.09 | $\begin{array}{llll}2 & 35 & 44.3\end{array}$ | 3.25 | 23224 | 2 |
| 41 | 24236 | $2 \cdot 75$ | $23947 \cdot 0$ | 2.89 | ${ }_{2}^{2} 3649 \cdot 3$ | $3 \cdot 04$ | 2 $3342 \cdot 3$ | . 20 | $23025 \cdot 5$ | $3 \cdot 37$ |  | 56 |
| 42 | 2373 | 2.84 | $\begin{array}{lllll}2 & 34 & 44 \cdot 1 \\ 2 & \end{array}$ | 2.99 | $\begin{array}{lllll}2 & 31 & 40 \cdot 1 \\ \end{array}$ | 3.15 |  | 3.32 |  | 3.51 | 22125 | 3.71 3.87 |
| 43 |  | 94 | $\begin{array}{lllll}2 & 29 & 37.6 \\ 2 & 2 & 26.9\end{array}$ | 3.10 | 22626.8 | 3.27 3.40 | $\begin{array}{llll}2 & 23 & 5 \cdot 4 \\ 2 & 17 & 39 \cdot 3\end{array}$ | 3.45 3.60 | $\begin{array}{llll}2 & 19 & 32 \cdot 5 \\ 2 & 13 & 57 \cdot 2\end{array}$ |  | $\begin{array}{ll}215 \\ 2 & 10\end{array}$ |  |
| 44 | 22734.6 | 3.05 | 22426.9 | 3.2 I | 2218.9 | 3.40 | 217393 | 3.60 | $1357 \cdot 2$ |  | Io | 6 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 。 | s. | s. | S. | s. | s. | S. | s. | s. | s. | s. | s. | s. |
| 0 | - 92 | -4.26 | - 1.00 |  | -r.08 | -4.30 | - $1 \times 16$ | $4 \cdot 32$ | $-\mathrm{I} \cdot 25$ | $-4.35$ | -1.33 | $4 \cdot 37$ |
| 2 | . 97 | . $4 \cdot 27$ | 1.05 | $4 \cdot 29$ | 1.13 | $4 \cdot 31$ | 1.21 | $4 \cdot 33$ | 1.29 | 4.36 | r.38 | $4 \cdot 38$ |
| 4 | I 01 | $4 \cdot 28$ | $\underline{1} \cdot 10$ | $4 \cdot 30$ | 1.18 | 4.32 | 1.26 | 4.35 | I. 34 | 4.37 | $1 \cdot 43$ | 4.40 |
| 6 | 1.06 | $4 \cdot 29$ | r.15 | $4 \cdot 32$ | 1.23 | $4 \cdot 34$ | 1.3I | $4 \cdot 36$ | 1.40 | 4.39 | $1 \cdot 48$ | 4.42 |
| 8 | 1.11 | $4 \cdot 31$ | 1.20 | $4 \cdot 33$ | 1.28 | $4 \cdot 35$ | 1.37 | $4 \cdot 38$ | I 45 | $4 \cdot 4 \mathrm{I}$ | 1.54 | 4.44 |
| ro | $1 \cdot 17$ | $4 \cdot 32$ | I. 25 | $4 \cdot 35$ | 1.34 | $4 \cdot 37$ | $1 \cdot 42$ | $4 \cdot 40$ | 1.51 | $4 \cdot 43$ | r.60 | $4 \cdot 46$ |
| 12 | $1 \cdot 22$ | $4 \cdot 34$ | I.35 | $4 \cdot 36$ | 1.40 | $4 \cdot 39$ | I 49 | $4 \cdot 42$ | I. 58 | $4 \cdot 45$ | $\mathrm{r} \cdot 67$ | 4.48 |
| 14 | 1.28 | $4 \cdot 35$ | 1.37 | $4 \cdot 38$ | r. 46 | 4.41 | I.55 | $4 \cdot 44$ | I. 64 | $4 \cdot 47$ | I.74 | 4.51 |
| 16 | 1.34 | $4 \cdot 37$ | 1.43 | $4 \cdot 40$ | I. 52 | 4.43 | 1.62 | 4.46 | 1.71 | 4.50 | I.81 | 4.54 |
| 18 | 1.41 | $4 \cdot 39$ | 1.50 | $4 \cdot 42$ | I. 59 | $4 \cdot 46$ | 1.69 | $4 \cdot 49$ | 1•79 | 4.53 | I•89 | 4.57 |
| 20 | 1.48 | 4.42 | 1.57 | 4.45 | 1.67 | $4 \cdot 48$ | 1・ク7 | $4 \cdot 52$ | 1.87 | $4 \cdot 56$ | 1.97 | $4 \cdot 60$ |
| 22 | I 55 | $4 \cdot 44$ | 1.65 | $4 \cdot 48$ | 1.75 | 4.51 | 1.85 | $4 \cdot 55$ | 1.95 | $4 \cdot 60$ | 2.06 | $4 \cdot 64$ |
| 24 | 1.63 | $4 \cdot 47$ | I.73 | 4.51 | r. 83 | 4.55 | $\underline{1} 94$ | 4.59 | $2 \cdot 05$ | 4.64 | $2 \cdot 16$ | 4.69 |
| 26 | I.75 | $4 \cdot 50$ | I. 82 | 4.54 | 1.93 | 4.58 | 2.04 | 4.63 | $2 \cdot 15$ | 4.68 | $2 \cdot 27$ | 4.74 |
| 28 | I.80 | $4 \cdot 53$ | I.91 | $4 \cdot 58$ | 2.02 | 4.63 | $2 \cdot 14$ | $4 \cdot 68$ | $2 \cdot 26$ | $4 \cdot 74$ | $2 \cdot 38$ | 4.80 |
| 30 | 1.90 | $4 \cdot 58$ | 2.02 | 4.62 | $2 \cdot 13$ | 4.68 | 2.25 | $4 \cdot 73$ | $2 \cdot 38$ | 4.79 | 2.51 | 4.86 |
| 32 | 2.01 | 4.62 | 2.13 | $4 \cdot 67$ | 2.25 | 4.73 | $2 \cdot 38$ | $4 \cdot 79$ | $2 \cdot 52$ | $4 \cdot 86$ | 2.66 | $4 \cdot 94$ |
| 34 | $2 \cdot 12$ | $4 \cdot 67$ | 2.25 | $4 \cdot 73$ | 2.38 | 4.80 | $2 \cdot 52$ | 4.87 | $2 \cdot 67$ | 4.94 | $2 \cdot 82$ | 5.02 |
| 36 38 | 2.25 2.39 | 4.73 4.80 | 2.39 2.54 | 4.80 4.88 | 2.53 2.69 | 4.87 4.96 | 2.68 2.86 | 4.95 5.05 | 2.83 3.03 | 5.03 5.14 | 3.00 3.20 | 5.13 5.25 |
|  | 2.39 |  |  |  |  |  |  |  |  |  |  |  |
| 40 | $2 \cdot 55$ | $4 \cdot 88$ | 2.71 | $4 \cdot 97$ | 2.88 | 5.06 | 3.06 | $5 \cdot 16$ | 3.25 | 5.28 | 3.45 | $5 \cdot 40$ |
| 41 | $2 \cdot 64$ | 4.93 | 2.81 | $5 \cdot 02$ | $2 \cdot 98$ | $5 \cdot 12$ | $3 \cdot 17$ | $5 \cdot 23$ | $3 \cdot 37$ | $5 \cdot 35$ | $3 \cdot 58$ | $5 \cdot 49$ |
| 42 | 2.74 | 4.98 | 2.91 | 5.08 | $3 \cdot 10$ | $5 \cdot 19$ | 3.29 | $5 \cdot 31$ | 3.51 | $5 \cdot 44$ | $3 \cdot 73$ | $5 \cdot 59$ |
| 43 | $2 \cdot 84$ | $5 \cdot 04$ | 3.02 | $5 \cdot 14$ | 3.22 | $5 \cdot 26$ | $3 \cdot 43$ | $5 \cdot 39$ | 3.65 | $5 \cdot 54$ | 3.90 | $5 \cdot 70$ |
| 44 | $2 \cdot 95$ | $5 \cdot 10$ | 3.14 | $5 \cdot 2 \mathrm{I}$ | $3 \cdot 35$ | $5 \cdot 34$ | $3 \cdot 57$ | $5 \cdot 48$ | 3.82 | $5 \cdot 64$ | 4.08 | $5 \cdot 82$ |

## LATITUDE $16^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.


190 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.
LATITUDE $17^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. <br> Var. | $5^{\circ}$ | Ded. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ}$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 6 & 0 & 0.0 \end{array}\right.$ | S. | $\left\lvert\, \begin{array}{ccc} \text { M. M. } & \text { S. } \\ 5 & 58 & 46 \cdot 6 \end{array}\right.$ | $\begin{gathered} \mathrm{S} \\ -\mathrm{r} \cdot 22 \end{gathered}$ | $\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 57 & 33 \cdot 2 \end{array}$ | $\begin{gathered} \mathrm{S} \\ -\mathrm{I} \cdot 22 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { 1. } & \text { M. } & \text { S. } \\ 5 & 56 & 19^{\circ} 7 \end{array}\right\|$ | $\begin{gathered} \mathrm{S} \\ -\mathrm{I} \cdot 23 \end{gathered}$ | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 55 & 6 \cdot 0 \end{array}\right\|$ | S. | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 53 & 52 \cdot \mathrm{I} \end{array}\right\|$ | s. $[.23]$ |
| 10 | $\begin{array}{llll}5 & 18 & 9 \cdot 1\end{array}$ | I. 24 | $\begin{array}{llll}5 & 5 & 46 \\ 5 & 16 & 54 \cdot 1\end{array}$ | I.26 | $\begin{array}{llll}5 & 57 & 33 \cdot 2 \\ 5 & 15 & 38 \cdot 2\end{array}$ | 1.27 |  | - 1.29 | $\begin{array}{lll}5 & 55 & 6.0 \\ 5 & 13 & 3.3\end{array}$ | - 31 | $5{ }_{5}^{5}$ II $44 \cdot 4$ | +132 |
| 12 | $\begin{array}{llll}5 & 9 & 46 \cdot 3\end{array}$ | I 25 | $\begin{array}{llll}5 & 8 & 30 \cdot 6\end{array}$ | 1.27 | $\begin{array}{llll}5 & 7 & 13.9\end{array}$ | I.29 | $5 \quad 5 \quad 56 \cdot 0$ | I-3I | $\begin{array}{llll}5 & 4 & 36 \cdot 8\end{array}$ | I-33 | $\begin{array}{llll}5 & 3 & 16 \cdot 5\end{array}$ | I.35 |
| 14 | 5 I 23.1 | I 26 | $\begin{array}{llll}5 & 0 & 6 \cdot 6\end{array}$ | 1.28 | $45849 \cdot 0$ | I 30 | 457 30.0 | $1 \cdot 33$ | $4{ }^{4} 56$ | 1.35 | $454 \quad 47 \cdot 7$ | 1.38 |
| 16 | 45259.5 | I 28 | 45 I $42 \cdot 2$ | I. 30 | 45023.4 | I.33 | $4493 \cdot 1$ | I 35 | 4 47 41.2 | $1 \cdot 38$ | $\begin{array}{lllllll}4 & 46 & 17 \cdot 8\end{array}$ | I.4 5 |
| 18 | $44435 \cdot 4$ | I. 29 | 443 17.0 | I.32 | $44157 \cdot 1$ | I. 35 | $44035 \cdot 4$ | 1.38 | 439 II.9 | 1.41 | $43746 \cdot 6$ | 1.44 |
| 20 | $43610 \cdot 6$ | I•3I | $43451 \cdot \mathrm{I}$ | I 34 | $433 \quad 29 \cdot 8$ | $1 \cdot 37$ | $\begin{array}{llll}4 & 32 & 6 \cdot 6\end{array}$ | 1-40 | $43041 \cdot 4$ | 1.44 | $4 \quad 29$ 14.1 | 1.47 |
| 22 | $42745 \cdot 2$ | I. 33 | 42624.4 | I.36 | $425 \quad 1 \cdot 6$ | I. 40 | $4 \begin{array}{lll}4 & 23 & 36 \cdot 8\end{array}$ | I. 43 | 42296 | 1.47 | $420 \quad 40 \cdot 2$ | I.5I |
| 24 | 4 I9 Ig.0 | $1 \cdot 35$ | $417756 \cdot 8$ | I. 39 | $\begin{array}{llll}4 & 16 & 32 \cdot 3\end{array}$ | I 43 | $\begin{array}{lll}4 & 15 & 5\end{array}$ | 1.47 | 4 I3 $36 \cdot 3$ | I.5I | $\begin{array}{llll}4 & 12 & 4 \cdot 6\end{array}$ | I 55 |
| 25 | $415 \quad 5 \cdot 5$ | 1.36 | $\begin{array}{llll}4 & 13 & 42 \cdot 6\end{array}$ | 1.40 | $41217 \cdot 2$ | I.44 | 41049.4 | I.48 | 4 9 I9.I | I.53 | 474611 | $1 \cdot 57$ |
| 26 | 4 10 5x.8 | I. 38 | $4 \quad 9 \quad 28 \cdot 1$ | 1.42 | $4 \begin{array}{lll}4 & 8 & \text { - } 8\end{array}$ | r.46 | $4 \quad 6 \quad 33.0$ | I. 50 | $4 \quad 5 \quad 1.4$ | 1.55 | $\begin{array}{llll}4 & 3 & 27 \cdot 1\end{array}$ | 1.59 |
| 27 | $4 \quad 6 \quad 37 \cdot 9$ | I.39 | $4 \quad 513 \cdot 3$ | I.43 | 436460 | 1.48 | $4 \quad 2 \quad 16 \cdot 0$ | I. 52 | $4 \quad 0 \quad 43.3$ | I. 57 | $\begin{array}{llll}3 & 59 & 7 \cdot 7\end{array}$ | I. 62 |
| 28 | $4 \quad 2 \quad 23 \cdot 7$ | 1.40 | $4058 \cdot \mathrm{I}$ | 1.45 | $3 \begin{array}{llll}3 & 59 & 29.9\end{array}$ | I. 49 | $35758 \cdot 7$ | $1 \cdot 54$ | $\begin{array}{lllll}3 & 56 & 24.7\end{array}$ | 1.59 | $\begin{array}{llll}3 & 54 & 47 \cdot 6\end{array}$ | I. 64 |
| 29 | $\begin{array}{llll}3 & 58 & 9 \cdot 2\end{array}$ | I 42 | $\begin{array}{llllllllllllllll}3 & 56 & 42 \cdot 7\end{array}$ | 1.47 | $\begin{array}{lllll}3 & 55 & 13 \cdot 3\end{array}$ | 1.51 | 353410 | I. 56 | $\begin{array}{llll}3 & 52 & 5 \cdot 5\end{array}$ | 1.62 | 35027.0 | I. 67 |
| 30 | 35354.4 | I 43 | $35226 \cdot 9$ | 1.48 | $35056 \cdot 3$ | I. 53 | $\begin{array}{lllll}3 & 49 & 22.7\end{array}$ | I'59 | 34745.8 | r.64 | $3 \begin{array}{lll}3 & 46 & 57\end{array}$ | $1 \cdot 70$ |
| 31 | 349 39'3 | 45 | 3 48 <br> 10.6  | 1.50 | $\begin{array}{llll}3 & 46 & 38 \cdot 9\end{array}$ | I•5 | 3454.0 | 1 | $\begin{array}{lll}3 & 43 & 25 \cdot 6\end{array}$ | 1.67 | 34143.8 | x 73 |
| 32 | $\begin{array}{lllll}3 & 45 & 23\end{array}$ | 1.47 | 34354.0 | I. 52 | 3422100 | I. 58 | 34044.7 | r. 64 | $\begin{array}{llll}3 & 39 & 4 \cdot 7\end{array}$ | 1.70 | $33721 \cdot 2$ | $\pm \cdot 76$ |
| 33 | 341519 | 1.49 | $\begin{array}{llll}3 & 39 & 37.0\end{array}$ | I. 54 | $\begin{array}{llll}3 & 38 & 2 \cdot 6\end{array}$ | 1.60 |  | I. 66 | $\begin{array}{llllll}3 & 34 & 43\end{array}$ | 1.72 | $\begin{array}{lllll}3 & 32 & 57 \cdot 9\end{array}$ | x 79 |
| 34 | $\begin{array}{lllll}3 & 36 & 51 \cdot 6\end{array}$ | 1.51 | $3 \begin{array}{llll}3 & 35 & 19.5\end{array}$ | 1.57 | $\begin{array}{llll}3 & 33 & 43 \cdot 7\end{array}$ | I. 63 | $\begin{array}{lll}3 & 32 & 4 \cdot 3\end{array}$ | I. 69 | 33021.0 | 1.75 | $\begin{array}{lllll}3 & 28 & 33 \cdot 8\end{array}$ | 1.82 |
| 35 | $\begin{array}{llll}3 & 32 & 34.9\end{array}$ | I. 53 | $33^{1} \mathrm{I}$ I 4 | I 59 | $3 \begin{array}{llll}3 & 29 & 24.2\end{array}$ | I. 65 | $32743 \cdot 1$ | $1 \cdot 72$ | $32558 \cdot 0$ | 1-79 | $\begin{array}{lll}3 & 24 & 8.8\end{array}$ | I. 86 |
| 36 | $3 \begin{array}{llll}3 & 28 & 17.8\end{array}$ | 1.55 | $\begin{array}{llll}3 & 26 & 42 \cdot 9\end{array}$ | 1.6I | $\begin{array}{lll}3 & 25 & 4 \cdot 1\end{array}$ | I. 68 | 32321.2 | 1•75 | $32134 * 3$ | I. 82 | 31942.9 | I. 89 |
| 37 | $\begin{array}{llll}3 & 24 & \text { O.I }\end{array}$ | I. 57 | $\begin{array}{llll}3 & 22 & 23.7\end{array}$ | 1.64 | $32043 \cdot 3$ | 1.71 | $\begin{array}{lllllllllllll}3 & 18 & 58\end{array}$ | r $\cdot 78$ | $\begin{array}{lllllllllllll}3 & 17 & 9 \cdot 6\end{array}$ | I.85 | $31516 \cdot 1$ | $1 \cdot 93$ |
| 3 | 31942.0 | 1.60 | $\begin{array}{llll}3 & 18 & 4^{\circ} 0\end{array}$ | 1.67 | $\begin{array}{llll}3 & 16 & 2 I \cdot 8\end{array}$ | 1'74 | 3 I4 $35 \cdot 3$ | I.82 | 3 I2 44-1 | I.89 | 3 10 48.3 | I.97 |
| 39 | $\begin{array}{lllllllllllll}3 & 15 & 23\end{array}$ | 1.62 |  | r.70 | 3 II $59 \cdot 6$ | 1•77 | 3 Io II'O | I.85 | $\begin{array}{lllllll}3 & 8 & 17 & 6\end{array}$ | I.93 | $3 \quad 6 \quad 19 \cdot 3$ | $2 \cdot 01$ |
| 40 | 3 II 3.9 | I. 65 | $\begin{array}{llll}3 & 9 & 22.5\end{array}$ | I'73 | $\begin{array}{llll}3 & 7 & 36 \cdot 6\end{array}$ | I.81 | $\begin{array}{llll}3 & 5 & 45.8\end{array}$ | I.89 | $3 \begin{array}{lll}3 & 3 & 50 \cdot 1\end{array}$ | 1.97 | 3 I 49.1 | 2.06 |
| 41 | $\begin{array}{lllll}3 & 6 & 43.9\end{array}$ | 1.68 | $\begin{array}{llll}3 & 5 & 0.7\end{array}$ | 1.76 | $\begin{array}{llll}3 & 3 & 12.7\end{array}$ | 184 | 3 1 1 19.6 | I.93 | 25921.4 | 2.02 | 25717.7 | 2.II |
| 42 | $\begin{array}{llll}3 & 2 & 23 \cdot 2\end{array}$ | $1 \cdot 71$ | 3 o $38 \cdot 0$ | 1.79 | $\begin{array}{lllllllll}2 & 58 & 47 \cdot 8\end{array}$ | 1.88 | 25652.4 | 1.97 | 254 51.5 | 2.06 | 25244.9 | 2.16 |
| 43 | $\begin{array}{lll}2 & 58 & \mathrm{I} \cdot 8\end{array}$ | 1.74 | $\begin{array}{llll}2 & 56 & 14.5\end{array}$ | I.83 | $2 \begin{array}{lll}2 & 54 & 22 \cdot 0\end{array}$ | I.92 | $25224 \cdot 0$ | $2 \cdot 01$ | $2 \begin{array}{llll}20 & 50 & 20 \cdot 3\end{array}$ | $2 \cdot 11$ | $\begin{array}{llll}2 & 48 & 10.5\end{array}$ | $2 \cdot 21$ |
| 44 | 25339.5 | r 78 | $25150 \cdot 1$ | I.87 | $2 \begin{array}{llll}2 & 49 & 55^{\prime} \mathrm{I}\end{array}$ | I.96 | $2 \begin{array}{llllllll} \\ 2 & 47 & 54.4\end{array}$ | 2.06 | $24547 \cdot 6$ | 2.16 | $2 \begin{array}{llll}2 & 43 & 34 \cdot 6\end{array}$ | $2 \cdot 27$ |
| 45 | 24916.4 | 1.82 | 24724.6 | I.9I | $2 \begin{array}{lllll}2 & 45 & 27 \cdot 0\end{array}$ | $2 \cdot \mathrm{OI}$ | 243123.4 | $2 \cdot 11$ | 24113.5 | $2 \cdot 22$ | 238156.8 | $2 \cdot 33$ |
| 46 | $24452 \cdot 3$ | 86 | $24258 \cdot 0$ | 1.96 | $24057 \cdot 6$ | 2.06 | $23^{8} 5 \mathrm{I} \cdot \mathrm{O}$ | $2 \cdot 17$ | $23637 \cdot 6$ | $2 \cdot 28$ | $23417 \cdot 2$ | 2.40 |
| 47 | $240 \quad 27 \cdot 2$ | 1.90 | $23^{2} 3130 \cdot 2$ | $2 \cdot 00$ | $\begin{array}{llll}2 & 36 & 26 \cdot 9\end{array}$ | $2 \cdot 11$ | 23416.9 | $2 \cdot 22$ | 23159.9 | $2 \cdot 35$ |  | 2.47 |
| 48 | $\begin{array}{lll}2 & 36 & 1 \cdot 0\end{array}$ | r.94 | $2 \begin{array}{lll}24 & 3 & 1 \cdot 2\end{array}$ | 2.05 | $23154 \cdot 7$ | $2 \cdot 17$ | 229 4I'I | $2 \cdot 29$ | $22720 \cdot 1$ | 2.41 | 224 51.4 | $2 \cdot 55$ |
| 49 | $2 \begin{array}{llll}2 & 31 & 33 \cdot 6\end{array}$ | 1.99 | $\begin{array}{llll}2 & 29 & 30 \cdot 7\end{array}$ | 2.II | $22720 \cdot 7$ | $2 \cdot 23$ | $\begin{array}{lll}2 & 25 & 3.4\end{array}$ | $2 \cdot 35$ | $2 \begin{array}{llllllll}2 & 22 & 38.2\end{array}$ | $2 \cdot 49$ | 2200477 | $2 \cdot 63$ |
| 50 | $\begin{array}{llll}2 & 27 & 4.8\end{array}$ | $2 \cdot 04$ | $22458 \cdot 6$ | 2.16 | $22245{ }^{\circ} \mathrm{O}$ | $2 \cdot 29$ | 22023.6 | $2 \cdot 43$ | 2 I7 $53 \cdot 8$ | $2 \cdot 57$ | 21515.2 | $2 \cdot 72$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | S. -4.18 | s. $-\quad .08$ | s. | S. | s. -4.19 | s. $-\quad .23$ | s. $-4 \cdot 19$ | s. $-\quad .31$ | s. $-4 \cdot 19$ | s. $-\quad .38$ | s. -4.20 |
| 4 | -09 | $4 \cdot 18$ | -17 | 4•19 | - 24 | $4 \cdot 19$ | $\cdot 32$ | $4 \cdot 20$ | -40 | $4 \cdot 20$ | $\cdot 47$ | 4.21 |
| 6 | -13 | $4 \cdot 18$ | . 21 | $4 \cdot 19$ | -29 | $4 \cdot 19$ | $\cdot 37$ | $4 \cdot 20$ | -44 | $4 \cdot 21$ | -52 | $4 \cdot 22$ |
| 8 | -18 | $4 \cdot 19$ | - 26 | 4.19 | -33 | $4 \cdot 20$ | -41 | $4 \cdot 20$ | -49 | $4 \cdot 21$ | - 57 | $4 \cdot 22$ |
| 10 | $\cdot 22$ | 4-19 | -30 | 4-19 | $\cdot 38$ | $4 \cdot 20$ | -46 | $4 \cdot 21$ | -54 | $4 \cdot 22$ | -62 | 4.23 |
| 12 | - 27 | $4 \cdot 19$ | $\cdot 35$ | 4.20 | -43 | $4 \cdot 20$ | -51 | $4 \cdot 21$ | $\cdot 59$ | $4 \cdot 22$ | . 67 | $4 \cdot 24$ |
| 14 | $\cdot 32$ | $4 \cdot 19$ | -40 | $4 \cdot 20$ | $\cdot 48$ | 4.21 | . 56 | 4.22 | - 64 | $4 \cdot 23$ | $\cdot 72$ | 4.24 |
| 16 | $\cdot 37$ | 4.20 | -45 | $4 \cdot 21$ | -53 | 4.22 | . 61 | 4.23 | -69 | 4.24 | $\cdot 78$ | 4.25 |
| 18 | -42 | $4 \cdot 20$ | -50 | 4.21 | - 58 | 4.22 | -66 | $4 \cdot 24$ | $\cdot 75$ | 4.25 | -83 | $4 \cdot 27$ |
| 20 | -47 | 4.21 | $\cdot 55$ | 4.22 | -63 | $4 \cdot 23$ | $\cdot 72$ | 4.24 | . 80 | $4 \cdot 26$ | -89 | $4 \cdot 28$ |
| 22 | - 52 | 4.21 | - 60 | 4.23 | $\cdot 69$ | 4.24 | $\cdot 78$ | $4 \cdot 25$ | $\cdot 86$ | $4 \cdot 27$ | -95 | $4 \cdot 29$ |
| 24 | - 57 | 4.22 | -66 | 4.23 | $\cdot 75$ | 4.25 | . 84 | 4.27 | -92 | $4 \cdot 28$ | $1 \cdot 02$ | $4 \cdot 30$ |
| 26 | . 63 | 4.23 | $\cdot 72$ | 4.24 | -81 | $4 \cdot 26$ | -90 | 4.28 | -99 | $4 \cdot 30$ | ro8 | $4 \cdot 32$ |
| 28 | -69 | $4 \cdot 24$ | $\cdot 78$ | $4 \cdot 25$ | $\cdot 87$ | 4.27 | -96 | $4 \cdot 29$ | x 06 | $4 \cdot 31$ | I.15 | 4.34 |
| 30 | $\cdot 75$ | 4.25 | $\cdot 84$ | 4.27 | -94 | 4.29 | $1 \cdot 03$ | $4 \cdot 31$ | $1 \cdot 13$ | 4.33 | $1 \cdot 23$ | 4.36 |
| 32 | .81 | 4.26 | .91 | 4.28 | I. 01 | 4.30 | 1.11 | 4.33 | I. 21 | 4.35 | r.31 | $4 \cdot 38$ |
| 34 36 | . 88 | 4.27 4.29 | .98 $\times 106$ | 4.30 4.31 | r.08 I 16 | 4.32 4.34 | r.18 I 27 | 4.35 4.37 | 1.29 1.37 | 4.38 4.40 | 1.39 1.49 | 4.41 4.44 |
| 38 | -103 | 4.31 | $1 \cdot 14$ | 4.33 | I 24 | $4 \cdot 36$ | I. 36 | 4.40 | 1.47 | $4 \cdot 43$ | I 59 | $4 \cdot 47$ |
| 40 | I•II | 4.33 | 1.22 | $4 \cdot 36$ | I 34 | $4 \cdot 39$ | $1 \cdot 45$ | $4 \cdot 43$ | 1.57 | 4.47 | 1.70 | 4.51 |
| 42 | 1.20 | $4 \cdot 35$ | $1 \cdot 32$ | $4 \cdot 38$ | $1 \cdot 43$ | 4.42 | I. 56 | $4 \cdot 46$ | 1.68 | 4.51 | 1.8 I | $4 \cdot 56$ |
| 44 | 1.29 | $4 \cdot 38$ | $1 \cdot 42$ | 4.42 | I 54 | 4.46 | I. 67 | $4 \cdot 50$ | I.81 | $4 \cdot 56$ | 1.95 | 4.61 |
| 46 | 1.40 | 4.41 | 1.53 | $4 \cdot 45$ | 1.66 | $4 \cdot 50$ | r. 80 | $4 \cdot 55$ | I.95 | $4 \cdot 61$ | $2 \cdot 10$ | $4 \cdot 68$ |
| 48 | 1.51 | $4 \cdot 45$ | 1. 65 | $4 \cdot 50$ | r 79 | $4 \cdot 55$ | I.94 | 4.61 | $2 \cdot 10$ | 4.68 | $2 \cdot 26$ | $4 \cdot 76$ |
| 50 | I. 64 | 4.49 | 1.79 | 4.55 | r94 | $4 \cdot 6 \mathrm{I}$ | $2 \cdot 11$ | $4 \cdot 68$ | $2 \cdot 28$ | $4 \cdot 76$ | 2.46 | 4.85 |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | s. |
| 0 | $\begin{array}{llll}5 & 52 & 38 \cdot 1\end{array}$ | -1.24 | $\begin{array}{llll}5 & 51 & 23 \cdot 7\end{array}$ | - I. 24 | $550 \quad 9.0$ | -I. 25 | $5{ }^{5} 48$ 53.9 | -1.25 | 514738.4 | -I.26 | $\begin{array}{llll}5 & 46 & 22.3\end{array}$ | - 1.27 |
| 6 | 5 27 20.2 | 1.30 | $\begin{array}{llll}5 & 26 & 2 \cdot 0\end{array}$ | $1 \cdot 31$ | $52443 \cdot 0$ | 1.32 | $\begin{array}{llll}5 & 23 & 23.0\end{array}$ | 1-34 | 522 2.I | I.36 | $52040 \cdot 0$ | 1.38 |
| 8 | $\begin{array}{lllll}5 & 18 & 52.7\end{array}$ | $1 \cdot 32$ | $\begin{array}{lllll}5 & 17 & 33\end{array}$ | I 34 | $\begin{array}{llll}5 & 16 & 12 \cdot 3\end{array}$ | 1.35 | $\begin{array}{lllllllllll}5 & 14 & 50.5\end{array}$ | $1 \cdot 37$ | $\begin{array}{llll}5 & 13 & 27 \cdot 5\end{array}$ | I•39 | $5 \begin{array}{lll}5 & 12 & 3 \cdot 2\end{array}$ | I. 42 |
| 10 | 5 10 24.3 | 1.34 | $\begin{array}{llll}5 & 9 & 3 & 0\end{array}$ | 1.36 | $\begin{array}{lllll}5 & 7 & 40 \cdot 5\end{array}$ | + 39 | $\begin{array}{llll}5 & 6 & 16 \cdot 6\end{array}$ | 1.41 | $\begin{array}{llll}5 & 4 & 51 \cdot 4\end{array}$ | 1.43 | $\begin{array}{llll}5 & 3 & 24.7\end{array}$ | I 46 |
| 12 | 5 I 54.9 | $1 \cdot 37$ | 5 ¢ 51.8 | 1.40 | $4 \quad 59 \quad 74$ | 1.42 | $45741 \cdot 4$ | 1.45 | $4 \quad 5613 \cdot 8$ | 1.47 | $4 \quad 54 \quad 44 \cdot 5$ | I.50 |
| 14 | $45324 \cdot 3$ | 1.40 | 4 51 59.4 | 1.43 | $45032 \cdot 8$ | I. 46 | $449 \quad 4 \cdot 5$ | I 49 | 44734.4 | I. 52 | $\begin{array}{llr}4 & 46 & 2.4\end{array}$ | I'55 |
| 16 | $44452 \cdot 5$ | 1.43 | $434325 \cdot 6$ | $1 \cdot 46$ | $44156 \cdot 7$ | 1.50 | $44025 \cdot 9$ | I. 53 | $438353 \cdot 1$ | I.56 | $43718 \cdot 2$ | I. 60 |
| 18 | 436619.4 | 1.47 | $43450 \cdot 2$ | I. 50 | $\begin{array}{llll}4 & 33 & 18 \cdot 9\end{array}$ | 1.54 | $43145 \cdot 4$ | 1.58 | 430097 | 1.6I | $42831 \cdot 6$ | I. 65 |
| 20 | $42744 \cdot 8$ | I.5I | 426 I3.I | I.55 | 42439.2 | 1.59 | $\begin{array}{llll}4 & 23 & 2 \cdot 7\end{array}$ | 1.63 | $42124^{\circ} \mathrm{O}$ | I. 67 | $41942 \cdot 5$ | I•7 |
| 22 | $4 \begin{array}{lll}4 & \text { I9 }\end{array}$ | I'55 | 4 I7 $34 \cdot 2$ | I 59 | $415 \quad 57 \cdot 4$ | I. 64 | 417417.9 | 1.68 | $4 \begin{array}{llll}42 & 35 \cdot 8\end{array}$ | 1.73 | 41050.6 | I.78 |
| 23 | $\begin{array}{llll}4 & 14 & 49 \cdot 6\end{array}$ | 1.57 | 4 I3 14.I | 1.62 | 4 II 35.7 | I. 66 | $4 \quad 9 \quad 54 \cdot 5$ | I.71 | $4 \begin{array}{lll}4 & 8 & 10.5\end{array}$ | I•6 | $\begin{array}{llll}4 & 6 & 23.4\end{array}$ | I.81 |
| 24 | 4 10 $30 \cdot 2$ | 1.60 | $4883 \cdot \mathrm{I}$ | 1.64 | $4 \begin{array}{llll}4 & 7 & 13.3\end{array}$ | I. 69 | $4 \cdot 530 \cdot 5$ | 1.74 | $4 \begin{array}{llll}4 & 3 & 44 \cdot 6\end{array}$ | I•79 | 4 I 55.5 | I. 85 |
| 25 | $4610 \cdot 4$ | I. 62 | 4 4 $3 I \cdot 8$ <br> 4 0  | 1.67 | $\begin{array}{lrr}4 & 2 & 50 \cdot 3\end{array}$ | I. 72 | 4 1 5.6 <br> 3 56  | 1.77 | $\begin{array}{llll}3 & 59 & 17.8\end{array}$ | I.82 | $\begin{array}{llll}3 & 57 & 26 \cdot 6\end{array}$ | I. 88 |
| 26 | 4 I 50.0 | I. 64 | $\begin{array}{rrrr}4 & 0 & 9.8\end{array}$ | 1.70 |  | I.75 | $\begin{array}{llll}3 & 56 & 40 \cdot 1\end{array}$ | I.80 | $\begin{array}{llll}3 & 54 & 50 \cdot 2\end{array}$ | I.86 | $\begin{array}{llll}3 & 52 & 56 \cdot 8\end{array}$ | I.92 |
| 27 | 35729.0 | 1.67 | $35547 \cdot 1$ | $1 \cdot 72$ | 354 2.1 | I'78 | 35213.7 | I. 84 | $35021 \cdot 7$ | I.90 | $\begin{array}{llll}3 & 4^{8} & 26 \cdot 1\end{array}$ | I•96 |
| 28 | $\begin{array}{lll}3 & 53 & 7 \cdot 4\end{array}$ | 1*70 | $35123 \cdot 8$ | 1.75 | $34936 \cdot 9$ | I. 81 | $34746 \cdot 5$ | r.87 | $\begin{array}{llll}3 & 45 & 52 \cdot 3\end{array}$ | 1.94 | $\begin{array}{llll}3 & 43 & 54.2\end{array}$ | 2.00 |
| 29 | $\begin{array}{llll}3 & 48 & 45 \cdot 1\end{array}$ | 1.73 | $\begin{array}{llll}3 & 46 & 59 \cdot 8\end{array}$ | 1.78 | $\begin{array}{llllll}3 & 45 & 10 \cdot 9\end{array}$ | I.85 | $\begin{array}{llll}3 & 43 & 18 \cdot 3\end{array}$ | 1.91 | $\begin{array}{llll}3 & 41 & 21 \cdot 9 \\ 3 & 3 & \end{array}$ | 1.97 | $\begin{array}{llll}3 & 39 & 21 \cdot 3\end{array}$ | 2.04 |
| 30 | $34422 \cdot 1$ | 1.76 | $\begin{array}{llll}3 & 42 & 34 \cdot 9\end{array}$ | 1.82 | $34^{\circ} 44^{\circ}$ | I.88 | $\begin{array}{llll}3 & 38 & 49 \cdot 2\end{array}$ | 1.95 | $\begin{array}{lllllllllll}3 & 36 & 50\end{array}$ | 2.02 | $\begin{array}{lllll}3 & 34 & 47 \cdot 2\end{array}$ | 2.09 |
| 31 | $\begin{array}{llll}3 & 39 & 58 \cdot 4\end{array}$ | 1.79 | $\begin{array}{rrrr}3 & 38 & 9 \cdot 3\end{array}$ | I. 85 | $\begin{array}{llll}3 & 36 & 16 \cdot 2\end{array}$ | I.92 | 3 34 $19 \cdot 1$ <br> 3 19  | 1.99 | $\begin{array}{lllll}3 & 32 & 17.7\end{array}$ | $2 \cdot 06$ | 3 30 11.8 <br> 3 25  | $2 \cdot 14$ |
| 32 | 33534.0 | 1.82 | $\begin{array}{llll}3 & 33 & 42 \cdot 7\end{array}$ | I. 89 | 3 31 47.4 | I.96 | $32947 \cdot 8$ | $2 \cdot 03$ | $32743 \cdot 8$ | $2 \cdot 10$ | $\begin{array}{llll}3 & 25 & 35 \cdot 1\end{array}$ | $2 \cdot 19$ |
| 33 | $\begin{array}{llr}3 & 31 & 8.6\end{array}$ | 1.86 | $\begin{array}{llll}3 & 29 & 15.2\end{array}$ | 1.92 | 32717.6 | $2 \cdot 00$ | 32515.5 | 2.07 | $\begin{array}{lll}3 & 23 & 8 \cdot 6\end{array}$ | $2 \cdot 15$ | $32056 \cdot 9$ | $2 \cdot 24$ |
| 34 | $\begin{array}{llll}3 & 2642.4\end{array}$ | I. 89 | $32446 \cdot 7$ | I.96 | $\begin{array}{llll}3 & 22 & 46 \cdot 6\end{array}$ | $2 \cdot 04$ | $32041 \cdot 8$ | $2 \cdot 12$ | $\begin{array}{llll}3 & 18 & 32 \cdot 1\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}3 & 16 & 17 \cdot 2\end{array}$ | $2 \cdot 29$ |
| 35 | $\begin{array}{llll}3 & 22 & 15 \cdot 3\end{array}$ | 1.93 | $32017 \cdot 2$ | $2 \cdot 01$ | $\begin{array}{llll}3 & 18 & 14.5\end{array}$ | $2 \cdot 09$ | $\begin{array}{llll}3 & 16 & 6 \cdot 9\end{array}$ | $2 \cdot 17$ | $\begin{array}{lllll}3 & 13 & 54.0\end{array}$ | $2 \cdot 26$ | 3 II $35 \cdot 8$ | $2 \cdot 35$ |
| 36 | 3177471 | I.97 | $\begin{array}{llll}3 & 15 & 46 \cdot 6\end{array}$ | 2.05 | 3 I3 4I•I | $2 \cdot 13$ |  | $2 \cdot 22$ | $\begin{array}{llll}3 & 9 & 14.4\end{array}$ | $2 \cdot 31$ | $\begin{array}{llll}3 & 6 & 52 \cdot 7\end{array}$ | 2.41 |
| 37 |  | $2 \cdot 01$ | 3 II 14.7 | 2.09 | $\begin{array}{lll}3 & 9 & 6 \cdot 3\end{array}$ | 2-18 | $3 \quad 6 \quad 52 \cdot 5$ | $2 \cdot 28$ | $3 \quad 433.0$ | $2 \cdot 37$ | $\begin{array}{lll}3 & 2 & 7 \cdot 5\end{array}$ | $2 \cdot 48$ |
| 38 | $\begin{array}{lll}3 & 8 & 47.4\end{array}$ | 2.06 | $\begin{array}{llll}3 & 6 & 41 & 4\end{array}$ | $2 \cdot 14$ | $\begin{array}{rrr}3 & 4 & 30 \cdot 0 \\ 2 & 59 & 52 \cdot 1\end{array}$ | $2 \cdot 24$ | $\begin{array}{rrrr}3 & 2 & 12.9\end{array}$ | $2 \cdot 34$ | $2 \begin{array}{llll}2 & 59 & 49 \cdot 8\end{array}$ | 2.44 | $25720 \cdot 3$ | $2 \cdot 55$ |
| 39 | $\begin{array}{lrrr}3 & 4 & 15 \cdot 8 \\ 2 & 59 & 42.7\end{array}$ | $2 \cdot 10$ | $\begin{array}{rrrr}3 & 2 & 6 \cdot 8 \\ 2 & 57 & 30 \cdot 7\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}2 & 59 & 52 \cdot 1\end{array}$ | 2.29 | $\begin{array}{llll}2 & 57 & 31 \cdot 5\end{array}$ | 2.40 | $\begin{array}{lll}2 & 55 & 4 \cdot 6\end{array}$ | $2 \cdot 50$ | $25230 \cdot 9$ | 2.62 |
| 40 | $\begin{array}{llll}2 & 59 & 42 \cdot 7\end{array}$ | $2 \cdot 15$ | $2 \begin{array}{llll}2 & 57 & 30.7\end{array}$ | $2 \cdot 25$ | $\begin{array}{llll}2 & 55 & 12 \cdot 6\end{array}$ | $2 \cdot 35$ | $\begin{array}{lllll}2 & 52 & 48 \cdot 2\end{array}$ | 2.46 | $2{ }^{2} 5017 \% 1$ | $2 \cdot 58$ | $\begin{array}{lllll}2 & 47 & 39 \cdot 0\end{array}$ | $2 \cdot 70$ |
| 41 | $\begin{array}{llr}2 & 55 & 8 \cdot 3\end{array}$ | 2.21 | $\begin{array}{llll}2 & 52 & 52 \cdot 9 \\ 2 & 48 & \end{array}$ | $2 \cdot 31$ | $25031 \cdot 1$ | 2.42 | $\begin{array}{lll}2 & 48 & 2.8 \\ 2 & 4 & \end{array}$ | 2.53 |  | $2 \cdot 65$ | $\begin{array}{llllll}2 & 42 & 44.4\end{array}$ | $2 \cdot 78$ |
| 42 | $25032 \cdot 2$ | $2 \cdot 26$ | $2 \begin{array}{llll}28 & 13 \cdot 3\end{array}$ | $2 \cdot 37$ | $24547 \cdot 7$ | $2 \cdot 48$ | $24315 \cdot 1$ | 2.61 | 24035.0 | 2.73 | $23746 \cdot 9$ | 2.87 |
| 43 | $\begin{array}{llll}2 & 45 & 54.5\end{array}$ | $2 \cdot 32$ | $\begin{array}{llll}2 & 43 & 31 \cdot 7\end{array}$ | $2 \cdot 44$ | $2 \begin{array}{lll}2 & 41 & 2 \cdot 0\end{array}$ | $2 \cdot 56$ | $\begin{array}{llll}2 & 38 & 24.9\end{array}$ | 2.68 | $\begin{array}{llll}2 & 35 & 39 \cdot 8\end{array}$ | 2.82 | $\begin{array}{llll}2 & 32 & 46 \cdot 2\end{array}$ | 2.97 |
| 44 | $2 \begin{array}{lllll}2 & 41 & 14.9\end{array}$ | $2 \cdot 39$ | $2 \begin{array}{llll}2 & 38 & 48 \cdot 1\end{array}$ | $2 \cdot 51$ | $23^{36} 14.0$ | 2.63 | $2 \begin{array}{llll}2 & 33 & 31 \cdot 9\end{array}$ | 2.77 | 23041.5 | 2.92 | 22742.0 | 3.07 |
| 45 | $2 \begin{array}{llll}26 & 33 \cdot 3\end{array}$ | 2.45 | $2 \begin{array}{lll}2 & 34 & 2 \cdot 2\end{array}$ | $2 \cdot 58$ | 23123.3 | $2 \cdot 72$ | $22836 \cdot 0$ | $2 \cdot 86$ | 225139.8 | 3.02 | $\begin{array}{lllll}2 & 22 & 33 \cdot 9\end{array}$ | $3 \cdot 19$ |
| 46 | $\begin{array}{lllll}2 & 31 & 49.4\end{array}$ | 2.53 | $\begin{array}{llll}2 & 29 & 13.7\end{array}$ | 2.66 | $\begin{array}{llll}2 & 26 & 29 \cdot 7\end{array}$ | 2.81 | $\begin{array}{llll}2 & 23 & 36 \cdot 8\end{array}$ | 2.96 | $\begin{array}{lllll}2 & 20 & 34.3\end{array}$ | $3 \cdot 13$ | $\begin{array}{lllll}2 & 17 & 21.4\end{array}$ | $3 \cdot 31$ |
| 47 | 227 3.2 | 2.61 | 22422.5 | 2.75 | $22133 \cdot 0$ | 2.90 | $\begin{array}{lllll}2 & 18 & 33.9\end{array}$ | 3.07 | 215124.5 | 3.25 | 21240 | 3.44 |
| VARIATION TO I' OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. $6^{\circ}$ | A. | L. $7{ }^{\circ}$ | A. | L. $8^{\circ}$ | A. | L. $9^{\circ}$ | A. | L. 10 | A. | L. 11 | A. |
| - | S. | s. | S. | s. | S. | S. | S. | S. | S. | S. |  | S. |
| 0 | - 46 | 4.21 | . 54 | $4 \cdot 21$ | - 62 | $-4.23$ | -. 69 | $-4.24$ | -77 | 4.25 | .85 | 4.27 |
| 2 | -51 | $4 \cdot 21$ | 58 | $4 \cdot 22$ | 66 | 4.23 | 74 | $4 \cdot 25$ | 82 | $4 \cdot 26$ | -90 | $4 \cdot 28$ |
| 4 | . 55 | $4 \cdot 22$ | -63 | $4 \cdot 23$ | -71 | $4 \cdot 24$ | -79 | $4 \cdot 26$ | -87 | 4.27 | -95 | $4 \cdot 29$ |
| 6 | -60 | $4 \cdot 23$ | . 68 | $4 \cdot 24$ | $\cdot 76$ | 4.25 | - 84 | 4.27 | -92 | $4 \cdot 28$ | I 00 | $4 \cdot 30$ |
| 8 | -65 | $4 \cdot 23$ | $\cdot 73$ | $4 \cdot 25$ | -8I | $4 \cdot 26$ | -89 | $4 \cdot 28$ | -97 | $4 \cdot 29$ | I-05 | 4.31 |
| 10 | $\cdot 70$ | 4.24 | -78 | 4.25 | -86 | 4.27 | -94 | $4 \cdot 29$ | 1.03 | 4.31 | I'II | 4.33 |
| 12 | $\cdot 75$ | $4 \cdot 25$ | -83 | $4 \cdot 26$ | $\cdot 92$ | $4 \cdot 28$ | 1.00 | $4 \cdot 30$ | I. 08 | 4.32 | I'17 | 4.34 |
| 14 | -80 | $4 \cdot 26$ | -89 | $4 \cdot 28$ | -97 | $4 \cdot 29$ | I.06 | $4 \cdot 31$ | I.14 | 4.34 | I. 23 | $4 \cdot 36$ |
| 16 | -86 | 4.27 | $\cdot 94$ | $4 \cdot 29$ | 1.03 | $4 \cdot 31$ | I-12 | $4 \cdot 33$ | I 20 | $4 \cdot 35$ | I-29 | $4 \cdot 38$ |
| 18 | $\cdot 92$ | $4 \cdot 28$ | I.00 | 4.30 | I.09 | $4 \cdot 32$ | I.I8 | 4.35 | 1.27 | $4 \cdot 37$ | I. 36 | $4 \cdot 40$ |
| 20 | -98 | $4 \cdot 30$ | $1 \cdot 07$ | $4 \cdot 32$ | I. 15 | $4 \cdot 34$ | I. 25 | $4 \cdot 36$ | I. 34 | $4 \cdot 39$ | 1.43 | 4.42 |
| 22 | I. 04 | $4 \cdot 31$ | I• 13 | $4 \cdot 33$ | I 22 | $4 \cdot 36$ | 1.3I | $4 \cdot 38$ | I-4I | 4.41 | I. 51 | 4.45 |
| 24 | I•II | $4 \cdot 33$ | I 20 | 4.35 | I 29 | $4 \cdot 38$ | I•39 | $4 \cdot 4 \mathrm{I}$ | I.49 | 4.44 | I. 59 | 4.47 |
| 26 | I.I8 | $4 \cdot 34$ | 1.27 | $4 \cdot 37$ | r.37 | $4 \cdot 40$ | 1.47 | 4.43 | I.57 | 4.47 | 1.67 | $4 \cdot 50$ |
| 28 | 1.25 | $4 \cdot 37$ | I.35 | 4.39 | 1.45 | 4.43 | 1.55 | $4 \cdot 46$ | r.66 | $4 \cdot 50$ | r.76 | $4 \cdot 54$ |
| 30 | I.33 | $4 \cdot 39$ | I. 43 | 4.42 | 1.54 | 4.46 | I-64 | $4 \cdot 49$ | 1.75 | $4 \cdot 53$ | I.86 | $4 \cdot 58$ |
| 32 | I-4I | $4 \cdot 41$ | I 52 | 4.45 | 1. 63 | $4 \cdot 49$ | I•74 | $4 \cdot 53$ | 1.85 | $4 \cdot 58$ | 1.97 | $4 \cdot 62$ |
| 34 | I.5I | $4 \cdot 44$ | I.6I | 4.48 | $1 \cdot 73$ | 4.53 | 1.85 | 4.57 | 1.97 | $4 \cdot 62$ | 2.09 | $4 \cdot 68$ |
| 36 | I. 60 | $4 \cdot 48$ | 1.72 | $4 \cdot 52$ | I.84 | $4 \cdot 57$ | I $\cdot 96$ | $4 \cdot 62$ | $2 \cdot 09$ | 4.67 | $2 \cdot 22$ | $4 \cdot 74$ |
| 38 | 1.71 | $4 \cdot 52$ | I.83 | 4.57 | I.96 | 4.62 | 2.09 | $4 \cdot 67$ | $2 \cdot 22$ | 4.74 | $2 \cdot 37$ | $4 \cdot 80$ |
| 40 | 1.82 | 4.56 | I.95 | $4 \cdot 62$ | 2.09 | $4 \cdot 67$ | $2 \cdot 23$ | $4 \cdot 74$ | $2 \cdot 37$ | $4 \cdot 8$ I | 2.53 | 4.89 |
| 42 | 195 | 4.61 | 2.09 | 4.68 | $2 \cdot 23$ | $4 \cdot 74$ | $2 \cdot 39$ | 4.82 | $2 \cdot 55$ | $4 \cdot 90$ | $2 \cdot 71$ | 4.98 |
| 44 | 2.09 | $4 \cdot 68$ | $2 \cdot 24$ | $4 \cdot 75$ | $2 \cdot 40$ | 4.82 | 2.57 | 4.91 | 2.74 | 5.00 | 2.92 | $5 \cdot 10$ |
| 46 | $2 \cdot 25$ | 4.75 | 2.42 | 4.83 | 2.59 | 4.92 | $2 \cdot 77$ | $5 \cdot 02$ | $2 \cdot 96$ | 5.13 | $3 \cdot 17$ | $5 \cdot 25$ |
| 47 | $2 \cdot 34$ | $4 \cdot 79$ | $2 \cdot 51$ | $4 \cdot 88$ | $2 \cdot 69$ | 4.97 | 2.89 | $5 \cdot 08$ | 3.09 | $5 \cdot 20$ | $3 \cdot 3 \mathrm{I}$ | $5 \cdot 34$ |

## LATITUDE $17{ }^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. | S. | H. M. S. | S. | H. M. | S. | H. M. | S. | H. M. | S. | H. M. | S. |
| 0 | $\begin{array}{llll}5 & 45 & 5 \cdot 8\end{array}$ | - I. 28 | $\begin{array}{llll}5 & 43 & 48 \cdot 6\end{array}$ | -I. 29 | $\begin{array}{llll}5 & 42 & 30 \cdot 8\end{array}$ | - I.30 | 54112.2 | - I. 32 | $\begin{array}{llll}5 & 39 & 52.9\end{array}$ | - I•33 | $\begin{array}{llll}5 & 38 & 32 \cdot 8\end{array}$ | - I 34 |
| 4 | 527 54.7 | I.36 | $\begin{array}{llll}5 & 26 & 32 \cdot 8\end{array}$ | I. 37 | $\begin{array}{llll}5 & 25 & 10.0\end{array}$ | I. 39 | $\begin{array}{lllllllllllll}5 & 23 & 46 \cdot 0\end{array}$ | I.41 | $\begin{array}{llll}5 & 22 & 20.9\end{array}$ | 1.43 | 52054.5 | 1.45 |
|  | 519170 | r. 39 | $\begin{array}{lllllllllll}5 & 17 & 52 \cdot 6\end{array}$ | 1.42 | $\begin{array}{llll}5 & 16 & 27 \cdot 0\end{array}$ | I.44 | $515 \quad 0 \cdot 1$ | 1.46 | 513 3I•8 | $1 \cdot 48$ | $5122 \cdot 0$ | $1 \cdot 51$ |
| 8 | 5 10 $37 \cdot 6$ | I. 44 | $\begin{array}{llll}5 & 9 & 10.6\end{array}$ | I 46 | $\begin{array}{cccc}5 & 7 & 42 \cdot 2\end{array}$ | 1-49 | $\begin{array}{llll}5 & 6 & 12 \cdot 1\end{array}$ | I.5I | $\begin{array}{llll}5 & 4 & 40 \cdot 5\end{array}$ | I. 54 | $\begin{array}{llll}5 & 3 & 7 \cdot 1\end{array}$ | 1.57 |
| 10 | 5 I 56.5 | 1.48 | $5 \quad 026.7$ | I. 51 | $4 \quad 58 \quad 55 \cdot 2$ | I-54 | $4 \quad 5721.9$ | 1.57 | $45546 \cdot 7$ | 1.60 | $4 \begin{array}{lll}4 & 54 & 9.5\end{array}$ | -64 |
| 12 | $45313 \cdot 6$ | I•53 | $45140 \cdot 7$ | I.56 | $4 \begin{array}{llr}40 & 5.9\end{array}$ | I. 60 | $\begin{array}{llll}4 & 48 & 29 \cdot 1\end{array}$ | 1.63 | $\begin{array}{llll}4 & 46 & 50 \cdot 2\end{array}$ | 1.67 | 445 9.1 | $\cdot 71$ |
| 14 | $44428 \cdot 5$ | I. 58 | $442 \quad 52 \cdot 4$ | I. 62 | 44114.2 | I. 66 | $4 \begin{array}{llll}4 & 39 & 33 \cdot 7\end{array}$ | I.70 | $43750 \cdot 7$ | I. 74 | $436 \quad 5 \cdot 3$ | 1.78 |
| 16 | $43541 \cdot 0$ | I. 64 | $434 \quad 1 \cdot 5$ | I. 68 | 432196 | I•72 | $43035 \cdot 2$ | I.76 | $42848 \cdot 0$ | I. 8 I | $42658 \cdot \mathrm{I}$ | I.86 |
| 18 | $42651 \cdot I$ | I.70 | $\begin{array}{llll}4 & 25 & 7 \cdot 9\end{array}$ | 1•74 | $4 \begin{array}{lll}4 & 23 & 22 \cdot 1\end{array}$ | I•79 | 42133.4 | I. 84 | $41941 \cdot 7$ | I.89 | 4 I7 46.9 | -94 |
| 19 | $42225 \cdot 1$ | I.73 | $42040 \cdot 0$ | - 78 | 4 I8 52.0 | I.82 | 4 I7 I•I | I. 87 | $415 \quad 7 \cdot 0$ | I'93 | $\begin{array}{llll}4 & 13 & 9 \cdot 7\end{array}$ | 1.98 |
| 20 | 4 I7 58.3 | I•76 | 4 16 11.2 | I | 4 I4 2I•I | . 86 | $41227 \cdot 9$ | I.9I | 4 10 31.3 | I.97 | $4 \begin{array}{lll}4 & 8 & 31 \cdot 3\end{array}$ | . 03 |
| 21 | $41330 \cdot 8$ | I•79 | 4 II 4I•6 | 1.85 | $4 \quad 9 \quad 49 \cdot 3$ | I.90 | $47753 \cdot 6$ | I.96 | $4 \quad 5 \quad 54 \cdot 5$ | 2.02 | $\begin{array}{lllll}4 & 3 & 51 \cdot 7\end{array}$ | 08 |
| 22 | $\begin{array}{lll}4 & 9 & 2.4\end{array}$ | I-83 | 47 II I I | I. 88 | $\begin{array}{llll}4 & 5 & 16 \cdot 4\end{array}$ | I.94 | $\begin{array}{llll}4 & 3 & 18 \cdot 3\end{array}$ | $2 \cdot 00$ | $4 \quad 1 \begin{array}{lll}4 & 165\end{array}$ | $2 \cdot 06$ | 3591009 | $2 \cdot 13$ |
| 23 | $\begin{array}{llll}4 & 4 & 33 \cdot 2\end{array}$ | I.86 | $\begin{array}{lrr}4 & 2 & 39 \cdot 6\end{array}$ | I. 92 | $4 \quad 0 \quad 42 \cdot 5$ | I.98 | $\begin{array}{llllll}3 & 58 & 41 \cdot 7\end{array}$ | $2 \cdot 04$ | $\begin{array}{llllllllll}3 & 56 & 37 \cdot 2\end{array}$ | $2 \cdot 11$ | $35428 \cdot 6$ | I |
| 24 | $4 \quad 3 \cdot 1$ | I.90 | $\begin{array}{llll}3 & 58 & 7 \cdot 1\end{array}$ | 1.96 | $\begin{array}{llll}3 & 56 & 7 \cdot 5\end{array}$ | 2.02 | $3 \begin{array}{lll}3 & 54 & 4 \cdot 1\end{array}$ | 2.09 | $35156 \cdot 6$ | 2.16 | 34944.9 | $2 \cdot 23$ |
| 25 | $\begin{array}{llll}3 & 55 & 31 \cdot 9\end{array}$ | 1.94 | $3 \begin{array}{lll}3 & 53 & 33.6\end{array}$ | 00 | 35131.4 | 2.07 | $\begin{array}{llll}3 & 49 & 25 \cdot 1\end{array}$ | $2 \cdot 14$ | 34714.6 | 2 I | $34459 \cdot 6$ | 2.29 |
| 26 | 3505059 | 1.98 | $\begin{array}{llllllllllll}3 & 48 & 58 \cdot 9\end{array}$ | 2.05 | 34653.9 | 2.12 | $34444 * 7$ | $2 \cdot 19$ | 342 3I•I | 2.27 | 34012.7 | $2 \cdot 35$ |
| 27 | $3 \begin{array}{llll}3 & 46 & 26 \cdot 5\end{array}$ | $2 \cdot 03$ | $34423 \cdot 0$ | 2.09 | $342 \begin{array}{llll}3 & 1\end{array}$ | $2 \cdot 17$ | $340 \quad 2 \cdot 9$ | $2 \cdot 24$ | $33746 \cdot 0$ | $2 \cdot 32$ | 335 24.1 | $2 \cdot 41$ |
| 28 | 34152.2 | 2.07 | $33945 \cdot 8$ | $2 \cdot 14$ | $\begin{array}{llllll}3 & 37 & 35 \cdot 1\end{array}$ | $2 \cdot 22$ | $\begin{array}{llll}3 & 35 & 19.6\end{array}$ | $2 \cdot 30$ | $\begin{array}{llll}3 & 32 & 59 \cdot 2\end{array}$ | $2 \cdot 38$ | $33033 \cdot 5$ | 2.47 |
| 29 | $\begin{array}{lllllllllllllllll}3 & 37 & 16.6\end{array}$ | $2 \cdot 12$ | $3 \begin{array}{lll}3 & 35 & 7 \cdot 3\end{array}$ | $2 \cdot 19$ | $3 \begin{array}{llll}32 & 53\end{array}$ | 2.27 | 33034.6 | $2 \cdot 36$ | $\begin{array}{llll}3 & 28 & 10.5\end{array}$ | $2 \cdot 45$ | $3254 \mathrm{I} \cdot \mathrm{O}$ | $2 \cdot 54$ |
| 30 | $\begin{array}{llll}3 & 32 & 39 \cdot 6\end{array}$ | $2 \cdot 17$ | $3 \begin{array}{lll}30 & 27 & 3\end{array}$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 28 & 10.2\end{array}$ | $2 \cdot 33$ | $32547 \cdot 8$ | 2.42 | $3 \begin{array}{lll}3 & 23 & 19.9\end{array}$ | $2 \cdot 51$ | $32046 \cdot 3$ | 61 |
| 31 | $\begin{array}{llll}3 & 28 & 1 \cdot 3\end{array}$ | $2 \cdot 22$ | $\begin{array}{lllllllllllll}3 & 25 & 45 \cdot 8\end{array}$ | $2 \cdot 30$ | $\begin{array}{llll}3 & 23 & 25 \cdot 2 \\ 3 & 18 & 3\end{array}$ | $2 \cdot 39$ | $320859 \cdot 1$ | 2.48 | $\begin{array}{llll}3 & 18 & 27 \cdot 2 \\ 3 & 18\end{array}$ | 2.58 |  | $2 \cdot 69$ |
| 32 | 3123121.4 | $2 \cdot 27$ | $\begin{array}{lll}3 & 21 & 2.6\end{array}$ | $2 \cdot 36$ | $\begin{array}{llll}3 & 18 & 38 \cdot 4\end{array}$ | 2.45 | $\begin{array}{llll}3 & 16 & 8.4\end{array}$ | $2 \cdot 55$ | $\begin{array}{llll}3 & 13 & 32 \cdot 2 \\ 3 & 8 & 3\end{array}$ | 2.66 | 3 10 49.7 | 2.77 |
| 33 | $\begin{array}{llll}3 & 18 & 40 \cdot 0\end{array}$ | 2.33 | 3 16 17・ク | 2.42 | $\begin{array}{lllll}3 & 13 & 49.6\end{array}$ | 2.52 | $\begin{array}{llll}3 & 11 & 15.4 \\ & 6 & 20.1\end{array}$ | 2.62 | $\begin{array}{llll}3 & 8 & 34 \cdot 8 \\ 3 & 3 & 34.8\end{array}$ | 2.73 | $3 \begin{array}{llll}3 & 5 & 47 \cdot 4\end{array}$ | 2.85 |
| 34 | 3 13 56.8 | 2.39 | 3 II $30 \cdot 8$ | 2.48 | $3 \begin{array}{llll}3 & 8 & 58 \cdot 7\end{array}$ | 2.59 | $3 \quad 6 \quad 20 \cdot 1$ | $2 \cdot 70$ | $\begin{array}{llll}3 & 3 & 34 \cdot 8\end{array}$ | 2.82 | $3 \quad 0 \quad 42 \cdot 2$ | -94 |
| 35 | $\begin{array}{llll}3 & 9 & \text { II.8 } \\ 3 & 4\end{array}$ | 2.45 | 3 6 41.8 | 2.55 | $\begin{array}{lrr}3 & 4 & 5 \cdot 5 \\ 2 & 50 & 9\end{array}$ | $2 \cdot 66$ | $\begin{array}{lrr}3 & 1 & 22 \cdot 3 \\ 2 & 56 & 21.6\end{array}$ | 2.78 | $\begin{array}{llll}2 & 58 & 31 \cdot 9 \\ 2 & 53 & 25 \cdot 9\end{array}$ | $2 \cdot 90$ | $\begin{array}{llll}2 & 55 & 33 \cdot 8 \\ 2 & 50 & \end{array}$ | 3.04 |
| 36 | $\begin{array}{rrrr}3 & 4 & 24.9 \\ 2 & 59 & \end{array}$ | 2.52 | $\begin{array}{lrrr}3 & 1 & 50.6 \\ 2 & 56 & 57.1\end{array}$ | 2.63 | $\begin{array}{llll}2 & 59 & 9 \cdot 8 \\ 2 & 54 & \end{array}$ | 2.74 | $\begin{array}{llll}2 & 56 & 21 \cdot 6 \\ 2 & 51 & 18 \cdot 0\end{array}$ | 2.87 | $\begin{array}{lllll}2 & 53 & 25 \cdot 9 \\ 2 & 48 & 16.5\end{array}$ | 3.00 | $\begin{array}{llll}2 & 50 & 21 \cdot 9 \\ 2 & 45 & 6 \cdot 3\end{array}$ | $3 \cdot 14$ |
| 37 | $\begin{array}{llll}2 & 59 & 35 \cdot 6 \\ 2 & 54 & \end{array}$ | 2.59 | $2 \begin{array}{lllll}2 & 56 & 57 \cdot 1 \\ 2 & 52 & \end{array}$ | $2 \cdot 70$ | 2541114 | 2.83 | $251818 \cdot 0$ | $2 \cdot 96$ | $\begin{array}{rrrr}2 & 48 & 16 \cdot 5 \\ 2 & 43 & 3.4\end{array}$ | 3.10 | $\begin{array}{rrr}2 & 45 & 6 \cdot 3 \\ 2 & 39 & 46 \cdot 5\end{array}$ | 3.25 3.37 |
| 38 | 2 54 44.2 <br> 2 4  | 2.66 | $\begin{array}{lll}2 & 52 & 0.9 \\ 2 & 47 & \end{array}$ | $2 \cdot 78$ | 249 10.0 | 2.92 | 2461100 | 3.05 | 24313.4 | 3.20 | $23946 \cdot 5$ | $3 \cdot 37$ |
| 39 | $24950 \cdot 1$ | $2 \cdot 74$ | 24718 | 2.87 | $\begin{array}{llll}2 & 44 & 5 \cdot 5\end{array}$ | 3.01 | 2410.5 | 3.16 | $23746 \cdot 2$ | $3 \cdot 32$ | $234121 \cdot 9$ | $3 \cdot 49$ |
| 40 | 24453.4 | $2 \cdot 83$ | $24159 * 7$ | 2.97 | $2 \begin{array}{llll}2 & 38 & 57 \cdot 4\end{array}$ | $3 \cdot 11$ | $235545 \cdot 9$ | 3.27 | $2 \begin{array}{llll}22 & 24 \cdot 5\end{array}$ | 3.45 | $\begin{array}{llll}2 & 28 & 52 \cdot 3\end{array}$ | 3.63 |
| 41 | 23953.5 | 2.92 |  | 3.07 | $2 \begin{array}{llll}2 & 33 & 45 \cdot 5\end{array}$ | 3.23 | $2{ }^{2} 3027 \cdot 0$ | 3.40 | $\begin{array}{lllll}2 & 26 & 57 \cdot 8\end{array}$ | $3 \cdot 58$ | $\begin{array}{llll}2 & 23 & 16 \cdot 9\end{array}$ | $3 \cdot 79$ |
| 42 | $\begin{array}{llll}2 & 34 & 50.4 \\ 2\end{array}$ | 3.02 | $\begin{array}{llll}2 & 31 & 44.8\end{array}$ | $3 \cdot 18$ | $\begin{array}{llll}2 & 28 & 29.3\end{array}$ | $3 \cdot 35$ | $\begin{array}{lll}2 & 25 & 3 \cdot 2 \\ 2 & \end{array}$ | 3.53 | 2 L 2125.5 | 3.73 | 2 I7 $35 \cdot 2$ | $3 \cdot 95$ |
| 43 | $\begin{array}{lllll}2 & 29 & 43.6 \\ 2 & 24 & \end{array}$ | $3 \cdot 12$ | $\begin{array}{llll}2 & 26 & 31 \cdot 3\end{array}$ | $3 \cdot 29$ | $\begin{array}{llll}2 & 23 & 8 \cdot 3\end{array}$ | 3.48 | $\begin{array}{llll}2 & 19 & 33.9 \\ 2 & 19 & 58.6\end{array}$ | $3 \cdot 68$ | $\begin{array}{llll}2 & 15 & 46 \cdot 9\end{array}$ | 3.90 | $2 \begin{array}{lll}2 & 11 & 46 \cdot 2 \\ 2 & 5 & 48 \cdot 9\end{array}$ | 4.14 4.35 |
| 44 | $22432 \cdot 8$ | $3 \cdot 24$ | 22113.2 | 3.42 | 2 I7 42.I | $3 \cdot 62$ | $2 \begin{array}{lllll}2 & 13 & 58 \cdot 6\end{array}$ | $3 \cdot 84$ | $2101 \cdot 3$ | 4.08 | $2 \quad 5 \quad 48 \cdot 9$ | 4.35 |

VARIATION TO $i^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | s. | s. | s. | s. | s. | S. | s. | S. | S. | s. | s. |
| o | - 93 | $-4.28$ | - 1.01 | -4.30 | -r.09 | $-4 \cdot 32$ | $-\mathrm{I} \cdot 18$ | -4.34 | - 1.26 | $-4.37$ | - I. 34 | 4.39 |
| 2 | -98 | $4 \cdot 30$ | I.06 | $4 \cdot 32$ | I-14 | $4 \cdot 34$ | 1.23 | $4 \cdot 36$ | $1 \cdot 31$ | $4 \cdot 38$ | 1.40 | 4.41 |
| 4 | $\pm .03$ | $4 \cdot 31$ | I•I | $4 \cdot 33$ | I. 20 | $4 \cdot 35$ | 1.28 | $4 \cdot 37$ | I. 36 | $4 \cdot 40$ | 1.48 | $4 \cdot 43$ |
| 6 | I. 08 | $4 \cdot 32$ | 1.1 | $4 \cdot 34$ | 1.25 | $4 \cdot 36$ | $1 \cdot 34$ | $4 \cdot 39$ | 1.42 | $4 \cdot 42$ | 1.51 | $4 \cdot 45$ |
| 8 | I. 14 | $4 \cdot 33$ | I-22 | $4 \cdot 36$ | $1 \cdot 31$ | $4 \cdot 38$ | I•39 | $4 \cdot 41$ | 1.48 | $4 \cdot 44$ | 1.57 | $4 \cdot 47$ |
| 10 | I•19 | $4 \cdot 35$ | $1 \cdot 28$ | $4 \cdot 37$ | $1 \cdot 37$ | $4 \cdot 40$ | $1 \cdot 46$ | 4.43 | 1.55 | 4.46 | 1. 64 | 4.49 |
| 12 | $1 \cdot 25$ | $4 \cdot 37$ | $1 \cdot 34$ | 4.39 | $1 \cdot 43$ | $4 \cdot 42$ | $1 \cdot 52$ | $4 \cdot 45$ | 1.61 | 4.48 | $1 \cdot 71$ | $4 \cdot 52$ |
| 14 | I 32 | 4.39 | 1.41 | 4.41 | 1.50 | $4 \cdot 44$ | I. 59 | $4 \cdot 47$ | 1.68 | $4 \cdot 51$ | I. 78 | 4.55 |
| 16 | $1 \cdot 38$ | 4.41 | 1.47 | $4 \cdot 43$ | $1 \cdot 57$ | $4 \cdot 47$ | 1.66 | $4 \cdot 50$ | 1.76 | $4 \cdot 54$ | 1.86 | $4 \cdot 58$ |
| 18 | 1.45 | $4 \cdot 43$ | I 55 | $4 \cdot 46$ | I. 64 | $4 \cdot 49$ | 1.74 | $4 \cdot 53$ | I. 84 | 4.57 | 1.94 | 4.61 |
| 20 | I. 53 | 4.45 | 1.62 | 4.49 | $1 \cdot 72$ | 4.52 | 1.82 | $4 \cdot 56$ | I.92 | $4 \cdot 60$ | 2.03 | $4 \cdot 65$ |
| 22 | 1.60 | $4 \cdot 48$ | 1・ク0 | $4 \cdot 52$ | I.81 | 4.56 | I.91 | $4 \cdot 60$ | 2.02 | $4 \cdot 64$ | $2 \cdot 13$ | $4 \cdot 69$ |
| 24 | 1.69 | 4.51 | I.79 | $4 \cdot 55$ | 1.90 | $4 \cdot 59$ | 2.01 | $4 \cdot 64$ | $2 \cdot 12$ | 4.69 | $2 \cdot 23$ | 4.74 |
| 26 | I 78 | $4 \cdot 54$ | 1.88 | 4.59 | $2 \cdot 00$ | 4.63 | $2 \cdot 11$ | $4 \cdot 68$ | 2.23 | $4 \cdot 74$ | $2 \cdot 35$ | 4.80 |
| 28 | 1.87 | $4 \cdot 58$ | 1.99 | $4 \cdot 63$ | $2 \cdot 10$ | $4 \cdot 68$ | 2.22 | $4 \cdot 74$ | $2 \cdot 35$ | $4 \cdot 80$ | $2 \cdot 47$ | $4 \cdot 86$ |
| 30 | $\pm .98$ | 4.63 | $2 \cdot 10$ | $4 \cdot 68$ | 2.22 | 4.73 | $2 \cdot 35$ | $4 \cdot 80$ | $2 \cdot 48$ | $4 \cdot 86$ | 2.61 | 4.93 |
| 32 | 2.09 | $4 \cdot 68$ | 2.22 | 4.73 | $2 \cdot 35$ | $4 \cdot 80$ | 2.48 | $4 \cdot 86$ | $2 \cdot 62$ | $4 \cdot 94$ | $2 \cdot 77$ | $5 \cdot 01$ |
| 34 | $2 \cdot 22$ | $4 \cdot 73$ | $2 \cdot 35$ | $4 \cdot 80$ | 2.49 | $4 \cdot 87$ | 2.63 | $4 \cdot 94$ | $2 \cdot 78$ | 5.02 | $2 \cdot 94$ | $5 \cdot 11$ |
| 36 | 2.36 | 4.80 4.88 | 2.50 | 4.87 | $2 \cdot 65$ | 4.95 | $2 \cdot 80$ | 5.04 | 2.97 | 5.13 | $3 \cdot 14$ | 5.23 |
| 38 | 2.52 | $4 \cdot 88$ | 2.67 | $4 \cdot 96$ | 2.83 | $5 \cdot 05$ | 3.00 | $5 \cdot 15$ | $3 \cdot 18$ | $5 \cdot 25$ | $3 \cdot 37$ | $5 \cdot 37$ |
| 40 | 2.69 | $4 \cdot 97$ | 2.86 | $5 \cdot 06$ | 3.03 | $5 \cdot 17$ | $3 \cdot 22$ | $5 \cdot 28$ | 3.42 | $5 \cdot 40$ | $3 \cdot 63$ | 5.54 |
| 41 | $2 \cdot 78$ | 5.02 | 2.96 | $5 \cdot 12$ | $3 \cdot 15$ | $5 \cdot 23$ | $3 \cdot 35$ | $5 \cdot 36$ | $3 \cdot 56$ | $5 \cdot 49$ | $3 \cdot 79$ | 5.64 |
| 42 | 2.89 | 5.08 | 3.07 | $5 \cdot 19$ | 3.27 | $5 \cdot 31$ | $3 \cdot 48$ | $5 \cdot 44$ | $3 \cdot 71$ | $5 \cdot 59$ | 3.95 | 5.76 |
| 43 | 3.00 | $5 \cdot 15$ | 3.19 | $5 \cdot 26$ | 3.40 3.55 | $5 \cdot 39$ | 3.63 | 5.54 | 3.87 | 5.70 5.82 | 4.14 | 5.89 |
| 44 | $3 \cdot 12$ | $5 \cdot 22$ | 3.33 | $5 \cdot 34$ | $3 \cdot 55$ | $5 \cdot 49$ | $3 \cdot 79$ | $5 \cdot 65$ | 4.06 | $5 \cdot 82$ | $4 \cdot 35$ | 6.03 |

## LATITUDE $17^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  | s. |  | s. |  |  |
| $\bigcirc$ | [5137 | - I 3.36 |  | -r.38 | $\begin{array}{llll}5 & 34 & 26 \cdot 7 \\ 5 & 25 & 28 \cdot 0\end{array}$ | - $\mathrm{I} \cdot 39$ |  | -1.41 | $\begin{array}{llll}5 & 31 & 37 \cdot 1 \\ 5 & 22 & 30.2\end{array}$ | - 1.43 | $\begin{array}{llll}5 & 30 & 10 \cdot 4 \\ 5 & 20 & 50 \cdot 0\end{array}$ | 6 |
| 2 | 5282 | 1. | $52654 \cdot 8$ | $1 \cdot 4$ | ${ }^{5} 2528280$ | 1.46 | 5 $23 \begin{array}{lll}59 & 59\end{array}$ | 1.48 | $5 \begin{array}{llll}5 & 22 & 30 \cdot 2\end{array}$ | I.51 | 52059.0 | I |
| 4 | $\begin{array}{lll}5 & 19 & 20 \\ 5 & 10 & 3\end{array}$ | 1.4 | $\begin{array}{lll}5 & 17 & 5 \\ 5 & 8 \\ 4\end{array}$ | 1 | 5 | 1.53 $\mathrm{r} \cdot 60$ | $\begin{array}{rrrr}5 & 14 & 54 \cdot 3 \\ 5 & 5 & 45 \cdot 9\end{array}$ |  | $\begin{array}{crrr}5 & 13 & 20 \cdot 3 \\ 5 & 4 & 7 \cdot 2\end{array}$ | r.66 | $\begin{array}{rrrr}5 & \text { II } & 44 \cdot 5 \\ 5 & 2 & 26 \cdot 4\end{array}$ | 1 |
| 8 | 5 I 31 | r. 60 | $45954 \cdot \%$ | 1.64 | $4 \quad 58 \quad 15 \cdot 6$ | 67 | $45634 \cdot 2$ | 71 | $454 \begin{array}{lll}40 \cdot 6\end{array}$ | $1 \cdot 75$ | $\begin{array}{lll}4 & 53 & 4 \cdot 6\end{array}$ | 79 |
| 10 | $45230 \cdot 3$ |  | 45048.8 | 7 | 449 5•1 | 75 | 44718.9 |  | $44530 \cdot \mathrm{I}$ |  | $44338 \cdot 6$ | . 88 |
| 12 | 44325.5 | 1.75 | 44139.5 | r.79 | $43950 \cdot 9$ | I.83 | $437 \quad 39.5$ | r.88 | $436 \quad 5 \cdot 3$ | r.93 | $434 \quad 7 \cdot 9$ | I.98 |
| 13 | 43851.8 | 8 | 4373.5 | I.83 | $43512 \cdot 3$ | r.88 | 43318.3 | -93 | $43121 \cdot 1$ | I-98 | $42920 \cdot 7$ | 2.03 |
| 14 | $43417 \cdot 3$ | 1.82 | 43226.4 | 87 | $43032 \cdot 6$ | 1.92 | $42835 \cdot 8$ | -97 | $42635 \cdot 7$ | 2.03 | 4 $2432 \cdot 2$ | 2.09 |
| 15 | 42941.7 | 1.86 | 42748.4 | r.91 | $42551 \cdot 9$ | I.97 | $42352 \cdot \mathrm{I}$ | 2.02 | 42149.0 |  | $41942 \cdot 2$ | $2 \cdot 14$ |
| 16 | $25 \quad 5 \cdot 2$ |  | 423 |  | $42 \mathrm{I} \quad 9.9$ |  | 4197.2 |  | $\begin{array}{lll}4 & 17 & 0.8\end{array}$ |  |  | 20 |
| 17 | 42027.5 | I. 95 | 41888 <br> 18 | $2 \cdot 01$ | 41626.7 | 2.07 | $41420 \cdot 8$ | $2 \cdot 13$ | ${ }_{4} 121212$ | $2 \cdot 19$ | $4 \quad 957 \cdot 5$ | $2 \cdot 26$ |
| 18 | $4 \begin{array}{llllllllll}4 & 15\end{array}$ | 2.00 | $\begin{array}{llllllllll}4 & 17\end{array}$ | 2.06 | $4 \mathrm{II} 42 \cdot \mathrm{I}$ | 2.12 | $\begin{array}{llll}4 & 9 & 33 \cdot 1 \\ 4 & 4\end{array}$ | $2 \cdot 18$ | $\begin{array}{lll}4 & 720 \cdot 0\end{array}$ | 2.25 | $\begin{array}{lll}4 & 5 & 2 \cdot 7 \\ 4 & 0 & 6 .\end{array}$ | 2.33 |
| 19 | $4 \begin{array}{lll}41 & 8.9\end{array}$ | 2.04 | $\begin{array}{lll}4 & 9 & 4.4\end{array}$ | $2 \cdot 11$ | $4 \quad 656 \cdot \mathrm{I}$ | $2 \cdot 17$ | $\begin{array}{lllll}4 & 4 & 43 \cdot 8\end{array}$ | 24 | $\begin{array}{llll}4 & 2 & 27.2 \\ 3 & 57 & 32.5\end{array}$ | $2 \cdot 31$ | 4 | $2 \cdot 39$ |
| 20 | $\begin{array}{llll}4 & 627.7\end{array}$ | 2.09 | $4 \quad 4 \quad 20 \cdot 2$ | $2 \cdot 16$ | $4 \quad 28.6$ | 2.23 | $35952 \cdot 8$ | $2 \cdot 30$ | $35732 \cdot 5$ | $2 \cdot 38$ | $\begin{array}{lll}3 & 55 & 7\end{array}$ | $2 \cdot 46$ |
| 21 | 4 I 45 - |  | 359 |  | 357 |  | $\begin{array}{lll}3 & 55 & 0.2\end{array}$ |  | $35236 \cdot 0$ |  | 3506.9 | 3 |
| 22 | 5718 | $2 \cdot 20$ | $35447 \cdot 2$ | $2 \cdot 27$ | 352 | $2 \cdot 35$ | 350 | $2 \cdot 43$ | $34737 \cdot 5$ | $2 \cdot 51$ | $3454{ }^{\circ} 0$ | \% |
| 23 | $\begin{array}{llll}3 & 52 & 15.8 \\ 3 & 47 & 28.7\end{array}$ | 2.25 |  | 33 | $\begin{array}{llllllll}3 & 47 & 36 \cdot 3\end{array}$ | 2.41 | $\begin{array}{llll}3 & 45 & 9.2\end{array}$ | $2 \cdot 50$ | $\begin{array}{llllll}3 & 42 & 36 \cdot 8 \\ 3 & 37 & \end{array}$ | 2.66 |  | 2.68 |
| 24 | 34728.7 | $2 \cdot 31$ | $345 \quad 7 \cdot 8$ | $2 \cdot 39$ | $34241 \cdot 9$ | $2 \cdot 48$ | $34010 \cdot 6$ | 2.57 | $33733 \cdot 9$ | 2.66 | 33451 | $2 \cdot 76$ |
| 25 | 34239 | $2 \cdot 37$ | $34015 \cdot 3$ | 2.45 | $3 \quad 3745 \%$ | 2.54 | $\begin{array}{llll}3 & 35 & 9.9\end{array}$ | $2 \cdot 64$ | $33228 \cdot 5$ | 2.74 | 32940 |  |
| 26 | 33749.4 | 2.43 | $3 \begin{array}{llll}35 & 20.8\end{array}$ | 52 | 33246.7 | 62 | 3306.7 | 2 | $32720 \cdot 5$ | 2.83 | $32427 \cdot 5$ | 94 |
| 27 | $\begin{array}{lllll}3 & 32 & 56.9\end{array}$ | $2 \cdot 5$ | $\begin{array}{llll}3 & 30 & 24.3\end{array}$ | $2 \cdot 59$ | $32745 \%$ | $2 \cdot 69$ | $\begin{array}{llll}3 & 25 & 1.0\end{array}$ | 2.80 | 32296 | $2 \cdot 9$ | $3 \mathrm{I9}$ II• | 3.04 |
| 28 | 3 28 | 2.5 |  | 2. | $\begin{array}{llll}322 & 42\end{array}$ | 2.77 | $\begin{array}{llll}3 & 19 & 52 \cdot 5\end{array}$ |  | 31655.6 | 3.01 | $\begin{array}{llll}3 & 13 & 51 \cdot 3\end{array}$ | $3 \cdot 14$ |
| 29 | $\begin{array}{llll}3 & 23 & 5 \cdot 6\end{array}$ | $2 \cdot 64$ | $\begin{array}{llll}3 & 20 & 24 \cdot 1\end{array}$ |  | 31736.0 | 86 | $\begin{array}{llllllllll}3 & 14 & 40 \cdot 9\end{array}$ | 2, | 3 II 38.4 | $3 \cdot \mathrm{Ir}$ | $\begin{array}{llll}3 & 8 & 27 \cdot 8\end{array}$ |  |
| 30 | $\begin{array}{llll}3 & 18 & 6.5\end{array}$ | 2.72 | $\begin{array}{lllll}3 & 15 & 20 \cdot 1\end{array}$ | 2.83 | $31226 \cdot$ | $2 \cdot 95$ | $\begin{array}{llll}3 & 9 & 26 \cdot 2\end{array}$ | 3.08 | $\begin{array}{llll}3 & 6 & 17.5\end{array}$ | 3.22 | $\begin{array}{lll}3 & 3 & 0 \cdot 3\end{array}$ | $3 \cdot 36$ |
| 3 | 13 | 2.80 |  | 22 | 3 7 14. | 3.04 | $\begin{array}{llll}3 & 4 & 7 \cdot 9 \\ 2\end{array}$ | 3.18 | $3 \quad 052$ | 3.33 | 257 | 49 |
| 32 | ${ }^{3}$ | $2 \cdot 89$ | $\begin{array}{llll}3 & 5 & 3.4\end{array}$ | 3.01 | 3 I 58.8 | . 15 | $\begin{array}{lllll}2 & 58 & 45 \cdot 7\end{array}$ | 3.29 | 25523.6 | 3.45 | 25151.8 | 3.62 |
| 33 | $\begin{array}{llll}3 & 2 & 52 \cdot 7\end{array}$ | $2 \cdot 98$ | $25950 \cdot 2$ | $3 \cdot 11$ | $25639 \cdot 3$ | $3 \cdot 26$ | 25319.4 | 3.41 | $24949 \cdot 8$ | $3 \cdot 58$ | 24698 | 3.7 |
| 34 | ${ }^{2} 5741 \cdot 9$ | 3.07 | $\begin{array}{llllllllllllll}2 & 54 & 33 \cdot 2\end{array}$ | 22 | ${ }^{2} 5115 \cdot 7$ | 37 | $24748 \cdot 5$ | $3 \cdot 54$ | $\begin{array}{lll}2 & 44 & 10 \cdot 9\end{array}$ |  | $\begin{array}{llll}2 & 40 & 21.9\end{array}$ | .92 |
| 35 | 25227.5 | 3.18 | $\begin{array}{lllll}2 & 49 & 12.3\end{array}$ | 3.33 | $24547 \cdot 6$ | 3.5 | 24212.5 | 3.68 | $238 \quad 26 \cdot 2$ | 3.87 | $23427 \cdot 6$ | 4.09 |
| 36 | 47 |  | $24347 \cdot 0$ |  | 24014.5 |  | 23630.9 | 3.83 | $23235 \cdot 1$ | 4 | 22825 | 28 |
| 37 | $\begin{array}{llllll}2 & 41 & 46 \cdot 7\end{array}$ | 3 | $\begin{array}{llll}2 & 38 & 16.8\end{array}$ | $3 \cdot 59$ | 23435.9 | $3 \cdot 78$ | 23043.0 | 3.99 | $22636 \cdot 9$ | 4.22 | 222 | $4{ }^{\text {a }}$ |
| 38 | $\begin{array}{lllllllllll}26 & 19.3\end{array}$ | 3.54 | $\begin{array}{lllll}2 & 32 & 41 \\ 2 & 3\end{array}$ | 3.8 | $\begin{array}{ll}2 & 28 \\ 2 & 51 \cdot 3\end{array}$ | 3.94 | $22448 \cdot \mathrm{I}$ | 4.17 | $22030 \cdot 6$ | 3 | 556.9 | 71 |
| 39 | $\begin{array}{llllll}2 & 30 & 46 \cdot 8 \\ 2\end{array}$ | 3 | $2 \begin{aligned} & 26659 \cdot 7\end{aligned}$ | $3 \cdot 89$ | $22259 \cdot 7$ |  |  | 4.37 | $21415 \cdot \mathrm{I}$ | 4.5 | $\begin{array}{ll}9 & 26 \cdot 9\end{array}$ | . 97 |
| 40 | $\begin{array}{lll}2 & 25 & 8\end{array}$ | 3.8 | 221115 | 4.07 | $217 \quad 0.4$ | $4 \cdot 32$ | 21233.6 | 4.59 | $2749 \cdot 1$ | 4.91 | $2 \quad 244.5$ | 6 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | s. | S. | s. | s. | s. | S. | s. | s. | - | s. | s. |  |
| 2 | - 1.43 1.48 | -4.42 4.44 | - 1.51 | 4.45 | - 1.60 $\mathbf{I} .66$ | -4.48 | - 1.69 | $4 \cdot 51$ | -1.78 | $4 \cdot 54$ | $-1.87$ | 4.58 |
| 4 | r. 54 | 4.46 | r.63 | 4.47 4.49 | r r . 72 | 4.50 4.52 | $\begin{array}{r}1.75 \\ \mathrm{r} \\ \hline\end{array}$ | 4.53 4.56 | r. 84 r 90 | 4.57 4.60 | 1.93 2.00 | 4.61 4.64 |
| 6 | 1.60 | $4 \cdot 48$ | r. 69 | $4 \cdot 51$ | r.78 | $4 \cdot 55$ | 1.87 | $4 \cdot 58$ | 1.97 | $4 \cdot 62$ | 2.07 | $4 \cdot 67$ |
| 8 | 1.66 | $4 \cdot 50$ | 1.75 | $4 \cdot 54$ | r. 85 | 4.57 | I.94 | $4 \cdot 61$ | 2.04 | 4.65 | $2 \cdot 14$ | $4 \cdot 70$ |
| 10 | r.73 | 4.53 | I. 82 | 4.56 | 1.92 | $4 \cdot 60$ | 2.02 | $4 \cdot 64$ | $2 \cdot 12$ | $4 \cdot 69$ | $2 \cdot 22$ | $4 \cdot 74$ |
| 12 | r.80 | 4.55 | 1.90 | $4 \cdot 59$ | $2 \cdot 00$ | $4 \cdot 63$ | 2.10 | $4 \cdot 68$ | 2.20 | 4.73 | 2.31 | $4 \cdot 78$ |
| 14 | r. 88 | 4.58 | $\underline{1.98}$ | $4 \cdot 63$ | 2.08 | $4 \cdot 67$ | 2.18 | 4.72 | $2 \cdot 29$ | $4 \cdot 77$ | 2.40 | $4 \cdot 82$ |
| 16 | 1.96 | 4.62 | 2.06 | $4 \cdot 66$ | $2 \cdot 16$ | 4.75 | 2.27 | 4.76 | $2 \cdot 38$ | 4.81 | $2 \cdot 50$ | $4 \cdot 87$ |
| 18 | 2.04 | 4.65 | $2 \cdot 15$ | 4.70 | $2 \cdot 26$ | $4 \cdot 75$ | $2 \cdot 37$ | 4.8 I | $2 \cdot 49$ | $4 \cdot 87$ | 2.61 | 4.93 |
| 20 | $2 \cdot 14$ | 4.70 | $2 \cdot 25$ | $4 \cdot 75$ | $2 \cdot 36$ | 4.80 | 2.48 | 4.86 | 2.60 | 4.93 | 2.73 | $4 \cdot 99$ |
| 22 | $2 \cdot 24$ | 4.74 | 2.36 | 4.80 | 2.47 | $4 \cdot 86$ | 2.60 | 4.92 | $2 \cdot 73$ | 4.99 | 2.86 | 5.07 |
| 24 | $2 \cdot 35$ | 4.80 | 2.47 | 4.86 | $2 \cdot 60$ | $4 \cdot 92$ | $2 \cdot 73$ | $4 \cdot 99$ | 2.86 | 5.07 | 3.01 | $5 \cdot 15$ |
| 26 | 2.47 | 4.86 | $2 \cdot 60$ | 4.92 | 2.73 | $5 \cdot 0$ | 2.87 | 5.07 | 3.02 | $5 \cdot 16$ | $3 \cdot 17$ | 5.25 |
| 28 | $2 \cdot 60$ | 4.93 | $2 \cdot 74$ | 5.00 | 2.88 | 5.08 | 3.03 | $5 \cdot 17$ | $3 \cdot 19$ | $5 \cdot 26$ | $3 \cdot 35$ | $5 \cdot 36$ |
| 30 | 2.75 | 5.01 | $2 \cdot 90$ | 5.09 | 3.05 | $5 \cdot 18$ | 3.21 | $5 \cdot 27$ | $3 \cdot 38$ | $5 \cdot 38$ | $3 \cdot 56$ | $5 \cdot 49$ |
| 32 | 2.92 | $5 \cdot 10$ | $3 \cdot 8$ | $5 \cdot 19$ | 3.24 | $5 \cdot 29$ | 3.42 | $5 \cdot 40$ | $3 \cdot 61$ | $5 \cdot 52$ | $3 \cdot 81$ | $5 \cdot 65$ |
| 33 | $3 \cdot 01$ | $5 \cdot 15$ | $3 \cdot 17$ | $5 \cdot 25$ | $3 \cdot 35$ | $5 \cdot 36$ | 3.54 | $5 \cdot 48$ | 3.73 | $5 \cdot 61$ | $3 \cdot 94$ | $5 \cdot 75$ |
| 34 | 3 HII | 5.21 | $3 \cdot 28$ | $5 \cdot 32$ | 3.46 | 5.43 5.51 | 3.66 3.79 | 5.56 5.65 | $3 \cdot 87$ 4.02 | 5.70 5.80 | 4.09 4.25 | 5.85 |
| 35 | $3 \cdot 2 \mathrm{I}$ | $5 \cdot 27$ | 3.39 | $5 \cdot 38$ | $3 \cdot 59$ | $5 \cdot 51$ | $3 \cdot 79$ | $5 \cdot 65$ | 4.02 | 5.80 | $4 \cdot 25$ | 5.97 |
| 36 | $3 \cdot 32$ | $5 \cdot 34$ | 3.51 | $5 \cdot 46$ | 3.72 | 5.60 | 3.94 | $5 \cdot 75$ | 4.18 | 5.91 | 4.43 | $6 \cdot 10$ |
| 37 | 3.44 | $5 \cdot 42$ | 3.64 | $5 \cdot 55$ | 3.86 | $5 \cdot 69$ | $4 \cdot 10$ | 5.86 | $4 \cdot 35$ | 6.04 | $4 \cdot 63$ | $6 \cdot 24$ |
| 38 | $3 \cdot 57$ | $5 \cdot 50$ | $3 \cdot 79$ | $5 \cdot 64$ | 4.02 | $5 \cdot 80$ | $4 \cdot 27$ | $5 \cdot 98$ | 4.55 | $6 \cdot 18$ | $4 \cdot 86$ | $6 \cdot 41$ |
| 39 | 3.71 3.86 | $5 \cdot 59$ | $3 \cdot 94$ | 5.75 5.87 | $4 \cdot 19$ | 5.92 | 4.47 | $6 \cdot 12$ | 4.77 | $6 \cdot 35$ | 5.11 | ${ }_{6}^{6 \cdot 60}$ |
| 40 | 3.86 | $5 \cdot 70$ | 4-II | 5.87 | $4 \cdot 39$ | 6.06 | $4 \cdot 69$ | $6 \cdot 28$ | 5.01 | $6 \cdot 53$ | $5 \cdot 39$ | $6 \cdot 82$ |

## LATITUDE $18^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0{ }^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $2^{\circ}$ | Decl. <br> Var. | $3^{\circ}$ | Decl. <br> Var. | $4{ }^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | 0 | S. | H. M. | S. | H. M. S. | S. | H. M. S. | -3 | $5447 \cdot 6$ | S. | $55329 \cdot 1$ | S. |
| 0 | $\begin{array}{llll}6 & 0 & 0 \cdot 0 \\ 5 & \end{array}$ | I. 30 | $5 \begin{array}{llll}5 & 58 & 42 \cdot 0\end{array}$ | - I. 30 | $\begin{array}{lllll}5 & 57 & 24.0 \\ 5 & 15 & 14.7\end{array}$ | 1.30 - 35 | $\begin{array}{rrrr}5 & 56 & 5 \cdot 9 \\ 5 & \text { I3 } & 53 \cdot 1\end{array}$ | 1.30 1.37 1.30 |  | I. 31 I 39 | 5 53 $29 \cdot 1$ <br> 5 II 6.6 <br> 5   | I.3I |
| 10 | 5 17 55'I | I-32 | $5 \begin{array}{lllll}5 & 16 & 35 \cdot 4\end{array}$ | I 34 | $\begin{array}{lllll}5 & 15 & 14 \cdot 7 \\ 5 & 5 & 4\end{array}$ | 1 | $\begin{array}{lllll}5 & 13 & 53 \cdot 1 \\ 5 & 5 & \end{array}$ | $1 \cdot 37$ | $\begin{array}{lllll}5 & 12 & 30 \cdot 4\end{array}$ | I•39 | $\begin{array}{cccc}5 & \text { II } & 6.6 \\ 5 & 2 & 35.6\end{array}$ | 1.41 |
| 12 | 929.4 | 33 | $5{ }^{5} 889.0$ | I.35 | $\begin{array}{llll}5 & 6 & 47.4 \\ 4 & 58 & \end{array}$ | I.37 | $\begin{array}{lllll}5 & 5 & 24 \cdot 7 \\ 4 & 56\end{array}$ | r 39 | 5 4 $0 \cdot 8$ <br> 4 55  <br> 0.3   | I.4 | $\begin{array}{llll}5 & 2 & 35 \cdot 6 \\ 4 & 54 & \end{array}$ | I.43 |
| 14 | $\begin{array}{llll}5 & 1 & 3.3\end{array}$ | I.34 | $\begin{array}{llll}4 & 59 & 42 \cdot 0 \\ 4 & 51\end{array}$ | I.36 | $\begin{array}{llll}4 & 58 & 19.5 \\ 4 & 49 & 50.8\end{array}$ | 1.39 | $\begin{array}{lllll}4 & 56 & 55 \cdot 6 \\ 4 & 48 & \end{array}$ | 1.41 | $\begin{array}{lllll}4 & 55 & 30 \cdot 3 \\ 4 & 46 & 58.8\end{array}$ | I.43 | $\begin{array}{llll}4 & 54 & 3.5 \\ 4 & 45 & 30.2\end{array}$ | I.46 |
| 16 | $45236 \cdot 6$ | 1.36 | 45 I 14.5 | I. 38 | $44950 \cdot 8$ | 1.41 | $44825 \cdot 6$ | I 43 | $44658 \cdot 8$ | I 46 | $44530 \cdot 2$ | -49 |
| 18 | 4489 | 7 | $44246 \cdot 2$ | 1.40 | 44121.2 | 1.43 | $43954 \cdot 6$ | 1.46 | 43826.0 | $1 \cdot 49$ | $43655 \cdot 6$ | I.52 |
| 20 | $4354 \mathrm{I} \cdot 5$ | I 39 | 43417.0 | 1.42 | $43250 \cdot 7$ | 1.45 | 43122.4 | I 49 | $42952 \cdot 0$ | r 52 | $4 \begin{array}{ll} \\ 48 & 19.6\end{array}$ | I.56 |
| 22 | 42712.9 | I-4 | 42547.0 | 1.45 | $4 \begin{array}{llll}4 & 24 & 19.1\end{array}$ | 1.48 | 42248.9 | I.52 | 42116.6 | I.56 | 419 4r.8 | 60 |
| 24 | $41843 \cdot 3$ | r. 44 | 41715.9 | I-48 | $41546 \cdot 2$ | 1.51 |  | I.56 | $\begin{array}{lllll}4 & 12 & 39.5\end{array}$ | I.60 | 4 II | r. 64 |
| 25 | $41428 \cdot 1$ | -45 | $4 \begin{array}{lllll}4 & 59.9\end{array}$ | 1.49 | 4 II 29.2 | I. 53 | $4 \quad 956 \cdot 0$ | I.57 | $4 \quad 8 \quad 20 \cdot 2$ | 1.62 | $4641 \%$ |  |
| 26 | 10 |  | $4 \quad 8 \quad 43.6$ | 1.51 | 47119 | 1.55 | $4 \quad 5 \quad 376$ |  | $\begin{array}{lll}4 & 4 & 0.5\end{array}$ |  | 2 | 69 |
| 27 | $556 \cdot 9$ | I. 48 | $4 \times 426 \cdot 9$ | I-52 | 4 42 | I-5 | $4 \begin{array}{llll}4 & 1 & 18.7\end{array}$ | r. 62 | $35940 \cdot 3$ | 1. 66 | 35759.0 | -7I |
| 28 | I $40 \cdot 9$ | I. 49 | $\begin{array}{lrrr}4 & 0 & 9 \cdot 9\end{array}$ | I-54 | $35836 \cdot 0$ | I. 59 | $\begin{array}{llll}3 & 56 & 59 \cdot 3\end{array}$ | I. 64 | 35519.6 | ז.69 | $35336 \cdot 7$ | I•74 |
| 29 30 | $\begin{array}{llrr}3 & 57 & 24.5 \\ 3 & 53 & 7.8\end{array}$ | I.51 | $\begin{array}{llll}3 & 55 & 52 \cdot 5 \\ 3 & 5 \mathrm{I} & 34 \cdot 6\end{array}$ | I. 56 <br> r 58 <br> 1 | $\begin{array}{llll}3 & 54 & 17 \cdot 5 \\ 3 & 49 & 58.4\end{array}$ | I 61 I 63 |  | I.68 | $\begin{array}{lllll}3 & 50 & 58 \cdot 2 \\ 3 & 46 & 36 \cdot 3\end{array}$ | I $\cdot 71$ I 74 | $\begin{array}{llll}3 & 49 & 13 \cdot 8 \\ 3 & 44 & 50 \cdot 2\end{array}$ | 7 |
| 30 | $\begin{array}{lll}3 & 53 & 7 \cdot 8\end{array}$ | 1.5 | 35134.6 | 1.58 | 34958.4 | I. 63 | $34819 \cdot 0$ | 1.6 | $34636 \cdot 3$ | I•74 | $34450 \cdot 2$ | - |
| $3{ }^{1}$ | $4850 \cdot 7$ | I. 55 | 34716.4 | 1.60 | 34538.8 | I. 65 | $34358 \cdot 0$ | I.71 | 34213.7 | 1.77 | $34025 \cdot 8$ | . 83 |
| 32 | 4433.2 | 1.57 | $34257 \cdot 6$ | I. 62 | 34118.8 | I. 68 | $\begin{array}{lllll}3 & 39 & 36 \cdot 4\end{array}$ | 1.74 | $33750 \cdot 4$ | r. 80 | $\begin{array}{llll}3 & 36 & 0 \cdot 7\end{array}$ | . 86 |
| 33 | 4015.2 | 159 | $\begin{array}{llll}3 & 38 & 38.4\end{array}$ | I. 64 | $3 \begin{array}{lllll}36 & 5 \cdot 1\end{array}$ | I.70 | $3 \quad 3514 \cdot 1$ | 1.76 |  | r. 83 | 3 31 34*7 | -89 |
| 34 | 35 56•8 | I. 61 | $33418 \cdot 6$ | 1.67 | $\begin{array}{lllll}3 & 32 & 36 \cdot 8\end{array}$ | $1 \cdot 73$ | $\begin{array}{llll}3 & 30 & 51 \cdot 2\end{array}$ | r 79 |  | r. 86 | $27 \quad 7 \cdot 9$ | I•93 |
| 35 | $\begin{array}{llll}3 & 31 & 38.0\end{array}$ | I. 63 | $32958 \cdot 3$ | I. 69 | $\begin{array}{llll}3 & 28 & 14.9\end{array}$ | I•76 | $\begin{array}{llll}3 & 26 & 27.5\end{array}$ | 1.82 | $32436 \cdot 0$ | I.89 | $32240 \cdot 1$ | 1.97 |
| 36 | 2718.6 | 1.6 | 32537.4 | I.72 | 32352.3 | - | 3223.0 |  | 32094 | I.93 | $318 \mathrm{II} \cdot 3$ | 2.01 |
| 37 | $2258 \cdot 6$ | I.68 | $32115 \cdot 8$ | - 75 | $\begin{array}{llll}3 & 19 & 28.9\end{array}$ | I.82 | $31737 \cdot 7$ | I.89 | $31541 \cdot 9$ | 1.97 | 31341.4 | 2.05 |
| 38 | $\begin{array}{llll}3 & 18 & 38 \cdot 0\end{array}$ | I•71 |  | I.78 | $\begin{array}{llll}3 & 15 & 4 \cdot 8\end{array}$ | I.85 | $3 \mathrm{I}_{3} \mathrm{II} \cdot 4$ | I.93 | 3 II 13.4 | 2.01 | $\begin{array}{llll}3 & 9 & 10 \cdot 4\end{array}$ | 2.09 |
| 39 | $\begin{array}{rrrr}3 & 14 & 16 \cdot 8 \\ 3 & 9 & 54 \cdot 8\end{array}$ | 1.73 1.76 |  | I. $\cdot 8 \mathrm{I}$ $\mathrm{I} \cdot 84$ | $\begin{array}{crrr}3 & 10 & 39 \cdot 7 \\ 3 & 6 & 13.8\end{array}$ | I 89 I .92 |  | 1.97 2.01 |  | 2.05 $2 \cdot 10$ | $\begin{array}{ccr}3 & 4 & 38 \cdot 1 \\ 3 & 0 & 4 \cdot 5\end{array}$ | $2 \cdot 14$ 219 |
| 40 | $\begin{array}{llll}3 & 9 & 54\end{array}$ | I•76 | $\begin{array}{llll}3 & 8 & 6 \cdot 7\end{array}$ | . 84 |  | 1.92 | 3416.0 | 2.0 | $\begin{array}{llll}3 & 2 & 12.9\end{array}$ | $2 \cdot 10$ | $\begin{array}{llll}3 & 0 & 4 \cdot 5\end{array}$ |  |
| 41 | 32.2 | I. 80 | $\begin{array}{llll}3 & 3 & 42.0\end{array}$ | I. 88 | $\begin{array}{llll}3 & 1 & 46.9\end{array}$ | 1.96 | $25946 \cdot 6$ | 2.05 | $25740 \cdot 8$ |  | 25529.4 | 2.24 |
| 42 | $\begin{array}{cccc}3 & 1 & 8.7\end{array}$ | I.83 | $\begin{array}{llll}2 & 59 & 16 \cdot 4 \\ 2 & 54\end{array}$ | I.91 | $\begin{array}{llll}2 & 57 & 19.0\end{array}$ | 2.00 | $25516 \cdot 0$ | $2 \cdot 10$ | $\begin{array}{llll}2 & 53 & 7 \cdot 4 \\ 2 & 4 & \end{array}$ | 2.19 |  | 2.30 2.35 |
| 43 | 25644.4 | 1.87 | $25449 \cdot 8$ | 1.95 | $25249 \cdot 8$ | 2.05 | $25044 \cdot \mathrm{I}$ | I 4 | $24832 \cdot 4$ | 2.25 | 24614.4 | 2.35 |
| 44 |  | I•90 | $25022 \cdot \mathrm{I}$ | $2 \cdot 00$ | $\begin{array}{llllll}2 & 48 & 19.4\end{array}$ | $2 \cdot 09$ | $24610 \cdot 8$ | 2.20 | $24355 \cdot 8$ | $2 \cdot 3$ | 24134.2 | $2 \cdot 42$ |
| 45 | 24752.8 | 94 | $24553 \cdot 3$ | 2.04 | $24347 \cdot 7$ | $2 \cdot 14$ | 24135.9 | 5 | 23917.4 | $2 \cdot 37$ | $23652 \cdot 0$ | $2 \cdot 49$ |
| 46 | 4325.4 | I•99 | $24123 \cdot 1$ | 2.09 | 23914.5 | 2.20 | 23659.3 | $2 \cdot 31$ | $23437 \cdot 1$ | 2.43 | $\begin{array}{lll}2 & 32 & 7.5\end{array}$ | 56 |
| 47 | $\begin{array}{lllll}2 & 38 & 56.8\end{array}$ | 2.03 | $2365 \mathrm{I} \cdot 6$ | $2 \cdot 14$ |  | 2.2 | $23220 \cdot 9$ | $2 \cdot 37$ | 22954.7 | 2.5 | $22720 \cdot 6$ | $2 \cdot 64$ |
| 48 | 23426.9 | 2.08 | 232 I 8.5 | $2 \cdot 20$ | 230302 | $2 \cdot 32$ | $22740 \cdot 5$ | 44 | $\begin{array}{lll}2 & 25 & 9.9\end{array}$ | 2.58 | $\begin{array}{llll}2 & 22 & 31 \cdot 1\end{array}$ | 2.72 |
| 49 | $22955 \cdot 6$ | $2 \cdot 14$ | 22743.8 | 26 | $2 \begin{aligned} & 25 \\ & 2\end{aligned}$ | 2.38 | $\begin{array}{lll}2 & 22 & 57.8 \\ 2 & 18 & \text { I2.7 }\end{array}$ | 2.52 2.60 | $\begin{array}{llll}2 & 20 & 22.7 \\ 2 & 15 & 32 \cdot 5\end{array}$ | 2.66 | $\begin{array}{llll}2 & 17 & 38.6 \\ 2 & 12 & 42.8\end{array}$ | 2.81 2.91 |
| 50 | 22522.7 | $2 \cdot 19$ | $223 \quad 7 \cdot 4$ | $2 \cdot 32$ | 22044.2 | $2 \cdot 46$ | 21812.7 | 2.60 | $21532 \cdot 5$ | $2 \cdot 75$ | 21242.8 | 2.91 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ | A. | L. $1^{\circ}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 。 | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| $\bigcirc$ | - .00 | -4.20 | --08 | -4.21 | $-\cdot 15$ | -4.21 | -. 23 | -4.21 | $-31$ | -4.22 | - 39 | $-4.22$ |
| 4 | $\cdot 9$ | 4.21 | -17 | 4.21 | $\cdot 25$ | 4.21 | $\cdot 33$ | 4.22 | $\cdot 41$ | 4.23 | - 48 | 4.23 |
| 6 | - I4 | 4.21 | - 22 | 4.21 | $\cdot 30$ | 4.22 | $\cdot 38$ | $4 \cdot 22$ | -46 | $4 \cdot 23$ | $\cdot 54$ | 4.24 |
| 8 | $\cdot 19$ | $4 \cdot 21$ | $\cdot 27$ | $4 \cdot 21$ | $\cdot 33$ | 4.22 | -43 | 4.23 | $\cdot 51$ | 4.24 | $\cdot 59$ | 4.25 |
| 10 | -24 | $4 \cdot 2 \mathrm{I}$ | -32 | $4 \cdot 22$ | -40 | 4.22 | -48 | 4.23 | $\cdot 56$ | $4 \cdot 24$ | . 64 | 4.25 |
| 12 | -29 | 4.21 | $\cdot 37$ | 4.22 | $\cdot 45$ | 4.23 | -53 | 4.24 | .6I | 4.25 | . 69 | 4.26 |
| 14 | $\cdot 34$ | 4.22 | -42 | 4.23 | - 50 | 4.24 | $\cdot 58$ | 4.25 | $\cdot 67$ | 4.26 | $\cdot 75$ | 4.27 |
| 16 | -39 | $4 \cdot 22$ | 48 | $4 \cdot 23$ | -56 | 4.24 | -64 | $4 \cdot 25$ | $\cdot 72$ | 4.27 | -81 | $4 \cdot 28$ |
| 18 | -45 | 4.23 | $\cdot 53$ | 4.24 | .61 | $4 \cdot 25$ | $\cdot 70$ | 4.26 | $\cdot 78$ | $4 \cdot 28$ | $\cdot 87$ | 429 |
| 20 | -50 | $4 \cdot 23$ | $\cdot 58$ | $4 \cdot 25$ | $\cdot 67$ | $4 \cdot 26$ | $\cdot 76$ | 4.27 | -84 | 4.29 | -93 | 431 |
| 22 | $\cdot 56$ | 4.24 | $\cdot 64$ | $4 \cdot 25$ | -73 | 4.27 | . 82 | $4 \cdot 28$ | -90 | $4 \cdot 30$ | -99 | $4 \cdot 32$ |
| 24 | . 61 | 4.25 | $\cdot 70$ | 4.26 | $\cdot 79$ | $4 \cdot 28$ | . 88 | $4 \cdot 30$ | -97 | $4 \cdot 32$ | I. 06 | 4.34 |
| 26 | $\cdot 67$ | $4 \cdot 26$ | $\cdot 76$ | $4 \cdot 27$ | . 86 | $4 \cdot 29$ | $\cdot 95$ | 4.31 | $\mathrm{r} \cdot 04$ | $4 \cdot 33$ | I. 13 | $4 \cdot 36$ |
| 28 30 | .74 | 4.27 4.28 | -83 | 4.29 | '92 | $4 \cdot 31$ | I. 02 | 4.33 | I•II | 4.35 | 1.21 | $4 \cdot 38$ |
| 30 | -80 | $4 \cdot 28$ | -90 | $4 \cdot 30$ | '99 | $4 \cdot 32$ | 1.09 | 4.35 | I•19 | $4 \cdot 37$ | I 29 | $4 \cdot 40$ |
| 32 34 | . 87 | 4.29 4.31 | $\cdot 97$ $\times 105$ | 4.32 4.33 | 1.07 1.15 | 4.34 4.36 | 1.17 1.25 | 4.37 4.39 | 1.27 1.36 | 4.39 4.42 | 1.38 1.47 | 4.43 4.46 |
| 36 | $1 \cdot 02$ | 4.33 | $1 \cdot 13$ | 4.35 | 1.23 | $4 \cdot 38$ | 1.34 | $4 \cdot 4 \mathrm{I}$ | I. 45 | $4 \cdot 45$ | 1.57 | $4 \cdot 49$ |
| 38 | I•10 | $4 \cdot 35$ | I-2I | $4 \cdot 38$ | 1.32 | $4 \cdot 41$ | I-44 | $4 \cdot 45$ | r. 56 | $4 \cdot 48$ | 1.68 | $4 \cdot 53$ |
| 40 | I•19 | $4 \cdot 37$ | $1 \cdot 31$ | 4.40 | 1.42 | $4 \cdot 44$ | $1 \cdot 54$ | $4 \cdot 48$ | 1. 67 | 4.52 | $1 \cdot 79$ | $4 \cdot 57$ |
| 42 | 1.29 | 4.40 | 1.41 | $4 \cdot 43$ | 1.53 | $4 \cdot 48$ | 1. 66 | $4 \cdot 52$ | 1•79 | 4.57 | 1.92 | 4.62 |
| 44 | I. 39 | $4 \cdot 43$ | I. 52 | $4 \cdot 47$ | I. 65 | $4 \cdot 52$ | 1.78 | 4.57 | I. 92 | 4.62 | $2 \cdot 07$ | 4.69 |
| 46 | $1 \cdot 50$ | 4.47 | I. 64 | $4 \cdot 5 \mathrm{I}$ | $1 \cdot 78$ | 4.57 | 1.92 | 4.62 | 2.07 | $4 \cdot 69$ | $2 \cdot 23$ | $4 \cdot 76$ |
| 48 | 1.63 | $4 \cdot 51$ | 1.77 | 4.56 | 1.92 | 4.62 | 2.08 | $4 \cdot 69$ | 2.24 | 4.77 | 2.42 | 4.85 |
| 50 | 1.77 | $4 \cdot 56$ | $1 \cdot 92$ | $4 \cdot 62$ | $2 \cdot 09$ | $4 \cdot 69$ | $2 \cdot 26$ | 4.77 | 2.44 | $4 \cdot 86$ | $2 \cdot 64$ | $4 \cdot 96$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 195

## LATITUDE $18^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| $\begin{aligned} & \text { True } \\ & \text { Alt. } \end{aligned}$ | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. | S. | H. M. | S. | M. | S. | H. M. S. | S. |  | S. | M. S. | s. |
| $\bigcirc$ | 552 10.3 | - $1 \cdot 3$ | 5505 | -I.32 | $5493 \mathrm{I} \cdot 8$ | -I. 33 | 548 12.0 | -I.33 | $5{ }_{5}^{5} 46$ | - I. 34 | $545 \quad 30 \cdot 9$ | - I*35 |
| 6 | $\begin{array}{lllll}5 & 26 & 43 \cdot 8\end{array}$ | $1 \cdot 3$ | $\begin{array}{lllll}5 & 25 & 20 \cdot 8\end{array}$ | I.39 | $\begin{array}{lllllllllll}5 & 23 & 57\end{array}$ | I.40 | 52232 | $1 \cdot 42$ | $\begin{array}{lll}5 & 21 & 6 \cdot 3\end{array}$ | I 44 | 5 I9 $39 \cdot 4$ | 1.46 |
| 8 | $\begin{array}{llllll}5 & 18 & 13 \cdot 2\end{array}$ | I. 40 | $\begin{array}{llll}5 & 16 & 48 \cdot 7\end{array}$ | 1 | $515 \begin{array}{llll}5 & 15 & 23\end{array}$ | I-43 | $\begin{array}{llll}5 & 13 & 56 \cdot 5\end{array}$ | I.46 | $\begin{array}{lllll}5 & 12 & 28 \cdot 5\end{array}$ | I. 48 | 5 10 $59 \cdot 2$ | I. 50 |
| 10 | $\begin{array}{llll}5 & 9 & 41 \cdot 7\end{array}$ | 1. | $\begin{array}{llll}5 & 8 & 15 \cdot 5\end{array}$ | 1 | $5 \quad 6 \quad 48 \cdot 0$ | 1.47 | $\begin{array}{lll}5 & 5 & 19\end{array}$ | I.49 | $\begin{array}{llll}5 & 3 & 49 \cdot 1\end{array}$ | I. 52 | $\begin{array}{llll}5 & 2 & 17 \cdot 3\end{array}$ | - 54 |
| 12 | $\begin{array}{lll}5 & 1 & 9 \cdot 1\end{array}$ | 1.45 | $4594 \mathrm{I} \cdot \mathrm{I}$ | 1. | 458 II•6 | I. 50 | $4 \quad 56 \quad 40 \cdot 6$ | I. 53 | 4558.0 | 1.56 | $453 \quad 33 \cdot 5$ | 1.59 |
| 14 | $45235 \cdot$ |  | 4515 |  | $44933 \cdot$ | I 5 | $\begin{array}{llr}4 & 48 & 0.2\end{array}$ |  | $\begin{array}{llll}4 & 46 & 24.9\end{array}$ | 60 | 444 47.6 | 4 |
| 16 | $444 \quad 0.0$ | $1 \cdot 5$ | $442 \quad 27 \cdot 9$ | I•55 | 44053.9 | I'5 | 43917.9 | 1.62 | $43739 \cdot 8$ | I-65 | 435 59.5 | 1.69 |
| 18 | $\begin{array}{llll}4 & 35 & 23 \cdot 3\end{array}$ | I. 56 | $43348 \cdot 9$ | 1.5 | $\begin{array}{llll}4 & 32 & 12.3\end{array}$ | I. | $43033 \cdot$ | 1.67 | $\begin{array}{llll}4 & 28 & 52.4\end{array}$ | I-71 | $\begin{array}{lll}4 & 27 & 8 \cdot 7\end{array}$ | 5 |
| 20 | $42644 \cdot 9$ | I. 60 | 42580 | 1. | $4 \begin{array}{lll}4 & 23 & 28 \cdot 6\end{array}$ | I. 68 |  | I.72 | 420204 | 1.76 | $4 \begin{array}{lll}48 & 15 \cdot 2\end{array}$ | I |
| 21 | 422250 | I. 62 | $42046 \cdot 7$ | 1.66 | $4 \begin{array}{lll}4 & 19 & 5.9\end{array}$ | I•70 | 4 17 22.6 | 1.75 | $41536 \cdot 4$ | r 79 | $4 \quad 13 \quad 47 \cdot 4$ | r. 84 |
| 22 | 4184 |  | 4 I6 25 | I. 68 | 414 |  | 41257 |  | 4 II 9.6 | 2 | $\begin{array}{llll}4 & 9 & 18 \cdot 6\end{array}$ | . 88 |
| 23 | $41343 \cdot 8$ | I | $412 \quad 2 \cdot 7$ |  | 4 10 18.7 | $1 \cdot 7$ | $48831 * 9$ | O | $4642 \cdot 1$ | 1.86 | $4 \quad 4$ | 1 |
| 24 | $4 \quad 922.4$ | I. 69 | $47739 \cdot 7$ | $1 \cdot 74$ | $4554 \cdot 1$ | I•78 | $\begin{array}{llll}4 & 4 & 5 \cdot 5\end{array}$ | I.84 | $\begin{array}{llll}4 & 2 & 13.7\end{array}$ | 1-89 | $\begin{array}{lrrr}4 & 0 & 18 \cdot 6\end{array}$ | I.95 |
| 25 | $\begin{array}{llr}4 & 5 & 0.4 \\ 4 & 0 & 3\end{array}$ |  | 4 3 $16 \cdot 1$ <br> 3 5 51.8 | I•76 | $\begin{array}{lrrr}4 & 1 & 28 \cdot 8\end{array}$ | I. | $\begin{array}{llll}3 & 59 & 38 \cdot 3 \\ 3 & 55 & 10 \cdot 2\end{array}$ | 1.87 | $\begin{array}{llll}3 & 57 & 44.4\end{array}$ | I.93 | $3{ }^{3} 55547 \cdot 1$ | 1.99 |
| 26 | $4 \quad 0 \quad 37 \cdot 8$ | $1 \cdot 74$ | $\begin{array}{lllll}3 & 58 & 51.8\end{array}$ | I.79 | $\begin{array}{lll}3 & 57 & 2.7\end{array}$ | 1.85 | 35510.2 | 1.90 | 35314.2 | I.96 | 35114.6 | 2.02 |
| 27 | 35614.5 |  | 35426.8 | I. 82 | $3515235 \cdot 8$ | I. 88 | $3504 \mathrm{I} \cdot$ |  | $34^{3} 4843 \cdot 1$ | - | $3{ }^{3} 464 \mathrm{I} \cdot \mathrm{O}$ | . 07 |
| 28 | $35150 \cdot 6$ | I.80 | 350 I•I | I. 85 | $\begin{array}{llll}3 & 48 & 8 \cdot 1\end{array}$ | I.91 | 346 II•4 | 8 | $\begin{array}{llllll}3 & 44 & 10 \cdot 9\end{array}$ | $2 \cdot 04$ | $3426 \cdot 3$ | II |
| 29 | 34725.9 | I.83 | $34534 \cdot 5$ | I-8 | $\begin{array}{lllll}3 & 43 & 39 & 4\end{array}$ | 1 | $34140 \cdot 5$ | 2 |  | $2 \cdot 0$ | $\begin{array}{llll}3 & 37 & 30 \cdot 3\end{array}$ | 16 |
| 30 | $\begin{array}{llll}3 & 43 & 0.5\end{array}$ | I-86 | 3415 | I.92 | $\begin{array}{llll}3 & 39 & 9 \cdot 8\end{array}$ | I.99 | $\begin{array}{llll}3 & 37 & 8 \cdot 5\end{array}$ | 2.06 | $\begin{array}{llll}3 & 35 & 3 \cdot 0\end{array}$ | $2 \cdot 13$ | $\begin{array}{llll}3 & 32 & 53 \cdot 1\end{array}$ | 0 |
| 31 | $\begin{array}{llll}3 & 38 & 34 \cdot 2\end{array}$ | r.89 | $\begin{array}{llll}3 & 36 & 38 \cdot 7\end{array}$ | I.96 | $33439 \cdot 2$ | 2.03 | $33235 \cdot 4$ |  | $3 \quad 30 \quad 27 \cdot 2$ | 2.17 | $3 \quad 2814.4$ | $2 \cdot 25$ |
| 32 | $\begin{array}{lll}3 & 34 & 7 \cdot 1\end{array}$ | -96 | $\begin{array}{lll}3 & 32 & 9.4 \\ 3 & 27 & \end{array}$ |  | $\begin{array}{lll}3 & 30 & 7 \cdot 5 \\ 3 & 25 & 34.6\end{array}$ | 2.07 | 3 28 r |  | 32550 | . 22 | 3 23 34.2 <br> 3 1  | I |
| 3 | $\begin{array}{lll}3 & 29 & 39 \cdot 0\end{array}$ | 1.96 | $\begin{array}{llll}3 & 27 & 39.0 \\ 3 & 23 & 7.5\end{array}$ | $2 \cdot 04$ | 3 25 34.6 <br> 3 21  | 2.11 | $\begin{array}{llll}3 & 23 & 25 \cdot 5 \\ 3 & 18 & 58\end{array}$ |  | 3 lll II• | $2 \cdot 28$ | $\begin{array}{lllll}3 & 18 & 52 \cdot 4 \\ 3 & 14 & 8 \cdot 9\end{array}$ | $2 \cdot 36$ |
| 3 | $\begin{array}{llll}3 & 25 & 10 \cdot 0\end{array}$ | $2 \cdot$ | $\begin{array}{llll}3 & 23 & 7 \cdot 5\end{array}$ | $2 \cdot$ | 3 lll | 2.16 | 3 l | 24 | $31631 \cdot 4$ | $2 \cdot 33$ | $\begin{array}{lllll}3 & 14 & 8 \cdot 9\end{array}$ | 2.42 |
| 35 | $\begin{array}{lllllllllllll}3 & 20 & 39.8\end{array}$ | 2 | $\begin{array}{llll}3 & 18 & 34 \cdot 9\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}3 & 16 & 25 \cdot 0\end{array}$ | $2 \cdot 21$ | $314410 \cdot 0$ | $2 \cdot 29$ | 3 II 49•7 | 2.39 | $\begin{array}{llll}3 & 9 & 23.6\end{array}$ | $2 \cdot 48$ |
| 36 | $\begin{array}{llll}3 & 16 & 8 \cdot 6\end{array}$ | $2 \cdot$ | $\begin{array}{llll}3 & 14 & 0.9\end{array}$ | $2 \cdot$ | 3 II 48.I | $2 \cdot 2$ | $\begin{array}{llll}3 & 9 & 29.9\end{array}$ | $2 \cdot 35$ | 376 6-1 | 2.45 | $\begin{array}{llll}3 & 4 & 36 \cdot 3\end{array}$ | $2 \cdot 55$ |
|  | 3 II 36.1 |  | $3 \quad 925 \cdot 6$ |  | $\begin{array}{lll}3 & 7 & 9 \cdot 7\end{array}$ |  | $3 \quad 4$3 4 | 2.41 | $\begin{array}{llll}3 & 2 & 20 \cdot 6\end{array}$ | 2 | $2 \begin{array}{llll}2 & 59 & 46 \cdot 8\end{array}$ | 62 |
| 38 | $\begin{array}{lll}3 & 7 & 2 \cdot 3\end{array}$ | $2 \cdot 18$ | $\begin{array}{llllllllllll}3 & 4 & 48 \cdot 8\end{array}$ | $2 \cdot 27$ | $\begin{array}{rrrr}3 & 2 & 29 \cdot 6\end{array}$ | $2 \cdot 37$ | $\begin{array}{lrrr}3 & 0 & 4.5 \\ 2 & 5 & 5\end{array}$ | 2.47 | 257 33.1 | 2.58 | $2 \begin{array}{lllll}2 & 54 & 54 \cdot 9\end{array}$ | $2 \cdot 69$ |
| 39 | $\begin{array}{llll}3 & 2 & 27 \cdot 1\end{array}$ | 2.23 | $\begin{array}{llll}3 & 0 & 10.4\end{array}$ | $2 \cdot 33$ | $2 \begin{array}{llllllll} & 57 & 47\end{array}$ | $2 \cdot 43$ | $\begin{array}{lllllllllllllll}2 & 55 & 18.8\end{array}$ | $2 \cdot 54$ | $25243 \cdot 2$ | $2 \cdot 65$ | $\begin{array}{lll}2 & 50 & 0.5\end{array}$ | .77 |
| 40 | $25750 \cdot 4$ | $2 \cdot 28$ | $\begin{array}{llll}2 & 55 & 30 \cdot 3\end{array}$ | $2 \cdot 3$ | $\begin{array}{llll}2 & 53 & 4^{\circ} 0 \\ 2 & 4 & \end{array}$ | $2 \cdot 49$ | $25031 \cdot 0$ | 2.61 | 24751.0 | 2.73 | $\begin{array}{llll}2 & 45 & 3 \cdot 4 \\ 2\end{array}$ | $2 \cdot 86$ |
| 41 | $25312 \cdot 0$ | $2 \cdot 34$ | $25048 \cdot 4$ | 2.45 | $24^{2} 818 \cdot 1$ | $2 \cdot 56$ | $24540 \cdot 8$ | $2 \cdot 68$ | $24256 \cdot 0$ | 2.81 | 240 | $2 \cdot 95$ |
| 42 | $2 \begin{array}{llll}2 & 48 & 31.9\end{array}$ | 2.40 | $\begin{array}{lll}2 & 46 & 4.4\end{array}$ | 2.52 | $\begin{array}{llll}2 & 43 & 29 \cdot 9\end{array}$ | $2 \cdot 6$ | $\begin{array}{lllllllll}2 & 40 & 47 \cdot 9\end{array}$ | . 8 | $23758 \cdot 1$ | 2.90 | 23459.8 | 3.05 |
| 43 | $24349 \cdot 8$ | 2.47 | $\begin{array}{llll}2 & 41 & 18.2\end{array}$ | 2.59 | $\begin{array}{llll}2 & 38 & 39 \cdot 2\end{array}$ | $2 \cdot 72$ | $2 \begin{array}{lllllllll}2 & 35 & 52 \cdot 3\end{array}$ | $2 \cdot 85$ | $232 \begin{array}{lllll} & 3 & 57 \cdot 0\end{array}$ | 3.00 |  | $3 \cdot 15$ |
| 44 | $\begin{array}{lllllllllllllllll}2 & 39 & 5 \cdot 6\end{array}$ | $2 \cdot 5$ | $\begin{array}{llll}2 & 36 & 29.6\end{array}$ | 2.66 | $\begin{array}{lllll}2 & 33 & 45 \cdot 8\end{array}$ | $2 \cdot 80$ | 230533.6 | 2.94 | 22752.4 | $3 \cdot 10$ | 22441.6 | $3 \cdot 27$ |
| 45 | $\begin{array}{llll}2 & 34 & \text { I9•1 }\end{array}$ | 2.61 | $\begin{array}{llll}2 & 31 & 38 \cdot 5\end{array}$ | 2.75 | $\begin{array}{llll}2 & 28 & 49.4\end{array}$ | $2 \cdot 89$ | 225 51.5 | 3.05 | 222243.9 | $3 \cdot 21$ | $\begin{array}{llll}2 & 19 & 25.9\end{array}$ | $3 \cdot 39$ |
| 46 | $22930 \cdot 1$ | $2 \cdot 69$ | $22644 * 4$ | $2 \cdot 84$ | $22349 \cdot 7 \mid$ | 2.99 | $22045 \cdot 5$ | 3.16 | 2 I7 31.0 | $3 \cdot 33$ | $2145 \cdot 3$ | $3 \cdot 53$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. 7 | A. | L. 8 | A. | L. 9 | A. | L. 10 | - A. | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | S. | S. | S. | S. | s. | s. | s. | s. | s. | S. | S. |
| 0 | - $\cdot 46$ | $-4.23$ | -. 54 | $-4.24$ | - 62 | $-4.25$ | - 70 | $-4.26$ | -.78 | $-4 \cdot 28$ | - 86 | $-4.29$ |
| 2 | $\cdot 51$ | $4 \cdot 24$ | - 59 | $4 \cdot 25$ | $\cdot 67$ | $4 \cdot 26$ | $\cdot 75$ | $4 \cdot 27$ | -83 | $4 \cdot 29$ | -91 | $4 \cdot 30$ |
| 4 | - 56 | $4 \cdot 24$ | -64 | $4 \cdot 25$ | $\cdot 72$ | 4.27 | -80 | $4 \cdot 28$ | -88 | $4 \cdot 30$ | -97 | $4 \cdot 32$ |
| 6 | . 61 | $4 \cdot 25$ | -69 | $4 \cdot 26$ | $\cdot 78$ | $4 \cdot 28$ | - 86 | $4 \cdot 29$ | -94 | $4 \cdot 31$ | I. 02 | $4 \cdot 33$ |
| 8 | . 67 | $4 \cdot 26$ | $\cdot 75$ | $4 \cdot 27$ | -83 | $4 \cdot 29$ | '91 | $4 \cdot 30$ | -99 | $4 \cdot 32$ | 1.08 | $4 \cdot 34$ |
| 10 | $\cdot 72$ | $4 \cdot 27$ | -80 | $4 \cdot 28$ | . 88 | $4 \cdot 30$ | -97 | $4 \cdot 32$ | I.05 | 4.33 | I'I4 | $4 \cdot 36$ |
| 12 | -78 | $4 \cdot 28$ | -86 | $4 \cdot 29$ | -94 | $4 \cdot 31$ | 1.03 | $4 \cdot 33$ | I•II | $4 \cdot 35$ | I 20 | $4 \cdot 37$ |
| 14 | -83 | 4.29 | -92 | $4 \cdot 30$ | I. 00 | $4 \cdot 32$ | 1.09 | 4.34 | I'I8 | 4.37 | I-26 | $4 \cdot 39$ |
| 16 | -89 | $4 \cdot 30$ | $\cdot 98$ | $4 \cdot 32$ | I. 06 | $4 \cdot 34$ | I-I5 | $4 \cdot 36$ | I. 24 | $4 \cdot 39$ | I-33 | $4 \cdot 41$ |
| 18 | -95 | 4.31 | I.04 | $4 \cdot 33$ | I.13 | $4 \cdot 36$ | I. 22 | 4.38 | I•3 | 4.41 | 1.40 | $4 \cdot 43$ |
| 20 | I. 02 | $4 \cdot 33$ | I•II | $4 \cdot 35$ | 1. 20 | $4 \cdot 37$ | 1.29 | $4 \cdot 40$ | 1.38 | 4.43 | 1.48 | $4 \cdot 46$ |
| 22 | I-08 | $4 \cdot 34$ | I•18 | $4 \cdot 37$ | 1.27 | $4 \cdot 39$ | I. 36 | $4 \cdot 42$ | $1 \cdot 46$ | $4 \cdot 45$ | I.56 | $4 \cdot 49$ |
| 24 | I•16 | $4 \cdot 36$ | 1.25 | 4.39 | 1-35 | $4 \cdot 42$ | I.45 | $4 \cdot 45$ | 1.54 | $4 \cdot 48$ | I.65 | 4.52 |
| 26 | I. 23 | $4 \cdot 38$ | I.33 | $4 \cdot 41$ | I. 43 | $4 \cdot 44$ | I.53 | 4.47 | r.63 | 4.51 | I.74 | $4 \cdot 55$ |
| 28 | I.3I | 4.40 | 1.41 | 4.44 | I.5I | $4 \cdot 47$ | I. 62 | 4.50 | 1.73 | $4 \cdot 55$ | I. 84 | 4.59 |
| 30 | I. 39 | 4.43 | I. 50 | 4.46 | I.6I | .4.50 | I•19 | 4.54 | I. 83 | 4.59 | I.94 | 4.63 |
| 32 | I. 48 | $4 \cdot 46$ | I. 59 | $4 \cdot 50$ | I-70 | 4.54 | I. 82 | $4 \cdot 58$ | I. 94 | 4.63 | $2 \cdot 06$ | $4 \cdot 68$ |
| 34 | 1.58 | $4 \cdot 49$ | I. 69 | 4.53 | I.8I | $4 \cdot 58$ | I.93 | 4.63 | 2.06 | 4.68 | $2 \cdot 19$ | $4 \cdot 74$ |
| 36 | +.69 | 4.53 | I.8I | 4.58 | I.93 | 4.63 | 2.06 | $4 \cdot 68$ | 2.19 | 4.74 | $2 \cdot 33$ | 4.81 |
| 38 | I.80 | $4 \cdot 57$ | I.93 | $4 \cdot 63$ | $2 \cdot 06$ | $4 \cdot 68$ | $2 \cdot 20$ | 4.74 | $2 \cdot 34$ | $4 \cdot 81$ | $2 \cdot 48$ | $4 \cdot 88$ |
| 40 | 1.92 | $4 \cdot 63$ | 2.06 | 4.68 | $2 \cdot 20$ | 4.75 | $2 \cdot 35$ | 4.82 | $2 \cdot 50$ | 4.89 | $2 \cdot 66$ | 4.98 |
| 42 | 2.06 | $4 \cdot 68$ | $2 \cdot 21$ | $4 \cdot 75$ | $2 \cdot 36$ | $4 \cdot 82$ | $2 \cdot 52$ | 4.90 | 2.69 | 4.99 | $2 \cdot 86$ | $5 \cdot 09$ |
| 44 | 2.22 | 4.76 | $2 \cdot 38$ | 4.83 | $2 \cdot 54$ | 4.91 | 2.72 | $5 \cdot 01$ | 2.90 | $5 \cdot 11$ | $3 \cdot 10$ | $5 \cdot 22$ |
| 45 | $2 \cdot 30$ | 4.80 | 2.47 2.57 | 4.88 | 2.64 | 4.97 | 2.83 | 5.07 | 3.02 | 5•18 | 3.23 | $5 \cdot 30$ |
| 46 | $2 \cdot 40$ | 4.84 | 2.57 | 4.93 | 2.75 | $5 \cdot 03$ | 2.94 | $5 \cdot 13$ | $3 \cdot 15$ | $5 \cdot 26$ | $3 \cdot 37$ | $5 \cdot 39$ |

## LATITUDE $18^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. |  | M. |  | , |  | M. | S | H. M. | S. | . M. S. | S. |
| 0 | $\begin{array}{llll}5 & 44 & 9 \cdot 6\end{array}$ | -I•36 | $54247 \cdot 5$ | - I. 37 | $5 \mathrm{~S}^{5} \mathrm{I} 24^{\cdot 8}$ | - $\mathbf{1} \cdot 38$ | 540 I'3 | - I.40 | $\begin{array}{llll}5 & 38 & 37 \cdot 0\end{array}$ | -1.41 | 537 II•8 | -I.43 |
| 2 | $\begin{array}{llll}5 & 35 & 31\end{array}$ | I. 40 | $\begin{array}{llll}5 & 34 & 7 \cdot 3\end{array}$ | 1.45 |  | 1.43 | 53115.9 | I 44 | $\begin{array}{llll}5 & 29 & 48 \cdot 7\end{array}$ | 1.46 | $\begin{array}{llll}5 & 28 & 20 \cdot 3\end{array}$ | I. 48 |
| 4 | $\begin{array}{llll}5 & 26 & 52 \cdot 3\end{array}$ | 1. | $\begin{array}{llll}5 & 25 & 25 \cdot 5\end{array}$ | 1.46 | $\begin{array}{llllllllllllll}5 & 23 & 57 \cdot 6\end{array}$ | 1.47 | $\begin{array}{llllllllllllllll}5 & 22 & 28 \cdot 6\end{array}$ | I-49 | $\begin{array}{llll}5 & 20 & 58 \cdot 3\end{array}$ | 2 | $\begin{array}{llllllllllllllll}5 & 19 & 26 \cdot 7\end{array}$ | 54 |
| 6 | $\begin{array}{llll}5 & 18 & \text { II } & 3\end{array}$ | 1. | 5 16 41.9 | O | $5 \mathrm{I} 5 \mathrm{II} \cdot 3$ | I. 52 | $5{ }_{5}^{5} 13139.2$ | I. 55 | $\begin{array}{lllll}5 & 12 & 5 \cdot 7\end{array}$ | I 57 | 5 10 $30 \cdot 6$ | 60 |
| 8 | $\begin{array}{llll}5 & 9 & 28 \cdot 6\end{array}$ | 1.52 | $5 \quad 7 \quad 56 \cdot 5$ | I'55 | $5 \quad 6 \quad 22 \cdot 9$ | 1.57 | $\begin{array}{llll}5 & 4 & 47 \cdot 6\end{array}$ | I 60 | $\begin{array}{llll}5 & 3 & 10.6\end{array}$ | I. 63 | 5 I 31.9 | I•66 |
| 10 | $5 \quad 044.0$ |  | $459 \quad 9.0$ |  | 4573 |  | $4 \quad 55 \quad 53 \cdot 5$ |  | 45412.9 |  | $45^{52} 30303$ | 73 |
| 12 | $45157 \cdot 3$ | I 62 | 450 19.2 | I. 65 | $44^{8} 3$ 39•1 | I. 69 | $44656 \cdot 8$ | I•72 | $44512 \cdot 3$ | I•76 | $44325 \cdot 5$ | O |
| 14 | 443884 | I. 67 | $44126 \cdot 9$ | 1 | $43943 \cdot 2$ | I•75 | $43757 \cdot 1$ | I•79 | 4368 | I. 83 | $43417 \cdot 3$ | 88 |
| 16 | $43416 \cdot 9$ | 1.73 | 4324 31 | I.77 | $43044 \cdot 3$ | I | $428 \quad 54 \cdot \mathrm{I}$ | I.86 | $4 \begin{array}{lll}4 & 27 & \text { I-1 }\end{array}$ | I.91 | $425 \quad 5 \cdot 2$ | -96 |
| $\underline{8}$ | $425 \quad 22 \cdot 6$ | I.79 | 42333.8 | I. 84 | $42 \mathrm{I} 42 \cdot \mathrm{I}$ | I.8 | $41947 \cdot 5$ | I.94 | 4 エ7 49.8 | I.99 | $41548 \cdot 8$ | $2 \cdot 04$ |
| 19 | 4205 | 82 | 4 I9 3.5 | 7 | 4 17 9•7 |  | 4151 | 8 | 4 I3 12.5 |  | 4 II $8 \cdot 9$ | 09 |
| 20 | $41625 \cdot 3$ | I. 86 | 4 I4 32.3 | 1.91 | $41236 \cdot 2$ | $\underline{1}$ | 4 Io $36 \cdot 8$ | 02 | $4834 \cdot 1$ | $2 \cdot 08$ | $4 \begin{array}{llll}4 & 6 & 27 \cdot 7\end{array}$ | 4 |
| 21 | 4 II 55.4 | I. 89 | 4 IO 0.2 | I.95 | 4 8 I | $2 \cdot 00$ | $4 \quad 5 \quad 59$. | 06 | $4 \quad 3 \quad 54.4$ | $2 \cdot 12$ | 4 I $45 \cdot 1$ | $2 \cdot 19$ |
| 22 | 47724.5 | I.93 | $\begin{array}{llll}4 & 5 & 27 \cdot 1\end{array}$ | I'9 | $\begin{array}{llll}4 & 3 & 26 \cdot 3\end{array}$ | $2 \cdot 04$ | $\begin{array}{lrrr}4 & 1 & 21.8\end{array}$ | $2 \cdot 11$ | $35913 \cdot 5$ | $2 \cdot 17$ | $\begin{array}{llll}3 & 57 & 1.2\end{array}$ | $2 \cdot 24$ |
| 23 | $4 \quad 2 \begin{array}{llll}4 & 52 \cdot 8\end{array}$ | 1.97 | $4 \quad 053.0$ | 2.03 | $\begin{array}{lllll}3 & 58 & 49 \cdot 6\end{array}$ | $2 \cdot 09$ | 35642. | 2-I 5 | 354 3I-2 | $2 \cdot 22$ | $\begin{array}{lllll}3 & 52 & 15.8\end{array}$ | $2 \cdot 29$ |
| 24 | 358 r |  | 3561 | 2.07 | 354 II. |  | $3 \begin{array}{lll} & 52 & \text { I•7 }\end{array}$ | $2 \cdot 20$ | $34947 \cdot 4$ | 2.27 | $\begin{array}{llll}3 & 47 & 28 \cdot 7\end{array}$ | . 35 |
| 25 | 353 46•1 | $2 \cdot$ | $35141 \cdot 3$ | $2 \cdot 11$ | $34932 \cdot 6$ | 2.18 | 347719.5 | $2 \cdot 25$ | $345 \quad 2 \cdot 1$ | $2 \cdot 33$ | $\begin{array}{llll}3 & 42 & 39 & 9\end{array}$ | 4 I |
| 26 | 349 II.2 | $2 \cdot$ | $\begin{array}{llll}3 & 47 & 37\end{array}$ | $2 \cdot 16$ | $34452 \cdot 0$ | $2 \cdot 23$ | $\begin{array}{llllllllllllll}3 & 42 & 35\end{array}$ | $2 \cdot 31$ | 340 I5.1 | $2 \cdot 39$ |  | $2 \cdot 47$ |
| 27 | $34435 \cdot 0$ | $2 \cdot 14$ |  | $2 \cdot 21$ | 34010 | $2 \cdot 28$ |  | $2 \cdot 36$ | $\begin{array}{llll}3 & 35 & 26.4\end{array}$ | 2.45 | $\begin{array}{lllll}3 & 32 & 56.9\end{array}$ | . 54 |
| 28 | $33957 \cdot 5$ | 2. | $\begin{array}{lllll}3 & 37 & 44\end{array}$ | $2 \cdot 2$ | $\begin{array}{llll}3 & 35 & 26 \cdot 5\end{array}$ | $2 \cdot 34$ | $\begin{array}{llll}3 & 33 & 3.7\end{array}$ | 2.42 | $\begin{array}{lllll}3 & 30 & 35 \cdot 8\end{array}$ | 2.5 I | $\begin{array}{llll}3 & 28 & 2.4\end{array}$ | 60 |
| 29 | $\begin{array}{llll}3 & 35 & 18 \cdot 7\end{array}$ |  | $\begin{array}{lll}3 & 33 & 2.4\end{array}$ |  | $33041 \cdot 3$ |  | 3281 | 2.48 | $\begin{array}{llll}3 & 25 & 43 \cdot 2\end{array}$ | $2 \cdot 58$ | $\begin{array}{lll}3 & 23 & 5.6\end{array}$ | . 68 |
| 30 | $\begin{array}{lllll}3 & 30 & 38 \cdot 5\end{array}$ | 28 | $\begin{array}{llll}3 & 28 & 19 & 0\end{array}$ | $2 \cdot 37$ | $\begin{array}{llllll}3 & 25 & 54\end{array}$ | $2 \cdot$ | 3232 | $2 \cdot 55$ | $\begin{array}{llll}3 & 20 & 48 \cdot 4\end{array}$ | $2 \cdot 65$ | $\begin{array}{llll}3 & 18 & 6 \cdot 5\end{array}$ | $\cdot 75$ |
| 31 |  | $2 \cdot 34$ | $312313{ }^{3}$ | 2.43 | $\begin{array}{lll}3 & 21 & 5 \cdot 5\end{array}$ | $2 \cdot 52$ | 3 I8 3I• | 2.62 | 3 I5 5I•3 | $2 \cdot 72$ |  | . 83 |
| 32 | 32113.2 | $2 \cdot 40$ | 3 I8 $46 \cdot 7$ | $2 \cdot 49$ | 31614.6 |  | $3 \mathrm{I} 3136 \cdot 3$ | 2.69 | 3 10 5I'7 | 2.80 | $\begin{array}{lll}3 & 8 & 0.2\end{array}$ | $2 \cdot 92$ |
| 33 | $\begin{array}{llllll}3 & 16 & 27 \cdot 9\end{array}$ | $2 \cdot 46$ | 315357.7 | $2 \cdot 55$ | 3 II 2I.5 | $2 \cdot 6$ | $\begin{array}{llll}3 & 8 & 38 \cdot 8\end{array}$ | 2.77 | $\begin{array}{llll}3 & 5 & 49.4\end{array}$ | 2.88 | $\begin{array}{llll}3 & 2 & 52 \cdot 7\end{array}$ | - 01 |
| 34 | 3 II $40 \cdot 8$ | $2 \cdot 52$ | $\begin{array}{llll}3 & 9 & 6\end{array}$ | 2 | 3626 |  | $\begin{array}{llll}3 & 3 & 38 \cdot 7\end{array}$ | $2 \cdot 85$ | $30044 \cdot 1$ | 2.97 | $25741 \cdot 9$ | -II |
| 35 | $\begin{array}{llll}3 & 6 & 5 \mathrm{I} \cdot 6\end{array}$ | $2 \cdot 59$ | $\begin{array}{llllll}3 & 4 & 13\end{array}$ | $2 \cdot$ | $\begin{array}{lrrr}3 & 1 & 27.9\end{array}$ | 2.81 | $\begin{array}{llll}2 & 58 & 35 \cdot 6\end{array}$ | $2 \cdot 93$ | $\begin{array}{lllll}2 & 55 & 35\end{array}$ | 3.07 | $\begin{array}{lllll}2 & 52 & 27 \cdot 5\end{array}$ | 2 I |
| 36 | $\begin{array}{lll}3 & 2 & 0 \cdot 1\end{array}$ | $2 \cdot 66$ |  | 2.77 | $2 \begin{array}{lllllll}2 & 56 & 27 \cdot 2\end{array}$ |  | $25329 \cdot 5$ | 3.03 | $25023 \cdot 7$ | 3.17 | 2479.2 | $3 \cdot 32$ |
| 3 | $2576 \cdot 2$ | 2.73 | $254518 \cdot 6$ | $2 \cdot 86$ | $2 \begin{array}{llll}2 & 51 & 23 \cdot 3\end{array}$ |  | $\begin{array}{llll}2 & 48 & 20.0\end{array}$ | $3 \cdot 13$ | $245 \quad 8 \cdot 0$ | 3.28 | $24146 \cdot 7$ | $\cdot 44$ |
| 38 | $2 \begin{array}{lll}252 & 9 \cdot 8\end{array}$ | $2 \cdot 82$ | 249 17\% 0 | 2.95 | 24616.2 | 3.08 | 24366 | 3.23 | 239 48.I | 3.40 | 23619.3 | $3 \cdot 57$ |
| 39 | 24710.4 | 2 | 24412.2 | 3 | 2415.5 | $3 \cdot 19$ | $23749 \cdot 5$ | $3 \cdot 35$ | $23423 \cdot$ | 3.52 | $23046 \cdot 8$ | $3 \cdot 71$ |
| 40 | $2 \begin{array}{lll}2 & 42 & 7 \cdot 9\end{array}$ | $3 \cdot 00$ | $\begin{array}{lll}2 & 39 & 3.9\end{array}$ | 3 | 2355007 | $3 \cdot 30$ | $232 \begin{array}{llll}27 & 27\end{array}$ | 3.47 | 22853.8 | 3.66 | 225083 | $3 \cdot 86$ |
| 41 | $\begin{array}{lll}2 & 37 & 2 \cdot 1\end{array}$ | $3 \cdot 10$ | 2 33 5 | $3 \cdot 25$ | 23031.7 | $3 \cdot 42$ | $\begin{array}{lll}2 & 27 & 0.8 \\ 2 & 21 & 28\end{array}$ | $3 \cdot 61$ | $\begin{array}{llll}2 & 23 & 18.4\end{array}$ | $3 \cdot 8 \mathrm{I}$ | $\begin{array}{llll}2 & 19 & 23 \cdot 3\end{array}$ | 4.03 |
| 42 | 231552.5 | $3 \cdot 20$ | $\begin{array}{llll}2 & 28 & 35 \cdot 3\end{array}$ | $3 \cdot 37$ | $\begin{array}{llllllllllllllllllllll}2 & 25 & 7 \cdot 6\end{array}$ | $3 \cdot 56$ | $\begin{array}{llllllllllllll}2 & 21 & 28.4\end{array}$ | $3 \cdot 76$ | $2 \begin{array}{lllllllllllll} \\ 2 & 17 & 36 \cdot 6\end{array}$ | $3 \cdot 98$ | $2 \begin{array}{llll}2 & 13 & 30 \cdot 9\end{array}$ | 4.21 |
| 43 | $22638 \cdot 7$ | $3 \cdot 32$ | 22314.2 | $3 \cdot 50$ | 21938.2 | 3.70 | $21549 \cdot 7$ | 3.92 | 2 II 47.6 | $4 \cdot 16$ | $2730 \cdot 1$ | $4 \cdot 41$ |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | s. | s. | S. | S. | S. | S. | S. | S. |
| $\bigcirc$ | - 94 | $-4.31$ | -I. O 2 | $-4.33$ | -I'II | $-4.35$ | -I.I9 | $-4.37$ | -I. 27 | -4.39 | -I.36 | $-4.42$ |
| 2 | - 99 | $4 \cdot 32$ | I.08 | $4 \cdot 34$ | I.16 | 4.36 | I. 24 | $4 \cdot 39$ | I 33 | 4.41 | I. 42 | 4.44 |
| 4 | I. 05 | $4 \cdot 33$ | I•13 | $4 \cdot 36$ | I 22 | 4.38 | 1.30 | $4 \cdot 40$ | 1.39 | 4.43 | $1 \cdot 47$ | $4 \cdot 46$ |
| 6 | I 10 | $4 \cdot 35$ | I•9 | $4 \cdot 37$ | $1 \cdot 27$ | $4 \cdot 39$ | I. 36 | 4.42 | 1.45 | $4 \cdot 45$ | I•54 | $4 \cdot 48$ |
| 8 | I•I6 | $4 \cdot 36$ | 1.25 | 4.39 | I. 34 | 4.45 | 1.42 | $4 \cdot 44$ | $1 \cdot 51$ | 4.47 | I. 60 | $4 \cdot 50$ |
| 10 | I. 22 | $4 \cdot 38$ | I•31 | 4.41 | I.40 | 4.43 | I 49 | $4 \cdot 46$ | 1.58 | 4.49 | 1.67 | 4.53 |
| 12 | I. 29 | $4 \cdot 40$ | 1.38 | 4.43 | I. 47 | 4.45 | I. 56 | $4 \cdot 48$ | I. 65 | $4 \cdot 52$ | I•75 | $4 \cdot 55$ |
| 14 | I 35 | 4.42 | 1.44 | 4.45 | I 54 | $4 \cdot 48$ | I. 63 | $4 \cdot 51$ | I.73 | 4.55 | I. 82 | $4 \cdot 58$ |
| 16 | 1.42 | 4.44 | I. 52 | $4 \cdot 47$ | I. 61 | $4 \cdot 50$ | I•7 | $4 \cdot 54$ | I.81 | $4 \cdot 58$ | I.91 | $4 \cdot 62$ |
| 18 | I. 50 | $4 \cdot 46$ | I. 59 | $4 \cdot 50$ | I. 69 | 4.53 | I•79 | 4.57 | 1.89 | $4 \cdot 61$ | $2 \cdot 00$ | $4 \cdot 65$ |
| 20 | 1.58 | 4.49 | I. 67 | 4.53 | ェ・78 | 4.57 | I. 88 | $4 \cdot 61$ | I. 98 | 4.65 | 2.09 | 4.70 |
| 22 | I. 66 | 4.52 | I.76 | 4.56 | 1.87 | 4.60 | I.97 | $4 \cdot 65$ | 2.08 | $4 \cdot 69$ | $2 \cdot 20$ | $4 \cdot 74$ |
| 24 | I. 75 | $4 \cdot 56$ | I. 86 | 4.60 | 1.96 | $4 \cdot 64$ | $2 \cdot 08$ | 4.69 | $2 \cdot 19$ | 4.74 | $2 \cdot 31$ | 4.80 |
| 26 | I. 84 | 4.59 | I.96 | $4 \cdot 64$ | 2.07 | $4 \cdot 69$ | $2 \cdot 19$ | $4 \cdot 74$ | $2 \cdot 31$ | 4.80 | $2 \cdot 43$ | 4.86 |
| 28 | I. 95 | 4.64 | $2 \cdot 06$ | $4 \cdot 69$ | 2.18 | 4.74 | $2 \cdot 31$ | 4.80 | 2.44 | 4.86 | $2 \cdot 57$ | 4.93 |
| 30 | 2.06 | 4.68 | 2.18 | 4'74 | $2 \cdot 31$ | $4 \cdot 80$ | 2.44 | 4.86 | $2 \cdot 58$ | $4 \cdot 93$ | $2 \cdot 72$ | 5.OI |
| 32 | 2.18 | $4 \cdot 74$ | $2 \cdot 31$ | 4.80 | $2 \cdot 45$ | 4.87 | $2 \cdot 59$ | $4 \cdot 94$ | 2.73 | $5 \cdot 02$ | 2.89 | 5.10 |
| 34 | $2 \cdot 32$ | 4.80 | $2 \cdot 46$ | 4.87 | 2.60 | 4.95 | 2.75 | $5 \cdot 03$ | 2.91 | $5 \cdot 11$ | 3.07 | 5.21 |
| 36 | 2.47 | $4 \cdot 88$ | $2 \cdot 62$ | 4.95 | 2.77 | $5 \cdot 04$ | 2.94 | $5 \cdot 13$ | 3.11 | $5 \cdot 23$ | $3 \cdot 29$ | $5 \cdot 34$ |
| 38 | 2.64 | 4.96 | $2 \cdot 80$ | $5 \cdot 05$ | $2 \cdot 97$ | 5.15 | $3 \cdot 15$ | $5 \cdot 25$ | $3 \cdot 34$ | $5 \cdot 37$ | 3.54 | $5 \cdot 50$ |
| 39 | 2.73 | 5.02 | 2.90 | 5•II | 3.08 | 5.21 | $3 \cdot 27$ | $5 \cdot 33$ | 3.47 | $5 \cdot 45$ | 3.68 | 5.59 |
| 40 | 2.83 | 5.07 | 3.01 | $5 \cdot 17$ | $3 \cdot 20$ | $5 \cdot 28$ | $3 \cdot 39$ | $5 \cdot 4 \mathrm{I}$ | 3.61 | $5 \cdot 54$ | $3 \cdot 84$ | 5.70 |
| 41 | 2.94 | $5 \cdot 13$ | $3 \cdot 12$ | $5 \cdot 24$ | $3 \cdot 32$ | $5 \cdot 36$ | $3 \cdot 53$ | $5 \cdot 49$ | 3.76 | $5 \cdot 64$ | 4.01 | 5.81 |
| 42 | 3.05 | 5.19 | 3.25 | $5 \cdot 31$ | $3 \cdot 46$ | $5 \cdot 45$ | 3.69 | $5 \cdot 59$ | $3 \cdot 93$ | 5•66 | $4 * 20$ | 5.94 |
| 43 | $3 \cdot 17$ | $5 \cdot 27$ | $3 \cdot 38$ | $5 \cdot 40$ | $3 \cdot 61$ | $5 \cdot 54$ | 3.85 | $5 \cdot 70$ | $4 \cdot 12$ | $5 \cdot 99$ | $4 \cdot 41$ | $6 \cdot 09$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 197

## LATITUDE $18^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | s. | H. M. S | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $\begin{array}{llllll}5 & 35 & 45 \cdot 6\end{array}$ | - I* 45 | $53418 \cdot 3$ | - I. 46 | $5 \quad 32$ 50.0 | - 1.48 | 5 31 20. 5 | -1.50 | $\begin{array}{llll}5 & 29 & 49.6\end{array}$ | - I 53 | $\begin{array}{lllll}5 & 28 & 17.4\end{array}$ | - $\mathrm{I} \cdot 55$ |
| 2 | $526650 \cdot 8$ | I. 50 | $5 \begin{array}{llll}5 & 25 & 19.9\end{array}$ | I. 52 | $\begin{array}{lllll}5 & 23 & 47 \cdot 8\end{array}$ | I.55 | 5 22214.2 | I. 57 | $5 \quad 20 \quad 39 \cdot 0$ | I.60 | $\begin{array}{llll}5 & 19 & 2 \cdot 2\end{array}$ | I. 63 |
| 4 | 515753.6 | I. 56 | $\begin{array}{llll}5 & 16 & 19 \cdot 0\end{array}$ | 1.59 | $\begin{array}{lllllllll}5 & 14 & 42 \cdot 8\end{array}$ | I. 62 | $\begin{array}{llll}5 & 13 & 4.9\end{array}$ | I. 65 | 5 II 25.2 | 1.68 | $\begin{array}{llll}5 & 9 & 43.7\end{array}$ | 1.71 |
| 6 | $\begin{array}{lllll}5 & 8 & 53.8\end{array}$ | I. 63 | $\begin{array}{llll}5 & 7 & 15 \cdot 3\end{array}$ | 1. 66 | $\begin{array}{llll}5 & 5 & 34 \cdot 8\end{array}$ | 1.69 | $\begin{array}{llll}5 & 3 & 52 \cdot 5\end{array}$ | I•72 | $\begin{array}{llr}5 & 2 & 8 \cdot 0\end{array}$ | I.76 | $5 \quad 0 \quad 2 \mathrm{I} \cdot 3$ | I.80 |
| 8 | $45951 \cdot 2$ | I. 69 | $\begin{array}{lll}4 & 58 & 8 \cdot 5\end{array}$ | 1.73 | $45623 \cdot 6$ | $1 \cdot 77$ | $45436 \cdot 5$ | I.8I | $45246 \cdot 9$ | I.85 | 45054.9 | I.89 |
| 10 | $45045 \cdot 4$ | 1.76 | $4 \begin{array}{llll}48 & 58 & 3\end{array}$ | I.81 | 44787 | I. 85 | 44516.6 | I. 89 | $44321 \cdot 7$ | I•94 | $44124^{\circ} 0$ | 1.98 |
| II | $446 \mathrm{II} \cdot 3$ | I.80 | $4442 \mathrm{I} \cdot 8$ | I. 85 | 44229.8 | I.89 | $44035 \cdot 0$ | I.94 | $\begin{array}{lllll}4 & 38 & 37.4\end{array}$ | I.99 | $43636 \cdot 7$ | $2 \cdot 03$ |
| 12 | $44136 \cdot 3$ | I. 84 | $43944 \cdot 4$ | I.89 | $43749 \cdot 8$ | $1 \cdot 93$ | $435152 \cdot 3$ | I.98 | $43351 \cdot 8$ | $2 \cdot 03$ | $43148 \cdot 1$ | 2.09 |
| 13 | $\begin{array}{llll}4 & 37 & 0.3\end{array}$ | I.88 | $435 \quad 5 \cdot 9$ | I.93 | $4338 \cdot 7$ | 1.98 | 431684 | 2.03 | $\begin{array}{llll}4 & 29 & 4.9\end{array}$ | $2 \cdot 09$ | $42658 \cdot 1$ | $2 \cdot 14$ |
| 14 | $1 \begin{array}{llll}4 & 32 & 23 \cdot 3\end{array}$ | 1.92 | 43026.4 | I.97 | $42826 \cdot 5$ | $2 \cdot 03$ | $4 \quad 26 \quad 23 \cdot 3$ | $2 \cdot 08$ | 42416.7 | $2 \cdot 14$ | 42266 | $2 \cdot 20$ |
| 15 | $42745 \cdot 3$ | 1.97 | $42545 \cdot 8$ | 2.02 | 42343.0 | 2.07 | $42136 \cdot 8$ | $2 \cdot 13$ | 4 I9 27.1 | $2 \cdot 19$ | 41713.5 | $2 \cdot 26$ |
| 16 | $4236 \cdot 2$ | $2 \cdot 01$ | 4213.9 | 2.07 | 4 I8 $58 \cdot 3$ | $2 \cdot 12$ | $41649 \cdot 0$ | $2 \cdot 19$ | 4 I4 $35 \cdot 9$ | $2 \cdot 25$ | 41218.8 | $2 \cdot 32$ |
| 17 | 41825.9 | $2 \cdot 06$ | 4 I6 $20 \cdot 8$ | $2 \cdot 11$ | $41412 \cdot 1$ | $2 \cdot 18$ | 4 II 59.6 | $2 \cdot 24$ | $4 \quad 943 \cdot 1$ | $2 \cdot 31$ | $4 \quad 7 \quad 22.4$ | $2 \cdot 38$ |
| 18 | 41344.4 | $2 \cdot 10$ | 4 II $36 \cdot 4$ | $2 \cdot 17$ | $4 \quad 924.5$ | $2 \cdot 23$ | 4787 | $2 \cdot 30$ | $\begin{array}{llll}4 & 4 & 48 \cdot 6\end{array}$ | $2 \cdot 37$ | $\begin{array}{llll}4 & 2 & 24 \cdot 1\end{array}$ | $2 \cdot 45$ |
| 19 | $\begin{array}{lll}4 & 9 & 1.6\end{array}$ | $2 \cdot 15$ | $4 \quad 6 \quad 50 \cdot 5$ | $2 \cdot 22$ | $4 \quad 435 \cdot 4$ | 2.29 | $4 \quad 2 \quad 16 \cdot 1$ | $2 \cdot 36$ | $35952 \cdot 3$ | $2 \cdot 44$ | $\begin{array}{llll}3 & 57 & 23.7\end{array}$ | 2.52 |
| 20 | $\begin{array}{llll}4 & 4 & 17.4\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}4 & 2 & 3 \cdot 2\end{array}$ | 2.27 | $35944 \cdot 7$ | $2 \cdot 35$ | $3 \begin{array}{llll}3 & 57 & 21.7\end{array}$ | $2 \cdot 42$ | $35454 \cdot 1$ | $2 \cdot 50$ | 35221.4 | 2.59 |
| 21 | $3593 \mathrm{I} \cdot 8$ | $2 \cdot 26$ | 35714.3 | $2 \cdot 33$ | $35452 \cdot 3$ | 2.41 | $\begin{array}{llll}3 & 52 & 25 \cdot 5\end{array}$ | $2 \cdot 49$ | $34953 \cdot 8$ | $2 \cdot 57$ | 34716.8 | $2 \cdot 66$ |
| 22 | $35444 \cdot 7$ | $2 \cdot 31$ | $\begin{array}{lllll}3 & 52 & 23.7\end{array}$ | $2 \cdot 39$ | $34958 \cdot 0$ | $2 \cdot 47$ | $\begin{array}{llllllll}3 & 47 & 27 \cdot 3\end{array}$ | $2 \cdot 56$ | $3445 \mathrm{I} \cdot 3$ | $2 \cdot 65$ | $\begin{array}{llll}3 & 42 & 9.8\end{array}$ | $2 \cdot 74$ |
| 23 | 34955.9 | $2 \cdot 37$ | $3473 \mathrm{I} \cdot 2$ | $2 \cdot 45$ | $\begin{array}{llll}3 & 45 & 1 \cdot 7\end{array}$ | 2.54 | $\begin{array}{llll}3 & 42 & 26 \cdot 9\end{array}$ | $2 \cdot 63$ | $\begin{array}{llll}3 & 39 & 46 \cdot 5\end{array}$ | $2 \cdot 72$ | $\begin{array}{lll}3 & 37 & 0.2\end{array}$ | 2.82 |
| 24 | $345 \quad 5 \cdot 3$ | 2.43 | $34236 \cdot 9$ | 2.52 | $\begin{array}{llll}3 & 40 & 3.4\end{array}$ | $2 \cdot 61$ | $3 \quad 3724^{* 2}$ | $2 \cdot 70$ | $33430 \cdot 2$ | 2.80 | 3 3I 47.8 | $2 \cdot 91$ |
| 25 | $\begin{array}{llll}3 & 40 & 12.9\end{array}$ | 2.49 | $\begin{array}{llll}3 & 37 & 40 \cdot 6\end{array}$ | 2.58 | $\begin{array}{lll}3 & 35 & 2 \cdot 8\end{array}$ | 2.68 | $\begin{array}{llll}3 & 32 & 19 \cdot 1\end{array}$ | 2.78 | $\begin{array}{lll}3 & 29 & 29 \cdot 1\end{array}$ | 2.89 | $\begin{array}{llll}3 & 26 & 32 \cdot 5\end{array}$ | 3.00 |
| 26 | $33518 \cdot 5$ | $2 \cdot 56$ | $\begin{array}{llll}3 & 32 & 42 \cdot 1\end{array}$ | $2 \cdot 66$ | $\begin{array}{llll}3 & 29 & 59 \cdot 8\end{array}$ | $2 \cdot 76$ | 327 II•3 | $2 \cdot 86$ | $32416 \cdot 2$ | $2 \cdot 98$ | 321140 | $3 \cdot 10$ |
| 27 | $33022 \cdot 0$ | 2.63 | $32741 \cdot 2$ | 2.73 | $\begin{array}{lllllll}3 & 24 & 54.2\end{array}$ | $2 \cdot 84$ | $\begin{array}{llll}3 & 22 & 0.7\end{array}$ | $2 \cdot 95$ | $3190 \cdot 1$ | 3.07 | $31552 \cdot 0$ | $3 \cdot 30$ |
| 28 | $\begin{array}{llll}3 & 25 & 23.2\end{array}$ | $2 \cdot 70$ | $\begin{array}{llll}3 & 22 & 37.8\end{array}$ | 2.81 | 31945.9 | 2.92 | 316470 | 3.04 | $\begin{array}{llll}3 & 13 & 40 \cdot 6\end{array}$ | 3.17 | $31026 \cdot 2$ | $3 \cdot 31$ |
| 29 | 32021.9 | 2.78 | $31731 \cdot 7$ | 2.89 | $31434 \cdot 6$ | $3 \cdot 01$ | 3 II $30 \cdot 0$ | $3 \cdot 14$ | $\begin{array}{lllll}3 & 8 & 17.5\end{array}$ | $3 \cdot 28$ | $\begin{array}{llll}3 & 4 & 56.4\end{array}$ | $3 \cdot 43$ |
| 30 | 31518.0 | $2 \cdot 86$ | $\begin{array}{llll}3 & 12 & 22 \cdot 7\end{array}$ | $2 \cdot 98$ | $3{ }^{3} 920.0$ | $3 \cdot 11$ | $\begin{array}{lll}3 & 6 & 9 \cdot 4 \\ 3 & 0 & 4\end{array}$ | 3.25 | $\begin{array}{llll}3 & 2 & 50 \cdot 3\end{array}$ | 3.39 | $25922 \cdot 1$ | $3 \cdot 55$ |
| 31 | $31011 \cdot 3$ | 2.95 | $\begin{array}{llll}3 & 7 & 10.5\end{array}$ | 3.08 | $\begin{array}{llll}3 & 4 & I \cdot 9\end{array}$ | $3 \cdot 21$ | $\begin{array}{llll}3 & 0 & 44.8\end{array}$ | $3 \cdot 36$ | $\begin{array}{llllllllllllllllllll}2 & 57 & 18 \cdot 6\end{array}$ | $3 \cdot 52$ | $25342 \cdot 9$ | $3 \cdot 69$ |
| 32 | $\begin{array}{llll}3 & 5 & 1 & 5\end{array}$ | 3.05 | $\begin{array}{llll}3 & 1 & 54.9\end{array}$ | $3 \cdot 18$ | $25840 \cdot 0$ | $3 \cdot 32$ | $25516 \cdot 0$ | $3 \cdot 48$ | 25142.4 | $3 \cdot 65$ |  | $3 \cdot 83$ |
| 33 | $25948 \cdot 2$ | $3 \cdot 14$ | $25635 \cdot 5$ | $3 \cdot 29$ | $\begin{array}{lllll}2 & 53 & 13.9\end{array}$ | 3.44 | $\begin{array}{llllllllll}2 & 49 & 42 \cdot 5\end{array}$ | $3 \cdot 61$ | $\begin{array}{lll}2 & 46 & 0.8\end{array}$ | $3 \cdot 79$ | $\begin{array}{llllll}2 & 42 & 7 \cdot 7\end{array}$ | $3 \cdot 99$ |
| 34 | $25431 \cdot 4$ | $3 \cdot 25$ | 25112.0 | $3 \cdot 40$ | $24743 \cdot 1$ | 3.57 | $244 \begin{array}{ll}2 & 3\end{array}$ | 3.75 | $240 \quad 13 \cdot 3$ | 3.94 | $2 \quad 36 \quad 10.4$ | $4 \cdot 16$ |
| 35 | $24910 \cdot 5$ | $3 \cdot 36$ | $24544 \cdot 1$ | 3.53 | $\begin{array}{lll}2 & 42 & 7 \cdot 3\end{array}$ | 3.71 | $\begin{array}{llll}2 & 38 & 19.4\end{array}$ | $3 \cdot 90$ | 23419.3 | 4.11 | $\begin{array}{lll}2 & 30 & 5.8\end{array}$ | $4 \cdot 35$ |
| 36 | $24345 \cdot 3$ | 3.48 | 240 II'I | $3 \cdot 66$ | $236 \quad 25 \cdot 9$ | $3 \cdot 85$ | $2 \begin{array}{lllll}2 & 32 & 28 \cdot 6\end{array}$ | $4^{\circ} 07$ | $22818 \cdot 0$ | $4 \cdot 30$ | $22352 \cdot 7$ | $4 \cdot 56$ |
| 37 |  | 3.62 | $23432 \cdot 7$ | 3.81 | $23038 \cdot 2$ | 4.02 | $2 \begin{array}{lllll}2 & 26 & 30 \cdot 6\end{array}$ | $4 \cdot 25$ | $\begin{array}{llll}2 & 22 & 8 \cdot 5\end{array}$ | $4 \cdot 50$ | 21730.2 | $4 \cdot 79$ |
| 38 | $\begin{array}{lllllllllll}2 & 32 & 39 \cdot 7\end{array}$ | $3 \cdot 76$ | $22848 \cdot 1$ | 3.97 | $22443 \cdot 6$ | $4 \cdot 20$ | $2 \begin{array}{llll}2 & 20 & 24.6\end{array}$ | 4.45 | 21549.6 | 4.73 | 2 Io $56 \cdot 7$ | $5 \cdot 05$ |
| 39 | $22658 \cdot 2$ | $3 \cdot 92$ | $22256 \cdot 7$ | $4 \cdot 14$ | 2 I8 4I'0 | $4 \cdot 39$ | 21419.5 | $4 \cdot 67$ | $2 \quad 9 \quad 20 \cdot 0$ | 4.99 | $2 \quad 4 \quad 10 \cdot 5$ | $5 \cdot 35$ |
| VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. $18^{\circ}$ | A. | L. $19^{\circ}$ | A. | L. $20^{\circ}$ | A. | L. $21{ }^{\circ}$ | A. | L. $22^{\circ}$ | A. | L. $23^{\circ}$ | A. |
| $\bigcirc$ | S. | S. | S. | s. | S. | S. | S. | S. | s. | s. | S. | S. |
| 0 | - I. 45 | 4.44 | - I'53 | 4.47 | - 1.62 | $4 \cdot 51$ | - $1 \cdot 71$ | 4.54 | -1.80 | $4 \cdot 57$ | - 1.89 | $4 \cdot 61$ |
| 2 | I. 50 | 4.47 | I.59 | $4 \cdot 50$ | 1.68 | 4.53 | 1.77 | $4 \cdot 56$ | 1.87 | $4 \cdot 60$ | I.96 | $4 \cdot 64$ |
| 4 | I.56 | 4.49 | I. 65 | $4 \cdot 52$ | I•74 | $4 \cdot 55$ | I. 84 | $4 \cdot 59$ | I.93 | 4.63 | $2 \cdot 03$ | $4 \cdot 67$ |
| 6 | I. 63 | 4.51 | I•72 | $4 \cdot 54$ | I.81 | $4 \cdot 58$ | I.91 | $4 \cdot 62$ | 2.00 | $4 \cdot 66$ | $2 \cdot 10$ | $4 \cdot 70$ |
| 8 | I. 69 | $4 \cdot 53$ | I•79 | $4 \cdot 57$ | I•88 | 4.61 | I•98 | 4.65 | $2 \cdot 08$ | $4 \cdot 69$ | 2.18 | 4.74 |
| 10 | I.76 | $4 \cdot 56$ | I. 86 | $4 \cdot 60$ | I.96 | $4 \cdot 64$ | $2 \cdot 06$ | $4 \cdot 68$ | 2-16 | 4.73 | $2 \cdot 27$ | 4.78 |
| 12 | I. 84 | 4.59 | I.94 | 4.63 | 2.04 | $4 \cdot 68$ | 2.14 | $4 \cdot 72$ | $2 \cdot 25$ | $4 \cdot 77$ | $2 \cdot 36$ | $4 \cdot 82$ |
| 14 | I.92 | $4 \cdot 62$ | 2.02 | 4.67 | $2 \cdot 13$ | 4.71 | $2 \cdot 24$ | 4.76 | $2 \cdot 34$ | 4.81 | $2 \cdot 46$ | $4 \cdot 87$ |
| 16 | $2 \cdot 01$ | $4 \cdot 66$ | $2 \cdot 12$ | 4*7I | $2 \cdot 22$ | $4 \cdot 76$ | $2 \cdot 33$ | 4.81 | 2.45 | 4.87 | 2.56 | $4 \cdot 93$ |
| 18 | $2 \cdot 10$ | 4.70 | $2 \cdot 21$ | $4 \cdot 75$ | $2 \cdot 32$ | $4 \cdot 80$ | 2.44 | 4.86 | 2.56 | 4.92 | $2 \cdot 68$ | $4 \cdot 99$ |
| 20 | $2 \cdot 20$ | 4*75 | $2 \cdot 32$ | 4.80 | $2 \cdot 43$ | 4.86 | 2.56 | $4 \cdot 92$ | $2 \cdot 68$ | 4.99 | 2.81 | 5.06 |
| 22 | $2 \cdot 31$ | $4 \cdot 80$ | 2.43 | $4 \cdot 86$ | $2 \cdot 55$ | 4.92 | $2 \cdot 68$ | $4 \cdot 99$ | $2 \cdot 8 \mathrm{I}$ | $5 \cdot 06$ | $2 \cdot 95$ | $5 \cdot 14$ |
| 24 | 2.43 | $4 \cdot 86$ | $2 \cdot 56$ | 4.92 | 2.69 | 4.99 | 2.82 | $5 \cdot 06$ | $2 \cdot 96$ | 5.14 | $3 \cdot 11$ | $5 \cdot 23$ |
| 26 | 2.56 | 4.92 | 2.69 | 4.99 | 2.83 | 5.07 | $2 \cdot 98$ | $5 \cdot 15$ | $3 \cdot 13$ | $5 \cdot 24$ | 3.29 | $5 \cdot 34$ |
| 28 | $2 \cdot 70$ | $5 \cdot 00$ | $2 \cdot 85$ | $5 \cdot 08$ | 3.00 | 5.16 | $3 \cdot 15$ | $5 \cdot 26$ | $3 \cdot 31$ | $5 \cdot 35$ | $3 \cdot 49$ | $5 \cdot 46$ |
| 30 | $2 \cdot 86$ | $5 \cdot 09$ | 3.02 | 5.18 | 3.18 | $5 \cdot 27$ | 3.35 * | $5 \cdot 38$ | 3.53 | $5 \cdot 49$ | $3 \cdot 72$ | $5 \cdot 61$ |
| 31 | $2 \cdot 95$ | 5.14 | $3 \cdot 11$ | $5 \cdot 23$ | $3 \cdot 28$ | $5 \cdot 33$ | $3 \cdot 46$ | $5 \cdot 44$ | $3 \cdot 64$ | $5 \cdot 57$ | $3 \cdot 84$ | $5 \cdot 70$ |
| 32 | $3 \cdot 05$ | 5.19 | $3 \cdot 21$ | $5 \cdot 29$ | $3 \cdot 39$ | $5 \cdot 40$ | 3.57 | $5 \cdot 52$ | $3 \cdot 77$ | $5 \cdot 65$ | $3 \cdot 98$ | $5 \cdot 79$ |
| 33 | 3.14 | $5 \cdot 25$ | $3 \cdot 32$ | $5 \cdot 36$ | 3.50 | $5 \cdot 47$ | $3 \cdot 70$ | $5 \cdot 60$ | 3.91 | 5•74 | 4.14 | $5 \cdot 90$ |
| 34 | $3 \cdot 25$ | $5 \cdot 31$ | 3.43 | $5 \cdot 43$ | $3 \cdot 63$ | $5 \cdot 55$ | $3 \cdot 84$ | $5 \cdot 69$ | 4.06 | $5 \cdot 85$ | $4 \cdot 30$ | 6.02 |
| 35 | $3 \cdot 36$ | $5 \cdot 38$ | $3 \cdot 56$ | $5 \cdot 51$ | $3 \cdot 76$ | $5 \cdot 64$ | $3 \cdot 98$ | 5•79 | $4 \cdot 22$ | 5.96 | $4 \cdot 48$ | $6 \cdot 15$ |
| 36 | 3.48 | $5 \cdot 46$ | 3.69 | 5.59 | 3.91 | $5 \cdot 74$ | $4 \cdot 15$ | $5 \cdot 91$ | 4.40 | $6 \cdot 09$ | $4 \cdot 69$ | $6 \cdot 30$ |
| 37 | $3 \cdot 62$ | $5 \cdot 55$ | 3.83 | $5 \cdot 69$ | 4.07 | 5.85 | $4 \cdot 33$ | $6 \cdot 03$ | 4.60 | $6 \cdot 24$ | $4 \cdot 91$ | 6.47 |
| 38 | $3 \cdot 76$ | $5 \cdot 64$ | 3.99 | $5 \cdot 80$ | 4.25 | $5 \cdot 98$ | $4 \cdot 52$ | $6 \cdot 18$ | 4.83 | $6 \cdot 40$ | $5 \cdot 16$ | $6 \cdot 66$ |
| 39 | $3 \cdot 92$ | 5.75 | $4 \cdot 17$ | $5 \cdot 92$ | $4 \cdot 44$ | $6 \cdot 12$ | $4 \cdot 74$ | $6 \cdot 34$ | $5 \cdot 07$ | $6 \cdot 59$ | $5 \cdot 44$ | 6.89 |

198 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $19^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S | M. S. |  | M. | S. | M. S. | S. | H. M. | S | M. | S. |
| O | 6 o | -1.38 | $1 \begin{array}{llll}5 & 58 & 37 \cdot 3\end{array}$ | - $1 \cdot 38$ | $5 \quad 5714.7$ | - I. 38 | $5 \begin{array}{llll}5 & 55 & 51 \cdot 9\end{array}$ | -I.38 | $\begin{array}{llll}5 & 54 & 28 \cdot 9\end{array}$ | - I-38 | $\begin{array}{llll}5 & 53 & 5 \cdot 7\end{array}$ | - I•39 |
| 8 | $\begin{array}{llll}5 & 26 & 8 \cdot 6\end{array}$ | I.39 | $5 \quad 2444 \cdot 7$ | I-40 | 52320 | I. 42 | $\begin{array}{lllll}5 & 21 & 54 \cdot 5\end{array}$ | 1.43 | $5 \quad 20 \quad 28 \cdot 2$ | 1.45 | $\begin{array}{lll}5 & 19 & 0.9\end{array}$ | 1.46 |
| 10 | 5 17 40.2 | 1.40 | 5 1615.6 | 1.42 | $51450 \cdot 2$ | 1.43 | $\begin{array}{llll}5 & 13 & 23.8\end{array}$ | 1.45 | 5 II $56 \cdot 2$ | I 47 | 5 10 $27 \cdot 6$ | 1.49 |
| 12 | $5 \quad 9$ II'3 | 1.41 | 55 7 46 | I-43 | $\begin{array}{llll}5 & 6 & 19 \cdot 7\end{array}$ | 1.45 | $\begin{array}{llll}5 & 4 & 52.2\end{array}$ | 1.47 | $\begin{array}{llll}5 & 3 & 23.4\end{array}$ | I. 49 | 5 I | 1.51 |
| 14 | 5 0 42.I | I. 42 | 45915.9 | I. 45 | $457 \quad 48 \cdot 6$ | 1.47 | $4 \begin{array}{llll}4 & 56 & 19.8\end{array}$ | 1-49 | $\begin{array}{llll}4 & 54 & 49 \cdot 5\end{array}$ | 1.52 | $45317 \cdot 7$ | I. 54 |
| 16 | $45212 \cdot 3$ | 1.4 | $45045 \cdot 1$ | I. 46 | 449 16.5 | I.49 | $44746 \cdot 3$ | I.52 | 44614.4 | r.54 | 444 40•91 | I. 57 |
| 18 | $\begin{array}{llll}4 & 43 & 41 \cdot 7\end{array}$ | I. 46 | $\begin{array}{llll}4 & 42 & 13.5\end{array}$ | I. 48 | $44043 \cdot 5$ | I-5I | $1 \begin{array}{llll}4 & 39 & 11 \cdot 7\end{array}$ | 1. 54 | $437 \begin{array}{llll}4 & 38 \cdot 1\end{array}$ | I. 58 | 436 | I.6I |
| 20 | $43510 \cdot 5$ | 1.48 | $43340 \cdot 9$ | I. 51 | $432 \begin{array}{lll}4 & 9 \cdot 4\end{array}$ | I. 54 | 43035.9 | I. 58 | 429003 | 1.61 | $\begin{array}{llll}4 & 27 & 22.6\end{array}$ | 1.65 |
| 22 | $\begin{array}{llll}4 & 26 & 38 \cdot 3\end{array}$ | 1.50 | $\begin{array}{llll}4 & 25 & 7 \cdot 3\end{array}$ | 1.53 | 423 34-I | 1.57 | $42158 \cdot 7$ | I.6I | $42021 \cdot 0$ | 1.65 | $4 \begin{array}{lllll}4 & 18 & 40 \cdot 8\end{array}$ | I. 69 |
| 24 | 4 I 8 5.I | I. 53 | $4 \begin{array}{llll}4 & 16 & 32\end{array}$ | I. 56 | 415457 | 1.60 | $4 \begin{array}{lll}4 & 19 & 19\end{array}$ | I. 65 | 4 II 39.8 | 1.69 | $\begin{array}{lllll}4 & 9 & 57.0\end{array}$ | 1.74 |
| 25 | 4 I3 48.I | I. 54 | $41214 \cdot 6$ | I. 58 | $41038 \cdot 5$ | . 62 | 48859.8 | I 67 | $\begin{array}{llll}4 & 7 & 18.4\end{array}$ | I. 71 | $4 \quad 5 \quad 34 \cdot 3$ | ェ・6 |
| 26 | $4 \quad 930 \cdot 8$ | I. 55 | $47756 \cdot 3$ | I. 60 | $4619 \cdot 1$ | I. 64 | $4 \begin{array}{llll}4 & 4 & 39 \cdot 2\end{array}$ | r 69 | $\begin{array}{llll}4 & 2 & 56 \cdot 5\end{array}$ | I•73 | 4 I 1110 | I.78 |
| 27 | $\begin{array}{llll}4 & 5 & 13 & 1 \\ 4 & 0 & 5\end{array}$ | I. 57 | $\begin{array}{rrrr}4 & 3 & 37 \cdot 6\end{array}$ | I.6I | $4 \begin{array}{llll}4 & 59.3\end{array}$ | 1. 66 | $4 \quad 0 \quad 18.2$ | 1・クI | 3 58 $34 \cdot \mathrm{I}$ | I.76 |  | I.81 |
| 28 | $40055 \cdot 1$ | I. 59 | $\begin{array}{lllll}3 & 59 & 18 \cdot 5\end{array}$ | I. 63 | $35739 \cdot 1$ | 1.68 | $\begin{array}{llll}3 & 55 & 56 \cdot 6\end{array}$ | r.73 | 354 II'I | I•9 | $35222 \cdot 3$ | I. 84 |
| 29 | $35636 \cdot 7$ | I. 60 | 35459.0 | I. 65 | $\begin{array}{llllllll}3 & 53 & 18.3\end{array}$ | $1 \cdot 70$ | $35134 \cdot 5$ | $1 \cdot 76$ | $34947 \cdot 4$ | I.8I | $34756 \cdot 9$ | I. 87 |
| 30 | $\begin{array}{llll}3 & 52 & 18 \cdot 0\end{array}$ | I. 62 | $35039 \cdot 1$ | I. 67 | $34857 \cdot 0$ | 1.73 | 347 II•7 | I•78 | $345 \quad 23.0$ | I. 84 | 343 30.8 | I.90 |
| 31 | 347588 | I. 64 | 34618.6 | 1.70 | $\begin{array}{llllllllllll}3 & 44 & \end{array}$ | 1-75 | $\begin{array}{lllll}3 & 42 & 48 \cdot 3\end{array}$ | I.8I | $3 \begin{array}{lllll}3 & 40 & 57 \cdot 9\end{array}$ | 1.87 | $\begin{array}{llll}3 & 39 & 3.8\end{array}$ | I 93 |
| 32 | $3 \begin{array}{llll}3 & 43 & 39 \cdot 1\end{array}$ | 1. 66 |  | I•72 | $34012 \cdot 7$ | r.78 | $\begin{array}{llll}3 & 38 & 24.2\end{array}$ | I.84 | $\begin{array}{llll}3 & 36 & 32 \cdot 0\end{array}$ | I.90 | 334 36.0 | I. 97 |
| 33 | $\begin{array}{lllll}3 & 39 & 18 \cdot 9\end{array}$ | I. 69 | 337 36.0 | I.74 | $33549 \cdot 6$ | I.80 | $\begin{array}{lllll}3 & 33 & 59.4\end{array}$ | 1.87 | $\begin{array}{llll}3 & 32 & 5 \cdot 3\end{array}$ | I-93 | $\begin{array}{lll}3 & 30 & 7 \cdot 2\end{array}$ | $2 \cdot 00$ |
| 34 | $\begin{array}{lllll}3 & 34 & 58\end{array}$ | I•71 | $3 \begin{array}{llll}3 & 33 & 13.9\end{array}$ | I.77 | $\begin{array}{llll}3 & 31 & 25.8\end{array}$ | I. 83 | 32933.8 | 1.90 | $\begin{array}{llll}3 & 27 & 37 \cdot 8\end{array}$ | 1.97 | $\begin{array}{llll}3 & 25 & 37 \cdot 4\end{array}$ | $2 \cdot 04$ |
| 35 | $33037 \cdot 0$ | - | 328 5I•I | I.80 | 327 1.3 | 86 | $\begin{array}{lll}3 & 25 & 7 \cdot 4\end{array}$ | I.93 | $\begin{array}{lll}3 & 23 & 9 \cdot 2\end{array}$ | $2 \cdot 01$ | 3216.6 | . 08 |
| 36 | 3 26 <br> $15 \cdot 1$  | I•76 | $32427 \cdot 6$ | I. 83 | $32236 \cdot 0$ | 1.90 | $32040 \cdot 1$ | 1.97 | $\begin{array}{llll}3 & 18 & 39 \cdot 7\end{array}$ | 2.04 | 316164.7 | $2 \cdot 12$ |
| 37 | $\begin{array}{llll}3 & 21 & 52 \cdot 6\end{array}$ | I•79 | $\begin{array}{llll}3 & 20 & 3.4\end{array}$ | I. 86 | $\begin{array}{llll}3 & 18 & 9.8\end{array}$ | I.93 | 3 x 611.8 | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}3 & 14 & 9 \cdot 1\end{array}$ | 2.09 | $\begin{array}{llll}3 & 12 & 1.5\end{array}$ | $2 \cdot 17$ |
| 38 | $\begin{array}{llll}3 & 17 & 29.4\end{array}$ | I.81 | $\begin{array}{lllll}3 & 15 & 38 \cdot 4\end{array}$ | I. 89 | $\begin{array}{llllllllllll}3 & 13 & 42.8\end{array}$ | I•97 | 3 II 42.5 | 2.05 | $\begin{array}{llll}3 & 9 & 37 \cdot 3\end{array}$ | $2 \cdot 13$ | $3 \begin{array}{llll}3 & 7 & 27 \cdot 1\end{array}$ | $2 \cdot 22$ |
| 39 | $\begin{array}{llll}3 & 13 & 5.5\end{array}$ | 1.85 | 3 II 12.5 | I.92 | $\begin{array}{llll}3 & 9 & 14.8\end{array}$ | 2.00 | $37 \mathrm{I} 2 \cdot \mathrm{I}$ | 2.09 | $\begin{array}{llll}3 & 5 & 4 \cdot 3\end{array}$ | $2 \cdot 17$ | $\begin{array}{llll}3 & 2 & 51 \cdot 2\end{array}$ | 2.27 |
| 40 | $\begin{array}{llll}3 & 8 & 40.8\end{array}$ | 1.88 | $\begin{array}{llll}3 & 6 & 45 \cdot 7\end{array}$ | I.96 |  | $2 \cdot 04$ | $3 \begin{array}{lll}3 & 2 & 40 \cdot 5\end{array}$ | $2 \cdot 13$ | $3030 \cdot 0$ | $2 \cdot 22$ | $2 \begin{array}{llll}28 & 13.8\end{array}$ | $2 \cdot 32$ |
| 41 | $\begin{array}{llll}3 & 4 & 15.2\end{array}$ | I•91 | $3 \quad 2 \begin{array}{lll}3 & 17\end{array}$ | $2 \cdot 00$ | $3 \quad 1515$ | $2 \cdot 08$ | $\begin{array}{llll}2 & 58 & 7 \cdot 7\end{array}$ | $2 \cdot 18$ | $2 \begin{array}{lllllllll} & 55 & 54.2\end{array}$ | 2.27 | $253134 \cdot 8$ | $2 \cdot 38$ |
| 42 | $\begin{array}{llll}2 & 59 & 48 \cdot 7 \\ 2 & 5\end{array}$ | 1.95 | 2 57 49 | $2 \cdot 0$ | 255144.1 | $2 \cdot 13$ | $2 \begin{array}{llll}2 & 53 & 33 \cdot 4\end{array}$ | 2.23 | $25116 \cdot 8$ | $2 \cdot 33$ | 24854.0 | $2 \cdot 44$ |
| 43 | $\begin{array}{llll}2 & 55 & 21 \cdot 2\end{array}$ | I.99 | 25319.1 | 2.08 | 2511114 | $2 \cdot 18$ | 248 57.7 | $2 \cdot 28$ | $24637 \cdot 7$ | $2 \cdot 39$ | 24411.2 | $2 \cdot 50$ |
| 44 | $25052 \cdot 7$ | $2 \cdot 03$ | $2 \begin{array}{lllll}2 & 48 & 47\end{array}$ | $2 \cdot 13$ | $246 \quad 37 \cdot 3$ | 2.23 | $244 \quad 20 \cdot 3$ | $2 \cdot 34$ | 24156.8 | $2 \cdot 45$ | $23926 \cdot 3$ | $2 \cdot 57$ |
| 45 | $\begin{array}{llll}2 & 46 & 22 \cdot 9\end{array}$ | 2.07 | $\begin{array}{lll}2 & 44 & 15.4\end{array}$ | 18 | $242 \quad 1 \cdot 6$ | $2 \cdot 28$ | 239 41•2 | 2.40 |  | $2 \cdot 52$ | $23439 \cdot 2$ | $2 \cdot 64$ |
| 46 | $2 \begin{array}{llll}2 & 41 & 51 \cdot 9\end{array}$ | $2 \cdot 12$ |  | $2 \cdot 23$ | $\begin{array}{lllllll}2 & 37 & 24.2\end{array}$ | $2 \cdot 34$ | 235 O.I | 2.46 |  | 2.59 | $22949 \cdot 5$ | $2 \cdot 72$ |
| 47 | $\begin{array}{lllll}2 & 3 & 19.5 \\ 2 & 3 & 19.6\end{array}$ | $2 \cdot 17$ | $\begin{array}{llll}2 & 35 & 5 \cdot 7 \\ 2 & 30 & \end{array}$ | 2.29 | $23245 \cdot 0$ | 2.41 | 23017.0 | 2.53 | $23741 \cdot 1$ | 2.67 | $22457 \cdot 0$ | 2.81 |
| 48 | $\begin{array}{llll}2 & 32 & 45 \cdot 6 \\ 2 & 28 & 10 \cdot 1\end{array}$ | 2.23 2.29 | $\begin{array}{llll}2 & 30 & 28 \cdot 4 \\ 2 & 25 & 49.1\end{array}$ | $2 \cdot 35$ | $\begin{array}{rrrr}2 & 28 & 3.8 \\ 2 & 23 & 20.4\end{array}$ | $2 \cdot 47$ | $2 \begin{array}{llll}25 & 31.5\end{array}$ | 2.61 | $\begin{array}{llll}2 & 22 & 50.9 \\ 2 & 1 & 5 & \end{array}$ | 2.75 | 22010 | $2 \cdot 90$ |
| 49 | $122810 \cdot 1$ | $2 \cdot 29$ | $22549 \cdot \mathrm{I}$ | 2.41 | $\begin{array}{llll}2 & 23 & 20 \cdot 4\end{array}$ | $2 \cdot 55$ | $22043 \cdot 4$ | $2 \cdot 69$ | 21757.6 | 2.84 | $215 \quad 2 \cdot 5$ | $3 \cdot 00$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{\circ}^{\circ}$ | - s . | s. -4.23 | S. | s. | S. $-\quad .16$ | s. -4.23 | s. -.23 | s. -4.23 | S. $-\quad .31$ | S. -4.24 | S. | S. -4.25 |
| 4 | $\cdot 10$ | 4.23 | . 18 | 4.23 | . 26 | 4.24 | . 34 | 4.24 | - 42 | -4.25 | - 39 -.50 | -4.25 4.26 |
|  | -15 | $4 \cdot 23$ | -23 | 4.24 | -31 | 4.24 | -39 | 4.25 | -47 | $4 \cdot 26$ | -55 | $4 \cdot 27$ |
| 8 | - 20 | $4 \cdot 23$ | $\cdot 28$ | 4.24 | $\cdot 36$ | 4.25 | - 44 | 4.25 | $\cdot 52$ | $4 \cdot 26$ | . 60 | $4 \cdot 27$ |
| Io | -26 | $4 \cdot 24$ | -34 | 4.24 | $\cdot 42$ | 4.25 | $\cdot 50$ | $4 \cdot 26$ | $\cdot 58$ | $4 \cdot 27$ | -66 | $4 \cdot 28$ |
| 12 | $\cdot 31$ | 4.24 4.24 | . 39 | 4.25 4.25 | -47 | 4.26 4.26 | . 55 | 4.27 | $\cdot 64$ | 4.28 | $\cdot 72$ | 4.29 |
| 16 | ${ }^{-32}$ | 4.24 4.25 | -45 | 4.25 4.26 | . 53 | $4 \cdot 26$ | . 61 | 4.27 | $\cdot 69$ | 4.29 | $\cdot 78$ | $4 \cdot 30$ |
| 18 | -48 | $4 \cdot 26$ | -56 | 4.27 4.27 | . 59 | 4.27 4.28 | . 73 | 4.28 4.29 | .75 .82 | 4.30 4.31 | . 84 | 4.31 |
| 20 | -53 | $4 \cdot 26$ | . 62 | $4 \cdot 28$ | $\cdot 71$ | $4 \cdot 29$ | $\cdot 79$ | $4 \cdot 30$ | -88 | $4 \cdot 32$ | $\cdot 97$ | $4 \cdot 34$ |
| 22 | -59 | 4.27 | . 68 | $4 \cdot 29$ | $\cdot 77$ | $4 \cdot 30$ | -86 | $4 \cdot 32$ | -95 | $4 \cdot 33$ | $1 \cdot 04$ | $4 \cdot 36$ |
| 24 | -66 | $4 \cdot 28$ | $\cdot 75$ | 4.30 | . 84 | $4 \cdot 31$ | -93 | $4 \times 33$ | 1.02 | $4 \cdot 35$ | I•II | $4 \cdot 37$ |
| 26 | $\cdot 72$ | 4.29 | .81 | 4.31 | -90 | 4.33 | 1.00 | $4 \cdot 35$ | I.09 | 4.37 | I-19 | 4.39 |
| 28 30 | .79 | 4.30 | -88 | $4 \cdot 32$ | $\cdot 98$ | 4.34 | $\underline{1} 07$ | $4 \cdot 36$ | I 17 | $4 \cdot 39$ | 1.27 | $4 \cdot 42$ |
| 30 | -86 | $4 \cdot 31$ | -96 | $4 \cdot 34$ | I.05 | 4.36 | I 15 | 438 | I 25 | 4.41 | I•36 | 4.44 |
| 32 | -93 | 4.33 | 1.03 | $4 \cdot 35$ | r. ${ }^{\text {r }}$ | $4 \cdot 38$ | I 24 | 4.41 | 1.34 | $4 \cdot 44$ | 145 | $4 \cdot 47$ |
| 34 | $1 \cdot 01$ | 4.35 | I'II | 4.37 | 1.22 | $4 \cdot 40$ | I 33 | 4.43 | 1.44 | $4 \cdot 47$ | 1.55 | $4 \cdot 50$ |
| 36 | I.09 | 4.37 | 1.20 | 4.40 | 1.31 | 4.43 | 1.42 | 4.46 | r.54 | 4.50 | 1.65 | 4.54 |
| 38 40 | 1-18 1.28 | 4.39 4.42 | 1.29 1.39 | 4.42 4.45 | 1.41 1.515 | 4.46 | 1.53 | $4 \cdot 50$ | r 65 | 4.54 | $1 \cdot 77$ | 4.59 |
| 40 | 1.28 | 4.42 | $1 \cdot 39$ | $4 \cdot 45$ | $1 \cdot 51$ | 4.49 | I. 64 | $4 \cdot 54$ | 1•77 | 4.58 | $1 \cdot 90$ | $4 \cdot 64$ |
| 42 | 1.38 | $4 \cdot 45$ | 1.50 | 4.49 | 1.63 | $4 \cdot 53$ | I.76 | 458 | I 90 | 4.64 | 2.04 | $4 \cdot 70$ |
| 44 | 1.49 | 4.49 | r.62 | 4.53 | I•76 | 4.58 | 1.90 | 464 | 2.05 | 470 | 2.20 | $4 \cdot 77$ |
| 46 48 | I.62 | 4.53 4.58 | I.76 | 4.58 | 1.90 | $4 \cdot 64$ | 2.05 | $4 \cdot 70$ | $2 \cdot 21$ | 4.77 | $2 \cdot 37$ | $4 \cdot 85$ |
| 48 49 | I•75 1.83 | $4 \cdot 58$ | I. 90 1.98 | 4.64 | 2.06 | $4 \cdot 71$ | $2 \cdot 22$ | $4 \cdot 78$ | $2 \cdot 39$ | 4.86 | $2 \cdot 58$ | 4.95 |
| 49 | 1.83 | $4 \cdot 61$ | I.98 | $4 \cdot 67$ | $2 \cdot 15$ | 4.74 | $2 \cdot 32$ | 4.82 | $2 \cdot 50$ | 4.91 | 2.69 | $5 \cdot 01$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 199 Latitude $19^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| $\begin{aligned} & \text { True } \\ & \text { Alt. } \end{aligned}$ | $6^{\circ}$ | Decl. Var. | $77^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. | S. | H. M. | S. | H. M. | S. | H. M. | S. | H. M. S. | S. |
|  | $55142 \cdot 3$ | - I. 39 | 5 50 I $8 \cdot 5$ | - 1.40 | $\begin{array}{llll}5 & 48 & 54 & 3\end{array}$ | - 1.41 | 54729.7 | - 1.41 | 5464.6 | - 1.42 | $54438 \cdot 9$ | - 1.43 |
| 6 | $\begin{array}{llll}5 & 26 & 6 \cdot 4\end{array}$ | r.46 | $52438 \cdot 6$ | r.47 | $\begin{array}{llll}5 & 23 & 9 \cdot 9\end{array}$ | 1.49 | $52140 \cdot 2$ | I. 50 | 520 | I. 52 | $\begin{array}{lllll}5 & 18 & 37 \cdot 5\end{array}$ | I•54 |
| 8 | 5 I7 $32 \cdot 6$ | 1.48 | $\begin{array}{llll}5 & 16 & 3 \cdot 3\end{array}$ | 1.50 | $\begin{array}{llll}5 & \text { I4 } & 32 \cdot 8\end{array}$ | I. 52 | $5 \mathrm{l}_{5} 131 \cdot \mathrm{I}$ | I. 54 | 5 II 28.I | I. 56 | $\begin{array}{llll}5 & 9 & 53 \cdot 8\end{array}$ | I. $5^{8}$ |
| 1 | $\begin{array}{llll}5 & 8 & 57.8\end{array}$ | 1.5 | $\begin{array}{lllll}5 & 7 & 26 \cdot 7\end{array}$ | 1.53 | $\begin{array}{lrrr}5 & 5 & 54 \cdot 3\end{array}$ | I. | $\begin{array}{llll}5 & 4 & 20 \cdot 4\end{array}$ | I. 58 | $\begin{array}{lllll}5 & 2 & 45 \cdot 1\end{array}$ | - | $\begin{array}{lrr}5 & 1 & 8 \cdot 2\end{array}$ | -63 |
| 12 | 5 0-2I•7 | I. 54 | $45848 \cdot 7$ | I. 56 | 45714.2 | I. 59 | $455 \quad 38 \cdot \mathrm{I}$ | I. 62 | $454 \quad 0.2$ | 1.65 | $452 \quad 20 \cdot 6$ | x. 68 |
| 14 | $45144 * 3$ | 1.57 | 450 |  | $4 \begin{array}{llll}48 & 32.5\end{array}$ |  | $4 \begin{array}{llll}46 & 53.9\end{array}$ | 66 | 445133 |  | $\begin{array}{llll}4 & 43 & 30 \cdot 7\end{array}$ | $\cdot 73$ |
| 16 | $\begin{array}{llll}4 & 43 & 5.4\end{array}$ | I 6 | 44128.2 | I 64 | $439388 \cdot 9$ | 1.67 |  | I | $4 \begin{array}{llll}46 & 24 \cdot 1\end{array}$ | 4 | $43438 \cdot 3$ | 78 |
| 18 | 43424.9 | I 6 | $43245 \cdot 2$ | I. 68 | $43113 \cdot 3$ | I.72 | 429 19.0 | I.76 | $42732 \cdot 4$ | - |  | 8 |
| 20 | $42542 \cdot 6$ | I. 69 | $424 \quad 0 \cdot 2$ | 3 | 422154 | I•77 | $42028 \cdot 0$ | 1.81 | $4 \begin{array}{llll}4 & 18 & 37 \cdot 9\end{array}$ | I.86 | $41645^{\circ} \mathrm{O}$ | I.91 |
| 21 | 42120.7 | I•7 | $41936 \cdot 9$ | I.75 | 41750.5 | I.80 | 416154 | I. 84 | $\begin{array}{llll}4 & 14 & 9.5\end{array}$ | I. 89 | 41214.7 | r.94 |
| 22 | $41658 \cdot 2$ |  | 41513.0 |  | 41325 | I. 82 | 4 II 34.I | 7 | 494 | 2 | $4 \quad 7 \quad 43.4$ | 8 |
| 23 | $41235 \cdot 2$ | I.76 | 4 Io $48 \cdot 3$ | I. 80 | $4 \begin{array}{llllllllllllllllllll}4 & 8 & 58 \cdot 7\end{array}$ | I.85 | 4760 | I.90 | $4 \quad 5 \quad 10 \cdot 3$ | -96 | $\begin{array}{lllll}4 & 3 & 11.2\end{array}$ | - 01 |
| 24 | 48 II.5 | I-78 | $4 \begin{array}{llll}4 & 6 & 23 \cdot I\end{array}$ | I.83 |  | 1.88 | $\begin{array}{llll}4 & 2 & 37 \cdot 1\end{array}$ | I.94 | $4 \quad 0 \quad 39 \cdot 3$ | I•99 | $\begin{array}{llll}3 & 5^{8} & 38 \cdot 0\end{array}$ | $2 \cdot 05$ |
| 25 | $43177 \cdot 2$ | I.81 | 4 I 57-1 |  | $4 \begin{array}{lll}4 & 0 & 3.9\end{array}$ | 1.91 | $\begin{array}{llll}3 & 58 & 7 \cdot 3\end{array}$ | I.97 | $\begin{array}{llll}3 & 56 & 7 \cdot 4\end{array}$ | 2.03 | $\begin{array}{llll}3 & 54 & 3.7\end{array}$ | 2.09 |
| 26 | $35922 \cdot 3$ | I-84 | $35730 \cdot 4$ | 1-89 | $35535 \cdot 2$ | I•95 | 35336.6 | $2 \cdot \mathrm{OI}$ | 3515134.4 | 2.07 | $349 \quad 28 \cdot 4$ | $2 \cdot 13$ |
| 2 | $35456 \cdot 6$ | I. 87 | $353 \quad 2.9$ | I•92 | 35150 | 8 | 34950 |  | 3470.4 | 1 | 344 5I.8 | 2-18 |
| 28 | $35030 \cdot 2$ | 1.90 |  | I•96 |  | 202 | $3 \begin{array}{llll}3 & 44 & 32 \cdot 2\end{array}$ | 2.08 | $\begin{array}{llll}3 & 42 & 25.2\end{array}$ | $2 \cdot 15$ | $3 \begin{array}{llll}3 & 40 & 13.9\end{array}$ | . 23 |
| 29 | 3463.0 | I.93 | 344 5*3 | 1.99 | $\begin{array}{llll}3 & 42 & 3.8\end{array}$ | 2.06 | $\begin{array}{lllll}3 & 39 & 58.4\end{array}$ | $2 \cdot 12$ | $\begin{array}{llllllllllllll}3 & 37 & 48\end{array}$ | $2 \cdot 20$ |  | $2 \cdot 27$ |
| 30 |  | I.96 | 3 39 $35 \cdot 1$ | $2 \cdot 03$ | $\begin{array}{llll}3 & 37 & 3 \mathrm{I} \cdot 3\end{array}$ | $2 \cdot 10$ | $\begin{array}{llll}3 & 35 & 23.4\end{array}$ | $2 \cdot 17$ | $3 \begin{array}{llll}3 & 33 & \text { II }\end{array}$ | $2 \cdot 24$ | $33054^{\circ}$ | $2 \cdot 32$ |
| 31 | $\begin{array}{llll}3 & 37 & 5.8\end{array}$ | $2 \cdot 00$ | $\begin{array}{llll}3 & 35 & 3 \cdot 8\end{array}$ | $2 \cdot$ | $3 \begin{array}{llll}3 & 32 & 57 \cdot 7\end{array}$ | 2. | $3 \begin{array}{llll} & 30 & 47 \cdot 1\end{array}$ | I | 32831 | $2 \cdot 29$ | 326 II.9 | $2 \cdot 38$ |
| 32 | $\begin{array}{llll}3 & 32 & 35 \cdot 9\end{array}$ |  | $33031 \cdot 5$ |  | $\begin{array}{llll}3 & 28 & 22.8\end{array}$ | $2 \cdot 1$ | $\begin{array}{lll}3 & 26 & 9 \cdot 5\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}3 & 23 & 51 \cdot 3\end{array}$ | $2 \cdot 35$ | $3 \begin{array}{llll}3 & 21 & 27.9\end{array}$ | 2.43 |
| 33 | $\begin{array}{llll}3 & 28 & 4.8\end{array}$ | 2.08 | $32558 \cdot 1$ | $2 \cdot 15$ | $32346 \cdot 6$ | $2 \cdot 23$ | $32130 \cdot 4$ | $2 \cdot 3$ | 319 9\%0 | $2 \cdot 40$ | 3 I6 42.3 | 49 |
| 3 | $\begin{array}{llll}3 & 23 & 32 \cdot 7\end{array}$ | $2 \cdot 12$ | 32123.3 | 2.20 | $\begin{array}{lll}3 & 19 & 9 \cdot 1\end{array}$ | $2 \cdot 2$ | $\begin{array}{llllllllllll}3 & 16 & 49\end{array}$ | $2 \cdot 37$ | 3 14 $25 \cdot 1$ | $2 \cdot 46$ | 3 II 54.7 | 56 |
| 35 |  | $2 \cdot 16$ | $31647 \cdot 3$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 14 & 30 \cdot 1\end{array}$ | $2 \cdot 33$ | $\begin{array}{llll}3 & 12 & 7 \cdot 5\end{array}$ | 2.42 |  | $2 \cdot 52$ | $\begin{array}{lll}3 & 7 & 5 \cdot 1\end{array}$ | $2 \cdot 62$ |
| 36 | $\begin{array}{llllllllllll}3 & 14\end{array}$ | $2 \cdot$ | $\begin{array}{lll}3 & 12 & 9.8\end{array}$ | $2 \cdot 29$ | $\begin{array}{llll}3 & 9 & 49.4\end{array}$ | $2 \cdot 39$ | $\begin{array}{llll}3 & 7 & 23.5\end{array}$ | $2 \cdot 48$ | $\begin{array}{llll}3 & 4 & 51.5\end{array}$ | $2 \cdot 58$ | $\begin{array}{llll}3 & 2 & 13 & 3\end{array}$ | $2 \cdot 69$ |
| 37 | $\begin{array}{llll}3 & 9 & 48 \cdot 9\end{array}$ | 26 | $\begin{array}{lll}3 & 7 & 30 \cdot 8\end{array}$ | 2 | $3 \begin{array}{lll}3 & 5 & 7 \cdot 1\end{array}$ | 44 | $\begin{array}{llll}3 & 2 & 37\end{array}$ | 2.55 | 3 O 1 I.6 | 2.65 | 257190 | 2.77 |
| 38 | $3{ }^{3} 50511.4$ | $2 \cdot 31$ | 3 2 $50 \cdot 1$ | $2 \cdot 40$ | $\begin{array}{lrrr}3 & 0 & 22.9\end{array}$ | 2.51 | $2 \begin{array}{llll}2 & 57 & 49.4\end{array}$ | 2.61 | $\begin{array}{llll}2 & 55 & 9 \cdot 3\end{array}$ | 2.73 | $25222 \cdot 1$ | 2.85 |
| 39 | $3 \quad 0 \quad 32.4$ | $2 \cdot 36$ | $2 \begin{array}{llll}2 & 58 & 7 & 7\end{array}$ | $2 \cdot 46$ | 25536 | 2.57 | $25259 \cdot 1$ | $2 \cdot 68$ | 25014.5 | 2.81 | 24722.4 | $2 \cdot 93$ |
| 40 | 25551.7 | 2.42 | $\begin{array}{llll}2 & 53 & 23 \cdot 3\end{array}$ | 2.53 | $2{ }_{2} 5048 \cdot 3$ | $2 \cdot 64$ | $\begin{array}{llll}2 & 48 & 6 \cdot 3\end{array}$ | $2 \cdot 76$ | $24516 \cdot 9$ | $2 \cdot 89$ | 24219.6 | $3 \cdot 03$ |
| 4 I | $2519 \cdot 1$ | $2 \cdot 48$ | $248 \quad 36 \cdot 8$ | $2 \cdot 60$ | 24557.6 | $2 \cdot 72$ | $\begin{array}{llllll}2 & 43 & 10 \cdot 9\end{array}$ | $2 \cdot 84$ | $240 \quad 16 \cdot 3$ | $2 \cdot 98$ | $2 \begin{array}{lllllllll} & 37 & 13.3\end{array}$ | $3 \cdot 13$ |
| 42 | 24624.5 | $2 \cdot 55$ | $24348 \cdot 1$ | 2.67 | 24154.2 | - | $2 \begin{array}{llll}2 & 38 & 12.5\end{array}$ | 2.93 | 23512.4 | 3.08 | $232 \begin{array}{ll}2 & 3\end{array}$ | 3.23 |
| 43 | $24137 \cdot 7$ | $2 \cdot 62$ | $\begin{array}{lllll}2 & 38 & 56 \cdot 8\end{array}$ | $2 \cdot 75$ | $2 \begin{array}{lll}26 & 8 \cdot \mathbf{r}\end{array}$ | $2 \cdot 88$ | 233 II.0 | 3.03 | $230 \quad 4.9$ | $3 \cdot 18$ | $22649 \cdot 1$ | $3 \cdot 35$ |
| 44 | $23648 \cdot 5$ | $2 \cdot 70$ | $\begin{array}{lll}2 & 34 & 2 \cdot 8\end{array}$ | 2.83 | $\begin{array}{lll}2 & 31 & 8 \cdot 8\end{array}$ | 2.97 | $\begin{array}{lll}2 & 28 & 5.8\end{array}$ | $3 \cdot 13$ | $2 \begin{array}{lllll}2 & 24 & 53 \cdot 3\end{array}$ | $3 \cdot 30$ | $22130 \cdot 3$ | 3.48 |
| 45 |  | $2 \cdot 78$ | $\begin{array}{llll}2 & 29 & 5 \cdot 8 \\ 2 & 24 & 5 \cdot 5\end{array}$ | 2.92 | $\begin{array}{rrrr}2 & 26 & 6 \cdot 1 \\ 2 & \end{array}$ | 3.07 | $\begin{array}{llll}2 & 22 & 56 \cdot 8\end{array}$ | 3.24 | $21937 \cdot 2$ | 3.42 | $\begin{array}{llll}2 & 16 & 6 \cdot 4\end{array}$ | $3 \cdot 62$ |
| 46 | $2 \begin{array}{llll}2 & 27 & 1.9\end{array}$ | $2 \cdot 87$ | $\begin{array}{llll}2 & 24 & 5 \cdot 5\end{array}$ | 3.02 | 22059.6 | $3 \cdot 18$ | 2 I7 43.4 | $3 \cdot 36$ | 2 I 4 I6.I | $3 \cdot 56$ | 2 10 $36 \cdot 6$ | $3 \cdot 77$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | ${ }^{\circ} \mathrm{A}$. | L. 7 | A. | L. 8 | - A. | L. $9^{\circ}$ | - A. | L. 10 | - A. | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | S. | s. | s. | S. | s. | s. | s. | s. | s. | s. | s. |
| 0 | - 47 | $-4.26$ | - 55 | $-4.26$ | - 63 | $-4.28$ | - 71 | $-4.29$ | - .79 | $-4.30$ | - 87 | $-4.32$ |
| 2 | $\cdot 52$ | $4 \cdot 26$ | -60 | $4 \cdot 27$ | -68 | $4 \cdot 28$ | $\cdot 76$ | $4 \cdot 30$ | -84 | $4 \cdot 31$ | -93 | $4 \cdot 33$ |
| 4 | - 58 | 4.27 | -66 | $4 \cdot 28$ | -74 | $4 \cdot 29$ | . 82 | $4 \cdot 31$ | -90 | $4 \cdot 33$ | $\cdot 98$ | $4 \cdot 34$ |
| 6 | -63 | $4 \cdot 28$ | $\cdot 71$ | $4 \cdot 29$ | $\cdot 79$ | $4 \cdot 30$ | $\cdot 87$ | $4 \cdot 32$ | $\cdot 96$ | $4 \cdot 34$ | I.04 | $4 \cdot 36$ |
| 8 | -69 | $4 \cdot 28$ | $\cdot 77$ | 4.30 | -85 | 4.31 | -93 | $4 \cdot 33$ | $1 \cdot 02$ | 4.35 | I•10 | $4 \cdot 37$ |
| 10 | $\cdot 74$ | $4 \cdot 29$ | -83 | $4 \cdot 3 \mathrm{I}$ | -91 | 433 | -99 | $4 \cdot 35$ | I. 08 | $4 \cdot 37$ | I•I7 | $4 \cdot 39$ |
| 12 | .80 | $4 \cdot 31$ | -89 | $4 \cdot 32$ | $\cdot 97$ | $4 \cdot 34$ | I•06 | $4 \cdot 36$ | 1.14 | $4 \cdot 38$ | 1.23 | 4.41 |
| 14 | . 86 | $4 \cdot 32$ | -95 | $4 \cdot 33$ | I 03 | 4.35 | I 12 | $4 \cdot 38$ | I. 21 | $4 \cdot 40$ | I 30 | $4 \cdot 43$ |
| 16 | -93 | $4 \cdot 33$ | $1 \cdot \mathrm{OI}$ | $4 \cdot 35$ | I• 10 | $4 \cdot 37$ | I•I9 | $4 \cdot 39$ | I 28 | $4 \cdot 42$ | r 37 | $4 \cdot 45$ |
| 18 | -99 | $4 \cdot 34$ | I.08 | 4.37 | I-I7 | 4.39 | I. 26 | 4.41 | I.36 | $4 \cdot 44$ | 1.45 | 4.47 |
| 20 | I.06 | $4 \cdot 36$ | I.15 | 4.39 | I. 24 | 4.41 | I. 34 | 4.44 | 1.43 | 4.47 | 1.53 | $4 \cdot 50$ |
| 22 | I•13 | $4 \cdot 38$ | I 23 | $4 \cdot 41$ | I 32 | $4 \cdot 43$ | I 42 | 4.46 | I. 52 | $4 \cdot 49$ | I. 62 | 4.53 |
| 24 | I-21 | $4 \cdot 40$ | I 30 | $4 \cdot 43$ | r-40 | $4 \cdot 46$ | I 50 | 4.49 | I. 60 | $4 \cdot 52$ | $1 \cdot 71$ | 4.56 |
| 26 | I-29 | $4 \cdot 42$ | I•39 | 4.45 | I-49 | $4 \cdot 48$ | I. 59 | 4.52 | I.70 | $4 \cdot 56$ | I.8I | 4.60 |
| 28 | $1 \cdot 37$ | $4 \cdot 45$ | 1.47 | 4.48 | I. 58 | $4 \cdot 52$ | I. 69 | 4.55 | 1.80 | $4 \cdot 60$ | 1.91 | $4 \cdot 64$ |
| 30 | I. 46 | $4 \cdot 48$ | 1.57 | $4 \cdot 51$ | 1. 68 | 4.55 | I•79 | 4.59 | I.91 | $4 \cdot 64$ | 2.03 | 4.69 |
| 32 | 1. 56 | 4.51 | 1.67 | $4 \cdot 55$ | I•79 | $4 \cdot 59$ | I 90 | $4 \cdot 64$ | 2.03 | 4.69 | $2 \cdot 15$ | 4.75 |
| 34 | 1. 66 | $4 \cdot 54$ | $1 \cdot 78$ | 4.59 | I.90 | $4 \cdot 64$ | 2.03 | $4 \cdot 69$ | $2 \cdot 15$ | 4.75 | $2 \cdot 29$ | 4.81 |
| 36 | I•78 | $4 \cdot 59$ | 1.90 | $4 \cdot 64$ | $2 \cdot 03$ | $4 \cdot 69$ | $2 \cdot 16$ | 4.75 | $2 \cdot 30$ | 4.81 | 2.44 | 4.88 |
| 38 | 1.90 | 4.64 | 2.03 | $4 \cdot 69$ | $2 \cdot 17$ | $4 \cdot 75$ | $2 \cdot 31$ | 4.82 | $2 \cdot 46$ | 4.89 | 2.61 | 4.97 |
| 40 | 2.03 | $4 \cdot 69$ | 2.18 | 4.76 | $2 \cdot 32$ | 4.83 | $2 \cdot 48$ | 4.90 | $2 \cdot 64$ | $4 \cdot 98$ | 2.80 | 5.08 |
| 42 | 2.19 | $4 \cdot 76$ | $2 \cdot 34$ | $4 \cdot 83$ | $2 \cdot 50$ | 4.91 | 2.66 | $5 \cdot 00$ | $2 \cdot 84$ | $5 \cdot 09$ | 3.03 | $5 \cdot 20$ |
| 44 | 2.35 | 4.84 | 2.52 | 4.92 | 2.70 | $5 \cdot 02$ | 2.88 | $5 \cdot 12$ | 3.08 | $5 \cdot 23$ | $3 \cdot 29$ | $5 \cdot 36$ |
| 45 | $2 \cdot 45$ | $4 \cdot 89$ | 2.62 | $4 \cdot 98$ | 2.81 | $5 \cdot 08$ | 3.00 | $5 \cdot 19$ | $3 \cdot 21$ | $5 \cdot 31$ | $3 \cdot 44$ | 5.45 |
| 46 | $2 \cdot 55$ | 4.94 | $2 \cdot 73$ | 5.03 | 2.93 | $5 \cdot 14$ | $3 \cdot 13$ | $5 \cdot 26$ | 3.35 | $5 \cdot 40$ | $3 \cdot 59$ | $5 \cdot 55$ |

## 200 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $19^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Vár. | $18^{\circ}$ | Dec <br> Var | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. Var. | $1^{17}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. | S. | M. | S. | M. | S. | H. M. S. | S. | M. | S. | M. S. | S. |
| 0 |  | - I | $54145 \%$ | - I. 46 | $54018 \cdot 0$ | - 1.47 | $\begin{array}{llll}5 & 38 & 49.5\end{array}$ | -I.48 | $53720 \cdot 1$ | - I.50 | $\begin{array}{llll}5 & 35 & 49.7\end{array}$ | -I.51 |
| 2 | $53431 \cdot 5$ | 1.48 | $\begin{array}{lll}5 & 33 & 2.3\end{array}$ | 1.50 | 5 31 32.0 | I• 51 | $\begin{array}{llll}5 & 30 & 0.7\end{array}$ | I 53 | $\begin{array}{llll}5 & 28 & 28 \cdot 3\end{array}$ | I. 55 |  | I. 57 |
| 4 | $52548 \cdot 8$ | 1.52 | $5 \quad 24 \quad 17 \cdot 0$ | 1.54 | $\begin{array}{llll}5 & 22 & 44 \cdot 1\end{array}$ | 1.56 | 512199 | 1 | $\begin{array}{llllll}5 & 19 & 34 \cdot 4\end{array}$ | I 60 | $\begin{array}{lllllllllll}5 & 17 & 57\end{array}$ | 1.63 |
| 8 | $\begin{array}{llll}5 & 17 & 4.4\end{array}$ | I. 56 | 515129.9 | $1 \cdot 5$ | 5 I3 $54 \cdot 1$ | $1 \cdot 61$ | $\begin{array}{lllll}5 & 12 & 16.9\end{array}$ | 1.63 | 5 10 38.0 | I. 66 | $\begin{array}{lllll}5 & 8 & 57 \cdot 5\end{array}$ | 1.69 |
| 8 | $58818 \cdot 1$ | 1.6 | $\begin{array}{llll}5 & 6 & 40 \cdot 8\end{array}$ | I.63 | $\begin{array}{lll}5 & 5 & 1 / 9\end{array}$ | I. 66 | $\begin{array}{llll}5 & 3 & 21.4\end{array}$ | 1.69 | 5 I 39.0 | I•72 | $45954 \%$ | 1.75 |
| 10 | 45929.7 |  | 45749 |  | $\begin{array}{lll}4 & 56 & 7 \cdot 3\end{array}$ |  | 45423 |  | $45^{2} 337 \cdot 1$ |  | $45048 \cdot 8$ | . 82 |
| 12 | $45039 \cdot 1$ | I• | $44^{8} 55 \cdot 6$ | $1 \cdot 74$ | $44710 \cdot 0$ | $1 \cdot 78$ | $44522 \cdot 2$ | I. 82 | 443 32.1 | I. 86 | 44139.5 | 90 |
| 14 | $44146 \cdot 0$ | 1 | 43959 | 1.80 | $\begin{array}{lll}4 & 38 & 9 \cdot 7\end{array}$ | 184 | $\begin{array}{llllll}4 & 36 & 17.9\end{array}$ | 188 | $434 \begin{array}{lll}4 & 23 \cdot 5\end{array}$ | 3 | $\begin{array}{llll}4 & 32 & 26 \cdot 4\end{array}$ | 8 |
| 16 | $43250 \cdot 2$ | 1.82 | $43059 \cdot 5$ | 1.87 | 429 | $1 \cdot 91$ | $42710 \cdot 1$ | I.96 | 425 II•2 | $2 \cdot \mathrm{OI}$ | $423 \quad 9 \cdot 2$ | . 06 |
| 17 | 428 2I•I | 1.85 | $42628 \cdot 5$ | 1.90 | 424 33.1 | I 95 | 42234.8 | $2 \cdot 00$ | $42033 \cdot 4$ | 2.05 | $4 \begin{array}{llll}4 & 18 & 28 \cdot 8\end{array}$ | $2 \cdot 10$ |
| 18 | 4235 |  | $42156 \cdot 7$ |  | 41959 | $1 \cdot 99$ | 4 175 |  | 41554.5 |  | 413 47•3 | 15 |
| 19 | $41920 \cdot 7$ | 1. | $4 \begin{array}{llll}4 & 17 & 23.9\end{array}$ | 7 | 4 I5 24. 1 | $2 \cdot 02$ | $4 \begin{array}{llll}4 & 13 & 20.9\end{array}$ | $2 \cdot 08$ | 4 II 14.5 | $2 \cdot 14$ | $4 \quad 9 \quad 44 \cdot 4$ | 20 |
| 20 | 4 I 4 49•1 | I 96 | 4 I2 50.2 | $2 \cdot \mathrm{OI}$ | $41047 \cdot 9$ | 2. | $\begin{array}{llll}4 & 8 & 42.4\end{array}$ | $2 \cdot 12$ | $4633 \cdot 1$ | $2 \cdot 18$ | $\begin{array}{lllll}4 & 4 & 20 \cdot 2\end{array}$ | $2 \cdot 25$ |
| 21 | 4 10 16.7 |  | $4 \begin{array}{llll}4 & 8 & 15.4\end{array}$ | 2.05 | 4610 | $2 \cdot 11$ | $\begin{array}{lll}4 & 4 & 2.5\end{array}$ | $2 \cdot 1$ | 4 I $50 \cdot 5$ | $2 \cdot 23$ | 35934.5 | 30 |
| 22 | $4 \quad 5 \quad 43 \cdot 2$ | 2.03 | $\begin{array}{llll}4 & 3 & 39 \cdot 6\end{array}$ | 2.09 | $4 \quad 132$. | $2 \cdot 15$ | $3 \begin{array}{llll}3 & 59 & 2 I \cdot 4\end{array}$ | 2.22 | $\begin{array}{llll}3 & 57 & 6.4\end{array}$ | $2 \cdot 28$ | $35447 \cdot 2$ | $2 \cdot 36$ |
| 23 | 4 I 18.7 |  | $\begin{array}{lll}3 & 59 & 2.6\end{array}$ |  |  |  | $\begin{array}{llll}3 & 54 & 38 \cdot 9\end{array}$ | $2 \cdot 27$ | $35220 \cdot 8$ | 4 | $3 \begin{array}{llll}3 & 49 & 58 \cdot 4\end{array}$ | -41 |
| 24 | $3{ }^{3} 5633 \cdot 1$ | $2 \cdot 11$ | 35424.4 | 8 | $3{ }^{3} 52$ II $\cdot 8$ | $2 \cdot 25$ | 34954.9 | 2 | 34743.7 | $2 \cdot 39$ | $\begin{array}{llll}3 & 45 & 7 \cdot 8\end{array}$ | . 47 |
| 25 | $35156 \cdot$ | 2. | 34944.9 |  |  | $2 \cdot 30$ | $\begin{array}{llll}3 & 45 & 9.4\end{array}$ | $2 \cdot 37$ | $\begin{array}{llllllll}3 & 42 & 44 \cdot 8\end{array}$ | $2 \cdot$ |  | . 53 |
| 26 | 34718.4 | 2.20 | 3 45 4 | $2 \cdot 27$ | $\begin{array}{lllll}3 & 42 & 45 \cdot 5\end{array}$ | 235 | $\begin{array}{llll}3 & 40 & 22 \cdot 3\end{array}$ | $2 \cdot 43$ | $\begin{array}{llll}3 & 37 & 54 \cdot 1\end{array}$ | 2.51 | $\begin{array}{lllll}3 & 35 & 20 \cdot 8\end{array}$ | $2 \cdot 60$ |
| 27 | $34239 \cdot 0$ | $2 \cdot$ | 34021.9 | $2 \cdot 32$ | $\begin{array}{llll}3 & 38 & 0.1\end{array}$ | 2.40 | $\begin{array}{lllll}3 & 35 & 33 \cdot 4\end{array}$ | $2 \cdot 49$ | $\begin{array}{llll}3 & 33 & 1.5\end{array}$ | $2 \cdot 58$ | $3 \begin{array}{llll}3 & 30 & 24\end{array}$ | 67 |
| 28 | $33758 \cdot 0$ | $2 \cdot 30$ | $\begin{array}{llll}3 & 35 & 38 \cdot 0\end{array}$ | $2 \cdot 3$ | $3 \begin{array}{lll}3 & 33 & 12.9\end{array}$ | 2 | $\begin{array}{llll}3 & 30 & 42 \cdot 6\end{array}$ |  | $\begin{array}{lll}3 & 28 & 6 \cdot 9\end{array}$ | 4 | 3125125.4 |  |
| 29 | $33316 \cdot 0$ | $2 \cdot 35$ | $3{ }^{3} 30582 \cdot 5$ | 2.43 | $\begin{array}{llll}3 & 28 & 23.9\end{array}$ | $2 \cdot 52$ | $\begin{array}{lllllllllll}3 & 25 & 49\end{array}$ | $2 \cdot 62$ |  | 1 | $3 \begin{array}{llll}3 & 20 & 24^{\prime} \mathrm{I}\end{array}$ | $2 \cdot 82$ |
| 30 | $\begin{array}{llll}3 & 28 & 32 \cdot 2\end{array}$ | $2 \cdot$ | $\begin{array}{llll}3 & 26 & 5 \cdot 3\end{array}$ | $2 \cdot$ | $\begin{array}{llll}3 & 23 & 32 \cdot 9 \\ 3 & 18 & 39.9\end{array}$ | 2.59 | $\begin{array}{lllll}3 & 20 & 54.8\end{array}$ | 8 | $\begin{array}{lllll}3 & 18 & 10 \%\end{array}$ | $2 \cdot 79$ | $3 \begin{array}{llll}3 & 15 & 20 \cdot 1\end{array}$ | .90 |
| 31 | $\begin{array}{llll}3 & 23 & 46 \cdot 7\end{array}$ | 2.46 | $\begin{array}{llll}3 & 21 & 16 \cdot 1\end{array}$ | $2 \cdot 56$ | $\begin{array}{llll}3 & 18 & 39.9\end{array}$ | 2.65 | $\begin{array}{llll}3 & 15 & 57.6\end{array}$ | $2 \cdot 76$ | $\begin{array}{llll}3 & 13 & 8.8\end{array}$ | $2 \cdot 87$ | $3 \begin{array}{llll}3 & 10 & 13.3\end{array}$ | -99 |
| 32 | $3 \begin{array}{lllll}3 & 18 & 59 & 3\end{array}$ | $2 \cdot 5$ | $\begin{array}{lllll}3 & 16 & 24.9\end{array}$ | $2 \cdot 62$ | 31344.5 | $2 \cdot 73$ | 3 10 57.8 | $2 \cdot 84$ | $\begin{array}{lll}3 & 8 & 4.2\end{array}$ | $2 \cdot 95$ | $\begin{array}{lll}3 & 5 & 3 \cdot 4\end{array}$ | .08 |
| 33 | $\begin{array}{lll}3 & 14 & 9 \cdot 9\end{array}$ | 2, | 3 II $31 \cdot 5$ |  | $388846 \cdot 8$ | 2.88 | 35555. | $2 \cdot 92$ | $\begin{array}{llll}3 & 2 & 56.5\end{array}$ | 3.04 | $\begin{array}{llll}2 & 59 & 50 \cdot 2\end{array}$ |  |
| 34 | $\begin{array}{llll}3 & 9 & 18.4\end{array}$ | $2 \cdot 66$ | $\begin{array}{llll}3 & 6 & 35 \cdot 8\end{array}$ |  | 3 3 $46 \cdot 4$ | 2.88 | $\begin{array}{rrrr}3 & 0 & 49 \cdot 8\end{array}$ | . O | $\begin{array}{llllllllllllll}2 & 57 & 45 \cdot 6\end{array}$ | 314 | $25433 \cdot 2$ | 3. 28 |
| 35 |  | 2.73 | $\begin{array}{lrrr}3 & 1 & 37.4\end{array}$ | $2 \cdot 85$ | 2 58 $43 \cdot 1$ | 2.97 |  | $3 \cdot 10$ | $25231 \cdot 1$ | $3 \cdot 24$ | $\begin{array}{llllll}2 & 49 & 12 \cdot 3\end{array}$ | 39 |
| 36 | $2 \begin{array}{llll}2 & 59 & 28 \cdot 4\end{array}$ | $2 \cdot 8$ | $25636 \cdot 4$ | $2 \cdot 93$ | $\begin{array}{lllll}2 & 53 & 36 \cdot 8\end{array}$ | 3.06 | $25029 \cdot 1$ | $3 \cdot 20$ | $24712 \cdot 7$ | $3 \cdot 35$ | $2 \begin{array}{llllll}2 & 43 & 47.0\end{array}$ | 3.51 |
| 37 | 25429.4 | 2.89 | $25132 \cdot 2$ | 3.02 | $24^{2} \quad 27 \cdot 0$ | 3.16 | 24513.2 | 3.31 | $24150 \cdot 0$ | 3.47 | $2 \begin{array}{lllll}28 & 16.8\end{array}$ |  |
| 38 | $24927 \cdot 5$ | 2.98 | $2 \begin{array}{llll}2 & 46 & 24 \cdot 8\end{array}$ | $3 \cdot 12$ |  | 3.26 | $23953 \cdot 1$ | $3 \cdot 42$ | $23622 \cdot 6$ | $3 \cdot 60$ | $23241 \times 2$ | 79 |
| 39 | $24422 \cdot 4$ | 3.07 | $\begin{array}{lllllllll}2 & 41 & 13.8 \\ 2 & 35 & 58\end{array}$ | $3 \cdot 22$ | $23756 \cdot 0$ | $3 \cdot 38$ | $234 \begin{array}{llll} & 3 & 28 \cdot 3\end{array}$ | $3 \cdot 55$ | 23049.9 | $3 \cdot 74$ | 22659.7 | 9 |
| 40 |  | $3 \cdot 17$ | $\begin{array}{lllll}2 & 35 & 58.8 \\ 2 & 30 & 39.4\end{array}$ | $3 \cdot 33$ | $\begin{array}{llll}2 & 32 & 33.9\end{array}$ | 3.50 | $\begin{array}{lllll}2 & 28 & 58 \cdot 5\end{array}$ | 13.69 | $2 \begin{array}{llll}25 & \text { II }\end{array}$ | 3.89 | $\begin{array}{llll}2 & 21 & 115 \\ 2 & 15 & 15\end{array}$ | $4 \cdot 11$ |
| 41 | $2341 \begin{array}{ll}2 & 1 \cdot 2\end{array}$ | $3 \cdot 28$ | 23039.4 | $3 \cdot 45$ | $\begin{array}{lllllllllllll}2 & 27 & 6.8\end{array}$ | 3.64 | $\begin{array}{lllll}2 & 23 & 22 \cdot 9\end{array}$ | $3 \cdot 84$ |  | 4.06 | $\begin{array}{lllll}2 & 15 & 15.6\end{array}$ | 43 |
| 42 | 22844.5 | $3 \cdot 40$ | $22515 \cdot 1$ | $3 \cdot 59$ | 22134.2 | 3.79 | 2 I7 $40 \cdot 8$ | $4 \cdot 00$ | $21333 \cdot 7$ | $4 \cdot 25$ | 9 II•2 | 4.52 |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | s. | S. | S. | S. | s. | S. | s. | s. | S. |
| 0 | -. 95 | $-4.34$ | -1.04 | $-4.35$ | -1.12 | $-4.37$ | - I. 20 | $-4.40$ | -1.30 | $-4.42$ | -1.38 | $-4.45$ |
| 2 | $1 \cdot \mathrm{OI}$ | $4 \cdot 35$ | I.09 | $4 \cdot 37$ | $1 \cdot 18$ | 439 | I. 26 | 4.41 | 1-35 | 4.44 | 1.44 | $4 \cdot 47$ |
| 4 | 1.07 | $4 \cdot 36$ | $1 \cdot 15$ | $4 \cdot 38$ | 1.24 | 4.41 | I. 32 | 4.43 | 1.41 | $4 \cdot 46$ | 1.50 | $4 \cdot 49$ |
| 6 | I-13 | $4 \cdot 38$ | I. 21 | 4.40 | $1 \cdot 30$ | $4 \cdot 43$ | I 39 | 4.45 | 1.48 | $4 \cdot 48$ | 1.57 | 4.51 |
| 8 | I.19 | 439 | I. 28 | 4.42 | 1.36 | 4.45 | I.45 | 4.47 | I 54 | 4.50 | 1.64 | $4 \cdot 54$ |
| 10 | I. 25 | 4.41 | I•34 | 4.44 | 1.43 | $4 \cdot 47$ | I.52 | 4.50 | I. 62 | 4.53 | 1.71 | 4.56 |
| 12 | I 32 | 4.43 | 1.41 | 4.46 | I. 50 | 4.49 | I. 60 | 4.52 | I. 69 | $4 \cdot 56$ | 1-79 | 4.59 |
| 14 | I. 39 | $4 \cdot 45$ | 1.48 | 4.48 | I. 58 | $4 \cdot 52$ | I. 67 | $4 \cdot 55$ | I.77 | 4.59 | 1.87 | $4 \cdot 63$ |
| 16 | 1.47 | 4.48 | I. 56 | $4 \cdot 51$ | I. 66 | $4 \cdot 54$ | I.76 | 4.58 | I. 86 | $4 \cdot 62$ | 1.96 | $4 \cdot 66$ |
| 18 | I. 55 | 4.50 | 1.64 | 4.54 | I•74 | 4.57 | I. 85 | $4 \cdot 62$ | 1.95 | $4 \cdot 66$ | 2.06 | $4 \cdot 70$ |
| 20 | 1.63 | 4.53 | 1.73 | 4.57 | I. 83 | $4 \cdot 61$ | 1.94 | 4.65 | 2.05 | $4 \cdot 70$ | $2 \cdot 16$ | $4 \cdot 75$ |
| 22 | I•72 | $4 \cdot 57$ | I. 82 | 4.61 | I.93 | $4 \cdot 65$ | 2.04 | $4 \cdot 70$ | $2 \cdot 15$ | 4.75 | $2 \cdot 27$ | $4 \cdot 80$ |
| 24 | - I.8I | $4 \cdot 60$ | I.92 | $4 \cdot 65$ | 2.03 | $4 \cdot 69$ | $2 \cdot 15$ | $4 \cdot 75$ | $2 \cdot 27$ | 4.80 | $2 \cdot 39$ | $4 \cdot 86$ |
| 26 | I. 92 | 4.64 | $2 \cdot 03$ | $4 \cdot 69$ | $2 \cdot 15$ | 4.74 | 2.27 | 4.80 | 2.39 | $4 \cdot 86$ | $2 \cdot 52$ | 4.92 |
| 28 | 2.03 | 4.69 | $2 \cdot 15$ | 4.74 | $2 \cdot 27$ | 4.80 | 2.40 | 4.86 | 2.53 | 4.93 | 2.67 | $5 \cdot 00$ |
| 30 | $2 \cdot 15$ | 4.74 | $2 \cdot 28$ | 4.80 | 2.41 | 4.87 | 2.54 | 4.93 | $2 \cdot 68$ | $5 \cdot 01$ | $2 \cdot 83$ | $5 \cdot 09$ |
| 32 | $2 \cdot 28$ | 4.81 | 2.42 | $4 \cdot 87$ | $2 \cdot 56$ | 4.94 | $2 \cdot 70$ | $5 \cdot 02$ | $2 \cdot 85$ | $5 \cdot 10$ | $3 \cdot 01$ | 5.19 |
| 34 | 2.43 | 4.88 | $2 \cdot 57$ | 4.95 | $2 \cdot 72$ | $5 \cdot 03$ | 2.88 | 5.12 | 3.04 | $5 \cdot 21$ | $3 \cdot 22$ | $5 \cdot 32$ |
| 36 | 2.59 | 4.96 | 2.75 | $5 \cdot 04$ | 2.91 | $5 \cdot 13$ | 3.08 | 5.23 | $3 \cdot 26$ | $5 \cdot 34$ | 3.46 | 5.46 5.55 |
| 37 | $2 \cdot 68$ | $5 \cdot 01$ | $2 \cdot 84$ | $5 \cdot 10$ | 3.01 | $5 \cdot 19$ | $3 \cdot 19$ | $5 \cdot 30$ | $3 \cdot 38$ | $5 \cdot 42$ | $3 \cdot 59$ | $5 \cdot 55$ |
| 38 | 2.77 | 5.06 | $2 \cdot 94$ | $5 \cdot 15$ | $3 \cdot 12$ | $5 \cdot 26$ | $3 \cdot 31$ | 5.37 | $3 \cdot 52$ | $5 \cdot 50$ | 3.73 | 5.64 |
| 39 | $2 \cdot 87$ | $5 \cdot 11$ | 3.05 | $5 \cdot 22$ | $3 \cdot 24$ | $5 \cdot 33$ | $3 \cdot 44$ | $5 \cdot 45$ | $3 \cdot 66$ | $5 \cdot 59$ | $3 \cdot 89$ | $5 \cdot 75$ |
| 40 | 2.98 | $5 \cdot 18$ | $3 \cdot 17$ | . $5 \cdot 29$ | $3 \cdot 37$ | $5 \cdot 4 \mathrm{I}$ | $3 \cdot 59$ | $5 \cdot 54$ | $3 \cdot 82$ | $5 \cdot 70$ | 4.07 | $5 \cdot 87$ |
| 41 | $3 \cdot 10$ | $5 \cdot 24$ | $3 \cdot 30$ | $5 \cdot 36$ | $3 \cdot 51$ | $5 \cdot 50$ | $3 \cdot 74$ | $5 \cdot 65$ | $3 \cdot 99$ | $5 \cdot 81$ | 4.26 | $6 \cdot 00$ |
| 42 | $3 \cdot 22$ | $5 \cdot 32$ | $3 \cdot 44$ | $5 \cdot 45$ | $3 \cdot 66$ | $5 \cdot 59$ | 3.91 | 5.76 | $4 \cdot 18$ | $5 \cdot 94$ | 4.47 | $6 \cdot 16$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 201 LATITUDE $19^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. | S. | H. M. S. | S. | H. M. | S. | H. M. | S. | H. M. S. | S. |
| 0 | $\begin{array}{llll}5 & 34 & 18 \cdot 3\end{array}$ | -1.53 | 5 $32345 \cdot 8$ | - 1.55 | $53112 \cdot 1$ | -1.57 | $\begin{array}{llll}5 & 29 & 37 \cdot 1\end{array}$ | - I. 59 | $\begin{array}{llll}5 & 28 & 0.8\end{array}$ | - I. 62 | $\begin{array}{llll}5 & 26 & 23.0\end{array}$ | - 1.64 |
| 2 | 512519.9 | I. 59 | $\begin{array}{llllll}5 & 23 & 43 \cdot 8\end{array}$ | I.61 | $\begin{array}{lll}5 & 22 & 6.2\end{array}$ | 1.64 | $52027 \cdot 0$ | I. 67 | $5 \begin{array}{llll}5 & 18 & 46 \cdot 3\end{array}$ | 1.69 | $\begin{array}{llll}5 & 17 & 3.8\end{array}$ | I•72 |
| 4 | $5 \begin{array}{llll}5 & 16 & 19.0\end{array}$ | I. 65 | $51439 \cdot 0$ | I. 68 | $\begin{array}{llll}5 & 12 & 57 \cdot 3\end{array}$ | $1 \cdot 71$ | 5 II I 3.8 | I•74 | $\begin{array}{lll}5 & 9 & 28 \cdot 3\end{array}$ | $1 \cdot 77$ | $\begin{array}{lllll}5 & 7 & 40 \cdot 9\end{array}$ | 1.81 |
| 6 | $\begin{array}{llllll}5 & 7 & 15 \cdot 3\end{array}$ | 1.72 | $5 \quad 5 \quad 3 \mathrm{l}$ [1.2 | 1.75 | $\begin{array}{llll}5 & 3 & 45 \cdot 1\end{array}$ | I•78 | 5 I $57 \cdot 0$ | I. 82 | $\begin{array}{rrrr}5 & 0 & 6.6\end{array}$ | I.86 | $45814 \cdot 0$ | 1.90 |
| 8 | $\begin{array}{llll}4 & 58 & 8 \cdot 5\end{array}$ | 1-79 | $45620 \cdot 0$ | 1.83 | $4 \quad 5429.4$ | I. 86 | $45236 \cdot 4$ | 1.90 | $450 \quad 40 \cdot 9$ | 1.95 | $\begin{array}{llll}4 & 48 & 42 \cdot 7\end{array}$ | 1.99 |
| 10 | $4 \begin{array}{llll}4 & 48 & 58 \cdot 3\end{array}$ | I. 86 | $\begin{array}{lll}4 & 47 & 5 \cdot 2 \\ 4 & 37 & 6 \cdot 5\end{array}$ | 1.90 | $\begin{array}{llll}4 & 45 & 9 \cdot 8\end{array}$ | I.95 | 443 II.6 | I. 99 | $44110 \cdot 5$ | $2 \cdot 04$ | 4396.5 | 2.09 |
| 12 | $43944 \cdot 4$ | I.94 | $43746 \cdot 5$ | 1.99 | 43545.9 | $2 \cdot 04$ | 433 42.1 | 2.09 | $43135 \cdot 2$ | $2 \cdot 14$ | 42925.0 | $2 \cdot 20$ |
| 14 | 43026.4 | $2 \cdot$ | $4 \begin{array}{llll}4 & 28 & 23.4\end{array}$ | $2 \cdot 08$ | 426 I7.1 | $2 \cdot 13$ | $4 \begin{array}{lll}4 & 24 & 7 \cdot 5\end{array}$ | $2 \cdot 19$ | 42154.3 | $2 \cdot 25$ | $41937 \cdot 2$ | $2 \cdot 32$ |
| I6 | $4 \begin{array}{lll}4 & 21 & 3.9\end{array}$ | $2 \cdot 11$ | $4 \begin{array}{lllllll}4 & 55 \cdot 3\end{array}$ | $2 \cdot 17$ | 4 I6 43-I | 2.23 | $41427 \cdot 1$ | $2 \cdot 30$ | 4124 7 | $2 \cdot 37$ | $4 \quad 9 \quad 42 \cdot 9$ | 2.44 |
| 18 | 4 II $36 \cdot 4$ | $2 \cdot 21$ | $\begin{array}{llll}4 & 9 & 21.8\end{array}$ | $2 \cdot 28$ | $473 \cdot 1$ | $2 \cdot 35$ | $4 \quad 4 \quad 40 \cdot 2$ | $2 \cdot 42$ | $4 \quad 2 \quad 12.9$ | 2.49 | $35940 \cdot 8$ | $2 \cdot 58$ |
| 19 | $4 \quad 6 \quad 50 \cdot 5$ | $2 \cdot 26$ | $\begin{array}{llll}4 & 4 & 32 \cdot 7\end{array}$ | $2 \cdot 33$ | $4 \quad 2 \begin{array}{llll}4 & 10.6\end{array}$ | 2.40 | $35944 \cdot 1$ | 2.48 | $\begin{array}{llll}3 & 57 & 12.9\end{array}$ | $2 \cdot 56$ | $35436 \cdot 7$ | $2 \cdot 65$ |
| 20 | $4 \begin{array}{llll}4 & 2 & 3.2\end{array}$ | $2 \cdot 32$ | $35942 \cdot 0$ | $2 \cdot 39$ | 35716.4 | $2 \cdot 47$ | 354 46•I | $2 \cdot 55$ | $35210 \cdot 8$ | 2.63 | 349 30.2 | $2 \cdot 72$ |
| 21 | 35714.3 | $2 \cdot 37$ | $35449 \cdot 6$ | $2 \cdot 45$ | $\begin{array}{lllll}3 & 52 & 20 \cdot 3\end{array}$ | 2.53 | $34946 \cdot 0$ | 2.61 | $\begin{array}{llll}3 & 47 & 6 \cdot 5\end{array}$ | 2.71 | 344 21-3 | 2:80 |
| 22 | $\begin{array}{llll}3 & 52 & 23 \cdot 7\end{array}$ | 2.43 | $34955 \cdot 4$ | $2 \cdot 5 \mathrm{I}$ | $\begin{array}{lllllllllllllll}3 & 47 & 22 \cdot 2\end{array}$ | $2 \cdot 60$ | $34443 \cdot 7$ | $2 \cdot 69$ |  | $2 \cdot 78$ | $\begin{array}{lll}3 & 39 & 9 \cdot 7\end{array}$ | $2 \cdot 88$ |
| 23 | $34731 \cdot 2$ | 2.49 | $344 \quad 59 \cdot 2$ | $2 \cdot 58$ | $\begin{array}{lllll}3 & 42 & 21.9\end{array}$ | $2 \cdot 67$ | $3 \begin{array}{llll}3 & 39 & 39 \cdot 1\end{array}$ | 2.76 | $\begin{array}{lllll}3 & 36 & 50 \cdot 4\end{array}$ | $2 \cdot 86$ | $3 \begin{array}{llll}3 & 55 *\end{array}$ | $2 \cdot 97$ |
| 24 | $34236 \cdot 9$ | 2.56 | $340 \quad 0.9$ | $2 \cdot 65$ | 313719.4 | 2.74 | 334 32.0 | $2 \cdot 84$ | 3 3I $38 \cdot 3$ | $2 \cdot 95$ | 3288380 | 3.06 |
| 25 | $33740 \cdot 6$ | 2.62 | $\begin{array}{lll}3 & 35 & 0.4\end{array}$ | 2.72 | 313214.4 | 2.82 | $\begin{array}{llll}3 & 29 & 22 \cdot 1\end{array}$ | $2 \cdot 93$ |  | 3.04 | $3 \begin{array}{llll}3 & 23 & 17 & 3\end{array}$ | $3 \cdot 16$ |
| 26 | $\begin{array}{llll}3 & 32 & 42 \cdot 1\end{array}$ | $2 \cdot 69$ |  | $2 \cdot 79$ | $\begin{array}{llll}3 & 27 & 6 \cdot 7\end{array}$ | 2.90 | $\begin{array}{llll}3 & 24 & 9.4\end{array}$ | 3.01 | $\begin{array}{llll}3 & 21 & 5 \cdot 0\end{array}$ | $3 \cdot 14$ | 3 17 53.1 | $3 \cdot 26$ |
| 27 | $\begin{array}{llllll}3 & 27 & 4 \mathrm{I} \cdot 2\end{array}$ | $2 \cdot 77$ | $\begin{array}{lllllllllllll}3 & 24 & 52 \cdot 0\end{array}$ | $2 \cdot 87$ | $\begin{array}{llllllllllllllll}3 & 21 & 56 \cdot 2\end{array}$ | 2.99 | $\begin{array}{lllll}3 & 18 & 53 \cdot 5\end{array}$ | $3 \cdot 11$ |  | $3 \cdot 24$ | $\begin{array}{llll}3 & 12 & 25 \cdot 1\end{array}$ | $3 \cdot 37$ |
| 28 | $3 \begin{array}{lll}3 & 22 & 37 \cdot 8\end{array}$ | $2 \cdot 85$ | 3 I9 43.7 | 2.96 | $\begin{array}{lllll}3 & 16 & 42 \cdot 7\end{array}$ | 3.08 | $\begin{array}{lllll}3 & 13 & 34 \cdot 2\end{array}$ | $3 \cdot 21$ | 31017.8 | $3 \cdot 34$ | $3 \quad 6 \quad 52.9$ | 3.49 |
| 29 | $3 \begin{array}{llll}3 & 17 & 31 \cdot 7\end{array}$ | 2.93 | $314 \begin{array}{llll}3 & 14 & 5\end{array}$ | 3.05 | 3 II 25.8 | 3.18 | $\begin{array}{llll}3 & 8 & 11 \cdot 3\end{array}$ | 3.31 | $\begin{array}{lrrr}3 & 4 & 48 \cdot 2\end{array}$ | 3.46 | 3 I 16.I | 3.62 |
| 30 | $\begin{array}{lllll}3 & 12.22 .7\end{array}$ | 3.02 | $\begin{array}{llll}3 & 9 & 17.9\end{array}$ | $3 \cdot 14$ | $\begin{array}{lll}3 & 6 & 5 \cdot 3\end{array}$ | $3 \cdot 28$ | $\begin{array}{lllll}3 & 2 & 44 \cdot 3\end{array}$ | 3.43 | $\begin{array}{llll}2 & 59 & 14.2\end{array}$ | $3 \cdot 58$ | $\begin{array}{llllll}2 & 55 & 34 \cdot 3\end{array}$ | 3.75 |
| 31 | $\begin{array}{llll}3 & 7 & 10 \cdot 5\end{array}$ | $3 \cdot 11$ | $\begin{array}{rrrr}3 & 3 & 59 \cdot 9\end{array}$ | $3 \cdot 25$ | $\begin{array}{rrrrr}3 & 0 & 40 \cdot 9\end{array}$ | $3 \cdot 39$ | $\begin{array}{lllll}2 & 57 & 13 \cdot 0 \\ 2 & 51 & 36.0\end{array}$ | $3 \cdot 55$ | $\begin{array}{llll}2 & 53 & 35 \cdot 3\end{array}$ | 3.72 | $\begin{array}{llllllll}2 & 49 & 47 \cdot 0\end{array}$ | 3.90 |
| 32 | $\begin{array}{llll}3 & 1 & 54.9\end{array}$ | $3 \cdot 21$ | $25^{2} 8688 \cdot 0$ | $3 \cdot 35$ | $\begin{array}{llll}2 & 55 & 12 \cdot 3\end{array}$ | 3.51 | $25136 \cdot 8$ | 3.68 | 24750.9 | $3 \cdot 86$ | $\begin{array}{llllllllllll}2 & 43 & 53.6\end{array}$ | $4 \cdot 06$ |
| 33 | $25635 \cdot 5$ | $3 \cdot 32$ | 25312.0 | $3 \cdot 47$ | $24938 \cdot 9$ | 3.64 | 24555.4 | 3.82 | 2420.6 | 4.02 | $23753 \cdot 5$ | $4 \cdot 23$ |
| 34 | 25112.0 | 3.43 | 24741.3 | $3 \cdot 60$ | 244003 | $3 \cdot 78$ | 240811 | 3.97 | $\begin{array}{llll}2 & 36 & 3 \cdot 7\end{array}$ | $4 \cdot 19$ | 23145.8 | 4.42 |
| 35 | $24544 \cdot \mathrm{I}$ | $3 \cdot 56$ | $\begin{array}{lllll}2 & 42 & 5 \cdot 6\end{array}$ | 3.73 | 23816.0 | 3.93 | 2341843 | $4 \cdot 14$ | 229859.3 | 4.37 |  | $4 \cdot 63$ |
| 36 | 240 II•I | 3.69 |  | 3.88 | $232 \begin{array}{llll} & 35 & 3\end{array}$ | 4.09 | $2 \begin{array}{llllll}2 & 28 & 13 \cdot 2\end{array}$ | $4 \cdot 32$ | $2 \begin{array}{lllllllllll} \\ 2 & 23 & 46 \cdot 5\end{array}$ | 4.58 | $\begin{array}{llll}2 & 19 & 3.6\end{array}$ | $4 \cdot 88$ |
| 37 | $\begin{array}{llll}2 & 34 & 32 \cdot 7 \\ 2 & 28 & 48.1\end{array}$ | 3.83 | $2 \begin{array}{llll}2 & 30 & 36 \cdot 6\end{array}$ | 4.04 | $\begin{array}{lllll}2 & 26 & 27 \cdot 5\end{array}$ | 4.27 | $\begin{array}{llll}2 & 22 & 3.9\end{array}$ | 4.53 | 217724.2 | $4 \cdot 81$ | 21226.5 | $5 \cdot 14$ |
| 38 | $22848 \cdot \mathrm{I}$ | 3.99 | $22442 \cdot 0$ | $4 \cdot 22$ | 22021.6 | 4.47 | $21545 \cdot 3$ | $4 \cdot 75$ | 2 10 51.0 | 5.07 | $2 \quad 5 \quad 36.6$ | $5 \cdot 41$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ}$ A. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | s. | S. | s. | s. | s. | s. | s. | S. | S. |
| 0 | - I. 46 | -4.47 | - I. 55 | $-4.50$ | -1.64 | -4.54 | - 1.73 | $-4.57$ | - I.83 | -4.6I | - I.92 | $-4.64$ |
| 2 | I. 52 | $4 \cdot 50$ | I.6I | $4 \cdot 53$ | I•I | $4 \cdot 56$ | I. 80 | $4 \cdot 60$ | I.89 | $4 \cdot 64$ | I.99 | 4.68 |
| 4 | I. 59 | $4 \cdot 52$ | 1.68 | $4 \cdot 55$ | 1•77 | $4 \cdot 59$ | 1.87 | 4.63 | 1.96 | $4 \cdot 67$ | 2.06 | $4 \cdot 71$ |
| 6 | I. 66 | 4.54 | 1.75 | $4 \cdot 58$ | I. 85 | 4.62 | I.94 | 4.66 | $2 \cdot 04$ | $4 \cdot 70$ | $2 \cdot 14$ | $4 \cdot 74$ |
| 8 | 1.73 | $4 \cdot 57$ | 1.83 | 4.61 | 1.92 | 4.65 | 2.02 | $4 \cdot 69$ | $2 \cdot 12$ | $4 \cdot 73$ | 2.23 | $4 \cdot 78$ |
| 10 | I.81 | 4.60 | 1.90 | 4.64 | $2 \cdot 00$ | 4.68 | $2 \cdot 11$ | $4 \cdot 73$ | $2 \cdot 21$ | 4:77 | $2 \cdot 32$ | $4 \cdot 82$ |
| 12 | I.89 | 4.63 | I•99 | $4 \cdot 67$ | 2.09 | 4.72 | $2 \cdot 20$ | $4 \cdot 77$ | 2.30 | 4.82 | 2.41 | $4 \cdot 87$ |
| 14 | 1.97 | $4 \cdot 67$ | 2.08 | $4 \cdot 71$ | $2 \cdot 18$ | 4.76 | $2 \cdot 29$ | $4 \cdot 81$ | $2 \cdot 40$ | 4.87 | 2.52 | 4.93 |
| I6 | 2.07 | 4.71 | 2.17 | $4 \cdot 76$ | $2 \cdot 28$ | 4.81 | 2.40 | $4 \cdot 86$ | 2.51 | 4.92 | 2.63 | 4.98 |
| 18 | 2.17 | 4.75 | $2 \cdot 28$ | $4 \cdot 80$ | $2 \cdot 39$ | 4.86 | 2.51 | 4.92 | 2.63 | 4.98 | $2 \cdot 76$ | $5 \cdot 05$ |
| 19 | $2 \cdot 22$ | 4.78 | $2 \cdot 33$ | 4.83 | 2.45 | 4.89 | 2.57 | 4.95 | $2 \cdot 70$ | 5.02 | 2.83 | 5.09 |
| 20 | $2 \cdot 27$ | 4.80 | $2 \cdot 39$ | 4.86 | $2 \cdot 51$ | 4.92 | 2.63 | $4 \cdot 98$ | $2 \cdot 76$ | $5 \cdot 05$ | 2.90 | $5 \cdot 13$ |
| 21 | $2 \cdot 33$ | 4.83 | $2 \cdot 45$ | $4 \cdot 89$ | $2 \cdot 57$ | 4.95 | 2.70 | $5 \cdot 02$ | 2.83 | $5 \cdot 09$ | 2.97 | $5 \cdot 17$ |
| 22 | $2 \cdot 39$ | 4.86 | $2 \cdot 51$ | 4.92 | 2.64 | 4.99 | $2 \cdot 77$ | $5 \cdot 06$ | 2.91 | $5 \cdot 13$ | 3.05 | $5 \cdot 22$ |
| 23 | 2.45 | 4.89 | $2 \cdot 58$ | 4.95 | $2 \cdot 71$ | 5.02 | 2.84 | 5.10. | $2 \cdot 99$ | 5.18 | 3.13 | $5 \cdot 26$ |
| 24 | 2.52 | 4.92 | $2 \cdot 65$ | 4.99 | 2.78 | 5.06 | $2 \cdot 92$ | 5.14 | 3.07 | $5 \cdot 23$ | 3.22 | $5 \cdot 32$ |
| 25 | $2 \cdot 58$ | $4 \cdot 96$ | $2 \cdot 72$ | $5 \cdot 03$ | 2.86 | 5.11 | $3 \cdot 00$ | $5 \cdot 19$ | $3 \cdot 15$ | $5 \cdot 28$ | $3 \cdot 31$ | $5 \cdot 37$ |
| 26 | 2.66 | $4 \cdot 99$ | $2 \cdot 79$ | 5.07 | 2.94 | $5 \cdot 15$ | 3.09 | $5 \cdot 24$ | $3 \cdot 25$ | $5 \cdot 33$ | 3.41 | $5 \cdot 43$ |
| 27 | 2.73 2.81 | 5.04 | 2.87 | $5 \cdot 11$ | 3.02 | 5.20 | $3 \cdot 18$ | $5 \cdot 29$ | $3 \cdot 35$ | $5 \cdot 39$ | 3.52 | $5 \cdot 50$ |
| 28 | 2.81 | 5.08 | 2.96 | $5 \cdot 16$ | $3 \cdot 11$ | $5 \cdot 25$ | $3 \cdot 28$ | $5 \cdot 35$ | 3.45 | $5 \cdot 46$ | 3.63 | 5.57 |
| 29 | $2 \cdot 89$ | 5.13 | 3.05 | 5.21 | 3.21 | $5 \cdot 31$ | $3 \cdot 38$ | 5.42 | 3.56 | 5.53 | 3.75 | $5 \cdot 65$ |
| 30 | 2.98 | 5-18 | $3 \cdot 14$ | $5 \cdot 27$ | $3 \cdot 31$ | $5 \cdot 37$ | 3.49 | 5.49 | $3 \cdot 68$ | $5 \cdot 61$ | $3 \cdot 88$ | 5.74 |
| 31 | 3.08 | 5.23 | 3.25 | $5 \cdot 33$ | 3.42 | $5 \cdot 44$ | $3 \cdot 61$ | $5 \cdot 56$ | $3 \cdot 81$ | $5 \cdot 69$ | 4.02 | $5 \cdot 84$ |
| 32 | $3 \cdot 18$ | $5 \cdot 29$ | $3 \cdot 35$ | $5 \cdot 40$ | $3 \cdot 54$ | $5 \cdot 52$ | 3.74 | $5 \cdot 65$ | 3.95 | $5 \cdot 79$ | $4 \cdot 18$ | 5.95 |
| 33 | $3 \cdot 29$ | $5 \cdot 37$ | 3.47 | $5 \cdot 47$ | 3.67 | $5 \cdot 60$ | $3 \cdot 88$ | $5 \cdot 74$ | 4.10 | 5.89 | $4 \cdot 35$ | 6.06 |
| 34 | 3.40 | 5.43 | $3 \cdot 60$ | $5 \cdot 55$ | 3.81 | $5 \cdot 69$ | 4.03 | $5 \cdot 84$ | $4 \cdot 27$ | $6 \cdot 01$ | 4.53 | $6 \cdot 20$ |
| 35 | 3.53 | $5 \cdot 51$ | 3.73 3.88 | $5 \cdot 64$ | $3 \cdot 95$ | $5 \cdot 79$ | $4 \cdot 19$ | $5 \cdot 96$ | 4.45 | $6 \cdot 14$ | 4.74 | $6 \cdot 35$ |
| 36 37 | 3.66 3.81 | 5.59 | $3 \cdot 88$ | $5 \cdot 74$ 5.85 | $4 \cdot 12$ | $5 \cdot 90$ | $4 \cdot 38$ | 6.09 | 4.66 | 6.29 | 4.97 | $6 \cdot 52$ |
| 37 38 | 3.81 3.97 | $5 \cdot 69$ 5.80 | 4.04 4.22 | 5.85 5.97 | 4.30 4.50 | 6.03 6.18 | $4 \cdot 58$ | 6.23 | 4.88 | 6.46 6.65 | $5 \cdot 22$ | $6 \cdot 72$ |
| 38 | $3 \cdot 97$ | $5 \cdot 80$ | $4 \cdot 22$ | $5 \cdot 97$ | $4 \cdot 50$ | $6 \cdot 18$ | $4 \cdot 80$ | $6 \cdot 39$ | $5 \cdot 13$ | $6 \cdot 65$ | $5 \cdot 50$ | $6 \cdot 96$ |

## 202 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $20^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4{ }^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. S. | S | M. | S. | M. S. | S. | . M. S. | S. | . M. S. | S. |
| 0 | 6 0 | - I.46 | $\begin{array}{llll}5 & 58 & 32 \cdot 6\end{array}$ | - I. 46 | $\begin{array}{llll}5 & 57 & 5 \cdot 2\end{array}$ | - I.46 | $\begin{array}{llll}5 & 55 & 37 \cdot 7\end{array}$ | - I. 46 | $55410 \cdot 0$ | - I 46 | $55242 \cdot I$ | - I.47 |
| 8 | $\begin{array}{llll}5 & 25 & 55.9\end{array}$ | 1.47 | $\begin{array}{llllllllllll}5 & 24 & 27.2\end{array}$ | I-48 | $5 \quad 22 \quad 57 \cdot 7$ | 1.50 | 52127.4 | 1.51 | 5 I9 56.2 | 1.53 | 5 I8 24.I | I. 54 |
| 10 | $51724 \cdot 2$ | 1.48 | 515454.9 | I 50 | 51424.6 | I-5 1 |  | I. 53 | 5 II $20 \cdot 9$ | 1.55 | $\begin{array}{llll}5 & 9 & 47 \cdot 3\end{array}$ | . 57 |
| 12 | $\begin{array}{llll}5 & 8 & 52 \cdot \mathrm{I}\end{array}$ | I-49 | $5 \quad 7 \quad 22 \cdot 0$ | I•5I | $\begin{array}{llll}5 & 5 & 50 \cdot 7\end{array}$ | I.53 | $\begin{array}{llll}5 & 4 & 18 \cdot 3\end{array}$ | I. 55 | $\begin{array}{lllll}5 & 2 & 44.5\end{array}$ | 1.57 | $\begin{array}{llll}5 & 1 & 9.4\end{array}$ | 1-60 |
| 14 | $5 \quad 0 \quad 19.5$ | I.5I | $4 \begin{array}{llll}48 & 48 \cdot 4\end{array}$ | I. 53 | 457 I6.1 | x-55 | $4 \quad 55 \quad 42 \cdot 3$ | I. 58 | $454 \quad 7 \cdot 0$ | 1.60 | $45230 \cdot 1$ | I. 63 |
| 16 | $45 \mathrm{I} 46 \cdot 2$ | I. 52 | 450 I4.I | I•55 | $44840 \cdot 5$ | 1.57 | 447 5.2 | x. 60 | $445 \quad 28 \cdot 2$ | I. 63 | 443 49*5 | x.66 |
| 18 | 44312.2 | I 54 | $441038 \cdot 9$ | 1.57 | $\begin{array}{lll}4 & 40 & 3.8\end{array}$ | 1.60 | $438 \quad 26 \cdot 9$ | x. 63 | $43648 \cdot 0$ | I 66 | $435 \quad 7 \cdot 2$ | I.70 |
| 20 | $43437 \cdot 4$ | I. 56 | 43312.6 | I. 59 | 4 3I $26 \cdot 0$ | I. 63 | $42947 \cdot 2$ | x. 66 | $\begin{array}{llll}4 & 28 & 6 \cdot 3\end{array}$ | I•70 | $4 \begin{array}{llll}4 & 26 & 23 \cdot 2\end{array}$ | I•74 |
| 22 | 42615 | I•59 | 42425.2 | I. 63 | 422467 | x. 66 | 42159 | x-70 | 4 I9 22.7 | I•74 | 4 I7 37.1 | I•78 |
| 24 | 4 エ〉 24.5 | I.6I | $415 \quad 46 \cdot 4$ | 1. 65 | $414 \quad 5 \cdot 9$ | I.70 | $41222 \cdot 9$ | I 74 | 4 10 $37 \cdot 2$ | - 78 | $48848 \cdot 8$ | I. 83 |
| 25 | 4135 | 1.63 | 4 II 26.5 | I. 67 | $4 \quad 9 \quad 44 \cdot 8$ | 1•72 | $\begin{array}{llr}4 & 8 & 0.6\end{array}$ | x.76 | 4 6 13.6 | I.8I | $\begin{array}{lrrr}4 & 4 & 23.7\end{array}$ | I. 86 |
| 26 | $4846 \cdot 1$ | 1.65 | $476 \cdot 1$ | I 69 | $4 \quad 5 \quad 23 \cdot 4$ | I•74 | $\begin{array}{llll}4 & 3 & 37 \cdot 8\end{array}$ | $1 \cdot 78$ | $4 \begin{array}{lll}4 & 49 \cdot 4\end{array}$ | 1.83 | $\begin{array}{llll}3 & 59 & 57.9\end{array}$ | 88 |
| 27 | $\begin{array}{llll}4 & 4 & 26 \cdot 4\end{array}$ | r. 66 | $\begin{array}{rrrr}4 & 2 & 45 \cdot 3\end{array}$ | I.71 | $\begin{array}{lll}4 & 1 & 1.4 \\ 3 & 5 & 3\end{array}$ | I.76 | $\begin{array}{llll}3 & 59 & 14.5\end{array}$ | I.81 | $\begin{array}{lllll}3 & 57 & 24.5\end{array}$ | I. 86 |  | -91 |
| 28 | $406 \cdot 3$ | I. 68 | $35824 \cdot 1$ | I.73 | $35638 \cdot 8$ | 1.78 | $35450 \cdot 5$ | I. 83 | 35259.0 | 1.88 | 3514.3 | I.94 |
| 29 | $35545 \cdot 8$ | I. 70 | $354 \quad 2 \cdot 3$ | I.75 | $35215 \cdot 7$ | 1.80 | $35026 \cdot 0$ | I. 86 | $34832 \cdot 8$ | I.91 | $346 \quad 36 \cdot 2$ | I.97 |
| 30 | $35124 \cdot 8$ | I.72 | 3493909 | 1.77 | $34752 \cdot 1$ | I. 83 | $\begin{array}{llll}3 & 46 & 0.7\end{array}$ | I.89 | $\begin{array}{lll}3 & 44 & 5 \cdot 9\end{array}$ | I.94 | $342 \begin{array}{lll}3 & 7 \times 4\end{array}$ | - 1 |
| 31 | $\begin{array}{llll}3 & 47 & 3.3\end{array}$ | I•74 | $34517 \% 2$ | I.80 |  | 1.85 | $34134 \cdot 7$ | I.91 | $\begin{array}{llll}3 & 39 & 38 \cdot 1\end{array}$ | x.98 | $\begin{array}{llllllllllllll}3 & 37 & 37 \cdot 6\end{array}$ | . 04 |
| 32 | $34241 \cdot 3$ | I.76 | $\begin{array}{llllllllllllllllll}3 & 40 & 53.8\end{array}$ | I. 82 | $\begin{array}{llll}3 & 39 & 2 \cdot 7\end{array}$ | 1.88 | $\begin{array}{llll}3 & 37 & 8 \cdot 0\end{array}$ | I'94 | $\begin{array}{llll}3 & 35 & 9.4\end{array}$ | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}3 & 33 & 6 \cdot 8\end{array}$ | . 08 |
| 33 | $\begin{array}{llll}3 & 38 & 18 \cdot 7\end{array}$ | I•79 | $\begin{array}{lllll}3 & 36 & 29 \cdot 7\end{array}$ | I.85 | $\begin{array}{llll}3 & 34 & 37 \cdot 1\end{array}$ | 1.91 | $\begin{array}{llll}3 & 32 & 40 \cdot 4\end{array}$ | 1.98 | $\begin{array}{lllll}3 & 30 & 39 \cdot 8\end{array}$ | $2 \cdot 04$ | $\begin{array}{llll}3 & 28 & 35 \cdot 1\end{array}$ | $2 \cdot 12$ |
| 34 | $33355 \cdot 6$ | I.81 | $\begin{array}{llll}3 & 32 & 5 \cdot 0\end{array}$ | I. 88 | 33010.5 | I•94 | $328.12 \cdot 0$ | $2 \cdot 01$ | $\begin{array}{llll}3 & 26 & 9 \cdot 3\end{array}$ | 2.08 | $\begin{array}{lll}3 & 24 & 2 \cdot 2\end{array}$ | 2.16 |
| 35 | 32931.8 | I. 84 | $\begin{array}{llll}3 & 27 & 39.5\end{array}$ | 90 | $\begin{array}{llll}3 & 25 & 43 \cdot 2\end{array}$ | 1.97 | $\begin{array}{llll}3 & 23 & 42 \cdot 6\end{array}$ | 2.05 | $\begin{array}{llll}3 & 21 & 37 \cdot 7\end{array}$ | $2 \cdot 12$ | 319 28.1 | 20 |
| 36 | $\begin{array}{llll}3 & 25 & 7 \cdot 3\end{array}$ | I. 87 |  | 1.94 | 32115.0 | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}3 & 19 & 12.3\end{array}$ | 2.08 | 3 17 5*0 | 2.16 | $\begin{array}{llllllllllllll}3 & \text { I4 }\end{array}$ | $2 \cdot 25$ |
| 37 | $32042 \cdot \mathrm{I}$ | I.90 |  | I.97 | $\begin{array}{llllllllllllll}3 & 16 & 45\end{array}$ | 2.04 | $\begin{array}{lllllllll}3 & 140 \cdot 9\end{array}$ | $2 \cdot 12$ | 3123120 | $2 \cdot 21$ | 3 10 16.1 | 2.29 |
| 38 | $316 \mathrm{I} \cdot \mathrm{I}$ | I-93 |  | 00 | $\begin{array}{lllll}3 & 12 & 15 \cdot 7\end{array}$ | $2 \cdot 08$ | 310803 | $2 \cdot 17$ | $\begin{array}{llll}3 & 7 & 55.8\end{array}$ | $2 \cdot 25$ | $3 \begin{array}{lllll}3 & 5 & 37 \cdot 9\end{array}$ | $2 \cdot 34$ |
| 39 | 3 II 49*3 | I.96 | $\begin{array}{llll}3 & 9 & 49 \cdot 3\end{array}$ | 2.04 | $\begin{array}{llll}3 & 7 & 44.4\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}3 & 5 & 34.4\end{array}$ | $2 \cdot 21$ | $3 \quad 319 \cdot \mathrm{I}$ | $2 \cdot 30$ | 3 0-18.I | $2 \cdot 40$ |
| 40 | 3721.5 | 2.00 | $3 \begin{array}{lll}3 & 5 & 19 \cdot 3\end{array}$ | 2. | $\begin{array}{llll}3 & 312.0\end{array}$ | 2.17 | $3 \quad 059 \cdot 2$ | 2.26 | $25840 \cdot 9$ | $2 \cdot 35$ | 256 I6.6 | 2.46 |
| 41 | $\begin{array}{llll}3 & 2 & 52 \cdot 8\end{array}$ | 2.03 | 3 30 | $2 \cdot 12$ | $25^{288} 38 \cdot 2$ | $2 \cdot 21$ |  | $2 \cdot 31$ | 254 I•I | 2.41 |  | 2.52 |
| 42 | $258823 \cdot 1$ | 2.07 | $2 \begin{array}{llllll} & 56 & 15\end{array}$ | $2 \cdot 17$ | $25413 \cdot 1$ | $2 \cdot 26$ | 25144.4 | $2 \cdot 36$ | 24919.5 | 2.47 | 24648.0 | $2 \cdot 58$ |
| 43 | $25352 \cdot \mathrm{I}$ | $2 \cdot 12$ | $251542 \cdot 3$ | $2 \cdot 21$ | $24926 \cdot 5$ | $2 \cdot 31$ | $\begin{array}{llll}2 & 47 & 4.5\end{array}$ | 2.42 | $24436 \cdot 0$ | 2.53 | $\begin{array}{lll}2 & 42 & 0.5\end{array}$ | $2 \cdot 65$ |
| 44 | $24920 \cdot 0$ | $2 \cdot 16$ | $247 \quad 7 \cdot 2$ | 2.26 | $24448 \cdot 3$ | $2 \cdot 37$ | 24222.7 | $2 \cdot 48$ | $23950 \cdot 3$ | $2 \cdot 60$ | 23710.5 | 2.73 |
| 45 | $24446 \cdot 5$ | $2 \cdot 21$ | $24230 \cdot 7$ | $2 \cdot 32$ | 240803 | 2.43 | $23739 \cdot 0$ | $2 \cdot 55$ | $\begin{array}{lll}2 & 35 & 2.4\end{array}$ | 2.67 | $\begin{array}{lllll}2 & 32 & 18.0\end{array}$ | 2.8I |
| 46 | 240115 | . 26 | $2 \begin{array}{llll}2 & 37 & 52 \cdot 4\end{array}$ | $2 \cdot 38$ | $2.35126 \cdot 4$ | 2.49 | $2 \begin{array}{llll}22 & 53 \cdot 0\end{array}$ | $2 \cdot 62$ | 2301119 | $2 \cdot 75$ | 2.2722 .5 | 2.90 |
| 47 | $23534 \cdot 9$ | $2 \cdot 32$ | $2 \begin{array}{lllllll} & 33 & 12 \cdot 3\end{array}$ | $2 \cdot 44$ | $23042 \cdot 4$ | $2 \cdot 56$ | $\begin{array}{lllllllllllllll}2 & 28 & 4.6\end{array}$ | $2 \cdot 70$ | 22518.6 | $2 \cdot 84$ | 22223.9 | $2 \cdot 99$ |
| 48 | $23056 \cdot 7$ | $2 \cdot 38$ | $\begin{array}{lllllllllllll}2 & 28 & 30 \cdot 2\end{array}$ | 2.51 | $22556 \cdot 0$ | $2 \cdot 64$ | $\begin{array}{lllll}2 & 23 & 13.5\end{array}$ | $2 \cdot 78$ | $2 \begin{array}{llll}20 & 22 \cdot 3\end{array}$ | $2 \cdot 93$ | $2 \mathrm{I} 721 \cdot 7$ | 3.09 |
| 49 | $22616 \cdot 5$ | $2 \cdot 44$ | $22345 \cdot 9$ | $2 \cdot 58$ | $2217 \times 1$ | $2 \cdot 72$ | 2 I8 I9.5 | 2.87 | $215 \quad 22.5$ | 3.03 | 21215.5 | $3 \cdot 2$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Ait. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. 3 | A. | L. $4^{\circ}$ | A. | L. 5 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | -.00 | $-4.26$ | -.08 | $-4.26$ | - •16 | -4.26 | -. 24 | $-4.26$ | - 32 | $-4.27$ | - .40 | $-4.27$ |
| 4 | -1I | $4 \cdot 26$ | -19 | 4.26 | - 26 | 4.26 | $\cdot 38$ | 4.27 | -43 | 4.28 | -51 | 4.29 |
| 6 | -16 | 4.26 | - 24 | $4 \cdot 26$ | $\cdot 31$ | $4 \cdot 27$ | -40 | $4 \cdot 28$ | -48 | 4.28 | - 56 | 4.29 |
| 8 | -22 | $4 \cdot 26$ | -30 | $4 \cdot 27$ | $\cdot 36$ | $4 \cdot 27$ | $\cdot 46$ | $4 \cdot 28$ | -54 | $4 \cdot 29$ | -62 | $4 \cdot 30$ |
| 10 | $\cdot 27$ | $4 \cdot 26$ | $\cdot 35$ | 4.27 | - 44 | $4 \cdot 28$ | $\cdot 52$ | 4.29 | - 60 | $4 \cdot 30$ | -68 | $4 \cdot 31$ |
| 12 | -33 | 4.27 | -41 | $4 \cdot 28$ | -49 | $4 \cdot 28$ | $\cdot 58$ | 4.30 | $\cdot 66$ | $4 \cdot 31$ | $\cdot 74$ | $4 \cdot 32$ |
| 14 | $\cdot 39$ | 4.27 | -47 | 4.28 | -55 | $4 \cdot 29$ | $\cdot 64$ | $4 \cdot 30$ | $\cdot 72$ | $4 \cdot 32$ | .81 | $4 \cdot 33$ |
| 16 | -45 | $4 \cdot 28$ | $\cdot 53$ | $4 \cdot 29$ | -61 | $4 \cdot 30$ | $\cdot 70$ | $4 \cdot 31$ | -79 | $4 \cdot 33$ | $\cdot 87$ | 4.34 |
| 18 | $\cdot 51$ | 4.29 | - 59 | 4.30 | - 68 | $4 \cdot 31$ | $\cdot 76$ | $4 \cdot 32$ | . 85 | $4 \cdot 34$ | $\cdot 94$ | $4 \cdot 36$ |
| 20 | - 57 | $4 \cdot 29$ | -66 | $4 \cdot 31$ | $\cdot 74$ | $4 \cdot 32$ | . 83 | $4 \cdot 34$ | -92 | $4 \cdot 36$ | I•OI | $4 \cdot 38$ |
| 22 | -63 | $4 \cdot 30$ | -72 | $4 \cdot 32$ | -81 | $4 \cdot 33$ | -90 | $4 \cdot 35$ | -99 | $4 \cdot 38$ | 1.09 | 4.39 |
| 24 | $\cdot 70$ | $4 \cdot 31$ | $\bigcirc 79$ | $4 \cdot 33$ | -88 | $4 \cdot 35$ | -97 | $4 \cdot 37$ | $1 \cdot 07$ | $4 \cdot 39$ | I-16 | 4.41 |
| 26 | $\cdot 77$ | $4 \cdot 32$ | - 86 | $4 \cdot 34$ | -95 | 4.36 | 1.05 | $4 \cdot 38$ | I'15 | 4.41 | I. 25 | 4.43 |
| 28 | . 84 | $4 \cdot 34$ | -93 | $4 \cdot 36$ | I.03 | $4 \cdot 38$ | 1-13 | $4 \cdot 40$ | I. 23 | 4.43 | I. 33 | $4 \cdot 46$ |
| 30 | -91 | $4 \cdot 35$ | I.OI | $4 \cdot 37$ | I-II | $4 \cdot 40$ | I. 22 | $4 \cdot 43$ | I. 32 | 4.46 | 1.42 | $4 \cdot 49$ |
| 32 | -99 | $4 \cdot 37$ | I-10 | $4 \cdot 40$ | 1.20 | 4.42 | $1 \cdot 31$ | 4.45 | I.4I | 4.49 | 1.52 | 4.52 4.56 |
| 34 | I.08 | 4.39 | I-18 | $4 \cdot 42$ | I. 29 | 4.45 | 1.40 | $4 \cdot 48$ | 1.51 | $4 \cdot 52$ | 1.63 1.74 | 4.56 4.60 |
| 36 | 1.17 | $4 \cdot 41$ | I. 28 | $4 \cdot 44$ | I.39 | $4 \cdot 48$ | I.51 | $4 \cdot 51$ | I.62 | 4.56 | 1.74 1.87 | 4.60 4.65 |
| 38 | I. 26 I. 36 | 4.44 4.47 | I. 38 I. 49 | 4.47 4.51 | 1.50 1.61 | $4 \cdot 51$ 4.55 | I. 62 $\mathrm{I} \cdot 74$ | 4.55 4.60 | $1 \cdot 74$ $\mathbf{1} \cdot 87$ | 4.60 4.65 | 1.87 2.01 | 4.65 4.71 |
| 40 | I•36 | 4.47 | 1.49 | $4 \cdot 5 \mathrm{I}$ | I. 61 | 4.55 | 1•74 | 4.60 | 1.87 | 4.65 | $2 \cdot 01$ | 4.71 |
| 42 | 1.48 | 4.50 | 1.60 | 4.55 | 1•74 | 4.60 | 1.87 | 4.65 | $2 \cdot \mathrm{OI}$ | $4 \cdot 71$ | 2.16 | 4.77 |
| 44 | 1.60 | 4.55 | I•73 | 4.60 | I. 88 | $4 \cdot 65$ | 2.02 | $4 \cdot 71$ | $2 \cdot 17$ | $4 \cdot 78$ | 2.33 | 4.85 |
| 46 | I.73 | 4.60 | I. 88 | 4.65 | 2.03 | $4 \cdot 72$ | 2.19 | 4.79 | 2.35 2.56 | $4 \cdot 86$ | 2.53 2.75 | 4.95 5.07 |
| 48 | 1.88 | 4.65 | 2.04 | 4.72 4.76 | 2.20 2.30 | $4 \cdot 79$ 4.84 | $2 \cdot 38$ 2.48 | $4 \cdot 88$ | 2.56 2.68 | 4.97 5.03 | $2 \cdot 75$ 2.88 | $5 \cdot 07$ $5 \cdot 14$ |
| 49 | 1.96 | $4 \cdot 69$ | $2 \cdot 13$ | $4 \cdot 76$ | $2 \cdot 30$ | 4.84 | $2 \cdot 48$ | 4*93 | $2 \cdot 68$ | $5 \cdot 03$ | $2 \cdot 88$ | $5 \cdot 14$ |

## LATITUDE $20^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. | S. | H. M. | . | H. M. S. | S. | H. M. S. | S. | H. M. | s. | H.M. S. | s. |
| $\bigcirc$ | $5 \begin{array}{llll}5 & 51 & 13.8\end{array}$ | -1.47 | $54945 \cdot 2$ | -1.48 | $5 \begin{array}{llll}5 & 48 & 16.3\end{array}$ | -I. 49 | 5 $4646 \cdot 8$ | - I. 49 | 54 4516.9 | - 1.50 | 5 434646 | I. 51 |
| 6 | 525 28-1 | I•54 | 52355.4 | I.55 | 52221.8 | I. 57 | 5 20 47.2 | I. 59 | 5 I 911 l 4 | r.61 | 5 17 34.3 | 1.63 |
| 8 | $51650 \cdot 9$ | I. 5 | 515516.6 | I-58 | $5134 \mathrm{I} \cdot \mathrm{I}$ | r.60 | $\begin{array}{llll}5 & 12 & 4.4\end{array}$ | I•62 | 5 10 26.3 | I.65 | $5 \quad 8 \quad 46 \cdot 9$ | 1.67 |
| 10 | $5 \begin{array}{llll}5 & 8 & 12.5\end{array}$ | $\underline{1} 59$ | $\begin{array}{llll}5 & 6 & 36 \cdot 4\end{array}$ | I.61 | $\begin{array}{llll}5 & 4 & 58 \cdot 9\end{array}$ | 1.64 | $\begin{array}{lllll}5 & 3 & 20 \cdot 0 \\ 4 & 5 & 33\end{array}$ | I-66 |  | r.69 | $4 \begin{array}{lll}4 & 59 & 57.4\end{array}$ | $1 \cdot 72$ |
| 12 | $45932 \cdot 8$ | 1.62 | $45754 \cdot 8$ | I. 65 | $4 \begin{array}{llll}56 & 15 \cdot \mathrm{I}\end{array}$ | 1.68 | $4 \quad 5433.7$ | 1.70 | $45250 \cdot 7$ | I•7 | $4515 \%$ | $1 \cdot 77$ |
|  | $45051 \cdot 7$ | 66 | 449 II•4 | . 69 | 44729.4 | r.72 | $44545 \cdot 5$ | . 75 | $44359 \cdot 6$ | r.78 | 442 II 5 | 1.82 |
| 16 | 4428.9 | I.69 | $44026 \cdot 3$ | I•73 | $4384 \mathrm{I} \cdot 7$ | I.76 | $\begin{array}{llll}4 & 36 & 55 \cdot 0\end{array}$ | I. 80 | $4356 \cdot 0$ | I. 84 | $43314 \cdot 7$ | 88 |
| 18 | 43324.3 | I.73 | 43139.2 | I.77 | $42951 \cdot 8$ | r.81 | $428 \quad 2 \cdot 0$ | I.85 | $\begin{array}{llll}4 & 26 & 9 \cdot 8 \\ 4 & 17 & \end{array}$ | 1.89 | 42414.8 | 94 |
| 20 | 42437.7 | 1.78 | 42249.8 | I. 82 | 42059.4 | I. 86 | 41963 | 1.91 |  | 1.96 | 415 II 6 | $2 \cdot 00$ |
| 21 | 42013.6 | I. 80 | 41824.2 | I. 85 | $41632 \cdot \mathrm{I}$ | 89 | $\begin{array}{llllllllllll}4 & 37\end{array}$ | I.94 | 41239.5 | r.99 | 4 1о 38.6 | 2.04 |
| 22 | $4 \begin{array}{llll}45 & 48.9\end{array}$ | I.83 | 41357.9 | 1.87 | $4 \begin{array}{lll}12 & 4.2\end{array}$ | I.92 | 4107.5 | I.97 | $\begin{array}{lll}4 & 8 & 7.7\end{array}$ | 2 | 4647 | 8 |
| 23 | 4 II 23.5 | I. 85 | $4 \quad 931 \cdot 0$ | I 90 | $4 \begin{array}{llll}4 & 7 & 35 \cdot 5\end{array}$ | r.95 | $4 \quad 5 \begin{array}{lll}4 & 36 \cdot 8\end{array}$ | $2 \cdot 0$ | $\begin{array}{llll}4 & 3 & 35\end{array}$ | 6 | $\begin{array}{llll}4 & 1 & 29.7\end{array}$ | 2.12 |
| 24 | $4 \quad 6 \quad 57 \cdot 5$ | 1.88 | $\begin{array}{llll}4 & 5 & 3.3\end{array}$ | I. 93 | $\begin{array}{lllll}4 & 3 & 5 \cdot 9\end{array}$ | I.98 | $4 \begin{array}{lll}4 & 5 \cdot 3\end{array}$ | 2.04 | $3591 \cdot 3$ | $2 \cdot 10$ | $3 \quad 56 \quad 53 \cdot 6$ | 16 |
| 25 | $\begin{array}{llll}4 & 2 & 30 \cdot 8 \\ 3 & 58\end{array}$ | 1.91 | $\begin{array}{lcc}4 & 0 & 34 \cdot 8 \\ 3 & 56 & 5 \cdot 4\end{array}$ | 1.96 | $\begin{array}{llll}3 & 58 & 35 \cdot 5 \\ 3 & 54 & 4 \cdot 1\end{array}$ | 2.02 | 3 56 $32 \cdot 7$ <br> 3 5  | 2.07 | $35426 \cdot 5$ | $\stackrel{2 \cdot 14}{2.18}$ |  | 20 |
| 26 | $3 \begin{array}{lll}3 & 58 & 3.3\end{array}$ | I.94 | $\begin{array}{lll}3 & 56 & 5 \cdot 4\end{array}$ | I.99 | 354 4-1 | 2.05 | 35159.2 | $2 \cdot 11$ | $34950 \cdot 6$ | 2.18 | $34737 \cdot 9$ | 25 |
| 27 | $35335 \cdot \mathrm{I}$ |  | 35135.2 |  | $3493 \mathrm{I} \cdot 8$ | 吅 | 34724.6 |  | $3 \quad 45 \quad 13.4$ |  | 34258 I | 29 |
| 28 | $3496 \cdot 0$ | $2 \cdot 00$ | $\begin{array}{lllll}3 & 47 & 4 \cdot 1\end{array}$ | . 06 | 34458.4 | 2.13 | $34248 \cdot 8$ | $2 \cdot 19$ | $34035 \cdot 1$ | $2 \cdot 2$ | $\begin{array}{llll}3 & 38 & 16.9\end{array}$ | 2.34 |
| 29 | $\begin{array}{llll}3 & 44 & 36 \cdot 0\end{array}$ | $2 \cdot 03$ | $34232 \cdot 0$ | $2 \cdot 10$ | 34024.0 | $2 \cdot 17$ |  | 2.24 | $33555 \cdot 3$ | $2 \cdot 3$ | $\begin{array}{lllllll}3 & 33 & 34.2\end{array}$ | 2.39 |
| 30 31 | $\begin{array}{llll}3 & 40 & 5 \cdot I \\ 3 & 35 & 33 \cdot I\end{array}$ | 2.07 $2 \cdot 11$ | $\begin{array}{llll}3 & 37 & 58 \cdot 8 \\ 3 & 33 & 24.4\end{array}$ | $2 \cdot 14$ $2 \cdot 18$ | $\begin{array}{llll}3 & 35 & 48 \cdot 3 \\ 3 & 31 & 11\end{array}$ | 2.21 2.25 | $\begin{array}{llll}3 & 33 & 33 \cdot 5 \\ 3 & 28 & 53 \cdot 8\end{array}$ | 2.28 2.33 | $\begin{array}{ccc}3 & 3 \mathrm{I} & 14 \cdot \mathrm{I} \\ 3 & 26 & \\ \\ \text { I }\end{array}$ | 2.3 2.4 | $\begin{array}{llr}3 & 28 & 49 \cdot 8 \\ 3 & 24 & 3 \cdot 7\end{array}$ | 2.45 2.50 |
| 3 I | $33533 \cdot 1$ | $2 \cdot 11$ | 33324.4 | $2 \cdot 18$ | $33^{1}$ II.4 | $2 \cdot 25$ | 32853.8 | 2.33 | $3 \quad 2631 \cdot 4$ |  | 324377 | O |
| 32 | 331 I O. I | 15 | $\begin{array}{lllll}3 & 28 & 48\end{array}$ | $2 \cdot 22$ | 32633.2 | 2.30 | 32412.6 | $2 \cdot 38$ | $32147 \%$ | $2 \cdot 47$ | $31916 \cdot 0$ | $\cdot 56$ |
| 33 | $\begin{array}{lllll}3 & 26 & 25.9\end{array}$ | 19 | $3 \quad 24$ 12•I | 2.27 | 32153.5 | $2 \cdot 35$ | 31929.9 | 2.44 | $317 \quad 0.9$ | $2 \cdot 53$ | $314 \quad 26 \cdot 2$ | 63 |
| 34 | $\begin{array}{llll}3 & 21 & 50.5\end{array}$ | 2.24 | 31933.9 | $2 \cdot 32$ | 31712.3 | $2 \cdot 40$ | 314450 | 2.50 |  | 2.59 | $3 \quad 934 \cdot 3$ | 2.69 |
| 35 |  | $2 \cdot 28$ | 31454.2 | 2.37 | 31229.4 | $2 \cdot 46$ | $3{ }^{5} 59$ | $2 \cdot 56$ | $3 \begin{array}{llll}3 & 72 \cdot 7\end{array}$ | $2 \cdot 66$ | $3{ }^{3} 40 \cdot 0$ | $2 \cdot 77$ |
| 36 | $\begin{array}{lllllllll}3 & 12 & 35\end{array}$ | $2 \cdot 3$ | 3 Io 13.0 | 2.42 | $\begin{array}{lllll}3 & 7 & 4.8\end{array}$ | 2.52 | $31510 \cdot 7$ |  | $\begin{array}{lllll}3 & 2 & 30 \cdot 3\end{array}$ | $2 \cdot 7$ | $25943 \cdot 3$ | . 84 |
| 37 | $\begin{array}{llll}3 & 7 & 55.8 \\ 3 & 3\end{array}$ | 2.38 | $\begin{array}{llll}3 & 5 & 30 \cdot 0\end{array}$ | . 48 | $3 \begin{array}{llll}3 & 2 & 58 \cdot 2\end{array}$ | 2.58 | 3 O $020 \cdot 2$ | , | $25735 \cdot 6$ | 2.80 | 25443.9 | $2 \cdot 92$ |
| 38 | $\begin{array}{llll}3 & 3 & 14.5\end{array}$ | 2.44 | 3 ○ $45 \cdot 1$ | 2.5 | $2{ }^{2} 58$ | 2.65 | $25527 \cdot 3$ | 2.76 | $25238 \cdot 2$ | 2 | $24941 \cdot 5$ | 3.01 |
| 39 | $\begin{array}{llll}2 & 58 & 31 \cdot 3\end{array}$ | 2.50 | $\begin{array}{lllll}2 & 55 & 58.3\end{array}$ | 2.61 | 2 53 | 2.72 | $25032 \cdot 0$ | 2.84 | 24737.9 | 2.97 | 2 44 35 | $3 \cdot 10$ |
| 4 4 | $\begin{array}{llll}2 & 53 & 46 \cdot 2 \\ 2 & 48 & 59 \cdot 2\end{array}$ | 2.56 2.63 |  | 2.67 2.75 | $\begin{array}{llll}2 & 48 & 25 \cdot 2 \\ 2 & 43 & 29.2\end{array}$ | 2.79 2.88 | $\begin{array}{llll}2 & 45 & 33.9 \\ 2 & 40 & 32.6\end{array}$ | 2.92 3.01 | $\begin{array}{llll}2 & 42 & 34 \cdot 6 \\ 2 & 37 & 27 \cdot 8\end{array}$ | 3.06 3.16 | $\begin{array}{llll}2 & 39 & 26.8 \\ 2 & 34 & 13.9\end{array}$ | 3.20 3.31 |
| 41 | 24859.2 | 2.63 | $24617 \cdot 8$ | $2 \cdot 75$ | $243 \quad 29.2$ | 2.88 | $24032 \cdot 6$ | 3.01 | 23727.8 | $3 \cdot 16$ | 23413.9 | $3 \cdot 3 \mathrm{I}$ |
| 42 | 244 96 | 2.7 | $\begin{array}{lllll}2 & 41 & 23.8\end{array}$ | 2.83 | $23830 \cdot 2$ | $2 \cdot 96$ | $\begin{array}{llll}2 & 35 & 28 \cdot 2\end{array}$ | 3.11 | 23217.3 | $3 \cdot 26$ | $2 \begin{array}{llll}28 & 56 \cdot 6\end{array}$ | 3.43 |
| 43 | $\begin{array}{llllllll}2 & 39 & 17.6\end{array}$ | 2.78 2.86 | 2 36 27.0 <br> 2 31  | 2.91 | $\begin{array}{llll}2 & 33 \\ 2 & 28 \cdot 0\end{array}$ | $3 \cdot 06$ | $23020 \cdot 1$ 2 | 3.21 | $\begin{array}{llll}2 & 27 & 2 \cdot 6 \\ 2 & 21 & \end{array}$ | $3 \cdot 38$ | $\begin{array}{llllllllllll}2 & 23 & 34 \cdot 6 \\ 2 & 18 & 7 \cdot 3\end{array}$ | $3 \cdot 56$ |
| 44 | 23423.0 | 2.86 | $23127 \cdot 1$ | 3.01 | $22822 \cdot 3$ | 3.16 | 2258.0 | 3.32 | 22143.3 | 3.51 | $2 \begin{array}{lll}18 & 7\end{array}$ | 70 |
| 45 | $\begin{array}{lllll}2 & 29 & 25.3\end{array}$ | 2.95 | $22623 \cdot 7$ | $3 \cdot 10$ | 22312.7 | 3.27 | $21951 \cdot 3$ | 3.45 | 21618.8 | 3. | $21234^{\circ}$ | 3.86 |
| 46 | 22424.3 | 3.05 | 22116 | 3.21 | 21758 | $3 \cdot 3$ | 21429.6 | $3 \cdot 58$ | 10 48.5 | 3.80 | 54 | $4 \cdot 03$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. 7 | A. | L. 8 | A. | L. $9^{\circ}$ | A. | L. 1 | $0^{\circ} \mathrm{A}$. | L. 1 | $1^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\begin{array}{cc}\text { S. } & \text { S. } \\ -.48 & -4.28\end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ -\cdot 56 & -4.29 \end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ -.64 & -4.30 \end{array}$ |  |  |  | $\begin{array}{cc} \mathrm{s} .8 \mathrm{~s} \\ -\quad .80 & -4 \cdot 33 \end{array}$ |  | $\begin{array}{cc}\text { s. } & \text { s. } \\ -.88 & -4.35\end{array}$ |  |
| 2 | . 53 | 4.29 | . 614.30 |  | . 69 4.3I |  | $\begin{array}{rrr}.78 & 4.33\end{array}$ |  | . $86 \quad 4.34$ |  | $\begin{array}{rr}\cdot 94 & 4.36 \\ \times \cdot 00 & 4.37\end{array}$ |  |
| 4 | - 59 | $4 \cdot 30$ | $\cdot 67$ | $4 \cdot 31$ | $\cdot 754.32$ |  | . $83 \quad 4.34$ |  | .92 4.35 |  |  |  |
| 6 | - 65 | $4 \cdot 31$ | $\cdot 73$ | $4 \cdot 32$ | $\begin{array}{ll}.8 \mathrm{I} & 4.33 \\ .87 & 4.35\end{array}$ |  | .89 <br> .96 |  | $\cdot 98$ | $4 \cdot 37$ | r.06 | $4 \cdot 39$ |
| 8 | $\cdot 70$ | $4 \cdot 32$ | $\cdot 79$ | $4 \cdot 33$ |  |  | 1.04 4.38 | 1.13 4.40 |  |  |  |
| 10 | $\cdot 77$ | 4.33 | $\cdot 85$ | $4 \cdot 34$ | -94 | $4 \cdot 36$ |  |  | I. 02 | $4 \cdot 38$ | 1.11 | $4 \cdot 40$ | 1.19 | 4.42 |
| 12 | .83 | 4.34 | $\cdot 91$ | 4.35 | I.00 | $4 \cdot 37$ | 1.09 | $4 \cdot 39$ | I.18 | 4.42 | r 27 | $4 \cdot 44$ |
| 14 | .89 | 4.35 | -98 | $4 \cdot 37$ | r.07 | 4.39 | r.16 | 4.41 | I. 25 | $4 \cdot 44$ | I. 34 | $4 \cdot 46$ |
| 16 | $\cdot 96$ | 4.36 | r.05 | $4 \cdot 38$ | I. 14 | 4.41 | I.23 | $4 \cdot 43$ | I. 32 | 4.46 | 1.42 | $4 \cdot 49$ |
| 18 | I.03 | $4 \cdot 38$ | I-I2 | 4.40 | 1.21 | $4 \cdot 43$ | $1 \cdot 31$ | $4 \cdot 45$ | 1.40 | $4 \cdot 48$ | I.50 | 4.51 |
| 20 | I•10 | $4 \cdot 40$ | I. 20 | $4 \cdot 42$ | I. 29 | 4.45 | I. 39 | $4 \cdot 48$ | 1.48 | 4.51 | I.58 | $4 \cdot 54$ |
| 22 | $\pm$ I. 8 | 4.42 | I. 28 | 4.44 | 1.37 | 4.47 | 1.47 | $4 \cdot 50$ | 1.57 | 4.54 | 1.67 | 4.57 |
| 24 | I. 26 | 4.44 | I. 36 | 4.47 | 1.46 | 4.50 | I.56 | 4.53 | 1.67 | 4.57 | I•7\% | 4.61 |
| 26 | I. 35 | 4.46 | I.45 | 4.50 | I.55 | 4.53 | r. 66 | 4.57 | $1 \cdot 77$ | 4.61 | I. 88 | 4.65 |
| 28 | 1 44 | 4.49 | I. 54 | 4.53 | I.65 | $4 \cdot 56$ | 1.76 | $4 \cdot 6 \mathrm{I}$ | 1.87 | $4 \cdot 65$ | I•99 | $4 \cdot 70$ |
| 30 | $\underline{5} 53$ | $4 \cdot 52$ | 1.64 | 4.56 | I.75 | $4 \cdot 60$ | 1.87 | $4 \cdot 65$ | 1.99 | 4.70 | $2 \cdot 11$ | $4 \cdot 75$ |
| 32 | I.64 | 4.56 | r.75 | $4 \cdot 60$ | I.87 | 4.65 | I.99 | 4.70 | $2 \cdot 12$ | 4.75 | 2.25 | $4 \cdot 81$ |
| 34 | I•75 | $4 \cdot 60$ | I.87 | $4 \cdot 65$ | 1.99 | 4.70 | 2.12 | $4 \cdot 76$ | $2 \cdot 26$ | 4.82 | $2 \cdot 40$ | $4 \cdot 88$ |
| 36 | 1.87 | $4 \cdot 65$ | $2 \cdot 00$ | $4 \cdot 70$ | $2 \cdot 13$ | 4.76 | $2 \cdot 27$ | $4 \cdot 82$ | 2.41 | 4.89 | 2.56 | $4 \cdot 97$ |
| 38 | 2.00 | $4 \cdot 70$ | $2 \cdot 14$ | $4 \cdot 76$ | $2 \cdot 28$ | 4.83 | 2.43 | 4.90 | $2 \cdot 58$ | 4.98 | 2.75 | $5 \cdot 07$ |
| 40 | 2.15 | 4.77 | $2 \cdot 30$ | $4 \cdot 84$ | 2.45 | 4.91 | $2 \cdot 61$ | 4.99 | 2.78 | 5.08 | 2.96 | $5 \cdot 18$ |
| 42 | 2.31 | 4.85 | $2 \cdot 47$ | $4 \cdot 92$ | $2 \cdot 64$ | $5 \cdot \mathrm{II}$ | 2.82 | $5 \cdot 10$ | 3.00 | $5 \cdot 21$ | 3.20 | $5 \cdot 33$ |
| 44 | 2.50 | 4.94 | 2.67 | 5.03 | 2.86 2.98 | $5 \cdot 13$ | 3.06 | $5 \cdot 24$ | 3.27 | $5 \cdot 36$ | 3.49 3.66 |  |
| 45 | 2.60 | 4.99 | 2.79 2.91 | 5.09 | $2 \cdot 98$ | $5 \cdot 20$ | $3 \cdot 19$ | $5 \cdot 32$ | 3.41 3.58 | 5.46 | 3.66 3.84 | 5.61 5.72 |
| 46 | $2 \cdot 71$ | $5 \cdot 05$ | $2 \cdot 91$ | $5 \cdot 15$ | $3 \cdot 11$ | 5.27 | $3 \cdot 34$ | $5 \cdot 41$ | $3 \cdot 58$ | $5 \cdot 56$ | 3.84 | $5 \cdot 72$ |

204 HOUR-ANGLES AND VARIATIONS TO $1^{\prime}$ OF LAT., DECL., AND ALT.
LATITUDE $20^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. | s. | H. M. S. | S. | H. M. | S. | H. M. S. | S. | H. M. S. | S. |
| - | $54215 \cdot 1$ | - I. 53 | $54043 \cdot 1$ | - I 54 | $\begin{array}{llll}5 & 39 & 10.4\end{array}$ | - I. 55 | 53736.8 | - I. 57 | $\begin{array}{llll}5 & 36 & 2 \cdot 2\end{array}$ | -1.58 | $53426 \cdot 7$ | 1.60 |
| 2 | $53330 \cdot 5$ | I.56 | $53156 \cdot 2$ | 1.58 | $530 \quad 20 \cdot 8$ | 1.60 | 52844.4 | I. 62 | $\begin{array}{lll}5 & 27 & 6.8\end{array}$ | 1.64 | $\begin{array}{llll}5 & 25 & 28 \cdot 0\end{array}$ | 1.66 |
| 4 | $5 \quad 24$ 44.2 | 1.60 | $\begin{array}{llll}5 & 23 & 7 \cdot 4\end{array}$ | I. 62 | 52129.2 | 1.65 | $\begin{array}{llllllllll}5 & 19 & 49.8\end{array}$ | I. 67 | 518180 | I.69 | $\begin{array}{llllllllllllllll}5 & 16 & 26 \cdot 7\end{array}$ | $1 \cdot 72$ |
| 6 |  | I. 65 |  | 1.67 | $\begin{array}{lllll}5 & 12 & 35 \cdot 4\end{array}$ | $1 \cdot 70$ | 5 10 $52 \cdot 8$ | I-72 | $\begin{array}{llll}5 & 9 & 8.6\end{array}$ | 1.75 | $\begin{array}{llll}5 & 7 & 22 \cdot 7\end{array}$ | I•78 |
| 8 | $\begin{array}{lll}5 & 7 & 5.9\end{array}$ | 1.70 | $\begin{array}{llll}5 & 5 & 23.4\end{array}$ | $1 \cdot 72$ | $\begin{array}{llll}5 & 3 & 39 \cdot 2\end{array}$ | 1.75 | 5 I 53.2 | I. 78 | $\begin{array}{lll}5 & 0 & 5.4\end{array}$ | I.8I | $4 \begin{array}{llll}4 & 5 & 15.6\end{array}$ | I. 85 |
| 10 | $\begin{array}{llll}4 & 58 & 13.6\end{array}$ | 1.75 | $4 \begin{array}{llll}46 & 27 \cdot 9\end{array}$ | 1-78 | $\begin{array}{llll}4 & 54 & 40 \cdot 4\end{array}$ | I.81 | $45250 \cdot 8$ | I.84 | 45059.0 | r.88 | 449 5.1 | I.92 |
| 12 | 44918.8 | I.80 | 44729.8 | I. 83 | $445 \quad 38 \cdot 7$ | 1.87 | $44345 \cdot 2$ | 1.91 | $44149 \cdot 3$ | 1.95 | $439 \quad 50 \cdot 9$ | $2 \cdot 00$ |
| 14 | $44021 \cdot 3$ | I.86 | $\begin{array}{llll}4 & 38 & 28 \cdot 7 \\ 4 & 29 & 24.4\end{array}$ | I.90 | $43633 \cdot 7$ | 1.94 | $43436 \cdot 1$ | 1.98 | $43235 \cdot 8$ | 2.03 | $43032 \cdot 6$ | 2.08 |
| 16 | 43120.9 | I.92 | 42924.4 | 1.96 | 42725.2 | 2.01 | $425 \quad 23.2$ | 2.06 | 423 I8.1 | $2 \cdot 11$ | 42190 | $2 \cdot 16$ |
| 17 | $426 \quad 49 \cdot 4$ | I•95 | $424 \quad 50 \cdot 9$ | $2 \cdot 00$ | $42249 \cdot 6$ | 2.05 | $42045 \cdot 2$ | $2 \cdot 10$ | $41837 \cdot 6$ | $2 \cdot 15$ | $41626 \cdot 7$ | $2 \cdot 21$ |
| 18 | 42217.1 | 1.99 | 42016.5 | 2.03 | 41812.9 | $2 \cdot 09$ | $416 \quad 6.0$ | 2.14 | 41355.9 | $2 \cdot 20$ | 4 II 42.1 | $2 \cdot 26$ |
| 19 | 417743.9 | 2.02 | $41541 \cdot 1$ | 2.07 | $4 \begin{array}{llll}4 & 13 & 35 \cdot 1\end{array}$ | 2.13 | $41125 \cdot 7$ | $2 \cdot 19$ | $\begin{array}{llll}4 & 9 & 12.8\end{array}$ | $2 \cdot 25$ | $4656 \cdot 1$ | $2 \cdot 31$ |
| 20 | $\begin{array}{llll}4 & 13 & 9 \cdot 8\end{array}$ | 2.06 | $\begin{array}{llll}4 & 11 & 4 \cdot 7\end{array}$ | $2 \cdot 11$ | $4836 \cdot 2$ | $2 \cdot 17$ | $\begin{array}{llll}4 & 6 & 44 \cdot 1\end{array}$ | 2.23 | $\begin{array}{lrr}4 & 4 & 28.4\end{array}$ | $2 \cdot 30$ | 4 2 8.6 <br> 3 57  | $2 \cdot 36$ |
| 21 | $\begin{array}{llll}4 & 8 & 34 \cdot 6\end{array}$ | $2 \cdot 10$ | $4 \quad 6 \quad 27 \cdot 1$ | $2 \cdot 15$ | $4 \begin{array}{rrrr}4 & 16 \cdot 0\end{array}$ | $2 \cdot 22$ | $\begin{array}{llll}4 & 2 & 1 \cdot 2\end{array}$ | $2 \cdot 28$ | $35942 \cdot 5$ | $2 \cdot 35$ | $\begin{array}{llll}3 & 57 & 19.6 \\ 3 & 5 & 18\end{array}$ | $2 \cdot 42$ |
| 22 | $\begin{array}{llll}4 & 3 & 58 \cdot 3\end{array}$ | $2 \cdot 14$ | 4 I $48 \cdot 3$ | $2 \cdot 20$ | $35934 \cdot 6$ | 2.26 | $\begin{array}{lllll}3 & 57 & 16.9\end{array}$ | $2 \cdot 33$ | $35455 \cdot 0$ | $2 \cdot 40$ | $\begin{array}{lllll}3 & 52 & 28.8\end{array}$ | $2 \cdot 47$ |
| 23 | $35920 \cdot 9$ | $2 \cdot 18$ | $\begin{array}{llr}3 & 57 & 8 \cdot 3\end{array}$ | $2 \cdot 24$ | $35451 \cdot 7$ | $2 \cdot 31$ | $35231 \cdot \mathrm{I}$ | $2 \cdot 38$ | 3506.0 | 2.46 | $34736 \cdot 3$ | $2 \cdot 54$ |
| 24 | $35442 \cdot 3$ | $2 \cdot 22$ | $\begin{array}{llll}3 & 52 & 26 \cdot 9\end{array}$ | $2 \cdot 29$ | 350 | $2 \cdot 36$ | $34743 \cdot 7$ | $2 \cdot 44$ | $34515 \cdot 2$ | 2.51 | $34241 \cdot 9$ | $2 \cdot 60$ |
| 25 | $\begin{array}{llr}3 & 50 & 2.4\end{array}$ | $2 \cdot 27$ | $\begin{array}{lllll}3 & 47 & 44.2\end{array}$ | $2 \cdot 34$ | $\begin{array}{llll}3 & 45 & 21 \cdot 7\end{array}$ | $2 \cdot 41$ | $34254 \cdot 5$ | 2.49 | $\begin{array}{llll}3 & 40 & 22 \cdot 6\end{array}$ | 2.58 | $\begin{array}{llll}3 & 37 & 45 \cdot 4\end{array}$ | $2 \cdot 66$ |
| 26 | $3{ }^{3} 45121 \cdot 1$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 43 & 0.0\end{array}$ | $2 \cdot 39$ | $3{ }^{3} 40 \begin{array}{lll} & 34 \cdot 2\end{array}$ | 2.47 | 3 38 3.6 <br> 3 33  | $2 \cdot 55$ | $335 \cdot 27 \cdot 9$ | 2.64 | $\begin{array}{llll}3 & 32 & 46 \cdot 7\end{array}$ | $2 \cdot 73$ |
| 27 | $34038 \cdot 4$ | 2.37 | $\begin{array}{llll}3 & 3814.2\end{array}$ | $2 \cdot 44$ | $33545 \cdot 0$ | 2.53 | $3 \begin{array}{llll}3 & 33 & 10.8\end{array}$ | 2.62 | $33031 \cdot \mathrm{I}$ | 2.71 | $\begin{array}{llll}3 & 27 & 457\end{array}$ | $2 \cdot 8 \mathrm{I}$ |
| 28 | $3 \begin{array}{lll}35 & 54 \cdot 2\end{array}$ | 2.42 | $\begin{array}{llll}3 & 33 & 26 \cdot 6\end{array}$ | $2 \cdot 50$ | 33053.9 | 2.59 | $\begin{array}{llll}3 & 28 & 15.9\end{array}$ | 2.68 | $32532 \cdot 1$ | 2.78 | $32242 \cdot 2$ | 2.88 |
| 29 | $\begin{array}{llll}3 & 31 & 8 \cdot 3\end{array}$ | 2.47 | $\begin{array}{llllllllllll}3 & 28 & 37 \cdot 3\end{array}$ | $2 \cdot 56$ | $\begin{array}{lll}3 & 26 & 0.9\end{array}$ | 2.65 |  | 2.75 | $\begin{array}{llll}3 & 20 & 30 \cdot 6\end{array}$ | $2 \cdot 86$ | $\begin{array}{llll}3 & 17 & 36 \cdot 0\end{array}$ | $2 \cdot 97$ |
| 30 | $\begin{array}{lll}3 & 26 & 20 \cdot 6\end{array}$ | 2.53 | $\begin{array}{llll}3 & 23 & 45 \cdot 9\end{array}$ | 2.62 | $\begin{array}{lll}3 & 21 & 5.6 \\ 3 & 16 & 8\end{array}$ | 2.72 | $\begin{array}{llllll}3 & 18 & 19.2\end{array}$ | $2 \cdot 83$ | $\begin{array}{llll}3 & 15 & 26.4\end{array}$ | $2 \cdot 94$ | $\begin{array}{llll}3 & 12 & 26 \cdot 8\end{array}$ | 3.05 |
| 31 | 3213151 | $2 \cdot 59$ | $\begin{array}{llll}3 & 18 & 52 \cdot 5\end{array}$ | $2 \cdot 69$ | 31680 | $2 \cdot 79$ | $\begin{array}{llllll}3 & 13 & 17 \cdot 1\end{array}$ | 2.90 | 31019.4 | 3.02 | $\begin{array}{llll}3 & 7 & 14.6\end{array}$ | $3 \cdot 15$ |
| 32 | 31639.5 | $2 \cdot 66$ | 31356.8 | $2 \cdot 76$ | 3 II $7 \cdot 9$ | $2 \cdot 87$ | $\begin{array}{llll} & 8 & 8 \\ \end{array}$ | $2 \cdot 99$ | $\begin{array}{llll}3 & 5 & 9.4\end{array}$ | $3 \cdot 11$ | 3 I 58.8 | $3 \cdot 24$ |
| 33 | 3 II 45.7 | 2.73 | $38858 \cdot 7$ | 2.84 | $\begin{array}{lll}3 & 6 & 5 \cdot 1\end{array}$ | 2.95 | $\begin{array}{llr}3 & 3 & 4 \cdot 3\end{array}$ | 3.08 | $2 \begin{array}{llll}2 & 59 & 55.9\end{array}$ | 3.21 | $2{ }_{2} 56$ | $3 \cdot 35$ |
| 34 | $36649 \cdot 5$ | 2.80 | $\begin{array}{llll}3 & 3 & 58 \cdot 0\end{array}$ | 2.92 | 3 O $\quad 0 \quad 59.4$ | 3.04 | 25753.2 | $3 \cdot 17$ | $25438 \cdot 8$ | 3.31 | $2 \begin{array}{llll}2 & 51 & 15.7\end{array}$ | $3 \cdot 46$ |
| 35 | 3 1 $150 \cdot 7$ | 2.88 | $2{ }^{2} 5854.4$ | 3.00 | $25550 \cdot 5$ | $3 \cdot 13$ | 252388.4 | $3 \cdot 27$ | 249 17•7 | $3 \cdot 42$ | $24547 \cdot 6$ | $3 \cdot 59$ |
| 36 | $25649 \cdot 3$ | $2 \cdot 96$ | $25347 \cdot 7$ | 3.09 | $25038 \cdot 1$ | 3.23 | 24719.8 | $3 \cdot 38$ | $2 \begin{array}{lllll}2 & 43 & 52 \cdot 2\end{array}$ | $3 \cdot 54$ | $\begin{array}{lllllllll}2 & 40 & 14.5\end{array}$ | $3 \cdot 72$ |
| 37 | $25144 \% 7$ | 3.05 | $24837 \cdot 6$ | 3.19 | $2452 \mathrm{I} \cdot 8$ | 3.34 | 24156.8 | $3 \cdot 50$ | $238 \quad 21 \cdot 8$ | 3.67 | $23435 \cdot 9$ | $3 \cdot 86$ |
| 38 | $24636 \cdot 9$ | $3 \cdot 15$ | 24323.8 | $3 \cdot 30$ | $240 \quad 1.4$ | $3 \cdot 46$ | $236 \quad 29 \cdot 1$ | 3.63 | $23246 \cdot 1$ | 3.81 | 22851.3 | 4.02 |
| 39 | 24125.5 | $3 \cdot 25$ | $\begin{array}{llll}2 & 38 & 5 \cdot 8\end{array}$ | 3.4 I | $23436 \cdot 4$ | $3 \cdot 58$ | $23056 \cdot 2$ | 3.77 | $2 \begin{array}{lll}27 & 4.3\end{array}$ | $3 \cdot 97$ | $22259 \cdot 7$ | $4 \cdot 19$ |
| 40 | $23610 \cdot 0$ | 3.36 | $\begin{array}{llll}2 & 32 & 43.4\end{array}$ | 3.53 | $\begin{array}{llll}2 & 29 & 6 \cdot 2\end{array}$ | $3 \cdot 72$ | $\begin{array}{llll}2 & 25 & 17.4\end{array}$ | 3.92 | 2 21 15.9 | $4 \cdot 14$ | $\begin{array}{llll}2 & 17 & 0.4\end{array}$ | 4.39 |
| 41 | $\begin{array}{llll}2 & 30 & 50 \cdot 2 \\ 2 & 25 & 25.5\end{array}$ | 3.48 3.6 | 22716.0 | 3.67 | $\begin{array}{lll}2 & 23 & 30 \cdot 3 \\ 2 & 17 & 47.9\end{array}$ | $3 \cdot 87$ | $\begin{array}{llll}2 & 19 & 32.0\end{array}$ | 4.09 | 21519.9 | 4.33 | 2 Io $52 \cdot 3$ | $4 \cdot 60$ |
| 42 | 22525.5 | $3 \cdot 61$ | $22142 \cdot 9$ | $3 \cdot 8 \mathrm{I}$ | 21747.9 | 4.03 | 21339.2 | 4.27 | 2915.2 | $4 \cdot 54$ | $2434 \cdot \mathrm{I}$ | 4.84 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 。 | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| $\bigcirc$ | - 97 | $-4.36$ | -1.05 | $-4 \cdot 38$ | -1.13 | $-4.40$ | -1.22 | $-4.43$ | $-\mathrm{I} \cdot 31$ | $-4.45$ | - I. 39 | $-4.48$ |
| 2 | 1.02 | 4.38 | $\underline{1} 11$ | 4.40 | 1.19 | 4.42 | 1.28 | $4 \cdot 45$ | 1-37 | $4 \cdot 47$ | $1 \cdot 46$ | 4.50 |
| 4 | 1.09 | $4 \cdot 39$ | I'17 | 4.41 | $\pm 26$ | 4.44 | 1.35 | $4 \cdot 47$ | 1.44 | 4.49 | 1.53 | 4.52 |
| 6 | $1 \cdot 15$ | 4.41 | $1 \cdot 24$ | $4 \cdot 43$ | $1 \cdot 32$ | $4 \cdot 46$ | 141 | 4.49 | 1.50 | $4 \cdot 51$ | 1.60 | $4 \cdot 55$ |
| 8 | $1 \cdot 22$ | $4 \cdot 43$ | 1.30 | 4.45 | I•39 | $4 \cdot 48$ | $1 \cdot 48$ | 4.51 | $1 \cdot 58$ | $4 \cdot 54$ | 1.67 | 4.57 |
| 10 | 1.28 1.36 | 4.45 4.47 | 1.37 1.45 | 4.47 4.50 | I. 47 | 4.50 | 1.56 | 4.53 | 1.65 | 4.57 | 1.75 | 4.60 |
| 12 | 1.36 | $4 \cdot 47$ | 1.45 | $4 \cdot 50$ | 1.54 | 4.53 | 1.64 | 4.56 | 1.73 | $4 \cdot 60$ | I.83 | 4.63 |
| 14 | 1.43 | 4.49 | I 53 | 4.52 | $\pm .62$ | 4.56 | I.72 | $4 \cdot 59$ | 1.82 | 4.63 | 1.92 | $4 \cdot 67$ |
| 16 | 1.51 | 4.52 | r.61 | 4.55 4.58 | 1.71 | 4.59 | I.81 | 4.63 | 1.91 | 4.67 | 2.02 | $4 \cdot 71$ |
| 18 | $1 \cdot 59$ | $4 \cdot 55$ | 1•70 | $4 \cdot 58$ | I.80 | $4 \cdot 62$ | 1.90 | $4 \cdot 66$ | 2.01 | 4'71 | $2 \cdot 12$ | 4.75 |
| 20 | 1.68 | 4.58 | 1•79 | $4 \cdot 62$ | 1.89 | $4 \cdot 66$ | $2 \cdot 00$ | $4 \cdot 70$ | $2 \cdot 11$ | 4.75 | $2 \cdot 23$ | 4.80 |
| 22 | 1.78 | 4.61 | I.89 | $4 \cdot 66$ | 2.00 | 4.70 | $2 \cdot 11$ | $4 \cdot 75$ | 2.23 | 4.80 | $2 \cdot 35$ | $4 \cdot 86$ |
| 24 | 1.88 | $4 \cdot 65$ | $1 \cdot 99$ | $4 \cdot 70$ | $2 \cdot 11$ | $4 \cdot 75$ | $2 \cdot 23$ | 4.80 | $2 \cdot 35$ | 4.86 | $2 \cdot 48$ | 4.92 |
| 26 | 1.99 | 4.70 | 2.11 | 4.75 | 2.23 | 4.80 | $2 \cdot 35$ | $4 \cdot 86$ | 2.48 | $4 \cdot 93$ | $2 \cdot 62$ | 5.00 |
| 28 | $2 \cdot 11$ | $4 \times 75$ | $2 \cdot 23$ | 4.8 I | 2.36 | 4.87 | $2 \cdot 49$ | $4 \cdot 93$ | 2.63 | $5 \cdot 0$ | $2 \cdot 77$ | $5 \cdot 08$ |
| 30 | 2.24 2.38 | 4.81 | 2.37 | 4.87 | 2.51 | 4.94 | 2.65 | 5.01 | 2.80 | $5 \cdot 09$ | 2.95 | 5.18 |
| 32 | $2 \cdot 38$ | $4 \cdot 88$ | $2 \cdot 52$ | 4.95 | 2.67 | 5.02 | 2.82 | $5 \cdot 11$ | 2.98 | $5 \cdot 20$ | $3 \cdot 15$ | $5 \cdot 29$ |
| 34 | 2.54 | 4.96 5 | 2.69 2.88 | 5.04 | 2.85 | 5.12 | 3.01 | $5 \cdot 22$ | 3.19 | $5 \cdot 32$ | $3 \cdot 37$ | $5 \cdot 43$ |
| 36 | 2.72 2.81 | 5.05 | 2.88 | $5 \cdot 14$ | 3.05 | $5 \cdot 24$ | $3 \cdot 24$ | $5 \cdot 35$ | 3.43 | 5.47 | $3 \cdot 63$ | $5 \cdot 60$ |
| 37 | 2.81 | $5 \cdot 10$ | $2 \cdot 99$ | $5 \cdot 20$ | $3 \cdot 17$ | $5 \cdot 31$ | $3 \cdot 36$ | $5 \cdot 42$ | 3.56 | $5 \cdot 55$ | $3 \cdot 78$ | $5 \cdot 69$ |
| 38 | 2.92 | $5 \cdot 16$ | $3 \cdot 10$ | $5 \cdot 26$ | 3.29 | $5 \cdot 38$ | $3 \cdot 49$ | 5.50 | 3.71 | $5 \cdot 65$ | 3.94 | $5 \cdot 80$ |
| 39 | 3.03 | $5 \cdot 22$ | 3.22 | $5 \cdot 34$ | $3 \cdot 42$ | $5 \cdot 46$ | 3.64 | $5 \cdot 60$ | 3.87 | $5 \cdot 75$ | $4 \cdot 12$ | $5 \cdot 92$ |
| 40 | $3 \cdot 15$ | $5 \cdot 29$ | 3.35 | 5.41 | $3 \cdot 56$ | $5 \cdot 55$ | 3.79 | $5 \cdot 70$ | 4.04 | 5.87 | 4.32 | $6 \cdot 06$ |
| 4 I | 3.27 | 5.37 | 3.49 3.64 | $5 \cdot 50$ | 3.72 3.89 | $5 \cdot 65$ | $3 \cdot 97$ | 5.82 | 4.24 | 6.01 | 4.53 | $6 \cdot 22$ |
| 42 | 3.41 | $5 \cdot 46$ | $3 \cdot 64$ | $5 \cdot 60$ | 3.89 | 5.76 | $4 \cdot 16$ | 5.95 | $4 \cdot 35$ | $6 \cdot 16$ | 4.78 | $6 \cdot 40$ |

## LATITUDE $20^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. M. S. | S. | H. M. | S. | H. M. S. | S. | H. M. S. | S. | H. M. | S. | H. M. S. | S. |
| 0 | $53250 \cdot 0$ | -r. 62 | $53112 \cdot 1$ | - 1.64 | $52933 \cdot 0$ | - r. 66 | $512752 \cdot 5$ | - I. 69 | 52610.5 | -1.71 | $52427 \cdot 0$ | - 1.74 |
| 2 | $52347 \cdot 8$ | I. 68 | $\begin{array}{llll}5 & 22 & 6 \cdot 2\end{array}$ | 1.71 | $52023 \cdot 0$ | I. 73 | $\begin{array}{llll}5 & 18 & 38 \cdot 3\end{array}$ | r•76 | 5 I6 5I.8 | 1.79 | $515 \quad 3.5$ | 1.82 |
| 4 | $\begin{array}{lllll}5 & 14 & 42 \cdot 8\end{array}$ | r.74 | $\begin{array}{llll}5 & 12 & 57 \cdot 3\end{array}$ | 1.77 | 5 II $8 \cdot 9$ | r.80 | $\begin{array}{lrrr}5 & 9 & 20 \cdot 7 \\ 4 & 59 & 59 \cdot 3\end{array}$ | 1.84 | $\begin{array}{rrrr}5 & 7 & 29.4 \\ 4 & 58 & 3.0\end{array}$ | 1.87 | $\begin{array}{lrrr}5 & 5 & 36 \cdot 0\end{array}$ | 1.91 |
| 6 | $\begin{array}{llll}5 & 5 & 34.8\end{array}$ | I. 81 | $\begin{array}{llll}5 & 3 & 45 \cdot 1\end{array}$ | 1.85 | 5 I $53 \cdot 3$ | I. 88 | $4 \quad 59 \quad 59 \cdot 3$ | 1.92 | $458 \quad 3 \cdot 0$ | r.96 | 456 | 2.00 |
| 8 | $456 \quad 23.6$ | I. 88 | 45429.4 | 1.92 | $\begin{array}{llll}4 & 52 & 32 \cdot 9\end{array}$ | I.96 | $45033 \cdot 8$ | 2.01 | $\begin{array}{llll}4 & 48 & 32 \cdot 2\end{array}$ | $2 \cdot 05$ | $44^{46} 27 \cdot 7$ | $2 \cdot 10$ |
| 10 | $447 \quad 8 \cdot 7$ | r.96 | $445 \quad 9 \cdot 8$ | $2 \cdot 00$ | $443 \quad 8 \cdot 2$ | $2 \cdot 05$ | 44 I | $2 \cdot 10$ | $4 \begin{array}{lll} & 38 & 56 \cdot 4\end{array}$ | 2.15 | $43645 \cdot 9$ | $2 \cdot 20$ |
| 12 | $43749 \cdot 8$ | $2 \cdot 04$ | $435 \quad 45 \cdot 9$ | 2.09 | $433 \begin{array}{lll}4 & 38 \cdot 9\end{array}$ | $2 \cdot 14$ | $4 \begin{array}{llll}4 & 31 & 28 \cdot 7\end{array}$ | $2 \cdot 20$ | $42915 \cdot 3$ | $2 \cdot 25$ | $4{ }_{4} 26 \begin{array}{lll} & 58\end{array}$ | $2 \cdot 31$ |
| 14 | $428 \quad 26 \cdot 5$ | $2 \cdot 13$ | 426 r $7 \cdot 1$ | $2 \cdot 18$ | $424 \quad 4.4$ | $2 \cdot 24$ | 4 21 48.I | $2 \cdot 30$ | 4 19 28-1 | $2 \cdot 37$ | $4 \mathrm{I} 74 \cdot \mathrm{I}$ | $2 \cdot 43$ |
| 16 | $418 \quad 58 \cdot 3$ | $2 \cdot 22$ | 4 I6 43.1 | $2 \cdot 28$ | 4 I4 24.1 | $2 \cdot 35$ | $4 \begin{array}{lll}12 & \text { I } 2\end{array}$ | $2 \cdot 42$ | $4 \quad 934 \cdot 1$ | $2 \cdot 49$ | $4 \quad 7 \quad 2.6$ | $2 \cdot 56$ |
| I8 | $4 \quad 924.5$ | $2 \cdot 32$ | $\begin{array}{lll}4 & 7 & 3 \cdot 1\end{array}$ | $2 \cdot 39$ | $4 \begin{array}{lll}4 & 4 & 37 \cdot 4\end{array}$ | 2.46 | $\begin{array}{llll}4 & 2 & 7 \cdot 3\end{array}$ | $2 \cdot 54$ | $35932 \cdot 6$ | 2.62 | $\begin{array}{llll}3 & 5652 \cdot 7\end{array}$ | $2 \cdot 71$ |
| 19 | $\begin{array}{llll}4 & 4 & 35\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}4 & 2 & 10 \cdot 6\end{array}$ | $2 \cdot 45$ | $35941 \cdot 4$ | $2 \cdot 53$ | 35774 | 2.61 | $\begin{array}{llll}3 & 54 & 28 \cdot 6\end{array}$ | $2 \cdot 69$ | 35144.4 | 78 |
| 20 | 359447 | $2 \cdot 43$ |  | 2.51 | $35443 \cdot 4$ | 2.59 | $3 \begin{array}{lll}3 & 52 & 5 \cdot 5\end{array}$ | 2.68 | $34922 \cdot 3$ | $2 \cdot 77$ | $34633 \cdot 6$ | 2.86 |
| 21 | $35452 \cdot 3$ | $2 \cdot 49$ | $\begin{array}{lllll}3 & 52 & 20 \cdot 3\end{array}$ | 2.57 | 34943.4 | 2.66 | 347 I•3 | $2 \cdot 75$ | $34413 \cdot 6$ | $2 \cdot 84$ | $34120 \cdot 0$ | $2 \cdot 94$ |
| 22 | $34958 \cdot 0$ | 2.55 | $347.22 \cdot 2$ | 2.64 | 344 4I•2 | 2.73 | 34154.7 | 2.82 | $\begin{array}{lll}3 & 39 & 2 \cdot 3\end{array}$ | 2.93 | $\begin{array}{llll}3 & 36 & 3 \cdot 6\end{array}$ | 3.03 |
| 23 | 345 I.7 | 2.62 | $342 \cdot 21 \cdot 9$ | 2.71 | $33936 \cdot 6$ | 2.80 | $\begin{array}{llll}3 & 36 & 45 \cdot 5\end{array}$ | 2.90 | $\begin{array}{lllll}3 & 33 & 48 \cdot 1\end{array}$ | 3.01 | $\begin{array}{llll}3 & 30 & 44 \cdot 1\end{array}$ | $3 \cdot 13$ |
| 24 | 340304 | 2.69 | $\begin{array}{llll}3 & 37 & 19 & 4\end{array}$ | $2 \cdot 78$ | 313429.5 | $2 \cdot 88$ | $3 \begin{array}{lll}31 & 33.6\end{array}$ | $2 \cdot 99$ | $\begin{array}{llll}3 & 28 & 30 \cdot 9\end{array}$ | $3 \cdot 10$ | $\begin{array}{llll}3 & 25 & 2 I \cdot 2\end{array}$ | $3 \cdot 22$ |
| 25 | $\begin{array}{llll}3 & 35 & 2 \cdot 8\end{array}$ | 2.76 | $3 \begin{array}{llll}3 & 32 & 14.4\end{array}$ | $2 \cdot 86$ | 312919.8 | 2.96 | $32618 \cdot 7$ | 3.08 |  | $3 \cdot 20$ | $\begin{array}{llll}3 & 19 & 54 \cdot 8\end{array}$ | $3 \cdot 33$ |
| 26 | $\begin{array}{llll}3 & 29 & 59.8\end{array}$ | 2.83 | $\begin{array}{llll}3 & 27 & 6 \cdot 7\end{array}$ | $2 \cdot 94$ | 3243 7 | 3.05 | $3210 \cdot 5$ | $3 \cdot 17$ | $31746 \cdot 5$ | $3 \cdot 30$ |  | $3 \cdot 44$ |
| 27 | 32454.2 | 2.91 |  | 3.02 | $3 \mathrm{I} 815 \mathrm{I} \cdot 3$ | $3 \cdot 14$ | $\begin{array}{lllll}3 & 15 & 38 \cdot 9\end{array}$ | $3 \cdot 27$ | $\begin{array}{lllll}3 & 12 & 18.6\end{array}$ | 3.41 | $\begin{array}{llll}3 & 8 & 49 \cdot 8\end{array}$ | $3 \cdot 56$ |
| 28 | 3 19 45.9 | 3.00 | $31642 \cdot 7$ | $3 \cdot 11$ | $3 \mathrm{I}_{3} 32 \cdot \mathrm{I}$ | $3 \cdot 24$ | 3 10 13.6 | $3 \cdot 38$ | $\begin{array}{llll}3 & 6 & 46 \cdot 6\end{array}$ | 3.53 | $3 \quad 3 \quad 10.5$ | 3.68 |
| 29 | $\begin{array}{llll}3 & 14 & 34.6\end{array}$ | 3.08 | 3 II 25.8 | 3.21 | $\begin{array}{llr}3 & 8 & 9 \cdot 2\end{array}$ | $3 \cdot 35$ | $\begin{array}{llll}3 & 4 & 44 \cdot 2\end{array}$ | 3.49 | $3 \quad 1 \begin{array}{lll}10 \cdot 0\end{array}$ | 3.65 | $25726 \cdot 1$ | 3.82 |
| 30 | $\begin{array}{llll}3 & 9 & 20 \cdot 0\end{array}$ | $3 \cdot 18$ | $\begin{array}{llll}3 & 6 & 5 \cdot 3\end{array}$ | $3 \cdot 3$ I | $\begin{array}{llll}3 & 2 & 42 \cdot 3\end{array}$ | $3 \cdot 46$ | $2 \begin{array}{llll}2 & 59 & 10 \cdot 3\end{array}$ | $3 \cdot 61$ | $255128 \cdot 5$ | $3 \cdot 78$ | $25136 \cdot 1$ | 3.97 |
| 31 | $\begin{array}{llll}3 & 4 & 1.9\end{array}$ | $3 \cdot 28$ | $\begin{array}{lrrr}3 & 0 & 40 \cdot 9\end{array}$ | 3.42 | 257110 | $3 \cdot 58$ | $253131 \cdot 5$ | 3.75 | $2494 \mathrm{I} \cdot 4$ | $3 \cdot 93$ | $\begin{array}{llllllllllll}2 & 45 & 39.9\end{array}$ | $3 \cdot 13$ |
| 32 | $\begin{array}{llll}2 & 58 \\ 2 & 50 \cdot 0\end{array}$ | 3.39 3.50 | $\begin{array}{llll}2 & 55 & 12.3 \\ 2 & 49 & 38.9\end{array}$ | 3.54 | $\begin{array}{llllll}2 & 51 & 34.8 \\ 2 & 45 & 53.6\end{array}$ | 3.71 |  | 3.89 | $2 \begin{array}{lllllll}2 & 43 & 48 \cdot 3\end{array}$ | 4.09 | $2 \begin{array}{lllll}2 & 39 & 36 \cdot 8\end{array}$ | $4 \cdot 30$ |
| 33 | 25313.9 | $3 \cdot 50$ | $24938 \cdot 9$ | 3.67 | $245 \quad 53 \cdot 6$ | $3 \cdot 85$ | 24157.1 | 4.04 | $23748 \cdot 3$ | $4 \cdot 26$ | $23326 \cdot 0$ | $4 \cdot 50$ |
| 34 | $24743 \cdot 1$ | 3.63 | $\begin{array}{llr}2 & 44 & 0.3\end{array}$ | $3 \cdot 8 \mathrm{I}$ | $\begin{array}{lll}2 & 40 & 6.4\end{array}$ | 4.00 | $\begin{array}{lll}2 & 36 & 0 \cdot 3\end{array}$ | 4.21 | $23140 \cdot 9$ | $4 \cdot 45$ | $2 \begin{array}{lll}27 & 6.5\end{array}$ | $4 \cdot 71$ |
| 35 | $\begin{array}{llll}2 & 42 & 7 \cdot 3\end{array}$ | $3 \cdot 76$ | 23816.0 | $3 \cdot 95$ | $\begin{array}{llll}2 & 34 & 12.7\end{array}$ | $4 \cdot 17$ | $22956 \cdot 0$ | 4.40 | $\begin{array}{llll}2 & 25 & 24.8\end{array}$ | $4 \cdot 66$ | $\begin{array}{lllllllllllll}2 & 20 & 37 \cdot 2\end{array}$ | $4 \cdot 95$ |
| 36 | $\begin{array}{llll}2 & 36 & 25.9\end{array}$ | 3.91 | $\begin{array}{llll}2 & 32 & 25 \cdot 3\end{array}$ | 4.12 | 22811.6 | $4 \cdot 35$ | $\begin{array}{lllll}2 & 23 & 43.4\end{array}$ | $4 \cdot 60$ | $\begin{array}{llll}2 & 18 & 59 \cdot 1\end{array}$ | 4.89 |  | $5 \cdot 20$ |
| 37 38 | $\begin{array}{llll}2 & 30 & 38 \cdot 2 \\ 2 & 24 & 43 \cdot 6\end{array}$ | 4.07 | $\begin{array}{llll}2 & 26 & 27.5 \\ 2 & 20 & 21.6\end{array}$ | 4.30 | $\begin{array}{rrr}2 & 22 & 2.4 \\ 2 & 15 & 43.8\end{array}$ | $4 \cdot 55$ | $\begin{array}{lllll}2 & 17 & 21.3 \\ 2 & 10 & 48\end{array}$ | 4.83 | $\begin{array}{rrrr}2 & 12 & 22 \cdot 2 \\ 2 & 5 & 32 \cdot 6\end{array}$ | $5 \cdot 15$ | 2 7 2.9 <br>  5 5 | $5 \cdot 48$ |
| 38 | $22443 \cdot 6$ | $4 \cdot 25$ | 22021.6 | $4 \cdot 50$ | $25543 \cdot 8$ | $4 \cdot 78$ | 2 10 $48 \cdot 3$ | 5.09 | $2 \quad 5 \quad 32.6$ | $5 \cdot 45$ | I 5953.8 | $5 \cdot 80$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ}$ | ${ }^{\circ}$ A. | L. $22^{\circ}$ | - A. | L. $23^{\circ}$ | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | s. | s. | S. | s. | s. | s. | s. | S. | S. | S. | S. |
| 0 | - I* 48 | $-4.51$ | -1.57 | $-4.54$ | -r. 66 | $-4.57$ | -r.76 | $-4.60$ | - 1.85 | $-4 \cdot 64$ | - 1.95 | $-4.68$ |
| 2 | I. 55 | $4 \cdot 53$ | r. 64 | 4.56 | I.73 | 4.60 | 1.83 | 4.63 | r.92 | 4.67 | 2.02 | $4 \cdot 71$ |
| 4 | I. 62 | 4.55 | 1.71 | 4.59 | r.80 | $4 \cdot 62$ | 1.90 | 4.66 | $2 \cdot 00$ | $4 \cdot 70$ | $2 \cdot 10$ | $4 \cdot 75$ |
| 6 | 1.69 | $4 \cdot 58$ | 1.78 | 4.62 | r. 88 | $4 \cdot 65$ | 1.98 | 4.69 | $2 \cdot 08$ | $4 \cdot 74$ | 2.18 | $4 \cdot 78$ |
| 8 | 1.77 | 4.6 I | r.86 | $4 \cdot 65$ | I.96 | $4 \cdot 69$ | 2.06 | $4 \cdot 73$ | $2 \cdot 17$ | $4 \cdot 78$ | 2.27 | 4.83 |
| 10 | I. 85 | $4 \cdot 64$ | I.95 | 4.68 | $2 \cdot 05$ | 4.73 | $2 \cdot \mathrm{I} 5$ | $4 \cdot 77$ | $2 \cdot 26$ | $4 \cdot 82$ | $2 \cdot 37$ | 4.87 |
| 12 | I•93 | $4 \cdot 68$ | $2 \cdot 04$ | $4 \cdot 72$ | $2 \cdot 14$ | $4 \cdot 77$ | $2 \cdot 25$ | $4 \cdot 81$ | $2 \cdot 36$ | $4 \cdot 87$ | $2 \cdot 47$ | 4.92 |
| 14 | 2.03 | $4 \cdot 71$ | 2.13 | 4.76 | $2 \cdot 24$ | 4.81 | $2 \cdot 35$ | 4.86 | 2.47 | 4.92 | $2 \cdot 59$ | 4.98 |
| 16 | $2 \cdot 12$ | $4 \cdot 76$ | 2.23 | 4.8 r | $2 \cdot 35$ | $4 \cdot 86$ | 2.47 | 4.92 | $2 \cdot 59$ | 4.98 | $2 \cdot 71$ | $5 \cdot 05$ |
| 18 | $2 \cdot 23$ | $4 \cdot 80$ | $2 \cdot 35$ | 4.86 | $2 \cdot 46$ | 4.92 | $2 \cdot 59$ | 4.98 | 2•71 | $5 \cdot 05$ | $2 \cdot 84$ | 5.12 |
| 19 | $2 \cdot 29$ | 4.83 | $2 \cdot 40$ | 4.89 | 2.53 | 4.95 | $2 \cdot 65$ | 5.01 | $2 \cdot 78$ | 5.09 | $2 \cdot 92$ | 5.16 |
| 20 | $2 \cdot 35$ | $4 \cdot 86$ | 2.47 | 4.92 | $2 \cdot 59$ | $4 \cdot 98$ | $2 \cdot 72$ | 5.05 | 2.85 | $5 \cdot 12$ | 2.99 | $5 \cdot 20$ |
| 21 | $2 \cdot 41$ | $4 \cdot 89$ | 2.53 | 4.95 | $2 \cdot 66$ | $5 \cdot 02$ | $2 \cdot 79$ | 5.09 | 2.93 | $5 \cdot 17$ | 3.07 | $5 \cdot 25$ |
| 22 | 2.47 | 4.92 | $2 \cdot 60$ | $4 \cdot 99$ | $2 \cdot 73$ | 5.06 | $2 \cdot 87$ | $5 \cdot 13$ | 3.01 | $5 \cdot 21$ | $3 \cdot 16$ | $5 \cdot 30$ |
| 23 | 2.54 | 4.95 | $2 \cdot 67$ | $5 \cdot 02$ | 2.80 | $5 \cdot 10$ | $2 \cdot 94$ | 5-18 | 3.09 | $5 \cdot 26$ | 3.25 | $5 \cdot 35$ |
| 24 | $2 \cdot 61$ | 4.99 | 2.74 | 5.06 | 2.88 | 5-14 | 3.03 | 5.22 | 3.18 | $5 \cdot 31$ | 3'34 | $5 \cdot 41$ |
| 25 | 2.68 | 5.03 | 2.82 | $5 \cdot 11$ | 2.96 | 5.19 | $3 \cdot 12$ | $5 \cdot 28$ | $3 \cdot 27$ | $5 \cdot 37$ | 3.44 | $5 \cdot 47$ |
| 26 | $2 \cdot 76$ | 5.07 | 2.90 | $5 \cdot 15$ | $3 \cdot 05$ | $5 \cdot 24$ | 3.21 | $5 \cdot 33$ | 3.37 | $5 \cdot 43$ | $3 \cdot 55$ | $5 \cdot 54$ |
| 27 28 | 2.84 2.92 | $5 \cdot 12$ $5 \cdot 16$ | 2.99 3.08 | 5.20 5.25 | 3.14 | 5.29 5.35 | 3.31 | 5.39 | 3.48 | $5 \cdot 50$ | $3 \cdot 66$ | $5 \cdot 62$ |
| 28 | $2 \cdot 92$ | 5•16 | $3 \cdot 08$ | $5 \cdot 25$ | $3 \cdot 24$ | $5 \cdot 35$ | 3.41 | $5 \cdot 46$ | $3 \cdot 59$ | $5 \cdot 57$ | $3 \cdot 79$ | 5•70 |
| 29 | 3.01 | $5 \cdot 22$ | 3.18 | $5 \cdot 31$ | 3.35 | 5.41 | 3.53 | 5.53 | 3.72 | $5 \cdot 65$ | 3.92 | $5 \cdot 79$ |
| 30 | $3 \cdot 11$ | $5 \cdot 27$ | $3 \cdot 28$ | $5 \cdot 37$ | $3 \cdot 46$ | $5 \cdot 48$ | $3 \cdot 65$ | $5 \cdot 61$ | $3 \cdot 85$ | $5 \cdot 74$ | $4 \cdot 06$ | $5 \cdot 88$ |
| 31 | $3 \cdot 21$ | $5 \cdot 33$ | $3 \cdot 39$ | $5 \cdot 44$ | $3 \cdot 58$ | $5 \cdot 56$ | $3 \cdot 78$ | $5 \cdot 69$ | 3.99 | $5 \cdot 83$ | $4 \cdot 22$ | $5 \cdot 99$ |
| 32 | $3 \cdot 32$ | $5 \cdot 40$ | $3 \cdot 51$ | $5 \cdot 52$ | 3.75 | $5 \cdot 64$ | 3.92 | 5.79 | $4 \cdot 15$ | $5 \cdot 94$ | $4 \cdot 39$ | $6 \cdot 11$ |
| 33 | 3.44 | $5 \cdot 47$ | $3 \cdot 64$ | $5 \cdot 60$ | $3 \cdot 85$ | $5 \cdot 74$ | 4.07 | 5.89 | $4 \cdot 32$ | $6 \cdot 06$ | $4 \cdot 58$ | $6 \cdot 25$ |
| 34 | 3.57 | 5.55 | $3 \cdot 78$ | $5 \cdot 69$ | 4.00 | $5 \cdot 84$ | 4.24 | 6.01 | 4.50 | $6 \cdot 20$ | $4 \cdot 79$ | 6.41 |
| 35 | 3.71 | $5 \cdot 64$ | 3.93 | $5 \cdot 79$ | $4 \cdot 17$ | $5 \cdot 96$ | 4.43 | $6 \cdot 14$ | $4 \cdot 71$ | $6 \cdot 35$ | $5 \cdot 02$ | $6 \cdot 58$ |
| 36 | $3 \cdot 85$ | 5.74 | $4 \cdot 09$ | 5.90 | $4 \cdot 35$ | $6 \cdot 09$ | $4 \cdot 63$ | $6 \cdot 29$ | $4 \cdot 94$ | $6 \cdot 52$ | $5 \cdot 29$ | 6.79 |
| 37 | 4.02 | 5.85 | 4.27 | $6 \cdot 03$ | 4.55 | $6 \cdot 23$ | $4 \cdot 86$ | $6 \cdot 46$ | $5 \cdot 19$ | $6 \cdot 72$ | $5 \cdot 58$ | 7.02 |
| 38 | $4 \cdot 20$ | $5 \cdot 98$ | 4.47 | 6.18 | $4 \cdot 78$ | $6 \cdot 40$ | $5 \cdot 11$ | $6 \cdot 66$ | $5 \cdot 48$ | $6 \cdot 95$ | 5.91 | $7 \cdot 30$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. <br> Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. <br> Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | M. | S. | M. | S. | M. | S. | M. | S. | I. M. | S. | M. | S. |
| 8 | $\begin{array}{llll}6 & 0 & 0.0\end{array}$ | - I. 53 | $5 \quad 58 \quad 27 \cdot 9$ | - I. 54 | $5 \quad 56 \quad 55 \cdot 7$ | - I. 54 | $\begin{array}{llll}5 & 55 & 23 \cdot 3\end{array}$ | - 1.54 | $55350 \cdot 8$ | -I. 54 | $55^{52}$ I8•1 | - 1.55 |
| 8 | $5 \quad 2542 \cdot 4$ | I 55 | $\begin{array}{llll}5 & 24 & 8.8\end{array}$ | 1.57 | 52234.5 | I 58 | $5 \quad 20 \quad 59 \cdot 3$ | 1.59 | $\begin{array}{llll}5 & 19 & 23 \cdot 3\end{array}$ | 1.61 | 5 I7 46.1 | I. 63 |
| 10 | $\begin{array}{llll}5 & 17 & 7 \cdot 3\end{array}$ | I. 56 | 5 I5 33.0 | 1.58 | $\begin{array}{llllllllllllllllll}57 & 13\end{array}$ | I 59 | 51221.6 | 1.6I | $51044 \cdot 2$ | 1.63 | $\begin{array}{lll}5 & 9 & 5 \cdot 6\end{array}$ | 1.65 |
| 12 | $\begin{array}{llll}5 & 8 & 31 \cdot 7\end{array}$ | I. 58 | $\begin{array}{llll}5 & 6 & 56 \cdot 6\end{array}$ | - 59 | $\begin{array}{llll}5 & 5 & 20 \cdot 4\end{array}$ | I.61 | $\begin{array}{llll}5 & 3 & 42 \cdot 9\end{array}$ | I. 64 | $\begin{array}{llll}5 & 2 & 4 \cdot 1\end{array}$ | 1.66 | $\begin{array}{llll}5 & 0 & 23.9\end{array}$ | I. 68 |
| 14 | $45955 \cdot 5$ | I. 59 | $4 \quad 58 \quad 19.5$ | I.6I | $4 \quad 56 \quad 42 \cdot 1$ | 1.64 | $45513 \cdot 2$ | 1.66 | $\begin{array}{llll}4 & 53 & 22.8\end{array}$ | I. 69 | $45 \mathrm{I} 40 \cdot 8$ | 1.71 |
| 16 | 45118.6 | 1 | 449 4I.4 | 63 | $\begin{array}{llll}4 & 48 & 2 \cdot 7\end{array}$ | -66 | $446 \quad 22 \cdot 2$ | 1.69 | 444 40.1 | 1.72 | 442 56.I | $\cdot 75$ |
| 18 | $44240 \cdot 9$ | I. 63 | 4412.4 | I. 66 | $42922 \cdot 1$ | I. 69 | 43739.9 | 1.72 | $435 \begin{array}{llll}4 & 55\end{array}$ | 1.75 | $434 \quad 9 \cdot 6$ | 1.79 |
| 20 | $\begin{array}{lll}4 & 34 & 2 \cdot 2\end{array}$ | 1.65 | $43222 \cdot 2$ | I. 68 | $43040 \cdot 2$ | I•72 | 428 56•I | 1.75 | $4 \begin{array}{lll}4 & 27 & 9.8\end{array}$ | I.79 | $42521 \cdot 2$ | . 83 |
| 22 | $425 \quad 22 \cdot 4$ | 1.68 | $42340 \cdot 7$ | $1 \cdot 71$ | $42156 \cdot 8$ | 1-75 | $42010 \cdot 5$ | I.79 | 418121.8 | 1.83 | $41630 \cdot 5$ | . 88 |
| 24 | $41641 \cdot 2$ | 1.71 | $41457 \cdot 6$ | 1.75 | 413 II.6 | I•79 | 4 II 23.0 | I.83 | $4 \quad 931 \cdot 6$ | I. 88 | $4 \quad 737 \cdot 4$ | r.93 |
| 25 | 41220 | 1.72 | $41035 \cdot 5$ | 1.76 | $4 \begin{array}{llll}4 & 8 & 48 \cdot 3\end{array}$ | I. 8 I | $4 \begin{array}{llll}4 & 6 & 58.4\end{array}$ | 86 | $\begin{array}{llll}4 & 5 & 5 \cdot 6\end{array}$ | -90 | $\begin{array}{lll}4 & 3 & 9.8\end{array}$ | -95 |
| 26 | $\begin{array}{lllll}4 & 7 & 58 \cdot 6\end{array}$ | I.74 | $4 \quad 6 \quad 12 \cdot 9$ | 1•78 | $\begin{array}{llll}4 & 4 & 24 \cdot 5\end{array}$ | I.83 | $\begin{array}{llll}4 & 2 & 33 \cdot 2\end{array}$ | I. 88 | $4 \quad 0 \quad 38 \cdot 9$ | . 93 | $\begin{array}{lllll}3 & 58 & 41 \cdot 5\end{array}$ | -98 |
| 27 | $\begin{array}{llll}4 & 3 & 36 \cdot 7\end{array}$ | 1.76 | 4 I 49.9 | I.80 | $\begin{array}{lll}4 & 0 & 0.2\end{array}$ | I. 85 | $\begin{array}{lllll}3 & 58 & 7 \cdot 4\end{array}$ | I.91 | $\begin{array}{lllll}3 & 56 & 11 & 5\end{array}$ | 1.96 | $\begin{array}{llllll}3 & 54 & 12.4\end{array}$ | - 01 |
| 28 | 35914.3 | I.78 | $\begin{array}{lllllllllllllllll}3 & 57 & 26 \cdot 3\end{array}$ | r.83 | $\begin{array}{llllllllll}3 & 55 & 35\end{array}$ | I. 88 | $35341 \cdot 0$ | I.93 | 35143.4 | 1.99 | $\begin{array}{llllllllllll}3 & 49 & 42.4\end{array}$ | . 5 |
| 29 | $35451 \cdot 5$ | I.80 | 353 2.1 | I. 85 | 35196 | I.90 | 34913.8 | I.96 | 347414.5 | 2.02 | 345 II. 6 | $2 \cdot 08$ |
| 30 | $35028 \cdot 1$ | 82 | $348 \quad 37 \cdot 4$ | 1.87 | 34643.4 | I'93 | $\begin{array}{llll}3 & 44 & 45 \cdot 8\end{array}$ | I.99 | 34244.7 | 2.05 | $34039 \cdot 8$ | 2.II |
| 31 | $\begin{array}{lll}3 & 46 & 4 \cdot 2\end{array}$ | I. 84 | 34412.0 | 1.90 | 312216.4 | I.96 | $\begin{array}{lllllllll}3 & 40 & \text { I } 71\end{array}$ | 2.02 | $\begin{array}{llll}3 & 38 & 14 & \text { I }\end{array}$ | $2 \cdot 08$ | $\begin{array}{llll}3 & 36 & 7 \cdot 0\end{array}$ | $2 \cdot 15$ |
| 32 | $34139 \cdot 7$ | 1.87 | $33946 \cdot 0$ | 1.92 |  | 1.99 | $\begin{array}{lllll}3 & 35 & 47 \cdot 5\end{array}$ | -5 | $\begin{array}{lllll}3 & 33 & 42 \cdot 4\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}3 & 31 & 33 \cdot 2\end{array}$ | $2 \cdot 19$ |
| 33 | $\begin{array}{lllll}3 & 37 & 14.6\end{array}$ | I.89 | $\begin{array}{llll}3 & 35 & 19.3\end{array}$ | I 95 | $\begin{array}{lllll}3 & 33 & 20 \cdot 2\end{array}$ | $2 \cdot 02$ | 3 31 I7.I | 2.09 | $\begin{array}{llll}3 & 29 & 9.8\end{array}$ | 2.16 | $\begin{array}{llll}3 & 26 & 58 \cdot 1\end{array}$ | $2 \cdot 23$ |
| 34 | 33248.8 | I.92 | 3 30-51.8 | r.98 | $32850 \cdot 8$ | $2 \cdot 05$ | $32645 \cdot 6$ | $2 \cdot 12$ | $32436 \cdot 0$ | . 20 | 32221.9 | 2.27 |
| 35 | $\begin{array}{llll}3 & 28 & 22 \cdot 3\end{array}$ | 1.95 | $\begin{array}{llll}3 & 26 & 23.5\end{array}$ | OI | $\begin{array}{llll}3 & 24 & 20 \cdot 5\end{array}$ | .09 | $32213 \cdot 1$ | 16 | 320 I•I | $2 \cdot 24$ | 3 I7 44.4 | 32 |
| 36 | $\begin{array}{llll}3 & 23 & 55^{\circ} \mathrm{O}\end{array}$ | 1.98 | $\begin{array}{llll}3 & 21 & 54 \cdot 3\end{array}$ | 2.05 | $\begin{array}{lllllllllll}3 & 19 & 49.2\end{array}$ | 12 | $\begin{array}{llllll}3 & 17 & 39.4\end{array}$ | $2 \cdot 20$ | 3 I5 24.9 | $2 \cdot 28$ | 3 I3 $5 \cdot 3$ | $2 \cdot 37$ |
| 37 | $\begin{array}{llll}3 & 19 & 26.9\end{array}$ | 2.01 | $\begin{array}{lllllllllll}3 & 17 & 24 \cdot 1\end{array}$ | $2 \cdot 08$ | $\begin{array}{lllll}3 & 15 & 16.8\end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}3 & 13 & 4.6\end{array}$ | $2 \cdot 25$ | 3 10 47.3 | $2 \cdot 33$ | $\begin{array}{llll}3 & 8 & 24.8\end{array}$ | 2.42 |
| 3 | 314579 | 2.04 | $\begin{array}{llll}3 & \text { I2 } & 52 \cdot 9\end{array}$ | 12 | 3 10 $43 \cdot 2$ | $2 \cdot 20$ | $\begin{array}{llll}3 & 8 & 28 \cdot 4\end{array}$ | $2 \cdot 29$ | $\begin{array}{llll}3 & 6 & 8 \cdot 3\end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}3 & 3 & 42 \cdot 7\end{array}$ | $2 \cdot 48$ |
| 39 | $31027 \cdot 9$ | 2.08 | $\begin{array}{llll}3 & 8 & 20 \cdot 7\end{array}$ | 2.16 | $\begin{array}{llll}3 & 6 & 8.4\end{array}$ | $2 \cdot 25$ | $\begin{array}{llll}3 & 3 & 50 \cdot 9\end{array}$ | $2 \cdot 34$ | $3 \begin{array}{llll}3 & 1 & 27.7\end{array}$ | $2 \cdot 43$ | 2 | $2 \cdot 53$ |
| 40 | $35556 \cdot 9$ | $2 \cdot 12$ | $3 \quad 3 \quad 47 \cdot 3$ | $2 \cdot 20$ | 3 I 32.3 | $2 \cdot 30$ | 259 II.8 | $2 \cdot 39$ | $25645 \cdot 4$ | $2 \cdot 49$ | $2 \begin{array}{lll}2 & 54 & 12.8\end{array}$ | $2 \cdot 60$ |
| 41 | $\begin{array}{llll}3 & 1 & 24.8\end{array}$ | 2.16 | $\begin{array}{lll}2 & 59 & 12.6 \\ 2 & 5 & 36\end{array}$ | $2 \cdot 25$ | $\begin{array}{llll}2 & 56 & 54 \cdot 8 \\ 2 & 52 & \end{array}$ | $2 \cdot 35$ | $2543 \mathrm{I} \cdot \mathrm{I}$ | $2 \cdot 45$ | $2 \begin{array}{lll}2 & 52 & 1 \cdot 2\end{array}$ | $2 \cdot 55$ | $\begin{array}{llll}2 & 49 & 24 \cdot 8\end{array}$ | $2 \cdot 66$ |
| 42 | 25651.4 | $2 \cdot 20$ | $25436 \cdot 5$ | $2 \cdot 30$ | $2 \begin{array}{lllll} & 52 & 15\end{array}$ | $2 \cdot 40$ | $24948 \cdot 6$ | 2.50 | 247150 | 2.62 | $2 \begin{array}{lllll}2 & 44 & 34\end{array}$ | $2 \cdot 73$ |
| 43 | $\begin{array}{llllll}2 & 52 & 16.8 \\ 2 & 47\end{array}$ | $2 \cdot 25$ | $24958 \cdot 9$ | $2 \cdot 35$ | 24734.8 | $2 \cdot 46$ | $2 \begin{array}{lll}2 & 45 & 4 \cdot 2\end{array}$ | 2.57 | $2 \begin{array}{lllll}2 & 42 & 26 \cdot 7\end{array}$ | $2 \cdot 69$ | $2 \begin{array}{llll}2 & 39 & 4 \\ \text { - } \\ \text { c }\end{array}$ | 2.81 |
| 44 | $24740 \cdot 8$ | $2 \cdot 30$ | $24519 \cdot 7$ | 2.41 | $24252 \cdot \mathrm{I}$ | $2 \cdot 52$ | 240 I7.6 | 2.63 | $23735 \cdot 9$ | $2 \cdot 76$ | $23446 \cdot 3$ | 2.89 |
| 45 | $\begin{array}{lll}2 & 43 & 3 \cdot 2\end{array}$ | $2 \cdot 35$ | $2 \begin{array}{llll}2 & 40 & 38 \cdot 7\end{array}$ | 2.46 | $\begin{array}{lll}2 & 38 & 7 \cdot 4\end{array}$ | $2 \cdot 58$ | $2 \begin{array}{lll}2 & 35 & 28.8\end{array}$ | $2 \cdot 71$ | $23242 \cdot 4$ | $2 \cdot 84$ | $22947 \cdot 8$ | $2 \cdot 98$ |
| 46 | $\begin{array}{lllll}2 & 38 & 23.9\end{array}$ | 2.41 | $2 \begin{array}{llll}2 & 35 & 55 \cdot 9\end{array}$ | 2.53 | $23320 \cdot 5$ | $2 \cdot 65$ | $23037 \cdot 5$ | $2 \cdot 79$ | $22746 \cdot 1$ | 2.93 | $22446 \cdot 0$ | $3 \cdot 08$ |
| 47 | 2 33 $42 \cdot 8$ | 2.47 | $2 \begin{array}{llll}21 & 31 & 10 \cdot 9\end{array}$ | $2 \cdot 60$ | $2 \begin{array}{llll}28 & 31 \cdot 2\end{array}$ | 2.73 | $22543 \cdot 3$ | 2.87 | $22246 \cdot 6$ | 3.02 | $21940 \cdot 6$ | 3.19 |
| 48 | 22 28 | $2 \cdot 54$ |  | 2.67 | 223 39.2 | 2.81 | $22046 \cdot 1$ | 2.96 | $21743 \cdot 6$ | $3 \cdot 13$ | $21431 \cdot 0$ | $3 \cdot 30$ |
| 49 | 22414.4 | 2.61 | 22133.6 | $2 \cdot 75$ | $21844 \cdot 2$ | 2.90 | 21545.4 | 3.06 | 2 I2 $36 \cdot 5$ | 3.24 | 2916.8 | $3 \cdot 43$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | S. -4.28 | S. $-\quad .08$ | s. -4.28 | - ${ }_{\text {s. }}{ }^{\text {I6 }}$ | s. -4.29 | S. 24 | S. | S. 32 | s. | ${ }^{\text {S }} 40$ | s. |
| 4 | -II | $4 \cdot 28$ | - 20 | $4 \cdot 29$ | . 28 | $4 \cdot 29$ | -36 | 4.30 | $\cdot 44$ | 4.3 I | -52 | 4.32 |
| 6 | '17 | 4.29 | . 25 | 4.29 | $\cdot 33$ | $4 \cdot 30$ | $\cdot 42$ | $4 \cdot 30$ | $\cdot 50$ | $4 \cdot 31$ | - 58 | $4 \cdot 32$ |
| 8 | -23 | 4.29 | -31 | $4 \cdot 30$ | -39 | $4 \cdot 30$ | 48 | $4 \cdot 31$ | $\cdot 56$ | $4 \cdot 32$ | $\cdot 64$ | 4.33 |
| 10 | - 29 | $4 \cdot 29$ | $\cdot 37$ | $4 \cdot 30$ | $\cdot 45$ | $4 \cdot 31$ | -54 | $4 \cdot 32$ | $\cdot 62$ | $4 \cdot 33$ | $\cdot 71$ | $4 \cdot 34$ |
| 12 | 35 | 4.30 | - 43 | 4.31 | $\cdot 52$ | $4 \cdot 32$ | -60 | $4 \cdot 33$ | $\cdot 69$ | $4 \cdot 34$ | $\cdot 77$ | $4 \cdot 35$ |
| 14 | $4 \mathrm{4I}$ | 4.30 | $\cdot 50$ | $4 \cdot 31$ | $\cdot 58$ | $4 \cdot 32$ | $\cdot 67$ | $4 \cdot 34$ | $\cdot 75$ | $4 \cdot 35$ | -84 | $4 \cdot 36$ |
| 16 | -47 | 4.31 | - 56 | 4.32 | $\cdot 65$ | 4.33 | $\cdot 73$ | $4 \cdot 35$ | . 82 | $4 \cdot 36$ | -91 | $4 \cdot 38$ |
| 18 | .54 | $4 \cdot 32$ | -62 | 4.33 | $\cdot 71$ | 4.34 | . 80 | $4 \cdot 36$ | $\cdot 89$ | 4.38 | $\cdot 98$ | 4.39 |
| 20 | . 60 | 4.33 | -69 | 4.34 | $\cdot 78$ | $4 \cdot 35$ | $\cdot 87$ | $4 \cdot 37$ | $\cdot 96$ | $4 \cdot 39$ | I.06 | $4 \cdot 4 \mathrm{I}$ |
| 22 | $\cdot 67$ | $4 \cdot 34$ | $\cdot 76$ | $4 \cdot 35$ | . 85 | $4 \cdot 37$ | -95 | 4.39 | I. 04 | 4.41 | $1 \cdot 13$ | 4.43 |
| 24 | $\cdot 74$ | 4.35 | . 84 | $4 \cdot 36$ | . 93 | 4.38 | 1.02 | $4 \cdot 40$ | I-12 | $4 \cdot 43$ | 1.22 | $4 \cdot 45$ |
| 26 | $\cdot 82$ | $4 \cdot 36$ | -91 | 4.38 | IOI | 4.40 | $1 \cdot 10$ | $4 \cdot 42$ | I. 20 | $4 \cdot 45$ | I. 30 | $4 \cdot 48$ |
| 28 | $\cdot 89$ | $4 \cdot 37$ | -99 | 4.40 | 1.09 | 4.42 | 1.19 | $4 \cdot 45$ | 1.29 | $4 \cdot 47$ | $1 \cdot 40$ | $4 \cdot 51$ |
| 30 | $\cdot 97$ | $4 \cdot 39$ | $1 \cdot 07$ | $4 \cdot 42$ | $1 \cdot 18$ | $4 \cdot 44$ | 1.28 | $4 \cdot 47$ | I-39 | $4 \cdot 50$ | I. 50 | $4 \cdot 54$ |
| 32 | r.06 | 4.41 | 1.16 | 4.44 | 1.27 | $4 \cdot 47$ | $1 \cdot 38$ | $4 \cdot 50$ | r 49 | 4.54 | 1.60 | 4.57 |
| 34 | 1.15 | 4.43 | 1.26 | $4 \cdot 46$ | 1.37 | $4 \cdot 50$ | $1 \cdot 48$ | $4 \cdot 53$ | r 60 | $4 \cdot 57$ | $1 \cdot 71$ | 4.61 |
| 38 | I. 24 | 4.46 | I.36 | 4.49 | 1.47 | 4.53 | $1 \cdot 57$ | $4 \cdot 59$ | $1 \cdot 71$ | 4.61 | 1.84 | $4 \cdot 66$ |
| 40 | 1.35 1.46 | 4.49 4.52 | 1.47 1.58 | 4.53 4.57 | 1.59 1.71 | 4.57 4.61 | 1.71 1.84 | $4 \cdot 61$ $4 \cdot 66$ | I 84 $\mathrm{r} \cdot 98$ | $4 \cdot 66$ $4 \cdot 72$ | 1.97 $2 \cdot 12$ | $4 \cdot 72$ $4 \cdot 78$ |
| 42 | I.58 | 4.57 | $\pm 75$ | $4 \cdot 61$ | 1.85 | 4.67 | 1-99 | 4.72 | $2 \cdot 14$ | $4 \cdot 79$ | $2 \cdot 29$ | 4.86 |
| 44 | I.75 | 4.61 | 1.85 | 4.67 | $2 \cdot 0$ | 4.73 | $2 \cdot 15$ | $4 \cdot 79$ | 2.31 | $4 \cdot 87$ | 2.48 | $4 \cdot 95$ |
| 46 | 1.86 | $4 \cdot 67$ | 2.01 | 4.73 | $2 \cdot 17$ | 4.80 | $2 \cdot 33$ | $4 \cdot 88$ | 2.51 | 4.96 | $2 \cdot 69$ | 5.06 |
| 48 | 2.02 | 4.74 | $2 \cdot 19$ | 4.8 I | $2 \cdot 36$ | $4 \cdot 89$ | $2 \cdot 54$ | 4.98 | $2 \cdot 74$ | 5.08 | 2.94 | $5 \cdot 20$ |
| 49 | $2 \cdot 11$ | 4.78 | $2 \cdot 28$ | 4.85 | $2 \cdot 47$ | 4.94 | $2 \cdot 66$ | $5 \cdot 04$ | 2.86 | $5 \cdot 15$ | 3.08 | $5 \cdot 28$ |

## LATITUDE $21^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. <br> Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. M. S. | S. | H. M. S | s. | H. M. S. | s. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| O | $55045 \cdot 1$ | - I. 55 | 549 II. 6 | -1.56 | $547 \begin{array}{lllll}5 & 47 & 8\end{array}$ | -1.57 | $\begin{array}{llll}5 & 46 & 3 \cdot 5\end{array}$ | -I. 58 | $\begin{array}{llll}5 & 44 & 28 \cdot 5\end{array}$ | - 1.59 | 54253.0 | - I•60 |
| 6 | $52448 \cdot 8$ | 1.62 | 523 IIPI | 1.63 | 5 21 32.6 | I. 65 | 5 I9 52.9 | r 67 | $51812 \cdot 0$ | I•69 | $\begin{array}{llll}5 & 16 & 29 \cdot 8\end{array}$ | I'71 |
| 8 | 5 I6 8.0 | 1.65 | $\begin{array}{lllllllllllllll}5 & 14 & 28 \cdot 6\end{array}$ | 1.67 | $51248 \cdot 1$ | I 69 | 5 II $6 \cdot 3$ | 1.71 | $\begin{array}{llll}5 & 9 & 23 \cdot 1\end{array}$ | I•73 | $\begin{array}{lllll}5 & 7 & 38 \cdot 4\end{array}$ | I• 76 |
| 10 | $\begin{array}{llll}5 & 7 & 25 \cdot 8\end{array}$ | I. 67 | $\begin{array}{lllllll}5 & 5 & 44.6\end{array}$ | I'70 | $\begin{array}{llll}5 & 4 & 2 \cdot 0\end{array}$ | 1.72 | $\begin{array}{lrrr}5 & 2 & 17.9\end{array}$ | I•75 | $\begin{array}{rrrr}5 & 0 & 32 \cdot 2\end{array}$ | I•78 | $45844 \cdot 8$ | I. 80 |
| 12 | $458 \quad 42 \cdot 3$ | I•71 | 45659.0 | I•73 | 455 I4.I | $\pm \cdot 76$ | $453 \quad 27 \cdot 5$ | I'79 | 4 5I 391I | I.82 | $449 \quad 48 \cdot 7$ | I. 86 |
| 14 | $44957 \cdot 1$ | I•74 | $44^{48}$ II.6 | ェ・ク7 | 4461243 | 1.80 | $44435 \cdot 0$ | I-84 | $\begin{array}{llll}4 & 42 & 43 \cdot 6\end{array}$ | I. 87 | $44050 \cdot 0$ | I'91 |
| 16 | $44110 \cdot 2$ | I.78 | $43922 \cdot 3$ | 1.82 | $43732 \cdot 2$ | I. 85 | $43540 \cdot 0$ | I.89 | $4 \quad 33 \quad 45 \cdot 4$ | 1.93 | $43148 \cdot 4$ | I.97 |
| 18 | $43221 \cdot 3$ | I. 82 | $43030 \cdot 7$ | I. 86 |  | I.90 | $42642 \cdot 3$ | I.94 | 424443 | I.99 | $42243 \cdot 5$ | $2 \cdot 04$ |
| 19 | $42756 \cdot 0$ | I. 85 | 42640 | I•89 | 424985 | I.93 | 42212.3 | r.97 | 42012.5 | 2.02 | $\begin{array}{lllll}4 & 18 & 9 \cdot 7\end{array}$ | 2.07 |
| 20 | 423 30.2 | I. 87 | $42136 \cdot 6$ | I'9I | $41940 \cdot 5$ | I.96 | 4 I7 4I.6 | $2 \cdot \mathrm{OI}$ | $4 \begin{array}{lllllll}4 & 39.8\end{array}$ | $2 \cdot 06$ | $41334 \cdot 9$ | $2 \cdot 11$ |
| 21 | $\begin{array}{llll}4 & 19 & 3.7\end{array}$ | I.90 | $\begin{array}{llll}4 & 17 & 8.6\end{array}$ | I'94 | 41510.8 | 1.99 | $41310 \cdot 0$ | 2.04 | 4 II $6 \cdot 2$ | $2 \cdot 09$ | $\begin{array}{llll}4 & 8 & 59 \cdot 2\end{array}$ | -14 |
| 22 | 4 I4 $36 \cdot 6$ | I'92 | 41239.9 | 1.97 | 4 Io $40 \cdot 2$ | 2.02 | $4837 \cdot 5$ | 2.07 | $4631 \cdot 7$ | $2 \cdot 13$ | $\begin{array}{llll}4 & 4 & 22.4\end{array}$ | $2 \cdot 18$ |
| 23 | 4 10 8.8 | I'95 | $\begin{array}{llll}4 & 8 & 10 \cdot 4\end{array}$ | $2 \cdot 00$ | $4 \begin{array}{lll}4 & 6 & 8 \cdot 9\end{array}$ | 2.05 | $\begin{array}{lrr}4 & 4 & 4 \cdot 2 \\ 3 & 59\end{array}$ | $2 \cdot 11$ | 4 I 56.I | $2 \cdot 16$ | $35944 \cdot 4$ | $2 \cdot 22$ |
| 24 | $\begin{array}{llll}4 & 5 & 40 \cdot 3\end{array}$ | I. 98 | $4 \quad 340 \cdot 0$ | 2.03 | $\begin{array}{llll}4 & \text { I } & 36 \cdot 6\end{array}$ | 2.08 | $3595129 \cdot 8$ | $2 \cdot 14$ | 35719.4 | $2 \cdot 20$ | $355 \quad 5 \cdot 3$ | $2 \cdot 27$ |
| 25 | 4 I II.O | $2 \cdot \mathrm{OI}$ | $\begin{array}{llll}3 & 59 & 8 \cdot 9\end{array}$ | 2.06 | $\begin{array}{lll}3 & 57 & 3\end{array}$ | $2 \cdot 12$ | 35454.3 | 2.18 | 352 4I•6 | $2 \cdot 24$ | $350 \quad 24.9$ | $2 \cdot 31$ |
| 26 | $35640 \cdot 8$ | 2.04 | $\begin{array}{llll}3 & 54 & 36 \cdot 7\end{array}$ | 10 | $35^{52}$ 29. 1 | $2 \cdot 16$ | $35017 \cdot 7$ | $2 \cdot 22$ | $\begin{array}{llll}3 & 48 & 2 \cdot 5\end{array}$ | $2 \cdot 29$ | $34543 \cdot 1$ | $2 \cdot 36$ |
| 27 | $\begin{array}{llll}3 & 52 & 9 \cdot 8\end{array}$ | 2.07 | 350 | $2 \cdot 13$ | 34753.8 | 20 | $34540 \cdot 0$ | $2 \cdot 26$ | $34322 \cdot 1$ | $2 \cdot 33$ | 34059.8 | $2 \cdot 41$ |
| 28 | $\begin{array}{lllllll}3 & 47 & 37 \cdot 9\end{array}$ | $2 \cdot 11$ | $3 \begin{array}{llll}3 & 45 & 29.5\end{array}$ | $2 \cdot 17$ | $\begin{array}{lllllllllll}3 & 43 & \text { I7. }\end{array}$ | $2 \cdot 24$ | 34 I I'O | $2 \cdot 31$ | $\begin{array}{lllll}3 & 38 & 40 \cdot 3\end{array}$ | $2 \cdot 38$ |  | $2 \cdot 46$ |
| 29 | $\begin{array}{llll}3 & 43 & 5 \cdot 0\end{array}$ | $2 \cdot 1$ | $\begin{array}{lllll}3 & 40 & 54.3\end{array}$ | I | $\begin{array}{llll}3 & 38 & 39.6\end{array}$ | $2 \cdot 28$ | $\begin{array}{llll}3 & 36 & 20 \cdot 6\end{array}$ | $2 \cdot 35$ | $33357 \cdot 0$ | $2 \cdot 43$ | $33128 \cdot 6$ | 2.51 |
| 30 | $33^{88} 3 \mathrm{I} \cdot 0$ | $2 \cdot 18$ | $\begin{array}{llll}3 & 3618 \cdot 0\end{array}$ | 2.25 | $\begin{array}{llll}3 & 34 & 0.7\end{array}$ | $2 \cdot 33$ | $33138 \cdot 8$ | 2.40 | 329 12.I | 2.49 | $32640 \cdot 4$ | 2.57 |
| 31 | $3 \begin{array}{lll}33 & 55 \cdot 8\end{array}$ | 2.22 | 3 3I 40.3 | $2 \cdot 30$ | $32920 \cdot 3$ | $2 \cdot 37$ | $\begin{array}{llll}3 & 26 & 55.4\end{array}$ | 2.46 | $32425 \cdot 5$ | $2 \cdot 54$ | $32150 \cdot 3$ | 2.63 |
| 32 | $\begin{array}{llllll}3 & 29 & 19.5\end{array}$ | $2 \cdot 26$ | $\begin{array}{lll}3 & 27 & 1.4\end{array}$ | $2 \cdot 34$ | $324 \begin{array}{llll}3 & 24 \cdot 4\end{array}$ | 2.42 | $\begin{array}{llll}3 & 22 & 10 \cdot 4\end{array}$ | 2.51 | $3 \begin{array}{llll}3 & 19 & 37 \cdot 1\end{array}$ | $2 \cdot 60$ | $\begin{array}{llllllllllllll}3 & 16 & 58\end{array}$ | $2 \cdot 70$ |
| 33 | $\begin{array}{llll}3 & 24 & 42 \cdot 0 \\ 3 & 20 & 3 \cdot 0\end{array}$ | 2.31 | $\begin{array}{llll}3 & 22 & 21 \cdot 0 \\ 3 & 12 & \end{array}$ | 2.39 | 3 19 54.9 <br> 3 1  | 2.48 | $\begin{array}{llll}3 & 17 & 23.6 \\ 3 & 12 & 34.9\end{array}$ | 2.57 | $\begin{array}{llll}3 & 14 & 46 \cdot 7\end{array}$ | 2.66 | $\begin{array}{rrrr}3 & 12 & 3.8 \\ 3 & 7 & 7.2\end{array}$ | $2 \cdot 77$ |
| 34 | $\begin{array}{llll}3 & 20 & 3.0\end{array}$ | $2 \cdot 36$ | 3 I7 39.0 | $2 \cdot 44$ | $\begin{array}{lll}3 & 15 & 9 \cdot 8\end{array}$ | $2 \cdot 53$ | $\begin{array}{lllll}3 & 12 & 34 \cdot 9\end{array}$ | 2.63 | $\begin{array}{llll}3 & 9 & 54 \cdot 2\end{array}$ | $2 \cdot 73$ | $\begin{array}{llll}3 & 7 & 7 \cdot 2\end{array}$ | $2 \cdot 84$ |
| 35 | 3 I5 $22 \cdot 5$ | 2.41 | $\begin{array}{llll}312 & 125 \%\end{array}$ | 2.50 | $31022 \cdot 7$ | 2.59 | 3744.2 | $2 \cdot 69$ | $\begin{array}{llll}3 & 4 & 59 \cdot 3\end{array}$ | $2 \cdot 80$ | $\begin{array}{llll}3 & 2 & 7.9\end{array}$ | 2.92 |
| 36 | $31040 \cdot 5$ | 2.46 | 38810.0 | 2.56 | $\begin{array}{llll}3 & 5 & 33.7\end{array}$ | 2.66 | $\begin{array}{llll}3 & 2 & 51 \cdot 2\end{array}$ | 2.76 | $\begin{array}{llll}3 & 0 & 2.0\end{array}$ | 2.88 | $\begin{array}{lll}2 & 57 & 5.9\end{array}$ | 3.00 |
| 37 | $3 \begin{array}{llll}3 & 5 & 56 \cdot 7\end{array}$ | 2.52 | 3 3 $22 \cdot 8$ <br>  58 33.4 | 2.62 | $\begin{array}{lrrr}3 & 0 & 42 \cdot 5 \\ 2 & 55 & 49\end{array}$ | 2.72 | $\begin{array}{llll}2 & 57 & 55 \cdot 8 \\ 2 & 52 & 57.8\end{array}$ | 2.84 | 22 55 $2 \cdot 0$ <br> 2 40  | 2.96 | $\begin{array}{rrrr}2 & 52 & 0.8 \\ 2 & 46 & 52.5\end{array}$ | 3.09 |
| 38 | $\begin{array}{lrrrr}3 & 1 & 11 \cdot 1 \\ 2 & 56 & 23.5\end{array}$ | 2.58 | $\begin{array}{llll}2 & 58 & 33.4 \\ 2 & 53 & 4\end{array}$ | $2 \cdot 68$ | $\begin{array}{llll}2 & 55 & 49 \cdot 0 \\ 2 & 50 & 53 \cdot 0\end{array}$ | 2.80 | $\begin{array}{lllll}2 & 52 & 57 \cdot 8 \\ 2 & 47 & 56 \cdot 9\end{array}$ | 2.92 | $\begin{array}{llll}2 & 49 & 59 \cdot 1 \\ 2 & \end{array}$ | 3.04 |  | $3 \cdot 18$ |
| 39 | $\begin{array}{llll}2 & 56 & 23 \cdot 5\end{array}$ | 2.64 | $25341 \cdot 7$ | 2.75 | $2 \begin{array}{lllll}2 & 50 & 53 \cdot 0\end{array}$ | 2.87 | $\begin{array}{lllllll}2 & 47 & 56 \cdot 9 \\ 2 & 42 & 5\end{array}$ | 3.00 | $\begin{array}{llll}2 & 44 & 52 \cdot 9 \\ 2 & \end{array}$ | $3 \cdot 14$ | $2 \begin{array}{lllllllll} & 41 & 40 \cdot 5\end{array}$ | $3 \cdot 28$ |
| 40 | 25133.7 | $2 \cdot 71$ | $24^{8} \quad 47 \cdot 6$ | 2.83 | 24554.2 | 2.96 | $2 \begin{array}{lllll}2 & 52 & 52\end{array}$ | 3.09 | $23943 \cdot 3$ | $3 \cdot 24$ | 23624.5 | $3 \cdot 39$ |
| 4 I | $2 \begin{array}{lll}2 & 46 & 4 \mathrm{I} \cdot 5\end{array}$ | $2 \cdot 78$ | $\begin{array}{llll}2 & 43 & 50.9\end{array}$ | 2.91 | $240 \quad 52.4$ | 3.04 | $\begin{array}{llll}2 & 37 & 45 \cdot 5\end{array}$ | $3 \cdot 19$ | $\begin{array}{llll}2 & 34 & 29 \cdot 7\end{array}$ | $3 \cdot 34$ | 23154.2 | 3.51 |
| 42 | $2{ }_{2} 4146 \cdot 8$ | 2.86 |  | 3.00 | $2 \begin{array}{lllllllll} & 35 & 47 \cdot 3\end{array}$ | $3 \cdot 14$ | $2 \begin{array}{llll}2 & 32 & 34 \cdot 4\end{array}$ | 3.29 | $2 \begin{array}{lll}299 & \text { II.9 } \\ 2\end{array}$ | $3 \cdot 46$ | $\begin{array}{llllllllllllll}2 & 25 & 38.9\end{array}$ | $3 \cdot 64$ |
| 43 | $\begin{array}{llll}2 & 36 & 49 \cdot 2\end{array}$ | 2.95 | $\begin{array}{lllll}2 & 33 & 48 \cdot 3\end{array}$ | 3.09 | $\begin{array}{llll}2 & 30 & 38 \cdot 5\end{array}$ | $3 \cdot 24$ | $22719 \cdot 1$ | 3.41 | $\begin{array}{llll}2 & 23 & 49 \cdot 3\end{array}$ | 3.59 | $\begin{array}{lll}2 & 20 & 8 \cdot 2\end{array}$ | 3.79 |
| 44 | $\begin{array}{llll}2 & 31 \\ 2 & 26 & 48 \cdot 5\end{array}$ | 3.04 | 2 28 $41 \cdot 8$ <br> 2 23  | $3 \cdot 19$ | $\begin{array}{llll}2 & 25 & 25 \cdot 6 \\ 2 & 20 & 8 \cdot 3\end{array}$ | $3 \cdot 36$ | 22159.1 | 3.53 | $\begin{array}{lllll}2 & 18 & 21.4 \\ 2 & 12 & 47.5\end{array}$ | 3.73 | 2 1 4 31.4 | 3.95 |
| 45 | 122644.4 | $3 \cdot 14$ | 223 31.5 | $3 \cdot 30$ | 22083 | $3 \cdot 48$ | 2 I6 34.0 | 3.67 | $21247 \cdot 5$ | $3 \cdot 89$ | $284, \cdot 7$ | 4.12 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. 70 A. |  | L. $8^{\circ} \mathrm{A}$. |  | L. 9 | A. | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. | S. | s. | S. | s. | s. | s. | S. | S. | S. | S. | S. |
| $\bigcirc$ | -. 48 | $-4.31$ | -. 56 | $-4.32$ | -.65 | $-4.33$ | - '73 | $-4.35$ | - 81 | $-4.36$ | -.89 | $-4.37$ |
| 2 | -54 | $4 \cdot 32$ | -62 | $4 \cdot 33$ | -71 | 4.34 | $\cdot 79$ | $4 \cdot 36$ | . 87 | $4 \cdot 37$ | -96 | 4.39 |
| 4 | -60 | 4.33 | -68 | $4 \cdot 34$ | $\cdot 77$ | 435 | -85 | 437 | -93 | 4.39 | 1.02 | 4.40 |
| 6 | -66 | 4.34 | -75 | $4 \cdot 35$ | -83 | $4 \cdot 36$ | -92 | $4 \cdot 38$ | 1.00 | $4 \cdot 40$ | 1.09 | $4 \cdot 42$ |
| 8 | $\cdot 73$ | 4.35 | -81 | $4 \cdot 36$ | -89 | 438 | -98 | $4 \cdot 39$ | 1.07 | $4 \cdot 42$ | 1.16 | 4.44 |
| 10 | -79 | $4 \cdot 37$ | - 88 | 4.37 | . 96 | $4 \cdot 39$ | I.05 | 4.41 | 1.14 | $4 \cdot 43$ | I. 23 | 4.46 |
| 12 | -86 | $4 \cdot 37$ | $\cdot 94$ | $4 \cdot 39$ | I. 03 | 4.41 | I•I2 | 4.43 | 1-21 | 4.45 | I. 30 | $4 \cdot 48$ |
| 14 | '93 | 4.38 | I-OI | 4.40 | I-10 | $4 \cdot 42$ | I•I9 | $4 \cdot 45$ | I. 29 | 4.47 | I. 38 | $4 \cdot 50$ |
| 16 | I 00 | 4.40 | I.09 | $4 \cdot 42$ | I-I 8 | $4 \cdot 44$ | I 27 | 4.47 | I 36 | $4 \cdot 50$ | I. 46 | $4 \cdot 53$ |
| 18 | 1.07 | $4 \cdot 42$ | I'I6 | 4.44 | 1.26 | 4.46 | I 35 | $4 \cdot 49$ | 1.45 | 4.52 | 1.55 | 4.56 |
| 20 | I'I5 | $4 \cdot 44$ | 1.24 | 4.46 | I•34 | $4 \cdot 49$ | 1.44 | $4 \cdot 52$ | I•54 | 4.55 | 1.64 | $4 \cdot 59$ |
| 22 | 1.23 | $4 \cdot 46$ | I 33 | 4.48 | I.43 | $4 \cdot 52$ | I. 53 | $4 \cdot 55$ | I. 63 | $4 \cdot 58$ | $1 \cdot 74$ | 4.62 |
| 24 | I. 32 | $4 \cdot 48$ | I* 42 | 4.51 | I.52 | 4.55 | I. 62 | $4 \cdot 58$ | I•73 | 4.62 | I. 84 | $4 \cdot 66$ |
| 26 | 1*4 | $4 \cdot 51$ | I-51 | $4 \cdot 54$ | 1.62 | $4 \cdot 58$ | $1 \cdot 73$ | 4.62 | I. 84 | $4 \cdot 66$ | I.95 | $4 \cdot 71$ |
| 28 | I. 50 | 4.54 | I.61 | 4.58 | I•72 | 4.62 | I. 84 | 4.66 | I 95 | 4.75 | 2.07 | $4 \cdot 76$ |
| 30 | I.6I | $4 \cdot 58$ | I•72 | 4.62 | I. 84 | $4 \cdot 66$ | I'95 | 4’71 | 2.08 | $4 \cdot 76$ | $2 \cdot 20$ | 4.82 |
| 32 | I• 72 | 4.61 | I. 84 | $4 \cdot 66$ | 1.96 | 4.71 | 2.08 | $4 \cdot 76$ | $2 \cdot 22$ | $4 \cdot 82$ | 2.35 | $4 \cdot 89$ |
| 34 | I-84 | $4 \cdot 66$ | I.96 | $4 \cdot 71$ | 2.09 | $4 \cdot 77$ | 2.23 | $4 \cdot 83$ | $2 \cdot 37$ | 4.89 | 2.51 | $4 \cdot 97$ |
| 36 | I.97 | 4.71 | $2 \cdot 10$ | $4 \cdot 77$ | $2 \cdot 24$ | 4.83 | $2 \cdot 38$ | 4.90 | 2.53 | 4.98 | 2.69 | $5 \cdot 06$ |
| 38 | $2 \cdot 11$ | $4 \cdot 78$ | $2 \cdot 26$ | $4 \cdot 84$ | 2.40 | 4.91 | $2 \cdot 56$ | $4 \cdot 99$ | $2 \cdot 72$ | $5 \cdot 08$ | 2.89 | $5 \cdot 17$ |
| 40 | 2.27 | 4.85 | $2 \cdot 43$ | 4.92 | 2.59 | 5.00 | $2 \cdot 76$ | 5.09 | $2 \cdot 94$ | 5.19 | 3.12 | $5 \cdot 30$ |
| 42 | 2.45 | 4.94 | $2 \cdot 62$ | $5 \cdot 02$ | 2.80 | $5 \cdot 12$ | $2 \cdot 98$ | $5 \cdot 22$ | 3-18 | $5 \cdot 34$ | $3 \cdot 39$ | $5 \cdot 47$ |
| 43 | 2.55 | 4.98 | $2 \cdot 73$ | 5.08 | 2.91 | 5-18 | $3 \cdot 11$ | $5 \cdot 29$ | $3 \cdot 32$ | $5 \cdot 42$ | $3 \cdot 55$ | $5 \cdot 56$ |
| 44 | $2 \cdot 65$ | $5 \cdot 04$ | 2.84 | $5 \cdot 14$ | 3.04 | $5 \cdot 25$ | 3.25 | $5 \cdot 38$ | $3 \cdot 47$ | $5 \cdot 51$ | 3.72 | $5 \cdot 67$ |
| 45 | $2 \cdot 77$ | 5.10 | 2.96 | $5 \cdot 21$ | $3 \cdot 17$ | $5 \cdot 33$ | 3.40 | $5 \cdot 47$ | $3 \cdot 64$ | $5 \cdot 62$ | $3 \cdot 90$ | $5 \cdot 79$ |

## 208 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $21^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. S. | S. | H. M. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $54116 \cdot 7$ | - 1.61 | $53939 \cdot 7$ | - I. 62 | $\begin{array}{llll}5 & 38 & 1.9\end{array}$ | - I•64 | $\begin{array}{llll}5 & 36 & 23 \cdot 1\end{array}$ | -I. 65 | $53443 \cdot 3$ | - 1.67 | $\begin{array}{llll}5 & 33 & 2 \cdot 5\end{array}$ | - $\mathbf{I} \cdot 69$ |
| 2 | $\begin{array}{llll}5 & 32 & 28 \cdot 6\end{array}$ | I. 65 | $53049 \cdot 0$ | 1.67 | $\begin{array}{llll}5 & 29 & 8.6\end{array}$ | I 68 | $\begin{array}{lllll}5 & 27 & 26.9\end{array}$ | 1.70 | $52544 \cdot 0$ | I•73 | $\begin{array}{llll}5 & 23 & 59.8\end{array}$ | I•75 |
| 4 | $\begin{array}{llll}5 & 23 & 38 \cdot 5\end{array}$ | 1.69 | 5 2I $56 \cdot 4$ | 1.71 | $5 \begin{array}{llll}5 & 20 & 13.0\end{array}$ | I'73 | $\begin{array}{lllll}5 & 18 & 28 \cdot 3\end{array}$ | I.76 | 5 I6 42.1 | $1 \cdot 78$ | $\begin{array}{lllll}5 & 14 & 54.3\end{array}$ | I.81 |
| 6 | $51446 \cdot 4$ | I.74 | $\begin{array}{llll}5 & 13 & 1.5\end{array}$ | I•76 | $5{ }_{5}^{511} 15 \cdot 1$ | $1 \cdot 79$ | 5 5 9 $2727 \cdot 1$ | I.81 | 5 7 $37 \cdot 4$ | I-84 | $\begin{array}{lrrr}5 & 5 & 45 \cdot 9\end{array}$ | 1.87 |
| 8 | $5 \quad 5 \quad 52 \cdot 2$ | I•78 | $5 \begin{array}{lll}5 & 4 & 4.3\end{array}$ | I.8I | $\begin{array}{llll}5 & 2 & 14.7\end{array}$ | I. 84 | $5 \begin{array}{llll}5 & 0 & 23.2\end{array}$ | I.87 | $4 \quad 58 \quad 29 \cdot 7$ | 1.91 | $45634 \cdot 2$ | I.94 |
| 10 | $45655 \cdot 6$ | r. 84 | 45514 | 1.87 | 453 II. 4 | I.90 | 4 51 16.1 | I'94 | 44918.7 | I. 98 | 447 18.9 | $2 \cdot 02$ |
| 12 | $44756 \cdot 3$ | I. 89 | $446 \quad 1.8$ | I.93 | $\begin{array}{lll}4 & 44 & 4.9\end{array}$ | I.97 | 44257 | $2 \cdot \mathrm{OI}$ | $4 \quad 40 \quad 3.9$ | $2 \cdot 05$ | 43759.5 | $2 \cdot 10$ |
| 14 | $43854 \cdot \mathrm{I}$ | r 95 | $436 \quad 55 \cdot 9$ | I. 99 | $43455 \cdot 0$ | 2.04 | $432 \begin{array}{lll}4 & 51 \\ 4\end{array}$ | 2.08 | $43045 \cdot 1$ | $2 \cdot 13$ | $42835 \cdot 8$ | 2.18 |
| 15 | 43421.9 | r.98 | 43221.6 | 2.03 | 430 | 2.07 | $\begin{array}{llll}4 & 28 & 12.9\end{array}$ | $2 \cdot 12$ | $\begin{array}{llll}4 & 26 & 4 \cdot 1\end{array}$ | $2 \cdot 17$ | 423 52•I | 2.23 |
| 16 | $42948 \cdot 8$ | 2.02 | $42746 \cdot 5$ | $2 \cdot 06$ | $42541 \cdot 3$ | $2 \cdot 11$ | 423 33.1 | 2.16 | 42121.8 | $2 \cdot 22$ | $419 \quad 7 \cdot 2$ | $2 \cdot 27$ |
| 17 | $\begin{array}{llll}4 & 25 & 14.8\end{array}$ | 2.05 | $\begin{array}{lll}4 & 23 & 10.4\end{array}$ | $2 \cdot$ | $4 \begin{array}{llr}41 & 2.9\end{array}$ | $2 \cdot 15$ | $\begin{array}{llll}4 & 18 & 52 \cdot 3\end{array}$ | $2 \cdot 20$ | $4 \mathrm{r} 638 \cdot 3$ | 2.26 | $4 \begin{array}{lll}44 & 20 \cdot 8\end{array}$ | $2 \cdot 32$ |
| 18 | 42039.9 | $2 \cdot 09$ | $41833 \cdot 2$ | $2 \cdot 14$ | 41623.4 | $2 \cdot 19$ | $4 \begin{array}{llll}4 & 14 & 10.2\end{array}$ | $2 \cdot 25$ | 4 II 53.5 | $2 \cdot 31$ | $4 \quad 933 \cdot 1$ | $2 \cdot 37$ |
| 19 | 4 I6 $3 \cdot 9$ | $2 \cdot 12$ | 4 I3 54.9 | $2 \cdot 18$ | 4 II $42 \cdot 7$ | $2 \cdot 23$ | $\begin{array}{llll}4 & 9 & 26.8\end{array}$ | $2 \cdot 30$ | $4 \begin{array}{lll}4 & 7 & 7 \cdot 2\end{array}$ | $2 \cdot 36$ | $4443 \cdot 8$ | $2 \cdot 43$ |
| 20 | 4 II 26•9 | $2 \cdot 16$ | $4 \quad 915.6$ | $2 \cdot 22$ | $\begin{array}{lll}4 & 7 & 0.7\end{array}$ | $2 \cdot 28$ | $\begin{array}{llll}4 & 4 & 42 \cdot 0\end{array}$ | $2 \cdot 34$ | $\begin{array}{llll}4 & 2 & 19.5\end{array}$ | 2.41 | $35952 \cdot 8$ | $2 \cdot 48$ |
| 21 | $4 \quad 6 \quad 48 \cdot 9$ | $2 \cdot 20$ | $4 \quad 434 \cdot 9$ | $2 \cdot 26$ | $4 \quad 21774$ | $2 \cdot 32$ | 35955.9 | $2 \cdot 39$ | $35730 \cdot 2$ | 2.46 | 3550.2 | $2 \cdot 54$ |
| 22 | $\begin{array}{lll}4 & 2 & 9.6\end{array}$ | $2 \cdot 24$ | $35953 \cdot \mathrm{I}$ | $2 \cdot 31$ | $35732 \cdot 6$ | $2 \cdot 37$ | $\begin{array}{llr}3 & 55 & 8 \cdot 1\end{array}$ | 2.44 | $35239 \cdot 2$ | $2 \cdot 52$ | $350 \quad 57$ | $2 \cdot 60$ |
| 23 | 357 29'1 | $2 \cdot 29$ | $\begin{array}{llll}3 & 55 & 9 \cdot 8\end{array}$ | $2 \cdot 35$ | $35246 \cdot 5$ | $2 \cdot 43$ |  | $2 \cdot 50$ | $34746 \cdot 4$ | $2 \cdot 58$ | $345 \quad 9 \cdot 2$ | $2 \cdot 66$ |
| 24 | 352476 | $2 \cdot 33$ | 35025.2 | 2.40 |  | 2.48 |  | $2 \cdot 56$ | $3{ }^{3} 425 \mathrm{I} \cdot 7$ | $2 \cdot 64$ | $34010 \cdot 6$ | $2 \cdot 73$ |
| 25 | $\begin{array}{llll}3 & 48 & 4^{1} \text { I }\end{array}$ | $2 \cdot 38$ | $\begin{array}{lllllllll}3 & 45 & 38\end{array}$ | 2.46 | $\begin{array}{llll}3 & 43 & 9 \cdot 2\end{array}$ | $2 \cdot 54$ | $34034 \cdot 6$ | $2 \cdot 62$ | 33755.0 | $2 \cdot 71$ | 33519.9 | 2.80 |
| 26 | 34319.3 | $2 \cdot 43$ | $3405 \mathrm{I} \cdot \mathrm{O}$ | 2.51 | $\begin{array}{lllllllll}3 & 38 & 17.9\end{array}$ | 2.59 | $3 \quad 3539 \cdot 7$ | $2 \cdot 68$ | $33256 \cdot 1$ | $2 \cdot 77$ | 3306.7 | 2.87 |
| 27 | 3 38 3 $3 \cdot 0$ | 2.49 | $\begin{array}{lll}3 & 36 & 1.4\end{array}$ | 2.57 | $\begin{array}{llll}3 & 33 & 24.7\end{array}$ | 2.66 | $33042 \cdot 6$ | $2 \cdot 75$ | 32754.8 | $2 \cdot 85$ | $\begin{array}{lll}3 & 25 & 1.0\end{array}$ | $2 \cdot 95$ |
| 28 | $33345 \cdot 0$ | $2 \cdot 54$ | 33199 | 2.63 | 3 218829.4 | $2 \cdot 72$ | $\begin{array}{lllllllllll}3 & 25 & 43 \cdot 2\end{array}$ | $2 \cdot 82$ | $\begin{array}{llll}3 & 22 & 51 \cdot 0\end{array}$ | 2.92 | $\begin{array}{llll}3 & 19 & 52 \cdot 5\end{array}$ | 3.03 |
| 29 | 3 28 | $2 \cdot 60$ | 32616.4 | $2 \cdot 69$ | $\begin{array}{llll}3 & 23 & 31 \cdot 9\end{array}$ | $2 \cdot 79$ | $\begin{array}{llll}3 & 20 & 41.4\end{array}$ | $2 \cdot 89$ | 31744.6 | 3.00 | $31440 \cdot 9$ | $3 \cdot 12$ |
| 30 | $\begin{array}{llll}3 & 24 & 3.2\end{array}$ | $2 \cdot 66$ | $32120 \cdot 7$ | $2 \cdot 76$ | $\begin{array}{lllllllllll}3 & 18 & 32 \cdot 0\end{array}$ | 2.86 | $\begin{array}{lllllllll}3 & 15 & 36 \cdot 9\end{array}$ | $2 \cdot 97$ |  | 3.09 | $\begin{array}{llll}3 & 9 & 26 \cdot 2\end{array}$ | $3 \cdot 21$ |
| 31 | $\begin{array}{llll}319 & 9 \cdot 5\end{array}$ | $2 \cdot 73$ | 31622.7 | $2 \cdot 83$ | 313829.5 | $2 \cdot 94$ | 31029.7 | 3.06 | 3722.6 | $3 \cdot 18$ | $\begin{array}{llll}3 & 4 & 7.9\end{array}$ | $3 \cdot 31$ |
| 32 | 31413.3 | 2.80 | 3 II 22.2 | 2.91 | $\begin{array}{llll}3 & 8 & 24 \cdot 3\end{array}$ | 3.02 | $\begin{array}{llll}3 & 5 & 19.3\end{array}$ | $3 \cdot 15$ | $\begin{array}{llll}3 & 2 & 6 \cdot 6\end{array}$ | 3.28 | $2 \begin{array}{llll}2 & 58 & 45 \cdot 7\end{array}$ | 3.42 |
| 33 | 3 3 14.7 | 2.87 | $\begin{array}{lllll}3 & 6 & 18 \cdot 9\end{array}$ | 2.99 | $\begin{array}{llll}3 & 3 & 16.0\end{array}$ | $3 \cdot 11$ | $\begin{array}{llll}3 & 0 & 5 \cdot 5 \\ 2 & 54 & 4\end{array}$ | $3 \cdot 24$ | $\begin{array}{llll}2 & 56 & 46 \cdot 8\end{array}$ | $3 \cdot 38$ | $\begin{array}{llll}2 & 53 & 19.4\end{array}$ | $3 \cdot 54$ |
| 34 |  | $2 \cdot 95$ | $\begin{array}{llll}3 & 1 & 12.8\end{array}$ | 3.07 | $\begin{array}{llll}2 & 58 & 4 \cdot 5\end{array}$ | 3.21 | $25448 \cdot 1$ | $3 \cdot 35$ | $\begin{array}{llll}2 & 51 & 23.0\end{array}$ | $3 \cdot 50$ | 24748.5 | $3 \cdot 66$ |
| 35 | $\begin{array}{lll}2 & 59 & 9 * 4\end{array}$ | $3 \cdot 04$ | $\begin{array}{llll}2 & 56 & 3.4\end{array}$ | $3 \cdot 17$ | $\begin{array}{lllll}2 & 52 & 49 \cdot 4\end{array}$ | $3 \cdot 3 \mathrm{I}$ | $2 \begin{array}{llll}2 & 49 & 26 \cdot 6\end{array}$ | 3.46 | $\begin{array}{llll}2 & 45 & 54 \cdot 6\end{array}$ | $3 \cdot 62$ | $\begin{array}{llll}2 & 42 & 12.5\end{array}$ | $3 \cdot 79$ |
| 36 | $254 \quad 2 \cdot 3$ | $3 \cdot 13$ | $25050 \cdot 6$ | 3.27 | $24730 \cdot 3$ | $3 \cdot 4 \mathrm{I}$ | 2440.8 | $3 \cdot 57$ | 24021.3 | $3 \cdot 75$ | $236 \quad 30.9$ | $3 \cdot 94$ |
| 37 | $2485 \mathrm{~F} \cdot 7$ | 3.22 | $\begin{array}{llll}2 & 45 & 33 \cdot 9\end{array}$ | $3 \cdot 37$ | $2 \begin{array}{lll}2 & 42 & 7 \cdot 0\end{array}$ | 3.53 | $\begin{array}{llll}2 & 38 & 30 \cdot 2\end{array}$ | 3.70 | $\begin{array}{llll}2 & 34 & 42 \cdot 5\end{array}$ | 3.89 | $23043 \cdot 0$ | $4 \cdot 10$ |
| 38 | $2 \begin{array}{llllllll} & 43 & 37 \cdot 4\end{array}$ | $3 \cdot 33$ | 240 13.1 | 3.49 | $\begin{array}{llll}2 & 36 & 38 \cdot 9\end{array}$ | $3 \cdot 66$ | $23254 \cdot 1$ | $3 \cdot 84$ | $\begin{array}{llll}2 & 28 & 57 \cdot 5\end{array}$ | 4.05 | $22448 \cdot 1$ | $4 \cdot 27$ |
| 39 |  | $3 \cdot 44$ | 23447.6 | 3.61 | 2 31 5.7 <br> 2 25  | $3 \cdot 80$ | 22712.0 | 4.00 | $\begin{array}{lll}2 & 23 & 5 \cdot 7\end{array}$ | 4.22 | $\begin{array}{lllll}2 & 18 & 45.4\end{array}$ | 4.47 |
| 40 | $23256 \cdot 1$ | 3.56 | 22917.0 | $3 \cdot 75$ | 22526.5 | 3.95 | $2 \begin{array}{llll}2 & 21 & 23.3\end{array}$ | $4 \cdot 17$ | 2 I 76.2 | 4.41 | 211233.6 | $4 \cdot 69$ |
| 41 | $22728 \cdot 2$ | $3 \cdot 70$ | $22340 \cdot 7$ | 3.90 | $21940 \cdot 7$ | $4 \cdot 11$ | $215 \quad 26 \cdot 9$ | $4 \cdot 36$ | 2 10 57.8 | $4 \cdot 63$ | 26 II.5 | $4 \cdot 93$ |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | s. | s. | S. | S. | S. | S. | S. | s. | S. | s. |
| 0 | - 98 | $-4.39$ | -r.06 | -4.41 | - I'15 | $-4.43$ | - I. 24 | $-4.46$ | - I.3I | $-4.48$ | - $\mathrm{I} \cdot 4 \mathrm{~T}$ | $-4.51$ |
| 2 | I. 04 | $4 \cdot 4 \mathrm{I}$ | I-13 | 4.43 | I.21 | 4.45 | I 30 | 4.48 | I 39 | 4.50 | I. 48 | 4.53 |
| 4 | I•II | $4 \cdot 43$ | I•19 | $4 \cdot 45$ | I. 28 | $4 \cdot 47$ | 1.37 | $4 \cdot 50$ | I.46 | 4.53 | I. 55 | $4 \cdot 56$ |
| 6 | I.17 | 4.44 | I 26 | $4 \cdot 47$ | I.35 | $4 \cdot 49$ | $1 \cdot 44$ | $4 \cdot 52$ | I 53 | $4 \cdot 55$ | I. 63 | 4.58 |
| 8 | I 24 | $4 \cdot 46$ | I.33 | $4 \cdot 49$ | I. 42 | 4.51 | I. 52 | 4.55 | 1.6I | $4 \cdot 58$ | I• 1 | $4 \cdot 6 \mathrm{I}$ |
| 10 | I. 32 | 4.48 | I.4I | 4.51 | 1.50 | $4 \cdot 54$ | 1.60 | $4 \cdot 57$ | I. 69 | 4.61 | I•79 | 4.64 |
| 12 | I 39 | 4.51 | 1.49 | 4.54 | I. 58 | 4.57 | 1.68 | 4.60 | 1.78 | $4 \cdot 64$ | I. 88 | $4 \cdot 68$ |
| 14 | 1.47 | 4.53 | I. 57 | 4.56 | I. 67 | 4.60 | 1.77 | $4 \cdot 64$ | 1.87 | $4 \cdot 67$ | 1.97 | $4 \cdot 72$ |
| 16 | I.56 | 4.56 | I. 66 | 4.59 | I.76 | 4.63 | I.86 | $4 \cdot 67$ | 1.97 | $4 \cdot 71$ | 2.08 | $4 \cdot 76$ |
| 18 | I. 65 | $4 \cdot 59$ | 1.75 | $4 \cdot 63$ | I.85 | $4 \cdot 67$ | I.96 | $4 \cdot 71$ | 2.07 | $4 \cdot 76$ | $2 \cdot 18$ | $4 \cdot 8 \mathrm{I}$ |
| 20 | 1.74 | 4.62 | 1.85 | 4.67 | r.96 | $4 \cdot 71$ | 2.07 | 4.76 | $2 \cdot 18$ | 4.81 | $2 \cdot 30$ | 4.86 |
| 22 | I.84 | 4.66 | 1.95 | $4 \cdot 71$ | 2.07 | $4 \cdot 76$ | 2.18 | 4.81 | $2 \cdot 30$ | 4.86 | $2 \cdot 43$ | $4 \cdot 92$ |
| 24 | 1.95 | 4.71 | 2.07 | 4.76 | $2 \cdot 19$ | 4.81 | $2 \cdot 31$ | $4 \cdot 87$ | $2 \cdot 44$ | $4 \cdot 93$ | 2.57 | $4 \cdot 99$ |
| 26 | 2.07 | 4.76 | $2 \cdot 19$ | $4 \cdot 8 \mathrm{I}$ | $2 \cdot 32$ | 4.87 | $2 \cdot 45$ | 4.93 | $2 \cdot 58$ | 5.00 | $2 \cdot 72$ | $5 \cdot 07$ |
| 28 | $2 \cdot 20$ | $4 \cdot 8 \mathrm{I}$ | $2 \cdot 33$ | 4.87 | $2 \cdot 46$ | 4.94 | 2.60 | 5.01 | $2 \cdot 74$ | $5 \cdot 08$ | $2 \cdot 89$ | $5 \cdot 17$ |
| 30 | $2 \cdot 34$ | 4.88 | 2.47 | 4.95 | $2 \cdot 61$ | $5 \cdot 02$ | $2 \cdot 76$ | $5 \cdot 10$ | $2 \cdot 92$ | 5.18 | 3.08 | $5 \cdot 27$ |
| 32 | 2.49 | 4.96 | 2.64 | $5 \cdot 03$ | $2 \cdot 79$ | $5 \cdot 11$ | 2.95 | $5 \cdot 20$ | $3 \cdot 12$ | $5 \cdot 30$ | 3.29 | $5 \cdot 40$ |
| 34 | 2.66 | $5 \cdot 04$ | $2 \cdot 82$ | 5.13 | $2 \cdot 99$ | $5 \cdot 22$ | $3 \cdot 16$ | $5 \cdot 32$ | $3 \cdot 34$ | $5 \cdot 43$ | $3 \cdot 54$ | $5 \cdot 56$ |
| 35 | 2.75 | $5 \cdot 09$ | 2.92 | $5 \cdot 18$ | 3.09 | $5 \cdot 28$ | $3 \cdot 28$ | $5 \cdot 39$ | 3.47 | 5.51 | $3 \cdot 68$ | $5 \cdot 65$ |
| 36 | $2 \cdot 85$ | 5.15 | 3.03 | $5 \cdot 25$ | 3.21 | $5 \cdot 35$ | $3 \cdot 40$ | $5 \cdot 47$ | $3 \cdot 61$ | $5 \cdot 60$ | $3 \cdot 83$ | 5.75 |
| 37 | $2 \cdot 96$ | 5.21 | $3 \cdot 14$ | $5 \cdot 31$ | $3 \cdot 33$ | $5 \cdot 43$ | $3 \cdot 54$ | $5 \cdot 56$ | 3.76 | 5.70 | 3.99 | 5.86 |
| 38 | 3.07 | $5 \cdot 27$ | $3 \cdot 26$ | $5 \cdot 39$ | 3.47 | $5 \cdot 51$ | $3 \cdot 68$ | $5 \cdot 65$ | $3 \cdot 92$ | $5 \cdot 81$ | $4 \cdot 17$ | $5 \cdot 98$ |
| 39 | 3.19 3.32 | $5 \cdot 34$ | 3.40 3.54 | 5.47 5.56 | 3.61 3.77 | $5 \cdot 60$ | 3.84 4.02 | $5 \cdot 76$ 5.88 | $4 \cdot 10$ $4 \cdot 29$ | 5.93 6.07 | 4.37 4.59 | $6 \cdot 12$ 6.28 |
| 40 | $3 \cdot 32$ | 5.42 | $3 \cdot 54$ | $5 \cdot 56$ | 3.77 | $5 \cdot 71$ | 4.02 | $5 \cdot 88$ | 4.29 4.51 | 6.07 6.22 | 4.59 4.84 | $6 \cdot 28$ 6.47 |
| 4 I | $3 \cdot 47$ | 5.51 | $3 \cdot 70$ | $5 \cdot 66$ | 3.95 | $5 \cdot 83$ | 4.22 | $6 \cdot \mathrm{Or}$ | 4.51 | $6 \cdot 22$ | 4.84 | $6 \cdot 47$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. S. | S. | H. M. S. | S. | H. M. | S. | M. | S. | H. M. S. | S. |
| 0 | $53120 \cdot 5$ | -I• 71 | 529 37.1 | - I•73 | $\begin{array}{llll}5 & 27 & 52.5\end{array}$ | -I.76 | $\begin{array}{lll}5 & 26 & 6 \cdot 3\end{array}$ | - I.78 |  | -I.8I | $\begin{array}{llll}5 & 22 & 29.4\end{array}$ | - 1.84 |
| 2 | $\begin{array}{lllll}5 & 22 & 14.2\end{array}$ | 1.77 | 52027.0 | 1.80 | $\begin{array}{lllllllllll}5 & 18 & 38 \cdot 3\end{array}$ | I.83 | $5 \mathrm{I} 647 \cdot 8$ | I. 86 | 514455.5 | I. 89 | $5 \mathrm{~F}_{5} \mathrm{~F}$ | I.92 |
| 4 | $\begin{array}{llll}5 & 13 & 4.9\end{array}$ | 1.84 | 5 II 13.8 | I.87 | $\begin{array}{llll}5 & 9 & 20 \%\end{array}$ | I.90 | $\begin{array}{lll}5 & 7 & 25 \cdot 6\end{array}$ | I.94 | $\begin{array}{lrrr}5 & 5 & 28 \cdot 4\end{array}$ | I.97 | $\begin{array}{llll}5 & 3 & 28 \cdot 9\end{array}$ | $2 \cdot 01$ |
| 6 | $\begin{array}{llll}5 & 3 & 52 \cdot 5\end{array}$ | 1.91 | 5 I 57*0 | I.94 | $45959 * 3$ | r.98 | $4 \begin{array}{llll}4 & 57 & 59.4\end{array}$ | 2.02 | $455 \quad 56 \cdot 9$ | $2 \cdot 06$ | $4 \quad 53520$ | $2 \cdot 11$ |
| 8 | $45436 \cdot 5$ | I.98 | 452364 | 2.02 | $45033 \cdot 8$ | $2 \cdot 06$ | $4 \quad 48 \quad 28 \cdot 7$ | $2 \cdot 11$ | $44620 \cdot 7$ | $2 \cdot 16$ | $444 \quad 9.9$ | $2 \cdot 2 \mathrm{I}$ |
| 10 | $44516 \cdot 6$ | 2.06 | 443 11. 6 | $2 \cdot 11$ | 441308 | $2 \cdot 15$ | $43853 \cdot 1$ | $2 \cdot 20$ | $436 \quad 39 \cdot 3$ | $2 \cdot 26$ | $43422 \cdot 1$ | $2 \cdot 32$ |
| 12 | $435 \quad 52 \cdot 3$ | $2 \cdot 14$ | $43342 \cdot 1$ | $2 \cdot 20$ | $43128 \cdot 7$ | $2 \cdot 25$ | 429 I2.1 | $2 \cdot 31$ | 426 5I•9 | $2 \cdot 37$ | $42428 \cdot 0$ | 2.43 |
| 14 | $42623 \cdot 3$ | $2 \cdot 24$ | $\begin{array}{lll}4 & 24 & 7 \cdot 5\end{array}$ | $2 \cdot 29$ | $42148 \cdot 1$ | $2 \cdot 35$ | 419250 | $2 \cdot 42$ | 4 I6 58.0 | $2 \cdot 48$ | $41426 \cdot 8$ | $2 \cdot 56$ |
| 16 | $41649^{\circ} \mathrm{O}$ | $2 \cdot 33$ | $\begin{array}{lllll}4 & 14 & 27 & \end{array}$ | $2 \cdot 40$ | $\begin{array}{lll}4 & 12 & 1.2\end{array}$ | $2 \cdot 47$ | $\begin{array}{lllll}4 & 9 & 3 \mathrm{I} \cdot 2\end{array}$ | $2 \cdot 54$ | $4 \quad 6 \quad 56 \cdot 8$ | $2 \cdot 61$ | $4{ }^{4} \begin{aligned} & 4 \\ & \text { I } 7 \cdot 6\end{aligned}$ | $2 \cdot 69$ |
| 17 | 4 II 59.6 | $2 \cdot 39$ | $4 \quad 934 \%$ | 2.45 |  | $2 \cdot 52$ | 44315 | $2 \cdot 60$ | 4 I 53.1 | $2 \cdot 68$ | $\begin{array}{lll}3 & 59 & 9.8\end{array}$ | $2 \cdot 77$ |
| 18 | $4 \quad 7 \quad 8 \cdot 7$ | $2 \cdot 44$ | $4440 \cdot 2$ | 2.51 | $\begin{array}{lll}4 & 2 & 7\end{array}$ | $2 \cdot 59$ | 359298 | 2.67 | $35647 \cdot 3$ | $2 \cdot 75$ | 35359.5 | $2 \cdot 84$ |
| 19 | $4216 \cdot 1$ | $2 \cdot 50$ | $35944^{\circ} \mathrm{I}$ | $2 \cdot 57$ | $\begin{array}{llll}3 & 57 & 74\end{array}$ | 2.65 | $\begin{array}{llll}3 & 54 & 25.9\end{array}$ | $2 \cdot 74$ | 3 51 39.1 | $2 \cdot 83$ | $34846 \cdot 7$ | 2.92 |
| 20 | $35721 \cdot 7$ | 2.56 | $35446 \cdot 1$ | $2 \cdot 63$ | $\begin{array}{llll}3 & 52 & 5 \cdot 5\end{array}$ | $2 \cdot 72$ | $3 \begin{array}{lllllll}3 & 49 & \text { I9 }\end{array}$ | $2 \cdot 8 \mathrm{I}$ | $346128 \cdot 3$ | $2 \cdot 90$ | 343 3I•I | $3 \cdot \mathrm{Or}$ |
| 21 | $35225 \cdot 5$ | $2 \cdot 62$ | $34946 \cdot 0$ | $2 \cdot 70$ | 34715 | $2 \cdot 79$ | 344 II 0 | $2 \cdot 89$ | 34114.9 | $2 \cdot 99$ |  | 3.09 |
| 22 | $34727 \cdot 3$ | $2 \cdot 68$ | $34443 \cdot 7$ | $2 \cdot 77$ | $34154 * 7$ | 2.87 | $\begin{array}{lllll}3 & 38 & 59.8\end{array}$ | 2.97 | $\begin{array}{llll}3 & 35 & 58 \cdot 7\end{array}$ | 3.07 | $\begin{array}{llll}3 & 32 & 50.9\end{array}$ | $3 \cdot 19$ |
| 23 | $\begin{array}{llll}3 & 42 & 26 \cdot 9\end{array}$ | 2.75 | 3 39 39 <br> 3 1  | $2 \cdot 84$ | $\begin{array}{llll}3 & 36 & 45 \cdot 5\end{array}$ | 2.94 | $\begin{array}{llll}3 & 33 & 45.7\end{array}$ | 3.05 | $\begin{array}{llll}3 & 30 & 39 \cdot 3\end{array}$ | $3 \cdot 16$ | $\begin{array}{llll}3 & 27 & 25.9\end{array}$ | 3.29 |
| 24 |  | 2.82 | $33432 \%$ | $2 \cdot 92$ | $3 \mathrm{3I} 33 \cdot 6$ | 3.03 | $\begin{array}{llll}3 & 28 & 28 \cdot 6\end{array}$ | $3 \cdot 14$ | 32516.6 | $3 \cdot 26$ | $32157 \cdot 1$ | $3 \cdot 39$ |
| 25 | $\begin{array}{llll}3 & 32 & \text { I9.1 }\end{array}$ | $2 \cdot 90$ | $\begin{array}{llll}3 & 29 & 22 \cdot 1\end{array}$ | 3.00 | $\begin{array}{llll}3 & 26 & 18 \cdot 6\end{array}$ | $3 \cdot 12$ | $\begin{array}{lll}3 & 23 & 8 \cdot 2 \\ & \end{array}$ | $3 \cdot 24$ | $31950 \cdot 3$ | $3 \cdot 36$ | $\begin{array}{llll}3 & 16 & 24.4\end{array}$ | 3.50 |
| 26 | $\begin{array}{llllll}3 & 27 & 11.3\end{array}$ | $2 \cdot 98$ | $\begin{array}{lll}3 & 24 & 9.4\end{array}$ | $3 \cdot 09$ | $\begin{array}{lll}3 & 21 & 0 \cdot 5\end{array}$ | $3 \cdot 21$ | 3 I7 44.3 | $3 \cdot 34$ | $\begin{array}{llll}3 & 14 & 20 \cdot 1\end{array}$ | $3 \cdot 47$ | 3 10 $47 \cdot 3$ | $3 \cdot 62$ |
| 27 | $\begin{array}{lll}3 & 22 & 0.7\end{array}$ | 3.06 | $\begin{array}{lllll}3 & 18 & 53.5\end{array}$ | $3 \cdot 18$ | $\begin{array}{llllll}3 & \text { I } & 38 \cdot 9\end{array}$ | 3.31 | 312165 | $3 \cdot 44$ | $\begin{array}{llll}3 & 8 & 45.6\end{array}$ | $3 \cdot 59$ | $\begin{array}{llll}3 & 5 & 5 \cdot 5\end{array}$ | $3 \cdot 75$ |
| 28 | $31647^{\circ} \mathrm{O}$ | $3 \cdot 15$ | 3 I3 34.2 | 3.28 | 31013.6 | 3.41 | $\begin{array}{llll}3 & 6 & 44 \cdot 6\end{array}$ | 3.56 | $\begin{array}{lll}3 & 3 & 6.4\end{array}$ | 3.72 | $2 \begin{array}{llll}2 & 59 & 18.4\end{array}$ | 3.89 |
| 29 | 3 II 30\%0 | $3 \cdot 25$ | $\begin{array}{llll}3 & 8 & \text { II'3 }\end{array}$ | $3 \cdot 38$ | $3 \quad 444 \cdot 2$ | 3.53 | 3 1 18.0 | 3.68 | $25722 \cdot 2$ | $3 \cdot 85$ | $253125 \cdot 7$ | $4 \cdot 04$ |
| 30 | $\begin{array}{lll}3 & 6 & 9.4\end{array}$ | $3 \cdot 35$ | $\begin{array}{llllll}3 & 2 & 44^{\circ} 3\end{array}$ | 3.49 | $25910 \cdot 3$ | 3.65 | $\begin{array}{llll}2 & 55 & 26 \cdot 5\end{array}$ | 3.82 | $25132 \cdot 3$ | 4.00 | 24726.6 | $4 \cdot 2 \mathrm{C}$ |
| 31 | $\begin{array}{rrrr}3 & 0 & 44 \cdot 8\end{array}$ | 3.46 | $2 \begin{array}{llll}2 & 57 & 1 & 3\end{array}$ | $3 \cdot 6 \mathrm{I}$ | $25331 \begin{array}{lll} \\ 2 & 51 & 5\end{array}$ | $3 \cdot 78$ | $24939 \cdot 5$ | 3.96 |  | 4.16 | $24120 \cdot 6$ | $4 \cdot 38$ |
| 32 | 255160 | 3.57 | $25136 \cdot 8$ | 3.74 | $24747 \cdot 3$ | 3.92 | $24346 \cdot 4$ | $4 \cdot 12$ | $23933 \cdot 3$ | $4 \cdot 33$ | $235 \quad 6 \cdot 7$ | $4 \cdot 57$ |
| 33 | $\begin{array}{lllllllllll}2 & 49 & 42 \cdot 5\end{array}$ | $3 \cdot 70$ | 24555.4 | 3.88 | $24157 \cdot 1$ | 4.07 | $2 \begin{array}{llll}2 & 37 & 46 \cdot 6\end{array}$ | $4 \cdot 29$ | 23322.7 | 4.52 | 22843.9 | $4 \cdot 78$ |
| 34 | $\begin{array}{llll}2 & 44 & 3.8\end{array}$ | $3 \cdot 84$ | $2408 \cdot 1$ | 4.03 | $\begin{array}{llll}2 & 36 & 0 \cdot 3\end{array}$ | 4.24 | $2 \mathrm{3I} 39 \cdot 2$ | 4.47 | $2 \begin{array}{lll}2 & 27 & 3 \cdot 3\end{array}$ | $4 \cdot 73$ | 222 II I I | $5 \cdot \mathrm{O} 2$ |
| 35 | $\begin{array}{llll}2 & 38 & 19.4\end{array}$ | $3 \cdot 98$ | $2 \begin{array}{llll}2 & 34 & 14.3\end{array}$ | $4 \cdot 19$ | $\begin{array}{llll}2 & 29 & 56 \cdot 0\end{array}$ | 4.43 | $\begin{array}{llll}2 & 25 & 23 \cdot 2\end{array}$ | 4.68 | $22034 \cdot 1$ | 4.97 | $215126 \cdot 8$ | $5 \cdot 29$ |
| 36 | $\begin{array}{lllll}2 & 32 & 28 \cdot 6 \\ 2 & 26 & 30 \cdot 6\end{array}$ | $4 \cdot 15$ |  | $4 \cdot 38$ | $\begin{array}{llll}2 & 23 & 43.4\end{array}$ | 4.63 | $2 \mathrm{I} 8{ }^{2} 576$ | 4.91 | $\begin{array}{lllll}2 & 13 & 53.7\end{array}$ | $5 \cdot 24$ | $\begin{array}{llll}2 & 8 & 29.3\end{array}$ | $5 \cdot 59$ |
| 37 | $22630 \cdot 6$ | 4.33 | 2223.9 | $4 \cdot 58$ | 2 I7 21.3 | $4 \cdot 86$ | 212208 | 5•18 | $270 \cdot 1$ | $5 \cdot 54$ | 2 I 16.2 | $5 \cdot 92$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| , | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| $\bigcirc$ | -1.50 | -4.54 | -1.59 | $-4.57$ | $-\mathrm{I} .69$ | $-4.60$ | $-\mathrm{I} \cdot 78$ | $-4.64$ | - 1.88 | -4.67 | -1.97 | $4 \cdot 72$ |
| 2 | 1.57 | 4.56 | 1.67 | $4 \cdot 60$ | 1.76 | 4.63 | 1.86 | $4 \cdot 67$ | I.95 | $4 \cdot 71$ | 2.05 | $4 \times 75$ |
| 4 | I.65 | 4.59 | I.74 | 4.63 | I. 84 | $4 \cdot 66$ | I.94 | $4 \cdot 70$ | 2.04 | $4 \cdot 74$ | $2 \cdot 14$ | $4 \cdot 79$ |
| 6 | I.72 | $4 \cdot 62$ | I. 82 | $4 \cdot 66$ | I.92 | $4 \cdot 69$ | 2.02 | $4 \cdot 74$ | $2 \cdot 12$ | $4 \cdot 78$ | $2 \cdot 23$ | 4.83 |
| 8 | I.85 | $4 \cdot 65$ | 1.90 | $4 \cdot 69$ | 2.01 | $4 \cdot 73$ | $2 \cdot 11$ | $4 \cdot 78$ | 2.21 | $4 \cdot 82$ | $2 \cdot 32$ | 487 |
| 10 | I.89 | $4 \cdot 68$ | 1.99 | 4.73 | 2-10 | 4.77 | 2.20 | 4.82 | $2 \cdot 31$ | 4.87 | 2.43 | 4.92 |
| 12 | 1.98 | $4 \cdot 72$ | 2.09 | $4 \cdot 77$ | $2 \cdot 20$ | $4 \cdot 81$ | 2.31 | $4 \cdot 87$ | 2.42 | 4.92 | 2.54 | $4 \cdot 98$ |
| 14 | 2.08 | $4 \cdot 76$ | $2 \cdot 19$ | 4.8 r | $2 \cdot 30$ | $4 \cdot 86$ | 2.42 | 4.92 | 2.54 | 4.98 | $2 \cdot 66$ | $5 \cdot 04$ |
| 16 | $2 \cdot 19$ | 4.81 | $2 \cdot 30$ | $4 \cdot 86$ | $2 \cdot 42$ | 4.92 | 2.54 | 4.98 | 2.66 | 5.04 | $2 \cdot 79$ | $5 \cdot \mathrm{II}$ |
| 17 | 2.24 | $4 \cdot 84$ | $2 \cdot 36$ | $4 \cdot 89$ | $2 \cdot 48$ | 4.95 | $2 \cdot 60$ | 5 Or | 2.73 | 5.08 | $2 \cdot 86$ | $5 \cdot 15$ |
| 18 | $2 \cdot 30$ | $4 \cdot 86$ | $2 \cdot 42$ | 4.92 | $2 \cdot 54$ | $4 \cdot 98$ | $2 \cdot 67$ | $5 \cdot 05$ | 2.80 | $5 \cdot 12$ | 2.93 | 5•19 |
| 19 | $2 \cdot 36$ | $4 \cdot 89$ | $2 \cdot 48$ | 4.95 | 2.61 | $5 \cdot 01$ | 2.74 | $5 \cdot 08$ | 2.87 | $5 \cdot 16$ | 3.01 | 5.24 |
| 20 | 2.42 | $4 \cdot 92$ | $2 \cdot 55$ | $4 \cdot 98$ | $2 \cdot 68$ | $5 \cdot 05$ | 2.81 | $5 \cdot 12$ | $2 \cdot 95$ | $5 \cdot 20$ | 3.09 | $5 \cdot 28$ |
| 2 I | 2.49 | 4.95 | $2 \cdot 61$ | $5 \cdot 02$ | $2 \cdot 75$ | 5.09 | $2 \cdot 89$ | $5 \cdot 17$ | 3.03 | $5 \cdot 25$ | $3 \cdot 18$ | $5 \cdot 33$ |
| 22 | $2 \cdot 56$ | 4.99 | 2.69 | $5 \cdot 06$ | 2.82 | $5 \cdot 13$ | $2 \cdot 97$ | $5 \cdot 21$ | $3 \cdot 11$ | $5 \cdot 30$ | 3.27 | $5 \cdot 39$ |
| 23 | 2.63 | 5.03 | 2.76 | $5 \cdot 10$ | 2.90 | $5 \cdot 18$ | 3.05 | 5.26 | 3.20 | $5 \cdot 35$ | 3.37 | $5 \cdot 45$ |
| 24 | 2.70 | $5 \cdot 06$ | 2.84 | $5 \cdot 14$ | 2.99 | $5 \cdot 22$ | $3 \cdot 14$ | $5 \cdot 31$ | $3 \cdot 30$ | $5 \cdot 41$ | $3 \cdot 47$ | $5 \cdot 51$ |
| 25 | 2.78 2.86 | $5 \cdot 11$ | 2.93 | $5 \cdot 19$ | 3.08 | 5.27 | 3.24 | $5 \cdot 37$ | 3.40 | $5 \cdot 47$ | $3 \cdot 58$ | $5 \cdot 58$ |
| 26 | $2 \cdot 86$ | $5 \cdot 15$ | 3.01 | $5 \cdot 24$ | $3 \cdot 17$ | 5.33 | $3 \cdot 34$ | $5 \cdot 43$ | $3 \cdot 51$ | 5.54 | $3 \cdot 69$ | 566 |
| 27 | $2 \cdot 95$ | $5 \cdot 20$ | $3 \cdot 11$ | $5 \cdot 29$ | $3 \cdot 27$ | $5 \cdot 39$ | $3 \cdot 44$ | $5 \cdot 50$ | 3.63 | $5 \cdot 61$ | $3 \cdot 8 \mathrm{I}$ | 5.74 |
| 28 | 3.04 | $5 \cdot 26$ | 3.21 | $5 \cdot 35$ | $3 \cdot 38$ | $5 \cdot 46$ | $3 \cdot 56$ | $5 \cdot 57$ | 3.75 | $5 \cdot 69$ | $3 \cdot 96$ | $5 \cdot 83$ |
| 29 | $3 \cdot 14$ | $5 \cdot 31$ | 3.31 | $5 \cdot 42$ | 349 | $5 \cdot 53$ | 3.68 | $5 \cdot 65$ | 3.88 | $5 \cdot 78$ | $4^{\text {- }} 10$ | 5.93 |
| 30 | $3 \cdot 25$ | $5 \cdot 38$ | 3.43 | $5 \cdot 49$ | $3 \cdot 61$ | 5.61 | 3.82 | $5 \cdot 74$ | 4.03 | $5 \cdot 88$ | $4 \cdot 26$ | $6 \cdot 04$ |
| $3 \mathrm{3I}$ | 3.36 3.48 | 5.44 5.52 | 3.55 3.68 | $5 \cdot 56$ | 3.75 | $5 \cdot 69$ | 3.96 | $5 \cdot 83$ | $4 \cdot 19$ | $5 \cdot 99$ | 4.43 | $6 \cdot 17$ |
| 32 | $3 \cdot 48$ | $5 \cdot 52$ | $3 \cdot 68$ | $5 \cdot 65$ | 3.89 | $5 \cdot 79$ | $4 \cdot 12$ | $5 \cdot 94$ | $4 \cdot 36$ | $6 \cdot \mathrm{II}$ | $4 \cdot 63$ | $6 \cdot 31$ |
| 33 | 3.61 | $5 \cdot 60$ | 3.82 | 5.74 | 4.04 | $5 \cdot 89$ | 4.29 | 6.06 | $4 \cdot 55$ | $6 \cdot 25$ | $4 \cdot 84$ | 6.46 |
| 34 | $3 \cdot 75$ | $5 \cdot 69$ | 3.97 | $5 \cdot 84$ | 4.21 | $6 \cdot 01$ | 4.47 | $6 \cdot 19$ | $4 \cdot 76$ | $6 \cdot 40$ | 5.07 | $6 \cdot 64$ |
| 35 | 3.90 | 5.79 | ${ }^{4.14}$ | 5.96 | 4.40 | 6.14 | $4 \cdot 68$ | 6.35 | 4.99 | $6 \cdot 58$ | 5.34 | $6 \cdot 85$ |
| 36 | 4.07 | 5.91 | 4.32 | 6.09 | $4 \cdot 60$ | 6.29 | 4.91 | $6 \cdot 52$ | $5 \cdot 26$ | $6 \cdot 78$ | $5 \cdot 65$ | 7.09 |
| 37 | 4.25 | $6 \cdot 03$ | $4 * 53$ | $6 \cdot 23$ | $4 \cdot 83$ | $6 \cdot 46$ | $5 \cdot 18$ | $6 \cdot 72$ | $5 \cdot 56$ | 7.02 | 6.00 | 7.37 |

## LATITUDE $22^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. S. | s. | H. M. | s. | H. M. S. | s. | H. M. S. | s. | H. M. S. | s. |
| 0 | 6 0-0.0 | -I. 62 | $\begin{array}{llll}5 & 58 & 23.0\end{array}$ | - I. 62 | $55646 \cdot 0$ | -I. 62 | $555 \quad 8.8$ | -I.62 | $5 \quad 53$ 3I'4 | - I. 62 | 5 51 53.9 | - 1.63 |
| 8 | $\begin{array}{llll}5 & 25 & 28 \cdot 1\end{array}$ | I. 63 | $52349 \cdot 6$ | I 65 | $\begin{array}{llll}5 & 22 & 10.4\end{array}$ | I. 66 | $5 \quad 2030 \cdot 2$ | I.68 | 5 I8 49•I | I. 69 | 5 17 7.0 | 1•71 |
| 10 | $515649 \cdot 4$ | 1.65 | $51510 \cdot 1$ | I. 66 | $\begin{array}{lllll}5 & 13 & 30 \cdot 0\end{array}$ | I 68 | 5 II 48.7 | I.70 | 5 10 6.2 | I. 72 | $\begin{array}{llll}5 & 8 & 22 \cdot 6\end{array}$ | I•74 |
| 12 | 58 10 | I. 66 | $5 \quad 6299$ | I 68 | $\begin{array}{lllll}5 & 4 & 48 \cdot 6\end{array}$ | I•70 | $\begin{array}{llll}5 & 3 & 6 \cdot 1\end{array}$ | I•72 | $\begin{array}{llll}5 & 1 & 22.2\end{array}$ | I•74 | $4 \begin{array}{llll}4 & 59 & 36 \cdot 9\end{array}$ | I•77 |
| 14 | $45930 \cdot 1$ | I. 67 | $45748 \cdot 9$ | I 70 | $4 \quad 56 \quad 6 \cdot 4$ | I•72 | $4 \quad 54 \quad 22.4$ | I.75 | $45236 \cdot 8$ | 1-77 | $45049 \cdot 6$ | 1.80 |
| I6 | $45049 \cdot 3$ | I.69 | $4496 \cdot 9$ | I•72 | 44723.0 | 1.75 | $4 \begin{array}{llll}4 & 45 & 37 \cdot 4\end{array}$ | I.78 | $44349 \cdot 9$ | I-8I | $442 \quad 0.6$ | I 84 |
| 18 | $442 \quad 7 \cdot 6$ | I•7 | 44023.9 | I•74 | $4 \begin{array}{llll}48 & 38 \cdot 3\end{array}$ | I.78 | $43650 \cdot 8$ | I.81 | 43515 | I. 84 | $\begin{array}{llll}4 & 33 & 9 \cdot 6\end{array}$ | I-88 |
| 20 | $43324 \cdot 8$ | 1•74 | $43139 \cdot 5$ | 1.77 | $42952 \cdot \mathrm{I}$ | I.8I | $\begin{array}{lll}4 & 28 & 2.6\end{array}$ | I. 84 | $42610 \cdot 7$ | I.88 | $42416 \cdot 5$ | I.92 |
| 22 | $42440 \cdot 8$ | I-77 | $42253 \cdot 6$ | I.80 | 42142 | I.84 | $\begin{array}{llll}4 & 19 & 12.4\end{array}$ | I. 88 | 4 17 18.0 | I.93 | 4 I5 2I.0 | r 97 |
| 23 | $420 \quad 18 \cdot 2$ | I-78 | 4 I8 30.1 | I. 82 | $\begin{array}{llll}4 & 16 & 39\end{array}$ | I. 86 | $41446 \cdot 5$ | I.91 | $41250 \cdot 8$ | I.95 | 4 10 52.2 | $2 \cdot 00$ |
| 24 | 44 15  <br> 1   | I.80 | $4146 \cdot 1$ | I. 84 | $\begin{array}{llll}4 & 12 & 14.4\end{array}$ | 1.88 | $41020 \cdot 0$ | 1.93 | $\begin{array}{llll}4 & 8 & 22.9\end{array}$ | 1.98 | $\begin{array}{llll}4 & 6 & 22 \cdot 8\end{array}$ | 2.03 |
| 25 | 4 II 3I.9 | I. 82 | $4 \quad 94 \mathrm{I} \cdot 6$ | I. 86 | 4 7 48 | $1 \cdot 90$ | $4 \quad 5 \quad 53 \cdot 0$ | I.95 | $\begin{array}{lllll}4 & 3 & 54.3\end{array}$ | $2 \cdot 00$ | 4 I 52.5 | $2 \cdot 06$ |
| 26 | 4778 | I.83 | 45167 | I. 88 | $\begin{array}{llll}4 & 3 & 22.5\end{array}$ | I-93 | $4 \begin{array}{llll}4 & 1 & 25\end{array}$ | I.98 | $35925 \%$ | $2 \cdot 03$ | $35721 \cdot 4$ | 2.09 |
| 27 | $\begin{array}{lllll}4 & 2 & 43 \cdot 9\end{array}$ | I.85 | $4051 \cdot 2$ | I.90 | $3 \quad 5855 \cdot 5$ | I-95 | $356156 \cdot 8$ | $2 \cdot \mathrm{OI}$ | 35454.8 | $2 \cdot 06$ | $35249 \cdot 5$ | $2 \cdot 12$ |
| 28 | $35^{88} \mathrm{I} 9 \cdot \mathrm{I}$ | 1.87 | $35625 \cdot 1$ | I-93 | $35428 \cdot 0$ | r.98 | $35227 \cdot 7$ | 2.03 | 35024.0 | $2 \cdot 09$ | 34816.7 | $2 \cdot 15$ |
| 29 | $\begin{array}{llll}3 & 53 & 53.8\end{array}$ | I.90 | 35158.4 | I.95 | 34959.8 | 2.01 | 347 57.7 | $2 \cdot 06$ | 345 52.I | $2 \cdot 12$ | $34342 \cdot 8$ | $2 \cdot 19$ |
| 30 | $34927: 9$ | I.92 | $34731 \cdot 1$ | r-98 | $34530 \cdot 8$ | $2 \cdot 03$ | 34327.0 | $2 \cdot 09$ | 34119.4 | $2 \cdot 16$ | $\begin{array}{llll}3 & 39 & 7.9\end{array}$ | $2 \cdot 23$ |
| 31 | 345104 | I.94 | 343 3.0 | $2 \cdot 00$ | 34 I I•I | 2.06 |  | $2 \cdot 13$ |  | $2 \cdot 19$ | 3134 31.9 | $2 \cdot 26$ |
| 32 | $34034 \cdot 1$ | $1 \cdot 97$ | $\begin{array}{llll}3 & 38 \\ 3\end{array}$ | $2 \cdot 03$ | $\begin{array}{llll}3 & 36 & 30 \cdot 4\end{array}$ | $2 \cdot 10$ | $3 \quad 3422 \cdot 7$ | $2 \cdot 16$ | 33210.8 | $2 \cdot 23$ | 32954.7 | $2 \cdot 31$ |
| 33 | $\begin{array}{llll}3 & 36 & 6 \cdot 3\end{array}$ | $2 \cdot 00$ | $\begin{array}{llll}3 & 34 & 4\end{array}$ | 2.06 | $33158 \cdot 9$ | $2 \cdot 13$ | 329 49•1 | $2 \cdot 20$ | 32734.9 | $2 \cdot 27$ | $32516 \cdot 2$ | $2 \cdot 35$ |
| 34 | 3 3I $37 \cdot 7$ | 2.03 | $\begin{array}{lll}3 & 29 & 34 \cdot 1\end{array}$ | 2.09 | $\begin{array}{llll}3 & 27 & 26.4\end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}3 & 25 & 14.3\end{array}$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 22 & 57 \cdot 7\end{array}$ | $2 \cdot 32$ | $3 \begin{array}{llll}3 & 20 & 36.4\end{array}$ | $2 \cdot 40$ |
| 35 | $\begin{array}{llll}3 & 27 & 8 \cdot 2\end{array}$ | $2 \cdot 06$ | $\begin{array}{llll}3 & 25 & 2 \cdot 7\end{array}$ | $2 \cdot 13$ | $\begin{array}{llll}3 & 22 & 52 \cdot 8\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}3 & 20 & 38 \cdot 4\end{array}$ | $2 \cdot 28$ | 31819.2 | $2 \cdot 36$ | $31555 \%$ | $2 \cdot 45$ |
| 36 | $322237 \cdot 9$ | 2.09 | $3 \quad 2030 \cdot 3$ | $2 \cdot 16$ | $\begin{array}{lllllllll}3 & 18 & 18 \cdot 2\end{array}$ | $2 \cdot 24$ | 3 I6 1.3 | $2 \cdot 32$ | $\begin{array}{lllllllllll}3 & 13 & 39\end{array}$ | 2.41 | 3 II I2.I | $2 \cdot 50$ |
| 37 | $\begin{array}{llll}3 & 18 & 6 \cdot 7\end{array}$ | $2 \cdot 12$ |  | $2 \cdot 20$ | $\begin{array}{llll}3 & 13 & 42 \cdot 3\end{array}$ | $2 \cdot 28$ | 3 II 22.7 | $2 \cdot 37$ |  | 2.46 | $\begin{array}{llll}3 & 6 & 27.4\end{array}$ | $2 \cdot 55$ |
| 38 |  | $2 \cdot 16$ | 3 II 22.3 | $2 \cdot 24$ | $\begin{array}{lll}3 & 9 & 5 \cdot 2\end{array}$ | $2 \cdot 33$ | $3 \quad 642 \cdot 7$ | 2.42 | $\begin{array}{llll}3 & 4 & 14.8\end{array}$ | $2 \cdot 5 \mathrm{I}$ | 3 I 4I'0 | $2 \cdot 61$ |
| 39 | $\begin{array}{llll}3 & 9 & 1 \cdot 1\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}3 & 6 & 46 \cdot 4\end{array}$ | $2 \cdot 29$ | $3 \quad 426.6$ | $2 \cdot 38$ | $\begin{array}{lll}3 & 2 & 1.2\end{array}$ | 2.48 | 25929.9 | $2 \cdot 57$ | 25652.5 | $2 \cdot 68$ |
| 40 | $\begin{array}{llll}3 & 4 & 26 \cdot 5\end{array}$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 2 & 9 \cdot 3\end{array}$ | $2 \cdot 33$ | $25946 \cdot 5$ | $2 \cdot 43$ | 257177.9 | $2 \cdot 53$ | $25443 \cdot 1$ | 2.63 | $252 \begin{array}{lll}2 & 1.8\end{array}$ | $2 \cdot 75$ |
| 41 | $25950 \cdot 7$ | -2.29 | $25730 \cdot 7$ | $2 \cdot 38$ | 2554.8 | $2 \cdot 48$ | $2 \begin{array}{lllll}2 & 52 & 32 \cdot 8\end{array}$ | $2 \cdot 59$ | 24954.2 | $2 \cdot 70$ | 24788.8 | $2 \cdot 82$ |
| 42 |  | $2 \cdot 34$ | $25250 \cdot 5$ | $2 \cdot 44$ | $2 \begin{array}{llll}201 & 50\end{array}$ | $2 \cdot 54$ | 24745.6 | $2 \cdot 65$ | $245 \quad 3 \cdot 0$ | 2.77 |  | $2 \cdot 90$ |
| 43 | 25034.9 | $2 \cdot 39$ | $2488 \cdot 6$ | $2 \cdot 49$ | $24535 \cdot 9$ | $2 \cdot 60$ | $24256 \cdot 3$ | $2 \cdot 72$ | $240 \quad 9.4$ | $2 \cdot 85$ | 23714.7 | $2 \cdot 98$ |
| 44 | 24554.6 | $2 \cdot 44$ | $243 \quad 24.9$ | $2 \cdot 55$ | $24048 \cdot 4$ | $2 \cdot 67$ | 23884.5 | 2.80 | $\begin{array}{lllll}2 & 35 & 12.9\end{array}$ | $2 \cdot 93$ | $23213 \cdot 1$ | 3.07 |
| 45 | 24112.6 | $2 \cdot 50$ | $\begin{array}{llll}2 & 38 & 39 \cdot 2\end{array}$ | $2 \cdot 62$ | $23558 \cdot 5$ | $2 \cdot 74$ | $23310 \cdot 1$ | $2 \cdot 87$ | 23013.5 | $3 \cdot 02$ | $2278 \cdot 1$ | $3 \cdot 17$ |
| 46 | 2361886 | 2.56 | 233 5I•2 | $2 \cdot 69$ | 23156 | $2 \cdot 82$ | 22812.8 | 2.96 | $22510 \cdot 8$ | $3 \cdot 11$ | $2 \begin{array}{llll}21 & 59\end{array}$ | $3 \cdot 28$ |
| 47 | $23142 \cdot 6$ | 2.63 | 229009 | $2 \cdot 76$ | $22611 \cdot 0$ | $2 \cdot 90$ | $\begin{array}{lllllllllllllllllllllll}2 & 23 & 12.4\end{array}$ | $3 \cdot 05$ | $2 \begin{array}{lll}2 & 20 & 4.4\end{array}$ | $3 \cdot 22$ | 2 16 46.3 | $3 \cdot 39$ |
| 48 | 22654.2 | 2.70 | $224 \quad 7 \cdot 8$ | $2 \cdot 84$ | 22112.8 | $2 \cdot 99$ | $2 \begin{array}{lll}18 & 8.4\end{array}$ | $3 \cdot 16$ | 2 I4 53.9 | 3.33 | 2 II $28 \cdot 5$ | $3 \cdot 52$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | \$. | s. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | -.00 | $-4.31$ | -. 08 | $-4.31$ | - 16 | $-4.32$ | - . 24 | $-4 \cdot 32$ | - 32 | $-4.32$ | - 41 | $-4.33$ |
| 2 | . 06 | $4 \cdot 31$ | -14 | $4 \cdot 32$ | - 22 | $4 \cdot 32$ | $\cdot 31$ | $4 \cdot 32$ | -39 | $4 \cdot 33$ | -47 | 4.34 |
| 4 | $\cdot 12$ | $4 \cdot 31$ | -20 | $4 \cdot 32$ | $\cdot 28$ | $4 \cdot 32$ | $\cdot 37$ | 4.33 | -45 | $4 \cdot 34$ | -53 | 4.35 |
| 6 | -18 | $4 \cdot 32$ | $\cdot 26$ | $4 \cdot 32$ | $\cdot 35$ | 4.33 | -43 | $4 \cdot 33$ | $\cdot 51$ | $4 \cdot 34$ | -60 | $4 \cdot 36$ |
| 8 | - 24 | $4 \cdot 32$ | -33 | $4 \cdot 33$ | -41 | $4 \cdot 34$ | -49 | $4 \cdot 34$ | $\cdot 58$ | 4.35 | -66 | $4 \cdot 37$ |
| 10 | $\cdot 31$ | $4 \cdot 32$ | -39 | $4 \cdot 33$ | -47 | $4 \cdot 34$ | . 56 | $4 \cdot 35$ | . 64 | $4 \cdot 36$ | $\cdot 73$ | $4 \cdot 38$ |
| 12 | $\cdot 37$ | $4 \cdot 33$ | -46 | $4 \cdot 34$ | - 54 | $4 \cdot 35$ | -63 | $4 \cdot 36$ | $\cdot 71$ | $4 \cdot 37$ | -80 | $4 \cdot 39$ |
| 14 | -44 | $4 \cdot 34$ | $\cdot 52$ | $4 \cdot 35$ | .61 | $4 \cdot 36$ | -69 | $4 \cdot 37$ | $\cdot 78$ | 4.38 | . 87 | 4.40 |
| I6 | -50 | $4 \cdot 34$ | - 59 | $4 \cdot 35$ | -68 | $4 \cdot 37$ | $\cdot 76$ | $4 \cdot 38$ | -85 | 4.40 | - 94 | 4.42 |
| 18 | -57 | $4 \cdot 35$ | . 66 | $4 \cdot 36$ | $\cdot 75$ | $4 \cdot 38$ | -84 | 4.39 | -93 | 4.41 | I 02 | 4.43 |
| 20 | . 64 | $4 \cdot 36$ | -73 | $4 \cdot 38$ | . 82 | $4 \cdot 39$ | -91 | $4 \cdot 41$ | I'OI | 4.43 | I.10 | 4.45 |
| 22 | -71 | $4 \cdot 37$ | -81 | $4 \cdot 39$ | -90 | $4 \cdot 4 \mathrm{I}$ | -99 | $4 \cdot 43$ | 1.09 | $4 \cdot 45$ | I•I8 | 4.47 |
| 24 | $\cdot 79$ | $4 \cdot 39$ | -88 | $4 \cdot 40$ | $\cdot 98$ | 4.42 | 1.07 | 4.45 | 1-17 | 4.47 | 1.27 | $4 \cdot 50$ |
| 26 | -87 | $4 \cdot 40$ | $\cdot 96$ | 4.42 | I.06 | 4.44 | I•16 | 4.47 | I. 26 | $4 \cdot 50$ | $1 \cdot 37$ | 4.53 |
| 28 | -95 | $4 \cdot 42$ | I.05 | $4 \cdot 44$ | I'I5 | $4 \cdot 46$ | I. 25 | $4 \cdot 49$ | 1.36 | 4.52 | 1.46 | 4.56 |
| 30 | 1.03 | 4.44 | I•14 | 4.46 | I. 24 | 4.49 | I•35 | 4.52 | 1.46 | 4.55 | 1.57 | 4.59 |
| 32 | I'I2 | $4 \cdot 46$ | I. 23 | $4 \cdot 49$ | I 34 | $4 \cdot 52$ | 1.45 | $4 \cdot 55$ | I. 57 | 4.59 | I. 68 | 4.63 |
| 34 | I. 22 | 4.48 | I'33 | $4 \cdot 52$ | I.45 | 4.55 | I.56 | 4.59 | I.68 | $4 \cdot 63$ | I-80 | 4.68 |
| 36 | I. 32 | 4.51 | I. 44 | 4.55 | 1.56 | 4.59 | I. 68 | 4.63 | I ${ }^{\text {8 }}$ | $4 \cdot 68$ | I.94 | 4.73 |
| $3^{8}$ | I. 44 | 4.55 | I 56 | 4.59 | I. 68 | $4 \cdot 63$ | I.8I | $4 \cdot 68$ | I.95 | $4 \cdot 73$ | 2.08 | 479 |
| 40 | 1.55 | 4.59 | I. 68 | 4.63 | I. 82 | $4 \cdot 68$ | I.96 | 4774 | $2 \cdot 10$ | 4.80 | 2.25 | 4.86 |
| 42 | I. 68 | $4 \cdot 63$ | $\mathrm{I} \cdot 82$ | $4 \cdot 68$ | 1.96 | $4 \cdot 74$ | 2-11 | $4 \cdot 80$ | 2.27 | $4 \cdot 87$ | 2.43 | $4 \cdot 95$ |
| 44 | I.83 | $4 \cdot 69$ | I.98 | $4 \cdot 74$ | $2 \cdot 13$ | $4 \cdot 8 \mathrm{I}$ | 2.29 | 4.88 | 2.46 | 4.97 | 2.63 | $5 \cdot 05$ |
| 46 | 1.99 | 4.75 | 2.15 | $4 \cdot 82$ | 2.32 | 4.90 | 2.49 | 4.98 | 2.67 | $5 \cdot 08$ | 2.87 | $5 \cdot 18$ |
| 48 | 2.17 | $4 \cdot 83$ | $2 \cdot 34$ | 4.91 | 2.53 | $5 \cdot 00$ | $2 \cdot 72$ | $5 \cdot 10$ | 2.93 | 5.21 | $3 \cdot 15$ | $5 \cdot 34$ |

LATITUDE $22^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | ${ }^{\circ} \mathrm{O}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. | S. | H. M. |  | M. |  | H. M. S. |  | H. M. S. | S. | M. S. | S. |
| $\bigcirc$ | 55015.9 | - I. 64 | 5 483837.5 | -1.64 | $54658 \cdot 8$ | - I. 65 | 54519.5 | - I•66 | $\begin{array}{llll}5 & 43 & 39 \cdot 5\end{array}$ | - 1.67 | $54158 \cdot 9$ | - 1.68 |
|  | $\begin{array}{llll}5 & 24 & 8 \cdot 5\end{array}$ | $1 \cdot 70$ | $\begin{array}{llll}5 & 22 & 25.9\end{array}$ | I.72 | $5 \quad 20 \quad 42 \cdot 2$ | I.74 | 5 I8 573 | I•76 | $\begin{array}{lllll}5 & 17 & 11\end{array}$ | I•78 | $\begin{array}{lllll}5 & 15 & 23.9\end{array}$ | . 80 |
| 8 | $\begin{array}{lllll}5 & 15 & 23 \cdot 8\end{array}$ | I.73 | $\begin{array}{llll}5 & 13 & 39 \cdot 3\end{array}$ | 1.75 | $\begin{array}{lllll}5 & \text { II } & 3\end{array}$ | x 77 | 5106.7 | I.80 | $\begin{array}{llll}5 & 8 & 18 \cdot 2\end{array}$ | I.82 | $\begin{array}{llll}5 & 6 & 28 \cdot 2\end{array}$ | I.85 |
| 10 | $\begin{array}{llll}5 & 6 & 37 \cdot 7\end{array}$ | I.76 | 5 4 $5 I$ <br> 4   | I-78 | $\begin{array}{llll}5 & 3 & 3\end{array}$ | 1. | 5 I $114 \cdot 1$ | I.84 | 45923.0 | 7 | $45730 \cdot 2$ | -90 |
| 12 | $45750 \cdot 0$ | I•79 | $4 \quad 56$ I. 5 | I.82 | 454 II 3 | I.85 | $4 \quad 52193$ | 1.88 | $45025 \cdot 5$ | I.91 | 44829.5 | I 95 |
| 14 | 4490.6 |  | $447 \quad 9.8$ | I. 86 | $44517 \cdot$ | I 90 | 44322 | I'93 | $44125 \cdot 3$ | $\cdot 97$ | $43926 \cdot 0$ | OI |
| 16 | $440 \quad 9 \cdot 3$ | 1.8 | 438159 | 1.91 | 43620 | 4 | $43422 \cdot$ | I.98 | $432 \quad 22 \cdot 2$ | $2 \cdot 03$ | 43019.3 | 2.07 |
| 18 | 43115.8 | I 92 | 42919.6 | r.96 | $42721 \cdot 0$ | $2 \cdot 00$ | 42519.8 | 2.04 | 42315.9 | $2 \cdot 09$ | 4219 | 14 |
| 19 | $42648 \cdot 1$ | 1 | $42450 \cdot 5$ | I'98 | 42250 | $2 \cdot 03$ | $42047 \cdot 2$ | 2.07 | 4 I8 $4 \mathrm{H} \cdot 4$ | $2 \cdot 12$ | $41632 \cdot 5$ | $2 \cdot 17$ |
| 20 | 42219.9 | I 97 | $42020 \cdot 6$ | 2•OI | 4 I8 I8.6 | $2 \cdot 06$ | 4 16 13.8 | 2 | $4146 \cdot 0$ | 2.16 | 4 II 54.9 | $2 \cdot 21$ |
| 21 | $41750 \cdot 9$ | 1.99 | 4155 |  | $41346 \cdot 2$ |  | 4 II 39.4 |  | $4 \begin{array}{lll}4 & 9 & 29.5\end{array}$ |  | $47816 \cdot 2$ | 25 |
| 22 | 4 I3 2I'3 | $2 \cdot 02$ | 4 II 18.6 | $2 \cdot$ | 4913.0 | $2 \cdot 12$ |  | $2 \cdot 17$ | $4 \quad 452 \cdot 0$ | $2 \cdot 23$ | $\begin{array}{rrrr}4 & 2 & 36 \cdot 3\end{array}$ | $2 \cdot 29$ |
| 23 | $4850 \cdot 9$ | $2 \cdot 05$ | $4 \quad 6 \quad 46 \cdot 4$ | $2 \cdot 10$ | $\begin{array}{llll}4 & 4 & 38 \cdot 8\end{array}$ | 5 | $\begin{array}{llll}4 & 2 & 27 \cdot 8\end{array}$ | $2 \cdot 21$ | 4 o 13. | $2 \cdot 27$ | $\begin{array}{lllllllllllllll}3 & 57 & 55 \cdot 2\end{array}$ | . 33 |
| 24 | $\begin{array}{llll}4 & 4 & 19.6\end{array}$ | $2 \cdot$ | $4 \begin{array}{llll}4 & 2 & 13.3\end{array}$ | 2 | $4 \quad 0 \quad 3.6$ | $2 \cdot 19$ | $\begin{array}{lllll}3 & 57 & 50 \cdot 4\end{array}$ | $2 \cdot 25$ | $\begin{array}{lllll}3 & 55 & 33 \cdot 5\end{array}$ | $2 \cdot 31$ | $\begin{array}{lllll}3 & 53 & 12.7\end{array}$ | $2 \cdot 38$ |
| 25 | $35947 \cdot 6$ | $2 \cdot$ | $35739 \cdot 2$ | 2. | $\begin{array}{llll}3 & 55 & 27 & 4\end{array}$ | $2 \cdot 23$ | $35311 \cdot 8$ | 2.29 | $35052 \cdot 4$ | $2 \cdot 36$ | $3 \begin{array}{llll}3 & 48 & 28 \cdot 9\end{array}$ | 2.43 |
| 26 | 35514. | $2 \cdot 14$ | 353 |  | 35050 | $2 \cdot 27$ | 3483 | $2 \cdot 33$ | 34610.0 | $2 \cdot 40$ | 3434 | 48 |
| 27 | $35040 \cdot 6$ | $2 \cdot$ | $34828 \cdot 0$ | 2 | 346 II 5 | $2 \cdot 31$ | $\begin{array}{llllll}3 & 43 & 50 \cdot 9\end{array}$ | $2 \cdot 38$ |  | 2.45 | $\begin{array}{llll}3 & 38 & 56 \cdot 7\end{array}$ | 2.53 |
| 28 | $\begin{array}{lll}3 & 46 & 5 \cdot 6\end{array}$ | 2.22 |  | $2 \cdot 28$ | 3413 I 7 | $2 \cdot 35$ | $\begin{array}{lll}3 & 39 & 8 \cdot 4\end{array}$ | 2.4 | $\begin{array}{lllllllllllll}3 & 36 & 40 \cdot 6\end{array}$ | $2 \cdot 50$ | $\begin{array}{llll}3 & 34 & 8 \cdot 0\end{array}$ | $2 \cdot 58$ |
| 29 | $\begin{array}{llll}3 & 41 & 29 \cdot 6\end{array}$ | $2 \cdot 25$ | $\begin{array}{llllll}3 & 39 & 12.2\end{array}$ | $2 \cdot 32$ | $\begin{array}{lllllllllllllllllllll}3 & 36 & 50\end{array}$ | $2 \cdot 40$ | $\begin{array}{llll}3 & 34 & 24.4\end{array}$ | 2.4 | $\begin{array}{llll}3 & 31 & 53.5\end{array}$ | $2 \cdot 56$ | $\begin{array}{llll}3 & 29 & 17.6\end{array}$ | $2 \cdot 64$ |
| 30 | $\begin{array}{llll}3 & 36 & 52 \cdot 3\end{array}$ | $2 \cdot 30$ | $334 \begin{array}{llll}32 \cdot 4\end{array}$ | $2 \cdot 37$ | $\begin{array}{llll}3 & 32 & 8 \cdot 0\end{array}$ | $2 \cdot 45$ | $\begin{array}{llll}3 & 29 & 38 \cdot 9\end{array}$ | $2 \cdot 53$ | 32747 | 2.61 | $32425 \cdot 2$ | $2 \cdot 70$ |
| 31 | $\begin{array}{llll}3 & 32 & 13.8\end{array}$ |  | $32951 \cdot 2$ |  | 32723.9 |  | 32451.5 |  | $\begin{array}{llll}3 & 22 & 13.9\end{array}$ | , | $31930 \cdot 7$ | $2 \cdot 77$ |
| 32 | 32734.0 | $2 \cdot 38$ | $\begin{array}{lll}3 & 25 & 8 \cdot 6\end{array}$ | $2 \cdot 47$ | $32238 \cdot 1$ | $2 \cdot 55$ | 320204 | $2 \cdot 64$ | 3 I7 2I'I |  | 3 I4 33.9 | 2.84 |
| 33 | $\begin{array}{llll}3 & 22 & 52 \cdot 8\end{array}$ | 2.43 | $\begin{array}{llll}3 & 20 & 24 \cdot 3\end{array}$ | $2 \cdot 5$ | $3 \mathrm{I} 7 \mathrm{l}^{50 \cdot 6}$ | $2 \cdot 61$ | 315 II.3 |  | 31226 |  | $\begin{array}{llll}3 & 9 & 34 \cdot 8\end{array}$ | $2 \cdot 91$ |
| 34 | $\begin{array}{llll}3 & 18 & 10.0\end{array}$ | $2 \cdot 4$ | $\begin{array}{llllll}3 & 15 & 38 \cdot 3\end{array}$ | 2.57 | $\begin{array}{llll}3 & 13 & 1.2\end{array}$ | $2 \cdot 67$ | $31018 \cdot 1$ | $2 \cdot 77$ | $\begin{array}{llll}3 & 7 & 28 \cdot 9\end{array}$ | $2 \cdot 88$ | $\begin{array}{lrrr}3 & 4 & 32 \cdot 9 \\ 2 & 59 & 28.4\end{array}$ | 2.99 |
| 35 | $\begin{array}{llll}3 & 13 & 25.5\end{array}$ | $2 \cdot 5$ | 3 10 50.5 | $2 \cdot 63$ | $\begin{array}{llll}3 & 8 & 9 \cdot 7\end{array}$ | 2.73 | $3 \quad 522 \cdot 6$ | $2 \cdot 84$ | $3 \quad 2 \quad 29 \cdot 0$ | $2 \cdot 95$ | 25928.4 | 3.07 |
| 36 | $\begin{array}{lll}3 & 8 & 39 \cdot 3\end{array}$ |  | $\begin{array}{lll}3 & 6 & 0.7\end{array}$ | 2.69 | $3 \quad 316 \cdot 0$ | $2 \cdot 80$ | $3 \begin{array}{lrr}3 & 0 & 24 \cdot 6\end{array}$ | $2 \cdot 91$ | 257 | 3.03 | $25420 \cdot 5$ | 3.16 |
| 3 | 3 3 $51 \cdot 2$ <br> 2 5  | $2 \cdot 65$ | $\begin{array}{lrr}\mathbf{3} & 1 & 8 \cdot 8 \\ 2 & 56 & \end{array}$ | $2 \cdot 76$ | 25819.8 | 2.87 | $\begin{array}{llll}2 & 55 & 23.9 \\ 2 & 50\end{array}$ | 2.99 | $25220 \cdot 6$ | $3 \cdot 12$ | $\begin{array}{llll}2 & 49 & 9 \cdot 3\end{array}$ | 3.26 |
| 3 | $\begin{array}{llll}2 & 59 & 1 \cdot 0 \\ 2 & 54 & 8 \cdot 5\end{array}$ | 2.72 | $2{ }^{2} 56114.4$ | $2 \cdot 83$ | 253 2I•I | 2.95 | $2 \begin{array}{llll}2 & 50 & 20 \cdot 3\end{array}$ | $3 \cdot 08$ | 24711.6 | $3 \cdot 22$ | $\begin{array}{lllll}2 & 43 & 54.4\end{array}$ | 3.36 |
| 39 | $\begin{array}{rrrr}2 & 54 & 8 \cdot 5 \\ 2 & 49 & 13.6\end{array}$ | 2.79 2.86 | $\begin{array}{llllll}2 & 51 & 17.7 \\ 2 & 46 & 18.1\end{array}$ | 2.91 | $\begin{array}{lllllllllllll}2 & 48 & 19.5\end{array}$ | 3.04 | $\begin{array}{lllllllllllllllll}2 & 45 & 13.4\end{array}$ | $3 \cdot 17$ | 24159.0 | $3 \cdot 32$ | $\begin{array}{lllll}2 & 38 & 35 \cdot 4\end{array}$ | 3.47 |
| 40 | 24913.6 | $2 \cdot 86$ | 246 I8•1 | $2 \cdot 99$ | 24314.7 | $3 \cdot 13$ | $240 \quad 3.0$ | $3 \cdot 27$ | $23642 \cdot 3$ | $3 \cdot 43$ | 233 II•9 | $3 \cdot 59$ |
| 41 | $24416 \cdot 0$ | 2.94 | 24115.5 | 3.08 | $\begin{array}{llll}2 & 38 & 6 \cdot 6\end{array}$ | . 22 | 2344888 | $3 \cdot 38$ | $23 \mathrm{I} 2 \mathrm{I} \cdot 3$ | $3 \cdot 54$ | 22743.4 | 3'73 |
| 42 | 23915.5 | 3.03 | 23619.5 | $3 \cdot 17$ | $2 \begin{array}{lllll}2 & 32 & 54 \cdot 7\end{array}$ | $3 \cdot 33$ | $\begin{array}{llll}2 & 29 & 30 \cdot 3\end{array}$ | 3.49 | $22555 \cdot 4$ | 3.67 | 222293 | 3.87 |
| 43 | $\begin{array}{llll}2 & 34 & 11.8\end{array}$ | $3 \cdot 12$ | $\begin{array}{llrr}2 & 31 & 9 \cdot 9 \\ 2 & 25 & 46 \cdot 3\end{array}$ | $3 \cdot 28$ | $2 \begin{array}{llllllllll} & 27 & 38 \cdot 6\end{array}$ | 3.44 | $\begin{array}{llll}2 & 24 & 7 \cdot 0\end{array}$ | $3 \cdot 62$ | $22024 \cdot 1$ | $3 \cdot 82$ | $\begin{array}{lllll}2 & 16 & 28 \cdot 9\end{array}$ | 4.03 |
| 44 | $\begin{array}{llll}2 & 29 & 45\end{array}$ | $3 \cdot 22$ |  | $3 \cdot 39$ | $2 \begin{array}{llll}22 & 17.9\end{array}$ | $3 \cdot 57$ | $\begin{array}{lllll}2 & 18 & 38 \cdot 4\end{array}$ | $3 \cdot 76$ | $21446 \cdot 6$ | 3.97 | 2 Io 4I.4 | 4.21 |
| 45 | 22353.3 | $3 \cdot 33$ | 22028.2 | 3.51 | $21652 \cdot 0$ | $3 \cdot 70$ |  | $3 \cdot 92$ | 2981 | $4 \cdot 15$ | $2445 \cdot 8$ | 4.41 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ | A. | L. ${ }^{\circ}$ | A. | L. 8 | A. | L. $9^{\circ}$ | A. | L. 1 | - A. | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | s. | S. | S. | S. | s. | S. | s. | . 82 | s. | S. | s. |
| $\bigcirc$ | - 49 | -4.34 | - .57 | -4.35 4.36 | - 65 | -4.36 4.37 | $\begin{array}{r}\text { - } 74 \\ \hline .80 \\ \hline 8\end{array}$ | -4.38 4.39 | - 8.82 | -4.39 4.40 | -.91 | -4.41 4.42 |
| 2 | - 55 | 4.35 4.36 | - 670 | 4.36 4.37 | . 78 | 4.37 4.38 | . 87 | 4.39 4.40 | -89 | 4.40 4.42 | $\begin{array}{r}\text { r } \\ \times 107 \\ \hline 104\end{array}$ | $4 \cdot 42$ 4.44 |
| 6 | -68 | $4 \cdot 37$ | $\cdot 76$ | $4 \cdot 38$ | . 85 | $4 \cdot 40$ | -94 | $4 \cdot 41$ | r .02 | $4 \cdot 43$ | r.II | $4 \cdot 46$ |
| 8 | $\cdot 75$ | $4 \cdot 38$ | . 83 | $4 \cdot 39$ | $\cdot 92$ | $4 \cdot 41$ | $1 \cdot 01$ | $4 \cdot 43$ | 1.09 | $4 \cdot 45$ | 1.18 | $4 \cdot 47$ |
| 10 | -81 | $4 \cdot 39$ | -90 | 4.41 | -99 | 4.43 | 1.08 | 4.45 | 1-17 | 4.47 | I 26 | $4 \cdot 49$ |
| 12 | -89 | $4 \cdot 40$ | -97 | 4.42 | I.06 | $4 \cdot 44$ | $1 \cdot 15$ | $4 \cdot 47$ | I. 25 | $4 \cdot 49$ | r 34 | $4 \cdot 52$ |
| 14 | -96 | $4 \cdot 42$ | 1.05 | $4 \cdot 44$ | 1.14 | $4 \cdot 46$ | 1.23 | 4.49 | 1.33 | 4.51 | 1.42 | 4.54 |
| 16 | I.03 | $4 \cdot 44$ | $1 \cdot 13$ | $4 \cdot 46$ | 1.22 | $4 \cdot 48$ | 1.31 | $4 \cdot 51$ | 1.41 | $4 \cdot 54$ | 1.51 | $4 \cdot 57$ |
| 18 | I•I | $4 \cdot 46$ | $1 \cdot 21$ | $4 \cdot 48$ | $1 \cdot 30$ | 4.51 | 1.40 | 4.54 | 1.50 | 4.57 | I. 60 | $4 \cdot 60$ |
| 20 | 1.20 | $4 \cdot 48$ | 1. 29 | 4.50 | $1 \cdot 39$ | 4.53 | 1.49 | 4.57 | 1. 59 | $4 \cdot 60$ | 1.70 | $4 \cdot 64$ |
| 22 | I. 28 | 4.50 | I. 38 | 4.53 | r.48 | 4.56 | I. 59 | $4 \cdot 60$ | 1. 69 | $4 \cdot 63$ | I. 80 | 4:67 |
| 24 | 1.37 | 4.53 | I.48 | 4.56 |  | 4.60 | I. 69 | 4.63 | 1.80 | 4.67 | 1.91 | $4 \cdot 72$ |
| 26 | 1.47 | $4 \cdot 56$ | I. 58 | 4.59 | r.69 | $4 \cdot 63$ | 1.80 | $4 \cdot 67$ | I.91 | $4 \cdot 72$ | 2.03 | $4 \cdot 77$ |
| 28 | 1.57 | 4.59 | 1.68 | 4.63 | 1.80 | $4 \cdot 67$ | 1.92 | 4.72 | $2 \cdot 04$ | $4 \cdot 77$ | - $2 \cdot 16$ | 4.83 |
| 30 | 1. 68 | $4 \cdot 63$ | 1.80 | $4 \cdot 67$ | 1.92 | $4 \cdot 72$ | 2.04 | $4 \times 7$ | $2 \cdot 17$ | $4 \cdot 83$ | $2 \cdot 30$ | $4 \cdot 89$ |
| 32 | 1.80 | 4.67 | $1 \cdot 93$ | $4 \cdot 72$ | 2.05 | $4 \cdot 78$ | $2 \cdot 18$ | $4 \cdot 83$ | $2 \cdot 32$ | 4.90 | $2 \cdot 46$ | $4 \cdot 97$ |
| 34 | 1.93 | 4.73 | 2.06 | $4 \cdot 78$ | $2 \cdot 20$ | 4.84 | $2 \cdot 34$ | 4.91 | $2 \cdot 48$ | 4.98 | 2.63 | 5.05 |
| 38 | 2.07 | 4.79 4.86 | 2.21 2.38 | $4 \cdot 85$ | 2.36 | 4.92 | 2.51 | 4.99 | $2 \cdot 66$ | 5.07 | 2.83 | $5 \cdot 16$ |
| 38 | $2 \cdot 23$ | 4.86 | $2 \cdot 38$ | $4 \cdot 93$ | 2.53 | 5.00 | $2 \cdot 70$ | $5 \cdot 09$ | 2.87 | $5 \cdot 18$ | 3.05 | $5 \cdot 28$ |
| 40 | $2 \cdot 40$ | 4.94 | 2.56 | 5.02 | 2.73 | $5 \cdot 11$ | 2.91 | $5 \cdot 20$ | $3 \cdot 10$ | $5 \cdot 31$ | $3 \cdot 30$ | $5 \cdot 43$ |
| 42 | $2 \cdot 60$ | $5 \cdot 03$ | $2 \cdot 77$ | $5 \cdot 13$ | 2.96 | $5 \cdot 23$ | $3 \cdot 16$ | $5 \cdot 35$ | $3 \cdot 37$ | $5 \cdot 48$ | $3 \cdot 60$ | $5 \cdot 56$ |
| 43 | $2 \cdot 70$ | 5.09 | $2 \cdot 89$ | $5 \cdot 19$ | 3.09 | $5 \cdot 31$ | $3 \cdot 30$ | $5 \cdot 43$ | $3 \cdot 53$ | $5 \cdot 57$ | 3.77 | $5 \cdot 73$ |
| 44 | $2 \cdot 82$ | $5 \cdot 15$ | 3.02 | $5 \cdot 26$ | 3.23 3.38 | $5 \cdot 39$ | $\begin{array}{r}3.45 \\ 3.62 \\ \hline\end{array}$ | 5.53 | 3.70 3.89 |  | $3 \cdot 96$ $4 \cdot 18$ |  |
| 45 | 2.94 | $5 \cdot 22$ | $3 \cdot 15$ | $5 \cdot 34$ | $3 \cdot 38$ | $5 \cdot 48$ | $3 \cdot 62$ | $5 \cdot 63$ | $3 \cdot 89$ | 5.8 I | $4 \cdot 18$ | $5 \cdot 99$ |

212 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. LATITUDE $22^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. |  | H. | s. | H. | s. | H. M. | s. | H. M. S. | s. | H. M. S. | s. |
| 0 | $54017 \cdot 6$ | - I 69 | $53835 \cdot 5$ | -r.71 | $53652 \cdot 5$ | -r.73 | $\begin{array}{llll}5 & 35 & 8 \cdot 4\end{array}$ | -r.74 | 53323.3 | - 1.76 | $53137 \cdot 1$ | r $\cdot 78$ |
| 2 | 53125.5 | I•73 | $5 \quad 2940 \cdot 9$ | r.75 | $52755 \cdot \mathrm{I}$ | r.77 | $\begin{array}{llll}5 & 26 & 8 \cdot 1\end{array}$ | r•79 | $5 \begin{array}{llll}5 & 24 & 19.8\end{array}$ | I. 82 | $5 \begin{array}{llll}522 & 30 \cdot 2\end{array}$ | r.84 |
| 4 | 522314 | r.78 | $52044 \cdot \mathrm{I}$ | I.80 | 5 I8 $55 \cdot 4$ | r. 82 | $\begin{array}{lllll}5 & 17 & 5\end{array}$ | r.85 | $\begin{array}{llllllllll}5 & 15 & 13.6\end{array}$ | 1.87 | $\begin{array}{lllll}5 & 13 & 20.3\end{array}$ | -90 |
| 6 | $\begin{array}{llllll}5 & 13 & 35.2\end{array}$ | I. 82 | 5 II $45^{\circ} \mathrm{O}$ | r. 85 | $5 \quad 9 \quad 53.2$ | r. 88 | $\begin{array}{lllll}5 & 7 & 59\end{array}$ | I.9I | $\begin{array}{lll}5 & 6 & 4.4\end{array}$ | I.94 | $4 \quad 7 \cdot 2$ | $5 \cdot 97$ |
| 8 | $\begin{array}{llll}5 & 4 & 36 \cdot 6\end{array}$ | 87 | $5 \quad 2433$ | I 90 | $5 \quad 048.2$ | I.93 | $4585 \mathrm{I} \cdot \mathrm{I}$ | r.97 | $4565 \mathrm{r} \cdot 9$ | 2.00 | $45450 \cdot 6$ | . 04 |
| 10 | $45535 \cdot 5$ | 193 | 45338.9 | 1.96 | 4 5I $40 \cdot \mathrm{I}$ | 2.00 | $44939 \cdot \mathrm{r}$ | 2.03 | 44735.9 | 2.07 | $44530 \cdot 1$ | 12 |
| 12 | $44631 \cdot 6$ | I.98 | 4443 r 3 | 2.02 | $44228 \cdot 7$ | 2.06 | 44023.6 | 2.11 | 43815.8 | $2 \cdot 5$ | $436 \quad 5 \cdot 3$ | 20 |
| 14 | 43724.5 | $2 \cdot 05$ | $435 \quad 20 \cdot 3$ | 2.09 | 43313.5 | 2.14 | 43153.9 | $2 \cdot 18$ | 42851.4 | $2 \cdot 23$ | $42635 \cdot 7$ | 29 |
| 15 | $\begin{array}{llll}4 & 32 & 49 \cdot 6 \\ 4 & 28 & 13.8\end{array}$ | 2.08 2.11 | 43043.4 | $2 \cdot 13$ | $\begin{array}{llll}4 & 28 & 34.4 \\ 4 & 23 & 54.2\end{array}$ | $2 \cdot 17$ | 42622.4 | 2.22 | $4 \begin{array}{lll}4 & 7 \cdot 4\end{array}$ | 2.28 | $42149 \cdot 0$ | $2 \cdot 34$ |
|  | 42813.8 | $2 \cdot 11$ | 265 | $2 \cdot 16$ | 42354.2 | 2.21 | $42139 \cdot 8$ | 2.27 | $41922 \cdot 1$ | 2.3 | 4170.8 | 8 |
| 17 | $4 \begin{array}{llll}4 & 23 & 37.1\end{array}$ |  | 42126.6 |  | $\begin{array}{llll}4 & 19 & 12.9\end{array}$ | 26 | $\begin{array}{llll}4 & 1655.9\end{array}$ | $2 \cdot 31$ | $4 \begin{array}{llll}4 & 35 \cdot 4\end{array}$ | $2 \cdot 37$ | 1211.2 | 2.44 |
| 18 | 41859.4 | $2 \cdot 19$ | 4 16 $46 \cdot 5$ | 2.24 | $4 \begin{array}{llllllll}4 & 30 \cdot 3\end{array}$ | $2 \cdot 30$ | $4 \begin{array}{llll}42 & 10.7\end{array}$ | 2.36 | $\begin{array}{lll}4 & 9 & 47.3\end{array}$ | 2.42 | $720 \cdot 0$ | 2.49 |
| 19 | $41420 \cdot 6$ | $2 \cdot 23$ | $4 \begin{array}{llll}4 & 12 & 5\end{array}$ | $2 \cdot 28$ | $4 \begin{array}{llll}4 & 9 & 46 \cdot 5\end{array}$ | 2.34 | $4724^{\circ}$ | 2.41 | $\begin{array}{llll}4 & 4 & 57.6\end{array}$ | 2.47 | $227 \cdot 2$ | 2.54 |
| 20 | $\begin{array}{llll}4 & 9 & 40 \cdot 6\end{array}$ | $2 \cdot 27$ | $4 \quad 7 \quad 22 \cdot 8$ | $2 \cdot 33$ | $\begin{array}{llll}4 & 5 & 1 & 3\end{array}$ | 2.39 | $\begin{array}{lll}4 & 2 & 35.9\end{array}$ | $2 \cdot 46$ | $\begin{array}{llll}4 & 0 & 6.4\end{array}$ | 2.53 | $5732 \cdot 5$ | $2 \cdot 60$ |
| 21 | $\begin{array}{llll}4 & 4 & 59 \cdot 4\end{array}$ | $2 \cdot 31$ | $4 \quad 2 \begin{array}{lll}48.9\end{array}$ | 2.37 | $4 \quad 0 \quad 14.6$ | 2.44 | $35746 \cdot 2$ | $2 \cdot 51$ |  | $2 \cdot 58$ | $35236 \cdot 0$ | 6 |
| 22 | 4 о 16.9 | $2 \cdot 35$ | 35753.7 | $2 \cdot 42$ | $\begin{array}{llll}3 & 55 & 26.4\end{array}$ | 2.49 | $3 \begin{array}{lllllll}3 & 52 & 54\end{array}$ | 2.56 | 35018.6 | 2.64 | 34737.5 | 2.73 |
| 23 | $35533 \cdot 2$ | $2 \cdot 4$ | $353 \quad 7 \cdot 0$ | 2.47 | $35036 \cdot 6$ | $2 \cdot 54$ | 3481.6 | 2.62 | $34521 \cdot 7$ | 2.71 | $\begin{array}{llllllll}3 & 42 & 36\end{array}$ | 2.79 |
| 24 | $35047 \cdot 9$ | $2 \cdot 45$ | 348 18•7 | $2 \cdot 52$ | $34545{ }^{\circ}$ | 2.60 | $343 \quad 6 \cdot 5$ | . 6 | 34022.9 | $2 \cdot 77$ | $\begin{array}{lllllllllll}3 & 37 & 3\end{array}$ | $2 \cdot 86$ |
| 25 | $346 \mathrm{r} \cdot \mathrm{I}$ | $2 \cdot 50$ | $34328 \cdot 7$ | 2.58 | $\begin{array}{lllll}3 & 40 & 51 \cdot 6\end{array}$ | $2 \cdot 66$ | $\begin{array}{llll}3 & 38 & 9.4\end{array}$ | 2.75 | 3 35 21.8 | 2.84 | $\begin{array}{lllll}3 & 32 & 28 \cdot 5 \\ 3 & 27 & 20.5\end{array}$ | .94 |
| 26 | 34112.7 | $2 \cdot 56$ | $\begin{array}{lllll}3 & 38 & 36\end{array}$ | $2 \cdot 64$ | $335 \quad 56 \cdot 2$ | $2 \cdot 72$ | 333 Io'I | 2.82 |  | 2.91 | $32720 \cdot 5$ | 3.02 |
| 27 | $\begin{array}{llll}3 & 36 & 22.5\end{array}$ | 2.61 | 33343.2 | 2.70 |  |  | $\begin{array}{llll}3 & 28 & 8.5\end{array}$ |  | 32512.2 | $2 \cdot 99$ | 229.6 | Io |
| 28 | $\begin{array}{llllll}3 & 31 & 30 \cdot 4\end{array}$ | $2 \cdot 67$ | $32847 \cdot 5$ | $2 \cdot 76$ | $\begin{array}{lllll}3 & 25 & 58.9\end{array}$ | 2.86 | $\begin{array}{llll}3 & 23 & 4 & 3\end{array}$ | 2.96 | 32034 | 3.07 | 31655.6 | -19 |
| 29 | $\begin{array}{llll}3 & 26 & 36 \cdot 4\end{array}$ | $2 \cdot 73$ | 32349.5 | 2.83 | $32056 \cdot 6$ | $2 \cdot 93$ | $317 \begin{array}{lllll}37\end{array}$ | 3.04 | $31451 \cdot 5$ | $3 \cdot 16$ | 3 II 38.4 | 3.28 |
| 30 | $32140 \cdot \mathrm{x}$ | 2.80 | 3 18 49 | $2 \cdot 90$ | 3153 1 | 3.01 |  | $3 \cdot 13$ | $\begin{array}{llll}3 & 9 & 36.4\end{array}$ | 3.25 | $\begin{array}{llll}3 & 6 & 175\end{array}$ | $3 \cdot 38$ |
| 31 | $3164 \mathrm{I} \cdot 6$ | 2.87 | $31346 \cdot 1$ | $2 \cdot 98$ | 3 10 44.0 | 3.09 | $\begin{array}{lllll}3 & 7 & 34\end{array}$ | 3.22 | $\begin{array}{lllll}3 & 4 & 17.8\end{array}$ | $3 \cdot 35$ | 3 O 52.7 | 3.49 |
| 32 | 3 II $40 \cdot 5$ | 2.95 | $\begin{array}{llllllllllllllll}3 & 8 & 40 \cdot 4\end{array}$ | 3.06 | $\begin{array}{llll}3 & 5 & 33.2\end{array}$ | 3.18 | $\begin{array}{llll}3 & 2 & 18.3\end{array}$ | 3.31 | $2 \begin{array}{llll}58 & 55.4\end{array}$ | $3 \cdot 46$ | $25523 \cdot 6$ | . 6 r |
| 33 | $\begin{array}{llll}3 & 6 & 36 \cdot 8\end{array}$ | 3.03 | $3 \quad 3 \quad 31 \cdot 7$ | $3 \cdot 15$ | $\begin{array}{llll}3 & 0 & 18.9\end{array}$ | 3.28 | $25658 \cdot 2$ | $3 \cdot 42$ | $25328 \cdot 7$ | 3.57 | $24949 \cdot 8$ | 3.73 |
| 34 | $31 \begin{array}{lll}130 \cdot 0\end{array}$ | $3 \cdot 11$ | $2 \begin{array}{llll} & 58 & 19.6\end{array}$ | $3 \cdot 24$ | 255 I•I | 3.38 | 25133.9 | $3 \cdot 53$ | 24757.5 | 3.69 | $24410 \cdot 9$ | 3.87 |
| 35 | 2 56 $20 \cdot I$ <br> 2 5  | 3. | 25340 | 3.34 | 2 4939.2 | 3.49 | $\begin{array}{lllll}2 & 46 & 5 \cdot 2\end{array}$ | 3.5 | $24221 \cdot 2$ | 3.82 | $\begin{array}{llll}2 & 38 & 26 \cdot 2\end{array}$ | 4.02 |
| 36 | 2516.8 | 3.30 | 24744.5 | $3 \cdot 45$ | 24413.0 | 3.61 | 24031.5 | $3 \cdot 78$ | $23639 \cdot 2$ | 3.97 | $23235 \cdot \mathrm{I}$ | 4-18 |
| 37 | $24549 \cdot 6$ | 3.40 | $24220 \cdot 7$ | $3 \cdot 56$ | $23^{8} 4 \mathrm{4r}$. 8 | 3.74 | 23452.3 | 3.92 | $2305 \mathrm{I} \cdot 0$ | $4 \cdot 13$ | $\begin{array}{llll}2 & 26 & 36.9\end{array}$ | . 35 |
| 38 | $\begin{array}{ll}2 & 40 \\ 28.2\end{array}$ | $3 \cdot 52$ | $23652 \cdot \mathrm{I}$ | 3.69 | $\begin{array}{llll}2 & 33 & 5.4\end{array}$ | $3 \cdot 88$ | $2 \begin{array}{lll}29 & 6.9\end{array}$ | 4.08 | $\begin{array}{lllll}2 & 24 & 55 \cdot 8 \\ 2\end{array}$ | 4.30 | $22030 \cdot 6$ | 4.55 |
| 39 | $\begin{array}{lll}2 & 35 & 2 \cdot 2\end{array}$ | 3.64 | 23118.3 | 3.83 | $\begin{array}{llll}2 & 27 & 22.8\end{array}$ | 4.03 | $2 \begin{array}{llll}2 & 23 & 14.8\end{array}$ | 4.25 | $2 \mathrm{I} 852 \cdot 7$ | $4 \cdot 50$ | $21415 \cdot 1$ | 4.77 |
| 40 | 22931.0 | $3 \cdot 78$ | $2 \begin{array}{lllll}2 & 258.6\end{array}$ | 3.98 | 22133.6 | 4.20 | 2 I 714.8 | 4.44 | 2124046 | 4.71 | $2749 \cdot 1$ | 5.0r |
| 41 | 223 54.r | 3.93 | $121952 \cdot 3$ | $4 \cdot 14$ | $21536 \cdot 8$ | $4 \cdot 39$ | 2 II 6.0 | $4 \cdot 6$ | $2618 \cdot 1$ | 4.96 | $2 \begin{array}{llll}10.9\end{array}$ | $5 \cdot 28$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ}$ A. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | S. | - I.08 | s. | s. | S. | s: | s. | s. | s. | s. | s. |
| - | - 066 | -4.43 | $-1 \cdot 15$ 1 | -4.44 4.46 | -r.17 | -4.47 4.49 | - 125 1.32 | -4.49 4.5 I | -1.34 | -4.52 4.54 | -r.43 | -4.54 4.57 |
| 4 | $1 \cdot 13$ | $4 \cdot 46$ | 1.22 | $4 \cdot 48$ | 1.3I | $4 \cdot 5 \mathrm{I}$ | 140 | $4 \cdot 53$ | r 49 | 4.56 | $\pm .58$ | $4 \cdot 60$ |
| 6 | I 20 | $4 \cdot 48$ | $1 \cdot 29$ | $4 \cdot 50$ | r.38 | 4.53 | 147 | $4 \cdot 56$ | $1 \cdot 57$ | $4 \cdot 59$ | 1.66 | 4.62 |
| 8 | I 27 | $4 \cdot 50$ | 1-37 | 4.53 | $1 \cdot 46$ | 4.55 | I.55 | $4 \cdot 59$ | r 65 | $4 \cdot 62$ | 1.75 | $4 \cdot 65$ |
| 10 | 1.35 | $4 \cdot 53$ | $1 \cdot 44$ | $4 \cdot 55$ | r.54 | $4 \cdot 58$ | I. 64 | $4 \cdot 62$ | r.73 | $4 \cdot 65$ | 1.84 | $4 \cdot 69$ |
| 12 | 1.43 | $4 \cdot 55$ | 1.53 | $4 \cdot 58$ | r.63 | $4 \cdot 61$ | r•73 | $4 \cdot 65$ | I. 83 | $4 \cdot 68$ | I-93 | 4.73 |
| 14 | r 52 | 4.57 | $\underline{1} 62$ | 4.6 I | $\mathrm{r} \cdot 72$ | $4 \cdot 64$ | I.82 | $4 \cdot 68$ | r92 | $4 \cdot 72$ | $2 \cdot 03$ | 4.77 |
| 16 | 1.61 | 4.60 | $1 \cdot 71$ | $4 \cdot 64$ | I.81 | $4 \cdot 68$ | I.92 | $4^{\bullet} 72$ | $2 \cdot 03$ | $4 \cdot 77$ | $2 \cdot 14$ | 4.81 |
| 18 | I'70 | $4 \cdot 64$ | x -81 | $4 \cdot 68$ | r-91 | $4 \cdot 72$ | 2.02 | $4 \cdot 77$ | $2 \cdot 14$ | 4.81 | $2 \cdot 25$ | 4.87 |
| 20 | I.80 | $4 \cdot 68$ | 1.91 | $4 \cdot 72$ | $2 \cdot 02$ | 4.77 | $2 \cdot 14$ | 4.81 | $2 \cdot 26$ | 4.87 | $2 \cdot 38$ | $4 \times 93$ |
| 22 | 1.91 | 4.72 | $2 \cdot 03$ | $4 \cdot 77$ | $2 \cdot 14$ | 4.82 | $2 \cdot 26$ | $4 \cdot 87$ | $2 \cdot 39$ | $4 \cdot 93$ | $2 \cdot 51$ | $4 \cdot 99$ |
| 24 | 2.03 | 4.77 | $2 \cdot 15$ | 4.82 | 2.27 | 4.87 | 2.40 | 4.93 | 2.53 | 5.00 | $2 \cdot 66$ | 5.07 |
| 26 28 | 2.15 2.29 | 4.82 4.88 | 2.28 $\mathbf{2 . 4 2}$ | $4 \cdot 88$ $4 \cdot 95$ | 2.41 2.56 | 4.94 5.02 | 2.54 2.70 | $5 \% 11$ 500 | 2.68 2.85 | 5.08 $5 \cdot 17$ | 2.83 3.01 | $5 \cdot 16$ 5.26 |
|  | 2.29 | 4.88 | $2 \cdot 42$ | 4.95 | $2 \cdot 56$ | 5.02 | $2 \cdot 70$ | $5 \times 09$ | $2 \cdot 85$ | $5 \cdot 17$ | 3.01 | $5 \cdot 26$ |
| 30 | 2.44 | 4.96 | $2 \cdot 58$ | $5 \cdot 03$ | $2 \cdot 73$ | $5 \cdot 10$ | $2 \cdot 88$ | $5 \cdot 19$ | $3 \cdot 05$ | $5 \cdot 28$ | 3.22 | $5 \cdot 38$ |
| 32 | 2.61 | $5 \cdot 04$ | $2 \cdot 76$ | $5 \cdot 12$ | $2 \cdot 92$ | $5 \cdot 21$ | 3.09 | $5 \cdot 30$ | $3 \cdot 26$ | $5 \cdot 4 \mathrm{x}$ | 3.45 | $5 \cdot 52$ |
| 34 | $2 \cdot 79$ | $5 \cdot 14$ | $2 \cdot 96$ | 5.23 | $3 \cdot 13$ | $5 \cdot 33$ | $3 \cdot 32$ | $5 \cdot 44$ | $3 \cdot 51$ | $5 \cdot 56$ | $3 \cdot 72$ | $5 \cdot 70$ |
| 35 | $2 \cdot 89$ | $5 \cdot 19$ | $3 \cdot 07$ | $5 \cdot 29$ | 3.25 | $5 \cdot 40$ | 3.44 | $5 \cdot 52$ | $3 \cdot 65$ | $5 \cdot 65$ | $3 \cdot 87$ | $5 \cdot 80$ |
| 36 | 3.00 | $5 \cdot 25$ | $3 \cdot 18$ | $5 \cdot 36$ | $3 \cdot 38$ | $5 \cdot 48$ | $3 \cdot 58$ | $5 \cdot 61$ | $3 \cdot 80$ | $5 \cdot 75$ | 4.04 | $5 \cdot 91$ |
| 37 | $3 \cdot 12$ | $5 \cdot 32$ | 3.31 | 5.44 | $3 \cdot 51$ | $5 \cdot 56$ | $3 \cdot 73$ | $5 \cdot 70$ | 3.97 | $5 \cdot 86$ | 4.22 | 6.04 |
| 38 | 3.24 | $5 \cdot 39$ | $3 \cdot 44$ | $5 \cdot 52$ | $3 \cdot 66$ | $5 \cdot 66$ | 3.90 | $5 \cdot 8 \mathrm{I}$ | $4 \cdot 15$ | $5 \cdot 99$ | 4.43 | $6 \cdot 18$ |
| 39 | $3 \cdot 37$ | $5 \cdot 48$ | $3 \cdot 59$ | $5 \cdot 61$ | $3 \cdot 82$ | $5 \cdot 76$ | 4.07 | $5 \cdot 93$ | 4.35 | $6 \cdot 13$ | $4 \cdot 65$ | $6 \cdot 35$ |
| 40 | $3 \cdot 52$ | $5 \cdot 57$ | $3 \cdot 75$ | $5 \cdot 72$ | 4.00 | $5 \cdot 88$ | 4.27 | $6 \cdot 07$ | 4.57 4.82 | $6 \cdot 29$ | 4.91 | $6 \cdot 53$ |
| 4 I | $3 \cdot 68$ | $5 \cdot 67$ | $3 \cdot 93$ | 5.83 | $4 \cdot 20$ | 6.02 | $4 \cdot 50$ | $6 \cdot 24$ | 4.82 | $6 \cdot 47$ | $5 \cdot 20$ | $6 \cdot 74$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Dec | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M | S. | H. M. |  |  |  |  |  | H. M. | S. | M. | S. |
| 0 | $\begin{array}{lllll}5 & 29 & 49 \cdot 6\end{array}$ | - 1.80 | $\begin{array}{llll}5 & 28 & 0.8\end{array}$ | - 1.83 | $\begin{array}{llll}5 & 26 & 10 \cdot 5\end{array}$ | -I.85 | $\left[\begin{array}{llll}5 & 24 & 18 \cdot 7\end{array}\right.$ |  | $1 \begin{array}{lll}5 & 22 & 25 \cdot 2\end{array}$ | -I.91 | $52030 \cdot 0$ | - I.94 |
| 2 | $52039{ }^{\circ} \mathrm{O}$ | 1.87 | 518186 | I.89 | 5 I6 $51 \cdot 8$ | I.92 | $51455 \cdot 5$ | I.95 | $\begin{array}{lllll}5 & 12 & 57 \cdot 3\end{array}$ | I.99 | $51057 \cdot 0$ | 2.02 |
| 4 | 5 II 25.2 | I'93 | $\begin{array}{llll}5 & 9 & 28 \cdot 3\end{array}$ | I.96 | $\begin{array}{llll}5 & 7 & 29.4\end{array}$ | $2 \cdot 00$ | $\begin{array}{llll}5 & 5 & 28 \cdot 4\end{array}$ | $2 \cdot 04$ | $5{ }_{5}^{5} 3125 \cdot 1$ | $2 \cdot 07$ | 5 I 19.5 | I |
| 6 | $\begin{array}{llll}5 & 2 & 8 \cdot 0\end{array}$ | 2.00 | $5 \quad 0 \quad 6.6$ | $2 \cdot 04$ | 4583.0 | 2.08 | 455 | $2 \cdot 12$ | 4533883 | $2 \cdot 17$ | $45136 \cdot 9$ | $2 \cdot 21$ |
| 8 | $45246 \cdot 9$ | 2.08 | $45040 \cdot 9$ | $2 \cdot 12$ | $44^{48} 32 \cdot 2$ | $2 \cdot 17$ | $4 \quad 46 \quad 20 \cdot 7$ | $2 \cdot 21$ | $44460 \cdot 4$ | $2 \cdot 26$ | $44148 \cdot 9$ | $2 \cdot 32$ |
| 10 | 4432 |  | 44 I |  | $43^{88} 56$ |  | 43639 | 31 | 43418.8 | $2 \cdot 37$ | $43154 \cdot 8$ | . 43 |
| 12 | $43351 \cdot 8$ | $2 \cdot 25$ | $43135 \cdot 2$ | $2 \cdot 30$ | $4 \quad 29 \quad 15 \cdot 3$ | $2 \cdot 36$ | $42651 \cdot 9$ | $2 \cdot 42$ | $\begin{array}{llll}4 & 24 & 24.8\end{array}$ | $2 \cdot 48$ | $42153 \cdot 8$ | $2 \cdot 55$ |
| 14 | $42416 \cdot 7$ | $2 \cdot 34$ | 42154.3 | $2 \cdot 40$ | 4 I9 28-1 | $2 \cdot 47$ | $41658 \cdot 0$ | $2 \cdot 54$ | $\begin{array}{llll}4 & 14 & 23.8\end{array}$ | $2 \cdot 61$ | 4 II 45.1 | . 68 |
| 15 | 419 27.1 | $2 \cdot 40$ | 4 I7 1.5 | $2 \cdot 46$ | 4 I4 $32 \cdot 0$ | $2 \cdot 53$ | $\begin{array}{llll}4 & \text { II } & 58.4\end{array}$ | $2 \cdot 60$ | $\begin{array}{llll}4 & 9 & 20 \cdot 3\end{array}$ | $2 \cdot 67$ | $4 \begin{array}{lll}4 & 6 & 37 \cdot 6\end{array}$ | $2 \cdot 75$ |
| 16 | $4 \begin{array}{llll}4 & 35 \cdot 9\end{array}$ | $2 \cdot 45$ | $412 \quad 7 \cdot 1$ | $2 \cdot 51$ | $4 \quad 934 \cdot 1$ | $2 \cdot 59$ | $4 \quad 6 \quad 56 \cdot 8$ | $2 \cdot 66$ | $4 \begin{array}{lll}4 & 4 & 14.8\end{array}$ | $2 \cdot 74$ | 4 I 27.8 | 2.83 |
| 17 | 4943 | 50 | 710.9 |  | 443 | 5 | 4 I 53. |  | $359 \quad 7 \cdot 0$ | .8I | $\begin{array}{llll}3 & 56 & 15 \cdot 6\end{array}$ | 90 |
| 18 | $4 \quad 4 \quad 48 \cdot 6$ | $2 \cdot 56$ | $\begin{array}{lllll}4 & 2 & 12.9\end{array}$ | $2 \cdot 63$ | $35932 \cdot 6$ | $2 \cdot 71$ | $35647 \cdot 3$ | 2.80 | $35356 \cdot 8$ | $2 \cdot 89$ | 35 I | $2 \cdot 98$ |
| 19 | $35952 \cdot 3$ | $2 \cdot 62$ | 35712.9 | $2 \cdot 70$ | $35428 \cdot 6$ | $2 \cdot 78$ | 3 5I 39'I | 2.87 | $34^{8} 44^{\circ} \mathrm{O}$ | $2 \cdot 97$ | $34543 \cdot 1$ | $3 \cdot 07$ |
| 20 | 3. 54 $54 \cdot \mathrm{I}$ <br> 3  | $2 \cdot 68$ | $\begin{array}{lllllllllll}3 & 52 & 10.8\end{array}$ | $2 \cdot 76$ | $34922 \cdot 3$ | $2 \cdot 85$ | $34^{3} 4688$ | 2.95 | $\begin{array}{llll}3 & 43 & 28 \cdot 5\end{array}$ | $3 \cdot 05$ | $\begin{array}{lllll}3 & 40 & 22 \cdot 5\end{array}$ | $3 \cdot 16$ |
| 21 | $34953 \cdot 8$ | $2 \cdot 75$ | $\begin{array}{llll}3 & 47 & 6.5\end{array}$ | 2.83 |  | $2 \cdot 93$ | $\begin{array}{lllllllll}3 & 41 & 14.9\end{array}$ | 3.03 | $\begin{array}{llll}3 & 38 & 10 \cdot 1\end{array}$ | $3 \cdot 14$ | $33458 \cdot 6$ | $3 \cdot 25$ |
| 22 | $34451 \cdot 3$ | 81 | 34159.7 |  | $\begin{array}{lll}3 & 39 & 2 \cdot 3\end{array}$ | 3.01 | $1 \begin{array}{lll}3 & 35 & 58\end{array}$ | $3 \cdot 11$ | $\begin{array}{llll}3 & 32 & 48 \cdot 5\end{array}$ | .23 | 32931.3 | $3 \cdot 35$ |
| 23 | $33946 \cdot 5$ | 2.89 | $3 \begin{array}{llll}36 & 50 \cdot 4\end{array}$ | $2 \cdot 99$ | $\begin{array}{llll}3 & 33 & 48 \cdot 1\end{array}$ | .09 | 33039. | $3 \cdot 20$ | $\begin{array}{lllll}3 & 27 & 23 \cdot 5\end{array}$ | $3 \cdot 33$ | $324 \quad 0 \cdot 2$ | $3 \cdot 46$ |
| 24 | $\begin{array}{llll}3 & 34 & 39 \cdot 2\end{array}$ | 2.96 | $33138 \cdot 3$ | 3.07 | $\begin{array}{llll}3 & 28 & 30 \cdot 9\end{array}$ | $3 \cdot 18$ | 32516.6 | $3 \cdot 30$ | $3 \begin{array}{lllllllll}3 & 21 & 54\end{array}$ | 3.43 | 3 18 $25^{\circ} \mathrm{O}$ | $3 \cdot 57$ |
| 25 | 329 29.1 | $3 \cdot 04$ | $326 \quad 23 \cdot 3$ | $3 \cdot 15$ | $\begin{array}{llll}3 & 23 & 10 \cdot 5\end{array}$ | 3.27 | $31950 \cdot 3$ | $3 \cdot 40$ | 3 I6 22.I | $3 \cdot 54$ | 312454 | 3.69 |
| 26 | $32416 \cdot 2$ | $3 \cdot 13$ | 32150 | $3 \cdot 25$ | 3 I7 46.5 | $3 \cdot 37$ | 3 I4 20.1 | 3.51 | $31045 \cdot 1$ | 3.66 | 3710 | $3 \cdot 82$ |
| 27 | $3190 \cdot 1$ | $3 \cdot 22$ | $31543 \cdot$ | $3 \cdot 35$ | 31218.6 | $3 \cdot 48$ | $\begin{array}{llll}3 & 8 & 45 \cdot 6\end{array}$ | $3 \cdot 63$ | $3 \begin{array}{lll}3 & 5 & 3.4\end{array}$ | 3.79 | 3 I II.3 | $3 \cdot 96$ |
| 28 | $31530 \cdot 6$ | $3 \cdot 31$ | 31017.8 | $3 \cdot 45$ | $\begin{array}{llll}3 & 6 & 46 \cdot 6\end{array}$ | $3 \cdot 59$ | $\begin{array}{llll}3 & 3 & 6 \cdot 4\end{array}$ | $3 \cdot 75$ | $\begin{array}{llll}2 & 59 & 16.4\end{array}$ | 3.92 | 25515.8 | $4 \cdot 11$ |
| 29 | $3 \begin{array}{llll}3 & 8 & 17 \cdot 5\end{array}$ | $3 \cdot 42$ | $3{ }^{3}$ | $3 \cdot 5$ | 3 I I | $3 \cdot \%=$ | $257122 \cdot 2$ | 3.88 | $\begin{array}{llllllllllllllllll}2 & 53 & 23 \cdot 8\end{array}$ | 4.07 | 24913.9 | $4 \cdot 27$ |
| 30 | $\begin{array}{llrr}3 & 2 & 50 \cdot 3\end{array}$ | $3 \cdot 53$ | 25914.2 | $3 \cdot 68$ | $2 \begin{array}{llll}2 & 55 & 28 \cdot 5\end{array}$ | $3 \cdot 85$ | $25132 \cdot 3$ | 4.03 | $\begin{array}{lllllllllll}2 & 47 & 24.8\end{array}$ | $4 \cdot 23$ | $\begin{array}{llllllllllll}2 & 43 & 4 \cdot 8\end{array}$ | 4.45 |
| 31 | $\begin{array}{lllll}2 & 57 & 18.6\end{array}$ | 3.64 | 253135 | 3.81 | 249414 | 3.99 | $245 \quad 36 \cdot 3$ | $4 \cdot 19$ | 24118.8 | 4.40 | $23647 \cdot 7$ | $4 \cdot 64$ |
| 32 | 25142.4 |  | $24750 \cdot 9$ | $3 \cdot 95$ | $\begin{array}{llll}2 & 43 & 48 \cdot 2\end{array}$ | $4 \cdot 15$ | 239333 | 4.36 | 23514.9 | $4 \cdot 60$ | $23021 \cdot 7$ | 4.86 |
| 33 | $2 \begin{array}{lll}2 & 46 & 0.8\end{array}$ | -91 | 2420.6 | $4 \cdot 10$ | $23748 \cdot 3$ | $4 \cdot 32$ | 23312.7 | $4 \cdot 55$ | $2 \begin{array}{llll}28 & 42 \cdot 3\end{array}$ | 4.81 | 22345.4 | -10 |
| 34 | $2 \begin{array}{lllllllll} & 40 & 13.3\end{array}$ | 4.06 | $\begin{array}{lllll}2 & 36 & 3.7\end{array}$ | $4 \cdot 27$ | $23140 \cdot 9$ | 4.50 | $227 \quad 3 \cdot 3$ | $4 \cdot 76$ | $\begin{array}{lllllllllllllllll}222 & 9.6\end{array}$ | 5.05 | $21657 \cdot 5$ | $5 \cdot 37$ |
| 35 | $\begin{array}{llll}2 & 34 & 19 \cdot 3\end{array}$ | $4 \cdot 22$ | 22959.3 |  | $\begin{array}{llll}2 & 25 & 24.8\end{array}$ | $4 \cdot 71$ | $22034 \cdot 1$ | 4.99 | $\begin{array}{lllll}2 & 15 & 25.4\end{array}$ | $5 \cdot 32$ | $2956 \cdot 1$ | $5 \cdot 68$ |
| 36 | $22818 \cdot 0$ | 4.40 | $22346 \cdot 5$ | $4 \cdot 66$ | 2 I8 59.1 | 4.94 | 21353.7 | $5 \cdot 26$ | $2 \quad 8 \quad 27.9$ | 5.62 | $2 \begin{array}{llll}2 & 2 & 38.8\end{array}$ | $6 \cdot 05$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.


DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. | S. | H. M. | S. | H. M. S. | S. | H. M. S. | S. | M. S. | S. |
| 0 | $6 \quad 0 \quad 0.0$ | - I•70 | $55^{58}$ I $8 \cdot 1$ | - I•70 | $\begin{array}{llll}5 & 56 & 36 \cdot 2\end{array}$ | - $\mathrm{I} \cdot 70$ | $55454 \cdot \mathrm{I}$ | - I 70 | 5 53 II•8 | - I•71 | 5 51 29.2 | - 1.71 |
| 8 | 52513.0 | I 72 | $\begin{array}{llll}5 & 23 & 29 \cdot 5\end{array}$ | I•73 | 5 21 $45 \cdot 2$ | I•74 | 520 0.1 | $1 \cdot 76$ | $\begin{array}{lllll}5 & 18 & 13.9\end{array}$ | 1.78 | $51626 \cdot 6$ | I.80 |
| 10 | $\begin{array}{lllllllllll}5 & 16 & 30 \cdot 3\end{array}$ | I•73 | 5 I4 46-I | I•74 | $\begin{array}{llll}5 & 13 & 0.9\end{array}$ | I-76 | $\begin{array}{llllll}5 & 11 & 14.5\end{array}$ | 1.78 | $\begin{array}{llll}5 & 9 & 26 \cdot 9\end{array}$ | 1.80 | $5738 \cdot 1$ | r. 82 |
| 12 | $5>47 \cdot 1$ | I•74 | $\begin{array}{lll}5 & 6 & 1\end{array} 9$ | I•76 | $\begin{array}{llll}5 & 4 & 15 \cdot 5\end{array}$ | $1 \cdot 78$ | $\begin{array}{lllll}5 & 2 & 27\end{array}$ | I.8I | 5 0 $38 \cdot 7$ | I.83 | $45848 \cdot 1$ | I.86 |
| 14 | $4593 \cdot 1$ | I.76 | $\begin{array}{llll}4 & 57 & 16.8\end{array}$ | I•78 | $45529 \cdot 1$ | I.8I | $4 \quad 53 \quad 39 \cdot 8$ | I.83 | 4 5I 49*0 | I. 86 | $44956 \cdot 4$ | I.89 |
| 16 | $45018 \cdot 2$ | I•78 | $44830 \cdot 6$ | I.8I | $4464 \mathrm{I} \cdot 4$ | I. 83 | 444 50*4 | I.86 | $44257 \cdot 6$ | I-90 | 44 I | I•93 |
| 18 | $44132 \cdot 3$ | I.80 | $43943 \cdot 2$ | I.83 | $43752 \cdot 3$ | I.86 | 43559.4 | I.90 | $\begin{array}{lll}4 & 34 & 4\end{array}$ | I•93 | $\begin{array}{lll}4 & 32 & 7 \cdot 2\end{array}$ | I.97 |
| 20 | $43245 \cdot 2$ | I. 83 | 43054.4 | I.86 | 429 1.6 | I.90 | $4276 \cdot 5$ | 1.94 | 42590 | I•98 | $423 \quad 9 \cdot 1$ | 2.02 |
| 22 | $42356 \cdot 7$ | I 86 | $4224^{\circ} \mathrm{O}$ | 1.90 | $420 \quad 90$ | 1-94 | $4 \begin{array}{lll}48 & \text { II. }\end{array}$ | 1.98 | 4 16 11•3 | $2 \cdot 02$ | $\begin{array}{llll}4 & \text { I4 } & 8 \cdot 4\end{array}$ | 2.07 |
| 23 | 4 I9 3I.8 | I.87 | 4 I7 38.1 | 1.92 | $41541 \cdot 9$ | r.96 | 4 I3 43.0 | $2 \cdot 00$ | 4 II 4I'4 | $2 \cdot 05$ | $4 \quad 9 \quad 37 \cdot 0$ | $2 \cdot 10$ |
| 24 | $4 \begin{array}{lll}45 & 6.5\end{array}$ | I. 89 | 413 II•7 | I•94 | 4 II 14.2 | I.98 | $4 \quad 9 \quad 14{ }^{\circ} \mathrm{O}$ | 2.03 | $4 \quad 7 \quad 10.9$ | $2 \cdot 08$ | $4 \quad 5 \quad 4 * 7$ | $2 \cdot 13$ |
| 25 | 4 10 $40 \cdot 8$ | I.91 | 4844.8 | I $\cdot 96$ | $4646 \cdot 0$ | 2.00 | $4444 \cdot 3$ | $2 \cdot 05$ | $\begin{array}{rrrr}4 & 2 & 39 \cdot 5\end{array}$ | $2 \cdot 10$ | $4 \quad 0 \quad 3 \mathrm{I} \cdot 7$ | $2 \cdot 16$ |
| 26 | $4 \begin{array}{llll}4 & 6 & 14.5\end{array}$ | I•93 | $4 \quad 4 \quad 17 \cdot 3$ | I. 98 | $\begin{array}{llll}4 & 2 & 17 & 1\end{array}$ | $2 \cdot 03$ | $4 \quad 0 \quad 13.9$ | 2.08 | $\begin{array}{llll}3 & 58 & 7 \cdot 4\end{array}$ | $2 \cdot 14$ | $355 \quad 57 \cdot 6$ | 2.19 |
| 27 | 4 I $47 \cdot 8$ | I'95 | $35949 \cdot 2$ | $2 \cdot 00$ | $35747 \cdot 5$ | $2 \cdot 05$ | $35542 \cdot 6$ | $2 \cdot 11$ | 35354.4 | $2 \cdot 17$ | $3 \mathrm{5I} 22 \cdot 7$ | $2 \cdot 23$ |
| 28 | $35720 \cdot 4$ | I.97 | $\begin{array}{lllll}3 & 55 & 20 \cdot 4\end{array}$ | $2 \cdot 03$ |  5  | $2 \cdot 08$ | 35110.6 | 2.14 | $349 \quad 0.5$ | $2 \cdot 20$ | $34646 \cdot 7$ | $2 \cdot 26$ |
| 29 | $35252 \cdot 5$ | 2.00 | $35051 \cdot 0$ | $2 \cdot 05$ | $34^{8} 46 \cdot 2$ | $2 \cdot 11$ | $3 \quad 46$ 37.7 | $2 \cdot 17$ | $\begin{array}{llll}3 & 44 & 25 \cdot 6\end{array}$ | $2 \cdot 23$ | 342977 | $2 \cdot 30$ |
| 30 | $\begin{array}{lllll}3 & 48 & 23.9\end{array}$ | 2.02 | $3 \begin{array}{llll}3 & 46 & 20 \cdot 8\end{array}$ | $2 \cdot 08$ | $\begin{array}{llll}3 & 44 & 14 \cdot 2\end{array}$ | $2 \cdot 14$ | 3423 42 | $2 \cdot 20$ | $33949 \%$ | $2 \cdot 27$ | $3 \begin{array}{llll}3 & 37 & 31\end{array}$ | $2 \cdot 34$ |
| 31 | 34354.6 | $2 \cdot 05$ | 34149.9 | $2 \cdot 11$ | $33941 \cdot 5$ | $2 \cdot 17$ | $3 \begin{array}{llll}3 & 3 & 29.1\end{array}$ | $2 \cdot 24$ | 33512.7 | $2 \cdot 31$ | $33252 \cdot 0$ | $2 \cdot 38$ |
| 32 | $\begin{array}{llll}3 & 39 & 24 \cdot 6\end{array}$ | 2.08 | 337 18•1 | $2 \cdot 14$ | $335 \quad 7 \cdot 7$ | $2 \cdot 21$ | $\begin{array}{llll}3 & 32 & 53.2\end{array}$ | $2 \cdot 28$ | $33034 \cdot 5$ | $2 \cdot 35$ | 328 II. 2 | $2 \cdot 43$ |
| 33 | $\begin{array}{llllllllllllll}3 & 34\end{array}$ | $2 \cdot 11$ | $32245 \cdot 4$ | $2 \cdot 17$ | $3 \quad 3033.0$ | $2 \cdot 24$ | $3 \begin{array}{llll}3 & 28 & 16 \cdot 2\end{array}$ | $2 \cdot 32$ | 32555.0 | $2 \cdot 39$ | $\begin{array}{llll}3 & 23 & 29.0\end{array}$ | $2 \cdot 47$ |
| 34 | $33022 \cdot 1$ | $2 \cdot 14$ | 328 II•7 | 2.21 | $3 \begin{array}{llll}3 & 25 & 57 \cdot 1\end{array}$ | $2 \cdot 28$ | $323 \begin{array}{lll}38 \cdot 0\end{array}$ | $2 \cdot 36$ | 32154.1 | $2 \cdot 44$ | $\begin{array}{llll}3 & 18 & 45 \cdot 3\end{array}$ | $2 \cdot 52$ |
| 35 | $\begin{array}{llll}3 & 25 & 49 \cdot 5\end{array}$ | $2 \cdot 17$ | $\begin{array}{lllll}3 & 23 & 37 \cdot 1\end{array}$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 21 & 20 \cdot 1 \\ 3 & 16 & \end{array}$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 18 & 58.4\end{array}$ | 2.40 | $\begin{array}{llll}3 & 16 & 31.8 \\ 3\end{array}$ | 2.49 | $\begin{array}{llll}3 & 13 & 59.8\end{array}$ | 2.58 |
| 36 | 32 x 16.0 | 2.21 | 3 Ig I'3 | $2 \cdot 28$ | 3 I6 4I'9 | $2 \cdot 37$ | 3 I4 I7.4 | $2 \cdot 45$ | 3 II $47 \cdot 8$ | $2 \cdot 54$ |  | 2.63 |
| 37 | 3 I 64 r 3 | $2 \cdot 24$ | 31424.3 | $2 \cdot 32$ | $\begin{array}{llll}3 & 12 & 2 \cdot 3\end{array}$ | 2.41 | $3 \quad 9 \quad 350$ | $2 \cdot 50$ | $\begin{array}{lll}3 & 7 & 2 \cdot 2\end{array}$ | 2.59 | $\begin{array}{llll}3 & 4 & 23 \cdot 6\end{array}$ | 2.69 |
| 38 | $\begin{array}{llll}3 & 12 & 5 \cdot 5\end{array}$ | $2 \cdot 28$ | $3 \quad 946 \cdot 0$ | $2 \cdot 37$ | 3 \% 2r.2 | $2 \cdot 46$ | $\begin{array}{llll}3 & 4 & 50 \cdot 9\end{array}$ | $2 \cdot 55$ | $\begin{array}{llll}3 & 2 & 14.7\end{array}$ | $2 \cdot 65$ | $25932 \cdot 5$ | $2 \cdot 76$ |
| 39 | $\begin{array}{llll}3 & 7 & 28 \cdot 5\end{array}$ | $2 \cdot 33$ | $\begin{array}{lll}3 & 5 & 6 \cdot 3\end{array}$ | 2.42 | $\begin{array}{llll}3 & 2 & 38 \cdot 5\end{array}$ | $2 \cdot 51$ | $3 \quad 0 \quad 50$ | 2.61 | 257125.2 | $2 \cdot 72$ | 254 39•1 | $2 \cdot 83$ |
| 40 | $\begin{array}{llll}3 & 2 & 50 \cdot 2\end{array}$ | $2 \cdot 37$ | $3 \quad 0 \quad 25 \cdot 1$ | $2 \cdot 47$ | $2 \begin{array}{lllllll} & 57 & 54\end{array}$ | $2 \cdot 57$ | 255 I7.I | $2 \cdot 67$ | $25233 \cdot 6$ | $2 \cdot 78$ | $24943 \cdot 2$ | $2 \cdot 90$ |
| 41 | $\begin{array}{llll}2 & 58 & 10 \cdot 5\end{array}$ | $2 \cdot 42$ |  | $2 \cdot 52$ | 253880 | 2.63 | $25027 \cdot 2$ | $2 \cdot 74$ | 247 39*5 | $2 \cdot 85$ | $24444 \cdot 7$ | $2 \cdot 98$ |
| 42 | $253{ }^{2} 59 \cdot 1$ | 2.47 | $25057 \cdot 7$ | $2 \cdot 58$ | $\begin{array}{llll}2 & 48 & 19.8\end{array}$ | $2 \cdot 69$ | $24535{ }^{\circ}$ | 2.81 | $24242 \cdot 9$ | $2 \cdot 93$ | $23943 \cdot 2$ | $3 \cdot 06$ |
| 43 | $24846 \cdot 1$ | 2.53 | $246 \mathrm{II} \cdot \mathrm{I}$ | $2 \cdot 64$ | $243 \quad 29.4$ | $2 \cdot 76$ | $24040 \cdot 3$ | $2 \cdot 88$ | $23743 \cdot 5$ | 3.01 | $23438 \cdot 5$ | $3 \cdot 16$ |
| 44 | $\begin{array}{lll}2 & 44 & \text { I } 3\end{array}$ | 2.59 | $\begin{array}{llll}2 & 41 & 22.5\end{array}$ | 2.71 | $\begin{array}{llll}2 & 38 & 36 \cdot 5\end{array}$ | $2 \cdot 83$ | $23542 \cdot 8$ | $2 \cdot 96$ | $2324 \mathrm{I} \cdot 0$ | $3 \cdot 10$ | 229 30.2 | 3.26 |
| 45 | $2 \begin{array}{llll}2 & 39 & 14.4\end{array}$ | $2 \cdot 65$ |  | $2 \cdot 78$ | 233 4I•I | $2 \cdot 91$ | 23042.4 | 3.05 | 22734.9 | $3 \cdot 20$ | $22418 \cdot 1$ | $3 \cdot 37$ |
| 46 | $\begin{array}{llll}2 & 34 & 25.3\end{array}$ | 2.72 | $23138 \cdot 1$ | $2 \cdot 86$ | $\begin{array}{lllll}2 & 28 & 42 \cdot 6\end{array}$ | 3.00 |  | $3 \cdot 15$ | $\begin{array}{llll}2 & 22 & 25 \cdot 1\end{array}$ | 3.31 | $\begin{array}{llll}2 & 19 & 1.5\end{array}$ | $3 \cdot 48$ |
| 47 | $\begin{array}{llll}2 & 29 & 33 \cdot 8 \\ 2 & 24 & 30.6\end{array}$ | 2.80 2.88 | 2 26 $4 \mathrm{I} \cdot 8$ | $2 \cdot 94$ | $\|$2 23 $4 r \cdot 2$ <br> 2   | 3.09 | 2 2 ¢ $31 \cdot 2$ | $3 \cdot 25$ | 2171111 | 3.43 | $21340 \cdot 1$ | $3 \cdot 62$ |
| 48 | $22439 \cdot 6$ | 2.88 | $22142 \cdot 5$ | 3.03 | 2 I8 $36 \cdot 1$ | $3 \cdot 19$ | 2 I5 19.6 | $3 \cdot 36$ | 2 II 52.3 | $3 \cdot 55$ | $28 \mathrm{IJ} \cdot \mathrm{I}$ | $3 \cdot 76$ |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | S. | s. | s. | s. | S. | S. | S. | S. | s. | s. | S. |
| 0 | - 00 | $-4.34$ | -.08 | $-4.35$ | - -16 | $-4.35$ | - 225 | $-4.35$ | - 33 | $-4.36$ | - 41 | $-4.36$ |
| 2 | -06 | 4.35 | -15 | $4 \cdot 35$ | . 23 | $4 \cdot 35$ | -3I | $4 \cdot 36$ | - 40 | $4 \cdot 36$ | . 48 | $4 \cdot 37$ |
| 4 | -13 | $4 \cdot 35$ | -2I | $4 \cdot 35$ | -30 | $4 \cdot 35$ | $\cdot 38$ | $4 \cdot 36$ | -46 | $4 \cdot 37$ | - 55 | $4 \cdot 38$ |
| 6 | -19 | $4 \cdot 35$ | $\cdot 28$ | $4 \cdot 35$ | $\cdot 36$ | $4 \cdot 36$ | -44 | $4 \cdot 37$ | -53 | $4 \cdot 38$ | -61 | 4.39 |
| 8 | -26 | 4.35 | -34 | $4 \cdot 36$ | -43 | $4 \cdot 37$ | -51 | $4 \cdot 38$ | $\cdot 60$ | $4 \cdot 39$ | -68 | $4 \cdot 40$ |
| 10 | -33 | $4 \cdot 36$ | -4I | $4 \cdot 37$ | -50 | $4 \cdot 37$ | - 58 | 4.38 | -67 | $4 \cdot 40$ | -75 | 4.41 |
| 12 | -39 | $4 \cdot 36$ | -48 | $4 \cdot 37$ | - 56 | $4 \cdot 38$ | -65 | $4 \cdot 39$ | -74 | 4.41 | -83 | $4 \cdot 42$ |
| 14 | $\cdot 46$ | 4.37 | -55 | 4.38 | -64 | $4 \cdot 39$ | -72 | 4.41 | -8I | 4.42 | -90 | $4 \cdot 44$ |
| 16 | -53 | $4 \cdot 38$ | . 62 | 4.39 | -71 | 4.40 | -80 | 4.42 | -89 | $4 \cdot 43$ | -98 | $4 \cdot 45$ |
| 18 | -60 | $4 \cdot 39$ | -69 | 4.40 | $\cdot 78$ | $4 \cdot 42$ | -88 | 4.43 | $\cdot 97$ | $4 \cdot 45$ | I*06 | $4 \cdot 47$ |
| 20 | -68 | $4 \cdot 40$ | $\cdot 77$ | 4.41 | -86 | 4.43 | -96 | 4.45 | I.05 | 4.47 | I-I5 | $4 \cdot 49$ |
| 22 | $\cdot 76$ | $4 \cdot 41$ | -85 | 4.43 | $\cdot 94$ | 4.45 | 1.04 | $4 \cdot 47$ | I'I4 | 4.49 | I 24 | 4*52 |
| 24 | -84 | 4.42 | -93 | 4.44 | I-O3 | 4.47 | I•13 | 4.49 | I. 23 | $4 \cdot 52$ | I.33 | $4 \cdot 54$ |
| 26 | $\cdot 92$ | $4 \cdot 44$ | I-02 | $4 \cdot 46$ | I'I2 | $4 \cdot 49$ | I. 22 | 4.51 | I. 32 | $4 \cdot 54$ | I.43 | $4 \cdot 57$ |
| 28 | I'OI | $4 \cdot 46$ | I•II | $4 \cdot 48$ | I-2I | $4 \cdot 5 \mathrm{I}$ | 1.32 | 4.54 | 1.43 | $4 \cdot 57$ | I•53 | $4 \cdot 61$ |
| 30 | 1.10 | $4 \cdot 48$ | I 20 | 4.51 | I•3I | $4 \cdot 54$ | 1*42 | 4.57 | I.53 | $4 \cdot 61$ | I.65 | $4 \cdot 65$ |
| 32 | I-19 | $4 \cdot 50$ | I 31 | $4 \cdot 54$ | I. 42 | $4 \cdot 57$ | I*53 | $4 \cdot 61$ | I. 65 | $4 \cdot 65$ | ェ・77 | $4 \cdot 69$ |
| 34 | I 30 | 4.53 | 1.41 | 4.57 | I. 53 | $4 \cdot 61$ | I.65 | $4 \cdot 65$ | 1.77 | $4 \cdot 69$ | I'90 | 4.74 |
| 36 | I.4I | 4.57 | I.53 | $4 \cdot 61$ | r.65 | $4 \cdot 65$ | I•78 | $4 \cdot 69$ | $1 \cdot 91$ | 4.75 | $2 \cdot 04$ | 4.80 |
| 38 | I 53 | $4 \cdot 6 \mathrm{I}$ | r.65 | $4 \cdot 65$ | I.78 | $4 \cdot 70$ | 1.92 | 4.75 | $2 \cdot 06$ | $4 \cdot 8 \mathrm{I}$ | $2 \cdot 20$ | 4.87 |
| 40 | 1. 66 | $4 \cdot 65$ | 1•79 | 4*70 | I.93 | 4.75 | $2 \cdot 07$ | 4.81 | $2 \cdot 22$ | $4 \cdot 88$ | $2 \cdot 38$ | 4*95 |
| 42 | 1.80 | $4 \cdot 70$ | I.94 | $4 \cdot 76$ | $2 \cdot 09$ | $4 \cdot 82$ | $2 \cdot 24$ | 4.89 | 2.41 | 4.97 | 2.57 | $5 \cdot 05$ |
| 44 | 1.95 | $4 \cdot 76$ | $2 \cdot 11$ | $4 \cdot 83$ | $2 \cdot 27$ | 4.90 | $2 \cdot 44$ | $4 \cdot 98$ | 2.61 | $5 \cdot 07$ | 2.80 | $5 \cdot 17$ |
| 46 | $2 \cdot 13$ | $4 \cdot 84$ | $2 \cdot 30$ | 4.91 | 2.47 | $5 \cdot 00$ | $2 \cdot 66$ | $5 \cdot 09$ | $2 \cdot 85$ | $5 \cdot 20$ | $3 \cdot 06$ | $5 \cdot 32$ |
| 48 | $2 \cdot 32$ | 4.93 | $2 \cdot 50$ | $5 \cdot 02$ | $2 \cdot 70$ | $5 \cdot 12$ | $2 \cdot 91$ | $5 \cdot 23$ | $3 \cdot 13$ | $5 \cdot 36$ | $3 \cdot 37$ | $5 \cdot 50$ |

## LATITUDE $23^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. S. | S. | . M. | S. | H. M. | S. | H. M. S | S. | H. M. S. | S. |
| 0 | $54946 \cdot 3$ | -I'72 | $5 \begin{array}{llll}5 & 48 & 3 \cdot 0 \\ 5 & 30 & \end{array}$ | - I.73 | 546 I9'2 | - I•73 | 5 $44454 \cdot 8$ | -I•74 | $5 \begin{array}{llll}5 & 42 & 49 \cdot 8\end{array}$ | - I.76 | $5414 \cdot 1$ | - 1.77 |
| 4 | $\begin{array}{lllll}5 & 32 & 14.7\end{array}$ | I*76 | 530 | I.78 | $\begin{array}{lllll}5 & 28 & 41 \cdot 5\end{array}$ | 1.79 | $\begin{array}{llll}5 & 26 & 53 \cdot 5\end{array}$ | I-8I | $\begin{array}{lll}5 & 25 & 4.6\end{array}$ | r.83 | $\begin{array}{llll}5 & 23 & 14.4\end{array}$ | I.85 |
| 6 | 523272 | I.79 | $521139 \cdot 3$ | I.8I | 5 If 50.5 | I 82 | $\begin{array}{lll}5 & 18 & 0 \cdot 5\end{array}$ | I 84 | $\begin{array}{llll}5 & 16 & 9 \cdot 2 \\ 5 & 7 & \end{array}$ | I.87 | $\begin{array}{llll}5 & 14 & 16 \cdot 5\end{array}$ | I.89 |
| 8 | $\begin{array}{lllll}5 & 14 & 38 \cdot 3\end{array}$ | 1.82 | $51248 \cdot 7$ | I. 84 | 5 10 57.8 | I. 36 | $\begin{array}{lll}5 & 9 & 5 \cdot 5\end{array}$ | I-88 |  | I.9I |  | I*94 |
| 10 | $5 \quad 5 \quad 48 \cdot 0$ | I 85 | $\begin{array}{llll}5 & 3 & 56.4\end{array}$ | I.87 | $\begin{array}{llll}5 & 2 & 3\end{array}$ | I 90 | 5 5 0 | I 933 | 45812.0 | I 966 | $4 \quad 56 \quad 13.6$ | 199 |
| 12 | $45656 \cdot 0$ | 工. 88 | $455 \quad 2 \cdot 1$ | I 91 | $453 \quad 6 \cdot 5$ | I 94 | 45 I 9•I | 1.97 | $449 \quad 9.6$ | 2.01 | $\begin{array}{lll}4 & 47 & 8 \cdot 1\end{array}$ | $2 \cdot 04$ |
| 14 | $448 \quad 2 \cdot 0$ | I 92 | $4 \begin{array}{lll}4 & 46 & 5 \cdot 8\end{array}$ | r 95 | $444 \quad 7 \cdot 5$ | I.99 | $44^{42} \quad 7 \cdot 1$ | 2.02 | $4{ }^{40} 40 \cdot 5$ | 2.06 | $\begin{array}{llll}4 & 37 & 59 \cdot 5\end{array}$ | $2 \cdot 10$ |
| 16 | 43960 | I 96 | 4374 7 | $2 \cdot 00$ | $435 \quad 5 \%$ | $2 \cdot 04$ | $\begin{array}{lll}4 & 33 & 2 \cdot 3\end{array}$ | $2 \cdot 08$ | $43056 \cdot 2$ | $2 \cdot 12$ | $428177 \cdot 4$ | $2 \cdot 17$ |
| 18 | $4 \begin{array}{llll}4 & 30 & 7 \cdot 7\end{array}$ | 2 OI | 42858 | 2.05 | $\begin{array}{lll}4 & 26 & 1.4\end{array}$ | $2 \cdot 10$ | $\begin{array}{llll}4 & 23 & 54.2\end{array}$ | $2 \cdot 14$ | $\begin{array}{llll}4 & 21 & 44.4\end{array}$ | $2 \cdot 19$ | $4 \begin{array}{llll}4 & 19 & 31 \cdot 5\end{array}$ | $2 \cdot 24$ |
| 19 | $42537 \cdot 5$ | $2 \cdot 04$ | $42334^{\circ}$ | $2 \cdot 08$ | $4212 \% 9$ | $2 \cdot \mathrm{I} 3$ | 4 I9 18.9 | $2 \cdot 17$ | 4 ェ7 $7 \times 0$ | $2 \cdot 22$ | $4 \quad 1451 * 9$ | $2 \cdot 28$ |
| 20 | $\begin{array}{lll}4 & 21 & 6 \cdot 7\end{array}$ | 2.06 | $\begin{array}{lll}4 & 19 & 1\end{array} 6$ | $2 \cdot 11$ | $4 \begin{array}{lll}46 & 53 \cdot 6\end{array}$ | $2 \cdot 16$ | 414427 | 2.21 | $4 \begin{array}{lll}42 & 28 \cdot 7\end{array}$ | $2 \cdot 26$ | 4 10 1I•2 | $2 \cdot 32$ |
| 21 | 4 16 $35 \cdot \mathrm{I}$ | 2.09 | $4 \begin{array}{llll}4 & 18 & 28 \cdot 2\end{array}$ | $2 \cdot 14$ | $\begin{array}{lllllllll}4 & 12 & 18\end{array}$ | $2 \cdot 19$ | 4 10 $5 \cdot 4$ | $2 \cdot 24$ | $4 \quad 7 \quad 49 \cdot 2$ | $2 \cdot 30$ | $\begin{array}{llll}4 & 5 & 29.4\end{array}$ | $2 \cdot 36$ |
| 22 | $\begin{array}{llll}4 & 12 & 2 \cdot 7\end{array}$ | $2 \cdot 12$ | $4 \quad 954{ }^{\circ} \mathrm{O}$ | $2 \cdot 17$ | $\begin{array}{lllll}4 & 7 & 42 \cdot 2\end{array}$ | $2 \cdot 22$ | $4_{4}^{4} 505127 \cdot 1$ | $2 \cdot 28$ | $\begin{array}{lrr}4 & 3 & 8 \cdot 5 \\ 3 & 5 & \end{array}$ | $2 \cdot 34$ | $\begin{array}{rrrr}4 & 0 & 46 \cdot 3\end{array}$ | $2 \cdot 40$ |
| 23 | 4729.5 | $2 \cdot 15$ | $\begin{array}{lllll}4 & 5 & 18 \cdot 9\end{array}$ | $2 \cdot 20$ | $\begin{array}{llll}4 & 3 & 5 & 0\end{array}$ | $2 \cdot 26$ | $48047 \cdot 6$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 58 & 26 \cdot 6\end{array}$ | $2 \cdot 38$ | $3{ }^{3} 56 \quad 1 \cdot 7$ | $2 \cdot 45$ |
| 24 | $1 \begin{array}{llll}4 & 2 & 55.4\end{array}$ | $2 \cdot 18$ | $4 \quad 0 \quad 42 \cdot 8$ | $2 \cdot 24$ | $\begin{array}{llll}3 & 58 & 26 \cdot 7\end{array}$ | $2 \cdot 30$ | $3 \begin{array}{lll}3 & 56 & 7\end{array}$ | $2 \cdot 36$ | $\begin{array}{llll}3 & 53 & 43 \cdot 4\end{array}$ | 2.43 | 35115.6 | $2 \cdot 50$ |
| 25 | $\begin{array}{llll}3 & 58 & 20.4\end{array}$ | 2.22 | $\begin{array}{llr}3 & 56 & 5 \cdot 7\end{array}$ | $2 \cdot 28$ | $353347 \cdot 3$ | $2 \cdot 34$ | 3 51 25.1 | 2.40 |  | 2.47 | $\begin{array}{llll}3 & 46 & 28 \cdot 3\end{array}$ | 2.55 |
| 26 | $\left\lvert\, \begin{array}{llll}3 & 53 & 44.4\end{array}\right.$ | 2.25 | $35127 \cdot 5$ | $2 \cdot 31$ | $\begin{array}{\|lll\|}3 & 49 & 6 \cdot 7\end{array}$ | 2.38 | $3{ }^{3} 464 \mathrm{4} \cdot 9$ | 2.45 | $\begin{array}{llll}3 & 44 & 12.8 \\ 3 & 39 & 25.1\end{array}$ | 2.52 | $\begin{array}{llll}3 & 41 & 39 \cdot 2 \\ 3 & 36 & 48 \cdot 3\end{array}$ | $2 \cdot 60$ |
| 27 | $\begin{array}{lll}3 & 49 & 7 \cdot 3\end{array}$ | 2.29 | $3{ }^{3} 4648 \cdot 0$ | $2 \cdot 35$ |  | 2.42 | $3{ }^{3} 415157.2$ | $2 \cdot 50$ | 3 39 $25 \cdot 1$ | 2.57 | $\begin{array}{llll}3 & 36 & 48 \cdot 3\end{array}$ | $2 \cdot 65$ |
| 28 | $\begin{array}{lllll}3 & 44 & 29 \cdot 1\end{array}$ | $2 \cdot 33$ | $\begin{array}{llll}3 & 42 & 7.4\end{array}$ | $2 \cdot 40$ | $3394 \mathrm{I} \cdot 4$ | 2.47 | $3{ }^{3} 37110$ | 255 | $\begin{array}{llll}3 & 34 & 35 \cdot 8\end{array}$ | 2.63 | $\begin{array}{llll}3 & 31 & 55 \cdot 6\end{array}$ | $\therefore 7 \%$ |
| 29 | $33949 \cdot 6$ | $2 \cdot 37$ | $\begin{array}{llll}3 & 37 & 25 \%\end{array}$ | $2 \cdot 44$ | $33456 \cdot 6$ | $2 \cdot 52$ | $33223 \cdot 1$ | $2 \cdot 60$ | $32944 \cdot 6$ | $2 \cdot 68$ | 32700.9 | $2 \cdot 78$ |
| 30 | $\begin{array}{llr}3 & 35 & 8.9\end{array}$ | 2.41 | $3 \begin{array}{lll}32 & 41 \cdot 9\end{array}$ | 249 | 33010.2 | 2.57 | $\begin{array}{llll}3 & 27 & 33.5\end{array}$ | $2 \cdot 66$ | $32451 \cdot 5$ | $2 \cdot 75$ | $\begin{array}{lll}3 & 22 & 3.9 \\ 3 & 7\end{array}$ | $2 \cdot 84$ |
| 31 | $\begin{array}{llll}3 & 30 & 26 \cdot 8\end{array}$ | $2 \cdot 46$ | $\begin{array}{lllll}3 & 27 & 56 \cdot 9\end{array}$ | $2 \cdot 54$ | 32522.0 | $2 \cdot 62$ | 32241199 | $2 \cdot 71$ | 3 I9 563 | $2 \cdot 8 \mathrm{I}$ | $\begin{array}{llll}3 & 17 & 4 \cdot 7\end{array}$ | $2 \cdot 91$ |
| 32 |  | 2.51 | $\begin{array}{llll}3 & 23 & 10.3\end{array}$ | 2.59 | $320032 \cdot 1$ | $2 \cdot 68$ | $\begin{array}{llllll}3 & 17 & 48 \cdot 4\end{array}$ | $2 \cdot 78$ | $311458 \cdot 8$ | $2 \cdot 88$ | $\begin{array}{llrr}3 & 12 & 3 \cdot 0\end{array}$ | $2 \cdot 98$ |
| 33 | $1320 \begin{array}{lll}3 & 58 \cdot 1\end{array}$ | $2 \cdot 56$ | $\begin{array}{llll}3 & 18 & 21.9\end{array}$ | $2 \cdot 65$ | $31540 \cdot 2$ | 2.74 | $\begin{array}{lrrr}3 & 12 & 52.7\end{array}$ | $2 \cdot 84$ | $\begin{array}{llll}3 & 9 & 58 \cdot 9\end{array}$ | $2 \cdot 95$ | $36588 \cdot 6$ | $3 \cdot 36$ |
| 34 | $3^{3} 16$ II'2 | $2 \cdot 61$ | $313 \begin{array}{llll}3 & 31.6\end{array}$ | 2.71 | 3 10 $46 \cdot 2$ | 2.81 | $3 \quad 7$ 7  | 2.91 | $\begin{array}{lllll}3 & 4 & 56 \cdot 4\end{array}$ | 3.03 | 3 I 5I'2 | $3 \cdot 15$ |
| 35 | $\left\lvert\, \begin{array}{lll}3 & 11 & 22.5\end{array}\right.$ | 2.67 | $\begin{array}{lll}3 & 8 & 39.2 \\ 3 & 3 & 44.6\end{array}$ | 2.77 2.8 | $\begin{array}{llll}3 & 5 & 49 \cdot 8 \\ 3 & 0 & 5\end{array}$ | 2.88 | $\begin{array}{lrr}3 & 2 & 53.9 \\ 2 & 5 & 5 \\ 5\end{array}$ | 2.99 | $\begin{array}{llll}2 & 59 & 51 & 0 \\ 2 & 54 & 42.5\end{array}$ | 311 | 2 56 $40 \cdot 7$ <br> 2 5  | 3.24 |
| 36 37 | $\left[\begin{array}{lll}3 & 6 & 31.8 \\ 3 & 1 & 38 \cdot 8\end{array}\right.$ | 2.73 | $\begin{array}{rrrr}3 & 3 & 44 \cdot 6 \\ 2 & 58 & 47 \cdot 6\end{array}$ | 2.84 | $\begin{array}{rrrr}3 & 0 & 51 \cdot 0 \\ 2 & 55 & 49 \cdot 5\end{array}$ | 2.95 | $\begin{array}{lllll}2 & 57 & 50 \cdot 5 \\ 2 & 52 & 44 \cdot 0\end{array}$ | 3.07 | $\begin{array}{lllll}2 & 54 & 42 \cdot 5 \\ 2 & 49 & 30 \cdot 6\end{array}$ | $3 \cdot 20$ | $2 \begin{array}{llll}2 & 51 & 26 \cdot 6 \\ 2 & 46 & 8 \cdot 7\end{array}$ | $3 \cdot 34$ |
| 37 | $\begin{array}{llll}3 & 1 & 38 \cdot 8\end{array}$ | 2.80 |  | 2.91 | $\begin{array}{llll}2 & 55 & 49 \cdot 5\end{array}$ | 3.03 | $25244^{\circ} \mathrm{O}$ | $3 \cdot 16$ | $\begin{array}{llll}2 & 49 & 30 \cdot 6\end{array}$ | $3 \cdot 29$ | $\begin{array}{llllllllllllllll}2 & 46 & 8 \cdot 7\end{array}$ | $3 \cdot 44$ |
| 38 | 2 | 2.87 | $\begin{array}{llllllllllllll}2 & 53 & 48 \cdot 1 \\ 2 & 48 & 45 \cdot 6\end{array}$ | 2.99 | $\begin{array}{lllll}2 & 50 & 45 \cdot 1 \\ 2 & 45 & 37 \cdot 4\end{array}$ | 3.12 | 24734.2 | 3.25 | $\begin{array}{llll}2 & 44 & 15 & \\ 2 & 0\end{array}$ | $3 \cdot 40$ | $\begin{array}{llllllllllllllllll}2 & 40 & 46 \cdot 7\end{array}$ | 3.55 |
| 39 | $25146 \%$ | $2 \cdot 95$ | $24845 \cdot 6$ | $3 \cdot 07$ | 245 37*4 | $3 \cdot 21$ | $242 \quad 20 \cdot 9$ | $3 \cdot 35$ | $23855 \cdot 3$ | 3.51 | 23519.9 | $3 \cdot 68$ |
| 40 | $124645 \cdot 5$ | 3.03 | $24340 \cdot 0$ | 3.16 | $2 \begin{array}{llll} & 40 & 26 \cdot 2\end{array}$ | $3 \cdot 30$ | $\begin{array}{llll}2 & 37 & 3\end{array}$ | $3 \cdot 46$ | 233 31.I | $3 \cdot 63$ | $22948 \cdot 1$ | 3.81 |
| 41 | $124142 \cdot 0$ | $3 \cdot 11$ | 23831.0 | $3 \cdot 26$ | 235111.1 | 3.41 | $23141 \cdot 7$ | $3 \cdot 58$ | 228 I.8 | $3 \cdot 76$ | $22410 \cdot 5$ | $3 \cdot 96$ |
| 42 | $\left[\begin{array}{lll}2 & 36 & 35 \cdot 1\end{array}\right.$ | 3.21 | 233188.2 | $3 \cdot 36$ | 22951.8 | 3.53 | $22615{ }^{\circ} \mathrm{O}$ | $3 \cdot 71$ | $\begin{array}{llll}2 & 22 & 26 \cdot 9\end{array}$ | 3.90 | $\begin{array}{llll}2 & 18 & 26.5\end{array}$ | $4 \cdot 12$ |
| 43 | $1 \begin{array}{lll}2 & 31 & 24 \cdot 7\end{array}$ | $3 \cdot 31$ | $\begin{array}{lll}2 & 28 & 1\end{array}$ | 3.47 | $\begin{array}{llll}2 & 24 & 27 \\ 2 & 7\end{array}$ | $3 \cdot 65$ | $\begin{array}{llllllll}2 & 20 & 42.9\end{array}$ | $3 \cdot 85$ | $\begin{array}{lllll}2 & 16 & 45 \cdot 8\end{array}$ | 4.06 | $\begin{array}{lllll}2 & 12 & 35.2\end{array}$ | $4 \cdot 30$ |
| 44 | 226 IO.I | $3 \cdot 42$ | $22239 \cdot 7$ | $3 \cdot 60$ | $218 \quad 58 \cdot 2$ | $3 \cdot 79$ | 2154.5 | 4.01 | 21057.5 | $4 \cdot 2$ | $2 \quad 6 \quad 35 \cdot 6$ | 4.51 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ}$ A. |  | L. $9^{\circ}$ A. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | s. | s. | s. | s. | s. | S. | s. | s. | s. | s. | s. | s. |
| 0 | - 50 | $-4 ; 37$ | -. 58 | $-4.38$ | - . 66 | $-4.39$ | -.75 | $-4.41$ | -.83 | $-4.42$ | - 92 | $-4.44$ |
| 2 | $\cdot 56$ | $4 \cdot 38$ | $\cdot 65$ | 4.39 | -73 | 4.41 | -82 | 4.42 | -90 | 4.44 | -99 | $4 \cdot 46$ |
| 4 | -63 | 4.39 | -72 | 4.40 | -80 | 4.42 | -89 | 4.44 | -97 | 4.45 | I.06 | $4 \cdot 47$ |
| 6 | -70 | 4.40 | -79 | 4.41 | -87 | 4.43 | -96 | $4 \cdot 45$ | I.05 | $4 \cdot 47$ | I'I4 | $4 \cdot 49$ |
| 8 | -77 | 4.41 | -86 | $4 \cdot 43$ | -94 | $4 \cdot 45$ | I.03 | $4 * 47$ | I-I2 | 4.49 | 1.2I | $4 \cdot 51$ |
| IO | . 84 | 4.43 | -93 | $4 * 44$ | I.02 | 4.46 | I'II | $4 * 49$ | I.20 | 4.51 | I. 29 | $4 \cdot 53$ |
| 12 | -92 | 4.44 | I'OI | $4 \cdot 46$ | I-10 | 4.48 | I-19 | $4 \cdot 51$ | I. 28 | $4 \cdot 53$ | I-38 | $4 \cdot 56$ |
| 14 | $\cdot 99$ | 4.46 | I.09 | $4 \cdot 48$ | I•I8 | $4 \cdot 50$ | I. 27 | $4 \cdot 53$ | I 37 | $4 \cdot 56$ | I.46 | $4 \cdot 59$ |
| I6 | I.07 | $4 \cdot 48$ | I•17 | $4 \cdot 50$ | I. 26 | 4.52 | I•36 | $4 \cdot 55$ | I.46 | $4 \cdot 58$ | I. 56 | $4 \cdot 62$ |
| 18 | I•16 | $4 \cdot 50$ | I 25 | $4 \cdot 52$ | I.35 | 4.55 | I 45 | $4 \cdot 58$ | I•55 | $4 \cdot 6 \mathrm{I}$ | I. 65 | $4 \cdot 65$ |
| 20 | I 24 | 4.52 | I.34 | 4.55 | I.44 | 4.58 | 1.55 | 4.6 I | 1.65 | $4 \cdot 65$ | 1.76 | $4 \cdot 69$ |
| 22 | I 34 | $4 \cdot 55$ | 1.44 | $4 \cdot 58$ | I•54 | $4 \cdot 61$ | 1.65 | $4 \cdot 65$ | 1.76 | $4 \cdot 69$ | 1.87 | $4 \cdot 73$ |
| 24 | 1.43 | $4 \cdot 58$ | I•54 | 4.61 | I 65 | $4 \cdot 65$ | I•76 | $4 \cdot 69$ | 1.87 | 4.73 | I.99 | $4 \cdot 78$ |
| 26 | I 54 | 4.61 | 1.65 | $4 \cdot 65$ | I•76 | $4 \cdot 69$ | I. 87 | 4.73 | I.99 | $4 \cdot 78$ | $2 \cdot 12$ | 4.83 |
| 28 | I. 65 | 4.65 | I•76 | $4 \cdot 69$ | 1.88 | 4.73 | $2 \cdot 00$ | 4.78 | $2 \cdot 13$ | $4 \cdot 84$ | $2 \cdot 25$ | $4 \cdot 89$ |
| 30 | 1.76 | $4 \cdot 69$ | 1.89 | 4.74 | $2 \cdot 01$ | $4 \cdot 79$ | 2.14 | $4 \cdot 84$ | 2.27 | 4.90 | 2.41 | 4.97 |
| 32 | I.89 | $4 \cdot 74$ | $2 \cdot 02$ | $4 \cdot 79$ | $2 \cdot 15$ | $4 \cdot 85$ | $2 \cdot 29$ | 4.91 | 2.43 | 4.98 | $2 \cdot 57$ | $5 \cdot 05$ |
| 34 | $2 \cdot 03$ | $4 \cdot 80$ | $2 \cdot 17$ | 4.86 | $2 \cdot 31$ | 4.92 | 2.45 | $4 * 99$ | $2 \cdot 60$ | $5 \cdot 07$ | $2 \cdot 76$ | $5 \cdot 15$ |
| 36 | $2 \cdot 18$ | 4.86 | $2 \cdot 33$ | 493 | 2.48 | 5.00 | 2.64 | 5.08 | $2 \cdot 80$ | $5 \cdot 17$ | $2 \cdot 97$ | $5 \cdot 27$ |
| 38 | $2 \cdot 35$ | 4.94 | $2 \cdot 51$ | 5.02 | 2.67 | 5.10 | $2 \cdot 84$ | 5.19 | $3 \cdot 02$ | $5 \cdot 29$ | $3 \cdot 22$ | $5 \cdot 4 \mathrm{I}$ |
| 40 | $2 \cdot 54$ | 5.03 | 2.71 | $5 \cdot 12$ | $2 \cdot 89$ | $5 \cdot 22$ | $3 \cdot 08$ | $5 \cdot 33$ | $3 \cdot 28$ | 5.45 | 3.50 | $5 \cdot 58$ |
| 4 I | $2 \cdot 64$ | $5 \cdot 09$ | 2.82 | $5 \cdot 18$ | 3.01 | $5 \cdot 29$ | 3.21 | 5.40 | 3.43 | $5 \cdot 53$ | 3.66 | $5 \cdot 68$ |
| 42 | 2.75 | $5 \cdot 14$ | 2.94 | $5 \cdot 25$ | $3 \cdot 14$ | $5 \cdot 36$ | $3 \cdot 36$ | $5 \cdot 49$ | $3 \cdot 58$ | 5.63 | 3.83 | $5 \cdot 79$ |
| 43 | 2.87 | $5 \cdot 21$ | 3.07 | $5 \cdot 32$ | $3 \cdot 28$ $3 \cdot 44$ | 5.45 5.54 | 3.51 3.68 | $5 \cdot 59$ | $3 \cdot 76$ | $5 \cdot 74$ | 4.03 | 5.92 6.07 |
| 44 | 3.00 | $5 \cdot 28$ | $3 \cdot 2 \mathrm{I}$ | $5 \cdot 40$ | 3.44 | $5 \cdot 54$ | $3 \cdot 68$ | 5.70 | 3.95 | $5 \cdot 87$ | $4 \cdot 24$ | 6.07 |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. | s. | $\begin{array}{cc} \text { H. M. } & \text { S. } \\ 5 & 37 \end{array}$ |  | н. м. s. | S. | H. M. S. | s. | 5 | S. | H. M. S. | S. |
| 2 | $\begin{array}{lllll}5 & 30 & 121 \\ 5 & 21 & 2\end{array}$ | I.82 | $\left\lvert\, \begin{array}{llll}5 & 37 & 30 \\ 5 & 28 & 31 \cdot 4\end{array}\right.$ | -1.80 r r | $\begin{array}{llll}5 & 35 \\ 5 & 26 & 40 \cdot 3\end{array}$ | -1.81 | $\begin{array}{llll}5 & 33 & 52 \cdot 6 \\ 5 & 24 & 47.9\end{array}$ | - 1.83 | 5 32 $2 \cdot 1$ <br> 5 22 $54 \cdot 2$ | $\begin{array}{r}1.85 \\ \mathrm{I} .9 \mathrm{I} \\ \hline\end{array}$ | $\begin{array}{llll}5 & 30 & 10.4 \\ 5 & 20 & 59.0\end{array}$ | .87 |
| 4 | 51212300 | I.87 | $51930 \cdot 3$ | I.89 | $51736 \cdot 3$ | $1 \times 91$ | $\begin{array}{lllllllll}5 & 15 & 40 \cdot 6\end{array}$ | I'94 | $\begin{array}{llll}5 & 13 & 43 \cdot 4\end{array}$ | $1 \cdot 97$ | II 44.5 | 2.00 |
|  | $\begin{array}{llll}512 & 22.4\end{array}$ | I.91 | 5 10 $26 \cdot 7$ | I•94 | $\begin{array}{llll}5 & 8 & 29.4\end{array}$ | $1 \cdot 97$ | $\begin{array}{llll}5 & 6 & 30 \cdot 3\end{array}$ | $2 \cdot 00$ | $\begin{array}{lll}5 & 4 & 29 \cdot 4\end{array}$ | 2.03 | $5 \quad 2 \quad 26 \cdot 4$ | 2.07 |
| 8 | $\begin{array}{llll}5 & 3 & 19.3\end{array}$ | $\pm \cdot 97$ | $5 \quad 120 \cdot 4$ | $2 \cdot 00$ | $4 \quad 59 \quad 19 \cdot 6$ | 2.03 | $4 \begin{array}{llll} & 57 & 16.8\end{array}$ | 2.06 | $455 \mathrm{II} \cdot 8$ | $2 \cdot 10$ | 53 4.6 | $2 \cdot 14$ |
| 10 | 45413.4 | 2. | $452 \mathrm{II} \cdot \mathrm{O}$ | 2.06 | 450 | 2.09 | 44759.7 | $2 \cdot 13$ | $44550 \cdot 5$ | $2 \cdot 18$ | $4338 \cdot 6$ | 2.22 |
| 12 | 4454.4 | 2.08 | $44258 \cdot 3$ | $2 \cdot 1$ | $44049 \cdot 8$ | $2 \cdot 16$ | 43838.6 | 2.21 | $\begin{array}{llll}4 & 36 & 24 \cdot 8\end{array}$ | 2.26 | $434 \quad 7 \cdot 9$ | $2 \cdot 31$ |
| 13 | 44028.6 | $2 \cdot 11$ | $43820 \cdot 6$ | $2 \cdot 15$ | $43610 \cdot 0$ | $2 \cdot 20$ | 43356.5 | 2.25 | $43140 \cdot 2$ | $2 \cdot 30$ | $42920 \cdot 7$ | $2 \cdot 35$ |
| 14 | 43552.0 | 2. | $43341 \cdot 9$ | 2.19 | 43129.0 | $2 \cdot 24$ | 42913.2 | $2 \cdot 29$ | $4 \begin{array}{llll}4 & 26 & 54\end{array}$ | $2 \cdot 34$ | $42432 \cdot 2$ | $2 \cdot 40$ |
| 15 | 43114.4 | $2 \cdot 18$ | 429292 | 23 | $42647 \cdot 0$ | $2 \cdot 28$ | 42428.7 | 2.33 | $\begin{array}{lll}4 \quad 22 & 7.2\end{array}$ | $2 \cdot 39$ | $41942 \cdot 2$ | $2 \cdot 45$ |
| 16 | 42635.9 | $2 \cdot 22$ | 24 | 7 | 4223.8 | $2 \cdot 32$ | 41942.9 | $2 \cdot 38$ | 4178186 | 2.43 | $1450 \cdot 7$ |  |
| 17 | $42156 \cdot 2$ | 2.2 | 41939.4 | $2 \cdot 31$ | $\begin{array}{llllll}4 & 17 & 19.3\end{array}$ | $2 \cdot 36$ | 41455.8 | $2 \cdot 42$ | $\begin{array}{llllll}4 & 12 & 28.6\end{array}$ | 2.49 | $957 \cdot 5$ | $2 \cdot 55$ |
| 18 | $\begin{array}{llllll}4 & 17 & 15.5\end{array}$ | $2 \cdot 29$ | $4 \begin{array}{llll}4 & 14 & 56.3\end{array}$ | $2 \cdot 35$ | $\begin{array}{lllllll}4 & 12 & 33.6\end{array}$ | 2.41 | 4107.2 | 2.47 | $\begin{array}{llll}4 & 7 & 36.9\end{array}$ | $2 \cdot 54$ | $\begin{array}{ll}5 & 2.7\end{array}$ | 2.61 |
| 19 | 4 12 <br> 4 33.6 | $2 \cdot 33$ | 41011.8 | $2 \cdot 39$ | $\begin{array}{lll}4 & 7 & 46 \cdot 4\end{array}$ | $2 \cdot 46$ | $\begin{array}{llll}4 & 5 & 17 \cdot 1\end{array}$ | $2 \cdot 52$ | $\begin{array}{ccrl}4 & 2 & 43.7\end{array}$ | $2 \cdot 59$ | - 6.0 | 2.67 |
| 20 | $4750 \cdot 5$ | $2 \cdot 38$ | $4 \quad 526 \cdot 0$ | 2.44 | $4 \quad 2577$ | $2 \cdot 50$ | $4 \quad 0 \quad 25 \cdot 4$ | 2.57 | $\begin{array}{llllllllll}3 & 57 & 48\end{array}$ | $2 \cdot 65$ | $\begin{array}{lll}3 & 55 & 7 \cdot 5\end{array}$ | $2 \cdot 73$ |
| 21 | 36.0 | $2 \cdot 42$ | 4 - 38.8 | 2.49 | $\begin{array}{lll}3 & 58 & 7 \cdot 5\end{array}$ | $2 \cdot 56$ | 355 31•9 | $2 \cdot 63$ | $35251 \cdot 8$ | 2.71 | $50 \quad 6 \cdot 9$ | $2 \cdot 79$ |
| 22 | $\begin{array}{llll}3 & 58 & 20 \cdot 2\end{array}$ | $2 \cdot 47$ | 355 50.0 | $2 \cdot 54$ | 35315.6 | 2.61 | $35036 \cdot 6$ | $2 \cdot 69$ | 34752.9 | 2.77 | 34540 | 2.86 |
| 23 | $5332 \cdot 8$ | $2 \cdot 52$ | $35059 \cdot 6$ | $2 \cdot 59$ | 34821.9 | $2 \cdot 67$ | 34539.4 | $2 \cdot 75$ | $\begin{array}{llll}3 & 42 & 51.8\end{array}$ | $2 \cdot 84$ | $\begin{array}{llll}3 & 39 & 58.9\end{array}$ | 2.93 |
| 24 | $\begin{array}{llll}3 & 48 & 43 \cdot 9\end{array}$ | 2.57 | $3 \begin{array}{lll}36 & 7 & 5\end{array}$ | $2 \cdot 65$ | $34326 \cdot 3$ | $2 \cdot 73$ | $34040 \cdot 0$ | 2.81 | 3 3748 | 2.91 | $33451 \cdot 2$ | 3.01 |
| 25 | $34353 \cdot 3$ | $2 \cdot 62$ | 34113.5 | $2 \cdot 70$ | $\begin{array}{llll}3 & 38 & 28.7\end{array}$ | $2 \cdot 79$ | $3 \quad 35 \quad 38 \cdot 5$ | 2.88 | $\begin{array}{ll}3 & 3242 \cdot 7\end{array}$ | 2.98 | $32940 \cdot 8$ | 3.08 |
| 26 | $\begin{array}{lll}3 & 39 & 0.9\end{array}$ | 68 | 33617.5 | 2.77 | 33328.8 | 2.86 | $33034 \cdot 5$ | $2 \cdot 95$ | 32734.2 | 3.06 | $32427 \cdot 5$ | $3 \cdot 17$ |
| 27 | $\begin{array}{llll}3 & 34 & 6 \cdot 5\end{array}$ | 2.74 | $\begin{array}{llllll}3 & 31 & 19.4\end{array}$ | 2.83 |  | $2 \cdot 93$ | $\begin{array}{llll}3 & 25 & 28 \cdot 0\end{array}$ | 3.03 | $\begin{array}{llll}3 & 22 & 22.9\end{array}$ | $3 \cdot 14$ | 319 II-1 | 3.26 |
| 28 | $\begin{array}{llll}3 & 29 & 10 \cdot 1\end{array}$ | 2.80 | $\begin{array}{llll}3 & 26 & 19 \cdot 1 \\ 3 & 19\end{array}$ | $2 \cdot 90$ | $\begin{array}{llll}3 & 23 & 22 \cdot 1\end{array}$ | 3.00 |  | $3 \cdot 11$ | $\begin{array}{llll}3 & 17 & 8.6\end{array}$ | 3.23 | $31351 \cdot 3$ | 3.35 |
| 29 | $\begin{array}{lllll}3 & 24 & 115 \\ 3 & 19 & 10\end{array}$ | 2.87 2.94 |  | 2.97 3.05 | $\begin{array}{lllll}3 & 18 & 14 \cdot 7 \\ 3 & 13 & 4 \cdot 4\end{array}$ | 3.08 3.17 | $\begin{array}{llll}3 & 15 & 6 \cdot 4 \\ 3 & 5 & \end{array}$ | 3.20 3.29 | $\begin{array}{llll}3 & 11 & 50 \cdot 9 \\ & 6 & 20.7\end{array}$ | 3.32 | $\begin{array}{ll}8 & 27 \cdot 8\end{array}$ | 3.45 3.56 |
| 30 | 31910.5 | 2.94 | $31610 \cdot 8$ | 3.05 | 3134 | $3 \cdot 17$ | $3 \quad 9 \quad 50 \cdot 9$ | 3.29 | 629.7 | 3.42 | $\begin{array}{ll}3 & 0.3\end{array}$ | 3.56 |
| 31 | $\begin{array}{llll}3 & 14 & 6.9\end{array}$ | 3.02 | $\begin{array}{ll}\text { II } & 2.5\end{array}$ | 3.13 | $\begin{array}{llll}3 & 7 & 50.9\end{array}$ | $3 \cdot 26$ | 4 3r 8 | 3.39 | $\begin{array}{llll}3 & 1 & 4.5\end{array}$ | 3.53 | $2 \begin{array}{llll}27 & 28.4\end{array}$ | 3.68 |
| -32 | $\begin{array}{llll}3 & 9 & 0 \cdot 6\end{array}$ | $3 \cdot 10$ | 5 51.1 | $3 \cdot 22$ | [ $30234 \cdot 1$ | 335 | 2 59 $8 \cdot 9$ <br> 2 5  | 3.49 | 2 $535^{\circ} \mathrm{O}$ | 3.64 | 25151.8 | $3 \cdot 8 \mathrm{I}$ |
| 33 | 3 3 51.2 | 3-19 | 3 O $\quad 36 \cdot 3$ | 3.31 |  | 3.45 | $2534 \mathrm{I} \cdot 8$ | 3.60 | 250 | 3.77 | 2469.8 | 3.94 |
| 34 | $2{ }^{2} 5838.6$ | $3 \cdot 28$ | ${ }_{2} 55517.9$ | $3 \cdot 42$ | 25148.7 | 3.56 | 248 10•1 | 3.73 | $24421 \cdot 5$ | 3.90 | $24021 \cdot 9$ | 4.09 |
| 35 | 25322.4 | $3 \cdot 38$ | $24955 \cdot 5$ | $3 \cdot 52$ | 24619.4 | 3.68 | $24233 \cdot 3$ | 3.86 | 23836.4 | $4 \cdot 05$ | $23427 \cdot 6$ | 4.25 |
| 36 | 248 48 | $3 \cdot 48$ | 24428.7 | $3 \cdot 64$ | $24045 \cdot 2$ | 3.8 r | $23650 \cdot 9$ | 4.00 | 23244.9 | 4.21 | 22825.9 | 43 |
| 37 | $\begin{array}{lllll}2 & 42 & 37 \cdot 8\end{array}$ | $3 \cdot 59$ | $2 \begin{array}{llll}2 & 38 & 56 \cdot 9\end{array}$ | $3 \cdot 77$ | $\begin{array}{llll}2 & 35 & 5.4\end{array}$ | $3 \cdot 95$ | $\begin{array}{lll}2 & 31 & 2 \cdot 3\end{array}$ | $4 \cdot 16$ | $\begin{array}{llll}2 & 26 & 46 \cdot 2\end{array}$ | $4 \cdot 38$ | $22216 \cdot 1$ | 4.63 |
| 38 | 2378.6 | 3.72 | 23319.9 | 3.91 | 22919.6 | $4 \cdot 1 \mathrm{I}$ | $\begin{array}{lll}2 & 25 & 6.6\end{array}$ | 4.33 | $22039 \cdot 5$ | $4 \cdot 58$ | 1556.9 | 4.86 |
| 39 | 2 31 34.2 <br> 2 25 53.8 | 3.86 | $2 \begin{array}{llll}2 & 27 & 36.8\end{array}$ | 4.06 | $\begin{array}{llll}2 & 23 & 26.9 \\ 2 & 17 & 6.3\end{array}$ | 4.28 | $\begin{array}{lll}2 & 19 & 3.0 \\ 2.0\end{array}$ | 4.53 | $\begin{array}{lllll}2 & 14 & 23.6\end{array}$ | $4 \cdot 80$ | $\begin{array}{ll}9 & 26 \cdot 9\end{array}$ | 1 |
| 40 | 22553.8 | 4.01 | $22147 \%$ | 4.23 | 21726.3 | 4.47 | 21250.4 | 4.74 | $757 \cdot 2$ | $5 \cdot 05$ | $244 \cdot 5$ | 5.39 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$ |  | I. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. | s. -4.46 | s. | s. | s. | s. | s. | s. | s. | s. | s. | S. |
| 2 | 1.08 | -4.48 | - $1 \cdot 17$ | 4.48 4.50 | $1 \cdot 26$ | 4.52 | 1.27 1.35 | 4.53 4.55 | 1.36 | 4.55 4.58 | - $\begin{array}{r}1.46 \\ 1.53\end{array}$ | 4.58 4.61 |
| 4 | I. 15 | $4 \cdot 50$ | $1 \cdot 24$ | $4 \cdot 52$ | I 33 | $4 \cdot 54$ | $1 \cdot 42$ | 4.57 | 1.52 | $4 \cdot 60$ | I.6I | $4 \cdot 64$ |
| 6 | $1 \cdot 23$ | $4 \cdot 52$ | $1 \cdot 32$ | $4 \cdot 54$ | $1 \cdot 41$ | $4 \cdot 57$ | r-5I | $4 \cdot 60$ | I. 60 | 4.63 | $1 \cdot 70$ | $4 \cdot 67$ |
| 8 | 1.31 | $4 \cdot 54$ | $1 \cdot 40$ | $4 \cdot 56$ | 1.49 | $4 \cdot 60$ | 1.59 | $4^{* 63}$ | I•69 | $4^{\cdot 66}$ | $1 \cdot 79$ | $4 \cdot 70$ |
| 10 | 1•39 | 4.56 | $1 \cdot 48$ | $4 \cdot 59$ | I. 58 | $4 \cdot 63$ | 1.68 | $4 \cdot 66$ | $1 \cdot 78$ | $4 \cdot 70$ | 1.88 | 4.74 |
| 12 | $1 \cdot 47$ | $4 \cdot 59$ | 1.57 | $4 \cdot 62$ | 1.67 | $4 \cdot 66$ | 1•77 | $4 \cdot 69$ | 1.88 | $4 \cdot 73$ | $1 \cdot 98$ | $4 \cdot 78$ |
| 14 | I.56 | $4 \cdot 62$ | 1.66 | $4 \cdot 65$ | $1 \cdot 77$ | $4 \cdot 69$ | 1.87 | $4 \cdot 73$ | 1•98 | $4 \cdot 77$ | $2 \cdot 09$ | 4.82 |
| 16 | ェ.66 | $4 \cdot 65$ | $1 \cdot 76$ | $4 \cdot 69$ | 1.87 | $4 \cdot 73$ | $\underline{1} \cdot 98$ | $4 \cdot 77$ | $2 \cdot 09$ | $4 \cdot 82$ | 2.20 | $4 \cdot 87$ |
| 18 | 1.76 | $4 \cdot 69$ | 1.87 | $4 \cdot 73$ | $1 \cdot 98$ | $4 \cdot 77$ | 2.09 | 4.82 | 2.21 | $4 \cdot 87$ | $2 \cdot 33$ | 4.93 |
| 20 | ¢.87 | 4.73 | 1.98 | $4 \cdot 77$ | $2 \cdot 09$ | 4.82 | $2 \cdot 21$ | 4.88 | $2 \cdot 33$ | 4.93 | $2 \cdot 46$ | $4 \cdot 99$ |
| 22 | I.98 | $4 \cdot 78$ | $2 \cdot 10$ | $4 \cdot 83$ | 2.22 | $4 \cdot 88$ | 2.34 | $4 \cdot 94$ | 2.47 | $5 \cdot 0$ | 2.60 | $5 \cdot 07$ |
| 24 | $2 \cdot 11$ | 4.83 | $2 \cdot 23$ | 4.88 | $2 \cdot 36$ | $4 \cdot 94$ | $2 \cdot 49$ | $5 \cdot 01$ | $2 \cdot 62$ | $5 \cdot 08$ | $2 \cdot 76$ | $5 \cdot 15$ |
|  | 2.24 2.39 | $4 \cdot 89$ 4.96 | 2.37 2.53 | 4.95 5.03 | 2.51 2.67 | $5 \cdot 5$ | 2.65 2.82 | 5.09 | $2 \cdot 72$ | $5 \cdot 16$ | $2 \cdot 94$ | $5 \cdot 25$ |
| 28 | $2 \cdot 39$ | $4 \cdot 96$ | 2.53 | 5.03 | $2 \cdot 67$ | $5 \cdot 10$ | 2.82 | $5 \cdot 18$ | $2 \cdot 98$ | $5 \cdot 27$ | $3 \cdot 14$ | $5 \cdot 36$ |
| 30 | 2.55 | $5 \cdot 04$ | 2.70 | $5 \cdot 11$ | $2 \cdot 85$ | $5 \cdot 20$ | 3.01 | $5 \cdot 29$ | $3 \cdot 18$ | $5 \cdot 39$ | 3.36 | $5 \cdot 49$ |
| 32 | $2 \cdot 73$ | $5 \cdot 13$ | 2.89 | $5 \cdot 22$ | 3.06 | $5 \cdot 31$ | 3.23 | $5 \cdot 42$ | 3.42 , | $5 \cdot 53$ | $3 \cdot 62$ | $5 \cdot 65$ |
| 33 | 2.83 | $5 \cdot 18$ | 2.99 | $5 \cdot 28$ | $3 \cdot 17$ | $5 \cdot 38$ | $3 \cdot 35$ | $5 \cdot 49$ | $3 \cdot 55$ | $5 \cdot 61$ | $3 \cdot 76$ | $5 \cdot 75$ 5.85 |
| 34 | 2.93 | $5 \cdot 24$ | 3.10 | $5 \cdot 34$ | 3.29 | $5 \cdot 45$ | 3.48 | $5 \cdot 57$ | $3 \cdot 69$ | $5 \cdot 70$ | $3 \cdot 92$ | $5 \cdot 85$ |
| 35 | $3 \cdot 04$ | $5 \cdot 30$ | $3 \cdot 22$ | $5 \cdot 41$ | $3 \cdot 42$ | $5 \cdot 53$ | $3 \cdot 63$ | $5 \cdot 66$ | $3 \cdot 85$ | $5 \cdot 80$ | 4.09 | 5.97 |
| 36 | $3 \cdot 16$ | $5 \cdot 37$ | $3 \cdot 35$ | $5 \cdot 49$ | $3 \cdot 56$ | $5 \cdot 62$ | 3.78 | 5.76 | 4.02 | $5 \cdot 92$ | 4.28 | $6 \cdot 10$ |
| 37 | $3 \cdot 28$ | $5 \cdot 45$ | 3.49 | $5 \cdot 57$ | 3.71 | 5.71 | 3.95 | 5.87 | 4.20 | $6 \cdot 04$ | $4 \cdot 48$ | $6 \cdot 24$ |
| 38 | 3.42 | 5.53 | $3 \cdot 64$ | $5 \cdot 67$ | 3.87 | $5 \cdot 82$ | $4 \cdot 13$ | $5 \cdot 99$ | 4.41 | $6 \cdot 19$ | $4 \cdot 71$ | $6 \cdot 41$ |
| 39 | 3.57 | $5 \cdot 62$ | 3.80 | $5 \cdot 77$ | 4.05 | $5 \cdot 94$ | $4 \cdot 33$ | $6 \cdot 13$ | $4 \cdot 63$ | $6 \cdot 35$ | 4.97 | 6.60 |
| 40 | $3 \cdot 73$ | $5 \cdot 73$ | 3.98 | $5 \cdot 89$ | 4.25 | $6 \cdot 08$ | $4 \cdot 56$ | $6 \cdot 30$ | $4 \cdot 89$ | $6 \cdot 54$ | $5 \cdot 26$ | $6 \cdot 82$ |

## LATITUDE $23^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| $\bigcirc$ | 52817.4 | - I.89 | $\begin{array}{llll}5 & 26 & 23 \cdot 0\end{array}$ | - I.92 | $\begin{array}{llll}5 & 24 & 27 \cdot 0\end{array}$ | - I'95 | $\begin{array}{llll}5 & 22 & 29.4\end{array}$ | - 1.97 | $5 \quad 2030 \cdot 0$ | $-2.00$ | $\begin{array}{llll}5 & 18 & 28.8\end{array}$ | $-2.04$ |
| 2 | $\begin{array}{llll}5 & 19 & 2 \cdot 2\end{array}$ | I.96 | $5 \mathrm{I} 713 \cdot 8$ | I•99 | $\begin{array}{llll}5 & 15 & 3.5\end{array}$ | $2 \cdot 02$ | $\begin{array}{llll}5 & 13 & 1.3\end{array}$ | $2 \cdot 05$ | 5 10 57.0 | $2 \cdot 09$ | $\begin{array}{llllllllllllllll}5 & 8 & 50 \cdot 6\end{array}$ | $2 \cdot 13$ |
| 4 | $\begin{array}{llll}5 & 9 & 43 \cdot 7\end{array}$ | $2 \cdot 03$ | $\begin{array}{lllll}5 & 7 & 40 \cdot 9\end{array}$ | $2 \cdot 06$ | $\begin{array}{llll}5 & 5 & 36 \cdot 0\end{array}$ | $2 \cdot 10$ | $\begin{array}{llll}5 & 3 & 28 \cdot 9\end{array}$ | $2 \cdot 14$ | 5 I 19.5 | $2 \cdot 18$ | $4 \quad 59 \quad 7 \cdot 5$ | $2 \cdot 22$ |
| 6 | $5021 \cdot 3$ | $2 \cdot 10$ | $45^{88} 14.0$ | $2 \cdot 14$ | 456 | 2.18 | $45352 \cdot 0$ | $2 \cdot 23$ | 45 I $36 \cdot 9$ | $2 \cdot 27$ | 449 I9'I | $2 \cdot 32$ |
| 8 | 45054.9 | 2.18 | $44^{8} 42 \cdot 7$ | $2 \cdot 23$ | $44627 \cdot 7$ | 2.27 | $444 \quad 9.9$ | $2 \cdot 32$ | 4 4I 48.9 | $2 \cdot 38$ | 43924.8 | 2.43 |
| 10 | $44124^{\circ} \mathrm{O}$ | $2 \cdot 27$ | $439 \quad 6 \cdot 5$ | $2 \cdot 32$ | 43645.9 | 2.37 | $434{ }^{2} 2^{\circ} 1$ | 2.43 | 4 3I $54 \cdot 8$ | $2 \cdot 49$ | $\begin{array}{llll}4 & 29 & 23.8\end{array}$ | $2 \cdot 55$ |
| 12 | $43148 \cdot 1$ | $2 \cdot 36$ | 429250 | $2 \cdot 41$ | $42658 \cdot 3$ | $2 \cdot 47$ | $42428 \cdot 0$ | $2 \cdot 54$ | $42153 \cdot 8$ | $2 \cdot 60$ | $\begin{array}{llll}4 & 19 & 15.5\end{array}$ | $2 \cdot 68$ |
| 14 | $4226 \cdot 6$ | 2.46 | $4 \begin{array}{llll}4 & 19 & 37 \cdot 2\end{array}$ | $2 \cdot 52$ | 4 I7 $4^{1.1}$ | 2.59 | 4 I4 $26 \cdot 8$ | $2 \cdot 66$ | 4 II $45^{\circ} \mathrm{I}$ | $2 \cdot 73$ | 48858.8 | 2.81 |
| 15 | 41713.5 | $2 \cdot 51$ | 4 I4 4I'O | $2 \cdot 58$ | 4124.3 | $2 \cdot 65$ | $4 \begin{array}{llll}4 & 9 & 23 \cdot 3\end{array}$ | $2 \cdot 72$ | $46637 \cdot 6$ | 2.80 | $\begin{array}{llll}4 & 3 & 47 \cdot 1\end{array}$ | $2 \cdot 89$ |
| I6 | 4 I2 I 8.8 | 2.56 | $4 \quad 942 \cdot 9$ | $2 \cdot 63$ | $4 \quad 7 \quad 2 \cdot 6$ | $2 \cdot 71$ | $4 \begin{array}{llll}4 & 4 & 17.6\end{array}$ | $2 \cdot 79$ | 4 1 27•8 | $2 \cdot 87$ | $\begin{array}{llll}3 & 58 & 32 \cdot 8\end{array}$ | 2.96 |
| 17 | 47722.4 | 2.62 | $\begin{array}{llll}4 & 4 & 42 \cdot 8\end{array}$ | $2 \cdot 70$ | $\begin{array}{rrr}4 & 1 & 58 \cdot 8\end{array}$ | $2 \cdot 77$ | $\begin{array}{llll}3 & 59 & 9 \cdot 8\end{array}$ | $2 \cdot 86$ | $35615 \cdot 6$ | $2 \cdot 95$ | $\begin{array}{llll}3 & 53 & 15.9\end{array}$ | $3 \cdot 04$ |
| 18 | $4224^{\circ} \mathrm{I}$ | $2 \cdot 68$ | $35940 \cdot 8$ | $2 \cdot 76$ | $35652 \cdot 7$ | $2 \cdot 84$ | $\begin{array}{llllllllll}3 & 53 & 59 & \end{array}$ | $2 \cdot 93$ | $3 \mathrm{5I} 0 \cdot 8$ | 3.03 | 347 56.2 | $3 \cdot 13$ |
| 19 | $\begin{array}{lllllllllllllll}3 & 57 & 23.7\end{array}$ | 2.74 | $\begin{array}{llll}3 & 54 & 36 \cdot 7\end{array}$ | 2.83 | $\begin{array}{llll}3 & 51 & 44.4 \\ 3 & 46 & 3\end{array}$ | 2.92 | 3 48 $46 \cdot 7$ <br> 3 43  <br> 1   | 3.01 | $\begin{array}{llll}3 & 45 & 43 \cdot 1 \\ 3 & 40 & 21.5\end{array}$ | 3.11 | $\begin{array}{llll}3 & 42 & 33 \cdot 3 \\ 3 & 37 & 7 \cdot 2\end{array}$ | $3 \cdot 22$ |
| 20 | 35221.4 | 2.81 | $34930 \cdot 2$ | $2 \cdot 90$ |  | 2.99 | 343 3I'I | 3.09 | $3 \begin{array}{llllllll}3 & 40 & 22.5\end{array}$ | 3.20 | $\begin{array}{llll}3 & 37 & 7 \cdot 2\end{array}$ | $3 \cdot 31$ |
| 21 | 34716.8 | 2.88 | 3442103 | $2 \cdot 97$ | $34 \mathrm{I} 20^{\circ} \mathrm{O}$ | $3 \cdot 07$ | $33^{88}$ 12.6 | 3.18 | $33458 \cdot 6$ | $3 \cdot 29$ | 3 31 37.6 | 3.41 |
| 22 | $\begin{array}{lll}3 & 42 & 9.8\end{array}$ | $2 \cdot 95$ | 3 39 $9 *$ | 3.05 | $\begin{array}{llll}3 & 36 & 3 \cdot 6\end{array}$ | $3 \cdot 16$ | $\begin{array}{llll}3 & 32 & 50.9\end{array}$ | 3.27 | $3293 \mathrm{I} \cdot 3$ | $3 \cdot 39$ | $32640 \cdot 1$ | 3.52 |
| 23 | $\begin{array}{lll}3 & 37 & 0.2\end{array}$ | 3.03 | 3 33 55.4 <br>    | $3 \cdot 13$ | $\begin{array}{llll}3 & 30 & 44 \cdot 1\end{array}$ | $3 \cdot 25$ | $\begin{array}{llll}3 & 27 & 25^{\circ} 9 \\ 3 & 21 & 5\end{array}$ | $3 \cdot 37$ | $\begin{array}{lll}3 & 24 & 0.2 \\ 3 & 18 & 250\end{array}$ | 3.49 | $\begin{array}{llllllllllllll}3 & 20 & 26 \cdot 5\end{array}$ | $3 \cdot 63$ |
| 24 | $3 \mathrm{3I} 4778$ | $3 \cdot 11$ | $\begin{array}{lllllllllll}3 & 28 & 38 \cdot 0\end{array}$ | 3.22 |  | $3 \cdot 34$ | $\begin{array}{llll}3 & 21 & 57 \cdot 1\end{array}$ | 3.47 | $\begin{array}{llll}3 & 18 & 25^{\circ} 0\end{array}$ | $3 \cdot 6 \mathrm{I}$ | 315444.3 | 3.75 |
| 25 | $32632 \cdot 5$ | $3 \cdot 20$ | $\begin{array}{lllll}3 & 23 & 17 \cdot 3\end{array}$ | $3 \cdot 31$ | $\begin{array}{lllllllll}3 & 19 & 54.8\end{array}$ | $3 \cdot 44$ | $\begin{array}{llll}3 & 16 & 24^{\circ} 4\end{array}$ | $3 \cdot 58$ | $\begin{array}{llll}3 & 12 & 45.4\end{array}$ | 3.73 | $3 \begin{array}{lllllll}3 & 8 & 57 \cdot 3\end{array}$ | $3 \cdot 88$ |
| 26 | 32114.0 | 3.29 | 317853.1 | $3 \cdot 4 \mathrm{I}$ | $\begin{array}{lllll}3 & 14 & 24.4\end{array}$ | $3 \cdot 55$ | 3 10 47.3 | 3.69 | $371 \cdot 0$ | $3 \cdot 85$ | $\begin{array}{lll}3 & 3 & 4.9\end{array}$ | 4.02 |
| 27 | $31552 \cdot 0$ | $3 \cdot 38$ | 3 I2 25.1 | $3 \cdot 52$ | $\begin{array}{llll}3 & 8 & 49 \cdot 8\end{array}$ | $3 \cdot 66$ | $\begin{array}{llll}3 & 5 & 5 \cdot 5\end{array}$ | 3.82 | 3 I II.3 | 3.99 | $2 \begin{array}{lll}2 & 57 & 6 \cdot 6\end{array}$ | 4.18 |
| 28 | 31026.2 | $3 \cdot 49$ | $3 \quad 6 \quad 52 \cdot 9$ | 3.63 | $\begin{array}{llll}3 & 3 & 10.5\end{array}$ | 3.79 | $\begin{array}{llll}2 & 59 & 18 \cdot 4\end{array}$ | $3 \cdot 96$ | $25515 \cdot 8$ | $4 \cdot 14$ | 251107 | $4 \cdot 34$ |
| 29 | $\begin{array}{lrrr}3 & 4 & 56 \cdot 4\end{array}$ | $3 \cdot 60$ | 3 1 $16 \cdot 1$ <br> 2 5  | 3.75 | $\begin{array}{llll}2 & 57 & 26 \cdot 1 \\ 2 & 51 & 36 \cdot 1\end{array}$ | 3.92 | 2 53 $25 \cdot 7$ <br> 2 4  | $4 \cdot 10$ | $\begin{array}{llll}2 & 49 & 13.9 \\ 2 & 43 & 4.8\end{array}$ | 4.30 | $\begin{array}{llll}2 & 44 & 49 \cdot 5\end{array}$ | $4 \cdot 52$ |
| 30 | $25922 \cdot I ~$ 2 | 3.72 | $\begin{array}{lll}2 & 55 & 34 \cdot 3\end{array}$ | 3.88 | $\begin{array}{llll}2 & 51 & 36 \cdot 1\end{array}$ | 4.06 | $\begin{array}{llll}2 & 47 & 26 \cdot 6\end{array}$ | 4.26 | $\begin{array}{lll}2 & 43 & 4 \cdot 8 \\ 2 & 36 & 4.7\end{array}$ | $4 \cdot 48$ | $\begin{array}{llll}2 & 38 & 2903 \\ 2 & 35 & 59\end{array}$ | $4 \cdot 72$ |
| 31 | $25342 \cdot 9$ | $3 \cdot 84$ | 24947.0 | $4^{\circ} \mathrm{O} 2$ | $24539{ }^{\circ} 9$ | $4 \cdot 22$ | $24120 \cdot 6$ | 4.43 | $23647 \cdot 7$ | $4 \cdot 67$ | 2315909 | 4.94 |
| 32 | $24758 \cdot 3$ | 3.98 | $\begin{array}{llll}2 & 43 & 53 \cdot 6\end{array}$ | $4 \cdot 18$ | $23936 \cdot 8$ | $4 \cdot 39$ | $\begin{array}{lll}2 & 35 & 6 \cdot 7\end{array}$ | 4.63 | 23021.7 | $4 \cdot 89$ | $225 \quad 20 \cdot 1$ | 5.18 |
| 33 | $2{ }_{2} 42$7 | $4 \cdot 14$ | $\begin{array}{llll}2 & 37 & 53.5 \\ 2 & 31 & 5\end{array}$ | $4 \cdot 35$ | $\begin{array}{llll}2 & 33 & 26 \cdot 0 \\ 2 & 27 & 6 \cdot 5\end{array}$ | $4 \cdot 58$ | $\begin{array}{llll}2 & 28 & 43 \cdot 9\end{array}$ | $4 \cdot 84$ | $\begin{array}{llll}2 & 23 & 45.4 \\ 2 & 16 & 5\end{array}$ | $5 \cdot 13$ | $\begin{array}{llll}2 & 18 & 28.5\end{array}$ | 5.46 |
| 34 | 23610.4 | $4 \cdot 30$ | $\begin{array}{llll}2 & 31 & 45 \cdot 8\end{array}$ | $4 \cdot 53$ | $\begin{array}{llr}2 & 27 & 6 \cdot 5\end{array}$ | 4.79 | $\begin{array}{lllll}2 & 22 & I I \cdot I \\ 2 & \end{array}$ | $5 \cdot 07$ | 2 I 657.5 | 5.40 | 2 II 23.2 | $5 \cdot 77$ |
| 35 | $\begin{array}{llll}2 & 30 & 5 \cdot 8\end{array}$ | $4 \cdot 48$ | $\begin{array}{llll}2 & 25 & 29.5\end{array}$ | $4 \cdot 74$ | $22037 \cdot 2$ | $5 \cdot 02$ | $2 \begin{array}{llll}2 & 15 & 26 \cdot 8\end{array}$ | $5 \cdot 34$ | $2956 \cdot 1$ | $5 \cdot 71$ | 2417 | $6 \cdot 13$ |
| 36 | $22352 \cdot 7$ | $4^{*} 69$ | $\begin{array}{llll}2 & 19 & 3.6\end{array}$ | 4.97 | $21356 \cdot 6$ | $5 \cdot 29$ | $2 \begin{array}{llll}2 & 8 & 29.3\end{array}$ | $5 \cdot 65$ | $2238 \cdot 8$ | $6 \cdot 07$ | I $562 \mathrm{I} \cdot 2$ | $6 \cdot 56$ |
| VARIATION TO $\mathbf{x}^{\prime}$ OF LATITUDE AND ALTITUDE. |  |  |  |  |  |  |  |  |  |  |  |  |
| Alt. | L. $18{ }^{\circ}$ | A. | L. $19^{\circ}$ | A | L. 20 | A. | L. 21 | A. | L. 22 | A. | L. 23 | A. |
| $\bigcirc$ | S. | , | , | S. | S. | S. |  | S. | S. | s. | s. | S. |
| 0 | - 1.55 | 4.61 | - I. 64 | -4.64 | - I•74 | $4 \cdot 68$ | - I. 84 | $-4.72$ | - I.94 | 4.75 | $-2.04$ | $-4.80$ |
| 2 | I. 63 | $4 \cdot 64$ | I•72 | $4 \cdot 68$ | I.82 | $4 \cdot 71$ | I•92 | $4 \cdot 75$ | $2 \cdot 02$ | $4 \cdot 79$ | $2 \cdot 13$ | $4 \cdot 84$ |
| 4 | I•7 | $4 \cdot 67$ | I.8I | 4.71 | I•91 | 4.75 | $2 \cdot 01$ | $4 \cdot 79$ | $2 \cdot 11$ | $4 \cdot 83$ | $2 \cdot 22$ | $4 \cdot 88$ |
| 6 | 1.80 | $4 \cdot 70$ | I.90 | $4 \cdot 74$ | $2 \cdot 00$ | 4.78 | $2 \cdot 11$ | 4.83 | $2 \cdot 21$ | $4 \cdot 88$ | $2 \cdot 32$ | $4 \cdot 93$ |
| 8 | I. 89 | 4.74 | I•99 | $4 \cdot 78$ | $2 \cdot 10$ | $4 \cdot 83$ | $2 \cdot 21$ | $4 \cdot 87$ | $2 \cdot 32$ | 4.95 | $2 \cdot 43$ | 4.98 |
| 10 | 1.99 | $4 \cdot 78$ | $2 \cdot 09$ | 4.82 | $2 \cdot 20$ | 4.87 | $2 \cdot 32$ | 4.92 | $2 \cdot 43$ | $4 \cdot 98$ | $2 \cdot 55$ | 5.04 |
| 12 | $2 \cdot 09$ | 4.82 | $2 \cdot 20$ | $4 \cdot 87$ | $2 \cdot 31$ | $4 \cdot 92$ | 2.43 | $4 \cdot 98$ | $2 \cdot 55$ | $5 \cdot 04$ | $2 \cdot 68$ | $5 \cdot 10$ |
| 14 | $2 \cdot 20$ | $4 \cdot 87$ | $2 \cdot 32$ | $4 \cdot 93$ | $2 \cdot 43$ | 4.98 | $2 \cdot 56$ | $5 \cdot 04$ | $2 \cdot 68$ | 5•11 | $2 \cdot 81$ | 5.18 |
| 15 | $2 \cdot 26$ | $4 \cdot 90$ | $2 \cdot 38$ | 4.95 | $2 \cdot 50$ | $5 \cdot 01$ | $2 \cdot 62$ | 5.08 | $2 \cdot 75$ | $5 \cdot 14$ | $2 \cdot 89$ | $5 \cdot 22$ |
| 16 | $2 \cdot 32$ | $4 \cdot 93$ | 2.44 | $4 \cdot 98$ | $2 \cdot 56$ | $5 \cdot 05$ | $2 \cdot 69$ | $5 \cdot 11$ | 2.83 | $5 \cdot 18$ | $2 \cdot 96$ | 5.26 |
| 17 | $2 \cdot 38$ | $4 \cdot 96$ | 2.51 | $5 \cdot \mathrm{OI}$ | $2 \cdot 63$ | $5 \cdot 08$ | $2 \cdot 77$ | 5.15 | $2 \cdot 90$ | $5 \cdot 22$ | $3 \cdot 04$ | $5 \cdot 30$ |
| 18 | $2 \cdot 45$ | $4 \cdot 99$ | 2.58 | 5*05 | $2 \cdot 71$ | $5 \cdot 12$ | $2 \cdot 84$ | 5.19 | $2 \cdot 98$ | $5 \cdot 27$ | 3'13 | $5 \cdot 35$ |
| 19 | 2.52 | $5 \cdot 02$ | $2 \cdot 65$ | 5.09 | $2 \cdot 78$ | 5.16 | 2.92 | $5 \cdot 24$ | $3 \cdot 07$ | $5 \cdot 32$ | $3 \cdot 22$ | $5 \cdot 41$ |
| 20 | 2.59 | $5 \cdot 06$ | 2.72 | $5 \cdot 13$ | $2 \cdot 86$ | $5 \cdot 20$ | 3.01 | $5 \cdot 28$ | 3.16 | $5 \cdot 37$ | 3.31 | $5 \cdot 46$ |
| 21 | $2 \cdot 66$ | $5 \cdot 10$ | 2.80 | 5•17 | 2.94 | $5 \cdot 25$ | $3 \cdot 09$ | $5 \cdot 33$ | $3 \cdot 25$ | $5 \cdot 43$ | 3.41 | $5 \cdot 53$ |
| 22 | $2 \cdot 74$ | $5 \cdot 14$ | 2.88 | $5 \cdot 22$ | $3 \cdot 03$ | $5 \cdot 30$ | 3.19 | $5 \cdot 39$ | 3.35 | $5 \cdot 49$ | $3 \cdot 52$ | $5 \cdot 59$ |
| 23 | $2 \cdot 82$ | 5.18 | $2 \cdot 97$ | 5.26 | $3 \cdot 13$ | $5 \cdot 35$ | 3.29 | $5 \cdot 45$ | $3 \cdot 46$ | $5 \cdot 55$ | $3 \cdot 63$ | $5 \cdot 66$ |
| 24 | 2.91 | $5 \cdot 23$ | 3.06 | $5 \cdot 32$ | 3.22 | $5 \cdot 41$ | 3.39 | $5 \cdot 51$ | $3 \cdot 57$ | $5 \cdot 62$ | 3.75 | 5.74 |
| 25 | $3 \cdot 00$ | $5 \cdot 28$ | $3 \cdot 16$ | $5 \cdot 37$ | 3.33 | $5 \cdot 47$ | $3 \cdot 50$ | $5 \cdot 58$ | 3.69 | $5 \cdot 70$ | $3 \cdot 88$ | $5 \cdot 83$ |
| 26 | $3 \cdot 10$ | $5 \cdot 34$ | $3 \cdot 26$ | $5 \cdot 43$ | 3.44 | $5 \cdot 54$ | $3 \cdot 62$ | $5 \cdot 66$ | $3 \cdot 82$ | $5 \cdot 78$ | $4^{.02}$ | $5 \cdot 92$ |
| 27 | 3.20 | $5 \cdot 40$ | 3.37 | $5 \cdot 50$ | $3 \cdot 56$ | $5 \cdot 62$ | 3'75 | 5.74 | $3 \cdot 96$ | $5 \cdot 88$ | $4^{1} 8$ | $6 \cdot 03$ |
| 28 | $3 \cdot 31$ | $5 \cdot 46$ | 3.49 | 5.57 | $3 \cdot 68$ | 5.70 | $3 \cdot 89$ | $5 \cdot 83$ | 4•11 | $5 \cdot 98$ | $4 \cdot 34$ | $6 \cdot 14$ |
| 29 | 3.43 | 5.53 | 3.62 | $5 \cdot 65$ | 3.82 | $5 \cdot 79$ | 4.04 | $5 \cdot 93$ | $4 \cdot 27$ | $6 \cdot 09$ | $4 \cdot 52$ | $6 \cdot 27$ |
| 30 | 3.55 | $5 \cdot 61$ | 3.75 | $5 \cdot 74$ | 3.97 | $5 \cdot 88$ | 4.20 | $6 \cdot 04$ | 4.45 | $6 \cdot 22$ | $4 \cdot 72$ | $6 \cdot 41$ |
| 3 I | 3.69 | $5 \cdot 70$ | 3.90 | $5 \cdot 84$ | 4•13 | $5 \cdot 99$ | $4 \cdot 38$ | $6 \cdot 17$ | $4 \cdot 64$ | $6 \cdot 36$ | 4.94 | $6 \cdot 58$ |
| 32 | $3 \cdot 83$ | $5 \cdot 79$ | 4.06 | $5 \cdot 95$ | 4.30 | $6 \cdot 11$ | 4.57 | $6 \cdot 31$ | $4 \cdot 86$ | $6 \cdot 52$ | 5.18 | $6 \cdot 76$ |
| 33 | $3 \cdot 99$ | $5 \cdot 90$ | $4 \cdot 23$ | $6 \cdot 06$ | 4.50 | $6 \cdot 25$ | $4 \cdot 78$ | $6 \cdot 46$ | $5 \cdot 10$ | $6 \cdot 70$ | $5 \cdot 46$ | $6 \cdot 97$ |
| 34 | $4 \cdot 16$ | $6 \cdot 02$ | 4.42 | $6 \cdot 20$ | $4 \cdot 71$ | $6 \cdot 41$ | $5 \cdot 02$ | $6 \cdot 64$ | $5 \cdot 37$ | $6 \cdot 91$ | $5 \cdot 77$ | 7.22 |
| 35 | 4.35 | $6 \cdot 15$ | 4.63 | $6 \cdot 35$ | 4.95 | $6 \cdot 58$ | $5 \cdot 29$ | $6 \cdot 85$ | $5 \cdot 69$ | $7 \cdot 16$ | $6 \cdot 13$ | $7 \cdot 52$ |
| . 36 | $4 \cdot 55$ | $6 \cdot 30$ | 4.86 | $6 \cdot 52$ | 5.20 | $6 \cdot 79$ | $5 \cdot 59$ | 7.09 | $6 \cdot 05$ | $7 \cdot 45$ | $6 \cdot 56$ | $7 \cdot 87$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ |  | $3{ }^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $4^{\circ}$ | Decl. Var. | $5{ }^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\lvert\, \begin{aligned} & \mathrm{H} . \\ & \hline \end{aligned}\right.$ |  |  | - r . 98 | $s$ | $\xrightarrow{\text { S. }}$ | H. M. ${ }_{\text {S }}$ S. |  | H. M. S. |  |  |  |
| 6 | $\begin{array}{llll}6 & 0 & 0 & 43 \\ 5 & 3\end{array}$ | 1 | $\begin{array}{lllll}5 & 58 & 18 \\ 5 & 31 & 55 \cdot 3\end{array}$ | I.80 | $\begin{array}{lll}5 \\ 5 & 30 & 6.8 \\ 5 & 1\end{array}$ |  |  | I.83 |  | I. 79 I. 84 | $\begin{array}{rrrr}5 & 51 & 4 \cdot 2 \\ 5 & 24 & 36 \cdot 6\end{array}$ | + |
| 8 | 52457.0 |  | 5238 | I.82 | 5 L 2119.1 | 1.83 | $\begin{array}{llll}5 & 19 & 28 \cdot 8\end{array}$ | 1.85 | $51737 \cdot 4$ | I.86 | $51545 \cdot 0$ | . 88 |
| 10 |  |  | $515420 \cdot 9$ | I.83 | $5 \begin{array}{lllll}5 & 12 & 305\end{array}$ |  | 5 10 38.9 | r.87 | $5846 \cdot 2$ | 1.89 | $5652 \cdot \mathrm{I}$ | 1.91 |
| 12 | 5722.8 | 1.83 | $\begin{array}{llll}5 & 5 & 32.4\end{array}$ | I.85 | $5 \begin{array}{llll}5 & 3 & 40 \cdot 8\end{array}$ | 1.87 | ${ }_{5}$ I $47 \times 9$ | I.89 | $45953: 5$ | 1.92 | $45757 \cdot 6$ | 1.95 |
| 16 | 45834 |  | $45643^{\circ} \mathrm{O}$ |  | $45450 \cdot 0$ | I.90 | 45255.4 | -92 | 45059.2 | 5 | 449 1•2 | .98 |
| 16 | 449453 | r.87 | $44752 \cdot 5$ | I 90 | 4.4557 .8 | r.93 | $\begin{array}{lll}4 & 44 & 1.4\end{array}$ | I.96 | 4423.1 | I•99 | $440 \quad 2 \cdot 8$ | 02 |
| 18 | $44055^{\circ}$ | -89 | 439005 | I•92 | $4374 \cdot 1$ | r.96 | $435{ }^{4} 6$ | I.99 | $4335^{\circ} \mathrm{O}$ | 2.03 | 4318 | 7 |
| 20 | $\begin{array}{llll}4 & 32 & 3.2\end{array}$ | I•92 | $\begin{array}{lll}4 & 30 & 6 \cdot 9\end{array}$ | r.96 | $4{ }^{4} 288$ | 99 | $\begin{array}{llll}4 & 26 & 77 \\ 4 & 17 & 7\end{array}$ | 2.03 | $\begin{array}{llll}4 & 24 & 4 \cdot 5\end{array}$ | 2.07 | 42158.9 | $2 \cdot \mathrm{I} 2$ |
| 22 | $42310 \cdot 0$ | 1-95 | 421 II 6 | I•99 | 41910.9 | $2 \cdot 03$ | $\begin{array}{llll}4 & 17 & 7.5\end{array}$ |  | $\begin{array}{llll}4 & 15 & 1.5\end{array}$ | $2 \cdot$ | $41252 \cdot 7$ | $2 \cdot 17$ |
| 23 | 41842 |  | 416 |  | 414 |  | 41236.4 | -10 | 4 10 28.8 | $2 \cdot 15$ | $8 \times 8.3$ |  |
| 24 | $\begin{array}{lllll}+14 & 14.9\end{array}$ | 99 | $\begin{array}{lllllllll}4 & 12 & 14.2\end{array}$ | 2.03 | 4 10 10.9 | $2 \cdot 08$ |  | -13 | $4 \quad 5 \quad 55 \cdot 5$ | 18 | $4 \quad 3{ }^{43 \cdot}$ | 3 |
| 25 | 7 | $2 \cdot 01$ | $\begin{array}{llll}4 & 7 & 44 \cdot 7\end{array}$ | 2.06 | $4 \begin{array}{llll}4 & 5 & 39.9\end{array}$ | $2 \cdot \mathrm{ro}$ | 4 3 $32 \cdot 1$ <br> 3 5  | $2 \cdot 16$ | $\begin{array}{rrrr}4 & 1 & 21 .\end{array}$ | 1 | 3 59 $7 \circ$ | 6 |
| 26 | $\begin{array}{llll}4 & 5 & 17 \cdot 8 \\ 4 & 0 & 48 \cdot 3\end{array}$ | O3 | $4 \begin{array}{llll}4 & 14.5\end{array}$ | $2 \cdot 08$ | $\begin{array}{rrrr}4 & \text { I } & 8 \cdot 2 \\ 3 & 56 & 35 \cdot 8\end{array}$ | $2 \cdot$ | $\begin{array}{llll}3 & 58 & 58 \cdot 8\end{array}$ | $2 \cdot 18$ $2 \cdot 21$ | $35646 \cdot 1$ | 4 | $\begin{array}{llll}3 & 54 & 29 * \\ 3 & 49 \\ 5\end{array}$ | O |
| 28 | 356 |  |  |  | 356 |  |  |  | $\begin{array}{lllll}3 & 52 & 100 \\ 3 & 47 & 32 \cdot 9\end{array}$ |  |  |  |
| 29 | 351 | $2 \cdot 10$ | 349 | $2 \cdot 16$ | $\begin{array}{llll}3 & 52 & 28 \cdot 6 \\ 3 & 47 & 28 \cdot 4\end{array}$ | 22 | 34513. | 2.28 | $34254 * 7$ | $2 \cdot 35$ | 32.0 |  |
| 30 | 347 | $2 \cdot 13$ | 3456.5 | 2.19 |  | $2 \cdot 25$ | $1340 \begin{array}{llll} & 46 \cdot 5\end{array}$ | $2 \cdot 32$ | $\begin{array}{llll}3 & 38 & 15 \cdot 5\end{array}$ | $2 \cdot 39$ | $3 \quad 35 \quad 50 \cdot 2$ | $2 \cdot 46$ |
| $3{ }^{\text {I }}$ | $\begin{array}{lllllllllll}3 & 42 & 43 \cdot 8\end{array}$ | $2 \cdot$ | $34032 \cdot 5$ | $2 \cdot 22$ |  | $2 \cdot 28$ |  | $2 \cdot 35$ | $\begin{array}{llll}3 & 33 & 34.9\end{array}$ | $2 \cdot 43$ | 3317 | $2 \cdot 50$ |
| 32 | $\begin{array}{lllll}3 & 38 & 10 & 7\end{array}$ | $2 \cdot 19$ | $\begin{array}{llll}3 & 35 & 57 \cdot 5\end{array}$ | 25 | $33340 \cdot 4$ | $2 \cdot 3$ | 31518.9 | $2 \cdot 39$ | $32853{ }^{\circ}$ | 2.47 |  | $2 \cdot 55$ |
| 33 | $\begin{array}{llll}3 & 33 & 36\end{array}$ |  | $33121 \cdot 6$ |  | $\begin{array}{lll}3 & 29 & 2 \cdot 2\end{array}$ | $2 \cdot 36$ | $\begin{array}{llll}3 & 26 & 38 \cdot 3\end{array}$ | 2.44 | $\begin{array}{llll}3 & 24 & 9.7\end{array}$ | $2 \cdot 52$ | $32136 \cdot 2$ | 60 |
| 3 | 29 |  | 32644.5 | $2 \cdot 33$ | $\begin{array}{llll}3 & 24 & 22 \cdot 7\end{array}$ | 2 | $\begin{array}{llllllll}3 & 21563\end{array}$ | 2 | $\begin{array}{lllll}3 & 19 & 24.9\end{array}$ | 2 5 | $\begin{array}{llll}3 & 16 & 48 \cdot 3\end{array}$ | 2.66 |
| 35 | $24 \begin{array}{ll}25.9\end{array}$ | 2.29 | $\begin{array}{llll}322 & 6.3\end{array}$ | $2 \cdot 37$ | $31942 \cdot 0$ | $2 \cdot 44$ | $\begin{array}{llll}3 & 17 & 12 \cdot 9\end{array}$ | 8 | $\begin{array}{llllllllllllllllllll}3 & 14 & 38.4\end{array}$ | $2 \cdot 62$ | 3 II 58.6 | 1 |
| 3 | $\begin{array}{llll}3 & 19 & 48 \\ 3 & 15 & 10\end{array}$ | 2.33 2.37 | $\begin{array}{llll}3 & \text { I7 } & 26 \cdot 8 \\ 3 & 12 & 46 \cdot 0\end{array}$ | 2.41 2.45 | $\left[\begin{array}{lll}3 & 14 & 59 \\ 3 & 10 & 16.9\end{array}\right.$ | $2 \cdot 49$ | $\begin{array}{rrrr}3 & 12 & 27 \cdot 8 \\ 3 & 7 & 4.0\end{array}$ | 8 | $\begin{array}{llll}3 & 9 & 50 \%\end{array}$ | $2 \cdot 67$ | $\begin{array}{lll}3 & 7 & 6 \cdot 8\end{array}$ |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 | $31031 \cdot 0$ |  | $3{ }^{3}$ |  | 3 5 3r.0 |  | $\begin{array}{llll}3 & 2 & 52.4\end{array}$ |  | $\bigcirc 7.8$ | -80 | $25716 \cdot 7$ | 1 |
| 39 | $50 \cdot 1$ | 2.46 | $\begin{array}{rrrr}3 & 3 & 19.9 \\ 2 & 58 & 34 \cdot 3 \\ & 5 & \end{array}$ | 2.55 2.65 | $\begin{array}{lllll}3 & 0 & 43.9 \\ 2 & 55 \\ 5\end{array}$ | . 65 | 2 58 19 <br> 2 53 9 <br> 1   | 5 | $\begin{array}{llll}2 & 55 & 13.4\end{array}$ | $2 \cdot 87$ | $\begin{array}{lllllll}2 & 52 & 18 \cdot 0\end{array}$ | 2.98 |
| 40 | 3 1 <br> 2 7 <br> 2 5 <br>   | 2.51 2.56 | $\begin{array}{lllll}2 & 58 & 34.3 \\ 2 & 53 & 46.0\end{array}$ | 2.61 |  | -71 | 223 $9 \cdot 1$ <br> 2  <br> 8  | 2 | 25016.4 | 2.94 | $24716 \cdot 5$ | -06 |
| 4 4 | $\begin{array}{llll}2 & 56 & 23 \cdot 6 \\ 2 & 51 & 37 \cdot 8\end{array}$ | 2.56 2.62 | $\begin{array}{llll}2 & 53 & 46 \cdot 9 \\ 2 & 48 & 57 \cdot 5\end{array}$ | $2 \cdot 66$ | $\begin{array}{rrrr}2 & 51 & 3 \cdot 8 \\ 2 & 46 & 10 \cdot 5\end{array}$ |  | $\begin{array}{lll}2 & 48 & 14.0 \\ 2 & 43 & 16.2\end{array}$ | 2.89 2.97 | $\begin{array}{llll}2 & 45 & 16 \cdot 6 \\ 2 & 40 & 14 \cdot 3\end{array}$ | 3.02 3.10 | 2 42  <br> 2 II  | 3.15 3.24 |
| 42 | $25137 \cdot 8$ |  | $24^{8} 57 \cdot 5$ | 2.73 | $24610 \cdot 5$ | $\cdot 8$ | 243 | $2 \cdot 97$ | 24014.3 | $3 \cdot 10$ | 2374.1 | 3.24 |
| 43 | ${ }_{2} 46$ 50*0 | 68 | 244 6.0 | 2.79 | $\begin{array}{llllllll}2 & 41 & 14.7\end{array}$ | 2.92 | $1 \begin{array}{llll}2 & 38 & 157\end{array}$ | 3.05 | $\begin{array}{llll}2 & 35 & 8.5\end{array}$ | 3.19 | 23152.5 |  |
| 44 | ${ }^{2} 428$ O•I | $2 \cdot 74$ | 23912.0 | -87 | $\begin{array}{lllll}2 & 36 & 16 \cdot 1\end{array}$ | 3.00 | 23312.0 | $3 \cdot 14$ | 22959.2 | $3 \cdot 29$ | $22637 \cdot 0$ | $3 \cdot 46$ |
| 45 | $\begin{array}{llll}2 & 37 & 8 \cdot 0\end{array}$ | 2.81 | $23415{ }^{\circ}$ | 95 | 23114.5 | 3.09 | $\begin{array}{llll}2 & 28 & 4.9\end{array}$ | $3 \cdot 24$ | 22445.9 | $3 \cdot 40$ | 22116.8 | 8 |
| 47 | $\begin{array}{llll}2 & 32 & 13.3 \\ 2 & 27 & 15 & 3\end{array}$ | 2.89 2.97 |  | $3 \cdot 12$ | $\begin{array}{llll}2 & 26 & 9 \cdot 5 \\ 2 & 21 & \text { I.0 }\end{array}$ | 3.1 3.2 | $\begin{array}{llll}2 & 22 & 54.0 \\ 2 & \text { I7 } & 38.8\end{array}$ |  |  | $3 \cdot 52$ | 2 I 515 l 7 | 3.71 |
| 47 | 22715.8 | $2 \cdot 97$ | 22413.0 | $3 \cdot 12$ | 22510 | $3 \cdot 2$ | 21738.8 | 3.4 | 214508 | $3 \cdot 65$ | IO 20 | 5 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. 4 | A. | L. $5^{\circ}$ | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | - ${ }_{-0}$ | s. | S. | s. | s. | s. | S. | s. | s. | s. | S. | S. |
| 0 | - 00 | $-4.38$ | - .08 | $-4.38$ | - 17 | $-4.38$ | - $\cdot 25$ | $-4.38$ | - 34 | $-4.39$ | - 42 | $-4.40$ |
| 2 | -07 | $4 \cdot 38$ | -15 | $4 \cdot 38$ | - 24 | $4 \cdot 38$ | $\cdot 32$ | $4 \cdot 39$ | 40 | $4 \cdot 40$ | -49 | $4 \cdot 4 \mathrm{I}$ |
| 4 | -14 | 438 | -22 | $4 \cdot 38$ | -30 | $4 \cdot 39$ | -39 | $4 \cdot 39$ | $\cdot 47$ | $4 \cdot 40$ | - 56 | 4.41 |
| 6 | - 20 | $4 \cdot 38$ | -30 | $4 \cdot 39$ | -37 | $4 \cdot 39$ | -46 | $4 \cdot 40$ | - 54 | $4 \cdot 41$ | -63 | $4 \cdot 42$ |
| 8 | -28 | $4 \cdot 38$ | -36 | $4 \cdot 39$ | -44 | $4 \cdot 40$ | -53 | 4.45 | . 62 | $4 \cdot 42$ | -70 | $4 \cdot 43$ |
| 10 | $\cdot 34$ | $4 \cdot 39$ | -43 | 4.40 | -52 | 4.41 | . 60 | 4.42 | -69 | $4 \cdot 43$ | $\cdot 78$ | $4 \cdot 45$ |
| 12 | -42 | $4 \cdot 40$ | $\cdot 50$ | 4.41 | '59 | $4 \cdot 42$ | -68 | 4.43 | $\cdot 77$ | $4 \cdot 44$ | - 86 | $4 \cdot 46$ |
| 14 | 49 | $4 \cdot 40$ | -58 | $4 \cdot 42$ | . 67 | $4 \cdot 43$ | $\cdot 76$ | 4.44 | -85 | $4 \cdot 46$ | $\cdot 94$ | $4 \cdot 48$ |
| 16 | $\cdot 56$ | 4.41 | $\cdot 65$ | 4.43 | $\cdot 74$ | 4.44 | -83 | $4 \cdot 46$ | -93 | $4 \cdot 47$ | 102 | $4 \cdot 50$ |
| 18 | . 64 | 4.42 | $\cdot 73$ | $4 \cdot 44$ | -82 | 4.45 | -92 | $4 \cdot 47$ | I-OI | $4 \cdot 49$ | I•II | $4 \cdot 52$ |
| 20 | $\cdot 72$ | 4.44 | . 81 | 4.45 | -91 | $4 \cdot 47$ | 1.00 | 4.49 | I•IO | 4.51 | I. 20 | $4 \cdot 54$ |
| 22 | -80 | $4 \cdot 45$ | -90 | 4.47 | -99 | $4 \cdot 49$ | I.09 | 4.51 | I•I9 | $4 \cdot 54$ | I 29 | $4 \cdot 57$ |
| 24 | $\cdot 89$ | 4.47 | $\cdot 98$ | 4.49 | 1.08 | 4.51 | I•I8 | $4 \cdot 54$ | I. 29 | $4 \cdot 56$ | I.39 | 4.59 |
| 26 | -98 | $4 \cdot 48$ | I•08 | $4 \cdot 51$ | I•I8 | $4 \cdot 53$ | I. 28 | $4 \cdot 56$ | I 39 | 4.59 | I 50 | 4.63 |
| 28 | 1.07 | $4 \cdot 5 \mathrm{I}$ | I•I7 | $4 \cdot 53$ | I-28 | 4.56 | I•38 | 4.59 | I.50 | $4 \cdot 63$ | I 61 | $4 \cdot 66$ |
| 30 | 1.17 | 4.53 | I 27 | $4 \cdot 56$ | I.38 | 4.59 | I.50 | $4 \cdot 63$ | 1.61 | $4 \cdot 66$ | I•73 | 4*\% |
| 32 | 1.27 | $4 \cdot 56$ | I. 38 | 4.59 | I. 50 | 4.63 | I. 61 | 4.67 | I.73 | $4 \cdot 71$ | I. 86 | $4 \cdot 76$ |
| 34 | I.38 | 4.59 | I. 50 | 4.63 | I. 62 | 4.67 | I•74 | $4 \cdot 71$ | 1.87 | $4 \cdot 76$ | $2 \cdot 00$ | 4.81 |
| 36 | 1.50 | $4 \cdot 63$ | I. 62 | 4.67 | I•75 | $4 \cdot 71$ | I. 88 | $4 \cdot 76$ | $2 \cdot 01$ | 4.82 | $2 \cdot 15$ | $4 \cdot 88$ |
| 38 | I 62 | $4 \cdot 67$ | 1.76 | $4 \cdot 72$ | 1.89 | $4 \cdot 77$ | 2.03 | $4 \cdot 83$ | 2.18 | $4 \cdot 89$ | $2 \cdot 33$ | 4.96 |
| 40 | I.76 | $4 \cdot 72$ | I.90 | $4 \cdot 77$ | $2 \cdot 05$ | 4.83 | $2 \cdot 20$ | 4.90 | $2 \cdot 35$ | 4.97 | 2.52 | $5 \cdot 05$ |
| 42 | I 92 | $4 \cdot 78$ | 2.07 | $4 \cdot 84$ | $2 \cdot 22$ | $4 \cdot 91$ | $2 \cdot 38$ | $4 \cdot 99$ | $2 \cdot 55$ | $5 \cdot 07$ | $2 \cdot 73$ | $5 \cdot 16$ |
| 44 | 2.09 | 4.85 | $2 \cdot 25$ | $4 \cdot 92$ | 2.42 | $5 \cdot 00$ | 2.59 2.89 | $5 \cdot 09$ | $2 \cdot 78$ 3.05 | $5 \cdot 19$ | 2.98 | $5 \cdot 30$ |
| 46 47 | $2 \cdot 28$ $2 \cdot 38$ | 493 488 | 245 | 5.02 | $2 \cdot 64$ | 5.11 5.17 | $2 \cdot 84$ | $5 \cdot 22$ $5 \cdot 29$ | 3.05 | $5 \cdot 33$ | 3.27 | 5.47 |
| 47 | $2 \cdot 38$ | 458 | $2 \cdot 57$ | $5 \cdot 07$ | $2 \cdot 76$ | $5 \cdot 17$ | $2 \cdot 97$ | $5 \cdot 29$ | $3 \cdot 20$ | $5 \cdot 42$ | $3 \cdot 44$ | $5 \cdot 57$ |

## HOUR-ANGLES AND VARIATIONS TO $\mathbf{1}^{\prime}$ OF LAT., DECL., AND ALT. 219

## LATITUDE $24^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | s. | M. | S. | H. M. S. | s. | H. M. S. | S. | H. M. S. | S. | M. S. | s. |
| 0 | $54916 \cdot 3$ | -r.80 | $\begin{array}{llll}5 & 47 & 27 & 9\end{array}$ | - I.81 | 54539.0 | - I. 82 | $54349 \cdot 5$ | - 1.83 | $\begin{array}{llll}5 & 41 & 59.4\end{array}$ | - I. 84 | $\begin{array}{llll}5 & 40 & 8 \cdot 4\end{array}$ | - I-86 |
| 4 | 5 3I $36 \cdot 4$ | x.85 | $52945 \cdot 1$ | I.86 | 527 53.0 | I.88 | 5 25 5 59.7 | I.90 | $\begin{array}{lll}5 & 24 & 5 \cdot 5\end{array}$ | r.01 | $5 \quad 2210 \cdot 0$ | I•93 |
| 6 | $52244^{\circ} 6$ | 1.87 | $5205 \mathrm{~S} \cdot 6$ | I.89 | 5 I8 $57 \cdot 6$ | I 91 | $\begin{array}{llll}5 & 17 & 2.2\end{array}$ | I 93 | $\begin{array}{llll}5 & 15 & 5 \cdot 6\end{array}$ | I•96 | $\begin{array}{llll}5 & 13 & 7 \cdot 5\end{array}$ | r•98 |
| 8 | 5 I3 51.4 | I 90 | 5 Ix $56 \cdot 6$ | I.92 | 5 Io 0.4 | I*95 | $\begin{array}{llll}5 & 8 & 2 \cdot 7\end{array}$ | I•97 | $\begin{array}{lll}5 & 6 & 3.5\end{array}$ | $2 \cdot 00$ | $\begin{array}{llll}5 & 4 & 2.6\end{array}$ | $2 \cdot 03$ |
| Io | $\begin{array}{llll}5 & 4 & 56 \cdot 6\end{array}$ | x 94 | $\begin{array}{llll}5 & 2 & 59 \cdot 7\end{array}$ | I.96 | 5 I I•I | I ${ }^{\text {99 }}$ | $459 \quad 0.9$ | $2 \cdot 02$ | $45658 \cdot 9$ | $2 \cdot 05$ | $4 \quad 54 \quad 54.9$ | $2 \cdot 08$ |
| 12 | 456 | I.97 | $454 \quad 0 \cdot 7$ | $2 \cdot 00$ | 45159.6 | $2 \cdot 03$ | $44956 \cdot 6$ | 2.07 | $44751 \cdot 5$ | $2 \cdot 10$ | 44544.2 | $2 \cdot 14$ |
| 14 | 447104 | $2 \cdot \mathrm{Or}$ | $44459 \cdot 5$ | $2 \cdot 05$ | $44255 \cdot 6$ | $2 \cdot 08$ | 44049.5 | $2 \cdot 12$ | $43^{88} 41 \cdot 1$ | $2 \cdot 16$ | $43630 \cdot 2$ | $2 \cdot 20$ |
| 16 | $4 \begin{array}{lll}488 & 0.4\end{array}$ | $2 \cdot 06$ | $43555 \cdot 8$ | $2 \cdot 10$ | $43348 \cdot 7$ | $2 \cdot 14$ | 431393 | $2 \cdot 18$ | 42927.2 | $2 \cdot 22$ | 42712.4 | $2 \cdot 27$ |
| 18 | $428 \quad 56 \cdot 9$ | $2 \cdot 11$ | $42649 \cdot 1$ | $2 \cdot 15$ | $4 \quad 2438 \cdot 8$ | 2.19 | $422 \quad 25 \cdot 7$ | $2 \cdot 24$ | $420 \quad 9 \cdot 6$ | $2 \cdot 29$ | 4 I7 50.5 | $2 \cdot 35$ |
| 19 | $42424 \cdot 1$ | 2•14 | $4 \quad 2214.6$ | 2.18 | 42025 | 2.23 | 417474 | $2 \cdot 28$ | $415 \quad 29.2$ | $2 \cdot 33$ | $\begin{array}{llll}4 & 13 & 7 \cdot 8\end{array}$ | $2 \cdot 39$ |
| 20 | 4 I9 50.5 | $2 \cdot 16$ | 4 I7 39*3 | $2 \cdot 21$ | $\begin{array}{llll}4 & 15 & 25\end{array}$ | $2 \cdot 26$ | $\begin{array}{llll}4 & 13 & 8 \cdot 1\end{array}$ | $2 \cdot 31$ | $41047 * 7$ | $2 \cdot 37$ | $4 \begin{array}{lll}4 & 8 & 23.9\end{array}$ | 2.43 |
| 21 | 4 I5 I6. I | $2 \cdot 19$ | 41331 | $2 \cdot 24$ | 4 10 $47{ }^{\circ} \mathrm{O}$ | $2 \cdot 29$ | $4 \begin{array}{lll}4 & 8 & 27 \cdot 7\end{array}$ | 2.35 | 4650 | 2.41 | $\begin{array}{lrrr}4 & 3 & 38 \cdot 6\end{array}$ | $2 \cdot 47$ |
| 22 | 4 10 40.8 | $2 \cdot 22$ | $4826 \cdot 0$ | $2 \cdot 27$ | $\begin{array}{lll}4 & 6 & 7 \cdot 8\end{array}$ | $2 \cdot 33$ | $\begin{array}{llll}4 & 3 & 46 \cdot 2\end{array}$ | $2 \cdot 39$ | 4 I 210 | $2 \cdot 45$ | 35852.0 | 2.52 |
| 23 | $4{ }^{4} 664.7$ | 2.25 | $\begin{array}{lrrr}4 & 3 & 47 \cdot 7\end{array}$ | $2 \cdot 31$ | 4 1 $27 \cdot 4$ <br>  56 45.8 | $2 \cdot 37$ | $\begin{array}{llll}3 & 59 & 3 \cdot 5\end{array}$ | 2.43 | $\begin{array}{llll}3 & 56 & 35^{\circ} 7\end{array}$ | 2.50 | $\begin{array}{llll}3 & 54 & 3.9\end{array}$ | $2 \cdot 56$ |
| 24 | 4 I 27.6 | 2.29 | $3598 \cdot 5$ | $2 \cdot 35$ | $35645 \cdot 8$ | $2 \cdot 4 \mathrm{I}$ | $\begin{array}{llll}3 & 54 & 19.4\end{array}$ | 2.47 | $35148 \cdot 9$ | $2 \cdot 54$ | 34914.2 | $2 \cdot 62$ |
| 25 | $\begin{array}{lllll}3 & 56 & 49 * 4\end{array}$ | $2 \cdot 32$ | $\begin{array}{lll}3 & 54 & 28 \cdot 1\end{array}$ | $2 \cdot 39$ | $352 \quad 300$ | $2 \cdot 45$ | $34933{ }^{\circ} 9$ | $2 \cdot 52$ | 3470.6 | $2 \cdot 59$ | $\begin{array}{llll}3 & 44 & 22 \cdot 8\end{array}$ | 2.67 |
| 26 | 3523 51 | $2 \cdot 36$ | $34946 \cdot 5$ | $2 \cdot 43$ | $\begin{array}{lllllllll}3 & 47 & 18 \cdot 9\end{array}$ | $2 \cdot 50$ | $34447^{\circ} \mathrm{O}$ | 2.57 | $\begin{array}{llll}3 & 42 & 10 \%\end{array}$ | 2.64 | $\begin{array}{lllll}3 & 39 & 29 \%\end{array}$ | $2 \cdot 72$ |
| 27 | $\begin{array}{lllll}3 & 47 & 29 \\ \\ 3 & 42\end{array}$ | 2.40 | $\begin{array}{llr}3 & 45 & 3 \cdot 6\end{array}$ | 2.47 | $\begin{array}{llll}3 & 42 & 33 \cdot 3\end{array}$ | 2.54 | $\begin{array}{llll}3 & 39 & 58 \cdot 5\end{array}$ | $2 \cdot 62$ | $\begin{array}{llll}3 & 37 & 19.0\end{array}$ | $2 \cdot 70$ | $\begin{array}{llll}3 & 34 & 34 \cdot 6\end{array}$ | 2.78 |
| 28 | 342480 | 2.44 | $\begin{array}{llll}3 & 40 & 19.3\end{array}$ | 2.52 | $\begin{array}{llll}3 & 37 & 46 \cdot 1 \\ & 3\end{array}$ | 2.59 | $\begin{array}{llll}3 & 35 & 8 \cdot 3\end{array}$ | 2.67 | $\begin{array}{llll}3 & 32 & 25 \cdot 5\end{array}$ | $2 \cdot 76$ | $\begin{array}{lllll}3 & 29 & 37.4\end{array}$ | 2.85 |
| 29 | $\begin{array}{llll}3 & 3^{8} & 5 \cdot 0\end{array}$ | 2.49 | $\begin{array}{llll}3 & 35 & 33.5\end{array}$ | $2 \cdot 56$ | $\begin{array}{lllll}3 & 32 & 57 \cdot 2\end{array}$ | $2 \cdot 64$ | $33016 \cdot 3$ | 2.73 | $132730 \cdot 0$ | 2.82 | 324 38.1 | 2.91 |
| 30 | $33^{3} 3320 \cdot 5$ | $2 \cdot 53$ | $33046 \cdot 1$ | 2.61 | $\begin{array}{lll}3 & 28 & 6.8\end{array}$ | $2 \cdot 70$ | $3125 \quad 22 \cdot 3$ | $2 \cdot 79$ | $32232 \cdot 2$ | 2.88 | $\begin{array}{lll}3 & 19 & 36 \cdot 3\end{array}$ | $2 \cdot 98$ |
| 31 | $3 \mathrm{llll}_{3} \mathbf{2 8} 34^{\circ} 6$ | $2 \cdot 58$ | $32557 \cdot 1$ | 2.67 | $\begin{array}{llll}3 & 23 & 14.4\end{array}$ | $2 \cdot 76$ | $32026 \cdot 2$ | $2 \cdot 85$ | 3 I7 $32 \cdot 2$ | $2 \cdot 95$ | $31432 \cdot 0$ | 3.06 |
| 32 | $\begin{array}{lllll}3 & 23 & 46 \cdot 9\end{array}$ | $2 \cdot 63$ | 3216.2 | $2 \cdot 72$ | $\begin{array}{llllllllll}3 & 18 & 200\end{array}$ | $2 \cdot 82$ | $3{ }^{3} 155 \quad 27 * 9$ | $2 \cdot 92$ |  | 3.02 | $319244^{\circ} 9$ | $3 \cdot 14$ |
| 33 | $\begin{array}{llllllllllll}3 & 18 & 57.5\end{array}$ | $2 \cdot 69$ | $\begin{array}{llll}3 & 16 & 13.4\end{array}$ | $2 \cdot 78$ | $\begin{array}{llll}3 & 13 & 23.3\end{array}$ | $2 \cdot 88$ | 3 10 $27 \cdot 2$ | $2 \cdot 99$ | $\begin{array}{llll}3 & 7 & 24.5\end{array}$ | $3 \cdot 10$ | $\begin{array}{llll}3 & 4 & 14.8\end{array}$ | $3 \cdot 22$ |
| 34 | $\begin{array}{lllll}3 & 14 & 6 \cdot 2\end{array}$ | 2.75 | $3 \begin{array}{llll}3 & 11 & 18.4\end{array}$ | $2 \cdot 85$ | $\begin{array}{llll}3 & 8 & 24.4\end{array}$ | 2.95 | $\begin{array}{llll}3 & 5 & 23.8\end{array}$ | 3.07 | $\begin{array}{llll}3 & 2 & 16 \cdot 3\end{array}$ | 3.19 | 25914 | 3.31 |
| 35 | $\begin{array}{llll}3 & 9 & 12.9\end{array}$ | 2.8 I | 3621.1 | $2 \cdot 92$ | 3 3 $22 \cdot 8$ <br>  5  | 3.03 | 3 3 $0 \times 17.6$ | $3 \cdot 15$ | $\begin{array}{lll}2 & 57 & 50\end{array}$ | $3 \cdot 28$ | 25344.5 | 3.41 |
| 36 | $\begin{array}{llll}3 & 4 & 17 \cdot 4\end{array}$ | $2 \cdot 88$ | $\begin{array}{rrrr}1 & 1 & 2 I \cdot 4\end{array}$ | $2 \cdot 99$ | $\begin{array}{lllll}2 & 58 & 18 & 5\end{array}$ | $3 \cdot 11$ | $2 \begin{array}{llr}255 & 8 \cdot 3\end{array}$ | $3 \cdot 24$ | $25150 \cdot 1$ | $3 \cdot 37$ | $\begin{array}{llll}2 & 48 & 23 \cdot 6\end{array}$ | $3 \cdot 52$ |
| 37 | 25919.4 | $2 \cdot 95$ | $2{ }^{2} 56618 \cdot 9$ | 3.07 | 253 IIII | $3 \cdot 19$ | $24955 \cdot 5$ | $3 \cdot 33$ | $24631 \cdot 5$ | 3.48 | $2 \begin{array}{lllllll}2 & 42 & 58.4\end{array}$ | $3 \cdot 63$ |
| 38 | $\begin{array}{llll}2 & 54 & 18.8 \\ 2 & 4\end{array}$ | 3.03 | $2 \begin{array}{llll}21 & 51 & 13.6\end{array}$ | 3.15 | $\begin{array}{llll}2 & 48 & 0.5\end{array}$ | $3 \cdot 29$ | $\begin{array}{lllll}2 & 44 & 39^{\circ} \\ 0\end{array}$ | 3.43 | 24188 | 3.59 | $\begin{array}{llllllllllllllll}2 & 37 & 28 \cdot 4\end{array}$ | 3.76 |
| 39 | 24915.4 | $3 \cdot 11$ | $24^{6} \quad 5 \cdot 0$ | $3 \cdot 24$ | $24246 \cdot 2$ | $3 \cdot 39$ | $2 \begin{array}{llll} & 39 & 18.5\end{array}$ | 3.54 | $23541 \cdot 1$ | 3.71 | 23153.2 | $3 \cdot 89$ |
| 40 | $\begin{array}{llll}2 & 44 & 8 \cdot 8\end{array}$ | $3 \cdot 20$ | $240 \quad 52 \cdot 8$ | $3 \cdot 34$ | $237127 * 9$ | 3.49 | 23353.4 | 3.66 | $\begin{array}{llll}2 & 30 & 8.5\end{array}$ | $3 \cdot 84$ | 226 I2.1 | $4^{\circ} 04$ |
| 41 | $\begin{array}{lllll}2 & 38 & 58 \cdot 8\end{array}$ | $3 \cdot 29$ | $23536 \cdot 8$ | 3.45 | $\begin{array}{llll}2 & 32 & 5 \cdot 2\end{array}$ | $3 \cdot 6 \mathrm{I}$ | $2 \begin{array}{llll}28 & 23 \cdot 3\end{array}$ | 3.79 | $2 \begin{array}{llll}24 & 30 \cdot 1\end{array}$ | $3 \cdot 99$ | 22024.5 | 4.21 |
| 42 | $23345 \%$ | 3.40 | 23016.5 | $3 \cdot 56$ |  | $3 \cdot 74$ |  | 3.94 | 2 I8 $45^{\circ} \mathrm{L}$ | $4 \cdot 15$ | $\begin{array}{llll}2 & 14 & 29 \cdot 3\end{array}$ | 4.39 |
| 43 | $\begin{array}{llllllllllll}2 & 28 & 27 \cdot 1\end{array}$ | 3.51 | $\begin{array}{llll}2 & 24 & 51.4\end{array}$ | $3 \cdot 69$ | $\begin{array}{llllllllllllllll} \\ 2 & 21 & 4.6\end{array}$ | $3 \cdot 88$ | 2 I7 5.5 | 4.10 | 21253.1 | 4.33 | $2825 \cdot 7$ | 4.59 |
| 44 | 2234.5 | $3 \cdot 63$ | 219210 | $3 \cdot 83$ | $2 \begin{array}{llll}2 & 15 & 25\end{array}$ | $4^{\circ} \mathrm{O} 4$ | 2 II 16.4 | $4 \cdot 27$ | $2652 \cdot 6$ | 4.53 | $2 \quad 2 \quad 12.3$ | $4 \cdot 83$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ}$ A. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | s. | s. | s. | s. | s. | S. | S. | S. | s. |
| 0 | - 50 | $-4.40$ | -. 59 | $-4.42$ | - 68 | $-4.43$ | - $\cdot 76$ | $-4.44$ | -.85 | $-4.46$ | -.93 | $-4 \cdot 48$ |
| 2 | - 57 | $4 \cdot 42$ | -66 | 4.43 | $\cdot 75$ | $4 * 44$ | -83 | 4.46 | -92 | $4 \cdot 47$ | 1-OI | 4.49 |
| 4 | -65 | $4 \cdot 43$ | -73 | 4.44 | -82 | $4 \cdot 45$ | -91 | 4.47 | I.00 | 4.49 | 1.08 | 4.51 |
| 6 | $\cdot 72$ | $4 * 4{ }^{-}$ | -80 | 4.45 | -89 | $4 \cdot 47$ | -98 | $4 * 49$ | I.07 | 4.51 | 1-16 | 4.53 |
| 8 | -79 | $4 \cdot 45$ | -88 | 4.47 , | $\cdot 97$ | $4 \cdot 48$ | I.06 | $4 \cdot 5 \mathrm{I}$ | I•15 | $4 \cdot 53$ | I-24 | $4 \cdot 55$ |
| 10 | -87 | 4.46 | $\cdot 96$ | 4.48 | I 05 | $4 \cdot 50$ | I•I4 | $4 \cdot 53$ | I 24 | $4 \cdot 55$ | 1.33 | $4 \cdot 58$ |
| 12 | $\bullet 95$ | 4.48 | r.04 | $4 \cdot 50$ | I-I3 | $4 \cdot 52$ | I. 23 | $4 \cdot 55$ | 1.32 | 4.57 | I.42 | $4 \cdot 61$ |
| 14 | $1 \cdot 03$ | $4 \cdot 50$ | I-12 | $4 \cdot 52$ | I. 22 | $4 \cdot 54$ | I.3I | $4 \cdot 57$ | I.4I | $4 \cdot 60$ | I.5I | 4.63 |
| 16 | I-II | $4 \cdot 52$ | 1.21 | $4 \cdot 54$ | I.3I | $4 \cdot 57$ | I-4I | $4 \cdot 60$ | I.5I | $4 \cdot 63$ | I-6I | $4 \cdot 66$ |
| 18 | I-20 | 4.54 | 1.30 | $4 \cdot 57$ | I.40 | $4 \cdot 60$ | I. 50 | $4 \cdot 63$ | I.61 | $4 \cdot 66$ | 1•71 | 4.70 |
| 20 | 1.30 | $4 \cdot 57$ | 1.40 | $4 \cdot 60$ | I. 50 | $4 \cdot 63$ | 1.61 | $4 \cdot 66$ | I*71 | 4*70 | $\mathrm{r} \cdot 82$ | 4•74 |
| 22 | I•39 | $4 \cdot 59$ | I. 50 | $4 \cdot 63$ | I.6I | $4 \cdot 66$ | I•71 | $4 \cdot 70$ | I. 83 | $4 \cdot 74$ | 1.94 | 4.79 |
| 24 | I. 50 | $4 \cdot 63$ | I.6I | $4 \cdot 66$ | I.72 | 4•70 | r.83 | $4 \cdot 75$ | I.94 | $4 \cdot 79$ | $2 \cdot 07$ | $4 \cdot 8.4$ |
| 26 | I.6I | $4 \cdot 66$ | I.72 | $4 \cdot 70$ | I.84 | $4 \cdot 75$ | I.96 | $4 \cdot 79$ | 2.08 | 4.85 | $2 \cdot 20$ | 4.90 |
| 28 | I.72 | $4 \cdot 71$ | I. 84 | $4 \cdot 75$ | I.96 | $4 \cdot 80$ | 2.09 | $4 \cdot 85$ | 2.22 | 4.91 | $2 \cdot 35$ | $4 \cdot 97$ |
| 30 | 1.85 | $4 * 75$ | 1*97 | $4 \cdot 80$ | $2 \cdot 10$ | $4 \cdot 86$ | $2 \cdot 24$ | 4*92 | $2 \cdot 37$ | $4 * 98$ | $2 \cdot 52$ | 5.05 |
| 32 | r-99 | $4 \cdot 8 \mathrm{I}$ | $2 \cdot 12$ | $4 \cdot 86$ | $2 \cdot 26$ | $4 \cdot 93$ | $2 \cdot 40$ | 4*99 | $2 \cdot 54$ | $5 \cdot 06$ | $2 \cdot 70$ | $5 \cdot 14$ |
| 34 | $2 \cdot 14$ | $4 \cdot 87$ | $2 \cdot 28$ | 4.94 | 2.43 | $5 \cdot 00$ | $2 \cdot 58$ | $5 \cdot 08$ | $2 \cdot 73$ | $5 \cdot 16$ | $2 \cdot 90$ | $5 \cdot 25$ |
| 36 | $2 \cdot 30$ | 4.95 | 2.45 | $5 \cdot 02$ | $2 \cdot 61$ | $5 \cdot 10$ | $2 \cdot 78$ | $5 \cdot 18$ | $2 \cdot 95$ | $5 \cdot 28$ | $3 \cdot 13$ | $5 \cdot 38$ |
| 38 | $2 \cdot 48$ | $5 \cdot 03$ | $2 \cdot 65$ | $5 \cdot 12$ | $2 \cdot 82$ | $5 \cdot 21$ | $3 \cdot 00$ | $5 \cdot 31$ | 3.19 | $5 \cdot 42$ | 3.40 | $5 \cdot 54$ |
| 40 | $2 \cdot 69$ | 5•14 | $2 \cdot 87$ | $5 \cdot 23$ | 3.06 | $5 \cdot 34$ | 3.26 | $5 \cdot 46$ | $3 \cdot 48$ | 5.59 | 3.71 | $5 \cdot 74$ |
| 41 | $2 \cdot 80$ | $5 \cdot 20$ | $2 \cdot 99$ | $5 \cdot 30$ | 3-19 | $5 \cdot 42$ | $3 \cdot 4 \mathrm{I}$ | $5 \cdot 55$ | $3 \cdot 64$ | $5 \cdot 69$ | $3 \cdot 89$ | $5 \cdot 86$ |
| 42 | 2.92 | $5 \cdot 26$ | $3 \cdot 12$ | $5 \cdot 38$ | $3 \cdot 34$ | $5 \cdot 50$ | $3 \cdot 57$ | $5 \cdot 65$ | $3 \cdot 82$ | $5 \cdot 81$ | $4 \cdot 09$ | $5 \cdot 99$ |
| 43 | $3 \cdot 05$ | $5 \cdot 34$ | 3.27 | $5 \cdot 46$ | $3 \cdot 50$ | $5 \cdot 60$ | $3 \cdot 74$ | 5•76 | $4^{\circ} \mathrm{OI}$ | $5 \cdot 94$ | $4 \cdot 3 \mathrm{I}$ | $6 \cdot 14$ |
| 44 | $3 \cdot 19$ | $5 \cdot 42$ | 3.42 | $5 \cdot 55$ | $3 \cdot 67$ | $5 \cdot 72$ | $3 \cdot 93$ | $5 \cdot 89$ | $4 \cdot 23$ | $6 \cdot 08$ | $4 \cdot 55$ | $6 \cdot 32$ |

## LATITUDE $24^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | н. М. |  | H. M. |  | H. M. S. | s. | M. s. | S. | H. M. S. | 94 | н. M. S. | 7 |
| 0 | $\begin{array}{llll}5 & 38 \\ 5 & 29 & 16 \cdot 1\end{array}$ | -1.87 | $\begin{array}{llll}5 & 36 & 24.1 \\ 5 & 27 & 20.8\end{array}$ | $1 \cdot 9$ | $\begin{array}{llll}5 & 34 & 3 \\ 5 & 25 & 24.3\end{array}$ | -r90 |  | - 1.92 | $\begin{array}{llll}5 & 30 & 39 \\ 5 & 21 & 27 \cdot 1\end{array}$ | 194 | $\begin{array}{llll}5 & 28 & 42.4 \\ 5 & 19 & 26 \cdot 2\end{array}$ | 2.03 |
| 4 | $5 \quad 2013.3$ | I•96 |  | I.98 | $51615 \%$ | 2.01 | 51414.3 | 2.04 | $\begin{array}{lllll}5 & 12 & 114\end{array}$ | 2.06 | 5 10 6.7 | $2 \cdot 09$ |
| 6 | 5 II $7 \times 9$ | 2.01 | $\begin{array}{llll}5 & 9 & 6.8\end{array}$ | $2 \cdot 03$ | $\begin{array}{llll}5 & 7 & 3.8\end{array}$ | $2 \cdot 06$ | $5489{ }^{5}$ | $2 \cdot 10$ | $5{ }_{5}^{5} 2252.2$ | $2 \cdot 13$ | 51083.4 | $2 \cdot 17$ |
| 8 | $\begin{array}{lll}5 & \text { I } 59.9\end{array}$ | $2 \cdot 06$ | 45955.4 | 2.09 | $45748 \cdot 9$ | $2 \cdot 13$ | $45540 \times 3$ | $2 \cdot 1$ | 45329.4 | $2 \cdot$ | 4 5I I6.I | 24 |
| 10 | $45248 \cdot 9$ | $2 \cdot 12$ | $45040 \cdot 9$ | $2 \cdot 15$ | $44^{8} 30 \cdot 5$ | 21 | $44617 \cdot 7$ | 2.23 | $444 \quad 2 \cdot 3$ | 2. | $44 \mathrm{I} 44^{\circ} \mathrm{L}$ | 2.33 |
| 1. | $44^{8} 12 \cdot 3$ | $2 \cdot 1$ | $446 \quad 2 \cdot 2$ | $2 \cdot 19$ | 443498 | $2 \cdot 23$ | 44134.8 | 2.27 | $43917 \cdot 1$ | $2 \cdot 32$ | $43656 \cdot 5$ | $2 \cdot 37$ |
| 12 | $44334 \cdot 7$ | 18 | $44122 \cdot 7$ | $2 \cdot 22$ | $\begin{array}{llll}4 & 39 & 8 \cdot 1\end{array}$ | 27 | $43650 \cdot 8$ | 2.31 | $43430 \cdot 6$ | 2.36 | $432 \begin{array}{ll}4 \times 4\end{array}$ | 2.41 |
| $\leq 3$ | 43856.2 | $2 \cdot 21$ | $43642 \cdot \mathrm{I}$ | $2 \cdot 2$ | 43425.4 | $2 \cdot 30$ | $432 \quad 5 \cdot 6$ | 235 | $42942 \cdot 9$ | 2.41 | $\begin{array}{llll}4 & 27 & 16 \cdot 9\end{array}$ | 2.46 |
| 14 | $43416 \cdot 8$ | $2 \cdot 25$ | $\begin{array}{lll}4 & 32 & 0.5\end{array}$ | $2 \cdot 29$ | $2941 \cdot 4$ | $2 \cdot 34$ | $4 \begin{array}{llll}4 & 27 & 19\end{array}$ | $2 \cdot 40$ | 42453.9 | 2.45 | $42225^{\circ}$ | .51 |
| ${ }^{5} 5$ | $\begin{array}{llll}4 & 29 & 36 \cdot 3\end{array}$ | 2.28 | $\begin{array}{llll}4 & 27 & 17.8 \\ 4 & 22 & 33.0\end{array}$ | 2.33 | $\begin{array}{llll}4 & 24 & 56 \cdot 3 \\ 4 & 20 & \\ 0\end{array}$ | 2.39 2.43 | $\begin{array}{llll}4 & 22 & 31 \cdot 5 \\ 4 & 17 & 42 \cdot 4\end{array}$ | 2.44 2.49 | $\begin{array}{ccc}4 & 20 & 3 \cdot 3 \\ 4 & 15 & 11.3\end{array}$ |  | $\begin{array}{llll}4 & 17 & 31 \cdot 6 \\ 4 & 12 & 36.4\end{array}$ | 6 |
| $1{ }^{16}$ | $\begin{array}{lllllllllll}4 & 24 & 54 \cdot 7 \\ 4 & 20 & 12 \cdot 0\end{array}$ | 2 | $\begin{array}{llll}4 & 22 & 33.9 \\ 4 & 17 & 48.8 \\ 4 & \end{array}$ | 2.37 2.42 | 4 20 $9 \cdot 9$ <br> 4 15 $22 \cdot 1$ | 2.43 2.47 | $\begin{array}{llll}4 & 17 & 42 \cdot 4 \\ 4 & 12 & 51.8\end{array}$ | . 54 | $\begin{array}{ccc}4 & 15 & 11 \cdot 3 \\ 4 & \text { 10 } & 17 \cdot 7\end{array}$ | 2.55 2.60 | $\begin{array}{rr}12 & 36 \cdot 4 \\ 7 & 39.6\end{array}$ | 2.61 2.67 |
| 18 | $41528 \cdot \mathrm{I}$ | $2 \cdot 40$ | 4138 | 2.46 | $41032 \cdot 9$ | $2 \cdot 52$ | 4759.7 | 2.5 | $4 \quad 5 \quad 22.4$ | $2 \cdot 6$ | $4 \quad 2 \quad 40 \cdot 8$ | $2 \cdot 73$ |
| 19 | 4 IO 42.9 | 44 | 48814.5 | $2 \cdot 51$ | $4 \quad 5 \quad 42 \cdot 2$ | 2.57 | $\begin{array}{llll}4 & 3 & 5.9\end{array}$ | 2.64 | $4 \quad 0 \quad 25 \cdot 3$ | $2 \cdot$ | $35740^{\circ}$ | $2 \cdot 7$ |
| 20 | $4 \quad 5 \quad 56 \cdot 4$ | 9 | $4 \quad 3 \quad 25 \cdot 2$ | 2.55 | 4 O 49.9 | 2.62 | 358 10 | 2.70 | $\begin{array}{llll}3 & 55 & 26 \cdot 2\end{array}$ | 2.77 | $\begin{array}{lllllll}3 & 52 & 37\end{array}$ | 2.86 |
| 21 | $4 \begin{array}{llll}4 & 8.5\end{array}$ | 54 | 3 58 <br> 8  | $2 \cdot 61$ | $35555 \cdot 8$ | $2 \cdot 68$ | $\begin{array}{lllll}3 & 53 & 12.8\end{array}$ | $2 \cdot 76$ | $35025 \cdot 1$ | $2 \cdot 84$ | $\begin{array}{ll}3 & 47 \\ 32 \cdot 3\end{array}$ | $2 \cdot 92$ |
| 22 | $\begin{array}{lllll}3 & 56 & 18 \cdot 9\end{array}$ | 2.59 | 35341.7 | $2 \cdot 66$ | $\begin{array}{lllllllllllll}3 & 50 & 59.9\end{array}$ | 7 | $\begin{array}{llll}3 & 48 & 13.4\end{array}$ | $2 \cdot 82$ | $3452 \mathrm{I} \cdot 8$ | 2.90 | $\begin{array}{llllll}3 & 42 & 24.9\end{array}$ | .00 |
| 23 | 35127.9 | $2 \cdot 64$ |  48 | $2 \cdot 71$ | 46 2•I | 2.80 | 343 rr 8 | $2 \cdot 8$ | $34016 \cdot 2$ | 2.97 | 33714.9 | $3 \cdot 07$ |
| 24 | $34635 \cdot 0$ | $2 \cdot 69$ | 343 $51 \cdot 1$ | 2.77 | 34122 |  | $\begin{array}{llll}3 & 38 & 7.9\end{array}$ | 95 | $\begin{array}{llll}3 & 35 & 8 \cdot 0\end{array}$ | - | $\begin{array}{llll}3 & 32 & 2 \cdot 1\end{array}$ | $3 \cdot 15$ |
| 25 | $34140 \cdot 3$ | 75 | $\begin{array}{llll}3 & 38 & 52 \cdot 8\end{array}$ | $2 \cdot 8$ | 36 | 2.93 | $\begin{array}{llll}3 & 33 & 1.6\end{array}$ | 2 | $\begin{array}{llll}3 & 29 & 57.2\end{array}$ | 3.13 | $\begin{array}{llll}3 & 26 & 46 \cdot 4\end{array}$ | 3.2 |
| 26 |  | 81 | $\begin{array}{llll}3 & 33 & 52 \cdot 4\end{array}$ | $2 \cdot 90$ | $33055 \cdot 5$ | 3.00 | $\begin{array}{llll}3 & 27 & 52.6\end{array}$ | O | $\begin{array}{lllllllll}3 & 24 & 43\end{array}$ | 3.21 |  |  |
| 27 | $\begin{array}{llll}3 & 31 & 44.9\end{array}$ | $2 \cdot 87$ | $\begin{array}{lllllllllll}3 & 28 & 49 \cdot 6\end{array}$ | 2.97 | $\begin{array}{llll}3 & 2548.4\end{array}$ | 3.07 | $\begin{array}{lllllllllllllll}3 & 22 & 40 \cdot 8\end{array}$ | 3.1 | $\begin{array}{lllll}3 & 19 & 26 \cdot 6\end{array}$ | 3.30 | $\begin{array}{llll}3 & 16 & 5 \cdot 1 \\ 3 & 10\end{array}$ | 42 |
| 29 | $\begin{array}{llll}3 & 26 & 43 \cdot 8 \\ 3 & 21 & 40 \cdot 3\end{array}$ | 2.94 3.01 | $\begin{array}{lll}3 & 23 & 44 \cdot 3 \\ 3 & 18 & 36 \cdot 3\end{array}$ | 3.04 3.12 | $\begin{array}{llll}3 & 20 & 38 \cdot 5 \\ 3 & 15 & 25.6\end{array}$ | $3 \cdot 15$ 3.24 | $\begin{array}{rrrr}3 & 17 & 25.9 \\ 3 & 12 & 7.8\end{array}$ | 3 | $\begin{array}{rrrr}3 & 14 & 6 \cdot 3 \\ 3 & 8 & 42 \cdot 3\end{array}$ | 3.39 3 | $\begin{array}{cc}3 & 10 \\ 3 & 5\end{array}$ |  |
| 29 | $32140 \cdot 3$ | 3.01 |  | $3 \cdot 12$ | 31525.6 | $3 \cdot 24$ | 31278 | $3 \cdot$ | $\begin{array}{lll}3 & 8 & 42 \cdot 3\end{array}$ | 3 | 35 |  |
| 30 | 31634.2 | 3.09 | 31325.4 | 3 | 3109.5 | 3.33 | $\begin{array}{lll}3 & 6 & 46 \cdot 0\end{array}$ | 3.46 |  | $3 \cdot 60$ | $\begin{array}{llll}2 & 59 & 33.9\end{array}$ | 75 |
| 31 | $\begin{array}{llllll}3 & 11 & 25.2\end{array}$ | 3.17 | $\begin{array}{llll}3 & 8 & 11 \cdot 3 \\ 3 & 2 & 53.7\end{array}$ | 3.29 3.39 | 4 <br> 49.9 <br> 9.9 | 3.42 3.53 | $\begin{array}{rrrr}3 & 1 & 20.3 \\ 2 & 5 & 50.3\end{array}$ | 3.57 | $\begin{array}{lllll}2 & 57 & 42 \cdot 0 \\ 2 & 5 & 4 & \end{array}$ | 3.72 3.8 | $\begin{array}{llll}2 & 53 & 54.3 \\ 2 & 48 & 0.3\end{array}$ | 28 |
| 32 | $\begin{array}{llll}3 & 6 & 13.1\end{array}$ | 3.26 | $\begin{array}{lllll}3 & 2 & 53.7 \\ 2 & 57 & 3 & \end{array}$ | 3.39 | $\begin{array}{lll}59 & 26 \cdot 4 \\ 53 & 58.7\end{array}$ | 3.53 | $\begin{array}{llll}2 & 55 & 50: 3 \\ 2 & 50 & 15 \cdot 6 \\ \end{array}$ | 3. | $\begin{array}{llll}2 & 52 & 4 \cdot 9 \\ 2 & 46 & 22 \cdot 4\end{array}$ | 3.8 | 2 48 9 <br> 2 42  <br> 18   | 7 |
| 33 | $3{ }^{3}$ | 3.35 |  | 49 | $5358 \cdot 7$ | 3.64 |  | 3.8 | $24622 \cdot 4$ | 3.98 |  | $4 \cdot 17$ |
| 34 | ${ }^{2} 5538 \cdot 5$ | 45 | $2{ }^{2} 52 \begin{array}{ll}7 \cdot 1\end{array}$ | $3 \cdot 60$ | 24826.4 | $3 \cdot 76$ | 2443577 | 3.9 | $24034 \cdot 1$ | 3 | 23620.6 | 4.33 |
| 35 | 25015.4 | 3.56 | $\begin{array}{lllllllllll}2 & 46 & 37 \cdot 2\end{array}$ | 3.72 | $24249{ }^{\circ}$ | $3 \cdot 89$ | $\begin{array}{lllll}2 & 38 & 49 & \\ 2 & 32\end{array}$ | $4 \cdot 08$ | $\begin{array}{llll}2 & 34 & 39.3\end{array}$ | 4.29 | 23015.5 | 4.52 |
| 36 | $24447 \cdot 9$ | $3 \cdot 68$ | $\begin{array}{llll}2 & 41 & 2.3\end{array}$ | $3 \cdot 85$ | 2376.0 | $4 \cdot 04$ | 2 32 <br> 2 580 | 4.24 | ${ }^{2} 22837 \cdot 1$ | 4.4 | $2242 \cdot 0$ | $4 \cdot 72$ |
| 37 | ${ }_{2}^{2} 3915.5$ | 3.80 | $\begin{array}{llll}2 & 35 & 21.9\end{array}$ | 3.99 | 23116.8 | 4.19 | 2 26 2688 | 4.42 | $\begin{array}{lllll}2 & 22 & 26 \cdot 8\end{array}$ | $4 \cdot 66$ | $21739^{\circ} \mathrm{O}$ | 4.94 |
| 38 | $23337 \cdot 7$ | 3.94 | 22935.4 | $4 \cdot 14$ | $25 \quad 20 \cdot 4$ | 4.37 | $\begin{array}{llll}2 & 20 & 51 \cdot 5\end{array}$ | 4.61 | 216 | 4 | 2 II 5 | 5.20 5.49 |
| 39 | 22753.9 | 4.0 | $2342{ }^{\circ}$ | 4.31 | 19 I6 | 4.5 | $21435{ }^{\circ}$ | 4.83 | 2936 | $5 \cdot 14$ | 4 I | 5.49 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | S. | S. | S. | s. |  |  | S. $-\mathrm{I} \cdot 39$ | S. | $\stackrel{\text { s. }}{\text { S }}$ | $\begin{gathered} \mathrm{s} . \\ -4.62 \end{gathered}$ |
| 0 |  | -4.50 4.51 | - $1 \cdot 11$ I. | -4.52 4.54 | - 1.20 1.28 | -4.54 4.56 | 1.129 -1.37 | -4.56 4.59 | 1.39 $\mathbf{1} 47$ | -4.59 4.62 | - 1.48 1. 56 | -4.62 4.65 |
| 4 | I.18 | 4.53 | $1 \cdot 27$ | $4 \cdot 56$ | 1.36 | 4.58 | $1 \cdot 45$ | $4 \cdot 61$ | I-55 | $4 \cdot 64$ | I. 65 | $4 \cdot 68$ |
| 6 | 1.26 | 4.56 | I 35 | $4 \cdot 58$ | 1-44 | $4 \cdot 61$ | 1-54 | $4 \cdot 64$ | 1. 64 | $4 \cdot 67$ | $1 \cdot 74$ | 4.71 |
| 8 | $1 \cdot 34$ | 4.58 | 1.43 | $4 \cdot 6 \mathrm{I}$ | I-53 | $4 \cdot 64$ | 1.63 | 4.67 | $1 \cdot 73$ | $4 \cdot 71$ | 1.83 | 4.75 |
| 10 | 143 | $4 \cdot 60$ | I. 52 | $4 \cdot 64$ | 1.62 | $4 \cdot 67$ | $1 \cdot 72$ | 4.71 | 1.83 | $4 \cdot 74$ | $1 \cdot 93$ | 4.79 |
| 12 | 1.52 | $4 \cdot 63$ | 1.62 | $4 \cdot 67$ | $1 \cdot 72$ | 4.70 | 1.82 | 4.74 | I.93 | $4 \cdot 78$ | $2 \cdot 04$ | 4.83 |
| 14 | 1.61 | 4.67 | 1.72 | $4 \cdot 70$ | 1.82 | 4.74 | I 92 | $4 \cdot 78$ | 2.04 | 4.83 | $2 \cdot 15$ | 4.88 |
| 16 | 1・ワ1 | $4 \cdot 70$ | 1.82 | $4 \cdot 74$ | $1 \cdot 93$ | 4.78 | 2.04 | 4.83 | $2 \cdot 16$ | $4 \cdot 88$ | $2 \cdot 27$ | 4.93 |
| 18 | 1.82 | 4•74 | 193 | $4 \cdot 79$ | $2 \cdot 05$ | 4.83 | $2 \cdot 16$ | $4 \cdot 88$ | $2 \cdot 28$ | $4 \cdot 94$ | $2 \cdot 40$ | $5 \cdot 00$ |
| 20 | 1•94 | 4'79 | $2 \cdot 05$ | $4 \cdot 83$ | $2 \cdot 17$ | 4.89 | 2.29 | 4.94 | 2.42 | 5.00 | 2.55 | 5.06 |
| 22 | 2.06 | $4 \cdot 84$ | $2 \cdot 18$ | $4 \cdot 89$ | $2 \cdot 30$ | $4 \cdot 95$ | 2.43 | $5 \cdot 01$ | $2 \cdot 56$ | 5.07 | $2 \cdot 70$ | $5 \cdot 14$ |
| 24 | $2 \cdot 19$ | 4.90 | $2 \cdot 32$ | 4.95 | 2.45 | $5 \cdot 02$ | $2 \cdot 59$ | 5.08 | $2 \cdot 73$ | $5 \cdot 16$ | $2 \cdot 87$ | $5 \cdot 24$ |
| 26 | $2 \cdot 33$ | $4 \cdot 96$ | $2 \cdot 47$ | $5 \cdot 03$ | $2 \cdot 61$ | $5 \cdot 10$ | 2.75 | $5 \cdot 17$ | $2 \cdot 91$ | 5.25 | 3.06 | $5 \cdot 34$ |
| 28 | $2 \cdot 49$ | 5.04 | $2 \cdot 64$ | $5 \cdot 11$ | $2 \cdot 79$ | $5 \cdot 19$ | $2 \cdot 94$ | $5 \cdot 27$ | $3 \cdot 11$ | $5 \cdot 37$ | $3 \cdot 28$ | $5 \cdot 47$ |
| 30 | $2 \cdot 67$ | $5 \cdot 13$ | $2 \cdot 82$ | $5 \cdot 21$ | $2 \cdot 98$ | $5 \cdot 30$ | $3 \cdot 15$ | $5 \cdot 40$ | 3.33 | $5 \cdot 50$ | $3 \cdot 52$ | $5 \cdot 62$ |
| 31 | $2 \cdot 70$ | $5 \cdot 18$ | 2.92 | $5 \cdot 26$ | 3.09 | $5 \cdot 36$ | 3.27 | $5 \cdot 46$ | $3 \cdot 46$ | $5 \cdot 58$ | $3 \cdot 66$ | 5780 |
| 32 | 2.86 | $5 \cdot 23$ | 3.03 | $5 \cdot 32$ | 3.21 | $5 \cdot 43$ | 3.39 | $5 \cdot 54$ | 3.59 | $5 \cdot 66$ | $3 \cdot 80$ | $5 \cdot 80$ |
| 33 | 2.96 | 5.29 | $3 \cdot 14$ | $5 \cdot 39$ | 3.33 | $5 \cdot 30$ | $3 \cdot 53$ | $5 \cdot 62$ | $3 \cdot 74$ | $5 \cdot 76$ | $3 \cdot 96$ | 5.91 |
| 34 | 3.08 | $5 \cdot 35$ | $3 \cdot 26$ | $5 \cdot 46$ | $3 \cdot 46$ | $5 \cdot 58$ | 3.67 | 5.71 | $3 \cdot 89$ | $5 \cdot 86$ | $4 \cdot 13$ | 6.02 |
| 35 | 3.20 | 5.42 | 3.39 | $5 \cdot 54$ | 3.60 | $5 \cdot 67$ | 3.82 3.90 | 5.81 5.93 | 4.06 4.25 |  | 4.33 4.53 |  |
| 36 37 | $\begin{array}{r}3.33 \\ 3.47 \\ \hline\end{array}$ | 5.50 5.58 | 3.53 3.69 | $5 \cdot 63$ 5.72 | 3.76 3.92 | 5.77 5.88 | 3.99 4.18 | 5.93 6.05 | 4.25 4.46 | $6 \cdot 10$ 6.25 | 4.53 4.77 | 6.30 6.47 |
| 38 | $3 \cdot 62$ | $5 \cdot 68$ | $3 \cdot 85$ | 5.83 | $4 \cdot 11$ | $6 \cdot 00$ | $4 \cdot 39$ | $6 \cdot 20$ | $4 \cdot 69$ | 6.42 | 5 '03 | $6 \cdot 67$ |
| 39 | $3 \cdot 78$ | 5*79 | $4 \cdot 05$ | 5.95 | $4 \cdot 32$ | $6 \cdot 14$ | $4 \cdot 62$ | $6 \cdot 36$ | $4 \cdot 95$ | $6 \cdot 61$ | $5 \cdot 33$ | $6 \cdot 90$ |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL.. AND ALT. 221

 LATITUDE $24^{\circ}$.DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. <br> Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. S. | S. |  | S. | H. M. S. | S. | S. | S. | H. M. S. | S. |
| 0 |  | - I.99 | $5 \begin{array}{llll}5 & 24 & 43 \cdot 6\end{array}$ | $-2.02$ | $5224 r \cdot 8$ | -2.04 | $5203^{8 \cdot 3}$ | $-2.07$ | $\begin{array}{llll}5 & 18 & 32.9\end{array}$ | $2 \cdot 11$ | $\begin{array}{llll}5 & 16 & 25 \cdot 5\end{array}$ | $-2.14$ |
| 2 | $\begin{array}{llllll}5 & 17 & 23.7\end{array}$ | 2.06 | 51515194 | $2 \cdot 09$ | $5 \begin{array}{llll}5 & \text { I3 } & \text { I } 3.2\end{array}$ | $2 \cdot 12$ | 5 II 4.9 | $2 \cdot 16$ | $\begin{array}{llllllllllllll}5 & 8 & 54 \cdot 5\end{array}$ | $2 \cdot 19$ | $5 \quad 6 \quad 4 \mathrm{I} \cdot 8$ | $2 \cdot 23$ |
| 4 | $\begin{array}{llll}5 & 8 & 0 & 0 \\ 4 & 8 & \end{array}$ | $2 \cdot 13$ | $\begin{array}{llll}5 & 5 & 51 \cdot 3\end{array}$ | $2 \cdot 16$ | $\begin{array}{llll}5 & 3 & 40 \cdot 3\end{array}$ | $2 \cdot 20$ | 5 I $27 \cdot 1$ | $2 \cdot 24$ | 459 II•3 | $2 \cdot 28$ | $\begin{array}{lllllllllllll}4 & 56 & 52.9\end{array}$ | $2 \cdot 33$ |
| 6 | $458132 \cdot 3$ | $2 \cdot 20$ | $\begin{array}{lllllll}4 & 56 & 18 \cdot 9\end{array}$ | $2 \cdot 24$ | $454 \quad 2 \cdot 9$ | $2 \cdot 29$ | $45^{1} 184.2$ | $2 \cdot 33$ | $4 \begin{array}{llllllll}4 & 49 & 22.7\end{array}$ | $2 \cdot 38$ | $44658 \cdot 2$ | 2.43 |
| 8 | $449 \quad 0.2$ | $2 \cdot 29$ | $14641 \cdot 7$ | 2.33 | $44420 \cdot 3$ | $2 \cdot 38$ | 44155.9 | $2 \cdot 43$ | $439 \quad 28 \cdot 2$ | $2 \cdot 49$ | $436 \quad 57 \cdot 1$ | $2 \cdot 55$ |
| 10 | $\begin{array}{llll}4 & 39 & 23 \cdot 3\end{array}$ | 2.37 | $4 \begin{array}{lll}4 & 36 & 59 \cdot 3\end{array}$ | 2.43 | $43432 \cdot 1$ | 2.48 | $4 \begin{array}{lll}42 & 1 \cdot 4\end{array}$ | $2 \cdot 54$ | $4 \begin{array}{lll}4 & 29 & 27 \cdot 1\end{array}$ | $2 \cdot 60$ | $4 \begin{array}{llll}4 & 26 & 48 \cdot 9\end{array}$ | $2 \cdot 67$ |
| 12 | $42940 \cdot 9$ | $2 \cdot 47$ | 427 II'I | $2 \cdot 53$ | $42437 \cdot 5$ | $2 \cdot 59$ | 422 O.1 | $2 \cdot 66$ | 4 I9 18.6 | 2.73 | 4 16 32•7 | $2 \cdot 80$ |
| 13 | $42447 \cdot 6$ | $2 \cdot 52$ |  | 2.58 | 4 I9 37.6 | $2 \cdot 65$ | 4 I6 $56 \cdot 6$ | 2.72 | $\mathrm{llll}_{4} \mathrm{I} 4 \mathrm{II} \mathrm{\cdot 3}$ | $2 \cdot 79$ | 4 Ir 21.4 | $2 \cdot 87$ |
| 14 | 4 I9 $52 \cdot 6$ | 2.57 | 4 I7 I6.3 | $2 \cdot 64$ | 4 I4 35.9 | $2 \cdot 71$ | 4 II 51.2 | $2 \cdot 78$ | $4 \begin{array}{lll}4 & 9 & 1.8\end{array}$ | $2 \cdot 86$ | $\begin{array}{llll}4 & 6 & 7 \cdot 6\end{array}$ | $2 \cdot 95$ |
| 15 | $4 \begin{array}{llll}4 & \text { I } & 55\end{array}$ | $2 \cdot 63$ | 4 I2 I6.2 | $2 \cdot 70$ | $4932 \cdot 1$ | 2.77 | $4 \quad 6 \quad 43 \cdot 5$ | $2 \cdot 85$ | $4350 \cdot 0$ | $2 \cdot 93$ | 4 - 5I.3 | 3.02 |
| 16 | $4 \quad 957.5$ | 2.68 | 4714.2 | $2 \cdot$ | $\begin{array}{llll}4 & 4 & 26 \cdot 3\end{array}$ | $2 \cdot 84$ | 4 I $33 \cdot 6$ | $2 \cdot 92$ | $\begin{array}{llll}3 & 58 & 35.6\end{array}$ | 3.01 | 35532.2 | $3 \cdot 11$ |
| 17 | $4{ }^{4} \quad 4 \begin{array}{ll} & 57 \cdot 1\end{array}$ | $2 \cdot 75$ | 422 IO*I | 2.82 | $359518 \cdot 2$ | $2 \cdot 91$ | $3{ }_{3} 562 \mathrm{I} \cdot 2$ | $3 \cdot 00$ |  | $3 \cdot 09$ | $35010 \cdot 3$ | $3 \cdot 19$ |
| 18 | $3 \begin{array}{llll}3 & 59 & 54.7\end{array}$ | 2.81 | $\begin{array}{llll}3 & 57 & 3 \cdot 8\end{array}$ | $2 \cdot 89$ | $\begin{array}{llll}3 & 54 & 7 \cdot 7\end{array}$ | 2.98 | $\begin{array}{llll}3 & 51 & 6 \cdot 2\end{array}$ | 3.07 | $3 \begin{array}{llllllllllllll}3 & 47 & 58\end{array}$ | $3 \cdot 17$ | $34445 \cdot 2$ | $3 \cdot 28$ |
| 19 | $\begin{array}{lllllllllllll}3 & 54 & 50 \cdot 2\end{array}$ | $2 \cdot 87$ | $\begin{array}{llll}3 & 51 & 55^{\circ} 2 \\ & & 6 & \end{array}$ | $2 \cdot 96$ | $\begin{array}{lllll}3 & 48 & 54 \cdot 7\end{array}$ | 3.06 | $\begin{array}{lllllll}3 & 45 & 48 \cdot 4\end{array}$ | $3 \cdot 16$ | 3 42 $35 \cdot 9$ <br> 3 37  | $3 \cdot 26$ | $\begin{array}{llllllllll}3 & 39 & 16 \cdot 9\end{array}$ | $3 \cdot 38$ |
| 20 | 34943.4 | 2.94 | $34^{6} 44^{\circ} \mathrm{O}$ | 3.04 | 343 38.9 | $3 \cdot 14$ | $34027 \cdot 6$ | $3 \cdot 24$ | $\begin{array}{llll}3 & 37 & 9 \cdot 8\end{array}$ | $3 \cdot 36$ | $\begin{array}{llll}3 & 33 & 44 * 8\end{array}$ | 3.48 |
| 21 | 3 44 $34^{\circ} \mathrm{I}$ | 3.02 | $\begin{array}{llll}3 & 41 & 30 \cdot 2\end{array}$ | $3 \cdot 12$ | $\begin{array}{llll}3 & 38 & 20 \cdot 2\end{array}$ | 3.22 | $\begin{array}{lll}3 & 35 & 3 \cdot 6\end{array}$ | 3.33 | $33140 \cdot 0$ | 3.46 | $\begin{array}{lll}3 & 28 & 8 \cdot 9\end{array}$ | 3.58 |
| 22 | $\begin{array}{llll}3 & 39 & 22 \cdot 2\end{array}$ | 3.09 |  | $3 \cdot 20$ | $\begin{array}{llll}3 & 32 & 58 \cdot 3\end{array}$ | $3 \cdot 3 \mathrm{I}$ | $\begin{array}{llll}3 & 29 & 36 \cdot I\end{array}$ | $3 \cdot 43$ | $\begin{array}{llll}3 & 26 & 6 \cdot 5\end{array}$ | $3 \cdot 56$ | $\begin{array}{llll}3 & 22 & 28 \cdot 8\end{array}$ | $3 \cdot 70$ |
| 23 | $\begin{array}{lll}3 & 34 & 7 \cdot 5\end{array}$ | $3 \cdot 18$ | $\left\lvert\, \begin{array}{llll}3 & 30 & 53 \cdot 7\end{array}\right.$ | $3 \cdot 29$ | $32733{ }^{3} \mathrm{O}$ | 3.4 I | $\begin{array}{lll}3 & 24 & 4 \cdot 8\end{array}$ | $3 \cdot 53$ | $32028 \cdot 8$ | 3.67 | $31644 \cdot 1$ | $3 \cdot 82$ |
| 24 | 3 28 $49 \cdot 8$ | 3.26 | $\begin{array}{llll}3 & 25 & 30 \cdot 6 \\ 3 & 20 & 3.8\end{array}$ | $3 \cdot 38$ | 32240 | $3 \cdot 5 \mathrm{r}$ | $\begin{array}{llll}3 & 18 & 29 \cdot 6 \\ 3 & 18 & 49.8\end{array}$ | $3 \cdot 64$ | $311446 \cdot 6$ | $3 \cdot 79$ | 3 10 54.4 | $3 \cdot 95$ |
| 25 | $\begin{array}{llll}3 & 23 & 28 \cdot 7\end{array}$ | $3 \cdot 35$ | $\begin{array}{llll}3 & 20 & 3 \cdot 8\end{array}$ | $3 \cdot 48$ | 3 16 3r-r | 3.62 | $31249 \cdot 8$ | 3.76 | $\begin{array}{llll}3 & 8 & 59.5\end{array}$ | 3.92 | $\begin{array}{llll}3 & 4 & 59 \cdot 2\end{array}$ | $4^{\circ} 09$ |
| 26 | $\begin{array}{llll}3 & 18 & 4.2\end{array}$ | 3.45 | 3 I4 33.2 | $3 \cdot 59$ | 3 10 53.7 | 3.73 | $\begin{array}{lll}3 & 7 & 5 \cdot 3\end{array}$ | $3 \cdot 89$ | $3{ }^{3} \quad 3 \begin{array}{lll} & 7 & 0\end{array}$ | 4.06 | $25858 \cdot 0$ | $4 \cdot 24$ |
| 27 | $\begin{array}{lllll}3 & 12 & 35 \cdot 8\end{array}$ | $3 \cdot 56$ |  | $3 \cdot 70$ | $3 \quad 5 \mathrm{II} \cdot 7$ | $3 \cdot 86$ | $\begin{array}{lll}3 & 1 & 15.4\end{array}$ | $4^{\circ} \mathrm{O} 3$ | 25786 | $4 \cdot 21$ | $25250 \cdot 2$ | 4.41 |
| 28 | $\begin{array}{llll}3 & 7 & 3 \cdot 3\end{array}$ | 3.67 | $\begin{array}{llll}3 & 3 & 18 \cdot 7\end{array}$ | 3.82 | $2 \begin{array}{llll} & 59 & 24.5\end{array}$ | 3.99 | $\begin{array}{\|lll\|}2 & 55 & 19 \cdot 8\end{array}$ | $4 \cdot 17$ | 2 51 3 3.6 | $4 \cdot 37$ | 24634.9 | $4 \cdot 59$ |
| 29 | 3 1 $26 \cdot 1$ <br>  55  | 3.79 | $25734^{\circ} \mathrm{O}$ | 3.95 | $\left\lvert\, \begin{array}{lll}2 & 53 & 31 \cdot 5\end{array}\right.$ | $4 \cdot 14$ | 249 17.7 | 4.33 | $2{ }_{2} 44$ 5I•4 | 4.55 | 240 II.4 | $4 \cdot 79$ |
| 30 | $25544^{\circ} \mathrm{O}$ | 3.92 | $25143 \cdot 7$ | 4.10 | 24732.2 | $4 \cdot 29$ | $\begin{array}{llll}2 & 43 & 8 \cdot 4\end{array}$ | $4 \cdot 51$ | 238 3-I | $4 \cdot 75$ | $23338 \cdot 7$ | $5 \cdot 01$ |
| 31 | $\begin{array}{llll}2 & 49 & 56.3\end{array}$ | 4.06 | $\begin{array}{llll}2 & 45 & 47 \cdot 3\end{array}$ | 4.25 | $\begin{array}{llll}2 & 41 & 25.9\end{array}$ | 4.47 | $\begin{array}{llll}2 & 36 & 51 \cdot 2\end{array}$ | $4 \cdot 70$ | $\begin{array}{llr}2 & 32 & \text { 1.6 }\end{array}$ | 4.97 | $22655 \cdot 3$ | $5 \cdot 26$ |
| 32 | $\begin{array}{lll}2 & 44 & 2.6 \\ 2 & 38 & 2.1\end{array}$ | $4 \cdot 21$ | $\begin{array}{llll}2 & 39 & 43.9\end{array}$ | 4.42 | $\begin{array}{llll}2 & 35 & 1 \mathrm{I} \cdot 8 \\ 2 & 8 & 4\end{array}$ | $4 \cdot 66$ | $\begin{array}{llll}2 & 30 & 25 \cdot 0\end{array}$ | $4 \cdot 92$ | $\begin{array}{llll}2 & 25 & 21 \cdot 7\end{array}$ | $5 \cdot 21$ | 220000 | $5 \cdot 53$ |
| 33 | $\begin{array}{rrrr}2 & 38 & 2 \cdot 1 \\ 2 & 31 & 54 \cdot 0\end{array}$ | $4 \cdot 38$ | $\begin{array}{llll}2 & 33 & 32 \cdot 8 \\ 2 & 27 & 1\end{array}$ | $4 \cdot 61$ | $\begin{array}{llll}2 & 28 & 48 \cdot 8 \\ 2 & 22 & 15.8\end{array}$ | $4 \cdot 87$ | $\begin{array}{llll}2 & 23 & 48 \cdot 6 \\ 2 & 1 & 4 & 0 \cdot 5\end{array}$ | $5 \cdot 16$ | $2 \begin{array}{llll}2 & 18 & 30 \cdot 0 \\ 2 & \end{array}$ | $5 \cdot 48$ | $\begin{array}{llll}2 & 12 & 50.7\end{array}$ | $5 \cdot 85$ |
| 34 35 | $\begin{array}{llll}2 & 31 & 54 \cdot 0 \\ 2 & 25 & 37 \cdot 4\end{array}$ | 4.56 4.77 | $\begin{array}{llll}2 & 27 & 13.0 \\ 2 & 20 & 43.4\end{array}$ | 4.82 5.05 | 2 22 $15 \cdot 8$  <br> 2 15 3  | $5 \cdot 10$ $5 \cdot 37$ | $\begin{array}{llrr}2 & 17 & 0 \cdot 5 \\ 2 & 9 & 58 \cdot 0\end{array}$ | 5.43 | 2 II 24.6 | $5 \cdot 79$ | 2 5 $25^{\prime} \mathrm{I}$ | $6 \cdot 22$ |
| 35 | $22537 \cdot 4$ | $4 \cdot 77$ | 22043.4 | $5 \cdot 05$ | $21531 \cdot 3$ | $5 \cdot 37$ | 2 2 9 58.9 | 5.73 | $43 \cdot 1$ | $6 \cdot 16$ | I $5740 \cdot \mathrm{I}$ | $6 \cdot 64$ |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | S. | S. | S. | S. | s. | s. | s. | s. | S. | S. |
| 0 | $-\mathbf{x} 57$ | $-4.65$ | - 1.67 | $-4 \cdot 68$ | - 1.77 | $-4.72$ | - 1.87 | $-4.76$ | - I.97 | $-4.80$ | $-2.07$ | $-4.84$ |
| 2 | 1.66 | $4 \cdot 68$ | I•76 | $4 \cdot 72$ | I.86 | $4 \cdot 75$ | 1.96 | 4.80 | $2 \cdot 06$ | $4 \cdot 84$ | 2•17 | $4 \cdot 88$ |
| 4 | 1.75 | 4.71 | I-85 | $4 \cdot 75$ | I'95 | $4 \cdot 79$ | $2 \cdot 05$ | $4 \cdot 84$ | $2 \cdot 16$ | $4 \cdot 88$ | 2.27 | $4 \cdot 93$ |
| 6 | I•84 | 4.75 | I.94 | 4*79 | $2 \cdot 05$ | 4.83 | $2 \cdot 15$ | $4 \cdot 88$ | $2 \cdot 26$ | $4 \cdot 93$ | $2 \cdot 38$ | $4 \cdot 98$ |
| 8 | 1.93 | 4.79 | $2 \cdot 04$ | $4 \cdot 82$ | $2 \cdot 15$ | $4 \cdot 88$ | $2 \cdot 26$ | 4.93 | $2 \cdot 37$ | 4.98 | 2.49 | 5.04 |
| 10 | $2 \cdot 04$ | $4 \cdot 83$ | $2 \cdot 15$ | $4 \cdot 88$ | $2 \cdot 26$ | 4.93 | $2 \cdot 38$ | 4.98 | 2.49 | 5.04 | $2 \cdot 62$ | 5.10 |
| 12 | $2 \cdot 15$ | $4 \cdot 88$ | $2 \cdot 26$ | 4.93 | $2 \cdot 38$ | 4.98 | $2 \cdot 50$ | $5 \cdot 04$ | $2 \cdot 62$ | $5 \cdot 11$ | $2 \cdot 75$ | $5 \cdot 17$ |
| 13 | $2 \cdot 21$ | 4.90 | $2 \cdot 32$ | $4 \cdot 96$ | 2.44 | $5 \cdot 01$ | $2 \cdot 56$ | $5 \cdot 07$ | 2.69 | $5 \cdot 14$ | 2.82 | $5 \cdot 21$ |
| 14 | $2 \cdot 27$ | 4.93 | $2 \cdot 38$ | 4.99 | 2.51 | $5 \cdot 05$ | $2 \cdot 63$ | 5.11 | $2 \cdot 76$ | 5.18 | $2 \cdot 90$ | $5 \cdot 25$ |
| 15 | $2 \cdot 33$ | 4.96 | 2.45 | $5 \cdot 02$ | $2 \cdot 58$ | $5 \cdot 08$ | $2 \cdot 70$ | $5 \cdot 15$ | 2.84 | $5 \cdot 22$ | $2 \cdot 98$ | $5 \cdot 29$ |
| 16 | $2 \cdot 39$ | 4.99 | $2 \cdot 52$ | 5.05 | $2 \cdot 65$ | 5•12 | 2•78 | 5•19 | 2.92 | 5.26 | $3 \cdot 06$ | $5 \cdot 34$ |
| 17 | $2 \cdot 46$ | $5 \cdot 02$ | $2 \cdot 59$ | $5 \cdot 09$ | $2 \cdot 72$ | $5 \cdot 15$ | 2.86 | $5 \cdot 23$ | $3 \cdot 00$ | $5 \cdot 31$ | $3 \cdot 15$ | $5 \cdot 39$ |
| 18 | 2.53 | $5 \cdot 06$ | $2 \cdot 66$ | $5 \cdot 12$ | $2 \cdot 80$ | $5 \cdot 20$ | $2 \cdot 94$ | $5 \cdot 27$ | 3.09 | $5 \cdot 36$ | $3 \cdot 24$ | $5 \cdot 44$ |
| 19 | 2.63 | $5 \cdot 09$ | $2 \cdot 74$ | $5 \cdot 16$ | 2.88 | $5 \cdot 24$ | $3 \cdot 02$ | $5 \cdot 32$ | 3.18 | $5 \cdot 41$ | $3 \cdot 33$ | $5 \cdot 50$ |
| 20 | $2 \cdot 68$ | 5.13 | $2 \cdot 82$ | $5 \cdot 21$ | $2 \cdot 96$ | $5 \cdot 29$ | $3 \cdot 11$ | $5 \cdot 37$ | $3 \cdot 27$ | $5 \cdot 47$ | 3.44 | $5 \cdot 57$ |
| 21 | 2.76 | 5.18 | $2 \cdot 90$ | $5 \cdot 25$ | 3.05 | $5 \cdot 34$ | 3.21 | $5 \cdot 43$ | 3.37 | 5:53 | 3.54 | 5.63 |
| 22 | $2 \cdot 85$ | $5 \cdot 22$ | 2.99 | $5 \cdot 30$ | $3 \cdot 15$ | $5 \cdot 39$ | $3 \cdot 31$ | 5*49 | $3 \cdot 48$ | 5.59 | 3.66 | $5 \cdot 71$ |
| 23 | $2 \cdot 93$ | $5 \cdot 27$ | $3 \cdot 09$ | $5 \cdot 36$ | $3 \cdot 25$ | $5 \cdot 45$ | $3 \cdot 42$ | $5 \cdot 55$ | $3 \cdot 60$ | $5 \cdot 67$ | $3 \cdot 78$ | $5 \cdot 79$ |
| 24 | 3.03 | $5 \cdot 32$ | $3 \cdot 19$ | $5 \cdot 42$ | $3 \cdot 35$ | $5 \cdot 52$ | 3.53 | $5 \cdot 62$ | 3.72 | $5 \cdot 74$ | $3 \cdot 92$ | $5 \cdot 87$ |
| 25 | $3 \cdot 13$ | $5 \cdot 38$ | $3 \cdot 29$ | $5 \cdot 48$ | 3.47 | $5 \cdot 58$ | $3 \cdot 65$ | 5.70 | $3 \cdot 85$ | $5 \cdot 83$ | 4.05 | $5 \cdot 97$ |
| 26 | 3.23 | $5 \cdot 44$ | 3.40 | $5 \cdot 55$ | 3'59 | $5 \cdot 66$ | $3 \cdot 78$ | 5779 | 3.99 | 5.92 | 4.21 | $6 \cdot 07$ |
| 27 | $3 \cdot 34$ | $5 \cdot 51$ | 3.52 | $5 \cdot 62$ | 3.72 3.86 | $5 \cdot 74$ | 3.92 | $5 \cdot 88$ | $4 \cdot 14$ | $6 \cdot 03$ | $4 \cdot 38$ | $6 \cdot 19$ |
| 28 | $3 \cdot 46$ | $5 \cdot 58$ | $3 \cdot 65$ | $5 \cdot 70$ | 3.86 | $5 \cdot 83$ | $4 \cdot 07$ | $5 \cdot 98$ | $4 \cdot 31$ | $6 \cdot 14$ | - $4 \cdot 56$ | $6 \cdot 32$ |
| 29 | $3 \cdot 59$ | $5 \cdot 66$ | 3.79 | $5 \cdot 79$ | 4.01 | 5.94 | $4 \cdot 24$ | $6 \cdot 09$ | 4.49 | $6 \cdot 27$ | $4 \cdot 76$ | $6 \cdot 47$ |
| 30 | $3 \cdot 72$ | 5.75 | 3.94 | $5 \cdot 89$ | $4^{117}$ | $6 \cdot 05$ | 4.42 | $6 \cdot 22$ | 4.69 | 6.41 | 4.98 | $6 \cdot 63$ |
| 31 | $3 \cdot 87$ | $5 \cdot 84$ | 4.10 | $6 \cdot 00$ | $4 \cdot 35$ | $6 \cdot 17$ | $4 \cdot 62$ | $6 \cdot 36$ | 4.91 | $6 \cdot 58$ | $5 \cdot 23$ | 6.82 |
| 32 | 4.03 | $5 \cdot 95$ | $4 \cdot 28$ | $6 \cdot 12$ | $4 \cdot 54$ | $6 \cdot 31$ | $4 \cdot 83$ | $6 \cdot 52$ | 5•15 | $6 \cdot 76$ | $5 \cdot 51$ | $7 \cdot 04$ |
| 33 | $4 \cdot 21$ | $6 \cdot 07$ | 4.47 | $6 \cdot 26$ | $4 \cdot 76$ | $6 \cdot 47$ | $5 \cdot 08$ | $6 \cdot 70$ | 5.43 | $6 \cdot 98$ | $5 \cdot 83$ | $7 \cdot 29$ |
| 34 | 4.40 | $6 \cdot 21$ | $4 \cdot 68$ | 6.41 | $5 \cdot 00$ | $6 \cdot 65$ | $5 \cdot 35$ | $6 \cdot 91$ | 5.75 | $7 \cdot 22$ | $6 \cdot 20$ | $7 \cdot 59$ |
| 35 | $4 \cdot 60$ | $6 \cdot 36$ | 4.92 | $6 \cdot 59$ | $5 \cdot 27$ | $6 \cdot 85$ | $5 \cdot 66$ | 7•16 | $6 \cdot 11$ | $7 \cdot 51$ | $6 \cdot 61$ | $7 \times 94$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. <br> Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | s. | H. M. S. | s. | H. M. |  | M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | 6 \% 0-0.0 | - 1.86 | $\begin{array}{llll}5 & 58 & 8 \cdot 1\end{array}$ | - 1.87 | $556 \mathrm{I} \cdot \mathrm{I}$ | - 1.87 | $\begin{array}{llll}5 & 54 & 23.9\end{array}$ | - 1.87 | 5 $52 \begin{array}{lll}52 & 31.5\end{array}$ | -1.87 | $\begin{array}{lllll}5 & 50 & 38 \cdot 9\end{array}$ | - I .88 |
| 6 | $53330 \cdot 5$ | 1.88 | $\begin{array}{llll}5 & 31 & 37 \cdot 5\end{array}$ | I.89 | $\begin{array}{llll}5 & 29 & 43.9\end{array}$ | I•90 | $52749 \cdot 5$ | 1.91 | $525 \quad 54.3$ | $1 \cdot 93$ | $\begin{array}{llll}5 & 23 & 58 \cdot 1\end{array}$ | I•94 |
| 8 | $52440 \cdot 0$ | I.89 | $\begin{array}{llll}5 & 22 & 46 \cdot 3\end{array}$ | I'90 | $5205 \mathrm{I} \cdot 8$ | I•92 | $\begin{array}{lllll}5 & 18 & 56 \cdot 3\end{array}$ | $1 \cdot 93$ | 5 $516 \quad 59 \cdot 7$ | r 95 | 5 I5 2'I | I•97 |
| 10 | $51549 \cdot 0$ | 1.90 | $\begin{array}{lllll}5 & 13 & 54 *\end{array}$ | I*92 | $\begin{array}{llllllllllll}5 & \text { If }\end{array}$ | I•94 | $5102 \cdot 0$ | I-96 | $\begin{array}{lll}5 & 8 & 3 \cdot 9\end{array}$ | I.98 | $\begin{array}{llll}5 & 6 & 4 * 5\end{array}$ | $2 \cdot 00$ |
| 12 | $5657 \cdot 1$ | I-92 | 5 5 1 | I•94 | $\begin{array}{lll}5 & 3 & 4.6\end{array}$ | I*96 | $5 \quad 1 \quad 6 \cdot 3$ | r.98 | 4596 | $2 \cdot 01$ | $4 \begin{array}{lll}4 & 57 & 5\end{array}$ | 2.04 |
| 14 | $\begin{array}{llll}4 & 58 & 4.4\end{array}$ | I'94 | $4 \begin{array}{lll}56 & 7 \cdot 5\end{array}$ | I.96 | $4 \quad 54 \quad 9.1$ | I'99 | $45^{52} \quad 9^{\circ} \mathrm{I}$ | 2.01 | 4507.4 | $2 \cdot 04$ | $\begin{array}{lll}4 & 48 & 3.9\end{array}$ | $2 \cdot 07$ |
| 16 | 449 10.6 | I•96 | $44712 \cdot 2$ | $1 \cdot 99$ | $4 \begin{array}{llllllll}4512\end{array}$ | $2 \cdot 02$ | 443 10.2 | $2 \cdot 05$ | 4416 | $2 \cdot 08$ | $439 \quad 0 \cdot 4$ | $2 \cdot 12$ |
| 18 | $44015 \cdot 5$ | I.98 | $43815 \cdot 5$ | $2 \cdot 02$ |  | $2 \cdot 05$ | $434 \quad 9 \cdot 3$ | $2 \cdot 09$ | 432300 | $2 \cdot 12$ | $42954 * 4$ | $2 \cdot 16$ |
| 20 | 43118.9 | 2.01 | 429 16.9 | $2 \cdot 05$ | 42712.8 | 2.09 | $425 \quad 6 \cdot 2$ | $2 \cdot 13$ | $42257 \cdot 2$ | $2 \cdot 17$ | $42045 \cdot 5$ | $2 \cdot 22$ |
| 22 | $42220 \cdot 5$ | 2.05 | $42016 \cdot 4$ | $2 \cdot 09$ | 41818 | $2 \cdot 13$ | 4160.5 | $2 \cdot 18$ | $4 \begin{array}{llll}4 & 48 \cdot 4\end{array}$ | 2.22 | 4 II $33 \cdot 5$ | 2.27 |
| 23 | $41750 \cdot 7$ | $2 \cdot 07$ | $4 \times 545 \cdot 3$ | $2 \cdot 11$ | $413 \quad 37 \cdot 4$ | $2 \cdot 16$ | 4 II 26.6 | $2 \cdot 20$ | 4912.9 | $2 \cdot 25$ | $4656 \cdot 1$ | $2 \cdot 31$ |
| 24 | $41320 \cdot 2$ | $2 \cdot 09$ | 4 II 13.6 | $2 \cdot 13$ | 494.2 | $2 \cdot 18$ | $4 \quad 651 \cdot 9$ | $2 \cdot 23$ | $4 \begin{array}{llll}4 & 4 & 36 \cdot 5\end{array}$ | $2 \cdot 28$ | $\begin{array}{llll}4 & 2 & 17 & 7\end{array}$ | $2 \cdot 34$ |
| 25 | $48849 \cdot 2$ | $2 \cdot 11$ | $4641 \cdot 3$ | $2 \cdot 16$ | $4 \quad 430 \cdot 4$ | $2 \cdot 21$ | $\begin{array}{llll}4 & 2 & 16.4\end{array}$ | $2 \cdot 26$ | $35959 \cdot 1$ | $2 \cdot 32$ | $3 \quad 5738 \cdot 5$ | $2 \cdot 37$ |
| 26 | $4 \begin{array}{llll}4 & 4 & 17\end{array}$ | $2 \cdot 13$ | $4 \quad 2 \quad 8 \cdot 2$ | $2 \cdot 18$ | $35955 \cdot 8$ | $2 \cdot 23$ | $35740 \%$ | $2 \cdot 29$ | $35520 \cdot 8$ | $2 \cdot 35$ | $\begin{array}{llll}3 & 52 & 58 \cdot 1\end{array}$ | 2.41 |
| 27 | $35945 \cdot 3$ | $2 \cdot 16$ | 35734.4 | 2.21 | $355 \quad 20 \cdot 3$ | $2 \cdot 26$ | $\begin{array}{llll}3 & 53 & 2 \cdot\end{array}$ | $2 \cdot 32$ | $35041 \cdot 5$ | $2 \cdot 38$ | $\begin{array}{llll}3 & 48 & 16 \cdot 5\end{array}$ | 2.45 |
| 28 | $35512 \cdot 3$ | $2 \cdot 18$ | $\begin{array}{llll}3 & 52 & 59 \cdot 8\end{array}$ | $2 \cdot 24$ | $35043 \cdot 9$ | 2.30 | $\begin{array}{llll}3 & 48 & 24.3\end{array}$ | $2 \cdot 36$ | 346 I•O | $2 \cdot 42$ | $34333 \cdot 7$ | 2.49 |
| 29 | 35038.6 | $2 \cdot 21$ | $\begin{array}{llll}3 & 48 & 24.4\end{array}$ | 2.27 | $\begin{array}{llll}3 & 46 & 6 \cdot 6\end{array}$ | $2 \cdot 33$ | $\begin{array}{lllll}3 & 43 & 44^{\prime} 9\end{array}$ | $2 \cdot 39$ | $34519 * 3$ | $2 \cdot 46$ | $\begin{array}{lllllllllll}3 & 38 & 49 & \end{array}$ | 2.53 |
| 30 | $34^{6} 4^{*} \times$ | $2 \cdot 24$ | $34348 \cdot 0$ | $2 \cdot 30$ | $34128 \cdot 2$ | $2 \cdot 36$ | $\begin{array}{llll}3 & 39 & 4.4\end{array}$ | $2 \cdot 43$ |  | $2 \cdot 50$ | $\begin{array}{llll}3 & 34 & 3 \cdot 9\end{array}$ | $2 \cdot 58$ |
| 3 I | $34128 \cdot 7$ | $2 \cdot 27$ | $\begin{array}{llll}3 & 39 & 10 \cdot 7\end{array}$ | $2 \cdot 33$ | $\begin{array}{lllllllllllll}3 & 36 & 48\end{array}$ | 2.40 | $\begin{array}{llll}3 & 34 & 22 \cdot 6\end{array}$ | $2 \cdot 47$ | 3 31 52.0 | $2 \cdot 55$ | $\begin{array}{llll}3 & 29 & 16 \cdot 8\end{array}$ | 2.63 |
| 32 | $33652 \cdot 3$ | $2 \cdot 30$ | $33432 \cdot 3$ | $2 \cdot 37$ | $\begin{array}{llll}3 & 32 & 8 \cdot 2\end{array}$ | 2.44 | 32939.5 | $2 \cdot 52$ | $\begin{array}{lll}3 & 27 & 6.3\end{array}$ | $2 \cdot 59$ | $\begin{array}{llll}3 & 24 & 28 \cdot 1\end{array}$ | $2 \cdot 68$ |
| 33 | 332150 | $2 \cdot 33$ | $32952 \cdot 8$ | 2.41 | $\begin{array}{llll}3 & 27 & 26 \cdot 3\end{array}$ | 2.48 | $32455 \cdot 0$ | $2 \cdot 56$ | $\begin{array}{llll}3 & 22 & 18 \cdot 9\end{array}$ | $2 \cdot 64$ | $\begin{array}{llll}3 & 19 & 37 \cdot 6\end{array}$ | $2 \cdot 73$ |
| 34 | $32736 \cdot 6$ | $2 \cdot 37$ | $325 \mathrm{I} 2 \cdot \mathrm{I}$ | $2 \cdot 45$ | $32243 \cdot 0$ | $2 \cdot 53$ | 320.90 | $2 \cdot 61$ | $\begin{array}{lllllllllll}3 & 17 & 29 \cdot 8\end{array}$ | $2 \cdot 70$ | $31445 \cdot 2$ | $2 \cdot 79$ |
| 35 | $32257 \cdot 0$ | 2.41 | $32030 \cdot 1$ | $2 \cdot 49$ | 3 I7 58.3 | $2 \cdot 57$ | 31521.4 | 2.66 | $3 \begin{array}{lllll}3 & 12 & 38 \cdot 9\end{array}$ | $2 \cdot 75$ | $\begin{array}{llll}3 & 9 & 50 \cdot 8\end{array}$ | $2 \cdot 85$ |
| 36 | 31816.2 | 2.45 | $31546 \cdot 7$ | $2 \cdot 53$ | 31312.0 | 2.62 | 310319 | $2 \cdot 72$ | $3746 \cdot 0$ | 2.81 | $\begin{array}{llll}3 & 4 & 54.1\end{array}$ | $2 \cdot 92$ |
| 37 | $31334{ }^{1}$ | $2 \cdot 49$ | 3 II I•8 | $2 \cdot 58$ | 3824.0 | $2 \cdot 68$ | $3540 \cdot 6$ | $2 \cdot 77$ | $3 \quad 251 * 0$ | 2.88 | $25955 \cdot 0$ | $2 \cdot 99$ |
| 38 | $\begin{array}{llll}3 & 8 & 50.5\end{array}$ | 2.54 | 3 Crrra | 2.64 | $\begin{array}{llll}3 & 3 & 34.2\end{array}$ | $2 \cdot 73$ | $3047 \cdot 1$ | $2 \cdot 84$ | 25753.6 | 2.95 | 25453.3 | $3 \cdot 06$ |
| 39 | $\begin{array}{llll}3 & 4 & 5 \cdot 3\end{array}$ | $2 \cdot 59$ | $\begin{array}{rrrr}3 & 1 & 26.9 \\ 2 & 56 & 36.6\end{array}$ | 2.69 | $\begin{array}{llll}2 & 58 & 42.4\end{array}$ | 2.79 | 25551.5 | $2 \cdot 90$ | 2 52 $53 \cdot 8$ <br> 2 4  | 3.02 | $24948 \cdot 8$ | $3 \cdot 15$ |
| 40 | 25918.5 | $2 \cdot 65$ | $25636 \cdot 6$ | $2 \cdot 75$ | $25348 \cdot 4$ | $2 \cdot 86$ | 25053.4 | $2 \cdot 98$ | 247 5I•I | $3 \cdot 10$ | 244 4I•I | $3 \cdot 23$ |
| 41 | $25429 \cdot 8$ | $2 \cdot 70$ | 25144.3 | 2.81 | $\begin{array}{llll}2 & 48 & 52 \cdot 1 \\ 2 & 43 & 53\end{array}$ | 2.93 | $\begin{array}{lllll}2 & 45 & 52 \cdot 6\end{array}$ | 3.06 | $2 \begin{array}{llll}2 & 42 & 45 \cdot 4\end{array}$ | $3 \cdot 19$ | $23930 \cdot 0$ | 3.33 |
| 42 | $24939 \cdot 1$ | $2 \cdot 77$ | $24649 \cdot 7$ | $2 \cdot 88$ | 243 53'1 | $3 \cdot 01$ | $24048 \cdot 9$ | $3 \cdot 14$ | $23736 \cdot 4$ | $3 \cdot 28$ | $23415 \cdot 2$ | $3 \cdot 43$ |
| 43 | $24446 \cdot 2$ | 2.83 | $2 \mathrm{4I} 52 \cdot 6$ | 2.96 | $23^{2} 815 \mathrm{I} \cdot 3$ | 3.09 | $23541 \cdot 9$ | $3 \cdot 23$ | $232 \begin{array}{llll}23 & 23\end{array}$ | $3 \cdot 38$ | $22856 \cdot 1$ | 3.54 |
| 44 | $23950 \cdot 9$ | $2 \cdot 91$ |  | $3 \cdot 04$ | $23346 \cdot 4$ | $3 \cdot 18$ | 23031.4 | $3 \cdot 33$ | 227 7.0 | $3 \cdot 49$ | $2 \begin{array}{lllll}23 & 32 \cdot 4\end{array}$ | $3 \cdot 67$ |
| 45 | $\begin{array}{lllll}2 & 34 & 52 \cdot 9\end{array}$ | $2 \cdot 98$ | $231490 \cdot 9$ | $3 \cdot 12$ | $\begin{array}{lllll}2 & 28 & 38 \cdot 1\end{array}$ | 3.27 | $22517^{\circ} \mathrm{O}$ | $3 \cdot 44$ | $2 \begin{array}{llll}2 & 21 & 45.7\end{array}$ | $3 \cdot 61$ | $2 \begin{array}{llll}2 & 18 & 3.5\end{array}$ | $3 \cdot 80$ |
| 46 | $22952 \cdot \mathrm{I}$ | 3.07 | $22643 \cdot 6$ | $3 \cdot 22$ | $\begin{array}{llll}2 & 23 & 25 \cdot 9\end{array}$ | $3 \cdot 38$ | 2 I9 58-1 | $3 \cdot 55$ |  | 3.74 | 21228.7 | $3 \cdot 95$ |
| 47 | $22448 \cdot 0$ | $3 \cdot 16$ | 2133.8 | $3 \cdot 32$ | $2 \begin{array}{llll}28 & 9.5\end{array}$ | $3 \cdot 50$ | 21434.3 | $3 \cdot 68$ | $21047 \cdot 3$ | $3 \cdot 89$ | $647 \cdot 3$ | $4 \cdot 12$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ} \mathrm{A}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. | S. | s. | s. | S. | s. | s. | s. | S. | S. | S. | S. |
| 0 | $\cdot 00$ | $-4.41$ | -.08 | $-4.41$ | - 17 | $-4.42$ | - $\cdot 26$ | $-4.42$ | - 34 | $-4.42$ | - $\cdot 43$ | $-4.43$ |
| 2 | -07 | 4.41 | 16 | $4 * 42$ | -24 | $4 \cdot 42$ | $\cdot 33$ | $4 \cdot 42$ | -41 | 4.43 | -50 | $4 \cdot 44$ |
| 4 | $\cdot 14$ | 4.42 | - 23 | $4 \cdot 42$ | $\cdots 1$ | $4 \cdot 42$ | -40 | $4 \cdot 43$ | -49 | 4.44 | - 57 | $4 * 45$ |
| 6 | - 21 | 4.42 | $\cdot 30$ | $4 \cdot 42$ | $\cdot 39$ | $4 \cdot 43$ | -48 | $4 \cdot 44$ | $\cdot 56$ | 4.45 | -65 | $4 \cdot 46$ |
| 8 | -29 | $4 \cdot 42$ | $\cdot 38$ | $4 \cdot 43$ | -46 | $4 \cdot 44$ | $\cdot 55$ | 4.45 | -64 | . 4.46 | $\cdot 73$ | $4 \cdot 47$ |
| 10 | $\cdot 36$ | 4.43 | -41 | $4 \cdot 44$ | -54 | 4.45 | -63 | $4 \cdot 46$ | $\cdot 72$ | 4.47 | -81 | $4 * 49$ |
| 12 | -44 | 4.44 | -48 | 4.44 | -62 | $4 \cdot 46$ | $\cdot 71$ | $4 \cdot 47$ | -80 | $4 \cdot 48$ | -89 | $4 \cdot 50$ |
| 14 | $\cdot 52$ | 4.44 | - 55 | $4 \cdot 45$ | $\cdot 70$ | 4.47 | $\cdot 79$ | $4 \cdot 48$ | -88 | 4.50 | -97 | $5 \cdot 52$ |
| 16 | -60 | 4.45 | -62 | 4.47 | -78 | $4 \cdot 48$ | -87 | $4 \cdot 50$ | -97 | $4 \cdot 52$ | I.06 | 4.54 |
| 18 | -68 | $4 \cdot 46$ | -69 | 4.48 | -86 | 4.50 | -96 | 4.52 | 1.05 | $4 \cdot 54$ | I'15 | 4.56 |
| 20 | -76 | $4 \cdot 48$ | -77 | $4 \cdot 50$ | -95 | $4 \cdot 5 \mathrm{I}$ | I.05 | $4 \cdot 54$ | I'15 | $4 \cdot 56$ | 1.25 | 4.59 |
| 22 | . 85 | $4 \cdot 49$ | - 85 | $4 \cdot 51$ | 1-04 | 4.53 | I'14 | 4.56 | I. 24 | 4.59 | 1.35 | 4.61 |
| 24 | $\cdot 94$ | 4.51 | -93 | 4.53 | I-14 | 4.56 | $1 \cdot 24$ | $4 \cdot 58$ | 1.35 | $4 \cdot 61$ | $1 \cdot 45$ | $4 \cdot 65$ |
| 26 | r-03 | 4.53 | I.02 | $4 \cdot 56$ | $1 \cdot 24$ | $4 \cdot 58$ | I 35 | $4 \cdot 61$ | 1.46 | $4 \cdot 65$ | 1.57 | $4 \cdot 68$ |
| 28 | I-13 | 4.56 | I•II | 4.58 | 1.35 | $4 \cdot 61$ | I-46 | $4 \cdot 65$ | 1.57 | 4.68 . | I. 69 | $4 \cdot 72$ |
| 30 | 1-23 | $4 \cdot 58$ | I. 20 | $4 \cdot 6 \mathrm{I}$ | 1.46 | $4 \cdot 65$ | 1.57 | $4 \cdot 69$ | 1.69 | $4 \cdot 73$ | I.81 | 4.77 |
| 32 | 1.35 | $4 \cdot 61$ | I-31 | $4 \cdot 65$ | 1.58 | $4 \cdot 69$ | 1.70 | $4 \cdot 73$ | 1.83 | $4 \cdot 78$ | $1 \cdot 95$ | $4 \cdot 83$ |
| 34 | 1.46 | $4 \cdot 65$ | 1.41 | $4 \cdot 69$ | $1 \cdot 71$ | 4.73 | I.84 | $4 \cdot 78$ | 1.97 | $4 \cdot 83$ | 2 II | 4.89 |
| 36 | 1.59 | $4 \cdot 69$ | 1.53 | $4 \cdot 74$ | 1.85 | $4 * 79$ | I.99 | $4 \cdot 84$ | $2 \cdot 13$ | 4.90 | 2.27 | $4 \cdot 96$ |
| 38 | 1•73 | 4.74 | I 65 | $4 \cdot 79$ | $2 \cdot 00$ | $4 \cdot 85$ | 2.15 | 4.91 | $2 \cdot 30$ | 4.98 | $2 \cdot 46$ | $5 \cdot 05$ |
| 40 | 1.88 | $4 \cdot 80$ | 1*79 | $4 \cdot 85$ | 2•17 | 4.92 | 2*33 | 4.99 | 2.49 | 5.07 | $2 \cdot 67$ | 5•16 |
| 42 | $2 \cdot 04$ | $4 \cdot 86$ | I'94 | $4 \cdot 93$ | $2 \cdot 36$ | $5 \cdot 01$ | 2.53 | $5 \cdot 09$ | 2.71 | $5 \cdot 18$ | 2.90 | 5.28 |
| 44 | 2.23 | $4 \cdot 94$ | $2 \cdot 40$ | $5 \cdot 02$ | $2 \cdot 58$ | $5 \cdot 11$ | $2 \cdot 76$ | $5 \cdot 21$ | $2 \cdot 96$ | $5 \cdot 32$ | $3 \cdot 18$ | 544 |
| 46 | 2.44 | 5.04 | $2 \cdot 62$ | $5 \cdot 13$ | 2.82 | $5 \cdot 24$ | $3 \cdot 03$ | $5 \cdot 36$ | 3.26 | $5 \cdot 49$ | 3.50 | $5 \cdot 63$ |
| 47 | $2 \cdot 56$ | $5 \cdot 10$ | $2 \cdot 74$ | $5 \cdot 20$ | 2.95 | $5 \cdot 31$ | $3 \cdot 18$ | $5 \cdot 44$ | 3.42 | $5 \cdot 59$ | 3.68 | 5.75 |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | . 8 | H. M. S | S. | H. M. S. | S. | H. M. S . | S. |  | - | H. M. S. | S. |
| $\bigcirc$ |  | -r.89 |  | - I'90 | $\begin{array}{llll}5 & 44 & 58 \cdot 1 \\ 5 & \\ 5\end{array}$ | -I.91 | $\begin{array}{llll}5 & 43 & 3.5\end{array}$ | -1.92 | $\begin{array}{lll} 5 & 41 & 8 \cdot 1 \end{array}$ | -1.93 | $5 \begin{array}{llll}5 & 39 & 119\end{array}$ | I.94 |
| 2 | $53952 \cdot \mathrm{I}$ | I.91 |  | I.92 | $\begin{array}{llll}5 & 36 & 1.5\end{array}$ | $\underline{r} 93$ | $\begin{array}{llll}5 & 34 & 5 \cdot 0\end{array}$ | 1.95 | 5 $32 \begin{array}{lll}5 & 7 \cdot 6\end{array}$ | 1.97 | $5 \begin{array}{lll}5 & 30 & 9 \cdot 1 \\ 5 & \end{array}$ | $\underline{1} 98$ |
| 4 | $53057 \cdot 2$ | 1. | $\begin{array}{llll}5 & 29 & 0.7 \\ 5 & 20 & 2.7\end{array}$ | I.95 | $\begin{array}{llll}5 & 27 & 3.2 \\ 5 & 18 & 3.2\end{array}$ | $1 \cdot 97$ | $\begin{array}{lll}5 & 25 & 4.7\end{array}$ | 1.98 | $\begin{array}{llll}5 & 23 & 5 \cdot 1 \\ 5 & 1 & \\ 5\end{array}$ | 5 | 5 $21 \begin{array}{ll}5 & 4.2\end{array}$ | 2.03 |
| 6 | $\begin{array}{lll}5 & 22 & 0 \cdot 9\end{array}$ | 1.96 | $\begin{array}{lll}5 & 20 & 2.7 \\ 5 & 11 & 2.9\end{array}$ | 1.98 | $\begin{array}{llll}5 & 18 & 3.2\end{array}$ | 2.00 | $\begin{array}{llll}5 & 16 & 2 \cdot 5 \\ 5 & 6 & 58\end{array}$ | 2.02 | $\begin{array}{llll}5 & 14 & 0 \cdot 4 \\ 5 & 4 & 59\end{array}$ | $2 \cdot 05$ | $5{ }_{5}^{5}$ II $56 \cdot 9$ | $2 \cdot 07$ |
| 8 | $\begin{array}{llll}5 & 13 & 3.2\end{array}$ | r.99 | $\begin{array}{llll}5 & \text { II } & 2.9\end{array}$ | 2.02 | $\begin{array}{llll}5 & 9 & 1 \cdot 3\end{array}$ | $2 \cdot 04$ | $\begin{array}{llll}5 & 6 & 58 \cdot 1\end{array}$ | 2.07 | $\begin{array}{lll}5 & 4 & 53.4\end{array}$ | 2.09 | $5 \quad 2 \quad 46 \cdot 9$ | $2 \cdot 12$ |
| 10 | $\begin{array}{llll}5 & 4 & 3.6\end{array}$ | $2 \cdot 03$ | -2 | 05 | 459 57-1 | 2.08 | $45751 \cdot 3$ | $2 \cdot 11$ | $45543 \cdot 7$ | $2 \cdot 14$ | $45334{ }^{\circ}$ | $2 \cdot 18$ |
| 12 | $455 \quad 2 \cdot 1$ | 07 | $45257 \cdot 3$ | $2 \cdot \mathrm{r}$ | $45050 \cdot 6$ | 2.13 | $44^{81} 419$ | $2 \cdot 16$ | $4463{ }^{\circ} \mathrm{O}$ | 2.20 | 44417.9 | $2 \cdot 24$ |
| 14 |  | $2 \cdot 11$ | $44350 \cdot 9$ | $2 \cdot 1$ | 44 I 4 r 3 | $2 \cdot 18$ | $4 \begin{array}{lll}4 & 39 & 29.3\end{array}$ | $2 \cdot 22$ | $43715{ }^{\circ}$ | $2 \cdot 26$ | $43458 \cdot 1$ | 2.30 |
| 16 | 4 $3652 \cdot 2$ | 15 | $\begin{array}{ll}4 & 34 \\ 4 & \text { I }\end{array}$ | $2 \cdot 19$ | $\begin{array}{llllllllllll}4 & 32 & 28.9\end{array}$ | $2 \cdot 24$ | 43013.4 | $2 \cdot 28$ | $42755 \cdot 3$ | $2 \cdot 33$ | $42534 \cdot 2$ | $2 \cdot 38$ |
| 18 | 42743.3 | $2 \cdot 21$ | $425 \quad 29.5$ | $2 \cdot 25$ | $4 \quad 2313.1$ | $2 \cdot 30$ | 42053.8 | 2.35 | $4 \begin{array}{llll}4815\end{array}$ | $2 \cdot 40$ | $4 \begin{array}{llll}46 & 5\end{array}$ | $2 \cdot 45$ |
| 19 | $\begin{array}{lll}4 & 23 & 7 \cdot 6\end{array}$ | 2 | $42052 \cdot 2$ | $2 \cdot 28$ | $\begin{array}{llll}4 & 18 & 33.8\end{array}$ | 2.33 | $4 \begin{array}{llll}46 & 12.4\end{array}$ | $2 \cdot 38$ | $4 \begin{array}{llll}43 & 47 \cdot 9\end{array}$ | $2 \cdot 44$ | 4 II 19.9 | O |
| 20 | $41831 \cdot 1$ | $2 \cdot 26$ | $4 \begin{array}{llll}46 & 13.8\end{array}$ | $2 \cdot 31$ | 41353.5 | $2 \cdot 37$ | 41129.9 | 2.42 | $4 \quad 9 \quad 3{ }^{\circ} \mathrm{O}$ | 2.48 | $4 \quad 632 \cdot 5$ | 2.54 |
| 21 | 41353.8 | 2.29 | 4 II 34.5 | $2 \cdot 35$ | $\begin{array}{llll}4 & 9 & 12 \cdot 1 \\ 4 & 4\end{array}$ | $2 \cdot 40$ | $\begin{array}{llll}4 & 6 & 462\end{array}$ | $2 \cdot 46$ | $\begin{array}{llll}4 & 4 & 16 \cdot 8\end{array}$ | $2 \cdot 52$ | $\begin{array}{llll}4 & 1 & 43 \cdot 7\end{array}$ | 2.59 |
| 22 | $4 \quad 9 \quad 15.4$ | $2 \cdot 33$ | $4 \quad 6 \quad 54 \cdot 2$ | $2 \cdot 38$ | $\begin{array}{llll}4 & 4 & 29 \cdot 5\end{array}$ | $2 \cdot 44$ | $\begin{array}{lll}2 & 1 & 3\end{array}$ | 2.50 | $\begin{array}{llll}3 & 59 & 29.3\end{array}$ | 2.57 | $35653 \cdot 3$ | 2.63 |
| 23 | $1 \begin{array}{ll}4 & 4 \\ 36 \cdot 1\end{array}$ | $2 \cdot 36$ | $4 \quad 2 \quad 12 \cdot 7$ | $2 \cdot 42$ | $35945 \cdot 8$ | $2 \cdot 48$ | $\begin{array}{llllll}3 & 57 & 15 \cdot 0\end{array}$ | 2.55 | $35440 \cdot 3$ | $2 \cdot 61$ | $3 \begin{array}{lll}3 & 52 & 14\end{array}$ | 2.69 |
| 24 | $\begin{array}{llllllll}3 & 59 & 55\end{array}$ | $2 \cdot 40$ | $\begin{array}{llll}3 & 57 & 30 \cdot 1\end{array}$ | $2 \cdot 46$ | $\begin{array}{llll}3 & 55 & 0 \cdot 7\end{array}$ | 52 | $52.27 \cdot 3$ | 2.59 | 34949.7 | $2 \cdot 66$ | 34787 | 74 |
| 25 | 35514.3 | $2 \cdot 44$ | $35246 \cdot 2$ | $2 \cdot 50$ | 35014.2 | 2.57 | $34738 \cdot 0$ | 2.64 | $34457 \cdot 5$ | 2.71 | $34212 \cdot 2$ |  |
| 26 | $3503 \mathrm{I} \cdot 5$ | $2 \cdot 48$ | 348 roo | 2.54 | $34526 \cdot 1$ | $2 \cdot 61$ | $\begin{array}{lllll}3 & 42 & 47 \cdot 2\end{array}$ | 2.69 | 340 | 2.77 | 33714.7 | 2.86 |
| 27 | $34547 \cdot 5$ | $2 \cdot 52$ | 34314.4 | $2 \cdot 59$ | $\begin{array}{llllllllllll}3 & 40 & 36 \cdot 8\end{array}$ | $2 \cdot 66$ | $3 \begin{array}{llll}37 & 54\end{array}$ | 2.74 | $\begin{array}{llll}3 & 35 & 74\end{array}$ | 2.83 | $33215 \cdot 1$ | 2 |
| 28 | $\begin{array}{llll}3 & 41 & 2 \cdot 1\end{array}$ | $2 \cdot 56$ | $33^{88} \quad 26 \cdot 2$ | $2 \cdot 64$ | $3 \quad 35 \cdot 45 \cdot 6$ | $2 \cdot 72$ | $\begin{array}{lll}3 & 33 & 0 \cdot 1\end{array}$ | 2.80 | $\begin{array}{llll}3 & 30 & 9.4\end{array}$ | 2.89 | $\begin{array}{llll}3 & 27 & 13.2\end{array}$ | $2 \cdot 99$ |
| 29 |  | 2.61 | $\begin{array}{llll}3 & 33 & 36.4\end{array}$ | $2 \cdot 69$ | $33052 \cdot 6$ | $2 \cdot 77$ | $\begin{array}{llll}3 & 28 & 3.7\end{array}$ | 2.86 | 3259.2 | 2.96 | $\begin{array}{llll}3 & 22 & 8.8\end{array}$ | 3.06 |
| 30 | $33^{31} 26 \cdot 8$ | $2 \cdot 66$ | $\begin{array}{llll}3 & 28 & 44.9\end{array}$ | 2 |  | 2.83 | $\begin{array}{llll}3 & 23 & 5 \cdot 0\end{array}$ | 2.93 | 3206.6 | 3.03 | $\begin{array}{llll}3 & 17 & 1.9\end{array}$ | $3 \cdot 13$ |
| 31 | $\begin{array}{llll}3 & 26 & 36 \cdot 7\end{array}$ | $2 \cdot 71$ | $\begin{array}{llllllllll}3 & 23 & 51 \cdot 4\end{array}$ | 2.80 | $\begin{array}{llll}3 & 21 & 0.6\end{array}$ | $2 \cdot 89$ | $\begin{array}{llll}3 & 18 & 4 \cdot 1\end{array}$ | $2 \cdot 99$ | $\begin{array}{lllll}3 & 15 & 1.4\end{array}$ | $3 \cdot 10$ | 3 II 52.I | 3.21 |
| 32 | $\begin{array}{lllll}3 & 21 & 44.8 \\ 3 & 16 & 50.9\end{array}$ | 2.77 2.8 | $\begin{array}{llll}3 & 18 & 56 \cdot 0\end{array}$ | 2.8 | $\begin{array}{llll}3 & 16 & 1 \cdot 4 \\ 3 & 10 & 50\end{array}$ | $2 \cdot 96$ | $\begin{array}{lllll}3 & 13 & 0 \cdot 7\end{array}$ | 3.07 | 953.4 | 3.18 | 3 6 39.2 | 3.30 |
| 33 | 31650.9 | 2.83 | 31358.3 | $2 \cdot 93$ | 3 IO 59.7 | 3.03 | 754.5 | 3.14 | $\begin{array}{llll}3 & 424\end{array}$ | $3 \cdot 26$ | 3 I 22.9 | $3 \cdot 39$ |
| 34 | 3 II $54 \cdot 8$ | 2.89 | $\begin{array}{llll}3 & 8 & 58 \cdot 3\end{array}$ | 3.00 | $\begin{array}{llll}3 & 5 & 55.3\end{array}$ | $3 \cdot 11$ | $\begin{array}{llll}3 & 2 & 45.4 \\ 2\end{array}$ | 3.23 | $25928 \cdot 2$ | $3 \cdot 35$ | $2 \begin{array}{lll}26 & 2 \cdot 9\end{array}$ | 3.49 |
| 35 36 | $\begin{array}{lll}3 & 6 & 56 \cdot 5 \\ 3 & 1 & 55 \cdot 7\end{array}$ | 2.96 3.03 | $\begin{array}{lrrr}3 & 3 & 55.8 \\ 2 & 58 & 50 \cdot 4 \\ 2\end{array}$ | 3.07 3.15 | $\begin{array}{cccc}3 & 0 & 48 \cdot 1 \\ 2 & 5 & 37 \cdot 8\end{array}$ | 3.19 3.27 | $\begin{array}{llll}2 & 57 & 33.2 \\ 2 & 52 & 17.4\end{array}$ | 3.31 3.41 | $\begin{array}{llll}2 & 54 & 10 \cdot 3 \\ 2 & 48 & 48 \cdot 6\end{array}$ | 3.45 3.56 | 25039 | 3.60 |
| 37 | $\begin{array}{llll} \\ 2 & 56 & 52.2\end{array}$ | $3 \cdot 11$ | $25342 \cdot 1$ | 3.23 | $25024 \cdot 1$ | 3.37 3.37 | 2 52 $17 \cdot 4$ <br>  46 $57 \cdot 8$ <br> 2   | 3.41 3.51 | $\begin{array}{llll}2 & 48 \\ 2 & 43 & 22 \cdot 6 \\ 2 & \end{array}$ | 3.65 3.67 | $\begin{array}{llllll}2 & 45 & 10 \cdot 6 \\ 2 & 39 & 37 \cdot 4\end{array}$ | 3.8 3.84 |
| 38 | $25145 \cdot 8$ | $3 \cdot 19$ | $24^{8} 30 \cdot 4$ | $3 \cdot 33$ | $2456 \cdot 7$ | 3.47 | 24134.0 | 3.62 | 23751.7 | 3.79 | 23358.8 | $3 \cdot 98$ |
| 39 | $24636 \cdot 1$ | $3 \cdot 28$ |  | 3.42 | $23945 \cdot 1$ | $3 \cdot 58$ | $\begin{array}{llll}2 & 36 & 5.6\end{array}$ | 3.75 | 23215.6 | 3.93 | $2 \begin{array}{llll}28 & 14.2\end{array}$ | $4 \cdot 13$ |
| 40 | 24122.9 | 3.38 | $23755 \cdot 8$ | 3.53 | 23419.1 | $3 \cdot 70$ | $23032 \cdot 0$ | 3.88 | $22633 \cdot 6$ | $4 \cdot 08$ | $22222 \cdot 8$ | 4.29 |
| 41 | $2 \begin{array}{llll}26 & 3 & 8\end{array}$ | $3 \cdot 48$ | $23232 \cdot \mathrm{I}$ | $3 \cdot 65$ | 22848.0 | $3 \cdot 83$ | $22452 \cdot 6$ | 4.02 | 22045.0 | 4.24 | 21623.7 | $4 \cdot 48$ |
| 42 | 23044.5 | $3 \cdot 60$ | $\begin{array}{lllll}2 & 27 & 3.4 \\ 2 & 21 & 29\end{array}$ | $3 \cdot 78$ | $\begin{array}{lllll}2 & 23 & 1113\end{array}$ | 3.97 | $\begin{array}{llr}2 & 19 & 6.9\end{array}$ | $4 \cdot 19$ |  | 4.42 | 2 10 16.1 | $4 \cdot 69$ |
| 43 | 22518.3 | $3 \cdot 72$ | 22129.3 | 3.92 | 217728.2 | $4 \cdot 13$ | 21313.7 | 4.36 | 844.4 | $4 \cdot 63$ | 2358.4 | $4 \cdot 92$ |

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. 7 | A. | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\text {® }} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | s. | S. | S. | S. | S. | S. | s. | S. | S. | S. | s. |
| 0 | - 515 | $-4.44$ | - . 60 | $-4.46$ | - . 69 | $-4.47$ | --77 | $-4.48$ | --86 | $-4.50$ | -.95 | $-4.51$ |
| 2 | - 59 | $4 \cdot 45$ | -67 | $4 \cdot 46$ | $\cdot 76$ | $4 \cdot 48$ | - 85 | 4.49 | -94 | 4.51 | I-03 | $4 \cdot 53$ |
| 4 | -66 | $4 \cdot 46$ | -75 | $4 \cdot 48$ | -84 | 4.49 | -93 | 4.51 | 1.02 | $4 \cdot 53$ | I•II | $4 \cdot 55$ |
| 6 | $\cdot 74$ | $4 \cdot 47$ | -83 | 4.49 | -92 | $4 \cdot 51$ | 1.01 | $4 \cdot 53$ | I•10 | $4 \cdot 55$ | I'I9 | $4 \cdot 57$ |
| 8 | -82 | $4 * 49$ | -91 | 4.51 | $1 \cdot 00$ | 4.53 | 1.09 | $4 \cdot 55$ | I•18 | 4.57 | I.28 | 4.59 |
| 10 | -90 | $4 \cdot 50$ | -99 | $4 \cdot 52$ | 1.08 | $4 \cdot 55$ | 1-18 | $4 \cdot 57$ | $1 \cdot 27$ | $4 \cdot 59$ | 1.37 | 4.62 |
| 12 | $\cdot 98$ | $4 \cdot 52$ | 1*07 | 4.54 | $1 \cdot 17$ | 4.57 | $1 \cdot 27$ | 4.59 | 1-36 | $4 \cdot 62$ | I-46 | $4 \cdot 65$ |
| 14 | I.07 | 4.54 | I•16 | $4 \cdot 56$ | 1.26 | 4.59 | 1.36 | 4.62 | I.46 | $4 \cdot 65$ | 1.56 | $4 \cdot 68$ |
| 16 | I•I6 | $4 \cdot 56$ | I. 26 | 4.59 | 1.35 | $4 \cdot 62$ | 1.46 | $4 \cdot 65$ | 1.56 | $4 \cdot 68$ | I-66 | $4 \cdot 72$ |
| 18 | I 25 | $4 \cdot 59$ | I 35 | $4 \cdot 62$ | 1.45 | $4 \cdot 65$ | I•56 | $4 \cdot 68$ | 1.67 | $4 \cdot 72$ | 1•77 | 4.76 |
| 20 | I.35 | $4 \cdot 61$ | 1.45 | 4.65 | 1.56 | $4 \cdot 68$ | 1.67 | 4*72 | ェ・78 | $4 \cdot 76$ | I.89 | 4.80 |
| 22 | I.45 | $4 \cdot 65$ | 1.56 | $4 \cdot 68$ | 1.67 | $4 \cdot 72$ | 1.78 | $4 \cdot 76$ | 1.90 | 4.80 | $2 \cdot 02$ | $4 \cdot 85$ |
| 24 | I.56 | $4 \cdot 68$ | I. 68 | $4 \cdot 72$ | 1.79 | $4 \cdot 76$ | 1-91 | 4.81 | $2 \cdot 03$ | $4 \cdot 86$ | $2 \cdot 15$ | 4.91 |
| 26 | I.68 | $4 \cdot 72$ | I.80 | $4 \cdot 76$ | $1 \cdot 92$ | 4.81 | 2.04 | 4.86 | $2 \cdot 17$ | 4.92 | $2 \cdot 30$ | $4 \cdot 98$ |
| 28 | I•8I | $4 \cdot 77$ | I.93 | $4 \cdot 82$ | 2.05 | $4 \cdot 87$ | 2.18 | $4 \cdot 92$ | $2 \cdot 32$ | $4 \cdot 98$ | 2.46 | 5.05 |
| 30 | I.94 | 4.82 | $2 \cdot 07$ | 4.87 | $2 \cdot 20$ | 4*93 | $2 \cdot 34$ | $5 \cdot 00$ | $2 \cdot 48$ | $5 \cdot 06$ | 2.63 | 5•14 |
| 32 | $2 \cdot 09$ | $4 \cdot 88$ | $2 \cdot 22$ | 4.94 | $2 \cdot 37$ | 5.01 | $2 \cdot 51$ | $5 \cdot 08$ | 2.67 | $5 \cdot 16$ | $2 \cdot 83$ | $5 \cdot 24$ |
| 34 | $2 \cdot 25$ | $4 \cdot 95$ | $2 \cdot 39$ | $5 \cdot \mathrm{O2}$ | $2 \cdot 55$ | 5.10 | $2 \cdot 71$ | $5 \cdot 18$ | $2 \cdot 87$ | $5 \cdot 27$ | 3.05 | $5 \cdot 37$ |
| 36 | 2.43 | $5 \cdot 04$ | $2 \cdot 58$ | $5 \cdot 11$ | $2 \cdot 75$ | $5 \cdot 20$ | $2 \cdot 92$ | $5 \cdot 29$ | $3 \cdot 11$ | $5 \cdot 40$ | $3 \cdot 30$ | $5 \cdot 51$ |
| 38 | 2.62 | $5 \cdot 13$ | $2 \cdot 80$ | $5 \cdot 22$ | $2 \cdot 98$ | $5 \cdot 32$ | $3 \cdot 17$ | $5 \cdot 43$ | $3 \cdot 38$ | $5 \cdot 56$ | $3 \cdot 60$ | $5 \cdot 69$ |
| 39 | $2 \cdot 73$ | 5.19 | 2.91 | $5 \cdot 29$ | $3 \cdot 11$ | $5 \cdot 40$ | $3 \cdot 31$ | $5 \cdot 52$ | 3.53 | $5 \cdot 65$ | $3 \cdot 76$ | $5 \cdot 80$ |
| 40 | $2 \cdot 85$ | $5 \cdot 25$ | $3 \cdot 04$ | $5 \cdot 36$ | $3 \cdot 24$ | $5 \cdot 48$ | $3 \cdot 46$ | $5 \cdot 61$ | 3.69 | $5 \cdot 75$ | 3.95 | $5 \cdot 92$ |
| 41 | 2.97 | $5 \cdot 32$ | $3 \cdot 17$ | $5 \cdot 44$ | $3 \cdot 39$ | $5 \cdot 56$ | $3 \cdot 62$ | $5 \cdot 71$ | 3.87 | $5 \cdot 87$ | 4.15 | $6 \cdot 06$ |
| 42 | $3 \cdot 10$ | $5 \cdot 40$ | $3 \cdot 32$ | $5 \cdot 52$ | 3.55 | $5 \cdot 66$ | $3 \cdot 80$ | $5 \cdot 82$ | $4 \cdot 07$ | $6 \cdot 00$ | $4 \cdot 37$ | $6 \cdot 21$ |
| 43 | 3.25 | $5 \cdot 48$ | $3 \cdot 48$ | $5 \cdot 62$ | 3.73 | $5 \cdot 78$ | 4.00 | $5 \cdot 96$ | $4 \cdot 29$ | $6 \cdot 16$ | $4 \cdot 62$ | $6 \cdot 39$ |

## LATITUDE $25^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| $\begin{gathered} \text { True } \\ \text { Alt. } \end{gathered}$ | $12^{\circ}$ | Decl. Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | $\stackrel{5}{5}$ | H. M. S. |  | H. M. S. | S. | H. M. S. | S. |  | S. | H. M. S. | s. |
| 2 | $\begin{array}{cccc}5 & 37 & 14.8 \\ 5 & 28 & 0.6\end{array}$ | r.96 | $\begin{array}{llll}5 & 35 & 16 \cdot 7 \\ 5 & 26 & 8.8\end{array}$ | - 1.98 |  | 1.99 2.05 | $\begin{array}{llll}5 & 31 & 17 \cdot 3 \\ 5 & 22 & 3\end{array}$ | $-2.02$ | $\begin{array}{lll} 5 & 29 & 15.8 \end{array}$ | $-2.04$ | $\left\|\begin{array}{llll} 5 & 27 & 12 \cdot 9 \\ 5 & 17 & 5 r \end{array}\right\|$ | $\begin{aligned} & 2 \cdot 06 \\ & 2 \cdot 72 \end{aligned}$ |
| 2 | $\left\|\begin{array}{lll} 5 & 28 & 9 \cdot 6 \\ 5 & 19 & 1 \cdot 9 \end{array}\right\|$ | 2.00 2.05 | $\begin{array}{rrrr}5 & 26 & 8 \cdot 8 \\ 5 & 16 & 58 \cdot 2\end{array}$ | 2.02 2.07 | $\begin{array}{ccrr}5 & 24 & 6 \cdot 7 \\ 5 & 14 & 53 \cdot 0\end{array}$ | 2.05 $2 \cdot 10$ |  | $2 \cdot 07$ $2 \cdot 13$ | $\begin{array}{llll}5 & 19 & 58 \cdot 3 \\ 5 & 10 & 37 \cdot 4\end{array}$ | 2.10 2.16 | $\begin{array}{ccc}5 & 17 & 51 \cdot 7 \\ 5 & 8 & 26 \cdot 9\end{array}$ | $2 \cdot 12$ $2 \cdot 19$ |
| 4 | $\left\|\begin{array}{rrrr} 5 & 19 & 1 \cdot 9 \\ 5 & 9 & 51 \cdot 7 \end{array}\right\|$ | $2 \cdot 05$ | $\begin{array}{rrrr}5 & 16 & 58 \cdot 2 \\ 5 & 7 & 44 \cdot 9\end{array}$ | $2 \cdot 07$ | $\begin{array}{rrrr}5 & 14 & 53.0 \\ 5 & 5 & 36.2\end{array}$ | 2.10 2.16 |  | $2 \cdot 13$ | $\begin{array}{ccc}5 & 10 & 37.4 \\ 5 & 1 & 12.9\end{array}$ | $2 \cdot 1$ |  | 2.19 2.27 |
| 8 | 5 5 $\quad 0 \quad 38.6$ | $2 \cdot 15$ | $4 \begin{array}{llll}488 & 28\end{array}$ | $2 \cdot 19$ | $4 \begin{array}{llll} \\ 4 & 56 & 15.9\end{array}$ | $2 \cdot 22$ | $54 \quad 1 \cdot 3$ | $2 \cdot 26$ | $45^{1} \quad 44.3$ | $2 \cdot 3$ | 44924.9 | $2 \cdot 35$ |
| 10 | $45122 \cdot 2$ | 2.21 | 4498.2 | $2 \cdot 25$ | $44651 \cdot 8$ | 2.29 | 44432.9 | 2.34 | 442 Ir.3 | $2 \cdot 38$ | $43946 \cdot 8$ | 43 |
| II | $44642 \cdot 8$ | 2.25 | $44426 \cdot 8$ | $2 \cdot 29$ | 4428.2 | $2 \cdot 33$ | $43947 \cdot 0$ | $2 \cdot 38$ | $43722 \cdot 9$ | 2.43 | 43455.9 | 48 |
| 12 | $442 \begin{array}{ll}4 & 2 \cdot 3\end{array}$ | 28 | 43944.3 | $2 \cdot 32$ | 43723.5 | 2.37 | 43459.9 | 2.42 | $43233 \cdot 3$ | 2 | 4303.4 | . 53 |
| 13 | $43720 \cdot 9$ | 3 I | 435007 | $2 \cdot 36$ | $43237 \cdot 6$ | 2.41 | $430 \mathrm{II} \cdot 5$ | $2 \cdot 46$ | $42742 \cdot 2$ | $2 \cdot 5$ | $\begin{array}{lll}4 & 25 & 9 \cdot 5\end{array}$ | 57 |
| 14 | $43238 \cdot 5$ | 35 | $43016 \cdot 0$ | $2 \cdot 40$ | $427 \quad 30 \cdot 5$ | $2 \cdot 45$ | 42521.8 | $2 \cdot 51$ | $42249 \cdot 7$ | $2 \cdot 56$ | 42014.0 | 63 |
| 15 | 42754.9 | $2 \cdot 3$ | $42530 \cdot 1$ | 2.44 | $4 \begin{array}{lll}4 & 23 & 2 \cdot 1\end{array}$ | 2.49 | $42030 \cdot 7$ | $2 \cdot 55$ | 41755.7 | 2.61 | $4 \begin{array}{llll}45 & 16.9\end{array}$ | 68 |
| 16 | $4 \quad 2310 \cdot 2$ | $2 \cdot 43$ | 42042.9 | $2 \cdot 48$ | $4 \begin{array}{llll}4812.2\end{array}$ | $2 \cdot 54$ | $41538 \cdot 0$ | 2.60 | $4 \begin{array}{llll}42 & 59\end{array}$ | 2.67 | 41017.9 | 4 |
| 17 | 41824.2 | $2 \cdot 47$ | 41554.4 | $2 \cdot 53$ | $\begin{array}{lllll}4 & 13 & 20.9\end{array}$ | $2 \cdot 59$ | 4 10 43.7 | 2.65 | $4 \begin{array}{lll}4 & 8 & 2 \cdot 5\end{array}$ | $2 \cdot 72$ | $\begin{array}{lllll}4 & 5 & 17 \cdot 1\end{array}$ | 86 |
| 18 |  | 2.51 |  | $2 \cdot 57$ | $\begin{array}{lll}4 & 8 & 28 \cdot I\end{array}$ | 2.64 | $4 \quad 5 \quad 47.9$ | 2.7 I | $\begin{array}{llll}4 & 3 & 3.2 \\ & 58 & \end{array}$ | $2 \cdot 78$ | $\begin{array}{lllll}4 & 0 & 14.2 \\ 3 & 55 & \end{array}$ | 86 |
| 19 | $4 \quad 8 \quad 48 \cdot 3$ | $2 \cdot 56$ | $4 \quad 6 \quad 12.9$ | $2 \cdot 62$ | $4 \quad 3 \quad 33 \cdot 6$ | $2 \cdot 69$ | - $50 \cdot \mathrm{I}$ | $2 \cdot 76$ | $3 \begin{array}{lll}38 & 2 \cdot 0\end{array}$ | $2 \cdot 84$ | $\begin{array}{lll}3 & 55 & 9 \cdot 2\end{array}$ | . 92 |
| 20 | $\begin{array}{llll}4 & 3 & 58 \cdot 2\end{array}$ | 60 | $\begin{array}{llll}4 & 1 & 19.9\end{array}$ | 67 |  | 5 | $55 \quad 50 \cdot 4$ | 2.82 |  | -90 | $350 \quad 1 \cdot 9$ | 99 |
| 21 | $\begin{array}{llll}3 & 59 & 6 \cdot 5\end{array}$ | $2 \cdot 65$ | $\begin{array}{llll}3 & 56 & 25 \cdot 1\end{array}$ |  | $\begin{array}{llllllllllll}3 & 53 & 39 \cdot 3\end{array}$ | 2.80 | $5048 \cdot 7$ | 2.88 | $\begin{array}{lllll}3 & 47 & 53 \cdot 1\end{array}$ | 2.97 | $\begin{array}{lllll}3 & 44 & 52 \cdot 1 \\ 3\end{array}$ | 3.06 |
| 22 | $35413 \cdot 1$ | $2 \cdot 71$ | 35128.5 | $2 \cdot 78$ | $\begin{array}{lllll}3 & 48 & 39 \cdot 1\end{array}$ | 2.86 | $34544 \cdot 7$ | $2 \cdot 95$ | $34245 \cdot \mathrm{I}$ | 3.04 | $33939 \cdot 7$ | $3 \cdot 14$ |
| 23 | 349 18.0 | $2 \cdot 76$ | $\begin{array}{llll}3 & 46 & 29.9\end{array}$ | $2 \cdot 84$ | $343 \quad 36 \cdot 9$ | 3 | $34038 \cdot 5$ | 3.02 | $\begin{array}{llll}3 & 37 & 34.5\end{array}$ | $3 \cdot 12$ | $3 \quad 3424 \cdot 5$ | 3.22 |
| 24 | $\begin{array}{ll}3 & 4420 \cdot 9\end{array}$ | 2.8 | 34129.3 | $2 \cdot 90$ | $\begin{array}{lllll}3 & 38 & 32 \cdot 3\end{array}$ | 3.00 | $3 \quad 35 \quad 29.7$ | 3.09 | $\begin{array}{llll}3 & 32 & 21.2\end{array}$ | $3 \cdot 1$ | $\begin{array}{lll}3 & 29 & 6 \cdot 3\end{array}$ | $3 \cdot 31$ |
| 25 | $\begin{array}{lllll}3 & 39 & 21.9\end{array}$ | $2 \cdot 88$ | $\begin{array}{llll}3 & 36 & 26 \cdot 4\end{array}$ | $2 \cdot 97$ | $\begin{array}{llll}3 & 33 & 25.3\end{array}$ | 3.07 |  | 3.17 | $\begin{array}{llll}3 & 27 & 4.9\end{array}$ | 3.28 | $\begin{array}{llll}3 & 23 & 44.8\end{array}$ | 3.40 |
| 26 |  | 9 | 3 31 21.2 | 3.4 |  | 3.14 | $\begin{array}{llll}3 & 25 & 3\end{array}$ | 3.25 | $32145 \cdot 5$ | 3. | $\begin{array}{llll}3 & 18 & 19.8\end{array}$ | 3.49 |
| 27 | $32917 \cdot \mathrm{I}$ | $3 \cdot 01$ | 32613.3 | 1 | $\begin{array}{llll}3 & 23 & 3.3\end{array}$ | 3.22 | 3 I9 $46 \cdot 5$ | 3 | 315622.5 | 3 46 | $\begin{array}{llllll}3 & 12 & 50 \cdot 9\end{array}$ | 3.60 |
| 28 | $324 \mathrm{II} \cdot \mathrm{I}$ | 3. | $\begin{array}{llll}3 & 21 & 2 \cdot 7\end{array}$ | $3 \cdot 19$ | 3 17 47 | 3.31 | 31425.6 | $3 \cdot 43$ | $31055 \cdot 8$ | $3 \cdot 56$ | $\begin{array}{llll}3 & 7 & 17.8\end{array}$ | 3.71 |
| 29 | $\begin{array}{llll}3 & 19 & 2 \cdot 3\end{array}$ | $3 \cdot 1$ | $3 \mathrm{I} 549 \cdot \mathrm{I}$ | $3 \cdot 28$ | $\begin{array}{lllll}3 & 12 & 28.9\end{array}$ | $3 \cdot 40$ | $9 \mathrm{I} \cdot 0$ | $3 \cdot 53$ | $\begin{array}{lll}3 & 5 & 25 \%\end{array}$ | 3.67 | I 40.2 | 3.83 |
| 30 | $\begin{array}{llll}3 & 13 & 50 \cdot 6 \\ 3 & 80\end{array}$ | 3.25 | 3 10 $32 \cdot 3$ | 3.37 | $\begin{array}{lll}3 & 7 & 6 \cdot 4\end{array}$ | 3.50 | $\begin{array}{llll}3 & 3 & 32.5\end{array}$ | 3.64 | 25949.7 | 3.79 | 255 57.6 | 3.95 |
| $3 \mathrm{3I}$ | 3 8 $35 \cdot 8$ <br> 3   | 3.33 | 3 5 119 <br>  50  | 3.46 | 3 1 $40 \cdot 1$ | 3.7 | $\begin{array}{llll}2 & 57 & 59 \cdot 5 \\ 2\end{array}$ | 3.8 | $\begin{array}{llll}2 & 54 & 9 \cdot 6\end{array}$ | 3. | 250 | 4.09 |
| 32 | $\begin{array}{llll}3 & 3 & 17.5 \\ 2 & 57 & 5\end{array}$ | 3.43 | $25947 \cdot 7$ | 3.57 | $\begin{array}{llll}2 & 56 & 9 \cdot 4 \\ 2 & 50\end{array}$ | 3.72 3 | $\begin{array}{llll}2 & 52 & 21.8 \\ 2 & 46 & 8\end{array}$ | 3.88 | $\begin{array}{llll}2 & 48 & 24^{\circ} \mathrm{O} \\ 2\end{array}$ | 4.05 | $\begin{array}{llllll}2 & 44 & 15.2\end{array}$ | 4.25 |
| 33 34 | $\begin{array}{llll}2 & 57 & 55 \cdot 4 \\ 2 & 52 & 29.2\end{array}$ |  | $\begin{array}{lll}2 & 54 & 19 \cdot 3 \\ 2 & 48 & 46 \cdot 3\end{array}$ | 3.68 3.80 | $\begin{array}{llll}2 & 50 & 34 \cdot 0 \\ 2 & 44 & 53 \cdot 5\end{array}$ | 3.84 3.97 | $\begin{array}{llll}2 & 46 & 38 \cdot 7 \\ 2 & 40 & 49 \cdot 8\end{array}$ | $4 \cdot 01$ $4 \cdot 16$ | $\begin{array}{llll}2 & 42 & 32 \cdot 4 \\ 2 & 36 & 34 \cdot 2\end{array}$ | 4.20 4.37 | $\begin{array}{rrrr}2 & 38 & 14.2 \\ 2 & 32 & 5.7\end{array}$ | 4.41 4.60 |
| 34 35 | $\begin{array}{llll}2 & 52 & 29 \cdot 2 \\ 2 & 46 & 58 \cdot 6\end{array}$ | 3.7 | $\begin{array}{llll}2 & 48 & 46 \cdot 3 \\ 2 & 43 & 8 \cdot 2\end{array}$ | 3.80 3.93 | $\begin{array}{cccc}2 & 44 & 53 \cdot 5 \\ 2 & 39 & 7 \cdot 1\end{array}$ | 3.97 4.12 | 40 $49 \cdot 8$ | $4 \cdot 16$ 4.32 | $\begin{array}{llll}2 & 36 & 34 \cdot 2 \\ 2 & 30 & 28 \cdot 6\end{array}$ | 4.37 4.55 | $\begin{array}{cccc}2 & 32 & 5 \cdot 7 \\ 2 & 25 & 48 \cdot 5\end{array}$ | 4.60 4.80 |
| 36 | $\begin{array}{lllll}2 & 41 & 22.9\end{array}$ | 3.88 | $\begin{array}{lllll}2 & 37 & 24.5\end{array}$ | 4.07 | $\begin{array}{llll}2 & 3 & 14.4\end{array}$ | $4 \cdot 27$ | $\begin{array}{llll}2 & 28 & 51 \cdot 5\end{array}$ | $4 \cdot 50$ | $\begin{array}{llll}2 & 24 & 14.5\end{array}$ | $4 \cdot 75$ | $\begin{array}{lllll}2 & 19 & 21 \cdot 7\end{array}$ | 5.03 |
| 37 | ${ }^{2} 354 \mathrm{4} \cdot 7$ | 4.02 | 23134.5 | 4.23 | 22714.5 | 4.45 | $22240 \cdot 5$ | $4 \cdot 70$ | $\begin{array}{lllllllll}2 & 17 & 50\end{array}$ | $4 \cdot 97$ | $21243 \cdot 7$ | $5 \cdot 28$ |
| 38 | 22954.4 | $4 \cdot 18$ | $22537 \cdot 4$ | $4 \cdot 40$ | 2216.6 | 4.6 | $1620 \cdot 1$ | 4.92 | 2 II 16.3 | 5.23 | 5 | 5.57 |
| 39 | 224 0. | $4 \cdot 35$ | 21932.5 | 4 | 1449.4 | 4.86 | 949 | $5 \cdot 17$ | $429 \cdot 2$ | $5 \cdot 52$ | 5846 | $5 \cdot 92$ |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | S. | s. | S. | s. | s. | - S. | S. | S. | s. | s. | s. |
| $\bigcirc$ | - I.04 | -4.53 | - I'13 | -4.56 | -r.22 | $4 \cdot 58$ | - 1.32 | $-4.60$ | -1.41 | -4.63 | - $1 \cdot 50$ | $4 \cdot 66$ |
| 2 | I•12 | $4 \cdot 55$ | 1.21 | $4 \cdot 58$ | I.30 | 4.60 | $1 \cdot 40$ | $4 \cdot 63$ | r.49 | $4 \cdot 66$ | r.59 | $4 \cdot 69$ |
| 4 | 1.20 | 4.57 | $1 \cdot 29$ | $4 \cdot 60$ | r 39 | $4 \cdot 63$ | r 49 | $4 \cdot 66$ | I 58 | $4 \cdot 69$ | r. 68 | $4 \cdot 72$ |
| 6 | 1.29 | $4 \cdot 60$ | $1 \cdot 38$ | $4 \cdot 62$ | I. 48 | $4 \cdot 65$ | $1 \cdot 58$ | $4 \cdot 69$ | 1.67 | $4 \cdot 72$ | I•78 | $4 \cdot 77$ |
| 8 | 1.37 | $4 \cdot 62$ | $1 \cdot 47$ | $4 \cdot 65$ | r.57 | $4 \cdot 68$ | 1.67 | 4.72 | $1 \cdot 77$ | $4 \cdot 76$ | 1.88 | $4 \cdot 80$ |
| 10 | 1.46 | $4 \cdot 65$ | 1.57 | $4 \cdot 68$ | 1.67 | $4 \cdot 72$ | r 77 | $4 \cdot 76$ | I. 88 | 4.80 | I.98 | $4 \cdot 84$ |
| 12 | I•56 | $4 \cdot 68$ | 1.66 | $4 \cdot 72$ | r 77 | 4.75 | 1.88 | $4 \cdot 80$ | I.98 | $4 \cdot 84$ | $2 \cdot 10$ | $4 \cdot 89$ |
| 14 | 1.66 | $4 \cdot 72$ | 1•77 | $4 \cdot 75$ | 1.88 | 4.80 | I•99 | $4 \cdot 84$ | $2 \cdot 10$ | $4 \cdot 89$ | $2 \cdot 22$ | $4 \cdot 94$ |
| 16 | $1 \cdot 77$ | $4 \cdot 76$ | r.88 | $4 \cdot 80$ | 1-99 | 4.84 | $2 \cdot 11$ | $4 \cdot 89$ | $2 \cdot 22$ | 4.94 | $2 \cdot 35$ | $5{ }^{\circ} 00$ |
| 18 | 1.88 | 4.80 | $2 \cdot 00$ | $4 \cdot 85$ | $2 \cdot 12$ | 4.89 | $2 \cdot 24$ | $4 \cdot 95$ | $2 \cdot 36$ | $5 \cdot 00$ | $2 \cdot 49$ | 5.07 |
| 20 | 2.01 | $4 \cdot 85$ | $2 \cdot 13$ | 4.90 | $2 \cdot 25$ | 4.95 | $2 \cdot 37$ | $5 \cdot 01$ | 2.50 | 5.07 | 2.64 | $5 \cdot 14$ |
| 22 | $2 \cdot 14$ | $4 \cdot 90$ | $2 \cdot 26$ | $4 \cdot 96$ | $2 \cdot 39$ | 5.02 | $2 \cdot 52$ | 5.08 | $2 \cdot 66$ | $5 \cdot 15$ | $2 \cdot 81$ | $5 \cdot 23$ |
| 24 | 2.28 | 4.97 | 2.41 | $5 \cdot 03$ | $2 \cdot 55$ | $5 \cdot 10$ | 2.69 | $5 \cdot 17$ | $2 \cdot 84$ | $5 \cdot 25$ | $2 \cdot 99$ | $5 \cdot 33$ |
| 26 | 2.43 | 5.04 | $2 \cdot 57$ | $5 \cdot 11$ | $2 \cdot 72$ | $5 \cdot 18$ | 2.87 | $5 \cdot 26$ | 3.03 | 5.35 | 3.20 | $5 \cdot 45$ |
| 28 | $2 \cdot 60$ | $5 \cdot 12$ | $2 \cdot 75$ | $5 \cdot 20$ | 2.91 | $5 \cdot 29$ | 3.07 | $5 \cdot 38$ | 3.25 | $5 \cdot 48$ | 3.43 | $5 \cdot 59$ |
| 30 | 2.79 2.89 | $5 \cdot 22$ | 2.95 | 5.31 | 3.12 | 5.41 | 3.30 | 5.51 | 3.49 3.63 | 5.63 5.71 |  |  |
| 31 | 2.89 | $5 \cdot 28$ | 3.06 | $5 \cdot 37$ | $3 \cdot 24$ | $5 \cdot 47$ | $3 \cdot 43$ | $5 \cdot 59$ | 3.63 3.78 | 5.71 5.81 | 3.84 | 5.85 |
| 32 | 3.00 | 5.34 5.40 | 3.18 | 5.44 | 3.37 | 5.55 | 3.56 | $5 \cdot 67$ | 3.78 | $5 \cdot 8 \mathrm{I}$ | ${ }_{4}^{4 \cdot 1} 1$ | 5.96 6.08 |
| 33 | $3 \cdot 11$ | $5{ }^{4} 40$ | 3.30 | $5 \cdot 51$ | $3 \cdot 50$ | $5 \cdot 63$ | $3 \cdot 71$ | $5 \cdot 77$ | 3.94 4.11 | 5.91 6.03 | $4 \cdot 18$ 4.37 |  |
| 34 | 3.24 | $5 \cdot 47$ | 3.43 | $5 \cdot 59$ | $3 \cdot 65$ | $5 \cdot 72$ | $3 \cdot 87$ | $5 \cdot 87$ | $4 \cdot 11$ | $6 \cdot 03$ | 4.37 | $6 \cdot 21$ |
| 35 | 3.37 | $5 \cdot 55$ | $3 \cdot 58$ | $5 \cdot 68$ | $3 \cdot 80$ | $5 \cdot 83$ | 4.04 | $5 \cdot 99$ | 4.30 | $6 \cdot 16$ | $4 \cdot 59$ | $6 \cdot 37$ |
| 36 | 3.51 | $5 \cdot 64$ | $3 \cdot 73$ | $5 \cdot 78$ | $3 \cdot 97$ | $5 \cdot 94$ | $4 \cdot 23$ | $6 \cdot \mathrm{II}$ | $4 \cdot 51$ | $6 \cdot 31$ | $4 \cdot 83$ | $6 \cdot 54$ |
| 37 | 3.67 | $5 \cdot 74$ | 3.90 | $5 \cdot 89$ | $4 \cdot 16$ | $6 \cdot 06$ | $4 \cdot 44$ | $6 \cdot 26$ | 4.75 | $6 \cdot 48$ | $5 \cdot 09$ | $6 \cdot 74$ |
| 38 | 3.83 | $5 \cdot 85$ | 4.09 | $6 \cdot 02$ | 4.37 | 6.21 | 4.67 | 6.43 | 5.02 | $6 \cdot 68$ | $5 \cdot 40$ | 6.97 |
| 39 | $4 \cdot 02$ | 5.97 | $4 \cdot 30$ | $6 \cdot 16$ | $4 \cdot 60$ | $6 \cdot 37$ | $4 \cdot 93$ | $6 \cdot 62$ | 5.31 | $6 \cdot 90$ | $5 \cdot 74$ | $7 \cdot 24$ |

HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 225

## LATITUDE $25^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.


VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21{ }^{3}$ | , A. | L. $22^{\circ}$ | - A. | L. $23^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | s. | S. | S. | S. | s. | s. | s. | s. | s. |
| 0 | - I. 60 | -4.70 | - $1 \cdot 70$ | $-4.73$ | - I. 80 | $-4.76$ | - I*90 | $-4.80$ | $-2.00$ | $-4 \cdot 85$ | $-2 \cdot 11$ | $-4.89$ |
| 2 | 1.69 | 4.73 | I•79 | $4 \cdot 76$ | 1.89 | $4 \cdot 80$ | I•99 | $4 \cdot 84$ | $2 \cdot 10$ | $4 \cdot 89$ | $2 \cdot 21$ | $4 \cdot 94$ |
| 4 | I•78 | 4.76 | I. 88 | $4 \cdot 80$ | 1.99 | $4 \cdot 84$ | $2 \cdot 10$ | $4 \cdot 88$ | $2 \cdot 21$ | 4.93 | $2 \cdot 32$ | $4 \cdot 98$ |
| 6 | 1.88 | $4 \cdot 80$ | I.99 | $4 \cdot 84$ | 2.09 | $4 \cdot 88$ | $2 \cdot 20$ | $4 \cdot 93$ | $2 \cdot 32$ | $4 \cdot 98$ | $2 \cdot 43$ | $5 \cdot 04$ |
| 8 | 1.98 | $4 \cdot 84$ | $2 \cdot 09$ | $4 \cdot 88$ | 2.20 | $4 \cdot 93$ | $2 \cdot 32$ | 4.99 | $2 \cdot 43$ | 5*04 | $2 \cdot 55$ | $5 \cdot 10$ |
| 10 | $2 \cdot 09$ | $4 \cdot 89$ | $2 \cdot 21$ | 4*93 | $2 \cdot 32$ | 4.99 | $2 \cdot 44$ | 5.04 | $2 \cdot 56$ | 5.10 | $2 \cdot 69$ | 5•17 |
| II | $2 \cdot 15$ | 4*91 | $2 \cdot 27$ | 4*96 | $2 \cdot 38$ | 5.02 | $2 \cdot 50$ | $5 \cdot 07$ | $2 \cdot 63$ | $5 \cdot 14$ | $2 \cdot 76$ | $5 \cdot 20$ |
| 12 | 2.21 | $4 * 94$ | $2 \cdot 33$ | 4*99 | 2.45 | $5 \cdot 05$ | 2.57 | 5-11 | 2.69 | 5.17 | $2 \cdot 83$ | $5 \cdot 24$ |
| 13 | $2 \cdot 27$ | 4.96 | $2 \cdot 39$ | $5 \cdot 02$ | $2 \cdot 51$ | 5.08 | $2 \cdot 64$ | $5 \cdot 14$ | $2 \cdot 77$ | 5.2I | 2•91 | 5•28 |
| 14 | $2 \cdot 34$ | $4 * 99$ | $2 \cdot 46$ | $5 \cdot 05$ | $2 \cdot 59$ | $5 \cdot 11$ | $2 \cdot 71$ | 5•18 | $2 \cdot 85$ | $5 \cdot 25$ | $2 \cdot 99$ | $5 \cdot 33$ |
| 15 | $2 \cdot 40$ | $5 \cdot 02$ | 2.53 | $5 \cdot 09$ | $2 \cdot 66$ | 5.15 | 2.79 | 5.22 | 2.93 | $5 \cdot 30$ | 3.07 | $5 \cdot 38$ |
| 16 | 2.47 | $5 \cdot 06$ | $2 \cdot 60$ | 5-12 | $2 \cdot 73$ | 5-19 | 2.87 | $5 \cdot 26$ | 3.01 | $5 \cdot 34$ | $3 \cdot 16$ | $5 \cdot 43$ |
| 17 | $2 \cdot 54$ | $5 \cdot 09$ | $2 \cdot 67$ | $5 \cdot 16$ | $2 \cdot 8 \mathrm{I}$ | $5 \cdot 23$ | 2.95 | $5 \cdot 31$ | $3 \cdot 10$ | $5 \cdot 39$ | $3 \cdot 25$ | $5 \cdot 48$ |
| 18 | $2 \cdot 62$ | 5*13 | $2 \cdot 75$ | $5 \cdot 20$ | $2 \cdot 89$ | $5 \cdot 28$ | $3 \cdot 04$ | $5 \cdot 36$ | $3 \cdot 19$ | 5*45 | $3 \cdot 35$ | $5 \cdot 54$ |
| 19 | $2 \cdot 70$ | 5.17 | $2 \cdot 84$ | $5 \cdot 25$ | $2 \cdot 98$ | $5 \cdot 33$ | $3 \cdot 13$ | 5.41 | $3 \cdot 29$ | $5 \cdot 51$ | $3 \cdot 46$ | $5 \cdot 61$ |
| 20 | $2 \cdot 78$ | $5 \cdot 21$ | $2 \cdot 92$ | $5 \cdot 29$ | 3.07 | $5 \cdot 38$ | $3 \cdot 23$ | $5 \cdot 47$ | $3 \cdot 40$ | 5.57 | 3.57 | $5 \cdot 67$ |
| 21 | $2 \cdot 86$ | $5 \cdot 26$ | $3 \cdot 01$ | $5 \cdot 34$ | $3 \cdot 17$ | $5 \cdot 43$ | $3 \cdot 33$ | $5 \cdot 53$ | $3 \cdot 50$ | $5 \cdot 64$ | $3 \cdot 68$ | $5 \cdot 75$ |
| 22 | $2 \cdot 95$ | $5 \cdot 31$ | $3 \cdot 11$ | $5 \cdot 40$ | $3 \cdot 27$ | $5 \cdot 49$ | $3 \cdot 44$ | $5 \cdot 60$ | $3 \cdot 62$ | $5 \cdot 71$ | $3 \cdot 81$ | $5 \cdot 83$ |
| 23 | 3.05 | $5 \cdot 36$ | $3 \cdot 21$ | $5 \cdot 46$ | $3 \cdot 38$ | $5 \cdot 56$ | $3 \cdot 56$ | $5 \cdot 67$ | $3 \cdot 75$ | $5 \cdot 79$ | $3 \cdot 95$ | $5 \cdot 92$ |
| 24 | $3 \cdot 15$ | $5 \cdot 42$ | $3 \cdot 32$ | $5 \cdot 52$ | $3 \cdot 50$ | $5 \cdot 63$ | $3 \cdot 68$ | $5 \cdot 75$ | $3 \cdot 88$ | $5 \cdot 88$ | $4^{\circ} 09$ | $6 \cdot 02$ |
| 25 | $3 \cdot 26$ | $5 \cdot 48$ | 3.43 | $5 \cdot 59$ | 3.62 | $5 \cdot 71$ | $3 \cdot 81$ | $5 \cdot 83$ | $4 \cdot 02$ | $5 * 97$ | $4 \cdot 25$ | $6 \cdot 12$ |
| 26 | $3 \cdot 37$ | $5 \cdot 55$ | 3.56 | $5 \cdot 67$ | $3 \cdot 75$ | $5 \cdot 79$ | $3 \cdot 96$ | $5 \cdot 93$ | $4 \cdot 18$ | $6 \cdot 08$ | 4.42 | $6 \cdot 24$ |
| 27 | 3.49 | $5 \cdot 63$ | $3 \cdot 69$ | $5 \cdot 75$ | $3 \cdot 89$ | $5 \cdot 88$ | $4 \cdot 11$ | $6 \cdot 03$ | $4 \cdot 35$ | $6 \cdot 19$ | $4 \cdot 60$ | $6 \cdot 38$ |
| 28 | $3 \cdot 62$ | $5 \cdot 71$ | $3 \cdot 83$ | $5 \cdot 84$ | $4 \cdot 04$ | $5 \cdot 99$ | $4 \cdot 28$ | $6 \cdot 15$ | $4 \cdot 53$ | $6 \cdot 32$ | 4.81 | $6 \cdot 52$ |
| 29 | $3 \cdot 76$ | $5 \cdot 80$ | $3 \cdot 98$ | $5 \cdot 94$ | $4 \cdot 21$ | 6.10 | $4 \cdot 46$ | 6.27 | $4 \cdot 73$ | $6 \cdot 47$ | $5 \cdot 03$ | $6 \cdot 69$ |
| 30 | 3.91 | $5 \cdot 90$ | 4.14 | $6 \cdot 05$ | $4 \cdot 39$ | $6 \cdot 23$ | 4.66 | $6 \cdot \frac{12}{4}$ | 4.96 | $6 \cdot 64$ | $5 \cdot 28$ | $6 \cdot 88$ |
| 31 | $4 \cdot 07$ | $6 \cdot 01$ | $4 \cdot 32$ | 6-18 | 4.59 | $6 \cdot 37$ | $4 \cdot 88$ | $6 \cdot 58$ | 5.21 | 6.82 | $5 \cdot 57$ | $7 \cdot 10$ |
| 32 | 4.25 | $6 \cdot 13$ | $4 \cdot 52$ | $6 \cdot 32$ | $4 \cdot 81$ | $6 \cdot 53$ | $5 \cdot 13$ | $6 \cdot 77$ | $5 \cdot 49$ | $7 \cdot 04$ | $5 \cdot 89$ | $7 \cdot 36$ |
| 33 | 4.45 | $6 \cdot 26$ | 4.73 | $6 \cdot 47$ | 5.05 | $6 \cdot 71$ | 5.41 | $6 \cdot 98$ | $5 \cdot 81$ | $7 \cdot 29$ | $6 \cdot 26$ | $7 \cdot 66$ |
| 34 | $4 \cdot 66$ | $6 \cdot 42$ | 4.98 | $6 \cdot 65$ | $5 \cdot 33$ | $6 \cdot 92$ | $5 \cdot 72$ | $7 \cdot 23$ | $6 \cdot 17$ | $7 \cdot 59$ | $6 \cdot 70$ | 8.02 |

DECLINATION-CONTRARY NAME TO-LATITUDE.


VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S. | S. | - ${ }^{\text {S. }}$ | s. -4.45 | - ${ }^{\text {S. }} 17$ | s. -4.45 | s. $-\quad .26$ | S. -4.46 | S. | $\stackrel{\text { S. }}{4.46}$ | $\stackrel{\text { S. }}{ }$ | $\stackrel{\text { S. }}{4.47}$ |
| 0 | . 08 | $4 \cdot 45$ | -16 | $4 \cdot 45$ | $\cdot 25$ | $4 \cdot 46$ | $\cdot 34$ | $4 \cdot 46$ | $\cdot 42$ | $4 \cdot 47$ | - 5 -51 | -4.4 4.48 |
| 4 | -15 | 4.45 | - 24 | $4 \cdot 46$ | $\cdot 33$ | $4 \cdot 46$ | $\cdot 41$ | 4.47 | -50 | $4 \cdot 48$ | -59 | $4 \cdot 49$ |
| 6 | $\cdot 22$ | $4 \cdot 46$ | $\cdot 32$ | $4 \cdot 46$ | -40 | $4 \cdot 47$ | -49 | $44^{8}$ | -58 | $4 \cdot 49$ | -67 | 4.50 |
| 8 | -31 | $4 * 46$ | -39 | $4 * 47$ | -48 | $4 \cdot 48$ | -57 | $4 \cdot 49$ | -66 | $4 \cdot 50$ | $\cdot 75$ | 4.51 |
| 10 | -39 | 4.47 | -47 | 4.48 | $\cdot 56$ | 4.49 | $\cdot 65$ | $4 \cdot 50$ | $\cdot 74$ | 4.51 | -84 | $4 \cdot 53$ |
| 12 | -46 | 4.47 | $\cdot 55$ | 4.49 | $\cdot 64$ | $4 \cdot 50$ | $\cdot 74$ | 4.51 | -83 | $4 \cdot 53$ | -92 | 4.55 |
| 14 | $\cdot 54$ | $4 \cdot 48$ | -64 | $4 \cdot 50$ | $\cdot 73$ | 4.51 | -82 | $4 \cdot 52$ | -92 | $4 \cdot 54$ | $\mathrm{r} \cdot \mathrm{O}$ | $4 \cdot 56$ |
| 16 | -63 | 4.49 | $\cdot 72$ | 4.51 | -82 | 4.52 | $\cdot 91$ | 4.54 | ror | 4.56 | $1 \cdot 10$ | 4.59 |
| 18 | $\cdot 72$ | $4 \cdot 51$ | -8I | $4 \cdot 52$ | -91 | $4 \cdot 54$ | r.00 | $4 \cdot 56$ | I'ro | $4 \cdot 58$ | 1.20 | $4 \cdot 6 \mathrm{r}$ |
| 20 | -80 | $4 \cdot 52$ | -90 | 4.54 | roo | $4 \cdot 56$ | I'ro | $4 \cdot 58$ | 120 | $4 \cdot 61$ | $1 \cdot 30$ | $4 \cdot 64$ |
| 22 | -89 | $4 \cdot 54$ | -99 | $4 \cdot 56$ | $1 \cdot 10$ | $4 \cdot 58$ | 1.20 | $4 \cdot 61$ | $1 \cdot 30$ | $4 \cdot 64$ | $1 \cdot 41$ | $4 \cdot 67$ |
| 24 | -99 | $4 \cdot 56$ | $1 \cdot 09$ | 4.58 | 1.20 | $4 \cdot 6 \mathrm{I}$ | $1 \cdot 30$ | $4 \cdot 64$ | 1.41 | $4 \cdot 67$ | $1 \cdot 52$ | 4.70 |
| 26 | $1 \cdot 09$ | 4.58 | $1 \cdot 20$ | $4 \cdot 61$ | $1 \cdot 30$ | $4 \cdot 64$ | -141 | $4 \cdot 67$ | 1.53 | $4 \times 0$ | 1. 64 | $4 \cdot 74$ |
| 28 | I•19 | $4^{\cdot 61}$ | $1 \cdot 30$ | $4 \cdot 64$ | 1.42 | $4 \cdot 67$ | 1.53 | 4•71 | I•65 | $4 \cdot 75$ | $1 \cdot 77$ | 4*79 |
| 30 | $1 \cdot 31$ | $4 \cdot 63$ | 1.42 | $4 \cdot 67$ | $1 \cdot 54$ | 4.71 | r.66 | $4 \cdot 75$ | I•78 | 4.79 | 1.91 | 4.84 |
| 32 | $1 \cdot 42$ | $4 \cdot 67$ | $1 \cdot 54$ | $4 \cdot 71$ | $1 \cdot 67$ | $4 \cdot 75$ | r•79 | $4 \cdot 80$ | $1 \cdot 92$ | $4 \cdot 85$ | $2 \cdot 05$ | $4 \cdot 90$ |
| 34 | I.55 | 4.71 | $1 \cdot 68$ | $4 \cdot 76$ | 1.81 | $4 \cdot 80$ | $1 \cdot 94$ | $4 \cdot 85$ | $2 \cdot 08$ | 4.91 | 2.22 | 4.97 |
| 36 | $1 \cdot 68$ | $4 \cdot 76$ | 1.82 | $4 \cdot 8 \mathrm{x}$ | 1.96 | $4 \cdot 86$ | $2 \cdot 10$ | $4 \cdot 92$ | $2 \cdot 26$ | $4 \cdot 98$ | $2 \cdot 40$ | $5 \cdot 06$ |
| 38 | 1.83 | $4 \cdot 81$ | $1 \cdot 98$ | $4 \cdot 87$ | $2 \cdot 12$ | 4.93 | 2.27 | $5 \cdot 00$ | 2.43 | $5 \cdot 07$ | $2 \cdot 60$ | $5 \cdot 15$ |
| 40 | 1-99 | $4 \cdot 88$ | $2 \cdot 15$ | 4.94 | 2.31 | $5 \cdot 01$ | 2.47 | 5.09 | $2 \cdot 64$ | 5.18 | 2.83 | $5 \cdot 27$ |
| 42 | $2 \cdot 17$ | 4.95 | 2.34 | $5 \cdot 03$ | 2.51 | $5 \cdot 1 \mathrm{II}$ | 2.69 | 5.20 | $2 \cdot 88$ | $5 \cdot 30$ | 3.09 | 5.42 |
| 44 | $2 \cdot 38$ | $5 \cdot 05$ | $2 \cdot 56$ | $5 \cdot 13$ | 2.75 | 5.23 | 2.95 | $5 \cdot 34$ | $3 \cdot 16$ | $5 \cdot 46$ | 3.39 | $5 \cdot 60$ |
| 45 46 | 2.50 | $5 \cdot 10$ | 2.67 2.80 | 5.19 | 2.88 3.02 | $5 \cdot 30$ | 3.09 3.25 | 5.42 | $3 \cdot 32$ | 5.55 | 3.57 | 5.70 5.82 |
| 46 | $2 \cdot 61$ | $5 \cdot 16$ | $2 \cdot 80$ | $5 \cdot 26$ | $3 \cdot 02$ | $5 \cdot 38$ | 3.25 | $5 \cdot 51$ | 3.49 | $5 \cdot 66$ | $3 \times 76$ | $5 \cdot 82$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. <br> Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | H. M. <br> 5 <br> 5 <br> 48 | - I.98 | $\left\lvert\, \begin{array}{lll} \text { H. M. } \\ 5 & 46 & \text { s. } 6.0 \end{array}\right.$ | S. | $\left\lvert\, \begin{array}{ll} \text { H. M. } & \text { S. } \\ 5 & 44 \\ \text { 土6. } \end{array}\right.$ | $\begin{gathered} \mathrm{s} . \\ -\mathrm{r} \cdot 99 \end{gathered}$ | $\left\lvert\, \begin{array}{ccc} \text { H. м. } \\ 5 & 42 & \text { S. } 6.7 \end{array}\right.$ | $\begin{gathered} \mathrm{S} . \\ -2.01 \end{gathered}$ | $\begin{array}{lll} \text { H. M. S. } \\ 5 & 40 & \text { I6. } \end{array}$ | $\begin{gathered} s . \\ 2 \cdot 02 \end{gathered}$ | $\left\lvert\, \begin{array}{lll} \text { H. M. } & \text { S. } \\ 5 & 38 & \mathbf{I 4}_{4} \end{array}\right.$ | 3 |
| 2 | 53916.5 | $2 \cdot 00$ | $537 \times 6.4$ | $2 \cdot 01$ | $\begin{array}{llllllll}5 & 35 & 15\end{array}$ | $2 \cdot 02$ | $\begin{array}{llllllllllllll}5 & 33 & 13.5\end{array}$ | 2.04 | $5{ }_{5}^{51} 10 \cdot 7$ | $2 \cdot 06$ | 5 $29 \begin{array}{lll}5 & 6.8\end{array}$ | 2.07 |
| 4 | $53017{ }^{\circ} \mathrm{O}$ | $2 \cdot 02$ | $\begin{array}{lllll}5 & 28 & 15.2\end{array}$ | 2.04 | $\begin{array}{lllllllllllll}5 & 26 & 12.4\end{array}$ | 2.06 | 5 $24 \begin{array}{lll}5.4\end{array}$ | $2 \cdot 08$ | $\begin{array}{llll}5 & 22 & 3\end{array}$ | $2 \cdot 10$ | 5 19 56.9 | $2 \cdot 12$ |
| 6 | 52116.0 | $2 \cdot 05$ | $5 \begin{array}{lllll}5 & 19 & 12.4\end{array}$ | 07 | 517875 | 2.09 | 5 $15 \begin{array}{lll}5 & 1 & 3\end{array}$ | $2 \cdot 1$ | $\begin{array}{lllll}5 & 12 & 53.7\end{array}$ | 2.14 | 5 10 44.5 | $2 \cdot 17$ |
| 8 |  | $2 \cdot 08$ | 5 10 7\% | $2 \cdot 11$ | $\begin{array}{lll}5 & 8 & 0.6\end{array}$ | $2 \cdot 13$ | $5 \quad 5 \quad 5 \mathrm{I} \cdot 8$ | -16 | $\begin{array}{llll}5 & 3 & 41\end{array}$ | $2 \cdot 19$ | 5 I $\quad 29.2$ | 2.22 |
| 10 | $\begin{array}{llll}5 & 3 & 8 \cdot 9\end{array}$ | 2.12 | $5 \begin{array}{lll}5 & 1 & 0.9\end{array}$ | $2 \cdot 15$ | $4585 \mathrm{I} \cdot 2$ | $2 \cdot 18$ | $4 \begin{array}{lll}56 & 39 \cdot 7\end{array}$ | 2.21 | $45426 \cdot 3$ | $2 \cdot$ | 452 10.7 | $2 \cdot 28$ |
| 12 | $454 \quad 2 \cdot 2$ | 16 | 4 51 5I•7 | $2 \cdot 19$ | $44939 \cdot 3$ | $2 \cdot 22$ | 44724.7 | $2 \cdot$ | 44580 | $2 \cdot 30$ | $44248 \cdot 8$ | 2.34 |
| 14 | 44 53.2 | $2 \cdot$ | $44239 \cdot 9$ | $2 \cdot 24$ | 44024.4 | $2 \cdot 28$ | 4386.5 | $2 \cdot$ | $43546 \cdot 1$ | $2 \cdot 36$ | 43322.9 | $2 \cdot 41$ |
| 16 | $3541 \cdot 5$ | 25 | 43325.1 | 2.29 | 43181 | $2 \cdot 34$ | 42844.5 | $2 \cdot 3$ | 4 26 20.1 <br> 4 21  <br> 15   | 2.43 | $\begin{array}{llll}4 & 23 & 52 \cdot 7 \\ 4 & 5 & 5\end{array}$ | 2.48 |
| 17 | $43 \mathrm{I} 4 \cdot 5$ | 2 | $42846 \cdot 4$ | $2 \cdot 32$ | 42625.7 | $2 \cdot 37$ | $424 \quad 2 \cdot 1$ | $2 \cdot 42$ | 42135.5 | 2.47 | $4 \begin{array}{lll}49 & 5\end{array}$ | 2.52 |
| 18 | $2626 \cdot 7$ | 31 | $424 \quad 6 \cdot 9$ | $2 \cdot 35$ | 42144.2 | 2.40 | $\begin{array}{llll}4 & 19 & 18.6\end{array}$ | $2 \cdot 45$ | $41649 \cdot 7$ | $2 \cdot 5 \mathrm{I}$ | $\begin{array}{lllll}4 & 14 & 17.6\end{array}$ | 2.56 |
| 19 | 42148.0 | $2 \cdot 34$ | 41926.4 | $2 \cdot 39$ | $417 \quad 1 \cdot 7$ | $2 \cdot 44$ | 41433.9 | 2.49 | 4122.7 | 2.55 | 4928.0 | 2.61 |
| 20 | 4178.5 | 2.37 | $41444 \cdot 9$ | 2.42 | $\begin{array}{llll}4 & 12 & 18 \cdot 1\end{array}$ | 47 | $4 \quad 948.0$ | 2.53 |  | 2.59 | $4 \quad 4 \quad 36 \cdot 9$ | 2.66 |
| 21 | 41228.0 | $2 \cdot 40$ | 4102.3 | $2 \cdot 46$ | $4 \quad 733.3$ | $2 \cdot 51$ | $\begin{array}{llll}4 & 5 & 0.8 \\ 4 & \text { 12. }\end{array}$ | 2.57 | $\begin{array}{llll}4 & 2 & 24.5\end{array}$ | 2.64 | $35944 * 3$ | $2 \cdot 70$ |
| 22 | $4746 \cdot 4$ | 43 | $4 \quad 5 \quad 18.6$ | $2 \cdot 49$ | $4 \quad 2 \quad 47 \cdot 2$ | $2 \cdot 55$ | $4 \quad 0 \quad 12.2$ | 2.6 | 35733.2 | $2 \cdot 6$ | $35450 \cdot 0$ | 76 |
| 23 | $3 \quad 377$ | 2.47 | 4 0 33.7 | $2 \cdot 53$ | 35759.8 | $2 \cdot 60$ | $35522 \cdot 1$ | $2 \cdot 66$ | 35240.2 | 2.73 | 34953.9 | 2.81 |
| 24 |  | 2.51 | $\begin{array}{llll}3 & 55 & 47 \cdot 4 \\ 3\end{array}$ | $2 \cdot 57$ | 3 53 11.0 <br> 3 48  | $2 \cdot 64$ | $\begin{array}{llll}3 & 50 & 30 \cdot 5 \\ 3\end{array}$ | $2 \cdot 71$ | 3 $474{ }^{3} \cdot 6$ | 2.79 | $34456 \cdot 0$ | 2.87 |
| 25 | $\begin{array}{lllllll}3 & 53 & 34.8\end{array}$ | 2.55 | $35059 \cdot 9$ | 2.62 |  | $2 \cdot 69$ | $34537 \cdot 2$ | $2 \cdot 76$ | 3 42 49 | $2 \cdot 84$ | $33956 \cdot 0$ | $2 \cdot 93$ |
| 26 | $34848 \cdot 5$ | 2.59 | $34610 \cdot 8$ | 66 | 3 43 $28 \cdot 8$ | $2 \cdot 74$ | $34042 \cdot 2$ | 2.82 |  | $2 \cdot 90$ | $\begin{array}{lllll}3 & 34 & 53.9 \\ 3 & 29 & 49\end{array}$ | 2.99 |
| 27 | $3440 \cdot 6$ |  | 3 41 20.2 | $2 \cdot 71$ | $33^{8} 35 \cdot 1$ | $2 \cdot 79$ | $33545 \cdot 2$ |  | 33250 I | 2.96 | $\begin{array}{llll}3 & 29 & 49.4\end{array}$ | 3.06 |
| 28 | 3911.3 | 2.68 | $\begin{array}{llll}3 & 36 & 27 \cdot 9\end{array}$ | $2 \cdot 76$ | $\begin{array}{llll}3 & 33 & 39 & 6\end{array}$ | $2 \cdot 85$ | $33046 \cdot 1$ | $2 \cdot 94$ | 3 $2747 \cdot 2$ | 3.03 | $32442 \cdot 5$ | 3.13 |
| 29 | $3420 \cdot 3$ | 2.73 |  | 2.82 2.88 | $\begin{array}{llllllllllll}3 & 28 & 42 \cdot 1 \\ 3 & 23 & 42 \cdot 4\end{array}$ | 2.91 | $\begin{array}{llll}3 & 25 & 44 \cdot 9 \\ 3 & 20\end{array}$ | 3.00 | $\begin{array}{llll}3 & 22 & 42 \cdot 0\end{array}$ | $3 \cdot 10$ | $\begin{array}{llll}3 & 19 & 32 \cdot 8 \\ 3 & 1 & 30.2\end{array}$ | 3.21 |
| 30 | $\begin{array}{llll}3 & 29 & 27 \cdot 6\end{array}$ | 2.79 2.9 |  | 2.88 |  | $2 \cdot 97$ | $\begin{array}{llll}3 & 20 & 41 \cdot 3 \\ 3\end{array}$ | 3.07 |  | $3 \cdot 18$ |  | 3.29 3.38 |
| 31 | $\begin{array}{llll}3 & 24 & 33 \cdot 0 \\ 3 & 19 & 36 \cdot 4\end{array}$ | 2.84 2.91 | $\begin{array}{cccc}3 & 21 & 39 \cdot 8 \\ 3 & 16 & 39 \cdot 2\end{array}$ | 2.94 3.00 | $\begin{array}{llll}3 & 18 & 40 \cdot 4 \\ 3 & 13 & 36 \cdot 0\end{array}$ | 3.04 3.11 | $\begin{array}{cccc}3 & 15 & 35 \cdot 1 \\ 3 & 10 & 26 \cdot 1\end{array}$ | 3.14 3.22 | $\begin{array}{crrr}3 & 12 & 23.3 \\ 3 & 7 & 9.4\end{array}$ | 3.26 3.34 | ( $\begin{array}{rrr}3 & 9 & 4.4 \\ 3 & 3 & 45 \cdot 2\end{array}$ | 3.38 3.47 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 33 | 1437.7 | $2 \cdot 97$ | 3 II $36 \cdot 4$ | 3.07 | $\begin{array}{llll}3 & 8 & 28.7\end{array}$ | $3 \cdot 18$ | $\begin{array}{llll}3 & 5 & 14.2\end{array}$ | 3.30 | $\begin{array}{llll}3 & 1 & 52.2\end{array}$ | 3.43 | $\begin{array}{llll}2 & 58 & 22.3\end{array}$ | 3.57 |
| 34 | $\begin{array}{llll}3 & 9 & 36 \cdot 5\end{array}$ | 3.04 | $\begin{array}{llll}3 & 6 & 31 \cdot 0\end{array}$ | $3 \cdot 15$ |  | $3 \cdot 27$ | $\begin{array}{lllll}2 & 59 & 58 \cdot 9\end{array}$ | 3.39 | $25631 \cdot 3$ | 3.53 | $\begin{array}{llllll}2 & 52 & 55 \cdot 2\end{array}$ | $3 \cdot 68$ |
| 35 | $\begin{array}{llllllllll}3 & 4 & 32 \cdot 8\end{array}$ | $3 \cdot$ | 3 1 $22 \cdot 7$ | 3.23 | $\begin{array}{llllllllll}2 & 58 & 5.3\end{array}$ | 3.35 | $25440 \cdot 1$ | 3.49 | $2515 \cdot 4$ | 3.64 | 24723.6 | $3 \cdot 79$ |
| 36 | $\begin{array}{llll}2 & 59 & 26.3 \\ 2 & 54 & 16.8\end{array}$ | 3.19 3.27 | $\begin{array}{llll}2 & 56 & 1113 \\ 2 & 50 & 56 \cdot 5\end{array}$ | 3.3 | $\begin{array}{lllll}2 & 52 & 48 \cdot 5 \\ 2 & 47 & 27.8\end{array}$ | 3.45 3.55 | $\begin{array}{lllllll}2 & 49 & 17.3 \\ 2 & 43 & 50.2\end{array}$ | 3.59 | $\begin{array}{llllll}2 & 45 & 37 \cdot 1 \\ 2 & 40 & \\ \end{array}$ | 3.75 3.88 | $24 \mathrm{I} 47 \cdot \mathrm{I}$ | 3.92 |
| 37 | 25416.8 | 3.27 | $25056 \cdot 5$ | 3.41 | 24727.8 | $3 \cdot 55$ | 24350.2 | $3 \cdot 71$ | $240 \quad 2 \cdot 9$ | 3.88 | $\begin{array}{llll}2 & 36 & 4.9\end{array}$ | 4.06 |
| 38 | 24940 | 3.36 | $24538 \cdot 0$ | 3.51 | $\begin{array}{llll}2 & 42 & 3.0\end{array}$ | $3 \cdot 66$ | $\begin{array}{lllll}2 & 38 & 18.4\end{array}$ | 3.83 | 23423.3 | 4.01 | 23016.7 | 4.21 |
| 39 | $\begin{array}{llllllllllll}2 & 43 & 47 \cdot 6\end{array}$ | 3.46 | $\begin{array}{lllll}2 & 40 & 15.3\end{array}$ | 3.62 | $\begin{array}{llllll}2 & 36 & 3 & 3\end{array}$ | 3 | $\begin{array}{llll}2 & 32 & 41 \\ 2\end{array}$ | $3 \cdot 97$ | $\begin{array}{ll}2 & 28 \\ 2 & 37 \cdot 6\end{array}$ | $4 \cdot 16$ | $2 \begin{array}{ll}24 & 21.6\end{array}$ | 4.38 |
| 40 | $\begin{array}{cccc}2 & 38 & 27 \cdot 1 \\ 2 & 33 & 2 \cdot 2\end{array}$ | 3.57 3.69 | $\begin{array}{llll}2 & 34 & 48 \cdot 2 \\ 2 & 29 & 15.0 \\ 2\end{array}$ | 3.73 <br> 3.86 | $\begin{array}{llll}2 & 30 & 58.9 \\ 2 & 25 & 18.4\end{array}$ | 3.92 4.06 | $\begin{array}{llll}2 & 26 & 58 \cdot 2 \\ 2 & 21 & 8.6\end{array}$ | 4.11 | $\begin{array}{llll}2 & 22 & 45 \cdot 3 \\ 2 & 16 & 45 \cdot 3\end{array}$ | 4.33 4.51 | $\begin{array}{llll}2 & 18 & 18.6 \\ 2 & \text { I2 } & 6.8\end{array}$ | 4.57 |
| 41 <br> 42 | $\left\lvert\, \begin{array}{rrrr}2 & 33 & 2 \cdot 2 \\ 2 & 27 & 32 \cdot 5\end{array}\right.$ | 3.69 3.81 |  | 3.01 4.01 | $\left\lvert\, \begin{array}{llll}2 & 25 & 18 \cdot 4 \\ 2 & 19 & 31.5\end{array}\right.$ |  | $\begin{array}{rrrr}2 & 21 & 8.6 \\ 2 & 15 & 11 & 5\end{array}$ | 4.28 4.46 | $\begin{array}{llll}2 & 16 & 45 \cdot 3 \\ 2 & \text { Io } & 36 \cdot 5\end{array}$ | 4.51 4.72 |  | 4.78 5.02 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ A. |  | L. $7^{\circ}$ | A. | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ}$ A. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | S. | S. | S. | S. | S. | S. | S. | S. | s. | S. | S. |
| 0 | -. 52 | $-4.48$ | - 61 | -4.49 | - 70 | $-4.51$ | - 79 | $-4.52$ | - .88 | -4.54 | - 97 | $-4.55$ |
| 2 | -60 | 4.49 | -69 | 4.50 | -78 | 4.52 | -87 | $4 \cdot 53$ | -96 | $4 \cdot 55$ | I.05 | 4.57 |
| 4 | -68 | $4 \cdot 51$ | $\cdot 77$ | $4 \cdot 52$ | -86 | 4.53 | -95 | 4.55 | I•04 | $4 \cdot 57$ | I'13 | 4.59 |
| 6 | $\cdot 76$ | $4 \cdot 52$ | -85 | $4 \cdot 53$ | -94 | $4 \cdot 55$ | I'03 | $4 \cdot 57$ | I-13 | $4 \cdot 59$ | I. 22 | 4.61 |
| 8 | - 84 | 4.53 | -93 | 4.55 | I.03 | 4.57 | I'I2 | $4 \cdot 59$ | I. 22 | $4 \cdot 61$ | I•3I | 4.63 |
| 10 | -93 | $4 \cdot 55$ | I.02 | 4.57 | I•12 | $4 \cdot 59$ | I.2I | $4 \cdot 61$ | I'3I | $4 \cdot 64$ | I'4I | 4.67 |
| 12 | $\underline{1} \mathrm{O} 2$ | 4.57 | I'II | 4.59 | I. 21 | $4 \cdot 61$ | I 31 | $4 \cdot 64$ | 1.41 | $4 \cdot 67$ | I•5I | 4.70 |
| 14 | I'II | 4.59 | I. 20 | $4 \cdot 61$ | I.30 | 4.64 | I.40 | $4 \cdot 67$ | I•5I | 4.70 | I 61 | 4•33 |
| 16 | I 20 | $4 \cdot 61$ | I 30 | $4 \cdot 64$ | I.40 | $4 \cdot 67$ | I.5I | $4 \cdot 70$ | I'6I | 4.73 | I•72 | 4.77 |
| 18 | I 30 | $4 \cdot 64$ | I.40 | $4 \cdot 67$ | I. 51 | $4 \cdot 70$ | I-62 | $4 \cdot 73$ | 1.73 | $4 \cdot 77$ | I•84 | $4 \cdot 8 \mathrm{I}$ |
| 20 | I.4I | $4 \cdot 67$ | I.5I | 4.70 | I. 62 | 4*74 | 1*73 | 4*78 | 1.85 | 4.82 | 1.96 | $4 \cdot 86$ |
| 22 | I. 52 | 4.70 | 1. 63 | 4.74 | I'74 | $4 \cdot 78$ | I.86 | $4 \cdot 82$ | 1.97 | 4.87 | $2 \cdot 10$ | 4.92 |
| 24 | I. 63 | 4.74 | I.75 | $4 \cdot 78$ | 1.87 | $4 \cdot 83$ | I.99 | $4 \cdot 87$ | $2 \cdot 11$ | 4.93 | $2 \cdot 24$ | $4 \cdot 98$ |
| 26 | I.76 | 4.78 | I.88 | $4 \cdot 83$ | $2 \cdot 00$ | $4 \cdot 88$ | $2 \cdot 13$ | $4 \cdot 93$ | $2 \cdot 26$ | 4.99 | 2.40 | $5 \cdot 05$ |
| 28 | I. 89 | $4 \cdot 84$ | $2 \cdot 02$ | $4 \cdot 89$ | $2 \cdot 15$ | $4 \cdot 94$ | $2 \cdot 28$ | $5 \cdot 00$ | $2 \cdot 42$ | $5 \cdot 07$ | 2.57 | $5 \cdot 14$ |
| 30 | $2 \cdot 04$ | $4 \cdot 89$ | 2.17 | 4.95 | 2.31 | 5.01 | 2.45 | 5.08 | $2 \cdot 60$ | $5 \cdot 16$ | $2 \cdot 76$ | $5 \cdot 24$ |
| 32 | $2 \cdot 19$ | 4.96 | $2 \cdot 34$ | $5 \cdot 03$ | $2 \cdot 48$ | 5.10 | $2 \cdot 64$ | $5 \cdot 17$ | $2 \cdot 80$ | 5.26 | $2 \cdot 97$ | $5 \cdot 35$ |
| 34 | 2.37 | 5.04 | 2.52 | $5 \cdot 11$ | $2 \cdot 68$ | $5 \cdot 19$ | 2.85 | $5 \cdot 28$ | 3.03 | $5 \cdot 38$ | 3.21 | $5 \cdot 49$ |
| 36 | 2.56 2.66 | 5.13 | 2.72 2.84 | $5 \cdot 22$ $5 \cdot 28$ | $2 \cdot 90$ | $5 \cdot 31$ $5 \cdot 38$ | 3.09 3.22 | 5.42 5.49 | 3.28 3.42 | 5.53 5.61 | 3.49 3.65 | $5 \cdot 66$ |
| 37 | $2 \cdot 66$ | 5.19 | $2 \cdot 84$ | $5 \cdot 28$ | $3 \cdot 02$ | $5 \cdot 38$ | 3.22 | $5 \cdot 49$ | 3.42 | $5 \cdot 61$ | 3.65 | $5 \cdot 75$ |
| 38 | 2.77 | 5.24 | $2 \cdot 96$ | $5 \cdot 34$ | 3.15 | 5.45 | $3 \cdot 36$ | $5 \cdot 57$ | $3 \cdot 58$ | $5 \cdot 71$ | 3.81 | $5 \cdot 86$ |
| 39 | $2 \cdot 89$ | $5 \cdot 31$ | 3.09 | 5.41 | $3 \cdot 29$ | 5.53 | $3 \cdot 51$ | $5 \cdot 67$ | $3 \cdot \% 5$ | $5 \cdot 82$ | 4.00 | $5 \cdot 98$ |
| 40 | 3.02 | $5 \cdot 38$ | 3.22 | 5.49 | 3.44 | $5 \cdot 63$ | 3.68 | $5 \cdot 77$ | 3.93 | $5 \cdot 94$ | 4.21 | $6 \cdot 12$ |
| 4 4 | $3 \cdot 16$ $3 \cdot 30$ | - $5 \cdot 45$ | 3.37 3.53 | $5 \cdot 58$ 5.68 | 3.61 3.79 | 5.73 5.84 | 3.86 4.06 | $5 \cdot 89$ 6.02 | 4.13 4.36 | 6.07 6.23 | 4.43 | $6 \cdot 28$ 6.47 |
| 42 | $3 \cdot 30$ | $5 \cdot 54$ | 3.53 | $5 \cdot 68$ | 3.79 | $5 \cdot 84$ | $4 \cdot 06$ | $6 \cdot 02$ | $4 \cdot 36$ | $6 \cdot 23$ | 4.69 | 6.47 |

## LATITUDE $26^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. Var. | $18^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | ${ }^{\mathrm{H}} .$ | S. | H. M. S. |  | H. M. | S. | н. м. | s. | H. M. S. | S. | s. | S. |
| 2 | $\begin{array}{\|ccc\|}5 & 36 & 11 \cdot 9 \\ 5 & 27 & 1 \cdot 7\end{array}$ | 2.05 2.09 | $\begin{array}{rrrr}5 & 34 & 8 \cdot 3 \\ 5 & 24 & 55 \cdot 4\end{array}$ | 2.07 2.12 | 5 32 $3 \cdot 7$ <br> 5 22 47 | 2.09 2.14 | $\begin{array}{llll}5 & 29 & 57 \cdot 8 \\ 5 & 20 & 38 \cdot 6\end{array}$ | 2.11 |  | 2.13 2.19 | $\begin{array}{llll}5 & 25 & 4 \mathrm{I} \cdot 8 \\ 5 & 16 \\ 15 & \\ 5\end{array}$ |  |
| 4 | $51749 \cdot 1$ | $2 \cdot 14$ | 51539.7 | 17 | 51328.8 | $2 \cdot 20$ | $51116 \cdot 0$ | 2.23 | $\begin{array}{llll}5 & 9 & 1.4\end{array}$ | $2 \cdot 26$ | 5644.9 | $2 \cdot 29$ |
|  | $833 \cdot 6$ | $2 \cdot 20$ | $5621 \cdot 0$ | $2 \cdot 23$ | $\begin{array}{llll}5 & 4 & 6 \cdot 5\end{array}$ | 2.26 | 5 I 49.9 | 2.29 | $4593 \mathrm{I} \cdot 2$ | 2.33 | 45710.2 | $2 \cdot 37$ |
| 8 | $45915 \cdot 1$ | 5 | $45658 \cdot 9$ | $2 \cdot 29$ | $45440 \cdot 5$ | $2 \cdot 33$ | $4 \begin{array}{lll}42 & 19.8\end{array}$ | $2 \cdot 37$ | $44956 \cdot 6$ | 2.41 | $44730 \cdot 8$ | 2.45 |
| 10 | 49 53.I | 2.31 | 44733.0 | $2 \cdot 36$ | $44510 \cdot 4$ | $2 \cdot 40$ | 44245.2 | 2.44 | 440 I7.2 | 2.49 | $43746 \cdot 3$ | 4 |
| 12 | $44027 \cdot 2$ | $2 \cdot 38$ | $438 \quad 2.9$ | 2.43 | $43535 \cdot 8$ | 2.48 | $433 \quad 5 \%$ | $2 \cdot 53$ | $43032 \cdot 5$ | $2 \cdot 58$ | 42755.9 | $2 \cdot 64$ |
| 14 | $3057 \cdot 1$ | 2.46 | $\begin{array}{llll}4 & 28 & 28 \cdot 2\end{array}$ | $2 \cdot 5$ | $42556 \cdot 1$ | 2.56 | $423120 \cdot 7$ | 2.62 | $42041 \cdot 7$ | $2 \cdot 68$ | 41759.0 | 4 |
| 16 | $42122 \cdot 2$ | $2 \cdot 54$ |  | 2.59 | $41610 \cdot 8$ | $2 \cdot 66$ | $4 \begin{array}{llll}4 & 13 & 29.5\end{array}$ | $2 \cdot 72$ | 4 10 $44 \cdot 3$ | $2 \cdot 79$ | $4 \quad 754 \cdot 9$ | 86 |
| 18 | 4 II 41.9 | 2.63 | $\begin{array}{lll}4 & 9 & 2.4\end{array}$ | $2 \cdot 69$ | 4619.0 | 2.76 | $4 \begin{array}{lll}4 & 31.4\end{array}$ | 2.83 | $4 \bigcirc 393$ | 2.91 | $35742 \cdot 5$ | $2 \cdot 99$ |
| 19 | 49 |  | 4 7.I | 4 | 4 I $20 \cdot 3$ | 2.81 | 33 58 <br> 1  | 2.89 | 35533.6 | $2 \cdot 97$ | $35232 \cdot 8$ | 3.06 |
| 20 | $55 \cdot 6$ | $2 \cdot 72$ | 359 Io'1 | 2.80 | $35620 \cdot 1$ | 2.87 | 35325.4 | 2.95 | $35025 \cdot 7$ | 3.04 | 347 20•7 | $3 \cdot 13$ |
| 21 | 5659.9 | $2 \cdot 7$ | $354 \mathrm{II} \cdot \mathrm{I}$ | 2.85 | 35117.6 | 2.93 | $\begin{array}{llllll}3 & 48 & 19\end{array}$ | 3.02 | 34515.3 | 3.11 | $\begin{array}{llllll}3 & 42 & 59\end{array}$ | 3.21 |
| 22 | $\begin{array}{llll}3 & 52 & 2 \cdot 5 \\ 3 & 47 & \end{array}$ | 2.83 |  | 2.91 |  | 3. | $\begin{array}{llll}3 & 43 & 10.4\end{array}$ | 3.09 | $\begin{array}{lll}3 & 40 & 2 \cdot 3\end{array}$ | $3 \cdot 18$ | $\begin{array}{llll}3 & 36 & 48 \cdot 2\end{array}$ | 3.29 |
| 23 | 347 3.0 | 2.89 | $\begin{array}{llll}3 & 44 & 7 \cdot 1\end{array}$ | $2 \cdot 98$ | 34 I 5.9 | 3.07 | $3 \quad 3759.2$ | $3 \cdot 16$ | $3 \quad 3446 \cdot 5$ | 3. | 3 31 27.4 | $3 \cdot 37$ |
| 24 | $\begin{array}{llll}3 & 42 & 1 \cdot 5 \\ 3 & 36 & 57\end{array}$ | 2.95 | 339 I | 3.04 | $\begin{array}{llll}3 & 35 & 56 \cdot 4\end{array}$ | $3 \cdot 14$ | $\begin{array}{llll}3 & 32 & 45 \cdot 2 \\ 3 & 27\end{array}$ | 3.24 | $\begin{array}{llll}3 & 29 & 27 \cdot 6\end{array}$ | 3.35 | $\begin{array}{llll}3 & 26 & 3.3 \\ 3 & 20 & 35 \cdot 5\end{array}$ | 3.47 |
| 25 |  | 3.02 | 3 33 53.9 <br> 3 28  | $3 \cdot 11$ | $\begin{array}{llll}3 & 30 & 44.2\end{array}$ | 3.21 | $\begin{array}{llll}3 & 27 & 28 \cdot 2 \\ 3 & 22 & 8.1\end{array}$ | 3.32 | $\begin{array}{llll}3 & 24 & 5.5\end{array}$ | 3.44 | $32035 \cdot 5$ | 3.56 |
|  |  | 3. | $\begin{array}{lllll}3 & 28 & 43.5 \\ 3 & 23 & 30.3\end{array}$ | $3 \cdot 19$ | $\begin{array}{llll}3 & 25 & 29 \cdot 1 \\ 3 & 20 & 10 \cdot 9\end{array}$ | 3.29 3.38 | 3 22 $8 \cdot 1$ <br> 3 16  <br> 1   | 3.41 | $\begin{array}{llll}3 & 18 & 39 \cdot 8\end{array}$ | 3.53 | 3 15 3.9 <br> 3   | 67 |
| 28 | $\begin{array}{llll}3 & 26 & 42 \cdot 9 \\ 3 & 21 & 31 \cdot 5\end{array}$ | 324 | $\begin{array}{lll}3 & 23 & 30.3 \\ 3 & 18 & 13.9\end{array}$ | 3.27 3.35 | $\begin{array}{llll}3 & 20 & 10 \cdot 9 \\ 3 & 14 & 49 & 3\end{array}$ | 4 | $\begin{array}{lll}3 & 1644.4 \\ 3 & \text { II } & 17.0\end{array}$ | 3.50 3.61 | 3 13 $10 \cdot 3$ <br> 3 7 $36 \cdot 6$ | 3.64 3.75 | $\begin{array}{llll}3 & 9 & 28 \cdot 0 \\ 3 & 3 & 47 \cdot 4\end{array}$ | 3.78 3.90 |
| 29 | $\begin{array}{lllll}3 & 16 & 17 \cdot 1\end{array}$ | 3.32 | 31254.3 | 3.44 | $3{ }^{3} 924{ }^{\circ} \mathrm{O}$ | 3.57 | $\begin{array}{llll}3 & 5 & 45 \cdot 6\end{array}$ | 3.71 | $\begin{array}{llll}3 & 1 & 58.4\end{array}$ | 3.87 | $2 \begin{array}{lll}28 & 177\end{array}$ | $4 \cdot 03$ |
| 30 | 3 10 59.4 | 3.41 | $\begin{array}{llll}3 & 7 & 31 \cdot 1\end{array}$ | 3.54 | 3 3 54 | $3 \cdot 68$ | $\begin{array}{llll}3 & 0 & 9 \cdot 6\end{array}$ | $3 \cdot 83$ | $25615 \cdot 1$ | $3 \cdot 99$ | $25210 \cdot 5$ | $4 \cdot 17$ |
| 31 | $\begin{array}{llll}3 & 5 & 38 \cdot 2\end{array}$ | $3 \cdot 50$ | 3 2 3.9 | $3 \cdot 64$ | $2582 \mathrm{I} \cdot \mathrm{O}$ | $3 \cdot 79$ | $1 \begin{array}{llll}2 & 54 & 28 \cdot 7\end{array}$ | 3.95 | $25026 \cdot 4$ | 4 | 24613.0 | $4 \cdot 32$ |
| 32 | $\begin{array}{lcl}3 & 0 & 13 \cdot 1 \\ & 51\end{array}$ | 3.72 | $\begin{array}{lllll}2 & 56 & 32.4 \\ 2 & 50 & 56.2\end{array}$ | 3.88 | $\begin{array}{ll}2 & 52 \\ 2 & 42 \cdot 5\end{array}$ | 3.95 | $\begin{array}{llllllllll}2 & 48 & 42.5 \\ 2 & 42 & 50.2\end{array}$ | 4.09 | 2 44 $3 \mathrm{I} \cdot 5$ <br> 2   | $4 \cdot 28$ | $\begin{array}{rrr}2 & 40 \\ 2 & 8.6\end{array}$ | 9 |
| 33 | $25443 \cdot 9$ | $3 \cdot 72$ | $25056 \cdot 2$ | 3.8 | 24658.6 | 4.05 | $24250 \cdot 2$ | 4.24 | $238 \quad 29 \cdot 8$ | 4.45 | 2.3356 .5 |  |
| 34 | $24910 \cdot 0$ | 3.8 | $\begin{array}{llll}2 & 45 & 14.9\end{array}$ | 4.01 | $\begin{array}{llll}2 & 41 & 8 \cdot 9\end{array}$ | $4 \cdot 20$ | $23651 \cdot 3$ | 4.40 | $23220 \cdot 6$ | 4.63 | 22735.6 | 4.88 |
| 35 | $\begin{array}{llllll}2 & 43 & 31 \cdot 0 \\ 2\end{array}$ | 3.97 | $\begin{array}{llllll}2 & 39 & 27 \cdot 7 \\ 2 & 3 & 3\end{array}$ | $4 \cdot 15$ |  | 4.36 | 23044.9 | $4 \cdot 58$ | $\begin{array}{lll}2 & 26 & 2 \cdot 8 \\ 2\end{array}$ | 83 | 22 I 4.9 | $5 \cdot 11$ |
| 36 | $\begin{array}{lllllllll}2 & 37 & 46 \cdot 4 \\ 2 & 315\end{array}$ | 4.11 | 23334.2 | 4.31 | 2 29.9 .2 | 4.53 | $\begin{array}{cccc}2 & 24 & 30 \cdot 1 \\ 2 & 18 & 5 \cdot 8\end{array}$ | 4.78 | $\begin{array}{llll}2 & 19 & 35 \cdot 3 \\ 2 & 12 & 56 \cdot 3\end{array}$ | 5.06 | $\begin{array}{llll}2 & 14 & 22.9 \\ 2 & 7 & 27.8\end{array}$ | 5.37 |
| 37 38 | $\begin{array}{llll}2 & 31 & 55 \cdot 6 \\ 2 & 25 & 57 \cdot 7\end{array}$ | 4.26 4.43 | $\begin{array}{llll}2 & 27 & 33.5 \\ 2 & 21 & 24.7\end{array}$ | 4.48 4.68 | $\begin{array}{llll}2 & 22 & 57.4 \\ 2 & 16 & 36.2\end{array}$ | $4{ }^{4 \cdot} 7$ | $\begin{array}{llll}2 & 18 & 5 \cdot 8 \\ 2 & \text { II } & 30 \cdot 5\end{array}$ | 5.1 5.26 | [ $\begin{array}{rlr}2 & 12 & 56 \cdot \\ 2 & 6 & 5 \cdot 1\end{array}$ | 5.32 5.61 | $\begin{array}{llll}2 & 7 & 27 \cdot 8 \\ 2 & 0 & 17.2\end{array}$ | 5.67 6.02 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $1^{17}{ }^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | s. | s. | s. | s. | S. | s. | S. | s. | s. |
| 0 | -r.06 | $-4.57$ | -I'15 | $-4.60$ | - 1.24 | -4.62 | -I.34 | $-4.65$ | - 1.43 | $-4.67$ | - 1.53 | $4 \cdot 70$ |
| 2 | I. 14 | $4 \cdot 59$ | 1.24 | $4 \cdot 62$ | $1 \cdot 33$ | 4.64 | 1.43 | $4 \cdot 67$ | 1.52 | $4 \cdot 70$ | 1.62 | $4 \cdot 74$ |
| 4 | $\underline{1} 23$ | $4 \cdot 62$ | $1 \cdot 32$ | $4 \cdot 64$ | 1.42 | $4 \cdot 67$ | 1.52 | $4 \cdot 70$ | 1.62 | $4 \cdot 74$ | $1 \cdot 72$ | $4 \cdot 77$ |
| 6 | $1 \cdot 32$ | $4 \cdot 64$ | 1.42 | $4 \cdot 67$ | $1 \cdot 51$ | $4 \cdot 70$ | 1.61 | $4 \cdot 73$ | $1 \cdot 72$ | $4 \cdot 77$ | 1.82 | 4.81 |
| 8 | 1.41 | $4 \cdot 67$ | 1.51 | 4*70 | $1 \cdot 61$ | 4.73 | $1 \cdot 71$ | $4 \cdot 77$ | 1.82 | $4 \cdot 8 \mathrm{I}$ | $1 \cdot 93$ | $4 \cdot 85$ |
| го | r.5I | 4.70 | 1.6I | $4 \cdot 73$ | 1.71 | $4 \cdot 77$ | 1.82 | 4.80 | $1 \cdot 93$ | 4.85 | $2 \cdot 04$ | 4.90 |
| 12 | 1.61 | $4 \cdot 73$ | I.72 | $4 \cdot 77$ | 1.82 | $4 \cdot 81$ | $1 \cdot 93$ | $4 \cdot 85$ | 2.04 | 4.90 | $2 \cdot 16$ | 4.94 |
| 14 | 1'72 | 4.77 | 1.83 | 4.81 | 1.94 | $4 \cdot 85$ | $2 \cdot 05$ | $4 \cdot 90$ | $2 \cdot 17$ | 4.95 | $2 \cdot 29$ | $5 \cdot 00$ |
| 16 | 1.83 | 4.81 | 194 | $4 \cdot 86$ | $2 \cdot 06$ | 4.90 | $2 \cdot 18$ | $4 \cdot 96$ | $2 \cdot 30$ | $5 \cdot \mathrm{OI}$ | $2 \cdot 42$ | $5 \cdot 07$ |
| 18 | 1•95 | $4 \cdot 86$ | 2.07 | $4 \cdot 91$ | 2'19 | $4 \cdot 96$ | $2 \cdot 31$ | $5 \cdot 02$ | $2 \cdot 44$ | $5 \cdot 07$ | $2 \cdot 57$ | $5 \cdot 14$ |
| 19 | 2.02 | $4 \cdot 89$ | $2 \cdot 14$ | 4.94 | $2 \cdot 26$ | $4 \cdot 99$ | $2 \cdot 39$ | $5 \cdot 05$ | 2.52 | $5 \cdot 11$ | $2 \cdot 65$ | 5•18 |
| 20 | 2.08 | $4 \cdot 91$ | 2.20 | 4*97 | $2 \cdot 33$ | 5.02 | $2 \cdot 46$ | $5 \cdot 09$ | 2.60 | $5 \cdot 15$ | 2.74 | $5 \cdot 22$ |
| 21 | $2 \cdot 15$ | $4 \cdot 94$ | $2 \cdot 28$ | $5 \cdot 00$ | $2 \cdot 41$ | 5.06 | 2.54 | $5 \cdot 12$ | $2 \cdot 68$ | $5 \cdot 19$ | 2.82 | $5 \cdot 27$ |
| 22 | $2 \cdot 22$ | 4.97 | $2 \cdot 35$ | 5.03 | $2 \cdot 48$ | $5 \cdot 10$ | $2 \cdot 62$ | 5•17 | 2.77 | $5 \cdot 24$ | $2 \cdot 92$ | $5 \cdot 32$ |
| 23 | $2 \cdot 30$ | $5 \cdot 01$ | 2.43 | 5.07 | $2 \cdot 57$ | $5 \cdot 14$ | $2 \cdot 71$ | 5.21 | $2 \cdot 86$ | $5 \cdot 29$ | 3.01 | $5 \cdot 37$ |
| 24 | $2 \cdot 37$ | $5 \cdot 04$ | 2.51 | $5 \cdot 11$ | $2 \cdot 65$ | $5 \cdot 18$ | $2 \cdot 80$ | $5 \cdot 26$ | $2 \cdot 95$ | $5 \cdot 34$ | $3 \cdot 11$ | $5 \cdot 43$ |
| 25 | 2.45 | $5 \cdot 08$ | 2.59 | $5 \cdot 15$ | $2 \cdot 74$ | 5.23 | $2 \cdot 90$ | $5 \cdot 31$ | 3.05 | $5 \cdot 40$ | $3 \cdot 22$ | $5 \cdot 49$ |
| 26 | $2 \cdot 54$ | $5 \cdot 12$ | $2 \cdot 68$ | $5 \cdot 20$ | $2 \cdot 84$ | $5 \cdot 28$ | $3 \cdot 00$ | $5 \cdot 36$ | $3 \cdot 16$ | $5 \cdot 46$ | $3 \cdot 34$ | $5 \cdot 56$ |
| 27 | 2.63 | $5 \cdot 17$ | $2 \cdot 78$ | $5 \cdot 25$ | $2 \cdot 94$ | $5 \cdot 33$ | $3 \cdot 10$ | 5.43 | $3 \cdot 28$ | $5 \cdot 53$ | $3 \cdot 46$ | $5 \cdot 64$ |
| 28 | 2.72 | $5 \cdot 21$ | $2 \cdot 88$ | $5 \cdot 30$ | 3.04 | $5 \cdot 39$ | $3 \cdot 22$ | $5 \cdot 49$ | 3.40 | $5 \cdot 60$ | 3•59 | $5 \cdot 72$ |
| 29 | $2 \cdot 82$ | $5 \cdot 27$ | $2 \cdot 98$ | $5 \cdot 36$ | $3 \cdot 15$ | 5.45 | $3 \cdot 34$ | $5 \cdot 56$ | $3 \cdot 53$ | $5 \cdot 68$ |  | $5 \cdot 81$ |
| 30 | $2 \cdot 92$ | $5 \cdot 32$ | 3.09 | $5 \cdot 42$ | 3.27 | $5 \cdot 52$ | 3.47 | 5.64 | 3.67 | $5 \cdot 77$ | $3 \cdot 88$ | $5 \cdot 91$ |
| 31 | 3.03 | $5 \cdot 39$ | $3 \cdot 21$ | $5 \cdot 49$ | $3 \cdot 40$ | $5 \cdot 60$ | 3.60 | $5 \cdot 73$ | $3 \cdot 82$ | $5 \cdot 86$ | $4 \cdot 05$ | $6 \cdot 02$ |
| 32 | $3 \cdot 15$ | $5 \cdot 45$ | 3.34 | $5 \cdot 56$ | 3.54 | $5 \cdot 69$ | $3 \cdot 75$ | $5 \cdot 82$ | $3 \cdot 98$ | $5 \cdot 97$ | $4 \cdot 23$ | $6 \cdot 14$ |
| 33 | $3 \cdot 28$ | $5 \cdot 53$ | $3 \cdot 47$ | $5 \cdot 65$ | $3 \cdot 69$ | $5 \cdot 78$ | 3.91 | $5 \cdot 93$ | $4 \cdot 16$ | $6 \cdot 09$ | $4 \cdot 42$ | $6 \cdot 27$ |
| 34 | 3.41 | $5 \cdot 61$ | $3 \cdot 62$ | 5`74 | $3 \cdot 85$ | $5 \cdot 88$ | $4 \cdot 09$ |  | $4 \cdot 35$ | $6 \cdot 22$ | $4 \cdot 64$ | $6 \cdot 43$ |
| 35 | 3.56 | $5 \cdot \%$ | $3 \cdot 78$ | $5 \cdot 84$ | $4 \cdot 02$ | $6 \cdot 00$ | $4 \cdot 28$ | $6 \cdot 18$ | $4 \cdot 57$ | $6 \cdot 38$ | $4 \cdot 88$ | $6 \cdot 61$ |
| 36 | 3.71 | $5 \cdot 79$ | 3.95 | 5.95 | 4.21 | $6 \cdot 13$ | 4.50 | 6.33 | $4 \cdot 8 \mathrm{I}$ | $6 \cdot 55$ | $5 \cdot 16$ | $6 \cdot 8 \mathrm{I}$ |
| 37 | $3 \cdot 88$ | 5.90 | 4.14 4 | $6 \cdot 08$ | 4.42 | $6 \cdot 27$ | 4.73 | $6 \cdot 50$ | $5 \cdot 08$ | $6 \cdot 75$ | $5 \cdot 46$ | $7 \cdot 05$ |
| 38 | 4*06 | $6 \cdot 03$ | $4 \cdot 35$ | $6 \cdot 22$ | $4 \cdot 66$ | $6 \cdot 44$ | $5 \cdot 00$ | $6 \cdot 69$ | $5 \cdot 38$ | $6 \cdot 98$ | $5 \cdot 81$ | 7.33 |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 229

## LATITUDE $26^{\circ}$.

DECLINATION-CONTRARY NAME TO—LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. <br> Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\left\lvert\, \begin{aligned} & \mathrm{H} \\ & 5 \end{aligned}\right.$ | $\begin{gathered} \mathrm{S} . \\ -2 \cdot 18 \end{gathered}$ |  | $-2.21$ | Н. м. |  | $\begin{array}{llc} \text { H. M. } & \text { S. } \\ 5 & \text { I6 } & 50 \cdot 2 \end{array}$ | $\begin{gathered} \mathrm{S} . \\ 2 \cdot 28 \end{gathered}$ | $\begin{array}{cc} \mathrm{c} & \mathrm{~s} . \\ + & 32 \cdot 4 \end{array}$ | S. | $\left\lvert\, \begin{array}{ll} \text { H. M. } \\ 5 & \text { I2 } \end{array}\right.$ | S. <br> 2.35 |
| 2 | $\begin{array}{llll}5 & 14 & 1.0\end{array}$ | 2.26 | 5 II $44 \cdot 6$ | - 2.29 |  | -2.25 | $\begin{array}{rr} \\ 7 & 50 \cdot 2 \\ 5\end{array}$ | 2.36 | 4 <br> 4 <br> 42 <br> 42 | 2.41 | (rrrr | 2.45 |
| 4 | $\begin{array}{llll}5 & 4 & 26 \cdot 1\end{array}$ | $2 \cdot 33$ | $5 \quad 2 \quad 511$ | 2.37 | $45941 \cdot 6$ | 2.41 | $4 \begin{array}{llllll} & 57 & 15\end{array}$ | 2.46 | 45446 | $2 \cdot 51$ | 45214.8 | $2 \cdot 56$ |
| 6 | $45446 \cdot 7$ | 2.41 | $45220 \cdot 6$ | 46 | $44951 \cdot 7$ | 2.51 | 44719.8 | $2 \cdot 56$ | $44444 \cdot 8$ | $2 \cdot 61$ | $4 \begin{array}{lll}4 & 42 & 4\end{array}$ | 2.67 |
| 8 | $445 \quad 2 \cdot 2$ | . 50 | $44230 \cdot 6$ | . 55 | $43955 \%$ | $2 \cdot 61$ | $4 \begin{array}{llll}47 & 17.7\end{array}$ | $2 \cdot 67$ | $43436 \cdot 0$ | 2.73 | $43150 \cdot 5$ | $2 \cdot 79$ |
| 10 | 435 |  | $43234 \cdot 6$ |  | 42953 | 2.72 | 4278.6 |  | 42419 | 2.85 | 42126 | 2.93 |
| Ir | 430147 | $2 \cdot 65$ | $42734 \cdot 1$ | 71 | $42449^{\circ}$ | $2 \cdot 77$ | $422 \begin{aligned} & 1 \cdot 1\end{aligned}$ | 2.84 | $4 \begin{array}{lll}49 & 8.3\end{array}$ | -92 | 41610 | $2 \cdot 99$ |
| 12 | $42515 \cdot 7$ | $2 \cdot 70$ | $42231 \cdot 7$ | 77 | $41943 \%$ | 2.83 | $41651 \cdot 5$ | 2.91 | $41354{ }^{4} 7$ | $2 \cdot 9$ | 4 10 $52 \cdot 9$ | 3.07 |
| 13 | 42014.9 | $2 \cdot 76$ | 41727.5 | 2.82 | 4 I4 35.9 | $2 \cdot 90$ | 4 II 39.6 | $2 \cdot 98$ | $\begin{array}{lll}4 & 8 & 38 \cdot 5\end{array}$ | 3. | $5 \quad 32 \cdot 3$ | $3 \cdot 15$ |
| 14 |  | $2 \cdot 81$ | 41221.3 | 2.89 | $\begin{array}{llll}4 & 9 & 25.7\end{array}$ | $2 \cdot 97$ | 625.4 | 3.05 | $\begin{array}{llll}4 & 3 & 19.9\end{array}$ | $3 \cdot$ | - 8.9 | 3.23 |
| 15 | 4 10 706 | 87 | $4 \quad 7 \quad 12.9$ | $2 \cdot 95$ | 44 | 04 | $8 \cdot 6$ | 2 | $35758 \cdot 5$ | 3.22 | 35442 | 32 |
| 16 | $4 \begin{array}{lll}4 & 5 & 0.9\end{array}$ | 2.94 | $\begin{array}{llll}4 & 2 & 2 \cdot 2\end{array}$ | 3.02 | 35858 | 1 | $35549 \cdot 1$ | 3.20 | $35234 \cdot 1$ | 3.30 | 34912.8 | 4 r |
| $1 \%$ | $35951 \cdot 9$ | 3.01 | $35649 \cdot 1$ | 3.09 | $35340 \cdot 8$ | $3 \cdot 19$ |  | 3.29 | $\begin{array}{llll}3 & 47 & 6.5\end{array}$ | 3.39 |  | $3 \cdot 51$ |
| 18 | $35440 \cdot 6$ | 3.08 | 35133.3 | $3 \cdot 17$ | $34820 \cdot$ | 3.27 | $\begin{array}{lll}3 & 45 & 1 \cdot 2\end{array}$ | $3 \cdot 37$ | $3 \mathrm{4r} 35 \cdot 5$ | 3.49 | $\begin{array}{llll}3 & 38 & 2 \cdot 9\end{array}$ | 3.61 |
| 19 | $34926 \cdot 7$ | $3 \cdot 15$ | 34614.8 | $3 \cdot 25$ | 342 | 3.35 | $3 \quad 3932 \cdot 4$ | 3.47 | 336 | 3.59 | $\begin{array}{llll}3 & 32 & 21.9\end{array}$ | $3 \cdot 72$ |
| 20 | 44100 | 3.23 | $\begin{array}{lllllll}3 & 40 & 53\end{array}$ | 3.33 | 33730.0 | 3.44 | $3 \begin{array}{llll}33 & 59.9\end{array}$ | $3 \cdot 56$ | 33022.2 | $3 \cdot 69$ | $32636 \cdot 7$ | 3.83 |
| 21 | $3850 \cdot 4$ | 3.31 |  | 3 | $33159 \%$ | 354 | $\begin{array}{llll}3 & 28 & 23.5\end{array}$ | , | ${ }^{3} 224394$ |  | $32046 \cdot 7$ | $3 \cdot 95$ |
| 22 | 3327.7 | $3 \cdot 40$ | $\begin{array}{lll}3 & 30 & 0 \cdot 3\end{array}$ | 3.52 | $\begin{array}{llll}326 & 25 \cdot 6\end{array}$ | $3 \cdot 64$ | $\begin{array}{llll}3 & 22 & 42 \cdot 9\end{array}$ | $3 \cdot 78$ | $\begin{array}{llll}3 & 18 & 51 \cdot 8\end{array}$ | 3.93 | 31451 | 4.09 |
| 23 | $\begin{array}{lll}3 & 28 \\ 3 & 1.5\end{array}$ | $3 \cdot 49$ | $\begin{array}{llll}3 & 24 & 28 \cdot 3 \\ 3 & 18 & 5 & \end{array}$ | 3.62 |  | $3 \cdot 75$ | $\begin{array}{lllll}3 & 16 & 57.8\end{array}$ | $3 \cdot 90$ | $\begin{array}{llll}3 & 12 & 59.2\end{array}$ | 4.06 | 3 8 $50 \cdot 6$ <br>    | 4.23 |
| 24 | $32231 \times 7$ | $3 \cdot 59$ | $\begin{array}{lllllllllll}3 & 18 & 52 \cdot 3\end{array}$ | $3 \cdot 73$ | $\begin{array}{llll}3 & 15 & 4.5\end{array}$ | $3 \cdot 87$ | 3 II 777 | 4.03 | $7 \quad 0 \cdot 9$ | $4 \cdot$ | $\begin{array}{llll}3 & 2 & 43.5\end{array}$ | $4 \cdot 39$ |
| 25 | $\begin{array}{llll}3 & 16 & 579\end{array}$ |  | 3 13 115 | $3 \cdot 4$ | $\begin{array}{llll}3 & 9 & 16.8\end{array}$ | 4.00 | 512.0 |  | - $56 \cdot 6$ | $4 \cdot 35$ | $2 \begin{array}{llll}26 & 29.6\end{array}$ | $4 \cdot 56$ |
| 26 | $\begin{array}{rrrr}3 & 11 & 19.7 \\ 3 & 5 & 36.8\end{array}$ | $3 \cdot 81$ |  | 3.97 | 3 3 23.7 <br> 2 5  | $4 \cdot 13$ | $\begin{array}{llllllll}2 & 59 & 10 \cdot 3\end{array}$ | $4 \cdot 32$ | $\begin{array}{llll}2 & 54 & 45.5\end{array}$ | 4.52 | 250 | $4 \cdot 74$ |
| 27 |  | 3.93 | $\begin{array}{lrrr}3 & 1 & 35.9 \\ 2 & 55 & \end{array}$ | $4 \cdot 10$ | $\begin{array}{llll}2 & 57 & 24.7\end{array}$ | $4 \cdot 28$ | $\begin{array}{llll}2 & 53 & 2 \cdot 0\end{array}$ | 4.48 | $\begin{array}{llllllll}2 & 48 & 26.9\end{array}$ | $4 \cdot 70$ | $\begin{array}{llllll}2 & 43 & 37 \cdot 9 \\ 2 & 36 & 58.2\end{array}$ | 4.94 |
| 28 | $25948 \cdot 6$ | 4.06 | $\begin{array}{llll}2 & 55 & 39 \cdot 6\end{array}$ | $4 \cdot 25$ | $2 \begin{array}{lll}2 & 51 & 19.1 \\ 2 & 45 & \end{array}$ | $4 \cdot 44$ | $24646 \cdot 3$ | $4 \cdot 66$ | $\begin{array}{lllll}2 & 41 & 59.9\end{array}$ | 4.90 | $\begin{array}{lllllllllll}2 & 368 \cdot 2\end{array}$ | $5 \cdot 17$ |
| 29 | 25354.9 | 4 | $24936 \cdot 7$ | $4 \cdot 40$ | 2456.3 | $4 \cdot 62$ | $240 \quad 22 \cdot 3$ | $4 \cdot 86$ | $235 \quad 23.4$ | $5 \cdot 12$ | $230 \begin{array}{ll}2 & 77\end{array}$ | $5 \cdot 42$ |
| 30 | $24754 \% 7$ | $4 \cdot 36$ | $\begin{array}{llll}2 & 43 & 26 \cdot 7\end{array}$ | 4.58 |  | $4 \cdot 8 \mathrm{I}$ | 233 49 | 5.08 | $22836 \cdot 2$ | $5 \cdot 37$ | $\begin{array}{llll}2 & 23 & 4.7\end{array}$ | 70 |
| 31 | 24147.5 | $4 \cdot 54$ | $\begin{array}{llll}2 & 37 & 8 \cdot 7\end{array}$ | $4 \cdot 77$ |  | $5 \cdot 03$ | 227503 | $5 \cdot 32$ | $22136 \cdot 9$ | $5 \cdot 65$ | $21547 \cdot 4$ | 02 |
| 32 | 23532 | 4.72 | 23041.8 | 98 | 22534.7 | $5 \cdot 27$ | $\begin{array}{llll}2 & 20 & 9.4\end{array}$ | $5 \cdot 59$ |  | 7 | 281313 | 9 |
| 33 | $\begin{array}{llll}2 & 29 & 8.6 \\ 2 & 22 & 3.6\end{array}$ | 4.93 | $\begin{array}{lll}24 & 4 \cdot 6\end{array}$ | $5 \cdot 22$ | $2 \mathrm{I} 842 \cdot 4$ | $5 \cdot 54$ | $\begin{array}{lllll}2 & 12 & 59.6\end{array}$ | 5.91 | 653.2 | 634 | $2{ }^{2} 519.2$ | 6.83 |
| 34 | 22234.6 | $5 \cdot 1$ | 1715 | $5 \cdot 4$ | 2 II 36.3\| | $5 \cdot 8$ | 533.5 | $6 \cdot 27$ | 5934 | $6 \cdot 77$ | $1 \begin{array}{ll}52 & 0.8\end{array}$ | $7 \cdot 36$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. -I .63 | s. -4.74 | s. $-\mathrm{I} \cdot 73$ | $\begin{gathered} \text { s. } \\ -4^{\circ} 76 \end{gathered}$ | ${ }_{\text {s. }}^{\text {s. }}$ | $\underset{-4 \cdot 8 \text { I }}{\mathbf{s}^{\prime}}$ | S. I•93 | s. 4.85 | $\begin{gathered} \text { s. } \\ -2 \cdot 04 \end{gathered}$ | s. | s. 2.15 2 | s. |
| 2 | 1•72 | $4 \cdot 77$ | I.83 | 4.81 | 1.93 | 4.85 | - 2.04 | 4.89 | $2 \cdot 14$ | 4.94 | $2 \cdot 26$ | -4.94 |
| 4 | 1.82 | 4.81 | r 93 | 4.85 | $2 \cdot 03$ | $4 \cdot 89$ | $2 \cdot 14$ | 4.94 | $2 \cdot 25$ | $4 \cdot 99$ | $2 \cdot 37$ | 5.04 |
| 6 | I.92 | $4 \cdot 85$ | $2 \cdot 03$ | $4 \cdot 89$ | $2 \cdot 14$ | $4 \cdot 94$ | 2.26 | 4*99 | $2 \cdot 37$ | $5 \cdot 04$ | 2.49 | $5 \cdot 10$ |
| 8 | 2.03 | 4.89 | $2 \cdot 15$ | 4.94 | $2 \cdot 26$ | $4 * 99$ | $2 \cdot 38$ | $5 \cdot 04$ | $2 \cdot 50$ | $5 \cdot 10$ | $2 \cdot 62$ | $5 \cdot 7$ |
| 10 | $2 \cdot 15$ | $4 \cdot 94$ | $2 \cdot 27$ | $5 \cdot 00$ | $2 \cdot 39$ | $5 \cdot 05$ | $2 \cdot 51$ | $5 \cdot 11$ | 2.63 | $5 \cdot 17$ | $2 \cdot 76$ | $5 \cdot 24$ |
| 11 | $2 \cdot 21$ | $4 \cdot 97$ | $2 \cdot 33$ | $5 \cdot 02$ | $2 \cdot 45$ | 5.08 | $2 \cdot 58$ | $5 \cdot 14$ | 2.71 | $5 \cdot 21$ | 2.84 | $5 \cdot 28$ |
| 12 | $2 \cdot 28$ | $5 \cdot 00$ | $2 \cdot 40$ | $5 \cdot 05$ | $2 \cdot 52$ | $5 \cdot \mathrm{Ir}$ | 2.65 | $5 \cdot 18$ | $2 \cdot 78$ | $5 \cdot 25$ | $2 \cdot 92$ | $5 \cdot 32$ |
| 13 | $2 \cdot 34$ | $5 \cdot 03$ | 2.46 2.53 | $5 \cdot 09$ | $2 \cdot 59$ | $5 \cdot 15$ | 2.72 | $5 \cdot 22$ | 2.86 | $5 \cdot 29$ | $3 \cdot 00$ | $5 \cdot 37$ |
| 14 | 2.41 | 5.06 | $2 \cdot 53$ | $5 \cdot 12$ | 2.67 | $5 \cdot 19$ | $2 \cdot 80$ | $5 \cdot 26$ | $2 \cdot 94$ | $5 \cdot 33$ | 3.09 | $5 \cdot 4 \mathrm{I}$ |
| 15 | 2.48 | 5.09 | $2 \cdot 61$ | $5 \cdot 16$ | 2.74 | 5.23 | 2.88 | $5 \cdot 30$ | 3.03 | $5 \cdot 38$ | 3.18 | $5 \cdot 47$ |
| 16 | $2 \cdot 55$ | $5 \cdot 13$ | $2 \cdot 69$ | $5 \cdot 20$ | 2.82 | $5 \cdot 27$ | $2 \cdot 97$ | $5 \cdot 35$ | $3 \cdot 12$ | $5 \cdot 43$ | 3.27 | $5 \cdot 52$ |
| 17 | 2.63 | $5 \cdot 17$ | $2 \cdot 77$ | 5.24 | 2.91 | $5 \cdot 32$ | $3 \cdot 06$ | $5 \cdot 40$ | $3 \cdot 21$ | $5 \cdot 49$ | $3 \cdot 37$ | $5 \cdot 58$ |
| 18 | 2.71 2.79 | 5.21 | $2 \cdot 85$ | 5.29 | $3 \cdot 00$ | $5 \cdot 37$ | 3.15 3.25 | 5.45 | 3.31 3.42 | 5.55 5.61 | 3.48 | $5 \cdot 65$ |
| 19 | $2 \cdot 79$ | 5.25 | $2 \cdot 94$ | $5 \cdot 33$ | 3.09 | $5 \cdot 42$ | $3 \cdot 25$ | 5.51 | 3.42 | $5 \cdot 61$ | $3 \cdot 59$ | 5•72 |
| 20 | 2.88 | $5 \cdot 30$ | 3.03 | 5.39 | $3 \cdot 19$ | $5 \cdot 48$ | 3.35 | $5 \cdot 57$ | 3.53 | $5 \cdot 68$ | 3.71 | $5 \cdot 79$ |
| 21 | $2 \cdot 97$ | $5 \cdot 35$ | $3 \cdot 13$ | $5 \cdot 44$ | 3.29 | $5 \cdot 54$ | 3.47 | $5 \cdot 64$ | $3 \cdot 65$ | $5 \cdot 75$ | $3 \cdot 84$ | $5 \cdot 88$ |
| 22 | 3.07 | $5 \cdot 4 \mathrm{I}$ | 3.23 | $5 \cdot 50$ | 3.41 | $5 \cdot 60$ | $3 \cdot 58$ | 5.71 | $3 \cdot 77$ | $5 \cdot 83$ | $3 \cdot 98$ | 5.97 |
| 23 | $3 \cdot 17$ 3 | 5.47 | 3.34 | 5.57 | 3.52 3.65 | $5 \cdot 68$ | 3.71 3.85 | $5 \cdot 79$ | 3.9 r | $5 \cdot 92$ | $4 \cdot 12$ | $6 \cdot 07$ |
| 24 | $3 \cdot 28$ | $5 \cdot 53$ | 3.46 | $5 \cdot 64$ | $3 \cdot 65$ | $5 \cdot 75$ | $3 \cdot 85$ | $5 \cdot 88$ | $4 \cdot 06$ | $6 \cdot 02$ | $4 \cdot 28$ | $6 \cdot 17$ |
| 25 | 3.40 | $5 \cdot 60$ | 3.58 | $5 \cdot 71$ | 3.78 | 5.84 | 3*99 | $5 \cdot 98$ | 4.21 | $6 \cdot 13$ | 4.45 | 6.30 |
| 26 | 3.52 | $5 \cdot 68$ | 3.72 3.86 | $5 \cdot 80$ | 3.93 | $5 \cdot 93$ | $4 \cdot 15$ | $6 \cdot 08$ | 4.38 | $6 \cdot 25$ | 4.64 | $6 \cdot 43$ |
| 27 | 3.65 | $5 \cdot 76$ | 3.86 | $5 \cdot 89$ | 4.08 | $6 \cdot 04$ | $4 \cdot 32$ | $6 \cdot 20$ | $4 \cdot 57$ | $6 \cdot 38$ | $4 \cdot 85$ | $6 \cdot 58$ |
| 28 | 3.80 3.95 | 5.85 | $\stackrel{4}{4 \cdot 101}$ | 5.99 6.11 | 4.25 4.43 | $6 \cdot 15$ 6.28 | 4.50 4.70 | $6 \cdot 33$ 6.48 | 4.78 5 | 6.53 6.70 | 5.08 | $6 \cdot 75$ 6.95 |
| 29 | $3 \cdot 95$ | $5 \cdot 95$ | $4 \cdot 18$ | $6 \cdot 11$ | $4 \cdot 43$ | $6 \cdot 28$ | 4.70 | $6 \cdot 48$ | $5 \cdot 00$ | $6 \cdot 70$ | $5 \cdot 33$ | $6 \cdot 95$ |
| 30 | 4.11 | $6 \cdot 06$ | 4.36 | 6.23 | $4 \cdot 63$ | 6.43 | 4.93 | $6 \cdot 64$ | $5 \cdot 26$ | $6 \cdot 89$ | $5 \cdot 62$ | $7 \cdot 17$ |
| 31 | 4.30 | $6 \cdot 18$ | $4 \cdot 56$ | 6.37 | $4 \cdot 86$ | $6 \cdot 59$ | $5 \cdot 18$ | $6 \cdot 83$ | $5 \cdot 54$ | 7.11 | $5 \cdot 95$ | $7 \cdot 43$ |
| 32 | 4.49 | $6 \cdot 32$ | $4 \cdot 78$ | $6 \cdot 53$ | $5 \cdot 11$ | $6 \cdot 77$ | $5 \cdot 46$ | $7 \cdot 05$ | $5 \cdot 87$ | $7 \cdot 36$ | $6 \cdot 33$ | $7 \cdot 73$ |
| 33 | 4.71 | ${ }^{6} \cdot 48$ | 5.03 | $6 \cdot 72$ | $5 \cdot 39$ | $6 \cdot 99$ | $5 \cdot 79$ | 7.30 | 6.24 | 7.67 | $6 \cdot 77$ | $8 \cdot 10$ 8.55 |
| 34 | 4.96 | $6 \cdot 66$ | 5.31 | $6 \cdot 93$ | $5 \cdot 71$ | $7 \cdot 24$ | $6 \cdot 16$ | $7 \cdot 60$ | $6 \cdot 68$ | 8.02 | $7 \cdot 30$ | $8 \cdot 55$ |

## LATITUDE $27^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline True Alt. \& \(0^{\circ}\) \& \begin{tabular}{l}
Decl. \\
Var.
\end{tabular} \& \(1{ }^{\circ}\) \& Decl. Var. \& \(2{ }^{\circ}\) \& \begin{tabular}{l}
Decl. \\
Var.
\end{tabular} \& \(3^{\circ}\) \& \begin{tabular}{l}
Decl. \\
Var.
\end{tabular} \& \(4^{\circ}\) \& \begin{tabular}{l}
Decl. \\
Var.
\end{tabular} \& \(5^{\circ}\) \& \begin{tabular}{l}
Decl. \\
Var.
\end{tabular} \\
\hline - \& H. M. \& S. \& H. \& S. \& M. \& S. \& H. M. S. \& S. \& H. M. S. \& s. \& H. M. S. \& 6 \\
\hline 0 \& \(\begin{array}{lll}6 \& 0 \& 0 \cdot 0 \\ 5 \& 33 \& 3 \cdot 1\end{array}\) \& -2.04 \&  \& -2.04 \& \(\begin{array}{lllll}5 \& 55 \& 55 \cdot 3 \\ 5 \& 28 \\ 55.5\end{array}\) \& -2.04 \& \(\begin{array}{lllll}5 \& 53 \& 52 \cdot 8 \\ 5 \& 26 \& 50 \cdot 5\end{array}\) \& \(-2.04\) \& \(5 \begin{array}{llll}5 \& 51 \& 50 \cdot 0 \\ 5\end{array}\) \& 2.05 \& \(\begin{array}{llll}5 \& 49 \& 46 \cdot 8 \\ 5 \& 2\end{array}\) \& 2.06 \\
\hline \& \(\begin{array}{llll}5 \& 33 \& 3.1 \\ 5 \& 24 \& 3.3\end{array}\) \& 2.05 \& 53059.6 \& 2.06 \& \(52855 \cdot 5\) \& \(2 \cdot 08\) \& \(52650 \cdot 5\) \& \(2 \cdot 09\) \& \(52444 \cdot 6\) \& \(2 \cdot I I\) \& \(52237 \cdot 7\) \& 2.12 \\
\hline - \& 5243 \& 2.07 \& \(52159 \cdot 1\) \& 8 \& 51953.9 \& 2.09 \& \(517847 \cdot 7\) \& \(2 \cdot 11\) \& \(\begin{array}{lllll}5 \& 15 \& 40 \cdot 4\end{array}\) \& 2.13 \& \(\begin{array}{llllll}5 \& 13 \& 31.9\end{array}\) \& \(2 \cdot 15\) \\
\hline 10 \& \(\begin{array}{ccc}5 \& 15 \& 2 \\ 5 \& 6 \& 1\end{array}\) \& O \& \begin{tabular}{|crrr}
5 \& 12 \& \(57 \cdot 6\) \\
5 \& 3 \& \(55 \cdot 0\)
\end{tabular} \& 2.10 \& (100 \(\begin{array}{ccc}5 \& 10 \& 51 \cdot 2 \\ 5 \& 1 \& 47 \cdot 2\end{array}\) \& 2. \& \(\begin{array}{rrrrr}5 \& 8 \& 43 \cdot 6 \\ 4 \& 59 \& 38 \cdot 0\end{array}\) \& \(2 \cdot 14\)
\(2 \cdot 17\) \& \(\begin{array}{ccc}5 \& 6 \& 34 \cdot 6 \\ 4 \& 57 \& 27 \cdot 1\end{array}\) \& 2.16
2.20 \& \(\begin{array}{llll}5 \& 4 \& 24.2 \\ 4 \& 5 \& 14.5\end{array}\) \& 9 \\
\hline \& \& \& \(4545 \mathrm{I} \cdot \mathrm{I}\) \& \& \& \& \(45030 \cdot 5\) \& \& \& \& \& \\
\hline 16 \& \(44755 \cdot \mathrm{I}\) \& \(2 \cdot 14\) \& \(4545 \cdot 6\) \& \(2 \cdot 17\) \& 43 34.3 \& 2.2 \& 4120.9 \& \& \(\begin{array}{rrr}4 \& 48 \\ 4 \& 39 \& 5.5\end{array}\) \& 2.2 \& \(3647 \cdot 9\) \& 2.37 \\
\hline 18 \& \(43849 \cdot 7\) \& \& \(43638 \cdot 3\) \& 2.21 \& 43424.8 \& \(2 \cdot 24\) \& 43290 \& 2. \& \(42950 \cdot 9\) \& 2.32 \& \(4 \quad 2730 \cdot 3\) \& \(2 \cdot 37\) \\
\hline 20 \& \(42942 \cdot 5\) \& 2.21 \& \(42728 \cdot 9\) \& \(2 \cdot 25\) \& 42513.0 \& \(2 \cdot 29\) \& 42254.4 \& \(2 \cdot 33\) \& 42033.2 \& \(2 \cdot 38\) \& 41893 \& \(2 \cdot 42\) \\
\hline 21 \& \(4258 \cdot 1\) \& 23 \& \(42253 \cdot 3\) \& \(2 \cdot 27\) \& \(42036 \cdot 0\) \& \(2 \cdot 31\) \& 41816.0 \& \(2 \cdot 36\) \& \(415 \quad 53.2\) \& 2.40 \& \(413 \quad 27.4\) \& \(2 \cdot 46\) \\
\hline 22 \& 3 \& \(2 \cdot 25\) \& \(41817 \cdot 1\) \& 2.29 \& \(4 \quad 15 \quad 58.3\) \& \(2 \cdot 34\) \& \(41336 \cdot 8\) \& \(2 \cdot 38\) \& 41112.2 \& \(2 \cdot 44\) \& \(4 \quad 8 \quad 44.5\) \& 2.49 \\
\hline 23 \& 415 57.6 \& \(2 \cdot 27\) \& \(41340 \cdot 2\) \& \(2 \cdot 31\) \& 41119.9 \& \(2 \cdot 36\) \& \(\begin{array}{llll}4 \& 8 \& 56 \cdot 6\end{array}\) \& \(2 \cdot 41\) \& \(4 \quad 6 \quad 30 \cdot 2\) \& \(2 \cdot 4\) \& \(\begin{array}{llll}4 \& 4 \& 0.4\end{array}\) \& \(2 \cdot 52\) \\
\hline 24 \& 41121.4 \& \(2 \cdot 29\) \& \(\begin{array}{llll}4 \& 9 \& 2.5\end{array}\) \& 34 \& \(4 \quad 6 \quad 40 \cdot 6\) \& 39 \& \(\begin{array}{llll}4 \& 4 \& 15 \cdot 6\end{array}\) \& 2.44 \& 4 I \(477 \cdot 2\) \& \(2 \cdot 5\) \& 35915.3 \& 56 \\
\hline 25 \& \(\begin{array}{ll}4 \& 6 \\ 4 \& 4.5 \\ 4 \& 2\end{array}\) \& \(2 \cdot 32\) \& \(\begin{array}{llll}4 \& 4 \& 24.0 \\ 3 \& 50\end{array}\) \& 37 \& \(\begin{array}{lrrr}4 \& 2 \& 0.4 \\ 3 \& 5 \& \end{array}\) \& 2 \& \(\begin{array}{lllll}3 \& 59 \& 33.5\end{array}\) \& 2.48 \& \(\begin{array}{llll}3 \& 57 \& 3 \cdot 0 \\ 3 \& 52\end{array}\) \& \(2 \cdot 5\) \& \(3 \begin{array}{llll}3 \& 54 \& 28 \cdot 9\end{array}\) \& \(2 \cdot 60\) \\
\hline 26 \& \(\begin{array}{llll}4 \& 2 \& 6.8\end{array}\) \& 34 \& \(35944 \cdot 7\) \& \(2 \cdot 40\) \& \(3 \begin{array}{llll}37 \& 19\end{array}\) \& -45 \& \(5450 \cdot 3\) \& 2.51 \&  \& \(2 \cdot 58\) \& 349 4I'2 \& 2.64 \\
\hline 27
28 \& \(\begin{array}{llll}3 \& 57 \& 28 \cdot 3 \\ 3 \& 52 \& 48 \cdot 9\end{array}\) \& 2.37
2.40 \& \(\begin{array}{rrrr}3 \& 55 \& 4 \cdot 4 \\ 3 \& 50 \& 23 \cdot 2\end{array}\) \& 6 \& \begin{tabular}{llll}
3 \& 52 \& \(37 \cdot 1\) \\
3 \& 47 \& \(53 \cdot 8\) \\
\hline
\end{tabular} \& 2.49 \& \begin{tabular}{|ccr}
3 \& 50 \& \(6 \cdot 1\) \\
3 \& 45 \& \(20 \cdot 6\) \\
\hline
\end{tabular} \& 5 \& \(\begin{array}{llll}3 \& 47 \& 3 I \cdot I \\ 3 \& 42 \& 43 \cdot 2\end{array}\) \& 2.62
2.66 \& \(\begin{array}{ccc}3 \& 44 \& 52 \cdot 1 \\ 3 \& 40 \& 1 \cdot 4 \\ \end{array}\) \& 69 \\
\hline 29 \&  \& \(2 \cdot 43\) \& 345410 \& 2.49 \& \begin{tabular}{llll}
3 \& 43 \& \\
\hline 184
\end{tabular} \& 2.52
2.56 \&  \& 2.59
2.63 \& \(\begin{array}{lllll}3 \& 42 \& 43 \cdot 2 \\ 3 \& 37 \& 53 \cdot 8 \\ \& 3 \& \end{array}\) \& 2.66
2.70 \& \(\begin{array}{llll}3 \& 40 \& 1 \cdot 4 \\ 3 \& 35 \& 9 \cdot 2\end{array}\) \& 2.73
2.78 \\
\hline 30 \&  \& \(2 \cdot 46\) \& \(340 \quad 57 \cdot 5\) \& \(2 \cdot 53\) \&  \& \(2 \cdot 60\) \& \(\begin{array}{lllllllllllll}3 \& 35 \& 45.5\end{array}\) \& \(2 \cdot 67\) \& \(\begin{array}{lllll}3 \& 33 \& 2 \cdot 8\end{array}\) \& \(2 \cdot 75\) \& 33015.2 \& \(2 \cdot 84\) \\
\hline 31 \& \(33^{8} 44.9\) \& \(2 \cdot 50\) \& \(3 \begin{array}{llll}36 \& 12.9\end{array}\) \& \(2 \cdot 57\) \& \(\begin{array}{llll}3 \& 33 \& 36 \cdot 6\end{array}\) \& \(2 \cdot 64\) \& \(3 \quad 3055.8\) \& \(2 \cdot 72\) \& \(\begin{array}{llll}3 \& 28 \& 10 \cdot 1\end{array}\) \& \(2 \cdot 80\) \& \(\begin{array}{lllll}3 \& 25 \& 19\end{array}\) \& -89 \\
\hline 32 \& \(\begin{array}{llll}3 \& 34 \& 1 \& 4\end{array}\) \& 2.54 \& 33127.0 \& 2.61 \& \(\begin{array}{llll}3 \& 28 \& 48 \cdot 2\end{array}\) \& \(2 \cdot 69\) \& \(\begin{array}{lll}3 \& 26 \& 4.4\end{array}\) \& \(2 \cdot 77\) \& \(\begin{array}{llll}3 \& 23 \& 15.6\end{array}\) \& 2.86 \& \(\begin{array}{llll}3 \& 20 \& 21.5\end{array}\) \& \(2 \cdot 95\) \\
\hline 33 \& 32916.6 \& \& \(\begin{array}{llll}3 \& 26 \& 39 \& 7\end{array}\) \& \(2 \cdot 15\) \& \(\begin{array}{llll}3 \& 23 \& 58 \cdot 1\end{array}\) \& 2.74 \& 321110 \& 2.82 \& \(\begin{array}{llllll}3 \& 18 \& 19.2\end{array}\) \& 292 \& 31521 \& 3.01 \\
\hline 34 \& \(32430 \cdot 5\) \& \(2 \cdot 62\) \& \(32150 \cdot 9\) \& 2.70 \& 31963 \& 2.79 \&  \& \(2 \cdot 88\) \& 3153007 \& 2.98 \& 3 10 19\%0 \& 3.08 \\
\hline 35 \& \(\begin{array}{lllll}3 \& 19 \& 42 \cdot 9\end{array}\) \& 2.66 \& \begin{tabular}{lll}
3 \& 17 \& 0.5 \\
\hline
\end{tabular} \& 2.75 \&  \& 2.84 \& \(\begin{array}{lllllllll}3 \& 11 \& 19.3\end{array}\) \& 2.94 \& \(\begin{array}{llll}3 \& 8 \& 19.9\end{array}\) \& 3.04 \& 3 5 14.0 \& \(3 \cdot 15\) \\
\hline 36 \& 31453.7 \& 71 \& 31283 \& 2.80 \& \(917 \cdot 2\) \& \(2 \cdot 90\) \& \(3620 \cdot 1\) \& 3.01 \& \(\begin{array}{lllll}3 \& 3 \& 16.5\end{array}\) \& \(3 \cdot 11\) \& \(\begin{array}{llll}3 \& 0 \& 6.3\end{array}\) \& 3.23 \\
\hline 37 \& \(310 \quad 2.9\) \& \& 714.2 \& 86 \& 419.5 \& 2.96 \& 1 18.4 \& 3.07 \& \(2{ }_{28} 510.6\) \& \(3 \cdot 19\) \& \(25455 \cdot 5\) \& \(3 \cdot 32\) \\
\hline 38 \& \(\begin{array}{llll}3 \& 5 \& 10.3\end{array}\) \& 2.82 \& \& 2.92 \& 25019.5 \& 3.03 \& 25614.2 \& \(3 \cdot 15\) \& \(\begin{array}{lll}2 \& 53 \& 1 \cdot 6\end{array}\) \& 3. \& \(2494 \mathrm{I} \cdot 4\) \& 3.41 \\
\hline 39 \& \begin{tabular}{llll}
3 \& 0 \& 15.6 \\
2 \& 55 \\
\hline
\end{tabular} \& \(2 \cdot 88\) \& \begin{tabular}{llll}
2 \& 57 \& 19.6 \\
2 \& 52 \\
\hline
\end{tabular} \& \&  \& 3.10
3 \& \begin{tabular}{llll}
2 \& 51 \& 7 \\
\hline
\end{tabular} \& 3.23 \& \(\begin{array}{lllllll}2 \& 47 \& 49.5\end{array}\) \& 3.36 \&  \& 3.50 \\
\hline 40 \& \(\begin{array}{llll}2 \& 55 \& 18.8 \\ 2 \& 50 \& 19.6\end{array}\) \& 2.94
3.0 O \& \(\begin{array}{llll}2 \& 52 \& 18 \cdot 8 \\ 2 \& 47 \& 15.2\end{array}\) \& 3.06
\(3 \cdot 14\) \& \(\begin{array}{rrrr}2 \& 49 \& \text { II } \cdot 6 \\ 2 \& 44 \& 3.2\end{array}\) \& 3.18
3.27 \& \(24556 \cdot 8\) \& 3.31 \& [ \(\begin{array}{llll}2 \& 42 \& 33 \cdot 8 \\ 2 \& 37 \& 14.2\end{array}\) \& 3.46
3.56 \& \(\begin{array}{rrrr}2 \& 39 \& 2.0 \\ 2 \& 33 \& 35.8\end{array}\) \& \(3 \cdot 61\) \\
\hline \& 24517.8 \& \& \& \& \& \& \& \& \& \& \& \\
\hline 42 \& \(\begin{array}{llll}2 \& 45 \& 17.8 \\ 2 \& 40 \& 13.2\end{array}\) \& \(3 \cdot 09\) \& 242
246
2 \& \& \(\begin{array}{llll}2 \& 38 \& 51.6\end{array}\) \& 3.36 \& 23525.6 \& 3.51 \& \(\begin{array}{llll}2 \& 31 \& 503\end{array}\) \& 3.67 \& \(2884 \cdot 7\) \& 3.85 \\
\hline 43 \& \begin{tabular}{lrr}
40 \& 13.2 \\
35 \& 5.5 \\
\hline 18
\end{tabular} \& 26 \& 2365 \& \(3 \cdot 31\) \& 233 36.2 \& 3.46 \& \(\begin{array}{rrr}2 \& 30 \\ 2 \& 3.9\end{array}\) \& 3.62 \& 22621.6 \& \(3 \cdot 80\) \& 222 \& 3.99 \\
\hline 45 \& \(\begin{array}{llllll}2 \& 29 \& 54.3\end{array}\) \& \(3 \cdot 35\) \& \(\begin{array}{llll}2 \& 31 \\ 2 \& 26 \& 28 \cdot 6\end{array}\) \& 3.51 \&  \& 3.57
3.69 \& \(\begin{array}{llr}2 \& 24 \& 37 \cdot 6 \\ 2 \& 19 \& 6 \cdot 0\end{array}\) \& 3.74
3.88 \& \(\begin{array}{llll}2 \& 20 \& 475 \\ 2 \& 15 \& 7 \cdot 4\end{array}\) \& 3.94
4.09 \& \(\begin{array}{ll}216 \\ 2 \& 10\end{array}\) \& 4.14
4.32

4 <br>
\hline 46 \& $22439 \cdot 3$ \& 3.46 \& 2216.9 \& $3 \cdot 63$ \& 21723.7 \& $3 \cdot 82$ \& 21328.6 \& 4.03 \& $2 \quad 920 \cdot 4$ \& $4 \cdot 2$ \& $2 \begin{array}{llll}2 & 4 & 57\end{array}$ \& I <br>
\hline
\end{tabular}

VARIATION TO I' OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ} \mathrm{A}$. |  | L. $3^{\circ} \mathrm{A}$. |  | L. $4^{\circ} \mathrm{A}$. |  | L. $5^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | - ${ }^{\text {S }}$ | S. -4.49 | - ${ }_{-}$ | S. -4.49 | S. ${ }_{\text {S }}$ | S. -4.49 | S. $-\quad .26$ | S. -4.50 | S. $-\quad 35$ | S. | S. ${ }_{\text {- }}$ | S. |
| 2 | -08 | $4 \cdot 49$ | -17 | $4 \cdot 49$ | -26 | $4 \cdot 50$ | . 35 | $4 \cdot 51$ | . 43 | 4.51 | . 52 | 4.52 |
| 4 | -16 | 449 | $\cdot 25$ | 4.50 | $\cdot 34$ | $4 \cdot 50$ | -43 | $4 \cdot 51$ | - 52 | 4.52 | -61 | $4 \cdot 53$ |
| 6 | $\cdot 24$ | 4.49 | -33 | $4 \cdot 50$ | $\cdot 42$ | 4.51 | $\cdot 51$ | 4.52 | -6a | 4.53 | $\cdot 69$ | $4 \cdot 54$ |
| 8 | $\cdot 32$ | $4 \cdot 50$ | -41 | 4.51 | -50 | $4 \cdot 52$ | $\cdot 59$ | $4 \cdot 53$ | $\cdot 68$ | 4.54 | $\cdot 78$ | $4 \cdot 56$ |
| 10 | -40 | 4.51 | '50 | $4 \cdot 52$ | $\cdot 59$ | $4 \cdot 53$ | -68 | 4.54 | -77 | $4 \cdot 55$ | -87 | 4.57 |
| 12 | -49 | 4.51 | $\cdot 58$ | $4 \cdot 53$ | -67 | 4.54 | $\cdot 77$ | $4 \cdot 55$ | -86 | $4 \cdot 57$ | $\cdot 96$ | 4.59 |
| 14 | - 57 | 4.52 | -67 | $4 \cdot 54$ | $\cdot 76$ | 4.55 | -86 | $4 \cdot 57$ | $\cdot 95$ | 4.59 | 1.05 | $4 \cdot 6 \mathrm{I}$ |
| 16 | -66 | 4.54 | $\cdot 76$ | 4.55 | $\cdot 85$ | 4.57 | $\cdot 95$ | $4 \cdot 59$ | 1.05 | $4 \cdot 61$ | $1 \cdot 15$ | $4 \cdot 63$ |
| 18 | $\cdot 75$ | $4 \cdot 55$ | . 85 | $4 \cdot 57$ | -95 | 4.59 | r.06 | $4 \cdot 61$ | $1 \cdot 15$ | $4 \cdot 63$ | $1 \cdot 25$ | $4 \cdot 66$ |
| 20 | -85 | 4.57 | -95 | $4 \cdot 59$ | 1-05 | $4 \cdot 61$ | $1 \cdot 15$ | $4 \cdot 63$ | 1.25 | 4.66 | 1.36 | $4 \cdot 69$ |
| 22 | -94 | 4.59 | 1.05 | $4 \cdot 6 \mathrm{I}$ | 1-15 | $4 \cdot 63$ | 1.25 | $4 \cdot 66$ | 1.36 | $4 \cdot 69$ | 1.47 | $4^{\prime} 72$ |
| 24 | I.05 | 4.61 | 1.15 | $4 \cdot 63$ | $1 \cdot 26$ | $4 \cdot 66$ | 1.37 | $4 \cdot 69$ | 1.48 | 4.73 | I. 59 | $4 \cdot 76$ |
| 26 | I'15 | . $\cdot 63$ | $1 \cdot 26$ | $4 \cdot 66$ | $1 \cdot 37$ | $4 \cdot 69$ | 1.48 | $4 \cdot 73$ | 1.60 | 4.77 | $1 \cdot 72$ | $4 \cdot 8 \mathrm{I}$ |
| 28 | 1.26 | $4 \cdot 66$ | I. $3^{8}$ | $4 \cdot 69$ | 1.49 | $4 \cdot 73$ | 1.61 | 4.77 | 1.73 | $4 \cdot 81$ | 1.83 | 4.86 |
| 30 | $1 \cdot 38$ | $4 \cdot 69$ | 1.50 | $4 \cdot 73$ | 1-62 | $4 \cdot 77$ | 1.74 | $4 \cdot 82$ | 1.87 | 4.86 | $2 \cdot 00$ | 4.92 |
| 32 | $1 \cdot 51$ | $4 \cdot 73$ | I•63 | $4 \cdot 78$ | r.76 | 4.82 | 1.89 | $4 \cdot 87$ | $2 \cdot 02$ | $4 \cdot 92$ | $2 \cdot 16$ | 4.98 |
| 34 | r.64 | $4 \cdot 78$ | 1.77 | $4 \cdot 83$ | 1.91 | $4 \cdot 88$ | 2.05 | $4 \cdot 93$ | $2 \cdot 19$ | 4.99 | $2 \cdot 34$ | 5.06 |
| 36 | $1 \cdot 79$ | 4.83 | -93 | $4 \cdot 89$ | $2 \cdot 07$ | $4 \cdot 94$ | 2.22 | $5 \cdot 01$ | 2.37 | $5 \cdot 08$ | 2.53 | $5 \cdot 15$ |
| 38 | 1-95 | $4 \cdot 89$ | $2 \cdot 10$ | 4.95 | $2 \cdot 25$ | $5 \cdot 02$ | $2 \cdot 41$ | $5 \cdot 09$ | $2 \cdot 58$ | $5 \cdot 18$ | $2 \cdot 75$ | $5 \cdot 26$ |
| 40 | $2 \cdot 12$ | 4.96 | 2.28 | $5 \cdot 04$ | 2.45 | $5 \cdot \mathrm{II}$ | 2.62 | $5 \cdot 20$ | 2.81 | 5.29 | $3 \cdot 00$ | $5 \cdot 40$ |
| 42 | $2 \cdot 32$ | $5 \cdot 05$ | 2.49 | $5 \cdot 13$ | $2 \cdot 67$ | $5 \cdot 23$ | $2 \cdot 87$ | $5 \cdot 33$ | 3.07 | $5 \cdot 44$ | $3 \cdot 29$ | 5.56 |
| 44 | $2 \cdot 54$ | $5 \cdot 16$ | $2 \cdot 72$ | $5 \cdot 25$ | $2 \cdot 93$ | $5 \cdot 36$ | $3 \cdot 15$ | 5.48 | $3 \cdot 38$ | $5 \cdot 62$ | $3 \cdot 63$ | 5.77 |
| 45 | 2.66 | $5 \cdot 22$ | 2.85 | 5.32 | 3.08 3.23 | 5.44 | 3.31 3.49 | $5 \cdot 57$ 5.68 | 3.55 3.75 | 5.73 | 3.82 4.02 | 5.90 |
| 46 | $2 \cdot 79$ | $5 \cdot 29$ | $2 \cdot 99$ | 5.40 | 3.23 | $5 \cdot 52$ | 3.49 | $5 \cdot 68$ | 375 | $5 \cdot 85$ | $4 \cdot 02$ | $6 \cdot 03$ |

## LATITUDE $27^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | yo | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. <br> Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H, M. | S. | H. M. | S. | M. | S. | H. M. | S. | H. M. S. | s. | H. M. s . | s. |
| $\bigcirc$ | $54743 \cdot 2$ | -2.06 | $\begin{array}{llll}5 & 45 & 39 \\ 5 & \text { I }\end{array}$ | $-2.07$ | $5{ }_{5}^{5} 4334.4$ | -2.08 | ${ }_{5}^{5} 41129.1$ | $-2.10$ |  | -2.11 | $1 \begin{array}{llll}5 & 37 & 15.8\end{array}$ | $2 \cdot 13$ |
| 2 | $\begin{array}{lllllllllll}5 & 38 & 40.2\end{array}$ | 2.08 | 53634.6 | $2 \cdot 10$ | $53428 \cdot 2$ | 2.11 | $\begin{array}{lllll}5 & 32 & 20.9\end{array}$ | $2 \cdot 13$ | $53012 \cdot 7$ | $2 \cdot 15$ | $\begin{array}{llll}5 & 28 & 3 \cdot 2 \\ 5 & 18 & 3\end{array}$ | $2 \cdot 17$ |
| 4 | $52935 \cdot 8$ | $2 \cdot 11$ | 52728.5 | $2 \cdot 13$ | $5 \quad 25 \quad 20 \cdot 2$ | $2 \cdot 15$ | $\begin{array}{llll}5 & 23 & 10 \cdot 8\end{array}$ | $2 \cdot 17$ | $\begin{array}{ccc}5 & 21 & 0 \cdot 1 \\ 5 & 11 & 5\end{array}$ | 19 | $\begin{array}{llllll}5 & 18 & 48 \cdot 1\end{array}$ | 2.21 |
|  | $\begin{array}{llll}5 & 20 & 29 \cdot 8 \\ 5 & 11 & 22 \cdot 1\end{array}$ | 2. | $\begin{array}{rrrr}58 & 18 \\ 5 & 20 \cdot 7\end{array}$ | 6 | $\begin{array}{cccc}5 & 16 & 10 \cdot 2 \\ 5 & 6 & 580\end{array}$ | 2.19 2.23 | $\begin{array}{llllll}5 & 13 & 58.4\end{array}$ | 2.21 |  | 2.23 | $\begin{array}{llll}5 & 9 & 30.2\end{array}$ | $2 \cdot 26$ |
| 8 | 5 II 22.1 | $2 \cdot$ | 5 9 10*8 | $2 \cdot 20$ | $5658 \cdot 0$ | 2.23 | $5443 \cdot 6$ | $2 \cdot 25$ | $\begin{array}{llll}5 & 2 & 27\end{array}$ | $2 \cdot 29$ | $\begin{array}{lll}5 & 0 & 9.3\end{array}$ | $2 \cdot 32$ |
| 10 | $5 \quad 212$ |  | $45958 \cdot 6$ | $2 \cdot 24$ | 45743.2 | 2.27 | 45525.9 | $2 \cdot 30$ | $4 \quad 53 \quad 6 \cdot 6$ | $2 \cdot 34$ | $5045 \cdot 1$ | $2 \cdot 38$ |
| 12 | 453002 | 25 | 45043.9 | 29 | $44^{4} \quad 25^{\prime} 6$ | $2 \cdot 32$ | 446 5'1 | $2 \cdot 36$ | $\begin{array}{lllll}4 & 43 & 42 \cdot 3\end{array}$ | 2.40 | 4 41 17.0 | 2.44 |
| 14 | $44345 \cdot 5$ | $2 \cdot 30$ | $44126 \cdot 3$ | 2.34 | $\begin{array}{lll}4 & 39 & 4.8\end{array}$ | 2.38 | $43640 \cdot 7$ | 2.42 | [43414.I | 2.47 | ${ }^{4} 31144.6$ | 2.51 |
| 16 | $43427 \cdot 9$ | $2 \cdot 35$ | 43254 | $2 \cdot 40$ | $42940 \cdot 3$ | $2 \cdot 44$ | 42712.4 | $2 \cdot$ | $42441 \cdot 6$ | $2 \cdot 54$ | $422 \quad 7 \cdot 7$ | $2 \cdot 59$ |
| 17 | $42947 \cdot 9$ | $2 \cdot 38$ | 42723.6 | $2 \cdot 43$ | $42456 \cdot 6$ | 2.47 | 42226.6 | $2 \cdot 52$ | $4 \begin{array}{llll}49 & 53.6\end{array}$ | $2 \cdot 58$ | $\begin{array}{llllll}4 & 17 & 17.2\end{array}$ | $2 \cdot 64$ |
| 18 | $425 \quad 70$ | 2.41 | 42240.9 | 2.46 | 42011.9 | 2.51 | $41739 \%$ | 2.56 | $\begin{array}{llll}4 & 15 & 4 \cdot 3\end{array}$ | 2.62 | 41225.3 | $2 \cdot 68$ |
| 19 | $\begin{array}{llll}4 & 20 & 25.3\end{array}$ | 2.44 | $4 \mathrm{I7} 57 \cdot \mathrm{I}$ | 2.49 | $41526 \cdot 0$ | 2.55 |  | $2 \cdot 60$ | $4 \begin{array}{lll}40 & 13.6\end{array}$ | 2.66 | $4731 \cdot 9$ | 7 |
| 20 | 415423 | $2 \cdot 48$ | $1 \begin{array}{llll}4 & 12.2\end{array}$ | $2 \cdot 53$ | 4 10 $38 \cdot 8$ | 2.58 | 48820 | 4 | $4 \begin{array}{llll}4 & 5 & 21.4\end{array}$ | 2. | $236 \cdot 9$ | 2.78 |
| 21 | 4 10 58.4 | 2.51 | $\begin{array}{llll}4 & 8 & 26 \cdot 2\end{array}$ | $2 \cdot 57$ | $4 \quad 5 \quad 50 \cdot 5$ | 2.63 | 438110 | $2 \cdot 6$ | $4 \quad 0 \quad 27.7$ | 2.7 | $5740 \cdot 2$ |  |
| 22 | $4 \quad 6 \quad 13.4$ | $2 \cdot 55$ | $4 \quad 3 \quad 38 \cdot 9$ | $2 \cdot 61$ | $0 \cdot 7$ | $2 \cdot 67$ | $3 \begin{array}{llll}38 & 18.6\end{array}$ | $2 \cdot 74$ | $35532 \cdot 4$ | 2.81 | $35241 \cdot 8$ | 8 |
| 23 | $\begin{array}{lll}4 & 1 & 27.2 \\ 3\end{array}$ | 58 |  | 65 | $3 \begin{array}{lll}3 & 56 & 9 \cdot 5\end{array}$ | 2.71 | $\begin{array}{llll}3 & 53 & 24.5\end{array}$ | 9 | 35035.2 | $2 \cdot 86$ | $4741 \cdot 3$ | $2 \cdot 94$ |
| 24 |  | . 62 | $\begin{array}{lll}3 & 54 & 0 \cdot 3\end{array}$ | 2.69 | 35116.7 | 2.76 | $\begin{array}{lllllll}3 & 48 & 28.8\end{array}$ | 2.84 | $34536 \cdot 2$ | 2 | $\begin{array}{llllllllll}3 & 42 & 38 \cdot 8\end{array}$ | 3.00 |
| 25 | $\begin{array}{llll}3 & 51 & 50 \cdot 9\end{array}$ | 2.67 | $3498 \cdot 7$ | 2.74 | 34622.2 | 2.81 | $\begin{array}{llllllllllll}3 & 43 & 31 \cdot 2\end{array}$ | $2 \cdot 89$ | $3 \begin{array}{llll}3 & 40 & 35.2\end{array}$ | $2 \cdot 98$ | 3734 I | 3.06 |
| 26 | $\begin{array}{ll}47 & 0 \cdot 6 \\ 42 & 8.7\end{array}$ | 2.71 2.76 | 3 44 $15 \cdot 6$ <br> 3 39  | 2.79 2.8 | $\begin{array}{llll}3 & 41 & 26 \cdot 0\end{array}$ | 2.87 |  | 2.95 | $\begin{array}{llll}3 & 35 & 32 \cdot 0\end{array}$ | 3.04 | 3227.0 | $3 \cdot 13$ |
| 27 | $428 \cdot 7$ | $2 \cdot 76$ | $\begin{array}{llll}3 & 39 & 20 \%\end{array}$ | 2.84 | $\begin{array}{llll}3 & 36 & 27.9\end{array}$ | $2 \cdot 92$ | $3 \quad 33 \quad 30 \cdot 0$ | 3.01 | $3 \quad 3026 \cdot 5$ | $3 \cdot 11$ | $\begin{array}{lllllll}3 & 27 & 17\end{array}$ | 3.20 |
| 28 | 3 3715.1 | 2.81 | $33424{ }^{\circ}$ | $2 \cdot 89$ | $33127 \cdot 7$ | $2 \cdot 98$ | $\begin{array}{ll}3 & 28 \\ 26 & 260\end{array}$ | 3.08 | $\begin{array}{llll}3 & 25 & 18.5\end{array}$ | $3 \cdot 18$ | 224.9 | 88 |
| 29 | $\begin{array}{llllllllll}3 & 32 & 19.8\end{array}$ | 2.87 | $\begin{array}{lllllll}3 & 29 & 25.3\end{array}$ | $2 \cdot 95$ | $3 \quad 2625.3$ | $3 \cdot 05$ | $\begin{array}{lllllllllllll}3 & 23 & 19.6\end{array}$ | $3 \cdot 14$ | $\begin{array}{llll}3 & 20 & 79\end{array}$ | 3.25 | $1649 \cdot 5$ | $3 \cdot 36$ |
| 30 | 2722.5 | 2.92 | $\begin{array}{lllll}3 & 24 & 24.4\end{array}$ | 3.02 | $32120 \cdot 6$ | 3 II | $3 \mathrm{r}^{8} \mathrm{ro} \cdot 6$ | 3 | 31454.2 | 3.33 | 3 II 30.8 | $3 \cdot 45$ |
| 31 | $2223 \cdot 1$ | 2.98 | $\begin{array}{llll}3 & 19 & 21.3\end{array}$ | 3.08 |  | $3 \cdot 19$ | $\begin{array}{lllll}3 & 12 & 58.8\end{array}$ | 3. | $\begin{array}{llll}3 & 9 & 37.4\end{array}$ | 3.42 | $\begin{array}{llll}3 & 6 & 8.6\end{array}$ | 3.55 |
| 32 | 31721.6 | 3.05 |  | $3 \cdot 15$ | 3 II $3 \cdot 2$ | 3.26 | $\begin{array}{llll}3 & 7 & 43.9\end{array}$ |  | $\begin{array}{llll}3 & 4 & 17.2\end{array}$ | $3 \cdot 51$ | - 42.5 | 3.65 |
| 33 |  | 3.12 | $\begin{array}{llll}3 & 9 & 7 \cdot 2\end{array}$ | 3.23 | $3 \quad 5 \quad 50 \cdot 1$ | 3.35 | $\begin{array}{llll}3 & 2 & 25.5\end{array}$ | 3.47 | $25^{2} 853.2$ | $3 \cdot 61$ | $2 \begin{array}{llll} & 12.3\end{array}$ | 3.76 |
| 34 | $\begin{array}{lllll}3 & 7 & 10.9\end{array}$ | $3 \cdot 19$ | $\begin{array}{llll}3 & 3 & 55.9 \\ 2\end{array}$ | 3.31 | 3 o $33 \cdot 6$ | $3 \cdot 44$ | $2 \begin{array}{lll}27 & 3.6\end{array}$ | 3.57 | $25325 \cdot 1$ | $3 \cdot 72$ | $24937 \cdot 4$ | $3 \cdot 88$ |
| 35 | $\begin{array}{llll}3 & 2 & 1.4\end{array}$ | 3.27 | $\begin{array}{lllll}2 & 58 \\ 2 & 41.4\end{array}$ |  | 2 55 13.7 | 3.5 | $25137 \cdot 6$ | 3.68 | $\begin{array}{llllllllllll}2 & 47 & 52.4\end{array}$ | $3 \cdot 83$ | 24357.5 | $4 \cdot 00$ |
| 36 | $\begin{array}{lllllll}2 & 56 & 48 \cdot 7 \\ 2 & 51 & 32 \cdot 7\end{array}$ | 3.36 | $\begin{array}{llll}2 & 53 & 23.4 \\ 2 & 48 & \text { I. }\end{array}$ |  | 24949.8 | 3.64 | $2{ }^{2} 46$ | $3 \cdot 79$ | $\begin{array}{llll}2 & 42 & 14.8\end{array}$ | $3 \cdot 96$ | ${ }^{2} 381118$ | $4 \cdot 14$ |
| 37 | $25132 \cdot 7$ | 45 | 248 1.6 | $3 \cdot 59$ | 24421.6 | $3 \cdot 75$ | $24031 \times 9$ | $3 \cdot 92$ | $23631 \cdot 6$ | 4.10 | $232 \quad 19.9$ | 4.29 |
| 38 | 24612.9 | 3.55 | 24235.6 | 3.70 | 23848.6 | 3.87 | $23451 \cdot 0$ | 4.05 | $23042 \cdot 3$ | 4.25 | $22621 \cdot 0$ | 47 |
| 39 | 40 49. I | $3 \cdot 66$ | $237.4 \cdot 8$ | $3 \cdot 82$ | $23310 \cdot 3$ | $4 \cdot 00$ | 229404 | $4 \cdot 20$ | $22446 \cdot 1$ | $4 \cdot 42$ | $22014 \cdot 1$ | $4 \cdot 66$ |
| 40 | $3520 \cdot 6$ | $3 \cdot 77$ | $23129^{\circ} \mathrm{O}$ | 3.95 | $\begin{array}{llll}2 & 27 & 26 \cdot 1\end{array}$ | $4 \cdot 15$ | 22310.9 | 4.37 | $21842 \cdot \mathrm{I}$ | $4 \cdot 61$ | 213 58.1 | $4 \cdot 87$ |
| 4 I | 29 47.2 | 3.90 | $22547 \cdot 3$ | $4 \cdot \mathrm{ro}$ | $\begin{array}{llllllllllll}2 & 21 & 35 \cdot 3\end{array}$ | $4 \cdot 3 \mathrm{I}$ | $\begin{array}{llll}2 & 17 & 9.7\end{array}$ | 4.55 | 212291 | $4 \cdot 82$ | 731.8 | 5. 2 |
| 42 | $248 \cdot 1$ | $4 \cdot 05$ | 1959.2 | 4. | 1537.0 | 4 | 2 Io 59.9 | $4 \cdot 76$ | 66. | $5 \cdot 06$ | - 53.3 | 5.39 |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ}$ A. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | s. | S. | s. 6 | s. | S. | S. | S. | s. | S. |  | s. | s. |
| 2 | -61 | -4.53 | - 70 | -4.54 | - 779 | -4.54 4.56 | - .89 | 4.56 4.58 | .898 | 4.58 4.59 | -98 1-07 | $4 \cdot 59$ 4.62 |
| 4 | $\cdot 70$ | 4.54 | $\cdot 79$ | 4.56 | -88 | 4.57 | $\cdot 97$ | $4 \cdot 59$ | 1.07 | $4 \cdot 6 \mathrm{I}$ | $1 \cdot 16$ | $4 \cdot 64$ |
| 6 | $\bullet 78$ | $4 \cdot 56$ | $\cdot 87$ | 4.57 | $\cdot 97$ | $4 \cdot 59$ | 1.06 | $4 \cdot 61$ | I•16 | $4 \cdot 64$ | $1 \cdot 25$ | $4 \cdot 66$ |
| 8 | $\cdot 87$ | $4 \cdot 57$ | $\cdot 96$ | $4 \cdot 59$ | 1.06 | $4 \cdot 61$ | 1-15 | $4 \cdot 63$ | $1 \cdot 25$ | $4 \cdot 66$ | $1 \cdot 35$ | $4 \cdot 69$ |
| 10 | $\bullet 96$ | $4 \cdot 59$ | 1.05 | $4 \cdot 61$ | I. 15 | $4 \cdot 63$ | 1.25 | $4 \cdot 66$ | 1.35 | $4 \cdot 69$ | $1 \cdot 45$ | $4 \cdot 72$ |
| 12 | $1 \cdot 05$ | $4 \cdot 61$ | r 15 | $4 \cdot 63$ | 1.25 | $4 \cdot 66$ | r.35 | $4 \cdot 69$ | 145 | $4 \cdot 72$ | $1 \cdot 55$ | $4 \cdot 75$ |
| 14 | I'15 | $4 \cdot 63$ | 1.25 | $4 \cdot 66$ | I 35 | $4 \cdot 69$ | 1.45 | $4 \cdot 72$ | 1.56 | $4 \cdot 75$ | 1.66 | $4 \cdot 79$ |
| 16 | 1.25 | $4 \cdot 66$ | r 35 | $4 \cdot 69$ | $1 \cdot 46$ | $4 \cdot 72$ | r 56 | 4.75 | r.67 | $4 \cdot 79$ | $1 \cdot 78$ | 4.83 |
| 18 | 1.36 | $4 \cdot 69$ | 1.46 | $4 \cdot 72$ | 1.57 | $4 \cdot 75$ | 1. 68 | $4 \cdot 79$ | 1-79 | $4 \cdot 83$ | 1.91 | $4 \cdot 88$ |
| 20 | 1.47 | 4.72 | 1.58 | $4 \cdot 76$ | I.69 | 4.80 | 1.80 | $4 \cdot 84$ | 1.92 | $4 \cdot 88$ | $2 \cdot 04$ | $4 \cdot 93$ |
| 22 | r 58 | 4.76 | $1 \cdot 70$ | 4.80 | r.8I | $4 \cdot 84$ | I.93 | $4 \cdot 89$ | 2.05 | $4 \cdot 94$ | $2 \cdot 18$ | $4 \cdot 99$ |
| 24 | r.71 | 4.80 | 1.82 | $4 \cdot 85$ | I.95 | $4 \cdot 89$ | 2.07 | $4 \cdot 94$ | 2.20 | $5 \cdot 00$ | $2 \cdot 33$ | 5.06 |
| 26 | 1•84 | $4 \cdot 85$ | r.96 | 4.90 | 2.09 | $4 \cdot 95$ | $2 \cdot 22$ | 5.01 | $2 \cdot 36$ | $5 \cdot 07$ | $2 \cdot 50$ | $5 \cdot 14$ |
| 28 | 1•98 | 4.91 | 2.11 | $4 \cdot 96$ | $2 \cdot 25$ | $5 \cdot 02$ | $2 \cdot 39$ | 5.09 | $2 \cdot 54$ | $5 \cdot 15$ | 2.69 | $5 \cdot 23$ |
| 30 | $2 \cdot 14$ | $4 \cdot 97$ | 2.29 | 5.03 | $2 \cdot 42$ | $5 \cdot 10$ | $2 \cdot 57$ | $5 \cdot 17$ | $2 \cdot 73$ | $5 \cdot 25$ | $2 \cdot 89$ | $5 \cdot 34$ |
| 32 | 2.31 | $5 \cdot 05$ | $2 \cdot 45$ | $5 \cdot 12$ | $2 \cdot 61$ | $5 \cdot 19$ | $2 \cdot 77$ | $5 \cdot 28$ | $2 \cdot 94$ | 5.37 | $3 \cdot 12$ | $5 \cdot 47$ |
| 34 | $2 \cdot 49$ | $5 \cdot 13$ | $2 \cdot 65$ | $5 \cdot 21$ | $2 \cdot 82$ | $5 \cdot 30$ | 3.00 | $5 \cdot 40$ | 3.19 | $5 \cdot 51$ | $3 \cdot 39$ | $5 \cdot 62$ |
| 36 | $2 \cdot 70$ | $5 \cdot 24$ | $2 \cdot 88$ | $5 \cdot 33$ | $3 \cdot 06$ | $5 \cdot 43$ | 3.26 | $5 \cdot 55$ | 3.47 | $5 \cdot 67$ | $3 \cdot 69$ | $5 \cdot 81$ |
| 37 | $2 \cdot 81$ | $5 \cdot 30$ | 3.00 | $5 \cdot 40$ | $3 \cdot 19$ | 5.51 | 3.40 | $5 \cdot 63$ | $3 \cdot 63$ | $5 \cdot 77$ | $3 \cdot 86$ | $5 \cdot 92$ |
| 38 39 | 2.93 3.07 | $5 \cdot 36$ 5.44 | 3.13 3.27 | 5.47 | 3.34 | $5 \cdot 59$ | $3 \cdot 56$ | 5.73 5.83 | 3.80 | $5 \cdot 88$ | 4.05 | $6 \cdot 04$ |
| 40 | 3.20 | $5 \cdot 52$ | 3.42 | $5 \cdot 65$ | 3.66 | $5 \cdot 79$ | $3 \cdot 3$ I | $5 \cdot 96$ | $4 \cdot 19$ | $6 \cdot 14$ | $4 \cdot 49$ | $6 \cdot 35$ |
| 41 | $3 \cdot 36$ | $5 \cdot 60$ | 3.59 | $5 \cdot 75$ | $3 \cdot 84$ | 5.91 | $4 \cdot 12$ | $6 \cdot 09$ | $4 \cdot 42$ | $6 \cdot 30$ | $4 \cdot 76$ | $6 \cdot 54$ |
| 42 | $3 \cdot 52$ | $5 \cdot 70$ | $3 \cdot 77$ | 5.86 | 4.04 | $6 \cdot 04$ | $4 \cdot 35$ | $6 \cdot 25$ | 4.68 | $6 \cdot 48$ | $5 \cdot 05$ | $6 \cdot 75$ |

# 232 HOUR－ANGLES AND VARIATIONS TO 1＇OF LAT．，DECL．，AND ALT． 

## LATITUDE $27^{\circ}$ ．

DECLINATION－CONTRARY NAME TO－LATITUDE．

| True Alt． | $12^{\circ}$ | Decl． Var． | $13^{\circ}$ | Decl． Var． | $14^{\circ}$ | Decl． <br> Var． | $15^{\circ}$ | Decl． Var． | $16^{\circ}$ | Decl． Var． | $17^{\circ}$ | Decl． <br> Var． |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| － | H．M． | S． | H．M． | S． | M． |  | ， | S． | M．S． | S． | M．S． | S． |
| 0 | $\begin{array}{llll}5 & 35 & 7 \cdot 8\end{array}$ | $-2 \cdot 14$ | $532 \begin{array}{llll}5 & 3 & 7\end{array}$ | $-2 \cdot 16$ | $53048 \cdot 4$ | $-2 \cdot 18$ | 52836.7 | $-2.21$ | （ $52623 \cdot 7$ | $-2.23$ | 524 9．1 | $-2.26$ |
| 2 | $525 \quad 52 \cdot 5$ | $2 \cdot 19$ | $52340 \cdot 5$ | $2 \cdot 21$ | $52127 \cdot 1$ |  | 5 I9 12．1 | $2 \cdot 26$ |  | 2.29 | 5 I4 36．9 | $2 \cdot 32$ |
| 4 | 5 16 34.6 | $2 \cdot 24$ | $5 \mathrm{lll}_{5} 19.4$ | 2.27 | $\begin{array}{llll}5 & 12 & 2 \cdot 6\end{array}$ |  | $5 \quad 944{ }^{\circ}$ | $2 \cdot 33$ | $\begin{array}{lllll}5 & 7 & 23.3\end{array}$ | $2 \cdot 36$ | $\begin{array}{lll}5 & 5 & 0.6\end{array}$ | $2 \cdot 40$ |
| 6 | $\begin{array}{llllll}5 & 7 & 13.6\end{array}$ | $2 \cdot 29$ | $\begin{array}{llll}5 & 4 & 55^{\circ} \mathrm{O}\end{array}$ | $2 \cdot 32$ | $\begin{array}{llll}5 & 2 & 34 \cdot 6\end{array}$ | $2 \cdot 36$ | 5 0 II．9 | 2.40 | $45747{ }^{\circ} \mathrm{O}$ | $2 \cdot 43$ | 45519.7 | $2 \cdot 48$ |
| 8 | 45749.2 | $2 \cdot 35$ | 455 27＇I | 2.39 | $453 \quad 2 \cdot 6$ | $2 \cdot 43$ | $45035 \cdot 6$ | $2 \cdot 47$ | $4486 \cdot 1$ | 2.51 | $445 \quad 33 \cdot 8$ | $2 \cdot 56$ |
| 10 | 44821.3 | 2.42 | $44555^{\circ} \mathrm{O}$ | $2 \cdot 46$ | 443 26．I | $2 \cdot 50$ | 44054.5 | $2 \cdot 55$ | 4381909 | $2 \cdot 60$ | $43542 \cdot 3$ | $\cdot 66$ |
| 12 | $43849^{\circ} \mathrm{I}$ | $2 \cdot 49$ | $43618 \cdot 4$ | $2 \cdot 54$ | $43344 \cdot 8$ | $2 \cdot 59$ | 4 3I 8．1 | $2 \cdot 64$ | $42828 \cdot 0$ | $2 \cdot 70$ | $42544 \cdot 5$ | $2 \cdot 76$ |
| 14 | $\left\lvert\, \begin{array}{lll}4 & 29 & 12 \cdot 3\end{array}\right.$ | $2 \cdot 56$ | $42636 \cdot 8$ | $2 \cdot 62$ | $\begin{array}{llll}4 & 23 & 58 \cdot I\end{array}$ | $2 \cdot 68$ | 4 21 15．7 | 2.74 | $4 \begin{array}{llll}48 & 29 & 7\end{array}$ | $2 \cdot 80$ | 415 39．7 | $2 \cdot 87$ |
| 16 | $41930 \cdot 4$ | $2 \cdot 65$ | 4 I6 49.6 | $2 \cdot 71$ | $\begin{array}{llll}4 & 14 & 5 \cdot I\end{array}$ | $2 \cdot 77$ | 4 11 16．7 | 2.84 | $48124^{\circ} \mathrm{O}$ | $2 \cdot 91$ | $4 \quad 5 \quad 27 \cdot 0$ | $2 \cdot 99$ |
| I7 | $41437 \cdot 3$ | $2 \cdot 70$ | 4 II 53.7 | $2 \cdot 76$ | $4 \quad 96 \cdot I$ | 2.83 | $4 \quad 6 \quad 14.4$ | $2 \cdot 90$ | $\begin{array}{lllll}4 & 3 & 18 \cdot 2\end{array}$ | $2 \cdot 98$ | $4 \quad 0 \quad 17 \cdot 3$ | $3 \cdot 06$ |
| 18 | $4 \quad 9 \quad 42 \cdot 6$ | 74 | 4656.0 | $2 \cdot 81$ | $\begin{array}{lll}4 & 4 & 5 \\ \end{array}$ | $2 \cdot 88$ | 4 1 10．1 | $2 \cdot 96$ | $3 \quad 58 \quad 10 \cdot 2$ | －04 | $355 \quad 5 \cdot 3$ | 3．13 |
| 19 | $4 \begin{array}{lllllll}4 & 4 & 46 \cdot 3\end{array}$ | $2 \cdot 79$ | 4 I 56.6 | $2 \cdot 86$ | $\begin{array}{llll}3 & 59 & 2.5\end{array}$ | $2 \cdot 94$ | 356 | 3.02 | $\begin{array}{lllll}3 & 52 & 59 \cdot 8\end{array}$ | $3 \cdot 11$ | $34950 \cdot 8$ | 3.20 |
| 20 | $35948 \cdot 3$ | 2.85 | $35655 \cdot 3$ | 2.92 | $3 \begin{array}{lllllllll}3 & 53 & 57\end{array}$ | $3 \cdot 00$ | 35054.9 | $3 \cdot 09$ | $34747 \cdot 0$ | $3 \cdot 18$ | $\begin{array}{lllll}3 & 44 & 33.4\end{array}$ | $3 \cdot 28$ |
| 21 | 354484 | 2.90 | $35151 \cdot 9$ | 2.98 | $34^{3} 4850 \cdot 5$ | 3.07 | $34543{ }^{\circ} 7$ | $3 \cdot 16$ | $\begin{array}{llll}3 & 42 & 31.5\end{array}$ | $3 \cdot 25$ | $\begin{array}{lllllll}3 & 39 & 13.2\end{array}$ | $3 \cdot 36$ |
| 22 | $34946 \cdot 5$ | $2 \cdot 96$ | $34646 \cdot 3$ | 3.05 | $34340 \cdot 9$ | 3．14 | $3 \quad 40 \quad 29.9$ | 3.23 | $33713 \cdot 1$ | $3 \cdot 33$ | $33349 * 8$ | $3 \cdot 44$ |
| 23 | $34442 \cdot 5$ | 3.02 | 34138.5 | $3 \cdot 11$ | $\begin{array}{llll}3 & 38 & 28 \cdot 9\end{array}$ | $3 \cdot 2 \mathrm{I}$ | $3 \begin{array}{lll}35 & 13.4\end{array}$ | $3 \cdot 11$ | 3 3I 5I•6 | 3.42 | 32823.0 | ． 54 |
| 24 | $\begin{array}{lllllllll}3 & 39 & 36 \cdot 2\end{array}$ | $3 \cdot 09$ |  | 3．18 | $3{ }^{3} 3314 \cdot 1$ | $3 \cdot 29$ | $\begin{array}{lllllllllll}3 & 29 & 53\end{array}$ | 3.94 | $\begin{array}{llll}3 & 26 & 26 \cdot 8\end{array}$ | $3 \cdot 5 \mathrm{I}$ | 32252.5 | $3 \cdot 63$ |
| 25 | $\begin{array}{llll}3 & 34 & 27 \cdot 5\end{array}$ | $3 \cdot 16$ | $3 \mathrm{3I} 15^{\circ} \mathrm{O}$ | $3 \cdot 26$ | $\begin{array}{llll}3 & 27 & 56 \cdot 3\end{array}$ | $3 \cdot 37$ | $\begin{array}{lllll}3 & 24 & 30 \cdot 8\end{array}$ | 3.48 | $\begin{array}{llll}3 & 20 & 58 \cdot 3 \\ 3 & 5 & 25 \cdot 9\end{array}$ | $3 \cdot 61$ | $3 \mathrm{I} 718 \cdot 0$ | 3.74 |
| 26 | 329 I6．I | 3.23 | 32559.0 | $3 \cdot 34$ | $\begin{array}{llll}3 & 22 & 35 \cdot 3\end{array}$ | $3 \cdot 45$ | 3 I9 4.4 | $3 \cdot 58$ | $\begin{array}{llll}3 & 15 & 25 \cdot 9\end{array}$ | $3 \cdot 71$ | 3 II 39.2 | $3 \cdot 85$ |
| 27 | $\begin{array}{llll}3 & 24 & 1.9\end{array}$ | 3.31 | 32039.9 | 3.43 | $31710 \cdot 8$ | $3 \cdot 55$ | 3 I3 34．2 | 3.68 | $\left\lvert\, \begin{array}{lll}3 & 9 & 49 \cdot 3\end{array}\right.$ | $3 \cdot 82$ | $\begin{array}{lllll}3 & 5 & 55 \cdot 7\end{array}$ | 3.97 |
| 28 | 3 I8 $44 \times 7$ | 3.40 | 315174 | 3.52 | 3 II $42 \cdot 6$ | $3 \cdot 65$ | $37759 \cdot 7$ | $3 \cdot 79$ | $\begin{array}{llr}3 & 4 & 8 \cdot 0\end{array}$ | 3.94 | $\begin{array}{llrr}3 & 0 & 6 \cdot 9\end{array}$ | －10 |
| 29 | $\begin{array}{llll}3 & 13 & 24 \cdot 1\end{array}$ | 3.49 | $3{ }^{3}$ | $3 \cdot 61$ | $\begin{array}{lll}3 & 6 & 10.3\end{array}$ | 3.75 | $\begin{array}{llll}3 & 2 & 20 \cdot 6\end{array}$ | 3.91 | $\left\lvert\, \begin{array}{lll}2 & 58 & 21 \cdot 6 \\ 2 & 52 & 20 \cdot 7\end{array}\right.$ | 4.07 | $\begin{array}{llll}2 & 54 & 12.4 \\ 2 & 4\end{array}$ | $4 \cdot 25$ |
| 30 | 375989 | $3 \cdot 58$ |  | $3 \cdot 72$ | $\begin{array}{llll}3 & 0 & 33.5\end{array}$ | 3.87 | $256136 \cdot 6$ | 4.03 | $\begin{array}{llll}2 & 52 & 29 \cdot 7 \\ 2 & 76 & \end{array}$ | 4.21 |  | 4.40 |
| 31 | 3 2 3 <br> 2 5 6 | $3 \cdot 68$ | $\begin{array}{llll}2 & 58 & 46 \cdot 4\end{array}$ | 3.83 | $\begin{array}{lllll}2 & 54 & 5 \mathrm{I} \cdot 8 \\ 2 & 4\end{array}$ | $3 \cdot 99$ | $25047 \cdot 1$ | $4 \cdot 17$ | 24631 | $4 \cdot 36$ | $\begin{array}{llll}2 & 42 & 3 & 7 \\ 2 & 35 & 4\end{array}$ | $4 \cdot 57$ |
| 32 | 25659.4 | $3 \cdot 80$ | $2537 \cdot 0$ | 3.96 | 249497 | $4 \cdot 13$ | 24451.4 | $4 \cdot 32$ | $240 \quad 26 \cdot 3$ | 4.53 | $23548 \cdot 0$ | $4 \cdot 76$ |
| 33 | $25122 \cdot 3$ | 3.92 | $2{ }^{2} 47 \begin{array}{lll}22 \cdot 3\end{array}$ | 4.09 | $\begin{array}{llll}2 & 43 & \text { II } 6\end{array}$ | $4 \cdot 28$ | 23849.0 | 4.48 | $\begin{array}{llll}2 & 34 & 13.4\end{array}$ | 4．71 | 22923.4 | 4．97 |
| 34 | $24539 \cdot 9$ | 4.05 | $2 \begin{array}{llll}2 & 41 & 3 I \cdot 8\end{array}$ | $4 \cdot 23$ | 23711.8 | 4.44 | $232 \cdot 38 \cdot 9$ | $4 \cdot 67$ | $2 \begin{array}{lllllll} \\ 2 & 27 & 51.8\end{array}$ | 4.92 | $22248 \cdot 8$ | $5 \cdot 20$ |
| 35 | 23951.8 | 4．19 | $\begin{array}{lllll}2 & 35 & 34.6\end{array}$ | 4.39 | $2 \begin{array}{lll}2 & 31 & 4 \cdot 6\end{array}$ | $4 \cdot 62$ | $22620 \cdot 3$ | $4 \cdot 87$ | $2 \begin{array}{lll}2120.4\end{array}$ | 5．15 | $2 \begin{array}{lll}2 & 16 & 2 \cdot 6\end{array}$ | $5 \cdot 46$ |
| 36 | 233 57＊4 | － 4.35 |  | 4．5 ${ }^{\text {¢ }}$ | 2 24 48  | $4 \cdot 82$ | 2 I9 52．0 | $5 \cdot 09$ | $2 \begin{array}{lllllllll} \\ 2 & 14 & 37.5\end{array}$ | $5 \cdot 4 \mathrm{I}$ | $2 \begin{array}{lll}2 & 9 & 3 \cdot 1\end{array}$ | 5．77 |
| 37 | 22755.6 | 4.52 | 2231774 | 4.77 | $\begin{array}{lllll}2 & 18 & 23\end{array}$ | 5.04 | 21312.5 | $5 \cdot 35$ | 741.6 | 5•71 | 2 I $48 \cdot 0$ | $6 \cdot 12$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE．

| Alt． | L． $12^{\circ} \mathrm{A}$ ． |  | L． $13^{\circ} \mathrm{A}$ ． |  | L． $14^{\circ} \mathrm{A}$ ． |  | L． $15^{\circ} \mathrm{A}$ ． |  | L． $16^{\circ} \mathrm{A}$ ． |  | L． $1^{\text {ry }}$ A． |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | S． | s． | s． | s． | S． | S． | S． | s． | S． | S． | S． | S． |
| 0 | －I．08 | $-4.62$ | －I＇I7 | $-4.64$ | －I． 27 | $-4 \cdot 66$ | －I．36 | $-4 \cdot 69$ | －I．46 | $-4.72$ | －I．56 | $-4.75$ |
| 2 | I＇17 | $4 \cdot 63$ | I． 26 | $4 \cdot 66$ | I．36 | $4 \cdot 69$ | I．46 | $4 \cdot 72$ | I． 56 | 4.75 | I．66 | $4 \cdot 78$ |
| 4 | I． 26 | $4 \cdot 66$ | r 35 | $4 \cdot 69$ | 1.45 | $4 \cdot 72$ | 1．55 | $4 \cdot 75$ | 1．65 | $4 \cdot 78$ | I•76 | 4.82 |
| 6 | 1•35 | $4 \cdot 69$ | I．45 | $4 \cdot 72$ | I． 55 | 4.75 | r．65 | $4 \cdot 78$ | $1 \cdot 76$ | 4.82 | I．86 | $4 \cdot 86$ |
| 8 | I．45 | $4 \cdot 72$ | I 55 | $4 \cdot 75$ | I． 65 | $4 \cdot 78$ | I•76 | $4 \cdot 82$ | I．87 | $4 \cdot 86$ | r．98 | 4.91 |
| 10 | I．55 | 4．75 | ェ． 66 | $4 \cdot 79$ | I．76 | 4.82 | 1．87 | 4.86 | I．98 | 4.91 | $2 \cdot 10$ | 4.96 |
| 12 | 1．66 | $4 \cdot 79$ | ェ・クワ | $4 \cdot 83$ | I． 88 | $4 \cdot 87$ | 1．99 | 4．91 | $2 \cdot 11$ | 4.96 | $2 \cdot 22$ | $5 \cdot 01$ |
| 14 | 1．77 | 4.83 | I．89 | $4 \cdot 87$ | $2 \cdot 00$ | 4.91 | 2.12 | 4.96 | $2 \cdot 24$ | $5 \cdot 02$ | $2 \cdot 36$ | $5 \cdot 07$ |
| 16 | 1．90 | $4 \cdot 87$ | $2 \cdot 01$ | 4.91 | $2 \cdot 13$ | 4.97 | 2.25 | $5 \cdot 02$ | $2 \cdot 38$ | $5 \cdot 08$ | 2.51 | 5•14 |
| 17 | r•96 | 4.90 | $2 \cdot 08$ | 4.95 | 2.20 | $5 \cdot 00$ | $2 \cdot 32$ | $5 \cdot 05$ | 2.45 | $5 \cdot 11$ | 2.59 | 5．18 |
| 18 | 2.02 | 4.92 | $2 \cdot 14$ | 4．98 | $2 \cdot 27$ | 5.03 | 2.40 | 5．09 | 2.53 | 5•15 | 2.67 | $5 \cdot 22$ |
| 19 | 2.09 | $4 \cdot 95$ | $2 \cdot 22$ | 5．OI | $2 \cdot 34$ | $5 \cdot 06$ | $2 \cdot 47$ | 5＇13 | $2 \cdot 61$ | 5．19 | 2.75 | $5 \cdot 27$ |
| 20 | $2 \cdot 16$ | 4.98 | $2 \cdot 29$ | $5 \cdot 04$ | $2 \cdot 42$ | 5．10 | $2 \cdot 56$ | 5•16 | $2 \cdot 70$ | $5 \cdot 24$ | $2 \cdot 84$ | $5 \cdot 31$ |
| 21 | $2 \cdot 23$ | $5 \cdot \mathrm{OI}$ | $2 \cdot 37$ | $5 \cdot 07$ | $2 \cdot 50$ | 5．14 | $2 \cdot 64$ | $5 \cdot 21$ | $2 \cdot 78$ | $5 \cdot 28$ | $2 \cdot 94$ | $5 \cdot 36$ |
| 22 | $2 \cdot 31$ | $5 \cdot 05$ | 2.45 | 5．II | $2 \cdot 58$ | $5 \cdot 18$ | $2 \cdot 73$ | $5 \cdot 25$ | $2 \cdot 88$ | $5 \cdot 33$ | 3.03 | $5 \cdot 42$ |
| 23 | $2 \cdot 39$ | 5．09 | 2.53 | 5＇15 | $2 \cdot 67$ | $5 \cdot 22$ | $2 \cdot 82$ | $5 \cdot 30$ | $2 \cdot 98$ | 5＇39 | 3＇14 | $5 \cdot 48$ |
| 24 | 2.47 | $5 \cdot 12$ | $2 \cdot 62$ | $5 \cdot 20$ | $2 \cdot 76$ | $5 \cdot 27$ | 2.92 | $5 \cdot 35$ | $3 \cdot 08$ | 5.44 | $3 \cdot 25$ | $5 \cdot 54$ |
| 25 | $2 \cdot 56$ | $5 \cdot 17$ | 2.71 | $5 \cdot 24$ | 2.86 | $5 \cdot 32$ | 3.02 | 5.41 | $3 \cdot 19$ | $5 \cdot 51$ | $3 \cdot 37$ | $5 \cdot 61$ |
| 26 | 2.65 | $5 \cdot 21$ | 2.80 | $5 \cdot 29$ | $2 \cdot 96$ | $5 \cdot 38$ | $3 \cdot 13$ | $5 \cdot 47$ | $3 \cdot 30$ | $5 \cdot 57$ | 3.49 | $5 \cdot 69$ |
| 27 | $2 \cdot 74$ | $5 \cdot 26$ | 2.90 | $5 \cdot 35$ | 3.07 | $5 \cdot 44$ | $3 \cdot 24$ | $5 \cdot 54$ | 3.43 | $5 \cdot 65$ | $3 \cdot 62$ | $5 \cdot 77$ |
| 28 | $2 \cdot 85$ | 5．31 | 3.01 | $5 \cdot 41$ | 3．18 | $5 \cdot 50$ | 3．37 | 5．6I | $3 \cdot 56$ | 5＇73 | 3．77 | $5 \cdot 86$ |
| 29 | 2.95 | $5 \cdot 37$ | $3 \cdot 12$ | $5 \cdot 47$ | 3.31 | $5 \cdot 58$ | 3.50 | $5 \cdot 69$ | $3 \cdot 70$ | $5 \cdot 82$ | 3.92 | $5 \cdot 96$ |
| 30 | 3.06 | 5.44 | $3 \cdot 25$ | $5 \cdot 54$ | 3.44 | $5 \cdot 65$ | $3 \cdot 64$ | $5 \cdot 78$ | $3 \cdot 86$ | $5 \cdot 92$ | 4.09 | $6 \cdot 07$ |
| 31 | $3 \cdot 18$ | $5 \cdot 50$ | $3 \cdot 37$ | $5 \cdot 62$ | $3 \cdot 58$ | $5 \cdot 74$ | $3 \cdot 79$ | $5 \cdot 88$ | $4 \cdot 02$ | $6 \cdot 03$ | $4 \cdot 27$ | $6 \cdot 20$ |
| 32 | $3 \cdot 3 \mathrm{I}$ | $5 \cdot 58$ | $3 \cdot 51$ | 5＇70 | $3 \cdot 73$ | $5 \cdot 83$ | $3 \cdot 96$ | $5 \cdot 98$ | 4.20 | $6 \cdot 15$ | 4.47 | $6 \cdot 34$ |
| 33 | 3.45 | $5 \cdot 66$ | $3 \cdot 66$ | 5．79 | 3.89 | 5．94 | 4．14 | $6 \cdot 10$ | 4.40 | $6 \cdot 29$ | $4 \cdot 69$ | 6.49 |
| 34 | $3 \cdot 60$ | $5 \cdot 75$ | $3 \cdot 82$ | $5 \cdot 90$ | $4 \cdot 07$ | $6 \cdot 06$ | $4 \cdot 33$ | $6 \cdot 24$ | $4 \cdot 62$ | 6.44 | 4.94 | $6 \cdot 67$ |
| 35 | $3 \cdot 76$ | $5 \cdot 85$ | 4.00 | 6.01 | $4 \cdot 26$ | $6 \cdot 19$ | $4 \cdot 55$ | $6 \cdot 39$ | $4 \cdot 86$ | $6 \cdot 62$ | $5 \cdot 21$ | $6 \cdot 88$ |
| 36 37 | 3.93 4.12 | 5.97 6.09 | $4 \cdot 19$ | $6 \cdot 14$ 6.29 | 4.48 | 6.34 6.51 | $4 \cdot 79$ | $6 \cdot 56$ | $5 \cdot 14$ | 6.82 | 5.53 | $7 \cdot 12$ |
| 37 | $4 \cdot 12$ | 6.09 | 4.41 | 6.29 | $4 \cdot 72$ | 6.51 | $5 \cdot 06$ | $6 \cdot 76$ | 5.45 | 7．06 | $5 \cdot 89$ | $7 \cdot 40$ |

## LATITUDE $27^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. |  | H. M. | S. | . | S. | , | S. | H. M. | S. | H. M. | S. |
| 0 | 52152.9 | $-2.28$ | 5 I9 34.9 | $-2.32$ | $51715{ }^{\circ}$ | $-2.35$ | 51453.0 | $-2.38$ | $51228 \cdot 8$ | $-2.42$ | 5 Io $2 \cdot 2$ | 2.46 |
| 2 | $\begin{array}{llll}5 & 12 & 16.5\end{array}$ | $2 \cdot 36$ | $5 \quad 9 \quad 53.9$ | $2 \cdot 39$ | 5729.2 | $2 \cdot 43$ | $5 \quad 5 \quad 2.0$ | 2.47 | $\begin{array}{llll}5 & 2 & 32 \cdot 3\end{array}$ | 2.52 | $45959 \cdot 8$ | $2 \cdot 56$ |
| 4 | 5 2 $35 \cdot 6$ <br> 4 5  | 2.44 | $\begin{array}{lcr}5 & 0 & 8 \cdot 2 \\ 4 & 50 & \end{array}$ | 2.48 | $45738 \cdot 2$ | 2.52 | 455 | $2 \cdot 57$ | $\begin{array}{llll}4 & 52 & 29 \cdot 8\end{array}$ | $2 \cdot 62$ | $44951{ }^{\circ} \mathrm{O}$ | $2 \cdot 68$ |
| 6 | $45249 \cdot 8$ | 2.52 | $45017 \times 1$ | $2 \cdot 57$ | $44741 \cdot 5$ | $2 \cdot 62$ | $445 \quad 2.8$ | 2.67 | $44220 \cdot 7$ | $2 \cdot 73$ | $43935{ }^{\circ}$ | 2.79 |
| 8 | $44258 \cdot 6$ | $2 \cdot 61$ | $440 \quad 20 \cdot 2$ | 2.67 | $43738 \cdot 5$ | $2 \cdot 72$ | $43453 \cdot 2$ | $2 \cdot 79$ | $4 \quad 32 \quad 4 \cdot 2$ | $2 \cdot 85$ | 429 II*I | $2 \cdot 92$ |
| 10 | $433 \mathrm{I} \cdot 2$ | $2 \cdot 71$ | 43016 | $2 \cdot 77$ | $\begin{array}{llll}4 & 27 & 28 \cdot 3\end{array}$ | $2 \cdot 84$ | $42436 \cdot 0$ | $2 \cdot 91$ | 42139.4 | $2 \cdot 98$ | $41838 \cdot 2$ | 3.06 |
| II | 428 O.I | $2 \cdot 77$ | 43512.2 | 2.83 | $42220 \cdot 3$ | 2.90 | 4 19 24.2 | $2 \cdot 97$ | $41623 \cdot 6$ | 3.05 | 413 I8.I | $3 \cdot 13$ |
| 12 | $42257 \cdot 1$ | 2.82 | $\begin{array}{lll}4 & 20 & 5.8\end{array}$ | 2.89 | 4 I7 10.3 | 2.96 | $\begin{array}{llll}4 & 14 & 10.2\end{array}$ | 3.04 | 4 II $5 \cdot 3$ | $3 \cdot 12$ | $4755 \cdot 2$ | $3 \cdot 21$ |
| 13 | $\begin{array}{lllll}4 & 17 & 52.3\end{array}$ | 2.88 | $\begin{array}{llll}4 & \text { If } & 57 \cdot 4\end{array}$ | $2 \cdot 95$ | 4 II 57.9 | 3.03 | $48833 \cdot 7$ | $3 \cdot 11$ | 45444.4 | $3 \cdot 20$ | 4 2 29.5 | $3 \cdot 30$ |
| 14 | $41245 \cdot 5$ | 2.94 | $4 \quad 9 \quad 46 \cdot 8$ | 3.02 | $4 \quad 6 \quad 43 \cdot 2$ | $3 \cdot 10$ | $4 \quad 3 \quad 34 \cdot 6$ | $3 \cdot 19$ | $4020 \cdot 6$ | $3 \cdot 28$ | 3570.8 | $3 \cdot 38$ |
| 15 | $47736 \cdot 5$ | 3.00 | $4 \begin{array}{lll}4 & 4 & 33\end{array}$ | 3.09 | 4 I $26 \cdot 0$ | $3 \cdot 17$ | $\begin{array}{llll}3 & 58 & 12.8\end{array}$ | 3.27 | 35453.9 | $3 \cdot 37$ | $3 \begin{array}{llll}3 & 51 & 28 \cdot 7\end{array}$ | 3.47 |
| 16 | $4 \quad 2 \quad 25 \cdot 2$ | 3.07 | $3 \begin{array}{lll}3 & 59 & 18 \cdot 3\end{array}$ | $3 \cdot 16$ | $\begin{array}{lll}3 & 56 & 6 \cdot 0\end{array}$ | $3 \cdot 25$ | $\begin{array}{lllll}3 & 52 & 48 \cdot 0\end{array}$ | $3 \cdot 35$ | 34923.9 | 3.46 | $345 \begin{array}{llll}3 & 51\end{array}$ | $3 \cdot 57$ |
| 17 | $\begin{array}{llll}3 & 57 & 114 \\ 3 & \end{array}$ | $3 \cdot 14$ | $\begin{array}{llr}3 & 54 & 0.2 \\ 3 & 48 & 30.2\end{array}$ | 3.23 | $\begin{array}{llll}3 & 50 & 43 \cdot 2\end{array}$ | 3.33 | $\begin{array}{llll}3 & 47 & 20 \cdot 1\end{array}$ | 3.44 | $\begin{array}{llll}3 & 43 & 50 \cdot 4\end{array}$ | 3.55 | $\begin{array}{llll}3 & 40 & 13.8\end{array}$ | $3 \cdot 67$ |
| 18 | 3 5 I 55.1 | 3.22 | $\begin{array}{llllllllllllll}3 & 48 & 39\end{array}$ | 3.32 | $\begin{array}{lllllllllll}3 & 45 & 17 \cdot 2\end{array}$ | 3.42 | $341548 \cdot 7$ | $3 \cdot 53$ | $\begin{array}{lllllll}3 & 38 & 13.3\end{array}$ | $3 \cdot 65$ | $\begin{array}{llll}3 & 34 & 30 \cdot 3\end{array}$ | $3 \cdot 78$ |
| 19 | $34636 \cdot 0$ | $3 \cdot 30$ | $34315 * 2$ | 3.40 | $\begin{array}{llll}3 & 39 & 47.9\end{array}$ | 3.51 | $3 \begin{array}{llll}3 & 36 & 13\end{array}$ | $3 \cdot 63$ | $\begin{array}{llll}3 & 32 & 32 \cdot 0\end{array}$ | $3 \cdot 76$ | $\begin{array}{llll}3 & 28 & 42 \cdot 4\end{array}$ | $3 \cdot 90$ |
| 20 | 34113.9 | $3 \cdot 38$ | $33747 * 9$ | $3 \cdot 49$ | $33415 \cdot 0$ | 3.61 | $33034 * 7$ | 3'74 | $32646 \cdot 5$ | 3.88 | 32249.6 | 4.02 |
| 21 | $\begin{array}{lllllllllll}3 & 35 & 48 \cdot 5\end{array}$ | 3.47 | $33^{3} 32$ 17•0 | $3 \cdot 59$ | $\begin{array}{llll}3 & 38 & 38 \cdot 2\end{array}$ | $3 \cdot 71$ | $3 \begin{array}{llll}3 & 24 & 51 & 4\end{array}$ | $3 \cdot 85$ | $32056 \cdot 1$ | 4.00 | $31645 \cdot 6$ | $4 \cdot 16$ |
| 22 | 33019.7 | 3.56 | $\begin{array}{llll}3 & 26 & 42.4\end{array}$ | 3.69 | $\begin{array}{llll}3 & 22 & 57 \cdot 1\end{array}$ | $3 \cdot 82$ | $3 \begin{array}{lll}3 & 19 & 3.5\end{array}$ | $3 \cdot 97$ | 31500.6 | $4 \cdot 13$ | 3 10 47.8 | $4 \cdot 30$ |
| 23 | $\begin{array}{lllllll}3 & 24 & 47 \cdot 2\end{array}$ | 3.66 |  | 3.80 | 3171115 | $3 \cdot 94$ | $\begin{array}{llll}3 & 13 & 10 & 4\end{array}$ | $4 \cdot 10$ | $\begin{array}{llll}3 & 8 & 59.5\end{array}$ | $4 \cdot 27$ | $\begin{array}{llll}3 & 4 & 37 \cdot 8\end{array}$ | $4 \cdot 46$ |
| 24 | $31910 \cdot 6$ | $3 \cdot 77$ | $\begin{array}{lllll}3 & 15 & 20.2\end{array}$ | 3.91 | 3 II 20.9 | 4.07 | 37 II.8 | $4 \cdot 24$ | $\begin{array}{llll}3 & 2 & 52 \cdot I\end{array}$ | 4.43 |  | $4 \cdot 63$ |
| 25 | 313129.5 | 3.88 | $3 \quad 9 \quad 32.0$ | 4.04 | $\begin{array}{llll}3 & 5 & 24 \cdot 8\end{array}$ | 4-21 | 3 I 7-1 | $4 \cdot 39$ | $2 \begin{array}{llll}26 & 37 \cdot 8\end{array}$ | $4 \cdot 59$ | 25155.9 | 4.82 |
| 26 | $\begin{array}{llll}3 & 7 & 43 \cdot 6\end{array}$ | 4.01 | $\begin{array}{llll}3 & 3 & 38 \cdot 4\end{array}$ | 4.17 |  | $4 \cdot 36$ | $25455 \cdot 6$ | $4 \cdot 56$ | 25015.9 | 4.78 | 245122.4 | $5 \cdot 02$ |
| 27 | 3 1 52.4 <br> 2 55 55.4 | $4 \cdot 14$ | $\begin{array}{lllll}2 & 57 & 38 \cdot 8 \\ 2 & 57 & 38.7\end{array}$ | $4 \cdot 32$ | $2 \begin{array}{llll}253 & 13.9\end{array}$ | 4.52 | $24^{2} 186 \cdot 5$ | $4 \cdot 74$ | $\begin{array}{llllllllll}2 & 43 & 45 \cdot 5\end{array}$ | $4 \cdot 98$ | $\begin{array}{llll}2 & 38 & 39 \cdot 2\end{array}$ | $5 \cdot 24$ |
| 28 | $2 \begin{array}{lllll}2 & 55 & 55\end{array}$ | $4 \cdot 28$ | $25132 \cdot 7$ | 4.48 | $24657 \cdot 7$ | 4.70 | 242 9*I | $4 \cdot 94$ | $2 \begin{array}{lll}37 & 5.4\end{array}$ | $5 \cdot 20$ | $23144{ }^{\circ} 9$ | 5.50 |
| 29 | $24952 \cdot 0$ | $4 \cdot 44$ | 2 | 4.66 | $24033 \cdot 3$ | 4.89 | 23532.3 | $5 \cdot 16$ | 23014.6 | $5 \cdot 45$ | 224 38.I | 5.78 |
| 30 | 24341.4 | $4 \cdot 6 \mathrm{I}$ | $2 \begin{array}{llll}28 & 57.8\end{array}$ | $4 \cdot 85$ | $23359 \cdot 5$ | 5.11 | 22844.7 | 5.40 | 22311.3 | 5.73 | $21716 \cdot 7$ | $6 \cdot 11$ |
| 31 | $\begin{array}{llll}2 & 37 & 22 \cdot 8\end{array}$ | $4 \cdot 80$ | $232 \begin{array}{llll} & 37 \cdot 2\end{array}$ | $5 \cdot 06$ | $2 \begin{array}{lllll} & 2 & 15 \cdot 2\end{array}$ | $5 \cdot 35$ | $2 \begin{array}{lllllll} & 21 & 4\end{array}$ | $5 \cdot 68$ | $2 \begin{array}{lllllll} & 15 & 53.6\end{array}$ | 6.05 | $2 \begin{array}{lllllll} & 9 & 38 \cdot 3\end{array}$ | 6.49 |
| 32 | $2 \begin{array}{llll}2 & 30 & 55.2 \\ 2 & \end{array}$ | $5 \cdot 01$ | $\begin{array}{llll}2 & 25 & 46 \cdot 2 \\ 2 & 1 & 5\end{array}$ | $5 \cdot 30$ |  | $5 \cdot 63$ | $214430 \cdot 9$ | $6 \cdot 00$ | 2819.1 | 6.43 | $2 \quad 1 \begin{array}{llll} & 1 & 39 \cdot 5\end{array}$ | $6 \cdot 93$ |
| 33 | $\begin{array}{llll}2 & 24 & 17.4 \\ 2 & 17 & 27.8\end{array}$ | 5.25 5.5 | $\begin{array}{lllll}2 & 18 & 53.2 \\ 2 & 15 & 46.5\end{array}$ | 5.57 5.88 | $\begin{array}{llll}2 & 13 & 8.6\end{array}$ | $5 \cdot 94$ | $\begin{array}{lll}2 & 7 & 0 \cdot 3\end{array}$ | $6 \cdot 37$ | $\begin{array}{rrrr}2 & 0 & 24 \cdot 6 \\ 5 & 5 & \end{array}$ | $6 \cdot 87$ | $1 \begin{array}{llll}153 & 16.2\end{array}$ | $7 \cdot 47$ |
| 34 | 21727.8 | $5 \cdot 52$ | 2 II $46 \cdot 5$ | 5.88 | 25410 | $6 \cdot 30$ | 159 1000 | $6 \cdot 80$ | I $52 \quad 5 \cdot 9$ | $7 \cdot 40$ | I 4422.5 | 8-13 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ}$ | $8^{\circ} \mathrm{A}$. | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | s. | s. | S. | s. | s. | s. | S. | S. | S. | s. | s. |
| 0 | -I.66 | $-4 \cdot 78$ | - 1.76 | $-4.82$ | - 1.87 | $-4.86$ | - I.97 | $-4.90$ | $-2.08$ | -4.94 | -2.19 | $-5.00$ |
| 2 | 1•76 | 4.82 | I.86 | $4 \cdot 86$ | I.97 | 4.90 | $2 \cdot 08$ | $4 \cdot 95$ | 2.19 | 4.99 | 2.30 | $5 \cdot 05$ |
| 4 | I.86 | $4 \cdot 86$ | I.97 | $4 \cdot 90$ | $2 \cdot 08$ | $4 \cdot 95$ | $2 \cdot 19$ | 4.99 | $2 \cdot 31$ | $5 \cdot 05$ | 2.43 | 5.10 |
| 6 | I.97 | 4.90 | $2 \cdot 08$ | 4.95 | $2 \cdot 20$ | $5 \cdot 00$ | $2 \cdot 31$ | 5.05 | $2 \cdot 43$ | $5 \cdot \mathrm{II}$ | 2.55 | $5 \cdot 17$ |
| 8 | 2.09 | $4 \cdot 95$ | $2 \cdot 20$ | 5.00 | $2 \cdot 32$ | 5.05 | 2.44 | $5 \cdot 11$ | 2.57 | $5 \cdot 17$ | 2.69 | $5 \cdot 24$ |
| 10 | $2 \cdot 21$ | 5.00 | $2 \cdot 33$ | $5 \cdot 06$ | 2.45 | 5•12 | $2 \cdot 58$ | 5.18 | 2.71 | 5-25 | $2 \cdot 84$ | 5.32 |
| 11 | $2 \cdot 28$ | $5 \cdot 03$ | 2.40 | $5 \cdot 09$ | $2 \cdot 52$ | 5.15 | 2.65 | $5 \cdot 21$ | $2 \cdot 79$ | $5 \cdot 28$ | 2.92 | $5 \cdot 36$ |
| 12 | $2 \cdot 34$ | $5 \cdot 06$ | 2.47 | 5.12 | $2 \cdot 60$ | 5.19 | $2 \cdot 73$ | $5 \cdot 25$ | $2 \cdot 87$ | $5 \cdot 33$ | $3 \cdot 1$ | $5 \cdot 40$ |
| 13 | 2.41 | 5•10 | 2.54 | 5•16 | $2 \cdot 67$ | 5.23 | 2.81 | $5 \cdot 30$ | 2.95 | $5 \cdot 37$ | $3 \cdot 10$ | $5 \cdot 45$ |
| 14 | 2.49 | 5.13 | $2 \cdot 62$ | $5 \cdot 20$ | $2 \cdot 75$ | $5 \cdot 27$ | 2.89 | $5 \cdot 34$ | 3.04 | $5 \cdot 42$ | 3•19 | $5 \cdot 51$ |
| 15 | $2 \cdot 56$ | 5.17 | $2 \cdot 70$ | $5 \cdot 24$ | $2 \cdot 84$ | $5 \cdot 31$ | 2.98 | 5.39 | $3 \cdot 13$ | $5 \cdot 47$ | 3.29 | $5 \cdot 56$ |
| 18. | $2 \cdot 64$ | $5 \cdot 21$ | $2 \cdot 78$ | $5 \cdot 28$ | 2.92 | $5 \cdot 36$ | 3.07 | $5 \cdot 44$ | $3 \cdot 23$ | $5 \cdot 53$ | 3.39 | $5 \cdot 62$ |
| 17 | $2 \cdot 72$ | $5 \cdot 25$ | $2 \cdot 87$ | $5 \cdot 33$ | $3 \cdot \mathrm{I}$ | 5.41 | $3 \cdot 17$ | $5 \cdot 49$ | $3 \cdot 33$ | 5.59 | 3.50 | $5 \cdot 69$ |
| 18 | $2 \cdot 81$ | 5:29 | 2.96 | $5 \cdot 37$ | $3 \cdot 11$ | $5 \cdot 46$ | 3.27 | $5 \cdot 55$ | 3.44 | $5 \cdot 65$ | $3 \cdot 61$ | $5 \cdot 76$ |
| 19 | $2 \cdot 90$ | $5 \cdot 34$ | 3.05 | 5.43 | 3.21 | $5 \cdot 52$ | $3 \cdot 38$ | $5 \cdot 62$ | $3 \cdot 55$ | $5 \cdot 72$ | 3.73 | $5 \cdot 84$ |
| 20 | $2 \cdot 99$ | $5 \cdot 40$ | $3 \cdot 15$ | $5 \cdot 48$ | $3 \cdot 32$ | $5 \cdot 58$ | 3.49 | $5 \cdot 68$ | 3.67 | $5 \cdot 80$ | $3 \cdot 86$ | 5.92 |
| 21 | 3.09 | $5 \cdot 45$ | $3 \cdot 26$ | $5 \cdot 55$ | 3.43 | $5 \cdot 65$ | $3 \cdot 61$ | $5 \cdot 76$ | $3 \cdot 80$ | $5 \cdot 88$ | $4 \cdot 00$ | $6 \cdot \mathrm{I}$ |
| 22 | $3 \cdot 20$ | $5 \cdot 51$ | $3 \cdot 37$ | $5 \cdot 61$ | $3 \cdot 55$ | $5 \cdot 72$ | 3.74 | $5 \cdot 84$ | $3 \cdot 94$ | $5 \cdot 97$ | $4 \cdot 15$ | $6 \cdot 11$ |
| 23 | 3.31 | $5 \cdot 58$ | 3.49 | $5 \cdot 68$ | 3.68 | 5.80 | 3.87 | $5 \cdot 93$ | $4 \cdot 09$ | $6 \cdot 07$ | $4 \cdot 31$ | 6.23 |
| 24 | 3.43 | $5 \cdot 65$ | $3 \cdot 61$ | $5 \cdot 76$ | $3 \cdot 81$ | $5 \cdot 89$ | 4.02 | $6 \cdot 03$ | $4 \cdot 25$ | 6.18 | 4.49 | $6 \cdot 35$ |
| 25 | $3 \cdot 55$ | $5 \cdot 72$ | 3.75 | $5 \cdot 85$ | 3.96 | $5 \cdot 98$ | 4.18 | $6 \cdot 13$ | 4.42 | $6 \cdot 30$ | $4 \cdot 68$ | $6 \cdot 49$ |
| 26 | 3.69 | $5 \cdot 81$ | 3.89 | $5 \cdot 94$ | 4.12 | $6 \cdot 09$ | $4 \cdot 35$ | $6 \cdot 25$ | 4.61 | $6 \cdot 44$ | 4.89 | $6 \cdot 64$ |
| 27 | 3.83 | 5.90 | 4.05 | 6.05 | 4.29 | $6 \cdot 21$ | $4 \cdot 54$ | $6 \cdot 39$ | 4.82 | $6 \cdot 59$ | $5 \cdot 12$ | $6 \cdot 81$ |
| 28 | $3 \cdot 99$ | $6 \cdot 00$ | $4 \cdot 22$ | $6 \cdot 16$ | 4.47 | $6 \cdot 34$ | 4.75 | $6 \cdot 53$ | 5.05 | $6 \cdot 76$ | $5 \cdot 38$ | $7 \cdot 01$ |
| 29 | $4 \cdot 16$ | $6 \cdot 12$ | 4.41 | $6 \cdot 29$ | $4 \cdot 68$ | $6 \cdot 48$ | 4.98 | $6 \cdot 70$ | $5 \cdot 31$ | $6 \cdot 95$ | $5 \cdot 67$ | $7 \cdot 23$ |
| 30 | $4 \cdot 34$ | $6 \cdot 24$ | 4.61 | $6 \cdot 43$ | 4.91 | $6 \cdot 65$ | $5 \cdot 23$ | $6 \cdot 89$ | $5 \cdot 60$ | 7•17 | $6 \cdot 01$ | $7 \cdot 50$ |
| 31 | 4.54 | $6 \cdot 38$ | $4 \cdot 83$ | $6 \cdot 60$ | $5 \cdot 16$ | $6 \cdot 84$ | $5 \cdot 52$ | $7 \cdot 11$ | $5 \cdot 93$ | $7 \cdot 43$ | $6 \cdot 39$ | $7 \cdot 81$ |
| 32 | $4 \cdot 76$ | $6 \cdot 54$ | $5 \cdot 09$ | $6 \cdot 78$ | $5 \cdot 44$ | 7.05 | $5 \cdot 85$ | 7.37 | $6 \cdot 31$ | $7 \cdot 74$ | $6 \cdot 84$ | 8.18 |
| 33 | 5.01 | $6 \cdot 73$ | $5 \cdot 37$ | 7700 | $5 \cdot 76$ | 7.31 | 6.22 | 7.67 | $6 \cdot 75$ | 8.11 | $7 \cdot 37$ | $8 \cdot 64$ |
| 34 | $5 \cdot 29$ | $6 \cdot 94$ | $5 \cdot 69$ | $7 \cdot 24$ | 6.14 | $7 \cdot 60$ | $6 \cdot 65$ | $8 \cdot 04$ | $7 \cdot 25$ | $8 \cdot 57$ | $7 \times 8$ | $0 \cdot 22$ |

## LATITUDE $28^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $0^{\circ}$ | Decl. Var. | $1^{\circ}$ | Decl. Var. | $2{ }^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. <br> Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S | S. | H. M. | S. | H. M. | S. | . M. | S. | H. M. | s. | . s . | S. |
|  | $6 \quad 0 \quad 000$ | $-2.13$ | 55752.4 | -2.I3 | $55544 \times 7$ | -2.13 | $55336 \cdot 8$ | -2.13 | $55128 \cdot 6$ | $-2 \cdot 14$ | 54920.1 | -2.15 |
| 6 | $\begin{array}{llll}5 & 32 & 48 \cdot 2\end{array}$ | $2 \cdot 14$ | 53039.4 | $2 \cdot 15$ | $\begin{array}{llll}5 & 28 & 29 \cdot 8\end{array}$ | $2 \cdot 17$ | $\begin{array}{lllll}5 & 26 & 19 & 4\end{array}$ | $2 \cdot 18$ | $\begin{array}{lll}5 & 24 & 8 \cdot 0\end{array}$ | $2 \cdot 20$ | $52185 \%$ | 2.21 |
| 8 | $\begin{array}{llll}5 & 23 & 43.5\end{array}$ | $2 \cdot 15$ | $5 \begin{array}{llll}5 & 21 & 33 \cdot 8\end{array}$ | $2 \cdot 17$ | $\begin{array}{lll}5 & 19 & 23 \cdot 2\end{array}$ | $2 \cdot 19$ | 517811.5 | $2 \cdot 20$ | $\begin{array}{llll}5 & 14 & 58.6\end{array}$ | $2 \cdot 22$ | 5 I2 44.5 | 2.25 |
| 10 | $\begin{array}{llllllllll}5 & 14 & 37 * 9\end{array}$ | $2 \cdot 17$ | $\begin{array}{llll}5 & 12 & 27 \cdot 1\end{array}$ | $2 \cdot 19$ | 5 10 $15 \cdot 3$ | $2 \cdot 21$ | $\begin{array}{lrrr}5 & 8 & 2 \cdot 1\end{array}$ | $2 \cdot 23$ | $\begin{array}{llll}5 & 5 & 47 \cdot 5\end{array}$ | $2 \cdot 26$ | $5 \quad 3 \quad 3 \mathrm{I} 4$ | $2 \cdot 28$ |
| 12 | $5 \quad 5 \quad 3 I \cdot 3$ | $2 \cdot 19$ | $\begin{array}{llll}5 & 3 & 19.3\end{array}$ | 2.21 | $5 \quad 15$ | $2 \cdot 24$ | $4585 \mathrm{~F} \cdot \mathrm{O}$ | $2 \cdot 26$ | $45634 * 4$ | $2 \cdot 29$ | 454 I6.I | $2 \cdot 32$ |
| 14 | $45623 \cdot 5$ | $2 \cdot 21$ | 454 10*0 | $2 \cdot 24$ | 45 I 54.9 | $2 \cdot 27$ | $44938 \cdot 0$ | $2 \cdot 30$ | 447 I9.I | $2 \cdot 33$ | $444 \quad 58 \cdot 3$ | $2 \cdot 36$ |
| 16 | 4474.3 | $2 \cdot 24$ | $44459{ }^{\circ} 0$ | $2 \cdot 27$ | $4424 r \cdot 8$ | $2 \cdot 30$ | $44022 \cdot 6$ | $2 \cdot 34$ | 438 1.3 | $2 \cdot 37$ | $435 \quad 37 \cdot 6$ | $2 \cdot 41$ |
| 18 | $\begin{array}{rrrr}4 & 38 & 3 \cdot 3\end{array}$ | 2.27 | $43546 \cdot 0$ | $2 \cdot 31$ | $433 \begin{array}{llll}4 & 36 \cdot 5\end{array}$ | $2 \cdot 34$ | $4 \begin{array}{lll}4 & 31 & 4 \cdot 8 \\ 4 & 26 & \end{array}$ | $2 \cdot 38$ | $\begin{array}{llll}4 & 28 & 40 \cdot 5\end{array}$ | 2.43 | 42613.6 | 2.47 |
| 19 | $\begin{array}{llll}4 & 33 & 27 \cdot 1\end{array}$ | $2 \cdot 29$ | 43158 | $2 \cdot 33$ | $\begin{array}{lllll}4 & 28 & 47 * 9\end{array}$ | $2 \cdot 37$ | $\begin{array}{lllll}4 & 26 & 24 \cdot 7\end{array}$ | 2.41 | $\begin{array}{llll}4 & 23 & 58 \cdot 9\end{array}$ | $2 \cdot 45$ | $42130 \cdot 3$ | $2 \cdot 50$ |
| 20 | $428 \quad 50 \cdot 3$ | $2 \cdot 31$ | $42630 \cdot 7$ | $2 \cdot 35$ | $\begin{array}{llll}4 & 24 & 8 \cdot 6\end{array}$ | $2 \cdot 39$ | 4 2I 43.9 | $2 \cdot 43$ | 4 I9 16.4 | $2 \cdot 48$ | 4 I6 46.0 | $2 \cdot 53$ |
| 21 | 424 12.9 | $2 \cdot 33$ | $42152 \cdot 0$ | $2 \cdot 37$ | $41928 \cdot 5$ | 2.41 | 4 I7 2.2 | $2 \cdot 46$ | $\begin{array}{llll}4 & 14 & 33 \cdot 0\end{array}$ | $2 \cdot 51$ | 4120.7 | $2 \cdot 57$ |
| 22 | 4 I9 35*0 | $2 \cdot 35$ | 4 17 12.7 | $2 \cdot 39$ | $41447 \cdot 7$ | $2 \cdot 44$ | 4121907 | $2 \cdot 49$ | $4 \begin{array}{llll}4 & 9 & 48 \cdot 6\end{array}$ | $2 \cdot 55$ | 4714.2 | $2 \cdot 60$ |
| 23 | $41456 \cdot 3$ | $2 \cdot 37$ | $4 \begin{array}{llll}4 & 12 & 32 \cdot 6\end{array}$ | $2 \cdot 42$ | 4 Io $5 \cdot 9$ | $2 \cdot 47$ | $4736 \cdot 1$ | $2 \cdot 52$ | $\begin{array}{llll}4 & 5 & 3 \cdot 1\end{array}$ | $2 \cdot 58$ | $\begin{array}{llll}4 & 2 & 26 \cdot 6\end{array}$ | $2 \cdot 64$ |
| 24 | $41016 \cdot 9$ | $2 \cdot 40$ | $4 \begin{array}{llll}4 & 7 & 5 \cdot 6\end{array}$ | $2 \cdot 45$ | $\begin{array}{llll}4 & 5 & 23 \cdot 2\end{array}$ | $2 \cdot 50$ | $\begin{array}{lrrr}4 & 2 & 5 I \cdot 6\end{array}$ | $2 \cdot 56$ | $4 \quad 0016.4$ | $2 \cdot 62$ | $35737 \%$ | $2 \cdot 68$ |
| 25 | $4 \quad 5 \quad 36 \cdot 8$ | $2 \cdot 42$ | $\begin{array}{llll}4 & 3 & 9 \cdot 8\end{array}$ | $2 \cdot 48$ | 4 - $39 \cdot 6$ | 2.53 | $\begin{array}{llll}3 & 58 & 5 \cdot 9\end{array}$ | 2.59 | $\begin{array}{llll}3 & 55 & 28 \cdot 6\end{array}$ | $2 \cdot 65$ | $3515247 \cdot 4$ | $2 \cdot 72$ |
| 26 | 4 0 $55 *$ <br> 3 56  | 2.45 | $\begin{array}{llll}3 & 58 & 27 \cdot 0\end{array}$ | 2.51 | $\begin{array}{llll}3 & 55 & 54.9\end{array}$ | 2.57 | $3{ }^{3} 5319.1$ | 2.63 | 35039.4 | $2 \cdot 69$ | $34755{ }^{\prime} 7$ | 2.76 |
| 27 | $\begin{array}{llll}3 & 56 & 13 \cdot 8\end{array}$ | $2 \cdot 48$ | $\begin{array}{llll}3 & 53 & 43.3\end{array}$ | $2 \cdot 54$ | $35^{3} 5199$ | $2 \cdot 60$ | $34831 \cdot 0$ | $2 \cdot 67$ | $34548 \cdot 9$ | $2 \cdot 74$ | 34312.4 | $2 \cdot 81$ |
| 28 | $35 \mathrm{I} 3 \mathrm{I} \cdot \mathrm{O}$ | $2 \cdot 51$ | $\begin{array}{llll}3 & 48 & 58 \cdot 4\end{array}$ | 2.57 | $3 \begin{array}{llll}3 & 46 & 22 \cdot 0\end{array}$ | $2 \cdot 64$ | 343 4I•6 | $2 \cdot 71$ | $34056 \cdot 8$ | $2 \cdot 78$ | $\begin{array}{llll}3 & 38 & 7 \cdot 5\end{array}$ | 2.86 |
| 29 | $34647 * 0$ | $2 \cdot 54$ |  | $2 \cdot 61$ | 34133.7 | $2 \cdot 68$ |  | $2 \cdot 75$ | 336 | $2 \cdot 83$ | 33.310 .8 | $2 \cdot 91$ |
| 30 | 34220 | $2 \cdot 58$ | $\begin{array}{llll}3 & 39 & 25 \cdot 1\end{array}$ | 2.65 | $33^{3} 643.9$ | $2 \cdot 72$ | $3 \begin{array}{llll}3 & 33 & 58 \cdot 2\end{array}$ | $2 \cdot 80$ | 3 31 7 7•7 | $2 \cdot 88$ | $3 \begin{array}{lllll} & 28 & 12 \cdot I\end{array}$ | $2 \cdot 97$ |
| 31 | $\begin{array}{llll}3 & 37 & 15.8\end{array}$ | 2.62 | $313436 \cdot 5$ | $2 \cdot 69$ | 33152.7 | 2.77 | 3 29 4 <br> 1   | 2.85 | 32610.4 | $2 \cdot 94$ | 323 II•4 | 3.03 |
| 32 | $\begin{array}{llll}3 & 32 & 28 \cdot 3\end{array}$ | $2 \cdot 66$ | $\begin{array}{llll}3 & 29 & 46 \cdot 4 \\ 3 & 24 & 54.8\end{array}$ | $2 \cdot 74$ | 3 26 $59 \cdot 8$ | $2 \cdot 82$ | $\begin{array}{llll}3 & 24 & 8 \cdot 1\end{array}$ | 2.91 | 3 II II'I | $3 \cdot 00$ | $\begin{array}{llll}3 & 18 & 8 \cdot 4\end{array}$ | 3.09 |
| 33 | $\begin{array}{llll}3 & 27 & 39 \cdot 4 \\ 3 & 22 & \end{array}$ | 2.70 | $\begin{array}{llll}3 & 24 & 54 \cdot 8 \\ 3 & 20 & \end{array}$ | $2 \cdot 78$ | $\begin{array}{lll}3 & 22 & 5 \cdot 2 \\ 3 & 17 & 8.7\end{array}$ | 2.87 | $\begin{array}{lll}3 & 19 & 10 \cdot 3\end{array}$ | 2.96 | $\begin{array}{llll}3 & 16 & 9 \cdot 7 \\ 3\end{array}$ | 3.06 | $3 \begin{array}{llll}3 & 13 & 3 \cdot 0\end{array}$ | $3 \cdot 16$ |
| 34 | $\begin{array}{llll}3 & 22 & 49^{\circ} \\ 3 & 17 & 5\end{array}$ | $2 \cdot 75$ | $\begin{array}{lll}3 & 20 & 1.5 \\ 3 & 15 & 6 \cdot 4\end{array}$ | $2 \cdot 84$ | $\begin{array}{llll}3 & 17 & 8 \cdot 7 \\ 3 & \text { 12 } & \end{array}$ | 2.93 | $\begin{array}{llll}3 & 14 & 10 \cdot 3\end{array}$ | 3.02 | $\begin{array}{llrr}3 & 11 & 5 \cdot 8 \\ 3 & 5 & 59 \cdot 5\end{array}$ | $3 \cdot 13$ |  | $3 \cdot 24$ |
| 35 | 3 I7 57*0 | $2 \cdot 80$ | $\begin{array}{llll}3 & 15 & 6 \cdot 4\end{array}$ | $2 \cdot 89$ | 3 I2 10*2 | $2 \cdot 99$ | $3 \begin{array}{lll}3 & 9 & 8 \cdot 0\end{array}$ | 3.09 | 355159.5 | $3 \cdot 20$ | $3244^{\prime} \mathrm{I}$ | $3 \cdot 32$ |
| 36 | $\begin{array}{lll}3 & 13 & 3 \cdot 2\end{array}$ | $2 \cdot 85$ | 31080 | 2.95 | $\begin{array}{lll}3 & 7 & 9 \cdot 5\end{array}$ | 3.05 | $\begin{array}{llll}3 & 4 & 3 & 3\end{array}$ | 3.16 | $3 \quad 050 \cdot 3$ | $3 \cdot 28$ | $25730 \cdot 2$ | 3.40 |
| 37 | $\begin{array}{llll}3 & 8 & 7 \cdot 5 \\ 3 & 3 & 0.8\end{array}$ | 2.91 | 3 5 $10 \cdot 1$ | 3.01 | 3 2 $6 \cdot 3$ <br> 2 5 $0 \cdot 6$ | $3 \cdot 12$ | $\begin{array}{llll}2 & 58 & 55 \cdot 8 \\ 2 & 53 & 45 \cdot 5\end{array}$ | 3.23 | $255138 \cdot 1$ | $3 \cdot 36$ | $\begin{array}{llll}2 & 52 & 12.8 \\ 2 & 4 & 5\end{array}$ | 3.49 |
| 38 | $\begin{array}{rrrr}3 & 3 & 9 \cdot 8 \\ 2 & 58 & 9 \cdot 8\end{array}$ | 2.97 | $\begin{array}{ccc}3 & 0 & 8 \cdot 5 \\ 2 & 55 & 4.5\end{array}$ | 3.08 | $\begin{array}{llr}2 & 57 & 0.6 \\ 2 & 51 & 52.0\end{array}$ | $3 \cdot 19$ | $\begin{array}{llllllllllll}2 & 53 & 45 \cdot 5 \\ 2 & 48 & 31.8\end{array}$ | $3 \cdot 32$ | $\begin{array}{llll}2 & 50 & 22.6 \\ 2 & 45 & 3.5\end{array}$ | 3.45 | $2 \mathrm{l}_{26} 46 \mathrm{5} \cdot 6$ | $3 \cdot 59$ |
| 39 | $\begin{array}{lll}2 & 58 & 9 \cdot 8 \\ 2 & 5 & 9\end{array}$ | 3.03 | $\begin{array}{llll}2 & 55 & 4 \cdot 5 \\ 2 & 49 & 5\end{array}$ | 3.15 | $2 \begin{array}{lll}2 & 51 & 52 \cdot 0 \\ 2 & 46 & 40 \cdot 2\end{array}$ | 3.27 | 2 48 31.8 | 3.40 | $\begin{array}{llll}2 & 45 & 3 \cdot 5\end{array}$ | $3 \cdot 54$ | 24126.4 | $3 \cdot 70$ |
| 40 | $\begin{array}{lll}2 & 53 & 7 \cdot 4\end{array}$ | $3 \cdot 10$ | $249 \quad 57 \cdot 6$ | $3 \cdot 23$ | $24640 \cdot 2$ | $3 \cdot 36$ | 24314.7 | 3.50 | $23940 \cdot 4$ | $3 \cdot 65$ | $23556 \cdot 6$ | $3 \cdot 8 \mathrm{I}$ |
| 41 | $\begin{array}{lll}2 & 48 & 2 \cdot 3\end{array}$ | 3•18 | $2 \begin{array}{llll}2 & 44 & 47 \cdot 7\end{array}$ | $3 \cdot 31$ | $2 \begin{array}{llll}2 & 41 & 25 \\ \text { I }\end{array}$ | 3.45 | $2 \begin{array}{llll}2 & 37 & 53.6\end{array}$ | $3 \cdot 60$ | $2{ }_{2} 3412.8$ | 3.77 | $23021 \cdot 7$ | $3 \cdot 94$ |
| 42 | 24254.3 | 3.26 | 23934.5 | 3.40 | $23^{2} 366 \cdot 1$ | $3 \cdot 55$ | $232 \begin{array}{llll} & 28 \cdot 3\end{array}$ | 3.71 | $22840 \cdot 3$ | $3 \cdot 89$ | 224 41*2 | 4.08 |
| 43 | $\begin{array}{llll}2 & 37 & 43 \cdot 0 \\ 2 & 32 & 20.1\end{array}$ | 3.35 3.45 | $\begin{array}{llll}2 & 34 & 17.6 \\ 2 & 28 & 56.6\end{array}$ | $3 \cdot 50$ | 2 30 42.9 <br> 2 25  | 3:66 |  | 3.84 | $\begin{array}{llll}2 & 23 & 2 \cdot 3 \\ 2 & 17 & 1\end{array}$ | 4.03 | $\begin{array}{lllll}2 & 18 & 54.4\end{array}$ | $4 \cdot 24$ |
| 44 | $\begin{array}{llll}2 & 3 & 32 & 28 \cdot 1 \\ 2 & 27 & \end{array}$ | 3.45 | 2 $288566 \cdot 6$ | $3 \cdot 6 \mathrm{I}$ | $22515 \cdot 1$ | $3 \cdot 78$ |  |  | $2 \begin{array}{lllll} \\ 2 & 17 & 18 \cdot 0\end{array}$ | $4 \cdot 19$ | $2 \begin{array}{lll}2 & 13 & 0 \cdot 3\end{array}$ | $4 \cdot 42$ |
| 45 | $\left\lvert\, \begin{array}{lll}2 & 27 & 9\end{array}\right.$ | $3 \cdot 55$ | 223 31-1 | $3 \cdot 73$ | $21942.0 \mid$ | 3.92 | $21540 \cdot 9$ | $4 \cdot 13$ | 2 II 26.8 | $4 \cdot 36$ | $2 \begin{array}{llll} & 6 & 58 \cdot I\end{array}$ | $4 \cdot 62$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 0 | A. | L. $1^{\circ}$ | A. | L. $2^{\circ}$ | A. | L. 3 | A. | L. 4 | A. | L. 5 | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | s. | S. | S. | S. | S. | S. | S. | s. | s. | s. |
| 2 | - $\quad .00$ | -4.53 4.53 | $\begin{array}{r}-\quad .09 \\ \hline .17\end{array}$ | -4.53 4.53 | -.18 .26 | -4.53 4.54 | - 27 -35 .34 | -4.53 4.54 | $\begin{array}{r}-.36 \\ -.44 \\ \hline\end{array}$ | -4.54 4.55 | - .45 | -4.55 4.56 4.57 |
| 4 | $\cdot 17$ | $4 \cdot 53$ | -26 | 4.54 | -35 | 4.54 | $\cdot 44$ | 4.55 | - 53 | 4.56 | . 62 | $4 \cdot 57$ |
| 6 | - 25 | $4 \cdot 54$ | -34 | $4 \cdot 54$ | -44 | 4.55 | - 53 | 4.56 | - 62 | 4.57 | $\cdot 71$ | 4.59 |
| 8 | $\cdot 34$ | $4 \cdot 54$ | $\cdot 43$ | 4.55 | -52 | $4 \cdot 56$ | $\cdot 62$ | $4 \cdot 57$ | $\cdot 71$ | $4 \cdot 58$ | -80 | $4 \cdot 60$ |
| 10 | -43 | 4.55 | -52 | $4 \cdot 56$ | -61 | $4 \cdot 57$ | $\cdot 71$ | $4 \cdot 58$ | -80 | $4 \cdot 60$ | -90 | $4 \cdot 62$ |
| 12 | -51 | $4 \cdot 56$ | - 61 | $4 \cdot 57$ | $\cdot 70$ | 4.58 | -80 | $4 \cdot 60$ | -89 | $4 \cdot 62$ | -99 | $4 \cdot 64$ |
| 14 | -60 | $4 \cdot 57$ | $\cdot 70$ | $4 \cdot 58$ | -80 | 4.60 | $\cdot 89$ | 4.62 | -99 | 4.64 | I-09 | $4 \cdot 66$ |
| 16 | $\cdot 70$ | $4 \cdot 58$ | -80 | $4 \cdot 60$ | -89 | $4 \cdot 62$ | -99 | $4 \cdot 64$ | 1.09 | $4 \cdot 66$ | 1.20 | $4 \cdot 69$ |
| 18 | $\cdot 79$ | $4 \cdot 60$ | -89 | $4 \cdot 62$ | -99 | $4 \cdot 64$ | I•IO | $4 \cdot 66$ | 1. 20 | $4 \cdot 69$ | r.30 | $4^{\prime} 72$ |
| 20 | -89 | $4 \cdot 62$ | I.00 | $4 \cdot 64$ | I-10 | $4 \cdot 66$ | r 20 | $4 \cdot 69$ | $1 \cdot 31$ | $4 \cdot 72$ | $1 \cdot 42$ | $4 \cdot 75$ |
| 22 | I.00 | $4 \cdot 64$ | I.10 | $4 \cdot 66$ | 1.21 | $4 \cdot 69$ | $1 \cdot 32$ | $4 \cdot 72$ | $1 \cdot 43$ | $4 \cdot 75$ | r 54 | $4 \cdot 78$ |
| 24 | r'10 | $4 \cdot 66$ | $1 \cdot 21$ | $4 \cdot 69$ | $1 \cdot 32$ | $4 \cdot 72$ | r 43 | $4 \cdot 75$ | $1 \cdot 55$ | 4.79 | 1.66 | $4 \cdot 83$ |
| 26 | $1 \cdot 22$ | $4 \cdot 69$ | $1 \cdot 33$ | $4 \cdot 72$ | 1.44 | $4 \cdot 75$ | I•56 | $4 \cdot 79$ | 1.68 | $4 \cdot 83$ | r.80 | 4.87 |
| 28 | I 33. | $4 \cdot 72$ | 1.45 | $4 \cdot 76$ | $1 \cdot 57$ | $4 \cdot 79$ | 1.69 | $4 \cdot 84$ | 1.82 | $4 \cdot 88$ | $1 \cdot 94$ | $4 \cdot 93$ |
| 30 | r.46 | $4 \cdot 76$ | I. 58 | $4 \cdot 80$ | 1.71 | $4 \cdot 84$ | I. 84 | $4 \cdot 89$ | $1 \cdot 97$ | 4.94 | $2 \cdot 10$ | 4.99 |
| 32 | 1.60 | 4.80 | $1 \cdot 72$ | $4 \cdot 85$ | 1.86 | $4 \cdot 90$ | I•99 | 4.95 | $2 \cdot 13$ | $5 \cdot 1$ | 2.28 | $5 \cdot 07$ |
| 34 | I• 74 | $4 \cdot 85$ | 1.88 | 4.90 | $2 \cdot \mathrm{Or}$ | $4 \cdot 96$ | $2 \cdot 16$ | $5 \cdot 02$ | $2 \cdot 31$ | $5 \cdot 08$ | 2.46 | $5 \cdot 16$ |
| 36 | I.90 | 4.91 | $2 \cdot 04$ | $4 \cdot 97$ | $2 \cdot 19$ | $5 \cdot 03$ | $2 \cdot 35$ | $5 \cdot 10$ | $2 \cdot 51$ | $5 \cdot 18$ | $2 \cdot 68$ | $5 \cdot 26$ |
| 38 | 2.07 | $4 \cdot 98$ | $2 \cdot 22$ | $5 \cdot 05$ | $2 \cdot 38$ | $5 \cdot 12$ | $2 \cdot 55$ | 5.20 | $2 \cdot 73$ | 5.29 | 2.91 | $5 \cdot 39$ |
| 40 | . $2 \cdot 26$ | $5 \cdot 06$ | 2.43 | $5 \cdot 14$ | $2 \cdot 60$ | $5 \cdot 22$ | $2 \cdot 79$ | $5 \cdot 32$ | $2 \cdot 98$ | $5 \cdot 42$ | $3 \cdot 19$ | $5 \cdot 54$ |
| 42 | 2.47 | $5 \cdot 16$ | $2 \cdot 66$ | $5 \cdot 25$ | $2 \cdot 85$ | $5 \cdot 35$ | 3.05 | $5 \cdot 46$ | $3 \cdot 27$ | $5 \cdot 59$ | 3.50 | $5 \cdot 73$ |
| 43 | 2.59 | $5 \cdot 22$ | $2 \cdot 78$ | $5 \cdot 32$ | $2 \cdot 98$ | $5 \cdot 42$ | $3 \cdot 20$ | $5 \cdot 55$ | $3 \cdot 44$ | $5 \cdot 69$ | 3.69 | $5 \cdot 84$ |
| 44 | $2 \cdot 71$ | $5 \cdot 28$ | 2.92 | $5 \cdot 39$ | $3 \cdot 13$ | $5 \cdot 51$ | 3.36 | $5 \cdot 64$ | $3 \cdot 61$ | $5 \cdot 80$ | 3.89 | 5.97 |
| 45 | 2.85 | $5 \cdot 35$ | 3.06 | $5 \cdot 47$ | $3 \cdot 29$ | $5 \cdot 60$ | $3 \cdot 54$ | 5.75 | $3 \cdot 81$ | $5 \cdot 92$ | $4 \cdot 11$ | $6 \cdot 11$ |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 235

LATITUDE $28^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. <br> Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H. M. S. ${ }^{\text {d }}$ | s. |  | S. | н. | S. | н. м. | S. | H. M. S. | s. | H. M. S. | s. |
| 0 | 547 II | $2 \cdot$ | $\begin{array}{lllll}5 & 45 & 1 \\ 5 & 6\end{array}$ | -2.16 | $\begin{array}{lllll}5 & 42 & 51 & 5\end{array}$ | -2 | $54040 \cdot 6$ | $-2 \cdot 19$ | $\begin{array}{lllll}5 & 38 & 28 \cdot 9\end{array}$ | 2.20 |  | 2 |
| 2 | $5{ }_{5} 3883.0$ | 2.18 | $\begin{array}{llll}5 & 35 & 52 \cdot 0 \\ 5 & 26 & 40 \cdot 7\end{array}$ | 2.19 | 55 33 $40 \cdot 1$ <br> 5 2  | 2.21 | $\begin{array}{lllll}5 & 31 & 27 \cdot 2 \\ 5 & 22 & \\ 5\end{array}$ | 2.22 | 5 512913.3 | 2.24 <br> 2.28 | 5 $266158 \cdot 2$ | $\cdot 26$ |
| 4 | 52853.4 | $2 \cdot 20$ | $\begin{array}{llll}5 & 26 & 40 \cdot 7\end{array}$ | $2 \cdot 22$ | $\begin{array}{llll}5 & 24 & 26 \cdot 8\end{array}$ | 2.24 | $\begin{array}{llll}5 & 22 & 11 \cdot 8\end{array}$ | $2 \cdot 26$ | $5 \begin{array}{lllll}5 & 19 & 55.4\end{array}$ | $2 \cdot 28$ |  | $2 \cdot 31$ |
| 6 | 5 I9 42.2 | 23 | 51727.5 | 2.26 | 51511.4 | $2 \cdot 28$ | $5 \quad 1253.9$ | $2 \cdot 30$ | 5 10 34.8 | 33 | 5814.0 | 2.36 |
| 8 | 5 10 29.1 | 27 | $\begin{array}{llll}5 & 8 & \text { I2.1 }\end{array}$ | 30 | $5 \quad 5 \quad 53 \cdot 6$ | $2 \cdot 32$ | $5 \quad 3 \quad 33 \cdot 3$ | $2 \cdot 3$ | 5 I IIP3 | $2 \cdot 38$ | $45847 \cdot 2$ | 2.42 |
| 10 |  | 2.31 2.35 | $\begin{array}{lllll}4 & 58 & 54.3 \\ 4 & 49 & 33 \cdot 7\end{array}$ | 2.39 | $45633 \cdot 0$ | $2 \cdot 42$ | 4 54 $9 \cdot 7$ <br> 4 44  <br> 2.8   | $2 \cdot$ | $\begin{array}{llll}4 & 51 & 44.4 \\ 4 & 42\end{array}$ | 2.44 | $\begin{array}{llll}4 & 49 & 16.8 \\ 4 & 39 & 42.2\end{array}$ | 48 |
| 12 | 45155.9 | $2 \cdot 35$ | 44933.7 | $2 \cdot 39$ | 4479.4 | $2 \cdot 42$ | 444 42.8 | $2 \cdot 46$ | $4 \begin{array}{llll}42 & 13\end{array}$ | $2 \cdot 50$ | $43942 \cdot 2$ | 2.55 |
| 14 | 44235.3 | $2 \cdot 40$ | 440 10.0 | 2.44 | $\begin{array}{lllll}4 & 37 & 42 \cdot 3\end{array}$ | 2.48 | $43512 \cdot 0$ | 2.53 | $43239^{\circ} 0$ | $2 \cdot 57$ | $\begin{array}{llll}4 & 30 & 3 \cdot 1 \\ 4 & 25 & 1\end{array}$ | 62 |
| 15 | $\begin{array}{lllll}4 & 37 & 53.8 \\ 4\end{array}$ | 2.43 | $\begin{array}{llll}4 & 35 & 26 \cdot 8\end{array}$ | 2.47 | $1 \begin{array}{lllll}4 & 32 & 57 \cdot 3\end{array}$ | $2 \cdot 5$ | $43025 \cdot 1$  <br> 4 25 | 2. | $\begin{array}{llll}4 & 27 & 49 \\ 4 & 2 \\ 4\end{array}$ | 2.61 2.65 | $\begin{array}{llll}4 & 25 & 11.6 \\ 4 & 20 & 18.8\end{array}$ | 66 |
| 16 | 433 II 5 | $2 \cdot 46$ | $43042 \cdot 7$ | 50 | 428 Ir 3 | $2 \cdot 55$ | $42537 \cdot 0$ | 2. | $42259 \cdot 6$ | $2 \cdot 65$ | 42018.8 | $2 \cdot 71$ |
| 17 | 42828.2 | 49 | $42557 \cdot 7$ | 2.53 | 42324.2 | 2.58 | $42047 \cdot 7$ | 2.64 | $\begin{array}{llll}4 & 18 & 7.9\end{array}$ | 2.69 | $4 \begin{array}{llll}4 & 15 & 24.6\end{array}$ | 2.75 |
| 18 | 42344.0 | $2 \cdot 52$ | 42111.5 | $2 \cdot 57$ | $4{ }^{18} 36 \cdot 0$ | $2 \cdot 62$ | 415 57.1 | $2 \cdot 68$ | $\begin{array}{llll}4 & 13 & 14.8\end{array}$ | $2 \cdot 74$ | 4 10 28.8 | 2.80 |
| 19 | $4 \begin{array}{llll}4 & 18 & 58\end{array}$ | $2 \cdot 55$ | $\begin{array}{llll}4 & 16 & 24.3\end{array}$ | $2 \cdot 60$ |  | 2.66 | 4 II 5.2 | 2.7 | $4820 \cdot 2$ | 2.78 | $4 \quad 5 \quad 31.4$ | 2.85 |
| 20 |  | $2 \cdot 58$ | 4 II $35 \cdot 8$ | 4 | $\begin{array}{llll}4 & 8 & 55 \cdot 6\end{array}$ | $2 \cdot 70$ | $4 \quad 6 \mathrm{Ir} 8$ | 6 | $\begin{array}{llll}4 & 3 & 24 \cdot 1 \\ 3 & 5\end{array}$ | 3 | $\begin{array}{rrrr}4 & 0 & 32\end{array}$ | 2.90 |
| 21 | $4 \quad 925 \cdot 1$ | 62 | $4 \quad 646 \cdot 1$ | $2 \cdot 68$ | $\begin{array}{llll}4 & 4 & 3.4\end{array}$ | $2 \cdot 74$ | $4 \begin{array}{llll}4 & 1 & 16.9\end{array}$ | $2 \cdot 81$ | $\begin{array}{llll}3 & 58 & 26 \cdot 2\end{array}$ | $2 \cdot 88$ | $35531 \cdot 3$ | $2 \cdot 95$ |
| 22 | $\begin{array}{lll}4 & 4 & 36 \cdot 4\end{array}$ | $2 \cdot 66$ | 4 I 55*0 | 2 | $3 \begin{array}{lll}3 & 59 & 9.7\end{array}$ | $2 \cdot 79$ | $\begin{array}{llll}3 & 56 & 20 \cdot 3\end{array}$ | 86 | $35326 \cdot 6$ | $2 \cdot 93$ | $35028 \cdot 3$ | 3.01 |
| 23 | $35946 \cdot 5$ | $2 \cdot 70$ | $\begin{array}{lll}3 & 57 & 2.4\end{array}$ | $2 \cdot$ |  | $2 \cdot 84$ | $35122 \cdot 0$ | 2.91 | $34^{3} 25^{\circ} 0$ | $2 \cdot 99$ | $\begin{array}{lllllllllllllll}3 & 45 & 23.2\end{array}$ | $3 \cdot 07$ |
| 24 | $35455 \cdot 1$ | $2 \cdot 74$ | $\begin{array}{llll}3 & 52 & 8.4\end{array}$ | 2.81 | $\begin{array}{llllll}3 & 49 & 17 \cdot 4 \\ 3\end{array}$ | $2 \cdot 89$ | $34621 \cdot 8$ | $2 \cdot 9$ | $\begin{array}{llllll}3 & 43 & 21.4\end{array}$ | 3.05 | 34015.8 | $3 \cdot 14$ |
| 25 | $\begin{array}{lll}3 & 50 & 2 \cdot 2\end{array}$ | 2.79 2.8 |  | 2.86 | $\begin{array}{lllll}3 & 44 & 18.5 \\ 3 & 30 & 17.7\end{array}$ | $2 \cdot 94$ | $\begin{array}{lllllllllll}3 & 41 & 19.6\end{array}$ | 3.02 |  | $3 \cdot 11$ | $\begin{array}{llll}3 & 35 & 6 \cdot 0 \\ 3 & 20 & 53.6\end{array}$ | 3.21 3.28 |
| 26 | $345 \quad 7 \cdot 7$ | 2.84 | $\begin{array}{lllllllllll} & 42 & 15 \cdot 1\end{array}$ | 2.92 |  | $3 \cdot 00$ | $3 \begin{array}{llll} & 36 & 15.2\end{array}$ | 3.09 | $\begin{array}{llll}3 & 33 & 7 \cdot 3\end{array}$ | $3 \cdot 18$ | $\begin{array}{llll}3 & 29 & 53\end{array}$ | 28 |
| 27 | 340 II•5 | $2 \cdot 89$ | $\begin{array}{lllll}3 & 37 & 15 \cdot 7\end{array}$ | $2 \cdot 97$ |  | 3.06 | $\begin{array}{llll}3 & 31 & 8.5\end{array}$ | 3.15 | $\begin{array}{llll}3 & 27 & 56 \cdot 5\end{array}$ | 3.25 | $\begin{array}{llll}3 & 24 & 38 \cdot 3\end{array}$ | $3 \cdot 36$ |
| 28 |  | $2 \cdot 94$ | 33214.2 | 3.03 | $\begin{array}{llll}3 & 29 & 9 \cdot 7\end{array}$ | $3 \cdot 12$ | $\begin{array}{llll}3 & 25 & 59\end{array}$ | $3 \cdot 22$ | 32242.9 | 3.33 | $\begin{array}{llll}3 & 19 & 19.9\end{array}$ | $3 \cdot 44$ |
| 29 | 33013.4 | $3 \cdot 00$ | $\begin{array}{lllllllllll}3 & 27 & 10 \cdot 6\end{array}$ | 3.09 | $\begin{array}{llll}3 & 24 & 2 \cdot 1 \\ 3 & 18\end{array}$ | $3 \cdot 19$ | $\begin{array}{llll}3 & 20 & 47 \cdot 5\end{array}$ | $3 \cdot 3$ |  | 3.41 | $\begin{array}{llllll}3 & 13 & 58.3\end{array}$ | 3.53 |
| 30 | $325 \mathrm{II} \cdot 2$ | 3.0 | $\begin{array}{llll}3 & 22 & 4.5\end{array}$ | 3 |  | 3 |  | 3 | $\begin{array}{llll}3 & 12 & 6 \cdot 6\end{array}$ | 3.50 | $\begin{array}{llll}3 & 8 & 33 \cdot 1\end{array}$ | 3.62 |
| 31 | 32067 | $3 \cdot 13$ | 31655.9 | 23 |  | $3 \cdot 3$ | 31014.7 | $3 \cdot$ | $\begin{array}{llll}3 & 6 & 43.2\end{array}$ | $3 \cdot 59$ | $\begin{array}{llll}3 & 3 & 3.9\end{array}$ | $\cdot 73$ |
| 32 | 31459.7 | 3.20 | $3 \mathrm{II} 44 \cdot 6$ | 3.31 | $\begin{array}{llll}3 & 8 & 22.6\end{array}$ | 3.43 | $\begin{array}{lllll}3 & 4 & 53.3\end{array}$ | 3.55 | 3 1 $16 \cdot 1$ | $3 \cdot 69$ | $2 \begin{array}{llll}2 & 57 & 30 \cdot 4\end{array}$ | $3 \cdot 84$ |
| 33 | $\begin{array}{llll}3 & 9 & 50 \cdot 0\end{array}$ | 3.27 | $\begin{array}{llll}3 & 6 & 30 \cdot 2\end{array}$ | 3.39 | 3 3 $3 \cdot 1$ <br>  5 3 | 3.52 | 2 59 $28 \cdot 1$ <br> 2 53  | $3 \cdot 65$ |  | 3.80 | 25152.2 | 3.96 |
| 34 | $\begin{array}{lllll}3 & 4 & 37 *\end{array}$ | $3 \cdot 35$ | $\begin{array}{llll}3 & 1 & 12.5 \\ 2 & 5 & 5\end{array}$ | 48 | $1 \begin{array}{llll}2 & 57 & 398 \\ 2 & 5\end{array}$ | $3 \cdot 61$ | $25358 \cdot 8$ | 3.8 | $\begin{array}{lll}2 & 50 & 8 \cdot 7\end{array}$ | $3 \cdot 92$ | $\begin{array}{llll}2 & 46 & 8 \cdot 8 \\ 2 & 40\end{array}$ | 4.09 |
| 35 | $25921 \cdot 6$ | 3.44 | $\begin{array}{llllllll}2 & 55 & 51 \\ 2 & 5 & 3\end{array}$ | 3.57 3.68 | $\begin{array}{lllll}2 & 52 & 12 \cdot 6 \\ 2 & 46 & 12\end{array}$ | 3.72 3.83 | $24825{ }^{\circ}$ | $3 \cdot 87$ |  | 4.04 | 2 40 19.6 <br> 2 34  <br> 10   | 4.23 |
| 36 | $2{ }^{2} 54 \quad 2 \cdot 3$ | 3.53 | $25026 \cdot 1$ | 3.68 | $2464{ }^{1} \cdot 0$ | 3.83 | $24246 \cdot 2$ | 4.00 | $23840 \cdot 8$ | 4.19 | $\begin{array}{llll}2 & 34 & 23.9\end{array}$ | 4.39 |
| 37 | $24^{4} 839 \cdot \mathrm{I}$ | 3.63 |  | $3 \cdot 79$ | $\begin{array}{lll}2 & 41 & 4.5 \\ 2 & \end{array}$ | 3.96 | $\begin{array}{lll}2 & 37 & \mathrm{I} \cdot 8 \\ 2\end{array}$ | $4 \cdot 14$ | $\begin{array}{lllll}2 & 32 & 47.8 \\ 2\end{array}$ | 4.34 | $22821 \cdot \mathrm{r}$ | 4.56 |
| 38 | $\begin{array}{lllll}2 & 43 & 19 & 8 \\ 2\end{array}$ | 3. 86 | $\begin{array}{lllll}2 & 39 & 22.3\end{array}$ | 3.91 | $\begin{array}{llll}2 & 35 & 22.5\end{array}$ | 4.09 | $\begin{array}{llll}2 & 31 & 11.3 \\ 2 & 5\end{array}$ | $4 \cdot 29$ |  | $4 \cdot 51$ | $\begin{array}{llll}2 & 28 & 10.2 \\ 2 & 10 & 50 \cdot 0\end{array}$ | 4.76 |
| 39 | 2 37 $39^{\circ} 7$ | $3 \cdot 86$ |  | 4.04 | $\begin{array}{llll}2 & 29 & 34.5 \\ 2 & 23 & 30.7\end{array}$ | 4.24 | $\begin{array}{lllll}2 & 25 & 13.8 \\ 2 & 19 & 8.6\end{array}$ | 4.46 | $\begin{array}{lllll}2 & 20 & 39 \cdot 6\end{array}$ | $4 \cdot 70$ | $\begin{array}{lllll}2 & 15 & 50 \cdot 0\end{array}$ | 4.97 |
| 40 | $\begin{array}{llll}2 & 32 & 2 \cdot 6\end{array}$ | 3.99 | 22757.3 | 4.19 | 22339.7 | 4.4 I | $2 \begin{array}{lll}2 & 19 & 8.6\end{array}$ | . | $\begin{array}{lllll}2 & 14 & 22.4 \\ 2 & 7 & \end{array}$ | $4 \cdot 91$ | $\begin{array}{lll}2 & 9 & 19.2\end{array}$ | 5.21 |
| 41 | 126619.5 | 4.14 | 225.0 | 4.35 | 21737.3 | 4.59 | 21254.4 | $4 \cdot 85$ | $2754{ }^{\circ}$ | $5 \cdot 1$ | 236 | $5 \cdot 49$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ}$ | A. | L. ryo A. |  | L. $8^{\circ}$ | - A. | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. 12 | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. S. |  | $\begin{array}{cc} \text { s. } & \mathrm{s} \\ -.63 & -4.57 \end{array}$ |  | S. S. |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ -.82 & -4.60 \end{array}$ |  | s. S. |  | S. | s. |
| 0 | -. 54 | $-4.56$ |  |  | - .72-4.59 |  |  |  | - .91-4.62 |  | -I.00 -4.64 |  |
| 2 | -63 | $4 \cdot 57$ | $\cdot 72$ | 4.59 | -81 4.60 |  | .90 4.62 |  | r -00 4.64 |  | I.09 4.66 |  |
| 4 | -71 | $4 \cdot 59$ | -81 | $4 \cdot 60$ | -90 4.62 |  | $1.00 \quad 4.64$ |  | -09 | $4 \cdot 66$ | I'r9 4.68 |  |
| 6 | -80 | $4 \cdot 60$ | $\cdot 90$ | $4 \cdot 62$ | $\begin{array}{rr} .99 & 4.64 \\ \mathrm{r} \cdot 09 & 4.66 \end{array}$ |  | I*OG 4.66 |  | $\begin{array}{ll}\text { r.19 } & 4.68\end{array}$ | $4 \cdot 68$ | 1.29 | $4 \cdot 71$ |
| 8 | -90 | $4 \cdot 62$ | -99 | $4 \cdot 64$ |  |  | $1 \cdot 194.68$ |  | I.29 4.71 |  | $1.394 * 74$ |  |
| 10 | -99 | $4 \cdot 64$ | 1.09 | $4 \cdot 66$ | r.19 4.68 |  | I.29 4.71 |  | $1.39 \quad 4.74$ |  | 1*49 4*77 |  |
| 12 | r.09 | $4 \cdot 66$ | I-19 | $4 \cdot 68$ | 1.29 4.71 |  | 1.39 4.74 |  | r.50 4.77 |  | I.6I 4.81 |  |
| 14 | I-19 | $4 \cdot 69$ | 1-30 | $4 \cdot 71$ | I-40 4.74 |  | 1504.77 |  | $\underline{169} 4.8 \mathrm{I}$ |  | $1 \cdot 724.85$ |  |
| 16 | I. 30 | 4.71 | 1.40 | $4 \cdot 74$ | 1.514 .78 |  | 1.62 4.81 |  | $\begin{array}{ll}1.73 & 4.85 \\ 1.86 & 4.90\end{array}$ |  | $1.85 \quad 4.89$ |  |
| 18 | I.4I | $4 \cdot 74$ | 1.52 | $4 \cdot 78$ | 1.63 | 4.81 | 1'74 4*85 |  |  |  | I.98 4.94 |  |
| 20 | I.53 | 4*78 | 1.64 | $4 \cdot 82$ | I.75 4.86 |  | $1.87 \quad 4.90$ |  | 1*99 4*95 |  | $2 \cdot 12 \quad 5 \cdot 00$ |  |
| 22 | r.65 | 4.82 | 1*77 | $4 \cdot 86$ | r.89 4.91 |  | 2.014 .96 |  | $2 \cdot 14$ 5.OI |  | 2.27 5.07 |  |
| 24 | I.78 | $4 \cdot 87$ | 1-91 | 4.91 | 2.034 .97 |  | 2.16 5.02 |  | 2.30 5.08 |  | 2.43 5.14 |  |
| 26 | I•93 | $4 \cdot 92$ | $2 \cdot 05$ | 4.97 | $2 \cdot 195003$ |  | $2 \cdot 325.09$ |  | $2 \cdot 47$ 5.16 |  | $2.61 \quad 5.23$ |  |
| 28 | $2 \cdot 08$ | $4 \cdot 98$ | $2 \cdot 21$ | $5 \cdot 04$ | 2.36 5.1 I 2.50 5.17 2.65 5.25 2.8 I 5.33 |  |  |  |  |  |  |  |
| 30 | $2 \cdot 24$ | $5 \cdot 06$ | $2 \cdot 39$ | $5 \cdot 12$ | 2.54 5.19 |  | $2 \cdot 70 \quad 5 \cdot 27$ |  | $2 \cdot 86 \quad 5 \cdot 36$ |  | 3.04 5.45 |  |
| 32 | $2 \cdot 43$ | $5 \cdot 14$ | $2 \cdot 58$ | $5 \cdot 21$ | 2.75 5.30 |  | 2.925 .39 |  | 3.10 5.49 |  | $3 \cdot 295 \cdot 60$ |  |
| 34 | $2 \cdot 63$ | $5 \cdot 24$ | $2 \cdot 80$ | $5 \cdot 32$ | $2.97 \quad 5.42$ |  | $3 \cdot 16 \quad 5 \cdot 53$ |  | $3 \cdot 365 \cdot 64$ |  | $3 \cdot 58$ 5*77 |  |
| 35 | 2.74 | $5 \cdot 29$ | 2.91 | $5 \cdot 39$ | $3 \cdot 10549$ |  | $\begin{array}{ll}3.30 \\ 3.45 & 5.60 \\ 5.69\end{array}$ |  | $\begin{array}{ll}3.51 & 5.73 \\ 3.67 & 5.83\end{array}$ |  | $3 \cdot 74$ 5.87 |  |
| 36 | 2.85 | $5 \cdot 35$ | 3.04 | $5 \cdot 46$ | 3.24 - 5.57 |  |  |  | 3.91 | $5 \cdot 99$ |
| 37 | 2.98 | 5.42 | 3.17 | 5.53 | 3.385 .65 |  | $3 \cdot 61$$3 \cdot 78$ | $5 \cdot 79$ |  |  | $3.85 \quad 5.94$ |  | $4 \cdot 11 \quad 6 \cdot 11$ |  |
| 38 | $3 \cdot 11$ | $5 \cdot 49$ | $3 \cdot 32$ | $5 \cdot 61$ | $3.54 \quad 5 \cdot 75$ |  |  | $\begin{array}{ll}3.78 & 5.90 \\ 3.97 & 6.02\end{array}$ |  | 4.04 6.07 |  | $\begin{array}{ll}4.32 & 6.26 \\ 4.56 & 6.42\end{array}$ |  |
| 39 | $3 \cdot 25$ | $5 \cdot 58$ | 3.47 | $5 \cdot 71$ | $3.71 \quad 5.86$ |  |  |  |  | $4.25 \quad 6.21$ |  | $\begin{array}{ll}4.56 & 6.42 \\ 4.82 & 6.62\end{array}$ |  |
| 40 | 3.41 | $5 \cdot 67$ | 3.64 | $5 \cdot 81$ | $\begin{array}{ll}3.90 & 5 \cdot 98 \\ 4 \cdot 11 & 6 \cdot 11\end{array}$ |  | $\begin{array}{ll}3.97 & 6.02 \\ 4.18 & 6.16\end{array}$ |  | 4.48 | $6 \cdot 37$ 6.56 |  |  |
| 41 | 3.57 | 5*77 | $3 \cdot 83$ | 5*94 |  |  | 4.415032 |  | $4.74 \quad 6 \cdot 56$ |  | $5 \cdot 12 \quad 6.83$ |  |

## 236 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

LATITUDE $28^{\circ}$.
DECLINATION-CONTRARY NAME TO-LATITUDE.

| True <br> Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ |  | $14^{\circ}$ | Decl. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 |  |  | H. M. S. | -2.26 | $\left\|\begin{array}{ccc} \text { H. M. } & \text { S. } \\ 5 & 29 & \text { 3I• } \end{array}\right\|$ | S. $2 \cdot 28$ |  |  |  |  | $\begin{array}{cc} \begin{array}{c:c} \text { H. M. } & \text { S. } \\ 5 & 22 \end{array} & 34 \cdot 7 \end{array}$ |  |
| - | $\begin{array}{lllll}5 & 34 & 24 & 4 \cdot 6\end{array}$ | 2.2 | $\begin{array}{llll}5 & 32 & 24 \cdot 1\end{array}$ | $2 \cdot 31$ | $520 \quad 4.8$ | $2 \cdot 3$ | $\begin{array}{lllll}5 & 17 & 43.8\end{array}$ | $2 \cdot 36$ |  | $2 \cdot 39$ | $\begin{array}{llll}5 & 12 & 56.5\end{array}$ | $2 \cdot 43$ |
| 4 | 512418.3 | $2 \cdot 34$ | $512 \begin{array}{llll}5 & 12\end{array}$ | $2 \cdot 36$ | 5 10 34.5 | $2 \cdot 40$ | 8 9.7 | $2 \cdot 43$ | $542 \cdot 9$ | $2 \cdot 46$ | 53 <br> 13.9 | 2.50 |
|  | $\begin{array}{lllll}5 & 5 & 51 \cdot 5\end{array}$ | $2 \cdot 3$ | 5 5 3 $266 \cdot 9$ | 2.43 | $5 \quad 1 \quad 0.3$ | 2.46 | $4583 \mathrm{I} \cdot 5$ | $2 \cdot 50$ | $4{ }^{56} \quad 0 \cdot 2$ | $2 \cdot 5$ | 45326.4 | 8 |
| 8 | 456 2I•I | $2 \cdot 45$ | $4 \begin{aligned} & 4 \\ & 4\end{aligned} 52 \cdot 7$ | 49 | 45 I 2 I 9 | $2 \cdot 53$ | $44848 \cdot 6$ | $2 \cdot 58$ | 44612.5 | $2 \cdot 62$ | $44333 \cdot 6$ | 7 |
| 10 | $44646 \cdot 7$ |  | 444 14*I | 2.57 | 44138.8 | 2.61 | 439 | $2 \cdot 66$ | 43619 |  | 433 34*7 |  |
| 12 | 4374 7 | $2 \cdot 60$ | $43430 \cdot 7$ | 2.65 | $43150 \cdot 4$ | $2 \cdot 7$ | 42968 | $2 \cdot 75$ | $42619 \cdot 8$ | I | $42329^{\circ} \mathrm{O}$ | 8 |
| 14 | $42724 \cdot 1$ | $2 \cdot 68$ | $42441 \cdot 9$ | 73 | $42156 \cdot 1$ | $2 \cdot 79$ | $4 \begin{array}{llll}49 & 6 \cdot 7\end{array}$ | $2 \cdot 86$ | $\begin{array}{lllllllll}4 & 16 & 13.3\end{array}$ | -92 | $4 \begin{array}{llll}4 & 15 & 15\end{array}$ | - |
| 16 | 41734.7 | 2.77 | $41446 \cdot 9$ | 2.83 | 4 II 55.2 | $2 \cdot 90$ | $4 \quad 8 \quad 59.3$ | 2.97 | $\begin{array}{llll}4 & 5 & 58 \cdot 9\end{array}$ | 3.04 | $4 \quad 254.0$ | $3 \cdot 12$ |
| 17 | 412377 |  | $4 \quad 946 \cdot 8$ | . 88 | $4 \quad 6 \quad 51.9$ | $2 \cdot 95$ | $352 \cdot 5$ | 3.03 | $4 \quad 0 \quad 48.5$ | $3 \cdot 11$ | $35739 \cdot 5$ | 19 |
| 18 | $\begin{array}{llll}4 & 7 & 38.9 \\ 4 & 2 & 38.9 \\ 3\end{array}$ | 86 | $\begin{array}{lrrr}4 & 4 & 45 \cdot 0 \\ 3 & 59 & 4 \mathrm{I} \cdot 2\end{array}$ | 2.93 | $\begin{array}{crrr}4 & 1 & 46 \cdot 7 \\ 3 & 56 & 30 \cdot 3\end{array}$ | 3.01 |  | 3.09 3.16 | $\begin{array}{lllll}3 & 5 & 5 & 35 \cdot 7 \\ 3 & 50 & 20 \cdot 3\end{array}$ | 3.18 3.25 | $\begin{array}{cccc}3 & 52 & 22.4 \\ 3 & 47 & 2.6\end{array}$ | 5 |
| 19 20 | $\begin{array}{rrrr}4 & 2 & 38 \cdot 5 \\ 3 & 57 & 36 \cdot 1\end{array}$ | 2.97 | $\begin{array}{llll}3 & 59 & 41 \cdot 2 \\ 3 & 54 & 35 \cdot 3\end{array}$ | 2.99 3.05 | $\begin{array}{ccc}3 & 56 & 39 \cdot 3 \\ 3 & 51 & 29 \cdot 6\end{array}$ | 3.07 3.14 | $\begin{array}{llll}3 & 53 & 32 \cdot 4 \\ 3 & 48 \\ 18 \cdot 7\end{array}$ | 3.23 | $\begin{array}{llll}3 & 50 & 20 \cdot 3 \\ 3 & 45 & 2 \cdot 2\end{array}$ | 3.25 3.32 | $\begin{array}{cccr}3 & 47 \\ 3 & 41 & 2 \cdot 6 \\ 39 \cdot 7\end{array}$ | 3 |
| 21 | 3 <br> 5 <br> 52 | 3.03 | 349 27*2 | $3 \cdot 12$ | $\begin{array}{llllllllll}3 & 46 & 17.5\end{array}$ | $3 \cdot 2 \mathrm{I}$ | $\begin{array}{llll}3 & 43 & 2 \cdot 3\end{array}$ | 3.30 | $3394 \mathrm{I} \cdot 2$ | 3.45 | $\begin{array}{llllll}3 & 36 & 13 \cdot 6\end{array}$ | 3.52 |
| 22 | 34725.1 | $3 \cdot 1$ | $\begin{array}{llllllllllll}3 & 44 & 16.7\end{array}$ | 3•18 | $34 \mathrm{I} \quad 2.9$ | $3 \cdot 28$ | $33743{ }^{\circ}$ | $3 \cdot 38$ | $\begin{array}{llll}3 & 34 & 16 \cdot 9\end{array}$ | $3 \cdot 49$ | 3 30 <br> $14 \cdot 1$  |  |
| 23 |  | 6 | $\begin{array}{lll}3 & 39 & 3\end{array} 7$ | 3.26 | 33545. | $3 \cdot 36$ | $33220 \cdot 7$ | 3.47 | $\begin{array}{llll}3 & 28 & 49.4\end{array}$ | 3.58 | $\begin{array}{llll}3 & 25 & 10.8\end{array}$ | 5 I |
| 24 | $\begin{array}{llll}3 & 37 & 4.8\end{array}$ | 3.23 | $3 \begin{array}{llll}33 & 47 \cdot 9\end{array}$ | 3.33 | $\begin{array}{lllllllllll}3 & 30 & 24.8\end{array}$ | $3 \cdot 44$ | $32655^{\circ} \mathrm{O}$ | 3 56 | 323 18.1 | 3.68 |  |  |
| 25 | 33 31 $50 \%$ | 31 | $\begin{array}{llll}3 & 28 & 29 \cdot 1\end{array}$ | $3 \cdot 1$ | $\begin{array}{lll}3 & 25 & 1 \cdot 0\end{array}$ | 3.5 | 32125.7 | 3.5 | $\begin{array}{lllllllll}3 & 17 & 42\end{array}$ | $3 \cdot 78$ | $31351 \cdot 6$ | 3.93 |
| 26 |  | 3.39 | $\begin{array}{lll}3 & 23 & 7.2\end{array}$ | 3.50 |  | $3 \cdot 62$ | 31552.5 | $3 \cdot 75$ | $\begin{array}{llll}3 & 12 & 3.2\end{array}$ | 3.90 | $\begin{array}{lll}3 & 8 & 5 \cdot 0\end{array}$ | 4.05 |
| 27 |  | 3.47 | 317418 | $3 \cdot 59$ | $\begin{array}{llll}3 & 14 & 2.5\end{array}$ | $3 \cdot 72$ | 3 10 15.0 |  | $\begin{array}{lll}3 & 618 \cdot 8\end{array}$ | 4.0 | 213.1 | 4.18 |
| 28 | 3155 |  | 31212.6 | 3.69 | $\begin{array}{ll}3 & 8 \\ 27 \cdot 1\end{array}$ | 3.83 | $\begin{array}{lll}3 & 4 & 32.9\end{array}$ | 3.98 | $3 \quad 0 \quad 29.2$ | $4 \cdot 15$ | 25615.4 | 2 |
| 29 | 3 10 22.8 | $3 \cdot$ | $\begin{array}{llll}3 & 6 & 39 \cdot 3\end{array}$ | 380 | 3 2 $47 \cdot 1$ | 3.95 | $25845 \cdot 6$ | 4.11 | 25433.9 | 4.29 | 2501112 | 48 |
| 30 | $\\|_{3}^{3}$ | 3.76 | $\begin{array}{llll}3 & 1 & 1.5\end{array}$ | 3.91 | $\begin{array}{lll}2 & 57 & 2.2 \\ 2 & 51\end{array}$ | 4.07 | 25252.8 24653.6 | 4.25 | $2 \begin{array}{lll}2 & 48.3 \\ 2\end{array}$ |  | $\begin{array}{llllll}2 & 43 & 59 \\ 2\end{array}$ | 65 |
| 31 32 |  | 3.87 4.00 | $\begin{array}{llll}2 & 55 & 18 \cdot 9 \\ 2 & 49 & 30 \cdot 7\end{array}$ | 4.04 4.17 | $\begin{array}{llll}2 & 51 & 11 \\ 2 & 45 & 15 & 7 \\ \end{array}$ | 4.2 I 4.36 | $24653 \cdot 6$ $24047 \cdot 6$ | 4.40 4.57 | $\begin{array}{llrr}2 & 42 & 23 \cdot 6 \\ 2 & 36 & 7 \cdot 1\end{array}$ | 4.6 r 4.80 | $\begin{array}{llll}2 & 37 & 40 \cdot 4 \\ 2 & 31 & 12 \cdot 0\end{array}$ | 84 |
| 32 | $25335 \cdot 6$ | $4{ }^{\circ}$ | $24930 \cdot 7$ | 4.17 | 24515.1 | $4 \cdot 3$ | $24047 \cdot 6$ | 4.57 | $236 \quad 7 \cdot 1$ | $4 \cdot 80$ | 23112.0 |  |
| 33 | 24749.8 | $4 \cdot 13$ | $24336 \cdot 7$ | $4 \cdot 32$ | $23911 \cdot 7$ | $4 \cdot 52$ | 23433.9 | $4 \cdot 75$ | $22941 \cdot 6$ | 5.00 | $22433 \cdot 4$ | 29 |
| 34 | 24158.2 | 4.27 | 23735.9 | 4.48 | 2330.7 | 4.70 | 228 IIf4 | $4 \cdot 95$ | 223 6.1 | $5 \cdot 24$ | $21743 \cdot 1$ | 5 |
| 35 | 23559.9 | 4.43 | $23127 \cdot 6$ | $4 \cdot 66$ | $22641 \cdot 2$ | 4.91 | $22138 \cdot 9$ | $5 \cdot 1$ | 21619.1 | $5 \cdot 50$ | 21039.2 | 6 |
| 36 | $\begin{array}{llll}2 & 29 & 54.5 \\ 2 & 23 & 40\end{array}$ | 4.61 | $22510 \cdot 9$ | 4.86 | 22011.8 | 5.13 | 21455.2 | $5 \cdot 44$ | 9 18.7 | 5 | 2 $\begin{aligned} & 1319.4\end{aligned}$ | $6 \cdot 22$ |
| 37 | $\left\lvert\, \begin{aligned} & 23 \\ & 23\end{aligned} 0^{\circ} 7\right.$ |  | 18 44 | $5 \cdot 08$ | 1331 | 5.39 | $758 \cdot 3$ |  | 2 | $6 \cdot 15$ | I $5540 \cdot 7$ | $6 \cdot 6$ |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{17} \mathrm{~A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | S. $-\mathrm{I} \cdot 10$ | $\begin{gathered} \text { s. } \\ -4 \cdot 66 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -\mathrm{I} \cdot \mathbf{1 9} \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 68 \end{gathered}$ | S. -I 29 | $\stackrel{\text { S. }}{4}$ | S. | S. | s. | S. | S. | S. |
| 2 | - 1 -19 | -4.68 | - $\begin{array}{r}\text { r. } \\ \text { 29 }\end{array}$ | -4.68 4.71 | -1.29 1.39 | -4.71 4.74 | -1.39 $\mathbf{1} 49$ | -4.74 4.78 | $\begin{array}{r}\text { r } \\ -1.49 \\ \mathbf{r} \\ \hline\end{array}$ | 4.80 | - 1.69 | 4.84 |
| 4 | I-29 | $4 \cdot 71$ | I.39 | $4 \cdot 74$ | 1.49 | $4 \cdot 77$ | I 59 | $4 \cdot 80$ | I• 69 | $4 \cdot 84$ | I. 80 | 4.87 |
| 6 | 1•39 | $4 \cdot 74$ | 1.49 | $4 \cdot 77$ | 1-59 | $4 \cdot 80$ | 1.70 | $4 \cdot 83$ | I.80 | $4 \cdot 87$ | I.91 | 4.91 |
| 8 | 1.49 | $4 \cdot 77$ | I•59 | 4.80 | 1.70 | 4.84 | I-81 | $4 \cdot 88$ | I-92 | $4 \times 92$ | $2 \cdot 03$ | $4 \cdot 97$ |
| 10 | I-60 | $4 \cdot 80$ | I・ク1 | $4 \cdot 84$ | 1.82 | $4 \cdot 87$ | 1•93 | 4.92 | $2 \cdot 04$ | 4.97 | $2 \cdot 16$ | 5.01 |
| 12 | $1 \cdot 71$ | $4 \cdot 84$ | 1.82 | $4 \cdot 88$ | 1.94 | $4 \cdot 93$ | $2 \cdot 05$ | $4 \cdot 97$ | $2 \cdot 17$ | $5 \cdot 02$ | 2.29 | 5.08 |
| 14 | 1.83 | $4 \cdot 89$ | 1.95 | $4 \cdot 93$ | 2.07 | 4.98 | $2 \cdot 19$ | $5 \cdot 03$ | $2 \cdot 31$ | $5 \cdot 09$ | $2 \cdot 44$ | $5 \cdot 15$ |
| 16 | I.96 | 4.94 | 2.08 | 4.99 | $2 \cdot 20$ | $5 \cdot 04$ | $2 \cdot 33$ | $5 \cdot 10$ | $2 \cdot 46$ | $5 \cdot 16$ | $2 \cdot 59$ | $5 \cdot 22$ |
| 17 | $2 \cdot 03$ | 4.96 | $2 \cdot 15$ | $5 \cdot 02$ | $2 \cdot 28$ | 5.07 | 2.41 | $5 \cdot 13$ | $2 \cdot 54$ | $5 \cdot 19$ | $2 \cdot 68$ | $5 \cdot 26$ |
| 18 | $2 \cdot 10$ | $4 \cdot 99$ | 2.22 | 5.05 | $2 \cdot 35$ | 5.10 | 2.49 | $5 \cdot 17$ | 2.62 | $5 \cdot 23$ | $2 \cdot 77$ | $5 \cdot 31$ |
| 19 | $2 \cdot 17$ | $5 \cdot 02$ | $2 \cdot 30$ | $5 \cdot 08$ | $2 \cdot 43$ | $5 \cdot 14$ | $2 \cdot 57$ | $5 \cdot 2 \mathrm{I}$ | $2 \cdot 71$ | $5 \cdot 28$ | 2.86 | $5 \cdot 36$ |
| 20 | 2.25 | $5 \cdot 06$ | $2 \cdot 38$ | $5 \cdot 12$ | 2.51 | 5. 18 | $2 \cdot 65$ | $5 \cdot 25$ | $2 \cdot 80$ | 5.33 | $2 \cdot 95$ | $5 \cdot 41$ |
| 21 | $2 \cdot 32$ | $5 \cdot 09$ | $2 \cdot 46$ | $5 \cdot 15$ | 2.60 | $5 \cdot 22$ | $2 \cdot 74$ | 5.30 | $2 \cdot 90$ | $5 \cdot 38$ | $3 \cdot 05$ | $5 \cdot 46$ |
| 22 | $2 \cdot 4 \mathrm{I}$ | 5.13 | 2.54 | $5 \cdot 20$ | $2 \cdot 69$ | $5 \cdot 27$ | $2 \cdot 84$ | $5 \cdot 35$ | 3.00 | $5 \cdot 43$ | $3 \cdot 16$ | $5 \cdot 52$ |
| 23 | $2 \cdot 49$ | $5 \cdot 17$ | $2 \cdot 63$ | $5 \cdot 24$ | 2.78 | $5 \cdot 32$ | $2 \cdot 94$ | $5 \cdot 40$ | $3 \cdot 10$ | $5 \cdot 49$ | 3.27 | 5.59 |
| 24 | $2 \cdot 58$ | 5.21 | $2 \cdot 73$ | $5 \cdot 29$ | 2.88 | $5 \cdot 37$ | $3 \cdot 04$ | $5 \cdot 46$ | 3.21 | $5 \cdot 55$ | $3 \cdot 39$ | $5 \cdot 66$ |
| 25 | 2.67 | $5 \cdot 26$ | 2.83 | $5 \cdot 34$ | 2.99 | $5 \cdot 43$ | $3 \cdot 15$ | $5 \cdot 92$ | 3.33 | $5 \cdot 62$ | 3.52 | 5.74 |
| 26 | $2 \cdot 77$ | $5 \cdot 31$ | 2.93 | 5.39 | 3.10 | $5 \cdot 49$ | $3 \cdot 27$ | $5 \cdot 55$ | $3 \cdot 46$ | $5 \cdot 70$ | $3 \cdot 66$ | 5.82 |
| 27 | $2 \cdot 87$ | $5 \cdot 36$ | 3.04 | $5 \cdot 45$ | 3.21 | $5 \cdot 55$ | $3 \cdot 40$ | $5 \cdot 66$ | $3 \cdot 59$ | $5 \cdot 78$ | $3 \cdot 80$ | $5 \cdot 91$ |
| 28 | $2 \cdot 98$ | $5 \cdot 42$ | $3 \cdot 15$ | $5 \cdot 52$ | 3.34 | $5 \cdot 63$ | $3 \cdot 53$ | $5 \cdot 74$ | 3.74 | 5.87 | $3 \cdot 96$ | $6 \cdot 02$ |
| 29 | $3 \cdot 10$ | $5 \cdot 49$ | $3 \cdot 28$ | 5.59 | 3.47 | $5 \cdot 71$ | 3.68 | $5 \cdot 83$ | $3 \cdot 89$ | $5 \cdot 97$ | $4 \cdot 13$ | $6 \cdot 13$ |
| 30 | 3.22 | $5 \cdot 56$ | 3.41 3.55 | $5 \cdot 67$ | 3.61 | $5 \cdot 79$ | 3.83 | $5 \cdot 93$ | 4.06 | $6 \cdot 09$ | 4.3 I | $6 \cdot 26$ |
| 31 | $3 \cdot 35$ | $5 \cdot 63$ | $3 \cdot 55$ | 5.76 | 3.82 | 5.89 | $4 \cdot 00$ | $6 \cdot 04$ | $4^{\text {l25 }}$ | $6 \cdot 21$ | $4 \cdot 52$ | $6 \cdot 40$ |
| 32 | $3 \cdot 49$ | $5 \cdot 72$ | $3 \cdot 70$ | $5 \cdot 85$ | 3.93 | $6 \cdot 00$ | $4 \cdot 18$ | $6 \cdot 16$ | 4.45 | $6 \cdot 35$ | 4.74 | $6 \cdot 56$ |
| 33 | 3.64 | $5 \cdot 8 \mathrm{I}$ | 3.87 | $5 \cdot 96$ | $4 \cdot 11$ | $6 \cdot 12$ | $4 \cdot 38$ | $6 \cdot 30$ | $4 \cdot 67$ | $6 \cdot 51$ | $4 \cdot 99$ | $6 \cdot 74$ |
| 34 | $3 \cdot 80$ | 5.92 | $4 \cdot 05$ | $6 \cdot 08$ | 4.31 | $6 \cdot 25$ | $4 \cdot 60$ | $6 \cdot 46$ | 4.92 | $6 \cdot 69$ | 5.27 | $6 \cdot 95$ |
| 35 | $3 \cdot 98$ | $6 \cdot 03$ | 4.24 | $6 \cdot 21$ | 4.53 | 6.41 | 4.85 | $6 \cdot 63$ | 5.20 | 6.89 | $5 \cdot 59$ | 7.20 |
| 36 | $4 \cdot 18$ | $6 \cdot 16$ | 4.46 | $6 \cdot 36$ | 4.77 | $6 \cdot 58$ | $5 \cdot 12$ | $6 \cdot 84$ | $5 \cdot 51$ | $7 \cdot 14$ | $5 \cdot 95$ | $7 \cdot 49$ |
| 37 | 4.39 | $6 \cdot 30$ | 4'70 | $6 \cdot 53$ | $5 \cdot 04$ | $6 \cdot 78$ | 5.43 | $7 \cdot 07$ | $5 \cdot 87$ | $7 \cdot 42$ | 6.38 | 7.83 |

## LATITUDE $28^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. <br> Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | M. | S. | H. M. | s. | H. M. S. | S. | H. M. S. | S. | . M. S. | S. |
| 0 | 52012.4 | -2.39 | 5 I7 48.2 | -2.42 | $515 \quad 21.9$ | $-2.46$ | $\begin{array}{llll}5 & 12 & 53.5\end{array}$ | -2.49 | 51022.8 | $-2.53$ | 5749.5 | $-2.58$ |
| 2 | 5 10 29.8 | $2 \cdot 46$ | $\begin{array}{llll}5 & 8 & 0 \cdot 9\end{array}$ | $2 \cdot 50$ | $\begin{array}{llll}5 & 5 & 29.6\end{array}$ | $2 \cdot 54$ | $\begin{array}{llll}5 & 2 & 55 \%\end{array}$ | $2 \cdot 58$ | 5 ¢ 019.4 | 2.63 | 457400 | $2 \cdot 68$ |
| 4 | $5 \quad 0 \quad 42 \cdot 5$ | $2 \cdot 54$ | 45888 | 2.59 | $4553 I \cdot 9$ | 2.63 | $4 \begin{array}{llll}42 & 52 \cdot 3\end{array}$ | $2 \cdot 68$ | 450997 | $2 \cdot 74$ | $44723 \cdot 7$ | $2 \cdot 79$ |
| 6 | $45050 \cdot 0$ | 2.63 | $44810 \cdot 5$ | $2 \cdot 68$ | 445 28.0 | $2 \cdot 74$ | $44242 \cdot 2$ | $2 \cdot 79$ | $439 \begin{array}{llll}4 & 52 \cdot 8\end{array}$ | $2 \cdot 85$ | $43659 \cdot 8$ | 2.92 |
| 7 | $44551 \cdot 5$ | $2 \cdot 68$ | $443 \quad 9 \cdot 2$ | $2 \cdot 73$ | $44023 \cdot 6$ | $2 \cdot 79$ | 43734.4 | $2 \cdot 85$ | 434 4I•5 | 2.91 | $43144 \cdot 6$ | $2 \cdot 98$ |
| 8 | 440 51.5 | $2 \cdot 73$ | $43^{8} \quad 6 \cdot 1$ | $2 \cdot 78$ | 435 I7•3 | $2 \cdot 84$ | $43224 * 7$ | $2 \cdot 91$ | $42928 \cdot 1$ | $2 \cdot 98$ | $42627 \cdot 2$ | 3.05 |
| 9 | $43549{ }^{\circ} 9$ | $2 \cdot 78$ | 43314 | $2 \cdot 84$ | 430911 | $2 \cdot 90$ | 42712.9 | 2.97 | 42412.4 | $3 \cdot 05$ | $421 \quad 7 \cdot 4$ | $3 \cdot 12$ |
| 10 | $43046 \cdot 6$ | $2 \cdot 83$ | 42754.7 | $2 \cdot 90$ | $4 \begin{array}{llll}4 & 24 & 58 \cdot 9\end{array}$ | $2 \cdot 96$ | 42158.9 | 3.04 | $4 \begin{array}{llll}4 & 18 & 54.4\end{array}$ | $3 \cdot 12$ | 4 I5 45 0 | 3.20 |
| 11 | $42541 \cdot 4$ | $2 \cdot 89$ | $42246 \cdot 1$ | $2 \cdot 96$ | 4 I9 $46 \cdot 6$ | $3 \cdot 03$ | 4 I6 42.6 | $3 \cdot 11$ | 44 13 $33 \cdot 8$ | $3 \cdot 19$ | 4 10 19*9 | $3 \cdot 28$ |
| 12 | $42034 \cdot 3$ | 2.95 | 4 I7 35.4 | 3.02 | 4 I4 32.0 | $3 \cdot 10$ | 4 II 23.9 | 3.18 | 4810.6 | $3 \cdot 27$ | $4451 \cdot 9$ | $3 \cdot 36$ |
| 13 | $4 \begin{array}{lll}45 & 25.2\end{array}$ | 3.00 | $\begin{array}{lll}4 & 12 & 22.5\end{array}$ | 3.09 | $4 \begin{array}{lll}4 & 9 & 14 * 9\end{array}$ | $3 \cdot 17$ | $\begin{array}{lll}4 & 6 & 2.4 \\ 4 & 0 & 3\end{array}$ | $3 \cdot 25$ | $4 \quad 2 \quad 44^{4} 5$ | $3 \cdot 35$ | $35920 \cdot 7$ | 3.45 |
| 14 | 4 IO 13.8 | $3 \cdot 07$ | 4 7 $7 \cdot 1$ | $3 \cdot 15$ | 4 3 $55 \cdot 3$ <br> 3 5  | $3 \cdot 24$ | $4 \quad 0 \quad 38 \cdot 2$ | $3 \cdot 33$ |  | $3 \cdot 43$ | $353146 \cdot 2$ | $3 \cdot 54$ |
| 15 | $\begin{array}{lll}4 & 5 & 0 \cdot 3\end{array}$ | $3 \cdot 14$ | $\begin{array}{rrrr}4 & 1 & 49 \cdot 3\end{array}$ | 3.23 | $\begin{array}{lllll}3 & 58 & 33 \cdot 0\end{array}$ | $3 \cdot 32$ | 355 II'O | 3.42 | 35142.9 | $3 \cdot 52$ | $\begin{array}{llll}3 & 48 & 8 \cdot 1\end{array}$ | $3 \cdot 64$ |
| 16 | 3 59 $44^{\circ} \mathrm{I}$ | 3.21 | $\begin{array}{llll}3 & 56 & 28 \cdot 7\end{array}$ | $3 \cdot 30$ | $\begin{array}{llll}3 & 53 & 7 \cdot 6 \\ 3 & 47 & \end{array}$ | $3 \cdot 40$ | $34940 \cdot 5$ | 3.5 I | $\begin{array}{llll}3 & 46 & 6.8\end{array}$ | $3 \cdot 62$ | $\begin{array}{llll}3 & 42 & 26 \cdot 2\end{array}$ | $3 \cdot 74$ |
| 17 | $35425 \cdot 2$ | $3 \cdot 29$ | $35 \mathrm{I} 5 \cdot 2$ | $3 \cdot 38$ | $\begin{array}{llll}3 & 47 & 39 \cdot 2\end{array}$ | $3 \cdot 49$ | $344 \quad 6 \cdot 5$ | 3.60 | $340 \quad 27 \cdot 1$ | $3 \cdot 72$ | $3 \begin{array}{lll}3640 \cdot 1\end{array}$ | $3 \cdot 85$ |
| 18 | $\begin{array}{llll}3 & 49 & 3.6\end{array}$ | $3 \cdot 36$ | $34538 \cdot 6$ | 3.47 | $\begin{array}{lll}3 & 42 & 7 \cdot 3\end{array}$ | $3 \cdot 58$ | $\begin{array}{llll}3 & 38 & 28 \cdot 9\end{array}$ | 3'70 | 33443.2 | $3 \cdot 83$ | 33049.4 | 3.97 |
| 19 | $3433^{3} 4 \cdot 8$ | $3 \cdot 45$ | 340 8.7 | $3 \cdot 56$ | $3{ }^{3} 3631 \cdot 7$ | $3 \cdot 68$ | $\begin{array}{llllllllll}3 & 32 & 47 \cdot 2\end{array}$ | $3 \cdot 8 \mathrm{I}$ | $\begin{array}{lllll}3 & 28 & 54.9\end{array}$ | $3 \cdot 94$ | $\begin{array}{llllll}3 & 24 & 53 \cdot 9\end{array}$ | 4.09 |
| 20 | 3 38 | $3 \cdot 54$ | $\begin{array}{lllll}3 & 34 & 35 \cdot 2\end{array}$ | $3 \cdot 65$ | $\begin{array}{llll}3 & 30 & 52 \cdot 1\end{array}$ | $3 \cdot 78$ | $3 \begin{array}{lll}3 & 27 & 1.2\end{array}$ | 3.92 | $\begin{array}{llll}3 & 23 & 1 & 7\end{array}$ | $4^{\circ} 07$ | $31853{ }^{\circ} \mathrm{O}$ | $4 \cdot 23$ |
| 21 | 3 32 39  <br>     | $3 \cdot 63$ | $\begin{array}{llll}3 & 28 & 57 \cdot 8\end{array}$ | $3 \cdot 76$ | $\begin{array}{llll}3 & 25 & 8 \cdot 3\end{array}$ | $3 \cdot 89$ | $\begin{array}{llll}3 & 21 & 10 \cdot 4\end{array}$ | $4 \cdot 04$ | $\begin{array}{llll}3 & 17 & 3 \cdot 3\end{array}$ | $4 \cdot 20$ | $\left(\begin{array}{llll}3 & 12 & 46 \cdot 3\end{array}\right.$ | $4 \cdot 37$ |
| 22 | $3274{ }^{3}$ | $3 \cdot 73$ | 323 I6.I | $3 \cdot 87$ | $\begin{array}{lllllllllll}3 & 19 & 19.8\end{array}$ | 4.01 | 31514.4 | 4.17 | 3 10 59*1 | $4 \cdot 34$ | $36633 \cdot 1$ | 4.53 |
| 23 | 32124.5 | $3 \cdot 84$ | 3 I7 29*9 | $3 \cdot 99$ | $\begin{array}{llll}3 & 13 & 26.2\end{array}$ | 4.14 | $3 \quad 9$ I2.8 | 4.31 | $3 \begin{array}{llll}3 & 4 & 48 \cdot 7\end{array}$ | 4.50 | 3 O 12.8 | $4 \cdot 70$ |
| 24 | $\begin{array}{lllllllll}3 & \text { I } & 40 \cdot 5\end{array}$ | $3 \cdot 96$ | 3 II 388 | $4 \cdot 11$ | $\begin{array}{llll}3 & 7 & 27 \cdot 1 \\ & 1\end{array}$ | $4 \cdot 28$ | $\begin{array}{llll}3 & 3 & 4.9\end{array}$ | 4.47 | $2{ }_{2} 583 \mathrm{l} \cdot 2$ | 4.77 | $\begin{array}{llll}2 & 53 & 44 \cdot 8\end{array}$ | $4 \cdot 89$ |
| 25 | $\begin{array}{llll}3 & 9 & 51 \cdot 6 \\ 3 & 3 & 57 \cdot 3\end{array}$ | 4.08 | $\begin{array}{lrrr}3 & 5 & 42^{\circ} 0 \\ 2 & 50 & \end{array}$ | $4 \cdot 25$ | $\begin{array}{lrrr}3 & 1 & 21.7\end{array}$ | 4.43 | $\begin{array}{llll}2 & 56 & 50 \cdot 1\end{array}$ | 4.63 | $\begin{array}{llll}2 & 52 & 5 \cdot 9\end{array}$ | $4 \cdot 85$ | $2 \begin{array}{llll}2 & 47 & 7.8\end{array}$ | $5 \cdot 09$ |
| 26 | $\begin{array}{rrrr}3 & 3 & 57 \cdot 3 \\ 2 & 57 & 57 \cdot 1\end{array}$ | 4.21 4.36 | $\begin{array}{llll}2 & 59 & 39 \cdot 2 \\ 2 & 53 & 29.8\end{array}$ | 4.40 4.56 | $\begin{array}{llrr}2 & 55 & 907 \\ 2 & 48 & 50 \cdot 1\end{array}$ | $4 \cdot 60$ | $\begin{array}{lllll}2 & 50 & 27 \cdot 7 \\ 2 & 43 & 56 \cdot 8\end{array}$ | $4 \cdot 8 \mathrm{I}$ | $\begin{array}{lllllllllll}2 & 45 & 320\end{array}$ | $5 \cdot 06$ | 2402100 | $5 \cdot 33$ |
| 27 | $25757 \cdot 1$ | 4.36 | $25329 \cdot 8$ | 4.56 | 248 50'I | 4.77 | $24356 \cdot 8$ | $5 \cdot 01$ | $2 \begin{array}{lllll}28 & 38 & 48\end{array}$ | $5 \cdot 28$ | $23323 \cdot 1$ | $5 \cdot 58$ |
| 28 | 2 51 50.3 | 4.52 | $24713{ }^{\circ} 0$ | 4.73 | 24222.1 | 4.97 | $23716 \cdot 3$ | $5 \cdot 24$ | 23153.7 | 5.53 | 22612.3 | $5 \cdot 86$ |
| 29 | $\begin{array}{llll}2 & 45 & 36 \cdot 2\end{array}$ | $4 \cdot 78$ | $\begin{array}{lllllllllll}2 & 40 & 47 \cdot 9\end{array}$ | 4.93 | $\begin{array}{lllllll}2 & 35 & 44^{\circ} 7\end{array}$ | 5•19 | 23024.9 | $5 \cdot 49$ | 22446.4 | $5 \cdot 32$ | $21846 \cdot 7$ | $6 \cdot 19$ |
| 30 | $23914{ }^{2} 0$ | $4 \cdot 89$ | $\begin{array}{lllll}2 & 34 & 13.5\end{array}$ | $5 \cdot 15$ |  | $5 \cdot 44$ | 223 2I'I | $5 \cdot 77$ | $21724 \cdot 6$ | $6 \cdot 14$ | 2 II 3.9 | $6 \cdot 58$ |
| 31 32 | $\begin{array}{llr}2 & 32 & 42 \cdot 6 \\ 2 & 26 & 0 \cdot 9\end{array}$ | $5 \cdot 10$ 5.34 | $\begin{array}{llll}2 & 27 & 28 \cdot 5 \\ 2 & 20 & 31 \cdot 5\end{array}$ | $5 \cdot 39$ $5 \cdot 66$ | $\begin{array}{llll}2 & 2 I & 56 \cdot I \\ 2 & \text { I } & 4\end{array}$ | $5 \cdot 71$ | $\begin{array}{rrrr}2 & 16 & 2.9 \\ 2 & 8 & 27.9\end{array}$ | 6.09 | $\begin{array}{llll}2 & 9 & 45 \% \\ 2 & 1 & 46 .\end{array}$ | $6 \cdot 52$ | $\begin{array}{llrr}2 & 3 & 0 \cdot 4\end{array}$ | $7 \cdot 03$ |
| 32 | $2260 \cdot 9$ | $5 \cdot 34$ | 22031.5 | $5 \cdot 66$ | 214415 | $6 \cdot 03$ | $2 \quad 8 \quad 27 \cdot 9$ | $6 \cdot 46$ | 2 I $46 \cdot 4$ | 6•96 | I $5432 \cdot \mathrm{I}$ | $7 \cdot 56$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ}$ A. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21{ }^{\circ}$ | - A. | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ}$ | ${ }^{\circ} \mathrm{A}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | S. | s. | S. | S. | S. | S. | S. | S. | S. | S. |
| 0 | - I. 69 | $-4.83$ | - 1.80 | $-4.87$ | - 1.90 | -4.91 | $-2 \cdot 01$ | $-4.96$ | $-2 \cdot 12$ | $-5 \cdot 00$ | -2.24 - | $-5.05$ |
| 2 | I.80 | $4 \cdot 87$ | I•90 | 4.91 | $2 \cdot \mathrm{OI}$ | 4.96 | 2.13 | $5 \cdot 00$ | $2 \cdot 24$ | $5 \cdot 05$ | $2 \cdot 36$ | $5 \cdot 11$ |
| 4 | 1.91 | 4.91 | $2 \cdot 02$ | $4 \cdot 96$ | $2 \cdot 13$ | $5^{\circ} 00$ | $2 \cdot 25$ | $5 \cdot 06$ | $2 \cdot 36$ | $5 \cdot 11$ | $2 \cdot 48$ | $5 \cdot 17$ |
| 6 | $2 \cdot 02$ | 4.96 | $2 \cdot 14$ | $5^{\circ} \mathrm{OI}$ | 2.25 | $5 \cdot 06$ | $2 \cdot 37$ | $5 \cdot 11$ | $2 \cdot 50$ | $5 \cdot 17$ | $2 \cdot 62$ | $5 \cdot 23$ |
| 7 | $2 \cdot 08$ | 4*99 | $2 \cdot 20$ | $5 \cdot 04$ | $2 \cdot 32$ | $5 \cdot 09$ | $2 \cdot 44$ | 5.15 | $2 \cdot 57$ | $5 \cdot 21$ | 2.70 | $5 \cdot 27$ |
| 8 | $2 \cdot 15$ | 5.01 | $2 \cdot 26$ | $5 \cdot 06$ | $2 \cdot 39$ | 5'12 | 2.51 | 5*18 | $2 \cdot 64$ | 5.24 | $2 \cdot 77$ | 5.31 |
| 9 | $2 \cdot 21$ | 5.04 | $2 \cdot 33$ | $5 \cdot 09$ | 2.46 | $5 \cdot 15$ | $2 \cdot 58$ | 5.21 | 2.71 | $5 \cdot 28$ | $2 \cdot 85$ | $5 \cdot 35$ |
| 10 | $2 \cdot 28$ | $5 \cdot 07$ | 2.40 | 5.13 | 2.53 | 5•19 | $2 \cdot 66$ | $5 \cdot 25$ | 2•79 | $5 \cdot 32$ | 2.93 | $5 \cdot 40$ |
| 11 | $2 \cdot 35$ | $5 \cdot 10$ | $2 \cdot 47$ | 5•16 | $2 \cdot 60$ | $5 \cdot 22$ | $2 \cdot 74$ | $5 \cdot 29$ | $2 \cdot 87$ | $5 \cdot 36$ | $3 \cdot 02$ | 5*44 |
| 12 | 2.42 | 5-13 | $2 \cdot 55$ | $5 \cdot 20$ | $2 \cdot 68$ | $5 \cdot 26$ | $2 \cdot 82$ | $5 \cdot 33$ | $2 \cdot 96$ | $5 \cdot 41$ | $3 \cdot 11$ | $5 \cdot 49$ |
| 13 | $2 \cdot 49$ | $5 \cdot 17$ | $2 \cdot 62$ | 5.24 | $2 \cdot 76$ | 5*30 | $2 \cdot 90$ | $5 \cdot 38$ | $3 \cdot 05$ | $5 \cdot 46$ | 3.20 | $5 \cdot 55$ |
| 14 | 2.57 | $5 \cdot 21$ | $2 \cdot 71$ | 5.28 | $2 \cdot 84$ | $5 \cdot 35$ | $2 \cdot 99$ | 5.43 | $3 \cdot 14$ | $5 \cdot 51$ | $3 \cdot 30$ | $5 \cdot 60$ |
| 15 | $2 \cdot 65$ | $5 \cdot 25$ | 2.79 | $5 \cdot 32$ | 2.93 | $5 \cdot 40$ | $3 \cdot 08$ | $5 \cdot 48$ | $3 \cdot 24$ | $5 \cdot 57$ | $3 \cdot 40$ | $5 \cdot 67$ |
| 16 | $2 \cdot 73$ | $5 \cdot 29$ | $2 \cdot 88$ | $5 \cdot 37$ | 3.03 | $5 \cdot 45$ | $3 \cdot 18$ | $5 \cdot 54$ | $3 \cdot 34$ | $5 \cdot 63$ | 3.51 | 5.73 |
| 17 | $2 \cdot 82$ | $5 \cdot 34$ | $2 \cdot 97$ | $5 \cdot 42$ | $3 \cdot 12$ | $5 \cdot 50$ | $3 \cdot 29$ | $5 \cdot 60$ | 3.45 | 5*70 | $3 \cdot 63$ | 5.8I |
| 18 | 2.91 | 5.39 | 3.07 | $5 \cdot 47$ | $3 \cdot 23$ | $5 \cdot 56$ | $3 \cdot 39$ | $5 \cdot 66$ | $3 \cdot 57$ | 5'77 | $3 \cdot 76$ | 5•88 |
| 19 | $3 \cdot 01$ | $5 \cdot 44$ | $3 \cdot 17$ | $5 \cdot 53$ | $3 \cdot 34$ | $5 \cdot 63$ | $3 \cdot 51$ | $5 \cdot 73$ | $3 \cdot 69$ | $5 \cdot 85$ | $3 \cdot 89$ | $5 \cdot 97$ |
| 20 | $3 \cdot 11$ | $5 \cdot 50$ | $3 \cdot 28$ | $5 \cdot 59$ | 3.45 | $5 \cdot 69$ | 3.63 | $5 \cdot 8 \mathrm{I}$ | $3 \cdot 83$ | $5 \cdot 93$ | $4 \cdot 03$ | $6 \cdot 06$ |
| 21 | $3 \cdot 22$ | $5 \cdot 56$ | $3 \cdot 39$ | $5 \cdot 66$ | $3 \cdot 57$ | $5 \cdot 77$ | $3 \cdot 76$ | $5 \cdot 89$ | $3 \cdot 97$ | $6 \cdot 02$ | 4.18 | $6 \cdot 17$ |
| 22 | $3 \cdot 33$ | $5 \cdot 62$ | $3 \cdot 51$ | $5 \cdot 73$ | $3 \cdot 70$ | $5 \cdot 85$ | 3.90 | 5.98 | 4.12 | $6 \cdot 12$ | $4 \cdot 35$ | $6 \cdot 28$ |
| 23 | 3.45 | 5'70 | $3 \cdot 64$ | 5.81 | $3 \cdot 84$ | $5 \cdot 94$ | 4.05 | $6 \cdot 08$ | $4 \cdot 28$ | $6 \cdot 23$ | 4.53 | $6 \cdot 40$ |
| 24 | 3.58 | $5 \cdot 77$ | $3 \cdot 78$ | $5 \cdot 90$ | 3.99 | $6 \cdot 04$ | $4 \cdot 22$ | 6.19 | 4.46 | $6 \cdot 36$ | $4 \cdot 72$ | $6 \cdot 54$ |
| 25 | $3 \cdot 72$ | $5 \cdot 86$ | 3.93 | $6 \cdot 00$ | $4 \cdot 15$ | $6 \cdot 14$ | 4.39 | $6 \cdot 31$ | $4 \cdot 65$ | $6 \cdot 49$ | 4.93 | 6.70 |
| 26 | $3 \cdot 86$ | $5 \cdot 95$ | 4.09 | $6 \cdot 10$ | $4 \cdot 33$ | $6 \cdot 26$ | $4 \cdot 58$ | $6 \cdot 44$ | $4 \cdot 86$ | $6 \cdot 65$ | $5 \cdot 17$ | $6 \cdot 87$ |
| 27 | 4.02 | $6 \cdot 06$ | $4 \cdot 26$ | $6 \cdot 22$ | $4 \cdot 52$ | $6 \cdot 40$ | $4 \cdot 79$ | $6 \cdot 59$ | 5.10 | $6 \cdot 82$ | $5 \cdot 43$ | $7 \cdot 07$ |
| 28 | $4 \cdot 19$ | $6 \cdot 17$ | 4.45 | $6 \cdot 35$ | 4.72 | $6 \cdot 54$ | 5.03 | $6 \cdot 77$ | $5 \cdot 36$ | $7 \cdot 02$ | 5•73 | $7 \cdot 30$ |
| 29 | $4 \cdot 38$ | $6 \cdot 30$ | 4.66 | $6 \cdot 50$ | 4.95 | $6 \cdot 71$ | $5 \cdot 28$ | $6 \cdot 96$ | $5 \cdot 65$ | 7.24 | 6.06 | $7 \cdot 57$ |
| 30 | $4 \cdot 59$ | $6 \cdot 45$ | $4 \cdot 88$ | $6 \cdot 66$ | $5 \cdot 21$ | $6 \cdot 90$ | $5 \cdot 58$ | $7 \cdot 18$ | $5 \cdot 99$ | 7.51 | $6 \cdot 45$ | $7 \cdot 88$ |
| 31 | 4.81 | $6 \cdot 61$ | $5 \cdot 14$ | $6 \cdot 85$ | 5.50 | $7 \cdot 12$ | $5 \cdot 91$ | 7.44 | $6 \cdot 37$ | $7 \cdot 82$ | $6 \cdot 91$ | $8 \cdot 26$ |
| 32 | $5 \cdot 06$ | $6 \cdot 79$ | $5 \cdot 42$ | $7 \cdot 06$ | $5 \cdot 82$ | $7 \cdot 38$ | $6 \cdot 29$ | 7.75 | $6 \cdot 83$ | 8.19 | $7 \cdot 45$ | $8 \cdot 72$ |

## 238 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $29^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | Decl. Var. | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4^{\circ}$ | Decl. Var. | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. | S. | H. M. S. | S. | M. S. | S. | M. | S. | S. | S. |
| o | 6 O 0.0 | $-2.22$ | $55746 \cdot 9$ | $-2.22$ | $5 \begin{array}{llll}55 & 33 \cdot 8\end{array}$ | $-2.22$ | $\begin{array}{llll}5 & 53 & 20.5\end{array}$ | $-2.22$ | 5 51 6.9 | $-2.23$ | $548152 \cdot 9$ | $-2.24$ |
| 6 | $\begin{array}{lllll}5 & 32 & 32 \cdot 7\end{array}$ | $2 \cdot 24$ | $53018 \cdot 3$ | $2 \cdot 25$ | $\begin{array}{llll}5 & 28 & 3.2\end{array}$ | $2 \cdot 26$ | $\begin{array}{llllllllll}5 & 25 & 47 \cdot 2\end{array}$ | $2 \cdot 27$ | 5 523 | $2 \cdot 29$ | $\begin{array}{llll}5 & 21 & 12.3\end{array}$ | $2 \cdot 31$ |
| 8 | $\begin{array}{llll}5 & 23 & 22.5\end{array}$ | $2 \cdot 25$ | 5 21 $7 \cdot 3$ | $2 \cdot 26$ | $5 \mathrm{I} 8 \mathrm{5I} \cdot \mathrm{I}$ | $2 \cdot 28$ | 5 16 $33 \cdot 8$ | $2 \cdot 30$ | $\begin{array}{lllll}5 & 14 & 15 *\end{array}$ | $2 \cdot 32$ | 5 II 55.6 | $2 \cdot 34$ |
| 10. | 5 I 411.5 | $2 \cdot 26$ | 5 II $55{ }^{\circ} 3$ | $2 \cdot 28$ | $\begin{array}{llllll}5 & 9 & 37 \cdot 8\end{array}$ | $2 \cdot 30$ |  | $2 \cdot 33$ | $\begin{array}{llll}5 & 4 & 58 \cdot 6\end{array}$ | $2 \cdot 35$ | $\begin{array}{llll}5 & 2 & 36 \cdot 7\end{array}$ | $2 \cdot 38$ |
| 12 | $54489 \cdot 6$ | $2 \cdot 28$ | $5 \quad 241 \cdot 9$ | $2 \cdot 31$ | $5 \quad 0 \quad 22 \cdot 8$ | $2 \cdot 33$ | $4 \quad 58 \quad 2 \cdot 1$ | $2 \cdot 36$ | $45539 \cdot 7$ | $2 \cdot 39$ | 45315.5 | 2.42 |
| 14 | $45516 \cdot 2$ | $2 \cdot 31$ | $\begin{array}{llll}4 & 53 & 26 \cdot 9\end{array}$ | $2 \cdot 34$ | 45150 | $2 \cdot 36$ | $\begin{array}{llll}4 & 48 & 43 \cdot 1\end{array}$ | $2 \cdot 40$ | $\begin{array}{lllll}4 & 46 & 18 \cdot 3\end{array}$ | 2.43 | 443 5I'5 | $2 \cdot 47$ |
| 16 | 446 3I•2 | $2 \cdot 34$ | 444 10• | $2 \cdot 37$ | 4 41 $47{ }^{\circ} 0$ | $2 \cdot 40$ | $43921 \cdot 7$ | $2 \cdot 44$ | 43654.3 | $2 \cdot 48$ | $43424 * 4$ | $2 \cdot 52$ |
| 18 | $4 \begin{array}{llll}4 & 37 & 14.3\end{array}$ | 2.37 | 4345100 | 2.41 | $432 \quad 25 \cdot 5$ | 2.45 | $\begin{array}{llll}4 & 29 & 57 \cdot 5\end{array}$ | 2.49 | $4 \begin{array}{llll}4 & 27 & 27 \cdot 0\end{array}$ | $2 \cdot 53$ | $\begin{array}{llll}4 & 24 & 53 \cdot 8\end{array}$ | $2 \cdot 58$ |
| 19 | $432 \begin{array}{llll}4 & 35 \cdot 1\end{array}$ | $2 \cdot 39$ | 430 10.6 | $2 \cdot 43$ | 42743.7 | $2 \cdot 47$ | $42514 \cdot 2$ | $2 \cdot 51$ | 422420 | $2 \cdot 56$ | $420 \quad 7 \cdot 0$ | $2 \cdot 61$ |
| 20 | $427 \quad 55 \cdot 2$ | 2.41 | $425 \quad 29.4$ | 2.45 | 423 I•I | $2 \cdot 49$ | $42030 \cdot 1$ | $2 \cdot 54$ | 4 I7 56.I | $2 \cdot 59$ | 415 I9.1 | $2 \cdot 64$ |
| 21 | $\begin{array}{llll}4 & 23 & 14.8\end{array}$ | $2 \cdot 43$ | $42047 \cdot 6$ | $2 \cdot 48$ | $\begin{array}{llll}4 & 18 & 17 \cdot 7\end{array}$ | $2 \cdot 52$ | 4 I5 44*9 | $2 \cdot 75$ | $413 \quad 9 \cdot 2$ | $2 \cdot 62$ | 4 Io 30.2 | $2 \cdot 68$ |
| 22 | $4 \begin{array}{llll}48 & 3\end{array}$ | $2 \cdot 45$ | $\begin{array}{llll}4 & 16 & 4.9\end{array}$ | $2 \cdot 50$ | $4 \begin{array}{llll}4 & 13 & 33.4\end{array}$ | $2 \cdot 55$ | 4 10 58.9 | $2 \cdot 60$ | $482 I \cdot I$ | $2 \cdot 66$ | $4540 \cdot 0$ | $2 \cdot 72$ |
| 23 | 4 I3 51.6 | $2 \cdot 48$ | 4 II 21.4 | 2.53 | $4 \begin{array}{llll}4 & 8 & 48 \cdot 1\end{array}$ | $2 \cdot 58$ | $4611 \cdot 7$ | $2 \cdot 63$ | 431319 | 2.69 | $4 \quad 0 \quad 48 \cdot 5$ | $2 \cdot 76$ |
| 24 | $\begin{array}{llr}4 & 9 & 8 \cdot 9\end{array}$ | $2 \cdot 50$ | $4 \quad 6 \quad 37 \cdot 0$ | $2 \cdot 56$ | $\begin{array}{llll}4 & 4 & 2 \cdot 0\end{array}$ | $2 \cdot 61$ | 4 I 423.5 | $2 \cdot 67$ | $\begin{array}{lllll}3 & 58 & 4 \mathrm{I}\end{array}$ | $2 \cdot 73$ | $35555 \cdot 5$ | $2 \cdot 80$ |
| 25 | $\begin{array}{llll}4 & 4 & 25 \cdot 3\end{array}$ | $2 \cdot 53$ | 4 I 5I•7 | $2 \cdot 59$ | 35914.7 | $2 \cdot 65$ | $35634{ }^{\circ} \mathrm{O}$ | $2 \cdot 71$ | $35349 \cdot 6$ | 2.77 | 35 I I•2 | $2 \cdot 84$ |
| 26 | $35940 \cdot 7$ | $2 \cdot 56$ | $\begin{array}{llll}3 & 57 & 5 \cdot 2\end{array}$ | $2 \cdot 62$ | $35426 \cdot 2$ | $2 \cdot 68$ | 35143.3 | $2 \cdot 75$ | $34856 \cdot 4$ | 2.82 | $346 \quad 5 \cdot 2$ | $2 \cdot 89$ |
| 27 | $35455 \cdot 2$ | $2 \cdot 59$ | $3{ }^{3} 52177 \cdot 7$ | $2 \cdot 66$ | $34936 \cdot 4$ | $2 \cdot 72$ | $34^{3} 4651 \cdot 1$ | $2 \cdot 79$ | $\begin{array}{llll}3 & 44 & 1 & 5\end{array}$ | 2.86 | 34175 | $2 \cdot 94$ |
| 28 | 350 | 2.63 | $\begin{array}{llll}3 & 47 & 29 & 0\end{array}$ | 2.69 | $\begin{array}{llllll}3 & 44 & 45 \cdot 3\end{array}$ | $2 \cdot 76$ | $3 \mathrm{4I} 57 \cdot 4$ | 2.83 | 3 39 $5 \cdot 1$ <br> 3   | 2.91 | $\begin{array}{lll}3 & 36 & 8.0\end{array}$ | $2 \cdot 99$ |
| 29 | $345 \quad 20 \cdot 8$ | $2 \cdot 66$ | $\begin{array}{llll}3 & 42 & 39\end{array}$ | $2 \cdot 73$ | $\begin{array}{llllllllllllll}3 & 39 & 52 \cdot 8\end{array}$ | $2 \cdot 8 \mathrm{I}$ | $\begin{array}{lll}3 & 37 & 2 \cdot 2\end{array}$ | 2.88 | $\begin{array}{lll}3 & 34 & 6 \cdot 8\end{array}$ | $2 \cdot 96$ | 33150.4 | 3.05 |
| 30 | $34031 \cdot 9$ | $2 \cdot 70$ | $\begin{array}{llll}3 & 37 & 47 \cdot 5\end{array}$ | $2 \cdot 78$ | $33458 \cdot 7$ | $2 \cdot 85$ | $\begin{array}{lll}3 & 32 & 5 \cdot 2\end{array}$ | 2.93 | $\begin{array}{llll}3 & 29 & 6 \cdot 7\end{array}$ | 3.02 | $326 \quad 2.8$ | 3.II |
| 31 | $33541 \cdot 5$ | $2 \cdot 74$ | $\begin{array}{llll}3 & 32 & 54 * 7\end{array}$ | 2.82 | $330 \quad 3.0$ | $2 \cdot 90$ | $\begin{array}{lll}3 & 27 & 6 \cdot 4\end{array}$ | 2.99 | $\begin{array}{lll}3 & 24 & 4 * 4\end{array}$ | 08 | $32056 \cdot 8$ | . 18 |
| 32 | $\begin{array}{lllll}3 & 30 & 49 \cdot 8\end{array}$ | 2.79 | $\begin{array}{lll}3 & 28 & 0 \cdot 1 \\ 3 & 23 & \end{array}$ | 2.87 | $\begin{array}{lll}3 & 25 & 5.5\end{array}$ | $2 \cdot 95$ | $\begin{array}{lll}3 & 22 & 5 \cdot 5 \\ 3 & 17 & 2 \cdot 5\end{array}$ | $3 \cdot 05$ | 3 19 000 | 3.14 | $3 \begin{array}{lllll}3 & 15 & 48 \cdot 4\end{array}$ | $3 \cdot 25$ |
| 33 | $\begin{array}{lllllllllllllllll}3 & 25 & 56.5\end{array}$ | 2.83 | $\begin{array}{lll}3 & 23 & 3.9 \\ 3 & 7\end{array}$ | $2 \cdot 92$ | 32060 | 3.01 | $\begin{array}{llll}3 & 17 & 2.5\end{array}$ | $3 \cdot 11$ | $\begin{array}{llll}3 & 13 & 53 \cdot 1\end{array}$ | 3.21 | $31037 \cdot 3$ | $3 \cdot 32$ |
| 34 | $\begin{array}{lll}3 & 21 & 1.5\end{array}$ | 2.88 | $\begin{array}{llll}3 & 18 & 5.8 \\ 3 & 13 & 5.6\end{array}$ | 2.97 | $\begin{array}{llll}3 & 15 & 4.5\end{array}$ | 3.07 | 3 II $57 \cdot 2$ | $3 \cdot 17$ | $\begin{array}{llll}3 & 8 & 43 \cdot 6\end{array}$ | $3 \cdot 28$ | $\begin{array}{llll}3 & 5 & 23.2\end{array}$ | $3 \cdot 40$ |
| 35 | 31647 | $2 \cdot 94$ | $\begin{array}{llll}3 & 13 & 5 \cdot 6\end{array}$ | $3 \cdot 03$ | 3100.6 | $3 \cdot 14$ | $3 \begin{array}{lll}3 & 6 & 49\end{array}$ | 3.24 | $\begin{array}{llll}3 & 3 & 31 \cdot 2\end{array}$ | $3 \cdot 36$ | 3 0 5\%9 | $3 \cdot 49$ |
| 36 | 3 II $6 \cdot 0$ |  | $\begin{array}{lll}3 & 8 & 3.3\end{array}$ | $3 \cdot 10$ | $\begin{array}{llll}3 & 4 & 54.3\end{array}$ | 3.21 | 3 I $38 \cdot 6$ | $3 \cdot 32$ | $25815 \cdot 7$ | 3.44 | $25445 \cdot 2$ | $3 \cdot 58$ |
| 37 | $\left\lvert\, \begin{array}{lll}3 & 6 & 5 \cdot 1\end{array}\right.$ | 3.06 | $\begin{array}{lrrr}3 & 2 & 58 \cdot 5\end{array}$ | $3 \cdot 16$ | $\begin{array}{lllll}2 & 59 & 45 \cdot 3\end{array}$ | $3 \cdot 28$ | $\begin{array}{llll}2 & 56 & 24.9\end{array}$ | $3 \cdot 40$ | 2525056 | 3.54 | $\begin{array}{llll}2 & 49 & 20 \cdot 6\end{array}$ | 3.68 |
| 38 | $\begin{array}{llll}3 & 1 & 1 & 8\end{array}$ | $3 \cdot 12$ | $25751 \cdot 1$ | $3 \cdot 24$ | $2 \begin{array}{llll}2 & 54 & 33^{\prime}\end{array}$ | $3 \cdot 36$ | 25170 | $3 \cdot 49$ | $24734 \cdot 2$ | 3.63 | $2 \begin{array}{llll}2 & 43 & 51 \cdot 8\end{array}$ | 3.79 |
| 39 | $\begin{array}{llll}2 & 55 & 56 \cdot 1 \\ 2 & 50 & \end{array}$ | $3 \cdot 19$ | $\begin{array}{llll}2 & 52 & 40 \cdot 9 \\ 2 & 47 & 27 \cdot 5\end{array}$ | 3.32 | 22 49 $18 \cdot 1$ | 3.45 | $24547 \cdot 2$ | $3 \cdot 59$ | 242704 | 3.74 | $\begin{array}{lllll}2 & 38 & 18 \cdot 2\end{array}$ | 3.91 |
| 40 | $25047 \cdot 6$ | $3 \cdot 27$ | $2 \quad 47 \quad 27 \cdot 5$ | 3.40 | 24359.4 | 3.54 | 24022.5 | 3.69 | $\begin{array}{llll}2 & 36 & 36 \cdot I\end{array}$ | 3.86 | $23239 \cdot 6$ | 4.04 |
| 4 I | $24536 \cdot 1$ | $3 \cdot 35$ | $2 \begin{array}{lll}2 & 42 & 10 \cdot 8\end{array}$ | 3.49 | $23836 \cdot 7$ | $3 \cdot 65$ | $\begin{array}{llll}2 & 34 & 53.3\end{array}$ | $3 \cdot 81$ | $230 \quad 59.8$, | 3.98 | 226551 | 4.18 |
| 42 | $24021 \cdot 2$ | 3.44 | $\begin{array}{llll}2 & 36 & 50 \cdot 1\end{array}$ | $3 \cdot 59$ | 2331988 | 3.76 | 22919.3 | $3 \cdot 93$ | $2 \begin{array}{llllll} \\ 2 & 25 & 17 & 7\end{array}$ | $4 \cdot 13$ | 2214.1 | $4 \cdot 34$ |
| 43 | $\begin{array}{llll}2 & 35 & 2 \cdot 7 \\ 2 & 29 & 40 \cdot 0\end{array}$ | 3.54 | $\begin{array}{lllll}2 & 31 & 25.4 \\ 2 & 25 & 55.8\end{array}$ | $3 \cdot 71$ | 22 27 38.0 <br> 2 22  | $3 \cdot 88$ | $\begin{array}{llll}2 & 23 & 39 \cdot 6 \\ 2 & 1 & 53 \cdot 8\end{array}$ | $4 \cdot 07$ | $\begin{array}{llll}2 & 19 & 29 \cdot 3 \\ 2 & 19 & 33 \cdot 7\end{array}$ | 4.28 | $\begin{array}{llrr}2 & 15 & 5 \cdot 7\end{array}$ | $4 \cdot 52$ |
| 44 | $\begin{array}{llll}2 & 29 & 40 \cdot 0 \\ 2 & 24 & 10.7\end{array}$ | 3.65 | 2 25 $55 \cdot 8$ <br> 2 20 $2 I \cdot 1$ | 3.83 | $\begin{array}{llr}2 & 22 & 0.8 \\ 2 & 16 & 17.5\end{array}$ | 4.02 | $\begin{array}{llll}2 & 17 & 53.8 \\ 2 & \text { I2 }\end{array}$ | $4 \cdot 23$ | $2 \begin{array}{llll}2 & 13 & 33 \%\end{array}$ | 4.46 |  | $4 \cdot 72$ |
| 45 | 22412.7 | 3.77 | 22021.1 | 3.96 | 2 16 17.5 | $4^{\circ} 17$ | 21200.9 | $4 \cdot 40$ | 729.9 | $4 \cdot 65$ | $242 \cdot 5$ | 4.94 |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ} \mathrm{A}$. |  | L. $1^{\circ} \mathrm{A}$. |  | L. $2^{\circ}$ | A. | L. 3 | A. | L. 4 | A. | L. 5 | - A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | - ${ }^{\text {S }}$ | S. -4.57 | $\stackrel{\text { S. }}{\text { - }}$ | s. | s. $-\quad{ }_{18} 8$ | $\begin{gathered} s . \\ -4 \cdot 58 \end{gathered}$ | - ${ }^{\text {S }}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 58 \end{gathered}$ | S. $-\quad 37$ |  | S. | s. |
| 2 | - 09 | -4.57 | -18 | -4.58 | -. 27 | -4.58 | - 36 | -4.59 | -. 46 | -4.60 | - .55 | -4.69 |
| 4 | -18 | $4 \cdot 58$ | $\cdot 27$ | 4.58 | $\cdot 36$ | 4.59 | $\cdot 45$ | 4.60 | $\cdot 55$ | $4 \cdot 61$ | -64 | $4 \cdot 62$ |
| 6 | $\cdot 27$ | $4 \cdot 58$ | $\cdot 36$ | $4 \cdot 59$ | -45 | $4 \cdot 60$ | $\cdot 55$ | $4 \cdot 61$ | -64 | $4 \cdot 62$ | $\cdot 73$ | $4 \cdot 63$ |
| 8 | $\cdot 36$ | $4 \cdot 59$ | $\cdot 45$ | $4 \cdot 60$ | -54 | 4.6 I | -64 | $4 \cdot 62$ | -73 | $4 \cdot 63$ | $\cdot 83$ | $4 \cdot 64$ |
| 10 | -45 | 4.59 | -54 | $4 \cdot 61$ | . 64 | $4 \cdot 62$ | $\cdot 73$ | 4.63 | -83 | $4 \cdot 65$ | -93 | $4 \cdot 67$ |
| 12 | $\cdot 54$ | $4 \cdot 60$ | $\cdot 64$ | $4 \cdot 62$ | $\cdot 73$ | 4.63 | . 83 | $4 \cdot 65$ | $\cdot 93$ | $4 \cdot 67$ | $\pm{ }^{-1}$ | $4 \cdot 69$ |
| 14 | -64 | $4 \cdot 62$ | $\cdot 74$ | $4 \cdot 63$ | . 83 | $4 \cdot 65$ | -93 | $4 \cdot 67$ | r.03 | $4 \cdot 69$ | $1 \cdot 14$ | $4 \cdot 71$ |
| 16 | $\cdot 74$ | $4 \cdot 63$ | $\cdot 84$ | $4 \cdot 65$ | -94 | $4 \cdot 67$ | $1 \cdot 04$ | $4 \cdot 69$ | I'14 | $4 \cdot 71$ | $1 \cdot 25$ | $4 \cdot 74$ |
| 18 | -84 | $4 \cdot 65$ | -94 | $4 \cdot 67$ | I.04 | $4 \cdot 69$ | I•15 | $4 \cdot 71$ | I 25 | $4 \cdot 74$ | 1.36 | $4 \cdot 77$ |
| 20 | -94 | $4 \cdot 67$ | 1.05 | $4 \cdot 69$ | 1.15 | 4.72 | 1.26 | $4 \cdot 74$ | $1 \cdot 37$ | $4 \cdot 77$ | 1.48 | 4.81 |
| 22 | 1.05 | $4 \cdot 69$ | 1-16 | $4 \cdot 72$ | 1.27 | 4.75 | 1.38 | $4 \cdot 78$ | 1.49 | 4.81 | $1 \cdot 61$ | $4 \cdot 85$ |
| 24 | I• 16 | $4 \cdot 72$ | $1 \cdot 28$ | $4 \cdot 75$ | I.39 | $4 \cdot 78$ | $1 \cdot 50$ | 4.81 | $\underline{1} \cdot 62$ | $4 \cdot 85$ | $1 \cdot 74$ | $4 \cdot 89$ |
| 26 | $1 \cdot 28$ | $4 \cdot 75$ | 1.40 | $4 \cdot 78$ | ${ }^{1} 52$ | 4.82 | $1 \cdot 64$ | $4 \cdot 86$ | r $\quad 76$ | 4.90 | 1.89 | $4 \cdot 95$ |
| 28 | 1.41 | $4 \cdot 78$ | $1 \cdot 53$ | $4 \cdot 82$ | I 66 | $4 \cdot 86$ | 178 | 4.91 | 1•91 | $4 \cdot 96$ | $2 \cdot 04$ | $5 \cdot \mathrm{~T}$ |
| 30 | I. 54 | 4.82 | 1.67 | 4.87 | 1.80 | 4.91 | 1.93 | $4 \cdot 96$ | 2.07 | $5 \cdot 02$ | 2.21 | 5.08 |
| 32 | I. 69 | 4.87 | 1.82 | 4.92 | 1.96 | 4.97 | $2 \cdot 10$ | $5 \cdot 03$ | 2.24 | $5 \cdot 09$ | 2.40 | $5 \cdot 16$ |
| 34 | 1.84 | 4.93 | 1.98 | 4.99 | $2 \cdot 13$ | $5 \cdot 04$ | $2 \cdot 28$ | $5 \cdot 11$ | 2.44 | $5 \cdot 18$ | $2 \cdot 60$ | $5 \cdot 26$ |
| 36 | 2.01 2.20 | 5.00 | $2 \cdot 16$ | $5 \cdot 06$ | 2.32 | $5 \cdot 13$ | $2 \cdot 48$ | $5 \cdot 20$ | $2 \cdot 65$ | $5 \cdot 29$ | $2 \cdot 83$ | $5 \cdot 38$ |
| $3^{8}$ | $2 \cdot 20$ | 5.07 | $2 \cdot 36$ | $5 \cdot 15$ | $2 \cdot 53$ | $5 \cdot 23$ | $2 \cdot 71$ | $5 \cdot 31$ | $2 \cdot 89$ | $5 \cdot 41$ | $3 \cdot 09$ | $5 \cdot 52$ |
| 40 | 2.40 2.64 | $5 \cdot 17$ $5 \cdot 28$ | 2.58 2.83 | $5 \cdot 25$ 5.38 | 2.77 3.04 | 5.34 5.49 | 2.96 3.26 | 5.45 5.61 | 3.17 3.49 | 5.56 5.75 | 3.39 3.75 3.7 | $5 \cdot 69$ |
| 43 | $2 \cdot 76$ | $5 \cdot 34$ | $2 \cdot 97$ | $5 \cdot 45$ | $3 \cdot 19$ | 5.57 | $3 \cdot 42$ | $5 \cdot 71$ | 3.67 | $5 \cdot 87$ | $3 \cdot 95$ | $6 \cdot 04$ |
| 44 | $2 \cdot 90$ | $5 \cdot 42$ | 3.11 | $5 \cdot 54$ | 3.35 | $5 \cdot 67$ | 3.60 | $5 \cdot 82$ | $3 \cdot 88$ | $5 \cdot 99$ | $4 \cdot 18$ | $6 \cdot 19$ |
| 45 | 3.05 | $5 \cdot 50$ | 3.28 | $5 \cdot 63$ | $3 \cdot 53$ | $5 \cdot 78$ | $3 \cdot 80$ | $5 \cdot 95$ | 4.10 | $6 \cdot 14$ | 4.43 | $6 \cdot 36$ |

## LATITUDE $29^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. <br> Var. | $8^{\circ}$ | Decl. <br> Var. | $9^{\circ}$ | Decl. <br> Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. S | S. | H. M. | s. | H. M. | S. | H. M. | S. | H. M. S. | S. |
| 0 | $\begin{array}{lllll}5 & 46 & 38 \cdot 4\end{array}$ | $-2.25$ | 5 44423.4 | $-2.26$ | $\begin{array}{llll}5 & 42 & 77\end{array}$ | $-2.27$ | $\begin{array}{llll}5 & 39 & 51 \cdot 2\end{array}$ | $-2.28$ | 5137 $5133 \cdot 8$ | $-2.30$ | $\begin{array}{llll}5 & 35 & 15 \cdot 5\end{array}$ | $-2 \cdot 3 \mathrm{I}$ |
| 2 | 53724.9 | 2.27 | $\begin{array}{llll}5 & 35 & 8.4\end{array}$ | $2 \cdot 28$ | 53250.9 | 2.30 | $5{ }_{5}^{5} 3032 \cdot 3$ | $2 \cdot 32$ | $\begin{array}{lllll}5 & 28 & 12.7\end{array}$ | $2 \cdot 34$ | 5251518 | $2 \cdot 36$ |
| 4 | 528100 | $2 \cdot 30$ | $\begin{array}{lllll}5 & 25 & 51 \cdot 6\end{array}$ | $2 \cdot 32$ | $52332 \cdot 0$ | $2 \cdot 34$ | 52 III 2 | $2 \cdot 36$ | $518189^{\circ} \mathrm{O}$ | $2 \cdot 38$ | $\begin{array}{llll}5 & 16 & 25 \cdot 4\end{array}$ | 2.4 I |
| 6 | 5 I 8133.2 | $2 \cdot 33$ | 5 I6 $32 \cdot 7$ | $2 \cdot 35$ | $5 \mathrm{llll}^{1} 10.9$ | $2 \cdot 38$ | 5 II $47 \cdot 6$ | $2 \cdot 40$ | $\begin{array}{llll}5 & 9 & 22.6\end{array}$ | $2 \cdot 43$ | $\begin{array}{llll}5 & 6 & 55 \cdot 8\end{array}$ | $2 \cdot 46$ |
| 8 | $\begin{array}{llll}5 & 9 & 34.3\end{array}$ | 2.37 | 5711.6 | $2 \cdot 39$ | $5 \begin{array}{lll}5 & 4 & 4 \% \\ \end{array}$ | $2 \cdot 42$ | $5 \quad 221 \cdot 0$ | $2 \cdot 45$ | $4 \quad 59 \quad 52 \cdot 9$ | $2 \cdot 49$ | 45722.7 | $2 \cdot 52$ |
| 10 | $5 \quad 0 \quad 13 \cdot 1$ | 2.41 | $45747 \cdot 8$ | $2 \cdot 44$ | $455 \quad 20 \cdot 5$ | 2.47 | 45251.2 | $2 \cdot 51$ | 45019.6 | $2 \cdot 55$ | $44745 \cdot 7$ | 2.59 |
| 12 | $45049 \cdot 3$ | 2.45 | 44821.0 | $2 \cdot 49$ | $4 \quad 45 \quad 50 \cdot 3$ | $2 \cdot 53$ | $44317 \times 7$ | $2 \cdot 57$ | 44042.4 | $2 \cdot 61$ | $4 \begin{array}{lll}48 & 4 & 3\end{array}$ | $2 \cdot 66$ |
| 13 | $4466 \cdot 0$ | 2.48 | $\begin{array}{llll}4 & 43 & 36 \cdot 4\end{array}$ | $2 \cdot 51$ | 4414.2 | $2 \cdot 56$ | $\begin{array}{llll}4 & 38 & 29 \cdot 5\end{array}$ | $2 \cdot 60$ | $43552 \cdot 1$ | $2 \cdot 65$ | $433 \mathrm{II} \cdot 8$ | 2.70 |
| 14 | 44122.4 | $2 \cdot 51$ | $43^{48} 50 \cdot 8$ | $2 \cdot 55$ | $43616 \cdot 8$ | $2 \cdot 59$ | $\begin{array}{llll}4 & 33 & 40 \cdot 1\end{array}$ | $2 \cdot 63$ | 43150.6 | $2 \cdot 68$ | $42818 \cdot 0$ | $2 \cdot 74$ |
| 15 | $43637 \cdot 6$ | 2.53 | 43444 | $2 \cdot 58$ | $43128 \cdot 4$ | $2 \cdot 62$ | $4 \quad 28 \quad 49 \cdot 6$ | $2 \cdot 67$ | $\begin{array}{lll}4 & 26 & 7 \cdot 8\end{array}$ | $2 \cdot 72$ | 42322.8 | $2 \cdot 78$ |
| 16 | 43152.0 | 2.5 | $4 \begin{array}{lll}4 & 29 & 16 \cdot 9\end{array}$ | $2 \cdot 61$ | $4 \begin{array}{llll}4 & 26 & 38 \cdot 9\end{array}$ | $2 \cdot 66$ | $423 \quad 57 \cdot 9$ | 2.71 | 42113.7 | $2 \cdot 76$ | $41826 \cdot 1$ | $2 \cdot 82$ |
| 17 | $4 \quad 27 \quad 5 \cdot 3$ | 2.59 | $42428 \cdot 3$ | $2 \cdot 64$ | $42148 \cdot 2$ | $2 \cdot 69$ | 4 I9 $4 \cdot 9$ | $2 \cdot 75$ | 4 I6 18.2 | 2.81 | $\begin{array}{llll}4 & 13 & 27.9\end{array}$ | 2.87 |
| 18 | $42217 \cdot 7$ | 2.63 | $4 \begin{array}{lllll}4 & 19 & 38\end{array}$ | $2 \cdot 68$ | 4 I6 $56 \cdot 3$ | $2 \cdot 73$ | $4 \begin{array}{llll}4 & 14 & 10.5\end{array}$ | $2 \cdot 79$ | 4 II 2I'I | $2 \cdot 85$ | $4 \quad 8 \quad 27 \cdot 9$ | $2 \cdot 92$ |
| 19 | 4 I7 28.9 | $2 \cdot 66$ | $41447 \cdot 6$ | $2 \cdot 72$ | $412 \quad 2 \cdot 9$ | $2 \cdot 77$ | $4 \begin{array}{llll}4 & 9 & 14.6\end{array}$ | $2 \cdot 84$ | $4 \quad 6 \quad 22.5$ | $2 \cdot 90$ | $\begin{array}{llll}4 & 3 & 26 \cdot 3\end{array}$ | $2 \cdot 97$ |
| 20 | 4 I2 $39{ }^{\circ} \mathrm{O}$ | $2 \cdot 70$ | $4 \begin{array}{lll}4 & 9 & 55.4\end{array}$ | 2.76 | $\begin{array}{llll}4 & 7 & 8 \cdot 2\end{array}$ | 2.82 | $44^{4} \begin{aligned} & \text { I } \\ & 7\end{aligned}$ | $2 \cdot 88$ | 4 I 22.1 | $2 \cdot 95$ | $\begin{array}{llll}3 & 58 & 22 \cdot 7\end{array}$ | 3.03 |
| 21 | $4787 \cdot 7$ | $2 \cdot 74$ | $4 \begin{array}{lll}4 & 5 & 1 * 7\end{array}$ | 2.80 | $4 \quad 2$ | 2.86 | $\begin{array}{llll}3 & 59 & 18 \cdot 0\end{array}$ | $2 \cdot 93$ | $\begin{array}{llll}3 & 56 & 19.8\end{array}$ | 3.01 |  | 3.09 |
| 22 | $4 \quad 255^{\circ} 2$ | $2 \cdot 78$ | $4 \quad 0 \quad 6 \cdot 6$ | $2 \cdot 84$ | $35714{ }^{\circ} \mathrm{O}$ | 2.91 | 354 IT•I | $2 \cdot 99$ | $35^{3} 515 \cdot 6$ | 3.06 | $34^{3} 489 \cdot 3$ | $3 \cdot 15$ |
| 23 | $\begin{array}{llll}3 & 58\end{array}$ | $2 \cdot 82$ | $\begin{array}{llll}3 & 55 & 9 \cdot 8\end{array}$ | 2.89 | 35214.3 | $2 \cdot 96$ | 349 14.2 | 3.04 | $\begin{array}{lll}3 & 46 & 9 \cdot 3\end{array}$ | $3 \cdot 12$ | 34259.2 | 3.21 |
| 24 | $\begin{array}{llll}3 & 53 & 5 \cdot 6\end{array}$ | 2.87 | $350 \mathrm{II} \cdot 5$ | $2 \cdot 94$ | 34712.7 | 3.02 | $\begin{array}{lll}3 & 44 & 9 \cdot 3\end{array}$ | 3.10 | $34100 \cdot 7$ | 3.19 |  | $3 \cdot 28$ |
| 25 | $\begin{array}{llll}3 & 4^{8} & 8 \cdot 4\end{array}$ | 2.92 | 345 II'2 | $2 \cdot 99$ | 342902 | 3.08 | $\begin{array}{llll}3 & 39 & 2 \cdot 1\end{array}$ | 3.16 | $3{ }^{3} 3549.6$ | 3.26 | $\begin{array}{llll}3 & 32 & 31 \cdot 3\end{array}$ | $3 \cdot 36$ |
| 26 | 3431905 | $2 \cdot 97$ | $340 \quad 9 \%$ | 3.05 | $\begin{array}{lll}3 & 37 & 3.5\end{array}$ | 3.14 | $3 \begin{array}{llll}3 & 33 & 52 \cdot 6\end{array}$ | 3.23 | $33036 \cdot 0$ | $3 \cdot 33$ | 32713.2 | 3.43 |
| 27 | $\begin{array}{llll}3 & 38 & 8 \cdot 6\end{array}$ | 3.02 | $\begin{array}{llll}3 & 35 & 4^{\circ} 7\end{array}$ | $3 \cdot 11$ | 33155.5 | $3 \cdot 20$ | $\begin{array}{llllllllllllllll}3 & 28 & 40 \cdot 5\end{array}$ | $3 \cdot 30$ | $\begin{array}{llll}3 & 25 & 19.5\end{array}$ | 3.40 | 3215109 | $3 \cdot 52$ |
| 28 | $\begin{array}{llll}3 & 33 & 5 \cdot 7\end{array}$ | 3.08 | $\begin{array}{llll}3 & 29 & 58 \cdot 2\end{array}$ | $3 \cdot 17$ | $32645{ }^{\circ} \mathrm{O}$ | 3.27 | $\begin{array}{llll}3 & 23 & 25 \cdot 7\end{array}$ | $3 \cdot 38$ | 3 I9 59.9 | 3.49 |  | $3 \cdot 6 \mathrm{I}$ |
| 29 | [rrr $\begin{array}{rrr}3 & 28 & 0 \cdot 7\end{array}$ | 3.14 | $\begin{array}{llll}3 & 24 & 49 \cdot 3\end{array}$ | $3 \cdot 24$ | 3 21 3I.8 | $3 \cdot 34$ | $\begin{array}{llrr}3 & 18 & 7 \cdot 9\end{array}$ | $3 \cdot 46$ | $3 \begin{array}{llllllllll}3 & 14 & 370\end{array}$ | $3 \cdot 58$ | 3 10 $58 \cdot 8$ | $3 \cdot 70$ |
| 30 | 32253.2 | $3 \cdot 21$ | $31937 *$ | $3 \cdot 31$ | 3 I6 15.7 | 3.42 | $31246 \cdot 8$ | $3 \cdot 54$ | $3 \quad 9 \begin{array}{llll} & 10.6\end{array}$ | 3.67 | $\begin{array}{llll}3 & 5 & 26.4\end{array}$ | $3 \cdot 8 \mathrm{I}$ |
| 31 | $\begin{array}{llll}3 & 17 & 43.2\end{array}$ | 3.28 | $\begin{array}{llll}3 & 14 & 23 \cdot 2\end{array}$ | 3.39 | 3 IO 56.4 | 3.51 | $3 \quad 7 \quad 22.2$ | 3.63 | $\begin{array}{lllll}3 & 3 & 40 \cdot 2\end{array}$ | 3.77 | $25949 \cdot 6$ | 3.92 |
| 32 | $\begin{array}{llll}3 & 12 & 30 \cdot 4\end{array}$ | $3 \cdot 36$ | $\begin{array}{llll}3 & 9 & 5 \cdot 7\end{array}$ | $3 \cdot 47$ | $3 \begin{array}{llll}3 & 5 & 33.7\end{array}$ | $3 \cdot 60$ | $\begin{array}{lllll}3 & 1 & 53.7\end{array}$ | 3.73 | $\begin{array}{llll}2 & 58 & 5 \cdot 5\end{array}$ | $3 \cdot 88$ | $254 \quad 8 \cdot 0$ | $4 \cdot 04$ |
| 33 | $\begin{array}{llll}3 & 7 & 14.7\end{array}$ | 3.44 | $\begin{array}{llll}3 & 3 & 44 \cdot 8\end{array}$ | $3 \cdot 56$ | $\begin{array}{lrrr}3 & 0 & 7 \cdot 2\end{array}$ | $3 \cdot 70$ | $2 \mathrm{l}_{26} \mathbf{5}$ 21.1 | $3 \cdot 84$ | 25226.0 | $4 \cdot 00$ | $2482 I \cdot T$ | $4 \cdot 17$ |
| 34 | $\begin{array}{rrrr}3 & 1 & 55 \cdot 6\end{array}$ | 3.52 | 2 58 $20 \cdot 2$ <br> 2 5  | $3 \cdot 66$ | $25436 \cdot 6$ | $3 \cdot 80$ | $\begin{array}{llllllllllllll}2 & 50 & 43 \cdot 8\end{array}$ | 3.96 | $2{ }_{2} 464 \mathrm{H} \cdot 4$ | $4 \cdot 13$ | $\begin{array}{llll}2 & 42 & 28 \cdot 3\end{array}$ | $4 \cdot 32$ |
| 35 | $2 \begin{array}{llll}26 & 32.9\end{array}$ | 3.62 | 25251.7 | 3.76 | 24915 | 3.92 | $245 \quad 1 \cdot 5$ | 4.09 | $24051 \cdot 0$ | $4 \cdot 27$ | $2 \begin{array}{llll}2 & 36 & 28 \cdot 9\end{array}$ | 4.47 |
| 36 | $2 \begin{array}{lll}21 & 6 \cdot 3\end{array}$ | 3.72 |  | $3 \cdot 87$ | $2 \begin{array}{llll}2 & 43 & 2 I & 3\end{array}$ | 4.04 | $\begin{array}{llll}2 & 39 & 13.4\end{array}$ | 4.23 | $23454 \cdot 1$ | 4.43 | $23022 \cdot 1$ | $4 \cdot 65$ |
| 37 | $\begin{array}{lllll}2 & 45 & 35 \cdot 4\end{array}$ | 3.83 | $24140 \cdot 7$ | $4^{\circ} 00$ | $\begin{array}{llllllllllllllllllll}2 & 37 & 35 \cdot 6\end{array}$ | $4^{\circ 18}$ | $2 \begin{array}{llll} & 33 & 19 \cdot 1\end{array}$ | 4.38 | $2 \begin{array}{llllll}2 & 28 & 50.0\end{array}$ | $4 \cdot 60$ | $\begin{array}{llll}2 & 24 & 7 \cdot 1\end{array}$ | 484 |
| 38 |  | $3 \cdot 95$ | 235157.4 | $4 \cdot 13$ | $23143 \%$ | $4 \cdot 33$ |  | 4.55 | $22237 \cdot 8$ | $4 \cdot 79$ | 21742.6 | $5 \cdot 07$ |
| 39 | $\begin{array}{llll}2 & 34 & 18 \cdot 7 \\ 2 & 28 & 31 \cdot 8\end{array}$ | $4 \cdot 08$ | $230 \begin{array}{lll}2 & 8 \cdot 0 \\ 2 & 24 & 1.8\end{array}$ | $4 \cdot 28$ | $\begin{array}{lllllll}2 & 25 & 44.9\end{array}$ | $4 \cdot 50$ | $\begin{array}{llr}2 & 21 & 8 \cdot 2 \\ 2 & 1 & 4\end{array}$ | $4 \times 74$ | $\begin{array}{llllll}2 & 16 & 16 \cdot 3\end{array}$ | 5.01 | $2 \begin{array}{lll}11 & 7 \cdot 3\end{array}$ | $5 \cdot 31$ |
| 40 | 22831.8 | $4 \cdot 23$ | 224 II•8 | 4.45 | $21938 \cdot 2$ | $4 \cdot 69$ | $21449 \cdot 6$ | 4.95 | 2944.1 | $5 \cdot 25$ | $2 \begin{array}{llll}2 & 4 & 19.5\end{array}$ | 5•59 |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $6^{\circ} \mathrm{A}$. |  | L. $7^{\circ} \mathrm{A}$. |  | L. $8^{\circ} \mathrm{A}$. |  | L. $9^{\circ} \mathrm{A}$. |  | L. $10^{\circ} \mathrm{A}$. |  | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{\circ} \mathrm{O}$ | $\stackrel{s .}{-\quad .55}$ | $\begin{gathered} s . \\ -4.60 \end{gathered}$ | $-{ }^{\mathrm{s}} .$ | $\begin{gathered} \mathrm{s} \\ -4.62 \end{gathered}$ | $\stackrel{s}{-} \cdot{ }_{74}$ | $\begin{gathered} \mathrm{s} \\ -4.63 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ -.83 \end{gathered}$ | $\begin{gathered} \text { s. } \\ -4.65 \end{gathered}$ | S. $\cdot 93$ | $\begin{gathered} \text { s. } \\ -4.66 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ -\mathrm{I} \cdot \mathrm{O} 2 \end{gathered}$ | s. |
| 2 | . 64 | 4.62 | . 74 | 4.63 | .83 | 4.65 | -92 | 4.67 | I.02 | 4.69 | I-12 | $4 \cdot 71$ |
| 4 | $\cdot 73$ | $4 \cdot 63$ | -83 | $4 \cdot 65$ | $\cdot 92$ | $4 \cdot 67$ | $1 \cdot 02$ | $4 \cdot 69$ | 1-12 | $4 \cdot 71$ | I. 22 | 4.73 |
| 6 | -83 | $4 \cdot 65$ | -93 | $4 \cdot 67$ | 1.02 | $4 \cdot 69$ | I-12 | $4 \cdot 71$ | 1.22 | $4 \cdot 73$ | I-32 | $4 \cdot 76$ |
| 8 | $\cdot 93$ | $4 \cdot 67$ | I-02 | $4 \cdot 69$ | 1.12 | $4 \cdot 71$ | I 22 | 4.73 | r-33 | $4 \cdot 76$ | I.43 | 4.79 |
| 10 | 1.03 | $4 \cdot 69$ | I 13 | $4 * 71$ | 1.23 | 4*74 | 1.33 | 4.76 | 1.43 | 4*79 | I.54 | $4 \cdot 83$ |
| 12 | I-13 | $4 \cdot 70$ | I 23 | $4 \cdot 74$ | 1.34 | $4 \cdot 77$ | 1.44 | 4.80 | I. 55 | $4 \cdot 83$ | 1.66 | $4 \cdot 87$ |
| 14 | I. 24 | $4 \cdot 74$ | I. 34 | $4 \cdot 77$ | 1.45 | $4 \cdot 80$ | I 56 | $4 \cdot 83$ | I. 67 | $4 \cdot 87$ | I•78 | 4.91 |
| x 6 | I. 35 | $4 \cdot 77$ | 1.46 | $4 \cdot 80$ | I. 57 | $4 \cdot 83$ | I.68 | $4 \cdot 87$ | I.80 | $4 \cdot 91$ | I.91 | $4 \cdot 96$ |
| 18 | 1.47 | $4 \cdot 80$ | I-58 | $4 \cdot 84$ | I. 69 | $4 \cdot 88$ | I.81 | 4.92 | 1-93 | $4 \cdot 96$ | 2.05 | $5 \cdot \mathrm{I}$ |
| 20 | 1.59 | $4 \cdot 84$ | $1 \cdot 71$ | 4.88 | r. 83 | $4 \cdot 92$ | I•95 | 4.97 | 2.07 | $5 \cdot 02$ | $2 \cdot 20$ | $5 \cdot 08$ |
| 22 | $1 \cdot 72$ | $4 \cdot 89$ | I.85 | 4.93 | 1.97 | $4 \cdot 98$ | $2 \cdot 10$ | $5 \cdot \mathrm{O}$ | $2 \cdot 23$ | 5.09 | $2 \cdot 37$ | $5 \cdot 15$ |
| 24 | 1.87 | $4 \cdot 94$ | I-99 | 4.99 | $2 \cdot 12$ | $5 \cdot 04$ | $2 \cdot 26$ | 5.10 | $2 \cdot 40$ | 5.16 | 2.54 | $5 \cdot 23$ |
| 26 | 2.02 | 5:00 | $2 \cdot 15$ | $5 \cdot 05$ | 2.29 | $5 \cdot 11$ | 2.43 | $5 \cdot 18$ | 2.58 | $5 \cdot 25$ | 2.74 | $5 \cdot 33$ |
| 28 | 2.18 | $5 \cdot 07$ | $2 \cdot 32$ | $5 \cdot 13$ | 2.47 | $5 \cdot 20$ | 2.62 | $5 \cdot 27$ | $2 \cdot 78$ | $5 \cdot 35$ | 2.95 | $5 \cdot 44$ |
| 30 | $2 \cdot 36$ | $5 \cdot 15$ | $2 \cdot 51$ | 5.22 | 2.67 | $5 \cdot 29$ | $2 \cdot 83$ | $5 \cdot 38$ | $3 \cdot 01$ | $5 \cdot 47$ | 3.19 | $5 \cdot 58$ |
| 32 | $2 \cdot 55$ | 5.24 | $2 \cdot 72$ | $5 \cdot 32$ | $2 \cdot 89$ | $5 \cdot 41$ | $3 \cdot 07$ | $5 \cdot 51$ | $3 \cdot 26$ | $5 \cdot 62$ | $3 \cdot 46$ | 5.74 |
| 33 | $2 \cdot 66$ | 5.29 | $2 \cdot 83$ | $5 \cdot 38$ | 3.01 | $5 \cdot 48$ | $3 \cdot 20$ | 5*58 | $3 \cdot 40$ | $5 \cdot 70$ | $3 \cdot 62$ | $5 \cdot 83$ |
| 34 | 2.77 | $5 \cdot 35$ | 2.95 | $5 \cdot 44$ | $3 \cdot 14$ | $5 \cdot 55$ | $3 \cdot 34$ | $5 \cdot 66$ | $3 \cdot 55$ | 5'79 | $3 \cdot 78$ | $5 \cdot 93$ |
| 35 | 2.89 | $5 \cdot 4 \mathrm{I}$ | 3.08 | $5 \cdot 51$ | $3 \cdot 28$ | $5 \cdot 63$ | $3 \cdot 49$ | 5•75 | $3 \times 72$ | $5 \cdot 89$ | $3 \cdot 96$ | $6 \cdot 05$ |
| 36 | $3 \cdot 02$ | $5 \cdot 48$ | $3 \cdot 22$ | 5.59 | $3 \cdot 43$ | $5 \cdot 71$ | $3 \cdot 65$ | $5 \cdot 85$ | 3.90 | $6 \cdot 01$ | $4 \cdot 16$ | $6 \cdot 18$ |
| 37 | 3*15 | $5 \cdot 55$ | $3 \cdot 36$ | $5 \cdot 68$ | $3 \cdot 59$ | $5 \cdot 81$ | $3 \cdot 83$ | $5 \cdot 96$ | $4 \cdot 09$ | $6 \cdot 14$ | 4.37 | $6 \cdot 33$ |
| 38 | -3.30 | $5 \cdot 64$ | $3 \cdot 52$ | $5 \cdot 77$ | $3 \cdot 76$ | $5 \cdot 92$ | 4.02 | $6 \cdot 09$ | $4 \cdot 30$ | $6 \cdot 28$ | $4 \cdot 62$ | $6 \cdot 50$ |
| 39 | $3 \cdot 46$ | $5 \cdot 73$ | 3.70 | $5 \cdot 88$ | $3 \cdot 95$ | $6 \cdot 05$ | $4 \cdot 23$ | $6 \cdot 23$ | $4 \cdot 54$ | $6 \cdot 45$ | 4.49 | $6 \cdot 69$ |
| 40 | $3 \cdot 63$ | $5 \cdot 84$ | $3 \cdot 89$ | $6 \cdot 00$ | $4 \cdot 17$ | $6 \cdot 19$ | $4 \cdot 47$ | $6 \cdot 40$ | $4 \cdot 8 \mathrm{I}$ | $6 \cdot 64$ | 5.19 | $6 \cdot 91$ |

## 240 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $29^{\circ}$.

DECLINATION--CONTRARY NAME TO--LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. Var. | $14^{\circ}$ | Decl. <br> Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | H. M. | S. | H. M. S. |  | H. M. S. |  | H. M. s. | S. | H. M. S. | S. | 52058 | S. |
| 0 | $53256 \cdot 0$ | -2. | 53035.4 |  | $\begin{array}{llll}5 & 28 & 13.5\end{array}$ |  | $\begin{array}{llll}5 & 25 & 50 \cdot 0\end{array}$ | -2.40 | $\begin{array}{llll}5 & 23 & 25^{\circ} 0\end{array}$ | $2 \cdot 43$ | $52058 \cdot 3$ | 2.46 |
| 2 | $523 \begin{array}{llll}5 & 29 & 6\end{array}$ | $2 \cdot 3$ | $\begin{array}{llll}5 & 21 & 5.9\end{array}$ | 2.41 | $51840 \cdot 7$ | $2 \cdot 44$ | 51613.6 | 2.47 | $5 \mathrm{I}_{3} 44^{\prime} 7$ | 2.50 | 5 II 13.8 | 2.53 |
| 4 | $5 \mathrm{lll}_{5}^{5} \mathrm{O}$ | $2 \cdot 44$ | 5 II 33. 1 | 2.47 | $\begin{array}{lll}5 & 9 & 4 \cdot 2\end{array}$ | 2.50 | $5{ }_{5}^{5} 633.2$ | 2.53 |  | 2.57 | 5 I 24.6 | 2.61 |
|  | $\begin{array}{llll}5 & 4 & 27 \cdot 1\end{array}$ | $2 \cdot 49$ | 5 I 56.5 | 2.53 | $45923 \cdot 6$ | $2 \cdot 57$ | 45648.4 | 2.61 | $45410 \cdot 6$ | 2.65 | $45 \mathrm{I} 30 \% 2$ | $2 \cdot 70$ |
| 8 | $45450 \cdot 4$ | 2.56 | $4 \quad 5215 \cdot 7$ |  | $44938 \cdot 5$ | 2.64 | $44658 \cdot 6$ | $2 \cdot 69$ | 44415.8 | $2 \cdot 74$ | $44 \mathrm{I} 30 \cdot 0$ | $2 \cdot 79$ |
| I2 | $\begin{array}{lllr}4 & 45 & 903 \\ 4 & 35 & 23.4\end{array}$ |  | $\begin{array}{lll}4 & 42 & 30 \cdot 2 \\ 4 & 32 & 39.5\end{array}$ | 2.68 | $\begin{array}{llll}4 & 39 & 48 \cdot 2 \\ 4 & 29 & 52 \cdot 3\end{array}$ | 2.81 | $\begin{array}{llll}4 & 37 & 3.2 \\ 4 & 27 & 1.7\end{array}$ | 2.87 | $\begin{array}{llll}4 & 34 & 15.0 \\ 4 & 24 & 7.4\end{array}$ | 2.83 2.04 | 4 3I 23.3 | -89 |
| 12 | 43523.4 | $2 \cdot 31$ | 43239.5 | 2.76 | $42952 \cdot 3$ | $2 \cdot 8$ | $4 \begin{array}{lll}4 & 27 & 17\end{array}$ | 2.87 | $424 \quad 7 \% 4$ | $2 \cdot 94$ | 42193 | .00 |
| 14 | $42532 \cdot 2$ | 2.79 | $\begin{array}{ll}4 & 22 \\ 4 & 42 \cdot 9\end{array}$ | $2 \cdot 85$ | $41950 \cdot 0$ | 2.91 | 41653.3 | $2 \cdot 98$ | $\begin{array}{lllllllllll}4 & 13 & 52.4\end{array}$ | 3.05 | 4 10 47.1 | 3.13 |
| 15 | $42034 \cdot 3$ | 2.84 2.8 | $\begin{array}{llllllllll}4 & 17 & 42 \cdot 2 \\ 4 & \text { I2 }\end{array}$ | 2.90 |  | 2.97 | $4 \begin{array}{lll}4 & \text { II } & 46 \cdot 2\end{array}$ | 3.04 | $\begin{array}{llll}4 & 8 & 41 \cdot 7 \\ 4 & 3 & 28\end{array}$ | $3 \cdot 11$ | $\begin{array}{llll}4 & 5 & 32.5\end{array}$ | 3.19 3.26 |
| 16 | $415 \quad 34.9$ | $2 \cdot 89$ | $4 \begin{array}{llll}42 & 39\end{array}$ | 2.95 | $4 \quad 9 \quad 40 \cdot 5$ | 3.02 | $4 \quad 636 \cdot 9$ | $3 \cdot 10$ | $4 \quad 3 \quad 28 \cdot 7$ | 3.18 | - 15.6 | $3 \cdot 26$ |
| 17 | 4 10 33.7 | $2 \cdot 94$ | $4 \quad 735.4$ | . 01 | $\begin{array}{ll}4 & 4 \\ 32\end{array}$ | 3.08 | 125.5 | $3 \cdot 16$ |  | 3.25 | $35455 \cdot 9$ | 34 |
| 18 | $4 \quad 5 \quad 30 \cdot 7$ | 99 | $4 \quad 2 \quad 29 \cdot 1$ | 3.06 | 35922.9 | $3 \cdot 14$ | $35611 \cdot 7$ | 3.23 | 35255.4 | 3.32 | $34933 \cdot 4$ | $3 \cdot 42$ |
| 19 | $4 \quad 0 \quad 25 \cdot 7$ | 3.05 | $35720 \cdot 6$ | $3 \cdot 13$ | $35410 \cdot 6$ | 3.21 | 35055.4 | 3.30 | $34734 \cdot 6$ | $3 \cdot 40$ | 344 | $3 \cdot 50$ |
| 20 | $35518 \cdot 7$ | II | $\begin{array}{llll}3 & 52 & 9 & 9\end{array}$ | $3 \cdot 19$ | $34855^{\circ} 9$ | $3 \cdot 28$ | $34536 \cdot 3$ | 3.37 | $34210 \cdot 9$ | 3.48 | 3 38 39 | 9 |
| 21 | 3509.5 | $3 \cdot 17$ | $34656 \cdot 7$ | 3.26 | $\begin{array}{llll}3 & 43 & 38 \cdot 5\end{array}$ | $3 \cdot 35$ | $3 \begin{array}{llllllll} & 40\end{array}$ | 3.45 | $\begin{array}{llll}3 & 36 & 43\end{array}$ | $3 \cdot 56$ | 3336 |  |
| 22 | $34457 \cdot 8$ | $3 \cdot 24$ | 3 41 40*9 | 3.33 | 318818.2 | 3.43 | 33449.2 | $3 \cdot 54$ | 33113.5 | $3 \cdot 65$ | $32730 \cdot 6$ | 78 |
| 23 | $33943{ }^{3} 7$ | 3 |  | 3.41 | $\begin{array}{llllllllllll}3 & 32 & 54 \cdot 8\end{array}$ | 3.51 | $\begin{array}{llllllllllll}3 & 29 & 20 \cdot 6\end{array}$ | 3.63 | 3251393 | 37 | $32150 \cdot 2$ | 3.89 |
| 24 | $\begin{array}{ll}3 & 3426 \cdot 8\end{array}$ | $3 \cdot 38$ | 3 31 0.8 | 3.49 | $\begin{array}{lllll}3 & 27 & 28 \cdot 1 \\ 3 & \text { I }\end{array}$ | $3 \cdot 60$ | $\begin{array}{llll}3 & 23 & 48.4\end{array}$ | $3 \cdot 73$ | 32010 | $3 \cdot 86$ | $\begin{array}{llll}3 & 16 & 5.4\end{array}$ | 4.00 |
| 25 | 3 29 $6 \cdot 9$ <br> 3 23  | 3.46 | $\begin{array}{llll}3 & 25 & 35.9\end{array}$ | 3.58 |  | $3 \cdot 70$ | $\begin{array}{llll}3 & 18 & 12.2\end{array}$ | 3.83 | $\begin{array}{lllll}3 & 14 & 188.3 \\ 3 & 8 & 30.8\end{array}$ | $3 \cdot 97$ | $\begin{array}{llll}3 & 10 & 15 \cdot 7 \\ 3 & 4 & \end{array}$ | 4.12 |
| 26 | $32343 \cdot 8$ | $3 \cdot 55$ | $320 \quad 7 \cdot 6$ | 3.67 | 31623.6 | $3 \cdot$ | $31231 \cdot 6$ | 3.94 | $\begin{array}{llll}3 & 8 & 30 \cdot 8\end{array}$ | 4.09 | $3 \quad 420 \cdot 5$ | 26 |
| 27 |  | $3 \cdot 64$ | $31435{ }^{\circ}$ | $3 \cdot 77$ | 3 10 $45 \cdot 1$ | 3.91 | $\begin{array}{lllll}3 & 6 & 46 \cdot 3\end{array}$ | 4.06 | $\begin{array}{llll}3 & 2 & 38 \cdot 0\end{array}$ | $4 \cdot 22$ | $2 \begin{array}{lll}58 & 19.4\end{array}$ | 40 |
| 28 | $31247{ }^{\circ}$ | 3.74 | $\begin{array}{llll}3 & 8 & 58.8\end{array}$ | 3.88 | $\begin{array}{llll}3 & 5 & 1 \cdot 9\end{array}$ | $4 \cdot 03$ | 3 - 55.7 | $4 \cdot 19$ | 25639.3 | $4 \cdot 37$ | 252 II•8 | $4 \cdot 56$ |
| 29 | $\begin{array}{llll}3 & 7 & 12 \cdot 6\end{array}$ | 3.84 | $\begin{array}{llll}3 & 3 & 17.8\end{array}$ | 3.99 | $\begin{array}{llllll}2 & 59 & 13 & 7\end{array}$ | $4 \cdot 15$ | $25459 \cdot 5$ | 4.33 | $25034 \cdot 2$ | $4 \cdot 52$ | 24556.9 | $4 \cdot 73$ |
| 30 | $\begin{array}{llll}3 & 1 & 33.7\end{array}$ | 3.95 | $25731 \cdot 8$ | 4. | ${ }^{2} 53319.8$ | 4.29 | $24856 \cdot 9$ | 448 | 24421.9 | 4.6 | $23933 \cdot 8$ | 4.92 |
| 31 | 25549.9 | 4 | $25 \mathrm{I} 40 \% 2$ | 5 | 2471907 | 4.44 | $24247 \cdot 2$ | $4 \cdot 65$ | 238 1•7 | 4.88 | 233186 | $5 \cdot 14$ |
| 32 | 2500.7 | 4.21 | $24542 \cdot 6$ | $4 \cdot 40$ |  | $4 \cdot 61$ | 23629.7 | $4 \cdot 84$ | $23132 \cdot 3$ | $5 \cdot 09$ | 22618.9 | . 38 |
| 33 | $\begin{array}{llll}2 & 44 & 5 \cdot 4\end{array}$ | $4 \cdot 36$ | $23938 \cdot \mathrm{I}$ | $4 \cdot 56$ | $\begin{array}{lllllll}2 & 34 & 57 \cdot 8\end{array}$ | $4 \cdot 79$ | 230 | $5 \cdot 04$ | $22452 \cdot 7$ | $5 \cdot 32$ | 21924.3 | .65 |
| 34 |  | 4.52 | $23326 \cdot 0$ | $4 \cdot 74$ | $\begin{array}{llll}2 & 28 & 34.3\end{array}$ | 4.99 | $223 \begin{array}{llll}26 \cdot 7\end{array}$ | $5 \cdot 27$ | $2 \begin{array}{lll}18 & 1\end{array}$ | 9 | $\begin{array}{llll}2 & 12 & 15.9\end{array}$ | 5.96 |
| 35 36 | 2 31 | 4.70 | $2 \begin{array}{lll}27 & 5\end{array}$ | 4.94 | $\begin{array}{lll}2 & 22 & 0.8 \\ 2 & 5 & 5\end{array}$ | 5.22 5.48 | $\begin{array}{llllll}2 & 16 & 38 \cdot 6 \\ 2 & & 3\end{array}$ | 5.54 5.8 | $21056 \cdot 5$ | $5 \cdot 89$ | 451.4 | $6 \cdot 32$ |
| 36 | $22536 \cdot 3$ | $4 \cdot 8$ | 22034.9 | 5.17 | $\begin{array}{llll} & 15 & 15.9\end{array}$ | $5 \cdot 4$ | $937 \cdot 2$ | $5 \cdot 83$ | $2335 \%$ | $6 \cdot 2$ | $57 \quad 7 \cdot 7$ | $6 \cdot 74$ |

VARIATION TO $x^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ} \mathrm{A}$. |  | L. $13^{\circ} \mathrm{A}$. |  | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{19} \mathrm{~A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\stackrel{\text { S. }}{\substack{\text { ¢ } \\-12}}$ | S. -4.71 | S. $-\mathrm{I} \cdot 22$ | s. | S. | s. $4 \cdot 76$ | S. | s. | S. | S. | s. | s. |
| 2 | I.22 | 4.73 | - 1.32 | -4.76 | - 1.42 | -4.79 | r -1.52 | -4.82 | - -1.62 | -4.82 4.85 | -1.62 1.73 | 4.85 4.89 |
| 4 | I 32 | $4 \cdot 76$ | 1.42 | $4 \cdot 79$ | 1.52 | 4.82 | I. 63 | $4 \cdot 85$ | I•3 | $4 \cdot 89$ | I. 84 | $4 \cdot 93$ |
| 6 | I-42 | $4 \cdot 79$ | 1.53 | $4 \cdot 82$ | 1.63 | $4 \cdot 86$ | $1 \cdot 74$ | $4 \cdot 89$ | I•85 | 4.93 | I.96 | $4 \cdot 98$ |
| 8 | 1.53 | $4 \cdot 82$ | I. 64 | $4 \cdot 86$ | 1.75 | $4 \cdot 90$ | I.86 | $4 \cdot 94$ | - 97 | $4 \cdot 98$ | $2 \cdot 09$ | $5 \cdot 03$ |
| 10 | I 65 | 4.86 | I.76 | 4.90 | 1.87 | $4 \cdot 94$ | $1 \cdot 99$ | $4 \cdot 99$ | $2 \cdot 10$ | $5 \cdot 03$ | $2 \cdot 22$ | $5 \cdot 09$ |
| 12 | 1•7 | 4.90 | I.88 | 4.95 | $2 \cdot 00$ | $4 \cdot 99$ | $2 \cdot 12$ | 5.04 | $2 \cdot 24$ | $5 \cdot 09$ | $2 \cdot 37$ | $5 \cdot 15$ |
| 14 | I.90 | $4 \cdot 95$ | 2.02 | $5 \cdot 00$ | $2 \cdot 14$ | $5 \cdot 05$ | $2 \cdot 26$ | $5 \cdot 10$ | $2 \cdot 39$ | $5 \cdot 16$ | $2 \cdot 52$ | $5 \cdot 22$ |
| 15 | I.96 | $4 \cdot 98$ | $2 \cdot 09$ | $5 \cdot 03$ | 2.21 | $5 \cdot 08$ | $2 \cdot 34$ | $5 \cdot 14$ | $2 \cdot 46$ | $5 \cdot 20$ | $2 \cdot 60$ | $5 \cdot 26$ |
| 16 | $2 \cdot 03$ | $5 \cdot 00$ | $2 \cdot 16$ | $5 \cdot 06$ | $2 \cdot 28$ | $5 \cdot 11$ | 2.41 | $5 \cdot 17$ | $2 \cdot 55$ | $5 \cdot 24$ | $2 \cdot 69$ | $5 \cdot 30$ |
| 17 | $2 \cdot 11$ | 5.03 | 2.23 | 5.09 | $2 \cdot 36$ | $5 \cdot 15$ | 2.50 | $5 \cdot 21$ | $2 \cdot 63$ | $5 \cdot 28$ | $2 \cdot 78$ | $5 \cdot 35$ |
| 18 | $2 \cdot 18$ | $5 \cdot 07$ | $2 \cdot 31$ | $5 \cdot 12$ | 2.44 | $5 \cdot 18$ | $2 \cdot 58$ | $5 \cdot 25$ | $2 \cdot 72$ | $5 \cdot 32$ | 2.87 | $5 \cdot 40$ |
| 19 | 2.26 | $5 \cdot 10$ | $2 \cdot 39$ | $5 \cdot 16$ | $2 \cdot 53$ | 5.22 | 2.67 | $5 \cdot 29$ | $2 \cdot 8 \mathrm{I}$ | $5 \cdot 37$ | $2 \cdot 97$ | 5.45 |
| 20 | $2 \cdot 33$ | $5 \cdot 13$ | $2 \cdot 47$ | $5 \cdot 20$ | $2 \cdot 61$ | $5 \cdot 27$ | $2 \cdot 76$ | $5 \cdot 34$ | 2.91 | $5 \cdot 42$ | $3 \cdot 07$ | $5 \cdot 51$ |
| 2 I | $2 \cdot 42$ | $5 \cdot 17$ | 2.56 | $5 \cdot 24$ | 2.71 | $5 \cdot 31$ | $2 \cdot 86$ | $5 \cdot 39$ | $3 \cdot 02$ | $5 \cdot 48$ | $3 \cdot 18$ | $5 \cdot 57$ |
| 22 | 2.51 | 5.21 | $2 \cdot 65$ | $5 \cdot 29$ | $2 \cdot 80$ | $5 \cdot 36$ | $2 \cdot 96$ | $5 \cdot 45$ | $3 \cdot 12$ | $5 \cdot 54$ | 3.30 | $5 \cdot 64$ |
| 23 | 2.60 | $5 \cdot 26$ | $2 \cdot 75$ | $5 \cdot 33$ | $2 \cdot 90$ | $5 \cdot 42$ | $3 \cdot 07$ | $5 \cdot 51$ | 3.24 | $5 \cdot 60$ | 3.42 | $5 \cdot 71$ |
| 24 | $2 \cdot 69$ | $5 \cdot 31$ | 2.85 | $5 \cdot 39$ | 3.01 | $5 \cdot 47$ | $3 \cdot 18$ | $5 \cdot 57$ | $3 \cdot 36$ | $5 \cdot 67$ | 3.55 | $5 \cdot 79$ |
| 25 | $2 \cdot 79$ | $5 \cdot 36$ | $2 \cdot 95$ | $5 \cdot 44$ | $3 \cdot 12$ | $5 \cdot 54$ | $3 \cdot 30$ | $5 \cdot 64$ | $3 \cdot 49$ | 5•75 | $3 \cdot 69$ | $5 \cdot 87$ |
| 26 | $2 \cdot 90$ | $5 \cdot 41$ | $3 \cdot 06$ | $5 \cdot 50$ | 3.24 | $5 \cdot 6 \mathrm{I}$ | 3.43 | 5.72 | $3 \cdot 63$ | $5 \cdot 84$ | 3.83 | $5 \cdot 97$ |
| 27 | $3 \cdot \mathrm{OI}$ | $5 \cdot 47$ | $3 \cdot 18$ | 5.57 | $3 \cdot 37$ | $5 \cdot 68$ | $3 \cdot 56$ | $5 \cdot 80$ | $3 \cdot 77$ | 5.93 | 3.99 | $6 \cdot 07$ |
| 28 | $3 \cdot 12$ | $5 \cdot 54$ | 3.31 | $5 \cdot 65$ | $3 \cdot 50$ | $5 \cdot 76$ | $3 \cdot 71$ | 5.89 | 3.93 | 6.03 | $4 \cdot 17$ | $6 \cdot 19$ |
| 29 | $3 \cdot 25$ | 5.61 | 3.44 | $5 \cdot 72$ | 3.65 | $5 \cdot 85$ | $3 \cdot 87$ | $5 \cdot 99$ | $4 \cdot 10$ | $6 \cdot 14$ | 4.36 | $6 \cdot 32$ |
| 30 | $3 \cdot 38$ | $5 \cdot 69$ | 3.59 | $5 \cdot 8 \mathrm{I}$ | $3 \cdot 8 \mathrm{I}$ | $5 \cdot 95$ | $4 \cdot 04$ | $6 \cdot 10$ | 4.29 | $6 \cdot 27$ | 4.56 | $6 \cdot 46$ |
| 31 | $3 \cdot 53$ | $5 \cdot 77$ | 3.74 | 5.91 | $3 \cdot 98$ | $6 \cdot 06$ | 4.22 | $6 \cdot 23$ | $4 \cdot 50$ | $6 \cdot 41$ | $4 \cdot 79$ | $6 \cdot 62$ |
| 32 | 3.68 | 5.87 | $3 \cdot 91$ | $6 \cdot 02$ | $4 \cdot 16$ | $6 \cdot 18$ | 4.43 | $6 \cdot 37$ | $4 \cdot 72$ | $6 \cdot 57$ | $5 \cdot 05$ | 6.81 |
| 33 | $3 \cdot 85$ | $5 \cdot 98$ | 4.09 | $6 \cdot 14$ | $4 \cdot 36$ | $6 \cdot 32$ | $4 \cdot 65$ | $6 \cdot 52$ | $4 \cdot 97$ | $6 \cdot 76$ | $5 \cdot 33$ | $7 \cdot 02$ |
| 34 | $4 \cdot 03$ | $6 \cdot 09$ | 4.29 | $6 \cdot 27$ | $4 \cdot 58$ | $6 \cdot 47$ | 4.90 | $6 \cdot 71$ | $5 \cdot 26$ | $6 \cdot 97$ | $5 \cdot 66$ | $7 \cdot 27$ |
| 35 | 4.23 | $6 \cdot 23$ | 4.5 I | $6 \cdot 43$ | 4.83 | $6 \cdot 65$ | $5 \cdot 18$ | 6.91 | $5 \cdot 58$ | 7.21 | 6.03 | 7.57 |
| 36 | 4.44 | $6 \cdot 38$ | 4.76 | $6 \cdot 60$ | 5•11 | 6.86 | $5 \cdot 50$ | $7 \cdot 15$ | $5 \cdot 95$ | $7 \cdot 50$ | 6.47 | 7.92 |

## HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT. 241

 LATITUDE $29^{\circ}$.DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. <br> Var. | $19^{\circ}$ | Decl. Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H | S. | M. | S. | . | S. | H. M. S. | S. | S. | S. | M. S. | S. |
| O | $\begin{array}{llll}5 & 18 & 29.8\end{array}$ | -2.49 | $\begin{array}{llll}5 & 15 & 59: 2\end{array}$ | -2.53 | $5 \begin{array}{llll}5 & 13 & 26.5\end{array}$ | $-2.56$ | 5 IO 51.5 | $-2.6$ | $5 \quad 814 \cdot 0$ | $-2.65$ | $5 \quad 5 \quad 33 \cdot 9$ | -2.69 |
| 2 | $\begin{array}{llll}5 & 8 & 40 \cdot 8\end{array}$ | 2.57 | $\begin{array}{lll}5 & 6 & 5\end{array}$ | $2 \cdot 61$ | $\begin{array}{llll}5 & 3 & 27 \cdot 5\end{array}$ | 2.65 | 5 o $46 \cdot 9$ | $2 \cdot 70$ | $\begin{array}{llll}4 & 58 & 3 \cdot 5\end{array}$ | $2 \cdot 75$ | 455 17•0 | 2.80 |
| 4 | $45846 \cdot 6$ | $2 \cdot 65$ | $4566 \cdot 0$ | $2 \cdot 70$ | $4 \begin{array}{llll}43 & 22.5\end{array}$ | $2 \cdot 75$ | $45036 \cdot 0$ | 2.80 | $44746 \cdot 2$ | 2.86 | $44452 \cdot 8$ | -92 |
| 5 | $45347 \cdot 5$ | $2 \cdot 70$ | 4514 | $2 \cdot 75$ | 448 I7.6 | $2 \cdot 80$ | $445 \quad 27.9$ | 2.86 | $44234 \cdot 6$ | $2 \cdot 92$ | $43937 \cdot 7$ | $2 \cdot 98$ |
| 6 | $4 \quad 48 \quad 46 \cdot 9$ | $2 \cdot 75$ | $446 \quad 0 \cdot 6$ | $2 \cdot 80$ | 443 II 0 | $2 \cdot 86$ | 440 17*9 | 2.92 | 437 2I•r | $2 \cdot 98$ | $43420 \cdot 3$ | 3.05 |
| 8 | 443 44*7 | 2.80 | $4 \quad 4055.4$ | 5 | $\begin{array}{llr}4 & 38 & 2.5\end{array}$ |  | $435 \quad 6 \cdot 0$ | $2 \cdot 97$ | $\begin{array}{lll}4 & 32 & 5 \cdot 5\end{array}$ | 3.04 | $429 \quad 0 \cdot 7$ | -12 |
| 8 | $43840 \cdot 9$ | $2 \cdot 85$ | $43548 \cdot 4$ | $2 \cdot 91$ | 432 52.1 | $2 \cdot 97$ | $4 \begin{array}{llll}4 & 29 & 519\end{array}$ | $3 \cdot 04$ | $42647 \cdot 5$ | $3 \cdot 11$ | $423 \quad 38 \cdot 6$ | 19 |
| 9 | $43335 \cdot 3$ | 2.90 | 43039.5 | $2 \cdot 96$ | $42739 \cdot 7$ | 3.03 | $42435 \cdot 7$ | 10 | $42127 \cdot 2$ | $3 \cdot 18$ | 41813.9 | $3 \cdot 26$ |
| 10 | $42827 \cdot 9$ | $2 \cdot 96$ | $\begin{array}{llll}4 & 25 & 28.6\end{array}$ | 3.02 | $42225^{\circ} \mathrm{O}$ | 3.10 | 4 I9 İ.I | $3 \cdot 17$ | $4 \begin{array}{lll}46 & 4.3\end{array}$ | $3 \cdot 25$ | $41246 \cdot 5$ | $3 \cdot 34$ |
| II | 42318.5 | 3.01 | $42015 \cdot 5$ | 3.09 | 4 I7 8.I | 3.16 | $\begin{array}{llll}4 & \text { I3 } & 55.9\end{array}$ | $3 \cdot 24$ | 4 10 38.7 | $3 \cdot 33$ | 478160 | 3.42 |
| 12 | $\begin{array}{llll}4 & 18 & 6 \cdot 9\end{array}$ | $3 \cdot 08$ | 415002 | I | 4 II $48 \cdot 7$ | 23 | $4832 \cdot 1$ | $3 \cdot 32$ | $\begin{array}{llll}4 & 5 & 10.2\end{array}$ | 3.41 | 4 I 42.4 | 1 |
| I 3 | $41253 \cdot 2$ | 3 | $4 \quad 942.4$ | 2 | $4 \quad 6 \quad 26 \cdot 6$ | $3 \cdot 3 \mathrm{I}$ | $\begin{array}{llll}4 & 3 & 5.4\end{array}$ | 3.40 | $\begin{array}{llllllllllllll}3 & 59 & \end{array}$ | 3.50 | $\begin{array}{llll}3 & 56 & 5 \cdot 4\end{array}$ | $3 \cdot 60$ |
| I 4 | $4737 \cdot 1$ | 3.21 | $4422 \cdot 1$ | $3 \cdot 29$ | 4 I I $1 \times 8$ | 3.39 | $35735 \cdot 7$ | 3.49 | $\begin{array}{llll}3 & 54 & 3 \cdot 5\end{array}$ | $3 \cdot 59$ | 35024.8 | $\cdot 70$ |
| 15 | $\begin{array}{rrrr}4 & 2 & 18.4\end{array}$ | $3 \cdot 28$ | 358590 | $3 \cdot 37$ | $\begin{array}{llll}3 & 55 & 33.9\end{array}$ | $3 \cdot 47$ | $\begin{array}{llll}3 & 52 & 2 \cdot 7\end{array}$ | 3.57 | $\begin{array}{llll}3 & 48 & 24.9\end{array}$ | 3.69 | $314440 \cdot 2$ | $3 \cdot 8 \mathrm{I}$ |
| 16 | $35657 \cdot 1$ | $3 \cdot 36$ | $353 \quad 32 \cdot 9$ | 3.45 | $3502 \cdot 8$ | $3 \cdot 56$ | $34626 \cdot 1$ | 3.67 | $34242 \cdot 5$ | 3.79 | $33^{8} 5 \mathrm{5} .4$ | $3 \cdot 92$ |
| 17 | $\begin{array}{llll}3 & 51 & 32 \cdot 8\end{array}$ | 3.43 | $\begin{array}{llll}3 & 48 & 3.8\end{array}$ | $3 \cdot 54$ | $\begin{array}{llll}3 & 44 & 28 \cdot 2\end{array}$ | 365 | $34045 \cdot 8$ | $3 \cdot 77$ | $\begin{array}{llll}3 & 36 & 55.9\end{array}$ | $3 \cdot 90$ | $313257 \cdot 9$ | 4 |
| 18 | $\begin{array}{llll}3 & 46 & 5 \cdot 5\end{array}$ | 3.52 | 3423100 | $3 \cdot 63$ | $\begin{array}{lllll}3 & 38 & 49 \cdot 9\end{array}$ | $3 \cdot 75$ | 33515 | 3.88 | $3 \mathrm{ll} 4 \cdot 8$ | 4.01 | $32659 \cdot 6$ | 16 |
| 19 | $\begin{array}{llll}3 & 40 & 34.8 \\ 3 & 35 & 0.5\end{array}$ | 3.61 | $\begin{array}{llll}3 & 36 & 54 * 9\end{array}$ | 3.73 | $\begin{array}{lllr}3 & 33 & 7 \cdot 6 \\ 3 & 27 & 20 \cdot 9\end{array}$ | $3 \cdot 85$ | $\begin{array}{llll}3 & 29 & 12.4\end{array}$ | $3 \cdot 99$ | $\begin{array}{llll}3 & 25 & 8 \cdot 7\end{array}$ | $4 \cdot 14$ | 32055.7 | 30 |
| 20 | $\begin{array}{lll}3 & 35 & 0.5\end{array}$ | 3.70 | 3 31 $14 \cdot 6$ | $3 \cdot 83$ | $\begin{array}{llll}3 & 27 & 20 \cdot 9\end{array}$ | 3.97 | $\begin{array}{llll}3 & 23 & 18 & 7\end{array}$ | $4 \cdot 11$ | $\begin{array}{llll}3 & 19 & 7 \cdot 3\end{array}$ | $4 \cdot 27$ | 3 I4 46.0 | $4 \cdot 44$ |
| 21 | $\begin{array}{ll}3 & 29 \\ 22 \cdot 3\end{array}$ | 3.80 | $32530 \cdot 1$ | 3.94 | $\begin{array}{llll}3 & 21 & 29.5\end{array}$ | 4.09 | $\begin{array}{llllll}3 & 17 & 19.8\end{array}$ | $4 \cdot 24$ | $3130 \cdot 1$ | 4.42 | $\begin{array}{llll}3 & 8 & 29.7\end{array}$ | -60 |
| 22 | $\begin{array}{lll}3 & 23 & 39^{\circ} 9\end{array}$ | 3.91 | 3 I9 40*9 | 4 | $\begin{array}{llll}3 & 15 & 32.9\end{array}$ | 4.22 | 3 II 15.0 | $4 \cdot 39$ | $36646 \cdot 5$ | 4.57 | $\begin{array}{llll}3 & 2 & 6 \cdot 2\end{array}$ | -77 |
| 23 | $\begin{array}{lllll}3 & \text { I7 } & 52.9\end{array}$ | 4.03 | $\begin{array}{llll}3 & 13 & 46 \cdot 6\end{array}$ | 4.19 | $\begin{array}{llll}3 & 9 & 30 \cdot 6\end{array}$ | $4 \cdot 36$ | $\begin{array}{lll}3 & 5 & 3.9\end{array}$ | 4.54 | 3 O | $4 \cdot 74$ | $2{ }^{2} 55534 \cdot 7$ | $4 \cdot 96$ |
| 24 | $\begin{array}{rrrr}3 & 12 & 0.9 \\ 3 & 6 & 3.4\end{array}$ | $4 \cdot 16$ | $37846 \cdot 7$ | $4 \cdot 32$ | $\begin{array}{lrrr}3 & 3 & 22.0 \\ 2 & 57 & 6.6\end{array}$ | 4.51 | $2 \begin{array}{llll}2 & 58 & 45 \cdot 8\end{array}$ | 4.71 | $\begin{array}{lllll}2 & 53 & 57 \cdot 1\end{array}$ | $4 \cdot 93$ |  | $5 \cdot 17$ |
| 25 | $\begin{array}{rrrr}3 & 6 & 3.4 \\ 2 & 59 & 59 *\end{array}$ | 4.29 | 3 1 $40 \cdot 7$ <br>  55 $27 \cdot 9$ | 4.47 | $\begin{array}{rrr}2 & 57 & 6.6 \\ 2 & 50 & 43.6\end{array}$ | $4 \cdot 67$ | $25220 \cdot 0$ | $4 \cdot 89$ | $\begin{array}{llllll}2 & 47 & 19 \cdot 6\end{array}$ | 5.13 | $\begin{array}{llll}2 & 42 & 3 \cdot 9\end{array}$ | $5 \cdot 40$ |
| 26 | 25959.9 | 4.44 | $255 \quad 27.9$ | $4 \cdot 64$ | $25043 \cdot 6$ | $4 \cdot 85$ | $24545 \cdot 5$ | 5.09 | $2 \quad 40 \quad 32 \cdot 3$ | $5 \cdot 36$ | $235 \quad 2 \cdot 1$ | $5 \cdot 66$ |
| 27 | $25349 \cdot 7$ | $4 \cdot 60$ | $\begin{array}{lll}2 & 49 & 7 \cdot 6\end{array}$ | 481 | 244 I2.0 | $5 \cdot 05$ | 239515 | $5 \cdot 32$ | $2 \begin{array}{lll}2 & 33 & 33 \cdot 8\end{array}$ | $5 \cdot 62$ | $22747 \cdot 3$ | 5 |
| 28 | $24732 \cdot 1$ | $4 \cdot 77$ | $\begin{array}{llll}2 & 42 & 38 \cdot 9\end{array}$ | 5.01 | $\begin{array}{llll}2 & 37 & 30 \cdot 8\end{array}$ | $5 \cdot 27$ | $\begin{array}{llrr}2 & 32 & 6 \cdot 0 \\ 2 & 24 & 5 & \end{array}$ | 5.57 | $\begin{array}{llll}2 & 26 & 22 \cdot 5\end{array}$ | $5 \cdot 90$ | 22017.6 | $6 \cdot 28$ |
| 29 | $\begin{array}{llll}2 & 41 & 6 \cdot 2\end{array}$ | 4.97 5 | 2 36 $0 \cdot 7$ <br> 2 29 1 | $5 \cdot 23$ | $2{ }_{2} 30$ | $5 \cdot 52$ | $2 \begin{array}{llll}2 & 24 & 58 \cdot 1 \\ 2\end{array}$ | 5.85 | $2 \begin{array}{llll}2 & 18 & 56.4\end{array}$ | 6.23 | $2 \begin{array}{llll}2 & 12 & 30 \cdot 3\end{array}$ | $6 \cdot 67$ |
| 30 | $\begin{array}{llll}2 & 34 & 31 \cdot 0\end{array}$ | $5 \cdot 18$ | $\begin{array}{llll}2 & 29 & 11.8 \\ 2 & 29 & \text { l }\end{array}$ | $5 \cdot 47$ | $\begin{array}{llll}2 & 23 & 34.2\end{array}$ | $5 \cdot 80$ | 217735.6 | 6-18 | 2 II 13.0 | $6 \cdot 61$ | $2 \begin{array}{lll} & 4 & 22 \cdot I\end{array}$ | $7 \cdot 12$ |
| 31 | $22745 \cdot 2$ | $5 \cdot 42$ | $22210 \cdot 7$ | $5 \cdot 75$ | $2 \begin{array}{llll}16 & 15.3\end{array}$ | $6 \cdot 12$ | $2956 \cdot 1$ | $6 \cdot 55$ | $2383 \cdot 9$ | 7.06 | I $5548 \cdot 7$ | $7 \cdot 66$ |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$. |  | L. $20^{\circ} \mathrm{A}$. |  | L. $21^{\circ} \mathrm{A}$. |  | L. $22^{\circ} \mathrm{A}$. |  | L. $23^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | s. | S. | S. | S. | s. | s. | s. | s. | s. | s. | s. | s. |
| 0 | - I.73 | -4.89 | - 1.83 | $-4.93$ | - I.94 | -4.97 | $-2.05$ | -5.01 | -2.17 | -5.06 | $-2.28$ | $-5 \cdot 11$ |
| 2 | I-84 | 4.93 | 1.95 | $4 \cdot 97$ | 2.06 | 5.02 | $2 \cdot 17$ | $5 \cdot 06$ | $2 \cdot 29$ | $5 \cdot 11$ | 2.41 | $5 \cdot 17$ |
| 4 | 1-95 | $4 \cdot 97$ | 2.07 | $5 \cdot 03$ | 2.18 | 5.07 | $2 \cdot 30$ | $5 \cdot 12$ | $2 \cdot 42$ | 5.18 | $2 \cdot 55$ | $5 \cdot 24$ |
| 5 | 2.02 | $5 \cdot 00$ | $2 \cdot 13$ | $5 \cdot 05$ | $2 \cdot 25$ | $5 \cdot 10$ | $2 \cdot 37$ | $5 \cdot 15$ | $2 \cdot 49$ | $5 \cdot 21$ | $2 \cdot 62$ | $5 \cdot 27$ |
| 6 | 2.08 | $5 \cdot 02$ | $2 \cdot 19$ | 5.07 | $2 \cdot 31$ | $5 \cdot 13$ | 2.44 | 5•18 | $2 \cdot 56$ | $5 \cdot 24$ | 2.69 | $5 \cdot 31$ |
| 7 | 2.14 | 5.05 | 2.26 | $5 \cdot 10$ | $2 \cdot 38$ | $5 \cdot 16$ | 2.51 | 5.22 | 2.64 | $5 \cdot 28$ | $2 \cdot 77$ | $5 \cdot 35$ |
| 8 | 2.21 | $5 \cdot 08$ | $2 \cdot 33$ | $5 \cdot 13$ | 2.45 | $5 \cdot 19$ | 2.58 | $5 \cdot 25$ | 2.72 | $5 \cdot 32$ | $2 \cdot 85$ | $5 \cdot 39$ |
| 9 | $2 \cdot 28$ | $5 \cdot 11$ | $2 \cdot 40$ | $5 \cdot 16$ | $2 \cdot 53$ | $5 \cdot 23$ | 2.66 | 5.29 | $2 \cdot 80$ | $5 \cdot 36$ | $2 \cdot 94$ | $5 \cdot 43$ |
| 10 | $2 \cdot 35$ | $5 \cdot 14$ | $2 \cdot 47$ | $5 \cdot 20$ | $2 \cdot 60$ | $5 \cdot 26$ | $2 \cdot 74$ | $5 \cdot 33$ | $2 \cdot 88$ | $5 \cdot 40$ | 3.02 | $5 \cdot 48$ |
| II | 2.42 | $5 \cdot 17$ | $2 \cdot 55$ | $5 \cdot 24$ | $2 \cdot 68$ | $5 \cdot 30$ | 2.82 | $5 \cdot 37$ | $2 \cdot 97$ | $5 \cdot 45$ | $3 \cdot 12$ | $5 \cdot 53$ |
| 12 | 2.50 | 5.21 | $2 \cdot 63$ | $5 \cdot 28$ | 2.77 | $5 \cdot 35$ | 2.91 | $5 \cdot 42$ | 3.06 | $5 \cdot 50$ | 3.21 | $5 \cdot 59$ |
| 13 | $2 \cdot 58$ | $5 \cdot 25$ | 2.71 | $5 \cdot 32$ | $2 \cdot 85$ | $5 \cdot 39$ | $3 \cdot 00$ | $5 \cdot 47$ | $3 \cdot 15$ | $5 \cdot 56$ | $3 \cdot 31$ | $5 \cdot 65$ |
| 14 | $2 \cdot 66$ | $5 \cdot 29$ | 2.80 | $5 \cdot 36$ | $2 \cdot 94$ | $5 \cdot 44$ | 3.10 | $5 \cdot 52$ | 3.25 | $5 \cdot 61$ | $3 \cdot 42$ | 5.71 |
| 15 | $2 \cdot 74$ | $5 \cdot 33$ | 2.89 | $5 \cdot 41$ | 3.04 | $5 \cdot 49$ | $3 \cdot 20$ | $5 \cdot 53$ | $3 \cdot 36$ | $5 \cdot 67$ | $3 \cdot 53$ | $5 \cdot 78$ |
| 16 | 2.83 | $5 \cdot 38$ | $2 \cdot 98$ | $5 \cdot 46$ | $3 \cdot 14$ | $5 \cdot 55$ | $3 \cdot 30$ | $5 \cdot 64$ | $3 \cdot 47$ | $5 \cdot 74$ | 3.65 | $5 \cdot 85$ |
| 17 | 2.93 | $5 \cdot 43$ | 3.08 | $5 \cdot 52$ | 3.24 | $5 \cdot 61$ | 3.41 | $5 \cdot 71$ | $3 \cdot 59$ | $5 \cdot 8 \mathrm{r}$ | $3 \cdot 78$ | 5.93 |
| 18 | $3 \cdot 03$ | $5 \cdot 48$ | $3 \cdot 19$ | $5 \cdot 57$ | $3 \cdot 35$ | $5 \cdot 67$ | 3.53 | $5 \cdot 78$ | $3 \cdot 72$ | $5 \cdot 89$ | 3.91 | $6 \cdot 02$ |
| 19 | 3.13 | $5 \cdot 54$ | 3.30 | $5 \cdot 64$ | 3.47 | $5 \cdot 74$ | $3 \cdot 66$ | $5 \cdot 85$ | 3.85 | $5 \cdot 98$ | $4 \cdot 06$ | $6 \cdot 11$ |
| 20 | $3 \cdot 24$ | $5 \cdot 60$ | 3.41 | $5 \cdot 71$ | $3 \cdot 60$ | 5.82 | 3.79 | $5 \cdot 94$ | $3 \cdot 99$ | $6 \cdot 07$ | 4.21 | $6 \cdot 22$ |
| 21 | 3.35 | $5 \cdot 67$ | $3 \cdot 54$ | $5 \cdot 78$ | $3 \cdot 73$ | $5 \cdot 90$ | 3.93 | 6.03 | $4 \cdot 15$ | $6 \cdot 17$ | $4 \cdot 38$ | $6 \cdot 33$ |
| 22 | $3 \cdot 48$ | $5 \cdot 74$ | 3.67 | $5 \cdot 86$ | 3.87 | $5 \cdot 99$ | 4.08 | $6 \cdot 13$ | $4 \cdot 31$ | $6 \cdot 29$ | $4 \cdot 56$ | $6 \cdot 46$ |
| 23 | $3 \cdot 61$ | $5 \cdot 82$ | 3.81 | $5 \cdot 95$ | $4 \cdot 02$ | $6 \cdot 09$ | $4 \cdot 25$ | $6 \cdot 24$ | $4 * 49$ | $6 \cdot 41$ | $4 \cdot 76$ | $6 \cdot 60$ |
| 24 | $3 \cdot 75$ | 5.91 | $3 \cdot 96$ | $6 \cdot 05$ | $4 \cdot 19$ | $6 \cdot 20$ | 4.43 | $6 \cdot 37$ | $4 \cdot 69$ | $6 \cdot 55$ | 4.97 | $6 \cdot 76$ |
| 25 | 3.90 | $6 \cdot 01$ | $4 \cdot 12$ | $6 \cdot 16$ | $4 \cdot 36$ | $6 \cdot 32$ | $4 \cdot 62$ | $6 \cdot 50$ | 4.90 | $6 \cdot 71$ | $5 \cdot 21$ | $6 \cdot 93$ |
| 26 | $4 \cdot 06$ | $6 \cdot 11$ | $4 \cdot 30$ | $6 \cdot 28$ | 4.56 | $6 \cdot 45$ | $4 \cdot 84$ | $6 \cdot 66$ | 5•14 | $6 \cdot 88$ | $5 \cdot 48$ | 7-14 |
| 27 | 4.23 | $6 \cdot 23$ | $4 \cdot 49$ | $6 \cdot 41$ | $4 \cdot 77$ | $6 \cdot 6 \mathrm{I}$ | 5.07 | 6.83 | $5 \cdot 41$ | 7.08 | $5 \cdot 78$ | $7 \cdot 37$ |
| 28 | $4 \cdot 42$ | $6 \cdot 36$ | $4 \cdot 70$ | $6 \cdot 56$ | $5 \cdot 00$ | $6 \cdot 78$ | $5 \cdot 33$ | $7 \cdot 03$ | $5 \cdot 70$ | $7 \cdot 31$ | $6 \cdot 12$ | $7 \cdot 64$ |
| 29 | $4 \cdot 63$ | $6 \cdot 51$ | 4.93 | $6 \cdot 73$ | $5 \cdot 26$ | $6 \cdot 97$ | $5 \cdot 63$ | $7 \cdot 25$ | $6 \cdot 04$ | 7.58 | $6 \cdot 52$ | $7 \cdot 96$ |
| 30 | $4 \cdot 86$ | $6 \cdot 67$ | $5 \cdot 19$ | $6 \cdot 92$ | $5 \cdot 55$ | $7 \cdot 20$ | 5.97 | 7.52 | $6 \cdot 44$ | 7.90 | 6.98 | $8 \cdot 35$ |
| 31 | $5 \cdot 12$ | $6 \cdot 87$ | $5 \cdot 48$ | $7 \cdot 14$ | 5.89 | $7 \cdot 45$ | $6 \cdot 35$ | $7 \cdot 83$ | $6 \cdot 90$ | 8.27 | 7.54 | 8.83 |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $0^{\circ}$ | Decl. Var. | $1{ }^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $2^{\circ}$ | Decl. Var. | $3^{\circ}$ | Decl. Var. | $4{ }^{\circ}$ | $\begin{aligned} & \text { Decl. } \\ & \text { Var. } \end{aligned}$ | $5^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | $\left\lvert\, \begin{aligned} & \mathrm{H} . \\ & 6 \end{aligned}\right.$ |  |  |  |  | S. -2.31 |  | c. ${ }_{\text {S. }}$ | $\left\|\begin{array}{ccc} \text { H. м. } & \text { S. } \\ 5 & 50 & 44 \cdot 7 \end{array}\right\|$ |  |  | S. |
| 4 | $5{ }_{5} 4 \mathrm{I}$ | - 232 |  | 2.32 | 5 36 | 2.31 2 | \|lllll | 2.32 2.35 |  | 2.32 <br> 2.36 |  | 2.33 <br> 2.38 |
| 6 | $\begin{array}{llll}5 & 32 & 16 \cdot 2\end{array}$ | $2 \cdot 33$ | 5 $29 \begin{array}{llll}56 \cdot 2\end{array}$ | $2 \cdot 34$ | $\begin{array}{lllllllllllll}5 & 27 & 35.5\end{array}$ | $2 \cdot 35$ | $\begin{array}{lllll}5 & 25 & 13.9\end{array}$ | $2 \cdot 37$ | $\begin{array}{llllll}5 & 22 & 51 & 3\end{array}$ | $2 \cdot 39$ | $52027 \cdot 6$ | 2.40 |
| 8 | 5230.5 | $2 \cdot$ | 52039.7 |  |  | $2 \cdot 37$ | $\begin{array}{llllllllll}5 & 15 & 54 \cdot 8\end{array}$ | $2 \cdot 39$ | $\begin{array}{llll}5 & 13 & 30 \cdot 5\end{array}$ | $2 \cdot 42$ | 5 II 4.9 | $2 \cdot 44$ |
| 10 | $5 \mathrm{I} 344{ }^{\circ}$ | $2 \cdot 36$ | $\begin{array}{llllll}5 & 11 & 21.9\end{array}$ | 38 | 588586 | 2.40 | $5 \quad 633.9$ | $2 \cdot 42$ | $\begin{array}{llll}5 & 4 & 7 \cdot 8\end{array}$ | $2 \cdot 45$ | 5 I 40.0 | . 48 |
| 12 | $5 \quad 426$ |  | $\begin{array}{llll}5 & 2 & 2 \cdot 7\end{array}$ | 2.40 | 45937 | 2.4 | 457 II | 2.46 | $45442 \cdot 8$ | 2.49 | $4 \begin{array}{lll}42 & 12.5\end{array}$ | 52 |
| 14 | $455 \quad 6 \cdot 9$ | 2.41 | $4524 \mathrm{I} \cdot 7$ | $2 \cdot 43$ | 45014.8 | $2 \cdot 46$ | $44746 \cdot 0$ | $2 \cdot 50$ | $44515 \cdot 1$ | $2 \cdot 53$ | 44242.0 | 7 |
| 16 | $\begin{array}{llll}4 & 45 & 45^{\circ} 9\end{array}$ | 2.44 | $\begin{array}{llll}4 & 43 & 18.7\end{array}$ | 47 | 44049.5 | $2 \cdot 50$ | ${ }_{4}^{4} 38818 \cdot 1$ | 2.54 | 43544.4 | $2 \cdot 58$ | $\begin{array}{llll}4 & 33 & 8 \cdot 1\end{array}$ | 2.63 |
| 18 | $43622 \cdot 8$ | 2.47 | 43353.3 | 2.51 | $43121 \cdot 5$ | 2.55 | 4 28 47\%2 | 2.59 | $42610 \cdot 2$ | 2.64 | $\begin{array}{llll}4 & 23 & 30 \cdot 5\end{array}$ | $2 \cdot 69$ |
| 19 | $43140 \times 3$ | 2.49 | 429 966 | $2 \cdot 53$ | $42636 \cdot 3$ | $2 \cdot 58$ | $4 \begin{array}{lll}4 & 204\end{array}$ |  | $42121 \% 7$ | 2.67 | 418400 | 72 |
| 20 | 4265 |  | 424 |  | $42150 \cdot 3$ |  | $41912 \cdot 7$ |  | $41632 \cdot 2$ |  | 413 | 76 |
| 21 | 4221 | 2.54 | 4 19 $39^{\circ}$ <br> 4   | 2.58 | 4 17 3.4 <br> 4 12  | 2.63 | 41424.0 | 2.68 | 4 II 41.5 | 2.74 | $4 \quad 8 \quad 55 \cdot 6$ | 79 |
| 22 | ${ }_{4}^{4} 171728.8$ | $2 \cdot 5$ | $1 \begin{array}{llll}4 & 14 & 53.6 \\ 4 & 10 & 6.6\end{array}$ | 2.61 |  | $2 \cdot 6$ | $\begin{array}{llll}4 & 9 & 34.2\end{array}$ | 2.72 2.75 | 4649 | $\begin{array}{r}2.77 \\ 2.8 \\ \hline\end{array}$ | 44 | 83 |
| 23 24 | $\begin{array}{crrr}4 & 12 & 43 \cdot 4 \\ 4 & 7 & 57 \cdot 1\end{array}$ | 2.6 2.6 | 4 10 $6 \cdot 6$ <br> 4 5 18.5 | 2.64 2.67 | $\begin{array}{llll}4 & 7 & 26 \cdot 6 \\ 4 & 2 & 36.6\end{array}$ | 2.69 2.73 | $\begin{array}{lllll}4 & 4 & 43 \\ 3 & 59 \\ & 5\end{array}$ | $2 \cdot 75$ | $\begin{array}{llll}4 & 1 & 56.4 \\ 3 & 57 & \text { 1.8 }\end{array}$ | 2.8 2.8 |  | 88 |
| 24 | $47857 \cdot 1$ | $2 \cdot$ | $\begin{array}{lll}4 & 5 & 18.5\end{array}$ | $2 \cdot 67$ | $4 \begin{array}{lll}4 & 2 & 36 \cdot 6\end{array}$ | $2 \cdot 73$ | $3595 \mathrm{I} \cdot \mathrm{I}$ | $2 \cdot 79$ | 357198 | 2.8 | $3 \begin{array}{lll}3 & 54 & 8\end{array}$ | 92 |
| 25 |  |  | $\begin{array}{llll}4 & 0 & 29.4 \\ 3 & 55 & \end{array}$ | 2.70 | 35745 | $2 \cdot 76$ | $35457 \cdot 6$ | 2.83 | $\begin{array}{llll}3 & 52 & 5.8\end{array}$ | 90 | $\begin{array}{lll}3 & 49 & 9 \cdot 8\end{array}$ | 2.97 |
| 26 |  |  | $35539 \cdot 1$ | 2.74 | $\begin{array}{lllllllllllll}3 & 52 & 52 \cdot 8\end{array}$ | $2 \cdot 80$ | $3502 \cdot 6$ | $2 \cdot 87$ | $\begin{array}{llll}3 & 47 & 8.2\end{array}$ | $2 \cdot 94$ | $\begin{array}{lll}3 & 44 & 9 \cdot 3\end{array}$ | 3.02 |
| 27 | $\begin{array}{llllllllllllll}3 & 53 & 32 \cdot 2\end{array}$ | $2 \cdot 71$ | $35047 \cdot 6$ | $2 \cdot 78$ | $34758 \cdot 9$ | $2 \cdot 85$ | $3456 \cdot 1$ | $2 \cdot 92$ | $\begin{array}{lllll}3 & 42 & 8 \cdot 9\end{array}$ | 99 | $3396 \cdot 9$ | 3.08 |
| 28 | 3 48 <br> 3 $41 \cdot 6$ | 2.75 | 34554.7 | 2.82 2.86 | $\begin{array}{ll}3 & 43 \\ 3\end{array}$ | 2.89 | 340 $8 \cdot 0$ <br> 3  | 2.97 | $\begin{array}{llll}3 & 37 & 7 \cdot 7 \\ 3 & 32 & 4\end{array}$ | 3.05 | $\begin{array}{llll}3 & 34 \\ 3 & 2 . \\ 3 & 28 & 5\end{array}$ | 3.13 |
| 29 | 34349.8 | $2 \cdot 79$ | 34 I |  | $\begin{array}{llll}3 & 38 & 6.6\end{array}$ | 2.94 | 335 | 3.02 | $\begin{array}{llll}3 & 32 & 4\end{array}$ |  | $32855 \cdot$ | $3 \cdot 19$ |
| 30 |  |  | $\begin{array}{lll}3 & 36 & 4 \cdot 6\end{array}$ | 90 | $\begin{array}{lll}3 & 33 & 7.9\end{array}$ | 2.99 | 3306 | 3.07 | 32659.3 | $3 \cdot 16$ | $\begin{array}{llll}3 & 23 & 46 \cdot 8\end{array}$ | 26 |
| 31 | 3 34 1.8 | 87 | 3317 | 95 | 3 28 $7 \cdot 4$ | 3 | $\begin{array}{llll}3 & 25 & 2.4 \\ 3 & 5\end{array}$ | $3 \cdot 13$ | $32151 \cdot 8$ | $3 \cdot 23$ | 31835. | 33 |
| 32 | $\begin{array}{llll}3 & 29 & 5 \cdot 5\end{array}$ | $2 \cdot 92$ |  | 3.01 | $\begin{array}{llll}3 & 23 & 4.8 \\ 3 & 18 & \end{array}$ | 3. |  | $3 \cdot 19$ | 316418 | $3 \cdot 29$ | 3 13 20.9 <br> 3 8  | 48 |
| 33 34 | $\begin{array}{ccc}3 & 24 & 7 \cdot 5 \\ 3 & 19 & 7 \cdot 6\end{array}$ | 2.97 | $\begin{array}{ccc}3 & 21 & 6 \cdot 6 \\ 3 & 16 & 3 \cdot 3\end{array}$ | 3.06 | $\begin{array}{ccc}3 & 18 & 0 \cdot 2 \\ 3 & 12 & 53 \cdot 1\end{array}$ | $3 \cdot 1$ | $\begin{array}{crrr}3 & 14 & 47 \cdot 7 \\ 3 & 9 & 36.6\end{array}$ | 3.26 | $\begin{array}{rrrr}3 & 11 & 29.0 \\ 3 & 6 & 13.4\end{array}$ | 3.37 3.45 | $\begin{array}{llr}3 & 8 & 3 \cdot 6 \\ 3 & 2 & 43 \cdot 0\end{array}$ | . 48 |
| 34 | 319 |  | $16 \quad 3.3$ |  | $31253 \cdot 1$ |  |  | $3 \cdot 33$ | 13.4 |  | $3 \quad 243{ }^{\circ}$ |  |
| 35 | 314 | $3 \cdot 15$ | 3 10 $57 \cdot 7$ | 3.8 | $\begin{array}{llll}3 & 7 & 43.5\end{array}$ | 3.29 | $\begin{array}{llll}3 & 4 & 22.6\end{array}$ | , | 3 O |  |  | 66 |
| 36 | 39 | $3 \cdot 15$ | $3 \begin{array}{llll}3 & 5 & 49\end{array}$ | 3.25 | $3 \begin{array}{llll}3 & 2 & 31 \cdot 2\end{array}$ | 3.37 | 2595.5 | 3.49 | $25532 \cdot 1$ | 3.62 | $25150 \cdot 6$ | 77 |
| 37 | 3 3 $55 \cdot 1$ <br>  58  | $3 \cdot 2$ | 3 O $39^{\circ} \mathrm{O}$ | 3.33 | 25715.8 | $3 \cdot 45$ | 25344.9 | $3 \cdot 58$ | $2 \begin{array}{lll}50 & 5.9\end{array}$ | 3.72 | $24618 \cdot 1$ | 3.88 |
| 38 | 2 2 28 2 | $3 \cdot 28$ | $25^{5}-25^{\circ} 3$ | 3.41 | $25157 \cdot 1$ | $3 \cdot 54$ | $24820 \cdot 7$ | 3.6 | $24435 \cdot 5$ | 3.83 | $24040 \cdot 8$ | 4.00 |
| 39 | $25334{ }^{\circ}$ | $3 \cdot 36$ | $2{ }^{2} 50804$ | 3.49 | $24634 \cdot 7$ | 3.63 | $24252 \cdot 3$ | $3 \cdot$ | $2 \begin{array}{lll}39 & 0.4\end{array}$ | $3 \cdot 95$ | $23458 \cdot 2$ | -13 |
| 40 | $\begin{array}{lllll}2 & 48 & 18.8\end{array}$ | 3.45 | $24447 \cdot 9$ | 3.59 | $\begin{array}{llll}2 & 41 & 8 \cdot 3\end{array}$ | 3.74 | $\begin{array}{lllllll}2 & 37 & 19.3\end{array}$ | 3.90 | $23320 \cdot 1$ | 4.08 | $\begin{array}{lll}2 & 29 & 9.7\end{array}$ | -27 |
| 41 | $\begin{array}{llll}2 & 43 & 0.3\end{array}$ | $3 \cdot 5$ | $\begin{array}{llll}2 & 39 & 23 \cdot 5\end{array}$ | 3 | $23537 \cdot 5$ | 3-5 | 231415 | $4 \cdot 03$ | $22734^{\circ} \mathrm{O}$ | 4.22 | 22314.5 | 44 |
| 42 |  | $3 \cdot 6$ | 233 | $3 \cdot 80$ | 2301.7 | 3.98 | $\begin{array}{llllll}2 & 25 & 57.5\end{array}$ | $4 \cdot 17$ | 22141.3 | 4.38 | $21711 \cdot 7$ | 63 |
| 43 | 2321103 | 3.8 | $22821 \cdot 3$ | 392 | $\begin{array}{llll}2 & 24 & 20 \cdot 4 \\ 2\end{array}$ | $4 \cdot 1$ | 2207.5 | 4 | 21541.3 | 4 | 2 II |  |
| 44 | $22640 \cdot 0$ | 3.87 | 22242.4 | 4.06 | 21832 | $4 \cdot 27$ | 214 Io'r | 4.5 | 2932. | $4 \cdot 76$ | $2439 \cdot \mathrm{I}$ | $5 \cdot 08$ |

VARIATION TO $r^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $0^{\circ}$ A. |  | L. $1^{\circ}$ | A. | L. $2^{\circ}$ | A. | L. $3^{\circ}$ | A. | L. $4^{\circ}$ | A. | L. $5^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $\begin{array}{cr}\text { S. } & \text { s. } \\ -.00 & -4.62\end{array}$ |  | $\begin{array}{cc} \text { s. } & \text { s. } \\ -\cdot 09 & -4.62 \end{array}$ |  | $\begin{array}{cc}\text { s. } & \text { s. } \\ -\quad .19 & -4.62\end{array}$ |  | $\begin{array}{cc} s . & \text { s. } \\ -: 28 & -4 \cdot 62 \end{array}$ |  | $\begin{array}{cc} \mathrm{s} . & \mathrm{s} . \\ -: 37 & -4 \cdot 63 \end{array}$ |  | s. |  |
| 2 | -.00-4.62 |  | $\begin{array}{rrr}-.09 & -4.62 \\ .19 & 4.62\end{array}$ |  | $\begin{array}{rr}-19 & -4.62 \\ .28 & 4.63\end{array}$ |  | $\begin{array}{rr}-.28 & -4.62 \\ .37 & 4.63\end{array}$ |  | $\begin{array}{rr} -37 & -4.63 \\ 47 & 4.64 \end{array}$ |  | $\begin{array}{rr} -.47 & -4.64 \\ -56 & 4.65 \end{array}$ |  |
| 4 | -19 | 4.62 | $\cdot 28$.38.363 |  | $.38 \quad 4.63$ |  | .47 4.64 |  | $\cdot 564.65$ |  | $\begin{array}{ll}.56 \\ .66 & 4.65 \\ .666\end{array}$ |  |
| 6 | -28 | $4 \cdot 63$ |  |  | $\cdot 46$ | $4 \cdot 64$ | . 574.65 |  | . $66 \quad 4.67$ |  | $\cdot 76 \quad 4.68$ |  |
| 8 | -37 | $4 \cdot 63$ | $\cdot 47 \quad 4.64$ |  | $\cdot 57 \quad 4.65$ |  | -66 4.67 |  | $\cdot 76 \quad 4.68$ |  | -86 4.70 |  |
| \%о | -47 | $4 \cdot 64$ | $\cdot 57$ | $4 \cdot 65$ | -67 | $4 \cdot 67$ | -77 | $4 \cdot 68$ | -86 | $4 \cdot 70$ | -96 | $4 \cdot 72$ |
| 12 | $\cdot 57$ | $4 \cdot 65$ | -67 | $4 \cdot 67$ | -77 | $4 \cdot 68$ | -87 | $4 \cdot 70$ | -97 | 4.72 | r.07 | $4 \cdot 74$ |
| 14 | -67 | $4 \cdot 67$ | $\cdot 77$ | $4 \cdot 68$ | $\cdot 87$ | $4 \cdot 70$ | -97 | $4 \cdot 72$ | $1 \cdot 07$ | 4.74 | I.18 | $4 \cdot 77$ |
| 16 | $\bullet 8$ | $4 \cdot 68$ | -88 | 4.70 | 1.00 | $4 \cdot 72$ | - 08 | $4 \cdot 74$ | I•I9 | $4 \cdot 77$ | I. 30 | $4 \cdot 80$ |
| 18 | -88 | $4 \cdot 70$ | -99 | $4 \cdot 72$ | $1 \cdot 09$ | $4 \cdot 75$ | $1 \cdot 20$ | $4 \cdot 77$ | $1 \cdot 31$ | 4.81 | 1.42 | $4 \cdot 83$ |
| 20 | -99 | $4 \cdot 72$ | 1-10 | $4 \cdot 75$ | 1.2I | 4.77 | $1 \cdot 32$ | $4 \cdot 80$ | 1.43 | 4.83 | I. 54 | $4 \cdot 87$ |
| 22 | $\underline{1 / 1}$ | $4 \cdot 75$ | $1 \cdot 22$ | $4 \cdot 78$ | 1.33 | 4.81 | $1 \cdot 45$ | $4 \cdot 84$ | $1 \cdot 56$ | $4 \cdot 88$ | I. 68 | 4.91 |
| 24 | 1.23 | $4 \cdot 78$ | I.34 | $4 \cdot 8 \mathrm{I}$ | 1.46 | $4 \cdot 84$ | $1 \cdot 58$ | 4.88 | $1 \cdot 70$ | 4.92 | I. 82 | $4 \cdot 97$ |
| 26 | I 36 | $4 \cdot 81$ | 1.47 | 4.85 | 1.60 | $4 \cdot 89$ | I.72 | 4.93 | 1.85 | 4.97 | ${ }^{1} 98$ | $5 \cdot 02$ |
| 28 | 149 | $4 \cdot 85$ | 1-61 | $4 \cdot 89$ | I•74 | 4.94 | 1.87 | $4 \cdot 98$ | $2 \cdot 01$ | $5 \cdot 04$ | $2 \cdot 14$ | $5 \cdot 09$ |
| 30 | 1.63 | 4.90 | 1.76 | $4 \cdot 94$ | r.90 | $4 \cdot 99$ | 2.03 | 5.05 | $2 \cdot 18$ | $5 \cdot 11$ | 2.33 | $5 \cdot 17$ |
| 32 | 1•79 | 4.95 | I•93 | $5 \cdot 00$ | $2 \cdot 07$ | $5 \cdot 06$ | $2 \cdot 21$ | $5 \cdot 12$ | $2 \cdot 37$ | 5•19 | $2 \cdot 52$ | $5 \cdot 26$ |
| 34 | 1.95 | $5 \cdot 01$ | $2 \cdot 10$ | $5 \cdot 07$ | $2 \cdot 25$ | $5 \cdot 14$ | 2.41 | $5 \cdot 21$ | $2 \cdot 57$ | $5 \cdot 29$ | $2 \cdot 74$ | $5 \cdot 37$ |
| 36 | $2 \cdot 13$ | $5 \cdot 09$ | $2 \cdot 29$ | $5 \cdot 16$ | $2 \cdot 46$ | $5 \cdot 23$ | $2 \cdot 63$ | 5.31 | $2 \cdot 81$ | $5 \cdot 40$ | $2 \cdot 99$ | $5 \cdot 50$ |
| 38 | $2 \cdot 33$ | $5 \cdot 17$ | $2 \cdot 50$ | $5 \cdot 25$ | $2 \cdot 68$ | $5 \cdot 34$ | 2.87 | $5 \cdot 44$ | $3 \cdot 07$ | 5.55 | $3 \cdot 28$ | $5 \cdot 67$ |
| 40 | $2 \cdot 56$ | 5.28 | $2 \cdot 75$ | $5 \cdot 37$ | $2 \cdot 94$ | $5 \cdot 48$ | $3 \cdot 16$ | 5.59 | 3.37 | $5 \cdot 72$ | $3 \cdot 61$ | 5.86 |
| 4 I | $2 \cdot 77$ | $5 \cdot 34$ | $2 \cdot 88$ | $5 \cdot 44$ | $3 \cdot 09$ | $5 \cdot 55$ | 3.31 | $5 \cdot 68$ | $3 \cdot 54$ | $5 \cdot 82$ | $3 \cdot 80$ | $5 \cdot 98$ |
| 42 | 2.81 | $5 \cdot 41$ | $3 \cdot 02$ | $5 \cdot 52$ | $3 \cdot 24$ | $5 \cdot 64$ | $3 \cdot 48$ | $5 \cdot 78$ | 3.73 | 5.94 | 4.01 | 6.02 |
| 43 | $2 \cdot 96$ | $5 \cdot 48$ | $3 \cdot 18$ | $5 \cdot 60$ | 3.41 | $5 \cdot 74$ | 3.67 | $5 \cdot 89$ | $3 \cdot 94$ | $6 \cdot 07$ | $4 \cdot 24$ | $6 \cdot 27$ |
| 44 | $3 \cdot 11$ | $5 \cdot 56$ | $3 \cdot 34$ | $5 \cdot 69$ | $3 \cdot 59$ | $5 \cdot 85$ | 3.87 | $6 \cdot 02$ | $4 \cdot 17$ | $6 \cdot 22$ | $4 \cdot 50$ | $6 \cdot 44$ |

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $6^{\circ}$ | Decl. Var. | $7{ }^{\circ}$ | Decl. Var. | $8^{\circ}$ | Decl. Var. | $9^{\circ}$ | Decl. Var. | $10^{\circ}$ | Decl. Var. | $11^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | 546 | S. | H. M. S. | S. | H. M. S. |  | $5 \quad 39 \quad 0.8$ | . 38 | H. M. S. | S. | M. | s. |
| $\bigcirc$ | 546 | -2.34 | $5 \begin{array}{llll}5 & 43 & 44.4\end{array}$ |  | 54123.0 |  | $\begin{array}{llll}5 & 39 & 0 \cdot 8 \\ 5 & 29 & 6.2\end{array}$ |  |  | - | $\begin{array}{lllll}5 & 34 & 13.5\end{array}$ | 41 |
| 2 | $53646 \cdot 0$ | $2 \cdot 36$ | $534{ }^{2} 3^{\circ} 7$ | $2 \cdot 38$ | $532 \begin{array}{llll}5 & 3 \\ 5 & 5\end{array}$ | $2 \cdot 40$ | $52936 \cdot 2$ | 2.41 | $52710 \times 7$ | 2.44 | 52443.9 | 2.46 |
| 4 | $52725^{5} 3$ | $2 \cdot 39$ | 55 25 $1 \cdot 1$ | 2.41 |  | 2.43 | 52091 | 2.46 | 5 I7 410 | 2.48 | 5151113 | 2.51 |
| 6 | $\begin{array}{llll}5 & 18 & 2 \cdot 7 \\ 5 & 8 & 7\end{array}$ | 2.43 | $5{ }_{5}^{5} 5$ | 45 | 51388 | $2 \cdot 47$ | 5 10 39*3 | $2 \cdot 50$ |  | 2.53 | $\begin{array}{llll}5 & 5 & 35 * 4\end{array}$ | $2 \cdot 56$ |
| 8 | $837 \cdot 8$ | $2 \cdot 46$ | 6 9'I | 2.49 | $\begin{array}{llll}5 & 3 & 38 \cdot 7\end{array}$ | $2 \cdot 52$ | 5 I 6.4 | 55 | 458 32-x | $2 \cdot 59$ | 45555.7 | 2.63 |
| 10 | 459 10 | 2.51 | $45639^{\circ} \mathrm{O}$ |  | $454 \quad 5 \cdot 6$ | $2 \cdot 57$ | $45 \mathrm{I} 30 \cdot \mathrm{I}$ | 2.61 | $44852 \cdot 2$ | 65 | $446 \mathrm{rr} \cdot 8$ | 2.69 |
| 12 | $44940 \cdot 2$ | $2 \cdot 56$ | 44759 | $2 \cdot 59$ | 444 29.0 | 2.63 | 44 I 49.7 | $2 \cdot 68$ | $\begin{array}{llll}4 & 39 & 7.9\end{array}$ | $2 \cdot 72$ | $43623 \cdot 2$ | $2 \cdot 77$ |
| 13 | 44453.8 | 2.58 | $44217 \cdot 7$ | . 62 | $43939 \cdot 1$ | $2 \cdot 66$ | 43657.9 | $2 \cdot 71$ | 43413.9 | $2 \cdot 76$ | 43126.9 | 2.81 |
| 14 | 406.6 | $2 \cdot 6$ | $43728 \cdot 7$ | $2 \cdot 65$ | $43448 \cdot 3$ | $2 \cdot 70$ | 43250 | 2.4 | 42918.7 | 2.80 | 42629.2 | $2 \cdot 85$ |
| 15 | 43518.5 | 2.64 | $43238 \cdot 7$ | $2 \cdot 69$ | $42956 \cdot 2$ | $2 \cdot 73$ | $42710 \cdot 7$ | $2 \cdot 78$ | $42422 \cdot 1$ | $2 \cdot 8$ | 421300 | 2.90 |
| 16 | 43029.3 | $2 \cdot 67$ | $42747 \cdot 6$ | 72 | $425 \quad 3.0$ | 2.77 | $\begin{array}{lllll}4 & 22 & 15 \cdot 1\end{array}$ | 2.82 | 41924.0 | 2.88 | $41629 \cdot 2$ | $2 \cdot 94$ |
| 17 | 425 39•I | $2 \cdot 70$ | 42255.3 | $2 \cdot 75$ | 4208.5 | 2.81 | 4 17 18.2 | 2.87 | 41424.3 | $2 \cdot 93$ | 4 II $26 \cdot 7$ | 2.99 |
| 18 | $42047 \times 7$ | $2 \cdot 74$ | $\begin{array}{lll}4 & 18 \\ 4 & 1.8\end{array}$ | $2 \cdot 79$ |  | $2 \cdot 85$ |  | $2 \cdot 91$ | $\begin{array}{ll}4 & 923 \cdot 1\end{array}$ | 2.98 | 4622 | 3.05 |
| 19 | 41555.2 | $2 \cdot 77$ | 413 | $2 \cdot 83$ | 41015.2 | $2 \cdot 89$ | $\begin{array}{llll}4 & 7 & 19.6\end{array}$ | 2.96 | $4{ }^{4} 220 \cdot 0$ | 3.03 | 4 I 1 | $3 \cdot 10$ |
| 20 | 4 II $1 \cdot 3$ | 2.81 | $4 \quad 8 \quad 10 \cdot 6$ | $2 \cdot 88$ | $4 \quad 5 \quad 16.2$ | $2 \cdot 94$ | $4 \quad 2 \quad 17.8$ | 3.01 | $35915 \cdot 1$ | $3 \cdot 08$ | $\begin{array}{lll}3 & 56 & 7 \cdot 8\end{array}$ | $3 \cdot 16$ |
| 21 | $\begin{array}{lll}4 & 6 & 6 \cdot 1\end{array}$ | 2.86 | 4 3 12.8 <br> 3 58  | 92 | $\begin{array}{lccc}4 & 0 & 15.6 \\ 3 & 55\end{array}$ | 2.99 | $\begin{array}{llll}3 & 57 & 14.1 \\ 3 & 52 & 8.5\end{array}$ | 3.06 | 3 54 $8 \cdot 1$ <br> 3 48  | 3.14 | $\begin{array}{lllll}3 & 50 & 57 \cdot 3 \\ 3 & 45 & 44 \cdot 4\end{array}$ | 3.22 |
| 22 | $4{ }^{4} 1094$ | 90 | $3 \quad 5813.4$ | $2 \cdot 97$ | $3{ }^{3} 55113.2$ | 3.04 | $\begin{array}{llll}3 & 52 & 8.5 \\ 3 & 47\end{array}$ | $3 \cdot 12$ | $34^{3} 59^{\circ} \mathrm{O}$ | $3 \cdot 20$ | 34544.4 | $3 \cdot 29$ |
| 23 | 356 Ir ] | 95 | 35312.3 | 3. | $\begin{array}{lll}3 & 50 & 8 \cdot 9\end{array}$ | 10 | $\begin{array}{llll}3 & 47 & 0.8 \\ 3\end{array}$ | $3 \cdot 1$ | $34347 \cdot 6$ | $3 \cdot 26$ | $34029 \cdot 0$ | 3.36 |
| 24 | $\begin{array}{lllll}3 & 51 \\ 3 & 11.2\end{array}$ | 2.99 | $\begin{array}{llll}3 & 48 & 9 \cdot 2 \\ 3 & 43 & 4 \cdot 2\end{array}$ | 3.07 3 | $\begin{array}{llll}3 & 45 & 2 \cdot 5 \\ 3 & 3\end{array}$ | $3 \cdot 15$ |  | 3.24 |  | 3.33 | $\begin{array}{llll}3 & 35 & 10 \cdot 8 \\ 3 & 29 & 49\end{array}$ | 3.43 3.51 |
| 25 | $\begin{array}{lll}3 & 46 & 9.4\end{array}$ | 3.05 | $\begin{array}{llll}3 & 43 & 42\end{array}$ | $3 \cdot 13$ | 33954.0 | 3.21 | $\begin{array}{lllll}3 & 36 & 38 \cdot 4\end{array}$ | -3 | $3 \begin{array}{llll}317 \cdot 1\end{array}$ | 3 | 3 29 <br> 19  | 3.51 |
| 26 | 34159 | 10 | $33757 \circ$ | 19 | $33443 \cdot 1$ | 3.28 | 3 31 23.4 | $3 \cdot 38$ | $32757 \cdot 6$ | 3.48 | 32425.3 | 3.60 |
| 27 | $\begin{array}{llllllllllllll}3 & 35 & 59\end{array}$ | $3 \cdot 16$ | $\begin{array}{lllllllllllll}3 & 32 & 47 \cdot 5\end{array}$ | 3.25 | $\begin{array}{llll}3 & 29 & 29.6\end{array}$ | 3.35 | $\begin{array}{llll}3 & 26 & 5 \cdot 5\end{array}$ | 3.45 | $32235{ }^{\circ}$ | 3.57 | $\begin{array}{lllllllllll}3 & 18 & 57 \cdot 5\end{array}$ | $3 \cdot 69$ |
| 28 | $\begin{array}{llll}3 & 30 & 51 \\ \text { - }\end{array}$ | 3.22 | $\begin{array}{lllllll}3 & 27 & 35\end{array}$ | 3.32 |  | 3.42 | $32044 \cdot 6$ | $3 \cdot 54$ | 31790 | 3.66 |  | $3 \cdot 78$ |
| 29 | $\begin{array}{lllll}3 & 25 & 4 \times 3\end{array}$ | 29 | $\begin{array}{llll}3 & 22 & 20.9\end{array}$ | 3 | $31818{ }^{3} \mathrm{I}$ | 350 | $\begin{array}{llll}3 & 15 & 20 \cdot 4\end{array}$ | $3 \cdot 62$ | 3 II 39.3 | 3.75 | $3 \quad 750 \cdot 3$ | $3 \cdot 89$ |
| 30 | 32028.3 | 36 | $\begin{array}{llll}3 & 17 & 3\end{array}$ | 3.47 | $\begin{array}{lllll}3 & 13 & 31\end{array}$ | $3 \cdot 5$ | $\begin{array}{llll}3 & 9 & 52 \cdot 5\end{array}$ | $3 \cdot 7$ | $\begin{array}{llll}3 & 6 & 5.6\end{array}$ | 3.85 | $3 \quad 2$ | 4.00 |
| 31 |  | 3.44 | 3 II 42.6 | 3.56 | $\begin{array}{llll}3 & 8 & 5 \cdot 6\end{array}$ | $3 \cdot 68$ | $\begin{array}{llll}3 & 4 & 20 \cdot 8 \\ 2 & 5\end{array}$ | $3 \cdot 82$ | $\begin{array}{llll}3 & 0 & 27 \cdot 5\end{array}$ | $3 \cdot 96$ | $25625 \cdot 1$ | 4.12 |
| 32 | $3 \quad 953.3$ | $3 \cdot 52$ | 618.4 | 3.65 | $\begin{array}{lllll}3 & 2 & 35 \cdot 7\end{array}$ | $3 \cdot 78$ | $2{ }^{2} 5844 \cdot 7$ | 3.93 | $25444 \cdot 6$ | 4.08 | $25034 \cdot 6$ | $4 \cdot 26$ |
| 33 | $\begin{array}{lllllllllll}3 & 4 & 30 \cdot 9\end{array}$ | $3 \cdot 6$ | $\begin{array}{llll}3 & 0 & 50.4\end{array}$ | 3.74 | $2 \begin{array}{lll} \\ 2 & 1 \cdot 7\end{array}$ | $3 \cdot 89$ | 223 3 3 <br> 2   | 4.04 | $2{ }^{2} 4856 \cdot 3$ | $4 \cdot 16$ | $24438 \cdot 0$ | $4 \cdot 40$ |
| 34 | 2 59 $4 \cdot 8$ <br> 2 53  | 3.70 | $\begin{array}{lllllll}2 & 55 & 18.4\end{array}$ | 3.85 | $\begin{array}{llll}2 & 51 & 22.9 \\ 2 & 45 & \end{array}$ | 4.00 | $\begin{array}{lllllll}2 & 47 & 17 \cdot 8\end{array}$ | $4 \cdot 17$ | 243 2-1 | $4 \cdot 36$ | $\begin{array}{llll}2 & 38 & 34 \cdot 8 \\ 2\end{array}$ | $4 \cdot 56$ |
| 35 | 25334.7 | 3.81 | 249 41•7 | 3.96 | 24539.2 | $4 \cdot 13$ | $24126 \cdot 0$ | $4 \cdot 31$ | $\begin{array}{lll}2 & 37 & 1.4\end{array}$ | $4 \cdot 52$ | $2{ }^{2} 324.1$ | $4 \cdot 74$ |
| 36 | $\begin{array}{lll}248 & 0.2\end{array}$ | $3 \cdot 92$ | 44 O.I | 4.09 | 23949.6 | 4.27 | 23527.7 | $4 \cdot 47$ | 23053.3 | $4 \cdot 69$ | $\begin{array}{llll}2 & 26 & 4.9\end{array}$ | -93 |
| 37 | $24220 \cdot 8$ | 4.4 |  | 4.22 | 23353.9 | 4.42 | $2 \begin{array}{llll}29 & 22.3\end{array}$ | $4 \cdot 64$ | $22436 \cdot 9$ | $4 \cdot 88$ | $21936 \cdot 1$ | $5 \cdot 15$ |
| 38 | $23635 \cdot 8$ | 4.18 | 23219.6 | 4.37 | 22750.9 | 4.59 | $\begin{array}{lllllllllllllllll}2 & 23 & 8.6\end{array}$ | 4.83 | $2 \mathrm{I} 8 \mathrm{II} \cdot \mathrm{O}$ | $5 \cdot 10$ | $21256 \cdot 2$ | $5 \cdot 40$ |
| 39 | 2 30 | 4.32 | $\begin{array}{llllll}2 & 26 & 19.2\end{array}$ | 4.54 | $22140^{\circ} \mathrm{O}$ | $4 \cdot 78$ | $21645 \cdot 6$ | 5.05 | 2 II 34.3 | $5 \cdot 35$ | $\begin{array}{llll}2 & 6 & 3 \cdot 6\end{array}$ | $5 \cdot 68$ |
| 40 | 24 47•1 | 4.49 | 220 II\% | $4 \cdot 73$ | 215200 | $4 \cdot 9$ | 2 IO 12.0 | $5 \cdot$ | 444.9 | . | I 5855 |  |

VARIATION TO $\mathrm{I}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. 6 | A. | L. $7^{\circ}$ | A. | L. $8^{\circ}$ | A. | L. $9^{\circ}$ | A. | L. 1 | A. | L. $11^{\circ} \mathrm{A}$. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | - ${ }^{\text {s. }}$ | s. -4.65 | s. 6 | $\begin{gathered} \text { s. } \\ -4 \cdot 66 \end{gathered}$ | s. ${ }^{75}$ | $\begin{gathered} \text { s. } \\ -4 \cdot 68 \end{gathered}$ | s. 85 | $\begin{gathered} \mathrm{s} . \\ -4 \cdot 60 \end{gathered}$ | S. ${ }^{\text {S }}$ | 5.71 | s. I. 04 | s. |
| 2 | . 66 | -4.66 | $\cdot 76$ | -4.68 | - .85 | $-4 \cdot 70$ 4.70 | -. 95 | -4.72 | - $\mathrm{I} \cdot 04$ | -4.71 4.74 | -1.04 I 15 | 4.73 4.76 |
| 4 | $\cdot 75$ | $4 \cdot 68$ | -85 | $4 \cdot 70$ | -95 | $4 \cdot 72$ | 1.05 | $4 \cdot 74$ | 1.15 | 4.76 | 1.25 | 4.78 |
| 6 | -85 | $4 \cdot 70$ | -96 | 4.72 | r.05 | $4 \cdot 74$ | - $\cdot 16$ | 4.76 | I. 26 | $4 \cdot 79$ | I.36 | 4.81 |
| 8 | $\cdot 96$ | $4 \cdot 72$ | r.06 | 4•74 | I•6 | $4 \cdot 76$ | $\mathbf{1} \cdot 26$ | $4 \cdot 79$ | 1.37 | $4 \cdot 82$ | 1.47 | $4 \cdot 85$ |
| 10 | 1.06 | $4 \cdot 74$ | $1 \cdot 17$ | $4 \cdot 76$ | 1.27 | $4 \cdot 79$ | 1.37 | 4.82 | 1.48 | 4.85 | 1.59 | $4 \cdot 89$ |
| 12 | $1 \cdot 17$ | $4 \cdot 77$ | 1.28 | $4 \cdot 79$ | $1 \cdot 38$ | $4 \cdot 82$ | r 49 | 4.85 | I.60 | $4 \cdot 88$ | $1 \cdot 71$ | 4.93 |
| 14 | $1 \cdot 29$ | 4.79 | x.39 | 4.82 | $1 \cdot 50$ | $4 \cdot 86$ | I. 61 | $4 \cdot 89$ | I.73 | 4.93 | I.84 | 4.97 |
| 16 | $1 \cdot 4$ | 4.83 | I.52 | 4.86 | 1.63 | 4.90 | 1.75 | 4.94 | I.86 | $4 \cdot 98$ | I.98 | $5 \cdot 03$ |
| 18 | 1.53 | $4 \cdot 87$ | 1.65 | 4.90 | 1•76 | $4 \cdot 94$ | I. 88 | $4 * 99$ | 2.01 | $5 \cdot 04$ | $2 \cdot 13$ | $5 \cdot 02$ |
| 20 | 1.66 | $4 \cdot 91$ | 1.78 | $4 \cdot 95$ | $1 \cdot 90$ | $5 \cdot 00$ | 2.03 | 5.05 | $2 \cdot 16$ | $5 \cdot 10$ | 2.29 | $5 \cdot 16$ |
| 22 | 1.80 | $4 \cdot 96$ | 1.93 | $5 \cdot 00$ | $2 \cdot 06$ | $5 \cdot 06$ | $2 \cdot 19$ | $5 \cdot \mathrm{II}$ | $2 \cdot 33$ | $5 \cdot 17$ | $2 \cdot 47$ | $5 \cdot 24$ |
| 24 | 1•95 | $5 \cdot 01$ | 2.08 | $5 \cdot 07$ | $2 \cdot 22$ | $5 \cdot 12$ | $2 \cdot 36$ | $5 \cdot 19$ | $2 \cdot 50$ | $5 \cdot 25$ | $2 \cdot 65$ | 5.33 |
| 26 | $2 \cdot 11$ | 5.08 | $2 \cdot 25$ | $5 \cdot 14$ | $2 \cdot 39$ | $5 \cdot 20$ | $2 \cdot 54$ | $5 \cdot 27$ | $2 \cdot 70$ | $5 \cdot 35$ | 2.86 | $5 \cdot 43$ |
| 28 | $2 \cdot 29$ | $5 \cdot 15$ | $2 \cdot 44$ | $5 \cdot 22$ | $2 \cdot 59$ | $5 \cdot 29$ | $2 \cdot 75$ | 5.38 | 2.92 | $5 \cdot 46$ | 3.09 | $5 \cdot 56$ |
| 30 | $2 \cdot 48$ | $5 \cdot 24$ | $2 \cdot 64$ | $5 \cdot 32$ | $2 \cdot 80$ | $5 \cdot 40$ | 2.98 | $5 \cdot 50$ | $3 \cdot 16$ | $5 \cdot 60$ | 3.36 | 5.71 |
| 32 | $2 \cdot 69$ | $5 \cdot 34$ | $2 \cdot 86$ | $5 \cdot 43$ | 3.05 | 5.53 | $3 \cdot 24$ | $5 \cdot 64$ | $3 \cdot 44$ | $5 \cdot 76$ | $3 \cdot 66$ | $5 \cdot 89$ |
| 33 | $2 \cdot 80$ | $5 \cdot 40$ | $2 \cdot 99$ | $5 \cdot 50$ | $3 \cdot 18$ | $5 \cdot 61$ | $3 \cdot 38$ | $5 \cdot 72$ | $3 \cdot 59$ | $5 \cdot 85$ | 3.82 | $6 \cdot 00$ |
| 34 | $2 \cdot 93$ | $5 \cdot 47$ | $3 \cdot 12$ | 5.57 | $3 \cdot 32$ | $5 \cdot 69$ | $3 \cdot 53$ | $5 \cdot 82$ | $3 \cdot 76$ | $5 \cdot 96$ | 4.01 | $6 \cdot 12$ |
| 35 | 3.06 | $5 \cdot 54$ | $3 \cdot 26$ | $5 \cdot 65$ | 3.47 | $5 \cdot 78$ | $3 \cdot 70$ | $5 \cdot 92$ | 3.94 | $6 \cdot 07$ | 4.21 | $6 \cdot 25$ |
| 36 | $3 \cdot 19$ | $5 \cdot 62$ | 3.40 | 5.74 | 3.63 | 5.88 | 3.88 | $6 \cdot 03$ | $4 \cdot 14$ | $6 \cdot 20$ | 4.43 | $6 \cdot 40$ |
| 37 | $3 \cdot 34$ | $5 \cdot 70$ | $3 \cdot 57$ | $5 \cdot 84$ | $3 \cdot 81$ | $5 \cdot 99$ | 4.07 | $6 \cdot 16$ | $4 \cdot 36$ | $6 \cdot 35$ | 4.67 | $6 \cdot 57$ |
| 38 | $3 \cdot 50$ | $5 \cdot 80$ | $3 \cdot 75$ | $5 \cdot 95$ | 4.00 | $6 \cdot 12$ | 4.29 | $6 \cdot 31$ | $4 \cdot 60$ |  |  |  |
| 39 | $3 \cdot 68$ | 5.91 | $3 \cdot 94$ | $6 \cdot 07$ | $4 \cdot 22$ | $6 \cdot 26$ | 4.53 4.80 | $6 \cdot 47$ 6.66 | 4.87 $5 \cdot 18$ | 6.72 6.93 | 5.26 5.61 | 7.00 7.27 |
| 40 | 3.87 | $6 \cdot 03$ | $4 \cdot 15$ | $6 \cdot 2 \mathrm{x}$ | 4.45 | $6 \cdot 42$ | $4 \cdot 80$ | $6 \cdot 66$ | 5.18 | $6 \cdot 93$ | 5.6 r | $7 \cdot 27$ |

## 244 HOUR-ANGLES AND VARIATIONS TO 1' OF LAT., DECL., AND ALT.

## LATITUDE $30^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $12^{\circ}$ | Decl. <br> Var. | $13^{\circ}$ | Decl. <br> Var. | $14^{\circ}$ | Decl. Var. | $15^{\circ}$ | Decl. <br> Var. | $16^{\circ}$ | Decl. <br> Var. | $17^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. | S. | H. M. | S. | M. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. |
| 0 | $\begin{array}{llll}5 & 31 & 48 \cdot 2\end{array}$ | -2.43 | 5 $2922 \mathrm{I} \cdot 7$ | $-2.45$ | $5 \begin{array}{llll}5 & 26 & 53.6\end{array}$ | $-2.48$ | 5124 24.2 | $-2.5 \mathrm{I}$ | 52152.9 | $-2.53$ | $51920 \cdot 0$ | $-2.57$ |
| 2 | $\begin{array}{llll}5 & 22 & 15 \cdot 7\end{array}$ | 2.48 | 5 I9 $46 \cdot 0$ | $2 \cdot 5 \mathrm{I}$ | 5 I7 14.6 | $2 \cdot 54$ | $5{ }_{5}^{5}$ I4 $411 \cdot 3$ | 2.57 | $5126 \cdot 1$ | $2 \cdot 60$ | $\begin{array}{llll}5 & 9 & 28 \cdot 8\end{array}$ | $2 \cdot 64$ |
| 4 | 512400 | $2 \cdot 54$ | 5 10 6.8 | 2.57 | $5 \quad 731 \cdot 6$ | 260 | $\begin{array}{llll}5 & 4 & 54.3\end{array}$ | $2 \cdot 64$ | (5rrrrl | $2 \cdot 68$ | $45932 \cdot 6$ | 2.72 |
| 6 | $\begin{array}{llll}5 & 3 & 0.5\end{array}$ | $2 \cdot 60$ | $\begin{array}{lll}5 & 0 & 23.5\end{array}$ | $2 \cdot 64$ | $45744^{4} 2$ | 2.67 | $\begin{array}{lll}4 & 55 & 2 \cdot 5\end{array}$ | $2 \cdot 72$ | $45^{4} 52$ 18.I | $2 \cdot 76$ | $44930 \cdot 8$ | $2 \cdot 8 \mathrm{I}$ |
| 8 | 45317.0 | $2 \cdot 67$ | $45035 \cdot 8$ | $2 \cdot 71$ | $44752 \cdot 0$ | $2 \cdot 75$ | $445 \quad 5 \cdot 3$ | $2 \cdot 80$ | 442 15\% 7 | 2.85 | $43922 \cdot 8$ | $2 \cdot 91$ |
| 10 | $44328 \cdot 8$ | $2 \cdot 74$ | 440430 | $2 \cdot 79$ | $4 \begin{array}{llll}4 & 37 & 54.2\end{array}$ | $2 \cdot 84$ | $\begin{array}{lll}4 & 35 & 2 \cdot 3\end{array}$ | $2 \cdot 89$ | $\begin{array}{lll}4 & 32 & 6 \cdot 8\end{array}$ | $2 \cdot 95$ | $\begin{array}{lll}4 & 29 & 7 \cdot 8\end{array}$ | $3 \cdot 02$ |
| 12 | $43335 \cdot 5$ | 2.82 | $43044 \cdot 6$ | 2.88 | $4 \quad 27$ 50.4 | 2.93 | $424 \quad 52 \cdot 5$ | $3 \cdot 00$ | $4 \begin{array}{llll}4 & 21 & 50.8\end{array}$ | $3 \cdot 06$ | $4 \begin{array}{llll}4 & 18 & 44^{\circ} 9\end{array}$ | $3 \cdot 13$ |
| 13 | $4 \begin{array}{llll}4 & 28 & 36 \cdot 7\end{array}$ | $2 \cdot 86$ | $\begin{array}{llll}4 & 25 & 43 \cdot 1\end{array}$ | 2.92 | $\begin{array}{llll}4 & 22 & 45 \cdot 9\end{array}$ | $2 \cdot 98$ | $\begin{array}{llll}4 & 19 & 44.9\end{array}$ | 3.05 | $\begin{array}{\|ccc\|}4 & 16 & 39 \cdot 8 \\ 4 & 11 & \end{array}$ | $3 \cdot 12$ | $\begin{array}{llll}4 & 13 & 30 \cdot 3 \\ 4 & 8 & \end{array}$ | 3.20 |
| 14 | $42336 \cdot 4$ | $2 \cdot 91$ | $\begin{array}{llll}4 & 20 & 39 & \\ 4 & 15 & 34\end{array}$ | 297 | $4 \begin{array}{llll}4 & 17 & 39 \cdot 6\end{array}$ | 3.04 | $4 \begin{array}{llll}4 & 14 & 35 \cdot 3\end{array}$ | $3 \cdot 11$ | 411126.6 | $3 \cdot 18$ | $4 \begin{array}{lll}4 & 8 & 13.2\end{array}$ | $3 \cdot 26$ |
| 15 | 4 I8 $34 \cdot 4$ | $2 \cdot 96$ | $41534 * 9$ | $3 \cdot 02$ | 4 I2 31.4 | 3.09 | $4 \quad 9 \quad 23 \cdot 5$ | $3 \cdot 17$ | $46 \mathrm{II} \cdot 0$ | $3 \cdot 25$ | $\begin{array}{llll}4 & 2 & 53.6\end{array}$ | $3 \cdot 33$ |
| 16 | $41330 \cdot 7$ | 3.01 | 4 10 28.0 | 3.08 | 4 7-721.0 | 3.15 | $\begin{array}{lll}4 & 4 & 9 \cdot 5\end{array}$ | 3.23 | $4{ }^{4} 0$ | $3 \cdot 32$ | $35731 \cdot 3$ | 3.41 |
| 17 | $4825{ }^{4} 8$ | 3.06 | $4{ }^{4} 515190$ | $3 \cdot 14$ | $\begin{array}{rrrr}4 & 2 & 8 \cdot 5 \\ 3 & 5 & 53\end{array}$ | 3.22 | $\begin{array}{llll}3 & 58 & 53 \cdot 0 \\ 3 & 5 & \end{array}$ | $3 \cdot 30$ | $\begin{array}{llll}3 & 55 & 32 \cdot 4 \\ 3 & 5 & \end{array}$ | $3 \cdot 39$ | 3 52 $6 \cdot 1$ <br> 3 4  | $3 \cdot 49$ |
| 18 |  | $3 \cdot 12$ | $4 \begin{array}{lll}4 & 0 & 79\end{array}$ | $3 \cdot 20$ | $\begin{array}{lllll}3 & 56 & 53.5\end{array}$ | $3 \cdot 28$ | $\begin{array}{llll}3 & 53 & 34^{\circ} \mathrm{O}\end{array}$ | $3 \cdot 37$ | $\begin{array}{lll}3 & 50 & 8 \cdot 9\end{array}$ | 3.47 | $3 \begin{array}{lllllllll}3 & 46\end{array}$ | $3 \cdot 57$ |
| 19 | 3 58 $7 \cdot 7$ <br> 3 5  | $3 \cdot 18$ | $\begin{array}{llll}3 & 54 & 54 \cdot 5\end{array}$ | $3 \cdot 26$ | $3 \begin{array}{llll}3 & 51 & 36 \cdot 1\end{array}$ | $3 \cdot 35$ | $\begin{array}{llll}3 & 48 & 12 \cdot 2 \\ 3 & 42 & 47 \cdot 4\end{array}$ | $3 \cdot 45$ | $\begin{array}{llll}3 & 44 & 42 \cdot 5\end{array}$ | 3.55 | $\begin{array}{llll}3 & 41 & 6 \cdot 2\end{array}$ | 3.66 |
| 20 | $\begin{array}{llll}3 & 52 & 55\end{array}$ | $3 \cdot 24$ | 34938.6 | $3 \cdot 33$ | $\begin{array}{llllll}3 & 46 & 15.9\end{array}$ | 3.43 | $\begin{array}{lllll}3 & 42 & 47 *\end{array}$ | 3.53 | $313912 \cdot 6$ | $3 \cdot 64$ | $33531 \cdot 0$ | $3 \cdot 75$ |
| 2 I | $3{ }^{3} 474 \mathrm{4} \cdot 4$ | $3 \cdot 3$ I | $344{ }^{2} 0^{\circ} 0$ | 3.40 | $340 \begin{array}{llll}3 & 40\end{array}$ | $3 \cdot 50$ | $\begin{array}{llll}3 & 37 & 19.4\end{array}$ | $3 \cdot 6 \mathrm{I}$ | $\begin{array}{llll}3 & 33 & 39 *\end{array}$ | 3.73 | 329 5I•9 | $3 \cdot 85$ |
| 22 | $\left[\begin{array}{llll}3 & 42 & 24.4\end{array}\right.$ | $3 \cdot 38$ | 3 3 38 $588 \cdot 6$ | $3 \cdot 48$ | $\begin{array}{llll}3 & 35 & 26.5\end{array}$ | 3.59 | $\begin{array}{llll}3 & 31 & 47 \cdot 9 \\ 3 & 26 & 1\end{array}$ | 3.70 | $\begin{array}{rrrr}3 & 28 & 2 \cdot 1 \\ 3 & 22 & 20 \cdot 8\end{array}$ | $3 \cdot 83$ | $\begin{array}{llll}3 & 24 & 8 \cdot 5\end{array}$ | $3 \cdot 96$ |
| 23 | [3074.6 | 3.46 | $\begin{array}{llll}3 & 33 & 34^{\bullet} 1 \\ 3 & 8 & \end{array}$ | $3 \cdot 56$ | $\begin{array}{lllll}3 & 29 & 56.9\end{array}$ | 3.68 | $\begin{array}{llll}3 & 26 & 12 \cdot 7 \\ 3 & 20 & 33 \cdot 4\end{array}$ | 3.80 | $\left\lvert\, \begin{array}{llll}3 & 22 & 20 \cdot 8 \\ 3 & 16 & 34 \cdot 9\end{array}\right.$ | 3.93 | $\begin{array}{llll}3 & 18 & 20 \cdot 6\end{array}$ | $4 \cdot 08$ |
| 24 | $\begin{array}{llll}3 & 31 & 41.8 \\ 3 & 26 & 15\end{array}$ | 3.54 | $\begin{array}{lll}3 & 28 & 6 \cdot 2 \\ 3 & 22 & 34.7\end{array}$ | $3 \cdot 65$ | $\begin{array}{llll}3 & 24 & 23 \cdot 6 \\ 3 & 18 & 46 \cdot 2\end{array}$ | 3.77 3.88 | $\begin{array}{llll}3 & 20 & 33 \cdot 4 \\ 3 & 1 & 4 & 49.6\end{array}$ | $3 \cdot 91$ | $\begin{array}{llll}3 & 16 & 34 * 9 \\ 3 & \text { 10 } & 44.2\end{array}$ | 4.05 | $\begin{array}{rrrr}3 & 12 & 27 \cdot 7\end{array}$ | $4 \cdot 20$ |
| 25 | $3{ }^{3} 2615 \times 7$ | $3 \cdot 62$ | $32234 \%$ | $3 \cdot 75$ | $\begin{array}{lllll}3 & 18 & 46 \cdot 2\end{array}$ | $3 \cdot 88$ | $\begin{array}{llllllllllll}3 & 14 & 49 \cdot 6\end{array}$ | $4^{\circ} \mathrm{O2}$ | 3 Io 44.2 | 4.17 | $\begin{array}{llll}3 & 6 & 29 & 3\end{array}$ | $4 \cdot 34$ |
| 26 | $\begin{array}{llll}3 & 20 & 46 \cdot 1\end{array}$ | 3'72 | 3 I 659.4 | 3.85 | $3 \begin{array}{lll}3 & 4.6\end{array}$ | 3.99 | $\begin{array}{lll}3 & 9 & \text { I'I }\end{array}$ | $4 \cdot 14$ | $\begin{array}{lllll}3 & 4 & 48 \cdot 1\end{array}$ | $4 \cdot 30$ | $3 \quad 0 \quad 24 \cdot 8$ | $4 \cdot 48$ |
| 27 | $\begin{array}{llll}3 & 15 & 12.7\end{array}$ | 3.8 I | $\left(\begin{array}{llll}3 & 11 & 19 \cdot 7\end{array}\right.$ | 3.95 | $\begin{array}{llll}3 & 7 & 18.2 \\ 3 & 1 & 26.5\end{array}$ | $4 \cdot 10$ | $\begin{array}{rrrr}3 & 3 & 7 \cdot 2 \\ 2 & 5 & 7 \cdot 5\end{array}$ | 4.27 | $\begin{array}{llll}2 & 58 & 46 \cdot 0\end{array}$ | 4.45 | $\begin{array}{llll}2 & 54 & 13 & 7\end{array}$ | $4 \cdot 64$ |
| 28 | $\begin{array}{llll}3 & 9 & 35.0 \\ 3 & 3 & 52.8\end{array}$ | 3.92 | $\left\lvert\, \begin{array}{rrrr}3 & 5 & 35 \cdot 4 \\ 2 & 59 & 46 \cdot 0\end{array}\right.$ | 4.07 | 3 1 $26 \cdot 5$ <br> 2 55 $20 \cdot 1$ | $4 \cdot 23$ | $\begin{array}{llll}2 & 57 & 7 \cdot 5 \\ 2 & 51 & 1.3\end{array}$ | 4.41 | $\begin{array}{llll}2 & 52 & 37 \cdot 4 \\ 2 & 46 & 21.4\end{array}$ | 4.60 | $247 \begin{array}{llll} & 4 & 5 \cdot 1\end{array}$ | $4 \cdot 82$ |
| 29 | 3 3 $52 \cdot 8$ <br> 2 5 5 | 4.04 | $25946 \cdot 0$ | $4 \cdot 20$ | $\begin{array}{llll}2 & 55 & 29^{\circ} 1 \\ 2 & 49 & 25\end{array}$ | $4 \cdot 37$ | $2 \begin{array}{lll}2 & 51 & 1 \\ 2 & 4 & 3\end{array}$ | $4 \cdot 56$ | $\begin{array}{lllll}2 & 46 & 21.4\end{array}$ | 4.77 | $\begin{array}{lllll}2 & 41 & 28 \cdot 3\end{array}$ | $5 \cdot 01$ |
| 30 | $\begin{array}{llll}2 & 58 & 5 \cdot 5\end{array}$ | $4^{\cdot 16}$ | $25350 * 9$ | 4.33 | 24925.4 | 4.52 | 244479 | $4 \cdot 73$ | 2395873 | 4.96 | $23452 \cdot \mathrm{I}$ | $5 \cdot 22$ |
| 31 | 25212.6 | $4 \cdot 30$ | $24749 \cdot 6$ | 4.48 | $\begin{array}{llll}2 & 43 & 14.6\end{array}$ | 4.69 | $2 \begin{array}{lll}2 & 38 & 26 \cdot 6\end{array}$ | 4.92 | $23324{ }^{\circ} \mathrm{O}$ | 5.18 | $\begin{array}{llll}2 & 28 & 5 \cdot 3\end{array}$ | $5 \cdot 46$ |
| 32 | $\begin{array}{llllllll}2 & 46 & 13.9\end{array}$ | $4 \cdot 44$ | $\begin{array}{lllll}2 & 4 \mathrm{I} & 4 \mathrm{I} \cdot 4 \\ 2 & \end{array}$ | $4 \cdot 65$ | $\begin{array}{lllll}2 & 36 & 55^{\circ} 9\end{array}$ | 4.88 | $2 \begin{array}{llll}2 & 31 & 56 \cdot 1\end{array}$ | $5 \cdot 13$ | $\begin{array}{llll}2 & 26 & 40 \cdot 3\end{array}$ | 5.41 | $2 \begin{array}{lll}21 & 6 \cdot 5\end{array}$ | $5 \cdot 73$ |
| 33 | $\begin{array}{rrr}2 & 40 & 8 \cdot 1 \\ 2 & 33 & 5 \cdot 8\end{array}$ | 4.61 | $\begin{array}{llll}2 & 35 & 25 \cdot 3 \\ 2 & 29 & 0.6\end{array}$ | $4 \cdot 83$ | $\begin{array}{llll}2 & 30 & 28 \cdot 3 \\ 2 & 23 & 50 \cdot 6\end{array}$ | $5 \cdot 08$ | $\begin{array}{llll}2 & 25 & 15.4 \\ 2 & 18 & 2.0\end{array}$ | $5 \cdot 36$ | 2 19 44. | $5 \cdot 68$ | $\begin{array}{llll}2 & 13 & 53.6\end{array}$ | 6.05 |
| 34 | 2 33 54.8 <br> 2 27  | $4 \cdot 78$ | $\begin{array}{rrr}2 & 29 & 0.6 \\ 2 & 22 & 25.9\end{array}$ | $5 \cdot 03$ | $\begin{array}{llll}2 & 23 & 50 \cdot 6 \\ 2 & 1 & 7 & \end{array}$ | $5 \cdot 31$ $5 \cdot 57$ | $\begin{array}{llll}2 & 18 & 22.9 \\ 2 & 11 & 16.9\end{array}$ | $5 \cdot 63$ | $\begin{array}{rrrr}2 & 12 & 35 \cdot 2 \\ 2 & 5 & 9.5\end{array}$ | $5 \cdot 99$ | 2 6 24.2 <br>  58 35.4 | 6.41 |
| 35 | $22732 \cdot 8$ | 4.98 | 122225.9 | $5 \cdot 26$ | 217173 | $5 \cdot 57$ | 2 II 16.9 | 5.93 | $2 \begin{array}{lll}2 & 5 & 9.5\end{array}$ | $6 \cdot 35$ | I 5835.4 | $6 \cdot 85$ |

VARIATION TO $\mathrm{r}^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $12^{\circ}$ | $2^{\circ} \mathrm{A}$. | L. $13^{\circ}$ | A. | L. $14^{\circ} \mathrm{A}$. |  | L. $15^{\circ} \mathrm{A}$. |  | L. $16^{\circ} \mathrm{A}$. |  | L. $17^{\circ}$ A. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| 0 | -I'14 | $-4 \cdot 76$ | -1.25 | $-4.78$ | - I. 35 | $-4.81$ | - I* 45 | $-4.84$ | - I. 55 | $-4.87$ | - r.66 | $-4.91$ |
| 2 | 1.24 | $4 \cdot 78$ | r 35 | 4.81 | 1.45 | $4 \cdot 84$ | I.56 | $4 \cdot 87$ | r.66 | $4 \cdot 91$ | 1.77 | 4.95 |
| 4 | I.35 | $4 \cdot 81$ | I•46 | $4 \cdot 84$ | I.56 | 4.88 | 1.67 | 4.91 | I•78 | 4.95 | I-89 | 4.99 |
| 6 | I.46 | $4 \cdot 85$ | 1.57 | 4.88 | I.68 | 4.91 | 1•79 | 4.95 | 1.90 | $5 \cdot 00$ | $2 \cdot 02$ | $5 \cdot 04$ |
| 8 | I*58 | $4 \cdot 88$ | I. 69 | 4.92 | I.80 | $4 \cdot 96$ | 1•92 | $5 \cdot 00$ | $2 \cdot 03$ | $5 \cdot 05$ | $2 \cdot 15$ | $5 \cdot 10$ |
| 10 | 1•70 | 4.92 | I.8r | $4 \cdot 96$ | I.93 | 5.01 | $2 \cdot 05$ | 5.05 | $2 \cdot 17$ | 5'10 | $2 \cdot 29$ | $5 \cdot 16$ |
| 12 | I.83 | 4.97 | I.95 | $5 \cdot 01$ | $2 \cdot 07$ | 5.06 | 2.19 | 5.11 | $2 \cdot 32$ | 5.16 | $2 \cdot 45$ | $5 \cdot 23$ |
| 13 | 1.90 | 4.99 | 2.02 | $5 \cdot 04$ | $2 \cdot 14$ | $5 \cdot 09$ | $2 \cdot 26$ | 5.14 | $2 \cdot 39$ | $5 \cdot 20$ | $2 \cdot 53$ | $5 \cdot 26$ |
| 14 | 1.96 | 5.02 | $2 \cdot 09$ | 5.07 | $2 \cdot 21$ | 5.12 | $2 \cdot 34$ | 5•18 | 2.47 | $5 \cdot 24$ | $2 \cdot 61$ | $5 \cdot 31$ |
| 15 | $2 \cdot 04$ | $5 \cdot 05$ | 2.16 | 5.10 | 2.29 | 5.15 | $2 \cdot 42$ | $5 \cdot 21$ | $2 \cdot 56$ | $5 \cdot 28$ | $2 \cdot 70$ | $5 \cdot 35$ |
| 16 | 2.11 | $5 \cdot 08$ | $2 \cdot 24$ | 5.13 | $2 \cdot 37$ | 5•19 | $2 \cdot 50$ | $5 \cdot 25$ | $2 \cdot 64$ | $5 \cdot 32$ | $2 \cdot 79$ | $5 \cdot 40$ |
| 17 | 2.19 | 5.11 | $2 \cdot 32$ | 5.17 | 2.45 | $5 \cdot 23$ | $2 \cdot 59$ | $5 \cdot 30$ | $2 \cdot 73$ | $5 \cdot 37$ | $2 \cdot 88$ | $5 \cdot 45$ |
| 18 | $2 \cdot 27$ | 5.14 | $2 \cdot 40$ | $5 \cdot 20$ | $2 \cdot 54$ | $5 \cdot 27$ | $2 \cdot 68$ | $5 \cdot 34$ | $2 \cdot 83$ | $5 \cdot 42$ | $2 \cdot 98$ | $5 \cdot 50$ |
| 19 | $2 \cdot 35$ | 5.18 | $2 \cdot 48$ | 5*24 | $2 \cdot 63$ | $5 \cdot 31$ | $2 \cdot 77$ | $5 \cdot 39$ | 2.93 | $5 \cdot 47$ | $3 \cdot 09$ | $5 \cdot 56$ |
| 20 | $2 \cdot 43$ | $5 \cdot 22$ | $2 \cdot 57$ | $5 \cdot 29$ | 2.72 | $5 \cdot 36$ | $2 \cdot 87$ | $5 \cdot 44$ | $3 \cdot 03$ | $5 \cdot 53$ | $3 \cdot 20$ | $5 \cdot 62$ |
| 21 | $2 \cdot 52$ | $5 \cdot 26$ | $2 \cdot 67$ | $5 \cdot 33$ | 2.82 | $5 \cdot 41$ | $2 \cdot 98$ | $5 \cdot 50$ | 3.14 | $5 \cdot 59$ | $3 \cdot 32$ | $5 \cdot 69$ |
| 22 | $2 \cdot 61$ | $5 \cdot 31$ | $2 \cdot 76$ | $5 \cdot 38$ | $2 \cdot 92$ | $5 \cdot 47$ | 3.09 | $5 \cdot 56$ | $3 \cdot 26$ | $5 \cdot 65$ | $3 \cdot 44$ | $5 \cdot 76$ |
| 23 | $2 \cdot 71$ | $5 \cdot 35$ | 2.87 | $5 \cdot 44$ | 3.03 | $5 \cdot 52$ | $3 \cdot 20$ | $5 \cdot 62$ | $3 \cdot 38$ | $5 \cdot 73$ | $3 \cdot 57$ | $5 \cdot 84$ |
| 24 | 2.81 | 5.41 | 2.97 | $5 \cdot 50$ | $3 \cdot 15$ | $5 \cdot 59$ | $3 \cdot 33$ | $5 \cdot 69$ | 3.51 | $5 \cdot 80$ | 3.71 | 5.93 |
| 25 | $2 \cdot 92$ | $5 \cdot 46$ | $3 \cdot 09$ | $5 \cdot 56$ | 3.27 | $5 \cdot 66$ | $3 \cdot 46$ | $5 \cdot 77$ | $3 \cdot 65$ | $5 \cdot 89$ | $3 \cdot 86$ | $6 \cdot 02$ |
| 26 | 3.03 | 5.52 | $3 \cdot 21$ | $5 \cdot 62$ | 3.40 | 5*73 | $3 \cdot 59$ | $5 \cdot 85$ | 3.80 | $5 \cdot 98$ | 4.03 | $6 \cdot 13$ |
| 27 | $3 \cdot 15$ | $5 \cdot 59$ | $3 \cdot 34$ | $5 \cdot 70$ | $3 \cdot 53$ | $5 \cdot 82$ | $3 \cdot 74$ | $5 \cdot 95$ | $3 \cdot 97$ | $6 \cdot 09$ | $4 \cdot 20$ | $6 \cdot 25$ |
| 28 | $3 \cdot 28$ | $5 \cdot 67$ | 3.48 | $5 \cdot 78$ | $3 \cdot 68$ | $5 \cdot 91$ | 3.90 | $6 \cdot 05$ | $4 \cdot 14$ | $6 \cdot 20$ | 4.40 | $6 \cdot 38$ |
| 29 | 3.41 | $5 \cdot 75$ | $3 \cdot 62$ | $5 \cdot 87$ | $3 \cdot 84$ | $6 \cdot 01$ | 4.08 | $6 \cdot 16$ | 4.33 | $6 \cdot 33$ | 4.6 I | $6 \cdot 52$ |
| 30 | $3 \cdot 56$ | $5 \cdot 83$ | $3 \cdot 78$ | $5 \cdot 97$ | 4.02 | 6.12 | $4 \cdot 27$ | $6 \cdot 29$ | 4.54 | $6 \cdot 48$ | $4 \cdot 84$ | $6 \cdot 69$ |
| 31 | 3.72 | $5 \cdot 93$ | $3 \cdot 95$ | 6.08 | $4 \cdot 20$ | $6 \cdot 25$ | 4.47 | $6 \cdot 43$ | 4.97 | $6 \cdot 64$ | 5.10 | $6 \cdot 88$ |
| 32 | $3 \cdot 89$ | $6 \cdot 04$ | $4 \cdot 13$ | $6 \cdot 20$ | 4.41 | $6 \cdot 39$ | 4*70 | $6 \cdot 59$ | $5 \cdot 02$ | $6 \cdot 83$ | $5 \cdot 39$ | $7 \cdot 10$ |
| 33 | 4.07 | $6 \cdot 16$ | $4 \cdot 33$ | $6 \cdot 34$ | $4 \cdot 63$ | $6 \cdot 54$ | $4 \cdot 96$ | $6 \cdot 78$ | $5 \cdot 31$ | $7 \cdot 04$ | $5 \cdot 71$ | $7 \cdot 35$ |
| 34 | 4.27 | $6 \cdot 29$ | $4 \cdot 56$ | $6 \cdot 50$ | $4 \cdot 88$ | $6 \cdot 72$ | $5 \cdot 24$ | $6 \cdot 99$ | $5 \cdot 64$ | $7 \cdot 29$ | $6 \cdot 10$ | $7 \cdot 65$ |
| 35 | 4.50 | $6 \cdot 44$ | $4 \cdot 8$ I | $6 \cdot 67$ | $5 \cdot 17$ | $6 \cdot 93$ | $5 \cdot 56$ | $7 \cdot 23$ | $6 \cdot 02$ | $7 \cdot 59$ | $6 \cdot 53$ | 8-01 |

## LATITUDE $30^{\circ}$.

DECLINATION-CONTRARY NAME TO-LATITUDE.

| True Alt. | $18^{\circ}$ | Decl. Var. | $19^{\circ}$ | Decl. <br> Var. | $20^{\circ}$ | Decl. Var. | $21^{\circ}$ | Decl. Var. | $22^{\circ}$ | Decl. Var. | $23^{\circ}$ | Decl. Var. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | H. M. S. | S. | H. M. | S. | H. M. S. | S. | H. M. S. | S. | H. M. S. | S. | M. S. | S. |
| 0 | 5 16 45*0 | $-2 \cdot 60$ | 5 I4 8 | $-2 \cdot 64$ | 5 II $28 \cdot 7$ | $-2.68$ | $5 \begin{array}{rrrr}5 & 8 & 46 \cdot 9\end{array}$ | $-2.72$ | $\begin{array}{llll}5 & 6 & 25\end{array}$ | $2 \cdot$ | $\begin{array}{lrrr}5 & 3 & 15.9\end{array}$ | $-2.81$ |
| 2 | $5 \quad 6 \quad 49 \cdot 2$ | $2 \cdot 68$ | $\begin{array}{llll}5 & 4 & 7 \cdot 2\end{array}$ | 2.72 | 5 I 22.5 | $2 \cdot 77$ | $45834{ }^{\circ} 9$ | $2 \cdot 82$ | 45544.4 | $2 \cdot 87$ | $45250 \cdot 6$ | 2.92 |
| 4 | $45647 \cdot 9$ | 2.77 | $454 \quad 0.4$ | 2.82 | 4 5I 909 | $2 \cdot 87$ | 448 16.1 | $2 \cdot 92$ | $4 \begin{array}{lllllll}45 & 18 \cdot 9\end{array}$ | $2 \cdot 98$ | 44217.9 | $3 \cdot 05$ |
| 5 | $45145^{\circ} \mathrm{O}$ | 8 I | 44 48 54 | 2.87 | 446 I 0 | $2 \cdot 92$ | 44303.9 | $2 \cdot 98$ | $4403 \cdot 1$ | $3 \cdot 05$ | $\begin{array}{llllllllllllllll}4 & 368.4\end{array}$ | $3 \cdot 12$ |
| 6 | $44640 \cdot 6$ | $2 \cdot 86$ | $44347 \cdot 2$ | 2.92 | $440 \quad 50 \cdot 3$ | $2 \cdot 98$ | $437 \quad 49 \cdot 7$ | $3 \cdot 04$ | $434 \quad 45^{\circ} 2$ | $3 \cdot 11$ | $43136 \cdot 5$ | $3 \cdot 18$ |
| 7 | 44134.5 | 2.91 | $4 \begin{array}{lll}4 & 38 & 37 \cdot 8\end{array}$ | 2 | $43537 \cdot 6$ | $\bullet$ - | $4 \begin{array}{llll}42 & 33 \cdot 3\end{array}$ | $3 \cdot 11$ | 42924.9 | 3.18 | 42612.0 | 3.26 |
| 8 | $43626 \cdot 5$ | $2 \cdot 97$ | $433 \begin{array}{lll}4 & 26 \cdot 6\end{array}$ | $3 \cdot 03$ | $43022 \cdot 7$ | $3 \cdot 10$ | 42714.7 | 3.17 | $424 \quad 2 \cdot 2$ | $3 \cdot 25$ | $42044 * 9$ | $3 \cdot 33$ |
| 9 | 4311516 | 3.02 | $\begin{array}{lll}4 & 28 & 13.3 \\ 4 & 22 & 57.8\end{array}$ | 3.09 | $\begin{array}{llll}4 & 25 & 5 \cdot 7 \\ 4 & 5 \cdot 7\end{array}$ | $3 \cdot 16$ | $\begin{array}{llll}4 & 21 & 53 \cdot 7 \\ 4 & 16 & 30 \cdot 1\end{array}$ | $3 \cdot 24$ | $4 \begin{array}{lll}48 & 36 \cdot 9 \\ 4\end{array}$ | $3 \cdot 32$ | 4 15 $15 \cdot 1$ <br> 4   | 3.41 |
| 10 | 426409 | $3 \cdot 08$ | $422 \begin{array}{llll}4 & 57\end{array}$ | $3 \cdot 15$ | 4 I9 $46 \cdot 3$ | $3 \cdot 23$ | $41630 \cdot 1$ | $3 \cdot 31$ | $4 \begin{array}{llll}4 & 8 \cdot 9\end{array}$ | 3.40 | $4 \quad 942 \cdot 1$ | $3 \cdot 49$ |
| II | $42050 \cdot 9$ | $3 \cdot 14$ | $41740 \%$ | $3 \cdot 22$ | 41424.5 | $3 \cdot 30$ | 4 II $3 \cdot 9$ | $3 \cdot 39$ | $4 \quad 7 \quad 37 \cdot 8$ | $3 \cdot 48$ | $446 \cdot 0$ | $3 \cdot 58$ |
| 12 | 41534.7 | 3.21 | $\begin{array}{llll}4 & 12 & 19.8\end{array}$ | 3.29 | $4 \begin{array}{lll}4 & 8 & 59.9\end{array}$ | $3 \cdot 38$ | $4 \quad 5 \quad 34 \cdot 6$ | 3.47 | $\begin{array}{llll}4 & 2 & 3.6\end{array}$ | 3.57 | $\begin{array}{llll}3 & 58 & 26 \cdot 4\end{array}$ | 3.67 |
| 13 | 4 10 16.1 | $3 \cdot 28$ | $4 \quad 6 \quad 56 \cdot 9$ | $3 \cdot 36$ | $4 \begin{array}{lll}4 & 3 & 32 \cdot 5\end{array}$ | $3 \cdot 45$ | $4 \quad 0 \quad 2 \cdot 3$ | $3 \cdot 55$ | $35626 \cdot 0$ | $3 \cdot 66$ | $35243 \cdot 2$ | $3 \cdot 77$ |
| 14 | 4454.9 | $3 \cdot 35$ | 4 I 3I'3 | 3.44 | $\begin{array}{llll}3 & 58 & 2 \cdot 0\end{array}$ | $3 \cdot 54$ | $35426 \cdot 6$ | $3 \cdot 64$ | $35044 \cdot 8$ | $3 \cdot 76$ | $34655 * 9$ | $3 \cdot 88$ |
| 15 | 35930.9 | $3 \cdot 42$ | $\begin{array}{lll}3 & 56 & 2 \cdot 6\end{array}$ | $3 \cdot 52$ | $3 \quad 52 \quad 28 \cdot 2$ | 3.63 | $34^{38} 4774$ | $3 \cdot 74$ | $34459 \cdot 6$ | 3.86 | 34143 | 3.99 |
| 16 | $3544^{\circ} \mathrm{O}$ | 3.51 | $35030 \cdot 6$ | $3 \cdot 6 \mathrm{I}$ | $3 \quad 4650 \cdot 9$ | 3.72 | $\begin{array}{llll}3 & 43 & 4\end{array}$ | $3 \cdot 84$ | $\begin{array}{llll}3 & 39 & 10.2\end{array}$ | $3 \cdot 97$ | $\begin{array}{lll}3 & 35 & 8 \cdot 1\end{array}$ | $4 \cdot 11$ |
| 17 | 3 48 33  | 3.59 | $34455 \cdot 3$ | $3 \cdot 70$ | $3 \mathrm{4I} 9{ }^{3} 9$ | 3.82 | $\begin{array}{llll}3 & 37 & 17.0\end{array}$ | 3.95 | $\begin{array}{llll}3 & 33 & 16 \cdot 2\end{array}$ | $4 \cdot 08$ | $\begin{array}{llr}3 & 29 & 6 \cdot 8\end{array}$ | . 23 |
| 18 | $\begin{array}{llll}3 & 43 & 0.5\end{array}$ | $3 \cdot 68$ | $3 \quad 3916 \cdot 2$ | 3.80 | $\begin{array}{llll}3 & 35 & 24 *\end{array}$ | 3.92 | 3 31 25.2 | 4.06 | $32717 \cdot 2$ | $4 \cdot 21$ | $\begin{array}{llll}3 & 22 & 59.9\end{array}$ | 4.37 |
| 19 | 33723.3 | 3.78 | 333 33. | 3.90 | 3 29 $35 \cdot \mathrm{I}$ | 4.04 | $\begin{array}{llll}3 & 25 & 28 \cdot 5\end{array}$ | $4 \cdot 19$ | $32112 \cdot 8$ | $4 \cdot 34$ | $31647^{\circ} \mathrm{I}$ | 4.52 |
| 2 | 3 31 42.2 | 3.88 | $\begin{array}{llll}3 & 27 & 45 \cdot 6\end{array}$ | $4 \cdot \mathrm{OI}$ | $\begin{array}{lllll}3 & 23 & 40 \cdot 6\end{array}$ | $4 \cdot 16$ | $\begin{array}{llll}3 & 19 & 26 \cdot 5\end{array}$ | $4 \cdot 32$ | $\begin{array}{lll}3 & 15 & 2 \cdot 5\end{array}$ | 4.49 | 3 10 $27 \cdot 6$ | $4 \cdot 68$ |
| 21 | $32556 \cdot 8$ | 3.99 | $32 \mathrm{I} 53 \cdot 4$ | $4^{-13}$ | 3 I7 40.9 | $4 \cdot 29$ |  | 4.46 | $\begin{array}{llll}3 & 8 & 45 \cdot 6\end{array}$ | $4 \cdot 65$ | $\begin{array}{lll}3 & 4 & 0.9\end{array}$ | $4 \cdot 85$ |
| 22 | 3206 | 4'10 | $31556 \cdot 0$ | $4 \cdot 26$ | 3 II 35.4 | 4.43 | $\begin{array}{llll}3 & 7 & 4.3\end{array}$ | 4.62 | $3 \quad 2 \quad 21.5$ | 4.82 | 2574509 | $5 \cdot 05$ |
| 23 | $\begin{array}{llll}3 & 14 & 11.6\end{array}$ | $4 \cdot 23$ | $\begin{array}{llll}3 & 9 & 52 \cdot 9\end{array}$ | $4 \cdot 40$ | $\begin{array}{lllll}3 & 5 & 23 \cdot 6\end{array}$ | $4 \cdot 58$ | $3 \quad 0 \quad 42 \cdot 8$ | 4.78 | 25549.4 | $5 \cdot \mathrm{Or}$ | $25041 \cdot 9$ | $5 \cdot 25$ |
| 24 | $\begin{array}{llll}3 & 8 & 10.9\end{array}$ | 4.37 | $\begin{array}{llll}3 & 3 & 43 \cdot 6\end{array}$ | $4 \cdot 55$ | $\begin{array}{llll}2 & 59 & 4 \cdot 8\end{array}$ | $4 \cdot 75$ | $2 \begin{array}{llll}24 & 13.5\end{array}$ | 4*97 | 24988.4 | 5.21 | $24347 \cdot 8$ | $5 \cdot 49$ |
| 25 | $\begin{array}{rrr}3 & 2 & 3 \cdot 9 \\ 2 & 55 & 50 \cdot 3\end{array}$ | $4 \cdot 52$ | $\begin{array}{lllll}2 & 57 & 27 \cdot 3\end{array}$ | 4.71 | $\begin{array}{llll}2 & 52 & 38 \cdot 3 \\ 2 & 46 & 3 \cdot 0\end{array}$ | 4.93 | $\begin{array}{llll}2 & 47 & 35 \cdot 4 \\ 2 & 40 & 47.4\end{array}$ | $5 \cdot 17$ | $\begin{array}{llll}2 & 42 & 17 & 3\end{array}$ | $5 \cdot 44$ | $\begin{array}{llll}2 & 36 & 42 \cdot 2\end{array}$ | $5 \cdot 74$ |
| 26 | $25550 \cdot 3$ | $4 \cdot 68$ | 25 I | $4 \cdot 89$ | $246 \quad 3 \cdot 0$ | 5•13 | $24047 \times 4$ | $5 \cdot 40$ | $2 \begin{array}{llll}25 & 14.9\end{array}$ | $5 \cdot 70$ | 22923.4 | $6 \cdot 04$ |
| 27 | 249 29*1 | 4.86 | $24431 \cdot 0$ | 5.09 | 23918.0 | $5 \cdot 36$ | 233 48.2 | $5 \cdot 65$ | 22759.5 | 5.99 | 2 2I 49*3 | 38 |
| 28 | 24259.5 | $5 \cdot 05$ | $23749{ }^{\circ}$ | $5 \cdot 31$ | $2 \begin{array}{llll}2 & 32 & 21.9\end{array}$ | $5 \cdot 6 \mathrm{I}$ | $22636 \cdot 1$ | $5 \cdot 94$ | 22029.1 | $6 \cdot 32$ | $21357 \cdot 5$ | $6 \cdot 77$ |
| 29 | $23620 \cdot 4$ | $5 \cdot 27$ | $23056 \cdot 1$ | $5 \cdot 56$ | $\begin{array}{lllll}2 & 25 & 13 \cdot 2\end{array}$ | $5 \cdot 89$ | 2 I9 $9 \cdot 3$ | $6 \cdot 27$ | $21241 \cdot 1$ | 6.71 | $2 \quad 544.5$ | $7 \cdot 23$ |
| 30 | $22930 \cdot 6$ | $5 \cdot 51$ | $22350 \cdot 7$ | $5 \cdot 84$ | 2 I 7149.9 | $6 \cdot 21$ | 2 II $25^{\circ} \mathrm{I}$ | $6 \cdot 65$ | $\begin{array}{llll}2 & 4 & 32 \cdot 2\end{array}$ | $7 \cdot 16$ | $\begin{array}{lll}\text { I } & 57 & 6 \cdot 0\end{array}$ | $7 \cdot 78$ |
| 31 | $22228 \cdot 5$ | $5 \cdot 79$ | 2 I6 $30 \cdot 8$ | $6 \cdot 16$ | 2109.5 | $6 \cdot 59$ | $2 \begin{array}{lll}2 & 3 & 20 \cdot 3\end{array}$ | $7 \cdot 09$ | I $5558 \cdot 1$ | $7 \cdot 70$ | I $4755 \cdot 8$ | $8 \cdot 46$ |

VARIATION TO $I^{\prime}$ OF LATITUDE AND ALTITUDE.

| Alt. | L. $18^{\circ} \mathrm{A}$. |  | L. $19^{\circ} \mathrm{A}$ |  | L. $20^{\circ}$ | $0^{\circ} \mathrm{A}$. | L. $21{ }^{\circ}$ | ${ }^{\circ} \mathrm{A}$. | L. $22^{\circ}$ | A. | L. $23^{\circ}$ | A. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | S. | s. |
| 0 | - 1.77 | $-4.94$ | - 1.87 | $-4.98$ | - I.98 | $-5 \cdot 02$ | $-2 \cdot 10$ | $-5 \cdot 07$ | $-2.22$ | $-5 \cdot 12$ | $-2.33-$ | $-5 \cdot 17$ |
| 2 | 1-88 | -4*99 | I•99 | $5 \cdot 03$ | $2 \cdot 11$ | $5 \cdot 08$ | $2 \cdot 23$ | $5 \cdot 13$ | $2 \cdot 35$ | $5 \cdot 18$ | 2.47 | $5 \cdot 24$ |
| 4 | $2 \cdot 00$ | 5•04 | $2 \cdot 12$ | $5 \cdot 08$ | $2 \cdot 24$ | $5 \cdot 13$ | $2 \cdot 36$ | 5.19 | 2.49 | $5 \cdot 25$ | $2 \cdot 61$ | $5 \cdot 30$ |
| 5 | $2 \cdot 07$ | $5 \cdot 06$ | 2.19 | $5 \cdot 11$ | $2 \cdot 31$ | $5 \cdot 16$ | $2 \cdot 43$ | $5 \cdot 22$ | $2 \cdot 56$ | $5 \cdot 28$ | 2.69 | $5 \cdot 34$ |
| 6 | $2 \cdot 13$ | $5 \cdot 09$ | $2 \cdot 26$ | $5 \cdot 14$ | $2 \cdot 38$ | 5.19 | 2.50 | 5:25 | 2.63 | $5 \cdot 32$ | $2 \cdot 77$ | $5 \cdot 39$ |
| 7 | 2.20 | 5.12 | $2 \cdot 33$ | $5 \cdot 17$ | $2 \cdot 45$ | $5 \cdot 23$ | 2.58 | 5:29 | 2.71 | $5 \cdot 36$ | $2 \cdot 85$ | 5*43 |
| 8 | $2 \cdot 27$ | $5 \cdot 15$ | $2 \cdot 40$ | $5 \cdot 20$ | $2 \cdot 53$ | $5 \cdot 27$ | 2.66 | $5 \cdot 33$ | 2.80 | $5 \cdot 40$ | 2.94 | $5 \cdot 47$ |
| 9 | 2.35 | $5 \cdot 18$ | 2.47 | $5 \cdot 24$ | $2 \cdot 61$ | $5 \cdot 30$ | 2.74 | $5 \cdot 37$ | 2.88 | $5 \cdot 44$ | 3.03 | $5 \cdot 52$ |
| 10 | 2.42 | $5 \cdot 21$ | 2.55 | $5 \cdot 28$ | $2 \cdot 69$ | $5 \cdot 34$ | 2.83 | $5 \cdot 41$ | 2.97 | $5 \cdot 49$ | $3 \cdot 12$ | $5 \cdot 58$ |
| II | 2.50 | $5 \cdot 25$ | 2.63 | $5 \cdot 32$ | $2 \cdot 77$ | $5 \cdot 39$ | 2.92 | $5 \cdot 46$ | $3 \cdot 07$ | $5 \cdot 54$ | $3 \cdot 22$ | $5 \cdot 63$ |
| 12 | $2 \cdot 58$ | 5.29 | $2 \cdot 72$ | $5 \cdot 36$ | 2.86 | 5.43 | $3 \cdot 01$ | $5 \cdot 51$ | $3 \cdot 16$ | $5 \cdot 60$ | 3.32 | $5 \cdot 69$ |
| 13 | 2.66 | $5 \cdot 33$ | 2.80 | $5 \cdot 40$ | $2 \cdot 95$ | $5 \cdot 48$ | $3 \cdot 11$ | $5 \cdot 57$ | $3 \cdot 27$ | $5 \cdot 66$ | $3 \cdot 43$ | $5 \cdot 75$ |
| 14 | $2 \cdot 75$ | $5 \cdot 38$ | $2 \cdot 90$ | $5 \cdot 45$ | $3 \cdot 05$ | $5 \cdot 53$ | 3.21 | $5 \cdot 62$ | $3 \cdot 37$ | $5 \cdot 72$ | $3 \cdot 55$ | $5 \cdot 82$ |
| 15 | $2 \cdot 84$ | $5 \cdot 42$ | $2 \cdot 99$ | $5 \cdot 50$ | $3 \cdot 15$ | $5 \cdot 59$ | $3 \cdot 32$ | $5 \cdot 69$ | 3.49 | 5•79 | 3.67 | $5 \cdot 90$ |
| 16 | $2 \cdot 94$ | $5 \cdot 47$ | $3 \cdot 10$ | $5 \cdot 56$ | 3.26 | $5 \cdot 65$ | 3.43 | $5 \cdot 75$ | $3 \cdot 61$ | $5 \cdot 86$ | $3 \cdot 80$ | $5 \cdot 98$ |
| 17 | $3 \cdot 04$ | $5 \cdot 53$ | $3 \cdot 20$ | 5.62 | $3 \cdot 37$ | $5 \cdot 72$ | $3 \cdot 55$ | $5 \cdot 83$ | 3.74 | $5 \cdot 94$ | 3.93 | 6.07 |
| 18 | $3 \cdot 14$ | $5 \cdot 59$ | $3 \cdot 31$ | $5 \cdot 68$ | 3.49 | $5 \cdot 79$ | $3 \cdot 68$ | $5 \cdot 90$ | $3 \cdot 87$ | 6.03 | 4.08 | $6 \cdot 16$ |
| 19 | $3 \cdot 25$ | $5 \cdot 65$ | 3.43 | $5 \cdot 75$ | $3 \cdot 62$ | $5 \cdot 87$ | $3 \cdot 81$ | $5 \cdot 99$ | 4.02 | $6 \cdot 12$ | $4 \cdot 24$ | $6 \cdot 27$ |
| 20 | $3 \cdot 37$ | $5 \cdot 72$ | $3 \cdot 56$ | $5 \cdot 83$ | $3 \cdot 75$ | $5 \cdot 95$ | 3.96 | $6 \cdot 08$ | $4 \cdot 17$ | $6 \cdot 23$ | 4.41 | $6 \cdot 38$ |
| 21 | 3.50 | $5 \cdot 79$ | $3 \cdot 69$ | $5 \cdot 91$ | $3 \cdot 90$ | $6 \cdot 04$ | $4^{\cdot 11}$ | $6 \cdot 18$ | $4 \cdot 34$ | $6 \cdot 34$ | 4.59 | $6 \cdot 51$ |
| 22 | 3.63 | $5 \cdot 88$ | $3 \cdot 83$ | $6 \cdot 00$ | 4.05 | $6 \cdot 14$ | $4 \cdot 28$ | $6 \cdot 30$ | 4.52 | $6 \cdot 47$ | 4.79 | 6.66 |
| 23 | $3 \cdot 77$ | $5 \cdot 96$ | 3.99 | $6 \cdot 10$ | $4 \cdot 22$ | $6 \cdot 25$ | 4.46 | $6 \cdot 42$ | 4.73 | $6 \cdot 61$ | $5 \cdot \mathrm{I}$ | $6 \cdot 82$ |
| 24 | 3.93 | $6 \cdot 06$ | $4 \cdot 15$ | $6 \cdot 21$ | $4 \cdot 40$ | $6 \cdot 38$ | 4.66 | $6 \cdot 56$ | $4 \cdot 94$ | $6 \cdot 77$ | $5 \cdot 25$ | $7 \cdot 00$ |
| 25 | 4.09 | $6 \cdot 17$ | $4 \cdot 33$ | $6 \cdot 33$ | $4 \cdot 59$ | $6 \cdot 51$ | $4 \cdot 87$ | $6 \cdot 72$ | $5 \cdot 18$ | $6 \cdot 95$ | $5 \cdot 52$ | $7 \cdot 20$ |
| 26 | $4 \cdot 27$ | $6 \cdot 29$ | 4.53 | $6 \cdot 47$ | $4 \cdot 81$ | $6 \cdot 67$ | 5-11 | $6 \cdot 89$ | $5 \cdot 45$ | $7 \cdot 15$ | $5 \cdot 83$ | $7 \cdot 44$ |
| 27 | $4 \cdot 46$ | $6 \cdot 42$ | $4 * 74$ | $6 \cdot 62$ | $5 \cdot 04$ | $6 \cdot 84$ | $5 \cdot 38$ | 7.09 | 5*75 | $7 \cdot 39$ | $6 \cdot 18$ | $7 \cdot 72$ |
| 28 | $4 \cdot 67$ | $6 \cdot 57$ | 4*98 | $6 \cdot 79$ | $5 \cdot 31$ | $7 \cdot 04$ | 5.68 | $7 \cdot 32$ | $6 \cdot 10$ | $7 \cdot 65$ | $6 \cdot 58$ | $8 \cdot 04$ |
| 29 | $4 \cdot 91$ | $6 \cdot 74$ | $5 \cdot 24$ | $6 \cdot 99$ | $5 \cdot 61$ | $7 \cdot 27$ | 6.02 | $7 \cdot 59$ | 6.49 | $7 \cdot 97$ | $7 \cdot 05$ | $8 \cdot 43$ |
| 30 | $5 \cdot 17$ | $6 \cdot 93$ | $5 \cdot 53$ | $7 \cdot 21$ | $5 \cdot 94$ | $7 \cdot 53$ | $6 \cdot 42$ | $7 \cdot 91$ | $6 \cdot 96$ | $8 \cdot 36$ | $7 \cdot 62$ | $8 \cdot 91$ |
| 31 | $5 \cdot 46$ | $7 \cdot 15$ | $5 \cdot 87$ | $7 \cdot 48$ | $6 \cdot 34$ | $7 \cdot 84$ | 6.88 | $8 \cdot 28$ | $7 \cdot 52$ | $8 \cdot 82$ | $8 \cdot 32$ | $9 \cdot 49$ |

SEXAGESIMAL PROPORTIONAL TABLE.

| ' | $\begin{gathered} \text { s. } \\ 0 \cdot 10 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ 0 \cdot 20 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 0 \cdot 30 \end{gathered}$ | $\begin{gathered} \mathrm{S} \\ 0.40 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 0.50 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 0.60 \end{gathered}$ | $\mathrm{s.}$ | $\begin{gathered} \mathrm{s} . \\ 0.80 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 0 \cdot 90 \end{gathered}$ | $\underset{\text { I•OO }}{\text { S. }}$ | $\begin{gathered} \text { S. } \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ \mathrm{I} \cdot 20 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ \mathrm{I} \cdot 30 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ \mathrm{I} \cdot \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ \mathrm{I} 50 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | 0.2 | 0.4 | 0.6 | 0.8 | I'O | 1-2 | I*4 | 1.6 | 1.8 | $2 \cdot 0$ | $2 \cdot 2$ | 2.4 | $2 \cdot 6$ | $2 \cdot 8$ | $3 \cdot 0$ |
| 3 | $0 \cdot 3$ | 0.6 | 0.9 | 1.2 | I'5 | I.8 | $2 \cdot 1$ | 2.4 | $2 \cdot 7$ | $3 \cdot 0$ | $3 \cdot 3$ | $3 \cdot 6$ | $3 \cdot 9$ | $4 \cdot 2$ | $4 \cdot 5$ |
| 4 | 0.4 | $0 \cdot 8$ | $\cdot 2$ | I. 6 | - | 2.4 | $2 \cdot 8$ | $3 \cdot 2$ | $3 \cdot 6$ | 4.0 | 4.4 | $4 \cdot 8$ | $5 \cdot 2$ | $5 \cdot 6$ | $6 \cdot 0$ |
| 5 | 0.5 | $1 \cdot 0$ | 1.5 | $2 \cdot 0$ | 2.5 | $3 \cdot 0$ | $3 \cdot 5$ | $4 \cdot 0$ | $4 \cdot 5$ | $5 \cdot 0$ | $5 \cdot 5$ | $6 \cdot 0$ | $6 \cdot 5$ | $7 \cdot 0$ | $7 \cdot 5$ |
| 6 | $0 \cdot 6$ | $1 \cdot 2$ | 1.8 | 2.4 | $3 \cdot 0$ | $3 \cdot 6$ | $4{ }^{2}$ | $4 \cdot 8$ | $5 \cdot 4$ | $6 \cdot 0$ | $6 \cdot 6$ | $7 \cdot 2$ | $7 \cdot 8$ | $8 \cdot 4$ | 9*0 |
| 7 | 0.7 | $1 \cdot 4$ | $2 \cdot 1$ | $2 \cdot 8$ | $3 \cdot 5$ | $4 \cdot 2$ | $4 \cdot 9$ | $5 \cdot 6$ | $6 \cdot 3$ | $7 \cdot 0$ | $7 \cdot 7$ | $8 \cdot 4$ | 9•1 | $9 \cdot 8$ | 10.5 |
| 8 | 0.8 | 1. 6 | 2.4 | $3 \cdot 2$ | $4 \cdot 0$ | $4 \cdot 8$ | $5 \cdot 6$ | $6 \cdot 4$ | $7 \cdot 2$ | $8 \cdot 0$ | $8 \cdot 8$ | $9 \cdot 6$ | 10.4 | II. 2 | 12.0 |
| 9 | $0 \cdot 9$ | I. 8 | $2 \cdot 7$ | $3 \cdot 6$ | $4 \cdot 5$ | $5 \cdot 4$ | $6 \cdot 3$ | $7 \cdot 2$ | 8-1 | $9 \cdot 0$ | $9 \cdot 9$ | 10.8 | 11.7 | 12.6 | 13.5 |
| 10 | 1.0 | $2 \cdot 0$ | $3 \cdot 0$ | $4^{\circ} 0$ | $5 \cdot 0$ | $6 \cdot 0$ | $7 \cdot 0$ | $8 \cdot 0$ | $9 \cdot 0$ | $10 \%$ | II'0 | 12.0 | 13.0 | 14.0 | 15.0 |
| II | I•I | $2 \cdot 2$ | $3 \cdot 3$ | $4 * 4$ | $5 \cdot 5$ | $6 \cdot 6$ | $7 \cdot 7$ | $8 \cdot 8$ | $9 \cdot 9$ | II*O | 12.1 | 13.2 | 14.3 | 15.4 | 16.5 |
| 12 | I•2 | $2 \cdot 4$ | $3 \cdot 6$ | $4 \cdot 8$ | $6 \cdot 0$ | $7 \cdot 2$ | $8 \cdot 4$ | $9 \cdot 6$ | 10.8 | 12.0 | 13.2 | 14.4 | 15.6 | 16.8 | $18 \cdot 0$ |
| 13 | 1-3 | $2 \cdot 6$ | $3 \cdot 9$ | $5 \cdot 2$ | $6 \cdot 5$ | $7 \cdot 8$ | $9 \cdot 1$ | 10.4 | 11.7 | 13.0 | 14.3 | 15.6 | $16 \cdot 9$ | 18.2 | 19.5 |
| 14 | $1 \cdot 4$ | $2 \cdot 8$ | $4 \cdot 2$ | $5 \cdot 6$ | $7 \cdot 0$ | $8 \cdot 4$ | $9 \cdot 8$ | $11 \cdot 2$ | 12.6 | $14^{\circ} 0$ | 15.4 | 16.8 | 18.2 | 19.6 | $2 \mathrm{I} \cdot 0$ |
| 15 | I•5 | $3 \cdot 0$ | $4 \cdot 5$ | $6 \cdot 0$ | $7 \cdot 5$ | $9 \cdot 0$ | 10.5 | 12.0 | 13.5 | 15.0 | 16.5 | 18.0 | 19.5 | 2I.0 | 22.5 |
| 16 | 1.6 | $3 \cdot 2$ | $4 \cdot 8$ | $6 \cdot 4$ | $8 \cdot 0$ | $9 \cdot 6$ | II.2 | 12.8 | 14.4 | 16.0 | $17 \cdot 6$ | 19.2 | $20 \cdot 8$ | 22.4 | $24^{\circ} 0$ |
| 17 | 1.7 | 3.4 | $5 \cdot 1$ | $6 \cdot 8$ | $8 \cdot 5$ | 10.2 | II•9 | 13.6 | 15.3 | 17.0 | 18.7 | 20.4 | $22 \cdot 1$ | $23 \cdot 8$ | $25 \cdot 5$ |
| 18 | I.8 | $3 \cdot 6$ | $5 \cdot 4$ | $7 \cdot 2$ | 9.0 | 10.8 | 12.6 | 14.4 | $16 \cdot 2$ | $18 \cdot 0$ | 19.8 | 21.6 | 23.4 | $25 \cdot 2$ | $27 \cdot 0$ |
| 19 | 1.9 | $3 \cdot 8$ | $5 \cdot 7$ | $7 \cdot 6$ | $9 \cdot 5$ | 11.4 | 13.3 | 15.2 | $17 \cdot 1$ | 19.0 | 20.9 | 22.8 | 24.7 | $26 \cdot 6$ | $28 \cdot 5$ |
| 20 | $2 \cdot 0$ | $4^{\circ} 0$ | $6 \cdot 0$ | $8 \cdot 0$ | 10.0 | $12 \cdot 0$ | I4.0 | 16.0 | 18.0 | $20 \cdot 0$ | 22.0 | $24^{\circ} 0$ | $26 \cdot 0$ | $28 \cdot 0$ | $30 \cdot 0$ |
| 21 | 2.1 | $4 \cdot 2$ | $6 \cdot 3$ | $8 \cdot 4$ | $10 \cdot 5$ | 12.6 | 14*7 | 16.8 | 18.9 | 21.0 | 23.1 | $25^{\circ} 2$ | $27 \cdot 3$ | 29.4 | 3I•5 |
| 22 | $2 \cdot 2$ | $4 \cdot 4$ | $6 \cdot 6$ | $8 \cdot 8$ | 11.0 | 13.2 | 15.4 | 17.6 | 19.8 | 22.0 | $24^{\circ} 2$ | $26 \cdot 4$ | $28 \cdot 6$ | $30 \cdot 8$ | $33 \cdot 0$ |
| 23 | $2 \cdot 3$ | $4 \cdot 6$ | $6 \cdot 9$ | $9 \cdot 2$ | II.5 | 13.8 | $16 \cdot 1$ | 18.4 | $20 \cdot 7$ | $23^{\circ} 0$ | $25 \cdot 3$ | $27 \cdot 6$ | $29^{\circ} 9$ | $32 \cdot 2$ | $34 \cdot 5$ |
| 24 | $2 \cdot 4$ | $4 \cdot 8$ | $7 \cdot 2$ | $9 \cdot 6$ | 12.0 | 14.4 | 16.8 | 19.2 | 21.6 | $24^{\circ} \mathrm{O}$ | $26 \cdot 4$ | $28 \cdot 8$ | 3I•2 | $33 \cdot 6$ | $36 \cdot 0$ |
| 25 | $2 \cdot 5$ | $5 \cdot 0$ | $7 \cdot 5$ | 10.0 | 12.5 | 15.0 | 17.5 | 20\% | 22.5 | $25^{\circ} \mathrm{O}$ | $27 \cdot 5$ | $30 \cdot 0$ | $32 \cdot 5$ | $35 \cdot 0$ | 37.5 |
| 26 | 2.6 | $5 \cdot 2$ | 7.8 | 10.4 | 13.0 | 15.6 | 18.2 | $20 \cdot 8$ | 23.4 | $26 \cdot 0$ | $28 \cdot 6$ | 31•2 | 33.8 | $36 \cdot 4$ | $39^{\circ} 0$ |
| 27 | $2 \cdot 7$ | $5 \cdot 4$ | $8 \cdot 1$ | 10.8 | 13.5. | 16.2 | $18 \cdot 9$ | $21 \cdot 6$ | $24^{\circ} 3$ | $27 \cdot 0$ | 29.7 | 32.4 | $35^{\prime}$ I | $37 \cdot 8$ | $40 \cdot 5$ |
| 28 | $2 \cdot 8$ | $5 \cdot 6$ | $8 \cdot 4$ | II 2 | $14^{\circ} \mathrm{O}$ | 16.8 | $19 \cdot 6$ | 22.4 | $25^{\circ}$ | $28 \cdot 0$ | $30 \cdot 8$ | 33.6 | 36.4 | $39 \cdot 2$ | 42.0 |
| 29 | 2.9 | $5 \cdot 8$ | $8 \cdot 7$ | II. 6 | 14.5 | 17.4 | $20 \cdot 3$ | $23 \cdot 2$ | $26 \cdot 1$ | $29^{\circ} 0$ | 31.9 | $34 \cdot 8$ | $37 \cdot 7$ | $40 \cdot 6$ | $43 \cdot 5$ |
| 30 | $3 \cdot 0$ | $6 \cdot 0$ | $9 \cdot 0$ | 12.0 | 15.0 | 18.0 | 21.0 | $24^{\circ} 0$ | 27.0 | $30 \cdot 0$ | $33 \cdot 0$ | $36 \cdot 0$ | $39^{\circ}$ | $42 \cdot 0$ | $45^{\circ} \mathrm{O}$ |
| 31 | 3.1 | $6 \cdot 2$ | $9 \cdot 3$ | 12.4 | 15.5 | 18.6 | 2I•7 | 24.8 | 27.9 | 31.0 | $34^{1} 1$ | 37.2 | $40 \cdot 3$ | $43 \cdot 4$ | $46 \cdot 5$ |
| 32 | $3 \cdot 2$ | $6 \cdot 4$ | $9 \cdot 6$ | 12.8 | $16 \cdot 0$ | 19.2 | 22.4 | $25 \cdot 6$ | $28 \cdot 8$ | 32.0 | $35 \cdot 2$ | $38 \cdot 4$ | 4I•6 | $44 \cdot 8$ | $48 \cdot 0$ |
| 33 | $3 \cdot 3$ | $6 \cdot 6$ | $9 \cdot 9$ | 13.2 | $16 \cdot 5$ | 19.8 | $23 \cdot 1$ | 26.4 | 29.7 | $33^{\circ} 0$ | $36 \cdot 3$ | 39.6 | $42 \cdot 9$ | $46 \cdot 2$ | $49 \cdot 5$ |
| 34 | 3.4 | $6 \cdot 8$ | 10.2 | 13.6 | $17 \cdot 0$ | 20.4 | 23.8 | 27.2 | $30 \cdot 6$ | $34^{\circ} \mathrm{O}$ | 37.4 | $40 \cdot 8$ | $44 \cdot 2$ | $47 \cdot 6$ | $5 \mathrm{I} \cdot 0$ |
| 35 | $3 \cdot 5$ | $7 \cdot 0$ | 10.5 | 14.0 | 17.5 | 21.0 | 24.5 | $28 \cdot 0$ | 31.5 | $35 \cdot 0$ | $38 \cdot 5$ | $42 \cdot 0$ | $45 \cdot 5$ | $49^{\circ}$ | 52.5 |
| 36 | $3 \cdot 6$ | $7 \cdot 2$ | 10.8 | 14.4 | $18 \cdot 0$ | 21.6 | 25.2 | 28.8 | 32.4 | $36 \cdot 0$ | $39^{\circ} 6$ | $43 \cdot 2$ | $46 \cdot 8$ | $50 \cdot 4$ | 54.0 |
| 37 | $3 \cdot 7$ | $7 \cdot 4$ | III 1 | 14.8 | 18.5 | 22.2 | $25 \cdot 9$ | $29 \cdot 6$ | $33 \cdot 3$ | 37.0 | $40 \cdot 7$ | 44.4 | $48 \cdot 1$ | $5 \mathrm{I} \cdot 8$ | $55 \cdot 5$ |
| 38 | $3 \cdot 8$ | $7 \cdot 6$ | II-4 | 15.2 | 19.0 | $22 \cdot 8$ | $26 \cdot 6$ | $30 \cdot 4$ | 34.2 | $38 \cdot 0$ | $4 \mathrm{I} \cdot 8$ | $45 \cdot 6$ | 49.4 | $53 \cdot 2$ | $57 \cdot 0$ |
| 39 | $3 \cdot 9$ | $7 \cdot 8$ | II'7 | 15.6 | 19.5 | 23.4 | $27 \cdot 3$ | $3 \pm \cdot 2$ | $35 \cdot 1$ | $39^{\circ}$ | $42 \cdot 9$ | $46 \cdot 8$ | $50 \cdot 7$ | $54 \cdot 6$ | $58 \cdot 5$ |
| 40 | $4^{\circ} 0$ | $8 \cdot 0$ | 12.0 | 16.0 | $20 \cdot 0$ | $24^{\circ} 0$ | $28 \cdot 0$ | $32 \cdot 0$ | $36 \cdot 0$ | $40^{\circ} 0$ | $44^{\circ}$ | $48 \cdot 0$ | $52 \cdot 0$ | $56 \cdot 0$ | 60.0 |
| 4 I | $4^{* 1}$ | $8 \cdot 2$ | 12.3 | 16.4 | $20 \cdot 5$ | $24 \cdot 6$ | $28 \cdot 7$ | $32 \cdot 8$ | $36 \cdot 9$ | $41^{\circ} 0$ | 45.I | $49^{\circ} 2$ | 53.3 | 57.4 | $6 \mathrm{r} \cdot 5$ |
| 42 | $4 \cdot 2$ | $8 \cdot 4$ | 12.6 | 16.8 | 21.0 | $25^{\circ} 2$ | $29^{\circ} 4$ | $33 \cdot 6$ | $37 \cdot 8$ | 42.0 | $46 \cdot 2$ | 50.4 | 54.6 | $58 \cdot 8$ | 63.0 |
| 43 | $4 \cdot 3$ | $8 \cdot 6$ | 12.9 | 17.2 | 21.5 | $25 \cdot 8$ | $30^{\prime} 1$ | 34.4 | $38 \cdot 7$ | $43^{\circ} \mathrm{O}$ | $47 \cdot 3$ | $5 \mathrm{I} \cdot 6$ | 55.9 | $60 \cdot 2$ | $64 \cdot 5$ |
| 44 | $4 \cdot 4$ | $8 \cdot 8$ | $13 \cdot 2$ | 17.6 | 22.0 | 26.4 | $30 \cdot 8$ | $35 \cdot 2$ | $39 \cdot 6$ | $44^{\circ} 0$ | $48 \cdot 4$ | $52 \cdot 8$ | $57 \cdot 2$ 58.5 | $6 \mathrm{I} \cdot 6$ | $66 \cdot 0$ |
| 45 | $4 \cdot 5$ | $9 \cdot 0$ | 13.5 | 18.0 | 22.5 | $27 \cdot 0$ | $3 \mathrm{I} \cdot 5$ | $36 \cdot 0$ | $40 \cdot 5$ | $45^{\circ} 0$ | $49 \cdot 5$ | 54.0 | $58 \cdot 5$ | $63 \cdot 0$ | 67.5 |
| 46 | $4 \cdot 6$ | $9 \cdot 2$ | 13.8 | 18.4 | 23.0 | $27 \cdot 6$ | $32 \cdot 2$ | $36 \cdot 8$ | 41*4 | $46 \cdot 0$ | $50 \cdot 6$ | 55.2 | 59.8 | 64.4 | $69 \cdot 0$ |
| 47 | $4 \cdot 7$ | 9.4 | 14.1 | 18.8 | $23 \cdot 5$ | $28 \cdot 2$ | $32 \cdot 9$ | $37 \cdot 6$ | $42 \cdot 3$ | $47 \cdot 0$ | $51 \cdot 7$ | 56.4 | $6 \mathrm{I} \cdot \mathrm{I}$ | $65 \cdot 8$ | $70 \cdot 5$ |
| 48 | $4 \cdot 8$ | $9 \cdot 6$ | 14.4 | 19.2 | $24^{\circ} 0$ | $28 \cdot 8$ | $33 \cdot 6$ | $38 \cdot 4$ | $43 \cdot 2$ | $48^{\circ} 0$ | $52 \cdot 8$ | $57 \cdot 6$ | $62 \cdot 4$ | $67 \cdot 2$ | $72 \cdot 0$ |
| 49 | $4 \cdot 9$ | $9 \cdot 8$ | 14.7 | $19 \cdot 6$ | 24.5 | $29 \cdot 4$ | 34.3 | $39 \cdot 2$ | 44.1 | $49^{\circ} 0$ | 53.9 | $58 \cdot 8$ | $63 \cdot 7$ | $68 \cdot 6$ | $73 \cdot 5$ |
| 50 | $5 \cdot 0$ | 10.0 | $15 \cdot 0$ | $20 \cdot 0$ | 25.0 | $30 \cdot 0$ | $35^{\circ} \mathrm{O}$ | $40 \cdot 0$ | $45^{\circ} \mathrm{O}$ | $50 \cdot 0$ | 55.0 | $60 \cdot 0$ | $65^{\circ}$ | $70 \cdot 0$ | 75.0 |
| 51 | 5.1 | 10.2 | 15.3 | $20 \cdot 4$ | $25 \cdot 5$ | $30 \cdot 6$ | $35 \cdot 7$ | $40 \cdot 8$ | 45.9 | 5100 | $56 \cdot 1$ | $6 \mathrm{I} \cdot 2$ | $66 \cdot 3$ | 71.4 | $76 \cdot 5$ |
| 52 | $5 \cdot 2$ | 10.4 | I5.6 | $20 \cdot 8$ | $26 \cdot 0$ | $3 \mathrm{I} \cdot 2$ | $36 \cdot 4$ | $4 \mathrm{~T} \cdot 6$ | $46 \cdot 8$ | 52.0 | $57 \cdot 2$ | 62.4 | $67 \cdot 6$ | $72 \cdot 8$ | $78 \cdot 0$ |
| 53 | $5 \cdot 3$ | $10 \cdot 6$ | 15.9 | $2 I \cdot 2$ | $26 \cdot 5$ | $3 \mathrm{I} \cdot 8$ | $37 \cdot 1$ | $42 \cdot 4$ | $47 \cdot 7$ | 53.0 | $58 \cdot 3$ | $63 \cdot 6$ | $68 \cdot 9$ | 74.2 | 79.5 |
| 54 | $5 \cdot 4$ | $10 \cdot 8$ | 16.2 | 21.6 | 27.0 | 32.4 | 37.8 | 43.2 | $48 \cdot 6$ | $54^{\circ} \mathrm{O}$ | 59.4 | $64 \cdot 8$ | $70 \cdot 2$ | $75 \cdot 6$ | $8 \mathrm{I} \cdot 0$ |
| 55 | $5 \cdot 5$ | II'O | 16.5 | 22.0 | $27 \cdot 5$ | 33.0 | $38 \cdot 5$ | $44^{\circ} \mathrm{O}$ | 49.5 | $55^{\circ} \mathrm{O}$ | $60 \cdot 5$ | $66 \cdot 0$ | $71 \cdot 5$ | $77 \cdot 0$ | 82.5 |
| 56 | $5 \cdot 6$ | II'2 | 16.8 | 22.4 | $28 \cdot 0$ | $33 \cdot 6$ | 39*2 | $44 \cdot 8$ | 50.4 | 56.0 | 6I•6 | $67 \cdot 2$ | 72.8 | 78.4 | $84^{\circ} \mathrm{O}$ |
| 57 | $5 \cdot 7$ | II.4 | 17'1 | 22.8 | $28 \cdot 5$ | 34.2 | $39^{\circ} 9$ | $45 \cdot 6$ | $5 \mathrm{I} \cdot 3$ | $57 \cdot 0$ | $62 \cdot 7$ | 68.4 | $74 \cdot 1$ | 79.8 | $85 \cdot 5$ |
| 58 | $5 \cdot 8$ | II.6 | 17.4 | $23 \cdot 2$ | $29^{\circ} \mathrm{O}$ | 34.8 | $40 \cdot 6$ | $46 \cdot 4$ | $52 \cdot 2$ | $58 \cdot 0$ | $63 \cdot 8$ | $69 \cdot 6$ | $75 \cdot 4$ | $8 \mathrm{I} \cdot 2$ | 87.0 |
| 59 | $5 \cdot 9$ | 11.8 | 17.7 | $23 \cdot 6$ | 29.5 | $35 \cdot 4$ | $4 \mathrm{I} \cdot 3$ | $47 \cdot 2$ | $53 \cdot 1$ | 59.0 | 64.9 | $70 \cdot 8$ | $76 \cdot 7$ | $82 \cdot 6$ | $88 \cdot 5$ |
| 60 | $6 \cdot 0$ | 12.0 | 18.0 | $24^{\circ} \mathrm{O}$ | $30^{\circ} 0$ | $36 \cdot 0$ | 42.0 | $48^{\circ} \mathrm{O}$ | 54.0 | $60 \cdot 0$ | $66 \cdot$ | $72 \cdot 0$ | $78 \cdot 0$ | $84^{\circ} 0$ | $90^{\circ} 0$ |

SEXAGESIMAL PROPORTIONAL TABLE.

| i | $\begin{gathered} s . \\ \mathrm{s} \cdot 60 \end{gathered}$ | $\stackrel{s .}{\mathbf{s} \cdot 70}$ | $\begin{gathered} \mathrm{s} . \\ \mathrm{r} \cdot 8 \mathrm{o} \end{gathered}$ | $\begin{gathered} \text { s. } \\ \text { I•90 } \end{gathered}$ | $\begin{gathered} \text { s. } \\ 2 \cdot 00 \end{gathered}$ | $\begin{gathered} \text { S. } \\ 2 \cdot 10 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 2 \cdot 20 \end{gathered}$ | $\begin{gathered} \text { S. } \\ 2 \cdot 30 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 2.40 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 2 \cdot 50 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 2 \cdot 60 \end{gathered}$ | $\underset{2.70}{\text { s. }}$ | $\begin{gathered} \mathrm{s} . \\ 2 \cdot 8 \mathrm{o} \end{gathered}$ | $\begin{gathered} \text { s. } \\ 2 \cdot 90 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 3.00 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | $3 \cdot 2$ | 3.4 | $3 \cdot 6$ | $3 \cdot 8$ | 4.0 | 4.2 | $4 * 4$ | $4 \cdot 6$ | $4 \cdot 8$ | 5.0 | $5 \cdot 2$ | $5 \cdot 4$ | $5 \cdot 6$ | 5•8 | $6 \cdot 0$ |
| 3 | $4 \cdot 8$ | $5 \cdot 1$ | $5 \cdot 4$ | $5 \cdot 7$ | $6 \cdot 0$ | $6 \cdot 3$ | $6 \cdot 6$ | $6 \cdot 9$ | $7 \cdot 2$ | $7 \cdot 5$ | $7 \cdot 8$ | 8-1 | $8 \cdot 4$ | $8 \cdot 7$ | $9 \cdot 0$ |
| 4 | 6. | $6 \cdot 8$ | $7 \cdot 2$ | $7 \cdot 6$ | $8 \cdot 0$ | $8 \cdot 4$ | $8 \cdot 8$ | $9 \cdot 2$ | $9 \cdot 6$ | $10 \cdot 0$ | 10.4 | 10.8 | 11.2 | II.6 | 12.0 |
| 5 | $8 \cdot 0$ | $8 \cdot 5$ | $9^{\circ} \mathrm{O}$ | $9 \cdot 5$ | 10.0 | 10.5 | II:O | II.5 | 12.0 | 12.5 | $13^{\circ} \mathrm{O}$ | 13.5 | 14.0 | 14.5 | 15.0 |
| 6 | $9 \cdot 6$ | 10.2 | 10.8 | II* 4 | 12.0 | 12.6 | 13.2 | 13.8 | 14.4 | $15^{\circ} \mathrm{O}$ | 15.6 | 16.2 | 16.8 | $17 \cdot 4$ | 18.0 |
| 7 | II.2 | 11.9 | 12.6 | 13.3 | $14{ }^{\circ} 0$ | 14.7 | 15.4 | 16.1 | 16.8 | 17.5 | $18 \cdot 2$ | 18.9 | 19.6 | $20 \cdot 3$ | 21.0 |
| 8 | 12.8 | 13.6 | 14.4 | 15.2 | 16.0 | 16.8 | $17 \cdot 6$ | 18.4 | 19.2 | $20 \cdot 0$ | $20 \cdot 8$ | 21.6 | 22.4 | $23 \cdot 2$ | $24^{\circ} \mathrm{O}$ |
| 9 | 14.4 | 15.3 | 16.2 | $17 \cdot 1$ | 18.0 | $18 \cdot 9$ | 19.8 | 20.7 | 21.6 | 22.5 | 23.4 | 24.3 | $25^{\circ} 2$ | $26 \cdot 1$ | $27^{\circ} \mathrm{O}$ |
| 10 | 16.0 | 17*0 | 18.0 | 19.0 | $20^{\circ} 0$ | 21.0 | 22.0 | $23^{\circ} \mathrm{O}$ | $24^{\circ} \mathrm{O}$ | 25.0 | $26 \cdot 0$ | 27.0 | $28 \cdot 0$ | $29^{\circ} 0$ | $30^{\circ} 0$ |
| II | I $7 \cdot 6$ | $18 \cdot 7$ | 19.8 | 20.9 | $22^{\circ} \mathrm{O}$ | $23^{\cdot 1}$ | $24^{\circ} 2$ | $25 \cdot 3$ | 26.4 | $27 \cdot 5$ | $28 \cdot 6$ | $29 \cdot 7$ | $30 \cdot 8$ | 31*9 | $33^{\circ} \mathrm{O}$ |
| 12 | 19.2 | 20.4 | 21.6 | $22 \cdot 8$ | $24^{\circ} \mathrm{O}$ | $25^{\circ} 2$ | 26.4 | $27 \cdot 6$ | $28 \cdot 8$ | 30.0 | $31 \cdot 2$ | $32 \cdot 4$ | $33 \cdot 6$ | $34 \cdot 8$ | $36 \cdot 0$ |
| 13 | $20 \cdot 8$ | $22 \cdot 1$ | 23.4 | $24^{\circ} 7$ | $26 \cdot 0$ | $27 \cdot 3$ | $28 \cdot 6$ | 29.9 | 31.2 | $32 \cdot 5$ | $33 \cdot 8$ | $35 \cdot 1$ | 36.4 | 37•7 | $39^{\circ}$ |
| 14 | 22.4 | $23 \cdot 8$ | $25 \cdot 2$ | $26 \cdot 6$ | $28 \cdot 0$ | 29.4 | $30 \cdot 8$ | $32 \cdot 2$ | 33.6 | 35.0 | $36 \cdot 4$ | $37 \cdot 8$ | $39 \cdot 2$ | $40 \cdot 6$ | $42 \cdot 0$ |
| 15 | $24^{\circ} 0$ | 25.5 | $27 \cdot 0$ | 28.5 | $30 \cdot 0$ | $31 \cdot 5$ | 33.0 | $34 \cdot 5$ | $36 \cdot 0$ | $37 \cdot 5$ | $39^{\circ} 0$ | $40 \cdot 5$ | $42^{\circ} \mathrm{O}$ | $43 \cdot 5$ | $45^{\circ} \mathrm{O}$ |
| 16 | $25 \cdot 6$ | $27 \cdot 2$ | $28 \cdot 8$ | $30 \cdot 4$ | $32^{\circ} \mathrm{O}$ | $33 \cdot 6$ | $35 \cdot 2$ | $36 \cdot 8$ | $38 \cdot 4$ | $40^{\circ} 0$ | 41.6 | $43^{\circ} 2$ | $44^{\cdot 8}$ | $46 \cdot 4$ | $48 \cdot 0$ |
| 17 | $27 \cdot 2$ | $28 \cdot 9$ | $30 \cdot 6$ | $32 \cdot 3$ | $34^{\circ} \mathrm{O}$ | $35 \cdot 7$ | $37 \cdot 4$ | $39^{1} 1$ | $40 \cdot 8$ | $42 \cdot 5$ | $44^{\circ} 2$ | 45.9 | $47 \cdot 6$ | $49 \cdot 3$ | 51.0 |
| 18 | 28.8 | $30 \cdot 6$ | 32.4 | $34^{\circ} 2$ | $36 \cdot 0$ | 37.8 | $39 \cdot 6$ | 41.4 | 43.2 | $45^{\circ} \mathrm{O}$ | $46 \cdot 8$ | $48 \cdot 6$ | $50 \cdot 4$ | $52 \cdot 2$ | $54{ }^{\circ} \mathrm{O}$ |
| 19 | $30 \cdot 4$ | $32 \cdot 3$ | $34 \cdot 2$ | $36 \cdot 1$ | $38 \cdot 0$ | 39.9 | 41.8 | $43 \cdot 7$ | $45 \cdot 6$ | $47 \cdot 5$ | $49 \cdot 4$ | 5I•3 | 53.2 | 55'I | $57 \cdot 0$ |
| 20 | $32 \cdot 0$ | $34^{\circ} \mathrm{O}$ | $36 \cdot 0$ | $38 \cdot 0$ | $40 \cdot 0$ | $42 \cdot 0$ | $44^{\circ} \mathrm{O}$ | 46•0 | $48 \cdot 0$ | $50 \cdot 0$ | $52 \cdot 0$ | $54^{\circ} \mathrm{O}$ | $56 \cdot 0$ | $58 \cdot 0$ | $60 \%$ |
| 21 | $33^{\circ} 6$ | 35 ${ }^{\circ} 7$ | $37 \cdot 8$ | 39 | $42^{\circ} \mathrm{O}$ | 44* ${ }^{\text {I }}$ | $46 \cdot 2$ | $48 \cdot 3$ | $50 \cdot 4$ | $52 \cdot 5$ | $54 \cdot 6$ | 56.7 | $58 \cdot 8$ | 60.9 | $63^{\circ} 0$ |
| 22 | $35 \cdot 2$ | $37 \cdot 4$ | $39 \cdot 6$ | $4 \mathrm{I} \cdot 8$ | $44^{\circ} \mathrm{O}$ | $46 \cdot 2$ | $48 \cdot 4$ | $50 \cdot 6$ | $52 \cdot 8$ | $55^{\circ} \mathrm{O}$ | $57 \cdot 2$ | 59.4 | $6 \mathrm{I} \cdot 6$ | $63 \cdot 8$ | $66 \cdot 0$ |
| 23 | $36 \cdot 8$ | $39 \cdot 1$ | $41 \cdot 4$ | 43.7 | $46 \cdot 0$ | $48 \cdot 3$ | $50 \cdot 6$ | 52.9 | $55 \cdot 2$ | $57 \cdot 5$ | $59 \cdot 8$ | $62 \cdot 1$ | 64.4 | $66 \cdot 7$ | $69 \cdot 0$ |
| 24 | $38 \cdot 4$ | $40 \cdot 8$ | $43 \cdot 2$ | $45 \cdot 6$ | $48 \cdot 0$ | 50.4 | $52 \cdot 8$ | $55^{\circ} 2$ | $57 \cdot 6$ | $60 \cdot 0$ | 62.4 | 64.8 | 67.2 | $69 \cdot 6$ | $72 \cdot 0$ |
| 25 | $40 \cdot 0$ | 42.5 | $45^{\circ} \mathrm{O}$ | $47 \cdot 5$ | $50 \times 0$ | $52 \cdot 5$ | 55.0 | $57 \cdot 5$ | $60 \cdot 0$ | $62 \cdot 5$ | $65 \cdot 0$ | $67 \cdot 5$ | $70 \cdot 0$ | $72 \cdot 5$ | $75 \cdot 0$ |
| 26 | 41•6 | $44^{\prime 2}$ | $46 \cdot 8$ | $49 \cdot 4$ | 52.0 | $54 \cdot 6$ | $57 \cdot 2$ | $59 \cdot 8$ | 62.4 | $65^{\circ} 0$ | $67 \cdot 6$ | 70.2 | $72 \cdot 8$ | 75.4 | $78 \cdot 0$ |
| 27 | $43 \cdot 2$ | $45^{\circ} 9$ | $48 \cdot 6$ | $5 \mathrm{I} \cdot 3$ | 54.0 | $56 \cdot 7$ | $59 \cdot 4$ | $62 \cdot 1$ | $64 \cdot 8$ | $67 \cdot 5$ | $70 \cdot 2$ | 72.9 | $75 \cdot 6$ | $78 \cdot 3$ | $8 \mathrm{I} \cdot 0$ |
| 28 | $44 \cdot 8$ | $47 \cdot 6$ | 50.4 | $53 \cdot 2$ | $56 \cdot 0$ | $58 \cdot 8$ | $6 \mathrm{I} \cdot 6$ | 64.4 | 67.2 | $70 \cdot 0$ | $72 \cdot 8$ | $75 \cdot 6$ | $78 \cdot 4$ | $8 \mathrm{I} \cdot 2$ | $84^{\circ} 0$ |
| 29 | $46 \cdot 4$ | $49 \cdot 3$ | $52 \cdot 2$ | $55^{1} \mathrm{I}$ | $58 \cdot 0$ | $60 \cdot 9$ | $63 \cdot 8$ | $66 \cdot 7$ | $69 \cdot 6$ | 72.5 | 75.4 | $78 \cdot 3$ | $8 \mathrm{I} \cdot 2$ | $84 \cdot 1$ | $87 \cdot 0$ |
| 30 | $48 \cdot 0$ | 51.0 | $54^{\circ} \mathrm{O}$ | 57.0 | $60 \cdot 0$ | $63 \cdot 0$ | $66 \cdot 0$ | $69 \cdot 0$ | $72 \cdot 0$ | $75^{\circ} \mathrm{O}$ | $78 \cdot 0$ | $8 \mathrm{I} \cdot 0$ | $84^{\circ} \mathrm{O}$ | $87 \cdot 0$ | $90 \cdot 0$ |
| 31 | $49 \cdot 6$ | $52 \cdot 7$ | 55.8 | $58 \cdot 9$ | 62.0 | $65 \cdot 1$ | $68 \cdot 2$ | 71.3 | 74.4 | 77.5 | $80 \cdot 6$ | 83.7 | 86.8 | 89.9 | $93^{\circ} \mathrm{O}$ |
| 32 | 51.2 | 54.4 | $57 \cdot 6$ | $60 \cdot 8$ | 64.0 | $67 \cdot 2$ | $70 \cdot 4$ | $73 \cdot 6$ | $76 \cdot 8$ | $80 \cdot 0$ | $83 \cdot 2$ | $86 \cdot 4$ | $89 \cdot 6$ | $92 \cdot 8$ | $96 \cdot 0$ |
| 33 | $52 \cdot 8$ | $56 \cdot 1$ | 59.4 | $62 \cdot 7$ | $66 \cdot 0$ | $69 \cdot 3$ | 72.6 | 75.9 | 79.2 | 82.5 | 85.8 | $89 \cdot 1$ | 92.4 | $95 \cdot 7$ | $99^{\circ} \mathrm{O}$ |
| 34 | 54.4 | $57 \cdot 8$ | $6 \mathrm{I} \cdot 2$ | $64 \cdot 6$ | $68 \cdot 0$ | 71.4 | $74 \cdot 8$ | $78 \cdot 2$ | $8 \mathrm{I} \cdot 6$ | $85 \cdot 0$ | $88 \cdot 4$ | $9 \mathrm{I} \cdot 8$ | $95 \cdot 2$ | $98 \cdot 6$ | $102{ }^{\circ} \mathrm{C}$ |
| 35 | $56 \cdot 0$ | $59 \cdot 5$ | $63 \cdot 0$ | $66 \cdot 5$ | $70 \cdot 0$ | $73 \cdot 5$ | $77 \cdot 0$ | $80 \cdot 5$ | $84^{\circ} \mathrm{O}$ | $87 \cdot 5$ | $91 \cdot 0$ | $94 \cdot 5$ | $98 \cdot 0$ | 101.5 | 105.0 |
| 36 | $57 \cdot 6$ | $6 \mathrm{I} \cdot 2$ | $64 \cdot 8$ | $68 \cdot 4$ | $72^{\circ} 0$ | $75 \cdot 6$ | 79.2 | $82 \cdot 8$ | 86.4 | $90 \cdot 0$ | $93 \cdot 6$ | 97.2 | $100 \cdot 8$ | 104.4 | 108.0 |
| 37 | $59 \cdot 2$ | $62 \cdot 9$ | $66 \cdot 6$ | $70 \cdot 3$ | $74{ }^{\circ}$ | $77 \cdot 7$ | 81.4 | $85 \cdot 1$ | $88 \cdot 8$ | $92 \cdot 5$ | $96 \cdot 2$ | $99^{\circ} 9$ | 103.6 | 107.3 | III 0 |
| 38 | $60 \cdot 8$ | $64 \cdot 6$ | $68 \cdot 4$ | $72 \cdot 2$ | $76 \cdot 0$ | $79 \cdot 8$ | $83 \cdot 6$ | $87 \cdot 4$ | $91 \cdot 2$ | 95.0 | 98.8 | 102.6 | 106.4 | 110.2 | 114.0 |
| 39 | $62 \cdot 4$ | $66 \cdot 3$ | $70 \cdot 2$ | $74 \cdot 1$ | $78 \cdot 0$ | $8 \mathrm{I} \cdot 9$ | $85 \cdot 8$ | $89 \cdot 7$ | 93.6 | 97.5 | IOI.4 | $105 \cdot 3$ | 109.2 | 113.1 | 117.0 |
| 40 | 64.0 | $68 \cdot 0$ | $72 \cdot 0$ | $76 \cdot 0$ | 80.0 | $84^{\circ} \mathrm{O}$ | $88 \cdot 0$ | $92 \cdot 0$ | 96.0 | 100.0 | 104.0 | 108.0 | I12.0 | 116.0 | 120.0 |
| 41 | $65 \cdot 6$ | $69 \cdot 7$ | $73 \cdot 8$ | 77•9 | $82 \cdot 0$ | $86 \cdot 1$ | $90 \cdot 2$ | 94.3 | 98.4 | 102.5 | 106.6 | 110.7 | 114.8 | 118.9 | 123.0 |
| 42 | $67 \cdot 2$ | 71.4 | $75 \cdot 6$ | $79 \cdot 8$ | 84.0 | $88 \cdot 2$ | 92.4 | $96 \cdot 6$ | $100 \cdot 8$ | $105 \cdot 0$ | 109.2 | 113.4 | 117.6 | 121.8 | 126.0 |
| 43 | $68 \cdot 8$ | $73 \cdot 1$ | $77 \cdot 4$ | $8 \mathrm{I} \cdot 7$ | $86 \cdot 0$ | $90 \cdot 3$ | $94 \cdot 6$ | 98.9 | 103.2 | $107 \cdot 5$ | III•8 | 116.1 | 120.4 | 124.7 | $129{ }^{\circ}$ |
| 44 | $70 \cdot 4$ | $74 \cdot 8$ | $79 \cdot 2$ | 83.6 | $88 \cdot 0$ | $92 \cdot 4$ | 96.8 | 101.2 | 105.6 | 1100 | 114.4 | II 8.8 | 123.2 | 127.6 | 132.0 |
| 45 | $72 \cdot 0$ | $76 \cdot 5$ | 8I•0 | $85 \cdot 5$ | $90 \cdot 0$ | $94^{\circ} 5$ | 99.0 | 103.5 | 108.0 | 112.5 | 117.0 | 121.5 | 126.0 | 130.5 | $135{ }^{\circ}$ |
| 46 | $73 \cdot 6$ | $78 \cdot 2$ | $82 \cdot 8$ | 87.4 | 92.0 | $96 \cdot 6$ | 1OI.2 | 105.8 | 110.4 | 115.0 | 119.6 | 124.2 | 128.8 | 133.4 | $138 \cdot 0$ |
| 47 | $75 \cdot 2$ | 79.9 | $84 \cdot 6$ | 89.3 | $94^{\circ} \mathrm{O}$ | $98 \cdot 7$ | 103.4 | 108.1 | 112.8 | II7.5 | 122.2 | 126.9 | 131.6 | $136 \cdot 3$ | $141{ }^{\circ} 0$ |
| 48 | $76 \cdot 8$ | $8 \mathrm{I} \cdot 6$ | $86 \cdot 4$ | 91.2 | $96 \cdot 0$ | $100 \cdot 8$ | 105.6 | I1O.4 | 115.2 | $120 \cdot 0$ | 124.8 | 129.6 | 134.4 | $139 \cdot 2$ | $144^{\circ}$ |
| 49 | 78.4 | 83.3 | 88.2 | $93^{\circ} \mathrm{I}$ | $98 \cdot 0$ | $102 \cdot 9$ | 107.8 | 112.7 | 117.6 | 122.5 | 127.4 | 132.3 | $137 \cdot 2$ | $142 \cdot 1$ | 147.0 |
| 50 | $80^{\circ} 0$ | $85^{\circ} \mathrm{O}$ | $90 \cdot 0$ | $95^{\circ} \mathrm{O}$ | 1000 | $105{ }^{\circ} \mathrm{O}$ | 110.0 | $115{ }^{\circ}$ | 120.0 | 125.0 | 130.0 | $135{ }^{\circ}$ | 140.0 | $145{ }^{\circ}$ | 150.0 |
| 51 | $8 \mathrm{I} \cdot 6$ | $86 \cdot 7$ | $9 \mathrm{I} \cdot 8$ | $96 \cdot 9$ | 1020 | 107•1 | 112.2 | 117.3 | 122.4 | 127.5 | 132.6 | 137.7 | 142.8 | 147*9 | 153.0 |
| 52 | $83 \cdot 2$ | $88 \cdot 4$ | $93 \cdot 6$ | 98.8 | 1040 | 109.2 | 114.4 | 119.6 | 124.8 | $130 \cdot 0$ | 135.2 | 140.4 | 145.6 | 150.8 | 156.5 |
| 53 | 84.8 | $90 \cdot 1$ | $95 \cdot 4$ | $100 \cdot 7$ | 106.0 | 1II•3 | 116.6 | 121.9 | 127.2 | 132.5 | $137 \cdot 8$ | $143 \cdot 1$ | 148.4 | 153.7 | $159{ }^{\circ}$ |
| 54 | 86.4 | 91.8 | $97 \cdot 2$ | $102 \cdot 6$ | 108.0 | II3.4 | 118.8 | $124^{\circ} 2$ | 129.6 | $135{ }^{\circ}$ | $140 \cdot 4$ | 145.8 | 151.2 | 156.6 | 162.0 |
| 55 | $88 \cdot 0$ | 93.5 | $99^{\circ}$ | 104.5 | 110.0 | I 15.5 | 121.0 | 126.5 | 132.0 | 137.5 | 143.0 | $148 \cdot 5$ | 154.0 | 159.5 | 165.0 |
| 56 | $89 \cdot 6$ | $95^{\circ} 2$ | $100 \cdot 8$ | 106.4 | 112.0 | 117.6 | 123.2 | 128.8 | 134.4 | 140.0 | 145.6 | 151.2 | 156.8 | 162.4 | 168.0 |
| 57 | $9 \mathrm{I} \cdot 2$ | $96 \cdot 9$ | 102.6 | 108.3 | $114{ }^{\circ} \mathrm{O}$ | 119.7 | 125.4 | 13I•I | 136.8 | 142.5 | 148.2 | 153.9 | 159.6 | 165.3 | 1710 |
| 58 | $92 \cdot 8$ | $98 \cdot 6$ | 104.4 | 110.2 | 116.0 | $12 \mathrm{I} \cdot 8$ | 127.6 | 133.4 | 139.2 | $145^{\circ} 0$ | 150.8 | 156.6 | 162.4 | 168.2 | $174{ }^{\circ}$ |
| 59 | 94.4 | $100 \cdot 3$ | 106.2 | I12.1 | I18.0 | 123.9 | 129.8 | 135.7 | 141.6 | $147{ }^{\circ} 5$ | 153.4 | 159.3 | 165.2 | 171.1 | $177{ }^{\circ}$ |
| 60 | 96.0 | $102 \cdot 0$ | 108.0 | 114.0 | $120{ }^{\circ}$ | 126.0 | $132^{\circ}$ | $138 \cdot 0$ | $144{ }^{\circ}$ | $150 \cdot 0$ | 156.0 | 162.0 | 168.0 | 174.0 | 180.0 |

SEXAGESIMAL PROPORTIONAL TABLE.

| i | $\begin{gathered} \text { S. } \\ 3 \cdot 10 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 3.20 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 3 \cdot 30 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 3.40 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 3.50 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 3 \cdot 60 \end{gathered}$ | $\begin{gathered} s . \\ 3.70 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 3.80 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 3 \cdot 90 \end{gathered}$ | $\underset{4 \cdot 00}{\text { s. }}$ | $\begin{gathered} \text { S. } \\ 4 \cdot 10 \end{gathered}$ | $\begin{gathered} \text { S. } \\ 4 \cdot 20 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 4 \cdot 30 \end{gathered}$ | $\underset{4 \cdot 40}{\text { S. }}$ | $\begin{gathered} \text { s. } \\ 4 \cdot 50 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | $6 \cdot 2$ | 6.4 | $6 \cdot 6$ | $6 \cdot 8$ | 7.0 | 7.2 | 7.4 | $7 \cdot 6$ | 7.8 | - | 8.2 | $8 \cdot 4$ | $8 \cdot 6$ | $8 \cdot 8$ | $9 \cdot 0$ |
| 3 | $9 \cdot 3$ | 9.6 | $9 \cdot 9$ | 10.2 | 10.5 | 10.8 | $11 \cdot 1$ | II.4 | $1 \mathrm{IF}^{7}$ | 12.0 | 12.3 | 12.6 | 12.9 | 13.2 | 13.5 |
| 4 | 12.4 | 12.8 | 13.2 | 13.6 | $14^{\circ} \mathrm{O}$ | 14.4 | 14.8 | 15.2 | 15.6 | 16.0 | 16.4 | 16.8 | 17.2 | 17.6 | 18.0 |
| 5 | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 | 18.0 | 18.5 | $19^{\circ} \mathrm{O}$ | 19.5 | 20.0 | $20 \cdot 5$ | 21.0 | 21.5 | 22.0 | $22 \cdot 5$ |
| 6 | 18.6 | 19.2 | 19.8 | $20 \cdot 4$ | 21.0 | 21.6 | 22.2 | 22.8 | 23.4 | $24^{\circ}$ | 24.6 | 25.2 | 25.8 | $26 \cdot 4$ | $27 \cdot 0$ |
| 7 | 21.7 | 22.4 | $23 \cdot 1$ | $23 \cdot 8$ | 24.5 | 25.2 | 25.9 | 26.6 | $27 \cdot 3$ | $28 \cdot 0$ | 28.7 | 29.4 | $30 \cdot 1$ | $30 \cdot 8$ | $31 \cdot 5$ |
| 8 | 24.8 | 25.6 | $26 \cdot 4$ | 27.2 | 28.0 | 28.8 | 29.6 | $30 \cdot 4$ | 31.2 | $32^{\circ}$ | 32.8 | 33.6 | 34.4 | 35.2 | $36 \cdot 0$ |
| , | 27.9 | $28 \cdot 8$ | 29.7 | $30 \cdot 6$ | 31.5 | 32.4 | 33.3 | 34.2 | $35^{1} 1$ | $36^{\circ}$ | $36 \cdot 9$ | $37 \cdot 8$ | 38.7 | $39^{6}$ | $40 \cdot 5$ |
| 10 | $31^{\circ}$ | $32^{\circ} \mathrm{O}$ | $33^{\circ} \mathrm{O}$ | $34^{\circ} \mathrm{O}$ | $35^{\circ}$ | 36.0 | $37^{\circ} 0$ | 38.0 | $39^{\circ}$ | $40^{\circ} 0$ | $41^{\circ}$ | 42.0 | $43^{\circ} \mathrm{O}$ | $44^{\circ} \mathrm{O}$ | $45^{\circ} 0$ |
| II | 34.1 | 35.2 | $36 \cdot 3$ | $37 \cdot 4$ | 38.5 | 39.6 | $40^{\prime} 7$ | 41.8 | $42^{\circ} 9$ | $44^{\circ} \mathrm{O}$ | $45^{1} 1$ | $46 \cdot 2$ | 47.3 | 48.4 | 49.5 |
| 12 | $37 \cdot 2$ | 38.4 | 39.6 | $40 \cdot 8$ | $42^{\circ} \mathrm{O}$ | 43.2 | 44.4 | $45 \cdot 6$ | $46 \cdot 8$ | 48.0 | 49.2 | $50 \cdot 4$ | 51.6 | 52.8 | 54.0 |
| 13 | $40 \cdot 3$ | $41 \cdot 6$ | 42.9 | $44^{\circ} 2$ | $45^{\circ} 5$ | $46 \cdot 8$ | 48.1 | 49.4 | $50 \cdot 7$ | 52.0 | 53.3 | 54.6 | 55.9 | $57 \cdot 2$ | $58 \cdot 5$ |
| 14 | 43.4 | 44.8 | $46 \cdot 2$ | 47.6 | $49^{\circ}$ | $50 \cdot 4$ | $5 \mathrm{~F} \cdot 8$ | 53.2 | 54.6 | 56.0 | 57.4 | $58 \cdot 8$ | $60 \cdot 2$ | $6 \mathrm{~L} \cdot 6$ | $63^{\circ}$ |
| 15 | $46 \cdot 5$ | 48.0 | 49.5 | 51.0 | 52.5 | $54^{\circ} \mathrm{O}$ | 55.5 | $57^{\circ} \mathrm{O}$ | 58.5 | $60 \cdot 0$ | $6 \mathrm{I} \cdot 5$ | 63.0 | 64.5 | $66 \cdot 0$ | 67.5 |
| 16 | $49 \cdot 6$ | $5 \mathrm{I} \cdot 2$ | 52.8 | 54 | $56 \cdot 0$ | $57 \cdot 6$ | 59.2 | 60.8 | 62.4 | 64.0 | $65 \cdot 6$ | $67 \cdot 2$ | 68.8 | + | 72.0 |
| 17 | $52 \cdot 7$ | 54.4 | 56.1 | 57.8 | $59 \cdot 5$ | 61.2 | 62.9 | $64 \cdot 6$ | $66 \cdot 3$ | 68.0 | $69 \cdot 7$ | 71.4 | $73 \cdot 1$ | 74.8 | $76 \cdot 5$ |
| 18 | 55.8 | $57 \cdot 6$ | 59.4 | 61.2 | 63.0 | $64 \cdot 8$ | $66 \cdot 6$ | 68.4 | $70 \cdot 2$ | 72.0 | $73 \cdot 8$ | 75.6 | 77.4 | 79.2 | 81.0 |
| 19 | 58.9 | 60.8 | 62.7 | $64 \cdot 6$ | $66 \cdot 5$ | 68.4 | $70 \cdot 3$ | 72.2 | 74.1 | 76.0 | 77.9 | 79.8 | $81 \cdot 7$ | 83.6 | 85.5 |
| 20 | 62.0 | $64^{\circ} \mathrm{O}$ | 66.0 | 68.0 | 70.0 | $72 \cdot 0$ | 74.0 | 76.0 | 78.0 | 80.0 | $82 \cdot 0$ | $84^{\circ}$ | $86 \cdot 0$ | 88.0 | 90.0 |
| 21 | 65 | 67.2 | 69 | 71.4 | 73.5 | $75 \cdot 6$ | $77 \cdot 7$ | 79.8 | 81.9 | 84.0 | $86 \cdot 1$ | $88 \cdot 2$ | 90.3 | 92.4 | 94.5 |
| 22 | 68.2 | 70.4 | $72 \cdot 6$ | 74.8 | $77^{\circ}$ | 79.2 | 81.4 | 83.6 | 85.8 | 88.0 | $90 \cdot 2$ | 92.4 | $94 \cdot 6$ | $96 \cdot 8$ | $99^{\circ} \mathrm{O}$ |
| 23 | $7 \mathrm{7} \cdot 3$ | $73 \cdot 6$ | 75.9 | 78.2 | $80 \cdot 5$ | $82 \cdot 8$ | $85 \cdot 1$ | 87.4 | 89.7 | 92.0 | $94 \cdot 3$ | $96 \cdot 6$ | 98.9 | Ior 2 | 103.5 |
| 24 | 74.4 | 76.8 | 79.2 82.5 | $8{ }^{8} \cdot 6$ | 84.0 | $86 \cdot 4$ | 88.8 | 91.2 | $93 \cdot 6$ | 96.0 | 98.4 | 100.8 | 103.2 | 105.6 | 108.0 |
| 25 | $77 \cdot 5$ | $80^{\circ} 0$ | $82 \cdot 5$ | $85^{\circ} \mathrm{O}$ | 87.5 | $90 \cdot 0$ | $92 \cdot 5$ | $95^{\circ} \mathrm{O}$ | $97 \cdot 5$ | $100 \cdot$ | 102.5 | 105.0 | 107.5 | 1100 | 112.5 |
| 26 | $80 \cdot 6$ | 83.2 | $85 \cdot 8$ | 88.4 | $91^{\circ} \mathrm{O}$ | $93 \cdot 6$ | $96 \cdot 2$ | 98.8 | 101.4 | 104.0 | $106 \cdot 6$ | 109.2 | 111.8 | 114.4 | 117.0 |
| 27 | 83.7 | 86.4 | $89^{\circ} \mathrm{I}$ | $9 \mathrm{P} \cdot 8$ | 94.5 | 97.2 | $99^{\prime} 9$ | $102 \cdot 6$ | $105 \cdot 3$ | 108.0 | $110 \cdot 7$ | 113.4 | 116.1 | 118.8 | 121.5 |
| 28 | $86 \cdot 8$ | $89 \cdot 6$ | 92.4 | $95 \cdot 2$ | $98 \cdot 0$ | 100.8 | 103.6 | $106 \cdot 4$ | 109.2 | 112.0 | 114.8 | 117.6 | 120.4 | 123.2 | 126.0 |
| 29 | 89.9 | $92 \cdot 8$ | 957 | $98 \cdot 6$ | 1015 | 104.4 | 107.3 | $110 \cdot 2$ | 113.1 | 116.0 | 118.9 | 121.8 | 124.7 | 127.6 | 130.5 |
| 30 | $93{ }^{\circ}$ | $96 \cdot$ | $99^{\circ}$ | 102.0 | 105.0 | 108.0 | III.O | $114^{\circ} \mathrm{O}$ | $117{ }^{\circ}$ | 120.0 | 123.0 | 126.0 | 129.0 | 132.0 | 135.0 |
| 31 | 96-I | 99.2 | 1023 | 105.4 | 108.5 | III• 6 | 114.7 | 117.8 | 120.9 | 124.0 | 127.1 | 130.2 | 133.3 | 136.4 | 139.5 |
| 32 | 99.2 | 102.4 | 105.6 | 108.8 | 112.0 | 115.2 | 118.4 | 121.6 | 124.8 | 128.0 | 131.2 | 134.4 | 137.6 | 140.8 | 144.0 |
| 33 | 102.3 | 105.6 | Io8.9 | 112.2 | 115.5 | 118.8 | 122.1 | 125.4 | 128.7 | 132.0 | I 35.3 | 138.6 | 141.9 | 145.2 | 148.5 |
| 34 |  | 108.8 | 112.2 | 115.6 | 119.0 | 122.4 | 125.8 | 129.2 | 132.6 | $136{ }^{\circ}$ | 139.4 | $142 \cdot 8$ | $146 \cdot 2$ | 149.6 | 153.0 |
| 35 | 108.5 | 112.0 | 115.5 | 119.0 | 122.5 | 126.0 | 129.5 | 133.0 | 136.5 | $140 \cdot 0$ | 143.5 | 147.0 | 150.5 | $154^{\circ}$ | 157.5 |
| 36 | 114.6 | 115.2 | 118.8 | 122.4 | 126.0 | 129.6 | 133.2 | 136.8 | 140.4 | 144.0 | $147 \cdot 6$ | 151.2 | 154.8 | 158.4 | 162.0 |
| 37 | 1154 | 118.4 | 122.1 | 125.8 | 129.5 | 133.2 | $136 \cdot 9$ | $140 \cdot 6$ | 144.3 | 148.0 | 151.7 | 155.4 | 159.1 | 162.8 | 166.5 |
| 38 | 117.8 | 121.6 | 125.4 | 129.2 | 133.0 | 136.8 | $140 \cdot 6$ | 144.4 | 148.2 | 152.0 | 155.8 | 159.6 | 163.4 | 167.2 | $17 \mathrm{I}^{\circ}$ |
| 39 | I20.9 | 124.8 | 128.7 | 132.6 | 136.5 | 140.4 | 144.3 | $148 \cdot 2$ | 152.1 | 156.0 | $159{ }^{\circ} 9$ | 163.8 | $167 \cdot 7$ | 171.6 | 175.5 |
| 40 | 124.0 | 128.0 | $132{ }^{\circ}$ | 136.0 | $140 \cdot 0$ | 144.0 | 148.0 | 152.0 | 156.0 | 160.0 | 164.0 | 168.0 | 172.0 | 176.0 | 180.0 |
| 4 I | 127.1 | 131.2 | 135.3 | 139.4 | 143.5 | 147.6 | 151.7 | 155.8 | 159.9 | 164.0 | 168.I | 172.2 | $176 \cdot 3$ | 180.4 | 184.5 |
| 42 | $130 \cdot 2$ | 134.4 | 138.6 | 142.8 | 147*0 | 151.2 | 155.4 | 159.6 | 163.8 | 168.0 | 172.2 | 176.4 | 180.6 | 184.8 | 189.0 |
| 43 | r 33.3 | 137.6 | 141.9 | 146.2 | 150.5 | 154.8 | 159.1 | 163.4 | 167.7 | 172.0 | $176 \cdot 3$ | 180.6 | 184.9 | 189.2 | 193.5 |
| 44 | I36.4 | $140 \cdot 8$ |  | 149.6 | 154.0 | 158.4 | 162.8 | $167^{2}$ | 171.6 | 176.0 | 180.4 | 184.8 | 189.2 | 193.6 | 198.0 |
| 45 | I 39.5 | 144.0 | 148.5 | 153.0 | 157.5 | 162.0 | 166.5 | 171.0 | 175.5 | 180.0 | 184.5 | 189.0 | 193.5 | 198.0 | $202 \cdot 5$ |
| 46 | 142.6 | 147.2 | 151.8 | $156 \cdot 4$ | 161.0 | 165.6 | 170.2 |  |  | 184.0 | 188.6 | 193.2 | 197.8 |  | $207 \cdot 0$ |
| 47 | 145.7 | $150 \cdot 4$ | 155.1 | 159.8 | 164.5 | 169.2 | 173.9 | 178.6 | 183.3 | 188.0 | 192.7 | 197.4 | $202 \cdot 1$ | $206 \cdot 8$ | 211.5 |
| 48 | r48.8 | 153.6 | 158.4 | 163.2 | 168.0 | 172.8 | $177 \cdot 6$ | 182.4 | 187.2 | 192.0 | 196.8 | $201 \cdot 6$ | $206 \cdot 4$ | 211.2 | 216.0 |
| 49 | 151.9 | 156.8 | $161 \cdot 7$ | 166.6 | $171 \cdot 5$ | $176 \cdot 4$ | 181.3 | 186.2 | 191.I | 196.0 | $200 \cdot 9$ | $205 \cdot 8$ | $210 \cdot 7$ | 215.6 | $220 \cdot 5$ |
| 50 | 155.0 | $160 \cdot 0$ | $165^{\circ}$ | 170.0 | $175{ }^{\circ}$ | 180.0 | $185{ }^{\circ} \mathrm{O}$ | 190.0 | 195'0 | $200 \cdot 0$ | 205.0 | 210.0 | 215.0 | 220.0 | 225.0 |
| 51 | ${ }^{158.1}$ | 163.2 | 168.3 | 173.4 | 178.5 | 183.6 | 188.7 | 193.8 | 198.9 | 204.0 | 209.1 | 214.2 | 219.3 | 224.4 | 229.5 |
| 52 | r61.2 | $166 \cdot 4$ | 171.6 | $176 \cdot 8$ | 182.0 | 187.2 | $192 \cdot 4$ | 197.6 | $202 \cdot 8$ | 208.0 | 213.2 | 218.4 | 223.6 | 228.8 | $234 \cdot 0$ |
| 53 | 1643 | 169.6 | 174.9 | 180.2 | 185.5 | $190 \cdot 8$ | 196.I | 2014 | $206 \cdot 7$ | 212.0 | $217 \cdot 3$ | 222.6 | 227.9 | 233.2 | $238 \cdot 5$ |
| 54 | 167.4 | 172.8 | 178.2 | 183.6 | $189^{\circ} 0$ | $194{ }^{\circ} 4$ | 199.8 | 205.2 | $210 \cdot 6$ | 216.0 | 221.4 | 226.8 | 232.2 | $237 \cdot 6$ | $243 \cdot 0$ |
| 55 | 170.5 | $176{ }^{\circ}$ | 181.5 | 187.0 | $192 \cdot 5$ | 198.0 | 203.5 | 209.0 | 214.5 | $220 \cdot 0$ | 225.5 | 231.0 | $236 \cdot 5$ | 242.0 | $247 \cdot 5$ |
| 56 | 173.6 | 179.2 | 184.8 |  | 196.0 | 201.6 | 207.2 | 212.8 | 218.4 | $224{ }^{\circ}$ | 229.6 | $235 \cdot 2$ | $240 \cdot 8$ |  | $252 \cdot 0$ |
| 57 | $176 \cdot 7$ | 182.4 | 188.1 | 193.8 | 199.5 | 205.2 | $210 \cdot 9$ | 216.6 | $222 \cdot 3$ | 228.0 | $233 \cdot 7$ | 239.4 | $245 \cdot 1$ | $250 \cdot 8$ | $256 \cdot 5$ |
| 58 | 179.8 182.0 | 185.6 188.8 | $191 \cdot 4$ | 197.2 | 203.0 | 208.8 | 214.6 | $220 \cdot 4$ | $226 \cdot 2$ | $232 \cdot 0$ | 237.8 | $243 \cdot 6$ | 249.4 | 255.2 | 261.0 |
| 59 60 | 182.9 186.0 | 188.8 192.0 | 194.7 198.0 | $200 \cdot 6$ 204.0 | $206 \cdot 5$ 210.0 | 212.4 216.0 | $218 \cdot 3$ 222.0 | 224.2 228.0 | $230 \cdot 1$ 234.0 | $236 \cdot 0$ $240 \cdot 0$ | $241 \cdot 9$ $246 \cdot 0$ | $247 \cdot 8$ 252.0 | 253.7 258.0 | $259 \cdot 6$ $264 \cdot 0$ | 265.5 270.0 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

SEXAGESIMAL PROPORTIONAL TABLE.

| ' | $\begin{gathered} \text { S. } \\ 4 \cdot 60 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 4.70 \end{gathered}$ | $\begin{gathered} \mathrm{S} . \\ 4 \cdot 80 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 4.90 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 5^{\circ} 00 \end{gathered}$ | $\begin{gathered} \text { S. } \\ 5 \cdot \mathrm{IO} \end{gathered}$ | $\begin{gathered} s . \\ 5 \cdot 20 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 5 \cdot 30 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 5 \cdot 40 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 5 \cdot 50 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 5 \cdot 60 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 5 \cdot 70 \end{gathered}$ | $\begin{gathered} \text { s. } \\ 5 \cdot 80 \end{gathered}$ | $\begin{gathered} \text { S. } \\ 5 \cdot 90 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 6 \cdot 00 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | $9 \cdot 2$ | $9 \times 4$ | $9 \cdot 6$ | 9.8 | $10 \cdot 0$ | 10.2 | 10.4 | 10.6 | 10.8 | I 1.0 | 2 | II'4 | II. 6 | II.8 | 12.0 |
| 3 | 13.8 | 14.1 | 14.4 | 14.7 | 15.0 | $15 \cdot 3$ | $15 \cdot 6$ | 15.9 | 16.2 | I6. 5 | 16.8 | $17 \cdot 1$ | 17.4 | $17 \times 7$ | $18 \cdot 0$ |
| 4 | 18.4 | 18.8 | 19.2 | 19.6 | $20^{\circ}$ | $20 \cdot 4$ | $20 \cdot 8$ | $2 \mathrm{I} \cdot 2$ | 21.6 | $22 \cdot 0$ | 22.4 | 22.8 | $23 \cdot 2$ | $23 \cdot 6$ | $24^{\circ} \mathrm{O}$ |
| 5 | $23 \cdot 0$ | 23.5 | $24^{\circ}$ | 24.5 | 25.0 | $25 \cdot 5$ | $26 \cdot 0$ | $26 \cdot 5$ | $27 \cdot 0$ | $27 \cdot 5$ | $28 \cdot 0$ | $28 \cdot 5$ | $29^{\circ} \mathrm{O}$ | $29 \cdot 5$ | $30^{\circ} 0$ |
| 6 | $27 \cdot 6$ | 28.2 | $28 \cdot 8$ | $29^{\circ} 4$ | 30.0 | $30 \cdot 6$ | 31.2 | 3I•8 | 32.4 | $33^{\circ} \mathrm{O}$ | $33 \cdot 6$ | 34² | $34 \cdot 8$ | $35^{\circ} 4$ | $36 \cdot 0$ |
| 7 | 32.2 | $32 \cdot 9$ | -33.6 | 34.3 | $35^{\circ} 0$ | $35 \cdot 7$ | $36 \cdot 4$ | $37 \cdot \tau$ | $37 \cdot 8$ | $38 \cdot 5$ | $39 \cdot 2$ | 39.9 | $40 \cdot 6$ | $4 \mathrm{I} \cdot 3$ | $42 \cdot 0$ |
| 8 | $36 \cdot 8$ | $37 \cdot 6$ | $38 \cdot 4$ | $39^{\circ} 2$ | $40^{\circ} 0$ | $40 \cdot 8$ | $4 \mathrm{I} \cdot 6$ | $42 \cdot 4$ | $43 \cdot 2$ | $44^{\circ} \mathrm{O}$ | $44 \cdot 8$ | $45 \cdot 6$ | $46 \cdot 4$ | $47 \cdot 2$ | $48 \cdot 0$ |
| 9 | 41.4 | $42 \cdot 3$ | $43^{\circ} 2$ | $44^{\circ} \mathrm{I}$ | $45^{\circ} \mathrm{O}$ | 45.9 | $46 \cdot 8$ | $47 \cdot 7$ | $48 \cdot 6$ | $49 \cdot 5$ | $50 \cdot 4$ | $51 \cdot 3$ | $52 \cdot 2$ | $53 \cdot 1$ | $54^{\circ} \mathrm{O}$ |
| ro | $46 \cdot 0$ | $47^{\circ} 0$ | $48 \cdot 0$ | $49^{\circ}$ | $50^{\circ} 0$ | $5 \mathrm{I} \cdot 0$ | $52 \cdot 0$ | $53 \cdot 0$ | 54.0 | $55^{\circ} \mathrm{O}$ | $56 \cdot 0$ | $57 \cdot 0$ | $58 \cdot 0$ | 59.0 | $60 \cdot 0$ |
| 11 | $50 \cdot 6$ | $5{ }^{1} 7$ | $52 \cdot 8$ | 53.9 | $55^{\circ} 0$ | $56 \cdot 1$ | $57 \cdot 2$ | 58.3 | 59.4 | $60 \cdot 5$ | 6I•6 | $62 \cdot 7$ | $63 \cdot 8$ | 64.9 | $66 \cdot 0$ |
| 12 | $55 \cdot 2$ | $56 \cdot 4$ | $57 \cdot 6$ | 58.8 | $60 \cdot 0$ | $6 \mathrm{I} \cdot 2$ | 62.4 | $63 \cdot 6$ | $64 \cdot 8$ | $66 \cdot 0$ | $67 \cdot 2$ | $68 \cdot 4$ | $69 \cdot 6$ | $70 \cdot 8$ | $72 \cdot 0$ |
| I3 | $59 \cdot 8$ | $6 \mathrm{I} \cdot \mathrm{I}$ | 62.4 | 63.7 | $65^{\circ}$ | $66 \cdot 3$ | $67 \cdot 6$ | $68 \cdot 9$ | $70 \cdot 2$ | $7 \mathrm{~F} \cdot 5$ | $72 \cdot 8$ | $74 \cdot 1$ | 75.4 | $76 \cdot 7$ | $78 \cdot 0$ |
| 14 | 64.4 | $65 \cdot 8$ | $67 \cdot 2$ | $68 \cdot 6$ | $70 \cdot 0$ | $71 \cdot 4$ | $72 \cdot 8$ | $74 \cdot 2$ | $75 \cdot 6$ | $77 \cdot 0$ | 78.4 | $79 \cdot 8$ | $81 \cdot 2$ | $82 \cdot 6$ | $84{ }^{\circ}$ |
| 15 | $69 \cdot 0$ | $70 \cdot 5$ | $72 \cdot 0$ | $73 \cdot 5$ | $75^{\circ}$ | $76 \cdot 5$ | $78 \cdot 0$ | 79.5 | $8 \mathrm{I} \cdot 0$ | 82.5 | $84^{\circ} 0$ | 85.5 | $87 * 0$ | $88 \cdot 5$ | $90 \cdot 0$ |
| 16 | 73.6 | $75^{\circ} 2$ | 76.8 | 784 | $80 \cdot 0$ | $8 \mathrm{x} \cdot 6$ | 83.2 | $84 \cdot 8$ | 86.4 | $88 \cdot 0$ | $89 \cdot 6$ | $91^{\circ} 2$ | $92 \cdot 8$ | $94^{\circ} 4$ | $96 \cdot 0$ |
| 17 | $78 \cdot 2$ | 79.9 | $8 \mathrm{I} \cdot 6$ | 83.3 | $85 \cdot 0$ | $86 \cdot 7$ | $88 \cdot 4$ | 90•1 | 91.8 | 93.5 | $95 \cdot 2$ | $96 \cdot 9$ | $98 \cdot 6$ | 100.3 | $102{ }^{\circ}$ |
| 18 | $82 \cdot 8$ | 84.6 | 86.4 | $88 \cdot 2$ | $90^{\circ} 0$ | $9 \mathrm{r} \cdot 8$ | $93 \cdot 6$ | $95 \cdot 4$ | $97 \cdot 2$ | 99.0 | $100 \cdot 8$ | 102.6 | 104.4 | $106 \cdot 2$ | 108.0 |
| 19 | 87.4 | $89 \cdot 3$ | $91 \cdot 2$ | $93^{\cdot 1}$ | $95^{\circ}$ | $96 \cdot 9$ | $98 \cdot 8$ | $100 \cdot 7$ | 102.6 | 104.5 | $106 \cdot 4$ | 108.3 | $110 \cdot 2$ | II2.I | 114.0 |
| 20 | 92.0 | $94^{\circ} \mathrm{O}$ | 96.0 | $98 \cdot 0$ | $100 \cdot 0$ | 102.0 | $104{ }^{\circ}$ | 106.0 | 108.0 | IIO.O | II $22^{\circ}$ | $114{ }^{\circ} \mathrm{O}$ | 116.0 | 1188.0 | $120^{\circ} 0$ |
| 21 | $96 \cdot 6$ | $98 \cdot 7$ | $100 \cdot 8$ | 102.9 | 105*0 | 107•1 | 109:2 | III*3 | II3.4 | II5.5 | 117.6 | 119*7 | 121.8 | 123.9 | 126.0 |
| 22 | 101.2 | 103.4 | $105 \cdot 6$ | 107.8 | 1100 | 112.2 | 114.4 | $116 \cdot 6$ | 118.8 | 121.0 | 123.2 | 125.4 | 127.6 | 129.8 | 132.0 |
| 23 | 105.8 | 108.I | 110.4 | 112.7 | II5 0 | 117.3 | 119.6 | 121.9 | 124.2 | 126.5 | 128.8 | 131.1 | 133.4 | 135*7 | I $38 \cdot 0$ |
| 24 | 110.4 | 112.8 | 115.2 | 117.6 | $120{ }^{\circ}$ | 122.4 | 124.8 | $127 \cdot 2$ | 129.6 | 132.0 | 134.4 | $136 \cdot 8$ | 139.2 | 141.6 | $144{ }^{\circ} \mathrm{O}$ |
| 25 | $115{ }^{\circ}$ | 117.5 | 120.0 | 122.5 | $125^{\circ}$ | 127.5 | 130.0 | 132.5 | 135.0 | 137.5 | 140.0 | 142.5 | I $45^{\circ} \mathrm{O}$ | 147.5 | 150.0 |
| 26 | 119.6 | 122.2 | 124.8 | $127 \cdot 4$ | 130.0 | 132.6 | 135.2 | 137.8 | $140 \cdot$ | $143{ }^{\circ} 0$ | 145.6 | 148.2 | $150 \cdot 8$ | 153.4 | $156 \cdot 0$ |
| 27 | 124.2 | 126.9 | 129.6 | $132 \cdot 3$ | $135^{\circ}$ | $137 \cdot 7$ | $140 \cdot 4$ | I43.I | 145.8 | 148.5 | I5I. 2 | 153.9 | $156 \cdot 6$ | 159.3 | 162.0 |
| 28 | 128.8 | 131.6 | 134.4 | $137 \cdot 2$ | $140{ }^{\circ}$ | I42.8 | $145 \cdot 6$ | $148 \cdot 4$ | $15 \mathrm{I} \cdot 2$ | $154{ }^{\circ}$ | I 56.8 | 159.6 | 162.4 | $165 \cdot 2$ | 168.0 |
| 29 | 133.4 | $136 \cdot 3$ | I $39^{\circ} 2$ | $142 \cdot 1$ | $145{ }^{\circ}$ | 147.9 | $150 \cdot 8$ | I53.7 | 156.6 | 159.5 | 162.4 | 165.3 | 168.2 | 17101 | $174{ }^{\circ}$ |
| 30 | $138 \cdot 0$ | 1410 | I44*O | 147.0 | 150.0 | 153.0 | $156 \cdot 0$ | 159.0 | 162.0 | $165{ }^{\circ}$ | 168.0 | 171.0 | 174.0 | $177 \cdot 0$ | 180.0 |
| 31 | 142.6 | 145*7 | $148 \cdot 8$ | 151.9 | $155{ }^{\circ} 0$ | 158.1 | 161.2 |  | 167.4 | $170 \cdot 5$ | 173.6 | 1\%6*7 | 179.8 | 182.9 | $186 \cdot 0$ |
| 32 | 147.2 | 150.4 | 153.6 | I56.8 | 160.0 | 163.2 | $166 \cdot 4$ | 169.6 | 172.8 | $176 \cdot 0$ | 179.2 | 182.4 | 185.6 | 188.8 | 192.0 |
| 33 | 151.8 | 155*'I | 158.4 | 161.7 | $165{ }^{\circ}$ | $168 \cdot 3$ | 171.6 | 174.9 | 178.2 | 181.5 | I 84.8 | 188.1 | 19 I 4 | 194.7 | 198.0 |
| 34 | 156.4 | 159.8 | 163.2 | $166 \cdot 6$ | 17000 | 173.4 | $176 \cdot 8$ | 180.2 | 183.6 | 187.0 | 190.4 | 193.8 | $197 \cdot 2$ | $200 \cdot 6$ | 204*0 |
| 35 | 161.0 | 164.5 | 168.0 | 171.5 | $175{ }^{\circ}$ | 1788.5 | 182.0 | 185.5 | $189{ }^{\circ}$ | 192.5 | 196.0 | 199.5 | 203.0 | $206 \cdot 5$ | $210 \cdot 0$ |
| 36 | 165.6 | 169.2 | 172.8 | 176.4 | $180 \cdot 0$ |  | 187.2 | 190.8 | 194.4 | 198.0 | 201.6 | 205.2 | $208 \cdot 8$ | 212.4 | $216 \cdot 0$ |
| 37 | $170 \cdot 2$ | 173.9 | 177.6 | I8I.3 | $185^{\circ}$ | $188 \cdot 7$ | 192.4 | 196.I | 199.8 | $203 \cdot 5$ | 207.2 | $210 \cdot 9$ | 214.6 | $218 \cdot 3$ | 222.0 |
| 38 | 174.8 | 178.6 | 182.4 | $186 \cdot 2$ | $190{ }^{\circ}$ | 193.8 | 197.6 | 201.4 | 205.2 | 209*0 | 212.8 | 216.6 | $220 \cdot 4$ | $224^{\circ} 2$ | $228 \cdot 0$ |
| 39 | 179.4 | 183.3 | $187 \cdot 2$ | 191'1 | $195{ }^{\circ}$ | 198.9 | $202 \cdot 8$ | 206.7 | 210.6 | 214.5 | $218 \cdot 4$ | 222.3 | 226.2 | $230^{\prime} 1$ | $234{ }^{\circ}$ |
| 40 | 184.0 | 188.0 | 1920 | 196.0 | 200\% | 204.0 | 208.0 | $2120^{\circ}$ | 216.0 | $220 \cdot 0$ | $224^{\circ} \mathrm{O}$ | 228.0 | $232 \cdot 0$ | $236 \cdot 0$ | $240^{\circ} 0$ |
| 41 | 188.6 | 192.7 | 196.8 | $200 \cdot 9$ | $205 \cdot 0$ | 209*1 | 213.2 | 217.3 | 221.4 | 225.5 | 229.6 | $233 \cdot 7$ | $237 \cdot 8$ | 241.9 | $246 \cdot 0$ |
| 42 | 193.2 | $197 \cdot 4$ | $201 \cdot 6$ | $205 \cdot 8$ | 210.0 | 214.2 | 218.4 | 222.6 | $226 \cdot 8$ | $231^{\circ} 0$ | $235 \cdot 2$ | $239 \cdot 4$ | $243 \cdot 6$ | $247 \cdot 8$ | $252 \cdot 0$ |
| 43 | $197 \cdot 8$ | 202.I | $206 \cdot 4$ | $210 \cdot 7$ | $215{ }^{\circ}$ | 219.3 | $223 \cdot 6$ | 227.9 | $232 \cdot 2$ | $236 \cdot 5$ | $240 \cdot 8$ | 245*I | $249 \cdot 4$ | 253.7 | $258 \cdot 0$ |
| 44 | $202 \cdot 4$ | $206 \cdot 8$ | 211.2 | 215.6 | $220^{\circ} 0$ | 224.4 | 228.8 | 233.2 | $237 \cdot 6$ | $242 \cdot 0$ | $246 \cdot 4$ | $250 \cdot 8$ | $255 \cdot 2$ | $259 \cdot 6$ | $264{ }^{\circ}$ |
| 45 | 207*0 | 2 II.5 | $216 \cdot 0$ | $220 \cdot 5$ | $225^{\circ} \mathrm{O}$ | 229.5 | $234{ }^{\circ}$ | $238 \cdot 5$ | $243 \cdot 0$ | $247 \cdot 5$ | $252^{\circ} \mathrm{O}$ | $256 \cdot 5$ | 261*O | $265 \cdot 5$ | $270 \cdot 0$ |
| 46 | 2II.6 | $216 \cdot 2$ | 220•8 | 225.4 | 230.0 | $234 \cdot 6$ | $239 \cdot 2$ | $243 \cdot 8$ | $248 \cdot 4$ | $253{ }^{\circ} 0$ | 257.6 | $262 \cdot 2$ | $266 \cdot 8$ | 271.4 | $276 \cdot 0$ |
| 47 | $216 \cdot 2$ | $220 \cdot 9$ | $225 \cdot 6$ | $230 \cdot 3$ | $235^{\circ} 0$ | 239.7 | 244.4 | $249 \cdot 1$ | 253.8 | $258 \cdot 5$ | 263.2 | $267 \cdot 9$ | $272 \cdot 6$ | $277 \cdot 3$ | $282 \cdot 0$ |
| 48 | 220.8 | $225 \cdot 6$ | $230 \cdot 4$ | $235 \cdot 2$ | $24^{\circ} \mathrm{O}$ | $244 \cdot 8$ | $249 \cdot 6$ | 254.4 | 259.2 | $264^{\circ} \mathrm{O}$ | $268 \cdot 8$ | 273.6 | $278 \cdot 4$ | 283.2 | $288 \cdot 0$ |
| 49 | 225.4 | $230 \cdot 3$ | $235{ }^{\circ} 2$ | $240^{\circ} \mathrm{I}$ | $245^{\circ} 0$ | 249.9 | $254 \cdot 8$ | $259 \times 7$ | 264.6 | $269 \cdot 5$ | 274.4 | 279.3 | 284.2 | $289 \cdot 1$ | $294^{\circ}$ |
| 50 | $230 \cdot 0$ | $235{ }^{\circ}$ | $240 \cdot 0$ | $245{ }^{\circ} \mathrm{O}$ | $250{ }^{\circ}$ | $255^{\circ} \mathrm{O}$ | $260 \cdot 0$ | 265.0 | $270 \cdot 0$ | $275{ }^{\circ}$ | $280 \cdot 0$ | $285{ }^{\circ}$ | $290 \cdot 0$ | $295{ }^{\circ}$ | $300 \cdot 0$ |
| 51 | $234 \cdot 6$ | 239*7 | $244 \cdot 8$ | $249 * 9$ | $255{ }^{\circ} 0$ | 260.1 | $265 \cdot 2$ | $270 \cdot 3$ | 275.4 | $280 \cdot 5$ | $285 \cdot 6$ | 290.7 | 295.8 | 300.9 | $306 \cdot 0$ |
| 52 | $239 \cdot 2$ | 244.4 | $249 \cdot 6$ | $254 \cdot 8$ | 260.0 | $265 \cdot 2$ | $270 \cdot 4$ | $275 \cdot 6$ | $280 \cdot 8$ | $286 \cdot 0$ | $29 \mathrm{I} \cdot 2$ | $296 \cdot 4$ | 301.6 | $306 \cdot 8$ | 312.0 |
| 53 | $243 \cdot 8$ | 249.1 | 254.4 | 259.7 | $265 \cdot 0$ | $270 \cdot 3$ | $275 \cdot 6$ | $280 \cdot 9$ | $286 \cdot 2$ | 291.5 | $296 \cdot 8$ | $302 \cdot 1$ | 307.4 | $312 \cdot 7$ | 318.0 |
| 54 | $248 \cdot 4$ | $253 \cdot 8$ 258.5 | 259.2 | 264.6 | $270 \cdot 0$ | $275 \cdot 4$ | $280 \cdot 8$ | $286 \cdot 2$ | 291.6 | 297.0 | 302.4 | $307 \cdot 8$ | 313.2 | 318.6 | $324{ }^{\circ}$ |
| 55 | 253.0 | $258 \cdot 5$ | $264{ }^{\circ}$ | $269 \cdot 5$ | $275{ }^{\circ}$ | $280 \cdot 5$ | 286.0 | 291.5 | 2970 | $302 \cdot 5$ | 308.0 | 313.5 | $319{ }^{\circ}$ | 324.5 | $330 \cdot 0$ |
| 56 | $257 \cdot 6$ | $263 \cdot 2$ | 268.8 | 274.4 | $280 \cdot 0$ | $285 \cdot 6$ | $291 \cdot 2$ | 296.8 | 302.4 | $308 \cdot 0$ | 313.6 | 319:2 | 324.8 | $330 \cdot 4$ | $336 \cdot 0$ |
| 57 | $262 \cdot 2$ | 267.9 | $273 \cdot 6$ | 279.3 | $285^{\circ} 0$ | 290.7 | $296 \cdot 4$ | $302 \cdot 1$ | $307 \cdot 8$ | 313.5 | 319.2 | 324.9 | $330 \cdot 6$ | $336 \cdot 3$ | $342 \cdot 0$ |
| 58 | 266.8 | $272 \cdot 6$ | 278.4 | 284.2 | $290 \cdot 0$ | $295 \cdot 8$ | $301 \cdot 6$ | $307 \cdot 4$ | 313.2 | 319.0 | 324.8 | $330 \cdot 6$ | $336 \cdot 4$ | $342 \cdot 2$ | $348 \cdot 0$ |
| 59 | 271.4 | $277 \cdot 3$ | 283.2 | 289.I | $295{ }^{\circ}$ | $300 \cdot 9$ | $306 \cdot 8$ | $3 \mathrm{I} 2 \cdot 7$ | 318.6 | 324.5 | $330 \cdot 4$ | $336 \cdot 3$ | $342 \cdot 2$ | $348 \cdot 1$ | $354{ }^{\circ}$ |
| 60 | $276 \cdot 0$ | 282.0 | 288.0 | 294.0 | 300.0 | $306 \cdot 0$ | 312.0 | $318 \cdot 0$ | 324.0 | $33^{\circ} 0$ | $33^{\circ} \mathrm{O}$ | $342 \cdot 0$ | $348 \cdot 0$ | $354{ }^{\circ}$ | $360 \cdot 0$ |

SEXAGESIMAL PROPORTIONAL TABLE.

| ' | \%. c . | s. | 5. 6.3 | $\begin{gathered} \mathrm{s} . \\ 6 \cdot{ }_{0} \end{gathered}$ | ¢ 6.50 | 5.6. | S. ${ }_{\text {S }}$ | S.8. | $\begin{aligned} & \mathrm{s} . \\ & 6 \cdot 9 \mathrm{o} \end{aligned}$ | $\begin{gathered} \text { s. } \end{gathered}$ | $\underset{\substack{\mathrm{s} \\ \hline \text { s.io }}}{ }$ | $\begin{gathered} \text { f. } \\ 7 \cdot 20 \end{gathered}$ | $\begin{gathered} \mathrm{s} . \\ 7 \cdot 30 \end{gathered}$ | $\begin{array}{r} \mathrm{s} .40 \end{array}$ | 7.50 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 |  |  |  | 12.8 | 13.0 |  |  | 13.6 | 13.8 | $14^{\circ}$ | 14.2 | 14.4 |  | 8 |  |
| 3 | 18.3 |  |  | 19.2 | 19.5 |  |  | 20.4 |  |  | 21.3 |  | 21 |  | 22.5 |
|  | 24.4 | 24.8 | 25.2 | ${ }_{32} 2{ }^{2}$ | $32 \cdot 5$ | ${ }^{26}{ }^{\circ} 4$ | 26.8 | $3{ }^{27.2}$ | 37.5 | $3{ }^{28.0}$ | ${ }_{35}^{28.5}$ | 28.8 | 29.2 36.5 | $3{ }^{29 .}$ |  |
|  | 30.5 | 3 F \% | 3 T 5 | $32^{\circ}$ | $32 \cdot 5$ | 33.0 | $33 \cdot 5$ | $34^{\circ} \mathrm{O}$ | $34 \cdot 5$ | $35^{\circ}$ | $35 \cdot 5$ | $36^{\circ}$ | 36.5 | $37^{\circ}$ |  |
| 6 | $36 \cdot 6$ | 37.2 | 37.8 | $38 \cdot 4$ | $39^{\circ}$ | 39.6 | $40^{\circ} 2$ | 40.8 | $4{ }^{1} 4$ | 42.0 | $42 \cdot 6$ | 43.2 | $43 \cdot 8$ |  | $45^{\circ}$ |
| 7 |  |  |  |  |  |  |  |  |  | 帾. | 49.7 |  |  |  |  |
|  |  | 55.8 | $56 \cdot 7$ |  | 50.5 |  | $60 \cdot 3$ | 54.4 | 52. | $6{ }^{\circ}{ }^{\circ}$ | 63.9 | 54.8 | $5{ }^{58.4}$ | 59.2 66.6 | $67 \cdot 5$ |
| \% | 6 | 62.0 | 63.0 | 64 | $65^{\circ}$ | 66. | 67.0 | 68.0 | $69^{\circ}$ | $70 \cdot 0$ | 71. | 72.0 | $73^{\circ}$ | $74^{\circ}$ | 75 |
| 11 | 67 | 68.2 | $69 \cdot 3$ |  | 71.5 | $72 \cdot 6$ |  | 74.8 | 75.9 |  | 78.1 | 79.2 | , |  | $2 \cdot 5$ |
| 12 |  | 74.4 |  |  |  | 85 |  | 81 |  | $84^{\circ}$ | $85 \cdot 2$ | 86.4 | 87.6 | 8.8 |  |
| I |  | ${ }_{86.8}$ | 88.2 |  | -5 | 85.8. | 87. |  | 7 | 91.0 | 92.3 | 93 | 94.9 | 2 | 97.5 |
| 15 | 91-5 | $93^{\circ}$ | $94 \cdot 5$ | 96. | - 5 | - | 100.5 | 102.0 | 103.5 | 105. | $106 \cdot 5$ | 108.0 | 109.5 | - | 112.5 |
| 16 | 97.6 | $99 \cdot 2$ |  |  |  | ros. 6 | 107.2 | Io | 4 | $12^{\circ} \mathrm{O}$ | II3.6 | 115.2 | 8 |  | 120\%0 |
| 17 | 103 | 105.4 | $107 \cdot 1$ | 108 | $110 \cdot 5$ | 112 | 113 | 115 | 117 |  |  | 122.4 | I |  |  |
|  |  |  | 113.4 | 115 | I17.0 |  |  | 12 | 124. |  | 127 |  |  |  |  |
| 12 | ${ }_{11}^{11}$ | 111 | 12 | 12 | 123.5 | 125.4 | 127.3 134 | ${ }_{129}^{129}$ | 1318. | $1333^{\circ} \mathrm{O}$ 140.0 | 134.9 | 13 | 138.7 | 140.6 | $142 \cdot 5$ $150 \cdot 0$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 L | I28.1 | 130 | 13 | 13 |  | 138 | $140 \cdot 7$ | 142.8 |  | 1470 |  | 151.2 |  |  | 157.5 |
|  |  |  |  |  |  | I 14 |  |  |  |  |  |  |  |  |  |
| 24 | 146 | ${ }_{14}^{142}$ | ${ }_{1512}^{144}$ | ${ }_{153}^{14.6}$ | 15 | 158.4 | 15 | 163.2 | 165.6 | 168. |  | 172 |  |  |  |
| 25 | 152.5 | $155^{\circ}$ | $157 \cdot 5$ | $160^{\circ}$ | 162.5 | $165{ }^{\circ}$ | $167 \cdot 5$ | $170^{\circ}$ | 172.5 | 175 | 177.5 | 180.0 | 182.5 | 185\% | 187.5 |
|  |  | 16 | 163 | 166 | 16 | 17 | 174.2 | 176.8 |  | 182.0 | $184 \cdot 6$ | 187.2 | . 8 |  |  |
| $\begin{aligned} & 27 \\ & 08 \end{aligned}$ | 164 | ${ }^{167}$ | ${ }^{160 \cdot 1}$ | 172.8 | $175{ }^{185}$ |  |  | 183.6 |  |  |  | 194.4 | ${ }^{1977}$ |  |  |
| 29 |  |  | 18 | 185 | 188.5 |  | 19 | 197.2 | 200.1 | 20 | 205.9 | 208.8 |  |  | 2175 |
| 30 | $183^{\circ}$ | 186 | 189.0 | 192\% | $195{ }^{\circ}$ | $198 \cdot 0$ | 201 | 204.0 | 2070 | 210 | 213.0 | 216 | 219 | 222.0 | $225^{\circ}$ |
|  | 189.1 |  | 195 | 198.4 | 20 | 204.6 | $207 \cdot 7$ | 210.8 | 213.9 | 217.0 | . | 223.2 | 3 |  |  |
| 32 | 195.2 | 19 | $201 \cdot 6$ | 204.8 | $208 \cdot$ | 211 | 214.4 | $217 \cdot 6$ |  | $224{ }^{\circ}$ | $227 \cdot 2$ | 230 | $233 \cdot 6$ |  |  |
|  |  |  |  |  | 221.5 |  |  | 224.4 | 2277 234 |  |  |  |  |  |  |
| 35 | 213.5 | 217.0 | $220 \cdot 5$ | $224{ }^{\circ}$ | $227 \cdot 5$ | 231.0 | $234 \cdot 5$ | 2380 | $24 \times 5$ | $245{ }^{\circ}$ | 248.5 | 252.0 | $255 \cdot 5$ | $259{ }^{\circ}$ | 26 |
|  |  | 223 | 226.8 | 230 | 234 | 23 | $241^{2}$ | 244.8 | 248.4 | $252 \cdot$ |  |  | 262.8 |  |  |
|  | 225 | 229 | $233 \cdot 1$ | $236 \cdot 8$ | $20^{\circ} \cdot 5$ |  | 24 | 251.6 | 255.3 |  |  |  | $270 \cdot \mathrm{I}$ |  |  |
|  |  |  |  |  |  |  |  | 258.4 265.2 | $262 \cdot 2$ 269 |  |  |  |  |  |  |
| 40 | 244.0 | 248 - | $252 \%$ | $256 \cdot 0$ | 260 | 264.0 | 268.0 | 272. | 276.0 | 280 | 284.0 | 28 | 292.0 | $296 \cdot 0$ |  |
|  |  |  |  |  | 266 | $270 \cdot 6$ | $274 \cdot 7$ |  |  | $287 \cdot 0$ | 291.1 | 295.2 |  |  |  |
| 42 | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 26 | 272 | $277 \cdot 2$ | ${ }_{281}^{281}$ | $286 \cdot$ | 29 | 294.8 |  | $303 \cdot 6$ | 308. |  | 3168 |  |  |  |
| 45 | $274 \cdot 5$ | 279.0 | 283.5 | $288{ }^{\circ}$ | $292 \cdot 5$ | 297.0 | 301.5 | 306.0 | $310 \cdot 5$ | 315 | 319.5 | 324 | 328.5 | 333. | $337 \cdot 5$ |
| 46 |  | 28 |  |  | $299^{\circ}$ | 303 | 308.2 | 31 | 317.4 | 322.0 | 32 |  | $335 \cdot 8$ |  |  |
| 47 |  |  | 29 |  | $305 \cdot 5$ |  | 31 | 319 |  |  | 333. |  | - |  |  |
|  |  | 297 |  | 307 | 312.0 318.5 | 31 | 321.6 328.3 | 326.4 | 33 | 336.0 | 340.8 | 345.6 | 350.4 | . 2 |  |
| ${ }_{50}^{49}$ | 298.9 | ${ }_{310}^{303}$ | ${ }_{315}^{308}$ | 313.6 320.0 | ${ }_{325}^{318.5}$ | 323.4 330.0 | 328•3 | 333.2 340 | ${ }_{345} 35^{\circ} \mathrm{I}$ | 340 | $347^{\circ} 9$ 355 | 350.8 | 357 <br> 365 | $362 \cdot 6$ $370 \cdot 0$ |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | 327 |  | ${ }_{33}^{331}$ |  |  |  |  | $\left\|\begin{array}{c} 3570 \\ 361 \cdot 0 \end{array}\right\|$ |  |  |  | 3774 384.8 |  |
| 53 | 3 | 3 | 333 | 339 | 344 |  | 35 |  | 36 | 37 | 37 |  |  | 392.2 | $397 \cdot 5$ |
|  | 325.5 | $334{ }^{\circ} 8$ | $340 \cdot 2$ $346 \cdot 5$ | 345.6 | 351.0 357.5 | 356.4 | 361.8 368.5 | 3672 | $372 \cdot 6$ 379.5 | 378.0 385.0 | 383.4 390.5 | 388.8 396.0 | 394.2 | 307.6 | $4{ }_{4} 4$ |
| 5 | 335 | $34{ }^{\circ} \mathrm{O}$ | $34 \cdot 5$ |  | 357 |  |  | $374^{\circ}$ | 379 | ${ }^{\circ}$ | 390 | 396 | 4015 |  |  |
| 56 |  |  |  |  | 364.0 |  |  | $380 \cdot 8$ | $386 \cdot 4$ | $33^{\circ} \cdot$ |  | 40 | 408.8 | 4 | $\cdot$ |
| $\begin{aligned} & 57 \\ & 58 \end{aligned}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 59 |  | 365 | 37 |  | 383.5 | 38 | $395 \cdot 3$ | 40 | $407 \cdot 1$ | 413.0 |  | $424 \cdot 8$ | 43 |  | $442 \cdot 5$ |
| 60 | 36 | 372.0 | 378.0 | 38 | 390.0 | 39 | 402.0 | 408 | 414.0 | $420 \cdot 0$ | $426 \cdot 0$ | 432 | $43^{8}$ | $444{ }^{\circ}$ | $450^{\circ}$ |

SEXAGESIMAL PROPORTIONAL TABLE.


SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF $1^{\prime}$ IN THE ALTITUDE.

| Lat. | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $90^{\circ}$ | $89^{\circ}$ | $88^{\circ}$ | $87^{\circ}$ | $86^{\circ}$ | $85^{\circ}$ | $84^{\circ}$ | $88^{\circ}$ | $82^{\circ}$ | $81^{\circ}$ | $80^{\circ}$ | $79^{\circ}$ | $78{ }^{\circ}$ | $77^{\circ}$ | $76^{\circ}$ |
|  | s. | s. | S. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. | s. |
| o | 4.00 | $4{ }^{\circ} \mathrm{OO}$ | 4.00 | 4.01 | 4.01 | 4.02 | $4 \cdot 02$ | 4.03 | 4.04 | 4.05 | 4.06 | 4.07 | $4 \cdot 09$ | 4-10 | $4 \cdot 12$ |
| 1 | $4 \cdot 00$ | $4 \cdot 00$ | 4.00 | 4.01 | 4 -01 | 4.02 | $4 \cdot 02$ | 4.03 | $4 \cdot 04$ | 4.05 | 4.06 | $4 \cdot 08$ | 4.09 | $4 \cdot 11$ | $4 \cdot 12$ |
| 2 | $4 \cdot 00$ | $4 \cdot 00$ | $4 \cdot 00$ | $4 \cdot 01$ | $4 \cdot 01$ | $4 \cdot 02$ | 4.02 | $4 \cdot 03$ | 4.04 | 4.05 | 4.06 | 4.08 | 4.09 | $4 \cdot 11$ | $4 \cdot 12$ |
| 3 | 4 -01 | $4 \cdot 01$ | $4 \cdot 01$ | 4.01 | 4.02 | 4.02 | $4 \cdot 03$ | 4.04 | 4.04 | 4.06 | 4.07 | 4.08 | 4.09 | $4 \cdot 11$ | 4.13 |
| 4 | 4 -01 | 4.01 | $4 \cdot 01$ | 4.02 | $4 \cdot 02$ | 4.03 | $4 \cdot 03$ | $4 \cdot 04$ | $4 \cdot 05$ | $4 \cdot 06$ | 4.07 | 4.08 | 4.10 | $4 \cdot 12$ | $4 \cdot 13$ |
| 5 | $4 \cdot 01$ | 4.02 | $4 \cdot 02$ | 4.02 | $4 \cdot 03$ | $4 \cdot 03$ | $4 \cdot 04$ | $4 \cdot 05$ | $4 \cdot 05$ | 4.07 | 4.08 | 4.09 | $4 \cdot 10$ | 4.12 | $4^{\cdot 14}$ |
| 6 | 4.02 | $4 \cdot 02$ | $4 \cdot 02$ | 4.03 | $4 \cdot 03$ | $4 \cdot 04$ | 4.04 | 4.05 | 4.06 | 4.07 | 4.08 | 4.10 | $4 \cdot 11$ | 4.13 | 4.15 |
| 7 | $4^{\circ} 03$ | 4.03 | 4.03 | 4.04 | $4 \cdot 04$ | 4.05 | 4.05 | 4.06 | 4.07 | 4.08 | 4.09 | 4.11 | 4.12 | $4 \cdot 14$ | $4 \cdot 15$ |
| 8 | 4.04 | 4.04 | $4 \cdot 04$ | 4.04 | 4.05 | 4.05 | 4.06 | 4.07 | 4.08 | 409 | 410 | 4 II | 413 | 415 | $4 \cdot 16$ |
| 9 | 4.05 | 4.05 | 4.05 | 4.06 | 4.06 | 4.07 | 4.07 | 4.08 | 4.09 | 4.10 | 4.11 | 4.13 | 4.14 | $4 \cdot 16$ | 4•17 |
| ro | 4.06 | 4.06 | $4 \cdot 06$ | 4.07 | $4 \cdot 07$ | $4 \cdot 08$ | 4.08 | 4.09 | 4.10 | $4 \cdot 11$ | $4 \cdot 12$ | 4.14 | 4.15 | $4 \cdot 17$ | 4•19 |
| II | 4.07 | $4 \cdot 08$ | $4 \cdot 08$ | 4.08 | 4.08 | 4.09 | 4.10 | $4 \cdot 11$ | 4.11 | 4.13 | 4.14 | 4.15 4.17 | 4.17 4.18 | 4.18 4.20 | 4.20 4.21 |
| 12 | 4.09 | $4 \cdot 09$ | $4 \cdot 09$ | 4.09 | 4.10 | 4.10 | 4.11 | 4.12 | 4.13 | 4.14 | 4.15 | 4.17 | 4-18 | 4.20 | 4.21 |
| 13 | 4•10 | $4 \cdot 11$ | 4.11 | 4.11 | $4 \cdot 12$ | 4.12 | 4.13 | 4.14 | $4 \cdot 15$ | 4.16 | 4.17 | 4.18 | 4.20 | 4.21 | 4.23 |
| 14 | $4 \cdot 12$ | 4.12 | $4 \cdot 12$ | 4.13 | $4 \cdot 13$ | $4 \cdot 14$ | $4 \cdot 15$ | 4.15 | $4 \cdot 16$ | 4.17 | 4.19 | 4.20 | $4 \cdot 2$ | 4.23 | 4.25 |
| 15 | 4.14 | $4 \cdot 14$ | $4 \cdot 14$ | 4.15 | 4.15 | 4.16 | $4 \cdot 16$ | 4.17 | $4 \cdot 18$ | 4.19 | $4 \cdot 20$ | 4.22 | $4 \cdot 23$ | 4.25 | $4 \cdot 27$ |
| 16 | 4.16 | $4 \cdot 16$ | 4.16 | 4.17 | $4 \cdot 17$ | 4•18 | 4•18 | 4-19 | $4 \cdot 20$ | 4.21 | 4.23 | 4.24 | 4.25 | 4.27 | 4.29 |
| 17 | 4•18 | 4.18 | 4.19 | 4.19 | 4.19 | 4.20 | 4.21 | 4.21 | 4.22 | $4 \cdot 23$ | 4.25 | $4 \cdot 26$ | $4 \cdot 28$ | 4.29 | $4 \cdot 31$ |
| 18 | $4 \cdot 21$ | 4.21 | $4 \cdot 21$ | $4 \cdot 21$ | 4.22 | 4.22 | 4.23 | 4.24 | 4.25 | $4 \cdot 26$ | 4.27 | $4 \cdot 28$ | $4 \cdot 30$ | $4 \cdot 32$ | 4.33 |
| 19 | 4.23 | 4.23 | 4.23 | 4.24 | 4.24 | 4.25 | 4.25 | $4 \cdot 26$ | 4.27 | 4.28 | $4 \cdot 30$ | $4 \cdot 31$ | 4.32 | 4.34 | 4.36 |
| 20 | 4.26 | 4.26 | $4 \cdot 26$ | 4.26 | 4.27 | 4.27 | $4 \cdot 28$ | 4.29 | $4 \cdot 30$ | $43^{1}$ | $4 \cdot 32$ | $4 \cdot 34$ | $4 \cdot 35$ | $4 \cdot 37$ | $4 \cdot 39$ |
| 21 | 4.28 | 4.29 | 4.29 | 4.29 | 4.30 | 4.30 | $4 \cdot 37$ | $4 \cdot 32$ | 4.33 | 4.34 | $4 \cdot 35$ | $4 \cdot 36$ | $4 \cdot 38$ | $4 \cdot 40$ | 4.42 |
| 22 | 4.31 | $4 \cdot 3 \mathrm{I}$ | $4 \cdot 32$ | $4 \cdot 32$ | $4 \cdot 32$ | 4.33 | $4 \cdot 34$ | $4 \cdot 35$ | 4.36 | 4.37 | $4 \cdot 38$ | $4 \cdot 39$ | 4.41 | $4 \cdot 43$ | 4.45 |
| 23 | $4 \cdot 34$ | 4.35 | $4 \cdot 35$ | 4.35 | 4.36 | 4.36 | 4.37 | $4 \cdot 38$ | 4.39 | 4.40 | 4.41 | 4.43 | 4.44 | $4 \cdot 46$ | 4.48 |
| 24 | $4 \cdot 38$ | 4.38 | 4.38 | 4.38 | 4.39 | 4.40 | 4.40 | $4 \cdot 41$ | 4.42 | 4.43 | 4.45 | 4.46 | 4.48 | 4.49 | 4.51 |
| 25 | 4.41 | $4 \cdot 41$ | $4 \cdot 42$ | $44^{42}$ | 4.42 | $4 \cdot 43$ | $4 \cdot 44$ | $4 \cdot 45$ | $4 \cdot 46$ | 4.47 | $4 \cdot 48$ | $4 \cdot 50$ | 4.51 | 4.53 | $4 \cdot 55$ |
| 26 | 4.45 | 4.45 | 4.45 | 4.46 | 4.46 | 4.47 | $4 \cdot 47$ | $4 \cdot 48$ | 4.49 | 4.51 | 4.52 | 4.53 | 4.55 | 4.57 | 4.59 |
| 27 | $4 \cdot 49$ | $4 \cdot 49$ | 4.49 | $4 \cdot 49$ | 4.50 | 4.51 | $4 \cdot 5 \mathrm{I}$ | $4 \cdot 52$ | 4.53 | 4.55 | $4 \cdot 56$ | $4 \cdot 57$ | 4.59 | $4 \cdot 61$ | 4.63 |
| 28 | 4.53 | $4 \cdot 53$ | $4 \cdot 53$ | $4 \cdot 54$ | $4 \cdot 54$ | $4 \cdot 55$ | 4.55 | 4.56 | 4.57 | 4.59 | $4 \cdot 60$ | 4.62 | 4.63 | $4 \cdot 65$ | 4.67 |
| 29 | 4.57 | 4.57 | 4.58 | 4.58 | 4.58 | 4.59 | $4 \cdot 60$ | $4 \cdot 61$ | 4.62 | 4.63 | $4 \cdot 64$ | $4 \cdot 66$ | 4.68 | $4 \cdot 69$ | $4 \cdot 71$ |
| 30 | $4 \cdot 62$ | $4 \cdot 62$ | $4 \cdot 62$ | $4 \cdot 63$ | 4.63 | $4 \cdot 64$ | $4 \cdot 64$ | $4 \cdot 65$ | $4 \cdot 66$ | $4 \cdot 68$ | $4 \cdot 69$ | 4.71 | $4 \cdot 72$ | $4 \cdot 74$ | $4 \cdot 76$ |
| 3 I | 4.67 | $4 \cdot 67$ | $4 \cdot 67$ | $4 \cdot 67$ | 4.68 | $4 \cdot 68$ | $4 \cdot 69$ | $4 \cdot 70$ | $4 \cdot 71$ | $4 \cdot 72$ | 4.74 | $4 \cdot 75$ | 4.77 | 4.79 | $4 \cdot 81$ |
| 32 | 4.72 | $4 \cdot 72$ | 4.72 | $4 \cdot 72$ | $4 \cdot 73$ | 4.73 | $4 \cdot 74$ | 4.75 | 4.76 | 4.78 | 4.79 | 4.80 | 4.82 | $4 \cdot 84$ | $4 \cdot 86$ |
| 33 | $4 \cdot 77$ | 4.77 | 4.77 | 4.78 | $4 \cdot 78$ | $4 \cdot 79$ | $4 \cdot 80$ | 4.81 | 4.82 | 4.83 | $4 \cdot 84$ | 4.86 | $4 \cdot 88$ | $4 \cdot 89$ | $4 \cdot 92$ |
| 34 | 4.82 | $4 \cdot 82$ | 4.83 | 4.83 | $4 \cdot 84$ | $4 \cdot 84$ | $4 \cdot 85$ | 4.86 | 4.87 | 4.89 | 4.90 | 4.92 | 4.93 | 4.95 | $4 \cdot 97$ |
| 35 | $4 \cdot 88$ | $4 \cdot 88$ | $4 \cdot 89$ | $4 \cdot 89$ | 4.90 | 4.90 | 4.91 | $4 \cdot 92$ | 4.93 | $4 \cdot 94$ | $4 \cdot 96$ | 4.97 | $4 \cdot 99$ | 5.0x | 5.03 |
| 36 | $4 \cdot 94$ | 4.95 | 4.95 | 4.95 | 4.96 | $4 \cdot 96$ | 4.97 | $4 \cdot 98$ | 4.99 | $5 \cdot 01$ | $5 \cdot 02$ | $5 \cdot 04$ | $5 \cdot 05$ | $5 \cdot 07$ | 5.10 |
| 37 | 5.01 | $5 \cdot 01$ | $5 \cdot \mathrm{OI}$ | $5 \cdot 02$ | $5 \cdot 02$ | $5 \cdot 03$ | 5.04 | 5.05 | 5.06 | $5 \cdot 07$ | 5.09 | $5 \cdot 10$ | $5 \cdot 12$ | $5 \cdot 14$ | $5 \cdot 16$ |
| 38 | 5.08 | $5 \cdot 08$ | $5 \cdot 08$ | $5 \cdot 08$ | $5 \cdot 09$ | $5 \cdot 10$ | $5 \cdot 10$ | $5 \cdot 11$ | $5 \cdot 13$ | $5 \cdot 14$ | $5 \cdot 15$ | $5 \cdot 17$ | 5.19 | 5.21 | $5 \cdot 23$ |
| 39 | 5.15 | $5 \cdot 15$ | $5 \cdot 15$ | $5 \cdot 15$ | 5.16 | 5.17 | 5•18 | 5.18 | $5 \cdot 20$ | $5 \cdot 21$ | 5.23 | $5 \cdot 24$ | $5 \cdot 26$ | $5 \cdot 28$ | $5 \cdot 30$ |
| 40 | 5.22 | $5 \cdot 22$ | $5 \cdot 22$ | $5 \cdot 23$ | $5 \cdot 23$ | 5•24 | $5 \cdot 25$ | $5 \cdot 26$ | $5 \cdot 27$ | $5 \cdot 29$ | $5 \cdot 30$ | $5 \cdot 32$ | $5 \cdot 34$ | $5 \cdot 36$ | $5 \cdot 38$ |
| 41 | $5 \cdot 30$ | $5 \cdot 30$ | $5 \cdot 30$ | 5.31 | $5 \cdot 31$ | $5 \cdot 32$ | $5 \cdot 33$ | $5 \cdot 34$ | $5 \cdot 35$ | $5 \cdot 37$ | $5 \cdot 38$ | $5 \cdot 40$ | 5.42 | 5.44 | $5 \cdot 46$ |
| 42 | $5 \cdot 38$ | $5 \cdot 38$ | $5 \cdot 39$ | $5 \cdot 39$ | $5 \cdot 40$ | $5 \cdot 40$ | 5.41 | $5 \cdot 42$ | $5 \cdot 44$ | $5 \cdot 45$ | $5 \cdot 47$ | $5 \cdot 48$ | $5 \cdot 50$ | $5 \cdot 52$ | 5.55 |
| 43 | 5.47 | $5 \cdot 47$ | $5 \cdot 47$ | $5 \cdot 48$ | $5 \cdot 48$ | 54.49 | $5 \cdot 50$ | 5.51 | $5 \cdot 52$ | $5 \cdot 54$ | $5 \cdot 55$ | $5 \cdot 57$ | $5 \cdot 59$ | $5 \cdot 61$ | $5 \cdot 6$ |
| 44 | $5 \cdot 56$ | $5 \cdot 56$ | $5 \cdot 56$ | $5 \cdot 57$ | 5.57 | $5 \cdot 58$ | $5 \cdot 59$ | $5 \cdot 60$ | 5.62 | 5.63 | $5 \cdot 65$ | 5.66 | $5 \cdot 68$ | $5 \cdot 71$ | $5 \cdot 73$ |
| 45 | 5.66 | $5 \cdot 66$ | $5 \cdot 66$ | $5 \cdot 66$ | 5.67 | 5.68 | $5 \cdot 69$ | 5.70 | 5•\%1 | $5 \cdot 73$ | $5 \cdot 74$ | $5 \cdot 76$ | $5 \cdot 78$ | 5.81 | 5.83 |
| 46 | $5 \cdot 76$ | $5 \cdot 76$ | $5 \cdot 76$ | 5.77 | $5 \cdot 77$ | $5 \cdot 78$ | $5 \cdot 79$ | $5 \cdot 80$ | 5.81 | 5.83 | 5.85 | 5.87 | $5 \cdot 89$ | 5.91 | 5.93 |
| 47 | 5.87 | $5 \cdot 87$ | $5 \cdot 87$ | $5 \cdot 87$ | 5.88 | $5 \cdot 89$ | 5.90 | 5.91 | $5 \cdot 92$ | $5 \cdot 94$ | $5 \cdot 96$ | 5.97 | $6 \cdot 00$ | 6.02 | $6 \cdot 04$ |
| 48 | $5 \cdot 98$ | 5.98 | 5.98 | 5.99 | 5.99 | $6 \cdot 00$ | 6.01 | 6.02 | 6.04 | $6 \cdot 05$ | $6 \cdot 07$ | $6 \cdot 09$ | $6 \cdot 11$ | $6 \cdot 14$ | $6 \cdot 16$ |
| 49 | $6 \cdot 10$ 6.22 | ${ }_{6 \cdot 10} 6$ | $6 \cdot 10$ 6.23 | $6 \cdot 11$ 6.23 | 6.11 6.24 | 6.12 6.25 | $6 \cdot 13$ 6.26 | 6.14 6.27 | $6 \cdot 16$ 6.28 | $6 \cdot 17$ $6 \cdot 30$ | $6 \cdot 19$ 6.32 | $6 \cdot 21$ 6.34 | $6 \cdot 23$ 6.36 | $6 \cdot 26$ $6 \cdot 39$ | $6 \cdot 28$ 6.41 |
| 50 | $6 \cdot 22$ | $6 \cdot 22$ | $6 \cdot 23$ | 6.23 | $6 \cdot 24$ | $6 \cdot 25$ | $6 \cdot 26$ | $6 \cdot 27$ | $6 \cdot 28$ | $6 \cdot 30$ | $6 \cdot 32$ | $6 \cdot 34$ | $6 \cdot 36$ | $6 \cdot 39$ | 6.41 |
| 51 | $6 \cdot 36$ | $6 \cdot 36$ | 6.36 | $6 \cdot 36$ | $6 \cdot 37$ | $6 \cdot 38$ | $6 \cdot 39$ | $6 \cdot 40$ | $6 \cdot 42$ | 6.44 | 6.45 | $6 \cdot 48$ | 6.50 | $6 \cdot 52$ | $6 \cdot 55$ |
| 52 | $6 \cdot 50$ | $6 \cdot 50$ | 6.50 | $6 \cdot 51$ | 6.51 | $6 \cdot 52$ | $6 \cdot 53$ | $6 \cdot 55$ | $6 \cdot 56$ | $6 \cdot 58$ | $6 \cdot 60$ | $6 \cdot 62$ | $6 \cdot 64$ | $6 \cdot 67$ | $6 \cdot 70$ |
| 53 | $6 \cdot 65$ | 6.65 | $6 \cdot 65$ | $6 \cdot 66$ | $6 \cdot 66$ | $6 \cdot 67$ | $6 \cdot 68$ | $6 \cdot 70$ | $6 \cdot 71$ | $6 \cdot 73$ | $6 \cdot 75$ | $6 \cdot 77$ | 6.80 | $6 \cdot 82$ | $6 \cdot 85$ |
| 54 | $6 \cdot 81$ | 6.8 r | $6 \cdot 8 \mathrm{I}$ | 6.81 | $6 \cdot 82$ | $6 \cdot 83$ | $6 \cdot 84$ | $6 \cdot 86$ | $6 \cdot 87$ | 6.89 | 6.91 | $6 \cdot 93$ | 6.96 | $6 \cdot 98$ | $7 \cdot 01$ |
| 55 | $6 \cdot 97$ | $6 \cdot 97$ | $6 \cdot 98$ | $6 \cdot 98$ | $6 \cdot 99$ | 7.00 | $7 \cdot 01$ | 7.03 | $7 \cdot 04$ | $7 \cdot 06$ | $7 \cdot 08$ | $7 \cdot 10$ | $7 \cdot 13$ | $7 \cdot 16$ | $7 \cdot 19$ |
| 56 | $7 \cdot 15$ | $7 \cdot 15$ | $7 \cdot 16$ | $7 \cdot 16$ | $7 \cdot 17$ | $7 \cdot 18$ | $7 \cdot 19$ | $7 \cdot 21$ | 7.22 | 7.24 | 7.26 | $7 \cdot 29$ | 7.31 | $7 \cdot 34$ | $7 \cdot 37$ |
| 57 | $7 \cdot 34$ | $7 \cdot 35$ | $7 \cdot 35$ | 7.35 | $7 \cdot 36$ | 7.37 | 7.38 | 7.40 | 7.42 | 7.44 | $7 \cdot 46$ | $7 \cdot 48$ | 7.51 | 7.54 | $7 \cdot 57$ |
| 58 | 7.55 | 7.55 | 7.55 | $7 \cdot 56$ | 7.57 | 7.58 | 7.59 | $7 \cdot 61$ | 7.62 | 7.64 | 7.66 | $7 \cdot 69$ | 7.72 | $7 \cdot 75$ | 7.78 |
| 59 60 | $7 \cdot 77$ 8.00 | $7 \cdot 77$ 8.00 | 7.77 8.00 | 7.78 8.01 | 7.79 8.02 | 7.80 8.03 | 7.81 8.04 | 7.82 8.06 | 7.84 8.08 | 7-86 | 7.89 8.12 | 7.91 8.15 | 7.94 8.18 | 7.97 8.21 | $8 \cdot 00$ 8.24 |
|  | 8.00 | $8 \cdot 00$ | $8 \cdot 00$ | $8 \cdot 01$ | 8.02 | 8.03 | 8.04 | $8 \cdot 06$ | $8 \cdot 08$ | $8 \cdot 10$ | $8 \cdot 12$ | $8 \cdot 15$ | $8 \cdot 1$ | 8.21 | 8.24 |

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF 1' IN THE ALTITUDE.

| Lat. | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $75^{\circ}$ | $74^{\circ}$ | $73^{\circ}$ | $72^{\circ}$ | $71^{\circ}$ | $70^{\circ}$ | $69^{\circ}$ | $68^{\circ}$ | ${ }^{\circ} 67^{\circ}$ | $66^{\circ}$ | $65^{\circ}$ | $64^{\circ}$ | $63^{\circ}$ | $62^{\circ}$ | $61^{\circ}$ |
|  | s. | S. | s. | s. | s. | s. | s. | s. | s. |  | s. | s. | S. | s. |  |
| 0 | 4.14 | 4.16 | 4.18 | 4.21 | 4.23 | 4.26 | $4 \cdot 28$ | 4.31 | $4 \cdot 35$ | $4 \cdot 38$ | 4.41 | 4.45 | $4 \cdot 49$ | 4.53 | 4.57 |
| I | 4.14 | 4.16 | 4.18 | 4.21 | 4.23 | 4.26 | 4.29 | $4 \cdot 31$ | $4 \cdot 35$ | $4 \cdot 38$ | 4.45 | $4 \cdot 45$ | $4 \cdot 49$ | $4 \cdot 53$ | $4 \cdot 57$ |
| 2 | 4•14 | 4•16 | 4-19 | $4 \cdot 21$ | 4.23 | 4.26 | 4.29 | $4 \cdot 32$ | $4 \cdot 35$ | $4 \cdot 38$ | $4 \cdot 42$ | 4.45 | 4.49 | $4 \cdot 53$ | $4 \cdot 58$ |
| 3 | 4.15 | 4.17 | $4 \cdot 19$ | 4.21 | 4.24 | $4 \cdot 26$ | 4.29 | $4 \cdot 32$ | $4 \cdot 35$ | $4 \cdot 38$ | $4 \cdot 42$ | 4.46 | $4 \cdot 50$ | 4.54 | 4.58 |
|  | 4.15 | $4 \cdot 17$ | $4 \cdot 19$ | 4.22 | 4.24 | 4.27 | $4 \cdot 30$ | 4.32 | $4 \cdot 36$ | $4 \cdot 39$ | $4 \cdot 42$ | 4.46 | $4 \cdot 50$ | 4.54 | 4.58 |
| 5 | 4•16 | 4.18 | $4 \cdot 20$ | $4 \cdot 22$ | $4 \cdot 25$ | 4.27 | $4 \cdot 30$ | 433 | 4.36 | $4 \cdot 40$ | $4 \cdot 43$ | $4 \cdot 47$ | $4 \cdot 51$ | $4 \cdot 55$ | $4 \cdot 59$ |
| 6 | 4•16 | 4-18 | $4 \cdot 2 \mathrm{I}$ | 4.23 | 4.25 | 4.28 | 4.31 | $4 \cdot 34$ | $4 \cdot 37$ | 4.40 | $4 \cdot 44$ | 4.47 | $4 \cdot 51$ | 4.56 | 4.60 |
| 7 | 4.17 | $4 \cdot 19$ | 4.21 | 4.24 | 4.26 | 4.29 | $4 \cdot 32$ | $4 \cdot 35$ | $4 \cdot 38$ | 4.41 | $4 \cdot 45$ | $4 \cdot 48$ | $4 \cdot 52$ | $4 \cdot 56$ | $4 \cdot 61$ |
| 8 | 4-18 | $4 \cdot 20$ | 4.22 | 4.25 | 4.27 | 4.30 | $4 \cdot 33$ | $4 \cdot 36$ | $4 \cdot 39$ | $4 \cdot 42$ | $4 \cdot 46$ | 4.49 | $4 \cdot 53$ | $4 \cdot 57$ | $4 \cdot 62$ |
| 9 | 4.19 | 4.21 | 4.23 | 4.26 | $4 \cdot 28$ | 4.31 | 4.34 | 4.37 | 4.40 | 4.43 | 4.47 | $4 \cdot 51$ | 4.55 | 4.59 | 4.63 |
| ı0 | 4.20 | 4.23 | $4 \cdot 25$ | $4 \cdot 27$ | $4 \cdot 30$ | $4 \cdot 32$ | $4 \cdot 35$ | $4 \cdot 38$ | 4.41 | $4 \cdot 45$ | $4 \cdot 48$ | $4 \cdot 52$ | $4 \cdot 56$ | $4 \cdot 60$ | $4 \cdot 64$ |
| II | $4 \cdot 2$ | 4.24 | 4. | 4.28 | 4.3 I | $4 \cdot 34$ | $4 \cdot 36$ | 4.39 | 4.43 | $4 \cdot 46$ | 4.50 | 4.53 | 4.57 | 4.62 | 4.66 |
| 12 | 4.23 | 4.25 | $4 \cdot 28$ | $4 \cdot 30$ | $4 \cdot 32$ | $4 \cdot 35$ | 4.38 | 4.41 | 4.44 | $4 \cdot 48$ | $4 \cdot 51$ | $4 \cdot 55$ | $4 \cdot 59$ | 4.63 | $4 \cdot 68$ |
| 13 | $4 \cdot 25$ | $4 \cdot 27$ | $4 \cdot 29$ | $4 \cdot 32$ | $4 \cdot 34$ | 4.37 | 4.40 | 4.43 | $4 \cdot 46$ | $4 \cdot 49$ | 4.53 | $4 \cdot 57$ | $4 \cdot 61$ | $4 \cdot 65$ | $4 \cdot 69$ |
| 14 | 4.27 | 4.29 | $4 \cdot 3$ I | $4 \cdot 33$ | $4 \cdot 36$ | 4.39 | 4.42 | 4.45 | $4 \cdot 48$ | 4.51 | 4.55 | 4.59 | $4 \cdot 63$ | $4 \cdot 67$ | 4.71 |
| 15 | $4 \cdot 29$ | $4 \cdot 3 \mathrm{I}$ | $4 \cdot 33$ | $4 \cdot 35$ | $4 \cdot 38$ | 4.41 | 4.44 | $4 \cdot 47$ | 4.50 | 4.53 | $4 \cdot 57$ | 4.6I | $4 \cdot 65$ | $4 \cdot 69$ | $4 \cdot 73$ |
| 16 | 4.31 | 4.33 | 4.35 | $4 \cdot 38$ | 4.40 | $4 \cdot 4$ | 4.46 | 4.49 | 4.5 | 4.56 | 4.59 | 4.63 | $4 \cdot 67$ | 4.71 | 4.76 |
| 17 | 4.33 | 4.35 | $4 \cdot 37$ | $4 \cdot 40$ | 4.42 | 4.45 | 4.48 | $4 \cdot 51$ | 4.54 | $4 \cdot 58$ | $4 \cdot 62$ | $4 \cdot 65$ | $4 \cdot 69$ | $4 \cdot 74$ | 4.78 |
| 18 | $4 \cdot 35$ | $4 \cdot 38$ | $4 \cdot 40$ | 4.42 | 4.45 | 4.48 | 4.51 | 4.54 | 4.57 | 4.60 | $4 \cdot 64$ | $4 \cdot 68$ | $4 \cdot 72$ | $4 \cdot 76$ | 4.81 |
| 19 | 4.38 | 4.40 | 4.42 | 4.45 | 4.47 | $4 \cdot 50$ | 4.53 | $4 \cdot 56$ | $4 \cdot 60$ | 4.63 | $4 \cdot 67$ | $4 \cdot 71$ | $4 \cdot 75$ | $4 \cdot 79$ | $4 \cdot 84$ |
| 20 | 4.41 | $4 \cdot 43$ | $4 \cdot 45$ | $4 \cdot 48$ | $4 \cdot 50$ | 4.53 | 4.56 | $4 \cdot 59$ | $4 \cdot 62$ | $4 \cdot 66$ | 4.70 | 4.74 | $4 \cdot 78$ | $4 \cdot 82$ | $4 \cdot 87$ |
| 21 | $4 \times 44$ | 4.46 | $4 \cdot 48$ | 4.51 | 4.53 | 4.56 | 4.59 | 4.62 | $4 \cdot 65$ | $4 \cdot 69$ | $4 \cdot 73$ | 4.77 | $4 \cdot 81$ | 4.85 | 4.90 |
| 22 | 4.47 | 4.49 | 4.51 | 4.54 | $4 \cdot 56$ | $4 \cdot 59$ | $4 \cdot 62$ | $4 \cdot 65$ | $4 \cdot 69$ | 4.72 | $4 \cdot 76$ | 4.80 | $4 \cdot 8$ | $4 \cdot 89$ | $4 \cdot 93$ |
| 23 | 4.50 | 4.52 | 4.54 | $4 \cdot 57$ | $4 \cdot 60$ | 4.62 | $4 \cdot 65$ | $4 \cdot 69$ | 4.72 | $4 \cdot 76$ | 4.79 | 4.83 | $4 \cdot 8$ | 4.92 | 4.97 |
| 24 | 4.53 | 4.56 | 4.58 | 4.60 | $4 \cdot 63$ | $4 \cdot 66$ | $4 \cdot 69$ | $4 \cdot 72$ | $4 \cdot 76$ | $4 \cdot 79$ | 4.83 | 4.87 | 4.91 | $4 \cdot 96$ | $5 \cdot 01$ |
| 25 | 4.57 | $4 \cdot 59$ | $4 \cdot 62$ | $4 \cdot 64$ | $4 \cdot 67$ | 4•70 | $4 \cdot 73$ | 4.76 | $4 \cdot 79$ | $4 \cdot 83$ | $4 \cdot 87$ | 4.91 | 4.95 | $5 \cdot 00$ | $5 \cdot 05$ |
| 26 | $4 \cdot 61$ | 4.63 | 4.65 | 4.68 | $4 \cdot$ | $4 \cdot 74$ | 4.77 | 4.80 | 4.83 | 4.87 | 4.91 | 4.95 | 4.99 | $5 \cdot 04$ | $5 \cdot 09$ |
| 27 | 4.65 | 4.67 | 4.69 | 4.72 | 4.75 | 4.78 | 4.81 | $4 \cdot 84$ | 4.88 | 4.91 | 4.95 | $5 \cdot 00$ | $5 \cdot 04$ | 5.08 | $5 \cdot 13$ |
| 28 | 4.69 4.73 | 4.71 4.76 | 4.74 4.78 | $4 \cdot 76$ 4.81 | 4.79 4.8 | 4.82 4.87 | 4.85 | $4 \cdot 89$ | 4.92 | $4 \cdot 96$ | $5 \cdot 00$ | 5.04 | 5.08 | 5.13 | $5 \cdot 18$ |
| 29 30 | $4 \cdot 73$ $4 \cdot 78$ | 4.76 4.80 | 4.78 | 4.8 I 4.86 | 4.84 4.88 | 4.87 | 4.90 | 4.93 4.98 | 4.97 5.02 | $5 \cdot 01$ | 5.05 | $5 \cdot 09$ $5 \cdot 14$ | $5 \cdot 13$ $5 \cdot 18$ | $5 \cdot 18$ 5.23 | 5.23 5.28 |
|  |  |  |  |  |  |  |  |  | 5 |  | 5 |  | 5 |  | 28 |
| 31 | 4.83 | $4 \cdot 85$ | 4.88 | 4.91 | 4.94 | 4.97 | 5.00 | 5.03 | 5.07 | $5 \cdot 11$ | $5 \cdot 15$ | 5.19 | $5 \cdot 24$ | 5.29 | 34 |
| 32 | 4.88 | 4.91 | 4.93 | 4.96 | 4.99 | 5.02 | $5 \cdot 05$ | 5.09 | $5 \cdot 12$ | $5 \cdot 16$ | 5.20 | 5.25 | $5 \cdot 29$ | $5 \cdot 34$ | $5 \cdot 39$ |
| 33 | 4.94 | 4.96 | 4.99 | $5 \cdot 01$ | 5.04 | 5.08 | $5 \cdot 11$ | $5 \cdot 14$ | $5 \cdot 18$ | 5.22 | 5.26 | $5 \cdot 31$ | $5 \cdot 35$ | $5 \cdot 40$ | 5.45 |
|  | 5.00 | 5.02 | $5 \cdot 05$ | $5 \cdot 07$ | 5.10 | $5 \cdot 13$ | $5 \cdot 17$ | 5.20 | $5 \cdot 24$ | 5.28 | 5.32 | $5 \cdot 37$ | $5 \cdot 42$ | $5 \cdot 46$ | 5.52 |
| 35 | 5.06 | 5.08 | 5•II | $5 \cdot 13$ | 5•16 | 5.20 | $5 \cdot 23$ | $5 \cdot 27$ | $5 \cdot 30$ | $5 \cdot 35$ | $5 \cdot 39$ | $5 \cdot 43$ | $5 \cdot 48$ | $5 \cdot 53$ | $5 \cdot 58$ |
| 36 | $5 \cdot 12$ | $5 \cdot 14$ | 5.17 | $5 \cdot 20$ | 5.23 | 5.26 | $5 \cdot 30$ | 5.33 | $5 \cdot 37$ | $5 \cdot 41$ | 5.46 | $5 \cdot 50$ | $5 \cdot 55$ | 5.60 | $5 \cdot 65$ |
|  | $5 \cdot 19$ |  | $5 \cdot 24$ | $5 \cdot 27$ | $5 \cdot 30$ | $5 \cdot 33$ | $5 \cdot 36$ | 5.40 | $5 \cdot 44$ | 5.48 | 5.53 | 5.57 | $5 \cdot 62$ | $5 \cdot 67$ | $5 \cdot 73$ |
| 38 | $5 \cdot 26$ | 5.28 | $5 \cdot 31$ | 5.34 | $5 \cdot 37$ | $5 \cdot 40$ | $5 \cdot 44$ | $5 \cdot 47$ | 5.51 | 5.56 |  | $5 \cdot 65$ | $5 \cdot 70$ | $5 \cdot 75$ | $5 \cdot 80$ |
| 39 | $5 \cdot 33$ | $5 \cdot 35$ | $5 \cdot 38$ | $5 \cdot 41$ | 5.44 | $5 \cdot 48$ | $5 \cdot 51$ | $5 \cdot 55$ | 5.59 | 5.63 | 5.68 | 5.73 | 5.78 | $5 \cdot 83$ | $5 \cdot 88$ |
| 40 | $5 \cdot 4 \mathrm{I}$ | $5 \cdot 43$ | $5 \cdot 46$ | $5 \cdot 49$ | $5 \cdot 52$ | 5•56 | $5 \cdot 59$ | 5.63 | $5 \cdot 67$ | $5 \cdot 72$ | 5.76 | 5.81 | 5.86 | 5.91 | $5 \cdot 97$ |
| 41 | 5.49 | 5.51 | 5.54 | 5.57 | $5 \cdot 61$ | $5 \cdot 64$ | $5 \cdot 68$ | 5.72 | 5.76 | 5.80 | $5 \cdot 85$ | 5.90 | 5.95 | $6 \cdot 00$ | 6.06 |
| 42 | $5 \cdot 57$ | $5 \cdot 60$ | $5 \cdot 63$ | 5.66 | $5 \cdot 69$ | 5.73 | 5.77 | 5.81 | 5.85 | 5.89 | 5.94 | $5 \cdot 99$ | $6 \cdot 04$ | 6.10 | $6 \cdot 15$ |
| 43 | 5.66 | 5.69 | 5.72 | 5.75 | $5 \cdot 78$ | 5.82 | 5.86 | 5.90 | 5.94 | 5.99 | $6 \cdot 03$ | $6 \cdot 09$ | $6 \cdot 14$ | $6 \cdot 19$ | $6 \cdot 25$ |
|  |  | $5 \cdot 78$ | $5 \cdot 81$ | 5.85 | 5.88 | $5 \cdot 92$ | $5 \cdot 96$ | $6 \cdot 00$ | 6.04 | $6 \cdot 09$ | $6 \cdot 14$ | 6.19 | $6 \cdot 24$ | $6 \cdot 30$ | $6 \cdot 36$ |
| 45 | $5 \cdot 86$ | $5 \cdot 88$ | $5 \cdot 92$ | 5.95 | 5.98 | $6 \cdot 02$ | 6.06 | 6-10 | $6 \cdot 15$ | 6.19 | $6 \cdot 24$ | $6 \cdot 29$ | $6 \cdot 35$ | $6 \cdot 41$ | $6 \cdot 47$ |
| 46 |  |  | 6.02 |  |  |  |  | 6.21 | 6.26 | 6.30 | $6 \cdot 35$ | $6 \cdot 41$ | $6 \cdot 46$ | 6.52 | $6 \cdot 58$ |
| 47 | $6 \cdot 07$ | 6.10 | $6 \cdot 13$ | $6 \cdot 17$ | $6 \cdot 20$ | $6 \cdot 24$ | $6 \cdot 28$ | $6 \cdot 33$ | $6 \cdot 37$ | $6 \cdot 42$ | $6 \cdot 47$ | 6.53 | $6 \cdot 58$ | $6 \cdot 64$ | 6.71 |
| 48 | 6.19 | $6 \cdot 22$ | $6 \cdot 25$ | $6 \cdot 29$ | $6 \cdot 32$ | $6 \cdot 36$ | $6 \cdot 40$ | $6 \cdot 45$ | $6 \cdot 49$ | $6 \cdot 54$ | $6 \cdot 60$ |  | 6.71 |  | 6.83 |
| 49 | $6 \cdot 3 \mathrm{I}$ | $6 \cdot 34$ | $6 \cdot 38$ | 6.41 | 6.45 | $6 \cdot 49$ | $6 \cdot 53$ | $6 \cdot 58$ | $6 \cdot 62$ | $6 \cdot 67$ | $6 \cdot 73$ | $6 \cdot 78$ | 6.84 | 6.91 | $6 \cdot 97$ |
| 50 | $6 \cdot 44$ | $6 \cdot 47$ | $6 \cdot 51$ | $6 \cdot 54$ | $6 \cdot 58$ | $6 \cdot 62$ | 6.67 | 6.71 | $6 \cdot 76$ | $6 \cdot 8$ I | 6.87 | $6 \cdot 92$ | $6 \cdot 98$ | $7 \cdot 05$ | 7-11 |
| 51 | $6 \cdot 58$ | 6.61 | $6 \cdot 65$ | $6 \cdot 68$ | $6 \cdot 72$ | 6.76 | 6.8 I | 6.86 | $6 \cdot 90$ | 6.96 | $7 \cdot 01$ | $7 \cdot 07$ | 7-13 | $7 \cdot 20$ | 7.27 |
| 52 | $6 \cdot 73$ | 6.76 | 6.79 | $6 \cdot 83$ | $6 \cdot 87$ | $6 \cdot 91$ | $6 \cdot 96$ | $7 \cdot 01$ | $7 \cdot 06$ | 7-11 | 7-17 | $7 \cdot 23$ | $7 \cdot 29$ | $7 \cdot 36$ | $7 \cdot 43$ |
| 53 | $6 \cdot 88$ | $6 \cdot 91$ | $6 \cdot 95$ | $6 \cdot 99$ | $7 \cdot 03$ | 7.07 | $7 \cdot 12$ | $7 \cdot 17$ | $7 \cdot 22$ | $7 \cdot 28$ | $7 \cdot 33$ | $7 \cdot 39$ | $7 \cdot 46$ | $7 \cdot 53$ | $7 \cdot 60$ |
| 54 | $7 \cdot 05$ | $7 \cdot 08$ | $7 \cdot 12$ | $7 \cdot 16$ | $7 \cdot 20$ | 7.24 | 7.29 | $7 \cdot 34$ | $7 \times 39$ | 7.45 | 7.51 | 7.57 | $7 \cdot 64$ | $7 \cdot 71$ | $7 \cdot 78$ |
| 55 | $7 \cdot 22$ | $7 \cdot 25$ | $7 \cdot 29$ | $7 \cdot 33$ | $7 \cdot 38$ | 7.42 | $7 \cdot 47$ | $7 \cdot 52$ | $7 \cdot 58$ | $7 \cdot 63$ | 7.69 | $7 \cdot 76$ | 7.83 | $7 \cdot 90$ | $7 \cdot 97$ |
| 56 | 7.41 | $7 \cdot 44$ | $7 \cdot 48$ | $7 \cdot 52$ | $7 \cdot 57$ | $7 \cdot 61$ | $7 \cdot 66$ | 7.71 | $7 \cdot 77$ | 7.83 | 7.89 | 7.96 | $8 \cdot 03$ | $8 \cdot 10$ | 8.18 |
| 57 | $7 \cdot 60$ | $7 \cdot 64$ | 7.68 | $7 \cdot 72$ | 7.77 | 7.82 | 7.87 | 7.92 | 7.98 | 8.04 | 8-10 | $8 \cdot 17$ | $8 \cdot 24$ | $8 \cdot 32$ | $8 \cdot 40$ |
| 58 | 7.81 | 7.85 <br> 8.08 | 7.89 | 7.94 | 7.98 | 8.03 8.26 | 8.09 8.32 | $8 \cdot 14$ 8.38 | 8.20 | 8.26 8.50 | $8 \cdot 33$ | $8 \cdot 40$ | $8 \cdot 47$ | 8.85 | 8.63 8.88 |
| 59 60 | 8.04 8.28 | $8 \cdot 08$ $8 \cdot 32$ | $8 \cdot 12$ 8.37 | $8 \cdot 17$ 8.41 | 8.21 8.46 | 8.26 8.51 | 8.32 8.57 | $8 \cdot 38$ 8.63 | 8.44 8.69 | 8.50 8.76 | 8.57 8.83 | 8.64 8.90 | 8.72 8.98 | 8.80 | 8.88 0.15 |
|  |  |  |  |  |  |  |  |  |  |  |  | $8 \cdot 90$ | $8 \cdot 9$ | 9.06 | 9•15 |

To convert time into longitude divide by 4. Thus $8 \cdot 28 \mathrm{~s} . \div 4=2^{\prime} \cdot 07$ long.

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF $1^{\prime}$ IN THE ALTITUDE.

| Lat. | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $60^{\circ}$ | $59^{\circ}$ | $58^{\circ}$ | $57^{\circ}$ | $56^{\circ}$ | $55^{\circ}$ | $54^{\circ}$ | $53^{\circ}$ | $52^{\circ}$ | $51^{\circ}$ | $50^{\circ}$ | $49^{\circ}$ | $48^{\circ}$ | $47^{\circ}$ | $46^{\circ}$ |
|  | s. | S. | s. | s. | s. | s. | s. | s. | s. | s. | S. | s. | s. | s. | s. |
| - | $4 \cdot 62$ | $4 \cdot 67$ | 4.72 | 4.77 | $4 \cdot 82$ | $4 \cdot 88$ | 4.94 | $5 \cdot 01$ | 5.08 | 5•15 | 5.22 | $5 \cdot 30$ | $5 \cdot 38$ | $5 \cdot 47$ | $5 \cdot 56$ |
| 1 | $4 \cdot 62$ | $4 \cdot 67$ | $4 \cdot 72$ | 4.77 | $4 \cdot 83$ | $4 \cdot 88$ | $4 \cdot 95$ | $5 \cdot 01$ | $5 \cdot 08$ | $5 \cdot 15$ | 5.22 | $5 \cdot 30$ | $5 \cdot 38$ | $5 \cdot 47$ | 5.56 |
| 2 | 4.62 | 4.67 | $4 \cdot 72$ | 4.77 | $4 \cdot 83$ | $4 \cdot 89$ | 4.95 | $5 \cdot 01$ | $5 \cdot 08$ | 5.15 | 5.22 | $5 \cdot 30$ | $5 \cdot 39$ | $5 \cdot 47$ | 5.56 |
| 3 | $4 \cdot 63$ | $4 \cdot 67$ | 4.72 | 4.78 | $4 \cdot 83$ | $4 \cdot 89$ | 4.95 | 5.02 | 5.08 | $5 \cdot 15$ | 5.23 | $5 \cdot 31$ | $5 \cdot 39$ | $5 \cdot 48$ | $5 \cdot 57$ |
| 4 | 4.63 | $4 \cdot 68$ | $4 \cdot 73$ | 4.78 | $4 \cdot 84$ | $4 \cdot 90$ | 4.96 | 5.02 | $5 \cdot 09$ | 5.16 | 5.23 | $5 \cdot 31$ | $5 \cdot 40$ | $5 \cdot 48$ | $5 \cdot 57$ |
| 5 | $4 \cdot 64$ | $4 \cdot 68$ | $4 \cdot 73$ | $4 \cdot 79$ | $4 \cdot 84$ | 4.90 | $4 \cdot 96$ | $5 \cdot 03$ | $5 \cdot 10$ | 5•17 | $5 \cdot 24$ | $5 \cdot 32$ | $5 \cdot 40$ | $5 \cdot 49$ | $5 \cdot 58$ |
| 6 | $4 \cdot 64$ | 4.69 | 4.74 | 4.80 | $4 \cdot 85$ | 4.91 | 4.97 | 5.04 | $5 \cdot 10$ | $5 \cdot 17$ | 5.25 | $5 \cdot 33$ | 5.41 | 5.50 | $5 \cdot 59$ |
| 7 | 4.65 | $4 \cdot 70$ | 4.75 | 4.8 I | $4 \cdot 86$ | 4.92 | $4 \cdot 98$ | $5 \cdot 05$ | $5 \cdot 11$ | $5 \cdot 19$ | 5.26 | $5 \cdot 34$ | $5 \cdot 42$ | $5 \cdot 51$ | $5 \cdot 60$ |
| 8 | $4 \cdot 66$ | 4.71 | $4 \cdot 76$ | 4.82 | 4.87 | 4.93 | $4 \cdot 99$ | 5.06 | $5 \cdot 13$ | $5 \cdot 20$ | 5.27 | $5 \cdot 35$ | $5 \cdot 44$ | $5 \cdot 52$ | 5.62 |
| 9 | 4.68 | $4 \cdot 72$ | $4 \cdot 78$ | $4 \cdot 83$ | $4 \cdot 89$ | 4.94 | $5 \cdot 01$ | $5 \cdot 07$ | 5•14 | 5.21 | 5.29 | $5 \cdot 37$ | $5 \cdot 45$ | $5 \cdot 54$ | 5.63 |
| ro | $4 \cdot 69$ | $4 \cdot 74$ | $4 \cdot 79$ | 4.84 | 4.90 | 4.96 | $5 \cdot 02$ | 5.09 | 5•15 | $5 \cdot 23$ | $5 \cdot 30$ | $5 \cdot 38$ | $5 \cdot 47$ | $5 \cdot 55$ | $5 \cdot 65$ |
| II | $4 \cdot 71$ | 4.75 | $4 \cdot 8 \mathrm{I}$ | 4.86 | $4 \cdot 92$ | 4.97 | $5 \cdot 04$ | $5 \cdot 10$ | 5.17 | 5.24 | $5 \cdot 32$ | $5 \cdot 40$ | $5 \cdot 48$ | $5 \cdot 57$ | 5.66 |
| 12 | $4 \cdot 72$ | $4 \cdot 77$ | $4 \cdot 82$ | 4.88 | $4 \cdot 93$ | $4 \cdot 99$ | $5 \cdot 05$ | $5 \cdot 12$ | 5.19 | $5 \cdot 26$ | $5 \cdot 34$ | $5 \cdot 42$ | $5 \cdot 50$ | $5 \cdot 59$ | 5.68 |
| 13 | 4.74 | 4.79 | 4.84 | 4.89 | 4.95 | $5 \cdot 01$ | $5 \cdot 07$ | 5.14 | 5.21 | $5 \cdot 28$ | $5 \cdot 36$ | 5.44 | $5 \cdot 52$ | $5 \cdot 61$ | $5 \cdot 71$ |
| 14 | 4.76 | 4.81 | $4 \cdot 86$ | 4.92 | $4 \cdot 97$ | 5.03 | 5•10 | 5•16 | 5.23 | $5 \cdot 30$ | $5 \cdot 38$ | $5 \cdot 46$ | $5 \cdot 55$ | $5 \cdot 64$ | $5 \cdot 73$ |
| 15 | $4 \cdot 78$ | $4 \cdot 83$ | $4 \cdot 88$ | 4.94 | $5 \cdot 00$ | $5 \cdot 06$ | $5 \cdot 12$ | $5 \cdot 19$ | $5 \cdot 26$ | $5 \cdot 33$ | $5 \cdot 41$ | $5 \cdot 49$ | $5 \cdot 57$ | $5 \cdot 66$ | $5 \cdot 76$ |
| 16 | 4.80 | 4.85 | 4.91 | 4.96 | $5 \cdot 02$ | 5.08 | $5 \cdot 14$ | $5 \cdot 21$ | $5 \cdot 28$ | $5 \cdot 35$ | $5 \cdot 43$ | 5.51 | $5 \cdot 60$ | $5 \cdot 69$ | $5 \cdot 78$ |
| 17 | 4.83 | $4 \cdot 88$ | $4 \cdot 93$ | 4.99 | 5.05 | $5 \cdot 11$ | $5 \cdot 17$ | $5 \cdot 24$ | $5 \cdot 31$ | $5 \cdot 38$ | $5 \cdot 46$ | $5 \cdot 54$ | 5.63 | $5 \cdot 72$ | $5 \cdot 81$ |
| 18 | 4.86 | 4.91 | 4.96 | 5.OI | $5 \cdot 07$ | $5 \cdot 13$ | 5.20 | $5 \cdot 27$ | $5 \cdot 34$ | 5.41 | $5 \cdot 49$ | $5 \cdot 57$ | $5 \cdot 66$ | $5 \cdot 75$ | 5.85 |
| 19 | $4 \cdot 88$ | $4 \cdot 94$ | $4 \cdot 99$ | $5 \cdot 04$ | 5•10 | $5 \cdot 16$ | $5 \cdot 23$ | $5 \cdot 30$ | $5 \cdot 37$ | $5 \cdot 44$ | $5 \cdot 52$ | $5 \cdot 60$ | 5.69 | 5.78 | $5 \cdot 88$ |
| 20 | $4 \cdot 92$ | $4 \cdot 97$ | $5 \cdot 02$ | 5.08 | $5 \cdot 13$ | $5 \cdot 20$ | 5.26 | $5 \cdot 33$ | $5 \cdot 40$ | $5 \cdot 48$ | $5 \cdot 56$ | $5 \cdot 64$ | $5 \cdot 73$ | 5.82 | $5 \cdot 92$ |
| 2 I | 4.95 | $5 \cdot 00$ | 5.05 | $5 \cdot 11$ | 5.17 | 5.23 | $5 \cdot 30$ | $5 \cdot 36$ | 5.44 | 5.51 | 5.59 | $5 \cdot 68$ | 5.77 | 5.86 | 5.96 |
| 22 | 4.98 | 5.03 | $5 \cdot 09$ | 5.14 | $5 \cdot 20$ | 5.27 | $5 \cdot 33$ | $5 \cdot 40$ | 5.47 | $5 \cdot 55$ | $5 \cdot 63$ | $5 \cdot 72$ | $5 \cdot 81$ | $5 \cdot 90$ | $6 \cdot 00$ |
| 23 | $5 \cdot 02$ | 5.07 | 5.12 | 5.18 | 5.24 | $5 \cdot 30$ | $5 \cdot 37$ | $5 \cdot 44$ | 5.5I | $5 \cdot 59$ | $5 \cdot 67$ | $5 \cdot 76$ | $5 \cdot 85$ | 5.94 | $6 \cdot 04$ |
| 24 | 5.06 | 5.11 | 5-16 | 5.22 | $5 \cdot 28$ | $5 \cdot 34$ | $5 \cdot 41$ | 5.48 | $5 \cdot 56$ | $5 \cdot 63$ | $5 \cdot 72$ | 5.80 | $5 \cdot 89$ | 5.99 | 6.09 |
| 25 | 5.10 | $5 \cdot 15$ | $5 \cdot 20$ | $5 \cdot 26$ | $5 \cdot 32$ | $5 \cdot 39$ | $5 \cdot 46$ | $5 \cdot 53$ | 5.60 | $5 \cdot 68$ | $5 \cdot 76$ | $5 \cdot 85$ | 5.94 | 6.03 | $6 \cdot 13$ |
| 26 | 5.14 | 5.19 | 5.25 | $5 \cdot 31$ | $5 \cdot 37$ | 5.43 | 5.50 | $5 \cdot 57$ | $5 \cdot 65$ | $5 \cdot 73$ | 5.8 I | 5.90 | $5 \cdot 99$ | $6 \cdot 09$ | 6.19 |
| 27 | 5.18 | 5.24 | 5.29 | $5 \cdot 35$ | $5 \cdot 42$ | $5 \cdot 48$ | $5 \cdot 55$ | 5.62 | 5.70 | $5 \cdot 78$ | 5.86 | 5.95 | $6 \cdot 04$ | $6 \cdot 14$ | 6.24 |
| 28 | 5.23 | 5.28 | $5 \cdot 34$ | $5 \cdot 40$ | $5 \cdot 46$ | $5 \cdot 53$ | $5 \cdot 60$ | 5.67 | $5 \cdot 75$ | 5.83 | 5.91 | $6 \cdot 00$ | 6•10 | $6 \cdot 19$ | $6 \cdot 30$ |
| 29 | 5.28 | $5 \cdot 34$ | $5 \cdot 39$ | 5.45 | 5.52 5.57 | 5.58 5.64 | 5.65 5.71 | 5.73 5.78 | 5.80 5.86 | 5.88 5.94 | 5.97 6.03 | $6 \cdot 06$ 6.12 | $6 \cdot 15$ $6 \cdot 22$ | $6 \cdot 25$ $6 \cdot 32$ | $6 \cdot 36$ 6.42 |
| 30 | $5 \cdot 33$ | $5 \cdot 39$ | $5 \cdot 45$ | $5 \cdot 51$ | $5 \cdot 57$ | $5 \cdot 64$ | 5.71 | 5.78 | $5 \cdot 86$ | 5.94 | 6.03 | $6 \cdot 12$ | $6 \cdot 22$ | $6 \cdot 32$ | $6 \cdot 42$ |
| 31 | 5.39 | $5 \cdot 44$ | 5.50 | 5.56 | $5 \cdot 63$ | 5.70 | 5.77 | $5 \cdot 84$ | 5.92 | $6 \cdot 00$ | 6.09 | $6 \cdot 18$ | 6.28 | $6 \cdot 38$ | $6 \cdot 49$ |
| 32 | 5.45 | 5.50 | $5 \cdot 56$ | 5.62 | $5 \cdot 69$ | $5 \cdot 76$ | $5 \cdot 83$ | 5.91 | $5 \cdot 99$ | $6 \cdot 07$ | 6•16 | $6 \cdot 25$ | $6 \cdot 35$ | $6 \cdot 45$ | $6 \cdot 56$ |
| 33 | 5.51 | $5 \cdot 56$ | $5 \cdot 62$ | 5.69 | $5 \cdot 75$ | $5 \cdot 82$ | 5.90 | $5 \cdot 97$ | $6 \cdot 05$ | $6 \cdot 14$ | $6 \cdot 23$ | 6.32 | $6 \cdot 42$ | $6 \cdot 52$ | $6 \cdot 63$ |
| 34 | 5.57 | $5 \cdot 63$ | 5.69 | $5 \cdot 75$ | $5 \cdot 82$ | $5 \cdot 89$ | $5 \cdot 96$ | $6 \cdot 04$ | $6 \cdot 12$ | $6 \cdot 21$ | $6 \cdot 30$ | $6 \cdot 39$ | $6 \cdot 49$ | $6 \cdot 60$ | $6 \cdot 71$ |
| 35 | $5 \cdot 64$ | 5.70 | 5.76 | 5.82 | 5.89 | $5 \cdot 96$ | $6 \cdot 04$ | $6 \cdot 11$ | $6 \cdot 20$ | $6 \cdot 28$ | $6 \cdot 37$ | $6 \cdot 47$ | $6 \cdot 57$ | $6 \cdot 68$ | $6 \cdot 79$ |
| 36 | 5.71 | 5.77 | 5.83 | 5.90 | $5 \cdot 96$ | $6 \cdot 04$ | $6 \cdot 11$ | $6 \cdot 19$ | 6.27 | $6 \cdot 36$ | $6 \cdot 45$ | $6 \cdot 55$ | $6 \cdot 65$ | 6.76 | $6 \cdot 87$ |
| 37 | $5 \cdot 78$ | $5 \cdot 84$ | 5.91 | 5.97 | $6 \cdot 04$ | 6.11 | 6.19 | $6 \cdot 27$ | $6 \cdot 36$ | $6 \cdot 44$ | $6 \cdot 54$ | $6 \cdot 64$ | $6 \cdot 74$ | $6 \cdot 85$ | $6 \cdot 96$ |
| 38 | $5 \cdot 86$ | 5.92 | 5.99 | $6 \cdot 05$ | 6.12 | 6.20 | $6 \cdot 27$ | $6 \cdot 36$ | 6.44 | $6 \cdot 53$ | $6 \cdot 63$ | 6.73 | 6.83 | $6 \cdot 94$ | 7.06 |
| 39 | $5 \cdot 94$ | $6 \cdot 00$ | $6 \cdot 07$ | $6 \cdot 14$ | $6 \cdot 21$ | $6 \cdot 28$ | $6 \cdot 36$ | $6 \cdot 44$ | $6 \cdot 53$ | $6 \cdot 62$ | $6 \cdot 72$ | 6.82 | $6 \cdot 93$ | $7 \cdot 04$ | $7 \cdot 16$ |
| 40 | $6 \cdot 03$ | $6 \cdot 09$ | 6•16 | 6.23 | $6 \cdot 30$ | $6 \cdot 37$ | $6 \cdot 45$ | $6 \cdot 54$ | $6 \cdot 63$ | $6 \cdot 72$ | $6 \cdot 82$ | $6 \cdot 92$ | 7.03 | $7 \cdot 14$ | $7 \cdot 26$ |
| 4 I | $6 \cdot 12$ | $6 \cdot 18$ | $6 \cdot 25$ | $6 \cdot 32$ | $6 \cdot 39$ | 6.47 | 6.55 | $6 \cdot 64$ | 6.73 | 6.82 | $6 \cdot 92$ | 7.02 | 7.13 | 7.25 | $7 \cdot 37$ |
| 42 | $6 \cdot 22$ | 6.28 | $6 \cdot 35$ | 6.42 | $6 \cdot 49$ | $6 \cdot 57$ | $6 \cdot 65$ | $6 \cdot 74$ | $6 \cdot 83$ | $6 \cdot 93$ | 7.03 | $7 \cdot 13$ | $7 \cdot 24$ | $7 \cdot 36$ | $7 \cdot 48$ |
| 43 | $6 \cdot 32$ | $6 \cdot 38$ | 6.45 | $6 \cdot 52$ | $6 \cdot 60$ | 6.68 | $6 \cdot 76$ | $6 \cdot 85$ | 6.94 | 7.04 | $7 \cdot 14$ | $7 \cdot 25$ | $7 \cdot 36$ | $7 \cdot 48$ | 7.60 |
| 44 | 6.42 | 6.49 | $6 \cdot 56$ | $6 \cdot 63$ | $6 \cdot 71$ | $6 \cdot 79$ | $6 \cdot 87$ | $6 \cdot 96$ | 7.06 | $7 \cdot 16$ | 7.26 | 7.37 | $7 \cdot 48$ | 7.60 | $7 \cdot 73$ |
| 45 | $6 \cdot 53$ | $6 \cdot 60$ | 6.67 | $6 \cdot 75$ | $6 \cdot 82$ | $6 \cdot 91$ | $6 \cdot 99$ | 7.08 | 7•18 | $7 \cdot 28$ | $7 \cdot 38$ | 7.50 | $7 \cdot 61$ | 7.73 | $7 \cdot 86$ |
| 46 | $6 \cdot 65$ | $6 \cdot 72$ | $6 \cdot 79$ | $6 \cdot 87$ | $6 \cdot 95$ | 7.03 | $7 \cdot 12$ | $7 \cdot 21$ | 7.31 | $7 \cdot 41$ | 7.52 | $7 \cdot 63$ | 7.75 | 7.87 | 8.00 |
| 47 | $6 \cdot 77$ | $6 \cdot 84$ | 6.92 | $6 \cdot 99$ | 7.07 | $7 \cdot 16$ | $7 \cdot 25$ | $7 \cdot 34$ | $7 \cdot 44$ | $7 \cdot 55$ | 7.66 | $7 \cdot 77$ | $7 \cdot 89$ | 8.02 | $8 \cdot 15$ |
| 48 | $6 \cdot 90$ | 6.97 | $7 \cdot 05$ | $7 \cdot 13$ | $7 \cdot 21$ | $7 \cdot 30$ | $7 \cdot 39$ | $7 \cdot 49$ | $7 \cdot 59$ | $7 \cdot 69$ | 7.80 | 7.92 | 8.04 | $8 \cdot 17$ | $8 \cdot 31$ |
| 49 | $7 \cdot 04$ | $7 \cdot 11$ | $7 \cdot 19$ | 7.27 | 7.35 | 7.44 | $7 \cdot 54$ | $7 \cdot 63$ | 7.74 | 7.85 | $7 \cdot 96$ | 8.08 | $8 \cdot 20$ | $8 \cdot 34$ | 8.48 |
| 50 | $7 \cdot 19$ | $7 \cdot 26$ | $7 \cdot 34$ | $7 \cdot 42$ | $7 \cdot 51$ | $7 \cdot 60$ | $7 \cdot 69$ | $7 \cdot 79$ | $7 \cdot 90$ | 8.01 | 8.12 | 8.25 | $8 \cdot 37$ | $8 \cdot 51$ | $8 \cdot 65$ |
| 5 I | $7 \cdot 34$ | 7.42 | 7.49 | 7.58 | $7 \cdot 67$ | $7 \cdot 76$ | $7 * 86$ | $7 \cdot 96$ | $8 \cdot 07$ | $8 \cdot 18$ | $8 \cdot 30$ | 8.42 | $8 \cdot 55$ | 8.69 | 8.84 |
| 52 | 7.50 | $7 \cdot 58$ | $7 \cdot 66$ | $7 \cdot 75$ | $7 \cdot 84$ | $7 \cdot 93$ | $8 \cdot 03$ | $8 \cdot 14$ | $8 \cdot 24$ | $8 \cdot 36$ | $8 \cdot 48$ | $8 \cdot 61$ | $8 \cdot 74$ | 8.88 | 9.03 |
| 53 | 7.67 | 7.75 | $7 \cdot 84$ | 7.93 | $8 \cdot 02$ | $8 \cdot 11$ | $8 \cdot 22$ | $8 \cdot 32$ | 8.43 | $8 \cdot 55$ | $8 \cdot 68$ | $8 \cdot 81$ | $8 \cdot 94$ | 9.09 | 9.24 |
| 54 | 7.86 | 7 | 8 | $8 \cdot 11$ 8.32 | $8 \cdot 21$ | $8 \cdot 31$ | 8.41 | $8 \cdot 52$ | 8.64 | $8 \cdot 76$ | $8 \cdot 88$ | 9.02 | $9 \cdot 16$ | 9.30 | 9.46 |
| 55 | $8 \cdot 05$ | $8 \cdot 14$ | 8.22 | $8 \cdot 32$ | 8.41 | $8 \cdot 51$ | $8 \cdot 62$ | $8 \cdot 73$ | $8 \cdot 85$ | $8 \cdot 97$ | 9.10 | 9.24 | $9 \cdot 38$ | $9 \cdot 54$ | $9 \cdot 69$ |
| 56 | $8 \cdot 26$ | $8 \cdot 35$ | 8.43 | 8.53 | $8 \cdot 63$ | $8 \cdot 73$ | $8 \cdot 84$ | $8 \cdot 96$ | 9.08 | 9.20 | 9.34 | $9 \cdot 48$ | 9.63 | 9.78 | 9.94 |
| 57 | 8.48 | $8 \cdot 57$ | $8 \cdot 66$ | 8.76 | $8 \cdot 86$ | $8 \cdot 97$ | 9.08 | $9 \cdot 20$ | $9 \cdot 32$ | $9 \cdot 45$ | $9 \cdot 59$ | $9 \cdot 73$ | 9.88 | 10.04 | 10.21 |
| 58 | $8 \cdot 72$ | 8.81 | $8 \cdot 90$ | $9 \cdot 00$ | 9.10 | $9 \cdot 21$ | 9.33 | 9.45 | $9 \cdot 58$ | $9 \cdot 71$ | 9.85 | 10.00 | Io. 16 | 10.32 | $10 \cdot 49$ |
| 59 | $8 \cdot 97$ | 9.06 | $9 \cdot 16$ | 9.26 | 9.37 | 9.48 | 9.60 | 9.72 | 9.86 | 9.99 | 10.14 | 10.29 | 10.45 | 10.62 | $10 \cdot 80$ |
| 60 | $9 \cdot 24$ | $9 \cdot 33$ | 9.43 | $9 \cdot 54$ | 9.65 | 9.77 | 9.89 | 10.02 | Io 15 | 10.29 | 10.44 | 10.60 | 10.77 | 10.94 | II.12 |

To convert time into longitude divide by 4 . Thus $9 \cdot 24$ S. $\div 4=2^{\prime} \cdot 3$ I long.

SHOWING THE ERROR PRODUCED IN THE TTME OR LONGITUDE BY AN ERROR OF 1＇IN THE ALITTUDE．

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | ${ }^{45^{\circ}} 144^{\circ}$ | $4^{4}$ | $43^{\circ}$ | 420 | $41^{\circ}$ | ${ }^{40}$ | 39 ${ }^{\circ}$ | ${ }^{38^{\circ}}$ | $37^{\circ}$ | $36^{\circ}$ | ${ }^{35}$ | $34^{\circ}$ | 33 ${ }^{\circ}$ | $3^{3}{ }^{32}$ | $32^{\circ}$ |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | Po | $\begin{aligned} & 5: 76,6 \\ & 5: \% 6) \\ & 5 \end{aligned}$ |  | $5 \cdot 98$ |  | $\begin{aligned} & 0 \\ & \hdashline \\ & 0 \\ & 0 \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 6.50 \\ & 6.550 \\ & 6.50 \end{aligned}$ |  |  |  |  |  |  |  |  |
|  |  | sit | 5：72 | cisisi |  |  |  | ${ }^{6 \cdot 56}$ |  |  |  |  |  |  | ${ }^{3}$ |  |  |
|  |  |  | 57 | 5：89 | － |  | ${ }_{6}^{625}$ | ${ }_{6 \cdot 38}$ | ${ }_{6 \cdot 52}$ |  |  |  | 778 |  | ${ }^{37} 78$ | $7 \cdot 58$ |  |
|  |  | ${ }_{5}^{5}$ | 5：7\％ | ${ }_{5}^{5} 5900$ | 1 |  |  | 6， 6 | \％ $6 \cdot 5$ | $\begin{aligned} & 6.68 \\ & 6.70 \end{aligned}$ |  |  | \％．19 |  | ${ }^{38}$ | 75 |  |
|  |  | $5 \cdot 8$ | 5：8， | 5．9 | ${ }^{2}$ |  |  | 6.44 | 6．58 | 0\％／3 | $6 \cdot 8$ | ${ }^{7} 70.04$ | －24 |  | \％42 |  |  |
|  |  | 5744 58 |  |  |  |  |  |  |  |  |  |  |  |  | 776 | 7.66 |  |
|  |  | Si：7 | 5. | 5：907 | \％ 6 | ＋${ }^{\circ}$ | ${ }^{4}$ | 6：48 | 6：62 | ${ }^{6.780}$ | 6，96 |  |  |  | ${ }_{51}^{488}$ |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | $5{ }_{5} 56$ | $5 \cdot 96$ | 6.07 |  |  | 过 | C53 | \％ | 退 |  | ${ }_{2} 22$ | ${ }^{3}$ | \％ | 5 | \％ 8. |  |
|  |  | 5 | 5：0 | ${ }_{6}^{6}$ |  |  |  | ${ }^{6} 6.65$ |  |  |  |  | ${ }_{7}^{7} 4$ | ${ }_{68}^{68}$ | 7）：68 | I：895 |  |
|  |  | 50 | 6 | （6．720 |  | （1） |  |  |  |  |  | ${ }_{7}^{2} 38$ |  |  |  |  |  |
|  |  |  | ${ }^{6.1}$ | $6 \cdot 2$ | 6.36 | 6.49 |  | 6；76 | $6 \cdot 97$ | － |  | 42 | 2， 6 | ¢ $2 \cdot 82$ | 982 | 8.03 |  |
|  |  | （10．06 6 | 6. | ${ }_{6}^{62}$ |  | － 50 |  | ${ }^{6} 6.88$ | ［0．06 |  |  |  |  |  | H．88 |  |  |
|  |  | （6．15 |  | ${ }^{6} 6$ | ${ }^{6} 5$ | \％ |  | 6.96 | T－1 | $2{ }^{28}$ | ${ }^{2}$ |  |  |  | 8．04 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 8．0\％ 8 ． | $8 \cdot 33$ |  |
|  |  | $\begin{gathered} 6.41 \\ \hline 6.46 \\ 6.40 \end{gathered}$ | 6. | 6 |  |  |  |  |  | 7，39 |  |  |  |  |  | ${ }^{47}$ |  |
|  |  |  | 6 |  | ${ }^{6} 8$ |  |  |  | ${ }_{7}^{7} 7$ | 7．60 | ${ }^{\text {a }}$ |  |  |  | Sti | $\begin{aligned} & 8.55 \\ & 8.850 \\ & 8,620 \end{aligned}$ |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 6：974 $6: 96$ | 6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | ${ }_{6}^{6098}$ | \％ | \％ |  | ${ }^{35}$ | ${ }_{4}^{5} 5$ | － | ${ }^{7} 7$ |  |  | ［ | 3 |  | （i．897 |  |  |
|  |  | ${ }^{6}$ | 7 |  |  | 54 |  |  | ${ }_{6} 8.0$ |  |  |  |  |  | 208 |  |  |
|  |  | ${ }_{7}^{7}$ | 7 |  | ${ }_{7}^{7} 78$ |  | － |  | （8）${ }_{8}^{8.24} 8$ |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | 7.96 |  |  |  |  | 5：88 |  |  |  | －59 9 | 9.85 |  |
|  |  | ${ }^{7} 5$ |  |  | ${ }_{8}^{8.92}$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | cive |  | （ion | （tay |  | 55 | 5 | （ex | ${ }^{\text {g，}}$ | 24046 | 9，56 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 8．7 |  |  |  | 9，77 | 㖪 9 |  |  |  |  |  |  |  |
|  |  | cors | 8．96 |  | ${ }^{\text {a }}$ | － | \％9 9.68 | \％ 9.89 | （ ${ }^{\text {gi：} 17}$ | （eat | ${ }^{3} 10$ | rob | ir13 |  | ${ }^{1}$ |  |  |
|  |  |  |  |  | 9，5 | ${ }^{9} 9$ |  |  |  | （1） | （iros |  | ${ }_{8}^{812.37}$ |  |  |  |  |
|  |  |  | 98． |  | \％ot |  |  |  |  | Ir |  |  |  |  |  |  |  |
|  |  |  |  |  | ${ }^{20} 10$ |  | ${ }^{1} 8.85$ |  |  |  |  |  | 12 |  | $12: 8$ |  |  |
|  |  | cote | Io | $\xrightarrow{10,4}$ |  |  |  |  |  | ${ }^{1128} 8$ |  |  |  |  |  |  |  |
|  |  |  |  |  |  | $\xrightarrow{\text { Ir．}}$ |  | 812 | ${ }^{\text {P12：62 }}$ |  |  |  |  |  | ${ }_{4} \times 6$ | ${ }_{4} 4.6$ |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | ${ }_{4} 69$ |  |  |

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF $1^{\prime}$ IN THE ALTITUDE.

| Lat. | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $30^{\circ}$ | $29^{\circ}$ | $28^{\circ}$ | $27^{\circ}$ | $26^{\circ}$ | $25^{\circ}$ | $24^{\circ}$ | $23^{\circ}$ | $22^{\circ}$ | $21^{\circ}$ | $20^{\circ}$ | $19^{\circ}$ | $18^{\circ}$ | $17^{\circ}$ | $16^{\circ}$ |
|  | s. | S. | S. | S. | s. | s. | s. | S. | S. | S. | S. | S. | s. | s. | S. |
| 0 | 8.00 | $8 \cdot 25$ | $8 \cdot 52$ | 8.81 | 9•12 | $9 \cdot 46$ | $9 \cdot 83$ | 10.2 | 10.7 | 11.2 | 11.7 | $12 \cdot 3$ | 13.0 | 13.7 | 14.5 |
| 1 | 8.00 | $8 \cdot 25$ | $8 \cdot 52$ | 8.81 | 9.13 | 9.47 | $9 \cdot 84$ | 10.2 | 10.7 | II.2 | 11.7 | 12.3 | 13.0 | 13.7 | 14.5 |
| 2 | 8.00 | $8 \cdot 26$ | $8 \cdot 53$ | $8 \cdot 82$ | 9.13 | $9 \cdot 47$ | 9.84 | 10.2 | $10 \cdot 7$ | $1{ }^{12}$ | 11.7 | $12 \cdot 3$ | $\mathrm{r}^{\circ} \mathrm{O}$ | 13.7 | 14.5 |
| 3 | 8.01 | $8 \cdot 26$ | 8.53 | $8 \cdot 82$ | $9 \cdot 14$ | $9 \cdot 48$ | $9 \cdot 85$ | $10 \cdot 3$ | 10.7 | $\mathrm{rI}^{2}$ | 11•7 | 12.3 | 13.0 | 13.7 | 14.5 |
| 4 | 8.02 | $8 \cdot 27$ | 8.54 | 8.83 | 9.15 | $9 \cdot 49$ | 9.86 | $10 \cdot 3$ | 10.7 | 11 | 11•7 | 12.3 | 13.0 | ${ }_{13}{ }^{1} 7$ | 14.5 |
| 5 | 8.03 | $8 \cdot 28$ | 8.55 | 8.84 | $9 \cdot 16$ | $9 \cdot 50$ | 9.87 | $10 \cdot 3$ | $10 \cdot 7$ | Ir 2 | II'7 | 12.3 | r3.0 | 13.7 | 14.6 |
| 6 | 8.04 | $8 \cdot 30$ | $8 \cdot 57$ | 8.86 | 9.17 | $9 \cdot 52$ | 9.89 | $10 \cdot 3$ | 10.7 | II.2 | Ir 8 | r2.4 | 13.0 | 13.8 | 14.6 |
| 7 | 8.06 | $8 \cdot 31$ | $8 \cdot 58$ | $8 \cdot 88$ | $9 \cdot 19$ | $9 \cdot 54$ | $9 \cdot 91$ | $10 \cdot 3$ | 10.8 | II | II.8 | 12.4 | 13.0 | 13.8 | 14.6 |
| 8 | 8.08 | $8 \cdot 33$ | 8.60 | $8 \cdot 90$ | 9.2I | $9 \cdot 56$ | $9 \times 93$ | 10*3 | 10.8 | II.3 | II.8 | 12.4 | 13.1 | 13.8 | 14.7 |
| 9 | $8 \cdot 10$ | $8 \cdot 35$ | 8.63 | $8 \cdot 92$ | 9.24 | $9 \cdot 58$ | $9 \cdot 96$ | $10 \cdot 4$ | 10.8 | II 3 | 11.8 | 12.4 | 13.1 | 13.9 | 14.7 |
| ro | $8 \cdot 12$ | $8 \cdot 38$ | $8 \cdot 65$ | $8 \cdot 95$ | $9 \cdot 27$ | 9.61 | $9 \cdot 99$ | 10.4 | 10.8 | II.3 | Ir 9 | 12.5 | 13.1 | 13.9 | 14.7 |
| II | $8 \cdot 15$ | 8.41 | $8 \cdot 68$ | $8 \cdot 98$ | $9 \cdot 30$ | $9 \cdot 64$ | 10.0 | 10.4 | 10.9 | II.4 | II•9 | 12.5 | 13.2 | 13.9 | 14.8 |
| 12 | $8 \cdot 18$ | $8 \cdot 43$ | 8.71 | 9.01 | $9 \cdot 33$ | 9.68 | 10.1 | 10.5 | 10.9 | I1.4 | 12.0 | 12.6 | 13.2 | 14.0 | 14.8 |
| 13 | 8.21 | 8.47 | 8.74 | $9 \cdot 04$ | $9 \cdot 36$ | 9.71 | 10.I | 10.5 | II.O | II• 5 | 12.0 | 12.6 | 13.3 | 14.0 | 14.9 |
| 14 | $8 \cdot 24$ | $8 \cdot 50$ | 8.78 | 9.08 | $9 \cdot 40$ | $9 \cdot 75$ | 10.I | $10 \cdot 6$ | Ir.O | II• 5 | $12 \cdot 1$ | 12.7 | 13.3 | I4.I | 15.0 |
| 15 | $8 \cdot 28$ | 8.54 | 8.82 | $9 \cdot 12$ | 9.45 | 9.80 | 10.2 | 10.6 | II•I | 11.6 | 12.1 | 12.7 | 13.4 | 14.2 | 15.0 |
| 16 | $8 \cdot 32$ | $8 \cdot 58$ | $8 \cdot 86$ | 9.17 | $9 \cdot 49$ | 9.85 | 10.2 | 10.6 | Ir.I | rr 6 | 12.2 | 12.8 | 13.5 | 14.2 | $15 \cdot 1$ |
| 17 | $8 \cdot 37$ | 8.63 | 8.91 | 9.21 | $9 \cdot 54$ | $9 \cdot 90$ | $10 \cdot 3$ | $10 \cdot 7$ | 11.2 | Ir.7 | 12.2 | 12.8 | 13.5 | 14.3 | 15.2 |
| 18 | $8 \cdot 4 \mathrm{I}$ | 8.68 | $8 \cdot 96$ | 9.26 | 9.59 | $9 \cdot 95$ | $10 \cdot 3$ | 10.8 | II. | Ir• 7 | $12 \cdot 3$ | 12.9 | 13.6 | 14.4 | 15.3 |
| 19 | $8 \cdot 46$ | 8.73 | 9.01 | $9 \cdot 32$ | $9 \cdot 65$ | 10*0 | $10 \cdot 4$ | 10.8 | $11 \cdot 3$ | 11.8 | 12.4 | $13^{\circ} \mathrm{O}$ | 13.7 | 14.5 | 15.3 |
| 20 | $8 \cdot 5 \mathrm{I}$ | $8 \cdot 78$ | $9 \cdot 07$ | $9 \cdot 38$ | $9 \cdot 71$ | 10.1 | $10 \cdot 5$ | 10.9 | 11.4 | II.9 | 12.4 | 13.I | 13.8 | 14.6 | 15.4 |
| 21 | 8.57 | 8.84 | $9 \cdot 13$ | 9.44 | 9.77 | 10.I | 10.5 | 11.0 | 11.4 | 12.0 | 12.5 | 13.2 | 13.9 | 14.7 | 15.5 |
| 22 | 8.63 | 8.90 | $9 \cdot 19$ | 9.50 | $9 \cdot 84$ | 10.2 | 10.6 | 11.0 | 11.5 | 12.0 | 12.6 | 13.3 | $14^{\circ} \mathrm{O}$ | 14.8 | 15.7 |
| 23 | $8 \cdot 69$ | $8 \cdot 96$ | 9.26 | 9.57 | 9.91 | $10 \cdot 3$ | $10 \cdot 7$ | rix | 11.6 | 12.1 | $12 \cdot 7$ | 13.3 | 14.1 | 14.9 | 15.8 |
| 24 | $8 \cdot 76$ | 9.03 | $9 \cdot 33$ | $9 \cdot 64$ | 9.99 | 10.4 | 10.8 | II. 2 | 11.7 | 12.2 | 12.8 | 13.4 | 14.2 | 15.0 | r5.9 |
| 25 | 8.83 | 9.10 | 9.40 | $9 \cdot 72$ | 10•I | 10.4 | 10.9 | II 3 | II.8 | 12.3 | 12.9 | 13.6 | 14.3 | 15.1 | 16.0 |
| 26 | 8.90 | 9.18 | 9.48 | $9 \cdot 80$ | $10 \cdot 2$ | $10 \cdot 5$ | 10.9 | II.4 | II.9 | 12.4 | 13.0 | 13.7 | 14.4 | 15.2 | 16. 1 |
| 27 | 8.98 | $9 \cdot 26$ | 9.56 | 9.89 | $0 \cdot 2$ | $10 \cdot 6$ | 11.0 | II.5 | 12.0 | 12.5 | 13.1 | 13.8 | 14.5 | 15.3 | $16 \cdot 3$ |
| 28 | 9.06 | $9 \cdot 34$ | $9 \cdot 65$ | 9.98 | $10 \cdot 3$ | $10 \cdot 7$ | $\mathrm{II}^{\text {I }}$ | Ir.6 | $12 \cdot \mathrm{I}$ | 12.6 | 13.2 | 13.9 | 14.7 | 15.5 | $16 \cdot 4$ |
| 29 | 9.15 | $9 \cdot 43$ | $9 \cdot 74$ | $10 \cdot 1$ | 10.4 | 10.8 | 11.2 | $1 \mathrm{I} \cdot 7$ | 12.2 | 12.8 | 13.4 | 14.0 | 14.8 | 15.6 | $16 \cdot 6$ |
| 30 | 9.24 | 9.53 | 9.84 | 10.2 | $10 \cdot 5$ | 10.9 | II4 4 | Ir. 8 | 12.3 | 12.9 | 13.5 | 14.2 | 14.9 | 15.8 | 16.8 |
| 3 r | 9.33 | $9 \cdot 63$ | 9.94 | $10 \cdot 3$ | 10. 6 | IIPO | 11.5 | II.9 | 12.5 | 13.0 | 13.6 | 14.3 | $15 \cdot 1$ | 16.0 | 16.9 |
| 32 | $9 \cdot 43$ | $9 \cdot 73$ | 10* | 10.4 | 10.8 | 11.2 | 11.6 | 12.1 | 12.6 | 13.2 | 13.8 | 14.5 | 15.3 | 16•I | $17 \cdot 1$ |
| 33 | 9.54 | $9 \cdot 84$ | $10 \cdot 2$ | $10 \cdot 5$ | 10.9 | II.3 | 11•7 | 12.2 | 12.7 | 13.3 | $14^{\circ} \mathrm{O}$ | 14.6 | 15.4 | $16 \cdot 3$ | $17 \cdot 3$ |
| 34 | 9.65 | 9.95 | $10 \cdot 3$ | $10 \cdot 6$ | II ${ }^{\circ}$ | 11.4 | II9 | 12.3 | 12.9 | 13.5 | 14.1 | 14.8 | 15.6 | $16 \cdot 5$ | 17.5 |
| 35 | $9 \cdot 77$ | $10 \cdot 1$ | $10 \cdot 4$ | 10.8 | II•I | II.6 | 12.0 | 12.5 | 13.0 | 13.6 | 14.3 | 15.0 | 15.8 | $16 \cdot 7$ | 17.7 |
| 36 | 9.89 | 10.2 | 10.5 | 10.9 | 11.3 | 1197 | 12.2 | 12.7 | 13.2 | 13.8 | 14.5 | 15.2 | 16.0 | 16.9 | 17.9 |
| 37 | $10 \cdot 0$ | $10 \cdot 3$ | $10 \cdot 7$ | 11.0 | II.4 | II.9 | 12.3 | 12.8 | r3.4 | 14.0 | 14.6 | 15.4 | $16 \cdot 2$ | 17.1 | 18.2 |
| 38 | 10.2 | $10 \cdot 5$ | 10.8 | II•2 | II 6 | 12.0 | 12.5 | 13.0 | 13.6 | 14.2 | 14.8 | 15.6 | $16 \cdot 4$ | 17.4 | 18.4 |
| 39 | $10 \cdot 3$ | $10 \cdot 6$ | $1 \mathrm{II} \cdot$ | 11.3 | ${ }_{11} 1 \cdot 7$ | 12.2 | $12 \cdot 7$ | 13.2 | $13 \cdot 7$ | 14.4 | $15^{\circ}$ | 15.8 | $16 \cdot 7$ | 17.6 | $18 \cdot 7$ |
| 40 | 10.4 | 10.8 | II'I | $1 \cdot 5$ | II.9 | 12.4 | 12.8 | 13.4 | 13.9 | 14.6 | 15.3 | 16.0 | 16.9 | 17.9 | 18.9 |
| 4 I | $10 \cdot 6$ | 10.9 | II•3 | 11.7 | 12.1 | 12.5 | $13^{\circ} \mathrm{O}$ | 13.6 | 14.1 | 14.8 | r $5 \cdot 5$ | $16 \cdot 3$ | 17.2 | 18.1 | 19.2 |
| 42 | 10.8 | Ir•I | Ir.5 | Ir 9 | 12.3 | 12.7 | 13.2 | ${ }_{13}{ }^{\text {P }}$ | 14.4 | 15.0 | 15.7 | $16 \cdot 5$ | 17.4 | 18.4 | 19.5 |
| 43 | $10 \cdot 9$ | Ir ${ }^{\text {P }}$ | II• 6 | 12.0 | $12 \cdot 5$ | 12.9 | 13.4 | 14.0 | 14.6 | 15.3 | 16.0 | 16.8 | 17.7 | 18.7 | 19.8 |
| 44 | II•I | II•5 | II•8 | 12.2 | 12.7 | 13.2 | $13 \cdot 7$ | 14.2 | 14.8 | 15.5 | 16.3 | $17 \cdot 1$ | 18.0 | 19.0 | 20.2 |
| 45 | II•3 | Ir•7 | 12.0 | 12.5 | 12.9 | 13.4 | 13.9 | 14.5 | 15.1 | 15.8 | 16.5 | 17.4 | 18.3 | 19.3 | $20 \cdot 5$ |
| 46 | Ir 5 | II•9 | 12.3 | 12.7 | 13.1 | 13.6 | 14.2 | 14.7 | 15.4 | 16.1 | 16.8 | 17.7 | 18.6 | 19.7 | 20.9 |
| 47 | 11•7 | $12 \cdot 1$ | 12.5 | 12.9 | 13.4 | 13.9 | 14.4 | 15.0 | 15.7 | 16.4 | 17.1 | 18.0 | 19.0 | $20 \cdot 1$ | 2 I 3 |
| 48 | 12.0 | 12.3 | 12.7 | 13.2 | 13.6 | 14.1 | 14.7 | 15.3 | $16 \cdot 0$ | $16 \cdot 7$ | 17.5 | 18.4 | 19.3 | $20 \cdot 4$ | $21 \cdot 7$ |
| 49 | 12.2 | 12.6 | 13.0 | 13.4 | 13.9 | 14.4 | 15.0 | 15.6 | 16.3 | 17.0 | 17.8 | 18.7 | 19.7 | 20.9 | 22.1 |
| 50 | 12.4 | 12.8 | 13.3 | $13 \times 7$ | 14.2 | 14.7 | $15 \%$ | 15.9 | 16.6 | 174 | 18.2 | 19.1 | $20 \cdot 1$ | 21.3 | 22.6 |
| 5 I | 12.7 | $13 \cdot 1$ | 13.5 | $14^{\circ} \mathrm{O}$ | 14.5 | 15.0 | 15.5 | 16.3. | 17.0 | 17.7 | 18.6 | 19.5 | $20 \cdot 6$ | 21.7 | 23.1 |
| 52 | 13.0 | 13.4 | 13.8 | 14.3 | 14.8 | 15.4 | $16 \cdot 0$ | 16.6 | 17.3 | 18.1 | 19.0 | 20.0 | 21.0 | 22.2 | 23.6 |
| 53 | 13.3 | 13.7 | 14.2 | 14.6 | 15.2 | 15.7 | $16 \cdot 3$ | 17.0 | $17 \cdot 7$ | 18.5 | 19.4 | $20 \cdot 4$ | 21.5 | 22.7 | ${ }^{24.1}$ |
| 54 | 13.6 | 14.0 | 14.5 | 15.0 | 15.5 | 16.1 | $16 \cdot 7$ | 17.4 | 18.2 | 19.0 | 19.9 | 20.9 | 22.0 | 23.3 | 24.7 |
| 55 | I3.9 | 14.4 | 14.9 | 15.4 | 15.9 | 16.5 | 17.1 | 17.8 | 18.6 | 19.5 | 20.4 | 21.4 | $22 \cdot 6$ | $23 \cdot 9$ | $25 \cdot 3$ |
| 56 | 14.3 | 14.8 | 15.2 | 15.8 | 16.3 | 16.9 | 17.6 | 18.3 | 19.1 | 20.0 | 20.9 | 22.0 | 23.1 | 24.5 | $26 \cdot 0$ |
| 57 | 14.9 | ${ }_{15}{ }^{\text {¢ }}$ I | 15.6 | 16.2 | 16.8 | 17.4 | $\underline{18.1}$ | 18.8 | 19.6 | 20.5 | $2 \mathrm{~F} \cdot 5$ | 22.6 | 23.8 | $25^{\circ} \mathrm{I}$ | $26 \cdot 4$ |
| 58 | 15.1 | 15.6 | $16 \cdot 1$ | $16 \cdot 6$ | 17.2 | 17.9 | 18.6 | 19.3 | 20.1 | 21.1 | 22.1 | 23.2 | 24.4 | 25.8 | 27.4 |
| 59 | 15.5 | $16 \cdot 0$ | $16 \cdot 5$ | 17.1 | 17.7 | 18.4 | $19 \cdot 1$ | 19.9 | $20 \cdot 7$ | 21.7 | 22.7 | 23.9 | $25^{\prime \prime}$ | 26.6 | 28.2 20 |
| 60 | $16 \cdot 0$ | 16.5 | 17.0 | 17.6 | 18.2 | 18.9 | 19.7 | $20 \cdot 5$ | 21.4 | 22.3 | 23.4 | 24.6 | 25.9 | 27.4 | $29^{\circ} 0$ |

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF $1^{\prime}$ IN THE ALTITUDE.

|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $15^{\circ}$ | $14^{\circ}$ | $13^{\circ}$ | $12^{\circ}$ | $11^{\circ}$ | $10^{\circ}$ | $9^{\circ}$ | $8^{\circ}$ | $7{ }^{\circ}$ | $6^{\circ}$ | $5^{\circ}$ | $4{ }^{\circ}$ | $3^{\circ}$ | 20 | $1^{\circ}$ |
|  | s.. | 5. | 5.8 | 5 | 21. | $2{ }^{\text {2 }}$ | 25.6 | 28.7 | 3.8 | 38.3 | 45 | 5 | . | 15 | s. |
|  | ${ }^{55} 5$ | 16:5 | 17\% | ${ }_{19}^{19} \cdot 3$ | ${ }_{21}^{21.0}$ | 23.0 | 25:6 | 28.7 | $32 \cdot 8$ <br> $32 \cdot 8$ | ${ }_{38}^{38.3}$ | 4599 | 57\%4 | ${ }_{76.4}^{76.4}$ | 115 | ${ }_{229}^{229}$ |
|  | Cs.5 | +18.5 | civis $\begin{gathered}17 \\ 7\end{gathered}$ | ${ }_{19}^{19} 3$ | 21.0 | 23. ${ }_{23}^{23}$ | ${ }_{25}^{25 \cdot 6}$ | 28.8 28.8 | 322 $32 \cdot 9$ | 38.3 | 45909 | 57\%4 | $76 \cdot 5$ | 115 | 229 |
|  | 15 | 16.6 | 17.8 | 19.3 | 21.0 | ${ }_{23}{ }^{2}$ | 25.6 | ${ }_{28.8}$ | 32.9 32 | ${ }_{38} 8$ |  | 57\% 5 | . 6 | 115 | 230 |
|  | $15 \cdot 5$ | 16.6 | 17.8 | ${ }^{9} 93$ | $21^{\circ}$ | ${ }^{23} \cdot 1$ |  |  |  |  | $4{ }^{6 \cdot 1}$ | 57.6 | $76 \cdot 7$ | 15 | 230 |
|  | 15:5 | ${ }_{\text {1 }}^{16 \cdot 6}$ | 17.9 | 19.3 | ${ }_{21}^{21.1}$ | 23.2 23.2 | 25.7 | 28.9 20 | 33.0. | 38.5 <br> 38.6 | ${ }_{46 \cdot 2}^{46 \cdot 1}$ | 57.7 | 76.9 | 115 | $3{ }^{30}$ |
| 8 | ${ }_{15} 5$ | 1 | 18.0 | 19.4 |  |  | ${ }_{25} 5$ | 29.0 | ${ }_{33}{ }^{\text {r }}$ | 38.6 | $4{ }^{46}$ | 57 | 77.2 | 116 | 231 |
| ${ }_{10}{ }^{9}$ | $15 \%$ | 16.7 | cis | 199.5 | ${ }_{21}^{21 \cdot 3}$ | 233.4 23 | 25.9. | ${ }_{29}^{29 \cdot 2}$ | ${ }_{33}^{33 \cdot 2}$ | 38.7 <br> 38.9 | ${ }_{46}^{46 \cdot 6}$ | 58.2 | 77.6 | 116 | ${ }_{233}^{232}$ |
| II | 15.7 | ${ }^{16.8}$ | 18.1 | 19.6 | ${ }^{21} 4$ | 23.5 | $26 \cdot 0$ | 29.3 | $33 \cdot 4$ | 390\% | 46.8 | 58.4 | 78 | 17 | 33 |
|  | 15 | 17\% | 18.2 | 19.7 | ${ }_{21} 2.5$ | 23 | ${ }_{26 \cdot 2}^{26 \cdot 1}$ |  | 337 | ${ }_{39}^{39 \cdot}$ | ${ }_{4}^{4} 7$ | 58.9 | 78.4 | 18 | 234 |
| I4 | (15.9 |  | cis | 19.8 | ${ }_{21}^{21.7}$ | ${ }_{23}^{23 \cdot 8}$ | ${ }_{26.5}^{26.4}$ | ${ }_{29}^{29.6}$ | 33:8. | 39.4 <br> 39 | 47•3 | 599.4 | ${ }_{79}^{78.8}$ | ${ }_{118}^{18}$ | 236 |
| 16 | 16.1 | 17.2 | 18.5 | $20 \cdot 0$ | 21 |  | 26.6 | 29.9 | 34' | 39.8 |  | 9.7 | 9\% | 19 | 38 |
| ¢ |  | 17.3 | ${ }_{18}^{18.6}$ | 20\% | 222.9 | ${ }_{24}^{24.2}$ | 26.7 26 | $3{ }^{\circ} 2$ | 34:3 | $40 \cdot 2$ | $4^{8 \cdot 3}$ | 60. | 9•9 | 120 | ${ }^{40}$ |
| 19 | 16 | 17 | 18.8 | 20.3 | $22 \cdot 2$ | $24 \cdot 4$ | 27.0 | $3{ }^{3}$ | 34.7 | $40 \cdot 5$ | 488.5 | 60.6 | \% 8 | 21 | 242 |
|  |  | 17.6 | 18 | 20.5 | 22:3 | 24.5 | 27.2 | 30.6 | $3^{3+9}$ | $40^{\circ} 7$ |  | $6{ }^{\circ}$ | 8r'3 | 22 | 244 |
| ${ }_{22}^{21}$ | 16.6 | 17\% | 19.0 | ${ }_{20.7}^{20.6}$ | 22:5 | 24:7 | 27.4 |  | 35.2 | ${ }_{41}^{41}$ | 49:2 | ¢104 6 | 8r ${ }_{\text {829 }}$ | 223 | 246 |
| 23 |  | 18.0 | 19 | 20.9 | 22:8 | $25^{\circ}$ | 27.8 | $3{ }^{1} \cdot 2$ | 35.7 | . | 99, | $62 \cdot 3$ | $8{ }^{8 .}$ | 25 | 249 |
| ${ }_{25}^{24}$ |  | (18.1 | 19.5 | $\xrightarrow[21]{2 r 12}$ | 23:19 | 25.2. | ${ }_{28.2}^{28 \cdot 0}$ | ${ }_{31}^{31.5}$ | 35.9 | ${ }_{42}^{41 \cdot 9}$ | 50:6 | 63:3 | ${ }_{84}^{83}$ | 125 | ${ }_{253}^{255}$ |
| 26 | 172 | 18.4 | 19.8 | $2{ }^{2} 4$ | $23 \cdot 3$ | $25 \cdot 6$ | 28 | 32.0 | $36 \cdot 5$ | 42.6 | ${ }_{515}$ | 63:8 | $85^{\circ}$ | 28 | 55 |
| 27 <br> 28 | 17 | 18 | ${ }_{20.1}^{20.0}$ | ${ }_{2 r}^{21 .}$ | 23, 23 | ${ }_{\text {cker }}^{\substack{25.8 \\ 26.1}}$ | ${ }_{29}{ }^{28}$ | cers | $37 \cdot 2$ | ${ }_{43}^{42}$ | 5200 | ${ }_{64.4}^{64}$ | ${ }_{86} 8$ | 129 | 250 |
| 29 | 17 | 18 | $20 \cdot 3$ |  | $24^{\circ} \mathrm{O}$ | 26:3 | 29.2 | 32:9 | $37 \cdot 9$ | ${ }_{4}^{43 \cdot 8}$ | 52.5 | 65.6 66.2 | ${ }_{88}^{87.4}$ | 132 | ${ }_{265}^{262}$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 | 18 | 19:5 | 20 | ${ }_{22} 22 \cdot 7$ | ${ }_{24}^{24}$ | ${ }_{27}^{27 \cdot 9}$ | ${ }_{30} 2.2$ | ${ }_{33} 3$ 9,9 | 38.7 38 | ${ }_{45 \cdot \mathrm{I}}^{44}$ |  | ${ }^{67} \cdot 6$ | \% | 134 | ${ }^{267}$ |
| 33 |  | 19.7 | ${ }_{21}^{2 \mathrm{Ir}^{2} \cdot}$ | ${ }_{23}^{22 \cdot 2}$ | 255.0 | 27.5 27.8 | cols 3 | ${ }_{34}^{34} 4$ | ${ }_{39}^{39}$ \% | ${ }_{46 \cdot 2}^{45}$ | $55 \cdot 4$ | ${ }_{692}$ | ${ }^{2} \cdot 2$ | ${ }_{138}$ | 273 |
| 35 | 18.9 | 20.2 | 21.7 | 23.5 | $25^{5}$ | 28.1 | $3{ }^{1} 2$ | ${ }_{35}{ }^{\text {5 }}$ | $44^{\circ}$ | $46 \cdot 7$ | 56.0 | $70 \cdot 0$ | 93.3 | 140 | 280 |
| 36 | 19 | 20.4 | ${ }_{22}^{22 \cdot 0}$ | ${ }_{\substack{23.8 \\ 24.1}}$ | ${ }_{265}^{25 \cdot 9}$ | 28.5 |  | 35.5 36.0 | ${ }_{4}^{40 \cdot 6}$ |  |  | ${ }_{77}^{70.9}$ | 94.5 | 42 | -83 |
| ${ }^{38}$ | 19 | 2100 | 22:6 | 24:4 | 26.6 | 29:2 | 32:4 | 36.5 | $4{ }_{4}$ | 48.6 | 58.2 | 73.8 | 978 | ${ }_{45}$ | 295 |
| ${ }_{40}^{39}$ |  | $\xrightarrow{215}$ | 22:9 | cis 2 2.8.8 | ${ }_{274}^{27.0}$ | ${ }^{29.6}$ |  | 37.0 | ${ }_{42}^{42 \cdot 8}$ | 50:0 | ${ }_{59}^{59.1}$ | $73 \cdot 8$ 74.9 | ${ }_{99} 98$ | ${ }_{150}^{147}$ | 299 |
| 4 | 20. | $22 \times 2$ | ${ }_{23}^{23.6}$ |  | 27.8 28.2 | $30 \cdot 5$ 315 | 33-9 | ${ }_{\text {ckir }}^{38.1}$ | $43 \cdot 5$ | ${ }_{5}^{50 \cdot 7}$ | 60.8 <br> 6.8 <br> 6, | ${ }^{7} 76$ | Yor | 5 | 8 |
| ${ }_{43}^{42}$ | 2 T | ${ }_{22}^{22}$ | 24.3 | 26:3 | 28.7 | 3r.5 | 35.0. | 39:3 | $44 \cdot 9$ | 52:3 | 528 |  | 105 | 154 | 313 |
| 4 | ${ }_{\text {arr }}^{2 \times 5}$ | 23.0. | 24.7 | ${ }_{27 \cdot 2}^{26 \cdot 7}$ | ${ }_{29}^{29 \cdot 6}$ | 32:0 |  | 40.0. | ${ }_{46 \cdot 4}^{45.6}$ |  | - 63.8 | ${ }_{8}{ }_{8}$ | 106 | 159 | 324 |
| 46 | $22 \cdot 2$ | 23.8 | ${ }^{25 \cdot 6}$ | 27.7 | 30.2 | 33.2 | ${ }_{3}^{36.8}$ | $4 \mathrm{~T} \cdot 4$ | 48.2 | ${ }_{55}^{55 \cdot}$ |  | 82 | I10 | 165 | , 6 |
| ${ }_{48}^{47}$ | ${ }^{23 \cdot 7}$ | 24 | ${ }_{26 \cdot 6}^{20.6}$ | 28.8 | 3r-3 | 34.4. | 37.5 | ${ }_{43}^{48}$ | ${ }_{49}{ }^{\text {P/ }}$ | 57-2 | 68.6 |  | 12 | 178 | ${ }^{336}$ |
| 49 | 23 |  |  | 29 | ${ }^{32 \cdot 6}$ | ${ }^{35 \cdot}$ | 39.0 39.8 | $4{ }_{44}^{43 \cdot 8}$ | ${ }_{5 \times 1}^{50.1}$ |  | 75.4 | 8 | 19 | 175 | ${ }_{357}^{349}$ |
|  | 24. | 25.7 | 27.7 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 24. | ${ }^{26 \cdot 3} 2$ | 28.3 28.9 | $\begin{aligned} & 30 \cdot 6 \\ & 3 \mathrm{r}_{2} \end{aligned}$ | ${ }_{34}^{33 \cdot 5}$ |  | ${ }_{4}^{40.6}$ | $4{ }^{45 \cdot 7}$ | $\begin{gathered} 52 \cdot 2 \\ 53: 3 \end{gathered}$ | $\begin{array}{\|c\|c\|c\|c\|c\|} 60 \cdot 1 \\ 620 \end{array}$ | $\begin{aligned} & 2 \cdot 9 \\ & \hline 7,5 \end{aligned}$ | ${ }_{93}{ }_{9}^{9 \times 1}$ |  |  | ${ }_{372}^{364}$ |
| 53 |  | ${ }^{28 \cdot \mathrm{~T}}$ | 29.5 | $32 \cdot 7$ | 5.7 | 38.3 |  | 47.8 | ${ }_{\text {54, }}^{53}$ | 63.6 | 帾 | 95:3 | 127 | 190 | ${ }^{381}$ |
| ${ }_{55} 5$ | 26 | ${ }_{28}^{28}$ | 3r. | ${ }_{3}^{32} 5$ | ${ }_{36}^{33.5}$ | 30.2 | 44.6 | ${ }_{50.1}^{48}$ | 57.2 | ${ }^{66.7}$ | - 78.1 | 97\% | $1 \begin{aligned} & 130 \\ & 133 \\ & 1\end{aligned}$ | 195 | 390 |
| 56 | 27.6 | 29.6 | 31.8 |  |  |  |  | Sr ${ }_{5}^{51}$ |  |  |  |  |  |  | 410 |
|  | ${ }_{29}^{28 \cdot 4}$ | ${ }_{3}^{30.4}$ | ${ }_{\text {32 }}^{32 \cdot 6}$ | coly | cock | 42:3 | $48 \cdot 3$ | 54.2 | $6 \mathrm{r} \cdot 9$ |  | 84.3 | 10953 |  | 18 | ${ }_{432}^{421}$ |
| 59 | $3 \cdot 9$ | ${ }_{33}^{32 \cdot \mathrm{r}}$ | ${ }_{35}^{34.5}$ | 37.4 38.5 | 419.9 | ${ }_{44}^{46.1}$ | ${ }_{51}^{49}$ | 55.8.8 | 63.7 65.6 | 74.3 | - | (1123 | ${ }_{1}^{148}$ | 223 | 445 |

When the Latitude Variation is + name the Azimuth the same name as Latitude. opposite name to the Latitude.
On the Equator the"Azimuth will have the same name as the Declination.

| Lat. <br> Var. <br> to $\mathrm{I}^{\prime}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $0^{\circ}$ | $5^{\circ}$ | $10^{\circ}$ | $13^{\circ}$ | $16^{\circ}$ | $18^{\circ}$ | $20^{\circ}$ | $22^{\circ}$ | $24^{\circ}$ | $25^{\circ}$ | $26^{\circ}$ | $27^{\circ}$ | $28^{\circ}$ | $29^{\circ}$ | $30^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $\bigcirc$ |
| 0.00 0.10 | 88.9 | 88.9 | ${ }^{90} 8.6$ | ${ }^{90 \cdot 0}$ | 90*0 | $880 \cdot 0$ | $80^{\circ}$ | 8880 | 7 | 88.9 | 0 | $90^{\circ}$ | 90.0 | - | - ${ }^{\circ} \mathrm{O}$ |
| - 0.20 | $87 \cdot 1$ | $87 \cdot 1$ | 87.2 | 87.2 | 87.2 | 87.3 | $87 \cdot 3$ | $87 \cdot 3$ | 87.4 | 87.4 | 87.4 | $87 \cdot 4$ | 87.5 | 7 | -8 |
| 0.30 | $85 \cdot 7$ | 85.7 | 85.8 | 85.8 | 85.9 | 85.9 | $86 \cdot 0$ | 86.0 | 86.1 | 86. I | $86 \cdot 1$ | 86.2 | $86 \cdot 2$ | $86 \cdot 2$ | $86 \cdot 3$ |
| $0 \cdot 40$ | 84.3 | 84.3 | 84.4 | 84.4 | 84.5 | 84.5 | $84 \cdot 6$ | 84.7 | 84.8 | 84.8 | 84.9 | 84.9 | $85 \cdot$ | 85.0 | $85 \cdot \mathrm{I}$ |
| 0.50 | 82.9 | 82.9 | 83.0 | 83.1 | 83.2 | 83.2 | 83.3 | 83.4 | 83.5 | 83.5 | $83 \cdot 6$ | $83 \cdot 6$ | $83 \cdot 7$ | 83.8 | $83 \cdot 8$ |
| 0.60 | $8 \mathrm{I} \cdot 5$ | $8 \mathrm{x} \cdot 5$ | $8 \mathrm{x} \cdot 6$ | $8 \mathrm{I} \cdot 7$ | $8 \mathrm{I} \cdot 8$ | $8 \mathrm{r} \cdot 9$ | $82 \cdot 0$ | $82 \cdot 1$ | 82.2 | 82.3 | $82 \cdot 3$ | 82.4 | 82.5 | 82.5 | 82.6 |
| 0.70 | $80^{\circ} \mathrm{I}$ | $8{ }^{80} 1$ | 80.2 | $80 \cdot 3$ | $80 \cdot 5$ | 80.6 | $80 \cdot 7$ | 80.8 | 80.9 | $8 \mathrm{r} \cdot 0$ | $8 \mathrm{r} \cdot \mathrm{I}$ | $8 \mathrm{x} \cdot 2$ | $8 \mathrm{r} \cdot 2$ | $81 \cdot 3$ | $8 \mathrm{r} \cdot 4$ |
| 0.80 | $78 \cdot 7$ | 78.7 | 78.9 | $79^{\circ}$ | 79.1 | 79.2 | 79.4 | 79.5 | $79 \cdot 6$ | $79 \cdot 7$ | $79 \cdot 8$ | $70 \cdot 9$ | $80 \cdot 0$ | $80 \cdot 1$ | $80 \cdot 2$ |
| $0 \cdot 90$ | 77.3 | 77.4 | 77.5 | 77.6 | $77 \cdot 8$ | 77.9 | 78.1 | 78.1 | 78.4 | $78 \cdot 5$ | 78.6 | $78 \cdot 7$ | 78.8 | 78.9 | 79.0 |
| 1.00 | $76 \cdot 0$ | 76.0 | $76 \cdot 2$ | $76 \cdot 3$ | $76 \cdot 5$ | 76.6 | 76.8 | 76.9 | 77•1 | 77.2 | $77 \cdot 3$ | 77.4 | 77.6 | 77•7 | 77.8 |
| 1.10 | $74 \cdot 6$ | 74.7 | 74.9 | $75^{\circ} \mathrm{O}$ | 75.2 | 75.4 | 75.5 | $75 \cdot 7$ | 75.9 | 76.0 | $76 \cdot 1$ | 76.2 | 76.4 | $76 \cdot 5$ | $76 \cdot 6$ |
| 1.20 | 73.3 | 73.4 | 73.5 | $73 \cdot 7$ | 73.9 | 74.1 | 74.3 | 74.5 | 74*7 | 74.8 | 74.9 | 75.0 | $75 \cdot 2$ | $75 \cdot 3$ | 75.4 |
| 1.30 | $72 \cdot 0$ | $72 \cdot 1$ | $72 \cdot 3$ | 72.4 | $72 \cdot 7$ | 72.8 | $73^{\circ} \mathrm{O}$ | 73.2 | 73.5 | 73.6 | $73 \cdot 7$ | 73.9 | $74^{\circ} \mathrm{O}$ | $74 \cdot 1$ | 74.3 |
| 1.40 | $70 \cdot 7$ | 70.8 | 71.0 | 71.2 | 71.4 | 71.6 | 71.8 | $72 \cdot 0$ | $72 \cdot 3$ | 72.4 | $72 \cdot 5$ | $72 \cdot 7$ | $72 \cdot 8$ | $73^{\circ}$ | $73^{\circ}$ |
| x 50 | 69.4 | 69.5 | $69 \cdot 7$ | 69.9 | 70.2 | $70 \cdot 4$ | $70 \cdot 6$ | 70.8 | 71 | 71.2 | 71 | 71.5 | $71 \cdot 7$ | 71.8 | 72.0 |
| 1.60 | $68 \cdot 2$ | 68.3 | 68.5 | $68 \cdot 7$ | $69^{\circ}$ | 69.2 | 69.4 | 69.7 | 69.9 | $70 \cdot 1$ | 70.2 | 70.4 | $70 \cdot 5$ | $70 \cdot 7$ | $70 \cdot 9$ |
| 1•\% | 67.0 | $67 \cdot 1$ | $67 \cdot 3$ | 67.5 | 67.8 | 68.0 | 68.2 | 68.5 | 68.8 | 68.9 | 69.1 | $69 \cdot 3$ | 69.4 | $69 \cdot 6$ | $69 \cdot 8$ |
| r.80 | $65^{\circ} 8$ | 65.9 | $66 \cdot 1$ | $66 \cdot 3$ | $66 \cdot 6$ | 66.8 | 67.1 | $67 \cdot 4$ | 67.7 | 67.8 | $69^{\circ}$ | 68.2 | $68 \cdot 3$ | 68.5 | $68 \cdot 7$ |
| 1.90 | 64.6 | 64.7 | 64.9 | $65 \cdot 2$ | $65 \cdot 5$ | $65 \cdot 7$ | 65.9 | $66 \cdot 2$ | $66 \cdot 5$ | $66 \cdot 7$ | $66 \cdot 9$ | 67.1 | $67 \cdot 2$ | 67.5 | $67 \cdot 6$ |
| 2.00 | 63.4 | 63.5 | 63.8 | $64^{\circ}$ | 64.3 | 64.6 | 64.8 | $65 \cdot 1$ | $65 \cdot 5$ | $65 \cdot 6$ | 65.8 | 66.0 | 66.2 | 66.4 | $66 \cdot 6$ |
| $2 \cdot 10$ | $62 \cdot 3$ | 62.4 | $62 \cdot 7$ | 62.9 | 63.2 | $63 \cdot 5$ | $63 \cdot 7$ | $64^{\circ}$ | 64.4 | 64.6 | 64•7 | 64.9 | 65.I | $65 \cdot 3$ | $65 \cdot 6$ |
| 2.20 | $6 \mathrm{I} \cdot 2$ | 6I.3 | 6x-6 | 61.8 | 62.1 | 62.4 | 62.7 | 63.0 | 63.3 | $63 \cdot 5$ | $63 \cdot 7$ | 63.9 | 64. 1 | $64 \cdot 3$ | 64.5 |
| 2.30 | $60 \cdot 1$ | $60 \cdot 2$ | $60 \cdot 5$ | $60 \cdot 7$ | 6r.I | 61-3 | 61.6 | 6x.9 | $62 \cdot 3$ | 62.5 | 62.7 | 62.9 | $63 \cdot 1$ | $63 \cdot 3$ | 63.5 |
| 2.40 | $59^{\circ}$ | $59 \cdot 1$ | 59.4 | 59.7 | $60 \cdot 0$ | $60 \cdot 3$ | $60 \cdot 6$ | 60.9 | 6 x 3 | 61.5 | $6 \mathrm{r} \cdot 7$ | 6x.9 | $62 \cdot 1$ | $62 \cdot 3$ | $62 \cdot 5$ |
| $2 \cdot 50$ | 58.0 | 58.1 | 58.4 | 58.7 | 59.0 | 59.3 | 59.6 | 59.9 | 60.3 | $60 \cdot 5$ | $60 \cdot 7$ | 60.9 | 6x-x | 61.3 | 6x.6 |
| 2.60 | 57\% | 57.1 | 57.4 | $57 \cdot 7$ | 58.0 | 58.3 | $58 \cdot 6$ | 58.9 | $59 \cdot 3$ | 59.5 | 59*7 | 59.9 | $60 \cdot 1$ | $60 \cdot 4$ | $60 \cdot 6$ |
| $2 \cdot 70$ | $56 \cdot 0$ | $56 \cdot 1$ | 56.4 | $56 \cdot 7$ | 57.0 | $57 \cdot 3$ | 57.6 | $58 \cdot 0$ | 58.3 | 58.5 | 58.8 | $59^{\circ}$ | 59.2 | 59.4 | 59.7 |
| $2 \cdot 80$ | $55^{\circ}$ | $55 \cdot 1$ | 55.4 | $55 \cdot 7$ | 56. ${ }^{\text {I }}$ | 56.3 | 56.7 | 57.0 | 57.4 | $57 \cdot 6$ | 57.8 | 58.0 | $58 \cdot 3$ | 58.5 | $58 \cdot 8$ |
| $2 \cdot 90$ | 54.1 | 54.2 | 54.5 | 54.8 | 55'1 | 55.4 | $55 \cdot 7$ | $56 \cdot 1$ | $56 \cdot 5$ | 56•7 | $56 \cdot 9$ | 57.1 | $57 \cdot 4$ | 57.6 | 57.9 |
| 3.00 | 53 | 53.2 | 53.6 | 53.8 | 54.2 | 54.5 | 54.8 | 55.2 | $55 \cdot 6$ | 55.8 | 56.0 | $56 \cdot 2$ | $56 \cdot 5$ | $56 \cdot 7$ | 57\% |
| $3 \cdot 10$ | $52 \cdot 2$ | 52.3 | $52 \cdot 6$ | 52.9 | 53.3 | 53.6 | 53.9 | $54 \cdot 3$ | 54.7 | 54.9 | 55•1 | 55.4 | $55 \cdot 6$ | $55^{\circ} 9$ | 56.1 |
| $3 \cdot 20$ | 51.3 | 51.4 | $5 \mathrm{x} \cdot 8$ | $52 \cdot 1$ | 52.4 | $52 \cdot 7$ | $53 \cdot 1$ | 53.4 | 53.8 | $54^{1} \mathrm{I}$ | 54.3 | $54 \cdot 5$ | 54.8 | $55^{\circ}$ | $55 \cdot 3$ |
| 3.30 | $50 \cdot 5$ 40.6 | $50 \cdot 6$ | $50 \cdot 9$ | 51.2 | $5 \mathrm{5} \cdot 6$ | 52.9 | 52.2 51.4 | $52 \cdot 6$ 51.8 | 53.0 | 53.2 52.4 | 53.4 52.6 | 53.7 | 53.9 | 54.2 | 54.5 |
| 3.40 | $49 \cdot 6$ | $49 \cdot 7$ | 50•I | 50.4 | 50.7 | 51.0 | 51.4 | 51.8 | $52 \cdot 2$ | 52.4 | 52.6 | 52.9 | 53.1 | 53.4 | $53 \cdot 6$ |
| 3.50 | $48 \cdot 8$ | $48 \cdot 9$ | 49.2 | 49.5 | $49 \cdot 9$ | 50.2 | $50 \cdot 6$ | 50.9 | $51 \cdot 4$ | 51.6 | 5x.8 | 52. | 52.3 | $52 \cdot 6$ | 52.8 |
| 3.60 | $48 \cdot 0$ | $48 \cdot 1$ | $48 \cdot 4$ | 48.8 | $49 \cdot 1$ | 49.4 | 49.8 | $50 \cdot 2$ | $50 \cdot 6$ | 50.8 | 51.0 | 51.3 | 51.5 | 51.8 | 52.1 |
| 3.70 3.80 | $47 \cdot 2$ | 47.3 | $47 \cdot 7$ | $48 \cdot 0$ | $48 \cdot 4$ | $48 \cdot 7$ | $49^{\circ}$ | 49.4 | $49 \cdot 8$ | $50 \cdot 0$ | $50 \cdot 3$ | $50 \cdot 5$ | $50 \cdot 8$ | 51.0 | $51 \cdot 3$ |
| 3.80 | $46 \cdot 5$ |  | 46.9 | 47.2 | $47 \cdot 6$ | 47.9 | 48.2 | $48 \cdot 6$ | $49^{\circ}$ | $49 \cdot 3$ | $49 \cdot 5$ | 49.8 | 50.0 | 50.3 | $50 \cdot 6$ |
| 3.90 | $45^{\circ} 7$ | $45 \cdot 8$ | $46 \cdot 2$ | $46 \cdot 5$ | $46 \cdot 9$ | 47.2 | 47.5 | 47.9 | $48 \cdot 3$ | $48 \cdot 5$ | 48.8 | $49 \cdot 0$ | $49 \cdot 3$ | 49.5 | $49 \cdot 8$ |
| 4.00 | $45^{\circ} \mathrm{O}$ | 45.1 | 45'4 | $45 \cdot 7$ | $46 \cdot 1$ | 46.4 | $46 \cdot 8$ | 47.2 | $47 \cdot 6$ | 47.8 | 48.1 | $48 \cdot 3$ | $48 \cdot 6$ | $48 \cdot 8$ | $49 \cdot 1$ |
| $4 \cdot 10$ | 44.3 | 44.4 | 44.7 | $45^{\circ}$ | 45.4 | 45.7 | $46 \cdot 1$ | $46 \cdot 5$ | $46 \cdot 9$ | 47.1 | $47 \cdot 3$ | $47 \cdot 6$ | $47 \cdot 9$ | $48 \cdot 1$ | 48.4 |
| 4.20 | $43 \cdot 6$ | 43.7 | $44^{\circ} \mathrm{O}$ | 44.3 | 44.7 | $45^{\circ}$ | 45.4 | $45 \cdot 8$ | $46 \cdot 2$ | $46 \cdot 4$ | $46 \cdot 7$ | $46 \cdot 9$ |  | 47.4 | $47 \cdot 7$ |
| 4.30 | 42.9 | 43.0 | 43.4 | $43 \cdot 7$ | 44. 1 | 44.4 | $44^{\prime} 7$ | $45 \cdot 1$ | $45 \cdot 5$ | $45^{\circ} 7$ | $46 \cdot 0$ | $46 \cdot 2$ | $46 \cdot 5$ | $46 \cdot 8$ | $47 \cdot 0$ |
| 4.40 | $42 \cdot 3$ | 42.4 | 42.7 | $43^{\circ} \mathrm{O}$ | $43 \cdot 6$ | $43 \cdot 7$ | 44. ${ }^{\text {r }}$ | $44^{6}$ | 44.9 | 45.1 | $45 \cdot 3$ | $45 \cdot 6$ | $45 \cdot 8$ | $46 \cdot 1$ | $46 \cdot 4$ |
| 4.50 | 41.6 | 4177 | 42.1 | 42.4 | $42 \cdot 8$ | 43'1 | 43.4 | 43.8 |  | 44.4 | $44^{\circ} 7$ | $44^{\circ} 9$ |  | 45.5 | $45 \cdot 7$ |
| 4.60 | $4 \mathrm{I} \cdot 0$ | $4 \mathrm{I} \cdot \mathrm{I}$ | $4 \mathrm{x} \cdot 4$ | $4 \mathrm{I} \cdot 7$ | $42 \cdot 1$ | 42.4 | 42.8 | $43 \cdot 2$ | $43 \cdot 6$ | $43 \cdot 8$ | $44 \cdot 1$ | $44 \cdot 3$ | $44 \cdot 6$ | 44.8 | $45 \cdot 1$ |
| 4.70 4.80 | $40 \cdot 4$ 39 | $40 \cdot 5$ 39.9 | $40 \cdot 8$ $40 \cdot 2$ | $41 \cdot 1$ $40 \cdot 5$ | $41 \cdot 5$ $40 \cdot 9$ | 41.8 41.2 | 42.2 41.5 | $42 \cdot 5$ 41.9 | 43.0 42.4 | 43.2 42.6 | 43.4 42.8 | $43 \cdot 7$ | 43.9 | 44.2 | 44.5 |
| 4.80 4.90 | $39 \cdot 8$ 39.2 | 39.9 39.3 | $40 \cdot 2$ 39 | $40 \cdot 5$ 40.0 | $40 \cdot 9$ $40 \cdot 3$ | $41 \cdot 2$ 40.6 | 41.5 41.0 | 41.9 414 | 42.4 41.8 | 42.6 42.0 | $42 \cdot 8$ $42 \cdot 2$ | $43 \cdot 1$ 42.5 | $43 \cdot 3$ $42 \cdot 8$ | 43.6 43.0 | $43 \cdot 9$ $43 \cdot 3$ |
| $5 \cdot 00$ | $38 \cdot 7$ | 38.8 | 39•1 | $39^{\circ} 4$ | $39 \cdot 8$ | 40'1 | $40 \cdot 4$ | $40 \cdot 8$ | 4192 | 41.4 | 4I'7 | 4199 | 42.2 | 42.4 | 42.7 |
| $5 \cdot 10$ | $38 \cdot \mathrm{I}$ | 38.2 | 38.5 | 38.8 | $39^{\prime 2}$ | 39.5 | $39 \cdot 8$ | $40 \cdot 2$ | $40 \cdot 6$ | $40 \cdot 9$ | $41 \cdot 1$ | $4 \mathrm{I} \cdot 4$ | $4 \mathrm{I} \cdot 6$ | 41.9 | $42 \cdot 2$ |
| 5.20 5.30 | 37.6 | $37 \cdot 7$ | $38 \cdot 0$ | 38.3 | $38 \cdot 7$ | $39^{\circ} \mathrm{O}$ | 39.3 | $39 \cdot 7$ | $40 \cdot 1$ | $40 \cdot 3$ | $40 \cdot 6$ | 40.8 | 41.1 | $4 \mathrm{r} \cdot 3$ | $4 \mathrm{r} \cdot 6$ |
| $5 \cdot 30$ | 3370 | $37 \cdot 1$ | $37 \cdot 5$ | 37.8 | $38 \cdot 1$ | 38.4 | $38 \cdot 8$ | 39.1 | $39^{\circ} 6$ | $39 \cdot 8$ | $40 \cdot 0$ | $40 \cdot 3$ | $40 \cdot 5$ | $40 \cdot 8$ | 41.0 |
| $5 \cdot 40$ | $36 \cdot 5$ | 36.6 | $36 \cdot 9$ | 37.2 | $37 \cdot 6$ | 37.9 | 38.2 | $38 \cdot 6$ | $39^{\circ}$ | $39 \cdot 3$ | $39 \cdot 5$ | $39 \cdot 7$ | $40 \cdot 0$ | $40 \cdot 3$ | $40 \cdot 5$ |
| $5 \cdot 50$ | 36.0 | $36 \cdot 1$ | 36.4 | $36 \cdot 7$ | 37.1 |  | 37.7 | 38.1 |  | $38 \cdot 7$ | $39^{\circ}$ | 39.2 | $39 \cdot 5$ | 39.7 | $40 \cdot 1$ |
| 5.60 5.70 | 35.5 35.1 | $35 \cdot 6$ $35 \cdot 2$ | $36 \cdot 0$ | $36 \cdot 2$ $35 \cdot 8$ | $36 \cdot 6$ | 36.9 | 37.2 36.8 | 37.6 | $38 \cdot 0$ | $38 \cdot 2$ 37.8 | 38.5 | 38.7 | $39^{\circ} \mathrm{O}$ | 39.2 | 39.5 |
| 5.70 5.80 | $35 \cdot \mathrm{I}$ 34 | $35 \cdot 2$ $34 \cdot 7$ | $35 \cdot 5$ $35 \cdot 0$ | $35 \cdot 8$ $35 \cdot 3$ | $36 \cdot 1$ $35 \cdot 7$ | 36.4 35.9 | $36 \cdot 8$ 36.3 | 37.1 36.6 | 37.5 37.0 | $38 \cdot 8$ $37 \cdot 3$ | 38.0 37.5 | $38 \cdot 2$ 37.7 | 38.5 38.0 | $38 \cdot 7$ 38.3 | 39.0 38.5 |
| 5.00 500 | $34 \cdot 6$ 34 | 34.7 34.2 | $35 \cdot 0$ 34.5 | $35 \cdot 3$ 34.8 | 35.7 35.2 | 35.9 35.5 | 36.3 35.8 | $36 \cdot 6$ $36 \cdot 2$ | $37 \cdot 0$ 36.6 | 37.3 36.8 | $37 \cdot 5$ 37 | $37 \cdot 7$ $37 \cdot 3$ | 38.0 37.5 | $38 \cdot 3$ $37 \cdot 8$ | ${ }_{3}^{38 \cdot 5}$ |

When the Latitude Variation is + name the Azimuth the same name as Latitude
opposite name to the Latitude.
On the Equator the Azimuth will have the same name as the Declination.

| Lat. Var. to $\mathrm{I}^{\prime}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $0^{\circ}$ | $5^{\circ}$ | $10^{\circ}$ | $13^{\circ}$ | $16^{\circ}$ | $18^{\circ}$ | $20^{\circ}$ | $22^{\circ}$ | $24^{\circ}$ | $25^{\circ}$ | $26^{\circ}$ | $27^{\circ}$ | $28^{\circ}$ | $29^{\circ}$ | $30^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| s. 6.00 | $33 \cdot 7$ | $33 \cdot 8$ | $34^{1} 1$ | 34.4 | $34^{\circ} 7$ | 35*0 | $35 \cdot 4$ | $35 \cdot 7$ | $36^{\circ} \cdot 1$ | $36 \cdot 3$ | 36.6 | $36 \cdot 8$ | $37^{\circ} 1$ | $3{ }^{\circ} \cdot 3$ | $\stackrel{\circ}{7} \cdot 6$ |
| $6 \cdot 10$ | 33.3 | $33 \cdot 3$ | $33^{\circ} 6$ | $33^{\prime} 9$ | $34 \cdot 3$ | 34.6 | 34.9 | $35 \cdot 3$ | $35 \cdot 6$ | 35.9 | $36 \cdot 1$ | $36 \cdot 3$ | $36 \cdot 6$ | $36 \cdot 9$ | $37 \cdot 1$ |
| $6 \cdot 20$ | $32 \cdot 8$ | $32 \cdot 9$ | $33^{\circ} 2$ | $33 \cdot 5$ | $33 \cdot 9$ | $34^{\circ} 2$ | 34.5 | $34^{\cdot 8}$ | $35^{\circ} 2$ | $35 \cdot 4$ | 35'7 | $35 \cdot 9$ | $36 \cdot 2$ | $36 \cdot 4$ | $36 \cdot 7$ |
| $6 \cdot 30$ | 32.4 | $32 \cdot 5$ | $32 \cdot 8$ | $33 \cdot 1$ | 33.4 | $33^{\circ} 7$ | $34^{\circ} 0$ | $34^{\prime} 4$ | $34^{-8}$ | $35^{\circ} \mathrm{O}$ | $35^{\circ} 2$ | $35 \cdot 4$ | $35 \cdot 7$ | $35 \cdot 9$ | $36 \cdot 2$ |
| $6 \cdot 40$ | $32 \cdot 0$ | $32 \cdot 1$ | $32 \cdot 4$ | $32 \cdot 7$ | $33^{\circ} \mathrm{O}$ | 33.3 | $33 \cdot 6$ | $34^{\circ} \mathrm{O}$ | 34.4 | $34^{\circ} 6$ | $34 \cdot 8$ | $35^{\circ}$ | $35 \cdot 3$ | $35 \cdot 5$ | $35 \cdot 8$ |
| $6 \cdot 50$ | 31.6 | 31.7 | $32 \cdot 0$ | $32 \cdot 3$ | $32 \cdot 6$ | $32 \cdot 9$ | 33.2 | $33^{\cdot 6}$ | $34^{\circ} 0$ | 34.2 | $34^{\circ} 4$ | $34^{\circ} 6$ | 34.9 | $35^{\circ} \mathrm{I}$ | $35^{\circ} 4$ |
| $6 \cdot 60$ | 31.2 | $31 \cdot 3$ | 31.6 | 31.9 | $32 \cdot 2$ | $32 \cdot 5$ | $32 \cdot 8$ | $33^{\prime} 2$ | $33 \cdot 6$ | $33^{\circ} 8$ | $34^{\circ} \mathrm{O}$ | $34^{\circ} 2$ | 34.5 | $34^{\prime 7}$ | $35^{\circ} \mathrm{O}$ |
| $6 \cdot 70$ | $30 \cdot 8$ | 30.9 | 31.2 | 3 I 5 | 31.8 | 32.1 | 32.4 | $32 \cdot 8$ | $33^{\circ} 2$ | 33.4 | $33 \cdot 6$ | $33 \cdot 8$ | 34. 1 | 34.3 | $34^{\circ} 6$ |
| $6 \cdot 80$ | $30 \cdot 5$ | $30 \cdot 6$ | $30 \cdot 9$ | $3 \mathrm{I} \cdot \mathrm{I}$ | 3I•5 | 31'7 | $32 \cdot 0$ | $32 \cdot 4$ | $32 \cdot 8$ | $33^{\circ} \mathrm{O}$ | $33^{\circ} 2$ | $33 \cdot 4$ | 33.7 | 33.9 | 34.2 |
| $6 \cdot 90$ | 30.1 | $30 \cdot 2$ | $30 \cdot 5$ | $30 \cdot 8$ | 3 I I | 3I'4 | $3 \mathrm{x} \cdot 7$ | $32 \cdot 0$ | 32.4 | $32 \cdot 6$ | $32 \cdot 8$ | $33 \cdot 0$ | $33 \cdot 3$ | $33 \cdot 5$ | $33 \cdot 8$ |
| $7 \cdot 00$ | 29.7 | $29 \cdot 8$ | $30 \cdot 1$ | $30 \cdot 4$ | $30 \cdot 7$ | 31.0 | 31-3 | $31 \cdot 6$ | 32.0 | $32 \cdot 2$ | 32.4 | $32 \cdot 7$ | 32.9 | $33^{2} 2$ | $33^{\prime} 4$ |
| 7•10 | 29.4 | 29.5 | $29 \cdot 8$ | $30 \cdot 0$ | $30 \cdot 4$ | $30 \cdot 6$ | $30 \cdot 9$ | 3I•3 | $3 \mathrm{I} \cdot 7$ | 3I•9 | $32 \cdot 1$ | $32 \cdot 3$ | $32 \cdot 5$ | $32 \cdot 8$ | $33^{\circ} \mathrm{O}$ |
| 7•20 | 29.1 | $29^{\circ} \mathrm{I}$ | 29.4 | $29^{\circ} 7$ | $30 \cdot 0$ | $30 \cdot 3$ | $30 \cdot 6$ | $30 \cdot 9$ | 31'3 | 3I•5 | 31•7 | 3 I 9 | 32.2 | 32.4 | $32 \cdot 7$ |
| 7.30 | $28 \cdot 7$ | $28 \cdot 8$ | 29.I | 29.4 | 29.7 | 29.9 | $30 \cdot 2$ | $30 \cdot 6$ | 31.0 | 31.2 | 3 I 4 | 3I•6 | 31.8 | $32 \cdot 1$ | $32 \cdot 3$ |
| $7 \cdot 40$ | $28 \cdot 4$ | $28 \cdot 5$ | $28 \cdot 8$ | $29^{\circ} 0$ | 29.4 | $29 \cdot 6$ | 29.9 | $30 \cdot 2$ | $30 \cdot 6$ | $30 \cdot 8$ | 3 r 0 | $3 \mathrm{I} \cdot 2$ | 31.5 | 31.7 | $32 \cdot 0$ |
| $7 \cdot 50$ | 28.1 | 28.2 | $28 \cdot 4$ | $28 \cdot 7$ | $29^{\circ} 0$ | 29.3 | 29.6 | 29.9 | $30 \cdot 3$ | $30 \cdot 5$ | $30 \cdot 7$ | $30 \cdot 9$ | $31 \cdot 1$ | 31.4 | $3 \mathrm{r} \cdot 6$ |
| $7 \cdot 60$ | $27 \cdot 8$ | $27 \cdot 8$ | $28 \cdot 1$ | $28 \cdot 4$ | $28 \cdot 7$ | 29.0 | $29 \cdot 3$ | $29^{\circ} 6$ | 29.9 | $30 \cdot 1$ | $30 \cdot 4$ | $30 \cdot 6$ | $30 \cdot 8$ | 31-0 | $31 \cdot 3$ |
| $7 \cdot 70$ | 27.4 | $27 \cdot 5$ | $27 \cdot 8$ | $28 \cdot 1$ | $28 \cdot 4$ | $28 \cdot 6$ | 28.9 | $29^{\circ} 3$ | $29^{\prime} 6$ | $29 \cdot 8$ | $30^{\circ} 0$ | $30 \cdot 2$ | $30 \cdot 5$ | $30 \cdot 7$ | 3 I - |
| 780 | 27* I | $27 \cdot 2$ | $27 \cdot 5$ | $27 \cdot 8$ | $28 \cdot 1$ | $28 \cdot 3$ | $28 \cdot 6$ | $28 \cdot 9$ | 29.3 | $29 \cdot 5$ | 29.7 | 29.9 | $30 \cdot 1$ | $30 \cdot 4$ | $30 \cdot 6$ |
| $7 \cdot 90$ | $26 \cdot 9$ | $26 \cdot 9$ | $27 \cdot 2$ | $27 \cdot 5$ | $27 \cdot 8$ | $28 \cdot 0$ | $28 \cdot 3$ | $28 \cdot 6$ | $29^{\circ} 0$ | 29.2 | 29.4 | $29 \cdot 6$ | $29 \cdot 8$ | $30^{\circ} 1$ | $30 \cdot 3$ |
| $8 \cdot 00$ | $26 \cdot 6$ | 26.7 | $26 \cdot 9$ | $27^{\circ} 2$ | $27 \cdot 5$ | $27 \cdot 7$ | 28.0 | $28 \cdot 3$ | $28 \cdot 7$ | $28 \cdot 9$ | $29^{\circ} \mathrm{I}$ | 29.3 | 29.5 | $29 \cdot 8$ | $30 \cdot 0$ |
| $8 \cdot 10$ | $26 \cdot 3$ | $26 \cdot 4$ | $26 \cdot 6$ | $26 \cdot 9$ | $27 \cdot 2$ | 27.4 | 27•7 | 28.0 | $28 \cdot 4$ | $28 \cdot 6$ | $28 \cdot 8$ | $29^{\circ} \mathrm{O}$ | $29^{2}$ | 29.4 | $29 \cdot 7$ |
| $8 \cdot 20$ | 26.0 | $26 \cdot 1$ | $26 \cdot 4$ | $26 \cdot 6$ | $26 \cdot 9$ | 27.2 | $27 \cdot 4$ | $27 * 7$ | $28 \cdot 1$ | $28 \cdot 3$ | $28 \cdot 5$ | $28 \cdot 7$ | 28.9 | $29^{1} 1$ | 29.4 |
| $8 \cdot 30$ | $25 \cdot 7$ | $25 \cdot 8$ | 26. I | $26 \cdot 3$ | $26 \cdot 6$ | $26 \cdot 9$ | 27-1 | $27 \cdot 5$ | 27.8 | $28 \cdot 0$ | $28 \cdot 2$ | $28 \cdot 4$ | $28 \cdot 6$ | $28 \cdot 9$ | $29^{\prime}$ I |
| $8 \cdot 40$ | 25.5 | $25 \cdot 5$ | $25 \cdot 8$ | 26.0 | $26 \cdot 4$ | $26 \cdot 6$ | $26 \cdot 9$ | $27 \cdot 2$ | $27 \cdot 5$ | 27•7 | 27.9 | $28 \cdot 1$ | $28 \cdot 3$ | $28 \cdot 6$ | 28.8 |
| $8 \cdot 50$ | $25^{\circ} 2$ | $25 \cdot 3$ | 25'5 | $25 \cdot 8$ | $26 \cdot 1$ | $26 \cdot 3$ | $26 \cdot 6$ | $26 \cdot 9$ | 27.3 | $27 \cdot 4$ | $27 \cdot 6$ | $27 \cdot 8$ | $28 \cdot 1$ | $28 \cdot 3$ | $28 \cdot 5$ |
| $8 \cdot 60$ | 24.9 | $25^{\circ} \mathrm{O}$ | $25 \cdot 3$ | $25 \cdot 5$ | $25^{\circ} 8$ | $26 \cdot 1$ | $26 \cdot 3$ | $26 \cdot 6$ | $27^{\circ} 0$ | $27 \cdot 2$ | $27 \cdot 4$ | $27 \cdot 6$ | $27 \cdot 8$ | $28 \cdot 0$ | $28 \cdot 2$ |
| $8 \cdot 70$ | $24^{\circ} 7$ | $24^{*} 8$ | $25^{\circ}$ | 25.3 | $25 \cdot 6$ | $25 \cdot 8$ | $26 \cdot 1$ | $26 \cdot 4$ | $26 \cdot 7$ | 26.9 | $27 \cdot 1$ | $27 \cdot 3$ | $27 \cdot 5$ | 27*7 | $28 \cdot 0$ |
| $8 \cdot 80$ | 24.4 | 24.5 | 24.8 | $25^{\circ} \mathrm{O}$ | $25 \cdot 3$ | $25 \cdot 5$ | $25 \cdot 8$ | $26 \cdot 1$ | $26 \cdot 5$ | $26 \cdot 6$ | $26 \cdot 8$ | 27.0 | $27 \cdot 2$ | 27.5 | $27 \cdot 7$ |
| $8 \cdot 90$ | $24^{\prime} 2$ | 24.3 | 24.5 | 24.8 | $25^{1} 1$ | $25 \cdot 3$ | $25 \cdot 6$ | 25.9 | $26 \cdot 2$ | 26.4 | $26 \cdot 6$ | $26 \cdot 8$ | 27*0 | 27•2 | $27 \cdot 4$ |
| 9.00 | $24^{\circ} \mathrm{O}$ | $24^{\circ} \mathrm{O}$ | $24 \cdot 3$ | 24.5 | $24 \cdot 8$ | $25^{\circ} \mathrm{O}$ | $25^{\circ} 3$ | 25.6 | 25.9 | 26.1 | $26 \cdot 3$ | $26 \cdot 5$ | $26 \cdot 7$ | $26 \cdot 9$ | 27.2 |
| $9 \cdot 10$ | $23 \cdot 7$ | $23^{-8}$ | $24^{\circ} \mathrm{O}$ | 24.3 | $24^{\cdot 6}$ | $24^{\circ} 8$ | $25^{1}$ I | 25.4 | $25 \cdot 7$ | 25.9 | $26 \cdot 1$ | $26 \cdot 3$ | $26 \cdot 5$ | $26 \cdot 7$ | $26 \cdot 9$ |
| $9 \cdot 20$ | $23 \cdot 5$ | $23 \cdot 6$ | 23.8 | $24^{\circ} \mathrm{O}$ | 24.3 | 24.6 | $24^{\circ} 8$ | $25^{1} 1$ | 25.5 | $25^{\circ} 6$ | $25 \cdot 8$ | $26 \cdot 0$ | $26 \cdot 2$ | $26 \cdot 4$ | $26 \cdot 7$ |
| 9.30 | 23.3 | 23.4 | $23 \cdot 6$ | $23 \cdot 8$ | $24^{1} 1$ | 24.3 | $24^{\circ} 6$ | $24^{\prime} 9$ | $25^{\prime} 2$ | 25.4 | $25^{\circ} 6$ | $25 \cdot 8$ | $26 \cdot 0$ | $26 \cdot 2$ | $26 \cdot 4$ |
| $9 \cdot 40$ | 23.1 | $23^{1}$ I | 23.4 | $23 \cdot 6$ | 23.9 | 24.1 | $24^{*} 4$ | $24^{\circ} 7$ | $25^{\circ} \mathrm{O}$ | $25 \cdot 2$ | $25 \cdot 3$ | $25 \cdot 5$ | $25 \cdot 7$ | $25 \cdot 9$ | $26 \cdot 2$ |
| $9 \cdot 50$ | 22.8 | $22 \cdot 9$ | $23 \cdot 1$ | 23.4 | $23 \cdot 7$ | 23.9 | $24^{\prime}$ I | 24.4 | $24 \cdot 7$ | 24.9 | 25.1 | $25 \cdot 3$ | $25^{\circ} 5$ | 25*7 | 25.9 |
| $9 \cdot 60$ | 22.6 | 22.7 | 22.9 | $23^{\circ} 2$ | 23.4 | $23 \cdot 7$ | $23 \cdot 9$ | $24^{\circ} 2$ | $24 \cdot 5$ | $24^{\circ} 7$ | 24.9 | $25^{1}$ I | $25^{\circ} 3$ | $25 \cdot 5$ | 25.7 |
| $9 \cdot 70$ | 22.4 | 22.5 | 22.7 | 22.9 | $23 \cdot 2$ | 23.4 | 23.7 | $24^{\circ} \mathrm{O}$ | 24.3 | 24.5 | $24 \cdot 6$ | 24.8 | $25^{\circ} \mathrm{O}$ | $25 \cdot 2$ | $25 \cdot 5$ |
| $9 \cdot 80$ | 22.2 | $22 \cdot 3$ | $22 \cdot 5$ | $22 \cdot 7$ | $23^{\circ} \mathrm{O}$ | 23.2 | $23 \cdot 5$ | $23 \cdot 8$ | $24 \cdot 1$ | $24^{\circ} 2$ | $24^{\circ} 4$ | $24 \cdot 6$ | 24.8 | $25^{\circ} \mathrm{O}$ | $25 \cdot 2$ |
| $9 \cdot 90$ | 22.0 | $22 \cdot 1$ | $22 \cdot 3$ | 22.5 | $22 \cdot 8$ | 23.0 | $23 \cdot 3$ | 23.5 | 23.9 | $24^{\circ} \mathrm{O}$ | $24^{2}$ | 24.4 | $24 \cdot 6$ | $24 \cdot 8$ | 25.0 |
| 10.00 | 21.8 | 21.9 | $22 \cdot 1$ | $22 \cdot 3$ | $22 \cdot 6$ | 22.8 | $23 \cdot 1$ | $23 \cdot 3$ | $23 \cdot 6$ | $23 \cdot 8$ | $24^{\circ} 0$ | $24^{\circ} 2$ | 24.4 | 24.6 | 24.8 |
| 10.10 | 21.6 | 21.7 | 21•9 | $22 \cdot 1$ | 22.4 | 22.6 | $22 \cdot 9$ | $23 \cdot 1$ | 23.4 | $23 \cdot 6$ | $23 \cdot 8$ | $24^{\circ} \mathrm{O}$ | 24.2 | 24.4 | $24 \cdot 6$ |
| 10.20 | 21.4 | 21.5 | $2 \mathrm{I} \cdot 7$ | 21.9 | $22 \cdot 2$ | 22.4 | $22 \cdot 7$ | 22.9 | $23 \cdot 2$ | 23.4 | 23.6 | $23 \cdot 8$ | $23^{\circ} 9$ | $24^{2}$ | $24^{\circ} 4$ |
| 10.30 | 21.2 | 2I•3 | 21.5 | 21'7 | $22 \cdot 0$ | $22 \cdot 2$ | $22 \cdot 5$ | $22 \cdot 7$ | 23.0 | 23.2 | $23 \cdot 4$ | $23 \cdot 5$ | $23 \cdot 7$ | 23.9 | $24^{\circ} 2$ |
| 10.40 | $21 \cdot 0$ | $21 \cdot 1$ | 21•3 | 2I•5 | 2I•8 | $22 \cdot 0$ | $22 \cdot 3$ | 22.5 | $22 \cdot 8$ | 23.0 | $23 \cdot 2$ | 23.3 | 23.5 | 23.7 | $33 \cdot 9$ |
| 10.50 | $20 \cdot 9$ | 20'9 | $2 \mathrm{I} \cdot 1$ | 21.4 | $2 \mathrm{I} \cdot 6$ | 21.8 | $22^{1} 1$ | $22 \cdot 3$ | 22.6 | 22.8 | 23.0 | $23 \cdot 1$ | 23.3 | $23 \cdot 5$ | 23.7 |
| 10.60 | 20.7 | $20 \cdot 7$ | 21.0 | $2 \mathrm{I} \cdot 2$ | 21.4 | $2 \mathrm{I} \cdot 6$ | 21.9 | 22.1 | 22.4 | $22 \cdot 6$ | $22 \cdot 8$ | 23.0 | $23 \cdot 1$ | $23 \cdot 3$ | $23 \cdot 5$ |
| 10.70 | 20.5 | $20 \cdot 6$ | $20 \cdot 8$ | 21.0 | $21 \cdot 3$ | 2I•5 | 21.7 | 22.0 | $22 \cdot 3$ | 22.4 | 22.6 | $22 \cdot 8$ | 22.9 | $23^{\prime}$ I | 23.3 |
| 10.80 | $20 \cdot 3$ | 20.4 | $20 \cdot 6$ | $20 \cdot 8$ | $2 \mathrm{I} \cdot \mathrm{I}$ | $2 \mathrm{I} \cdot 3$ | 2I•5 | 21.8 | $22 \cdot 1$ | $22 \cdot 2$ | 22.4 | 22.6 | $22 \cdot 8$ | 23.0 | $23 \cdot 2$ |
| 10.90 | $20 \cdot 2$ | $20 \cdot 2$ | 20.4 | $20 \cdot 6$ | 20.9 | $2 \mathrm{I} \cdot \mathrm{I}$ | 21•3 | 2 I 6 | 21.9 | 22.0 | $22 \cdot 2$ | 22.4 | 22.6 | $22 \cdot 8$ | $33^{\circ} 0$ |
| II*00 | $20^{\circ} \mathrm{O}$ | 20'1 | $20 \cdot 3$ | $20 \cdot 5$ | 20.7 | 20.9 | $21 \cdot 2$ | 21.4 | 21•7 | 21.9 | 22.0 | 22.2 | 22.4 | 22.6 | $22 \cdot 8$ |
| II•IO | 19.8 | 19.9 | $20 \cdot 1$ | $20 \cdot 3$ | $20 \cdot 5$ | $20 \cdot 8$ | 21.0 | $2 \mathrm{I} \cdot 2$ | 21.5 | $2 \mathrm{I} \cdot 7$ | 2 F 8 | 22.0 | $22 \cdot 2$ | 22.4 | $22 \cdot 6$ |
| II•20 | 19.7 | 19.7 | 19.9 | $20^{\circ} \mathrm{I}$ | 20.4 | $20 \cdot 6$ | $20 \cdot 8$ | $21 \cdot 1$ | 2 I 4 | 2 I 5 | 21*7 | 21.8 | 22.0 | 22.2 | 22.4 |
| I1.30 | 19.5 | 19.6 | 19.8 | 20.0 | $20 \cdot 2$ | $20 \cdot 4$ | $20 \cdot 6$ | 20.9 | 21.2 | 21.3 | 21.5 | 2 P 7 | 2I•8 | $22.0{ }^{\circ}$ | $22 \cdot 2$ |
| II*40 | 19.3 | 19.4 | 19.6 | 19.8 | 20.1 | $20 \cdot 3$ | $20 \cdot 5$ | $20 \cdot 7$ | $21 \cdot 0$ | 21.2 | 21.3 | 21.5 | 21.7 | 219 | 22.1 |
|  | 19.2 | 19.2 | 19.5 | 19.6 | 19.9 | $20 \cdot 1$ | $20 \cdot 3$ | $20 \cdot 6$ | $20 \cdot 8$ | $21^{\circ} \mathrm{O}$ | $2 \mathrm{I} \cdot 2$ | 2I•3 | 21.5 | 21.7 | 21.9 |
| II.60 | 19.0 | $19 \cdot 1$ | 19.3 | 19.5 | 19.7 | 19.9 | $20 \cdot 2$ | $20 \cdot 4$ | $20 \cdot 7$ | $20 \cdot 8$ | 21.0 | $2 \mathrm{I} \cdot 2$ | 2 I 3 | 21.5 | 21.7 |
| II•70 | 18.9 | 18.9 | 19.1 | 19.3 | 19.6 | $19 \cdot 8$ | 20.0 | $20 \cdot 2$ | $20 \cdot 5$ | $20 \cdot 7$ | $20 \cdot 8$ | 21.0 | $2 \mathrm{I} \cdot 2$ | 21.3 | 21.5 |
| II.80 | $18 \cdot 7$ | 18.8 | 19.0 | 19.2 | 19.4 | 19.6 | 19.8 | $20 \cdot 1$ | $20 \cdot 4$ | $20 \cdot 5$ | 20.7 | $20 \cdot 8$ | 2 I 0 | $21 \cdot 2$ | 21.4 |
| 11.90 | 18.6 | 18.6 | 18.8 | 19.0 | 19.3 | 19.5 | 19.7 | 19.9 | $20 \cdot 2$ | $20 \cdot 3$ | $20 \cdot 5$ | $20 \cdot 7$ | $20 \cdot 8$ | 21.0 | 21.2 |

When the Latitude Variation is＋name the Azimuth the same name as Latitude． opposite name to the Latitude．
On the Equator the Azimuth will have the same name as the Declination．

| Lat． Var． to $I^{\prime}$ | LATITUDES． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $0^{\circ}$ | $5^{\circ}$ | $10^{\circ}$ | $13^{\circ}$ | $16^{\circ}$ | $18^{\circ}$ | $20^{\circ}$ | $22^{\circ}$ | $24^{\circ}$ | $25^{\circ}$ | $26^{\circ}$ | $27^{\circ}$ | $28^{\circ}$ | $29^{\circ}$ | $80^{\circ}$ |
|  | AZIMUTHS． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S． | 18.4 | $18 \cdot 5$ | 18.7 | I8．9 | 19•1 | 19.3 | $19^{\circ} 5$ | 19.8 | $20^{\circ} 0$ | $20 \cdot 2$ | $20 \cdot 3$ | $20^{\circ} 5$ | 20．7 | $20^{\circ} \cdot 9$ | $\stackrel{\circ}{1} \cdot 1$ |
| 12．10 | $18 \cdot 3$ | 18.4 | 18.6 | $18 \cdot 7$ | 19．0 | 19．2 | 19.4 | 19.6 | 19.9 | 20.0 | $20 \cdot 2$ | 20.4 | 20.5 | 20．7 | 20.9 |
| 12.20 | $18 \cdot 2$ | $18 \cdot 2$ | $18 \cdot 4$ | $18 \cdot 6$ | I8．9 | 19＊0 | 19.2 | 19.5 | 19.7 | 19.9 | $20 \cdot 0$ | 20．2 | $20 \cdot 4$ | $20 \cdot 5$ | $20 \cdot 7$ |
| 12.30 | $18 \cdot 0$ | I8．I | $18 \cdot 3$ | $18 \cdot 5$ | $18 \cdot 7$ | 18.9 | 19＊1 | 19.3 | 19.6 | $19{ }^{\circ} 7$ | 19.9 | $20 \cdot 1$ | $20 \cdot 2$ | $20 \cdot 4$ | $20 \cdot 6$ |
| 12.40 | 17．9 | I7．9 | $18 \cdot 1$ | $18 \cdot 3$ | 18.6 | $18 \cdot 7$ | 18．9 | $19 \cdot 2$ | 19.4 | 19.6 | $19 \cdot 7$ | 19.9 | $20^{1} 1$ | $20 \cdot 2$ | $20 \cdot 4$ |
| 12.50 | 17＊ 7 | I7．8 | 18•O | 18.2 | 18.4 | 18．6 | $18 \cdot 8$ | $19 \cdot 0$ | 19.3 | 19.4 | 19.6 | 19.8 | 19．9 | 20•1 | $20 \cdot 3$ |
| 12.60 | 17.6 | $17 \cdot 7$ | 17.9 | $18 \cdot 0$ | $18 \cdot 3$ | $18 \cdot 5$ | $18 \cdot 7$ | $18 \cdot 9$ | 19.2 | 19＊3 | 19.5 | 19.6 | $19 \cdot 8$ | 19.9 | $20 \cdot 1$ |
| 12.70 | 17.5 | I7．5 | $17 \cdot 7$ | 17．9 | $18 \cdot 1$ | 18．3 | $18 \cdot 5$ | 18.8 | $19 \cdot 0$ | 19.2 | 19.3 | I9．5 | $19 \cdot 6$ | 19.8 | $20 \cdot 0$ |
| 12.80 | 17.4 | I7．4 | $17 \cdot 6$ | 17.8 | $18 \cdot 0$ | I8．2 | 18.4 | 18.6 | $18 \cdot 9$ | 19.0 | 19.2 | 19.3 | 19.5 | 19.7 | 19.8 |
| 12.90 | 1グ2 | $17 \cdot 3$ | I $7 \cdot 5$ | 17•7 | 17.9 | I $8 \cdot 1$ | $18 \cdot 3$ | $18 \cdot 5$ | $18 \cdot 7$ | $18 \cdot 9$ | 19.0 | I9．2 | 19.3 | 19.5 | 19.7 |
| 13.00 | 17•1 | 17.2 | 17.4 | 17.5 | 17・ク | 17．9 | 18．I | $18 \cdot 4$ | 18.6 | 18.8 | 18•9 | 19.0 | $19^{\circ} 2$ | 19.4 | 19.6 |
| 13.20 | 16＊9 | $16 \cdot 9$ | $17 \cdot 1$ | 17．3 | 17.5 | $17 \times 7$ | 17．9 | $18 \cdot 1$ | $18 \cdot 4$ | $18 \cdot 5$ | $18 \cdot 6$ | $18 \cdot 8$ | $18 \cdot 9$ | $19 \cdot 1$ | 19.3 |
| 13.40 | $16 \cdot 6$ | $16 \cdot 7$ | $16 \cdot 9$ | $17 \cdot 0$ | 17．3 | 17．4 | 17．6 | 17.8 | $18 \cdot 0$ | $18 \cdot 2$ | $18 \cdot 4$ | $18 \cdot 5$ | $18 \cdot 7$ | 18.8 | 19.0 |
| 13.60 | 16.4 | 16.4 | $16 \cdot 6$ | 16.8 | $17 \cdot 0$ | 17.2 | 17.4 | 17.6 | 17.8 | $18 \cdot 0$ | $18 \cdot 1$ | $18 \cdot 3$ | 18.4 | $18 \cdot 6$ | 18.8 |
| 13.80 | 16．2 | 16.2 | 16.4 | I6．6 | I6．8 | I6．9 | Iク・I | I7．4 | I $7 \cdot 6$ | 17．7 | 17.9 | $18 \cdot 0$ | $18 \cdot 2$ | $18 \cdot 3$ | 18.5 |
| 14.00 | 15．9 | 16．0 | 16.2 | $16 \cdot 3$ | 16．6 | 16.7 | 16．9 | I7•I | 17.4 | 17.5 | 17.6 | 17.8 | 17.9 | $18 \cdot 0$ | $18 \cdot 3$ |
| 15.00 | 14.9 | 15.0 | $15 \cdot 2$ | $15 \cdot 3$ | 15.5 | $15 * 7$ | $15 \cdot 8$ | I6•0 | I6．3 | 16.4 | 16.5 | $16 \cdot 7$ | 16.8 | 17.0 | $17 \cdot 1$ |
| 16.00 | $14^{\circ} \mathrm{O}$ | $14^{\circ} \mathrm{I}$ | 14.2 | 14.4 | 14.6 | 14.7 | 14.9 | $15 \cdot 1$ | 15.3 | 15.4 | 15.5 | $15 \cdot 7$ | 15.8 | 16.0 | $16 \cdot 1$ |
| 17.00 | $13 \cdot 2$ | 13.3 | 13.4 | I 3.6 | 13.8 | 13.9 | $14^{\circ} \mathrm{O}$ | 14.2 | 14.4 | 14.6 | 14.7 | 14.8 | 14.9 | $15 \cdot 0$ | $15 \cdot 2$ |
| 18.00 | 12.5 | 12.6 | $12 \cdot 7$ | 12.8 | 13.0 | 13.2 | 13.3 | 13.5 | 13.7 | 13.8 | 13.9 | 14.0 | $14^{\circ} \mathrm{I}$ | 14.3 | 14.4 |
| 19.00 | II＇9 | II•9 | 12.0 | 12．2 | 12.3 | 12.5 | 12.6 | 12.8 | 13.0 | 13.0 | 13.2 | 13.3 | 13.4 | 13.5 | 13.7 |
| 20.00 | II•3 | II．4 | II＇5 | II•6 | II•8 | II．9 | I2．0 | 12.2 | 12.3 | 12.4 | 12.5 | 12.7 | 12.8 | 12.9 | $13 \cdot 0$ |
| 21.00 | 10.8 | $10 \cdot 8$ | 10.9 | II | II．2 | II＇3 | II•5 | II•6 | II•8 | II•9 | 12.0 | 12.1 | 12.2 | 12.3 | 12.4 |
| 22.00 | 10.3 | 10.3 | 10.5 | $10 \cdot 6$ | $10 \cdot 7$ | $10 \cdot 8$ | II＇O | II•I | II．3 | II＇3 | II．4 | II• 5 | II＇6 | II•7 | 1199 |
| 23.00 | $9 \cdot 9$ | $9^{\circ} 9$ | 100 | 10＇I | $10 \cdot 3$ | 10.4 | 10.5 | 10．6 | 10.8 | 10.9 | II＇O | II•O | II＇I | II•2 | 1 I 4 |
| $24^{\circ} 00$ | $9 \cdot 5$ | $9 \cdot 5$ | $9 \cdot 6$ | $9 \cdot 7$ | 9.8 | 9.9 | 10．1 | 10.2 | $10 \cdot 3$ | 10.4 | 10.5 | $10 \cdot 6$ | 10.7 | 10.8 | 10.9 |
| $25 \cdot 00$ | $9 \cdot 1$ | $9 \cdot 1$ | $9 \cdot 2$ | $9 \cdot 3$ | $9 \cdot 4$ | $9 \cdot 5$ | $9 \cdot 7$ | $9 \cdot 8$ | $9 \cdot 9$ | $10 \cdot 0$ | $10 \cdot 1$ | 10.2 | $10 \cdot 3$ | 10.4 | $10 \cdot 5$ |
| 26.00 | $8 \cdot 7$ | $8 \cdot 8$ | $8 \cdot 9$ 8.6 | $9 \cdot 0$ | 9．1 | $9 \cdot 2$ | $9 \cdot 3$ | 9.4 | $9 \cdot 6$ | $9 \cdot 6$ | $9 \cdot 7$ | $9 \cdot 8$ | $9 \cdot 9$ | $10 \cdot 0$ | $10 \cdot 1$ |
| 27.00 | $8 \cdot 4$ $8 \cdot 1$ | $8 \cdot 5$ 8.2 | $8 \cdot 6$ | $8 \cdot 6$ | $8 \cdot 8$ | $8 \cdot 9$ 8.5 | 9．0 | $9 \cdot 1$ | $9 \cdot 2$ | $9 \cdot 3$ | $9 \cdot 4$ | $9 \cdot 4$ | $9 \cdot 5$ | $9 \cdot 6$ | $9 \cdot 7$ |
| 28.00 | $8 \cdot 1$ | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 3$ | $8 \cdot 5$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 8$ | $8 \cdot 9$ | $9 \cdot 0$ | $9{ }^{\circ}$ | $9 \cdot 1$ | $9 \cdot 2$ | 9.3 | $9 \cdot 4$ |
| 29＊00 | $7 \cdot 9$ | $7 \cdot 9$ | $8 \cdot 0$ | 8－1 | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 3$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 7$ | $8 \cdot 7$ | $8 \cdot 8$ | $8 \cdot 9$ | $9^{\circ} 0$ | $9 \times 0$ |
| 30.00 | $7 \cdot 6$ | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 8$ | $7 \cdot 9$ | $8 \cdot 0$ | $8 \cdot 0$ | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 4$ | $8 \cdot 4$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 7$ | $8 \cdot 8$ |
| 31．00 | $7 \cdot 3$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 5$ | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 8$ | $7 \cdot 9$ | $8 \cdot 0$ | $8 \cdot 1$ | $8 \cdot 2$ | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 4$ | $8 \cdot 5$ |
| 32.00 | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 2$ | $7 \cdot 3$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 8$ | $7 \cdot 9$ | $7 \cdot 9$ | $8 \cdot 0$ | $8 \cdot 1$ | $8 \cdot 1$ | $8 \cdot 2$ |
| 33．00 | $6 \cdot 9$ | $6 \cdot 9$ | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 3$ | $7 \cdot 3$ | 7.4 | $7 \cdot 6$ | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 7$ | $7 \cdot 8$ | 7.9 | 8．0 |
| 34＊00 | $6 \cdot 7$ | $6 \cdot 7$ | $6 \cdot 8$ | $6 \cdot 9$ | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 4$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 5$ | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 7$ |
| $35 \cdot 00$ | $6 \cdot 5$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 8$ | $6 \cdot 9$ | $6 \cdot 9$ | $7 \cdot 1$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 2$ | $7 \cdot 3$ | $7 \cdot 4$ | $7 \cdot 4$ | $7 \cdot 5$ |
| 36.00 | $6 \cdot 3$ | 6.4 | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 7$ | $6 \cdot 8$ | $6 \cdot 9$ | $7 \cdot 0$ | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 2$ | $7 \cdot 3$ |
| 37．00 | $6 \cdot 2$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 8$ | $6 \cdot 9$ | $6 \cdot 9$ | 7.0 | 7.0 | $7 \cdot 1$ |
| 38.00 | $6 \cdot 0$ | $6 \cdot 0$ | $6 \cdot 1$ | $6 \cdot 2$ | $6 \cdot 2$ | $6 \cdot 3$ | 6.4 | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 7$ | $6 \cdot 8$ | $6 \cdot 9$ | $6 \cdot 9$ |
| 3900 | $5 \cdot 9$ | $5 \cdot 9$ | $5 \cdot 9$ | $6 \cdot 0$ | 6．1 | $6 \cdot 2$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 8$ |
| 40.00 | $5 \cdot 7$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 9$ | $5 \cdot 9$ | $6 \cdot 0$ | 6．1 | $6 \cdot 2$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 6$ |
| $42 \cdot 00$ | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 6$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 9$ | $6 \cdot 0$ | $6 \cdot 0$ | $6 \cdot 0$ | $6 \cdot 1$ | $6 \cdot 2$ | $6 \cdot 2$ | $6 \cdot 3$ |
| 44.00 | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 5$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 8$ | $5 \cdot 9$ | $5 \cdot 9$ | $6 \cdot 0$ |
| $46 \cdot 00$ | $5 \cdot 0$ | $5 \cdot 0$ | $5 \cdot 0$ | $5 \cdot 1$ | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 5$ | $5 \cdot 6$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 7$ |
| $48 \cdot 00$ | $4 \cdot 8$ | $4 \cdot 8$ | $4 \cdot 8$ | 4．9 | 5.0 | $5 \cdot 0$ | $5 \cdot 1$ | $5 \cdot 1$ | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 3$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 5$ |
| $50 \cdot 00$ | $4 \cdot 6$ | $4 \cdot 6$ | $4 \cdot 6$ | $4 \cdot 7$ | $4 \cdot 8$ | $4 \cdot 8$ | 4.9 | $4 \cdot 9$ | $5 \cdot 0$ | $5 \cdot 0$ | $5 \cdot 0$ | $5 \cdot 1$ | $5 \cdot 2$ | 5．2 | $5 \cdot 3$ |
| 52.00 | $4 \cdot 4$ | $4 \cdot 4$ | $4 \cdot 5$ | $4 \cdot 5$ | 4.6 | $4 \cdot 6$ | $4 * 7$ | $4^{\circ} 7$ | $4 \cdot 8$ | $4 \cdot 8$ | 4.9 | $4 \cdot 9$ | $5 \cdot 0$ | $5 \cdot 0$ | $5 \cdot 1$ |
| 54.00 | $4 \cdot 2$ | $4 \cdot 3$ | $4 \cdot 3$ | $4 \cdot 3$ | $4 \cdot 4$ | $4 \cdot 5$ | $4 \cdot 5$ | $4 \cdot 6$ | $4 \cdot 6$ | $4 \cdot 7$ | $4 \cdot 7$ | $4 \cdot 8$ | $4 \cdot 8$ | $4 \cdot 8$ | $4 \cdot 9$ |
| 56.00 | $4^{\circ} \mathrm{I}$ | $4^{\circ 1}$ | $4^{\cdot 1}$ | $4 \cdot 2$ | $4 \cdot 3$ | $4 \cdot 3$ | $4 \cdot 3$ | 4.4 | 4.4 | $4 \cdot 5$ | $4 \cdot 5$ | $4 \cdot 6$ | $4 \cdot 6$ | $4 \cdot 7$ | $4 \cdot 7$ |
| 58.00 | $4 \cdot 0$ | $4^{\circ} \mathrm{O}$ | $4^{\circ} 0$ | $4^{\circ} 0$ | $4^{17}$ | 4．1 | $4 \cdot 2$ | $4 \cdot 3$ | $4 \cdot 3$ | 4.4 | $4 \cdot 4$ | $4 \cdot 4$ | $4 \cdot 5$ | $4 \cdot 5$ | $4 \cdot 6$ |
| $60 \cdot 00$ | $3 \cdot 8$ | $3 \cdot 8$ | $3 \cdot 9$ | $3 \cdot 9$ | 4.0 | 4.0 | $4 \cdot 1$ | $4 \cdot 1$ | $4 \cdot 2$ | 4.2 | $4 \cdot 2$ | $4 \cdot 3$ | $4 \cdot 3$ | $4 \cdot 4$ | 4.4 |
| 70.00 | $3 \cdot 3$ | $3 \cdot 3$ | $3 \cdot 3$ | 3.4 | 3.4 | $3 \cdot 4$ | 3.5 | $3 \cdot 5$ | 3.6 | $3 \cdot 6$ | $3 \cdot 6$ | $3 \cdot 7$ | $3 \cdot 7$ | $3 \cdot 7$ | $3 \cdot 8$ |
| 80.00 | $2 \cdot 9$ | $2 \cdot 9$ | 2.9 | $2 \cdot 9$ | 3.0 | $3 \cdot 0$ | $3 \cdot 0$ | $3 \cdot 1$ | $3 \cdot 1$ | $3 \cdot 2$ | $3 \cdot 2$ | $3 \cdot 2$ | $3 \cdot 2$ | $3 \cdot 3$ | $3 \cdot 3$ |
| 90．00 | $2 \cdot 5$ | $2 \cdot 6$ | 2.6 | $2 \cdot 6$ | 2.6 | $2 \cdot 7$ | $2 \cdot 7$ | $2 \cdot 7$ | $2 \cdot 8$ | $2 \cdot 8$ | $2 \cdot 8$ | $2 \cdot 9$ | $2 \cdot 9$ | $2 \cdot 9$ | $2 \cdot 9$ |
| 1000 | $2 \cdot 3$ | $2 \cdot 3$ | $2 \cdot 3$ | 2.4 | 24 | $2 \cdot 4$ | 2.4 | 2.5 | $2 \cdot 5$ | $2 \cdot 5$ | $2 \cdot 5$ | $2 \cdot 6$ | $2 \cdot 6$ | $2 \cdot 6$ | $2 \cdot 6$ |
| 120.0 | $1 \cdot 9$ | $1 \cdot 9$ | 1＊9 | $2 \cdot 0$ | $2 \cdot 0$ | $2 \cdot 0$ | $2 \cdot 0$ | $2 \cdot 1$ | $2 \cdot 1$ | $2 \cdot 1$ | $2 \cdot 1$ | $2 \cdot 1$ | $2 \cdot 2$ | $2 \cdot 2$ | $2 \cdot 2$ |
| $150 \cdot 0$ | I． 5 | I． 5 | I． 6 | $1 \cdot 6$ | 1．6 | $1 \cdot 6$ | I•6 | 1．6 | 1．7 | $1 \cdot 7$ | 1•7 | $1 \cdot 7$ | $1 \cdot 7$ | 1・ク | I－K |
| 2000 | I＇I | I．2 | $1 \cdot 2$ | I．2 | 1．2 | $1 \cdot 2$ | $1 \cdot 2$ | 1.2 | $1 \cdot 3$ | 1．3 | $1 \cdot 3$ | I．3 | I•3 | 1．3 | I．3 |
| $300 \cdot 0$ | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | $0 \cdot 9$ |

When the Latitude Variation is + name the Azimuth the same name as Latitude.
"
,
"
opposite name to the Latitude.

| Lat. <br> Var. <br> to $\mathrm{I}^{\prime}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $31^{\circ}$ | $32^{\circ}$ | $33^{\circ}$ | $34^{\circ}$ | $35^{\circ}$ | $36^{\circ}$ | $37^{\circ}$ | $38^{\circ}$ | $39^{\circ}$ | $40^{\circ}$ | $41^{\circ}$ | $42^{\circ}$ | $43^{\circ}$ | $44^{\circ}$ | $45^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $0 \cdot 00$ | $90 \cdot 0$ | 90.0 | $90 \cdot 0$ | 90.0 |  | 00.0 | $00 \cdot 0$ |  |  |  |  |  |  |  | $0 \cdot 0$ |
| -0.00 | 90.0 | 90.0 | $90^{\circ}$ | $90 \cdot$ 88.8 | 900 | $90^{\circ} 0$ | 90•0 | 90.0 | 90.0 | $90^{\circ}$ | 90*0 | 90•0 | 900 | - | 0.0 |
| $0 \cdot 20$ | 87.5 | 87.6 | 87.6 | 87.6 | $87 \cdot 7$ | 87.7 | $87 \cdot 7$ | $87 \cdot 7$ | 87.8 | $87 \cdot 8$ | 87.8 | $87 \cdot 9$ | $87 \cdot 9$ | 87.9 |  |
| $0 \cdot 30$ | $86 \cdot 3$ | 86.4 | 86.4 | 86.4 | $86 \cdot 5$ | 86.5 | $86 \cdot 6$ | 86.6 | $86 \cdot 7$ | 86.7 | 86.8 | 86.8 | $86 \cdot 9$ | 86.9 | $87 \cdot 0$ |
| $0 \cdot 40$ | $85^{\circ} \mathrm{I}$ | $85 \cdot 2$ | 85.2 | $85 \cdot 3$ | $85 \cdot 3$ | 85.4 | $85 \cdot 4$ | 85.5 | 85.6 | 85.6 | 85.7 | $85 \cdot 7$ | $85 \cdot 8$ | $85 \cdot 9$ | 86.0 |
| 0.5 | 83 | 83 | $84^{\circ}$ | 84 | 84.2 | 84.2 | 84.3 | 84. | 84.4 | 84.5 | 84.6 | $84 \cdot 7$ | 84.8 | 84.9 | 84.9 |
| 0.60 | $82 \cdot 7$ | 82.8 | 82.8 | $82 \cdot 9$ | $83^{\circ} \mathrm{O}$ | $83 \cdot 1$ | 83.2 | $83 \cdot 3$ | 83.4 | 83.4 | 83.5 | 83.6 | $83 \cdot 7$ | $83 \cdot 8$ | $83 \cdot 9$ |
| $0 \cdot 70$ | $8 \mathrm{I} \cdot 5$ | $8 \mathrm{I} \cdot 6$ | $8 \mathrm{I} \cdot 7$ | 81.7 | $8 \mathrm{I} \cdot 8$ | $8 \mathrm{I} \cdot 9$ | $82^{\circ} \mathrm{O}$ | $82 \cdot 1$ | 82.3 | $82 \cdot 4$ | 82.5 | $82 \cdot 6$ | $82 \cdot 7$ | 82.8 | $82 \cdot 9$ |
| 0.80 | $80 \cdot 3$ | 80.4 | $80 \cdot 5$ | $80 \cdot 6$ | $80 \cdot 7$ | 80.8 | $80 \cdot 9$ | 81.0 | $8 \mathrm{I} \cdot 2$ | $8 \mathrm{I} \cdot 3$ | 81.4 | 81.5 | $8 \mathrm{I} \cdot 7$ | $8 \mathrm{I} \cdot 8$ | $82 \cdot$ |
| $0 \cdot 90$ | 79 I | $79 \cdot 2$ | 79.3 | 79.4 | 79.6 | $79 \cdot 7$ | $79 \cdot 8$ | 79.9 | $80 \cdot 1$ | $80 \cdot 2$ | $80 \cdot 4$ | $80 \cdot 5$ | $80 \cdot 6$ | 80.8 | $8 \mathrm{I} \cdot 0$ |
| 1.00 | $77 \cdot 9$ | 78.0 | 78.2 | $78 \cdot 3$ | 78.4 | 78.6 | 78.7 | 78. | 79.0 | 79.2 | 79.3 | 79.5 | 79.6 | 79.8 | $80 \cdot 0$ |
| I'ro | $76 \cdot 7$ | $76 \cdot 9$ | 77.0 | 77.2 | $77 \cdot 3$ | 77.4 | 77.6 | 77.8 | 77.9 | $78 \cdot 1$ | $78 \cdot 3$ | 78.4 | $78 \cdot 6$ | 78.8 | $79^{\circ} \mathrm{O}$ |
| I | $75 \cdot 6$ | $75 \cdot 7$ | 75.9 | $76 \cdot 0$ | $76 \cdot 2$ | 76.4 | $76 \cdot 5$ | $76 \cdot 7$ | 76.9 | $77 \cdot 1$ | 77.2 | 77.4 | $77 \cdot 6$ | 77.8 | - |
| 1.30 | 74.4 | 74.6 | 74.8 | 74.9 | $75 \cdot 1$ | $75 \cdot 3$ | 75.4 | 75.6 | 75. | $76 \cdot 0$ | 76.2 | $76 \cdot 4$ | $76 \cdot 6$ | $76 \cdot 8$ | $77 \cdot 1$ |
| I.40 | $73 \cdot 3$ | 73.5 | $73 \cdot 6$ | 73.8 | 74.0 | 74.2 | 74.4 | 74.6 | 74.8 | 75.0 | $75^{2}$ | $75 \cdot 4$ | 75.6 | 75.9 | -I |
| 1.50 | 72 | 72 | 72 | 72.7 | 72.9 | $73 \cdot 1$ | 73.3 | 73. | 73.8 | 74 | 74. | 74.4 | 74'7 | 74.9 | $5 \cdot 1$ |
| I 60 | 71.1 | 71.3 | 71.5 | 71•7 | 71.9 | $72 \cdot 1$ | $72 \cdot 3$ | $72 \cdot 5$ | $72 \cdot 7$ | $73^{\circ}$ | 73.2 | 73. | 73.7 | 73.9 | $74 \cdot 2$ |
| I•70 | $70 \cdot 0$ | $70 \cdot 2$ | 70.4 | $70 \cdot 6$ | $70 \cdot 8$ | $7 \mathrm{r} \cdot 0$ | $7 \mathrm{~F} \cdot 4$ | 71.5 | 71.7 | $72^{\circ} \mathrm{O}$ | 72.2 | 72.5 | $72 \cdot 7$ | $73^{\circ}$ | $73 \cdot 3$ |
| 1.80 ${ }^{\text {P }}$ | 68.9 | $69 \cdot 1$ | $69 \cdot 3$ | $69 \cdot 5$ | 69:8 | 70.0 | 70.2 | 70.5 | $70 \cdot 7$ | 71.0 | 71.2 | 71.5 | 71.8 | $72 \cdot 1$ | $72 \cdot 3$ |
| 1.90 | 67.8 | $68 \cdot 1$ | $68 \cdot 3$ | 68.5 | $68 \cdot 7$ | $69^{\circ}$ | $69 \cdot 2$ | 69.5 | 69.8 | $70 \cdot 0$ | $70 \cdot 3$ | .70.6 | 70.8 | 71.1 | $7 \mathrm{r} \cdot 4$ |
| 2.00 | 66.8 | 67.0 | $67 \cdot 2$ | 67.5 | $67 \cdot 7$ | $68 \cdot 0$ | $68 \cdot 2$ | 68.5 | 68.8 | 69.0 | $69 \cdot 3$ | $69 \cdot 6$ | 69.9 | $70 \cdot 2$ | $70 \cdot 5$ |
| $2 \cdot 10$ | $65 \cdot 8$ | $66 \cdot 0$ | $66 \cdot 2$ | $66 \cdot 4$ | $66 \cdot 7$ | $67 \cdot 0$ | $67 \cdot 3$ | 67.5 | 67.8 | $68 \cdot 1$ | 68.4 | 68.7 | $69 \cdot 0$ | $69 \cdot 3$ | $69 \cdot 6$ |
| 2.20 | 64.8 | $65^{\circ}$ | $65 \cdot 2$ | $65 \cdot 5$ | $65 \cdot 7$ | $66^{\circ}$ | $66 \cdot 3$ | 66.6 | $66 \cdot 9$ | 67.2 | 67.5 | 67.8 | $68 \cdot 1$ | 68.4 | 68.7 |
| $2 \cdot 30$ | $63 \cdot 8$ | $64^{\circ}$ | $64 \cdot 3$ | 64.5 | 64.8 | $65 \cdot 1$ | $65 \cdot 3$ | 65.6 | $65 \cdot 9$ | $66 \cdot 2$ | $66 \cdot 5$ | $66 \cdot 8$ | 67.2 | $67 \cdot 5$ | 67.9 |
| 2.40 | $62 \cdot 8$ | $63^{\circ}$ | $63 \cdot 3$ | 63.6 | 63.8 | $64^{\text {- }}$ | 64.4 | $64 \cdot 7$ | 65.0 | $65 \cdot 3$ | $65 \cdot 6$ | $66 \cdot 0$ | $66 \cdot 3$ | $66 \cdot 7$ | $67 \cdot 0$ |
| 2.50 | 61 | 62 | $62 \cdot 3$ | 62 | $62 \cdot 9$ | 63.2 | 63 | $63 \cdot 8$ | $64 \cdot$ I | 64.4 | $64 \cdot 8$ | $65 \cdot 1$ | $65 \cdot 4$ | $65 \cdot 8$ | $66 \cdot 1$ |
| 2.60 | 60.9 | 61 - | $6 \mathrm{I} \cdot 4$ | $6 \mathrm{I} \cdot 7$ | 62.0 | $62 \cdot 3$ | $62 \cdot 6$ | 62.9 | $63 \cdot 2$ | $63 \cdot 5$ | 63.9 | $64^{2}$ | $64 \cdot 6$ | 64.9 | $65 \cdot 3$ |
| 2.70 | 59.9 | 60 | 60.5 | $60 \cdot 8$ | 6I•I | 61.4 | $6 \mathrm{r} \cdot 7$ | $62^{\circ}$ | 62.3 | $62 \cdot 6$ | $63^{\circ}$ | $63 \cdot 3$ | 63.7 | 64. 1 | 64.5 |
| 2.80 | $59^{\circ} \mathrm{O}$ | 59.3 | 59.6 | 59.9 | $60 \cdot 2$ | $60 \cdot 5$ | $60 \cdot 8$ | $6 \mathrm{r} \cdot \mathrm{I}$ | $61 \cdot 5$ | $6 \mathrm{I} \cdot 8$ | $62 \cdot 2$ | $62 \cdot 5$ | $62 \cdot 9$ | 63.3 | 63.7 |
| 2.90 | 58.1 | 58.4 | 58.7 | $59^{\circ}$ | $59 \cdot 3$ | $59 \cdot 6$ | 59.9 | $60 \cdot 3$ | 60.6 | 6I.0 | 6I.3 | 61.7 | $62 \cdot 1$ | $62 \cdot 5$ | $62 \cdot 9$ |
| 3 |  | 57 | 57.8 | 58.1 | 58 | 58.8 | 59 |  | 59 | $60 \cdot 1$ | $60 \cdot 5$ | $00 \cdot 9$ | $6 \mathrm{I} \cdot 3$ | 6I•7 | 62.I |
| 3.10 | 56.4 | 56.7 | 57.0 | 57.3 | 57.6 | 57.9 | $58 \cdot 3$ | 58.6 | $58 \cdot 9$ | 59.3 | 59.7 | 60. 1 | $60 \cdot 5$ | 60.8 | $6 \mathrm{r} \cdot 3$ |
| 3.20 | $55 \cdot 6$ | $55 \cdot 8$ | $56 \cdot 1$ | 56.4 | 56.8 | 57.1 | 57.4 | $57 \cdot 8$ | 58.1 | 58.5 | 58.9 | 59. | 59.7 | 60.1 | $60 \cdot 5$ |
| $3 \cdot 30$ | 54.7 | $55^{\circ}$ | 55.3 | $55 \cdot 6$ | 55.9 | 56.3 | $56 \cdot 6$ | $57^{\circ}$ | 57.3 | 57.7 | $58 \cdot \mathrm{I}$ | 58.5 | 58.9 | 59.3 | 59.7 |
| $3 \cdot 40$ | 53.9 | 54.2 | $54 \cdot 5$ | 54.8 | $55 \cdot 2$ | $55 \cdot 5$ | $55 \cdot 8$ | 56.2 | 56. | 56.9 | 57.3 | 57•7 | 58-1 | $58 \cdot 6$ | $59 \cdot 0$ |
| 3.50 | 53.1 | 53.4 | 53.7 | 54.0 | 54.4 | 54.7 | 55.1 | 55.4 | $55 \cdot 8$ | 56.2 | 56.6 | 57.0 | 57.4 | 57.8 | $58 \cdot 3$ |
| 3.60 | 52.4 | $52 \cdot 6$ | 53.0 | 53.3 | 53.6 | 53.9 | 54.3 | 54.7 | 55.0 | $55 \cdot 4$ | 55.8 | 56.2 | $56 \cdot 6$ | 57.1 | 57. 5 |
| 3.70 | $5 \mathrm{I} \cdot 6$ | 51.9 | $52 \cdot 2$ | 52.5 | 52.8 | 53.2 | 53.5 | 53.9 | 54.3 | $54 \%$ | $55^{1}$ I | $55 \cdot 5$ | 55.9 | 56.4 | 56.8 |
| 3.80 | $50 \cdot 8$ | 51-1 | 51.5 | 5I•8 | $52 \cdot 1$ | $52 \cdot 5$ | 52.8 | 53.2 | 53.6 | $54^{\circ}$ | 54.4 | 54.8 | 55.2 | $55 \%$ | 56.1 |
| 3.90 | $50 \cdot 1$ | $50 \cdot 4$ | 50•7 | 51-I | 51.4 | $51 \cdot 7$ | 52•I | $52 \cdot 5$ | $52 \cdot 8$ | 53.2 | 53.7 | $54 \cdot 5$ | 55.0 | 55.5 | $55 \cdot 9$ |
| 4.00 | 49.4 | $49 \cdot 7$ | $50 \cdot 0$ | 50 | 50.7 | 51.0 | $51 \cdot 4$ | 51.8 | 52. | 52.5 | $53^{\circ} \mathrm{O}$ | 53.4 | 53.8 | 54.3 | 54*7 |
| $4 \cdot 10$ | $48 \cdot 7$ | $49^{\circ} \mathrm{O}$ | $49 \cdot 3$ | $49 \cdot 6$ | 50.0 | $50 \cdot 3$ | 50٪7 | 51 | $51 \cdot 5$ | $5 \mathrm{I} \cdot 9$ | 52.3 | $52 \cdot 7$ | 53.1 | $53 \cdot 6$ | 54.I |
| 4.20 | $48 \cdot 0$ | $48 \cdot 3$ |  | $49^{\circ}$ | $49 \cdot 3$ | $49 \cdot 7$ | $50 \cdot 1$ | $50 \cdot 4$ | $50 \cdot 8$ |  | $51 \cdot 6$ | $52 \cdot 0$ | 52.5 | 52.9 | 53.4 |
| 4.30 | 47.3 | $47 \cdot 6$ | $48 \cdot 0$ | $48 \cdot 3$ | $48 \cdot 6$ | $49^{\circ} \mathrm{O}$ | 49.4 | $49 \cdot 7$ | 50•I | $50 \cdot 5$ | $50 \cdot 9$ | $51 \cdot 3$ | ${ }_{51} \mathrm{I} 8$ | 52.3 | $52 \cdot 8$ |
| 4.40 | $46 \cdot 7$ | $47^{\circ}$ | $47 \cdot 3$ | 47.6 | 48•0 | $48 \cdot 3$ | $48 \cdot 7$ | 49.I | 49.5 | 49.9 | $50 \cdot 3$ | $50 \cdot 7$ | 51.2 | 51.6 | 52. |
| 4.50 | 46.I | $46 \cdot 3$ | $46 \cdot 7$ | 47.0 | $47 \cdot 3$ | $47 \cdot 7$ | 48.I | $48 \cdot 4$ | $48 \cdot 8$ | $49 \cdot 2$ | $49 \cdot 7$ | 50.1 | $50 \cdot 6$ | 51.0 | 51.5 |
| $4 \cdot 60$ | 45.4 | $45 \%$ | $46 \cdot 0$ | $46 \cdot 4$ | $46 \cdot 7$ | 47.1 | 47.4 | 47.8 | $48 \cdot 2$ | $48 \cdot 6$ | $49^{\circ}$ | $49 \cdot 5$ | 49.9 | $50 \cdot 4$ | $50 \cdot 9$ |
| 4.70 | $44^{-8}$ | 45.1 | $45 \cdot 4$ | $45 \cdot 8$ | $46 \cdot 1$ | $46 \cdot 5$ | $46 \cdot 8$ | 47.2 | $47 \cdot 6$ | 48.0 | $48 \cdot 4$ | $48 \cdot 9$ | $49 * 3$ | $49 \cdot 8$ | $50 \cdot 3$ |
| 4.80 | $44^{\circ} 2$ | 44.5 | $44 \cdot 8$ | $45 \cdot 1$ | $45 \cdot 5$ | $45 \cdot 8$ | $46 \cdot 2$ | $46 \cdot 6$ | $47^{\circ}$ | 47.4 | 47.8 | $48 \cdot 3$ | $48 \cdot 7$ | 49.2 | $49 \cdot 7$ |
| 4.90 | $43 \cdot 6$ | 43.9 | 44 | 44.6 | 44.9 | $45 \cdot 3$ | $45 \cdot 6$ | $46 \cdot 0$ | $46 \cdot 4$ | $46 \cdot 8$ | 47.2 | $47 \cdot 7$ | 48-1 | $48 \cdot 6$ | 49•1 |
| $5 \cdot 00$ | $43^{\circ} \mathrm{O}$ | $43 \cdot 3$ | $43 \cdot 6$ | 44.0 | 44.3 | 44.7 | $45^{\circ}$ | 45.4 | 45.8 | $46 \cdot 2$ | $46 \cdot 7$ | 47-1 | $47 \cdot 6$ | 48.0 | $48 \cdot 5$ |
| $5 \cdot 10$ | 42.5 | $42 \cdot 8$ | $43 \cdot 1$ | 43.4 | $43^{\circ} 8$ | 44. ${ }^{\text {I }}$ | 44.5 | 44.9 | $45 \cdot 3$ | $45 \cdot 7$ | 46•I | $46 \cdot 5$ | $47^{\circ} \mathrm{O}$ | $47 \cdot 5$ | $48 \cdot 0$ |
| 5.20 | 41.9 | $42 \cdot 2$ | $42 \cdot 5$ | $42 \cdot 9$ | $43^{\prime 2}$ | $43 \cdot 6$ | $43 \cdot 9$ | $44 \cdot 3$ | $44^{\prime} 7$ | $45 \cdot 1$ | $45 \cdot 5$ | $46 \cdot 0$ | $46 \cdot 4$ | $46 \cdot 9$ | 47.4 |
| 5.30 | 41.4 | 41'7 | 42.0 | 42.3 | $42 \cdot 7$ | $43^{\circ} \mathrm{O}$ | 43.4 | $43^{-8}$ | 44.1 | $44^{6}$ | $45^{\circ}$ | $45 \cdot 4$ | $45 \cdot 9$ | $46 \cdot 4$ | $46 \cdot 9$ |
| $5 \cdot 40$ | $40 \cdot 8$ | 41.1 | 41.5 | 41.8 | $42 \cdot 1$ | $42 \cdot 5$ | $42 \cdot 8$ | $43^{2}$ | $43 \cdot 6$ | $44^{\circ} \mathrm{O}$ | 44.5 | $44^{\circ} 9$ | $45 \cdot 4$ | $45 \cdot 8$ | $46 \cdot 3$ |
| 5.50 5.60 | $40 \cdot 3$ 39.8 | $40 \cdot 6$ | $40 \cdot 9$ $40 \cdot 4$ | $41 \cdot 3$ $40 \cdot 7$ | 1r. 6 | 42.0 | $42 \cdot 3$ $4 \mathrm{I} \cdot 8$ | $42 \cdot 7$ | $43 \cdot 1$ 42.6 | 43.5 | 43.9 43.4 | 44.4 | 44.8 | $45 \cdot 3$ | $45^{\circ} 8$ |
| 5.70 | 39.3 | $39 \cdot 6$ | 39.9 | $40 \cdot 2$ | $40 \cdot 6$ | $40 \cdot 9$ | 41.3 | $42 \cdot 7$ | $42 \cdot 6$ 42 | 43.0 42.5 | 43.4 42.9 | 43.9 43.4 | $44 \cdot 3$ 43 | $44 \cdot 8$ 44.3 | $45 \cdot 3$ 44 |
| $5 \cdot 80$ | 38.8 | $39^{-1}$ | 39.4 | $39 \cdot 8$ | $40 \cdot 1$ | $40 \cdot 4$ | $40 \cdot 8$ | 41.2 | 41.6 | 42.0 | 42.4 | $42 \cdot 9$ | $43 \cdot 3$ | $43 \cdot 8$ | $44 \cdot 3$ |
| $5 \cdot 90$ | 38.3 | 38.6 | $39^{\circ} \mathrm{O}$ | $39 \cdot 3$ | 39.6 | $40^{\circ} \mathrm{O}$ | $40 \cdot 3$ | $40 \cdot 7$ | 4I•I | 41.5 | 41.9 | $42 \cdot 4$ | $42 \cdot 8$ | $43 \cdot 3$ | $43 \cdot 8$ |

When the Latitude Variation is + name the Azimuth the same name as Latitude.

| Lat. Var. to $\mathrm{I}^{\prime}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $31^{\circ}$ | $32^{\circ}$ | $33^{\circ}$ | $34^{\circ}$ | $35^{\circ}$ | $36^{\circ}$ | $37^{\circ}$ | $38^{\circ}$ | $39^{\circ}$ | $40^{\circ}$ | $41^{\circ}$ | $42^{\circ}$ | $43^{\circ}$ | $44^{\circ}$ | $45^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| s. $6 \cdot 00$ | $37 \cdot 9$ | $38^{\circ} \cdot 2$ | $38 \cdot 5$ | 38.8 | $39^{\prime} 1$ | 39. 5 | $39^{\circ} 9$ | 40.2 | $40 \cdot 6$ | 410 | 41.5 | 41.9 | $42 \cdot 4$ | $4 \stackrel{\circ}{2}^{-8}$ | $43 \cdot 3$ |
| $6 \cdot 10$ | 37.9 37 | $37 \cdot 7$ | $38 \cdot 0$ | $38 \cdot 3$ | $38 \cdot 7$ | $39^{\circ} \mathrm{O}$ | $39^{\circ} 4$ | 39.8 | $40 \cdot 1$ | $40 \cdot 5$ | 41.0 | 41.4 | 41.9 | $42 \cdot 3$ | $42 \cdot 8$ |
| 6.20 | $37^{\circ} 0$ | 37.3 | $37 \cdot 6$ | 37.9 | $38 \cdot 2$ | $38 \cdot 6$ | $38 \cdot 9$ | $39^{\circ} 3$ | 39.7 | $40 \cdot 1$ | $40 \cdot 5$ | 42.0 | 41.4 | 41.9 | 42.4 |
| $6 \cdot 30$ | $36 \cdot 5$ | $36 \cdot 8$ | 37'1 | 37.4 | $37 \cdot 8$ | $38 \cdot 1$ | $38 \cdot 5$ | $38 \cdot 8$ | $39 \cdot 2$ | $39 \cdot 6$ | $40 \cdot 1$ | $40 \cdot 5$ | $40 \cdot 9$ | 41.4 | 41.9 |
| $6 \cdot 40$ | $36 \cdot 1$ | $36 \cdot 4$ | $36 \cdot 7$ | $37 \cdot 0$ | $37 \cdot 3$ | $37 \cdot 7$ | $38 \cdot 0$ | 38.4 | $38 \cdot 8$ | $39 \cdot 2$ | $39 \cdot 6$ | 40•1 | $40 \cdot 5$ | 41'0 | $41 \cdot 5$ |
| $6 \cdot 50$ | 35*7 | $36 \cdot 0$ | $36 \cdot 3$ | $36 \cdot 6$ | $36 \cdot 9$ | $37 \cdot 2$ | $37 \cdot 6$ | $38 \cdot 0$ | $38 \cdot 4$ | $38 \cdot 8$ | $39^{\circ} 2$ | 39.6 | 40.1 | $40 \cdot 5$ | $41 \cdot 0$ |
| $6 \cdot 60$ | $35 \cdot 3$ | $35 \cdot 6$ | $35 \cdot 9$ | $36 \cdot 2$ | $36 \cdot 5$ | $36 \cdot 8$ | $37 \cdot 2$ | $37 \cdot 6$ | $38 \cdot 0$ | $38 \cdot 3$ | $38 \cdot 8$ | 39.2 | $39 \cdot 6$ | $40 \cdot 1$ | $40 \cdot 6$ |
| $6 \cdot 70$ | $34^{\circ} 9$ | $35 \cdot 1$ | $35 \cdot 4$ | $35 \cdot 8$ | $36 \cdot 1$ | $36 \cdot 4$ | $36 \cdot 8$ | 37-1 | $37 \cdot 5$ | $37 \cdot 9$ | $38 \cdot 3$ | 38.8 | $39 \cdot 2$ | $39 \cdot 7$ | $40 \cdot 2$ |
| $6 \cdot 80$ | 34.5 | $34^{\circ} 7$ | $35^{\circ} 0$ | $35 \% 4$ | 35.7 | $36 \cdot 0$ | $36 \cdot 4$ | $36 \cdot 7$ | $37 \cdot 1$ | $37 \cdot 5$ | $37 \cdot 9$ | $38 \cdot 4$ | $38 \cdot 8$ | $39 \cdot 3$ | $39 \cdot 8$ |
| $6 \cdot 90$ | $34^{\circ} \mathrm{I}$ | 34.4 | 34.7 | $35^{\circ} \mathrm{O}$ | $35 \cdot 3$ | $35 \cdot 6$ | 36.0 | $36 \cdot 3$ | $36 \cdot 7$ | $37 \cdot 1$ | $37 \cdot 5$ | $38 \cdot 0$ | 38.4 | $38 \cdot 9$ | $39 \cdot 3$ |
| $7 \cdot 00$ | $33 \cdot 7$ | $34^{\circ} 0$ | 34.3 | $34 \cdot 6$ | 34.9 | 35.2 | $35 \cdot 6$ | $35 \cdot 9$ | $36 \cdot 3$ | $36 \cdot \%$ | 37.1 | $37 \cdot 6$ | $38 \cdot 0$ | $38 \cdot 5$ | $38 \cdot 9$ |
| $7 \cdot 10$ | $33 \cdot 3$ | $33 \cdot 6$ | $33 \cdot 9$ | $34^{\circ} 2$ | 34.5 | 34.8 | $35^{\circ} 2$ | $35 \cdot 6$ | $35 \cdot 9$ | $36 \cdot 3$ | $36 \cdot 7$ | $37 \cdot 2$ | $37 \cdot 6$ | $38 \cdot 1$ | $38 \cdot 5$ |
| $7 \cdot 20$ | 32.9 | $33 \cdot 2$ | $33 \cdot 5$ | $33 \cdot 8$ | $34^{\circ} \mathrm{I}$ | 34.5 | $34^{\circ} 8$ | 35'2 | $35 \cdot 6$ | $36 \cdot 0$ | 36.4 | $36 \cdot 8$ | $37 \cdot 2$ | 37•7 | $38 \cdot 2$ |
| $7 \cdot 30$ | $32 \cdot 6$ | $32 \cdot 9$ | 33.2 | 33.5 | $33 \cdot 8$ | 34.1 | $34^{\circ} 4$ | $34 \cdot 8$ | $35^{\circ} 2$ | $35^{\prime} 6$ | 36.0 | 36.4 | $36 \cdot 8$ | 37.3 | $37 \cdot 8$ |
| $7 \cdot 40$ | $32 \cdot 3$ | $32 \cdot 5$ | $32 \cdot 8$ | $33 \cdot 1$ | 33.4 | 33.7 | $34^{\prime} \mathrm{I}$ | 34.4 | $34 \cdot 8$ | $35 \cdot 2$ | $35 \cdot 6$ | 36.0 | $36 \cdot 5$ | $36 \cdot 9$ | $37 \cdot 4$ |
| $7 \cdot 50$ | 31*9 | 32.2 | $32 \cdot 4$ | 32.7 | $33^{\prime 1}$ | 33.4 | 33.7 | $34^{\prime 1}$ | 34.5 | $34 \cdot 8$ | $35^{\prime} 2$ | 35'7 | $36 \cdot 1$ | $36 \cdot 5$ | $37 \cdot 0$ |
| $7 \cdot 60$ | $3 \mathrm{I} \cdot 6$ | 3I•8 | $32 \cdot 1$ | 32.4 | $32 \cdot 7$ | $33^{\circ} \mathrm{O}$ | 33.4 | $33^{\circ} 7$ | $34^{\circ} \mathrm{I}$ | $34 \cdot 5$ | $34^{\circ} 9$ | $35 \cdot 3$ | $35^{\circ} 7$ | $36 \cdot 2$ | $36 \cdot 7$ |
| $7 \cdot 70$ | $35 \cdot 2$ | 31.5 | 3I-8 | $32 \cdot 1$ | 32.4 | $32 \cdot 7$ | $33^{\circ} \mathrm{O}$ | 33.4 | $33^{\circ} 8$ | $34^{\circ} \mathrm{I}$ | $34^{\circ} 5$ | $35^{\circ} \mathrm{O}$ | 35.4 | $35 \cdot 8$ | 36•3 |
| $7 \cdot 80$ | 30.9 | $31 \cdot 2$ | $3 \mathrm{I} \cdot 4$ | 31'7 | $32 \cdot 0$ | 32.4 | $32 \cdot 7$ | $33^{\cdot 1}$ | $33^{\circ} 4$ | $33 \cdot 8$ | $34^{\circ} 2$ | $34^{\circ} 6$ | $35^{\circ} \mathrm{O}$ | $35 \cdot 5$ | $36 \cdot 0$ |
| $7 \cdot 90$ | $30 \cdot 6$ | $30 \cdot 8$ | 3I•1 | $31 \cdot 4$ | 31.7 | $32 \cdot 0$ | $32 \cdot 4$ | $32 \cdot 7$ | $33 \cdot 1$ | $33 \cdot 5$ | $33 \cdot 8$ | $34 \cdot 3$ | $34 \cdot 7$ | $35^{\prime} \mathrm{I}$ | $35 \cdot 6$ |
| $8 \cdot 0$ | $30 \cdot 3$ | $30 \cdot 5$ | $30 \cdot 8$ | $31 \cdot 1$ | 31•4 | 31•7 | $32 \cdot 0$ | $32 \cdot 4$ | $32 \cdot 8$ | 33.1 | 33.5 | 33'9 | 34.4 | $34 \cdot 8$ | 35*3 |
| $8 \cdot$ | 29.9 | 30.2 | $30 \cdot 5$ | $30 \cdot 8$ | 3I•I | $3 \mathrm{I} \cdot 4$ | $31 \cdot 7$ | $32 \cdot 1$ | 32.4 | $32 \cdot 8$ | $33 \cdot 2$ | $33 \cdot 6$ | $34^{\circ} \mathrm{O}$ | 34.5 | 34.9 |
| $8 \cdot 20$ | $29 \cdot 6$ | 29.9 | $30 \cdot 2$ | $30 \cdot 5$ | $30 \cdot 8$ | $31 \cdot 1$ | 31.4 | 31.8 | $32 \cdot 1$ | 32.5 | $32 \cdot 9$ | $33 \cdot 3$ | $33 \cdot 7$ | $34 \cdot 1$ | $34 \cdot 6$ |
| $8 \cdot 30$ | 29.3 | $29 \cdot 6$ | 29.9 | $30 \cdot 2$ | $30 \cdot 5$ | $30 \cdot 8$ | $31 \cdot 1$ | $3 \mathrm{I} \cdot 4$ | $3 \mathrm{I} \cdot 8$ | $32 \cdot 2$ | $32 \cdot 6$ | $33^{\circ} \mathrm{O}$ | $33 \cdot 4$ | $33 \cdot 8$ | $34 \cdot 3$ |
| $8 \cdot 40$ | $29^{\circ} \mathrm{I}$ | 29.3 | $29 \cdot 6$ | 29.9 | $30 \cdot 2$ | $30 \cdot 5$ | $30 \cdot 8$ | $3 \mathrm{I} \cdot \mathrm{I}$ | 31.5 | 31.9 | $32 \cdot 3$ | $32 \cdot 7$ | $33 \cdot 1$ | 33.5 | $34^{\circ} 0$ |
| $8 \cdot 50$ | 28.8 | $29^{\circ} 0$ | 29.3 | 29.6 | $29^{\circ} 9$ | 30•2 | $30 \cdot 5$ | $30 \cdot 8$ | 31•2 | 31.6 | 31•9 | $32 \cdot 3$ | $32 \cdot 8$ | $33 \cdot 2$ | $33^{\circ} 6$ |
| $8 \cdot 60$ | $28 \cdot 5$ | $28 \cdot 7$ | 29.0 | 29.3 | $29 \cdot 6$ | 29*9 | 30.2 | $30 \cdot 6$ | $30 \cdot 9$ | 3I•3 | 31.6 | $32 \cdot 0$ | $32 \cdot 5$ | $32 \cdot 9$ | $33 \cdot 3$ |
| $8 \cdot 70$ | 28.2 | 28.4 | $28 \cdot 7$ | 29.0 | 29.3 | 29.6 | 29.9 | $30 \cdot 3$ | 30.6 | $35 \cdot 0$ | $3 \mathrm{I} \cdot 3$ | $31 \cdot 7$ | $32 \cdot 2$ | $32 \cdot 6$ | $33^{\circ} \mathrm{O}$ |
| $8 \cdot 80$ | 27.9 | $28 \cdot 2$ | $28 \cdot 5$ | $28 \cdot 7$ | $29^{\circ} 0$ | 29.3 | 29.6 | 30.0 | $30 \cdot 3$ | 30.7 | 3I'I | $3 \mathrm{I} \cdot 5$ | 31.9 | $32 \cdot 3$ | $32 \cdot 7$ |
| $8 \cdot 90$ | 27•7 | 27.9 | 28.2 | $28 \cdot 5$ | $28 \cdot 7$ | $29^{\circ} 0$ | $29 \cdot 3$ | $29^{\circ} 7$ | $30 \cdot 0$ | $30 \cdot 4$ | $30 \cdot 8$ | $31 \cdot 2$ | $31 \cdot 6$ | $32 \cdot 0$ | 32.4 |
| $9 \cdot 00$ | 27.4 | $27 \cdot 7$ | $27 \cdot 9$ | $28 \cdot 2$ | $28 \cdot 5$ | 28.8 | $29^{1} 1$ | 29.4 | $29 \cdot 8$ | 30'I | $30 \cdot 5$ | 30.9 | 31•3 | 3I•7 | $32 \cdot 2$ |
| $9^{\circ} \mathrm{I} 0$ | 27.1 | 27.4 | $27 \cdot 6$ | $27 \cdot 9$ | $28 \cdot 2$ | $28 \cdot 5$ | $28 \cdot 8$ | $29 \cdot 1$ | 29.5 | $29 \cdot 8$ | $30 \cdot 2$ | $30 \cdot 6$ | 31.0 | 3I-4 | $3 \mathrm{I} \cdot 9$ |
| $9 \cdot 20$ | $26 \cdot$ | $27 \cdot 1$ | 27.4 | $27 \cdot 7$ | $28 \cdot 0$ | $28 \cdot 3$ | $28 \cdot 6$ | $28 \cdot 9$ | 29.2 | $29 \cdot 6$ | 29.9 | $30 \cdot 3$ | $30 \cdot 7$ | 3 I -1 | 3I-6 |
| $9 \cdot 30$ | $26 \cdot 6$ | $26 \cdot 9$ | $27 \cdot 1$ | $27 \cdot 4$ | $27 \cdot 7$ | $28 \cdot 0$ | $28 \cdot 3$ | $28 \cdot 6$ | $29 \cdot 0$ | $29 \cdot 3$ | $29 \cdot 7$ | $30 \cdot 0$ | $30 \cdot 4$ | $30 \cdot 9$ | $3 \mathrm{I} \cdot 3$ |
| 9.40 | $26 \cdot 4$ | $26 \cdot 6$ | $26 \cdot 9$ | 27.2 | $27 \cdot 5$ | 27•7 | 28.0 | 28.4 | $28 \cdot 7$ | 29.1 | 29.4 | $29 \cdot 8$ | $30 \cdot 2$ | $30 \cdot 6$ | $31 \cdot 0$ |
| $9 \cdot 5$ | $26 \cdot 1$ | 26.4 | 26.6 | 26.9 | $27 \cdot 2$ | 27.5 | 27.8 | $28 \cdot 1$ | 28.4 | $28 \cdot 8$ | 29.2 | $29 \cdot 5$ | 29.9 | $30 \cdot 3$ | $30 \cdot 8$ |
| $9 \cdot 60$ | 25.9 | $26 \cdot 2$ | $26 \cdot 4$ | $26 \cdot 7$ | $27 \cdot 0$ | $27 \cdot 2$ | $27 \cdot 6$ | 27.9 | $28 \cdot 2$ | $28 \cdot 5$ | $28 \cdot 9$ | $29 \cdot 3$ | $29 \cdot 7$ | $30 \cdot 1$ | $30 \cdot 5$ |
| $9 \cdot 70$ | 25.7 | 25.9 | $26 \cdot 2$ | 26.4 | $26 \cdot 7$ | 27.0 | 27.3 | $27 \cdot 6$ | 27.9 | $28 \cdot 3$ | 28.6 | $29^{\circ}$ | 29.4 | $29 \cdot 8$ | $30 \cdot 2$ |
| 9.80 | 25.5 | 25.7 | $26 \cdot 0$ | $26 \cdot 2$ | $26 \cdot 5$ | $26 \cdot 8$ | $27 \cdot 1$ | 27.4 | $27 \cdot 7$ | $28 \cdot 0$ | $28 \cdot 4$ | $28 \cdot 8$ | 29.2 | $29 \cdot 6$ | $30 \cdot 0$ |
| 9.90 | $25^{\prime} 2$ | $25 \cdot 5$ | $25 \cdot 7$ | 26.0 | $26 \cdot 2$ | $26 \cdot 5$ | $26 \cdot 8$ | 27-1 | 27.4 | $27 \cdot 8$ | $28 \cdot 1$ | $28 \cdot 5$ | $28 \cdot 9$ | 29.3 | 29*7 |
| 10.00 | $25^{\circ} \mathrm{O}$ | $25^{\circ} 3$ | 25.5 | $25 \cdot 8$ | $26 \cdot 0$ | $26 \cdot 3$ | $26 \cdot 6$ | 26.9 | $27 \cdot 2$ | $27 \cdot 6$ | 27.9 | 28.3 | $28 \cdot 7$ | 29.1 | 29.5 |
| 10.10 | 24.8 | $25^{\circ} \mathrm{O}$ | 25.3 | 25.5 | $25 \cdot 8$ | $26 \cdot 1$ | 26.4 | $26 \cdot 7$ | $27^{\circ} \mathrm{O}$ | 27.3 | $27 \cdot 7$ | 28.0 | 28.4 | $28 \cdot 8$ | 29.2 |
| 10.20 | 24.6 | $24^{\circ} 8$ | 25.1 | 25.3 | $25 \cdot 6$ | 25.9 | $26 \cdot 2$ | $26 \cdot 5$ | $26 \cdot 8$ | $27 \cdot 1$ | 27.5 | $27 \cdot 8$ | $28 \cdot 2$ | $28 \cdot 6$ | $29^{\circ} \mathrm{O}$ |
| $10 \cdot 30$ | $24^{*} 4$ | $24^{\circ} 6$ | $24^{-8}$ | $25^{\circ} \mathrm{I}$ | 25.4 | 25.6 | 25.9 | $26 \cdot 2$ | $26 \cdot 5$ | $26 \cdot 9$ | $27^{2}$ | $27 \cdot 6$ | $28 \cdot 0$ | $28 \cdot 3$ | $28 \cdot 8$ |
| 10.40 | $24^{\circ} 2$ | 24.4 | $24^{6} 6$ | 24.9 | $25 \cdot 2$ | 25.4 | 25.7 | $26 \cdot 0$ | $26 \cdot 3$ | $26 \cdot 7$ | 27.0 | 27.4 | $27 \cdot 7$ | $28 \cdot 1$ | 28.5 |
| 10.50 | $24^{\circ} \mathrm{O}$ | $24^{\prime 2}$ | 244 | 24.7 | $24 * 9$ | $25^{\circ} 2$ | $25 \cdot 5$ | 25.8 | $26 \cdot 1$ | 26.4 | $26 \cdot 8$ | 27•1 | $27 \cdot 5$ | 27.9 | $28 \cdot 3$ |
| 10.60 | 23.8 | $24^{\circ} \mathrm{O}$ | $24^{2} 2$ | 24.5 | $24^{\circ} 7$ | $25^{\circ} \mathrm{O}$ | $25 \cdot 3$ | 25.6 | $25 \cdot 9$ | $26 \cdot 2$ | $26 \cdot 6$ | $26 \cdot 9$ | $27 \cdot 3$ | $27 \cdot 6$ | $28 \cdot 1$ |
| 10.70 | 23.6 | 23.8 | $24^{\circ} \mathrm{O}$ | 24.3 | $24^{\circ} 5$ | 24.8 | $25 \cdot 1$ | 25.4 | $25 \cdot 7$ | $26 \cdot 0$ | $26 \cdot 3$ | $26 \cdot 7$ | 27-1 | 27.4 | $27 \cdot 9$ |
| 10.80 | 23.4 | $23 \cdot 6$ | $23 \cdot 8$ | 24.1 | $24^{\circ} 3$ | $24 \cdot 6$ | $24^{\circ} 9$ | $25^{\prime} \cdot$ | 25.5 | $25 \cdot 8$ | $26 \cdot 1$ | $26 \cdot 5$ | $26 \cdot 9$ | $27 \cdot 2$ | $27 \cdot 6$ |
| 10.90 | 23.2 | 23.4 | 23.6 | 23.9 | 24.1 | 24.4 | 24.7 | $25 \cdot 0$ | $25 \cdot 3$ | $25 \cdot 6$ | 25.9 | $26 \cdot 3$ | $26 \cdot 6$ | $27 \cdot 0$ | $27 \cdot 4$ |
| 11.00 | $23^{\circ} \mathrm{O}$ | 23.2 | 23.4 | 23.7 | 23.9 | 24.2 | 24.5 | 24.8 | $25^{\prime} 1$ | 25.4 | $25 \cdot 7$ | $26 \cdot 1$ | $26 \cdot 4$ | 26.8 | $27 \cdot 2$ |
| II'10 | 22.8 | $23^{\circ} \mathrm{O}$ | 23.2 | 23.5 | $23 \cdot 7$ | $24^{\circ} \mathrm{O}$ | 24.3 | 24.6 | $24^{\circ} 9$ | 25.2 | $25 \cdot 5$ | $25 \cdot 9$ | $26 \cdot 2$ | $26 \cdot 6$ | $27^{\circ} 0$ |
| 11.20 | $22 \cdot 6$ | 22.8 | $23 \cdot 1$ | 23.3 | $23 \cdot 6$ | $23 \cdot 8$ | 24.I | 24.4 | $24^{\circ} 7$ | $25^{\circ} \mathrm{O}$ | 25.3 | $25 \cdot 7$ | $26 \cdot 0$ | 26.4 | $26 \cdot 8$ |
| II. 30 | 22.4 | $22 \cdot 6$ | 22.9 | 23.1 | 23.4 | $23 \cdot 6$ | 23.9 | $24^{\circ} 2$ | 24.5 | 24.8 | $25 \cdot 1$ | $25 \cdot 5$ | $25 \cdot 8$ | $26 \cdot 2$ | $26 \cdot 6$ |
| II.40 | $22 \cdot 3$ | 22.5 | 22.7 | 22.9 | $23 \cdot 2$ | 23.4 | 23.7 | $24^{\circ} 0$ | 24.3 | $24 \cdot 6$ | 24.9 | $25 \cdot 3$ | $25 \cdot 6$ | $26 \cdot 0$ | $26 \cdot 4$ |
| 11.50 | $22 \cdot 1$ | $22 \cdot 3$ | 22.5 | 22.8 | $23^{\circ} \mathrm{O}$ | 23.2 | 23.5 | 23.8 | $24^{\circ} \mathrm{I}$ | $24^{\circ} 4$ | 24*7 | 25.1 | $25^{\circ} 4$ | $25 \cdot 8$ | $26 \cdot 2$ |
| 11.60 | 21.9 | $22 \cdot 1$ | 22.4 | 22.6 | $22 \cdot 8$ | $23 \cdot 1$ | 23.4 | $23 \cdot 6$ | 23.9 | $24^{\circ} 2$ | $24 \cdot 6$ | $24^{\circ} 9$ | $25^{\circ} 2$ | $25 \cdot 6$ | $26 \cdot 0$ |
| $11 \cdot 70$ | $21 \cdot 7$ | 21.9 | 22.2 | 22.4 | 22.6 | $22 \cdot 9$ | $23 \cdot 2$ | 23.4 | $23 \cdot 7$ | $24^{\circ} 0$ | 24.4 | 24.7 | $25^{\circ} \mathrm{O}$ | $25 \cdot 4$ | $25 \cdot 8$ |
| II.80 | 21.6 | $2 \mathrm{I} \cdot 8$ | 22.0 | 22.2 | 22.5 | $22 \cdot 7$ | $23^{\circ} \mathrm{O}$ | $23 \cdot 3$ | $23 \cdot 6$ | 23.9 | 24.2 | 24.5 | $24^{\circ} 9$ | $25^{\prime} 2$ | $25^{\circ} 6$ |
| 11.90 | 21.4 | 21.6 | 21.8 | 22.1 | 22.3 | $22 \cdot 5$ | 22.8 | $23 \cdot 1$ | 23.4 | 23.7 | $24^{\circ} 0$ | 24.3 | 24.7 | $25^{\circ} \mathrm{O}$ | $25 \cdot 4$ |

When the Latitude Variation is + name the Azimuth the same name as Latitude.
"

- ,
opposite name to the Latitude.

| Lat. Var. to $I^{\prime}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $31^{\circ}$ | $32^{\circ}$ | $33^{\circ}$ | $34^{\circ}$ | $35^{\circ}$ | $36^{\circ}$ | $37^{\circ}$ | $38^{\circ}$ | 89 ${ }^{\circ}$ | $40^{\circ}$ | $41^{\circ}$ | $42^{\circ}$ | $43^{\circ}$ | $44^{\circ}$ | $45^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S. | $2 \mathrm{I} \cdot 2$ | $21 \cdot 5$ | 2I•7 | 21.9 | $22 \cdot 1$ | 22.4 | $22 \cdot 7$ | 22.9 | 23.2 | $23 \cdot 5$ | $23 \cdot 8$ | $24^{\circ} 2$ | $24^{\circ} 5$ | $24^{\circ} 9$ | $25^{\circ} 2$ |
| 12.10 | $2 \mathrm{I} \cdot \mathrm{I}$ | $21 \cdot 3$ | 21.5 | 21.7 | 22.0 | 22.2 | 22.5 | $22 \cdot 7$ | 23.0 | 23.3 | 23.6 | $24^{\circ} \mathrm{O}$ | $24 \cdot 3$ | $24 \cdot 7$ | $25^{\circ} \mathrm{O}$ |
| 12.20 | $20 \cdot 9$ | $2 \mathrm{I} \cdot \mathrm{I}$ | 21.4 | 21.6 | 21.8 | 22.1 | $22 \cdot 3$ | $22 \cdot 6$ | 22.9 | $23 \cdot 2$ | $23 \cdot 5$ | 23.8 | $24^{\circ} \mathrm{I}$ | 24.5 | $24^{\circ} 9$ |
| 12.30 | $20 \cdot 8$ | 21.0 | $2 \mathrm{I} \cdot 2$ | 21.4 | $2 \mathrm{I} \cdot 6$ | 219 | $22 \cdot 1$ | 22.4 | 22.7 | $23^{\circ} 0$ | 23.3 | 23.6 | 23.9 | 24.3 | $24^{\circ} 7$ |
| 12.40 | 20.6 | 20.8 | 21.0 | 21.3 | 21.5 | $21 \cdot 7$ | $22 \cdot 0$ | $22 \cdot 3$ | 22.5 | $22 \cdot 8$ | 23.1 | $23 \cdot 5$ | $23 \cdot 8$ | $24^{\circ} 2$ | 24.5 |
| 12.50 | 20.4 | 20.7 | 20.9 | $2 \mathrm{I} \cdot \mathrm{I}$ | 2I•3 | 21.6 | 2I•8 | 22.1 | 22.4 | 22.7 | 23.0 | 23.3 | $23 \cdot 6$ | $24^{\circ} \mathrm{O}$ | 24.3 |
| 12.60 | $20 \cdot 3$ | $20 \cdot 5$ | 20.7 | 21*0 | $21 \cdot 2$ | 21.4 | 21.7 | $21 \cdot 9$ | $22 \cdot 2$ | 22.5 | 22.8 | $23 \cdot 1$ | $23 \cdot 5$ | $23 \cdot 8$ | $24^{\circ}$ |
| 12.70 | 20.2 | 20.4 | $20 \cdot 6$ | 20.8 | $21^{\circ} \mathrm{O}$ | $21 \cdot 3$ | 21.5 | $2 \mathrm{I} \cdot 8$ | 22.0 | $22 \cdot 3$ | 22.6 | 22.9 | $23 \cdot 3$ | $23 \cdot 6$ | $24^{\circ} \mathrm{O}$ |
| 12.80 | 20.0 | $20 \cdot 2$ | 20.4 | 20.7 | 20.9 | 2I•I | 21.4 | $2 \mathrm{I} \cdot 6$ | 21.9 | 22.2 | $22 \cdot 5$ | 22.8 | 23.1 | $23 \cdot 5$ | $23 \cdot 8$ |
| 12.90 | 19.9 | $20 \cdot 1$ | $20 \cdot 3$ | $20 \cdot 5$ | 20.7 | $20 \cdot 9$ | $21 \cdot 2$ | $21 \cdot 5$ | $21 \cdot 7$ | 22.0 | $22 \cdot 3$ | 22.6 | 22.9 | $23 \cdot 3$ | $23 \cdot 7$ |
| 13.00 | 19*7 | 19.9 | 20.1 | 20.4 | $20 \cdot 6$ | $20 \cdot 8$ | $2 \mathrm{I} \cdot \mathrm{I}$ | 2I'3 | 21.6 | 2I'9 | 22.2 | $22 \cdot 5$ | $22 \cdot 8$ | 23.2 | $23 \cdot 5$ |
| 13.20 | 19.5 | 19.7 | 19.9 | $20 \cdot 1$ | $20 \cdot 3$ | $20 \cdot 5$ | $20 \cdot 8$ | 21.0 | $2 \mathrm{I} \cdot 3$ | $2 \mathrm{I} \cdot 6$ | 2I.9 | 22.2 | 22.5 | $22 \cdot 8$ | $23 \cdot 2$ |
| 13.40 | 19.2 | 19.4 | 19.6 | 19.8 | $20 \cdot 0$ | $20 \cdot 3$ | 20.5 | 20.7 | $21 \cdot 0$ | 21.3 | $2 \mathrm{I} \cdot 6$ | 21.9 | $22 \cdot 2$ | $22 \cdot 5$ | 22.9 |
| 13.60 | $18 \cdot 9$ | 19.1 | 19.3 | 19.5 | 19.8 | 20.0 | $20 \cdot 2$ | $20 \cdot 5$ | 20.7 | 21.0 | 2I•3 | 21.6 | 21.9 | 22.2 | $22 \cdot 6$ |
| 13.80 | $18 \cdot 7$ | 18.9 | 19.0 | 19.3 | 19.5 | 19*7 | 19.9 | $20 \cdot 2$ | $20 \cdot 4$ | $20 \cdot 7$ | $21 \cdot 0$ | 21.3 | $21 \cdot 6$ | 21.9 | 22.3 |
| 14.00 | 18.4 | 18.6 | 18.8 | 19.0 | 19.2 | 19.4 | $19 \cdot 7$ | 19.9 | $20 \cdot 2$ | 20.5 | $20 \cdot 7$ | 21.0 | $21 \cdot 3$ | 21.7 | $22 \cdot 0$ |
| 15.00 | 17.3 | 17.5 | 17.6 | 17.8 | $18 \cdot 0$ | $18 \cdot 2$ | 18.5 | $18 \cdot 7$ | 18.9 | 19.2 | 19.5 | 19.7 | $20 \cdot 0$ | 20.3 | 20.7 |
| 16.00 | $16 \cdot 3$ | 16.4 | 16.6 | 16.8 | 170 | $17 \cdot 2$ | 17.4 | 17.6 | 17.8 | $18 \cdot 1$ | 18.3 | 18.6 | $18 \cdot 9$ | $19 \cdot 2$ | 19.5 |
| 17.00 | 15.3 | 15.5 | 15.7 | 15.8 | 16.0 | 16.2 | 16.4 | 16.6 | 16.8 | $17 \cdot 1$ | 17.3 | I7.5 | 18 | $18 \cdot 1$ | 18.4 |
| 18.00 | 14.5 | 14.7 | 14.8 | 15.0 | 15.2 | 15.4 | 15.5 | 15.7 | 16.0 | 16.2 | 16.4 | 16.6 | 16.9 | $17 \cdot 2$ | 174 |
| 19.00 | 13.8 | 13.9 | 14* 1 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 | $16 \cdot 1$ | $16 \cdot 3$ | 16.6 |
| 20.00 | $13 \cdot 1$ | 13.3 | 13.4 | $13 \cdot 6$ | 13.7 | 13.9 | $14^{\circ} \mathrm{I}$ | 14.2 | 14.4 | 14.6 | 14.8 | $15 \cdot 1$ | 15.3 | 15.5 | 15.8 |
| 21.00 | 12.5 | 12.6 | 12.8 | 12.9 | 13.1 | $13 \cdot 2$ | 13.4 | 13.6 | 13.8 | 13.9 | 14.1 | 14.4 | 14.6 | 14.8 | 15.1 |
| $22 \cdot 00$ | 12.0 | 12.1 | 12.2 | 12.4 | 12.5 | 12.7 | 12.8 | 13.0 | 13.2 | 13.4 | 13.5 | $13 \cdot 7$ | 14.0 | 14.2 | 14.4 |
| 23.00 | II• 5 | II. 6 | 11.7 | II.8 | 12.0 | 12.1 | 12.3 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 |
| $24^{\circ} 00$ | II'O | II'I | 11.2 | II.4 | II•5 | II•6 | II•8 | II•9 | $12 \cdot 1$ | 12.3 | 12.5 | 12.6 | 12.8 | 13.0 | 13.3 |
| $25^{\circ} 00$ | 10.6 | $10 \cdot 7$ | $10 \cdot 8$ | $10 \cdot 9$ | II'O | II.2 | II•3 | II•5 | II•6 | 11.8 | 12.0 | 12.1 | 12.3 | 12.5 | 12.7 |
| $26 \cdot 00$ | 10.2 | $10 \cdot 3$ | 10.4 | 10.5 | 10.6 | 10.8 | 10.9 | II'O | 11.2 | II*4 | II•5 | $11 \times 7$ | II•9 | 12.1 | 12.3 |
| $27 \cdot 00$ | 9.8 | $9 \cdot 9$ | $10 \cdot 0$ | 10.I | 10.2 | 10.4 | 10.5 | 10.6 | 10.8 | 10*9 | II•I | II•3 | 11.4 | 11.6 | 11.8 |
| $28 \cdot 00$ | $9 \cdot 5$ | $9 \cdot 6$ | $9 \cdot 7$ | $9 \cdot 8$ | 9.9 | $10 \cdot 0$ | 10.1 | $10 \cdot 3$ | 10.4 | 10.6 | 10.7 | 10.9 | II•I | II•2 | I I. 4 |
| 29*00 | $9 \cdot 1$ | $9 \cdot 2$ | $9 * 3$ | 9.4 | 9.5 | $9 \cdot 7$ | $9 \cdot 8$ | $9 \cdot 9$ | $10 \cdot 0$ | 10.2 | $10 \cdot 3$ | 10.5 | 10.7 | 10.8 | II•O |
| 30.00 | $8 \cdot 8$ | $8 \cdot 9$ | $9 \cdot 0$ | $9 \cdot 1$ | $9 \cdot 2$ | $9 \cdot 4$ | $9 * 5$ | $9 \cdot 6$ | $9 \cdot 7$ | 9.9 | $10 \cdot 0$ | 10.2 | 10.3 | 10.5 | $10 \cdot 7$ |
| $31 \cdot 00$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 7$ | $8 \cdot 8$ | $8 \cdot 9$ | $9 \cdot 1$ | $9 \cdot 2$ | $9 \cdot 3$ | $9 \cdot 4$ | $9 \cdot 6$ | $9 \cdot 7$ | $9 \cdot 8$ | 10.0 | 10.2 | $10 \cdot 3$ |
| $32 \cdot 00$ | $8 \cdot 3$ | $8 \cdot 4$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 7$ | $8 \cdot 8$ | $8 \cdot 9$ | $9{ }^{\circ}$ | $9 \cdot 1$ | $9 \cdot 3$ | $9 \cdot 4$ | 9.5 | $9 \cdot 7$ | 9.9 | $10 \cdot 0$ |
| $33 \cdot 00$ | $8 \cdot 0$ | $8 \cdot 1$ | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 4$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 7$ | $8 \cdot 8$ | $9 \cdot 0$ | $9 \cdot 1$ | $9 \cdot 2$ | 9.4 | $9 \cdot 6$ | $9 \cdot 7$ |
| 34*00 | $7 \cdot 8$ | $7 \times 9$ | $8 \cdot 0$ | 8-1 | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 4$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 7$ | $8 \cdot 8$ | $9^{\circ} 0$ | $9^{\circ} 1$ | $9 \cdot 3$ | $9 * 4$ |
| $35 \cdot 00$ | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 7$ | $7 \cdot 8$ | $7 \cdot 9$ | $8 \cdot 0$ | 8-1 | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 7$ | $8 \cdot 9$ | $9 \cdot 0$ | $9 \cdot 2$ |
| $36 \cdot 00$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 5$ | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 8$ | $7 \cdot 9$ | $8 \cdot 0$ | $8 \cdot 1$ | $8 \cdot 3$ | $8 \cdot 4$ | $8 \cdot 5$ | $8 \cdot 6$ | $8 \cdot 8$ | $8 \cdot 9$ |
| 37-00 | $7 \cdot 2$ | $7 \cdot 2$ | $7 \cdot 3$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 8$ | $7 \cdot 9$ | $8 \cdot 0$ | 8-1 | $8 \cdot 3$ | 8.4 | $8 \cdot 5$ | $8 \cdot 7$ |
| $38 \cdot 00$ | $7 \cdot 0$ | 7-1 | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 3$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 6$ | 777 | $7 \cdot 8$ | $7 \cdot 9$ | $8 \cdot 0$ | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 5$ |
| 39.00 | $6 \cdot 8$ | $6 \cdot 9$ | $7^{\circ} 0$ | 7.0 | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 3$ | $7 * 4$ | $7 \cdot 5$ | $7 \cdot 6$ | $7 \times 7$ | $7 \cdot 8$ | $8 \cdot 0$ | 8.1 | $8 \cdot 2$ |
| $40 \cdot 00$ | $6 \cdot 7$ | $6 \cdot 7$ | $6 \cdot 8$ | $6 \cdot 9$ | 7.0 | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 3$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 7$ | $7 \cdot 8$ | $7 \cdot 9$ | $8 \cdot 0$ |
| $42 \cdot 00$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 8$ | $6 \cdot 9$ | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 3$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 6$ |
| $44^{\circ} 00$ | $6 \cdot 0$ | 6.I | $6 \cdot 2$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 8$ | $6 \cdot 9$ | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 3$ |
| $46 \cdot 00$ | $5 \cdot 8$ | $5 \cdot 8$ | $5 \cdot 9$ | 6.0 | $6 \cdot 0$ | $6 \cdot 1$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 8$ | 6.9 | $7 * 0$ |
| $48 \cdot 00$ | $5 \cdot 5$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 9$ | $5 \cdot 9$ | $6 \cdot 0$ | $6 \cdot 1$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 7$ |
| $50 \cdot 00$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 4$ | $5 \cdot 6$ | $5 \cdot 6$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 9$ | $6 \cdot 0$ | $6 \cdot 1$ | $6 \cdot 1$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 4$ |
| $52 \cdot 00$ | 5.I | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 3$ | 5*3 | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 6$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 9$ | $6 \cdot 0$ | $6 \cdot 1$ | $6 \cdot 2$ |
| 54.00 | $4 \cdot 9$ | $5 \cdot 0$ | $5 \cdot 0$ | $5 \cdot 1$ | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 9$ | $6 \cdot 0$ |
| 56.00 | $4 \cdot 7$ | $4 \cdot 8$ | $4 \cdot 8$ | 4.9 | $5 \cdot 0$ | $5 \cdot 0$ | $5 \cdot 1$ | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 8$ |
| 58.00 | $4 \cdot 6$ | $4 \cdot 6$ | $4 \cdot 7$ | $4 \cdot 7$ | 4.8 | $4 \cdot 9$ | $4 \cdot 9$ | $5 \cdot 0$ | $5 \cdot 1$ | 5.1 | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 6$ |
| $60 \cdot 00$ | 4.4 | $4 \cdot 5$ | $4 \cdot 5$ | $4 \cdot 6$ | $4 \cdot 7$ | 4.7 | $4 \cdot 8$ | $4 \cdot 8$ | $4 \cdot 9$ | $5 \cdot 0$ | $5 \cdot 0$ | $5 \cdot 1$ | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 4$ |
| $70 \cdot 00$ | $3 \cdot 8$ | 3.8 | $3 \cdot 9$ | $3 \cdot 9$ | $4^{\circ} 0$ | $4 \cdot 0$ | $4^{\cdot 1}$ | $4 \cdot 1$ | $4 \cdot 2$ | $4 \cdot 3$ | $4 \cdot 3$ | 4.4 | $4 \cdot 5$ | $4 \cdot 5$ | $4 \cdot 6$ |
| $80 \cdot 00$ | $3 \cdot 3$ | 3.4 | $3 \cdot 4$ | $3 \cdot 5$ | $3 \cdot 5$ | $3 \cdot 5$ | $3 \cdot 6$ | $3 \cdot 6$ | $3 \cdot 7$ | $3 \cdot 7$ | $3 \cdot 8$ | 3.8 | $3 \cdot 9$ | $4^{\circ} 0$ | 4.0 |
| $90 \cdot 00$ | $3 \cdot 0$ | 3.0 | $3 \cdot 0$ | $3 \cdot 1$ | $3 \cdot 1$ | $3 \cdot 1$ | $3 \cdot 2$ | $3 \cdot 2$ | $3 \cdot 3$ | $3 \cdot 3$ | 3.4 | 3.4 | $3 \cdot 5$ | $3 \cdot 5$ | $3 \cdot 6$ |
| $100^{\circ} 0$ | 2.7 | $2 \cdot 7$ | $2 \cdot 7$ | $2 \cdot 8$ | $2 \cdot 8$ | $2 \cdot 8$ | 2.9 | 2.9 | $2 \cdot 9$ | $3 \cdot 0$ | $3 \cdot 0$ | $3 \cdot 1$ | $3 \cdot 1$ | $3 \cdot 2$ | $3 \cdot 2$ |
| $120{ }^{\circ}$ | $2 \cdot 2$ | $2 \cdot 2$ | $2 \cdot 3$ | $2 \cdot 3$ | $2 \cdot 3$ | $2 \cdot 3$ | $2 \cdot 4$ | $2 \cdot 4$ | 2.4 | $2 \cdot 5$ | $2 \cdot 5$ | $2 \cdot 6$ | $2 \cdot 6$ | $2 \cdot 6$ | $2 \cdot 7$ |
| 150.0 | 1.8 | 5.8 | I.8 | I. 8 | I•9 | I-9 | I-9 | I•9 | $2 \cdot 0$ | $2 \cdot 0$ | 2.0 | $2 \cdot 1$ | $2 \cdot 1$ | $2 \cdot 1$ | $2 \cdot 2$ |
| 2000 | 1-3 | 1.4 | 1.4 | $1 \cdot 4$ | 1.4 | $1 \cdot 4$ | $1 \cdot 4$ | I'5 | I'5 | I•5 | I. 5 | I. 5 | 1.6 | I. 6 | 1.6 |
| 3000 | $0 \cdot 9$ | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | I•O | I'0 | 1-0 | I'O | I-O | 1.0 | I.0 | I•I |

When the Latitude Variation is + name the Azimuth the same name as Latitude.
opposite name to the Latitude.

| Lat. <br> Var. <br> to $I^{\prime}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $46^{\circ}$ | $47^{\circ}$ | $48^{\circ}$ | $49^{\circ}$ | $50^{\circ}$ | $51^{\circ}$ | $52^{\circ}$ | $53^{\circ}$ | $54^{\circ}$ | $55^{\circ}$ | $56^{\circ}$ | $57^{\circ}$ | $58^{\circ}$ | 59 ${ }^{\circ}$ | $60^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| s. 0.00 | $90^{\circ} 0$ | 90*0 | $90^{\circ} 0$ | $90^{\circ}$ | $90^{\circ} 0$ | $90 \cdot 0$ | $90 \cdot 0$ | 90.0 |  | 90\% | $0 \cdot 0$ |  |  |  | - |
| $\bigcirc$ | $89^{\circ}$ | 890 | $89^{\circ} \mathrm{O}$ | $89^{\circ}$ | $89^{\circ}$ | $89^{\circ}$ | $89^{\prime} \times$ | $89 \cdot 1$ | 89.2 | 89.2 | 89.2 | $8{ }^{90 \cdot 0}$ | $90 \cdot 0$ 80.2 | $90 \cdot 0$ 80.3 8 | O.0 |
| $0 \cdot 20$ | 88.0 | $88 \cdot 0$ | 88.1 | $88 \cdot \mathrm{I}$ | 88.2 | 88.2 | $88 \cdot 2$ | 88.3 | 88.3 | 88.4 | 88.4 | 88.4 | 88.5 | 88.5 | 88.6 |
| $0 \cdot 30$ | 87.0 | $87 \cdot 0$ | 87.x | $87 \cdot 2$ | 87.2 | 87.3 | 87.4 | 87.4 | $87 \cdot 5$ | $87 \cdot 5$ | $87 \cdot 6$ | $87 \cdot 7$ | $87 \cdot 7$ | 87.8 | 87.9 |
| $0 \cdot 40$ | 86.0 | 86. 1 | $86 \cdot 2$ | 86.2 | $86 \cdot 3$ | $86 \cdot 4$ | $86 \cdot 5$ | $86 \cdot 6$ | 86.6 | $86 \cdot 7$ | 86.8 | $86 \cdot 9$ | 87.0 | $87 \cdot 1$ | $87 \cdot 1$ |
| 0.50 | $85^{\circ} \mathrm{O}$ | 85. 1 | 85.2 | 85.3 | 85.4 | 85.5 | $85 \cdot 6$ | 85.7 | 85.8 | 85.9 | 86.0 | $86 \cdot 1$ | 86.2 | $86 \cdot 3$ | $86 \cdot 4$ |
| 0.60 | $84^{\cdot 1}$ | 84.2 | 84.3 | 84.4 | 84.5 | $84^{6} 6$ | $84 \cdot 7$ | 84.8 | $85^{\circ}$ | $85 \cdot 1$ | 85.2 | 85.3 | $85 \cdot 5$ | $85 \cdot 6$ | $85 \cdot 7$ |
| $0 \cdot 70$ | $83^{\circ} \mathrm{O}$ | 83.2 | 83.3 | 83.5 | $83^{6} 6$ | $83^{\prime} 7$ | 83.9 | $84^{\circ} \mathrm{O}$ | $8{ }^{8 \cdot 1}$ | 84.3 | 84.4 | $84^{6} 6$ | $84^{\circ} 7$ | $84^{\circ} 9$ | $85^{\circ}$ |
| 0.80 | $8{ }^{8 \cdot 1}$ | 82.2 | 82.4 | 82.5 | 82.7 | $82 \cdot 8$ | $83^{\circ}$ | $83 \cdot 1$ | 83.3 | 83.5 | 83.6 | $83 \cdot 8$ | $84^{\circ}$ | $84^{\cdot 1}$ | 84.3 |
| 0.90 | $8 \mathrm{r} \cdot \mathrm{I}$ | $8 \mathrm{r} \cdot 3$ | 8 r 4 | $8 \mathrm{r} \cdot 6$ | $8 \mathrm{r} \cdot 8$ | 81.9 | $82 \cdot 1$ | 82.3 | $82 \cdot 5$ | 82.6 | 82.8 | $83^{\circ} \mathrm{O}$ | 83.2 | 83.4 | 83.4 |
| roo | $80 \cdot 1$ | $80 \cdot 3$ | $80 \cdot 5$ | 80.7 | $80 \cdot 9$ | $8 \mathrm{r} \cdot \mathrm{I}$ | $8 \mathrm{r} \cdot 2$ | $8 \mathrm{I} \cdot 4$ | $8 \mathrm{r} \cdot 6$ | $8 \mathbf{8} \cdot 8$ | $82^{\circ}$ | $82 \cdot 2$ | 82.5 | $82 \cdot 7$ | 82.9 |
| r.10 | 79.2 | 79.4 | $79 \cdot 6$ | 79.8 | $80 \cdot 0$ | 80.2 | $80 \cdot 4$ | $80 \cdot 6$ | $80 \cdot 8$ | 8 r 0 | $8 \mathrm{r} \cdot 3$ | 8 l 5 | $81 \cdot 7$ | $8 \mathrm{r} \cdot 9$ | $82 \cdot 2$ |
| 1.20 | 78.2 | 78.4 | 78.6 | 78.9 | 79.1 | 79.3 | 79.5 | 79.8 | $80 \cdot 0$ | 80.2 | 80.5 | $80 \cdot 7$ | $8 \mathrm{I} \cdot 0$ | $8 \mathrm{r} \cdot 2$ | 8 r 5 |
| I 30 | 77.3 | 77.5 | 77.7 | 78.0 | 78.2 | 78.4 | $78 \cdot 7$ | 78.9 | 79.2 | 79.4 | $79 \cdot 7$ | $80 \cdot 0$ | 80.2 | 80.5 | 80.8 |
| r 40 | $76 \cdot 3$ | 76.6 | $76 \cdot 8$ | $77 \cdot 1$ | 77.3 | $77 \cdot 6$ | $77 \cdot 8$ | $78 \cdot 1$ | 78.4 | $78 \cdot 6$ | 78.9 | 79.2 | 79.5 | 79.8 | $80 \cdot 1$ |
| 1.50 | 75.4 | 75.7 | 75.9 | $76 \cdot 2$ | 76.4 | $76 \cdot 7$ | $77^{\circ} \mathrm{O}$ | 77.3 | 77.6 | 77.9 | 78.2 | 78.5 | 78.8 | $79 \cdot 1$ | $79 \cdot 4$ |
| 1.60 | 74.5 | $74 \cdot 7$ | $75^{\circ}$ | $75 \cdot 3$ | $75 \cdot 6$ | 75.9 | $76 \cdot 2$ | $76 \cdot 5$ | $76 \cdot 8$ | $77 \cdot 1$ | 77.4 | $77 \cdot 7$ | 78.0 | 78.4 | $78 \cdot 7$ |
| 1・ヶ0 | 73.6 | 73.8 | $74^{\circ} \mathrm{I}$ | 74.4 | $7{ }^{7} 7$ | $75^{\circ}$ | $75 \cdot 3$ | $75 \cdot 7$ | $76 \cdot 0$ | 76.3 | $76 \cdot 6$ | $77 \cdot 0$ | 77.3 | $77 \cdot 7$ | 78.0 |
| $\underline{1.80}$ | 72.6 | 72.9 | 73.2 | 73.6 | 73.9 | 74.2 | 74.5 | 74.8 | 75.2 | 75.5 | 75.9 | $76 \cdot 2$ | 76.6 | $77^{\circ}$ | $77 \cdot 3$ |
| r 90 | $71 \cdot 7$ | 72.1 | 72.4 | $72 \cdot 7$ | $73^{\circ} 0$ | 73.4 | 73.7 | $74^{\circ} \mathrm{O}$ | 74.4 | 74.8 | $75^{\prime} \mathrm{r}$ | 75.5 | $75 \cdot 9$ | $76 \cdot 3$ | $76 \cdot 6$ |
| 2.00 | 70.8 | 71.2 | 71.5 | 7 x 8 | 72.2 | 72.5 | 72.9 | 73.3 | 73.6 | $74^{\circ} \mathrm{O}$ | 74.4 | 74.8 | 75.2 | 75.6 | 76.0 |
| $2 \cdot 10$ | $70 \cdot 0$ | $70 \cdot 3$ | $70 \cdot 6$ | 71.0 | 71.4 | 71.7 | 72.1 | 72.5 | 72.9 | 73.2 | $73 \cdot 6$ | 74.0 | 74.5 | 74.9 | 75.3 |
| 2.20 | $69 \cdot 1$ | 69.4 | $69 \cdot 8$ | $70 \cdot 2$ | $70 \cdot 5$ | $70 \cdot 9$ | $7 \mathrm{r} \cdot 3$ | 71.7 | $72 \cdot 1$ | $72 \cdot 5$ | $72 \cdot 9$ | $73 \cdot 3$ | $73 \cdot 8$ | 74.2 | $74 \cdot 6$ |
| $2 \cdot 30$ | 68.2 | 68.6 | $69^{\circ}$ | $69 \cdot 3$ | $69 \cdot 7$ | $70 \cdot 1$ | $70 \cdot 5$ | $70 \cdot 9$ | 71.3 | $71 \cdot 7$ | $72 \cdot 2$ | $72 \cdot 6$ | $73^{\prime} \mathrm{I}$ | 73.5 | 74.0 |
| $2 \cdot 40$ | $67 \cdot 4$ | 67•7 | $68 \cdot \mathrm{I}$ | 68.5 | 68.9 | 69.3 | $69 \cdot 7$ | 70•1 | $70 \cdot 6$ | 71.0 | 71.5 | 71.9 | 72.4 | 72:8 | $73^{\circ} 3$ |
| 2.50 | $66 \cdot 5$ | $66 \cdot 9$ | 67.3 | $67 \cdot 7$ | $68 \cdot \mathrm{I}$ | $68 \cdot 5$ | 69.0 | 69.4 | 69.8 | $70 \cdot 3$ | 70.7 | 71.2 | 7 F 7 | $72 \cdot 2$ | $72 \cdot 6$ |
| 2.60 | 65.7 | 66.I | $66 \cdot 5$ | 66.9 | 67.3 | $67 \cdot 8$ | 68.2 | 68.6 | 69.1 | $69 \cdot 6$ | 70.0 | $70 \cdot 5$ | $7 \mathrm{r} \cdot$ | $7 \mathrm{I} \cdot 5$ | 720 |
| $2 \cdot 70$ | 64.9 | $65 \cdot 3$ | $65^{\circ} 7$ | $66 \cdot 1$ | $66 \cdot 5$ | $67 \cdot 0$ | $67 \cdot 4$ | $67 \cdot 9$ | 68.4 | 68.9 | 69.3 | $69 \cdot 8$ | $70 \cdot 3$ | $70 \cdot 8$ | 71.4 |
| 2.80 | $64 \cdot 1$ | $64 \cdot 5$ | 64.9 | 65.3 | $65 \cdot 8$ | $66 \cdot 2$ | $66 \cdot 7$ | $67 \cdot 2$ | $67 \cdot 6$ | $68 \cdot 1$ | $68 \cdot 6$ | ${ }^{69} \cdot{ }^{\text {I }}$ | $69 \cdot 6$ | 70.2 | $70 \cdot 7$ |
| $2 \cdot 90$ | $63 \cdot 3$ | $63^{\circ} 7$ | $64 \cdot 1$ | $64 \cdot 6$ | $65^{\circ}$ | 65.5 | 65.9 | 66.4 | 66.9 | $67 \cdot 4$ | 67.9 | 68.5 | 69.0 | 69.5 | 70•x |
| 3.00 | 62.5 | $62 \cdot 9$ | 63.4 | $63 \cdot 8$ | 64.3 | $64 \cdot 7$ | 65.2 | 65.7 | 66.2 | $66 \cdot 7$ | 67.2 | 67.8 | $68 \cdot 3$ | $68 \cdot 9$ | 69.4 |
| $3 \cdot 10$ | 61.7 | 62. I | $62 \cdot 6$ | $63^{\circ} \mathrm{O}$ | 63.5 | $64^{\circ} \mathrm{O}$ | 64.5 | 65.0 | $65 \cdot 5$ | $66 \cdot$ | $66 \cdot 6$ | $67 \cdot 1$ | $67 \cdot 7$ | $68 \cdot 2$ | $68 \cdot 8$ |
| 3.20 | 60.9 | $6 \mathrm{I} \cdot 4$ | ${ }_{61} \cdot 8$ | $62 \cdot 3$ | $62 \cdot 8$ | 63.3 | $63 \cdot 8$ | 64.3 | $64 \cdot 8$ | $65 \cdot 4$ | 65.9 | 66.5 | $67^{\circ}$ | 67.6 | 68.2 |
| 3.30 | 60.2 | $60 \cdot 6$ | 6I•I | 6I. 6 | 62. 1 | 62.6 | 631 | 63.6 | $64^{\prime} \mathrm{r}$ | $64 \%$ | 65.2 | 658 | 66.4 | $67 \cdot 0$ | $67 \cdot 6$ |
| 3.40 | 59.4 | 59.9 | $60 \cdot 4$ | $60 \cdot 9$ | 6r.3 | $6 \mathrm{r} \cdot 9$ | 62.4 | $62 \cdot 9$ | 63.5 | $64^{\circ}$ | $64 \cdot 6$ | 65.2 | $65 \cdot 8$ | 66.4 | $67 \cdot 0$ |
| 3.50 | $58 \cdot 7$ | $59^{\circ} 2$ | 59'7 | $60 \cdot 1$ | $60 \cdot 6$ | 6r.2 | ${ }_{6 r} \cdot 7$ | 62.2 | 62.8 | 63.3 | 63.9 | 64.5 | $65 \cdot 1$ | 65.7 | 66.4 |
| 3.60 | 58.0 | $58 \cdot 5$ | $58 \cdot 9$ | 59.4 | $60 \cdot 0$ | $60 \cdot 5$ | $6 \mathrm{r} \cdot \mathrm{O}$ | 6r.6 | 62.1 | 62.7 | $63 \cdot 3$ | 63.9 | $64 \cdot 5$ | $65 \cdot 1$ | $65 \cdot 8$ |
| $3 \cdot 70$ | 57.3 | $57 \cdot 8$ | 58.2 | $58 \cdot 7$ | 59.3 | 59.8 | 60.3 | 60.9 | 61.5 | $62 \cdot 1$ | $62 \cdot 7$ | 63.3 | 63.9 | $64 \cdot 5$ | 65.2 |
| 3.80 | $56 \cdot 6$ | 57.1 | $57 \cdot 6$ | 58.1 | 58.6 | 59.1 | 59.7 | $60 \cdot 2$ | $60 \cdot 8$ | $6 \mathrm{r} \cdot 4$ | 62.0 | $62 \cdot 6$ | 63.3 | $63 \cdot 9$ | $64 \cdot 6$ |
| 3.90 | 55.9 | $56 \cdot 4$ | $56 \cdot 9$ | 57.4 | 57.9 | $58 \cdot 5$ | 59.0 | $59 \cdot 6$ | $60 \cdot 2$ | $60 \cdot 8$ | 61.4 | 62.0 | 62.7 | $63 \cdot 3$ | $64^{\circ}$ |
| 4.00 | 55.2 | $55 \cdot 7$ | $56 \cdot 2$ | $56 \cdot 7$ |  | 57-8 | 58.4 | $59^{\circ}$ | 59.6 | 60.2 | 60.8 | 61.4 | 62. 1 | 62.7 | 63.4 |
| 4.10 | 54.6 | 55*o | $55 \cdot 6$ | $56 \cdot 1$ | $56 \cdot 6$ | 57.2 | 57•7 | $58 \cdot 3$ | $58 \cdot 9$ | 59.5 | $60 \cdot 2$ | $60 \cdot 8$ | 61.5 | 62.2 | $62 \cdot 9$ |
| 4.20 | 53.9 | 54.4 | 54.9 | 55.4 | $56 \cdot 0$ | $56 \cdot 5$ | 57.1 | $57 \cdot 7$ | $58 \cdot 3$ | $58 \cdot 9$ | 59.6 | 60.2 | $60 \cdot 9$ | 61.6 | $62 \cdot 3$ |
| 4.30 | 53.3 | 53.8 | 54.3 | 54.8 | 55.4 | 55.9 | 56.5 | 57.1 | 57*7 | $58 \cdot 3$ | $59^{\circ}$ | $59 \cdot 7$ | $60 \cdot 3$ | $6 \mathrm{I} \cdot 0$ | $61 \cdot 7$ |
| 4.40 | 52.6 | 53.1 | $53 \cdot 6$ | 54.2 | $54 * 7$ | $55 \cdot 3$ | 55.9 | $56 \cdot 5$ | 57.1 | 57.8 | 58.4 | $59^{\circ} \mathrm{x}$ | 59.8 | $60 \cdot 5$ | 6I.2 |
| $4 \cdot 50$ | 52.0 | 52.5 | 53.0 | $53 \cdot 6$ | 54• $\times$ | 54.7 | 55.3 | $55 \cdot 9$ | $56 \cdot 5$ | 57.2 | 57.8 | 58.5 | 59.2 | 59.9 | $60 \cdot 6$ |
| 460 | 51.4 | $51 \cdot 9$ | 52.4 | 53.0 | 53.5 | 54.x | 54.7 | $55^{\circ} 3$ | 55.9 | 56.6 | $57 \cdot 3$ | 57.9 | $58 \cdot 6$ | 59.4 | $60 \cdot 1$ |
| 4.70 | 50.8 | $5 \mathrm{r} \cdot 3$ | 51.8 | 52.4 | 52.9 | 53.5 | 54.1 | 54*7 | $55 \cdot 4$ | 56.0 | $56 \cdot 7$ | 57.4 | 58.0 | 58.8 | 59.6 |
| $4 \cdot 80$ | $50 \cdot 2$ | 50.7 | 51.2 | 51.8 | 52.4 | $52 \cdot 9$ | 53.5 | 54.2 | 54.8 | $55 \cdot 5$ | $56 \cdot \mathrm{r}$ | $56 \cdot 8$ | 57.5 | $58 \cdot 3$ | $59^{\circ} \mathrm{O}$ |
| 4.90 | $49 \cdot 6$ | $50^{\circ} \mathrm{I}$ | 50\%7 | 51.2 | 51-8 | $52 \cdot 4$ | $53^{\circ}$ | 53.6 | 54.2 | $54 \cdot 6$ | $55^{6}$ | $56 \cdot 3$ | $57 \cdot 0$ | 57.8 | $58 \cdot 5$ |
| 5.00 | $49^{\circ} \mathrm{O}$ | 49.6 | 50.r | $50 \cdot 6$ | 51.2 | $5 \mathrm{r} \cdot 8$ | 52.4 | 53.0 | 53.7 | 54.4 | 55.0 | $55 \cdot 8$ | $56 \cdot 5$ | 57.2 | 58.0 |
| 5.10 | $48 \cdot 5$ | $49^{\circ} \mathrm{O}$ | $49 \cdot 5$ | 50•. | 50.7 | $5 \mathrm{~F} \cdot 3$ | 5r.9 | $52 \cdot 5$ | 53.2 | $53 \cdot 8$ | $54 \cdot 5$ | $55^{\circ} 2$ | $56 \cdot 0$ | $56 \cdot 7$ | 57.5 |
| $5 \cdot 20$ | 47.9 | $48 \cdot 4$ | $49 \cdot 0$ | $49 \cdot 5$ | 50. 1 | 50•7 | 51.3 | $52 \cdot 0$ | $52 \cdot 6$ | 53.3 | 54.0 | $54 \cdot 7$ | 55.4 | 56.2 | 57.0 |
| 5.30 5.40 | 47.4 46.8 | 47.9 47.4 | 48.4 47.9 | 49.0 48.5 | $49 \cdot 6$ | $50 \cdot 2$ | $50 \cdot 8$ $50 \cdot 3$ | 51.4 | 52•1 | $52 \cdot 8$ | 53.5 | 54.2 | 54.9 | 55.7 | 56.5 56.0 |
| $5 \cdot 40$ | $46 \cdot 8$ | $47 \cdot 4$ | $47 \cdot 9$ | $48 \cdot 5$ | 49`1 | $49 \cdot 7$ | 50.3 | $50 \cdot 9$ | 51.6 | $52 \cdot 3$ | $53 \cdot 0$ | $53 \cdot 7$ | 54.4 | $55 \cdot 2$ | 56.0 |
| $5 \cdot 50$ | $46 \cdot 3$ | $46 \cdot 8$ | 47.4 | $47 \cdot 9$ | $48 \cdot 5$ | 49. 1 | $49 \cdot 8$ | $50 \cdot 4$ | 51-1 | 51.7 | 52.4 | 53.2 | 53.9 | 54.7 | 55.5 |
| $5 \cdot 60$ | $45 \cdot 8$ | $46 \cdot 3$ | $46 \cdot 9$ | $47 \cdot 4$ | $48 \cdot 0$ | 48.6 | 49.2 | $49^{\circ} 9$ | $50 \cdot 5$ | 51.2 | $51 \cdot 9$ | $52 \cdot 7$ | $53 \cdot 4$ | 54.2 | $55^{\circ} \mathrm{O}$ |
| 57 5 | $45 \cdot 3$ | $45 \cdot 8$ | $46 \cdot 4$ | $46 \cdot 9$ | $47 \cdot 5$ | 48.1 | $48 \cdot 7$ | $49 \cdot 4$ | $50 \cdot 1$ | 50.7 | 51.4 | $52 \cdot 2$ | $52 \cdot 9$ | $53 \cdot 7$ | $54 \cdot 5$ |
| $5 \cdot 80$ | 44.8 | $45 \cdot 3$ | $45 \cdot 9$ | $46 \cdot 4$ | $47 \cdot 0$ | 47.6 | $48 \cdot 2$ | $48 \cdot 9$ | $49 \cdot 6$ | $50 \cdot 3$ | $51^{\circ} \mathrm{O}$ | $51 \cdot 7$ | 52.5 | 53.2 | $54 \cdot \mathrm{r}$ |
| $5 \cdot 90$ | 44.3 | 44.8 | $45 \cdot 4$ | $45 \cdot 9$ | $46 \cdot 5$ | 47.1 | $47 \cdot 8$ | $48 \cdot 4$ | 49'1 | $49 \cdot 8$ | $50 \cdot 5$ | 51.2 | $52 \cdot$ | 52.8 | $53 \cdot 6$ |

When the Latitude Variation is + name the Azimuth the same name as Latitude.
"
opposite name to the Latitude.

| Lat. <br> Var. <br> to $\mathrm{I}^{\prime}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $46^{\circ}$ | $47^{\circ}$ | $48^{\circ}$ | $49^{\circ}$ | $50^{\circ}$ | $51^{\circ}$ | $52^{\circ}$ | $53^{\circ}$ | $54^{\circ}$ | $55^{\circ}$ | $56^{\circ}$ | $57^{\circ}$ | $58^{\circ}$ | $59^{\circ}$ | $80^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6.00 | $43^{\circ} 8$ | $44 \cdot 3$ | 44.9 | $45 \cdot 5$ | $4{ }^{\circ} \cdot 0$ | $46 \cdot 7$ | 47.3 | 47.9 | 48.6 | $49^{\circ} 3$ | 50․o. | $50 \cdot 8$ | $5 \stackrel{\circ}{1} 5$ | $52 \cdot 3$ | $5{ }^{\circ} \cdot 1$ |
| $6 \cdot 10$ | $43 \cdot 3$ | $43 \cdot 9$ | $44^{\circ} 4$ | $45^{\circ}$ | $45 \cdot 6$ | $46 \cdot 2$ | $46 \cdot 8$ | $47 * 4$ | $48 \cdot 1$ | 48.8 | $49 \cdot 5$ | $50 \cdot 3$ | 51.0 | $5 \mathrm{I} \cdot 8$ | 52.7 |
| 6.20 | $42 \cdot 9$ | $43 \cdot 4$ | $44^{\circ}$ | 44.5 | 45. ${ }^{\text {I }}$ | $45 \cdot 7$ | $46 \cdot 3$ | $47 \cdot 0$ | $47 \cdot 7$ | $48 \cdot 4$ | $49 \cdot 1$ | $49 \cdot 8$ | $50 \cdot 6$ | 51.4 | 52.2 |
| $6 \cdot 30$ | 42.4 | $42 \cdot 9$ | $43 \cdot 5$ | $44^{\circ}$ | $44 \cdot 6$ | $45^{\circ} 2$ | $45 \cdot 9$ | $46 \cdot 5$ | 47.2 | 47.9 | $48 \cdot 6$ | $49 \cdot 4$ | $50 \cdot 1$ | 50.9 | - |
| $6 \cdot 40$ | $42 \cdot 0$ | 42.5 | $43 \cdot 0$ | $43 \cdot 6$ | 44.2 | $44 \cdot 8$ | $45 \cdot 4$ | 46•1 | $46 \cdot 8$ | $47 \cdot 5$ | $48 \cdot 2$ | $48 \cdot 9$ | $49^{\circ} 7$ | $50 \cdot 5$ | I 3 |
| 6.50 | $41 \cdot 5$ | 42 | 42 | 43 | $43 \cdot 7$ | 44.3 | 45. | $45 \cdot 6$ | $46 \cdot 3$ | 47 | $47 \%$ | 48.5 | $49^{\circ} 3$ | 50.1 | 50.9 |
| 6.60 | 41•I | $4 \mathrm{I} \cdot 6$ | $42 \cdot 2$ | $42 \cdot 7$ | $43 \cdot 3$ | $43 \cdot 9$ | $44 \cdot 5$ | $45^{\circ} 2$ | $45 \cdot 9$ | $46 \cdot 6$ | 47.3 | 48.1 | $48 \cdot 8$ | $49 \cdot 6$ | $50 \cdot 5$ |
| 6.70 | $40 \cdot 7$ | 41.2 | 41•7 | $42 \cdot 3$ | $42 \cdot 9$ | $43 \cdot 5$ | $44^{\cdot 1}$ | $44 \cdot 8$ | $45 \cdot 4$ | $46 \cdot 1$ | $46 \cdot 9$ | $47 \cdot 6$ | 48.4 | $49 \cdot 2$ | 50.0 |
| $6 \cdot 80$ | $40 \cdot 3$ | $40 \cdot 8$ | 41.3 | $41 \cdot 9$ | $42 \cdot 5$ | $43 \cdot 1$ | $43 \cdot 7$ | $44 \cdot 3$ | $45^{\circ}$ | $45 \cdot 7$ | $46 \cdot 4$ | 47.2 | $48 \cdot 0$ | $48 \cdot 8$ | 49.6 |
| $6 \cdot 90$ | $39 \cdot 8$ | $40 \cdot 3$ | $40 \cdot 9$ | $41 \cdot 5$ | $42 \cdot 0$ | $42 \cdot 6$ | $43 \cdot 3$ | 43.9 | $44^{6}$ | $45 \cdot 3$ | $46 \cdot 0$ | $46 \cdot 8$ | 47.6 | $48 \cdot 4$ | $\cdot 2$ |
| $7 \cdot 00$ | $39^{\circ} 4$ | 39.9 | $40 \cdot 5$ | 41.1 | 41.6 | 42.2 | 42.9 | $43 \cdot 5$ | 44.2 | 44.9 | $45 \cdot 6$ | 46.4 | 47.2 | $48 \cdot 0$ | $8 \cdot 8$ |
| $7 \cdot 10$ | $39^{\circ} \mathrm{O}$ | $39 \cdot 5$ | 40•I | $40 \cdot 6$ | $41 \cdot 2$ | 41.8 | $42 \cdot 4$ | $43 \cdot 1$ | $43^{\circ} 8$ | $44 \cdot 5$ | $45 \cdot 2$ | $46 \cdot 0$ | $46 \cdot 7$ | $47 \cdot 6$ | . 4 |
| 7.20 | $38 \cdot 7$ | 39.2 | 39•7 | $40 \cdot 3$ | $40 \cdot 8$ | 41.4 | $42 \cdot 1$ | $42 \cdot 7$ | 43.4 | $44^{1}$ I | 44.8 | 45.6 | $46 \cdot 4$ | 47.2 |  |
| 7.30 | $38 \cdot 3$ | 38.8 | $39 \cdot 3$ | $39 \cdot 9$ | $40 \cdot 4$ | $4{ }^{1} 0$ | $41 \cdot 7$ | $42 \cdot 3$ | $43^{\circ} \mathrm{O}$ | $43 \cdot 7$ | 44.4 | 45.2 | $46 \cdot 0$ | $46 \cdot 8$ | $47 \cdot 6$ |
| $7 \cdot 40$ | 37.9 | 38.4 | 38.9 | $39 \cdot 5$ | 40•1 | $40 \cdot 7$ | 4I•3 | 41•9 | $42 \cdot 6$ | $43 \cdot 3$ | $44^{\circ}$ | 44.8 | $45 \cdot 6$ | $46 \cdot 4$ | 47.2 |
| 7.50 | 37.5 | 38.0 | $38 \cdot 5$ | 39 | 39.7 | $40 \cdot 3$ | $40 \cdot 9$ | 41.5 | 42.2 | 42.9 | 43. | 44.4 | 45.2 | $46 \cdot 0$ | $6 \cdot 8$ |
| 7.60 | $37 \cdot 1$ | 37.7 | $38 \cdot 2$ | 38.7 | $39 \cdot 3$ | 39.9 | $40 \cdot 5$ | 41.2 | $4 \mathrm{I} \cdot 8$ | 42.5 | $43 \cdot 3$ | $44^{\circ} \mathrm{O}$ | 44.8 | $45 \cdot 6$ | $6 \cdot 5$ |
| $7 \cdot 70$ | 36.8 | 37.3 | $37 \cdot 8$ | 38.4 | 38.9 | 39.5 | $40 \cdot 1$ | 40.8 | $4 \mathrm{I} \cdot 5$ | 42.2 | 42.9 | $43 \cdot 6$ | $44^{\circ}$ | $45 \cdot 2$ | 46.1 |
| $7 \cdot 80$ | 36.4 | 36.9 | 37.5 | 38.0 | $38 \cdot 6$ | 39.2 | $39 \cdot 8$ | $40 \cdot 4$ | $4 \mathrm{I} \cdot \mathrm{I}$ | $4 \mathrm{I} \cdot 8$ | $42^{\circ} 5$ | $43 \cdot 3$ | $44 \cdot 1$ | 44.9 | $45 \cdot 7$ |
| 7.90 | $36 \cdot 1$ | $36 \cdot 6$ | 37•1 | $37 \cdot 6$ | $38 \cdot 2$ | 38.8 | 39.4 | $40 \cdot 0$ | 40•7 | 41.4 | 42-1 | $42 \cdot 9$ | $43 \cdot 7$ | 44.5 | $45 \cdot 3$ |
| $8 \cdot 00$ | $35 \cdot 7$ | 36.2 | $36 \cdot 8$ | $37 \cdot 3$ | 37.9 | 38.5 | $39 \cdot 1$ | $39 \cdot 7$ | $40 \cdot 4$ | 41.1 | 41.8 | $42 \cdot 6$ | $43 \cdot 3$ | $44^{\circ} 2$ | $45^{\circ}$ |
| $8 \cdot 10$ | $35 \cdot 4$ | 35.9 | $36 \cdot 4$ | $37 \cdot 0$ | 37.5 | $38 \cdot 1$ | $38 \cdot 7$ | $39 \cdot 4$ | $40^{\circ} \mathrm{O}$ | $40 \cdot 7$ | 41.4 | $42 \cdot 2$ | $43 \cdot 0$ | $43^{\circ} 8$ | $44 \cdot 6$ |
| $8 \cdot 2$ | $35 \cdot 1$ | $35 \cdot 6$ | 36-1 | $36 \cdot 6$ | 37.2 | 37.8 | 38.4 | $39^{\circ} \mathrm{O}$ | $39 \cdot 7$ | $40 \cdot 4$ | 41-I | 4 I | $42 \cdot 6$ | 43.4 | $44 \cdot 3$ |
| $8 \cdot 30$ | $34^{\circ} 7$ | 35.2 | $35 \cdot 7$ | $36 \cdot 3$ | 36.8 | 37.4 | $38 \cdot 0$ | $38 \cdot 7$ | $39 \cdot 3$ | $40 \cdot 0$ | 40\% | 41.5 | $42 \cdot 3$ | 43. | $43 \cdot 9$ |
| $8 \cdot 40$ | 34.4 | 34.9 | 35.4 | $36 \cdot 0$ | $36 \cdot 5$ | $37 \cdot 1$ | $37 \cdot 7$ | $38 \cdot 4$ | $39^{\circ}$ | $39 \cdot 7$ | $40 \cdot 4$ | 41.2 | 41.9 | $42 \cdot 8$ | $\cdot 6$ |
| 8.50 | 34*I | 34.6 | $35 \cdot \mathrm{I}$ | $35 \cdot 6$ | 36.2 | 36.8 | 37.4 | 38.0 | $38 \cdot 7$ | 39.4 | $40 \cdot 1$ | $40 \cdot 8$ | 41.6 | $42 \cdot 4$ | 43.2 |
| 8.60 | $33^{-8}$ | 34.3 | 34.8 | $35 \cdot 3$ | 35.9 | $36 \cdot 5$ | $37 \cdot 1$ | $37 \cdot 7$ | 38.4 | $39^{\circ} \mathrm{O}$ | 39•8 | $40 \cdot 5$ | $41 \cdot 3$ | 42•I | $42 \cdot 9$ |
| $8 \cdot 70$ | $33 \cdot 5$ | 34.0 | $34 \cdot 5$ | $35^{\circ}$ | $35 \cdot 6$ | $36 \cdot 1$ | $36 \cdot 7$ | 37.4 | $38 \cdot 0$ | $38 \cdot 7$ | 39.4 | $40 \cdot 2$ | $40 \cdot 9$ | 41•7 | $42 \cdot 6$ |
| 8.80 | 33.2 | $33^{\circ} 7$ | 34.2 | $34^{\prime} 7$ | $35 \cdot 3$ | 35.8 | $36 \cdot 4$ | 37.1 | $37 \cdot 7$ | 38.4 | 39.1 | 39.8 | $40 \cdot 6$ | 41.4 | $42 \cdot 3$ |
| 8.90 | 32.9 | $33 \cdot 4$ | 33.9 | 34.4 | 34.9 | $35 \cdot 5$ | $36 \cdot 1$ | $36 \cdot 7$ | $37 \cdot 4$ | $38 \cdot 1$ | $38 \cdot 8$ | 39.5 | $40 \cdot 3$ | 4I•I | 4 I 9 |
| 9 | $32 \cdot 6$ | 33 | $33 \cdot 6$ | 34 | 34 | 35. | $35 \cdot 8$ | 36.4 | 37 | 37.8 | 38.5 | $39^{\circ} 2$ | $40 \cdot 0$ | $40 \cdot 8$ | - 6 |
| $9 \cdot 10$ | $32 \cdot 3$ | $32 \cdot 8$ | $33 \cdot 3$ | $33 \cdot 8$ | 34.4 | 34.9 | $35 \cdot 5$ | $36 \cdot 1$ | $36 \cdot 8$ | 37.5 | $38 \cdot 2$ | 38.9 | $39 \cdot 7$ | $40 \cdot 5$ | $\cdot 3$ |
| $9 \cdot 20$ | 32.0 | $32 \cdot 5$ | $33^{\circ} \mathrm{O}$ | $33 \cdot 5$ | 34.1 | 34.6 | 35.2 | $35 \cdot 8$ | $36 \cdot 5$ | 37.2 | 37.9 | $38 \cdot 6$ | 39.4 | $40^{\circ}$ | 410 |
| $9 \cdot 30$ | $31 \cdot 7$ | 32.2 | 32.7 | 33.2 | $33 \cdot 8$ | 34.3 | 34.9 | $35 \cdot 5$ | $36 \cdot 2$ | 36.9 | $37 \cdot 6$ | $38 \cdot 3$ | $39 \cdot 1$ | 39.9 | $40 \cdot 7$ |
| $8 \cdot 40$ | $31 \cdot 5$ | $32 \cdot 0$ | $32 \cdot 5$ | $33^{\circ} \mathrm{O}$ | $33 \cdot 5$ | $34 \cdot 1$ | $34 \cdot 6$ | $35 \cdot 3$ | $35 \cdot 9$ |  | $37 \cdot 3$ | $38 \cdot 0$ | 38.8 | $39 \cdot 6$ | $40 \cdot 4$ |
| $9 \cdot 50$ | 3I•2 | 31.7 | $32 \cdot 2$ | $32 \cdot 7$ | $33 \cdot 2$ | $33 \cdot 8$ | 34.4 | $35 \cdot 0$ | $35 \cdot 6$ | $36 \cdot 3$ | 37.0 | 37.7 | 38.5 | $39 \cdot 3$ | 40.1 |
| 9.60 | 31.0 | 31.4 | $3 \mathrm{r} \cdot 9$ | 32.4 | $33^{\circ}$ | 33.5 | 34.1 | 34.7 | 35.3 | $36 \cdot 0$ | $36 \cdot 7$ | 37.4 | 38.2 | $39^{\circ}$ | 39.8 |
| 9.70 | 30.7 | $31 \cdot 1$ | 31.6 | 32.1 | $32 \cdot 7$ | 33.2 | $33 \cdot 8$ | 34.4 | $35^{\circ}$ | $35 \cdot 7$ | $36 \cdot 4$ | $37 \cdot 1$ | 37.9 | $38 \cdot 7$ | $39 \cdot 5$ |
| 9.80 | 30.4 | 30.9 | $3 \mathrm{I} \cdot 4$ | 31.9 | $32 \cdot 4$ | $33^{\circ} \mathrm{O}$ | 33.5 | $34 \cdot 1$ | $34 \cdot 8$ | 35.4 | 36•I | $36 \cdot 8$ | $37 \cdot 6$ | $38 \cdot 4$ | $39^{2}$ |
| 9.90 | $30 \cdot 2$ | $30 \cdot 6$ | 3I-I | 31.6 | $32 \cdot 1$ | $32 \cdot 7$ | $33 \cdot 3$ | $33^{\circ} 9$ | $34^{\circ} 5$ | $35 \cdot 1$ | $35 \cdot 8$ | 36.6 | $37 \cdot 3$ | $38 \cdot 1$ | 38.9 |
| 10.0 |  | 30 |  | 31 |  | $32 \cdot 4$ | 33.0 | $33 \cdot 6$ | 34.2 |  | $35 \cdot 6$ | $36 \cdot 3$ | 37.0 | 37.8 | 38.7 |
| $10 \cdot 1$ | $29 \cdot 7$ | $30 \cdot 1$ | $30 \cdot 6$ | 31-I | 31.6 | 32.2 | $32 \cdot 7$ | $33 \cdot 3$ | $34^{\circ}$ | 34.6 | $35 \cdot 3$ | $36 \cdot 0$ | 36.8 | 37.5 | 38.4 |
| 10.2 | 29.4 | 29.9 | $30 \cdot 4$ | 30.9 | 31.4 | 31.9 | 32.5 | $33 \cdot 1$ | $33 \cdot 7$ | 34.4 | $35^{\circ} \mathrm{O}$ | $35 \cdot 8$ | 36.5 | $37 \cdot 3$ | 3-1 |
| 10.30 | 29.2 | 29.6 | $30 \cdot 1$ | $30 \cdot 6$ | $31 \cdot 1$ | $3 \mathrm{I} \cdot 7$ | 32.2 | 32.8 | 33.4 | $34 \cdot 1$ | 34.8 | 35.5 | $36 \cdot 2$ | 37.0 | 37.8 |
| 10.40 | $29^{\circ} \mathrm{O}$ | 29.4 | 29.9 | $30 \cdot 4$ | $30 \cdot 9$ | 31. | 32.0 | $32 \cdot 6$ | 332 | 33.8 | 34.5 | 35.2 | $36 \cdot 0$ | 368 | $37 \cdot 6$ |
| ro. 50 | $28 \cdot 7$ | 29.2 | $29 \cdot 6$ | 30.1 | $30 \cdot 6$ | $3 \mathrm{I} \cdot 2$ | $31 \cdot 7$ | $32 \cdot 3$ | 32.9 | $33 \cdot 6$ | 34.2 | 35.0 | 35.7 | $36 \cdot 5$ | $37 \cdot 3$ |
| 10.60 | $28 \cdot 5$ | $29^{\circ}$ | 29.4 | 29.9 | 30.4 | 30.9 | $31 \cdot 5$ | $32 \cdot 1$ | $32 \cdot 7$ | 33.3 | $34^{\circ} \mathrm{O}$ | 34.7 | 35.5 | $36 \cdot 2$ | $37^{\circ}$ |
| 10.70 | $28 \cdot 3$ | 28.7 | 29.2 | 29.7 | 30.2 | $30 \cdot 7$ | 3r.3 | $3 \mathrm{I} \cdot 8$ | 32.4 | $33 \cdot 1$ | $33 \cdot 7$ | 34.4 | 35.2 | $36 \cdot 0$ | $36 \cdot 8$ |
| 10.80 | $28 \cdot 1$ | 28.5 | $29^{\circ}$ | 29.4 | $30 \cdot 0$ | $30 \cdot 5$ | 31.0 | 31.6 | $32 \cdot 2$ | 32.9 | $33 \cdot 5$ | 34.2 | $35^{\circ} \mathrm{O}$ | $35 \cdot 7$ | $36 \cdot 5$ |
| 10.90 | 27.8 | $28 \cdot 3$ | $28 \cdot 7$ | 29.2 | 29.7 | $30 \cdot 2$ | $30 \cdot 8$ | 31.4 | $32 \cdot 0$ | $32 \cdot 6$ | 33.3 | $34^{\circ} \mathrm{O}$ | $34 \cdot 7$ | $35 \cdot 5$ | $36 \cdot 3$ |
| 11.00 | $27 \cdot 6$ | $28 \cdot 1$ | $28 \cdot 5$ | $29 \cdot 0$ | 29.5 | 30.0 | 30.6 | $31 \cdot 1$ | $3 \mathrm{I} \cdot 7$ | 32.4 | $33^{\circ} \mathrm{O}$ | $33 \cdot 7$ | 34.5 | $35 \cdot 2$ | 36.0 |
| II | 27.4 | 27.8 | $28 \cdot 3$ | 28.8 | 29.3 | 29.8 | $30 \cdot 3$ | 30.9 | 31.5 | $32 \cdot 1$ | $32 \cdot 8$ | 33.5 | $34^{\circ} 2$ | $35^{\circ} \mathrm{O}$ | $35 \cdot 8$ |
| Ir 120 | $27 \cdot 2$ | $27 \cdot 6$ | $28 \cdot 1$ | 28.6 | $29 \cdot 1$ | 29.6 | $30 \cdot 1$ | $30 \cdot 7$ | 31.3 | 31.9 | $32 \cdot 6$ | 33.3 | $34 \cdot 0$ | $34^{\circ} 7$ | 35.5 |
| II. 30 | 27.0 | 27.4 | 27.9 | 28.3 | 28.8 | 29.3 | 29.9 | $30 \cdot 4$ | 31.0 | $31 \cdot 7$ | $32 \cdot 3$ | $33^{\circ}$ | 33.7 | $34 \cdot 5$ | $35 \cdot 3$ |
| II 40 | 26.8 | 27.2 | 27.7 | 28-I | 28.6 | 29.1 | $29 \cdot 7$ | $30 \cdot 2$ | $30 \cdot 8$ | $31 \cdot 5$ | $32 \cdot 1$ | $32 \cdot 8$ | 33.5 | $34 \cdot 3$ | $35 \cdot 1$ |
| Ir 50 | 26.6 | 27.0 | 27.5 | 27.9 | 28.4 | 28.9 | 29.5 | $30 \cdot 0$ | 30.6 | 31.2 | 31.9 | 32.5 | $33 \cdot 3$ | $34^{\circ}$ | 34.8 |
| II. 60 | 26.4 | 26.8 | $27 \cdot 3$ | $27 \cdot 7$ | 28.2 | $28 \cdot 7$ | $29^{\circ} 3$ | 29.8 | 30.4 | 31.0 | $31 \cdot 7$ | 32.3 | $33 \cdot 1$ | 33.8 | $34 \cdot 6$ |
| 11.70 | $26 \cdot 2$ | 26.6 | $27 \cdot 1$ | $27 \cdot 5$ | $28 \cdot 0$ | 28.5 | $29^{\circ} \mathrm{O}$ | 29.6 | 30.2 | 30.8 | 31.4 | 32.1 | 32.8 | 33.6 | $34 \cdot 3$ |
| 11.80 | $26 \cdot 0$ | 26.4 | 26.9 | $27 \cdot 3$ | 27.8 | $28 \cdot 3$ | 28.8 | 29.4 | $30 \cdot$ | $30 \cdot 6$ | 31.2 | 31.9 | $32 \cdot 6$ | $33^{4} 4$ | $34^{1}$ |
| II.90 | 25.8 | $26 \cdot 2$ | $26 \cdot 7$ | $27 \cdot 1$ | 27.6 | 28.I | 28.6 | 29.2 | 29.7 | $30 \cdot 4$ | 31.0 | $3 \mathrm{I} \cdot 7$ | 32.4 | $33 \cdot 1$ | 33.9 |

When the Latitude Variation is + name the Azimuth the same name as Latitude.
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opposite name to the Latitude.

| Lat. <br> Var. <br> to 1 | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  | $46^{\circ}$ | $47^{\circ}$ | $48^{\circ}$ | $49^{\circ}$ | $50^{\circ}$ | $51^{\circ}$ | $52^{\circ}$ | $53^{\circ}$ | $54^{\circ}$ | $55^{\circ}$ | $56^{\circ}$ | $57^{\circ}$ | $58^{\circ}$ | $59^{\circ}$ | $60^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S. 12.00 | $25 \cdot 6$ | 26.0 | 26.5 | 26.9 | $27 \cdot 4$ | $27 \cdot 9$ | $28 \cdot 4$ | 29.0 | $29^{\circ} 6$ | $30 \cdot 2$ | $3{ }^{\circ} \cdot 8$ | $3{ }^{1} 5$ | $32 \cdot 2$ | 32.9 | $3 \cdot 7$ |
| 12.10 | 25.4 | 25.8 | $26 \cdot 3$ | $26 \cdot 7$ | 27.2 | 27.7 | 28.2 | 28.8 | 29.3 | $30 \cdot 0$ | 30.6 | $3 \mathrm{~F} \cdot 2$ | $3 \mathrm{I} \cdot 9$ | $32 \cdot 7$ | 33.5 |
| 12.20 | $25 \cdot 3$ | 25.7 | $26 \cdot 1$ | $26 \cdot 6$ | 27.0 | $27 \cdot 5$ | 28.0 | $28 \cdot 6$ | 29.2 | 29.8 | 30.4 | $3 \mathrm{r} \cdot 0$ | $31 \cdot 7$ | $32 \cdot 5$ | $33 \cdot 3$ |
| 12.30 | $25^{\circ} \mathrm{I}$ | 25.5 | 25.9 | 26.4 | 26.8 | $27 \cdot 3$ | 27.8 | 28.4 | $29^{\circ}$ | 29.6 | $30 \cdot 2$ | $30 \cdot 8$ | 31.5 | $32 \cdot 3$ | $33 \cdot 0$ |
| 12.40 | 24.9 | $25 \cdot 3$ | 25.7 | $26 \cdot 2$ | $26 \cdot 6$ | $27 \cdot 1$ | 27.7 | 28.2 | 28.8 | 29.4 | $30 \cdot 0$ | $30 \cdot 6$ | 3 r 3 | $32 \cdot 1$ | 32.8 |
| 12.50 | 24.7 | $25 \cdot 1$ | 25.5 | $26 \cdot 0$ | 26.4 | 26.9 | 27.5 | 28.0 | 28.6 | 29.2 | 29.8 | 30.4 | 31.1 | 31.8 | $32 \cdot 6$ |
| 12.6 | 24.6 | $25^{\circ}$ | 25.4 | $25 \cdot 8$ | $26 \cdot 3$ | 26.8 | 27.3 | 27.8 | 28.4 | $29^{\circ}$ | 29.6 | $30 \cdot 2$ | $30 \cdot 9$ | 31.6 | $32 \cdot 4$ |
| 12.70 | 24.4 | 24.8 | $25 \cdot 2$ | $25 \cdot 6$ | $26 \cdot 1$ | 26.6 | $27 \cdot 1$ | $27 \cdot 6$ | 28.2 | 28.8 | 29.4 | $30 \cdot 0$ | $30 \cdot 7$ | 31.4 | $32 \cdot 2$ |
| 12.80 | 24.2 | $24^{\circ} 6$ | $25^{\circ}$ | 25.5 | $25 \cdot 9$ | 26.4 | 26.9 | 27.4 | 28.0 | 28.6 | 29.2 | $29 \cdot 8$ | 30.5 | 31.2 | 32.0 |
| 12.90 | $24^{\circ} \mathrm{O}$ | $24^{\circ} 4$ | 24.8 | $25 \cdot 3$ | $25 \cdot 7$ | $26 \cdot 2$ | $26 \cdot 7$ | $27 \cdot 2$ | 27.8 | 28.4 | 29.0 | 29.6 | $30 \cdot 3$ | 31.0 | 31.8 |
| 13.00 | 23.9 | 24.3 | 24.7 | $25^{\prime}$ I | $25 \cdot 6$ | $26 \cdot 1$ | 26.6 | 27.1 | 27.6 | 28.2 | 28.8 | 29.5 | $30 \cdot 1$ | 30.9 | $31 \cdot 6$ |
| 13.10 | $23 \cdot 7$ | 24.1 | 24.5 | $25^{\circ} \mathrm{O}$ | 25.4 | 25.9 | 26.4 | 26.9 | 27.4 | 28.0 | 28.6 | 29.3 | 29.9 | $30 \cdot 7$ | 31.4 |
| 13.20 | 23.6 | $24^{\circ} \mathrm{O}$ | 24.4 | 24.8 | $25^{\circ} 2$ | 25.7 | $26 \cdot 2$ | $26 \cdot 7$ | $27 \cdot 3$ | $27 \cdot 8$ | 28.5 | 29.1 | 29.8 | $30 \cdot 5$ | $31 \cdot 2$ |
| 13.30 | 23.4 | $23 \cdot 8$ | 24.2 | 24.6 | $25 \cdot 1$ | 25.5 | 26.0 | 26.5 | $27 \cdot 1$ | 27.7 | 28.3 | 28.9 | 29.6 | $30 \cdot 3$ | 31.0 |
| 13.40 | 23.3 | 23.6 | 24.0 | 24.5 | 24.9 | 25.4 | 25.9 | $26 \cdot 4$ | 26.9 | 27.5 | $28 \cdot 1$ | $28 \cdot 7$ | 29.4 | $30 \cdot 1$ | $30 \cdot 8$ |
| 13.50 | 23•1 | 23.5 | 23.9 | 24.3 | 24.7 | $25^{\circ} 2$ | 25.7 | 26.2 | 26.7 | $27 \cdot 3$ | 27.9 | 28.5 | 29.2 | 29.9 | $30 \cdot 6$ |
| 13.60 | 22.9 | $23 \cdot 3$ | 23.7 | $24^{\text { }}$ I | 24.6 | $25^{\circ}$ | 25.5 | $26 \cdot 0$ | $26 \cdot 5$ | $27 \cdot 1$ | 27.7 | 28.4 | 29.0 | 29.7 | $30 \cdot 5$ |
| 13.70 | 22.8 | 23.2 | 23.6 | $24^{\circ} \mathrm{O}$ | 24.4 | 24.9 | 25.4 | 25.9 | 26.4 | 27.0 | 27.6 | $28 \cdot 2$ | 28.8 | $29 \cdot 5$ | $30 \cdot 3$ |
| 13.80 | 22.6 | 23.0 | 23.4 | 23.8 | 24.3 | 24.7 | 25.2 | 25.7 | $26 \cdot 2$ | 26.8 | $27 \cdot 4$ | $28 \cdot 0$ | $28 \cdot 7$ | 29.4 | $30 \cdot 1$ |
| 13.90 | 22.5 | $22 \cdot 9$ | 23.3 | 23.7 | $24^{-1}$ | 24.6 | 25.0 | 25.6 | $26 \cdot 1$ | $26 \cdot 6$ | $27 \cdot 2$ | 27.8 | 28.5 | 29.2 | 29.9 |
| 14.0 | 22.4 | $22 \cdot 7$ | 23.1 | 23.5 | $24^{\circ} \mathrm{O}$ | 24.4 | 24.9 | 25.4 | 25.9 | 26.5 | 27.1 | 27.7 | $28 \cdot 3$ | $29^{\circ} \mathrm{O}$ | 29.7 |
| 14.10 | 22.2 | $22 \cdot 6$ | 23.0 | 23.4 | $23 \cdot 8$ | 24.3 | 24.7 | 25.2 | 25.8 | $26 \cdot 3$ | $26 \cdot 9$ | 27.5 | 28.2 | 28.8 | $29 \cdot 6$ |
| 14.20 | $22 \cdot 1$ | 22.4 | 22.8 | $23 \cdot 2$ | 23.7 | $24 \cdot 1$ | 24.6 | 25.1 | 25.6 | $26 \cdot 2$ | $26 \cdot 7$ | 27.3 | 28.0 | $28 \cdot 7$ | 29.4 |
| 14.30 | 21.9 | 22.3 | $22 \cdot 7$ | $23 \cdot 1$ | 23.5 | 24.0 | 24.4 | 24.9 | 25.4 | $26 \cdot 0$ | $26 \cdot 6$ | $27 \cdot 2$ | 27.8 | 28.5 | 29.2 |
| 14.40 | 21.8 | 22.2 | 22.5 | 22.9 | 23.4 | 23.8 | 24.3 | 24.8 | $25 \cdot 3$ | 25.8 | $26 \cdot 4$ | 27.0 | 27.7 | 28.3 | $29^{\circ}$ |
| 14.50 | 21.7 | $22 \cdot 0$ | 22.4 | 22.8 | 23.2 | 23.7 | 24'I | 24.6 | 25.1 | 25.7 | $26 \cdot 3$ | $26 \cdot 9$ | $27 \cdot 5$ | 28.2 | 28.9 |
| 14.60 | 2 F 5 | 21.9 | $22 \cdot 3$ | 22.7 | $23 \cdot 1$ | 23.5 | $24^{\circ} \mathrm{O}$ | 24.5 | $25^{\circ}$ | 25.5 | 26.1 | $26 \cdot 7$ | $27 \cdot 3$ | 28.0 | 28.7 |
| 14.70 | 21.4 | 21.8 | $22 \cdot 1$ | $22 \cdot 5$ | 22.9 | 23.4 | $23 \cdot 8$ | 24.3 | 24.8 | 25.4 | 25.9 | $26 \cdot 5$ | 27.2 | $27 \cdot 8$ | 28.6 |
| 14.80 | $21 \cdot 3$ | 21.6 | 22.0 | 22.4 | 22.8 | $23 \cdot 2$ | 23.7 | 24.2 | 24.7 | $25 \cdot 2$ | $25^{\circ} 8$ | 26.4 | 27.0 | $27 \cdot 7$ | 28.4 |
| 14.90 | $21 \cdot 1$ | 21.5 | 21.9 | 22.3 | $22 \cdot 7$ | 23.1 | 23.6 | $24^{\circ} \mathrm{O}$ | 24.5 | $25^{1} 1$ | $25 \cdot 6$ | 26.2 | $26 \cdot 9$ | 27.5 | $28 \cdot 2$ |
| 15.00 | 21.0 | 21.4 | 21.7 | $22 \cdot 1$ | 22.5 | 23.0 | 23.4 | 23.9 | 24.4 | 24.9 | $25 \cdot 5$ | $26 \cdot 1$ | $26 \cdot 7$ | $27 \cdot 4$ | 28.1 |
| 15.10 | $20 \cdot 9$ | 21.2 | 21.6 | 22.0 | 22.4 | $22 \cdot 8$ | $23 \cdot 3$ | $23 \cdot 8$ | $24 \cdot 3$ | $24 \cdot 8$ | $25 \cdot 3$ | 25.9 | $26 \cdot 6$ | $27 \cdot 2$ | $27 \cdot 9$ |
| 15.20 | $20 \cdot 7$ | 21.1 | 21.5 | 21.9 | $22 \cdot 3$ | 22.7 | $23 \cdot 1$ | 23.6 | $24 \cdot 1$ | 24.6 | 25.2 | 25.8 | 26.4 | 27-1 | 27.8 |
| 15.30 | 20.6 | 21.0 | 21.3 | 21.7 | $22 \cdot 1$ | 22.6 | $23^{\circ}$ | 23.5 | $24^{\circ} \mathrm{O}$ | 24.5 | 25•1 | 25.6 | $26 \cdot 3$ | $26 \cdot 9$ | $27 \cdot 6$ |
| 15.40 | $20 \cdot 5$ | 20.8 | 21.2 | 21.6 | 22.0 | 22.4 | $22 \cdot 9$ | 23.3 | 23.8 | 24.4 | 24.9 | 25.5 | $26 \cdot 1$ | $26 \cdot 8$ | $27 \cdot 4$ |
| 15.50 | 20.4 | 20.7 | 21.1 | 2 F 5 | 21.9 | 22.3 | $22 \cdot 7$ | 23.2 | 23.7 | 24.2 | 24.8 | $25 \cdot 3$ | $26 \cdot 0$ | $26 \cdot 6$ | $27 \cdot 3$ |
| 15.60 | $20 \cdot 3$ | $20 \cdot 6$ | $2 \mathrm{I}^{\circ} \mathrm{O}$ | 21.3 | 21.7 | 22.2 | $22 \cdot 6$ | $23 \cdot 1$ | 23.6 | 24.1 | 24.6 | 25.2 | $25 \cdot 8$ | $26 \cdot 5$ | $27 \cdot 1$ |
| 15.70 | 20.1 | $20 \cdot 5$ | $20 \cdot 8$ | 21.2 | 21.6 | 22.0 | 22.5 | 22.9 | 23.4 | 23.9 | 24.5 | 25•1 | 25.7 | $26 \cdot 3$ | $27^{\circ}$ |
| 15.80 | 20.0 | $20 \cdot 4$ | $20 \cdot 7$ | 21.1 | 21.5 | 21.9 | $22 \cdot 3$ | 22.8 | 23.3 | 23.8 | 24.4 | 24.9 | 25.5 | $26 \cdot 2$ | $26 \cdot 9$ |
| 15.90 | 19.9 | $20 \cdot 2$ | $20 \cdot 6$ | 21.0 | 21.4 | 21.8 | 22.2 | 22.7 | 23.2 | $23 \cdot 7$ | 24.2 | 24.8 | 25.4 | $26 \cdot 0$ | $26 \cdot 7$ |
| 16.00 | 19.8 | 20.1 | $20 \cdot 5$ | 20.9 | 21.3 | 21.7 | $22 \cdot 1$ | 22.6 | 23.0 | 23.6 | 24. 1 | 24.7 | $25 \cdot 3$ | 25.9 | $26 \cdot 6$ |
| 16.20 | 19.6 | 19.9 | $20 \cdot 3$ | $20 \cdot 6$ | 21.0 | 21.4 | 21.8 | 22.3 | 22.8 | $23 \cdot 3$ | 23.8 | 24.4 | $25^{\circ} \mathrm{O}$ | $25 \cdot 6$ | $26 \cdot 3$ |
| 16.40 | 19.3 | 19.7 | $20 \cdot 0$ | 20.4 | 20.8 | 21.2 | 21.6 | 22.1 | 22.5 | $23^{\circ} \mathrm{O}$ | 23.6 | 24.I | 24.7 | 25.3 | $26 \cdot 0$ |
| 16.60 | $19 \cdot 1$ | 19.5 | 19.8 | $20 \cdot 2$ | 20.5 | 21.0 | 21.4 | 21.8 | 22.3 | $22 \cdot 8$ | $23 \cdot 3$ | 23.9 | 24.4 | $25 \cdot 1$ | $25 \cdot 7$ |
| 16.80 | 18.9 | 19.2 | 19.6 | 19.9 | $20 \cdot 3$ | 20.7 | 21.1 | 21.6 | 22.0 | $22 \cdot 5$ | $23 \cdot 1$ | $23 \cdot 6$ | 24.2 | 24.8 | 25.5 |
| 17.00 | 18.7 | 19.0 | 19.4 | 19.7 | 20.1 | $20 \cdot 5$ | $20 \cdot 9$ | 21.4 | 21.8 | $22 \cdot 3$ | $22 \cdot 8$ | 23.4 | 23.9 | 24.6 | 25.2 |
| 17.20 | 18.5 | 18.8 | 19.2 | 19.5 | 19.9 | $20 \cdot 3$ | $20 \cdot 7$ | $21 \cdot 1$ | 21.6 | $22 \cdot 1$ | 22.6 | $23 \cdot 1$ | $23 \cdot 7$ | 24.3 | 24.9 |
| 17.40 | $18 \cdot 3$ | 18.6 | 19*0 | 19.3 | 19.7 | 20•1 | 20.5 | $20 \cdot 9$ | 21.4 | 21.8 | $22 \cdot 3$ | 22.9 | 23.4 | 24. ${ }^{\text {r }}$ | $24 \cdot 7$ |
| 17.60 | 18.1 | 18.4 |  | $19 \cdot 1$ | 19.5 | 19.9 | $20 \cdot 3$ | $20 \cdot 7$ | 21.1 | 21.6 | 22.1 | 22.6 | 23.2 | $23 \cdot 8$ | 24.4 |
| 17.80 | 17.9 | 18.2 | 18.6 | 18.9 | 19.3 | 19.6 | 20.0 | $20 \cdot 5$ | 20.9 | 21.4 | 21.9 | 22.4 | 23.0 | 23.6 | 24.2 |
| 18.00 18.20 |  | 18.0 | 18.4 | 18.7 | 19.1 | 19.4 | 19.8 | $20 \cdot 3$ | $20 \cdot 7$ | 21.2 | 2 F 7 | $22 \cdot 2$ | 22.8 | $23 \cdot 3$ | $24^{\circ} \mathrm{O}$ |
| 18.20 | 17.6 | 17.9 | 18.2 | 18.5 | 18.9 | 19.2 | 19.6 | 20.1 | 20.5 | 21.0 | 21.5 | 22.0 | 22.5 | $23 \cdot 1$ | 23.7 |
| 18.40 | 17.4 | $17 \cdot 7$ | $18 \cdot 0$ | 18.3 | 18.7 | 19•I | 19.4 | 19.9 | $20 \cdot 3$ | 20.8 | 21.2 | 21.8 | $22 \cdot 3$ | 22.9 | 23.5 |
| 18.60 | 17.2 | 17.5 | 17.8 | 18.1 | 18.5 | 18.9 | 19.2 | 19.7 | 20.1 | $20 \cdot 5$ | 21.0 | 21.5 | 22.1 | 22.7 | $23 \cdot 3$ |
| 18.80 | 17.0 | 17.3 | 17.6 | 18.0 | 18.3 | 18.7 | 19*0 | 19.5 | 19.9 | $20 \cdot 3$ | $20 \cdot 8$ | 21.3 | 21.9 | 22.4 | $23^{\circ}$ |
| 19.00 | 16.9 | 17.2 | 17.5 | 17.8 | 18.1 | 18.5 | 18.9 | 19.3 | 19.7 | 20.2 | 20.6 | 21.1 | 21.7 | $22 \cdot 2$ | 22.8 |
| 19.20 | 16.7 | 17.0 | 17.3 | 17.6 | 18.0 | 18.3 | 18.7 | 19.1 | 19.5 | $20 \cdot 0$ | 20.4 | 20.9 | 21.5 | 22.0 | $22 \cdot 6$ |
| 19.40 | 16.5 | 16.8 | $17 \cdot 1$ | 17.4 | 17.8 | 18.1 | 18.5 | 18.9 | 19.3 | 19.8 | $20 \cdot 2$ | $20 \cdot 7$ | $2 \mathrm{I} \cdot 3$ | 21.8 | 22.4 |
| 19.60 | 16.4 | 16.7 16.5 | 17.0 | 17.3 | 17.6 | 18.0 | 18.3 | $18 \cdot 7$ | $19 \cdot 1$ | 19.6 | $20 \cdot 0$ | $20 \cdot 5$ | 21-1 | $2 \mathrm{I} \cdot 6$ | 22.2 |
| 19.80 | $16 \cdot 2$ | 16.5 | 16.8 | 17.1 | 17.4 | 17.8 | 18.2 | 18.6 | 19.0 | 19.4 | 19.9 | $20 \cdot 3$ | 20.9 | 214 | 22.0 |

When the Latitude Variation is + name the Azimuth the same name as Latitude.
"

| Lat. Var. to $I^{\prime}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $46^{\circ}$ | $47^{\circ}$ | $48^{\circ}$ | $49^{\circ}$ | $50^{\circ}$ | $51^{\circ}$ | $52^{\circ}$ | $53^{\circ}$ | $54^{\circ}$ | $55^{\circ}$ | $56^{\circ}$ | $57^{\circ}$ | $58^{\circ}$ | $59^{\circ}$ | $60^{\circ}$ |
|  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} \text { s. } \\ 20.00 \end{gathered}$ | 16‥1 | 16․3 | 16.6 | $17^{\circ} 0$ | 17*3 | 17.6 | I8.0 | 18.4 | 18.8 | $19 \cdot 2$ | 19.7 | ${ }^{\prime} \stackrel{\circ}{20} \cdot$ | $20^{\circ} 7$ | $2 \stackrel{\circ}{1}^{1} 2$ | $\stackrel{\circ}{1} \cdot 8$ |
| $20 \cdot 20$ | I5.9 | 16.2 | 16.5 | 16.8 | I7•1 | 17.5 | 17.8 | 18.2 | 18.6 | 190 | 19.5 | $20 \cdot 0$ | $20 \cdot 5$ | $2 \mathrm{I} \cdot \mathrm{O}$ | 21.6 |
| $20 \cdot 40$ | 15.8 | 16.0 | $16 \cdot 3$ | $16 \cdot 6$ | 17.0 | 17.3 | $17 \cdot 7$ | 18.0 | 18.4 | $18 \cdot 9$ | 19.3 | 19.8 | $20 \cdot 3$ | $20 \cdot 8$ | 21.4 |
| $20 \cdot 60$ | $15 \cdot 6$ | 15.9 | 16.2 | $16 \cdot 5$ | $16 \cdot 8$ | 17*I | 17.5 | 17.9 | $18 \cdot 3$ | $18 \cdot 7$ | 19.1 | 19.6 | $20 \cdot 1$ | $20 \cdot 7$ | $21 \cdot 2$ |
| $20 \cdot 80$ | 15.5 | 15.7 | 16.0 | $16 \cdot 3$ | $16 \cdot 7$ | 17.0 | I7.3 | 17•7 | 18.1 | 18.5 | 19.0 | 19.4 | 19.9 | $20 \cdot 5$ | 21.0 |
| 21.00 | 15.3 | 15.6 | 15.9 | $16 \cdot 2$ | 16.5 | 16.8 | 17.2 | 17.6 | 17.9 | 18.4 | 18.8 | 19.3 | 19.8 | $20 \cdot 3$ | $20 \cdot 8$ |
| $21 \cdot 20$ | 15.2 | $15 \cdot 5$ | $15 \cdot 7$ | $16 \cdot 0$ | 16.4 | 16.7 | 17.0 | 17.4 | 17.8 | $18 \cdot 2$ | $18 \cdot 6$ | 19'I | I9.6 | 20.1 | 20.7 |
| 21.40 | 15.0 | 15.3 | 15.6 | 15.9 | $16 \cdot 2$ | $16 \cdot 5$ | $16 \cdot 9$ | 17.2 | 17.6 | $18 \cdot 0$ | 18.5 | $18 \cdot 9$ | 19.4 | 19.9 | 20.5 |
| 21.60 | 14.9 | 15.2 | 15.5 | 15.8 | 16.1 | 16.4 | $16 \cdot 7$ | $17 \cdot 1$ | 17.5 | 17.9 | $18 \cdot 3$ | 18.8 | 19.3 | 19.8 | $20 \cdot 3$ |
| $2 \mathrm{I} \cdot 80$ | 14.8 | $15^{\circ} 1$ | $15 \cdot 3$ | 15.6 | 15.9 | $16 \cdot 3$ | $16 \cdot 6$ | 16.9 | 17.3 | $17 \cdot 7$ | $18 \cdot 2$ | 18.6 | I9.I | 19.6 | 20:2 |
| 22.00 | 14.7 | 14.9 | 15.2 | I5.5 | 15.8 | I6. 1 | $16 \cdot 5$ | 16.8 | 17.2 | I7.6 | $18 \cdot 0$ | $18 \cdot 5$ | I8.9 | 19.4 | $20 \cdot 0$ |
| $22 \cdot 20$ | 14.5 | 14.8 | 15.1 | 15.4 | 15.7 | $16 \cdot 0$ | 16.3 | $16 \cdot 7$ | 170 | 17.4 | 17.9 | $18 \cdot 3$ | 18.8 | 19.3 | 19.8 |
| 22.40 | 14.4 | 14.7 | 14.9 | 15.2 | 15.5 | 15.8 | $16 \cdot 2$ | $16 \cdot 5$ | 16.9 | $17 \times 3$ | $17 \cdot 7$ | $18 \cdot 2$ | $18 \cdot 6$ | $19 \cdot 1$ | 19.7 |
| 22.60 | $14 * 3$ | 14.5 | 14.8 | 15.1 | 15.4 | 15\%7 | 16.0 | $16 \cdot 4$ | $16 \cdot 8$ | $17 \cdot 1$ | 17.6 | $18 \cdot 0$ | $18 \cdot 5$ | 190 | 19.5 |
| $22 \cdot 80$ | 14.2 | 14.4 | 14.7 | 15.0 | $15 \cdot 3$ | 15.6 | 15.9 | $16 \cdot 2$ | 16.6 | 17.0 | $17 \cdot 4$ | 17.8 | $18 \cdot 3$ | 18.8 | I9.3 |
| 23.00 | $14^{\circ} 0$ | 14.3 | 14.6 | 14.8 | 15.1 | 15.4 | 15.8 | $16 \cdot 1$ | 16.5 | 16.9 | 17.3 | $17 \cdot 7$ | 18.2 | 18.7 | 19.2 |
| $23 \cdot 20$ | 13.9 | $14^{\circ} 2$ | 14.4 | 14.7 | 15.0 | 15.3 | 15.6 | 16.0 | $16 \cdot 3$ | $16 \cdot 7$ | 17•1 | 17.6 | $18 \cdot 0$ | 18.5 | 19.0 |
| 23.40 | 13.8 | $14^{1.1}$ | 14.3 | $14^{*} 6$ | 14.9 | 15.2 | 15.5 | 15.9 | 16.2 | $16 \cdot 6$ | 17.0 | 17.4 | 17.9 | 18.4 | $18 \cdot 9$ |
| $23 \cdot 60$ | 13.7 | 14.0 | 14.2 | 14.5 | 14.8 | $15 \cdot 1$ | 15.4 | $15 \cdot 7$ | $16 \cdot 1$ | 16.5 | 16.9 | 17.3 | $17 \cdot 7$ | $18 \cdot 2$ | $18 \cdot 7$ |
| $23 \cdot 80$ | 13.6 | 13.8 | $14^{\circ} \mathrm{I}$ | 14.4 | 14.6 | 14.9 | $15 \cdot 3$ | 15.6 | 15.9 | 16.3 | 16.7 | $17 \cdot 1$ | $17 \cdot 6$ | $18 \cdot 1$ | I8.6 |
| 24.00 | 13.5 | 13.7 | 14*0 | 14.3 | 14.5 | 14.8 | 15.1 | 15.5 | 15.8 | 16.2 | 16.6 | 17.0 | 17.5 | $17 \times 9$ | 18.4 |
| 24.40 | 13.3 | I3.5 | 13.8 | 14.0 | 14.3 | 14.6 | 14.9 | 15.2 | 15.6 | 15.9 | 16.3 | $16 \cdot 7$ | 17.2 | 17.7 | $18 \cdot 1$ |
| $24 \cdot 80$ | 13.1 | 13.3 | 13.5 | 13.8 | $14^{\prime} \mathrm{I}$ | 14.4 | 14.7 | 15.0 | 15.3 | 15.7 | $16 \cdot 1$ | 16.5 | 16.9 | $17 \times 4$ | 17.9 |
| $25^{\circ} 20$ | 12.9 | $13 \cdot 1$ | 13.3 | 13.6 | 13.9 | 14.2 | 14.5 | 14.8 | $15 \cdot 1$ | 15.5 | 15.8 | $16 \cdot 2$ | $16 \cdot 7$ | $17 \cdot 1$ | 17.6 |
| $25 \cdot 60$ | 12.7 | 12.9 | 13.1 | 13.4 | 13.7 | 13.9 | $14^{\circ} 2$ | I. 4.6 | 14.9 | 15.2 | 15.6 | 16.0 | 16.4 | 16.9 | $17 \times 3$ |
| 26.00 | 12.5 | 12.7 | 12.9 | 13.2 | 13.5 | 13.7 | $14^{\circ} \mathrm{O}$ | 14.3 | 14.7 | 15.0 | 15.4 | 15.8 | $16 \cdot 2$ | $16 \cdot 6$ | 17•I |
| 27-00 | $12 \cdot 0$ | 12.2 | 12.5 | $12 \cdot 7$ | $13^{\circ} \mathrm{O}$ | 13.2 | 13.5 | 13.8 | 14.1 | 14.5 | 14.8 | 15.2 | $15 \cdot 6$ | 16.0 | $16 \cdot 5$ |
| 28.00 | II•6 | II.8 | 12.I | $12 \cdot 3$ | 12.5 | 12.8 | 13.1 | 13.4 | $13 \cdot 7$ | $14^{\circ} \mathrm{O}$ | 14.3 | 14.7 | 15.1 | 15.5 | 15.9 |
| $29^{\circ} 00$ | II•2 | II.4 | II•6 | II.9 | 12.1 | 12.4 | 12.6 | 12.9 | 13.2 | 13.5 | 13.8 | 14.2 | 14.6 | $15^{\circ} 0$ | 15.4 |
| 30.00 | $10 \cdot 9$ | III | II.3 | II.5 | II•7 | 12.0 | 12.2 | 12.5 | 12.8 | I3.1 | 13.4 | 13.8 | 14.1 | 4.5 | 14.9 |
| 31.0 | $10 \cdot 5$ | $10 \cdot 7$ | 10.9 | III 1 | II•3 | II•6 | II.8 | 12.1 | 12.4 | 12.7 | 13.0 | 13.3 | 13.7 | 4.0 | 14.5 |
| 32.0 | 10.2 | 10.4 | $10 \cdot 6$ | 10.8 | 110 | II. 2 | II• 5 | 11.7 | 12.0 | 12.3 | 12.6 | 12.9 | $13 \cdot 3$ | 3.6 | $14^{\circ} \mathrm{O}$ |
| $33^{\circ} 0$ | $9 \cdot 9$ | 10'I | 10.3 | $10 \cdot 5$ | 10.7 | 10.9 | II'I | II.4 | II'6 | II.9 | 12.2 | 12.5 | $12 \cdot 9$ | 3.2 | $13 \cdot 6$ |
| $34^{\circ} 0$ | $9 \cdot 6$ | $9 \cdot 8$ | $10 \cdot 0$ | 10.2 | 10.4 | $10 \cdot 6$ | 10.8 | II'I | II.3 | II.6 | 11.9 | 12.2 | I2.5 | 12.9 | $13 \cdot 2$ |
| $35^{\circ} 0$ | $9 \cdot 3$ | $9 \cdot 5$ | $9 \cdot 7$ | $9 \cdot 9$ | 10'I | $10 \cdot 3$ | $10 \cdot 5$ | 10.7 | II*O | 11.3 | 11.5 | II.8 | 12.2 | 12.5 | 12.9 |
| $36 \cdot 0$ | $9^{\prime \prime}$ | $9 \cdot 3$ | 9.4 | $9 \cdot 6$ | $9 \cdot 8$ | 1000 | $10 \cdot 2$ | $10 \cdot 5$ | $10 \cdot 7$ | II'O | II.2 | II.5 | Ix-8 | 12.2 | 12.5 |
| $37 \cdot 0$ | $8 \cdot 8$ | $9 \cdot 0$ | $9 \cdot 2$ | $9 \cdot 4$ | $9 \cdot 5$ | $9 \cdot 7$ | $10^{\circ} \mathrm{O}$ | $10 \cdot 2$ | $10 \cdot 4$ | 10.7 | $10 \cdot 9$ | II•2 | II*5 | 1.8 | 12.2 |
| $38^{\circ} \mathrm{o}$ | $8 \cdot 6$ | $8 \cdot 8$ | $8 \cdot 9$ | 9'I | $9 \cdot 3$ | $9 \cdot 5$ | $9 \cdot 7$ | $9 \cdot 9$ | 10.1 | $10 \cdot 4$ | $10 \cdot 7$ | $10 \cdot 9$ | II'2 | 1.5 | II•9 |
| $39^{\circ} \mathrm{O}$ | 8.4 | $8 \cdot 5$ | $8 \cdot 7$ | $8 \cdot 9$ | $9 \cdot 1$ | $9 \cdot 3$ | $9 \cdot 5$ | $9 \cdot 7$ | $9 \cdot 9$ | $10 \cdot 1$ | 10.4 | $10 \cdot 7$ | Ir ${ }^{\text {O }}$ | I.3 | II•6 |
| $40 \cdot 0$ | $8 \cdot 2$ | $8 \cdot 3$ | $8 \cdot 5$ | $8 \cdot 7$ | $8 \cdot 8$ | $9 \cdot 0$ | $9 \cdot 2$ | $9 \cdot 4$ | $9 \cdot 7$ | 9.9 | 10.1 | 10.4 | $10 \cdot 7$ | I.0 | II*3 |
| $42^{\circ} \mathrm{O}$ | $7 \cdot 8$ | $7 \cdot 9$ | 8-1 | $8 \cdot 3$ | $8 \cdot 4$ | 8.6 | $8 \cdot 8$ | $9^{\circ} 0$ | $9^{\circ} 2$ | 9.4 | $9 \cdot 7$ | $9 \cdot 9$ | 10.2 | $0 \cdot 5$ | 10.8 |
| $44^{\circ} 0$ | 7:5 | $7 \cdot 6$ | $7 \cdot 7$ | $7 \cdot 9$ | $8 \cdot 0$ | $8 \cdot 2$ | $8 \cdot 4$ | $8 \cdot 6$ | $8 \cdot 8$ | $9^{\circ} 0$ | $9 \cdot 2$ | $9 \cdot 5$ | $9 \cdot 7$ | 0.0 | 10.3 |
| $46 \cdot 0$ | $7 \cdot 1$ $6 \cdot 8$ | $7 \cdot 3$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 7$ | $7 \cdot 9$ | $8 \cdot 0$ | $8 \cdot 2$ | $8 \cdot 4$ | $8 \cdot 6$ | 8.8 | $9 \cdot 1$ | $9 \cdot 3$ | $9 \cdot 6$ | $9 \cdot 9$ |
| $48 \cdot 0$ | $6 \cdot 8$ | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 6$ | $7 \cdot 9$ | $8 \cdot 1$ | $8 \cdot 3$ | 8.5 | $8 \cdot 7$ | $8 \cdot 9$ | 9.2 | $9 \cdot 5$ |
| $50 \cdot 0$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 8$ | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 2$ | $7 \cdot 4$ | $7 \cdot 6$ | $7 \cdot 8$ | $7 \cdot 9$ | S.1 | $8 \cdot 4$ | $8 \cdot 6$ | $8 \cdot 8$ | $9^{11}$ |
| 52.0 | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 8$ | $7 \cdot 0$ | $7 \cdot 1$ | $7 \cdot 3$ | $7 \cdot 5$ | $7 \cdot 6$ | 7.8 | $8 \cdot 0$ | $8 \cdot 3$ | $8 \cdot 5$ | $8 \cdot 7$ |
| $54^{\circ} \mathrm{O}$ | $6 \cdot 1$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 6$ | $6 \cdot 7$ | $6 \cdot 9$ | $7 \cdot 0$ | $7 \cdot 2$ | $7 \cdot 4$ | $7 \cdot 5$ | $7 \cdot 7$ | $8 \cdot 0$ | $8 \cdot 2$ | $8 \cdot 4$ |
| 56.0 | $5 \cdot 9$ | $6 \cdot 0$ | $6 \cdot 1$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 5$ | $6 \cdot 6$ | $6 \cdot 8$ | $6 \cdot 9$ | $7 \cdot 1$ | $7 \cdot 3$ | $7 \cdot 5$ | $7 \cdot 7$ | $7 \cdot 9$ | $8 \cdot 1$ |
| $58 \cdot 0$ | $5 \cdot 7$ | $5 \cdot 8$ $5 \cdot 6$ | $5 \cdot 9$ | $6 \cdot 0$ $5 \cdot 8$ | $6 \cdot 1$ | $6 \cdot 3$ | $6 \cdot 4$ | $6 \cdot 5$ | $6 \cdot 7$ 6.5 | $6 \cdot 9$ | 7.0 6.8 | 7.2 | $7 \cdot 4$ | $7 \cdot 6$ | $7 \cdot 8$ |
| $60 \cdot 0$ | $5 \cdot 5$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 9$ | $6 \cdot 0$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 5^{*}$ | $6 \cdot 6$ | $6 \cdot 8$ | 7.0 | $7 \cdot 2$ | $7 \cdot 4$ | $7 \cdot 6$ |
| $64^{\circ} \mathrm{O}$ | $5 \cdot 1$ | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 8$ | $5 \cdot 9$ | $6 \cdot 1$ | $6 \cdot 2$ | 6.4 | $6 \cdot 5$ | $6 \cdot 7$ | $6 \cdot 9$ | $7 \cdot 1$ |
| $70 \cdot 0$ | $4 \cdot 7$ | $4 \cdot 8$ | $4 \cdot 9$ | $5 \cdot 0$ | $5 \cdot 1$ | $5 \cdot 2$ | $5 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 6$ | $5 \cdot 7$ | $5 \cdot 8$ | $6 \cdot 0$ | $6 \cdot 2$ | $6 \cdot 3$ | $6 \cdot 5$ |
| $80^{\circ} 0$ | $4 \cdot 1$ | $4 \cdot 2$ | $4 \cdot 3$ | 4.4 | $4 \cdot 4$ | 4.5 | $4 \cdot 6$ | $4 \cdot 7$ | $4 \cdot 9$ | $5 \cdot 0$ | $5 \cdot 1$ | $5 \cdot 2$ | $5 \cdot 4$ | $5 \cdot 5$ | $5 \cdot 7$ |
| 90\%0 | $3 \cdot 7$ | $3 \cdot 7$ | $3 \cdot 8$ | 3.9 3.5 | 4.0 | $4 \cdot 0$ | $4 \cdot 1$ | $4 \cdot 2$ | $4 \cdot 3$ | 4.4 | $4 \cdot 5$ | $4 \cdot 7$ | $4 \cdot 8$ | $4^{*} 9$ | $5 \cdot 1$ |
| 1000 | $3 \cdot 3$ | $3 \cdot 4$ | $3 \cdot 4$ | $3 \cdot 5$ | $3 \cdot 6$ | $3 \cdot 6$ | $3 \cdot 7$ | $3 \cdot 8$ | $3 \cdot 9$ | $4 \cdot 0$ | $4 \cdot 1$ | 4.2 | $4 \cdot 3$ | 4.4 | $4 \cdot 6$ |
| 120.0 | $2 \cdot 7$ | $2 \cdot 8$ | $2 \cdot 8$ | $2 \cdot 9$ | $3 \cdot 0$ | $3 \cdot 0$ | $3 \cdot 1$ | $3 \cdot 2$ | $3 \cdot 2$ | $3 \cdot 3$ | $3 \cdot 4$ | $3 \cdot 5$ | $3 \cdot 6$ | 37 | $3 \cdot 8$ |
| $140^{\circ} 0$ | $2 \cdot 4$ | $2 \cdot 4$ | 2.4 | $2 \cdot 5$ | $2 \cdot 5$ | $2 \cdot 6$ | $2 \cdot 7$ | $2 \cdot 7$ | $2 \cdot 8$ | $2 \cdot 8$ | $2 \cdot 9$ | $3 \cdot 0$ | $3 \cdot 1$ | 32 | $3 \cdot 3$ |
| 1600 | $2 \cdot 1$ | $2 \cdot 1$ | $2 \cdot 1$ | $2 \cdot 2$ | $2 \cdot 2$ | $2 \cdot 3$ | $2 \cdot 3$ | 2.4 | $2 \cdot 4$ | $2 \cdot 5$ | $2 \cdot 6$ | $2 \cdot 6$ | $2 \cdot 7$ | 2.8 | $2 \cdot 9$ |
| $200 \cdot 0$ | I. 6 | $1 \cdot 7$ | $1 \cdot 7$ | 1.7 | I•8 | 1.8 | $1 \cdot 9$ | I.9 | I•9 | $2 \cdot 0$ | 2.0 | $2 \cdot 1$ | $2 \cdot 2$ | $2 \cdot 2$ | $2 \cdot 3$ |
| 3000 | I'I | I•I | $1 \cdot 1$ | $1 \cdot 2$ | $1 \cdot 2$ | I.2 | I-2 | I•3 | $1 \cdot 3$ | I'3 | 1.4 | 1.4 | 1.4 | 1.5 | I-5 |

AZIMUTH CORRESPONDING TO LATITUDE VARIATION IN DEPARTURE.

| $\left\|\begin{array}{c} \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{array}\right\|$ | Azim. | Lat. in Dep. | Azim. |  | Azim. | $\begin{gathered} \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{gathered}$ | Azim. | $\begin{gathered} \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{gathered}$ | Azim. | $\begin{array}{c\|} \hline \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{array}$ | Azim. | Lat. Var. in Dep. | Azim. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| s. |  | s. |  | s. |  | s. |  | s. |  | s. |  | s. |  |
| -000 | $90^{\circ}$ | -449 | $83^{\circ} 6$ | -909 | $77^{\circ} 2$ | 1-393 | $70 \cdot 8$ | I'916 | $64^{\circ} 4$ | $2 \cdot 500$ | 58.0 | $3 \cdot 170$ | $5{ }^{\circ} \cdot 6$ |
| -007 | 89.9 | -456 | 83.5 | $\bullet 916$ | 77.1 | 1401 | $70 \cdot 7$ | I.925 | 64.3 | 2509 | 57.9 | 3182 | $5 \mathrm{I} \cdot 5$ |
| -014 | $89 \cdot 8$ | -463 | 83.4 | -924 | 77.0 | 1.409 | $70 \cdot 6$ | r.934 | $64 \cdot 2$ | 2.519 | 57.8 | 3. 193 | $5 \times 4$ |
| -021 | $89 \cdot 7$ | -470 | $83 \cdot 3$ | -931 | 76.9 | 1.416 | $70 \cdot 5$ | 1.942 | $64 \cdot 1$ | 2.529 | $57 \cdot 7$ | 3.204 | $51 \cdot 3$ |
| $\cdot 028$ | 89.6 | -477 | 83.2 | -938 | $76 \cdot 8$ | 1-424 | 70.4 | r-95 | 64.0 | 2.538 | $57 \cdot 6$ | $3 \cdot 216$ | $51 \cdot 2$ |
| -035 | 89.5 | -484 | $83^{1}$ 1 | -946 | 76.7 | 1.432 | $70 \cdot 3$ | r.960 | 63.9 | 2548 | 57.5 | 3.228 | 5 I I |
| -042 | 89.4 | -491 | 83.0 | -953 | $76 \cdot 6$ | 1440 | $70 \cdot 2$ | r.968 | 63.8 | 2.558 | $57 \cdot 4$ | 3.239 | $5 \mathrm{r} \cdot \mathrm{O}$ |
| -049 | 89.3 | - 498 | 82.9 | -960 | $76 \cdot 5$ | I 4448 | $70 \cdot 1$ | 1.977 | $63 \cdot 7$ | 2.568 | 57.3 | 3.251 | $50 \cdot 9$ |
| -056 | $89 \cdot 2$ 89.1 | -505 | $82 \cdot 8$ | -968 | 76.4 | I. 456 | $70 \cdot 0$ | r. 986 | 63.6 | 2.578 | $57 \cdot 2$ | $3 \cdot 262$ | $50 \cdot 8$ |
| -063 | 89.1 | 512 | $82 \cdot 7$ | -975 | $76 \cdot 3$ | 1.464 | 69.9 | r.994 | 63.5 | 2.588 | $57 \cdot 1$ | 3.274 | $50 \cdot 7$ |
| $\cdot 070$ | 89.0 | - 520 | 82.6 | -982 | $76 \cdot 2$ | 1.472 | 69.8 | 2.003 | 63.4 | 2.598 | 57.0 | 3.286 | $50 \cdot 6$ |
| -07\% | 88.9 | -527 | 82.5 | -990 | $76 \cdot 1$ | I 480 | $69 \cdot 7$ | 2.012 | 63.3 | 2.608 | 56.9 | 3.297 | $50 \cdot 5$ |
| -084 | 88.8 | - 534 | 82.4 | '997 | $76 \cdot 0$ | 1-488 | 69.6 | 2.021 | 63.2 | 2.618 | $56 \cdot 8$ | $3 \cdot 309$ | 50.4 |
| -091 | $88 \cdot 7$ | -541 | $82 \cdot 3$ | r.005 | $75 \cdot 9$ | 1-496 | $69 \cdot 5$ | 2.029 | $63 \cdot 1$ | $2 \cdot 628$ | $56 \cdot 7$ | $3 \cdot 321$ | $50 \cdot 3$ |
| -098 | 88.6 | -548 | $82 \cdot 2$ | r-012 | 75.8 | 1-504 | 69.4 | 2.038 | $63^{\circ} \mathrm{O}$ | $2 \cdot 638$ | $56 \cdot 6$ | $3 \cdot 333$ | $50 \cdot 2$ |
| -105 | $88 \cdot 5$ | -552 | 82.1 | r.020 | 75.7 | 1.512 | 69.3 | $2 \cdot 047$ | 62.9 | 2.648 | $56 \cdot 5$ | $3 \cdot 344$ | $50 \cdot 1$ |
| -112 | $88 \cdot 4$ | $\cdot 562$ | 82.0 | 1.027 | $75 \cdot 6$ | 1.520 | $69 \cdot 2$ | 2.056 | $62 \cdot 8$ | 2.658 | 56.4 | $3 \cdot 356$ | $50 \cdot 0$ |
| -119 | $88 \cdot 3$ | $\cdot 569$ | $8 \mathrm{r} \cdot 9$ | I-034 | 75.5 | 1.528 | $69 \cdot 1$ | 2.065 | $62 \cdot 7$ | 2.668 | $56 \cdot 3$ | 3.368 | $49 \cdot 9$ |
| -126 | $88 \cdot 2$ | $\cdot 576$ | 8 rr 8 | r-042 | 75.4 | r. 536 | 69.0 | 2.073 | 62.6 | $2 \cdot 678$ | 562 | $3 \cdot 380$ | $49 \cdot 8$ |
| -133 | $88 \cdot 1$ | -584 | $8 \mathrm{r} \cdot 7$ | 1-049 | $75 \cdot 3$ | 1.544 | 68.9 | 2.082 | 62.5 | 2.688 | 56.1 | $3 \cdot 392$ | $49 \cdot 7$ |
| - 140 | 88.0 | -591 | $8 \mathrm{I} \cdot 6$ | r.057 | 75.2 | I. 552 | 68.8 | 2.091 | 62.4 | $2 \cdot 698$ | $56 \cdot 0$ | $3 \cdot 404$ | $49 \cdot 6$ |
| - 147 | 87.9 | - 598 | $8 \mathrm{r} \cdot 5$ | 1.064 | 75.1 | 1.560 | $68 \cdot 7$ | $2 \cdot 100$ | $62 \cdot 3$ | $2 \cdot 708$ | $55 \cdot 9$ | $3 \cdot 416$ | $49 \cdot 5$ |
| - 154 | $87 \cdot 8$ | -605 | 8 rr 4 | $1 \cdot 072$ | $75^{\circ}$ | 1. 568 | 68.6 | 2-109 | $62 \cdot 2$ | $2 \cdot 718$ | $55 \cdot 8$ | $3 \cdot 428$ | 49.4 |
| -161 | $87 \cdot 7$ | -612 | 8 r 3 | 1.079 | 74.9 | 1.576 | $68 \cdot 5$ | 2.118 | $62 \cdot 1$ | $2 \cdot 729$ | $55 \cdot 7$ | 3.44 I | 493 |
| -168 | $87 \cdot 6$ | -619 | $8 \mathrm{r} \cdot 2$ | 1.087 | 74.8 | 1.584 | $68 \cdot 4$ | 2-127 | 62.0 | 2-739 | $55 \cdot 6$ | 3.453 | $49 \cdot 2$ |
| - 175 | 87.5 | -626 | $8 \mathrm{r} \cdot \mathrm{x}$ | r.094 | 74.7 | 1.592 | $68 \cdot 3$ | $2 \cdot 136$ | 6 r 9 | $2 \cdot 749$ | $55^{\circ} 5$ | $3 \cdot 465$ | $49 \cdot 1$ |
| - 182 | 87.4 | -634 | 81.0 | 1-102 | $74 \cdot 6$ | 1.600 | 68.2 | 2.145 | $6 \mathrm{r} \cdot 8$ | $2 \cdot 759$ | 55.4 | 3.477 | $49^{\circ}$ |
| - 189 | $87 \cdot 3$ | -641 | $80 \cdot 9$ | I•I09 | $74 \cdot 5$ | I. 608 | 68.1 | $2 \cdot 154$ | $6 \mathrm{r} \cdot 7$ | $2 \cdot 769$ | 55.3 | 3.490 | $48 \cdot 9$ |
| -196 | $87 \cdot 2$ | -648 | $80 \cdot 8$ | r-117 | 74.4 | I.616 | 68.0 | 2.163 | 61.6 | $2 \cdot 780$ | $55^{\circ} 2$ | 3.502 | 48.8 |
| -203 | $87 \cdot x$ | -655 | $80 \cdot 7$ | I•124 | 74.3 | I 624 | 67.9 | 2-172 | 6 x 5 | 2.790 | $55^{1}$ | $3 \cdot 514$ | $48 \cdot 7$ |
| -210 | 87.0 | -662 | $80 \cdot 6$ | 1.132 | 74.2 | 1.632 | 67.8 | $2 \cdot 181$ | 6 F 4 | $2 \cdot 80 \mathrm{x}$ | $55^{\circ}$ | 3.526 | 48.6 |
| -217 | $86 \cdot 9$ | -669 | $80 \cdot 5$ | 1.140 | $74 \cdot 1$ | I. 640 | $67 \cdot 7$ | $2 \cdot 190$ | 6 r 3 | $2 \cdot 811$ | 54.9 | 3.539 | $48 \cdot 5$ |
| -224 | $86 \cdot 8$ | -677 | $80 \cdot 4$ | 1-147 | $74^{\circ} \mathrm{O}$ | I. 649 | 67.6 | 2.199 | 6 r 2 | 2.822 | 54.8 | 3.552 | 48.4 |
| $\cdot 23 \mathrm{x}$ | $86 \cdot 7$ | -684 | $80 \cdot 3$ | 1.154 | 73.9 | r.657 | 67.5 | $2 \cdot 208$ | $6 \mathrm{r} \cdot \mathrm{I}$ | $2 \cdot 832$ | $54 \cdot 7$ | 3.564 | $48 \cdot 3$ |
| $\cdot 238$ | $86 \cdot 6$ | $\cdot 691$ | $80 \cdot 2$ | I•162 | 73.8 | I 665 | 67.4 | 2.217 | $6 \mathrm{I} \cdot$ | $2 \cdot 843$ | $54 \cdot 6$ | 3.576 | $48 \cdot 2$ |
| - 245 | $86 \cdot 5$ | -698 | $80 \cdot 1$ | 1-170 | $73 \cdot 7$ | 1.673 | $67 \cdot 3$ | 2.226 | $60 \cdot 9$ | 2.853 | 54.5 | 3.589 | $48 \cdot 1$ |
| - 252 | $86 \cdot 4$ | $\cdot 705$ | $80 \cdot 0$ | 1-17\% | 73.6 | 1.681 | $67 \cdot 2$ | 2.236 | $60 \cdot 8$ | 2.864 | $54 \cdot 4$ | 3.602 | $48 \cdot 0$ |
| -259 | $86 \cdot 3$ | -712 | 79.9 | 1-185 | 73.5 | I.690 | 67.1 | $2 \cdot 245$ | $60 \cdot 7$ | $2 \cdot 874$ | 54.3 | 3.614 | 47.9 |
| -266 | $86 \cdot 2$ | $\cdot 720$ | 79.8 | 1.192 | 73.4 | I. 698 | 67.0 | 2.254 | $60 \cdot 6$ | 2.885 | $54 \cdot 2$ | 3.627 | $47 \cdot 8$ |
| -273 | $86 \cdot 1$ | $\cdot 727$ | $79 \cdot 7$ | 1-200 | $73 \cdot 3$ | 1.706 | 66.9 | 2.263 | 60.5 | 2.896 | 54.1 | 3.640 | 47.7 |
| -280 | $86 \cdot 0$ | -734 | 79.6 | I. 208 | 73.2 | 1.714 | 66.8 | 2.272 | $60 \cdot 4$ | 2.906 | 54.0 | 3.652 | 47.6 |
| $\cdot 287$ | 85.9 | $\bigcirc 741$ | 79.5 | I-215 | $73 \cdot 1$ | 1.723 | $66 \cdot 7$ | $2 \cdot 282$ | $60 \cdot 3$ | 2.917 | 53.9 | 3.665 | $47 \cdot 5$ |
| - 294 | $85 \cdot 8$ | $\cdot 748$ | 79.4 | r-223 | $73^{\circ}$ | 1.731 | $66 \cdot 6$ | 2.291 | $60 \cdot 2$ | 2.928 | $53 \cdot 8$ | 3.678 | 47.4 |
| $\cdot 301$ | $85 \cdot 7$ | '756 | 79.3 | 1.230 | $72 \cdot 9$ | -739 | $66 \cdot 5$ | $2 \cdot 300$ | $60 \cdot 1$ | 2.938 | $53 \cdot 7$ | 3.691 | 47.3 |
| -308 | $85 \cdot 6$ | $\cdot 763$ | 79.2 | 1.238 | $72 \cdot 8$ | 1.748 | 66.4 | $2 \cdot 309$ | $60 \cdot 0$ | 2.949 | $53 \cdot 6$ | 3.704 | 47.2 |
| $\cdot 315$ | $85 \cdot 5$ | 970 | 79.1 | I. 246 | $72 \cdot 7$ | 1.756 | 66.3 | $2 \cdot 319$ | 59.9 | 2.960 | 53.5 | 3.717 | 47.1 |
| $\cdot 322$ | 85.4 | $\cdots 78$ | $79^{\circ}$ | 1.254 | $72 \cdot 6$ | I.764 | $66 \cdot 2$ | $2 \cdot 328$ | 59.8 | 2.971 | 53.4 | 3.730 | $47^{\circ} \mathrm{O}$ |
| $\cdot 329$ | $85 \cdot 3$ | $\cdot 785$ | 78.9 78.8 | 1.261 | 72.5 | 1.772 | $66 \cdot 1$ | 2.337 | 59.7 | 2.982 | $53 \cdot 3$ | 3.743 | $46 \cdot 9$ |
| -336 | $85 \cdot 2$ 85.1 | -792 | 78.8 | I. 269 | $72 \cdot 4$ | 1.781 | $66^{\circ} \mathrm{O}$ | 2.347 | 59.6 | 2.992 | $53^{2}$ | 3.756 | $46 \cdot 8$ |
| -343 | $85^{\prime}$ | -799 | $78 \cdot 7$ | 1-276 | $72 \cdot 3$ | 1-789 | 65.9 | $2 \cdot 356$ | 59.5 | 3.003 | $53^{1} 1$ | 3.769 | $46 \cdot 7$ |
| -350 | $85^{\circ} \mathrm{O}$ | -806 | $78 \cdot 6$ | 1. 284 | 72.2 | 1•798 | 65.8 | $2 \cdot 366$ | 59.4 | 3.014 | $53^{\circ} \mathrm{O}$ | 3.783 | $46 \cdot 6$ |
| -357 | $84 \cdot 9$ | -814 | $78 \cdot 5$ | I 292 | $72 \cdot 1$ | 1-806 | 65.7 | $2 \cdot 375$ | $59 \cdot 3$ | 3.025 | $52 \cdot 9$ | 3.796 | $46 \cdot 5$ |
| -364 | $84 \cdot 8$ | .821 | 78.4 | 1 300 | 72.0 | 1.814 | $65 \cdot 6$ | $2 \cdot 384$ | 59.2 | 3.036 | $52 \cdot 8$ | $3 \cdot 809$ | $46 \cdot 4$ |
| -371 | $84 \cdot 7$ | -828 | $78 \cdot 3$ | 1-308 | $7 \mathrm{y} \cdot 9$ | I. 823 | $65 \cdot 5$ | $2 \cdot 394$ | 59.1 | 3.047 | $52 \cdot 7$ | 3.822 | $46 \cdot 3$ |
| $\cdot 378$ | $84 \cdot 6$ | $\cdot 836$ | 78.2 | 1.315 | $7 \mathrm{r} \cdot 8$ | 1.83I | 65.4 | $2 \cdot 403$ | $59^{\circ}$ | 3.058 | $52 \cdot 6$ | 3.836 | $46 \cdot 2$ |
| $\cdot 385$ | 84.5 | -842 | 78.1 | 1.323 | $7 \mathrm{7} \times 7$ | I. 840 | $65 \cdot 3$ | 2.413 | 58.9 | 3.069 | 52.5 | 3.849 | $46 \cdot 1$ |
| -392 | 84.4 | -850 | 78.0 | r.33r | $7 \mathrm{~F} \cdot 6$ | 1.848 | $65 \% 2$ | 2.422 | 58.8 | 3.081 | 52.4 | 3.863 | $46 \cdot 0$ |
| $\cdot 399$ | $84 \cdot 3$ | -858 | 77.9 | 1.338 | 7 yr 5 | r.857 | $65^{\prime} 1$ | $2 \cdot 432$ | 58.7 | 3.092 | $52 \cdot 3$ | 3.876 | $45 \cdot 9$ |
| 406 | $8{ }^{8} \cdot{ }^{\circ} \mathrm{C}$ | -865 | 77.8 | r.346 | 7 yr 4 | r.865 | $65^{\circ}$ | 2.442 | 58.6 | 3.103 | $52 \cdot 2$ | 3.890 | $45 \cdot 8$ |
| 413 | 84.1 | $\cdot 872$ | $77 \cdot 7$ | r.354 | 7 7 3 | r.874 | 64.9 | $2 \cdot 45 \mathrm{I}$ | $58 \cdot 5$ | 3.114 | $52 \cdot 1$ | 3.904 | $45 \%$ |
| $\cdot 420$ | $84^{\circ} \mathrm{O}$ | -880 | 77.6 | 1.362 | 71.2 | r. 882 | 64.8 | $2 \cdot 461$ | 58.4 | 3.125 | $52 \cdot 0$ | 3.917 | $45 \cdot 6$ |
| $\cdot 428$ | $83 \cdot 9$ | -887 | 77.5 | 1.370 | $71 \cdot 1$ | 1.891 | $64 \cdot 7$ | 2.470 | $58 \cdot 3$ | 3.136 | $5 \mathrm{~F} \cdot 9$ | 3.931 | 45.5 |
| -434 | $83 \cdot 8$ | - 894 | $77 \cdot 4$ | r 378 | $7 \mathrm{r} \cdot 0$ | r.899 | 64.6 | $2 \cdot 480$ | 58.2 | 3.148 | $5 \mathrm{~F} \cdot 8$ | $3 \cdot 945$ | $45^{\circ} 4$ |
| -441 | $8{ }^{8 \cdot 7}$ | -902 | 77.3 | r.385 | $70 \cdot 9$ | r.908 | $64 \cdot 5$ | 2.490 | $58 \cdot 1$ | 3.159 | 51.7 | 3.958 | $45 \cdot 3$ |
| $\bullet 449$ | $83 \cdot 6$ | -909 | 77.2 | r 393 | $70 \cdot 8$ | I.916 | 64.4 | 2.500 | $58 \cdot$ | $3 \cdot 170$ | $5 \mathrm{r} \cdot 6$ | 3.972 | $45^{2}$ |

aZIMUTH CORRESPONDING TO LATTTUDE VARIATION IN DEPARTURE.

| Lat. <br> Var. <br> in Dep | Azim. | $\begin{array}{\|c\|} \hline \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{array}$ | Azim. | $\begin{array}{\|c\|} \hline \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{array}$ | Azim. | Lat. Var. in Dep. | Azim. | $\begin{array}{\|c\|} \hline \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{array}$ | Azim. |  | Azim. | $\left\lvert\, \begin{gathered} \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{gathered}\right.$ | Azim. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. |  | S. |  | 6.30 |  | S. |  | S. |  | ${ }_{17}{ }_{\text {S. }}$ |  | S. |  |
| 3.972 | $45^{\circ} 2$ | 4.975 | 38 | $6 \cdot 303$ | 32.4 32.3 | 8.20 | $26^{\circ}$ | II.30 | 19.5 | 17.33 | $13^{\circ} \cdot$ | 35.1 | $6 \cdot 5$ |
| 3.986 4.000 | $45^{4.1}$ | ${ }^{4.993}$ | $38 \cdot 7$ 38.6 | $6 \cdot 327$ 6.352 | $32 \cdot 3$ $32 \cdot 2$ | 8.24 8.27 | 25.9 25 | 11.36 II 42 | 19.4 | 17.46 17.61 | 12.9 12.8 | $35 \cdot 7$ 36.2 | $6 \cdot 4$ |
| 4.000 4.014 | $44^{\circ} 9$ | 5 | $38 \cdot 5$ | 6.376 | $32 \cdot 1$ $32 \cdot 1$ | 8.31 | $25^{\circ} 7$ | II 42 | 19.2 | 17.75 | 12.7 | $36 \cdot 8$ | $6 \cdot 3$ |
| 4.028 | $44^{\circ} 8$ | 5.047 | $38 \cdot 4$ | $6 \cdot 401$ | 32.0 | $8 \cdot 35$ | $25 \cdot 6$ | II 55 | 19.1 | 17.89 | 12.6 | 37.4 | $6 \cdot 1$ |
| 4.042 | $44^{7} 7$ | 5.065 | $38 \cdot 3$ | $6 \cdot 426$ | $31 \cdot 9$ | $8 \cdot 39$ | 25.5 | 11.62 | 19.0 | 18.04 | 12.5 | $38 \cdot 1$ | $6 \cdot 0$ |
| 4.056 | $44 \cdot 6$ | 5.083 | $38 \cdot 2$ | 6.451 | $31 \cdot 8$ | $8 \cdot 42$ | 25.4 | II. 68 | 18.9 | 18.19 | 12.4 | $38 \cdot 7$ | $5 \cdot 9$ |
| 4.070 | 44.5 | $5 \cdot 101$ | $38 \cdot 1$ | 6.476 | $31 \cdot 7$ | $8 \cdot 46$ | $25 \cdot 3$ | 11.75 | 18.8 | 18.35 | 12.3 | $39 \cdot 4$ | $5 \cdot 8$ |
| 4.084 | 44.4 | $5 \cdot 120$ | 38.0 | $6 \cdot 502$ | 3 I 6 | $8 \cdot 50$ | $25 \cdot 2$ | 11.82 | 18.7 | 18.50 | 12.2 | $40^{1} 1$ | $5 \cdot 7$ |
| 4.099 | $44 \cdot 3$ | $5 \cdot 138$ | 37.9 | 6.527 | $31 \cdot 5$ | $8 \cdot 54$ | 25.1 | 11.89 | 18.6 | 18.66 | $12 \cdot 1$ | $40 \cdot 8$ | $5 \cdot 6$ |
| 4.113 | $44^{2}$ | $5 \cdot 157$ | 37.8 | 6.553 | 31.4 | $8 \cdot 58$ | 25.0 | II.95 | 18.5 | 18.82 | $12 \cdot 0$ | 41.5 | $5 \cdot 5$ |
| 4.128 | $44^{\text {¹ }}$ | 5.175 | $37 \cdot 7$ | 6.579 | $3 \mathrm{r} \cdot 3$ | $8 \cdot 62$ | 24.9 | 12.02 | $18 \cdot 4$ | 18.98 | $12 \cdot 9$ | $42 \cdot 3$ | $5 \cdot 4$ |
| $4 \cdot 142$ | $44^{\circ}$ | 5.194 | 37.6 | 6.605 | $3 \mathrm{I} \cdot 2$ | $8 \cdot 66$ | 24.8 | 12.09 | 18.3 | 19.15 | 11.8 | 43.1 | $5 \cdot 3$ |
| 4.157 | 43.9 | 5.213 | 37.5 | 6.631 | 3 I 1 | $8 \cdot 70$ | $24 \cdot 7$ | $12 \cdot 17$ | 18.2 | 19.31 | 11.7 | $43 \cdot 9$ | $5 \cdot 2$ |
| 4-172 | $43 \cdot 8$ | $5 \cdot 232$ | $37 \cdot 4$ | $6 \cdot 657$ | $31 \cdot 0$ | $8 \cdot 74$ | 24.6 | 12.24 | 18.1 | 19.49 | 11.6 | $44 \cdot 8$ | $5 \cdot 1$ |
| $4 \cdot 186$ | $43 \cdot 7$ | 5.251 | $37 \cdot 3$ $37 \cdot 2$ | 6.684 | $30 \cdot 9$ 30.8 | 8.78 8.82 | 24.5 | 12.31 12.38 | 18.0 | 19.66 | II.5 | $45 \cdot 7$ | $5 \cdot 0$ |
| 4.200 4.216 | $43 \cdot 6$ | 5.270 5.289 | $37 \cdot 2$ $37 \cdot 1$ | 6.710 6.737 | $30 \cdot 8$ $30 \cdot 7$ | 8.82 8.86 | 24.4 | 12.38 12.46 | 17.9 17.8 | 19.84 20.02 | 11.4 II | $46 \cdot 7$ $47 \cdot 6$ | 4.9 4.8 |
| 4.230 | $43 \cdot 4$ | $5 \cdot 308$ | 37.0 | $6 \cdot 764$ | $30 \cdot 6$ | $8 \cdot 90$ | 24.2 | 12.53 | 17.7 | $20 \cdot 20$ | II. 2 | $48 \cdot 6$ | $4 \cdot 7$ |
| 4.244 | 43.3 | $5 \cdot 328$ | 36.9 | 6.791 | $30 \cdot 5$ | $8 \cdot 94$ | $24^{\prime} 1$ | 12.61 | 17.6 | 20.3 | II• | $49 \cdot 7$ | $4 \cdot 6$ |
| 4.260 | $43^{2} 2$ | $5 \cdot 347$ | $36 \cdot 8$ | 6.818 | $30 \cdot 4$ | $8 \cdot 98$ | 24.0 | 12.69 | 17.5 | 20.58 | $11 \cdot 0$ | 50.8 | 4.5 |
| 4.275 | $43^{\cdot 1}$ | $5 \cdot 366$ | $36 \cdot 7$ | 6.845 | $30 \cdot 3$ | $9 \cdot 03$ | $23 \cdot 9$ | 12.76 | 17.4 | $20 \cdot 77$ | 10.9 | $52 \cdot 0$ | 4.4 |
| 4.289 | $43^{\circ} \mathrm{O}$ | $5 \cdot 386$ | $36 \cdot 6$ | $6 \cdot 873$ | $30 \cdot 2$ | $9 \cdot 07$ | $23 \cdot 8$ | 12.84 | 17.3 | 20.97 | 10.8 | 53.2 | $4 \cdot 3$ |
| $4 \cdot 304$ | $42 \cdot 9$ | $5 \cdot 406$ | $36 \cdot 5$ | $6 \cdot 901$ | $30 \cdot 1$ | 9.11 | $23 \cdot 7$ | 12.92 | 17.2 | 21.17 | $10 \cdot 7$ | 54.5 | $4 \cdot 2$ |
| 4.320 | $42 \cdot 8$ | $5 \cdot 426$ | $36 \cdot 4$ | 6.929 | $30 \cdot 0$ | $9 \cdot 16$ | $23 \cdot 6$ | 13.00 | $17 \cdot 1$ | 21.37 | $10 \cdot 6$ | 55.8 | $4 \cdot 1$ |
| 4.336 | $42 \cdot 7$ | 5.445 | $36 \cdot 3$ | 6.956 | 29.9 | 9.20 | $23 \cdot 5$ | 13. | 17.0 | 21.58 | 10.5 | $57 \cdot 2$ | $4 \cdot 0$ |
| 4.350 | $42 \cdot 6$ | $5 \cdot 465$ | $36 \cdot 2$ | 6.984 | $29 \cdot 8$ | $9 \cdot 24$ | 23.4 | 13.17 | 16.9 | 21.79 | 10.4 | 58.7 | $3 \cdot 9$ |
| 4.364 | $42 \cdot 5$ | $5 \cdot 485$ | $36 \cdot 1$ | $7 \cdot 013$ | 29.7 | $9 \cdot 29$ | 23.3 | 13.25 | 16.8 | 22.01 | $10 \cdot 3$ | $60 \cdot 2$ | $3 \cdot 8$ |
| 4.380 | $42 \cdot 4$ | $5 \cdot 506$ | $36 \cdot 0$ | 7.041 | 29.6 | 9.33 | $23 \cdot 2$ | 13.33 | 16.7 | 22.23 | $10 \cdot 2$ | $6 \mathrm{I} \cdot 9$ | $3 \cdot 7$ |
| 4.396 | $42 \cdot 3$ | $5 \cdot 526$ | 35.9 | $7 \cdot 070$ | 29.5 | $9 \cdot 38$ | $23 \cdot 1$ | 13.42 | 16.6 | 22.46 | 10.1 | $63 \cdot 6$ | 3.6 |
| 4.412 | $42 \cdot 2$ | $5 \cdot 546$ | $35 \cdot 8$ | $7 \cdot 099$ | 29.4 | 9.42 | $23 \cdot 0$ | 13.50 | 16.5 | 22.68 | ro.0 | 65.4 | 3.5 |
| $4 \cdot 427$ | $42 \cdot 1$ | $5 \cdot 567$ | $35 \cdot 7$ | 7.128 | $29 \cdot 3$ | 9.47 | $22 \cdot 9$ | 13.59 | 16.4 | 22.92 | $9 \cdot 9$ | $67 \cdot 3$ | $3 \cdot 4$ |
| 4.442 | $42^{\circ}$ | 5.587 | $35 \cdot 6$ | $7 \cdot 157$ | 29.2 | 9.52 | $22 \cdot 8$ | 13.68 | 16.3 | $23 \cdot 16$ | $9 \cdot 8$ | 69.4 | $3 \cdot 3$ |
| 4.458 | $41 \cdot 9$ | $5 \cdot 608$ | $35 \cdot 5$ | 7.186 | $29^{1}$ | $9 \cdot 56$ | 22.7 | 13.77 | $16 \cdot 2$ | 23.40 | $9 \cdot 7$ | 71.5 | $3 \cdot 2$ |
| 4.474 | 41.8 | 5.628 | $35 \cdot 4$ | $7 \cdot 216$ | $29^{\circ}$ | 9.61 | 22.6 | 13.86 | 16.1 | $23 \cdot 65$ | $9 \cdot 6$ | 73.9 | $3 \cdot 1$ |
| $4 \cdot 489$ | $41 \cdot 7$ | $5 \cdot 649$ | 35.3 | 7.246 | 28.9 | 9.66 | 22.5 | 13.95 | $16 \cdot 0$ | 23.90 | $9 \cdot 5$ | $76 \cdot 3$ | $3 \cdot 0$ |
| $4 \cdot 505$ | $4 \mathrm{I} \cdot 6$ | 5.670 | $35^{\circ} 2$ | 7.276 | $28 \cdot 8$ | $9 \cdot 70$ | 22.4 | 14.04 | $15 \cdot 9$ | $24 \cdot 16$ | $9 \cdot 4$ | $79^{\circ}$ | $2 \cdot 9$ |
| 4.52 I | $41 \cdot 5$ | 5.691 | $35 \cdot 1$ | $7 \cdot 306$ | $28 \cdot 7$ | 9.75 | $22 \cdot 3$ | 14.14 | 15.8 | 24.43 | $9 \cdot 3$ | 8 P -8 | $2 \cdot 8$ |
| 4.537 | 41.4 | 5.713 | $35 \cdot 0$ | 7.336 | $28 \cdot 6$ | 9.80 | 22.2 | 14.23 | 15.7 | 24.70 | $9 \cdot 2$ | 84.8 | $2 \cdot 7$ |
| 4.553 | $41 \cdot 3$ | 5.734 | 34.9 | $7 \cdot 367$ | $28 \cdot 5$ | 9.85 | 22.1 | 14.33 | 15.6 | 24.97 | 9 I | $88 \cdot \mathrm{I}$ | 2.6 |
| 4.569 | $4 \mathrm{I} \cdot 2$ | $5 \cdot 755$ | 34.8 | 7-398 | $28 \cdot 4$ | 9.90 | 22.0 | 14.42 | 15.5 | 25.25 | $9 \cdot 0$ | 91.6 | $2 \cdot 5$ |
| 4.585 | $41 \cdot 1$ | 5.777 | $34^{\circ} 7$ | $7 \cdot 429$ | $28 \cdot 3$ | $9 \cdot 95$ | 21.9 | 14.52 | 15.4 | 25.54 | $8 \cdot 9$ | $95 \cdot$ | 2.4 |
| $4 \cdot 602$ | 410 | $5 \cdot 798$ | $34 \cdot 6$ | $7 \cdot 460$ | $28 \cdot 2$ | 10.00 | $2 \mathrm{P} \cdot 8$ | 14.62 | 15.3 | $25 \cdot 84$ | $8 \cdot 8$ | $99 \cdot 6$ | $2 \cdot 3$ |
| $4 \cdot 618$ | $40 \cdot 9$ | $5 \cdot 820$ | 34.5 | $7 \cdot 491$ | 28.1 | 10.05 | 21.7 | 14.72 | 15.2 | $26 \cdot 14$ | $8 \cdot 7$ | 104 | $2 \cdot 2$ |
| $4 \cdot 634$ | $40 \cdot 8$ | $5 \cdot 842$ | $34 \cdot 4$ | $7 \cdot 523$ | 28.0 | 10.10 | 21.6 | 14.82 | $15^{\circ} 1$ | 26.45 | $8 \cdot 6$ | 109 | $2 \cdot 1$ |
| 4.650 | $40 \cdot 7$ | 5.864 | $34 \cdot 3$ | $7 \cdot 555$ | 27.9 | $10 \cdot 15$ | 21.5 | 14.93 | 15.0 | 26.76 | $8 \cdot 5$ | 114 | $2 \cdot 0$ |
| $4 \cdot 667$ | $40 \cdot 6$ | $5 \cdot 886$ | $34 \cdot 2$ | 7.587 | 27.8 | 10.21 | 21.4 | 15.03 | 14.9 | 27.09 | $8 \cdot 4$ | 121 | I•9 |
| $4 \cdot 683$ | $40 \cdot 5$ | 5.908 | $34^{1}$ | 7.619 | 27.7 | 10.26 | 21.3 | 15.14 | 14.8 | $27 \cdot 42$ | $8 \cdot 3$ | 127 | 1.8 |
| 4.700 | $40 \cdot 4$ | 5.930 | 34.0 | 7.651 | 27.6 | 10.31 | 21.2 | 15.25 | 14.7 | $27 \cdot 76$ | $8 \cdot 2$ | 135 | $1 \cdot 7$ |
| 4.717 | $40 \cdot 3$ | 5.953 | 33.9 | $7 \cdot 684$ | 27.5 | $10 \cdot 37$ | $21 \cdot 1$ | 15.36 | 14.6 | 28.10 | 8-1 | 143 | 1.6 |
| 4.733 | $40 \cdot 2$ | 5.975 | $33 \cdot 8$ | 7.717 | 27.4 | 10.42 | 21.0 | 15.47 | 14.5 | 28.46 | $8 \cdot 0$ | 153 | $1 \cdot 5$ |
| 4.750 | $40 \cdot 1$ | 5.998 | $33 \cdot 7$ | $7 \cdot 750$ | 27.3 | 10.47 | $20 \cdot 9$ | 15.58 | 14.4 | 28.83 | $7 \cdot 9$ | 164 | 1.4 |
| 4.767 | $40 \cdot 0$ | $6 \cdot 020$ | $33 \cdot 6$ | $7 \cdot 783$ | 27.2 | $10 \cdot 53$ | $20 \cdot 8$ | 15.69 | 14.3 | 29.20 | $7 \cdot 8$ | 176 | r 3 |
| 4.784 4.801 | 39.9 30.8 | 6.043 6.066 | $33 \cdot 5$ 33.4 | 7.817 7.850 | 27.1 27.0 | 10.59 10.64 | $20 \cdot 7$ 20.6 | 15.81 15.92 | 14.2 14.1 | 29.58 | 77.7 | 191 | r. 2 r. |
| 4.801 | $39 \cdot 8$ | 6.066 | $33 \cdot 4$ | 7.850 | 27.0 | 10.64 | $20 \cdot 6$ | 15.92 | 14.1 | 29.98 | $7 \cdot 6$ | 208 | I•I |
| 4.818 | $39 \cdot 7$ | $6 \cdot 090$ | $33 \cdot 3$ | $7 \cdot 884$ | 26.9 | 10.70 | 20.5 | 16.04 | 14.0 | 30.38 | $7 \cdot 5$ | 229 | ro |
| 4.835 | $39 \cdot 6$ | $6 \cdot 113$ | $33 \cdot 2$ | 7.919 | 26.8 | $10 \cdot 76$ | $20 \cdot 4$ | $16 \cdot 16$ | 13.9 | $30 \cdot 80$ | $7 \times 4$ | 255 | $0 \cdot 9$ |
| 4.852 | 39.5 | 6.136 | $33^{\prime}$ | 7.953 | $26 \cdot 7$ | 10.81 | $20 \cdot 3$ | 16.28 | 13.8 | 31.22 | $7 \cdot 3$ | 286 | 0.8 |
| 4.870 4.887 | $39^{\circ} 4$ | 6.160 | $33^{\circ} 0$ | 7.988 | 26.6 | 10.87 | $20 \cdot 2$ | 16.41 | 13.7 | $3 \mathrm{I} \cdot 66$ | $7 \cdot 2$ | 327 | $\bigcirc \cdot 7$ |
| 4.887 | $39 \cdot 3$ | $6 \cdot 183$ | $32 \cdot 9$ | 8.023 | $26 \cdot 5$ | $10 \cdot 93$ | $20 \cdot 1$ | 16.53 | 13.6 | 32.11 | $7 \cdot 1$ | 382 | $0 \cdot 6$ |
| 4.904 4.922 | 39.2 39.1 | $6 \cdot 207$ $6 \cdot 231$ | 32.8 32.7 | 8.058 8.093 | 26.4 26.3 | 10.99 11.05 | $20 \cdot 0$ | 16.66 | 13.5 13.4 | $32 \cdot 58$ $33 \cdot 05$ | $7 \cdot 0$ 6.0 | 458 | 0.5 0.4 |
| 4.940 | $39^{\circ} \mathrm{O}$ | $6 \cdot 255$ | 32.6 | 8.129 | $26 \cdot 2$ | ITII | 19.8 | 16.92 | 13.3 | 33.54 | 6.8 | 764 | $\bigcirc$ |
| 4.958 | 38.9 | 6.279 | 32.5 | $8 \cdot 165$ | $26 \cdot 1$ | II•I7 | 19.7 | 17.05 | 13.2 | 34.05 | $6 \cdot 7$ | 1146 | $0 \cdot 2$ |
| 4.975 | $38 \cdot 8$ | $6 \cdot 303$ | 32.4 | 8.20I | 26.0 | 11.23 | 19.6 | 17.19 | 13.1 | 34.57 | $6 \cdot 6$ | 2292 | $0 \cdot 1$ |

# POSITION LINES CORRESPONDING TO LATITUDE VARIATION FOR USE WITH THE PLANE SCALE CHART. 

When the Latitude Variation is + name the Position Line contrary Name to Latitude. When - same Name as Latitude.

| $\begin{gathered} \text { Lat. } \\ \text { Var. } \\ \text { in Dep. } \end{gathered}$ | Posn. Line. |  | Posn. Line. |  | Posn. Line. | Lat. Var. in Dep. | Posn. Line. | Lat. Var. in Dep. | Posn. Line. | Lat. Var. in Dep. | Posn. Line. | Lat. Var. in Dep. | Posn. Line. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| s. |  | s. |  | , |  | S. |  | S. |  | S. |  | S. |  |
| -00 | $\bigcirc$ | -91 | 12.8 | I.92 | $25^{\circ} 6$ | 3.17 | 38.4 | 4.97 | $5 \mathrm{I} \cdot 2$ | 8.20 | $64^{\circ} \mathrm{O}$ | 17.3 | $\cdot$ |
| - 01 | 0.2 | $\cdot 92$ | 13.0 | I.93 | $25 \cdot 8$ | $3 \cdot 19$ | 38.6 | $5 \cdot 1$ | 51.4 | 8.27 | $64 \cdot 2$ | $17 \cdot 6$ | $77 \cdot 2$ |
| . 03 | $0 \cdot 4$ | -94 | 13.2 | I.95 | $26 \cdot 0$ | $3 \cdot 22$ | 38.8 | 5.05 | $5 \mathrm{I} \cdot 6$ | $8 \cdot 35$ | 64.4 | 17.9 | 77.4 |
| -04 | $0 \cdot 6$ | -95 | 13.4 | 1.97 | $26 \cdot 2$ | 3.24 | $39^{\circ}$ | $5 \cdot 08$ | $5 \mathrm{I} \cdot 8$ | $8 \cdot 42$ | 64.6 | 18.2 | $77 \cdot 6$ |
| -06 | -8 | -97 | 13.6 | I•99 | $26 \cdot 4$ | $3 \cdot 26$ | 39.2 | 5.12 | $52 \cdot 0$ | $8 \cdot 50$ | $64 \cdot 8$ | 18. | 77.8 |
| -07 | $1 \cdot 0$ | -98 | 13.8 | $2 \cdot 00$ | $26 \cdot 6$ | $3 \cdot 29$ | 39.4 | 5•16 | $52 \cdot 2$ | 8.58 | $65 \cdot$ | 18.8 | $78 \cdot 0$ |
| -08 | 1.2 | $1 \cdot 00$ | 14.0 | $2 \cdot 02$ | $26 \cdot 8$ | $3 \cdot 31$ | $39 \cdot 6$ | $5 \cdot 19$ | 52.4 | $8 \cdot 66$ | $65 \cdot 2$ | 19.1 | 78.2 |
| - 10 | 1.4 | $1 \cdot 01$ | 14.2 | $2 \cdot 04$ | 27.0 | $3 \cdot 33$ | $39 \cdot 8$ | 5.23 | $52 \cdot 6$ | $8 \cdot 74$ | 65.4 | 19.5 | 78.4 |
| - II | 1.6 | r.03 | 14.4 | $2 \cdot 06$ | 27.2 | $3 \cdot 36$ | $40 \cdot 0$ | $5 \cdot 27$ | $52 \cdot 8$ | 8.82 | $65 \cdot 6$ | 19.8 | 78.6 |
| -13 | I. 8 | $1 \cdot 04$ | 14.6 | $2 \cdot 07$ | 27.4 | $3 \cdot 38$ | $40 \cdot 2$ | $5 \cdot 31$ | $53 \cdot 0$ | 8.90 | $65 \cdot 8$ | 20.2 | $78 \cdot 8$ |
| - 14 | $2 \cdot 0$ | 1.06 | 14.8 | 2.09 | 27.6 | $3 \cdot 40$ | $40 \cdot 4$ | $5 \cdot 35$ | 53.2 | 8.98 | $66 \cdot 0$ | $20 \cdot 6$ | $79 \cdot 0$ |
| - 15 | 2.2 | 1.08 | 15.0 | $2 \cdot \mathrm{II}$ | $27 \cdot 8$ | $3 \cdot 43$ | $40 \cdot 6$ | $5 \cdot 39$ | 53.4 | $9 \cdot 7$ | $66 \cdot 2$ | 21.0 | $79 \cdot 2$ |
| -17 | 2.4 | 1.09 | 15.2 | ${ }^{2} \cdot 13$ | $28 \cdot 0$ | 3.45 | $40 \cdot 8$ | 5.43 | 53.6 | $9 \cdot 16$ | $66 \cdot 4$ | 21.4 | 79.4 |
| -18 | $2 \cdot 6$ | I•II | 15.4 | $2 \cdot 14$ | 28.2 | $3 \cdot 48$ | $4{ }^{\circ} \mathrm{O}$ | $5 \cdot 46$ | 53.8 | 9.24 | $66 \cdot 6$ | 21.8 | $79 \cdot 6$ |
| - 20 | $2 \cdot 8$ | 1.12 | 15.6 | $2 \cdot 16$ | 28.4 | 3.50 | 41.2 | $5 \cdot 51$ | 54.0 | $9 \cdot 33$ | $66 \cdot 8$ | 22.2 | $79 \cdot 8$ |
| . 21 | $3 \cdot 0$ | $1 \cdot 14$ | 15.8 | $2 \cdot 18$ | 28.6 | $3 \cdot 53$ | 41.4 | $5 \cdot 55$ | $54 \cdot 2$ | $9 \cdot 42$ | 67.0 | 22.7 | $80 \cdot 0$ |
| $\cdot 22$ | $3 \cdot 2$ | $1 \cdot 15$ | $16 \cdot 0$ | $2 \cdot 20$ | 28.8 | 3.55 | $4 \mathrm{I} \cdot 6$ | $5 \cdot 59$ | 54.4 | 9.52 | $67 \cdot 2$ | 23.2 | $80 \cdot 2$ |
| $\cdot 24$ | 3.4 | I.17 | 16.2 | 2.22 | $29^{\circ}$ | $3 \cdot 58$ | $4 \mathrm{I} \cdot 8$ | 5.63 | $54 \cdot 6$ | 9.61 | 67.4 | 23.6 | 80.4 |
| $\cdot 25$ | 3.6 | I-18 | 16.4 | 2.24 | $29 \cdot 2$ | $3 \cdot 60$ | 42.0 | $5 \cdot 67$ | 54.8 | 9.70 | $67 \cdot 6$ | 24.2 | $80 \cdot 6$ |
| $\cdot 27$ | 3.8 | $1 \cdot 20$ | $16 \cdot 6$ | 2.25 | 29.4 | 3.63 | $42 \cdot 2$ | $5 \cdot 71$ | $55 \cdot 0$ | 9.80 | $67 \cdot 8$ | 24.7 | 80.8 |
| $\cdot 28$ | 4.0 | 1.21 | 16.8 | $2 \cdot 27$ | 29.6 | $3 \cdot 65$ | $42 \cdot 4$ | $5 \cdot 75$ | 55.2 | 9.90 | 68.0 | 25.2 | $8 \mathrm{I} \cdot 0$ |
| $\cdot 29$ | $4 \cdot 2$ | 1. 23 | $17 \cdot 0$ | 2.29 | 29.8 | $3 \cdot 68$ | $42 \cdot 6$ | $5 \cdot 80$ | 55.4 | 10.00 | $68 \cdot 2$ | $25 \cdot 8$ | $8 \mathrm{I} \cdot 2$ |
| $\cdot 31$ | $4 \cdot 4$ | 1.25 | 17.2 | $2 \cdot 31$ | $30 \cdot 0$ | 3.70 | $42 \cdot 8$ | $5 \cdot 84$ | $55 \cdot 6$ | 10.10 | 68.4 | 26.4 | $8 \mathrm{I} \cdot 4$ |
| $\cdot 32$ | $4 \cdot 6$ | 1.26 | 17.4 | $2 \cdot 33$ | $30 \cdot 2$ | $3 \cdot 73$ | $43 \cdot 0$ | $5 \cdot 89$ | $55 \cdot 8$ | 10.21 | $68 \cdot 6$ | $27 \cdot 1$ | $8 \mathrm{r} \cdot 6$ |
| $\cdot 34$ | $4 \cdot 8$ | 1.28 | 17.6 | $2 \cdot 35$ | $30 \cdot 4$ | $3 \cdot 76$ | $43 \cdot 2$ | $5 \cdot 93$ | 56.0 | 10.31 | $68 \cdot 8$ | $27 \cdot 8$ | $8 \mathrm{I} \cdot 8$ |
| -35 | $5 \cdot 0$ | 1.29 | 17.8 | 2.37 | $30 \cdot 6$ | 3.78 | $43 \cdot 4$ | $5 \cdot 97$ | 56.2 | 10.42 | $69 \cdot 0$ | 28.5 | 82.0 |
| $\cdot 36$ | $5 \cdot 2$ | $1 \cdot 31$ | 18.0 | $2 \cdot 38$ | 30.8 | 3.81 | $43 \cdot 6$ | $6 \cdot 02$ | $56 \cdot 4$ | 10.53 | $69 \cdot 2$ | 29.2 | 82.2 |
| $\cdot 38$ | $5 \cdot 4$ | 1-32 | 18.2 | 2.40 | 3 r 0 | $3 \cdot 84$ | $43 \cdot 8$ | $6 \cdot 07$ | 56.6 | 10.64 | 69.4 | $30 \cdot 0$ | 82.4 |
| $\cdot 39$ | $5 \cdot 6$ | r-34 | 18.4 | 2.42 | 31.2 | 3.86 | 44.0 | $6 \cdot 11$ | 56.8 | $10 \cdot 76$ | 69.6 | $30 \cdot 8$ | 82.6 |
| $\cdot 4 \mathrm{I}$ | $5 \cdot 8$ | I•35 | $18 \cdot 6$ | 2.44 | 31.4 | $3 \cdot 89$ | 44.2 | $6 \cdot 16$ | 57.0 | 10.87 | 69.8 | $3 \mathrm{r} \cdot 7$ | 82.8 |
| $\cdot 42$ | $6 \cdot 0$ | $1 \cdot 37$ | 18.8 | 2.46 | 31.6 | 3.92 | 44.4 | 6.21 | $57 \cdot 2$ | 10.99 | $70 \cdot 0$ | $32 \cdot 6$ | 83.0 |
| -43 | $6 \cdot 2$ | 1.38 | 19.0 | 2.48 | 31.8 | $3 \cdot 94$ | $44 \cdot 6$ | $6 \cdot 25$ | $57 \cdot 4$ | II•II | $70 \cdot 2$ | $33 \cdot 5$ | $83 \cdot 2$ |
| $\cdot 45$ | $6 \cdot 4$ | 1.40 | 19.2 | $2 \cdot 50$ | $32 \cdot 0$ | 3.97 | $44 \cdot 8$ | $6 \cdot 30$ | 57.6 | 11.23 | $70 \cdot 4$ | $34 \cdot 6$ | 83.4 |
| $\cdot 46$ | $6 \cdot 6$ | 1.41 | 19.4 | $2 \cdot 52$ | $32 \cdot 2$ | $4 \cdot 00$ | $45^{\circ} \mathrm{O}$ | $6 \cdot 35$ | 57.8 | I1.36 | $70 \cdot 6$ | $35 \cdot 7$ | 83.6 |
| $\cdot 48$ | $6 \cdot 8$ | 1.42 | 19.6 | $2 \cdot 54$ | 32.4 | $4 \cdot 03$ | 45.2 | $6 \cdot 40$ | $58 \cdot 0$ | II49 | $70 \cdot 8$ | $36 \cdot 8$ | $83 \cdot 8$ |
| 49 | 7.0 | 1.44 | 19.8 | $2 \cdot 56$ | $32 \cdot 6$ | 4.06 | $45 \cdot 4$ |  | 58.2 | 11.62 | 71.0 | $38 \cdot 1$ | 84.0 |
| $\cdot 50$ | $7 \cdot 2$ | r.46 | 20.0 | $2 \cdot 58$ | $32 \cdot 8$ | 4.08 | $45 \cdot 6$ | $6 \cdot 50$ | 58.4 | 1 rr 75 | $71 \cdot 2$ | 39.4 | 84.2 |
| $\cdot 52$ | $7 \cdot 4$ | 1.47 | $20 \cdot 2$ | $2 \cdot 60$ | $33 \cdot 0$ | $4 \cdot 11$ | $45 \cdot 8$ | $6 \cdot 55$ | $58 \cdot 6$ | Ir 89 | 71.4 | $40 \cdot 8$ | 84.4 |
| $\cdot 53$ | $7 \cdot 6$ | I. 49 | 20.4 | $2 \cdot 62$ | $33 \cdot 2$ | ${ }^{4 \cdot 14}$ | $46 \cdot 0$ | 6.60 | 58.8 | 12.02 | 71.6 | $42 \cdot 3$ | 84.6 |
| -55 | $7 \cdot 8$ | $1 \cdot 50$ | $20 \cdot 6$ | $2 \cdot 64$ | 33.4 | $4 \cdot 17$ | $46 \cdot 2$ | $6 \cdot 66$ | 59.0 | 12.17 | $7 \mathrm{~F} \cdot 8$ | $43 \cdot 9$ | 84.8 |
| $\cdot 56$ | $8 \cdot 0$ | $1 \cdot 52$ | 20.8 | 2.66 | $33 \cdot 6$ | 4.20 | $46 \cdot 4$ | $6 \cdot 71$ | 59.2 | 12.31 | $72 \cdot 0$ | 45.7 | 85.0 |
| - 58 | $8 \cdot 2$ | I-54 | 21.0 | $2 \cdot 68$ | 33.8 | 4.23 | $46 \cdot 6$ | $6 \cdot 76$ | 59.4 | 12.46 | $72 \cdot 2$ | $47 \cdot 6$ | 85.2 |
| $\cdot 59$ | 8.4 | I. 55 | 21.2 | 2.70 | $34^{\circ} \mathrm{O}$ | $4 \cdot 26$ | $46 \cdot 8$ | $6 \cdot 82$ | 59.6 | 12.61 | 72.4 | 49.7 | 85.4 |
| . 60 | $8 \cdot 6$ | $1 \cdot 57$ | 21.4 | $2 \cdot 72$ | 34.2 | $4 \cdot 29$ | 47.0 | 6.87 | 59.8 | 12.76 | $72 \cdot 6$ | 52.0 | $85 \cdot 6$ |
| -62 | $8 \cdot 8$ | 1.58 | 21.6 | $2 \cdot 74$ | 34.4 | $4 \cdot 32$ | $47 \cdot 2$ | $6 \cdot 93$ | $60 \cdot 0$ | 12.92 | 72.8 | 54.5 | $85 \cdot 8$ |
| .63 | $9 \cdot 0$ | I. 60 | 21.8 | $2 \cdot 76$ | $34 \cdot 6$ | 4.35 | $47 \cdot 4$ | $6 \cdot 98$ | 60.2 | 13.08 | $73^{\circ} 0$ | 57.2 | $86 \cdot 0$ |
| $\cdot 65$ | $9 \cdot 2$ | 1.62 | 22.0 | $2 \cdot 78$ | $34 \cdot 8$ | $4 \cdot 38$ | $47 \cdot 6$ | 7.04 | 60.4 | 13.25 | $73 \cdot 2$ | $60 \cdot 2$ | $86 \cdot 2$ |
| -66 | $9 \cdot 4$ | 1. 63 | $22 \cdot 2$ | 2.80 | 35.0 | $4 \cdot 41$ | 47.8 | $7 \cdot 10$ | $60 \cdot 6$ | 13.42 | 73.4 | $63 \cdot 6$ | 86.4 |
| $\cdot 68$ | $9 \cdot 6$ | 1.65 | 22.4 | 2.82 | $35 \cdot 2$ | $4 \cdot 44$ | 48.0 | $7 \cdot 16$ | $60 \cdot 8$ | 13.59 | $73 \cdot 6$ | $67 \cdot 3$ | $86 \cdot 6$ |
| $\cdot 69$ | $9 \cdot 8$ | 1.66 | $22 \cdot 6$ | $2 \cdot 84$ | 35.4 | 4.47 | $48 \cdot 2$ | 7.22 | $6 \mathrm{I} \cdot 0$ | 13.77 | 73.8 | 71.5 | 86.8 |
| $\cdot 70$ | $10 \cdot 0$ | 1-68 | 22.8 | 2.86 | $35 \cdot 6$ | $4 \cdot 50$ | 48.4 | $7 \cdot 28$ | $6 \mathrm{x} \cdot 2$ | 13.95 | 74.0 | $76 \cdot 3$ | 87.0 |
| $\cdot 72$ | $10 \cdot 2$ | - 70 | 23.0 | 2.88 | $35 \cdot 8$ | $4 \cdot 54$ | $48 \cdot 6$ | $7 \cdot 34$ | 61.4 | 14.14 | $74 \cdot 2$ | $8 \mathrm{I} \cdot 8$ | 87.2 |
| $\cdot 73$ | 10.4 | 1.71 | 23.2 | 2.91 | $36 \cdot 0$ | 4.57 | 48.8 | $7 \cdot 40$ | $6 \mathrm{I} \cdot 6$ | 14.33 | 74.4 | 88.1 | 87.4 |
| $\cdot 75$ | $10 \cdot 6$ | 1.73 | 23.4 | $2 \cdot 93$ | $36 \cdot 2$ | $4 \cdot 60$ | $49^{\circ} \mathrm{O}$ | $7 \cdot 46$ | $6 \mathrm{I} \cdot 8$ | 14.52 | 74.6 | $95 \cdot 4$ | 87.6 |
| $\cdot 76$ | 10.8 | 1-75 | $23 \cdot 6$ | $2 \cdot 95$ | $36 \cdot 4$ | $4 \cdot 63$ | $49 \cdot$ | $7 \cdot 52$ | 62. | 14.72 | $74 \cdot 8$ | 104 | $87 \cdot 8$ |
| $\cdot 78$ | $1{ }^{\circ} \mathrm{O}$ | I.76 | 23.8 | $2 \cdot 97$ | $36 \cdot 6$ | 4.67 | $49 \cdot 4$ | $7 \cdot 59$ | 62.2 | 14.93 | 75.0 | 114 | 88.0 |
| $\cdot 79$ | $11 \cdot 2$ | 1.78 | $24^{\circ} \mathrm{O}$ | $2 \cdot 99$ | 36.8 | $4 \cdot 70$ | $49 \cdot 6$ | $7 \cdot 65$ | 62.4 | 15.14 | $75 \cdot 2$ | 127 | 88.2 |
| -81 | 11.4 | I. 80 | 24.2 | 3.01 | $37 \cdot 0$ | $4 \cdot 73$ | $49 \cdot 8$ | 7.72 | $62 \cdot 6$ | 15.36 | 75.4 | 143 | 88.4 |
| $\cdot 82$ | II.6 | I.81 | 24.4 | 3.04 | $37 \cdot 2$ | $4 \cdot 77$ | $50 \cdot 0$ | $7 \cdot 78$ | $62 \cdot 8$ | 15.58 | $75 \cdot 6$ | 163 | $88 \cdot 6$ |
| -84 | II.8 | I.83 | 24.6 | 3.06 | 37.4 | 4.80 | $50 \cdot 2$ | $7 \cdot 85$ | 63.0 | 15.81 | $75 \cdot 8$ | 190 | $88 \cdot 8$ |
| . 85 | 12.0 | I. 85 | 24.8 | 3.08 | $37 \cdot 6$ | 4.83 | $50 \cdot 4$ | $7 \cdot 92$ | 63.2 | 16.04 | $76 \cdot 0$ | 229 | $89^{\circ} \mathrm{O}$ |
| . 86 | 12.2 | r.86 | 25.0 | $3 \cdot 10$ | 37.8 | 4.87 | $50 \cdot 6$ | $7 \cdot 99$ | 63.4 | 16.28 | $76 \cdot 2$ | 286 | $89 \cdot 2$ |
| . 88 | 12.4 | 1.88 | $25 \cdot 2$ | $3 \cdot 12$ | 38.0 | 4.90 | $50 \cdot 8$ | 8.06 8.15 | 63.6 63.8 | 16.53 | 76.4 76.6 | 382 573 | 89.4 80.6 |
| -89 | 12.6 12.8 | 1.90 1.02 | 25.4 25.6 | 3.15 3.17 | $38 \cdot 2$ $38 \cdot 4$ | 4.94 | ${ }_{51}^{51.0}$ | 8.13 8.20 | $63 \cdot 8$ 64.0 | 16.79 1 7.05 | 76.6 76.8 |  |  |
| -91 | 12.8 | 1•92 | 25.6 | 3.17 | 38.4 | $4 \cdot 97$ | 51.2 | $8 \cdot 20$ | $64^{\circ}$ | 17.05 | $76 \cdot 8$ | 1146 | 89.8 |

It must be borne in mind that Table VJ. does not give the true geographical lines of position, but lines of position which will give the same result as to latitude and longitude on a plane chart as the true lines of position would give on a Mercator chart.

This table has been published on account of the difficulty often experienced in getting a suitable scale Mercator chart for plotting Sumner positions, as the ocean charts are usually on too small a scale, and, moreover, it saves the trouble of getting out an ordinary chart.

Plane Sumner charts can naturally be published at a much cheaper price, as one chart does for all latitudes; or the position may be plotted on paper with squared lines ruled on it. If neither of these are at hand, the Sumner position may be plotted in the work book by drawing a horizontal line representing the D. R. latitude at time of second observation, and a line at right angles to this as a meridian of longitude, which may be used for laying off the position-lines by a protractor.

On the horizontal line set off the points of two longitudes at a distance from one another of say 1 min . to $10^{\prime}$ of longitude. From these two points lay off the Sumner lines, and from the point where they intersect draw a perpendicular to the parallel of D.R. latitude ; the longitude at the point struck by the perpendicular is the longitude required, and can be measured from either of the points of longitude.

With ex-meridian latitudes the position-lines would of course be set off from the meridian, from the starting-points of the latitudes by the observations.

Special Caution.-When double altitudes are taken with a run interval between the sights the traverse table should be employed to bring both observations up to the same instant of time, as the true course plotted on the plane chart would not give a correct result. If the course is plotted it must be altered in the same way as shown below for the position-lines. A small 6 -inch boxwood protractor rule with a diagonal scale of inches for measuring to $\frac{1}{100}$ part of an inch may be bought for about is., and is the only instrument which will be required.

The examples on accompanying chartlet below will show how a plane chart may be used, and illustrates clearly how both the Mercator and plane charts may be made to give the same final position from position. line plottings.

The upper longitude scale with the meridian scale represents a Mercator chart in latitude $60^{\circ} \mathrm{N}$., where $I^{\prime}$ of latitude would equal $2^{\prime}$ of longitude, and the lower longitude scale represents with the same meridian scale of latitude a plane Sumner chart, where the scales of latitude and longitude are equal, as on the Equator.

Two positions are plotted, one from a parallel of latitude starting from latitude $59^{\circ} 55^{\prime} \mathrm{N}$. and longitudes $10^{\circ} 0^{\prime} \mathrm{W}$. and $10^{\circ} 20^{\prime} \mathrm{W}$. with true position-lines $\mathrm{N} .26^{\circ} \mathrm{W}$. and N . $26^{\circ} \mathrm{E}$., and the other from a meridian starting from longitude $10^{\circ} 0^{\prime} \mathrm{W}$. and latitudes $59^{\circ} 55^{\prime} \mathrm{N}$. and $60^{\circ} 5^{\prime} \mathrm{N}$. with true position-lines $\mathrm{N} .45^{\circ} \mathrm{E}$. and $\mathrm{S} .45^{\circ} \mathrm{E}$.

First observation star's bearing N. $64^{\circ}$ E., position-line N. $26^{\circ}$ W., in latitude $60^{\circ}$ gives (p. 264, Table IV.) lat. var. $3^{3.90}$, which gives (p. 270, Table VI.), position-line for plane chart N. $44 \frac{1}{}^{\circ} \mathrm{W}$., and for the second position-line in same way $\mathrm{N}_{.} 444^{1^{\circ}} \mathrm{E}$.

For second position star's bearing N. $45^{\circ} \mathrm{W}$. and S. $45^{\circ} \mathrm{W}$. gives (p.265) lat. var. $8 \mathrm{~s} \cdot \mathrm{oo}$, which gives (p. 270) position-lines for plane chart N. $63^{\circ} \cdot 4 \mathrm{E}$. and S. $63^{\circ} \cdot 4 \mathrm{E}$.

Upper longitudes represent scale on a Mercator Chart. Position-lines on Mercator Chart represented by continuous lines.


Lower longitudes represent scale on a Plane Chart. Position-lines on Plane Chart represented by dotted lines.
Note.-Without the aid of this table the Sumner position from simultaneous observations of two stars, or from two sun observations (if the course and true interval is applied from the traverse table), will always give the same latitude when taken from a plane as from a Mercator chart, and the correct longitude will be found by converting the departure into d. long.

In the example above in latitude $60^{\circ}$, $10^{\prime}$ dep. gives $20^{\prime}$ d. long.

## 272 TABLE VII.-HOUR-ANGLE LIMITS FOR EX-MERIDIAN TABLE VIII.

the table shows the limits within which the reduction at 1 Min., as given IN TABLE VIII., WHEN MULTIPLIED BY THE NUMBER OF MINUTES IN TABLE BELOW, WILL NOT GIVE A GREATER ERROR IN REDUCTION THAN $01_{2}^{\prime}$.


| INFERIOR TRANSIT. |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DECLINATION. |  |  |  |  |  |  |  |  |  |  |  |
|  | Lat. | $25^{\circ}$ | $30^{\circ}$ | $35^{\circ}$ |  | 45 | $50^{\circ}$ | $55^{\circ}$ | $60^{\circ}$ | $65^{\circ}$ | $70^{\circ}$ |
|  |  | m. | м. | м. | м. | $\stackrel{ }{\text { m. }}$ | м. | $\stackrel{\text { m. }}{ }$ | ${ }^{\text {m. }}$ | $\cdots$. | g |
| $g$ Signifies that true reduction is greater | 32 |  | $\because$ | $\because$ |  | $\cdots$ |  |  |  | 94 g | ${ }^{87 \mathrm{~g}} \mathrm{~g}$ |
| than tabular reduction ${ }^{\text {dion }}$ | 35 |  |  |  | . | $\cdots$ |  | I20 | 110 g | $100{ }^{10}$ | 92 g |
| $l$ Signifies that true reduction is less | 45 |  | $\because$ | $\because$ | .. |  |  | 1201 1001 | 140 ${ }_{140}^{101}$ | 118 g <br> 138 | 100 g 104 |
| $r$ Signifies that there will be no error in | 5 | $\because$ | $\cdots$ | .. |  | 741 |  |  | 1041 | 1561 | 140 g |
| the reduction within the limits given greater than $0^{\prime}$ |  | $\cdots$ |  |  |  | 741 | 801 | 821 801 | 881 | $\xrightarrow{1121} 1$ | ${ }_{1261}^{210 \mathrm{~g}}$ |
|  |  | 641 | $\ddot{661}$ |  |  | 1721 | $\mid 741$ | 801 | $8_{81}^{861}$ | 1001 891 | 1201 |


| LATITUDE AND DECLINATION OF CONTRARY NAME |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | DECLINATION. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $0^{\circ}$ | $2{ }^{\circ}$ | $4^{\circ}$ | $6^{\circ}$ | $8^{\circ}$ | $10^{\circ}$ | $15^{\circ}$ | $20^{\circ}$ | $25^{\circ}$ | $30^{\circ}$ | $35^{\circ}$ | $40^{\circ}$ | $45^{\circ}$ | $50^{\circ}$ | $60^{\circ}$ | 70 |
|  | m. |  |  |  |  |  |  |  |  |  |  |  |  |  | m. |  |
| $\stackrel{1}{1}$ | 7 n | 20 n | 34 g | 45 g | 43 g | 42 g | 43 g | 45 g | 47 g | 49 g | ${ }_{52}{ }^{\text {g }}$ | 53 g | 56 g | 58 g | 63 g | ${ }_{71} 78$ |
| 2 | 14 n | 26 n | ${ }_{451}^{408}$ | ¢ $\begin{aligned} & 51 \mathrm{~g} \\ & 62\end{aligned}$ | 508g | ${ }_{55}^{44 \mathrm{~g}}$ | 45g | ${ }^{46 \mathrm{~g}}$ | ${ }_{51}^{48 \mathrm{~g}}$ | 50 g | 54. | ${ }^{55 \mathrm{~g}}$ | ${ }_{58}^{56 \mathrm{~g}}$ | ${ }^{58 \mathrm{~g}}$ | ${ }_{63}^{63 \mathrm{~g}}$ | ${ }_{70 \mathrm{~g}}^{71 \mathrm{~g}}$ |
| 4 | 271 | 361 | 471 | 561 | 82 n | 66 g | 56 g | 55 g | 56 g | ${ }_{57}{ }^{5}$ | ${ }_{58}{ }^{\text {g }}$ | $5_{58}$ | 58 g | 6r ${ }^{\text {g }}$ | 64 g | 70 g |
| 6 | 301 | 371 | 391 | 451 | 581 | 701 | 74 g | 60 g | 60 g | 57 g | 57 g | 58 g | 60 g | 62 g | 678 | 70 g |
| 8 | 311 | 361 | 401 | 451 | 521 | 591 | riol | 70 g | 66 g | 66 g | 66 g | 62 g | 63 g | 64 g | 68 g | 72 g |
| 10 | 331 | 361 | 401 |  | 481 | 521 | 721 | 110 g | 74 g | 7 g | 68 g | 66 g | 67 g | 67 g | 70 | 73 g |
| 12 | 331 | 361 | 401 | 431 | 461 | 501 481 | 631 | 901 | 900 |  | 748 | 72 g | 70 g | 70 g | 70 g | 74 g |
| 15 20 | 341 351 | ${ }_{381} 361$ | 401 | ${ }_{421}^{401}$ | ${ }_{451}^{451}$ | 461 | 551 501 | ${ }_{561}^{681}$ | 681 | 1028 691 | 80 g | 77 g 106 g | 782 g | ${ }^{72 \mathrm{~g}}$ | 79 |  |
| 25 |  | 401 | 421 |  | 461 |  |  |  |  |  |  |  |  |  |  |  |
| 30 | 401 | 421 | 441 | 451 | 461 | 491 | 51 | 561 | 621 | 661 | 781 | 861 | ro9 | 146 g |  |  |
| 35 | 421 | 44 | 451 | 461 | 481 | 501 | 521 | 571 | 601 | 661 | 701 | 801 | ${ }_{901}$ | 1151 |  |  |
| 45 | 441 | 451 | 471 | 481 | 491 | $5{ }_{51}$ | 531 | 581 | 601 | 641 | 781 | 751 | 801 |  |  |  |
| 45 | 461 | 481 | 481 | 501 | 501 | 521 | 541 | 581 | 60 | 631 | 681 | 701 |  |  |  |  |
| 50 | 481 | 491 | 501 | 511 | 521 |  |  |  | 601 | 631 | 671 |  |  | $\cdots$ |  |  |
| 55 60 | 501 521 | 541 | ${ }_{511}^{551}$ | 531 551 | 541 561 | 541 561 | 561 571 | 581 581 | 601 | $6_{3} 1$ |  | $\because$ | $\cdots$ | $\because$ |  |  |
| 70 | 571 | ${ }_{6} 1$ | $6{ }^{6} 1$ | 601 | 581 | 621 | ${ }_{631}$ |  |  |  |  |  |  |  |  |  |

SHOWING THE REDUCTION AT 1 mIN . FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $1^{\circ}$ | $1^{\circ} \cdot 5$ | $2^{\circ} 0$ | $2^{\circ} 4$ | $2{ }^{\circ} 8$ | $3^{\circ} \cdot$ | $3^{\circ} \cdot 2$ | $3^{\circ}$ | $3^{\circ} \cdot 6$ | $3^{\circ} 8$ | $4^{\circ} 0$ | $4^{\circ}$ | $4^{\circ} \cdot 4$ | $4^{\circ}$. | $4^{\circ} \mathrm{P}$ | $5^{\circ} .0$ |
| REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| : | -131 | -196 | - 262 | 314 | -367 | 393 | 419 | 445 | -471 | -498 | - 524 | . 550 | -576 | O2 | . 629 | 655 |
|  | -131 | -196 | -261 | -313 | - 366 |  | .418 | 444 | - 470 | -496 | - 522 | 549 | - 575 | Or | -627 | . 653 |
| 8 | -130 | -194 | -259 |  | -363 | -388 | -415 | -441 | -467 | -493 | - 510 | 545 | - 571 | - 597 | -622 | - 649 |
| 10 | - 129 | -193 | - 258 | -309 | - 361 | -387 | -413 | -438 | -464 | -490 |  | 542 | - 46 | -593 | 19 | 5 |
| 12 | -128 | -192 | -256 | -307 | - 359 | - 384 | -410 | - 435 | -461 | -487 | -512 | 538 | -464 | -589 | -615 | . 641 |
| 14 | - | -190 | - 254 | - 305 | -356 | -381 | -406 | -432 | -457 | -483 | - 508 | 534 | 559 | 85 | 610 | 36 |
| 16 | -126 | -189 | - 252 | -302 |  |  | -403 |  | -453 |  | 04 |  | 548 | -579 |  |  |
| 181819 | -125 | . 188 | -249 | $\stackrel{297}{297}$ | - 344 | - $\begin{array}{r}\text { - } 374 \\ -371\end{array}$ | -396 | . 423 | -446 | 473 | -499 | -520 | - 545 | - 570 | 594 | -623 |
| 20 | -123 | -184 | -246 | -295 | - 344 | - 369 | -394 | -418 | - 443 | -468 | -492 | -517 | -541 | 66 | 591 | 6 |
| 21 | . 122 | - 183 |  | 293 |  | -367 | 391 | 416 | 440 | -465 | 489 | 513 | -538 | - 562 | 87 | 12 |
| 22 | -121 | -18181 | - 243 | -291 |  | - 364 | $\cdot 388$ | -413 | - 437 | -469 |  | -510 | - 534 | - 559 | - 583 | 07 |
| 23 | -12 | -181 | -241 | -289 | 337 | -362 | -386 | - 410 | -434 | -458 | -482 | - 506 | 530 | - 555 | - 579 | 02 |
| 24 | -120 | -179 | - 239 | -287 | - 335 | -359 | $\cdot 383$ | 407 | -431 | -455 | -479 | - 502 | 526 | 50 | . 574 | ${ }_{5} 59$ |
| 25 | -119 | -178 | -237 | -285 | -332 | -356 | $\cdot 380$ | 403 | -427 | -451 | -475 | 498 | 522 | - 546 | - 570 | 593 |
| 26 | -118 | 176 | -235 | -28 | -3 | 353 | 377 | 400 | -424 | 447 | 471 | -494 | . 518 | - 541 | . 565 | 588 |
| 27 | $\cdots$ | -175 | $\stackrel{233}{ } \cdot 231$ | 280 | -327 | 350 | -373 | 397 | -420 | $\cdot_{-433} \cdot 4$ | ${ }_{462}^{467}$ | -490 | -513 | . 537 | -560 | - 88 |
| 28 29 | -116 | -173 | 231 $\cdot 229$ | 277 | -321 | 347 | -370 | - 38 | 412 | ${ }_{-435}^{439}$ | 458 | -481 | -509 | - 527 | 550 | 578 573 |
| 30 | -113 | - 170 | 22 | 272 | -317 | 340 | 363 | - 388 | 408 | ${ }_{-431}$ | 454 | -476 | -499 | - 522 | 544 | 567 |
| 31 | 11 | -168 | 22 | -269 | -314 | 337 | 359 | 382 |  | 427 | 449 | 71 | 94 | - 516 | 539 | 561 |
| 32 | 11 | - 166 | -222 | 26 | -311 | 333 | 355 | -378 | 400 | 22 |  | 466 |  | 11 | 533 | 55 |
| 33 | $\cdot 11$ | -165 |  | -263 | - 307 | 329 | -351 | -373 | 395 | 417 |  | 461 | $\stackrel{483}{\cdot 478}$ | - 505 | 521 |  |
| 34 <br> 35 | -108 | -163 | $\xrightarrow{217}$ | -257 | - 304 | -322 | $\stackrel{347}{ } \cdot 3$ | - 36 | -391 | $\stackrel{412}{408}$ | -434 | 45 | 472 | ${ }_{-493}$ | 515 | + |
| 36 | -106 | 159 | . 212 | . 254 | - 29 | - 318 | 339 | $\cdot 360$ | -38r |  | -424 | 445 | 466 | 487 | 508 |  |
| 37 | - 104 | -157 | -209 | $\cdot 251$ |  | 314 | -335 | - 356 | $\cdot 376$ | - 397 | -418 | 439 | -460 | -480 | -502 |  |
| 38 | -10 | -155 | -206 | -247 | $\stackrel{289}{-285}$ | 310 | -330 | -351 | -371 | -392 | - 413 | 433 | -454 | -475 | -495 | 516 |
| 39 | -102 | -152 | -203 | 244 | $\stackrel{285}{\square}$ | 305 | ${ }_{-}^{-326}$ | -346 | -366 | -387 | - | 427 | 448 | -468 | -482 | ( 509 |
| 40 | 100 | -150 | -200 | 241 | -281 | 301 | 321 | 341 | 361 | 381 | 401 | 42 I | 441 | -461 |  | 502 |
| 4 I | -0, | - 148 | -198 | 237 | -277 | -296 | -316 | 337 | 356 | -376 | - 395 | 415 | . 4328 | -455 | 474 |  |
| 42 | -090000 | - | -195 | 230 | $\xrightarrow{-272}$ | -292 | -317 | 331 | 345 | $\stackrel{.370}{.364}$ | -389 | 402 | ${ }_{4} 42 \mathrm{~L}$ | ${ }_{-441}^{448}$ | -467 | 9 |
| 43 44 | -99 | ${ }_{-141}$ | -188 | ${ }_{226}$ | . 264 | -283 | -301 | . 320 | 339 | - 354 | . 377 | 396 | -414 | 433 | 452 | 47 x |
| 45 | -092 | -139 | . 185 | 222 | -259 | -27 | 296 | 315 | 333 | -352 | -37 | 389 | -407 | 426 | -444 |  |
| 46 | -091 | -136 | -182 | -218 | 255 | - | 291 | 309 | 327 | - 346 | - 364 | 382 | 400 | 418 | 437 | 455 |
| 47 |  | $\cdot \mathrm{r}$ | -179 | -214 | 250 | -26 | ${ }_{2}^{286}$ | -208 | 15 | . 33 | -35 | 368 | 386 | 403 | ${ }_{4}^{429}$ | 迷8 |
| ${ }_{49}^{48}$ | -086 | -12 | ${ }_{-172}^{175}$ | . 20 | $\stackrel{245}{240}$ | ${ }_{-258}^{263}$ | ${ }^{2} 275$ |  |  | -326 | -344 | 361 | -388 | -395 | ${ }_{-42}^{421}$ | 430 |
| 50 | -084 | 12 | -168 | . 202 | -236 | -252 | . 269 | -286 | -303 | - 320 | - 337 | 353 | 370 | 387 | -404 | 42I |
| 51 | -082 | - 1 | - 16 | -198 | -231 | - 247 | 264 | 280 | 297 |  | \% | 346 | 363 | . 379 | 96 | 412 |
| 52 | $\bigcirc$ | -121 | -161 | -193 | 6 | -242 | -258 | -274 | -290 | -306 | -322 | 3339 | 355 | 371 | -387 | 403 |
| 53 54 | $\stackrel{0}{-07}$ |  | $\stackrel{158}{\cdot 154}$ | -189 | $\stackrel{221}{215}$ | $\stackrel{236}{231}$ | ${ }^{2} 242$ | $\stackrel{268}{ }{ }_{262}$ | -284 | -299 | -315 | 331 | 347 339 | 362 | -378 | 334 |
| 55 | -075 | -113 | - 150 | 180 | -210 | -225 | . 240 | -255 | 270 | -285 | - 300 | 5 | 330 | 34 | 360 | 江 |
| 56 | .07 | -110 | -146 | 176 | - 205 | . 220 | . 234 | 249 | -26 | -278 | - 293 | 307 | 322 | 337 | 51 | 366 |
| 57 | -071 | - 107 | -143 | 171 | - 200 | -214 | . 228 | . 242 | 257 | -271 | -285 | 300 | 314 | . 328 | 342 | 357 |
| 58 | -06 | -1 | $\stackrel{139}{\cdot 135}$ | -166 | -194 |  | . 222 | -236 | -250 | $\xrightarrow{264}$ |  | -292 | 95 | 319 |  | 3347 |
| 69 | $\stackrel{.067}{.065}$ | -1018 | $\stackrel{1}{\cdot 135}$ | -157 | -189 | - 196 | -210 | . 223 | . 236 | -249 | . 262 | -275 | -288 | 301 | 314 | -37 |
| 6 I | . 063 |  | - 127 | -152 | -178 | 190 | - 203 | 216 | 228 | 241 | 54 | 267 | 279 |  | 305 | 318 |
| 62 | -06 | -092 | - 123 | - 14 | -172 | 184 | -197 | -209 | 22 L | - 234 | -246 | 258 | . 270 | -283 | 295 | 30 |
| 63 | -05 | -089 | -119 | 142 | - 166 | -178 | - 190 | - 202 | 214 | - 226 | -238 | 25 | -262 | -274 | 285 | 297 |
| 64 | -057 | . 086 | -115 | - 138 | -161 | -172 | -184 | - 198 | -207 | -218 | -230 | 24 | 253 | -264 | -276 | -287 |
| 65 | -055 | . 083 | -III | 133 | 155 | -166 | -177 | - 188 | -19 | 21 | . 221 | 23 | . 243 | -255 | -26 | -27 |
| 66 | -05 | -080 | - | 128 | 149 | 160 | - 170 | 18 r |  | 202 | -213 | 224 | 234 | 24 | 256 | 266 |
| 67 | -05 | -077 | $\cdot 1$ | -123 | - 143 | -154 | - 164 | -174 | -184 | -194 | . 205 | 5 | -225 | -235 | -246 | 256 |
| 68 | -04 | -074 | -098 |  | , | ${ }_{-141}$ | 157 150 | ${ }_{-160}$ | -169 | -178 | . 188 |  | -206 |  | 236 | ${ }_{235}^{245}$ |
| 70 | -0 | . 067 | -090 | - 107 | - 125 | 34 | 143 | -152 | '161 | O | 9 | 88 | 197 | 6 | 5 | -224 |

# SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN. 

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $5^{\circ} 2$ | $5^{\circ}$ | $5^{\circ} .6$ | $5^{\circ} 8$ | $8^{\circ} .0$ | $6^{\circ} \cdot 2$ | $6^{\circ}$. | $6^{\circ} \cdot 6$ | $8^{\circ} 8$ | $7{ }^{\circ}$ | $7{ }^{0} \cdot 2$ | 70. 4 | 70. 8 | $7^{\circ}$ | $8^{\circ}$ | $8^{\circ} .2$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF 1 MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| : | .681 | $\cdot 70$ | . 73 | $\cdot 760$ | 786 | .812 | . 839 | - 865 | . 891 | . 917 |  |  | 996 | 1.023 | . 049 | I.075 |
| 4 | 681 | -705 | - 732 | ${ }^{-758}$ | . 784 |  | -837 | -863 | .881 | .915 | -942 | 8 | -994 | ${ }_{\text {r }}$ | 1.046 | 1.072 |
| 8 | -69 |  | ${ }^{727}$ | $\cdot 753$ | -778 |  | - 83 | - 85 |  | - | -935 | 51 | -986 |  |  |  |
| 10 | -671 | -696 | - 723 | -749 | -774 |  | -825 | -852 | -877 | . 8903 | $\cdot{ }^{-933}$ | -945 | :981 |  | $\mathrm{r} \cdot 033$ <br> $\mathrm{r} \cdot 026$ | 1.052 |
| 12 | -66 | -692 | $\cdot 717$ | . 744 | -769 | -794 | - 820 | . 846 | . 872 | . 897 | -923 | . 949 | -974 | I•000 |  | $1 \cdot 052$ |
| 14 | -6 | . 686 | . 711 | -738 | . 763 | -788 | .813 | . 839 | - 865 | - 890 | -916 | -94I | -967 | -993 | 8 | 1.043 |
| ${ }^{16}$ | - 6 | - 6 | $\cdot 7$ | -730 |  | -781 | - 806 | . 832 | . 857 | . 882 |  | -932 |  | ${ }^{82}$ |  |  |
| 18 | -648 | -673 | -697 | -722 | -748 | -772 | -797 | -823 | -847 | -872 | -897 | -923 | -948 | . 972 | -998 | r.023 |
| 19 | -644 | $\stackrel{.669}{-665}$ | -693 | ${ }^{\text {-718 }}$ | 734 | -768 | -793 | -818 | -8 8 | -868 | -882 | $\stackrel{9}{\cdot 917}$ | . 9436 | -960 | . 9885 |  |
| 21 | - 6 | -661 |  | . 709 |  | 758 |  | - 808 | , | . 857 | .88I | 906 |  |  |  |  |
| 22 | . 631 | - 656 |  | - 704 | $\cdot 729$ | 753 | -778 | -802 | . 826 | .851 | . 875 | 99 | -924 | 948 | 72 | 997 |
| 23 | -627 | -651 | -675 | - 6 | $\cdot 724$ |  | 72 | -797 | . 820 | -845 |  | -893 | 17 |  | - 965 |  |
| $\begin{aligned} & 24 \\ & 25 \end{aligned}$ | $\stackrel{622}{ } \cdot 617$ | -646 | -670 | -694 | -719 | -742 | -766 | . 783 | . 808 | -838 | . 855 | . 886 | $\stackrel{9}{970}$ | -926 | -958 | 82 |
| 26 | . 6 | -636 | - 659 | . 683 | $\cdot 7$ |  | $\cdot 754$ | -777 | -801 | 25 | - 848 | 72 | 96 | 19 | 43 | 67 |
| 27 | -60\% | . 630 | - 653 | - 677 | -700 | -724 | $\cdot 748$ | -770 | - 794 | -818 | -841 | -864 | - 888 | II | 35 | 88 |
| 28 | -601 | -624 | -64 | -6 | -694 | 71 | $\cdot 741$ | -76 | -787 |  | . 833 |  |  | - |  |  |
| 29 | -596 | -618 | -641 | -65 | -687 |  | ${ }^{-734}$ | -756 | :779 | 94 | -81 | -848 | -872 | . 8885 | -918 | I |
| 30 | - 590 | -612 |  | - 6 |  | $\cdot 70$ |  | - 749 | -772 | 94 |  |  |  |  |  |  |
| 31 | - 5 | -60 | - 629 | $\cdot 6$ |  | - 696 | -788 | $\cdot 741$ | 64 | -786 | -809 | -831 | - 854 | 76 |  | 922 |
| 32 | - 5 | -60 | -622 | -6 |  |  | $\cdot 7$ | -733 | . 756 | -778 | - 8 |  |  |  |  | 9II |
| 33 | - 578 | -593 | -615 | $\cdot 6$ | -659 |  | $\cdot 7$ |  | $\begin{array}{r}747 \\ \hdashline 739\end{array}$ | 969 | -791 | 814 <br> 804 | -835 | 87 | . 869 | . 8091 |
| 35 | - 565 | - 5879 | -608 | -6 | -652 | -674 | -695 | -717 | $\stackrel{7}{739}$ | $\stackrel{760}{ } \cdot 7$ | .782 $\cdot 773$ | - 795 | -826 | . 838 | . 859 | . 880 |
| 36 | 551 | $\cdot 5$ |  |  | 6 | . 657 | -678 |  | 721 | 42 | . 763 | 785 | 䉼 | . 827 | 8 | 70 |
| 37 | 544 | - 565 | -586 | -607 | . 628 | -649 | - 670 | -691 | 712 | $\cdot 733$ | . 754 | 775 | -796 | - | 838 | 859 |
| 38 | . 537 | -558 | . 578 | - 599 | -620 | -640 | $\stackrel{661}{ }$ | -682 | . 702 | -723 | ${ }^{7} 74$ | 764 | $\cdot 785$ | - 806 | 827 | 47 |
| 39 | 5 | 550 | - 5 | - 5 | . 603 | -631 | $\stackrel{6}{\cdot 6}$ | -672 | -693 | . 7123 | -734 | 7.754 | -774 | .795 | .815 |  |
| 40 | 52 | 542 | . 562 |  | 60 | -62 |  |  |  | 703 | -723 | 743 | 3 |  |  |  |
| 41 | 51 |  | - 554 |  |  | 613 | .632 | -653 | -673 | 3 | 12 | $\cdot 732$ | 52 | 72 | 922 |  |
| 4 | 49 | -525 | - 545 | - 5 | 5 | -604 | $\stackrel{+623}{-613}$ | -643 | -662 | -682 | .702 -690 |  |  | -760 | . 7868 | 87 |
| 44 | 490 | 50 | -528 | - 547 | - 565 | - 585 | . 603 | . 623 | . 641 | . 660 | - 679 |  | -717 | . 736 | . 754 | 774 |
| 45 | -482 | -500 | -519 | - 537 | - 556 | - 575 | - 593 | -61 | -630 | -648 | - 66 |  | -704 | $\cdot 723$ | - 74 |  |
| 46 |  | 491 | -510 | - 528 |  | 565 | ${ }^{-583}$ | -600 | . 619 | . 63 | - 656 |  | -692 |  | 28 | ${ }^{747}$ |
| 4 | -465 | -482 | 500 | - 518 | . 536 | 554 | - 583 | -590 | - 6 | 26 | -643 | -662 | 78 |  | .715 | -734 |
| 48 | $\cdot 4$ | -473 | ${ }^{-490}$ | $\stackrel{5}{-4}$ | -526 | 4 |  | - 5 | - 597 | 602 | -631 | -649 |  |  | . 688 |  |
| 50 | -438 | 455 | -475 | -488 |  | . 523 | -540 | - 556 | 573 | -59 | -606 | -624 | -640 | . 658 |  | 硅 |
| 51 | 429 | 446 | -46I | -478 | -495 | 5 II | . 527 | - 544 | 561 | - 578 | - 594 | -610 | -627 | . 644 | . 660 | 676 |
| 52 | -420 | 435 | -451 | -468 | -484 | 500 <br> 488 <br> 8 | - 5 | 2 | 497 | - 565 | -581 | . 584 | 4 |  | -645 | -662 |
| 53 <br> 54 | -410 |  | ${ }_{-4}^{4}$ |  | -473 | -488 |  | . 521 |  | 532 | -568 | . 584 | . 588 | . 602 | -631 | ${ }^{6} 632$ |
| 55 | -391 | -406 | -421 | -436 | -451 | . 466 | - | -496 | -511 | 526 | -541 | - 556 | - 572 | - 586 | -602 | ${ }^{6}$ |
| 56 | -38I | - 3 | 410 | 424 | 439 | 454 | -469 | - 484 | 499 | 513 | - 528 | . 542 | . 558 | 571 | -587 |  |
| 57 | -37 | -3 | -480 | -413 | -428 | 442 | - 45 | -471 | -486 | 50 | 14 | 888 | - 542 | - 55 | . 575 | - 58 |
|  | -351 | -36 | -3 |  |  | 4488 | 44 | -459 |  | 471 | - 500 | 514 |  | 542 | . 55 |  |
| 60 | $\cdot 341$ | - 354 | -367 | -380 | -393 | 406 | -419 | $\cdot 432$ | 444 | 45 | -472 | 485 | -498 | 51 | - 524 |  |
| 61 | , | -342 | - 356 | 369 | -381 |  | - 406 |  | 432 | 44 | -458 | 470 | -48 | -496 | 808 | . 52 |
| 6 | . 32 | -332 | $\cdot 3$ | - 357 | $\cdot 369$ | 381 | - 394 | -406 | -419 | 4 | - 443 | 455 | 468 |  |  | 884 |
| 63 | ${ }^{31}$ | -321 | - 333 | 344 | . 357 | - 369 | -381 | -392 | -405 | 416 | -429 | -440 | 52 | -464 | 76 | -488 |
| 64 65 | -288 | $\cdot 3$ | -322 | -333 | - 345 | . 356 | - 368 | -379 | -391 | 402 | -414 | -425 | -437 | - 443 | $\cdot 460$ | -471 |
|  | 287 | -29 | 3II | -321 | -333 | 343 | - 35 | -365 | - 377 | 38 | - 39 | 410 | -42I | $\cdot 432$ |  |  |
|  |  | - 288 | - 298 | $\cdot 309$ | :319 | 30 | -342 | 352 | -362 | 373 | -384 | 395 | -406 | -416 | $\cdot 427$ | 437 |
| 68 | - 255 | -277 | -286 | $\stackrel{-297}{285}$ | 4 | 317 304 | - 314 | -324 | 3488 | 354 | -368 | . 369 | 389 373 | 400 383 | 9 | 403 |
| 69 | -244 | -254 | -263 | . 273 |  | 291 | - 300 | - 315 | 319 |  | -338 | -348 | 357 | - 367 | 376 | . 385 |
| 70 | -233 | . 242 | -251 | . 260 | 269 | 278 | $\cdot 2$ | 29 | 305 | 314 | - 323 | 332 | 1 | - 350 | 59 | ${ }^{3} 6$ |

SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $8^{\circ} .4$ | $8^{\circ} .6$ | $8^{\circ} 8$ | $9^{\circ} 0$ | $9^{\circ} 2$ | $9^{0} \cdot 4$ | $9^{\circ} 6$ | $9^{\circ} 8$ | $10^{\circ} .0$ | $10^{\circ} 2$ | $10^{\circ} \cdot 4$ | $10^{\circ} 6$ | $10^{\circ} 8$ | $11^{\circ} .0$ | $11^{\circ} 2$ |
| REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| : | 1•102 | 1.128 | 1.154 | r. 80 | $1 \cdot 207$ | 1.233 | I259 | 1.286 | 1.312 | 1.339 | r. 365 | 1.392 | 1.418 | 45 | 475 |
| 4 | 1-099 | 1.125 | $1 \cdot 151$ | 1-177 | T.204 | 1.230 | 1256 | I-283 | 1.309 |  |  | I.389 | I.415 | 441 | 1.467 |
| 8 | ${ }^{1} \cdot 091$ | IT117 | $\stackrel{1}{1} 143$ | 1.169 | I.195 | 1.221 | I. 247 | 1.274 |  | 1.326 1.319 | I.352 | 1.339 1.371 1 | I.404 | 1.431 | 1.457 |
| 10 | I.085 |  | 1.137 | $\underset{\mathrm{r}}{\mathrm{I} \cdot 152}$ | $\xrightarrow{\text { r }} 1 \times 189$ | I-214 | I.240 | r ${ }_{\text {r }} \cdot 2658$ | $\xrightarrow{1.292}$ | I.319 | I.344 | 1-371 | I.397 |  | 1.449 T 439 |
| 14 | r.0 | r.09 | 120 | 1.145 | 1-171 | 1.996 | $1 \cdot 222$ | 1.248 | 1. | 1. | 25 | 50 | 76 |  |  |
| 12 | 1.059 | 1.08 | 1.109 | r 134 | $1 \cdot 160$ | I. 185 | 1211 | $1 \cdot 236$ | 1.2 | $1 \cdot 287$ | I.312 | 1.337 | I•363 | 1.388 | 1-414 |
| 18 | ${ }^{1} \cdot 048$ | ${ }^{1} \cdot{ }^{\circ} 7^{2}$ | r-098 |  | I. 147 | I•r73 | r.198 | 1.223 | 1.248 | $\xrightarrow{1} 274$ | r.298 | 1.323 1.355 1.351 | I.349 | r.374 |  |
| 120 | $\xrightarrow{\text { r}} \times 042$ | $\xrightarrow{\text { r}} \mathrm{r}$-066 069 | $\xrightarrow{\text { r }}$-097 ${ }^{\text {Pr }}$ | I•109 |  | 59 | $\xrightarrow{\text { I } 1918}$ | ${ }_{1}^{12209}$ | 1.241 | 1.258 | 1.281 | 1.315 | 1.332 | r-357 | - |
| 21 | r.0 | I.05 | 1.078 | $1 \cdot$ | $1 \cdot$ | 1.151 | 1.176 | 1.201 | $1 \cdot 225$ | 1.250 | r.275 | 1299 | 1.323 | I. 348 | ז.373 |
| 22 | ${ }_{1}$ | I. 045 | 1.070 | 1. |  | ${ }_{\text {r }}^{1}+143$ | r.168 | r.193 | r217 | I. 241 | I.266 | I.290 | r.314 | r. 3 res | r.364 |
| 23 | İ○ | I.038 | r.063 | 1.078 | $\xrightarrow[\text { r.1 }]{\text { r }}$ | ¢ | +160 | r.183 | - | 1.232 | I.257 | $\xrightarrow[\text { 1.281 }]{\text { I } 271}$ | r-295 | r $1 \cdot 320$ | 1.354 |
| 24 25 | ${ }^{-998}$ | 1.022 | 1.046 | r.069 | 1.094 | T.118 | $1 \cdot 14 \mathrm{I}$ | r-165 | $1 \cdot 189$ | 12213 | r.238 | $1 \cdot 261$ | r-285 | x-309 | r 333 |
| 26 | -990 | 1. | 1.038 | I.06I | r.085 | 1•109 | 1.131 | 1•155 | 1.179 | 1.203 | 1.227 | 1.250 | 1.274 | 1.298 | 22 |
| 27 | -98 | $1 \cdot 005$ | 1.029 | 1.051 | 1.075 | 1.099 | $1 \cdot 122$ | 1. 145 | 1.169 | ${ }^{1 \cdot 192}$ |  | 1.239 | I.263 | T.287 |  |
| 28 | ${ }^{-972}$ | .996 | $\xrightarrow{\text { r.019 }}$ | ${ }_{1}^{1.042}$ |  |  | $\xrightarrow{\text { r.112 }} \mathrm{l}$ | ${ }_{\text {I }-135}^{\text {I } 125}$ | ${ }_{\text {I }}^{1 \cdot 159}$ |  |  |  | I.252 | Y.275 |  |
| 29 30 | .954 | -977 | 1.000 | ${ }_{1}$ | I.045 | r-068 | r-091 | ${ }_{\text {r }} 114$ | $1 \cdot 136$ | r.160 | I. 183 | 1-2 | $1 \cdot 228$ | $1 \cdot 251$ | r.274 |
| 3 I | -944 | -967 | -990 | 1.011 | 1.035 | 1.057 | 1.079 | 1-102 | 1.125 | I. 148 | 1.170 | 1•193 | 1.216 | 1.238 | I |
| 32 | 93 | . 957 | $\stackrel{979}{ } 9$ | 1-001 | ${ }^{1}$ |  |  | 1 | r.113 |  |  |  | 1.203 | 1.225 | ${ }^{48}$ |
| 33 <br> 34 | ${ }^{\cdot} \cdot 924$ | . 9345 | .956 | -978 | 1.008 | r-022 | $\xrightarrow{1}$ | r.066 | r.088 | r.150 | -13I | ${ }_{\text {r }}$ | 1-176 | I-198 | 1220 |
| 35 | $\cdot 902$ | -923 | -945 | $\cdot 967$ | $\cdot 989$ | ro | 1.032 | r.054 | r.075 | r•096 |  | I. 140 | T•162 | I-184 | I-205 |
| 36 | -89r | -912 | -933 | -955 | $\cdot 976$ |  | I-019 | r.04I | r.062 | I.083 | I•104 | 1-126 | $1 \cdot 148$ | I•169 | 1 190 |
| 37 38 38 | -879 | . 880 | -921 |  | -963 | -984 |  | r.027 | $\xrightarrow{\text { I.048 }}$ | 1.069 | r-090 | ${ }_{\text {r }}$ 1III | 1.133 | I•154 |  |
| 39 | . 856 | . 876 | :897 | 917 | .938 | .958 | .978 | r.000 | I-020 | I.04I | $1 \cdot 061$ | I-081 |  | I-123 | T•143 |
| 40 | . 844 | . 864 | . 884 | $\cdot 904$ | $\cdot 924$ | -944 | -965 | -986 | I-006 | I.026 | 1.046 | r•066 | 1.086 | 1•107 | 1-127 |
| 41 | . 831 | - 85 | -871 | -891 | -9rı | -930 | $\cdot 950$ | -971 | -991 | I-OII | 1.030 | 1.050 | 1.070 | 1.091 | -110 |
| 42. | .818 | . 838 | $\cdot 858$ | 863 | -887 | 916 | 936 | . 955 | . 976 | .995 | - 15 | T034 | I. 054 | 1.073 |  |
| 4 | ${ }^{-805}$ | . 825 | -844 | -863 | -883 | .902 | .922 | .942 | -944 |  | .9982 |  | I.037 | r.056 |  |
| 44 | -792 | . 798 | . 816 | -834 | $\cdot 854$ | . 872 | . 891 | . 909 | -928 | . 946 | . 966 | $\stackrel{984}{ }$ | 1.003 | - 3 | r-039 |
| 46 | 765 | $\cdot 783$ | -802 | . 820 | $\cdot 839$ | $\cdot 856$ | . | -893 | 12 | -930 | 949 | -967 | 85 |  | -022 |
| 47 | $\cdot 755$ | . 769 | -787 | -805 | -823 | ${ }^{-841}$ | $\cdot 858$ | . 878 | . 895 | .913 | -932 | -949 | .968 | 985 | -003 |
| 48 | $\cdot 737$ | - 754 | . 773 | -790 | -80 | . 825 | -842 | . 844 |  | .8796 | . 805 | .931 | . 9438 | .967 |  |
| 49 50 | -708 | - 725 | -7542 | -774 | -7918 | . 8909 | .8269 | . 824 | . 8461 | .869 | . 8795 | .913 | .930 | .948 | -965 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 51 52 | -693 | -710 | ${ }^{\cdot} 778$ | $\cdot 743$ | ${ }^{\cdot 759}$ | . 7759 | -793 | . 8172 | . 828 | .843 | . 859 |  | .892 | .809 | ${ }_{9}^{906}$ |
| 53 | . 663 | - 679 | $\cdot 694$ | 710 | -726 | $\cdot 742$ | $\cdot 758$ | .774 | $\cdot 789$ | . 805 | .821 | . 838 | . 854 | .870 | . 886 |
| 54 | -648 | $\cdot 663$ | $\cdot 678$ | -694 | -709 | -225 | -740 | $\cdot 756$ | -771 | 787 | . 802 | . 818 | . 834 | . 849 | . 865 |
| 55 | $\cdot 632$ | - 646 | .662 | -677 | -692 | - 707 | -722 | 737 | 752 | $\cdot 768$ | $\cdot 783$ | $\cdot 798$ | -814 | . 829 | . 844 |
| 56 | .616 | . 630 | $\cdot 645$ | . 660 | $\cdot 675$ | - 690 |  | . 719 | $\cdot 734$ | 749 | 764 | .778 | -793 | 808 | 23 |
| 57 58 58 | . 68 | .654 | . 628 | -643 | -658 | -672 | . 686 | .700 | . 714 | 7.729 | ${ }^{7} 744$ | 75 | .772 | 787 |  |
| 59 | - 568 | . 588 | '6II | . 608 | . 622 | . 635 | -649 | . 662 | . 676 | . 69 | . 72 | - | 7 | . 744 | ${ }_{7} 8$ |
| 60 | -551 | -564 | -577 | -590 | $\cdot 603$ | $\cdot 6$ | . 630 | $\cdot 643$ | -656 | -669 | . 68 | 66 | $\cdot 709$ | 7 | $\cdot 736$ |
| 61 | -534 | 47 | - 560 | . 572 | . 585 | - 597 | -610 | . 624 | . 636 | . 649 | . 662 | . 675 | . 688 |  |  |
| 62 | -577 | . 530 | . 542 | 554 | - 568 | -578 | . 597 |  | . 656 | . 628 |  |  | . 664 | . 678 | -6691 |
| 63 | . 500 | . 512 | - 524 | . 517 | - 548 | . 559 | - 575 | . 584 | . 5975 | . 588 | . 598 | .632 | . 624 | . 635 | -668 |
| 65 | ${ }^{-466}$ | -476 | -488 | - 519 | . 515 | - 522 | . 532 | . 544 | . 555 | $\cdot 566$ | -57 | -588 | 599 | .6II | . 622 |
| 66 | 448 | 459 | -470 | -480 | -49x | -50r | 512 | . 523 | -534 | -545 | 555 | -566 | . 576 | . 588 | . 598 |
| 67 | -431 | -441 | $\cdot 45 \mathrm{~T}$ | . 444 4 | -472 | ${ }_{462}^{482}$ | 4492 | . 502 | . 513 | . 523 | . 533 | . 542 | . 554 | . 565 | . 574 |
| 69 | - 393 |  |  | ${ }^{4} 423$ |  | 442 | ${ }_{451}^{471}$ | ${ }^{4661}$ | 470 |  | 51 | 522 | -531 | . 5418 | 51 |
| 70 | $\cdot 377$ | -386 | 4 | -404 | 412 | 422 | , | 440 | 49 | 458 | 467 | \% | 485 | 495 | 503 |

## SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $11^{\circ} .4$ | $11^{\circ} \cdot 6$ | $11^{\circ} .8$ | $12^{\circ} \cdot 0$ | $12^{\circ} \cdot 2$ | $12^{\circ} 4$ | $12^{\circ} \cdot 6$ | $12^{\circ} \cdot 8$ | $13^{\circ} \cdot 0$ | $13^{\circ} \cdot 2$ | $13^{\circ} \cdot 4$ | $13^{\circ} \cdot 6$ | $13^{\circ} .8$ | $14^{\circ} \cdot 0$ | $14^{\circ} \cdot 2$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| : | 1.498 | I•524 | 1.550 | 1-577 | 1-603 | 1.630 | I.656 | I.683 | 710 |  |  |  | 15 |  |  |
| 4 | 1-494 | 1.520 | 1.546 | 1.573 | 1.599 | 1.626 | 1.652 | 1.679 | 1.705 | 1-732 | 58 | 1-785 | 1.8II | I. 838 | I. 864 |
| 8 | I. 482 | I•509 | 1.535 | I. 562 | 1.587 | I-614 | I.640 | 1.667 | 1.692 | I'719 | - 745 | 1.772 | I.797 | I.824 | I. 850 |
| 10 | $\underline{1} 474$ | $\underline{1} 501$ | 1.526 | 1.553 | 1.579 | I•605 | 1.631 | 1.657 | 1-683 | I•710 | 1.735 | 1.762 | 1.788 | 1.814 | I. 840 |
| 12 | 1-464 | 1 -491 | 1-516 | I. 543 | I. 568 | 1.594 | I-620 | 1.646 | 1.672 | I•698 | 1.724 | I•750 | 1•775 | 1.802 | I.827 |
| 14 | 1.453 | 1.479 | 1.504 | 1.530 | I 555 | I. 582 | 1.607 | 1.633 | 1.659 | 1.685 | 1.710 | 1.736 | 1.76I | 1.787 | 1.813 |
| 16 | I 433 | I 465 | r.490 | 1.516 | 1.54r | 1.567 | 1.592 | 1.618 | 1.643 | I.669 | I 694 | I•720 | I•745 | I•71 | I•796 |
| 18 | I 424 | I 445 | $1 \cdot 474$ | 1.500 | 1-525 | I 550 | 1.575 | $1 \cdot 601$ | I 626 | 1.65I | 1.676 | 1 7702 | 1726 | 1-752 | 1 777 |
| 19 | 1.416 | I.441 | I 466 | r.491 | 1.516 | 1.541 | I. 566 | I.591 | I.616 | I 642 | I. 666 | I-691 | 1.716 | 1 742 | I•767 |
| 20 | 1.407 | 1-432 | $1 \cdot 457$ | $1 \cdot 482$ | 1.507 | 1.532 | r.556 | 1.582 | I 605 | I-632 | I.656 | I-681 | I•706 | 1•73 | I•756 |
| 21 | r.398 | 1.423 | 1.447 | 1.472 | 1.497 | 1.522 | 1.546 | 1.571 | I.596 | 1.62I | 1.645 | 1.670 | I. 695 | I.720 | r•744 |
| 22 | - 389 | 1.413 | 1.437 | 1•462 | 1.486 | 1.511 | $1 \cdot 536$ | 1.561 | 1.585 | I•610 | 1.634 | 1.658 | 1.683 | I•708 | 1•733 |
| 23 | 1-379 | 1.403 | 1.427 | 1.451 | 1.476 | 1.50 | I. 525 | 1-549 | 1-574 | I•597 | 1.622 | I.646 | 1-671 | I.696 | 1•20 |
| 24 | I-368 | 1-393 | 1416 | 1.440 | I•465 | 1.489 | 1.513 | 1.538 | 1.562 | I-585 | - 610 | I. 634 | I. 659 | 1.683 | 1.707 |
| 25 | 1-357 | 1.382 | 1.405 | 1.429 | 1.453 | 1.477 | 1.501 | 1.526 | 1.550 | 1.573 | 1-597 | I•62I | I•645 | I.670 | I•694 |
| 26 | 1.346 | $1 \cdot$ | I.393 | 1.41 | 1. | 1.465 | 1.489 | I.513 | I.536 | 1.560 | 1.584 | 1-608 | 1.632 | 1.656 | 80 |
| 27 | $1 \cdot 335$ | 1.358 | I 388 | $1 \cdot 405$ | r 429 | I $1 \times 52$ | 1.476 | 1.500 | 1.523 | I 546 | 1.570 1 556 | 1.594 | 1.618 | 1641 | I 6685 |
| 28 | $1 \cdot 323$ | 1.346 | r 369 | 1.392 | 1.416 | 1.439 | 1.463 | 1.486 | 1.509 | I'532 | 1-556 | I 580 | 1.603 | I 627 | I.650 |
| 29 | 1.310 | 1.333 | I 356 | 1.379 1.366 | 1.402 1.389 | I.426 | I.449 | I.472 | I 495 | r.518 | I.541 | I 565 | 1.588 | I.611 | 1.634 1.618 |
| 30 | 1-297 | 1-319 | 1.342 | 1-366 | 1.389 | 1.412 | 1.435 | 1.458 | 1.480 | 1.503 | 1-526 | 1.550 | $1 \cdot 573$ | I•595 | 8 |
| 3 I | 1.283 | 1.306 | $1 \cdot 329$ | 1.352 | 1.374 | 1-397 | $1 \cdot 420$ | 1.443 | 1.465 | 1.488 | 1.5II | I•534 | 1-556 | 1.579 | I-601 |
| 32 | 1.270 | I-292 | 1-314 | 1.337 | I.360 | I-382 | 1.404 | 1.427 | 1.450 | 1.472 | 1*495 | I.518 | I.540 | $1 \cdot 562$ | 1.584 |
| 33 | I. 256 | 1.278 | 1-300 | 1.323 | I 345 | I-367 | 1-389 | I-411 | I 434 | 1456 | 1.478 | I.500 | 1.523 | I.545 | 1.567 |
| 34 | I.241 | 1.263 | I 288 | I.308 | I.329 | I.351 | - 373 | r•39 | 1.417 | 1-439 |  | 1.483 | I.506 | I. 527 | I•549 |
| 35 | 1.227 | 1-248 | 1.270 | 1-292 | 1-354 | 1.335 | 1-357 | 1.378 | $1 \cdot 401$ | 1422 | $1 \cdot 444$ | 1-465 | I 487 | $1 \cdot 509$ | 1.531 |
| 36 | I 2 | 1.233 | r. 254 | 1.276 | 1.297 | 1.319 | 1.340 | 1.361 | 1.383 | 1.405 | 1-426 | 1.447 | 1*468 | 1-491 | 1.512 |
| 37 | I•196 | 1.217 | r238 | I 260 | r 281 | 1-302 | 1.323 | I•344 | I.366 |  |  | 1.429 | 1.450 | 1-471 | I 492 |
| 38 | I-180 | 1-20 | 1.221 | 1.242 | I 264 | r-284 | $1 \cdot 305$ | I 326 | I 347 | 1.368 |  | r 410 | 1.430 | 1.452 | 14473 |
| 39 | I•164 | $\underline{\mathrm{I} \cdot 184}$ | $\begin{array}{r}1.205 \\ \mathrm{r} \\ \hline 185\end{array}$ | 1.225 1.208 | I. 246 | I 267 | 1.287 | I 308 | I 328 | I.349 | r 370 | I 390 | I 411 | I 43 I | I 4452 |
| 40 | I•147 | I•167 | 1-187 | 1-208 | I-229 | I-249 | I. 269 | I-289 | 1.309 | I 330 | I 350 | 1-371 | I-39 | 1-411 | 1.432 |
| 4 I | r-13 | -15 | I•I | I. 190 | I 2 | 1.230 | 250 |  | I 290 |  | I.330 | I 350 | 1.370 |  | 10 |
| 42 | 1.113 | I-133 | I'152 | 1.172 | I•192 | I-2II | $1 \cdot 231$ | $1 \cdot 250$ | $1 \cdot 270$ | I 292 | r 3130 | I 3330 | I 349 | I 3.368 | I 388 |
| 43 | I.096 | I-115 | I'134 | I'153 | 1-173 | I•192 | 1-212 | I.231 | 1250 | I 269 | r-289 | 1-309 | I-328 | I-347 | I 366 |
| 44 | I.077 | 1.096 | 1-115 | I•134 | I-153 | I-173 | 1-192 | 1.210 | 1.230 | 1.248 |  | I 286 | I-306 | I-325 | I 344 |
| 45 | 1.059 | I-078 | r.096 | I-115 | 1-133 | I•153 | 1-172 | I-190 | I 209 | 1.227 | 1. 246 | I 265 | I-284 | 1-302 |  |
| 46 | r.040 | I.059 | 1•077 | 1.096 | 1-113 | I•132 | 1.150 | 1-169 | 1.188 | I 206 | I 2225 | 1. 242 | I-261 | 1.279 | 1. 298 |
| 47 | , | r.040 | I 057 | r.076 | 1.093 | 1 | I.129 | 1.148 | I.165 | 184 | I. 202 | I 222 | 1.238 | 1.256 | I 275 |
| 48 | 1.00 | 1.020 | r 037 | 1.056 | 1.073 | 1-091 | I-108 | I'126 | I 144 | I•162 | 1-180 | I'197 | 1-215 | 1.232 | I. 251 |
| 49 | $\cdot 983$ | 1.000 | 1-017 | r.035 | $1 \cdot 052$ |  | I.086 | I-104 | 1.12I | I•139 | I.157 | I•174 | I•191 | $\underline{1} \cdot 208$ | I 2226 |
| 50 | '963 | $\cdot 980$ | $\cdot 996$ | $1-013$ | 1.030 | I•048 | 1.065 | 1.082 | 09 | I•It | 1.133 | 1-150 | 1-166 | I-184 |  |
| 51 | -943 | - 960 | -975 | -992 | 1.009 | I-026 | I.042 | 1.059 | r.076 |  |  | I•126 | 1.142 | I'159 | I• 176 |
| 52 | '922 | -938 | -954 | -971 | -987 | $1 \cdot 004$ | 1.020 | 1.036 | I-053 | I-069 | I.085 | I'IOI | 1-117 | I-134 | 1.150 |
| 53 | $\cdot 902$ | .917 | -933 | -949 | -965 | -981 | -997 | I.013 | $1 \cdot 029$ | I.045 | I.060 | 1.076 | 1.092 | I-108 | I-124 |
| 54 | -880 | . 895 | $\cdot 911$ | $\cdot 927$ | -942 | 958 | -974 | $\cdot 989$ | r 005 | 1-020 | I.036 | 1.051 | 1.067 | I.083 | I•098 |
| 55 | -85 | $\cdot 874$ | $\cdot 889$ | '905 | -920 | 935 | '950 | $\cdot 966$ | 980 | 995 | I 010 | 1.026 | 1.041 | 1.056 | 1.072 |
| 56 | -837 | . 852 | - 867 | - 882 | - 897 | -91 | -927 | -94I | -956 | -970 | -985 | 1.000 | 1.015 | 1.030 | I.045 |
| 57 | -816 | . 830 | . 844 | -859 | . 873 | . 888 | -902 | $\cdot 917$ | -931 | -945 | $\cdot 960$ | $\cdot 974$ | $\cdot 989$ | I.003 | I-018 |
| 58 | -794 | -807 | $\cdot 821$ | $\cdot 836$ | . 850 | -864 | . 877 | . 892 | -906 | -920 | -934 | -948 | -962 | -976 | 991 |
| 59 | '770 | $\cdot 785$ | $\cdot 798$ | . 813 | . 826 | -840 | . 853 | -866 | -88I | 894 | . | $\cdot 922$ | -935 | '949 | 962 |
| 60 | $\cdot 749$ | $\cdot 762$ | $\cdot 775$ | $\cdot 78$ | O2 | -815 | . 828 | . 84 I | 855 | . 868 | -88I | - 894 | '908 | 921 | 034 |
| 6 | $\cdot 726$ | -739 | $\cdot 751$ | $\cdot 764$ | -778 | -790 | -803 | -815 | -829 | $\cdot 842$ | -854 | . 867 | -881 | . 893 | -906 |
| 62 | $\cdot 704$ | $\checkmark 76$ | $\cdot 728$ | $\cdot 740$ | $\cdot 753$ | 765 | $\cdot 778$ | $\cdot 790$ | -802 | . 815 | . 827 | . 840 | . 853 | . 865 | . 877 |
| 63 | -679 | -692 | $\cdot 704$ | $\cdot 716$ | -728 | 740 | -752 | $\cdot 764$ | $\cdot 776$ | $\cdot 788$ | -800 | . 812 | . 824 | . 836 | - 848 |
| 64 | . 656 | -668 | -679 | -691 | $\cdot 702$ | $\cdot 715$ | $\cdot 726$ | -737 | $\cdot 749$ | $\cdot 761$ | $\cdot 773$ | $\cdot 784$ | 795 | -808 | -819 |
| 5 | . 633 | -644 | -655 | $\cdot 667$ | -677 | - 689 | 700 | 711 | -722 | $\cdot 733$ | $\cdot 745$ | $\cdot 756$ | $\cdot 767$ | $\cdot 77$ | 790 |
| 6 | -609 | -620 | . 630 | -642 | . 652 | -663 | -674 | -684 | -695 | $\cdot 706$ | $\cdot 717$ | $\cdot 728$ | $\cdot 738$ | - 749 | $\cdot 760$ |
| 7 | -585 | -596 | -606 | $\cdot 616$ | . 626 | . 637 | -647 | -657 | -668 | $\cdot 678$ | . 689 | -699 | $\cdot 709$ | $\cdot 720$ | 730 |
| 8 | -561 | -570 | -581 | -591 | -600 | -61 | -620 | -630 | -641 | $\cdot 650$ | -660 | $\cdot 670$ | -680 | - 690 | $\cdot 700$ |
| 69 | $\begin{array}{r}\text { - } \\ \cdot \\ .537 \\ \hline\end{array}$ | - 546 | - 555 | $\cdot 565$ | - 574 | - 584 | - 593 | . 603 | . 612 | $\cdot 622$ | . 632 | . 641 | . 651 | -660 | -670 |
| 70 | -513 | -521 | -530 | -539 | $\cdot 548$ | -557 | - 566 | -576 | -584 | -594 | . 603 | 612 | -621 | $\cdot 630$ | $\cdot 639$ |

showing the reduction at 1 min. From the meridian corresponding to AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $14^{\circ} 4$ | $14^{\circ} 6$ | $14^{\circ} 8$ | $15^{\circ} .0$ | $15^{\circ} 2$ | $15^{\circ} .4$ | $15^{\circ} 6$ | $15^{\circ} 8$ | $16^{\circ} 0$ | $16^{\circ} 2$ | $16^{\circ} .4$ | $16^{\circ} \cdot 6$ | $16^{\circ} 8$ | $17^{\circ} 0$ | $17^{\circ} \cdot 2$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF i Min. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| : | 1.895 | 1.922 | -948 | 1•975 | $2 \cdot 002$ | 2.028 | $2 \cdot 055$ | $2 \cdot 081$ | 08 | $2 \cdot 135$ | 2. 16 I | 2. 88 | 15 | $2 \cdot 242$ | 2.268 |
| 4 |  | 1.917 | $\begin{array}{r}1.943 \\ 1 \\ \hline 1029\end{array}$ |  | 1.997 | 2.023 |  | 2.076 | $2 \cdot 103$ 2.088 2 | 2.130 $2 \cdot 14$ | - 2.156 | 2.183 | 10 | 2.237 |  |
| ${ }^{10}$ |  |  |  | I.956 | $\stackrel{\text { r.983 }}{1} \mathrm{P} 92$ |  | ${ }_{2}^{2.025}$ | 2.061 | 2.076 | ${ }_{2 \cdot}^{2 \cdot 114}$ | - ${ }_{\text {2.1. } 128}$ | 2.167 | - ${ }_{2} \cdot 1.183$ | 20 | 2.246 |
| 12 | r. 854 | I.880 | 1.906 | r.932 | r. 958 | r. 984 | $2 \cdot 010$ | 2.036 | 2.062 | $2 \cdot 088$ | $2 \cdot 114$ | 2.140 | 2.167 | 2•193 | 2.219 |
| 14 | 1.83 | I. 865 | I.890 | 1.916 | I 942 | I.968 | 1.994 |  | $2 \cdot 046$ | $2 \cdot 072$ | 7 | 2.123 | 2. 149 | $2 \cdot 175$ | I |
| 16 18 | ${ }_{\text {r }}^{1} \mathrm{P} 822$ | I. 848 | 1.873 | 1.899 1.879 | 1.924 | 1.950 r.929 | 1.976 |  | 2.027 2.005 | 2.051 2.030 | 2.077 2.055 | 2.108 | 2.129 | 2.155 | $2 \cdot 180$ <br> $2 \cdot 157$ |
| 19 | 1-792 | r. 817 | I.842 | r.868 | r.892 | 1.918 | I.942 | 1.968 | 1-994 | $2 \cdot 0$ | $2 \cdot 043$ | 2.069 | $2 \cdot 095$ | $2 \cdot 120$ | $2 \cdot 145$ |
| 20 | I•781 | r.806 | I.831 | 1.856 | 1.880 | 1-906 | 1.930 | I•956 | I. 980 | 2.0 | 2.031 | $2 \cdot 057$ | 2.082 | 2.107 | $2 \cdot 132$ |
| 2 L | 1.769 | 1.794 | I.819 | I.844 | I. 868 | x. 894 | 1.918 | I.943 | I-968 | 1.993 | 2.018 | 2.043 | 2.068 | 2.093 | 18 |
| 22 | 1.757 | I.782 | 1.807 | r.832 | 1.855 |  | 1.005 |  | I.954 |  |  | 2.028 2.014 | 2.053 2.038 | 2.079 2.064 | 88 |
| 23 24 | - 1 1745 | I.756 | 1.794 1.780 | $\stackrel{\text { r }}{1.805}$ | I.828 | r-852 | 1.877 | ${ }_{\text {I }}^{1.901}$ | 1.940 | 1.965 | I.974 | 2.014 | 2.023 | 2.047 | 2.073 |
| 25 | 1.718 | 1.742 | 1.766 | 1.789 | I.854 | I-838 | 1.862 | ז.886 | 1.910 | 1.9 | r.959 | r .983 | 2.007 | 2.031 | 2.056 |
| 26 | r. | 1-728 | $1 \cdot 751$ | 1.775 |  | I. 823 | I. 847 | 1.870 | I. 894 | 1-918 | 1.942 | r.966 | 1.990 | 14 | 9 |
| 27 | ${ }^{1} \cdot 6$ | 1.713 | ${ }^{\text {r }} 7336$ | 1.759 | I. |  |  |  |  |  |  | I.949 | I. 973 |  |  |
| 28 28 | ${ }_{1} \cdot 6$ | $\xrightarrow{\text { r.697 }}$ | $\xrightarrow{\text { 1.720 }} \mathrm{r}$-704 | - 1.743 | $\xrightarrow{\text { r.767 }} \mathrm{r} 7$ | - | $\xrightarrow{\text { r }} \mathrm{r} 797$ | 1.820 | $\xrightarrow{\mathrm{I} \cdot 844}$ | r.867 | I. 890 | 1.914 | r.937 | 1.979 |  |
| 30 | 1.641 | 1-665 | I-687 | 1.710 | 1.733 | 1-756 | I•779 | O2 |  | I. 849 | r. 872 | 1.895 | 1.918 | 1.941 | I•964 |
| 31 | 1.624 | 1.647 | 1.670 | 1-693 |  | 1.738 | 1.761 | r. 784 | 1.807 | I. 830 | 1.852 | \% | 88 | 1.921 |  |
| 32 |  | ${ }_{1}^{1.629}$ | 1.652 | 1.675 | ${ }_{\text {r }}^{\text {r.697 }}$ | I.720 | 1.742 |  |  |  |  |  |  |  |  |
| 34 | T.571 | - 593 | $1 \cdot 65$ | r.637 | 1.659 | 1-682 | I. 724 | 1.725 | 1.748 | 17970 | I•792 |  | 1.836 |  | r. $88{ }^{\text {r }}$ |
| 35 | I-552 | 1.574 | 1-596 | 1.6I8 | 1.639 | I.662 | 1.683 | 1.705 | I•726 | $1 \cdot 749$ | $1 \cdot 770$ | r-793 | 1-814 | I. 836 | I. 858 |
| 36 | 1.533 | r.554 | 1.576 | 1.598 | 1.619 | 1.641 | 1.662 | I. 684 | I• 705 | 1.727 | 1.748 | 1.770 | 1792 | I.813 | 35 |
| 37 38 38 | 1.513 | 1.534 | 1.556 | 1.577 <br> 1.556 | 1.598 | 1.619 | ${ }^{1.641}$ |  |  | 1.705 |  | 1.747 | 1.769 | I.790 |  |
| 39 | $1{ }^{1} 473$ | rs | r.514 | 1.535 | r. 555 | r. 576 | 1.597 | 1.617 | I.638 | I.659 | r-680 | 1.700 | $1 \cdot 72 \mathrm{I}$ | 1.742 | ${ }_{1} \cdot 763$ |
| 40 | $1 \cdot$ | 1-472 | I•492 | 1513 | 1-533 | r-553 | 1.574 | 1.594 | ${ }^{1} 615$ | I.6 | 1.656 | I.676 | 1.697 | r.7 | 37 |
| 4 I | 30 | $1 \cdot 450$ | 1470 | 1491 | 1.510 | 1.531 | 1.551 | 1.571 | $1 \cdot 591$ | 1.611 | 1.63I | I. 65 I | 1.672 | I•692 | 1.712 |
| 42 | T. | ${ }^{1} 4.428$ | 1.448 | 1.468 | T. 64 | T. 83 | 1.527 | 1.547 | I.567 | 1.586 | 1.606 | 1.626 | ${ }^{1} \cdot 646$ | 1.666 |  |
| 43 44 | r.36 | r. 382 | 1.402 | 1.42 T |  | I-459 | 1.478 | 1.497 | 1.517 | I. 535 |  | r. 574 |  | I.612 | 1.632 |
| 45 | I.340 | I.359 | 1.378 | $1 \cdot 396$ | 1445 | T-434 | $1 \cdot 453$ | 1472 | $1 \cdot 491$ | 1.509 | 28 | 1.547 | 1-566 | r.585 | 1.604 |
| 46 | 1.317 | 1.335 | $1 \cdot 354$ | 13 | 1-390 | $1 \cdot 409$ | 1.427 | 1446 | 1465 | $1 \cdot 483$ | 1.501 | $1 \cdot 520$ | 1.538 | 57 | 6 |
| 47 | T. | I. 1.2 | 1.3 | 1.347 1.321 1 | I.365 | I. 384 | ${ }^{1} 4.401$ | I.420 | 1.437 | 1.4 | $1{ }^{1}$ | 1.492 |  | 2 |  |
| 49 | $1 \cdot 2$ | 1-261 | 1.278 | res | r.313 | 1.330 | 1. 348 | 1.366 | I. 383 | I-400 |  | I.435 | 1453 | $1 \cdot 471$ | 1.489 |
| 50 | 1.218 | 1.235 | 1.252 | I-269 | I-287 | 1.303 | 1.32I | I.338 | I-355 | 1.372 | I-389 | $1 \cdot 406$ | I-424 | r.44I | $1 \cdot 458$ |
| 51 | I-1 | $1 \cdot 209$ | 1.226 | 124.3 | 1.260 | 1.276 | 1.293 | 1.350 | 1.327 | $1 \cdot 343$ | 1.360 | 1.377 | 1.394 | $1{ }^{1} 11$ | 27 |
| 52 | 1-167 | 1•183 | I•199 | 1216 | I.232 | $1 \cdot 249$ | 1265 | $1 \cdot 282$ | $1 \cdot 298$ | 1.31 | $1 \cdot 331$ | 1-347 | 1.364 | 1.380 |  |
| 53 | ${ }^{1} 1.140$ | 1.156 | 1.173 | $\xrightarrow{\text { r.189 }} \mathrm{C}$ (6) | 1. | $\xrightarrow{\text { r.22I }}$ | 1.237 | 1.253 | I. 262 | I.28 | ${ }_{\text {r }}^{1} \mathrm{r} 301$ | ${ }_{1}^{1} \cdot 317$ | ${ }_{1}^{1.333}$ | 1.349 |  |
| 54 | - | I•192 | IT.18 |  | ${ }_{\text {r }}^{1} 1.148$ | IT192 | I.179 | 1.194 |  | 1.225 | I 240 | I255 | 1.271 | 1-286 | 1.301 |
| 56 | r.060 | 1.075 | r.ogo |  | I'119 | $1 \cdot 135$ | 1.149 | 1•164 | 1.178 |  | I 209 | 1.223 | 1.239 | r. 254 |  |
| 57 | I. | 1.047 | 1.062 | 1.076 | 1.090 | I•104 | I. 120 | r-134 | $1 \cdot 148$ | I•163 | 1-17\% | 1•19 | r207 | $1 \cdot 221$ | 1.236 |
| 58 | 05 | 1-018 | 1.032 | r.047 | 1.061 | r.074 | r.088 | I. | r.117 | I•131 | ${ }_{\text {I }}^{1} 146$ | 1.159 | ${ }_{\text {r }}^{1} 1.174$ | 58 | 68 |
| 59 | .976 | .990 | 1.003 .974 | 1.018 .987 | $\xrightarrow{\text { r.03I }} \mathrm{O}$ |  | r.058 r .027 | $\xrightarrow{\mathrm{r}} \mathrm{r} \cdot 042$ | $\xrightarrow{\text { r.086 }}$ | (1.099 | ¢-113 | $\xrightarrow{\text { I-127 }} \mathrm{l}$ | $\xrightarrow[\text { r.140 }]{\text { r-107 }}$ | I•155 | -134 |
| 61 |  | -932 | -945 | -957 | 971 | $\cdot 983$ | -996 | 1.009 | $1 \cdot 022$ | r.035 | 1.048 | 1.061 | 1.073 | 1.087 |  |
| 62 | . 889 | -902 | -915 | -927 | . 940 | .952 | -964 | -978 | -990 | 1.00 | 1.015 | 1.027 | I. 04 | 1.05 | 1.065 |
| 63 | . 860 | . 873 | . 885 | . 896 |  | .921 | -933 | . 945 | -957 | -969 | -982 | . 994 | 1.005 | 1. | 1.030 |
| 64 | . 831 | . 843 | . 85 | . 856 | . 878 | 890 | 898 | . 818 | . 8 | . 936 | .948 | . 959 | . 975 | 暏 | 995 |
| 65 | 801 | 812 | . 823 | . 835 | . 846 | . 857 | . 868 | . 88 | . 890 | '902 | 914 | -924 | .936 | -948 | -959 |
|  | 771 | 782 | 792 | . 803 | . 814 | . 825 | . 836 | . 847 | . 857 | . 868 | . 880 | . 890 | . 801 | 2 | .922 |
| 68 |  | ${ }_{7}^{751}$ | . 738 | -772 | 782 | . 792 | 8703 | . 813 | . 824 | .834 | . 844 | . 825 |  |  |  |
| 69 |  | . 689 | . 698 |  |  |  | 737 | 774 | 756 | 析 | -774 | -784 |  |  |  |
| 70 | $\cdot 648$ | . 658 | 67 | -676 |  | -694 | 703 | .711 | 721 | $\cdot 731$ |  | .7 |  | $\cdot 767$ | $\cdot 776$ |

## showing the reduction at 1 min．from the meridian Corresponding to AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM the meridian．

| AZIMUTHS． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat． | $17^{\circ} \cdot 4$ | $17^{\circ} \cdot 6$ | $17^{\circ} 8$ | $18^{\circ} \cdot 0$ | $18^{\circ} \cdot 2$ | $18^{\circ} .4$ | $18^{\circ} \cdot 6$ | $18^{\circ} .8$ | $19^{\circ} \cdot 0$ | $19^{\circ} \cdot 2$ | $19^{\circ} \cdot 4$ | $19^{\circ} \cdot 6$ | $19^{\circ} .8$ | $20^{\circ} \cdot 0$ | $20^{\circ} \cdot 2$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR－ANGLE OF $~ M I N$ ． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ |  | $2 \cdot 322$ | 349 | 2．376 | 03 | 30 | 57 | 2.484 | $2 \cdot 511$ | 2.537 | $2 \cdot 564$ | 2.591 | $2 \cdot 618$ |  | $2 \cdot 672$ |
| 4 | $2 \cdot 289$ | $2 \cdot 316$ | $2 \cdot 343$ | 2.370 | $2 \cdot 397$ | $2 \cdot 424$ | $2 \cdot 45$ I | 2.478 | 2.505 | 2.53 I | 2.558 | 2.585 | $2 \cdot 612$ | $2 \cdot 639$ | 2.665 |
| 8 | 2.273 | $2 \cdot 299$ | $2 \cdot 326$ | $2 \cdot 353$ | $2 \cdot 380$ | $2 \cdot 406$ | 2.433 | 2.460 | 2.487 | 2.512 | 2.539 | 2.566 | 2.593 | $2 \cdot 619$ | $2 \cdot 646$ |
| 10 | $2 \cdot 260$ | $2 \cdot 287$ | $2 \cdot 313$ | $2 \cdot 340$ | $2 \cdot 367$ | $2 \cdot 393$ | 2.420 | $2 \cdot 446$ | 2.473 | 2.499 | $2 \cdot 525$ | $2 \cdot 552$ | $2 \cdot 578$ | $2 \cdot 605$ | $2 \cdot 631$ |
| 12 | $2 \cdot 245$ | $2 \cdot 271$ | 2．298 | $2 \cdot 324$ | $2 \cdot 35 \mathrm{I}$ | $2 \cdot 377$ | $2 \cdot 403$ | 2.430 | 2.456 | 2.482 | $2 \cdot 508$ | 2.534 | 2.561 | $2 \cdot 587$ | $2 \cdot 614$ |
| 14 | $2 \cdot 227$ | $2 \cdot 253$ | $2 \cdot 279$ | $2 \cdot 306$ | $2 \cdot 332$ | $2 \cdot 358$ | $2 \cdot 384$ | 2.410 | 2.436 | 2.462 | 2.488 | 2.514 | 2.540 | 2.567 | 2.593 |
| 16 | 2.206 | 2.232 | 2.258 | $2 \cdot 284$ | $2 \cdot 310$ | $2 \cdot 335$ | $2 \cdot 361$ | $2 \cdot 388$ | $2 \cdot 414$ | 2.439 | $2 \cdot 465$ | 2.491 | $2 \cdot 517$ | 2.543 | $2 \cdot 569$ |
| 18 | ${ }^{2} \cdot 183$ | $2 \cdot 208$ | $2 \cdot 234$ | $2 \cdot 260$ | $2 \cdot 286$ | $2 \cdot 311$ | $2 \cdot 336$ | $2 \cdot 362$ | $2 \cdot 388$ | 2.413 | $2 \cdot 439$ | $2 \cdot 464$ | 2.490 | $2 \cdot 516$ | $2 \cdot 541$ |
| 19 | $2 \cdot 170$ | 2．196 | 2.222 | 2.247 | $2 \cdot 272$ | $2 \cdot 297$ | $2 \cdot 323$ | $2 \cdot 348$ | $2 \cdot 374$ | 2.399 | 2.425 | $2 \cdot 450$ | $2 \cdot 476$ | $2 \cdot 501$ | $2 \cdot 527$ |
| 20 | 2．157 | 1．182 | $2 \cdot 208$ | 2.233 | $2 \cdot 258$ | $2 \cdot 283$ | $2 \cdot 308$ | $2 \cdot 333$ | $2 \cdot 360$ | $2 \cdot 384$ | 2.410 | $2 \cdot 435$ | $2 \cdot 461$ | $2 \cdot 486$ | $2 \cdot 5 \mathrm{II}$ |
| 2 I |  | 2． 168 | 2•194 | $2 \cdot 219$ | $2 \cdot 244$ | $2 \cdot 268$ | $2 \cdot 293$ | $2 \cdot 318$ | $2 \cdot 344$ | 2．369 | $2 \cdot 394$ | $2 \cdot 419$ | $2 \cdot 445$ | 2.470 | $2 \cdot 495$ |
| 22 | $2 \cdot \mathrm{I}$ | $2 \cdot 153$ | 2．178 | 2.203 | 2.228 | 2.253 | $2 \cdot 278$ | $2 \cdot 302$ | $2 \cdot 328$ | 2．353 | 2．378 | $2 \cdot 402$ | 2.428 | 2.453 | $2 \cdot 478$ |
| 23 | $2 \cdot 113$ | $2 \cdot 138$ | $2 \cdot 162$ | 2－188 | 2.212 | $2 \cdot 237$ | 2．26x | $2 \cdot 286$ | $2 \cdot 311$ | $2 \cdot 336$ | $2 \cdot 360$ | $2 \cdot 385$ | $2 \cdot 411$ | 2.435 | $2 \cdot 460$ |
| 24 | $2 \cdot 097$ | $2 \cdot 121$ | $2 \cdot 146$ | $2 \cdot 171$ $2 \cdot 153$ | $2 \cdot 196$ $2 \cdot 178$ | $2 \cdot 220$ | 2.244 | 2.269 2.259 | 2.294 | 2.318 | $2 \cdot 343$ | $2 \cdot 367$ | $2 \cdot 391$ | 2.417 | 2.441 |
| 25 | 2.080 | 2．105 | 2．129 | 2．153 | 2．178 | $2 \cdot 202$ | 2.226 | 2.251 | 2.275 | $2 \cdot 300$ | $2 \cdot 324$ | $2 \cdot 348$ | $2 \cdot 372$ | $2 \cdot 398$ | 2.422 |
| 26 | $2 \cdot 063$ | $2 \cdot 087$ | $2 \cdot 1$ | $2 \cdot 135$ | $2 \cdot 160$ | 2．184 | $2 \cdot 208$ | 2.232 | 2.256 | 2.28 I | $2 \cdot 305$ | $2 \cdot 329$ | $2 \cdot 353$ | $2 \cdot 378$ | $2 \cdot 402$ |
| 27 | 2.045 | 2.069 | $2 \cdot 093$ | 2.117 | 2．141 | $2 \cdot 165$ <br> 2． 146 | $2 \cdot 189$ 2．16 | 2.213 | 2.236 | 2.261 | 2.285 | $2 \cdot 309$ | $2 \cdot 333$ | 2.357 | 2．38I |
| 28 | 2.027 | 2.050 | 2.074 | $2 \cdot 098$ | $2 \cdot 122$ | 2．146 | $2 \cdot 169$ 2 | $2 \cdot 193$ | 2.216 | 2.24 I | 2.264 | 2.288 | 2.311 | 2.335 | 2.359 2.337 |
| 29 30 | 2：008 | $2 \cdot 031$ | 2.055 2.034 | $2 \cdot 078$ | 2．102 | －1．126 | 2－149 | $2 \cdot 172$ $2 \cdot 151$ | 2．195 2．174 | 2.220 2.197 | 2.243 2.221 | 2．266 2－244 | 2.290 2.267 | 2.313 2.290 | 2.337 2.314 |
|  |  | 2 |  |  |  |  |  |  |  |  |  |  |  | 290 | 2.314 |
| 31 | I．968 | 1．991 | 2.014 | 2.036 | $2 \cdot 060$ | 2.082 | 2．106 | $2 \cdot 129$ | 2．151 | $2 \cdot 175$ | 2．198 | 2.221 | $2 \cdot 244$ | $2 \cdot 267$ | 2.291 |
| 32 | I．947 | r 966 | r．992 | $2 \cdot 015$ | 2.038 | 2.060 | 2.084 | $2 \cdot 106$ | $2 \cdot 129$ 2 | 2．152 | 2．175 | $2 \cdot 197$ | 2.220 | 2.243 | $2 \cdot 266$ |
| 33 | I．925 | － 948 | r 970 | － 9993 | 2.015 | 2.038 | $2 \cdot 06 \mathrm{I}$ | 2.083 | 2－105 | 2．128 | $2 \cdot 151$ | $2 \cdot 173$ | $2 \cdot 196$ | $2 \cdot 218$ | 2.241 |
| 34 | x．902 | I．925 | r．948 | r．970 | I． 992 | 2.014 | 2.037 | 2.059 | 2．08I | $2 \cdot 103$ | $2 \cdot 126$ | $2 \cdot 148$ | $2 \cdot 171$ | 2.193 | 2.216 |
| 35 | I． 880 | 1．902 | r－924 | 1．946 | I 968 | r 990 | $2 \cdot 013$ | 2.034 | 2.056 | 2.078 | 2－IOI | $2 \cdot 123$ | $2 \cdot 145$ | 2．167 | $2 \cdot 189$ |
| 36 | I． 857 | I．879 | I．900 | 1．922 | I－944 | I．966 | 1．987 | $2 \cdot 009$ | 2.031 | 2.053 | 2.075 | $2 \cdot 096$ | $2 \cdot 119$ | $2 \cdot 140$ | 2．162 |
| 37 | $\pm .833$ | 1．855 | r．876 | r－898 | － 919 | I 944 | r 9662 | 1．984 | $2 \cdot 005$ | 2.027 | 2.048 | 2.069 | $2 \cdot 091$ | 2－112 | $2 \cdot 134$ |
| 38 | I．809 | 1．830 | I．851 | 1.873 | 1．893 | 1．915 | 1936 | $1 \cdot 957$ | I•978 | 2．000 | 2.020 | 2.042 | $2 \cdot 063$ | 2.084 | 2．106 |
| 39 | I． 784 | r．805 | I． 826 | I． 847 | I． 867 | I．889 | － 909 | 1－930 | 1．95I | I．972 | I．992 | 2.014 | $2 \cdot 034$ | 2.056 | 2.077 |
| 40 | I＇758 | 1•779 | 1．800 | 1．821 | I－84 1 | I．862 | 1．882 | $1 \cdot 903$ | 1－923 | 1－944 | I•964 | 1．985 | $2 \cdot 005$ | 2.026 | 2.047 |
| 41 | 1.732 | I．753 | 1.773 | r．794 | 1．813 | I．833 | － 854 | 1．875 | 1．894 | 1.915 | － 933 | 1．956 | I．976 | I．996 | 17 |
| 42 | I．706 | I．726 | I•746 | r．766 | $1 \cdot 786$ | $\underline{1} 805$ | 1．826 | 1．846 | I．865 | I．886 | I．905 | $\underline{1} \cdot 026$ | I 946 | r．966 | I．986 |
| 43 | I．679 | 1．699 | 1．718 | r．737 | r．757 r． 728 | $1 \cdot 777$ $\mathrm{I} \cdot 748$ | 1－797 | 1.817 1.787 | r．836 $\mathrm{r} \cdot 806$ | I．855 1．825 rest | r．875 1．845 | 1．895 r 864 | I．915 | I．935 | 1.955 |
| 44 | 1.651 1．623 | 1.671 1.642 | I． 690 I 661 | 1.709 1．680 | r．728 r 699 | I＇748 1 | 1.767 1.737 | 1.787 1.757 | r．806 1－775 | 1．825 | I．845 I－813 | 1．864 1．832 | I． 883 I .852 | r．903 I．87I |  |
| 46 |  | I．614 | I． 632 | 1．650 | 1．669 | I－688 |  | 1＊726 | $1 \times 744$ | 1•762 | I•78I | 1．800 | I．819 | I． 838 | 1．857 |
| 47 | 1．566 | 1.584 | I－602 | I．620 | I． 639 | 1．657 | 1.676 | 1．694 | 1－712 | 1．730 | I－749 | 1－767 | r．786 | I． 803 | 1．823 |
| 48 | r．536 | I． 554 | I 572 | I． 590 | 1．608 | I．626 | I． 644 | 1．661 | 1－680 | r．698 | 1－716 | r 734 | 1.751 | $1 \cdot 770$ | $1 \cdot 789$ |
| 49 | $1 \cdot 506$ | 1.523 | 1.541 | r．559 | 1.577 | r．594 | r．6II | I 629 | I． 647 | I．665 | I．683 | I 700 | 1．717 | －735 | I•753 |
| 50 | $1 \cdot 475$ | 1.492 | 1．510 | 1．527 | 1．545 | 1．562 | 1．579 | 1．596 | 1．613 | 1．63x | 1．649 | 1．666 | I 683 | I• 700 | 1・クリア |
| 51 | 1.444 | I•461 | 1.479 | 1．495 | 1．512 | 1．529 | 1．546 | 1．563 | 1－580 | 1－597 | 1－614 | 1．631 | 1．648 | I 664 | 1．681 |
| 52 | 1.413 | 1429 | I 447 | I． 463 | 1.480 | I 496 | 1.512 | I． 529 | I． 545 | I．563 | 1．579 | I． 596 | I．612 | I． 628 | r．645 |
| 53 | I•381 | I 397 | 1414 | 1.430 | 1．446 | r 462 | 1．478 | I 495 | 1．511 | I•527 | 1．544 | r．560 | 1.576 | I．592 | 1．608 |
| 54 | I．349 | 1．365 | 1．380 | $1 \cdot 397$ | 1413 | I•428 | r．444 | 1.460 | 1.475 | 1.491 | 1．508 | 1.523 | 1．539 | I 555 | 1.570 |
| 55 | 1．316 | 1．332 | 1．347 | $1 \cdot 362$ | r 379 | I•394 | 1－409 | 1．424 | 1.440 | 1－455 |  | 1.487 | 1.502 | 1．517 | r．532 |
| 56 | 1．284 | I－298 | 1－314 | 1．328 | r 344 | I 359 | I． 374 | I． 389 | I－404 | 1.419 | 1－434 | 1.449 | 1．464 | 1479 | I－494 |
| 57 | I 250 | $1 \cdot 265$ | 1．279 | 1.294 | I． 309 | $1 \cdot 323$ | r．338 | I．353 | $1 \cdot 367$ | r 383 | I 396 | 1－412 | 1.426 | 1.44 I | I 455 |
| 58 | 1．217 | I－230 | I－245 | $1 \cdot 259$ | I－274 | 1.287 | 1.302 | I 316 | 1．330 | I•345 | I•359 | 1－373 | $1 \cdot 387$ | I．402 | r－4 6 |
| 59 | I－182 | I－196 | 1.210 | 1.224 | 1238 | 1251 | 1．265 | I 279 | I 293 | 1－307 | I．320 | I 335 | I 348 | I．363 | ェ．376 |
| 60 | I．148 | I•161 | 1．175 | 1－188 | I 201 | 1.215 | 1－228 | I－242 | 1．255 | 1－269 | 1－282 | 1－296 | － 309 | 1．323 | 1．336 |
| 61 | x．113 | I－126 | 1．138 | 1．152 | 1．165 | 1．x 78 | 1－191 | 1．204 | 1．217 | 1．231 | 1．243 | 1－257 | 1－269 | 1．282 | I． 295 |
| 62 | I．078 | 1．090 | I•103 | 1－116 | I•28 | I．141 | I．153 | I•166 | I•179 | I－192 | I 204 | 12217 | 1．229 | I 241 | 1．254 |
| 63 | I． 042 | I－054 | r 066 | r $\cdot 079$ | r 09 y | I－103 | I－115 | I－128 | I． 140 | I－152 | I－164 | 1．177 | $1 \cdot \mathrm{r} 89$ | I 201 | 1.213 |
| 64 | I． 006 |  | I．030 | 1．042 | 1.053 |  | r．077 | I．089 | 1．100 | I＇II2 | I＇124 | r．r36 | I． 148 | 1．159 | 1－171 |
| 65 | 970 | $\cdot 981$ | －993 | r 000 | I 015 | I•027 | I．038 | r．050 | r•06r | r．072 | I－084 | 1．096 | I•106 | I＇II8 | I•129 |
| 66 | ＇933 | －945 | －956 | －966 | ＇977 | －988 | I．000 | I－OII | 1－021 | 1．032 | I•043 | 1．054 | I．065 | r．076 | I． 087 |
| 67 | ． 897 | $\cdot 907$ | $\cdot 918$ | $\cdot 928$ | －939 | －949 | $\cdot 960$ | －970 | $\cdot 981$ | －992 | I．002 | $1 \cdot 013$ | r 023 | r 034 | I．044 |
| 68 | －860 | － 870 | －880 | 890 | －900 | －911 | －921 | －930 | －940 | －951 | －961 | －970 | ，98I | 991 | I．001 |
| 69 70 | $\cdot 823$ $\cdot$ $\cdot 885$ | －832 | ． 842 | ．851 | ． 861 | ．871 | ． 880 | ． 890 | ． 900 | $\stackrel{.910}{ } \cdot 868$ | $\cdot 919$ | $\cdot 928$ | －938 | －948 | ＇958 |
| 70 | －785 | $\cdot 794$ | ． 803 | 813 | －822 | －831 | $\cdot 840$ | －849 | $\cdot 858$ | －868 | $\cdot 878$ | $\cdot 886$ | －896 | －905 | ＇914 |

SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZDIUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| La | $20^{\circ} \cdot 4$ | $20^{\circ} \cdot 6$ | $20^{\circ} \cdot 8$ | $21^{\circ} .0$ | $21^{\circ} \cdot 2$ | $21^{\circ} 4$ | $21^{\circ} .6$ | $21^{\circ} 8$ | $22^{\circ}$ | $22^{\circ} \cdot 2$ | 22 | $22^{\circ} \cdot 6$ | $22^{\circ} 8$ | $23^{\circ} \cdot 0$ | $23^{\circ} \cdot 2$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF $~$ m M |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ |  |  |  | 2.781 | 2.808 | $2 \cdot 836$ | 2.862 | 2.889 | 2.917 |  |  | $2 \cdot 998$ |  | 52 | 80 |
| 4 | 2 | $2 \cdot 720$ | $2 \cdot 747$ | $2 \cdot 774$ | $2 \cdot 801$ | $2 \cdot 828$ | $2 \cdot 855$ | 2.882 | 2.910 | 2.937 | 964 | $2 \cdot 99 \mathrm{I}$ | 18 | 3.044 | 3.072 |
| 8 | 2.673 | $2 \cdot 700$ | $2 \cdot 727$ | 2.754 | $2 \cdot 78 \mathrm{I}$ | 2.807 | 2.834 | $2 \cdot 86 \mathrm{I}$ | $2 \cdot 889$ | 2.915 | $2 \cdot 942$ | 2.970 | $2 \cdot 995$ | 3.022 | 3.050 |
| 10 | $2 \cdot 658$ | $2 \cdot 685$ | 2.712 | 2.739 | $2 \cdot 765$ | 2.792 | 2.819 | $2 \cdot 845$ | $2 \cdot 873$ | $2 \cdot 899$ | $2 \cdot 926$ | 2.953 | $2 \cdot 979$ | 3.006 | 3.032 |
| 12 | $2 \cdot 640$ | $2 \cdot 667$ | 2.694 | $2 \cdot 720$ | 2.747 | $2 \cdot 773$ | 2.800 | 2.826 | 2.853 | 2.880 | 2.906 | $2 \cdot 933$ | $2 \cdot 959$ | $2 \cdot 985$ | 3.012 |
|  | 2 | $2 \cdot 64$ | $2 \cdot 672$ | $2 \cdot 698$ | 25 | $2 \cdot 751$ | 2.777 | 2.803 | 2.830 | 2.857 | 2.883 | $2 \cdot 909$ | $2 \cdot 935$ | $2 \cdot 961$ | 87 |
| 16 | 2.595 | 2.621 | 2.647 | 2.673 | 2.700 | $2 \cdot 725$ | 2.75 I | 2.777 | $2 \cdot 803$ | 2.830 | 2.856 | 2.882 | 2.908 | $2 \cdot 934$ | 2.960 |
| 18 | $2 \cdot 567$ | 2.593 | 2.618 | 2.645 | 2.675 | 2.696 | 2.722 | $2 \cdot 748$ | $2 \cdot 774$ | 2.800 | 2.826 | $2 \cdot 852$ | $2 \cdot 877$ | $2 \cdot 903$ | 2.929 |
| 19 | 2.552 | $2 \cdot 578$ | $2 \cdot 603$ | 2.630 | $2 \cdot 655$ | $2 \cdot 681$ | 2.706 | $2 \cdot 732$ | $2 \cdot 757$ | $2 \cdot 784$ | 2.809 | $2 \cdot 835$ | 2.860 | $2 \cdot 886$ | 2.912 |
| 20 | $2 \cdot 537$ | $2 \cdot 562$ | $2 \cdot 587$ | $2 \cdot 613$ | $2 \cdot 639$ | $2 \cdot 664$ | $2 \cdot 690$ | $2 \cdot 715$ | 2.741 | $2 \cdot 767$ | $2 \cdot 792$ | 2.818 | $2 \cdot 843$ | 88 | $2 \cdot 894$ |
| 21 | 2.5 | $2 \cdot 5$ | $2 \cdot 57$ | $2 \cdot 596$ | 2 | 647 | 2.672 | $2 \cdot 698$ | $2 \cdot 723$ | 2.749 | 2.774 | 2•799 | 4 | 2.849 | 5 |
| 22 | 2.503 | $2 \cdot 52$ | $2 \cdot 553$ | 2.579 | 2.603 | $2 \cdot 629$ | $2 \cdot 654$ | 2.679 | $2 \cdot 704$ | 2.730 | $2 \cdot 755$ | $2 \cdot 780$ | $2 \cdot 805$ | $2 \cdot 830$ | $2 \cdot 855$ |
| 23 | 2.485 | 2.510 | $2 \cdot 534$ | 2.560 | 2.584 | $2 \cdot 610$ | 2.635 | $2 \cdot 660$ | $2 \cdot 685$ | $2 \cdot 710$ | 2.735 | 2.760 | $2 \cdot 785$ | $2 \cdot 810$ | $2 \cdot 835$ |
| 24 | $2 \cdot 466$ | $2 \cdot 49 \mathrm{I}$ | 2.515 | $2 \cdot 541$ | $2 \cdot 565$ | $2 \cdot 590$ | 2.615 | $2 \cdot 640$ | $2 \cdot 664$ | 2.690 | $2 \cdot 714$ | 2.739 | $2 \cdot 764$ | $2 \cdot 788$ | $2 \cdot 813$ |
| 25 | $2 \cdot 446$ | $2 \cdot 471$ | $2 \cdot 495$ | 2.521 | $2 \cdot 545$ | $2 \cdot 570$ | 2.594 | 2.619 | $2 \cdot 643$ | 2.668 | $2 \cdot 693$ | 2.717 | $2 \cdot 742$ | 2.766 | $2 \cdot 791$ |
| 26 | 2.426 | $2 \cdot 4$ |  | $2 \cdot 500$ | 2. | 2 | $2 \cdot 573$ | 2.597 | $2 \cdot 621$ | $2 \cdot 6$ | $2 \cdot 670$ | $2 \cdot 694$ |  | 3 | 2•768 |
| 27 | $2 \cdot 405$ | 2.430 | $2 \cdot 453$ | $2 \cdot 478$ | $2 \cdot 502$ | 2.527 | 2.550 | $2 \cdot 574$ | $2 \cdot 599$ | $2 \cdot 623$ | $2 \cdot 647$ | $2 \cdot 671$ | 2.696 | 2.720 | 2.744 |
| 28 | $2 \cdot 383$ | $2 \cdot 408$ | 2.431 | $2 \cdot 456$ | 2.479 | $2 \cdot 504$ | 2.527 | 2.55I | 2.575 | $2 \cdot 599$ | $2 \cdot 623$ | $2 \cdot 647$ | $2 \cdot 671$ | 2.695 | 2.719 |
| 29 | $2 \cdot 361$ | $2 \cdot 385$ | $2 \cdot 408$ | 432 | $2 \cdot 45$ | 2.480 | $2 \cdot 503$ | 2.527 | $2 \cdot 551$ | $2 \cdot 574$ | $2 \cdot 599$ | 2.622 | $2 \cdot 646$ | 2.669 | 93 |
| 30 | 2.338 | $2 \cdot 362$ | $2 \cdot 385$ | 2.409 | $2 \cdot 432$ | $2 \cdot 455$ | $2 \cdot 479$ | $2 \cdot 502$ | $2 \cdot 526$ | $2 \cdot 549$ | 2.573 | $2 \cdot 596$ | $2 \cdot 620$ | $2 \cdot 643$ |  |
| 31 | $2 \cdot 314$ | 2.337 | $2 \cdot 360$ | $2 \cdot 384$ | $2 \cdot 407$ | 2.430 | 2.453 | 2.477 | 2.500 | $2 \cdot 523$ | 2.547 | 2.570 | $2 \cdot 594$ | 6 |  |
| 32 | $2 \cdot 289$ | 2.313 | $2 \cdot 335$ | $2 \cdot 359$ | $2 \cdot 382$ | $2 \cdot 404$ | 2.427 | 2.450 | 2.474 | $2 \cdot 496$ | $2 \cdot 520$ | 2.543 | $2 \cdot 566$ | $2 \cdot 589$ | 612 |
| 33 | $2 \cdot 26$ | $2 \cdot 28$ | $2 \cdot 309$ | $2 \cdot 333$ | $2 \cdot 355$ | $2 \cdot 377$ | $2 \cdot 401$ | 2.4 | $2 \cdot 447$ | $2 \cdot 469$ | $2 \cdot 492$ | $2 \cdot 515$ | 2.537 | $2 \cdot 560$ | $2 \cdot 583$ |
| 34 | $2 \cdot 238$ | $2 \cdot$ | $2 \cdot 283$ | $2 \cdot 306$ | $2 \cdot 328$ | $2 \cdot 350$ | $2 \cdot 373$ | $2 \cdot 396$ | 2.418 | 2.440 | $2 \cdot 463$ | $2 \cdot 486$ | $2 \cdot 508$ | $2 \cdot 531$ | $2 \cdot 553$ |
| 35 | 2.212 | 2.233 | $2 \cdot 256$ | $2 \cdot 278$ | $2 \cdot 300$ | $2 \cdot 322$ | $2 \cdot 345$ | $2 \cdot 367$ | $2 \cdot 389$ | 2.41 I | $2 \cdot 434$ | $2 \cdot 456$ | $2 \cdot 478$ | $2 \cdot 501$ | $2 \cdot 523$ |
| 36 | $2 \cdot 184$ | $2 \cdot 206$ | $2 \cdot 228$ |  |  |  | $2 \cdot 316$ | $2 \cdot 338$ | $2 \cdot 359$ | $2 \cdot 382$ |  | 2.426 |  | - | 92 |
| 37 | $2 \cdot 155$ | $2 \cdot 177$ | $2 \cdot 199$ | $2 \cdot 221$ | $2 \cdot 242$ | $2 \cdot 264$ | 2.286 | $2 \cdot 308$ | $2 \cdot 329$ | $2 \cdot 351$ | $2 \cdot 373$ | $2 \cdot 395$ | $2 \cdot 416$ | $2 \cdot 437$ | $2 \cdot 459$ |
| 38 | 2.127 | $2 \cdot 148$ | $2 \cdot 170$ | 2-192 | 2.212 | 2.234 | 2.256 | 2.276 | $2 \cdot 298$ | $2 \cdot 320$ | $2 \cdot 34 \mathrm{I}$ | $2 \cdot 362$ | $2 \cdot 384$ | $2 \cdot 405$ | $2 \cdot 427$ |
| 39 |  | $2 \cdot 119$ | $2 \cdot 140$ | $2 \cdot 161$ | $2 \cdot 182$ | $2 \cdot 203$ | 2.225 | $2 \cdot 245$ | 2-266 | $2 \cdot 288$ | $2 \cdot 309$ | $2 \cdot 330$ | $2 \cdot 351$ |  | $2 \cdot 394$ |
| 40 | 2.0 | $2 \cdot 089$ | $2 \cdot 110$ | $2 \cdot 131$ | $2 \cdot 151$ | $2 \cdot 172$ | 2-193 | $2 \cdot 213$ | $2 \cdot 234$ | 2.255 | $2 \cdot 276$ | $2 \cdot 296$ | $2 \cdot 317$ | $2 \cdot 338$ | 9 |
| 4 I | 37 | $2 \cdot 058$ | 2.078 | 2 | $2 \cdot 11$ | 2.140 | 160 | 81 | $2 \cdot 201$ | $2 \cdot 222$ | $2 \cdot 242$ | $2 \cdot 263$ | 2.283 | $2 \cdot 304$ | 24 |
| 42 |  | $2 \cdot 02$ | 2.047 | 2.06; | 2.087 | $2 \cdot 107$ | $2 \cdot 127$ | 2.147 | 2.168 | 2. 188 |  |  | 2.248 |  |  |
| 43 |  | I.99 | 2.014 | $2 \cdot 034$ | $2 \cdot 054$ | $2 \cdot 074$ | $2 \cdot 094$ | $2 \cdot 113$ | $2 \cdot 133$ | $2 \cdot 153$ | 2-173 | 2-193 | 2.213 | 3 | 5 |
| 44 | I $\cdot 942$ | I.962 | I.98I | $2 \cdot 001$ | 2.020 | $2 \cdot 040$ | $2 \cdot 059$ | 2.079 | $2 \cdot 098$ | $2 \cdot 118$ | $2 \cdot 137$ | $2 \cdot 157$ | 2.176 | $2 \cdot 196$ | $2 \cdot 215$ |
| 45 | 1.909 | 1.928 | 1.948 | 1.967 |  | $2 \cdot 005$ | 2.024 | 2.043 | $2 \cdot 063$ | 2.082 | 2-101 | 2.120 | $2 \cdot 139$ | $2 \cdot 159$ |  |
| 46 | 76 | I |  |  | 1 |  |  | 2.008 | 26 |  | $2 \cdot 064$ | $2 \cdot 083$ | 2 |  | 40 |
| 47 | 1.84I | I.859 | I. 878 | I.897 | I-916 | I.934 | I 953 | I 9 | 1.990 | -00 | 2.027 | 2.045 | $2 \cdot 064$ | 2.082 | 100 |
| 48 | r.806 | 1.824 | 1.842 | 1-861 | 1.879 | I. 897 | r.916 | 1.933 | 1-951 | 1.970 | 1.988 | $2 \cdot 006$ | 2.025 | 2.043 | - |
| 49 | 1.771 | I.788 | I 806 | r 825 | I 8442 | I.860 | I. 878 | I.895 | -913 | r.932 | r.949 | I.967 | 1.985 | $2 \cdot 003$ |  |
| 50 | 1.735 | 1•752 | 1.770 | 1788 |  | I-82 | I 840 | I.8 | I. 875 | I. 892 | 1.910 | I'927 | 1-944 | I.963 | 1.979 |
| 51 |  | 1.7 | 1.733 | 1.750 | 1.767 | 1.784 | 1.801 | 18 | r.835 | 1.852 | I. 870 | 1.887 | I-903 | 20 | 38 |
| 52 | I-66 | 1.679 | I. 695 | r 713 | 1.729 | I•745 | $1 \cdot 762$ | $1 \cdot 779$ | I•796 | 1812 | 1.830 | 1.846 | 1.862 | I-880 | -896 |
| 53 | I. 625 | I 641 | 1.657 | I.674 | I.690 | r.706 | I.722 | I.739 | r.755 | x 771 | r 788 | $\underline{\mathrm{I}} \mathrm{P} 804$ | r-820 | I 837 | r.854 |
| 54 | 1.587 I. 548 | I.603 | 1.618 | I.635 | $\xrightarrow{\text { I } 651}$ |  | I.682 | r.699 | I.714 | I.730 | I 7447 | r 1.762 | I•778 | r•794 | 811 |
| 55 | 548 | I 5 | I 579 | I. 596 | 1.61 |  |  |  | I | I.688 | I•705 |  | 1'735 |  |  |
| 56 | 1.509 | 1.525 | I 54 | 1.555 | 1-571 | 1.586 | I-600 | 1.615 | 1.63I | I 646 | I. 662 | 1.677 | 1.692 | 1-706 | 1.717 |
| 57 | 1.470 | 1.485 | 1.500 | I-514 | I. 529 | 1.544 | 1.559 | r. 574 | I. 589 | I.603 | I.619 | I.632 | I. 647 | I.661 | r.672 |
| 58 | I 4330 | I 444 | I 459 | I-473 | I. 488 | 1.503 | 1.517 | 1.53I | 1.546 | 1.560 | r.575 | I.588 | I. 603 | I.616 | I.627 |
| 59 | -390 | r 404 | r.418 | 432 | I 444 | 1.461 | 1.474 | 1.488 | I.502 | 1.516 | r.53I | I.544 | I. 558 | 1.571 | I.58I |
| 60 | 350 | 1-363 | $1 \cdot 377$ | - | 1.404 | 1 | 1.431 | 1-445 | 1.458 | I.472 | 1.485 | 1•499 | 1.513 | 1-526 | I.540 |
| 6 | 09 | I 322 | I.335 | 1-348 | 1.361 | 1.375 | 1-388 | 1401 | 1.414 | $1 \cdot 427$ | 1.440 | I•454 | 1.467 | 1.480 | r 493 |
| 62 | 1.267 | I-280 | I 293 | I. 305 | I 319 | 1.331 | 1-344 | 1.356 | I-369 | r 382 | I•394 | 1.408 | 1420 | 1433 | r 446 |
| 63 | 1.225 | I-238 | I 250 | I. 262 | I. 275 | I-287 | I. 299 | r311 | 1.324 | r 337 | I 348 | I 361 | I 373 | I•386 | I 398 |
| 64 | $\underline{1} 183$ | r.195 | $\underline{1} 208$ | I219 | 1.230 |  | 1255 | 1.267 | 1.279 | I 291 | I•302 | I 315 | 1.326 | I.338 | I.350 |
| 65 | 1.141 | 1.153 | I•164 | 1.175 | I•186 | 1-198 | 1210 | 1-221 | 1.233 | I 244 | I 255 | 1-267 | 1.278 | 1290 | 1-301 |
| 66 | I-098 |  | 1.120 | 1 | 1.142 | I'153 | 1-164 | $1 \cdot 175$ | 1.187 | I•198 | 1.208 | 1.219 | 1.230 | 1-242 | I 253 |
| 67 | $1 \cdot 055$ | I-066 | r 076 | I.086 | I•097 | I-108 | I-118 | I. 129 | 1.140 | I 150 | I 160 | I'171 | I-182 | I•193 | I'204 |
| 68 | 1.012 | 02I | 1.031 | I.04I | I.052 | r-062 | r-072 | 1.083 | r-093 | -102 | r 113 | I'123 | r.133 | I 143 | I'154 |
| 70 | $\cdot \cdot 967$ | $\cdot 977$ | $\cdot 987$ | -996 | I.006 | -016 | I-026 | r.035 | 1.045 | r 055 | r-064 | 1.075 | I 084 | r 094 | I•103 |
| 70 | '923 | -932 | '942 | -951 | -961 | 970 | 79 | '988 | 997 | 1.007 | I.016 | 1.026 | 1.035 | I 044 | r.053 |

## SHOWLNG THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $23^{\circ}$ | $23^{\circ} \cdot 6$ | $23^{\circ} 8$ | $24^{\circ} \cdot 0$ | 2 | $24^{\circ}$ | $24^{\circ} \cdot 6$ | $24^{\circ}$ | $25^{\circ}$ | 25 | $25^{\circ} \cdot 4$ | $25^{\circ} \cdot 6$ | $25^{\circ} 8$ | $26^{\circ} \cdot 0$ | $26^{\circ}$. 2 |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF a MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| : |  |  | 3.16I | 188 | $3 \cdot 216$ |  |  |  |  |  |  |  |  |  |  |
| 4 | 3.099 | 3.126 | $3 \cdot 153$ | $3 \cdot 180$ | 3.208 | $3 \cdot 235$ | $3 \cdot 263$ | 3.290 | 3.318 | 3.345 | 3.373 | $3 \cdot 400$ | 428 | 54 |  |
| 8 | 3.077 | $3 \cdot 103$ | $3 \cdot 130$ | $3 \cdot 157$ | 3.185 | 3.211 | 3.239 | 3.266 | 3.292 | $3 \cdot 320$ | $3 \cdot 348$ | $3 \cdot 375$ | $3 \cdot 401$ | $3 \cdot 429$ | 3.457 |
| 10 | 3.060 | $3 \cdot 086$ | $3 \cdot 113$ | $3 \cdot 140$ | $3 \cdot 167$ | 3.194 | 3.221 | $3 \cdot 248$ | 3.275 | 3.302 | 3.330 | $3 \cdot 356$ | $3 \cdot 383$ | 3.410 | 3.438 |
| 12 | 3.039 | 3.066 | 3.092 | 3.119 | 3.146 | 3•172 | 3.200 | $3 \cdot 226$ | 3.252 | 3.280 | $3 \cdot 307$ | $3 \cdot 334$ | $3 \cdot 360$ | $3 \cdot 387$ | $3 \cdot 415$ |
| 14 | 3.01 | 3.041 | 3.06 | 3.093 | $3 \cdot 120$ | $3 \cdot 146$ | 3•174 | $3 \cdot 200$ | 3.226 | 3.253 | $3 \cdot 280$ | $3 \cdot 307$ | $3 \cdot 333$ | $3 \cdot 360$ | $3 \cdot 387$ |
| 16 | $2 \cdot 987$ | $3 \cdot 013$ | 3.038 | 3.065 | 3.090 | 3.117 | 3.144 | $3 \cdot 170$ | 3.196 | 3.223 | 3.250 | 3.276 | $3 \cdot 302$ | 3.329 | $3 \cdot 356$ |
| 18 | $2 \cdot 955$ | $2 \cdot 98 \mathrm{I}$ | 3.006 | 3.032 | 3.058 | 3.085 | $3 \cdot 111$ | 3•137 | $3 \cdot 163$ | $3 \cdot 189$ | 3.216 | $3 \cdot 242$ | 3.267 | $3 \cdot 294$ | $3 \cdot 320$ |
| 19 | $2 \cdot 937$ | $2 \cdot 963$ | $2 \cdot 989$ | $3 \cdot 015$ | 3.040 | 3.066 | 3.093 | 3.119 | $3 \cdot 144$ | $3 \cdot 170$ | 3.197 | 3.223 | $3 \cdot 248$ | 3.274 | 3.301 |
| 20 | 2.919 | $2 \cdot 945$ | $2 \cdot 971$ | $2 \cdot 996$ | $3 \cdot 021$ | 3.048 | $3 \cdot 074$ | $3 \cdot 100$ | 3.125 | 3-151 | 3-177 | 3.203 | $3 \cdot 228$ | 3.254 | $3 \cdot 281$ |
| 21 | 2 | 2.92 | $2 \cdot 95$ | $2 \cdot 977$ | 3. | 3.0 | $3 \cdot 05$ | 3.0 | $3 \cdot$ | $3 \cdot 130$ | 3.156 | 3.182 | 3.207 | 3.233 | $3 \cdot 259$ |
| 22 | 2.88 | 2.90 | 2.93 I | $2 \cdot 956$ | 2.98I | 3.007 | 3.033 | $3 \cdot 0$ | 3.0 | $3 \cdot 109$ | 3.135 | $3 \cdot 159$ | 3.185 | 3.211 | 3.237 |
| 23 | $2 \cdot 860$ | $2 \cdot 885$ | 2.910 | 2.935 | $2 \cdot 960$ | 2.985 | 3.010 | 3.036 | $3 \cdot 0$ | 3.087 | $3 \cdot 112$ | 3.137 | 3.162 | $3 \cdot 188$ | 3.214 3.189 |
| 24 | 2.838 2.815 | $2 \cdot 863$ | $2 \cdot 888$ | 2.913 | $2 \cdot 937$ | 2.963 | 2.988 2.964 | $3 \cdot 012$ | $3 \cdot 0$ | 3.063 | $3 \cdot 089$ | $3 \cdot 11$ | 8 | $3 \cdot 164$ $3 \cdot 138$ | $3 \cdot 1$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 | $2 \cdot 792$ | 2.817 | $2 \cdot 8$ | $2 \cdot 866$ | 2.890 | $2 \cdot 915$ | 2.940 | $2 \cdot 964$ | 2.989 | 3.014 | 3.038 | 3.063 | 3.088 | $3 \cdot 113$ | 3.138 |
| 27 | $2 \cdot 76$ | $2 \cdot 793$ | 2.81 | $2 \cdot 840$ | 2.865 | 2.890 | 2.915 | $2 \cdot 939$ | $2 \cdot 963$ | $2 \cdot 988$ | 3.012 | 3.036 | $3 \cdot 061$ | 3.086 | $3 \cdot 110$ |
| 28 | 2.743 | $2 \cdot 767$ | 2.791 | 2.814 | 2.839 2.812 | 2.863 | 2.888 | 2.912 | $2 \cdot 936$ | $2 \cdot 961$ | $2 \cdot 984$ | $3 \cdot 009$ | 3.033 | 3.058 | 3.082 |
| 29 | 2.717 2.691 | 2.740 2.715 | 2.76 | 2.788 2.761 | 2.812 | 2.836 2.809 | $2 \cdot 860$ | $2 \cdot 884$ 2.856 | $2 \cdot 9$ | $2 \cdot 933$ | $2 \cdot 956$ | 2.980 | 3.005 | $3 \cdot 029$ | $3 \cdot 053$ |
| 30 |  | $2 \cdot 715$ | $2 \cdot 73$ | 2.76x | $2 \cdot 785$ | 2.809 | 2.833 | $2 \cdot 856$ | 2.8 | 2.904 | 2.927 | $2 \cdot 952$ | $2 \cdot 976$ | 3.000 | 3.024 |
| 31 | 2.663 | 2.686 | 2.710 | $2 \cdot 733$ | $2 \cdot 7$ | $2 \cdot 7$ | $2 \cdot 8$ | $2 \cdot 82$ | $2 \cdot 851$ | $2 \cdot 875$ | $2 \cdot 897$ | $2 \cdot 921$ | 2.945 | 69 | $2 \cdot 993$ |
| 32 | 2.635 | $2 \cdot 657$ | $2 \cdot 68$ | $2 \cdot 704$ | $2 \cdot 727$ | $2 \cdot 751$ | $2 \cdot 774$ | $2 \cdot 79$ | $2 \cdot 82$ | $2 \cdot 844$ | 2.867 | 2.890 | 2.914 | $2 \cdot 937$ |  |
| 33 | $2 \cdot 606$ | 2.628 2.508 | 2.651 2.621 | 2.674 2.644 | 2.697 2.666 | 2.720 2.689 | 2.743 | 2.76 | $2 \cdot 789$ | 2.813 | 2.835 2.802 | 2.859 2.826 | 2.882 2.849 | 2.905 2.872 | 28 |
| 34 | 2.576 | $2 \cdot 598$ | $2 \cdot 621$ | 2.644 2.612 | 2.666 2.635 | 2.6 | 2.712 2.680 | 2.735 2.702 | $2 \cdot 75$ | 2.780 | 2.802 2.769 | $2 \cdot 826$ 2.792 | 2.849 2.815 | 2.872 2.837 | 94 |
| 35 | 2 |  |  | $2 \cdot 12$ | 2.63 |  |  |  | $2 \cdot 7$ |  |  |  |  |  |  |
| 36 | 2.514 | 2.535 | 2.558 | 2.580 | $2 \cdot 602$ | $2 \cdot 624$ | $2 \cdot 647$ | $2 \cdot 669$ | 2.690 | 2.712 | $2 \cdot 735$ | $2 \cdot 758$ | 2.779 | 2.801 | 825 |
| 37 |  | $2 \cdot 502$ | 2.524 | $2 \cdot 546$ | $2 \cdot 568$ | 2.590 | $2 \cdot 612$ | $2 \cdot 634$ | $2 \cdot 655$ | 2.677 | $2 \cdot 699$ | $2 \cdot 721$ | $2 \cdot 743$ | 2.765 | 788 |
| 38 | $2 \cdot 448$ | 2.469 | $2 \cdot 491$ | 2.513 | 2.535 | $2 \cdot 555$ | $2 \cdot 578$ | 2.599 | $2 \cdot 620$ | $2 \cdot 642$ | 2.663 | 2.685 | 2.707 | $2 \cdot 729$ | $2 \cdot 750$ |
| 39 | 2.414 | $2 \cdot 436$ | 2.457 | 2.477 | 2.499 | 2.520 | $2 \cdot 542$ | $2 \cdot 563$ | $2 \cdot 584$ | $2 \cdot 606$ | 2.627 | $2 \cdot 648$ | $2 \cdot 670$ | $2 \cdot 691$ | 2.713 |
| 40 | $2 \cdot 380$ | $2 \cdot 401$ | 2.422 | $2 \cdot 442$ | $2 \cdot 463$ | $2 \cdot 484$ | $2 \cdot 506$ | 2.526 | $2 \cdot 547$ | $2 \cdot 568$ | 2.589 | 2.611 | 2.632 | 2.653 | 75 |
| 41 | $2 \cdot 345$ | $2 \cdot 365$ | $2 \cdot 386$ |  | $2 \cdot 427$ | $2 \cdot 447$ | $2 \cdot 468$ | 2.489 | $2 \cdot 510$ | 2.530 | $2 \cdot 551$ | 2.572 | $2 \cdot 593$ | 13 | 34 |
| 42 | $2 \cdot 309$ | $2 \cdot 329$ | $2 \cdot 349$ | $2 \cdot 369$ | $2 \cdot 390$ | 2.410 | 2.430 | $2 \cdot 451$ | $2 \cdot 471$ | 2.492 | 2.512 | 2.533 | 2.553 | $2 \cdot 573$ | $2 \cdot 594$ |
| 43 | 2.272 | 2.292 | $2 \cdot 312$ | 2.332 | $2 \cdot 352$ | $2 \cdot 372$ | $2 \cdot 392$ | $2 \cdot 412$ | $2 \cdot 432$ | 2.452 | 2.472 | 2.493 | 2.513 | $2 \cdot 533$ | $2 \cdot 553$ |
| 44 | 2.235 | 2.255 | $2 \cdot 274$ | 2.294 | $2 \cdot 313$ | $2 \cdot 333$ | 2.352 | $2 \cdot 373$ | $2 \cdot 392$ | 2.412 | 2.43 L | 2.452 | 2.471 | 2.491 | 2.511 2.468 |
| 45 | $2 \cdot 197$ | 2.216 | $2 \cdot 235$ | $2 \cdot 255$ | $2 \cdot 274$ | $2 \cdot 293$ | $2 \cdot 312$ | $2 \cdot 332$ | $2 \cdot 352$ | $2 \cdot 371$ | $2 \cdot 390$ | 2.410 | 2.429 | 2.449 | $2 \cdot 468$ |
| 46 | 2.159 | $2 \cdot 177$ | 2-196 | 15 | $2 \cdot 23$ | $2 \cdot 253$ | $2 \cdot 27$ | $2 \cdot 292$ | $2 \cdot 310$ | $2 \cdot 329$ | $2 \cdot 348$ | -2.368 | $2 \cdot 387$ | $2 \cdot 406$ | $2 \cdot 424$ |
| 47 | $2 \cdot 119$ | $2 \cdot 138$ | $2 \cdot 156$ | $2 \cdot 175$ | 2.193 | 2.212 | 2.230 | $2 \cdot 250$ | $2 \cdot 268$ | 2.287 | $2 \cdot 305$ | $2 \cdot 325$ | $2 \cdot 343$ | $2 \cdot 362$ | $2 \cdot 380$ |
| 4 | 2.079 | 2.097 | 2-116 | $2 \cdot 134$ | $2 \cdot 152$ | 2.170 | 2-188 | $2 \cdot 206$ | $2 \cdot 226$ | $2 \cdot 244$ |  | $2 \cdot 280$ | $2 \cdot 299$ | $2 \cdot 317$ | $2 \cdot 335$ |
| 59 | 2.039 | $2 \cdot 057$ | $2 \cdot 074$ | $2 \cdot 091$ | $2 \cdot 110$ | 2-128 | $2 \cdot 145$ | $2 \cdot 164$ | $2 \cdot 182$ |  |  | 2.236 | $2 \cdot 254$ | $2 \cdot 272$ | 2.290 |
| 50 | - 997 | $2 \cdot 015$ | $2 \cdot 032$ | $2 \cdot 049$ | 2.067 | $2 \cdot 085$ | 2.102 | $2 \cdot 12$ | 2.138 | 2.155 | 2.173 | 2-191 | $2 \cdot 209$ | $2 \cdot 226$ | 2.243 |
| 5 I | I•954 | 1-972 | I 989 | 2 | $2 \cdot 024$ | $2 \cdot 041$ | 2.057 | 2.075 | $2 \cdot 092$ | $2 \cdot 1$ | $2 \cdot 127$ | $2 \cdot 144$ | 2-161 | $2 \cdot 179$ | $2 \cdot 196$ |
| 52 |  | I.930 | I 947 | I.963 | 1.980 | I•997 | 2.013 | 2.031 | $2 \cdot 047$ | $2 \cdot 065$ | 2.081 | 2.098 | $2 \cdot 115$ | 2.132 | 2.149 |
| 53 |  | I. 886 | $\mathrm{r} \cdot 903$ | I.919 |  | I-952 | I.968 | 1.985 | $2 \cdot 001$ | $2 \cdot 018$ | 2.034 | 2.051 | $2 \cdot 067$ | $2 \cdot 084$ | $2 \cdot 100$ |
| 54 | 1.826 | I•842 | I.859 | - 1874 | 1.890 | I.907 | I.922 | I.939 | $1 \cdot 955$ | 1.971 | I.987 | $\xrightarrow{2.004}$ | 2.019 | 2.036 | 2.051 |
| 55 |  | 1'797 | I-813 |  | 1.844 | 1.860 | 1.875 | I.892 | I 907 | 1-923 | 1.939 | 1.955 | 1.970 | 1•986 |  |
| 56 | r.737 | 1.752 | 1.768 | 1.783 | 1-798 | 1.814 | 1.829 | I 8445 | 1.859 | I. 8 | I-890 | I.906 | 1-921 | 1.937 | 1.952 |
| 57 | 1.692 | I•706 | I•722 | I.737 | I•751 | I 7766 | I• 781 | I•795 | I.811 | I 826 | I-841 | I. 855 | 1.871 | I.886 | I.900 |
| 58 | r 647 | I 660 | I 675 | I.689 | I. 704 | I•19 | 1.733 | 1.747 | I•762 | 1.777 | I•791 | r 806 | 1.820 | 1.835 | 1.849 |
| 59 | I.600 | ${ }_{\text {I }} \cdot 614$ | 1.629 | I.642 | I. 656 | 1.671 | 1.684 | 1-699 | I•713 | 1.727 | I•741 | 1•755 | $1 \cdot 770$ | $1 \cdot 784$ | I'798 |
| 60 | I•553 | 1-567 | 1.580 | I 594 | 1.60 | 1.622 | 1.635 | 1•649 | I.663 | 1.677 | 1.690 | $1 \cdot 704$ | $1 \cdot 718$ | 1.732 | I•74 |
| 61 | 1.506 | 1.519 | I.533 | I 546 | 1. 559 | 1.573 | 1.585 | 1.599 | 1.613 | 1.625 | 1.639 | I 655 | 1. 666 | 1.678 | I.692 |
| 62 | $\underline{1458}$ | I 472 | 1.485 | 1.497 | 1.510 | 1.523 | 1.535 | 1-549 | 1.562 | 1.574 | 1.587 | I 600 | I-613 | 1.625 | I.638 |
| 63 | 1.410 | 1.423 | r.436 | 1.448 | I 460 | 1.472 | 1.485 | I 498 | I 509 | 1.522 | I. 535 | I. 548 | $\stackrel{1}{5} 559$ | 1.572 | 1.585 |
| 64 65 |  | 1.374 $\mathrm{r} \cdot 324$ | r 386 1-336 | I•398 | 1.410 1. 358 | I.421 | 1.434 | I. 446 | 1.458 | 1.470 | I-482 | I.494 | 1.506 - 451 | I.518 1.463 | 1.530 |
| 65 |  | r-324 | I-3 | 1-348 | $1 \cdot 3$ | 1.370 | $1 \cdot 382$ | I 393 | 1 405 | 14 | 1.428 | 1.4 | 1-45 | 3 |  |
| 66 | I. 264 | 1.275 | 1. 285 | 1. 296 | I-308 | I•319 | 1.330 | I 341 | 1-352 | I•364 | I 375 | I•386 | I 397 | I.408 | 1.420 |
| 67 | 1.215 | I 2225 | I.235 | I 246 | I. 256 | I. 267 | 1.278 | I.289 | I-299 | I 310 | I 321 | I 332 | I 342 | I 353 | 1.364 |
| 68 | I•I64 | I•174 | I-183 | I-194 | 1-204 | 1-214 | 1-225 | 1.235 | I 245 | 1.256 | I 266 | I 276 | 1.287 | 1.297 | ${ }^{1} 307$ |
| 69 | 1-113 | 1-123 | 1.132 | I'143 | I•152 | 1-162 | 1-172 | 1-182 | I-192 | I 202 | I-211 | 1.221 | 1.231 | I 224 | I 251 |
| 70 | 062 | 1.072 | I-081 | I 09 I | 1-100 | I•109 | I-118 | 1-128 | I-13 ${ }^{8}$ | 1.147 | I•156 | I•66 | I-175 | I-185 | 1-194 |

## SHOWING THE REDUCTION AT 1 MIN. FROM THE MERDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \multicolumn{16}{|c|}{AZIMUTHS.} <br>
\hline Lat. \& $28^{\circ} 4$ \& $28^{\circ} \cdot 6$ \& $26^{\circ} 8$ \& $27^{\circ} 0$ \& $27^{\circ} 2$ \& $27^{\circ} 4$ \& $27^{\circ} \cdot 6$ \& $27^{\circ} 8$ \& $28^{\circ}$ \& $28^{\circ}$ \& $28^{\circ} 4$ \& $28^{\circ} 6$ \& $28^{\circ} 8$ \& $29^{\circ} 0$ \& $29^{\circ}$ <br>
\hline \& \multicolumn{15}{|c|}{REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN.} <br>
\hline : \& $3 \cdot 518$ \& $3 \cdot 546$ \& \& $3 \cdot 601$ \& 3.629 \& \& $3 \cdot 684$ \& \& \& $3 \cdot 768$ \& \& \& .851 \& \& <br>
\hline 4 \& $3 \cdot 509$ \& 3.537 \& 3.565 \& 3.592 \& \& $3 \cdot 648$ \& 3.675 \& \& 3.731 \& 3.759 \& \& \& .841 \& 69 \& <br>
\hline 8 \& \& $3 \cdot 5$ \& \& \& \& \& \& \& \& \& \& \& 3.813 \& 41 \& <br>
\hline 12 \& \& 3.4 \& \& $3 \cdot 546$ \& \& \& $3 \cdot 6$
3 \& \& \& 85 \& \& \& 93 \& \& <br>
\hline \& \& \& \& \& \& \& \& \& $3 \cdot 628$ \& \& \& \& \& \& <br>
\hline 14
16 \& \& \&  \& 3.494
$3 \cdot 461$ \& \& \& 541 \& \% \& 3.628
3.594 \& 5 \& \& \& \& 29 \& <br>
\hline 18 \& $3 \cdot$ \& 3.373 \& \& $3 \cdot 425$ \& $3 \cdot 452$ \& $3 \cdot 477$ \& 3.504 \& 3.531 \& 3.557 \& 3.583 \& \& \& \& \& <br>
\hline 19 \& \& \& \& \& \& \& \& \& \& \& \& ${ }_{3}^{3.593}$ \& \& \& <br>
\hline \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline 21 \& \& \& $3 \cdot 3$ \& $3 \cdot 3$ \& \& 3.413 \& 3.439 \& $3 \cdot 465$ \& \& \& \& \& \& \& <br>
\hline $$
\begin{aligned}
& 22 \\
& 23
\end{aligned}
$$ \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline 24 \& $3 \cdot$ \& 3.239 \& $3 \cdot 264$ \& \& 3 \& $3 \cdot 340$ \& $3 \cdot 366$ \& $3 \cdot 391$ \& \& $3 \cdot 442$ \& \& 3-493 \& 3.518 \& $3 \cdot 543$ \& 570 <br>
\hline 25 \& \& 3.213 \& $2 \cdot 238$ \& $3 \cdot 263$ \& \& $3 \cdot 3$ \& 3.339 \& $3 \cdot 364$ \& $3 \cdot 3$ \& 3 \& \& \& $3 \cdot 4$ \& $3 \cdot 515$ \& 41 <br>
\hline 26 \& 3. 162 \& 3. \& 3.212 \& 3.237 \& 3.262 \& $3 \cdot 287$ \& $3 \cdot 3$ \& 3.337 \& $3 \cdot 362$ \& 3.387 \& 3.412 \& 36 \& 6 x \& 3.486 \& <br>
\hline 27 \& \& $3 \cdot$ \& \& \& $3 \cdot 2$ \& \& \& \& 3.332 \& \& \& \& 3.431 \& \& <br>
\hline 28
29
20 \& $3 \cdot 0$ \& ${ }_{3}^{3 \cdot 1}$ \& \& \& 3.1. \& \& 3.222 \& 3.247 \& \& \& 3.351 \& 3.376
3.344
3 \& 3.400 \& 3.392 \& <br>
\hline 30 \& 3.047 \& $3 \cdot$ \& 3.095 \& $3 \cdot 119$ \& 3.143 \& \& 3.191 \& $3 \cdot 215$ \& $3 \cdot$ \& $3 \cdot 263$ \& $3 \cdot 287$ \& 1 \& $3 \cdot 335$ \& - \& <br>
\hline 31 \& \& \& 3. \& \& \& \& $3 \cdot 158$ \& 3 \& 3.205 \& \& \& \& \& \& <br>
\hline 32 \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline 33
34 \& ${ }^{2.951}$ \& 2. \& 2.920 \& \& ${ }^{3} 3^{\circ}$ \& \& \& \& \& \& \& \& \& 3.216 \& <br>
\hline 34
35 \& $2 \cdot 8$ \& 2.905 \& 2.927 \& $2 \cdot 950$ \& 2.972 \& 5 \& $3 \cdot 019$ \& 3.041 \& 3.064 \& \& 3•109 \& 3.132 \& $3 \cdot 155$ \& 7 \& I <br>
\hline 36 \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& I <br>
\hline 37 \& \& $2 \cdot 8$ \& \& \& \& \& $2 \cdot 942$ \& $2 \cdot 965$ \& \& \& \& 3.053 \& \& 3 \& <br>
\hline 38 \& $2 \cdot 7$
2
2 \& 2. 2. \& \& 2.838 \& \& \& \& \& \& \& \& 3.013 \& \& 3.057 \& <br>
\hline 39
40 \& 2.734
2.695 \& 2.756
2.716 \& 2.7788
2.738 \& 2.799
2.759 \& 2.780
2.780 \& 2.842
2.801 \& 2.863
2.822 \& $2 \cdot 844$ \& 2.864 \& $2 \cdot 886$ \& 2.9 \& 2.929 \& 2.950 \& 2.972 \& 4 <br>
\hline 41 \& $2 \cdot$ \& $2 \cdot 6$ \& $2 \cdot 697$ \& \& \& $2 \cdot 7$ \& $2 \cdot 780$ \& 2.802 \& $2 \cdot 822$ \& 4 \& 64 \& 86 \& \& \& <br>
\hline 42 \& $2 \cdot 614$ \& 2.635 \& 2.656 \& 2.6 \& \& \& \& \& \& \& \& 2.84I \& \& 2.883 \& <br>
\hline 43
44 \& \& 2.5 \& \& \& \& \& \& \& 2.735 \& \& \& \& \& \& <br>
\hline 45 \& $2 \cdot$ \& $2 \cdot 5$ \& $2 \cdot 526$ \& 2.547 \& 2. \& $2 \cdot 5$ \& $2 \cdot 6$ \& \& $2 \cdot 645$ \& 4 \& \& 2.703 \& $2 \cdot 723$ \& 3 \& <br>
\hline 46 \& \& \& 24 \& \& \& \& $2 \cdot 559$ \& \& 98 \& \& \& 56 \& 76 \& 94 \& <br>
\hline 47 \& \& \& 2.437 \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline 49 \& \& \& \& 2.4 \& 2.3 \& \& \& \& \& \& \& \& ${ }_{2}^{2.5}$ \& 2.545 \& <br>
\hline 50 \& $2 \cdot 261$ \& \& 2.297 \& $2 \cdot 315$ \& $2 \cdot 333$ \& $2 \cdot 3$ \& $2 \cdot 369$ \& \& $2 \cdot 4$ \& 2.422 \& $2 \cdot 439$ \& 2.458 \& $2 \cdot 476$ \& $2 \cdot 4$ \& 析 <br>
\hline 51 \& \& \& \& $2 \cdot$ \& $2 \cdot 284$ \& \& 2 \& \& 2 \& \& \& $2 \cdot 406$ \& 2 \& \& <br>
\hline 52 \& \& \& $2 \cdot 20$ \& 2.217 \& \& $2 \cdot 251$ \& 2.269 \& \& \& \& 23 \& $2 \cdot 354$ \& 2 \& $2 \cdot 3$ \& $2 \cdot 405$ <br>
\hline 5 \& 2.1. \& $2 \cdot$ \& $2 \cdot 150$ \& ${ }^{2 \cdot 1}$ \& $2 \cdot$ \& \& $2 \cdot 2$ \& 2 \& 2.251 \& 2.268 \& \& $2 \cdot 2$ \& 2.318 \& 2.334
2.280 \& 2.351 <br>
\hline 54
54
54 \& $\xrightarrow{2.068} \begin{aligned} & \text { 2.018 }\end{aligned}$ \& \& \& 2. \& $\xrightarrow{2 \cdot 133}$ \& \& \& \& \& - \& $$
\mid 2 \cdot 177
$$ \& 2.247
2.193 \& \& \& <br>
\hline 56 \& \& \& \& \& \& \& \& \& \& \& \& \& \& 9 \& <br>
\hline 5 \& \& $1 \cdot$ \& - ${ }^{4}$ \& - 961 \& , \& 1 \& \& 2021 \& , ${ }^{\text {a }}$ \& 51 \& \& \& \& \& <br>
\hline 58 \& \& 1. \& r.8 \& r r -909 \& \& \& 1. \& 1.967 \& I.981 \& 96 \& ${ }^{\text {2.011 }}$ \& \& I \& 2.05 \& <br>
\hline 69 \&  \& \&  \& r r 801 \& 14 \& 1.828 \& 1-842 \& \& $$
\begin{aligned}
& 1.026 \\
& 1.870
\end{aligned}
$$ \& \& $$
\left\lvert\, \begin{gathered}
\mathrm{T} \cdot 055 \\
\mathrm{r} \cdot 898
\end{gathered}\right.
$$ \& $$
\begin{aligned}
& \mathrm{r} .969 \\
& \mathrm{r} .912
\end{aligned}
$$ \& $$
\begin{aligned}
& 1.984 \\
& 1.926
\end{aligned}
$$ \& $$
\begin{aligned}
& \mathrm{I} \cdot 998 \\
& \mathrm{r} 940
\end{aligned}
$$ \& 13 <br>
\hline ${ }_{61}$ \& \& \& \& \& , \& \& r.786 \& 1.800 \& r. 813 \& \& \& I. 854 \& I. 868 \& r.88 \& <br>
\hline 62 \& \& \& \& \& \& \& I. \& $\xrightarrow{1.74}$ \& \& 1.769 \& I.782 \& \& I.809 \& I.821 \& I. 834 <br>
\hline 63
64 \& \& \& + $1.56{ }^{\text {r }}$ \& \& \& \& \(1673

r61\) \& 1.62 \& \& I. 651 \& \& \& I. \& \& <br>
\hline 65 \& $1 \cdot 486$ \& T-498 \& - \& 1.521 \& 1.534 \& - \& 1-557 \& 1.569 \& 1.580 \& I-592 \& I.60 \& 1.615 \& I. 627 \& r-639 \& 1-65r <br>
\hline 66 \& \& \& \& I-464 \& 1.476 \& 1.488 \& 1.499 \& 1.5 \& \& 1.5 \& \& 1.555 \& 1.5 \& \& P589 <br>
\hline 67 68 \& \& \& \& \& I.418 \& \& \& \& \& \& \& \& \& \& <br>
\hline 69 \& \& \& \& \& \& \& \& 1.331 \& - \& \& \& \& \& \& <br>
\hline 70 \& \& -213 \& 1.222 \& $1 \cdot 231$ \& I-241 \& 1.250 \& \& I 270 \& 1.279 \& 9 \& \& $1 \cdot 308$ \& $1 \cdot 317$ \& 7 \& - 336 <br>
\hline
\end{tabular}

SHOWING THE REDUCTION AT 1 MIN. FROM THE MERDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat | $29^{\circ}$ | $29^{\circ} \cdot 6$ | $29^{\circ} \cdot 8$ | 30 | $30^{\circ} \cdot 2$ | 30 | $30^{\circ}$ | $30^{\circ} .8$ | 31 | 31 | $31^{\circ} \cdot 4$ | $31^{\circ} \cdot 6$ | $31^{\circ} .8$ | $32^{\circ} \cdot 0$ | $32^{\circ} \cdot 2$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - |  | 3.963 |  | 40019 | 4.048 | 4.076 | -104 | 4.132 | 4.160 | 4.188 | 16 | $4 \cdot 245$ | 73 | -301 | 330 |
| 4 |  | 3.953 | 3.98 I | 4•009 | $4 \cdot 038$ | 4.066 | 4.094 | 4-122 | 4•150 | 4•178 | 4.206 | $4 \cdot 235$ | $4 \cdot 262$ | $4 \cdot 290$ | 4.319 |
| 8 |  | 3.924 | 3.952 | 3.980 | 4.007 | 4.036 | 4.064 | 4.092 | 4-119 | 4.147 | 4-175 | $4 \cdot 203$ | $4 \cdot 231$ | $4 \cdot 259$ | $4 \cdot 287$ |
| 10 | 3.875 | 3.903 | 3.930 | 3.958 | 3.986 | 4 -O14 | 4.042 | 4.069 | $4 \cdot 097$ | $4 \cdot 125$ | 4-152 | 4-I8I | $4 \cdot 208$ | 4-236 | $4 \cdot 263$ |
| 12 | 3.849 | $3 \cdot 876$ | $3 \cdot 904$ | 3.931 | 3.959 | 3.987 | 4.014 | 4.042 | 4.069 | 4.097 | 4-124 | 4•152 | 4.180 | 4-207 | 4.235 |
| 1 | 3.818 | 3.845 | $3 \cdot$ |  | 3.927 | 3.954 | 3.982 | 4.009 | 4.036 | 4.063 | 4.091 | 4.119 | $4 \cdot 146$ | 4.173 | $4 \cdot 200$ |
| 16 | $3 \cdot 783$ | $3 \cdot 809$ | 3.836 | 3.863 | 3.890 | 3.917 | 3.945 | 3.972 | $3 \cdot 999$ | $4 \cdot 026$ | 4.053 | 4.080 | 4-107 | 4-134 | 4.I6I |
| 18 | $3 \cdot 743$ | $3 \cdot 769$ | $3 \cdot 796$ | 3.823 | $3 \cdot 849$ | 3.876 | 3.903 | 3.930 | 3.956 | 3.983 |  | 4.037 | 4.064 | $4 \cdot 091$ | 4-118 |
| 19 | $3 \cdot 721$ | 3.747 | $3 \cdot 774$ | $4 \cdot 801$ | 3.827 | 3.853 | $3 \cdot 88 \mathrm{I}$ | 3.907 | 3.933 | 3.960 | 3.987 | $4 \cdot 013$ | $4 \cdot 040$ | 4-067 | 4.094 |
| 20 | $3 \cdot 698$ | $3 \cdot 724$ | $3 \cdot 750$ | $3 \cdot 777$ | 3.803 | 3.830 | 3.857 | 3.883 | 3.909 | 3.936 | 3.962 | $3 \cdot 988$ | 4-016 | $4 \cdot 042$ | 4.069 |
|  |  |  | $3 \cdot$ |  |  |  | 3.830 | 3.857 | $3 \cdot 8$ |  | 3.936 | 3.962 |  |  | 4.042 |
| 22 | $3 \cdot 649$ | 3.675 | $3 \cdot 700$ | $3 \cdot 727$ | $3 \cdot 753$ | 3.779 | 3.804 | 3.83I | 3.857 | 3.884 | $3 \cdot 909$ | $3 \cdot 935$ | 3•962 | 3.988 | 4.014 |
| 23 | $3 \cdot 623$ | $3 \cdot 648$ | $3 \cdot 674$ | $3 \cdot 700$ | $3 \cdot 726$ | 3.75 I | $3 \cdot 777$ | 3.804 | 3.829 | 3.855 | 3.88 I | 3.907 | $3 \cdot 934$ | 3.959 | 3.985 |
| 24 | 3.595 | 3.621 | $3 \cdot 646$ | 3.672 | 3.698 | $3 \cdot 723$ | $3 \cdot 748$ | 3.775 | 3.800 | 3.826 | 3.852 | 3.877 | 3.904 | 3.929 | $3 \cdot 955$ |
| 25 | 3.566 | $3 \cdot 592$ | $3 \cdot 617$ | $3 \cdot 643$ | $3 \cdot 66$ |  | 3.718 | $3 \cdot 745$ | $3 \cdot 770$ | 3•795 | 3.821 | 3.846 | 3.873 |  | 3.924 |
| 26 | 3 | $3 \cdot 562$ | $3 \cdot 587$ | 3.612 | 3.638 | 3.663 | 3.688 | 3.714 | $3 \cdot 7$ | $3 \cdot 764$ | 3•790 | 3.815 | 3.84 I | 3.866 | 3.892 |
| 27 | 3.507 | $3 \cdot 531$ | 3.556 | 3.581 | 3.607 | 3.63 I | 3.656 | $3 \cdot 682$ | 3•7 | 3.73 I | 3.757 | $3 \cdot 782$ | 3.808 | 3.832 | 3.857 |
| 28 | $3 \cdot 475$ | 3.499 | $3 \cdot 524$ | 3.548 | $3 \cdot 574$ | $3 \cdot 598$ | 3.623 | 3.648 | 3.673 |  | $3 \cdot 7$ | $3 \cdot 747$ | $3 \cdot 773$ | $3 \cdot 797$ | 22 |
| 29 | $3 \cdot 442$ | $3 \cdot 466$ | 3.490 | 3.515 | 3.540 | 3.564 | $3 \cdot 589$ | 3.614 | 3.638 | 3.663 | 3.688 | 3.712 | $3 \cdot 737$ | $3 \cdot 762$ | 3.786 |
| 30 | $3 \cdot 409$ | 3.433 | 3.457 | $3 \cdot 481$ | $3 \cdot 506$ | 3.530 | 3.554 | 3.579 |  | $3 \cdot 627$ | $3 \cdot 651$ | $3 \cdot 676$ | $3 \cdot 701$ | $3 \cdot 725$ | 3.749 |
| 3 | 3 | $3 \cdot 3$ | $3 \cdot$ | 3. | 3.469 | 3. | $3 \cdot 517$ | 3.542 | $3 \cdot 5$ | $3 \cdot 5$ | $3 \cdot 614$ | 3.638 | $3 \cdot 663$ |  | 11 |
| 32 |  | $3 \cdot 36$ | $3 \cdot 38$ | $3 \cdot 409$ | 3.432 | $3 \cdot 457$ | 3.480 | $3 \cdot 50$ | $3 \cdot 5$ | $3 \cdot 552$ | $3 \cdot 575$ | $3 \cdot 600$ | $3 \cdot 623$ | $3 \cdot 648$ | 3.672 |
| 33 | $3 \cdot$ | $3 \cdot 32$ | $3 \cdot 347$ | 3.371 | $3 \cdot 394$ | $3 \cdot$ | 3.442 | $3 \cdot 466$ | $3 \cdot 489$ | $3 \cdot 513$ | $3 \cdot 536$ | $3 \cdot 560$ | $3 \cdot 583$ | $3 \cdot 607$ | 3.631 |
| 34 | 3.263 | $3 \cdot 286$ | $3 \cdot 309$ | 3.332 | $3 \cdot 355$ | $3 \cdot 379$ | $3 \cdot 402$ | $3 \cdot 426$ | 3.449 | $3 \cdot 472$ | 3.495 | 3.519 | $3 \cdot 542$ | $3 \cdot 566$ | $3 \cdot 589$ |
| 35 | 3.223 | 3.247 | 3.270 | $3 \cdot 293$ | $3 \cdot 315$ | 3•339 | $3 \cdot 362$ | 3.385 |  | 3.43I | $3 \cdot 454$ | $3 \cdot 477$ | $3 \cdot 500$ | $3 \cdot 523$ | $3 \cdot 547$ |
| 36 | $3 \cdot 184$ | 3.207 | 3.229 | $3 \cdot 252$ | $3 \cdot 275$ | 3.298 | $3 \cdot 320$ | $3 \cdot 342$ | 3.366 | $3 \cdot 389$ | 3.411 | 3.434 | 7 | 3.480 | 03 |
| 37 | $3 \cdot 142$ | $3 \cdot 165$ | $3 \cdot 187$ $3 \cdot 145$ | 3.210 | 3.232 | 3.254 | 3.277 | 3.299 | $3 \cdot 222$ | 3.344 | $3 \cdot 367$ | 3.390 | $3 \cdot 41$ | $3 \cdot 435$ | $3 \cdot 458$ |
| 38 | $3 \cdot 101$ | 3. 124 | 3.145 | 3.167 | 3.190 | 3.211 | 3.234 | 3.256 | $3 \cdot 278$ | $3 \cdot 300$ | $3 \cdot 323$ | $3 \cdot 345$ | $3 \cdot 367$ | $3 \cdot 389$ | 3.412 |
| 39 |  | 3.081 | $3 \cdot 102$ | $3 \cdot 123$ | 3.146 | 3.167 | $3 \cdot 189$ | 3.211 | 3.233 3.187 | 3.255 | $3 \cdot 277$ | 3.299 | 3.321 | $3 \cdot 343$ |  |
|  | $3 \cdot 015$ | 3.036 | $3 \cdot$ | 3.079 | 3•IOI | $3 \cdot 122$ | $3 \cdot 144$ | $3 \cdot 165$ |  |  | 3.230 | $3 \cdot 252$ | $3 \cdot 273$ | $3 \cdot 295$ |  |
| 41 | 2.970 | $2 \cdot 991$ | 3.012 | $3 \cdot$ | 3.05 | 3.076 | 3.097 | 3-118 | 3.140 | 3.161 | 3.182 | 3.203 | $3 \cdot 225$ | 3.246 | 3.267 |
| 42 |  | 2.945 | $2 \cdot 966$ | $2 \cdot 987$ |  |  | $3 \cdot 050$ | 3.070 | 3.091 | 3.112 | 3.134 | 3. 154 | $3 \cdot 175$ | 3•197 | 3.217 |
| 43 |  |  | 2.919 | 2.940 | $2 \cdot 961$ | 2.981 | 3.002 | 3.022 | 3.043 | 3.063 | 3.083 | 3.104 | $3 \cdot 125$ | 3•146 | 3.167 |
| 4 |  | $2 \cdot 851$ |  | 2.892 | $2 \cdot 911$ | 2.932 | $2 \cdot 952$ | 2.972 | $2 \cdot 992$ | 3.013 |  | 3.053 | 3.074 |  | $3 \cdot 115$ |
| 45 |  | 2.802 | 2.822 | 2.843 | $2 \cdot 8$ | 2. | 2902 | 2.92I | 2.942 | 2.962 | 2.981 | 3.001 | $3 \cdot 02$ | $3 \cdot 042$ | 3.062 |
| 46 |  | $2 \cdot 753$ |  |  | 3.812 | 2. | $2 \cdot 851$ | $2 \cdot 870$ | 2.890 |  |  |  |  |  | 3.008 |
| 47 | 2.68 | 2.703 | 2.722 | 2.741 | $2 \cdot 760$ | $2 \cdot 780$ | $2 \cdot 799$ | 2.818 | 2.837 | 2.857 | 2.875 | 2.895 | 2.914 |  | $2 \cdot 952$ |
| 48 | 2.633 | 2.652 | 2.671 | $2 \cdot 689$ | $2 \cdot 708$ | 2.727 | $2 \cdot 745$ | $2 \cdot 765$ | $2 \cdot 784$ | $2 \cdot 802$ | 2.82 I | 2.840 | $2 \cdot 859$ | 2.878 | 2.897 |
| 49 | $2 \cdot 581$ | 2.600 | 2.619 2.566 | 2.637 | $2 \cdot 656$ | $2 \cdot 674$ | $2 \cdot 692$ | $2 \cdot 711$ | 2.729 2.674 | $2 \cdot 747$ | $2 \cdot 766$ | $2 \cdot 785$ | 2.803 | $2 \cdot 822$ | $2 \cdot 840$ |
| 50 | 2.529 | $2 \cdot 548$ | 2.566 | $2 \cdot 5$ | $2 \cdot 602$ | 2. | 2.638 | $2 \cdot 656$ | 2.674 | $2 \cdot 692$ | $2 \cdot 710$ | $2 \cdot 729$ | $2 \cdot 747$ | 2.765 | $2 \cdot 783$ |
| 51 | 2.476 | $2 \cdot 494$ | $2 \cdot 512$ | $2 \cdot 529$ | $2 \cdot 547$ | $2 \cdot 565$ | $2 \cdot 582$ | $2 \cdot 600$ | 2.618 | $2 \cdot 635$ | $2 \cdot 653$ | $2 \cdot 671$ | $2 \cdot 689$ |  |  |
| 52 | 2. | $2 \cdot 440$ | 2.458 | 2.475 | $2 \cdot 492$ | $2 \cdot 509$ | 2.526 | $2 \cdot 544$ | $2 \cdot 561$ | 2.579 | 2.596 | 2.613 | 2.631 | $2 \cdot 648$ | 2.666 |
| 53 | $2 \cdot 368$ | $2 \cdot 385$ | $2 \cdot 402$ | 2.419 | $2 \cdot$ | $2 \cdot 452$ | $2 \cdot 469$ | $2 \cdot 486$ | $2 \cdot 504$ | $2 \cdot 521$ | 2.538 | $2 \cdot 555$ | 2.572 | $2 \cdot 589$ | . 606 |
| 54 |  | $2 \cdot 330$ | $2 \cdot 346$ | $2 \cdot 363$ | $2 \cdot 379$ | $2 \cdot 395$ | 2.412 | $2 \cdot 429$ | 2.445 | $2 \cdot 462$ | $2 \cdot 479$ | $2 \cdot 495$ | 2.512 | $2 \cdot 529$ | $2 \cdot 545$ |
| 55 | $2 \cdot 257$ | 2.273 | $2 \cdot 289$ | $2 \cdot 305$ | $2 \cdot 321$ | $2 \cdot 337$ | $2 \cdot 353$ | 2.370 | $2 \cdot 386$ | $2 \cdot 402$ | $2 \cdot 419$ | $2 \cdot 435$ | $2 \cdot 451$ | $2 \cdot 467$ | 483 |
| 56 | $2 \cdot 201$ | 2.216 | 2.232 | 2.247 | $2 \cdot 263$ | $2 \cdot 279$ | 2.295 | $2 \cdot 310$ | $2 \cdot 326$ | $2 \cdot 342$ | $2 \cdot 358$ | $2 \cdot 374$ | $2 \cdot 390$ |  | 2.421 2.357 |
| 5 |  | $2 \cdot 158$ | $2 \cdot 174$ 2.15 | 2.189 | $2 \cdot 204$ | $2 \cdot$ | 2.235 | 2.250 2.180 | 2.265 2.204 | 2.280 2.219 | 2.296 | 2.312 | 2.327 2.265 | 2.343 | 2.357 |
| 58 | 2.085 2.027 | $2 \cdot 100$ | $2 \cdot 115$ 2.056 | 2.130 2.070 | 2.145 2.085 |  | 2.174 | 2-1 2.I | 2.204 2.143 | $2 \cdot 219$ $2 \cdot 157$ | $2 \cdot 234$ $2 \cdot 171$ | 2.249 2.186 | 2.265 2.200 | 2.279 2.216 | 2.294 2.230 |
| 59 60 | 2.027 1.968 | 2.042 1.982 | 2.056 1.996 | 2.070 2.010 | 2.085 2.024 |  | 2.114 2.052 | $2 \cdot 1$ $2 \cdot 0$ | 2.143 2.080 | 2.157 2.094 | 2-171 | 2.186 2.122 | 2.136 | $2 \cdot 216$ | 2.230 2.165 |
| 61 |  |  | I.935 |  | I.963 | 1.976 | 1-989 | $2 \cdot 003$ | 2.017 | 2.031 | $2 \cdot 044$ | 2•058 |  | 08 | 2.099 |
| 62 | 1.847 | I 860 | I.874 | 1.887 | I-gor | I.914 | I-927 | I 9.940 | I.953 | I-966 | I.980 | I•993 | 2.006 | $2 \cdot$ | $2 \cdot 032$ |
| 63 | 1.786 | I•999 | I-813 | 1.825 | I.837 | I-85I | 1-863 | I. 876 | I.889 | I-902 | I.914 | I-927 | I.940 | I.953 | 965 |
| 64 | I•725 | 1.737 | I.750 | 1.762 | 1-774 | I.786 | - 799 | 12 | I.824 | I.836 | I-849 | I.86I | I. 873 | 1.886 | 1.898 |
| 65 | I. 663 | I.674 | 1.687 | 1.698 | 1-710 | 1.722 | 1-734 | 1-746 | I•758 | 1•769 | I-782 | I•794 | I.805 | 1.817 | I.829 |
| 66 | I. 600 | I.612 | 1.624 | I. 635 | I-646 | 1.657 | 1.669 | 1.681 | 1.692 | 1.703 | 1.715 | 1-727 |  |  | 761 |
| 67 | 1.538 | $1 \cdot 548$ | I.559 | $1 \cdot 571$ | 1.582 | I•592 | 1.603 | 1.615 | I.625 | 1.636 | 1.647 | 1.659 | I.669 | I.680 | 1.692 |
| 68 | -474 | 1.484 | $1 \cdot 494$ | 1-506 | I.516 | I. 526 | 1-537 | 1.548 | I 5558 | 1.569 | 1.579 | r. 590 | I. 600 | I 611 | I-622 |
| 69 | 1.410 | 1.420 | 1.430 | I-440 | 1.451 | 1-461 | 1.470 | 1.48 I | 1.491 | 1.501 | I. 511 | I. 522 | 1.531 | I 5151 | 551 |
| 70 | I 344 | I 354 | 1.365 | 1-372 | $1 \cdot 385$ | I 394 | 1.403 | 1.414 | 1.423 | : 433 | 1.442 | 1.452 | 1.462 | I | 1.48 I |

showna the reduction at 1 min. from the meridian corresponding to AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $32^{\circ} \cdot 4$ | $32^{\circ}$ | $32^{\circ} \cdot 8$ | $33^{\circ} \cdot 0$ | $33^{\circ}$ | $33^{\circ} \cdot 4$ | $33^{\circ} \cdot 6$ | $33^{\circ} \cdot 8$ | $34^{\circ} \cdot 0$ | $34^{\circ} \cdot 2$ | $34^{\circ} \cdot 4$ | $34^{\circ} \cdot 6$ | 8 | $35^{\circ} \cdot 0$ | $35^{\circ} \cdot 2$ | $35^{\circ} \cdot 4$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF $r$ MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ | $4 \cdot 36$ | $4 \cdot 39$ | 4.41 | 4.44 | 4.47 | 4.50 | 4.53 | 4.56 | 4.59 | $4 \cdot 61$ | $4 \cdot 64$ | $4 \cdot 6$ |  | $4 \cdot 73$ |  |  |
| 4 | $4 \cdot 35$ | $4 \cdot 38$ | 4.40 | $4 \cdot 43$ | $4 \cdot 46$ | $4 \cdot 49$ | $4 \cdot 52$ | $4 \cdot 55$ | $4 \cdot 58$ | $4 \cdot 60$ | $4 \cdot 63$ | $4 \cdot 66$ | $4 \cdot 69$ | $4 \cdot 72$ | $4 \cdot 75$ | $4 \cdot 78$ |
| 8 | 4.35 | 4.34 | $4 \cdot 37$ | $4 \cdot 40$ | $4 \cdot 43$ | $4 \cdot 46$ | $4 \cdot 48$ | $4 \cdot 51$ | $4 \cdot 54$ | 4.57 | 4.60 | $4 \cdot 63$ | $4 \cdot 65$ | $4 \cdot 68$ | 4.71 | $4 \cdot 74$ |
| 10 | 4.29 | 4.32 | 4.35 | 4.38 | 4.40 | 4.43 | 4.46 | 4.49 | 4.52 | 4.54 | 4.57 | $4 \cdot 60$ | 4.63 | 4.66 | 4.69 | 4.75 |
| 12 | $4 \cdot 26$ | 4.29 | $4 \cdot 32$ | $4 \cdot 35$ | $4 \cdot 37$ | $4 \cdot 40$ | $4 \cdot 43$ | $4 \cdot 46$ | 4.49 | 4.51 | 4.54 | $4 \cdot 57$ | 4.60 | 4.63 | 4.65 | $4 \cdot 68$ |
| 14 | $4 \cdot 23$ | 4.26 | $4 \cdot 28$ | 4.31 | 4.34 | 4.37 | 4.39 | 4.42 | 4.45 | 4.48 | 4.5 | $4 \cdot 53$ | $4 \cdot 56$ | 4.59 | $4 \cdot 62$ | 4. 64 |
| 16 | $4 \cdot 19$ | $4 \cdot 22$ | 4.24 | 4.27 | $4 \cdot 30$ | 4.33 | 4.35 | $4 \cdot 38$ | 4.41 | 4.44 | $4 \cdot 46$ | 4.49 | 4.52 | 4.55 | 4.57 | $4 \cdot 60$ |
| 18 | $4 \cdot 14$ | $4 \cdot 17$ | 4.20 | 4.23 | $4 \cdot 25$ | $4 \cdot 28$ | $4 \cdot 31$ | $4 \cdot 33$ | $4 \cdot 36$ | $4 \cdot 39$ | $4 \cdot 42$ | $4 \cdot 44$ | 4.47 | 4.50 | 4.53 | $4 \cdot 55$ |
| 19 | $4 \cdot 12$ | $4 \cdot 15$ | $4 \cdot 17$ | 4.20 | 4.23 | $4 \cdot 26$ | 4.28 | 4.31 | $4 \cdot 34$ | 4.36 | $4 \cdot 39$ | $4 \cdot 42$ | 4.44 | $4 \cdot 47$ | $4 \cdot 50$ | 4.53 |
| 20 | 4.10 | 4.12 | $4 \cdot 15$ | 4.18 | 4.20 | $4 \cdot 23$ | 4.26 | 4.28 | 4.31 | $4 \cdot 34$ | $4 \cdot 36$ | $4 \cdot 39$ | 4.42 | 4.44 | $4 \cdot 47$ | $4 \cdot 50$ |
| 21 | 4.0 | 4 | $4 \cdot$ | $4 \cdot 15$ | $4 \cdot 17$ | 4.20 | $4 \cdot 23$ | 4.2 | 4. | 4.31 | 4.34 | $4 \cdot 36$ | 4.39 | 4.41 | 4.44 | 47 |
| 22 | 4.04 | $4 \cdot 07$ | 4.09 | $4 \cdot 12$ | $4 \cdot 15$ | $4 \cdot 17$ | $4 \cdot 20$ | 4.23 | 4.25 | 4.28 | 4.31 | $4 \cdot 33$ | $4 \cdot 36$ | $4 \cdot 38$ | $4 \cdot 41$ | $4 \cdot 44$ |
| 23 | 4.01 | 4.04 | 4.06 | 4.09 | $4 \cdot 12$ | 4.14 | 4.17 | $4 \cdot 19$ | 4.22 | 4.25 | 4.27 | $4 \cdot 30$ | 4.33 | $4 \cdot 35$ | $4 \cdot 38$ | 4.41 |
| 24 | 3.98 | 4.01 | 4.03 | 4.06 | $4 \cdot 08$ | $4 \cdot 11$ | $4 \cdot 14$ | 4.16 | 4.19 | 4.22 | 4.24 | 4.27 | 4.29 | 4.32 | 4.35 | 4.37 |
| 25 | 3.95 | 3.97 | 4.00 | $4 \cdot 03$ | $4 \cdot 05$ | $4 \cdot 08$ | $4 \cdot 10$ | 4.13 | 4.16 | 4.18 | 4.21 | $4 \cdot 23$ | 4.26 | $4 \cdot 29$ | $4 \cdot 31$ | 4.34 |
| 26 | 3. | 3.94 | 3.97 | 3.99 | 4.02 | 4.05 | 4.07 | $4 \cdot 10$ | 4-12 | $4 \cdot 15$ | $4 \cdot 17$ | $4 \cdot 20$ | 4.22 | 4.25 | $4 \cdot 28$ | $4 \cdot 30$ |
| 27 | $3 \cdot 8$ | 3.91 | 3.93 | 3.96 | 3.98 | $4 \cdot 01$ | $4 \cdot 03$ | 4.06 | 4.09 | $4 \cdot 11$ | 4-14 | 4-16 | 4.19 | 4.21 | $4 \cdot 24$ | $4 \cdot 27$ |
| 28 | $3 \cdot 85$ | 3.87 | 3.90 | 3.92 | 3.95 | 3.97 | 4.00 | 4.02 | 4.05 | 4.07 | 4-10 | $4 \cdot 1$ | $4 \cdot 15$ | $4 \cdot 18$ | $4 \cdot 20$ | 4.23 |
| 29 | 3.81 | 3.84 | 3.86 | $3 \cdot 89$ | 3.91 | 3.94 | 3.96 | 3.99 | 4.01 | 4.04 | 4.06 | 4.09 | $4 \cdot 11$ | $4 \cdot 14$ | 4.16 | $4 \cdot 19$ |
| 30 | $3 \cdot 77$ | 3.80 | 3.82 | 3.85 | 3.87 | $3 \cdot 90$ | 3.92 | 3.95 | $3 \cdot 97$ | 4.00 | 4.02 | $4 \cdot 05$ | $4 \cdot 07$ | $4 \cdot 10$ | $4 \cdot 12$ | 4.15 |
| 31 | 3. | 3.76 | 3.78 | $3 \cdot 8 \mathrm{I}$ | 3.83 | 3.86 | 3.88 | $3 \cdot$ | 3. | 3.96 | 3.98 | $4 \cdot$ | 4.03 | 4.05 | 4.08 | 0 |
| 32 | $3 \cdot 70$ | 3.72 | 3.74 | $3 \cdot 77$ | $3 \cdot 79$ | $3 \cdot 82$ | $3 \cdot 84$ | $3 \cdot 87$ | $3 \cdot 89$ | 3.91 | $3 \cdot 94$ | 3.96 | 3.99 | $4 \cdot 1$ | $4 \cdot 04$ | 4.06 |
| 33 | 3.65 | 3.68 | 3.70 | 3.73 | $3 \cdot 75$ | 3.77 | $3 \cdot 80$ | 3.82 | 3.85 | $3 \cdot 87$ | $3 \cdot 89$ | 3.92 | 3.94 | 3.97 | $3 \cdot 99$ | 4.01 |
| 34 | 3.61 3.57 | 3.64 3.59 | $3 \cdot 66$ | 3.68 | 3.71 3.66 | 3.73 | 3.75 | 3.78 | 3.80 | 3.83 | 3.85 3.80 | 3.87 3.83 | 3.90 | 3.92 | 3.94 | 3.97 |
| 35 | $3 \cdot 5$ | 3.59 | 3.62 | 3.64 | 3.66 | 3.69 | $3 \cdot 71$ | 3.73 | $3 \cdot 76$ | $3 \cdot 78$ | $3 \cdot 80$ | $3 \cdot 83$ | $3 \cdot 8$ | 3.87 | 3.90 | 3.92 |
| 36 | 3.53 | 3.55 | 3.57 | 3.59 | 3.62 | 3.64 | 3.66 | 3.69 | 3.71 | 3.73 | 3.76 | 3.78 | 3.80 | 3.83 | 3.85 | 3.87 |
| 37 | 3.48 | 3.50 | 3.53 | $3 \cdot 55$ | $3 \cdot 57$ | $3 \cdot 59$ | 3.62 | 3.64 | $3 \cdot 66$ | 3.68 | 3.71 | 2.73 | 3.75 | 3.78 | $3 \cdot 80$ | 3.82 |
| 38 | 3.43 | 3.46 | 3.48 | 3.50 | 3.52 | 3.55 | 3.57 | 3.59 | 3.61 | 3.64 | $3 \cdot 66$ | $3 \cdot 68$ | $3 \cdot 70$ | 3.73 | $3 \cdot 75$ | 3.77 |
| 39 | 3.39 | 3.45 | 3.43 | 3.45 | 3.48 | 3.50 | 3.52 | 3.54 | $3 \cdot 56$ | 3.59 | $3 \cdot 61$ | 3.63 | $3 \cdot 65$ | $3 \cdot 68$ | 3.70 | 3.72 |
| 40 | $3 \cdot 34$ | 3.36 | 3.38 | 3.40 | $3 \cdot 43$ | 3.45 | 3.47 | 3.49 | $3 \cdot 5$ I | $3 \cdot 53$ | $3 \cdot 56$ | 3.58 | $3 \cdot 60$ | $3 \cdot 62$ | $3 \cdot 65$ | 3.67 |
| 4 I | 3.29 | $3 \cdot 3$ | 3.33 | 3.35 | $3 \cdot 37$ | 3.40 | 3.42 | 3.44 | $3 \cdot 46$ | 3.48 | $3 \cdot 50$ | 3.53 | $3 \cdot 55$ | 3.57 | $3 \cdot 59$ | 3.61 |
| 42 | $3 \cdot 24$ | 3.26 | 3.28 | $3 \cdot 30$ | $3 \cdot 32$ | $3 \cdot 34$ | 3.36 | 3.39 | 3.41 | 3.43 | $3 \cdot 45$ | $3 \cdot 47$ | 3.49 | 3.51 | $3 \cdot 54$ | $3 \cdot 56$ |
| 43 | 3.19 3.13 | 3.21 | 3.23 | 3.25 | 3.27 | $3 \cdot 29$ | 3.31 | 3.33 | $3 \cdot 35$ | 3.37 | 3.40 | 3.42 | $3 \cdot 44$ | 3.46 | 3.48 | $3 \cdot 50$ |
| 44 | 3.13 3.08 | $3 \cdot 16$ | $3 \cdot 17$ | 3.20 | 3.22 | 3.24 3.18 | 3.26 | 3.28 | $3 \cdot 30$ | $3 \cdot 32$ | 3.34 | 3.36 | $3 \cdot 38$ | $3 \cdot 40$ | 3.42 | 3.44 |
| 45 | 3.08 | 3.10 | $3 \cdot 12$ | 3.14 | $3 \cdot 16$ | $3 \cdot 18$ | 3.20 | 3.22 | 3.24 | $3 \cdot 26$ | $3 \cdot 28$ | $3 \cdot 30$ | $3 \cdot 32$ | $3 \cdot 34$ | $3 \cdot 36$ | $3 \cdot 38$ |
| 46 | 3.03 | 3.05 | 3.07 | 3.09 | $3 \cdot 11$ | 3.13 | 3.15 | 3.17 | 3•19 | 3.20 | 3.22 | 3.24 | 3.27 | 3.29 | 3.31 | 3.33 |
| 47 | 2.97 | 2.99 | 3.01 | 3.03 | 3.05 | $3 \cdot 07$ | 3.09 | $3 \cdot 11$ | $3 \cdot 13$ | $3 \cdot 15$ | $3 \cdot 17$ | $3 \cdot 19$ | 3.20 | 3.22 | $3 \cdot 25$ | 3.26 |
| 48 | $2 \cdot 92$ | 2.93 | 2.95 | $2 \cdot 97$ | $2 \cdot 99$ | $3 \cdot 01$ | 3.03 | 3.05 | 3.07 | 3.09 | $3 \cdot 11$ | $3 \cdot 13$ | 3.14 | $3 \cdot 16$ | 3.18 | 3.20 |
| 49 | $2 \cdot 86$ | 2.88 | 2.90 | 2.91 | 2.93 | $2 \cdot 95$ | $2 \cdot 97$ | 2.99 | $3 \cdot \mathrm{Or}$ | 3.03 | 3.05 | 3.06 | 3.08 | $3 \cdot 10$ | $3 \cdot 12$ | $3 \cdot 14$ |
| 50 | $2 \cdot 80$ | 2.82 | $2 \cdot 84$ | $2 \cdot 86$ | 2.87 | $2 \cdot 89$ | 2.91 | $2 \cdot 93$ | $2 \cdot 95$ | $2 \cdot 97$ | $2 \cdot 98$ | $3 \cdot 00$ | 3.02 | 3.04 | 3.06 | 3.08 |
| 51 |  | 2.76 | 2.78 | $2 \cdot 80$ | 2.81 | $2 \cdot 83$ | $2 \cdot 85$ | $2 \cdot 87$ | 2.89 | 2.90 | 2.92 | 2.94 | 2.96 | 2.98 | 2.99 | 3.01 |
| 52 | 2.68 | $2 \cdot 70$ | $2 \cdot 72$ | 2.74 | 2.75 | 2.77 | 2.79 | $2 \cdot 81$ | 2.82 | $2 \cdot 84$ | $2 \cdot 86$ | 2.88 | $2 \cdot 89$ | 2.91 2.85 | 2.93 | 2.95 2.88 |
| 53 | 2.62 | 2.64 | 2.66 | 2.67 | 2.69 | 2.71 | 2.72 | 2.74 2.68 | 2.76 | 2.78 | 2.79 | 2.81 | 2.83 | $2 \cdot 85$ | 2.86 | 2.88 |
| 54 | 2.56 2.50 | 2.58 2.52 | 2.59 | 2.61 2.55 | 2.63 | 2.64 2.58 | 2.66 | 2.68 | 2.69 | $2 \cdot 71$ | 2.73 2.66 | 2.75 2.68 | $2 \cdot 76$ | 2.78 | 2.80 | 2.81 |
| 55 | 2.50 | $2 \cdot 52$ | $2 \cdot 53$ | $2 \cdot 55$ | $2 \cdot 36$ | $2 \cdot 58$ | $2 \cdot 60$ | $2 \cdot 61$ | $2 \cdot 63$ | $2 \cdot 65$ | $2 \cdot 66$ | $2 \cdot 68$ | $2 \cdot 70$ | 2.71 | $2 \cdot 73$ | $2 \cdot 75$ |
| 56 | 2.44 | $2 \cdot 45$ | 2.47 | 2.48 | $2 \cdot 50$ | 2.52 | $2 \cdot 53$ | $2 \cdot 55$ | $2 \cdot 56$ | 2.58 | $2 \cdot 60$ | 2.61 | 2.63 | $2 \cdot 64$ | $2 \cdot 66$ | $2 \cdot 68$ |
| 57 | $2 \cdot 37$ | $2 \cdot 39$ | 2.40 | 2.42 | $2 \cdot 43$ | 2.45 | $2 \cdot 47$ | $2 \cdot 48$ | $2 \cdot 50$ | 2.51 | $2 \cdot 53$ | 2.54 | $2 \cdot 56$ | $2 \cdot 57$ | $2 \cdot 59$ | 2.61 |
| 58 | $2 \cdot 31$ | $2 \cdot 32$ | $2 \cdot 34$ | $2 \cdot 35$ | $2 \cdot 37$ | 2.38 | $2 \cdot 40$ | 2.41 | 2.43 | 2.44 | $2 \cdot 46$ | $2 \cdot 48$ | 2.49 | $2 \cdot 51$ | $2 \cdot 52$ | 2.54 |
| 59 | 2.24 | 2.26 | 2.27 | $2 \cdot 29$ | 2.30 | 2.32 | 2.33 | 2.35 | $2 \cdot 36$ | $2 \cdot 38$ | $2 \cdot 39$ | 2.41 | 2.42 | 2.44 | 245 | 2.47 |
| 60 | $2 \cdot 18$ | 2.19 | $2 \cdot 21$ | 2.22 | 2.24 | 2.25 | 2.26 | 2.28 | $2 \cdot 29$ | $2 \cdot 31$ | $2 \cdot 32$ | $2 \cdot 34$ | $2 \cdot 35$ | $2 \cdot 36$ | $2 \cdot 38$ | $2 \cdot 39$ |
| 61 | $2 \cdot 11$ | $2 \cdot 13$ | $2 \cdot 14$ | $2 \cdot 15$ | $2 \cdot 17$ | 2-18 | $2 \cdot 19$ | 2.21 | 2.22 | $2 \cdot 24$ | 2.25 | $2 \cdot 26$ | 2.28 | $2 \cdot 29$ | 2.31 | $2 \cdot 32$ |
| 62 | 2.05 | $2 \cdot 06$ | $2 \cdot 07$ | $2 \cdot 08$ | $2 \cdot 10$ | $2 \cdot 11$ | $2 \cdot 13$ | $2 \cdot 14$ | $2 \cdot 15$ | 2.17 | $2 \cdot 18$ | $2 \cdot 19$ | 2.21 | $2 \cdot 22$ | $2 \cdot 23$ | $2 \cdot 25$ |
| 63 | I.98 | r.99 | $2 \cdot 00$ | $2 \cdot 02$ | 2.03 | $2 \cdot 04$ | $2 \cdot 06$ | 2.07 | $2 \cdot 08$ | $2 \cdot 09$ | 2.11 | $2 \cdot 12$ | 2.13 | 2.15 | $2 \cdot 16$ | 2.17 |
| 64 | $\mathrm{I} \cdot 91$ | r•92 | I.93 | I.95 | I.96 | r-97 | I.98 | $2 \cdot 00$ | $2 \cdot \mathrm{OI}$ | $2 \cdot 02$ | 2.03 | 2.05 | 2.06 | $2 \cdot 07$ | $2 \cdot 09$ | $2 \cdot 10$ |
| 65 | x.84 | 1.85 | I.86 | I. 88 | 1.89 | 1.90 | I.91 | $1 \cdot 93$ | 1•94 | I-95 | I.96 | I•97 | I•99 | $2 \cdot 00$ | $2 \cdot 01$ | $2 \cdot 0$ |
| 66 | 1.77 | 1.78 | 1.80 | 1.81 | 1.82 | 1.83 | I. 84 | 1.85 | 1.86 | 1.88 | I-89 | I.90 | $1 \cdot 91$ | I.92 | 1.93 | 1.95 |
| 67 | 1.70 | $1 \cdot 71$ | $1 \cdot 72$ | 1.74 | I.75 | I 76 | I.77 | I•88 | $1 \cdot 79$ | 1.80 | I.8I | I. 83 | I. 84 | I.85 | r. 36 | I. 87 |
| 68 | I. 63 1.56 | 1.64 1.57 | I. 65 | I. 66 | r.67 | 1. 68 | I.70 | 1.75 | $1 \cdot 72$ | $1 \cdot 73$ | I.74 | I.75 | r.76 | I.77 | ${ }^{1} 78$ | r•79 |
| 69 | I.56 | 1.57 | I•58 | I•59 | 1.60 | I.6I | I.62 | I. 63 | 1.64 | 1.65 | I.66 | I.67 | I.68 | I.69 | 1.70 | 1.71 1.64 |
| 70 | x 49 | 1.50 | I.51 | 1.52 | r.53 | 1. 54 | r.55 | I.56 | 1.57 | $1 \cdot 58$ | I•59 | I•60 | I•6I | I. 62 | 1.63 | 1.64 |

SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $35^{\circ} \cdot 6$ | $35^{\circ} 8$ | $36^{\circ} 0$ | $36^{\circ}$. | $36^{\circ} \cdot 4$ | $36^{\circ} 6$ | $36^{\circ} 8$ | $37^{\circ} \cdot 0$ | $37^{\circ} \cdot 2$ |  | 3 | $37^{\circ} 8$ | $38^{\circ} \cdot 0$ | $38^{\circ} \cdot 2$ | $38^{\circ} \cdot 4$ | $8^{\circ} \cdot 6$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ | 4.82 | 4.84 | 4.87 | 4.90 | 4.93 | 4.96 | 4.99 | $5 \cdot 02$ | $5 \cdot 05$ | 5.08 | 5•II | 5.14 | 5•17 | $5 \cdot 19$ | $5 \cdot 22$ | $5 \cdot 25$ |
| 4 | $4 \cdot 80$ | 4.83 | 4.86 | 4.89 | $4 \cdot 92$ | $4 \cdot 95$ | $4 \cdot 98$ | $5 \cdot 1$ | 5.04 | 5.07 | $5 \cdot 09$ | $5 \cdot 12$ | 5.15 | 5.18 | $5 \cdot 21$ | $5 \cdot 24$ |
| 8 | $4 \cdot 77$ | $4 \cdot 80$ | 4.83 | 4.85 | 4.88 | 4.91 | 4.94 | $4 \cdot 97$ | 5.00 | 5.03 | 5.06 | 5.09 | 5•II | $5 \cdot 14$ | 5.17 | $5 \cdot 20$ |
| 10 | $4 \cdot 74$ | 4.77 | 4.80 | 4.83 | 4.86 | 4.89 | 4.91 | 4.94 | 4.97 | $5 \cdot 00$ | 5.03 | $5 \cdot 06$ | $5 \cdot 09$ | $5 \cdot 12$ | 5.14 | 5•17 |
| 12 | 4•1 | 4.74 | $4 \cdot 77$ | 4.80 | 4.82 | 4.85 | $4 \cdot 88$ | $4 \cdot 91$ | 4.94 | 4.97 | $5 \cdot 00$ | $5 \cdot 02$ | $5 \cdot 05$ | $5 \cdot 08$ | 5.11 | $5 \cdot 14$ |
| 14 | $4 \cdot 67$ | 4. | 4. | 4.76 | 4.78 | 4.81 | 4.84 | 4.87 | 4.90 | 3 | 4.96 | 4.98 | $5 \cdot 01$ | 5.04 | 5.07 | 10 |
| 16 | $4 \cdot 63$ | 4.66 | $4 \cdot 68$ | 4.71 | 4.74 | $4 \cdot 77$ | $4 \cdot 80$ | $4 \cdot 82$ | 4.85 | 4.88 | 4.91 | $4 \cdot 94$ | 4.96 | 4.99 | 5.02 | 5.05 |
| 18 | $4 \cdot 58$ | 4.61 | $4 \cdot 64$ | $4 \cdot 66$ | $4 \cdot 69$ | $4 \cdot 72$ | 4.75 | 4.77 | 4.80 | 4.83 | 4.86 | 4.88 | 4.91 | 4.94 | 4.97 | $5 \cdot 00$ |
| 19 | 4.55 | 4.58 | $4 \cdot 61$ | $4 \cdot 64$ | $4 \cdot 66$ | $4 \cdot 69$ | 4.72 | 4.75 | 4.77 | $4 \cdot 80$ | $4 \cdot 83$ | $4 \cdot 86$ | $4 \cdot 88$ | 4.91 | 4.94 | $4 \cdot 97$ |
| 20 | 4.53 | 4.55 | $4 \cdot 58$ | $4 \cdot 61$ | $4 \cdot 63$ | $4 \cdot 66$ | $4 \cdot 69$ | $4 \cdot 72$ | $4 \cdot 74$ | 4.77 | $4 \cdot 80$ | $4 \cdot 83$ | 4.85 | $4 \cdot 88$ | 4.91 | $4 \cdot 94$ |
| 2 I | $4 \cdot 5$ | 4.52 | 4.55 | 4.58 | $4 \cdot 60$ | $4 \cdot 63$ | $4 \cdot 66$ | 4.69 | $4 \cdot 71$ | $4 \cdot 74$ | 4.77 | 4•79 | 4.82 | 4.85 | 4.88 | 4.90 |
| 22 | 4.47 | 4.49 | $4 \cdot 52$ | 4.55 | 4.57 | $4 \cdot 60$ | $4 \cdot 63$ | $4 \cdot 65$ | 4.68 | 4.71 | 4.74 | $4 \cdot 76$ | $4 \cdot 79$ | 4.82 | $4 \cdot 84$ | $4 \cdot 87$ |
| 23 | 4.43 | 4.46 | $4 \cdot 49$ | 4.51 | 4.54 | 4.57 | 4.59 | 4.62 | 4.65 | 4.67 | $4 \cdot 70$ | $4 \cdot 73$ | 4.75 | $4 \cdot 78$ | 4.81 | $4 \cdot 83$ |
| 24 | 4.40 | 4.43 | 4.45 | 4.48 | 4.51 | 4.53 | 4.56 | 4.59 | $4 \cdot 61$ | $4 \cdot 64$ | 4.67 | 4.69 | 4.72 | 4.74 | 4.77 | 4.80 |
| 25 | $4 \cdot 36$ | 4.39 | $4{ }^{42}$ | $4 \cdot 44$ | 4.47 | 4.50 | 4.52 | 4.55 | 4.57 | 4.60 | $4 \cdot 63$ | $4 \cdot 65$ | $4 \cdot 68$ | $4 \cdot 71$ | 4.73 | $4 \cdot 76$ |
| 26 | 4.3 | $4 \cdot 35$ | $4 \cdot 38$ | 4.41 | 4.43 | $4 \cdot 46$ | $4 \cdot 48$ | 4.51 | 4.54 | 4.56 | 4.59 | $4 \cdot 62$ | $4 \cdot 64$ | 4.67 | $4 \cdot 70$ | 72 |
| 27 | 4.29 | 4.32 | 4.34 | $4 \cdot 37$ | $4 \cdot 39$ | 4.42 | 4.45 | 4.47 | 4.50 | 4.52 | 4.55 | 4.58 | 4.60 | $4 \cdot 63$ | $4 \cdot 65$ | 4.68 |
| 28 | 4.25 | 4.28 | $4 \cdot 30$ | $4 \cdot 33$ | 4.35 | 4.38 | 4.41 | 4.43 | 4.46 | 4.48 | 4.51 | $4 \cdot 53$ | 4.56 | $4 \cdot 59$ | $4 \cdot 61$ | $4 \cdot 64$ |
| 29 | 4.21 | 4.24 | 4.26 | 4.29 | 4.31 | 4.34 | $4 \cdot 36$ | 4.39 | 4.42 | 4.44 | 4.47 | $4 \cdot 49$ | 4.52 | 4.54 | 4.57 | 4.59 |
| 30 | 4-17 | 4.20 | 4.22 | $4 \cdot 25$ | $4 \cdot 27$ | 4.30 | $4 \cdot 32$ | $4 \cdot 35$ | $4 \cdot 37$ | 4.40 | $4 \cdot 42$ | $4 \cdot 45$ | 4.47 | $4 \cdot 50$ | $4 \cdot 52$ | 4.55 |
| 31 | $4 \cdot$ | $4 \cdot 15$ | 4.18 | 4.20 | 4.23 | 4.25 | 4.28 | 4.30 | 4.33 | 4.35 | 4.38 | 4.40 | 4.43 | 4.45 | 4.48 | 4.50 |
| 32 | 4.08 | $4 \cdot 11$ | $4 \cdot 13$ | $4 \cdot 16$ | $4 \cdot 18$ | $4 \cdot 21$ | 4.23 | $4 \cdot 26$ | 4.28 | 4.31 | 4.33 | $4 \cdot 36$ | $4 \cdot 38$ | 4.41 | 4.43 | $4 \cdot 46$ |
| 33 | $4 \cdot 0$ | 4.06 | 4.09 | $4 \cdot 11$ | $4 \cdot 14$ | $4 \cdot 16$ | $4 \cdot 18$ | 4.21 | 4.23 | 4.26 | 4.28 | $4 \cdot 31$ | 4.33 | 4.36 | 4.38 | 4.41 |
| 34 | 3.99 | 4.02 | 4.04 | 4.06 | 4.09 | $4 \cdot 11$ | 4.14 | $4 \cdot 16$ | $4 \cdot 18$ | 4.21 | 4.23 | 4.26 | $4 \cdot 28$ | 4.31 | 4.33 | $4 \cdot 36$ |
| 35 | $3 \cdot 94$ | 3.97 | $3 \cdot 99$ | $4 \cdot 02$ | 4.04 | 4.06 | 4.09 | $4 \cdot 11$ | 4.14 | $4 \cdot 16$ | 4.18 | $4 \cdot 21$ | 4.23 | 4.26 | $4 \cdot 28$ | $4 \cdot 30$ |
| 36 | 3.90 | 3. |  | $3 \cdot 9$ | 3.99 | 4. |  | 4.06 | 4.08 | 4 | 4.13 | 4.16 | 4.18 | 4.20 | 4.23 | 25 |
| 37 | $3 \cdot 85$ | 3.87 | $3 \cdot 89$ | 3.92 | 3.94 | 3.96 | 3.98 | 4.01 | 4.03 | 4.05 | 4.08 | 4.10 | $4 \cdot 12$ | $4 \cdot 15$ | 4.17 | $4 \cdot 20$ |
| 38 | $3 \cdot 79$ | 3.82 | $3 \cdot 84$ | 3.86 | 3.89 | 3.91 | 3.93 | 3.96 | 3.98 | 4.00 | 4.02 | 4.05 | 4.07 | 4.09 | $4 \cdot 12$ | $4 \cdot 14$ |
| 39 | $3 \cdot 74$ | $3 \cdot 76$ | 3.79 | $3 \cdot 81$ | $3 \cdot 83$ | 3.86 | 3.88 | 3.90 | 3.92 | 3.95 | 3.97 | 3•99 | 4.01 | 4.04 | 4.06 | 4.08 |
| 40 | $3 \cdot 69$ | $3 \cdot 71$ | 3.73 | $3 \cdot 76$ | $3 \cdot 78$ | $3 \cdot 80$ | 3.82 | $3 \cdot 84$ | 3.87 | 3.89 | 3.91 | $3 \cdot 93$ | 3.96 | $3 \cdot 98$ | $4 \cdot 00$ | $4 \cdot 02$ |
| 41 | 3.63 | 3.66 | $3 \cdot 68$ | $3 \cdot 70$ | $3 \cdot 72$ | 3.74 | $3 \cdot 76$ | 3.79 | 3.81 | 3.83 | 3.85 | 3.88 | 3.90 | 3.92 | 3.94 | $3 \cdot 96$ |
| 42 | $3 \cdot 58$ | $2 \cdot 60$ | 3.62 | 3.64 | 3.66 | 3.69 | 3.71 | 3.73 | 3.75 | $3 \cdot 77$ | $3 \cdot 79$ | $3 \cdot 82$ | $3 \cdot 84$ | $3 \cdot 86$ | $3 \cdot 88$ | 3.90 |
| 43 | $3 \cdot 52$ | 3.54 | $3 \cdot 56$ | $3 \cdot 59$ | $3 \cdot 61$ | 3.63 | 3.65 | 3.67 | 3.69 | 3.71 | $3 \cdot 73$ | $3 \cdot 76$ | $3 \cdot 78$ | 3.80 | 3.82 | $3 \cdot 84$ |
| 44 | $3 \cdot 46$ | 3.48 | 3.51 | $3 \cdot 53$ | $3 \cdot 55$ | 3.57 | 3.59 | 3.61 | 3.63 | 3.65 | $3 \cdot 67$ | $3 \cdot 69$ | $3 \cdot 72$ | 3.74 | 3.76 | $3 \cdot 78$ |
| 45 | $3 \cdot 40$ | 3.42 | $3 \cdot 45$ | $3 \cdot 47$ | 3.49 | 3.51 | 3.53 | $3 \cdot 55$ | 3.57 | $3 \cdot 59$ | 3.61 | $3 \cdot 63$ | $3 \cdot 65$ | $3 \cdot 67$ | $3 \cdot 69$ | $3 \cdot 71$ |
| 46 | $3 \cdot 3$ | 3.36 | 3.39 | 3.41 | 3.43 | 3.45 | $3 \cdot 47$ | 3.49 | 3.51 | 3.53 |  | $3 \cdot 57$ | 3.59 | 3.6I | 3.63 | 3.65 |
| 47 | 3.28 | $3 \cdot 30$ | 3.32 | $3 \cdot 34$ | 3.36 | 3.38 | 3.40 | 3.42 | 3.44 | $3 \cdot 46$ | 3.48 | $3 \cdot 50$ | $3 \cdot 52$ | $3 \cdot 54$ | 3.56 | 3.58 |
| 48 | 3.22 | 3.24 | 3.26 | 3.28 | $3 \cdot 30$ | 3.32 | 3.34 | 3.36 | 3.38 | 3.40 | 3.42 | 3.44 | $3 \cdot 46$ | $3 \cdot 48$ | 3.49 | 3.51 |
| 49 | $3 \cdot 16$ | 3.18 | 3. | 3.22 | 3.23 | 3.25 | 3.27 | 3.29 | 3.31 | 3.33 | 3.35 | $3 \cdot 37$ | 3.39 | 3.41 | 3.43 | 3.45 |
| 50 | 3.10 | $3 \cdot 11$ | 3.13 | 15 | 3.17 | $3 \cdot 19$ | 3.21 | 3.23 | 3.24 | 3.26 | 3.28 | $3 \cdot 30$ | $3 \cdot 32$ | 3.34 | 3.36 | $3 \cdot 38$ |
| 51 | 3.03 | 3.05 | 3.07 | 3.08 | 3.10 | $3 \cdot 12$ | 3.14 | $3 \cdot 16$ | $3 \cdot 18$ | 3.19 | 3.21 | 3.23 | 3.25 | 3.27 | 3.29 | 3.31 |
| 52 | $2 \cdot 97$ | $2 \cdot 98$ | 3.00 | 3.02 | 3.04 | 3.05 | 3.07 | 3.09 | 3.11 | $3 \cdot 13$ | 3.14 | 3.16 | $3 \cdot 18$ | 3.20 | 3.22 | 3.23 |
| 53 | 2.90 | 2.91 | 2.93 | 2.95 | $2 \cdot 97$ | 2.98 | $3 \cdot 00$ | 3.02 | 3.04 | 3.05 | $3 \cdot 07$ | 3.09 | $3 \cdot 11$ | $3 \cdot 13$ | $3 \cdot 14$ | $3 \cdot 16$ |
| 54 | 2.83 | $2 \cdot 85$ | $2 \cdot 86$ | $2 \cdot 88$ | $2 \cdot 90$ | 2.91 | $2 \cdot 93$ | $2 \cdot 95$ | $2 \cdot 97$ | 2.98 | 3.00 | 3.02 | 3.04 | 3.05 | 3.07 | $3 \cdot 09$ |
| 55 | $2 \cdot 76$ | $2 \cdot 78$ | $2 \cdot 79$ | $2 \cdot 81$ | $2 \cdot 83$ | 2.84 | 2.86 | 2.88 | $2 \cdot 90$ | 2.91 | $2 \cdot 93$ | 2.94 | 2.96 | $2 \cdot 98$ | 3.00 | $3 \cdot 01$ |
| 56 | $2 \cdot 69$ | 2.71 | 2.7 | $2 \cdot 74$ | $2 \cdot 76$ | 2.77 | $2 \cdot 79$ | $2 \cdot 81$ | 2.82 | $2 \cdot 84$ | $2 \cdot 86$ | 287 | 2.89 | 2.90 | $2 \cdot 92$ | $2 \cdot 94$ |
| 57 | 2.62 | $2 \cdot 64$ | $2 \cdot 65$ | 2.67 | $2 \cdot 69$ | 2.70 | $2 \cdot 72$ | $2 \cdot 73$ | $2 \cdot 75$ | $2 \cdot 76$ | $2 \cdot 78$ | $2 \cdot 80$ | 2.81 | $2 \cdot 83$ | $2 \cdot 84$ | $2 \cdot 86$ |
| 58 | 2.55 | 2.57 | $2 \cdot 58$ | $2 \cdot 60$ | $2 \cdot 61$ | 2.63 | 2.64 | 2.66 | 2.67 | $2 \cdot 69$ | $2 \cdot 71$ | $2 \cdot 72$ | 2.74 | 2.75 | $2 \cdot 77$ | $2 \cdot 78$ |
| 59 | 2.48 | 2.49 | 2.51 | 2.52 | $2 \cdot 54$ | 2.55 | 2.57 | 2.58 | $2 \cdot 60$ | 2.61 | 2.63 | $2 \cdot 64$ | 2.66 | $2 \cdot 67$ | $2 \cdot 69$ | $2 \cdot 70$ |
| 60 | 2.41 | 2.42 | 2.44 | $2 \cdot 45$ | $2 \cdot 47$ | 2.48 | 2.49 | 2.51 | $2 \cdot 52$ | 2.54 | $2 \cdot 55$ | $2 \cdot 57$ | $2 \cdot 58$ | $2 \cdot 60$ | $2 \cdot 61$ | $2 \cdot 63$ |
| 61 | 2.33 | 2.35 | $2 \cdot 36$ | $2 \cdot 38$ | $2 \cdot 39$ | $2 \cdot 40$ | 2.42 | 2.43 | 2.45 | $2 \cdot 46$ | 2.48 | 2.49 | $2 \cdot 50$ | $2 \cdot 52$ | 2.53 | $2 \cdot 55$ |
| 62 | $2 \cdot 26$ | $2 \cdot 27$ | $2 \cdot 29$ | $2 \cdot 30$ | $2 \cdot 31$ | $2 \cdot 33$ | $2 \cdot 34$ | $2 \cdot 36$ | $2 \cdot 37$ | $2 \cdot 38$ | $2 \cdot 40$ | 2.41 | 2.42 | 2.44 | 2.45 | 2.47 |
| 6 | $2 \cdot 19$ | 2.20 | 2.21 | 2.22 | 2.24 | 2.25 | $2 \cdot 26$ | $2 \cdot 28$ | 2.29 | $2 \cdot 30$ | $2 \cdot 32$ | $2 \cdot 33$ | 2.34 | $2 \cdot 36$ | $2 \cdot 37$ | $2 \cdot 38$ |
| 64 | $2 \cdot 11$ | $2 \cdot 12$ | $2 \cdot 14$ | 2.15 | $2 \cdot 16$ | $2 \cdot 17$ | $2 \cdot 19$ | $2 \cdot 20$ | $2 \cdot 21$ | $2 \cdot 23$ | $2 \cdot 24$ | $2 \cdot 25$ | $2 \cdot 26$ | $2 \cdot 28$ | $2 \cdot 29$ | $2 \cdot 30$ |
| 65 | $2 \cdot 03$ | $2 \cdot 05$ | $2 \cdot 06$ | $2 \cdot 07$ | $2 \cdot 08$ | $2 \cdot 10$ | $2 \cdot 11$ | $2 \cdot 12$ | 2•13 | $2 \cdot 14$ | $2 \cdot 16$ | 2.17 | $2 \cdot 18$ | $2 \cdot 19$ | $2 \cdot 21$ | $2 \cdot 22$ |
| 66 | 1.96 | 1.97 | 1-98 | 1.99 | $2 \cdot \mathrm{OI}$ | $2 \cdot 02$ | $2 \cdot 03$ | 2.0 | $2 \cdot 05$ | 2.06 | $2 \cdot 8$ | $2 \cdot 09$ | $2 \cdot 10$ | $2 \cdot 1$ | $2 \cdot 12$ | $2 \cdot 14$ |
| 67 | 1.88 | I.89 | I.90 | I•9x | 1.93 | I.94 | I.95 | I.96 | r.97 | I.98 | $2 \cdot 00$ | $2 \cdot 01$ | 2.02 | $2 \cdot 03$ | $2 \cdot 04$ | $2 \cdot 05$ |
| 68 | 1.80 | r.81 | I.82 | I. 84 | I.85 | I.86 | 1.87 | - 88 | I-89 | I•90 | I•91 | I. 92 | I.93 | I•95 | -96 | I•97 |
| 69 | $\underline{1} 73$ | I.74 | I.75 | 1.76 | - 77 | 1.78 | I•79 | I.80 | I.81 | 1.82 | I.83 | I. 84 | I. 85 | - $\cdot 86$ | r-87 | I.88 |
| 70 | 1.65 | I.66 | 1.67 | I•68 | I•69 | I 70 | 1•71 | 1-72 | 1.73 | I•74 | I•75 | 1.76 | 1.77 | 1•78 | 1•79 | 1.80 |

shownag the reduction at 1 min. From the meridian corresponding to AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

|  |  |  |  |  |  |  | AZIMUTHS. |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $38^{\circ} \cdot 8$ | $39^{\circ} \cdot$ | $39^{\circ} \cdot 2$ | $39^{\circ} \cdot 4$ |  | $39^{\circ}$ | $40^{\circ} \cdot 0$ | $40^{\circ} \cdot 2$ | $40^{\circ} \cdot 4$ | $40^{\circ} \cdot 6$ | 400.8 | $41^{\circ} \cdot 0$ | $41^{\circ} \cdot 2$ | $41^{\circ} \cdot 4$ |  | 8 |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| \% | $5 \cdot 28$ | 5.31 | $5 \cdot 34$ | $5 \cdot 37$ | 5.40 | $5 \cdot 43$ | $5 \cdot 46$ | 5.49 | $5 \cdot 52$ | 5.55 | $5 \cdot 58$ | 5.61 | 4 |  |  |  |
| 4 | $5 \cdot 27$ | 5.30 | $5 \cdot 33$ | $5 \cdot 36$ | $5 \cdot 39$ | $5 \cdot 42$ | $5 \cdot 45$ | $5 \cdot 48$ | 5.51 | 5.54 | $5 \cdot 56$ | $5 \cdot 59$ | $5 \cdot 62$ | $5 \cdot 65$ | 5.68 | 5.71 |
| 8 | 5.23 | $5 \cdot 26$ | $5 \cdot 29$ | $5 \cdot 32$ | $5 \cdot 35$ | $5 \cdot 38$ | $5 \cdot 41$ | 5.43 | $5 \cdot 46$ | 5.49 | $5 \cdot 52$ | $5 \cdot 55$ | $5 \cdot 58$ | $5 \cdot 61$ | $5 \cdot 64$ | $5 \cdot 67$ |
| 10 | 5.20 | 5.23 | $5 \cdot 26$ | 5.29 | $5 \cdot 32$ | $5 \cdot 35$ | $5 \cdot 38$ | $5 \cdot 41$ | $5 \cdot 43$ | 5.46 | 5.49 | $5 \cdot 52$ | $5 \cdot 55$ | $5 \cdot 58$ | $5 \cdot 61$ | 5.64 |
| 12 | $5 \cdot 17$ | $5 \cdot 20$ | 5.22 | $5 \cdot 25$ | 5.28 | $5 \cdot 31$ | $5 \cdot 34$ | $5 \cdot 37$ | $5 \cdot 40$ | $5 \cdot 43$ | 5.46 | $5 \cdot 49$ | 5.51 | $5 \cdot 54$ | $5 \cdot 57$ | 5.60 |
| 14 |  | 5.15 | $5 \cdot 18$ | 5.21 | $5 \cdot 24$ | 5.27 | 5.30 | $5 \cdot 33$ | 5.35 | 5.38 | 5.41 | 5.44 | $5 \cdot 47$ | $5 \cdot 50$ | 5.53 | $5 \cdot 56$ |
| 16 | 5 | $5 \cdot 10$ | $5 \cdot 13$ | 5.16 | $5 \cdot 19$ | $5 \cdot 22$ | $5 \cdot 25$ | 5.28 | 5.31 | $5 \cdot 33$ | $5 \cdot 36$ | 5.39 | 5.42 | $5 \cdot 45$ | 5.48 | $5 \cdot 51$ |
| 18 | 5.02 | 5.05 | $5 \cdot 08$ | $5 \cdot 11$ | 5.14 | $5 \cdot 1$ | 5.19 | $5 \cdot 22$ | $5 \cdot 25$ | $5 \cdot 28$ | $5 \cdot 30$ | $5 \cdot 33$ | $5 \cdot 36$ | $5 \cdot 39$ | $5 \cdot 42$ | 5.45 |
| 19 | 4.99 | 5.02 | 5.05 | $5 \cdot 08$ | 5.11 | $5 \cdot 13$ | 5.16 | 5.19 | $5 \cdot 22$ | 5.25 | $5 \cdot 27$ | 5.30 | $5 \cdot 33$ | $5 \cdot 36$ | $5 \cdot 39$ | $5 \cdot 42$ |
| 20 | $4 \cdot 96$ | 4.99 | 5.02 | $5 \cdot 05$ | $5 \cdot 07$ | $5 \cdot 10$ | $5 \cdot 13$ | 5•16 | 5•19 | 5.21 | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 30$ | $5 \cdot 33$ | $5 \cdot 35$ | $5 \cdot 38$ |
| 21 | 4.93 | $4 \cdot 96$ | 4.99 | 5 | 5.04 | 5.07 | $5 \cdot 10$ | 5 | $5 \cdot 15$ | $5 \cdot 1$ | $5 \cdot 21$ | $5 \cdot 24$ | $5 \cdot 26$ | $5 \cdot 29$ | $5 \cdot 32$ | 35 |
| 22 | 4.90 | 4.92 | 4.95 | 4.98 | $5{ }^{\circ} \mathrm{OI}$ | 5.03 | 5.06 | $5 \cdot 09$ | $5 \cdot 12$ | $5 \cdot 14$ | 5.17 | 5.20 | 5.23 | 5.26 | $5 \cdot 28$ | $5 \cdot 3 \mathrm{I}$ |
| 23 | 4.86 | 4.89 | 4.92 | 4.94 | 4.97 | 5.00 | 5.03 | $5 \cdot 05$ | $5 \cdot 08$ | $5 \cdot 11$ | $5 \cdot 13$ | 5•16 | $5 \cdot 19$ | $5 \cdot 22$ | $5 \cdot 24$ | $5 \cdot 27$ |
| 24 | 4.82 | $4 \cdot 85$ | 4.88 | 4.91 | 4.93 | 4.96 | 4.99 | $5 \cdot 1$ | 5.04 | $5 \cdot 07$ | 5.10 | $5 \cdot 12$ | 515 | 5.18 | $5 \cdot 20$ | $5 \cdot 23$ |
| 25 | $4 \cdot 79$ | $4 \cdot 81$ | 4.84 | 4.87 | 4.89 | 4.92 | 4*95 | 4.97 | 5*00 | $5 \cdot 03$ | 5.06 | $5 \cdot 08$ | $5 \cdot 11$ | 5•14 | 5•16 | 5.19 |
| 26 | 4.75 | $4 \cdot 77$ | 4.80 | 4.83 | 4.85 | 4.88 | 4.91 | 4.93 | 4.96 | 4.99 | 5.01 | 4 | 5.07 | 5.09 | 5.12 | $5 \cdot 15$ |
| 27 | 4.71 | 4.73 | $4 \cdot 76$ | $4 \cdot 78$ | 4.81 | 4.84 | 4.86 | 4.89 | 4.92 | 4.94 | 4.97 | 5.00 | 5.02 | 5.05 | 5.08 | $5 \cdot 10$ |
| 28 | 4.66 | 4.69 | 4.72 | 4.74 | 4.77 | $4 \cdot 79$ | 4.82 | 4.85 | 4.87 | 4.90 | 4.93 | 4.95 | 4.98 | $5 \cdot 00$ | 5.03 | 5.06 |
| 29 | $4 \cdot 62$ | 4.64 | 4.67 | 4.70 | $4 \cdot 72$ | $4 \cdot 75$ | 4.77 | 4.80 | 4.83 4.78 | 4.85 4.81 |  | 4.90 4.86 | 4.93 4.88 | 4.96 | 4.98 | 5.01 4.06 |
| 30 | $4 \cdot 57$ | $4 \cdot 60$ | 4.63 | $4 \cdot 65$ | 4.68 | $4 \cdot 70$ | 4.73 | 4.75 | $4 \times 78$ | 4.81 | 4.83 | 4.86 | 4.88 | 4.91 | 4.93 | 4.96 |
| 3 I | $4 \cdot$ | $4 \cdot 5$ | 4.58 | $4 \cdot 60$ | 4.63 | 4.65 | $4 \cdot 68$ | $4 \cdot 70$ | $4 \cdot 73$ | 4.76 | $4 \cdot 78$ | 4.81 | 4.83 | 4.86 | 4.88 | 4.91 |
| 32 | $4 \cdot 48$ | $4 \cdot 50$ | 4.53 | $4 \cdot 55$ | 4.58 | $4 \cdot 60$ | 4.63 | $4 \cdot 65$ | $4 \cdot 68$ | $4 \cdot 70$ | $4 \cdot 73$ | $4 \cdot 76$ | 4.78 | 4.81 | $4 \cdot 83$ | 4.86 |
| 33 | 4.43 | 4.45 | 4.48 | $4 \cdot 50$ | 4.53 | 4.55 | 4.58 | 4.60 | $4 \cdot 63$ | 4.65 | 4.68 | 4.70 | $4 \cdot 73$ | $4 \cdot 75$ | $4 \cdot 78$ | 4.80 |
| 34 | 4.38 | 4.40 | 4.43 | 4.45 | 4.48 | $4 \cdot 50$ | 4.53 | 4.55 | 4.57 | $4 \cdot 60$ | 4.62 | 4.65 | $4 \cdot 67$ | $4 \cdot 70$ | 4.72 | $4 \cdot 75$ |
| 35 | 4.33 | $4 \cdot 35$ | $4 \cdot 38$ | $4 \cdot 40$ | 4.42 | $4 \cdot 45$ | 4.47 | $4 \cdot 50$ | $4 \cdot 52$ | $4 \cdot 54$ | 4.57 | 4.59 | $4 \cdot 62$ | $4 \cdot 64$ | 4.67 | $4 \cdot 69$ |
| 36 | 4.27 | 4.30 | $4 \cdot 32$ | 4.35 | $4 \cdot 37$ | 4.39 | 4.42 | 4.44 | 4.46 | 4.49 | 4.51 | $4 \cdot 54$ | 4.56 | 4.59 | $4 \cdot 6 \mathrm{I}$ | $4 \cdot 63$ |
| 37 | 4.22 | 4.24 | $4 \cdot 27$ | 4.29 | 431 | 4.34 | 4.36 | 4.38 | $4 \cdot 41$ | 4.43 | 4.45 | 4.48 | 4.50 | 4.53 | 4.55 | $4 \cdot 57$ |
| 38 | $4 \cdot 16$ | 4-18 | $4 \cdot 21$ | 4.23 | 4.25 | $4 \cdot 28$ | 4.30 | 4.32 | 4.35 | 4.37 | 4.40 | 4.42 | 4.44 | 4.47 | 4.49 | 4.51 |
| 39 | $4 \cdot 10$ | $4 \cdot 13$ | 4.15 | 4.17 | $4 \cdot 20$ | 4.22 | 4.24 | 4.27 | 4.29 | 4.31 | 4.33 | $4 \cdot 36$ | $4 \cdot 38$ | 4.40 | 4.43 | 4.45 |
| 40 | 4.05 | 4.07 | 4.09 | 4-II | $4 \cdot 14$ | 4•16 | 4•18 | 4.20 | 4.23 | 4.25 | 4.27 | 4.30 | $4 \cdot 32$ | 4.34 | $4 \cdot 36$ | 4.39 |
| 41 | 3.9 | 4 - 01 | $4 \cdot 03$ | 4.05 | 4.07 | 4. | $4 \cdot 1$ | 4.14 | $4 \cdot 16$ | 419 | 4.21 | 4.23 | 4.25 | 4.28 | 4.30 | $4 \cdot 32$ |
| 42 | $3 \cdot 9$ | 3.95 | 3.97 | $3 \cdot 99$ | 4.01 | 4.03 | 4*06 | 4.08 | $4 \cdot 10$ | 4.12 | 4.14 | 4.17 | 4.19 | 4.21 | 4.23 | 4.26 |
| 43 | 3.86 | 3.88 | 3.91 | 3.93 | 3.95 | 3.97 | 3.99 | 4.01 | 4.04 | 4.06 | 4.08 | 4.10 | 4•12 | $4 \cdot 15$ | 4.17 | 4.19 |
| 44 | 3.80 | 3.82 | $3 \cdot 84$ | $3 \cdot 86$ | 3.88 | 3.91 | 3.93 | 3.95 | 3.97 | 3.99 | 4.01 | 4.03 | 4.06 | 4.08 | $4 \cdot 10$ | 4.12 |
| 45 | $3 \cdot 74$ | $3 \cdot 76$ | $3 \cdot 78$ | 3.80 | 3.82 | 3.84 | $3 \cdot 86$ | 3.88 | 3.90 | 3.92 | 3.94 | $3 \cdot 97$ | 3.99 | 4.01 | 4.03 | 4.05 |
| 46 | 3.67 | 3.69 | 3.71 | 3.73 | 3.75 | 3.77 | 3.79 | 3.81 | $3 \cdot 83$ | $3 \cdot 85$ | 3.87 | 3.90 | 3.92 | 3.94 | 3.96 | 3.98 |
| 47 | 3.60 | $3 \cdot 62$ | $3 \cdot 64$ | 3.66 | $3 \cdot 68$ | $3 \cdot 70$ | $3 \cdot 72$ | $3 \cdot 74$ | $3 \cdot 76$ | $3 \cdot 78$ | 3.80 | $3 \cdot 82$ | $3 \cdot 85$ | 3.87 | 3.89 | 3.91 |
| 48 | 3.53 | 3.55 | $3 \cdot 57$ | 3.59 | $3 \cdot 61$ | 3.63 | $3 \cdot 65$ | $3 \cdot 67$ | 3.69 | 3.71 | 3.73 | 3.75 | $3 \cdot 77$ | 3.79 | 3.81 | $3 \cdot 83$ |
| 49 | 3.46 | 3.48 | $3 \cdot 50$ | 3.52 | 3.54 | 3.56 | 3.58 3.51 | 3.60 3.53 | 3.62 3.55 | 3.64 3.57 | 3.66 | 3.68 3.60 | 3.70 3.62 | 3.72 3.64 | 3.74 3.66 | 3.76 3.68 |
| 50 | 3.39 | 3.41 | $3 \cdot 43$ | $3 \cdot 45$ | $3 \cdot 47$ | $3 \cdot 49$ | $3 \cdot 51$ | $3 \cdot 53$ | $3 \cdot 55$ | 3.57 | $3 \cdot 59$ | 3.60 | 3.62 | 3.64 | 3.66 | $3 \cdot 68$ |
| 51 | 3.32 | 3.34 | $3 \cdot 36$ | 3.38 | $3 \cdot 40$ | 3.42 | 3.43 | 3.45 | $3 \cdot 47$ | 3.49 | 3.51 | 3.53 | 3.55 | 3.57 | 3.59 | $3 \cdot 60$ |
| 52 | 3.25 | 3.27 | $3 \cdot 29$ | $3 \cdot 31$ | $3 \cdot 32$ | 3.34 | 3.36 | 3.38 | $3 \cdot 40$ | $3 \cdot 42$ | 3.43 | 3.45 | 3.47 | $3 \cdot 49$ | 3.51 | $3 \cdot 53$ |
| 53 | 3.18 | $3 \cdot 20$ | 3.21 | 3.23 | 3.25 | 3.27 | $3 \cdot 28$ | 3.30 | $3 \cdot 32$ | 3.34 | $3 \cdot 36$ | 3.37 | 3.39 | 3.41 | 3.43 | $3 \cdot 45$ |
| 54 | $3 \cdot 10$ | $3 \cdot 12$ | 3.14 | $3 \cdot 16$ | $3 \cdot 17$ | 3.19 | 3.21 | 3.23 | 3.24 | 3.26 | 3.28 | 3.30 | $3 \cdot 31$ | 3.33 | 3.35 | 3.37 |
| 55 | 3.03 | 3.05 | 3.06 | $3 \cdot 08$ | $3 \cdot 10$ | $3 \cdot 11$ | $3 \cdot 13$ | 3.15 | $3 \cdot 16$ | 3.18 | 3.20 | 3.22 | 3.23 | 3.25 | 3.27 | 3.29 |
| 56 | 2.95 | 2.97 | 2.99 | 3.00 | 3.02 | 3.04 | 3.05 | $3 \cdot 07$ | 3.09 | 3.10 | 3.12 | 3.14 | $3 \cdot 15$ | $3 \cdot 17$ | 3.19 | $3 \cdot 20$ |
| 57 | 2.88 | 2.89 | 2.91 | $2 \cdot 92$ | 2.94 | 2.96 | 2.97 | $2 \cdot 99$ | 3.01 | 3.02 | 3.04 | 3.05 | $3 \cdot 07$ | 3.09 | $3 \cdot 10$ | $3 \cdot 12$ |
| 58 | 2.80 | $2 \cdot 81$ | 2.83 | $2 \cdot 85$ | 2.86 | 2.88 | $2 \cdot 89$ | 2.91 | 2.92 | 2.94 2.86 | 2.96 | 2.97 | 2.99 | 3.00 | 3.02 | 3.04 |
| 59 | 2.72 | $2 \cdot 74$ | $2 \cdot 75$ | $2 \cdot 77$ | $2 \cdot 78$ | 2.80 | 2.81 | 2.83 | 2.84 | 2.86 | 2.87 | 2.89 | 2.90 2.82 | 2.92 | 2.93 | $2 \cdot 95$ |
| 60 | $2 \cdot 64$ | $2 \cdot 66$ | 2.67 | $2 \cdot 68$ | $2 \cdot 70$ | $2 \cdot 71$ | 2.73 | $2 \cdot 74$ | 2.76 | $2 \cdot 77$ | $2 \cdot 79$ | 2.80 | 2.82 | 2.83 | $2 \cdot 85$ | 2.86 |
| 61 | $2 \cdot 56$ | $2 \cdot 57$ | $2 \cdot 59$ | 2.60 | $2 \cdot 62$ | $2 \cdot 63$ | $2 \cdot 65$ | $2 \cdot 66$ | 2.67 | $2 \cdot 69$ | 2.70 | $2 \cdot 72$ | $2 \cdot 73$ | 2.75 | 2.76 | 2.78 |
| 62 | 2.48 | 2.49 | 2.51 | $2 \cdot 52$ | 2.54 | $2 \cdot 55$ | $2 \cdot 56$ | $2 \cdot 58$ | 2.59 | $2 \cdot 60$ | $2 \cdot 62$ | 2.63 | 2.65 | 2.66 | $2 \cdot 67$ | 2.69 |
| 63 | $2 \cdot 40$ | 2.41 | 2.42 | 2.44 | $2 \cdot 45$ | 2.46 | 2.48 | 2.49 | 2.50 | 2.52 | 2.53 | $2 \cdot 55$ | 2.56 | 2.57 | $2 \cdot 59$ | $2 \cdot 60$ |
| 64 | $2 \cdot 32$ | 2.33 | $2 \cdot 34$ | 2.35 | $2 \cdot 37$ | $2 \cdot 38$ | $2 \cdot 39$ | 2.41 | 2.42 | $2 \cdot 43$ | 2.45 | 2.46 | $2 \cdot 47$ | $2 \cdot 48$ | $2 \cdot 50$ | $2 \cdot 51$ |
| 65 | $2 \cdot 23$ | $2 \cdot 24$ | $2 \cdot 26$ | 2.27 | $2 \cdot$ | $2 \cdot 29$ | $2 \cdot 31$ | $2 \cdot 32$ | $2 \cdot 33$ | $2 \cdot 34$ | $2 \cdot 36$ | $2 \cdot 37$ | $2 \cdot 38$ | 2.39 | 2.41 | $2 \cdot 4$ |
| 66 | $2 \cdot 15$ | $2 \cdot 16$ | 2.17 | 2-18 | 2.20 | 2.21 | 2.22 | 2.23 | 2.24 | $2 \cdot 26$ | $2 \cdot 27$ | $2 \cdot 28$ | 2.29 | 2.30 | $2 \cdot 32$ | $2 \cdot 33$ |
| 67 | 2.06 | 2.07 | 2.09 | $2 \cdot 10$ | $2 \cdot 11$ | 2.12 | $2 \cdot 13$ | 2.15 | 2.16 | 2.17 | $2 \cdot 18$ | $2 \cdot 19$ | 2.20 | $2 \cdot 21$ | 2.23 | 2.24 2.15 |
| 68 | r. 98 | r.99 | $2 \cdot 00$ | 201 | -02 | $2 \cdot 03$ | 2.05 | $2 \cdot 06$ | 2.07 | 2.08 | 2.09 | $2 \cdot 10$ | 2.11 | $2 \cdot 1$ | 2.13 | 2.15 |
| 69 70 | r $\cdot 89$ <br> r <br> 8 I | r.90 1.82 | r.91 <br> r 83 | I.92 | 1.93 r .85 | I. 94 I 86 | ז.96 | I.97 | r.98 | 1.99 | $2 \cdot 0$ | 2.0 | $2 \cdot 0$ | 2.03 | $2 \cdot 04$ | 2.05 |
| 70 | 1.81 | I. 82 | 1.83 |  | 1.85 |  | I.87 | 1.88 | r. 89 | I'90 | 1.91 | 1.92 | I'93 | 1.94 | 1.95 | 1.96 |

SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $42^{\circ} \cdot 0$ | $42^{\circ} \cdot 2$ | $42^{\circ} \cdot 4$ | $42^{\circ} \cdot 6$ | $42^{\circ} 8$ | $43^{\circ} \cdot 0$ | $43^{\circ} \cdot 2$ | $43^{\circ} 4$ | $43^{\circ} \cdot 6$ |  | 4 | $44^{\circ} \cdot 2$ | $44^{\circ} \cdot 4$ | $44^{\circ} \cdot 6$ |  | 0 |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF ¢ MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ |  | 5•79 | $5 \cdot 82$ | $5 \cdot 85$ | $5 \cdot 88$ | $5 \cdot 91$ |  | $5 \cdot 97$ | 6.00 | 6.03 | $6 \cdot 06$ | 6.09 | $6 \cdot 12$ | 6.15 | $6 \cdot 18$ |  |
| 4 | $5 \cdot 74$ | $5 \cdot 77$ | $5 \cdot 80$ | $5 \cdot 83$ | $5 \cdot 86$ | $5 \cdot 89$ | $5 \cdot 92$ | $5 \cdot 95$ | 5.99 | 6.02 | $6 \cdot 05$ | $6 \cdot 08$ | $6 \cdot 11$ | $6 \cdot 14$ | $6 \cdot 17$ | 6.20 |
| 8 | $5 \cdot 70$ | 5.73 | $5 \cdot 76$ | $5 \cdot 79$ | $5 \cdot 82$ | $5 \cdot 85$ | $5 \cdot 88$ | $5 \cdot 91$ | $5 \cdot 94$ | $5 \cdot 97$ | $6 \cdot 00$ | $6 \cdot 03$ | $6 \cdot 06$ | $6 \cdot 09$ | $6 \cdot 12$ | 6.15 |
| 10 | 5.67 | $5 \cdot 70$ | 5.73 | $5 \cdot 76$ | $5 \cdot 79$ | $5 \cdot 82$ | $5 \cdot 85$ | $5 \cdot 88$ | $5 \cdot 91$ | $5 \cdot 94$ | $5 \cdot 97$ | $6 \cdot 00$ | $6 \cdot 03$ | $6 \cdot 06$ | $6 \cdot 09$ | $6 \cdot 12$ |
| 12 | 5.63 | $5 \cdot 66$ | $5 \cdot 69$ | $5 \cdot 72$ | $5 \cdot 75$ | $5 \cdot 78$ | $5 \cdot 81$ | $5 \cdot 84$ | 5.87 | $5 \cdot 90$ | 5.93 | 5.96 | 5.99 | 6.02 | $6 \cdot 05$ | $6 \cdot 08$ |
| 14 | 5.59 | $5 \cdot 62$ | $5 \cdot 65$ | $5 \cdot 67$ | 5.70 | 5.73 | $5 \cdot 76$ | $5 \cdot 79$ | 5.82 | $5 \cdot 85$ | $5 \cdot 88$ | 5.91 | $5 \cdot 94$ | 5.97 | $6 \cdot 00$ | 6.03 |
| 16 | $5 \cdot 53$ | $5 \cdot 56$ | $5 \cdot 59$ | $5 \cdot 62$ | 5.65 | $5 \cdot 68$ | 5.71 | $5 \cdot 74$ | $5 \cdot 77$ | $5 \cdot 80$ | 5.83 | $5 \cdot 85$ | 5.88 | 5.91 | $5 \cdot 94$ | 5.97 |
| 18 | 5.48 | $5 \cdot 50$ | $5 \cdot 53$ | $5 \cdot 56$ | $5 \cdot 59$ | $5 \cdot 62$ | $5 \cdot 65$ | $5 \cdot 68$ | $5 \cdot 70$ | $5 \cdot 73$ | $5 \cdot 76$ | $5 \cdot 79$ | $5 \cdot 82$ | $5 \cdot 85$ | 5.88 | 5.91 |
| 19 | 5.44 | 5.47 | $5 \cdot 50$ | $5 \cdot 53$ | $5 \cdot 56$ | $5 \cdot 59$ | $5 \cdot 61$ | $5 \cdot 64$ | $5 \cdot 67$ | $5 \cdot 70$ | $5 \cdot 73$ | $5 \cdot 76$ | $5 \cdot 79$ | 5.82 | 5.85 | 5.87 |
| 20 | $5 \cdot 41$ | $5 \cdot 44$ | $5 \cdot 47$ | $5 \cdot 50$ | $5 \cdot 52$ | $5 \cdot 55$ | $5 \cdot 58$ | $5 \cdot 61$ | $5 \cdot 64$ | $5 \cdot 67$ | $5 \cdot 69$ | $5 \cdot 72$ | $5 \cdot 75$ | $5 \cdot 78$ | 5.81 | $5 \cdot 84$ |
| 21 | 5.37 | $5 \cdot 40$ | $5 \cdot 43$ | $5 \cdot 46$ | $5 \cdot 49$ | $5 \cdot 52$ | $5 \cdot 54$ | $5 \cdot 57$ | $5 \cdot 60$ | $5 \cdot 63$ | $5 \cdot 66$ | $5 \cdot 69$ | $5 \cdot 71$ | 5.74 | 5.77 | $5 \cdot 80$ |
| 22 | $5 \cdot 34$ | 5.36 | $5 \cdot 39$ | $5 \cdot 42$ | $5 \cdot 45$ | $5 \cdot 48$ | 5.51 | $5 \cdot 53$ | 5•56 | 5.59 | $5 \cdot 62$ | $5 \cdot 65$ | $5 \cdot 67$ | $5 \cdot 70$ | $5 \cdot 73$ | $5 \cdot 76$ |
| 23 | $5 \cdot 30$ | $5 \cdot 33$ | $5 \cdot 35$ | $5 \cdot 38$ | $5 \cdot 41$ | $5 \cdot 44$ | $5 \cdot 47$ | $5 \cdot 49$ | $5 \cdot 52$ | $5 \cdot 55$ | $5 \cdot 58$ | 5.61 | 5.63 | 5.66 | 5.69 | $5 \cdot 72$ |
| 24 | $5 \cdot 26$ | $5 \cdot 29$ | $5 \cdot 31$ | $5 \cdot 34$ | 5.37 | $5 \cdot 40$ | $5 \cdot 42$ | $5 \cdot 45$ | $5 \cdot 48$ | 5.51 | $5 \cdot 54$ | $5 \cdot 56$ | $5 \cdot 59$ | $5 \cdot 62$ | $5 \cdot 65$ | $5 \cdot 68$ |
| 25 | $5 \cdot 22$ | $5 \cdot 24$ | $5 \cdot 27$ | $5 \cdot 30$ | $5 \cdot 33$ | $5 \cdot 35$ | $5 \cdot 38$ | $5 \cdot 4 \mathrm{I}$ | $5 \cdot 44$ | $5 \cdot 46$ | 549 | $5 \cdot 52$ | $5 \cdot 55$ | $5 \cdot 58$ | $5 \cdot 60$ | 3 |
| 26 | 5 | $5 \cdot 20$ | 5 | 5 | 5.28 | $5 \cdot 31$ | $5 \cdot 34$ | $5 \cdot 36$ | $5 \cdot 39$ | 5.42 | $5 \cdot 45$ | $5 \cdot 47$ | $5 \cdot 50$ | $5 \cdot 53$ | $5 \cdot 56$ | $5 \cdot 58$ |
| 27 | $5 \cdot 1$ | $5 \cdot 16$ | 5•18 | $5 \cdot 2 \mathrm{I}$ | $5 \cdot 24$ | $5 \cdot 26$ | $5 \cdot 29$ | $5 \cdot 32$ | $5 \cdot 35$ | $5 \cdot 37$ | $5 \cdot 40$ | $5 \cdot 43$ | $5 \cdot 45$ | $5 \cdot 48$ | $5 \cdot 51$ | $5 \cdot 54$ |
| 28 | $5 \cdot 0$ | $5 \cdot 11$ | 5.14 | $5 \cdot 16$ | 5•19 | $5 \cdot 22$ | $5 \cdot 24$ | $5 \cdot 27$ | $5 \cdot 30$ | $5 \cdot 32$ | $5 \cdot 35$ | $5 \cdot 38$ | $5 \cdot 40$ | 5.43 | $5 \cdot 46$ | 5.49 |
| 29 | 5.04 | 5.06 | $5 \cdot 09$ | $5 \cdot 11$ | 5.14 | $5 \cdot 17$ | $5 \cdot 19$ | $5 \cdot 22$ | $5 \cdot 25$ | $5 \cdot 27$ | $5 \cdot 30$ | $5 \cdot 33$ | $5 \cdot 35$ | $5 \cdot 38$ | $5 \cdot 41$ | $5 \cdot 43$ |
| 30 | 4.99 | $5 \cdot 01$ | $5 \cdot 04$ | $5 \cdot 06$ | $5 \cdot 09$ | 5•12 | 5•14 | $5 \cdot 17$ | $5 \cdot 20$ | $5 \cdot 22$ | $5 \cdot 25$ | $5 \cdot 27$ | $5 \cdot 30$ | $5 \cdot 33$ | $5 \cdot 35$ | $5 \cdot 38$ |
| 31 | 4.94 | 4.96 | 4.99 | 5.01 | $5 \cdot$ | 5.06 | 5.09 | $\cdot 12$ | $5 \cdot 14$ | 5.17 | $5 \cdot 19$ | 5.22 | 5.25 | 5.27 | 5.30 | $5 \cdot 33$ |
| 32 | $4 \cdot 88$ | 4.91 | 4.93 | 4.96 | 4.98 | $5 \cdot 01$ | $5 \cdot 04$ | $5 \cdot 06$ | $5 \cdot 09$ | $5 \cdot 11$ | 5.14 | $5 \cdot 16$ | 5.19 | $5 \cdot 22$ | $5 \cdot 24$ | $5 \cdot 27$ |
| 33 | 4.83 | $4 \cdot 85$ | $4 \cdot 88$ | 4.90 | 4.93 | 4.95 | 4.98 | $5 \cdot 01$ | $5 \cdot 03$ | $5 \cdot 06$ | 5.08 | $5 \cdot 11$ | $5 \cdot 13$ | $5 \cdot 16$ | 5.18 | 5.21 |
| 34 | 4.77 | $4 \cdot 80$ | 4.82 | 4.85 | 4.87 | 4.90 | 4.92 | 4.95 | 4.97 | $5 \cdot 00$ | 5.02 | $5 \cdot 05$ | $5 \cdot 07$ | $5 \cdot 10$ | $5 \cdot 13$ | $5 \cdot 15$ |
| 35 | 4.72 | $4 \cdot 74$ | $4 \cdot 77$ | 4.79 | $4 \cdot 82$ | 4.84 | $4 \cdot 86$ | $4 \cdot 89$ | 4.91 | 4.94 | $4 \cdot 96$ | 4.99 | $5 \cdot 01$ | 5.04 | 5.06 | $5 \cdot 09$ |
| 36 | 4.66 | 4.68 | 4.71 | 4.73 | 4.76 | 4.78 | $4 \cdot 80$ | $4 \cdot 83$ | $4 \cdot 85$ | $4 \cdot 88$ | 4.90 | 4.93 | 4.95 | 4.98 | 5.00 | 5.03 |
| 37 | $4 \cdot 60$ | $4 \cdot 62$ | $4 \cdot 65$ | 4.67 | $4 \cdot 69$ | 4.72 | $4 \cdot 74$ | $4 \cdot 77$ | 4*79 | $4 \cdot 82$ | $4 \cdot 84$ | 4.86 | $4 \cdot 89$ | $4 \cdot 91$ | 4.94 | 4.96 |
| 38 | 4.54 | 4.56 | 4.58 | $4 \cdot 61$ | 4.63 | $4 \cdot 66$ | $4 \cdot 68$ | 4.70 | $4 \cdot 73$ | $4 \cdot 75$ | $4 \cdot 77$ | $4 \cdot 80$ | 4.82 | $4 \cdot 85$ | 4.87 | 4.90 |
| 39 | 4.47 | 4.50 | $4 \cdot 52$ | 4.54 | 4.57 | 4.59 | 4.62 | $4 \cdot 64$ | $4 \cdot 66$ | $4 \cdot 69$ | $4 \cdot 71$ | 4.73 | $4 \cdot 76$ | $4 \cdot 78$ | 4.80 | 4.83 |
| 40 | 4.41 | $4 \cdot 43$ | $4 \cdot 46$ | 4.48 | 4.50 | 4.53 | 4.55 | $4 \cdot 57$ | 4.60 | 4.62 | $4 \cdot 64$ | $4 \cdot 67$ | 4.69 | $4 \cdot 71$ | 4.74 | $4 \cdot 76$ |
| 41 | $4 \cdot 3$ | $4 \cdot 37$ | 4.39 | 4.41 | 4.44 | 4.46 | $4 \cdot 48$ | 4.50 | 4.53 | $4 \cdot 55$ | 4.57 | $4 \cdot 60$ | 4.62 | $4 \cdot 64$ | 4.67 | $4 \cdot 69$ |
| 42 | $4 \cdot 2$ | $4 \cdot 30$ | $4 \cdot 32$ | 4.35 | $4 \cdot 37$ | 4.39 | 4.41 | 4.44 | $4 \cdot 46$ | 4.48 | 4.50 | 4.53 | 4.55 | 4.57 | 4.59 | $4 \cdot 62$ |
| 43 | 4.21 | 4.23 | 4.25 | 4.28 | 4.30 | 4.32 | $4 \cdot 34$ | $4 \cdot 37$ | $4 \cdot 39$ | $4 \cdot 41$ | 4.43 | 4.45 | 4.48 | 4.50 | $4 \cdot 52$ | $4 \cdot 54$ |
| 44 | 4.14 | $4 \cdot 16$ | $4 \cdot 18$ | 4.21 | 4.23 | 4.25 | 4.27 | 4.29 | 4.32 | $4 \cdot 34$ | $4 \cdot 36$ | $4 \cdot 38$ | 4.40 | 4.42 | 4.45 | $4 \cdot 47$ |
| 45 | $4 \cdot 07$ | $4 \cdot 09$ | $4 \cdot 11$ | 4.13 | $4 \cdot 16$ | $4 \cdot 18$ | 4.20 | 4.22 | 4.24 | 4.26 | 4.28 | 4.31 | 4.33 | 4.35 | $4 \cdot 37$ | $4 \cdot 39$ |
| 46 | 4.00 | 4.02 | 4.04 | 4.06 | 4.08 | $4 \cdot 10$ | 4.12 | 4.15 | $4 \cdot 17$ | 4•19 | 4.21 | 4.23 | 4.25 | 4.27 | 4.29 | $4 \cdot 32$ |
| 47 | 3.93 | 3.95 | 3.97 | 3.99 | 4.01 | 4.03 | 4.05 | 4.07 | 4.09 | $4 \cdot 11$ | $4 \cdot 13$ | $4 \cdot 15$ | $4 \cdot 17$ | 4.20 | 4.22 | $4 \cdot 24$ |
| 48 | $3 \cdot 85$ | 3.87 | $3 \cdot 89$ | 3.91 | 3.93 | 3.95 | 3.97 | 3.99 | 4.01 | 4.03 | 4.05 | 4.08 | 4.10 | $4 \cdot 12$ | 4 | 4•16 |
| 49 | $3 \cdot 78$ | 3.80 | 3.82 | $3 \cdot 84$ | $3 \cdot 86$ | $3 \cdot 88$ | 3.90 | 3.92 | 3.94 | 3.96 | 3.97 | 4.00 | 4.01 | 4.04 | $4 \cdot 06$ | $4 \cdot 08$ |
| 50 | $3 \cdot 70$ | 3.72 | 3.74 | $3 \cdot 76$ | $3 \cdot 78$ | $3 \cdot 80$ | . $3 \cdot 82$ | 3.84 | $3 \cdot 86$ | 3.88 | 3.90 | 3.91 | 3.93 | 3.95 | 3.97 | 3.99 |
| 51 | 3.62 | 3.64 | 3.66 | 3.68 | 3.70 | $3 \cdot 72$ | 3.74 | 3.76 | 3.77 | 3.79 | 3.81 | 3.83 | 3.85 | $3 \cdot 87$ | 3.89 | 3.91 |
| 52 | $3 \cdot 54$ | 3.56 | $3 \cdot 58$ | $3 \cdot 60$ | $3 \cdot 62$ | $3 \cdot 64$ | 3.66 | 3.67 | 3.69 | 3.71 | 3.73 | 3.75 | 3.77 | 3.79 | 3.81 | $3 \cdot 82$ |
| 53 | 3.47 | 3.48 | $3 \cdot 50$ | 3.52 | 3.54 | 3.56 | 3.57 | 3.59 | 3.61 | 3.63 | 3.65 | 3.67 | 3.68 | 3.70 | 3.72 | $3 \cdot 74$ |
| 54 | $3 \cdot 38$ | 3.40 | 3.42 | 3.44 | 3.45 | 3.47 | 3.49 | 3.51 | 3.53 | 3.54 | 3.56 | 3.58 | 3.60 | 3.62 | 3.63 | 3.65 |
| 55 | $3 \cdot 30$ | $3 \cdot 32$ | $3 \cdot 34$ | $3 \cdot 35$ | 3.37 | $3 \cdot 39$ | 3.41 | 3.42 | 3.44 | 3.46 | $3 \cdot 47$ | 3.49 | 3.51 | 3.53 | 3.55 | $3 \cdot 56$ |
| 56 | 3.22 | 3.24 | 3.25 | 3.27 | 3.29 | 3.30 | 3.32 | 3.34 | 3.35 | 3.37 | $3 \cdot 39$ | 3.41 | 3.42 | 3.44 | 3.46 | $3 \cdot 47$ |
| 57 | $3 \cdot 13$ | $3 \cdot 15$ | $3 \cdot 17$ | 3.18 | 3.20 | 3.22 | 3.23 | 3.25 | 3.27 | 3.28 | $3 \cdot 30$ | $3 \cdot 32$ | $3 \cdot 33$ | $3 \cdot 35$ | 3.37 | $3 \cdot 38$ |
| 58 | 3.05 | 3.07 | 3.08 | $3 \cdot 10$ | 3.11 | $3 \cdot 13$ | $3 \cdot 15$ | $3 \cdot 16$ | $3 \cdot 18$ | $3 \cdot 20$ | $3 \cdot 21$ | 3.23 | 3.24 | 3.26 | 3.28 | $3 \cdot 29$ |
| 59 | 2.96 | $2 \cdot 98$ | $3 \cdot 00$ | $3 \cdot 01$ | 3.03 | 3.04 | 3.06 | 3.07 | 3.09 | $3 \cdot 10$ | $3 \cdot 12$ | 3.14 | 3.15 | $3 \cdot 17$ | $3 \cdot 1$ | 3.20 |
| 60 | 2.88 | 2.89 | 2.91 | 2.92 | $2 \cdot 94$ | $2 \cdot 95$ | $2 \cdot 97$ | $2 \cdot 98$ | $3 \cdot 00$ | 3.01 | $3 \cdot 03$ | 3.04 | 3.06 | 3.08 | 3.09 | $3 \cdot 11$ |
| 61 | 279 | 2.81 | $2 \cdot 82$ | $2 \cdot 84$ | $2 \cdot 85$ | 2.86 | 2.88 | $2 \cdot 89$ | 2.91 | 2.92 | $2 \cdot 94$ | 2.95 | $2 \cdot 97$ | 2.98 | 3.00 | 3.01 |
| 62 | 2.70 | 2.72 | 2.73 | 2.75 | 2.76 | 2.77 | 2.79 | 2.8 | $2 \cdot 82$ | $2 \cdot 83$ | $2 \cdot 84$ | $2 \cdot 86$ | $2 \cdot 87$ | $2 \cdot 89$ | 2.90 | 2.92 2.82 |
| 63 | $2 \cdot 61$ | $2 \cdot 63$ | $2 \cdot 64$ | 2.66 | $2 \cdot 67$ | $2 \cdot 68$ | $2 \cdot 70$ | 2.71 | $2 \cdot 72$ | 2.74 | $2 \cdot 75$ | $2 \cdot 76$ | $2 \cdot 78$ | 2.79 | $2 \cdot 81$ | 2.82 |
| 64 65 | 2.52 2.43 | 2.54 2.45 | 2.55 | 2.56 | 2.58 | 2.59 | $2 \cdot 60$ | 2.62 | $2 \cdot 63$ | $2 \cdot 64$ | $2 \cdot 66$ | $2 \cdot 67$ | 2.68 | $2 \cdot 70$ | $2 \cdot 71$ | 2.72 |
| 65 | $2 \cdot 43$ | 2.45 | $2 \cdot 46$ | 2.47 | $2 \cdot 48$ | $2 \cdot 50$ | $2 \cdot 51$ | $2 \cdot 52$ | $2 \cdot 53$ | $2 \cdot 55$ | $2 \cdot 56$ | $2 \cdot 57$ | $2 \cdot 59$ | $2 \cdot 60$ | $2 \cdot 61$ | 2.63 |
| 66 | $2 \cdot 34$ | 2.35 | 2.37 | $2 \cdot 38$ | $2 \cdot 39$ | 2.40 | 2.42 | 2.43 | 2.44 | 2.45 | 2.46 | 2.48 | 2.49 | $2 \cdot 50$ | $2 \cdot 51$ | 2.53 |
| 67 | $2 \cdot 25$ | $2 \cdot 26$ | 2.27 | $2 \cdot 28$ | $2 \cdot 30$ | $2 \cdot 31$ | $2 \cdot 32$ | $2 \cdot 33$ | $2 \cdot 34$ | $2 \cdot 36$ | $2 \cdot 37$ | $2 \cdot 38$ | $2 \cdot 39$ | $2 \cdot 40$ | 2.41 | 2.43 |
| 68 | 2.16 | $2 \cdot 17$ | 2.18 | $2 \cdot 19$ | $2 \cdot 20$ | 2.21 | 2.22 | 2.24 | $2 \cdot 25$ | $2 \cdot 26$ | 2.27 | $2 \cdot 28$ | $2 \cdot 29$ | $2 \cdot 30$ | 2.32 | 2.33 |
| 69 | 2.06 | $2 \cdot 07$ | $2 \cdot 08$ | $2 \cdot 10$ | $2 \cdot 11$ | $2 \cdot 12$ | $2 \cdot 13$ | 2.14 | $2 \cdot 15$ | $2 \cdot 16$ | $2 \cdot 17$ | 2.18 | 2.19 | $2 \cdot 20$ | $2 \cdot 2$ | 2.23 |
| 70 | 1•97 | 1.98 | 1.99 | $2 \cdot 00$ | 2.01 | 2.02 | 2.03 | $2 \cdot 04$ | $2 \cdot 05$ | $2 \cdot 06$ | $2 \cdot 07$ | 2.08 | $2 \cdot 09$ | $2 \cdot 10$ | $2 \cdot 11$ | $2 \cdot 12$ |

SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $45^{\circ} 1$ | $45^{\circ} \cdot 2$ | $45^{\circ} 3$ | $45^{\circ} \cdot 4$ | $45^{\circ} \cdot 5$ | $45^{\circ} \cdot 6$ | $45^{\circ} \cdot 7$ | $45^{\circ} \cdot 8$ | $45^{\circ} \cdot 9$ | $46^{\circ} \cdot 0$ | $46^{\circ} \cdot 1$ | $46^{\circ} \cdot 2$ | $46^{\circ} \cdot 3$ | $46^{\circ} \cdot 4$ | $46^{\circ} \cdot 5$ |
| REDUCTION TO THE MERIDIAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ | 6.23 | $6 \cdot 24$ | $6 \cdot 26$ | $6 \cdot 27$ | 6.29 | $6 \cdot 31$ | $6 \cdot 32$ | $6 \cdot 34$ | 6.35 | 6.3 | $6 \cdot 38$ | $6 \cdot 40$ | 6.41 | 6.43 | 6 |
| 2 | $6 \cdot 22$ | $6 \cdot 24$ | $6 \cdot 25$ | $6 \cdot 27$ | $6 \cdot 29$ | $6 \cdot 30$ | $6 \cdot 32$ | $6 \cdot 33$ | $6 \cdot 35$ | $6 \cdot 36$ | $6 \cdot 38$ | $6 \cdot 39$ | 6.41 | $6 \cdot 42$ | 6.44 |
| 4 | $6 \cdot 21$ | 6.23 | $6 \cdot 24$ | $6 \cdot 26$ | $6 \cdot 27$ | $6 \cdot 29$ | $6 \cdot 31$ | $6 \cdot 32$ | $6 \cdot 34$ | $6 \cdot 35$ | $6 \cdot 37$ | $6 \cdot 38$ | 6.40 | $6 \cdot 41$ | $6 \cdot 43$ |
| 6 | $6 \cdot 19$ | 6.21 | $6 \cdot 22$ | $6 \cdot 24$ | $6 \cdot 25$ | $6 \cdot 27$ | $6 \cdot 29$ | $6 \cdot 30$ | $6 \cdot 32$ | $6 \cdot 33$ | $6 \cdot 35$ | $6 \cdot 36$ | $6 \cdot 38$ | $6 \cdot 39$ | $6 \cdot 4 \mathrm{I}$ |
| 8 | $6 \cdot 17$ | 6.18 | $6 \cdot 20$ | 6.21 | 6.23 | $6 \cdot 24$ | $6 \cdot 26$ | 6.27 | $6 \cdot 29$ | $6 \cdot 31$ | $6 \cdot 32$ | $6 \cdot 34$ | $6 \cdot 35$ | $6 \cdot 37$ | $6 \cdot 38$ |
| 9 | $6 \cdot 15$ | $6 \cdot 17$ | $6 \cdot 18$ | $6 \cdot 2$ | 6.21 | 6.23 | 6.24 | 6.26 | $6 \cdot 2$ | $6 \cdot 29$ | $6 \cdot 30$ | $6 \cdot 32$ | $6 \cdot 33$ | $6 \cdot 35$ | $6 \cdot 37$ |
| 10 | $6 \cdot 13$ | $6 \cdot 15$ | $6 \cdot 16$ | $6 \cdot 18$ | 6.19 | 6.21 | 6.23 | $6 \cdot 24$ | $6 \cdot 26$ | $6 \cdot 27$ | $6 \cdot 29$ | $6 \cdot 30$ | $6 \cdot 32$ | $6 \cdot 33$ | $6 \cdot 35$ |
| 11 | 6.II | $6 \cdot 13$ | $6 \cdot 14$ | 6.16 | ${ }^{6 \cdot 17}$ | $6 \cdot 19$ | $6 \cdot 21$ | $6 \cdot 22$ | $6 \cdot 24$ | $6 \cdot 25$ | $6 \cdot 27$ | $6 \cdot 28$ | $6 \cdot 30$ | $6 \cdot 31$ | $6 \cdot 33$ |
| 12 | $6 \cdot 09$ | $6 \cdot 11$ | $6 \cdot 12$ | 6.14 | $6 \cdot 15$ $6 \cdot 13$ | ${ }^{6 \cdot 17}$ | $6 \cdot 18$ $6 \cdot 16$ | 6.20 | 6.21 | 6.23 | $6 \cdot 24$ | $6 \cdot 26$ | 6.27 | 6.29 | 6.30 |
| 13 | $6 \cdot 07$ | 6.08 | $6 \cdot 10$ | $6 \cdot 11$ | 6.13 | $6 \cdot 14$ | 6.16 | $6 \cdot 17$ | 6.19 | $6 \cdot 20$ | $6 \cdot 22$ | $6 \cdot 23$ | 6.25 | $6 \cdot 26$ | $6 \cdot 28$ |
| 14 | 6.04 | 6.06 | 6.07 | 6.09 | 6.10 | 6.12 | $6 \cdot 13$ | $6 \cdot 15$ | 6.16 | 6.18 | 6.19 | $6 \cdot 21$ | $6 \cdot 22$ | $6 \cdot 24$ | $6 \cdot 25$ |
| 15 | $6 \cdot 02$ | $6 \cdot 03$ | 6.05 | 6.06 | 6.08 | $6 \cdot 09$ | $6 \cdot 10$ | $6 \cdot 12$ | $6 \cdot 13$ | $6 \cdot 15$ | 6.16 | $6 \cdot 18$ | $6 \cdot 19$ | $6 \cdot 21$ | 6.22 |
| 16 | 5.99 | 6.00 | 6.02 | $6 \cdot 03$ | $6 \cdot 05$ | 6.06 | 6.08 | $6 \cdot 09$ | $6 \cdot 11$ | $6 \cdot 12$ | ${ }^{6 \cdot 14}$ | $6 \cdot 15$ | $6 \cdot 17$ | $6 \cdot 18$ | $6 \cdot 20$ |
| 17 | 5.96 | 5.97 | $5 \cdot 99$ | $6 \cdot 00$ | $6 \cdot 02$ | 6.03 | 6.04 | $6 \cdot 06$ | 6.07 | 6.09 | $6 \cdot 10$ | $6 \cdot 12$ | $6 \cdot 13$ | $6 \cdot 15$ | ${ }^{6 \cdot 16}$ |
| 18 | 5.92 | 5.94 | 5.95 | $5 \cdot 97$ | $5 \cdot 98$ | $6 \cdot 00$ | $6 \cdot 01$ | $6 \cdot 03$ | 6.04 | $6 \cdot 05$ | $6 \cdot 07$ | 6.08 | 6.10 | $6 \cdot \mathrm{II}$ | $6 \cdot 13$ |
| 19 | $5 \cdot 89$ | 5. | 5. | 5.93 | 5.95 | 5.96 | 5.98 | 5.99 | 6.01 | 6.0 | 6.03 | 6.05 | 6.06 | 6.08 | $6 \cdot 09$ |
| 20 | $5 \cdot 85$ | $5 \cdot 87$ | $5 \cdot 88$ | $5 \cdot 90$ | 5.91 | $5 \cdot 93$ | $5 \cdot 94$ | $5 \cdot 95$ | 5.97 | $5 \cdot 98$ | $6 \cdot 00$ | 6.01 | 6.03 | $6 \cdot 04$ | $6 \cdot 06$ |
| 21 | $5 \cdot 81$ | 5.83 | 5.84 5.8 | 5.86 | 5.87 | 5.89 5.85 | 5.90 5.86 | 5.91 | 5.93 | 5.94 | 5.96 | 5.97 | 5.99 | 6.00 | 6.02 5.08 |
| 22 | $5 \cdot 77$ 5 | $5 \cdot 79$ 5 | 5.80 5.76 | 5.82 5.78 | 5.83 5.79 | 5.85 5.80 | 5.86 5.82 | 5.87 5.83 | 5.89 5.85 | 5.90 5.86 | 5.92 | 5.93 5.89 | 5.95 5.90 | 5 | 5.98 5.93 |
| 23 24 | 5.73 5.69 | 5.75 5.70 | 5.76 5.72 | $5 \cdot 78$ 5.73 | $5 \cdot 79$ 5.75 | 5.80 5.76 | 5.62 5.77 | 5.83 5.79 | $5 \cdot 85$ 5.80 | 5.06 5.82 | 5.88 5.83 | 5.9 5.84 | 5.90 5.86 | 5.92 5.87 | 5.93 |
| 25 | 5.65 | $5 \cdot 66$ | $5 \cdot 67$ | $5 \cdot 69$ | 5.70 | 5.71 | $5 \cdot 73$ | 5.74 | $5 \cdot 76$ | $5 \cdot 77$ | 5.78 | 5.80 | $5 \cdot 8 \mathrm{I}$ | 5.83 | 5.84 |
| 26 | $5 \cdot 60$ | 5.61 | $5 \cdot 63$ | $5 \cdot 64$ | 5.65 | $5 \cdot 67$ | $5 \cdot 68$ | $5 \cdot 70$ | 5.71 | 5.72 | $5 \cdot 74$ | $5 \cdot 75$ | $5 \cdot 76$ | $5 \cdot 78$ | $5 \cdot 79$ |
| 27 | 5.55 | $5 \cdot 56$ | 5.58 | $5 \cdot 59$ | 5.60 | 5.62 | 5.63 | $5 \cdot 65$ | 5.66 | $5 \cdot 67$ | 5.69 | $5 \cdot 70$ | $5 \cdot 71$ | $5 \cdot 73$ | $5 \cdot 74$ |
| 28 | $5 \cdot 50$ | $5 \cdot 51$ | $5 \cdot 53$ | $5 \cdot 54$ | $5 \cdot 55$ | $5 \cdot 57$ | $5 \cdot 58$ | $5 \cdot 59$ | $5 \cdot 61$ | $5 \cdot 62$ | $5 \cdot 64$ | $5 \cdot 65$ | $5 \cdot 66$ | $5 \cdot 68$ | 5.69 |
| 29 | $5 \cdot 45$ | 5.46 | 5.47 5.4 | 5.49 | $5 \cdot 50$ | 5.52 | $5 \cdot 53$ | $5 \cdot 54$ | $5 \cdot 56$ | 5.57 | 5.58 | 5.60 | 5.61 | $5 \cdot 62$ | 5.64 5.58 |
| 30 | 5.39 | 5.41 | $5 \cdot 42$ | 5.43 | 5.45 | 5.46 | 5.47 | 5.49 | $5 \cdot 50$ | 5.51 | 5.53 | $5 \cdot 54$ | $5 \cdot 55$ | $5 \cdot 57$ | $5 \cdot 58$ |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | $46^{\circ} \cdot 6$ | $46^{\circ} \cdot 7$ | $46^{\circ} 8$ | $46^{\circ} \cdot 9$ |  |  | $47^{\circ} \cdot 2$ | $47^{\circ} 3$ | $47^{\circ} \cdot 4$ | $47^{\circ} \cdot 5$ | $47^{\circ} \cdot 6$ | $47^{\circ} \cdot 7$ | $47^{\circ} \cdot 8$ | $47^{\circ} \cdot 9$ | $48^{\circ} \cdot 0$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - | $6 \cdot 46$ | $6 \cdot 48$ | $6 \cdot 49$ | 6.51 | $6 \cdot 52$ | 6.54 | $6 \cdot 55$ | 6.57 | 6.58 | $6 \cdot 60$ | $6 \cdot 62$ | $6 \cdot 63$ | $6 \cdot 65$ | $6 \cdot 66$ | 6. 68 |
| 2 | $6 \cdot 46$ | $6 \cdot 47$ | $6 \cdot 49$ | 6.50 | $6 \cdot 52$ | 6.53 | $6 \cdot 55$ | $6 \cdot 56$ | $6 \cdot 58$ | $6 \cdot 60$ | $6 \cdot 6$ I | $6 \cdot 63$ | $6 \cdot 64$ | $6 \cdot 66$ | $6 \cdot 67$ |
| 4 | $6 \cdot 44$ | $6 \cdot 46$ | $6 \cdot 48$ | $6 \cdot 49$ | 6.51 | $6 \cdot 52$ | $6 \cdot 54$ | $6 \cdot 55$ | $6 \cdot 57$ | $6 \cdot 58$ | $6 \cdot 60$ | $6 \cdot 62$ | 6.63 | $6 \cdot 65$ | $6 \cdot 66$ |
| 6 | $6 \cdot 42$ | $6 \cdot 44$ | $6 \cdot 46$ | $6 \cdot 47$ | $6 \cdot 49$ | $6 \cdot 50$ | $6 \cdot 52$ | $6 \cdot 53$ | $6 \cdot 55$ | $6 \cdot 56$ | $6 \cdot 58$ | $6 \cdot 59$ | 6.61 | 6.63 | $6 \cdot 64$ |
| 8 | $6 \cdot 40$ | $6 \cdot 41$ | $6 \cdot 43$ | 6.44 | $6 \cdot 46$ | $6 \cdot 47$ | $6 \cdot 49$ | $6 \cdot 5$ | $6 \cdot 52$ | $6 \cdot 54$ | $6 \cdot 55$ | $6 \cdot 57$ | $6 \cdot 58$ | $6 \cdot 60$ | $6 \cdot 61$ |
| 9 | $6 \cdot 38$ | $6 \cdot 40$ | $6 \cdot 41$ | 6.43 | 6.44 | $6 \cdot 46$ | 6.47 | $6 \cdot 49$ | 6.50 | $6 \cdot 52$ | 6.53 | $6 \cdot 55$ | 6.56 | $6 \cdot 58$ | 6.60 |
| 10 | $6 \cdot 36$ | $6 \cdot 38$ | $6 \cdot 39$ | $6 \cdot 41$ | $6 \cdot 42$ | $6 \cdot 44$ | $6 \cdot 45$ | $6 \cdot 47$ | $6 \cdot 48$ | $6 \cdot 50$ | $6 \cdot 51$ | $6 \cdot 53$ | $6 \cdot 55$ | $6 \cdot 56$ | $6 \cdot 58$ |
| 11 | $6 \cdot 34$ | $6 \cdot 36$ | $6 \cdot 37$ | $6 \cdot 39$ | $6 \cdot 40$ | $6 \cdot 42$ | $6 \cdot 43$ | $6 \cdot 45$ | $6 \cdot 46$ | $6 \cdot 48$ | $6 \cdot 49$ | $6 \cdot 51$ | 6.53 | $6 \cdot 54$ | $6 \cdot 56$ |
| 12 | $6 \cdot 32$ | $6 \cdot 33$ | $6 \cdot 35$ | $6 \cdot 36$ | 6.38 | $6 \cdot 40$ | $6 \cdot 41$ | $6 \cdot 43$ | $6 \cdot 44$ | $6 \cdot 46$ | $6 \cdot 47$ | $6 \cdot 49$ | $6 \cdot 50$ | $6 \cdot 52$ | 6.53 |
| 13 | $6 \cdot 29$ | $6 \cdot 31$ | $6 \cdot 32$ | $6 \cdot 34$ | $6 \cdot 35$ | $6 \cdot 37$ | $6 \cdot 3^{8}$ | $6 \cdot 40$ | $6 \cdot 42$ | $6 \cdot 43$ | $6 \cdot 45$ | $6 \cdot 46$ | 6.48 | 6.49 | $6 \cdot 5 \mathrm{I}$ |
| 14 | 6.27 | 6.28 | $6 \cdot 30$ | $6 \cdot 31$ | $6 \cdot 33$ | $6 \cdot 34$ | $6 \cdot 36$ | 6.37 | $6 \cdot 39$ | $6 \cdot 40$ | $6 \cdot 42$ | $6 \cdot 43$ | $6 \cdot 45$ | $6 \cdot 47$ | $6 \cdot 48$ |
| 15 | $6 \cdot 24$ | 6.25 | $6 \cdot 27$ | $6 \cdot 28$ | $6 \cdot 30$ | $6 \cdot 31$ | $6 \cdot 33$ | $6 \cdot 34$ | $6 \cdot 36$ | $6 \cdot 37$ | $6 \cdot 39$ | $6 \cdot 40$ | $6 \cdot 42$ | $6 \cdot 44$ | $6 \cdot 45$ |
| 16 | $6 \cdot 21$ | $6 \cdot 23$ | $6 \cdot 24$ | 6.25 | $6 \cdot 27$ | $6 \cdot 28$ | $6 \cdot 30$ | $6 \cdot 31$ | $6 \cdot 33$ | $6 \cdot 34$ | $6 \cdot 36$ | $6 \cdot 37$ | $6 \cdot 39$ | 6.41 | $6 \cdot 42$ |
| 17 | 6•18 | 6•19 | $6 \cdot 21$ | $6 \cdot 22$ | $6 \cdot 24$ | $6 \cdot 25$ | $6 \cdot 27$ | $6 \cdot 28$ | $6 \cdot 30$ | $6 \cdot 31$ | $6 \cdot 33$ | $6 \cdot 34$ | $6 \cdot 36$ | $6 \cdot 37$ | $6 \cdot 39$ |
| 18 | 6•14 | 6.16 | $6 \cdot 17$ | $6 \cdot 19$ | $6 \cdot 20$ | $6 \cdot 22$ | $6 \cdot 23$ | $6 \cdot 25$ | $6 \cdot 26$ | $6 \cdot 28$ | $6 \cdot 29$ | $6 \cdot 31$ | $6 \cdot 32$ | $6 \cdot 34$ | $6 \cdot 35$ |
| 19 | 6.11 | $6 \cdot 12$ | $6 \cdot 14$ | $6 \cdot 15$ | $6 \cdot 17$ | $6 \cdot 18$ | 6.20 | 6.21 | 6.23 | 6.24 | $6 \cdot 26$ | 6.27 | $6 \cdot 28$ | $6 \cdot 30$ | $6 \cdot 31$ |
| 20 | 6.07 | 6.09 | $6 \cdot 10$ | 6.11 | $6 \cdot 13$ | $6 \cdot 14$ | 6.16 | 6•17 | 6-19 | 6.20 | 6.22 | 6.23 | $6 \cdot 25$ | $6 \cdot 26$ | $6 \cdot 27$ |
| 21 | 6.03 | $6 \cdot 05$ | 6.06 | 6.07 | 6.09 | $6 \cdot 10$ | $6 \cdot 12$ | $6 \cdot 13$ | 6.15 | 6-16 | 6-18 | $6 \cdot 19$ | $6 \cdot 20$ | $6 \cdot 22$ | $6 \cdot 23$ |
| 22 | 5.99 | $6 \cdot 00$ | 6.02 | 6.03 | $6 \cdot 05$ | 6.06 | $6 \cdot 08$ | $6 \cdot 09$ | 6-11 | $6 \cdot 12$ | $6 \cdot 13$ | $6 \cdot 15$ | 6-16 | 6-18 | 6.19 |
| 23 | 5.95 | 5.96 | $5 \cdot 98$ | 5.99 | $6 \cdot 00$ | 6.02 | 6.03 | $6 \cdot 05$ | $6 \cdot 06$ | 6.08 | $6 \cdot 09$ | $6 \cdot 10$ | $6 \cdot 12$ | $6 \cdot 13$ | $6 \cdot 15$ |
| 24 | 5.90 | 5.92 | $5 \cdot 93$ | $5 \cdot 94$ | $5 \cdot 96$ | $5 \cdot 97$ | $5 \cdot 99$ | $6 \cdot 00$ | 6.01 | 6.03 | 6.04 | $6 \cdot 06$ | 6.07 | 609 | 6.10 |
| 25 | 5.86 | 5.87 | 5.88 | $5 \cdot 90$ | 5.91 | 5.93 | $5 \cdot 94$ | $5 \cdot 95$ | 5.97 | 5.98 | $6 \cdot 00$ | 6.01 | 602 | $6 \cdot 04$ | $6 \cdot 05$ |
| 26 | 5.81 | $5 \cdot 82$ | 5.83 | 5.85 | 5.86 | 5.88 | $5 \cdot 89$ | 5.90 | 5.92 | $5 \cdot 93$ | $5 \cdot 95$ | $5 \cdot 96$ | 5.97 | 5.99 | $6 \cdot 00$ |
| 27 | $5 \cdot 76$ | $5 \cdot 77$ | $5 \cdot 78$ | 5.80 | 5.81 | 5.83 | $5 \cdot 84$ | $5 \cdot 85$ | 5.87 | 5.88 | 5.89 | 5.91 | $5 \cdot 92$ | 5.94 | 5.95 |
| 28 | 5.70 | $5 \cdot 72$ 5.66 | 5.73 | 5.75 | $5 \cdot 76$ | $5 \cdot 77$ | 5799 | $5 \cdot 80$ | 5.81 | 5.83 | 5.84 | 5.86 | 5.87 | 5.88 | 5.90 |
| 29 | $5 \cdot 65$ | $5 \cdot 66$ | $5 \cdot 68$ | $5 \cdot 69$ | $5 \cdot 70$ | $5 \cdot 72$ 5.66 | $5 \cdot 73$ | $5 \cdot 75$ | $5 \cdot 76$ | $5 \cdot 77$ | 5.79 | $5 \cdot 80$ | 5.81 | 5.83 | 5.84 |
| 30 | $5 \cdot 59$ | $5 \cdot 61$ | $5 \cdot 62$ | 5.63 | $5 \cdot 65$ | $5 \cdot 66$ | $5 \cdot 67$ | $5 \cdot 69$ | $5 \cdot 70$ | $5 \cdot 72$ | $5 \cdot 73$ | $5 \cdot 74$ | $5 \cdot 76$ | $5 \cdot 77$ | 5.78 | AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.


| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $48^{\circ} \cdot 1$ | $48^{\circ} \cdot 2$ | 48 ${ }^{\circ} 3$ | $48^{\circ} \cdot 4$ | $48^{\circ} \cdot 5$ | $48^{\circ} .6$ | $48^{\circ} \cdot 7$ | $48^{\circ} 8$ | $48^{\circ} \cdot 9$ | $49^{\circ} \cdot 0$ | $49^{\circ} \cdot 1$ | $49^{\circ} \cdot 2$ | $49^{\circ} \cdot 3$ | $49^{\circ} \cdot 4$ | $49^{\circ} \cdot 5$ |
| 8 | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF i MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 6.696.696.686.666.63 | $6 \cdot 71$ | 6.73 | 6. 74 6.76 |  | $6 \cdot 77$ | $6 \cdot 79$ | 6.80 | $6 \cdot 82$ | $6 \cdot 84$ | $6 \cdot 85$ | $6 \cdot 87$ | 6.886.88 | 6.90 | 6.91 |
|  |  | $6 \cdot 69$ | $6 \cdot 72$ | 6.74 | $6 \cdot 75$ | $6 \cdot 77$ | 6.78 | $6 \cdot 80$ | $6 \cdot 82$ | 6.83 | $6 \cdot 85$ | $6 \cdot 86$ |  | 6.89 | $6 \cdot 91$ |
|  |  |  | $6 \cdot 7 \mathrm{r}$ | 6.736.706.68 | $6 \cdot 74$ | ${ }^{6 \cdot 74}$ | 6.75 | $6 \cdot 77$ | $6 \cdot 78$ | 6.826.80 | $\begin{aligned} & 6 \cdot 84 \\ & 6 \cdot 8 \mathrm{r} \end{aligned}$ | $6 \cdot 85$6.83 | 6.876.85 | $\begin{aligned} & 6 \cdot 88 \\ & 6 \cdot 86 \end{aligned}$ | $6 \cdot 90$6.88 |
|  |  | $6 \cdot 67$ | $\begin{aligned} & 6 \cdot 69 \\ & 6.66 \end{aligned}$ |  | $6 \cdot 72$ 6.6 |  |  |  |  |  | $6 \cdot 8 \mathrm{I}$ |  |  |  |  |
| 10 |  | 6.63 | $6 \cdot 64$ | $6 \cdot 66$ | $6 \cdot 67$ | $6 \cdot 69$ | $6 \cdot 70$ | $6 \cdot 72$ | $6 \cdot 74$ | $6 \cdot 75$ | 6.77 | $6 \cdot 78$ | $6 \cdot 80$ | 6.8x | $6 \cdot 83$6.8 x |
|  | 6.6I |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $6 \cdot 59$ | 6.596.56 | $6 \cdot 62$ | $6 \cdot 64$ | $6 \cdot 65$ | $6 \cdot 67$ | 6.68 | $6 \cdot 70$ | 6:72 | $6 \cdot 73$ | $6 \cdot 75$ | $6 \cdot 76$ | $6 \cdot 78$ | $6 \cdot 79$ |  |
| II | 6.57 |  | $6 \cdot 60$6.586.55 | $\begin{aligned} & 6 \cdot 62 \\ & 6 \cdot 59 \\ & 6.57 \end{aligned}$ |  | $\begin{aligned} & 6 \cdot 65 \\ & 6 \cdot 63 \end{aligned}$ |  | $\begin{aligned} & 6 \cdot 68 \\ & 6.65 \end{aligned}$ | $\begin{aligned} & 6 \cdot 69 \\ & 6.67 \end{aligned}$ | $\begin{aligned} & 6 \cdot 7 x \\ & 6.69 \end{aligned}$ | $\begin{aligned} & 6.73 \\ & 6.70 \end{aligned}$ | $6 \cdot 74$ | $6 \cdot 76$ | $6 \cdot 77$ | $6 \cdot 79$ |
| 12 | 6.55 | $\begin{aligned} & 6 \cdot 56 \\ & 6 \cdot 54 \end{aligned}$ |  |  |  |  |  |  |  |  |  | $6 \cdot 72$6.69 | 6.71 | $6 \cdot 75$ | $6 \cdot 76$ |
| 13 | $6 \cdot 52$ |  |  |  | $\begin{array}{r} 6 \cdot 6 \mathrm{I} \\ 6.58 \end{array}$ | $\begin{aligned} & 6 \cdot 63 \\ & 6 \cdot 60 \end{aligned}$ | $\begin{aligned} & 6 \cdot 64 \\ & 6 \cdot 6 \mathrm{I} \end{aligned}$ | $\begin{aligned} & 6 \cdot 65 \\ & 6 \cdot 63 \end{aligned}$ | $6 \cdot 67$ 6.64 | $\begin{aligned} & 6.69 \\ & 6.66 \end{aligned}$ | 6.68 |  |  | $6 \cdot 72$ | $6 \cdot 74$ |
| 14 | 6.50 | 6.516 .53 |  | $6 \cdot 54$ | 656 | $6 \cdot 57$ | 6.596.56 | $6 \cdot 60$ | $6 \cdot 62$ | 6.63 | $6 \cdot 65$ | $6 \cdot 66$ | $6 \cdot 68$ | 6.696.66 | $6 \cdot 71$6.68 |
| 15 | $6 \cdot 47$ | $6 \cdot 48$ | $6 \cdot 50$ | $6 \cdot 51$ | $6 \cdot 53$ | $6 \cdot 54$ |  | $6 \cdot 57$ | $6 \cdot 59$ | $6 \cdot 60$ | $6 \cdot 62$ | 6.636.60 | $6 \cdot 65$6.62 |  |  |
| 16 | $6 \cdot 44$ | $6 \cdot 45$ | $6 \cdot 46$ | $6 \cdot 48$ | $6 \cdot 50$ | $6 \cdot 51$6.48 | $6 \cdot 53$6.49 | $6 \cdot 54$ | $6 \cdot 56$ | $6 \cdot 57$ | $6 \cdot 59$ |  |  | $6 \cdot 63$ | $6 \cdot 65$ |
| 18 | 6.40 | $6 \cdot 42$$6 \cdot 38$ | 6.436.40 | $6 \cdot 45$ | $6 \cdot 46$ |  |  | $\begin{aligned} & 6 \cdot 5 x \\ & 6 \cdot 47 \end{aligned}$ | $6 \cdot 52$ | $6 \cdot 54$ | $6 \cdot 55$ | $6 \cdot 57$ | $6 \cdot 58$ | $6 \cdot 60$ | $6 \cdot 6 \mathrm{r}$ |
|  | $6 \cdot 37$ |  |  | $\begin{aligned} & 0.45 \\ & 6.4 x \end{aligned}$ | $6 \cdot 43$ | 644 | $6 \cdot 49$ 646 |  | $6 \cdot 49$ | $6 \cdot 50$ | $6 \cdot 52$ | $6 \cdot 53$ | $6 \cdot 55$ |  | $6 \cdot 58$6.54 |
| 19 | 6.33 | $6 \cdot 30$ | $\begin{aligned} & 6 \cdot 36 \\ & 6 \cdot 32 \end{aligned}$ | $6 \cdot 37$6.336.3 | 6.396.35 | $6 \cdot 40$6.36 | $6 \cdot 42$$6 \cdot 38$ | $\begin{aligned} & 6.43 \\ & 6.39 \end{aligned}$ | 6.45$6 \cdot 41$ | $\begin{aligned} & 6 \cdot 46 \\ & 6 \cdot 42 \end{aligned}$ | $\begin{aligned} & 6.48 \\ & 6.44 \end{aligned}$ | $6 \cdot 49$$6 \cdot 45$ | $6 \cdot 51$ | $\begin{aligned} & 6 \cdot 52 \\ & 6 \cdot 48 \end{aligned}$ |  |
| 20 | $6 \cdot 29$ |  |  |  |  |  |  |  |  |  |  |  | $6 \cdot 47$6.43 |  | 6.54 6.50 6. |
| 21 | $6 \cdot 25$ | $6 \cdot 26$ | $6 \cdot 28$ | $6 \cdot 29$ | $6 \cdot 31$ | $6 \cdot 32$6.28 | $6 \cdot 34$ | $6 \cdot 35$ | $6 \cdot 37$ | $6 \cdot 38$ | $6 \cdot 40$ | 6.45 |  | $6 \cdot 44$ | $6 \cdot 46$ |
| 22 | 6.21 | $6 \cdot 22$$6 \cdot 18$ | 6.24 | $6 \cdot 25$ | 6.266.226.15 |  | $6 \cdot 29$ | $6 \cdot 31$ | $6 \cdot 32$ | $6 \cdot 34$ | 6.35 | $6 \cdot 37$ | $6 \cdot 38$ | $6 \cdot 40$ | 6.41 |
| 23 | $6 \cdot x 6$ |  | $6 \cdot 19$ | $6 \cdot 2 \mathrm{I}$$6 \cdot 16$ |  | 6.23 | $6 \cdot 25$ | $6 \cdot 26$ | $6 \cdot 28$ | $6 \cdot 29$ | $6 \cdot 31$ | $6 \cdot 32$ | $6 \cdot 34$ | $6 \cdot 35$ | $6 \cdot 37$ |
| 24 | $6 \cdot \mathrm{x}$ | $6 \cdot 13$ | $6 \cdot 14$ |  | $6 \cdot 17$ | $6 \cdot 19$ | $6 \cdot 20$ | 6.22 | 6.23 | $6 \cdot 24$ | 6.26 | $6 \cdot 27$ | $6 \cdot 29$ | $6 \cdot 30$ | $6 \cdot 32$ |
| 25 | 6.07 | 6.08 | 6.09 | $6 \cdot \mathrm{xx}$ | $6 \cdot 12$ | $6 \cdot 14$ | $6 \cdot 15$ | $6 \cdot 17$ | $6 \cdot 18$ | 6. 19 | 6.2 r | $6 \cdot 22$ | $6 \cdot 24$ | 6.25 | 6.27 |
| 26 | 6.02 | 6.03 | 6.04 | $6 \cdot 06$ | 6.07 | 6.09 | $6 \cdot 10$ | $6 \cdot 12$ | $6 \cdot 13$ | 6. 14 | 6.16 | $6 \cdot 17$ | 6.19 | $6 \cdot 20$ | $6 \cdot 22$ |
| 27 | 5.96 | $5 \cdot 98$ | 5.99 | 6.01 | 6.02 | 6.03 | 6.05 | 6.06 | $6 \cdot 08$ | $6 \cdot 09$ | 6.11 | 6.12 | $6 \cdot 13$ | $6 \cdot 15$ | ${ }^{6 \cdot 16}$ |
| 28 | 5.91 | 5.92 | 5.94 5.88 | 5.95 | $5 \cdot 97$ | $5 \cdot 98$ | $5 \cdot 99$ | 6.01 | 6.02 | $6 \cdot 04$ | $6 \cdot 05$ | 6.06 | 6.08 | $6 \cdot 09$ | 6.118 |
| 29 | $5 \cdot 86$ | $5 \cdot 87$ | 5.88 | $5 \cdot 90$ | $5 \cdot 91$ | $5 \cdot 92$ | $5 \cdot 94$ | $5 \cdot 95$ | $5 \cdot 97$ | $5 \cdot 98$ | 5.99 | $6 \cdot 01$ | $6 \cdot 02$ | 6.03 | 6.05 |
| 30 | $5 \cdot 80$ | 5.81 | 5.82 | $5 \cdot 84$ | 8.85 | 5.87 | 5.88 | $5 \cdot 89$ | 5.91 | $5 \cdot 92$ | 5.93 | 5 '95 | 5.96 | 5.97 | $5 \cdot 99$ |
|  |  |  |  |  |  |  | ZI | TH |  |  |  |  |  |  |  |
| Lat. | $49^{\circ} \cdot 6$ | $49^{\circ} \cdot 19$ | $49^{\circ} \cdot 8$ | $49^{\circ} \cdot 9$ | $50^{\circ} \cdot 0$ | $50^{\circ} \cdot 1$ | $50^{\circ} \cdot 2$ | $50^{\circ} 3$ | $50^{\circ} \cdot 4$ | $50^{\circ} \cdot 5$ | $50^{\circ} \cdot 6$ | $50^{\circ} \cdot 19$ | $50^{\circ} \cdot 8$ | $50^{\circ} \cdot 9$ | $51^{\circ} \cdot 0$ |
|  |  | DU | TIO | TO | TH | E M | RI | AN | AT | HOUR | A | LE | F | MI |  |
| - | 6.93 | 6.95 | 6.96 | 6.98 | $6 \cdot 99$ | $7 \cdot 01$ | 7.03 | 7.04 | $7 \cdot 06$ | 7.07 | 7'09 | $7 \cdot 11$ | $7 \cdot 12$ | $7 \cdot 14$ | $7 \cdot 15$ |
| 2 | $6 \cdot 93$ | 6.94 | $6 \cdot 96$ | $6 \cdot 97$ | $6 \cdot 99$ | 7.00 | 7.02 | 7.04 | 7.05 | 7.07 | 7.09 | $7 \cdot 10$ | $7 \cdot 12$ | 7-13 | $7 \cdot 15$ |
| 4 | 6.91 | 6.93 | 6.95 | $6 \cdot 96$ | $6 \cdot 98$ | $6 \cdot 99$ | 7.01 | 7.03 | $7 \cdot 04$ | $7 \bullet 06$ | 7.07 | $7 \times 09$ | $7 \cdot 11$ | $7 \cdot 12$ | 7-14 |
| 6 | 6.89 | 6.91 | 6.92 | $6 \cdot 94$ | 6.96 | $6 \cdot 97$ | $6 \cdot 99$ | 7.00 | 7.02 | $7 \cdot 04$ | 7.05 | 7.07 | 7.08 | $7 \cdot 10$ | $7 \cdot 12$ |
| 8 | 6.86 | 6.88 | 6.90 | 6.91 | $6 \cdot 93$ | 6.94 | 6.96 | 6.97 | 6.99 | $7 \cdot 01$ | 7.02 | 7.04 | 7.05 | $7 \cdot 07$ | 7.09 |
| 9 | 6.85 | 6.86 | 6.88 | $6 \cdot 89$ | 6.91 | 6.92 | $6 \cdot 94$ | 6.96 | $6 \cdot 97$ | 6.99 | 7.00 | 7.02 | 7.03 | $7 \cdot 05$ | 7.07 |
| xo | 6.83 | $6 \cdot 84$ | 6.86 | 6.87 | 6.89 | $6 \cdot 90$ | $6 \cdot 92$ | 6.94 | 6.95 | $6 \cdot 97$ | $6 \cdot 98$ | $7 \cdot 00$ | 7.01 | 7.03 | 7.05 |
| 11 | $6 \cdot 80$ | 6.82 | $6 \cdot 84$ | 6.85 | 6.87 | 6.88 | $6 \cdot 90$ | $6 \cdot 91$ | $6 \cdot 93$ | $6 \cdot 94$ | $6 \cdot 96$ | 6.98 | 6.99 | $7 \cdot 01$ | 7.02 |
| 12 | $6 \cdot 78$ | $6 \cdot 80$ | 6.81 | 6.83 | $6 \cdot 84$ | 6.86 | $6 \cdot 87$ | 6.89 | $6 \cdot 90$ | $6 \cdot 92$ | $6 \cdot 94$ | $6 \cdot 95$ | $6 \cdot 97$ | 6.98 | 7.00 |
| ${ }^{1} 3$ | 6.75 | 6.77 | $6 \cdot 78$ | 6.80 | $6 \cdot 8 \mathrm{r}$ | 6.83 | $6 \cdot 85$ | 6.86 | 6.88 | $6 \cdot 89$ | $6 \cdot 9 \mathrm{x}$ | $6 \cdot 92$ | $6 \cdot 94$ | 6.96 | $6 \cdot 97$ |
| 14 | $6 \cdot 72$ | $6 \cdot 74$ | $6 \cdot 76$ | 6.77 | $6 \cdot 79$ | 6.80 | 6.82 | 6.83 | 6.85 | 6.86 | 6.88 | $6 \cdot 89$ | 6.91 | 6.93 | $6 \cdot 94$ |
| 15 | 6.69 | $6 \cdot 71$ | $6 \cdot 73$ | 6.74 | $6 \cdot 76$ | $6 \cdot 77$ | $6 \cdot 79$ | 6.80 | 6.82 | $6 \cdot 83$ | $6 \cdot 85$ | 6.86 | 6.88 | 6.89 | $6 \cdot 91$ |
| x6 | $6 \cdot 66$ | $6 \cdot 68$ | $6 \cdot 69$ | 6.71 | $6 \cdot 72$ | $6 \cdot 74$ | $6 \cdot 76$ | $6 \cdot 77$ | $6 \cdot 78$ | 6.80 | 6.82 | $6 \cdot 83$ | 6.85 | 6.86 | 6.88 |
| 17 | $6 \cdot 63$ | $6 \cdot 64$ | $6 \cdot 66$ | $6 \cdot 67$ | $6 \cdot 69$ | 6.71 | $6 \cdot 72$ | $6 \cdot 73$ | 6.75 | 6.77 | $6 \cdot 78$ | 6.80 | $6 \cdot 8 \mathrm{I}$ | $6 \cdot 83$ | $6 \cdot 84$ |
| 18 | $6 \cdot 59$ | $6 \cdot 61$ | $6 \cdot 62$ | $6 \cdot 64$ | $6 \cdot 65$ | $6 \cdot 67$ | $6 \cdot 68$ | $6 \cdot 70$ | $6 \cdot 71$ | $6 \cdot 73$ | $6 \cdot 74$ | $6 \cdot 76$ | $6 \cdot 77$ | $6 \cdot 79$ | $6 \cdot 80$ |
| 19 | $6 \cdot 55$ | 6.57 | $6 \cdot 58$ | $6 \cdot 60$ | $6 \cdot 61$ | $6 \cdot 63$ | $6 \cdot 64$ | $6 \cdot 66$ | 6.67 | $6 \cdot 69$ | $6 \cdot 70$ | $6 \cdot 72$ | 6.73 | 6.75 | $6 \cdot 76$ |
| 20 | $6 \cdot 51$ | $6 \cdot 53$ | $6 \cdot 54$ | $6 \cdot 56$ | $5 \cdot 57$ | $6 \cdot 59$ | $6 \cdot 60$ | $6 \cdot 62$ | 6.63 | $6 \cdot 65$ | $6 \cdot 66$ | $6 \cdot 68$ | $6 \cdot 69$ | $6 \cdot 71$ | $6 \cdot 72$ |
| 21 | $6 \cdot 47$ | $6 \cdot 48$ | $6 \cdot 50$ | 6.51 | 6.53 | $6 \cdot 54$ | $6 \cdot 56$ | $6 \cdot 57$ | $6 \cdot 59$ | $6 \cdot 60$ | 6.62 | 6.63 | $6 \cdot 65$ | 6.66 | $6 \cdot 68$ |
| 22 | $6 \cdot 43$ | $6 \cdot 44$ | $6 \cdot 46$ | 6.47 | $6 \cdot 48$ | $6 \cdot 50$ | $6 \cdot 51$ | $6 \cdot 53$ | $6 \cdot 54$ | $6 \cdot 56$ | $6 \cdot 57$ | $6 \cdot 59$ | $6 \cdot 60$ | $6 \cdot 62$ | 6.63 |
| 23 | $6 \cdot 38$ | $6 \cdot 39$ | 6.41 | 6.42 | $6 \cdot 44$ | $6 \cdot 45$ | $6 \cdot 47$ | 6.48 | $6 \cdot 50$ | $6 \cdot 51$ | $6 \cdot 53$ | $6 \cdot 54$ | $6 \cdot 56$ | $6 \cdot 57$ | $6 \cdot 59$ |
| 24 | $6 \cdot 33$ | $6 \cdot 35$ | $6 \cdot 36$ | $6 \cdot 38$ | $6 \cdot 39$ | $6 \cdot 40$ | $6 \cdot 42$ | 6.43 | 6.45 | $6 \cdot 46$ | 6.48 | 6.49 | $6 \cdot 51$ | $6 \cdot 52$ | $6 \cdot 54$ |
| 25 | 628 | $6 \cdot 30$ | 6.31 | $6 \cdot 33$ | $6 \cdot 34$ | $6 \cdot 35$ | $6 \cdot 37$ | $6 \cdot 38$ | $6 \cdot 40$ | 6.41 | $6 \cdot 43$ | $6 \cdot 44$ | 6.46 | 6.47 | $6 \cdot 48$ |
| 26 | $6 \cdot 23$ | $6 \cdot 24$ | $6 \cdot 26$ | $6 \cdot 27$ | $6 \cdot 29$ | $6 \cdot 30$ | $6 \cdot 32$ | $6 \cdot 33$ | $6 \cdot 34$ | $6 \cdot 36$ | $6 \cdot 37$ | $6 \cdot 39$ | $6 \cdot 40$ | 6.42 | $6 \cdot 43$ |
| 27 | $6 \cdot 18$ | 6.19 | $6 \cdot 20$ | $6 \cdot 22$ | 6.23 | $6 \cdot 25$ | $6 \cdot 26$ | $6 \cdot 28$ | $6 \cdot 29$ | $6 \cdot 30$ | $6 \cdot 32$ | $6 \cdot 33$ | $6 \cdot 35$ | $6 \cdot 36$ | $6 \cdot 38$ |
| 28 | $6 \cdot 12$ 6.06 | $6 \cdot 13$ 6.08 | $6 \cdot 15$ 6.09 | 6.16 | ${ }_{6 \cdot 18} 6$ | ${ }^{6 \cdot 19}$ | $6 \cdot 20$ | 6.22 | $6 \cdot 23$ | $6 \cdot 25$ | 6.26 | $6 \cdot 27$ | 6.29 | $6 \cdot 30$ | $6 \cdot 32$ |
| 29 30 | 6.06 6.00 | 6.08 6.02 | 6.09 6.03 | $6 \cdot 10$ 6.04 | $6 \cdot 12$ $6 \cdot 06$ | $6 \cdot 13$ $6 \cdot 07$ | $6 \cdot 14$ 6.08 | 6.16 $6 \cdot 10$ | $6 \cdot 17$ $6 \cdot 11$ | ${ }_{6 \cdot 19}$ | $6 \cdot 20$ $6 \cdot 14$ | 6.2 x 6.15 | 6.23 | $6 \cdot 24$ | $6 \cdot 26$ |
| 30 |  |  | $6 \cdot 3$ | 6.04 |  | 6.07 |  | 6.70 |  | 6 | -14 | $6 \cdot 15$ | $6 \cdot 17$ | $6 \cdot 18$ | $6 \cdot 20$ |

## SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $51^{\circ} 1$ | $51^{\circ} .2$ | $51^{\circ} 3$ | $51^{\circ} .4$ | $51^{\circ} 5$ | $51^{\circ} 6$ | 519.\% | $51^{\circ} 8$ | $51^{\circ} \cdot 9$ | $52^{\circ} \cdot 0$ | $52^{\circ} \cdot 1$ | 520.2 | $52^{\circ} 3$ | $52^{\circ} \cdot 4$ | $52^{\circ} \cdot 5$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF a MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ | 7•17 | 7•19 | $7 \cdot 20$ | $7 \cdot 22$ | ' 324 | \% 25 | $7 \cdot 27$ | 7-28 | $7 \cdot 30$ | $7 \cdot 32$ | $7 \cdot 33$ | $7 \times 35$ | $7 \cdot 36$ | $7 \cdot 38$ | 7*40 |
| 2 | $7 \cdot 17$ | 7.18 | 7.20 | 7.21 | 7.23 | 7.25 | $7 \cdot 26$ | $7 \cdot 28$ | $7 \cdot 29$ | 7.31 | $7 \cdot 33$ | $7 \cdot 34$ | $7 \cdot 36$ | $7 \cdot 38$ | $7 \cdot 39$ |
| 4 | $7 \cdot 15$ | 7-17 | $7 \cdot 19$ | $7 \cdot 20$ | 7.22 | 7.23 | $7 \cdot 25$ | 7.27 | 7.28 | 7.30 | $7 \cdot 32$ | 7.33 | $7 \cdot 35$ | $7 \cdot 36$ | $7 \cdot 38$ |
| 6 | $7 \cdot 13$ | $7 \cdot 15$ | $7 \cdot 16$ | $7 \cdot 18$ | 7.20 | 7.21 | $7 \cdot 23$ | $7 \cdot 24$ | 7.26 | $7 \cdot 28$ | 7.29 | 7.31 | $7 \cdot 32$ | $7 \cdot 34$ | 7.36 |
| 8 | $7 \cdot 10$ | $7 \cdot 12$ | $7 \cdot 13$ | $7 \cdot 15$ | 717 | $7 \cdot 18$ | $7 \cdot 20$ | $7 \cdot 21$ | 7.23 | $7 \cdot 24$ | $7 \cdot 26$ | $7 \cdot 28$ | $7 \cdot 29$ | 7•3I | $7 \cdot 33$ |
| 9 | 7.08 | $7 \cdot 10$ | $7 \cdot 11$ | $7 \cdot 13$ | $7 \cdot 15$ | 7.16 | $7 \cdot 18$ | $7 \cdot 19$ | 7.21 | 7.23 | $7 \cdot 24$ | $7 \cdot 26$ | $7 \cdot 27$ | 7.29 | 7.31 |
| 10 | 7.06 | 7.08 | 7.09 | $7 \cdot 11$ | $7 \cdot 13$ | 7.14 | $7 \cdot 16$ | $7 \cdot 17$ | $7 \cdot 19$ | $7 \cdot 20$ | $7 \cdot 22$ | $7 \cdot 24$ | $7 \cdot 25$ | 7.27 | $7 \cdot 28$ |
| 11 | 7.04 | 7.05 | 7.07 | 7.09 | $7 \cdot 10$ | $7 \cdot 12$ | $7 \cdot 13$ | $7 \cdot 15$ | $7 \cdot 17$ | 7•18 | $7 \cdot 20$ | 7.21 | $7 \cdot 23$ | $7 \cdot 25$ | $7 \cdot 26$ |
| 12 | 7.01 | 7.03 | $7 \cdot 05$ | 7.06 | 7.08 | $7 \cdot 09$ | 7.11 | $7 \cdot 12$ | $7 \cdot 14$ | $7 \cdot 16$ | $7 \times 17$ | $7 \cdot 19$ | $7 \cdot 20$ | $7 \cdot 22$ | 7.24 |
| 13 | $6 \cdot 99$ | $7 \cdot 00$ | $7 \cdot 02$ | 7.03 | $7 \cdot 05$ | 7.07 | $7 \cdot 08$ | $7 \cdot 10$ | 7.11 | $7 \cdot 13$ | 7•14 | 7•16 | 7•18 | 7•19 | 7.21 |
| 14 | $6 \cdot 96$ | 6.97 | $6 \cdot 99$ | 7.00 | 7.02 | 7.04 | 7.05 | 7.07 | 7.08 | $7 \cdot 10$ | $7 \cdot 11$ | $7 \cdot 13$ | $7 \cdot 15$ | $7 \cdot 16$ | 7•18 |
| 15 | $6 \cdot 93$ | $6 \cdot 94$ | 6.96 | 6.97 | $6 \cdot 99$ | 7.00 | 7.02 | 7.03 | 7.05 | 7.07 | 7.08 | $7 \cdot 10$ | $7 \cdot 11$ | $7 \cdot 13$ | $7 \cdot 14$ |
| 16 | $6 \cdot 89$ | $6 \cdot 91$ | $6 \cdot 92$ | $6 \cdot 94$ | $6 \cdot 95$ | $6 \cdot 97$ | 6.99 | 7.00 | 7.02 | 7.03 | 7.04 | 7.06 | 7.08 | $7 \cdot 10$ | $7 \cdot 11$ |
| 17 18 | 6.86 6.82 | 6.87 6.83 | 6.89 6.85 | 6.90 6.87 | 6.92 6.88 | $6 \cdot 93$ 6.90 | 6.95 6.91 | $6 \cdot 97$ 6.93 | $6 \cdot 98$ 6.94 | 7.00 6.96 | 7.01 6.97 | 7.03 6.99 | 7.04 7.00 | $7 \cdot 06$ 7.02 | $7 \cdot 07$ 7.03 |
| 19 | $6 \cdot 78$ | $6 \cdot 79$ | 6.81 | 6.83 | 6.84 | 6.86 | 6.87 | 6.89. | $6 \cdot 90$ | 6.92 | $6 \cdot 93$ | 6.95 | 6.96 | 6.98 | $6 \cdot 99$ |
| 20 | $6 \cdot 74$ | 6.75 | 6.77 | $6 \cdot 78$ | $6 \cdot 80$ | 6.81 | $6 \cdot 83$ | $6 \cdot 84$ | 6.86 | 6.87 | 6.89 | 6.90 | $6 \cdot 92$ | $6 \cdot 94$ | 6.95 |
| 21 | $6 \cdot 69$ | $6 \cdot 71$ | $6 \cdot 72$ | $6 \cdot 74$ | $6 \cdot 75$ | 6.77 | $6 \cdot 78$ | $6 \cdot 80$ | 6.8 I | $6 \cdot 83$ | $6 \cdot 84$ | $6 \cdot 86$ | 6.88 | $6 \cdot 89$ | 6.91 |
| 22 | $6 \cdot 65$ | 6.66 | 6.68 | $6 \cdot 69$ | $6 \cdot 71$ | $6 \cdot 72$ | $6 \cdot 74$ | $6 \cdot 75$ | 6.77 | $6 \cdot 78$ | $6 \cdot 80$ | 6.8 r | 6.83 | $6 \cdot 84$ | 6.86 |
| 23 | $6 \cdot 60$ | $6 \cdot 61$ | $6 \cdot 63$ | $6 \cdot 64$ | 6.66 | $6 \cdot 67$ | $6 \cdot 69$ | $6 \cdot 70$ | $6 \cdot 72$ | 6.73 | $6 \cdot 75$ | $6 \cdot 76$ | $6 \cdot 78$ | $6 \cdot 79$ | $6 \cdot 81$ |
| 24 | $6 \cdot 55$ | $6 \cdot 56$ | $6 \cdot 58$ | $6 \cdot 59$ | 6.61 | $6 \cdot 62$ | $6 \cdot 64$ | $6 \cdot 65$ | $6 \cdot 67$ | $6 \cdot 68$ | $6 \cdot 70$ | $6 \cdot 7 \mathrm{I}$ | 6.73 | $6 \cdot 74$ | $6 \cdot 76$ |
| 25 | 6.50 | 6.51 | 6.53 | $6 \cdot 54$ | $6 \cdot 56$ | $6 \cdot 57$ | $6 \cdot 59$ | $6 \cdot 60$ | 6.62 | 6.63 | $6 \cdot 64$ | 6.66 | $6 \cdot 68$ | $6 \cdot 69$ | $6 \cdot \% 0$ |
| 26 | $6 \cdot 45$ | $6 \cdot 46$ | $6 \cdot 47$ | $6 \cdot 49$ | $6 \cdot 50$ | $6 \cdot 52$ | $6 \cdot 53$ | $6 \cdot 55$ | $6 \cdot 56$ | $6 \cdot 58$ | $6 \cdot 59$ | $6 \cdot 60$ | $6 \cdot 62$ | $6 \cdot 63$ | $6 \cdot 65$ |
| 27 | $6 \cdot 39$ | $6 \cdot 40$ | $6 \cdot 42$ | $6 \cdot 43$ | $6 \cdot 45$ | $6 \cdot 46$ | $6 \cdot 48$ | 6.49 | 6.50 | $6 \cdot 52$ | $6 \cdot 53$ | $6 \cdot 55$ | $6 \cdot 56$ | $6 \cdot 58$ | $6 \cdot 59$ |
| 28 | $6 \cdot 33$ | $6 \cdot 35$ | $6 \cdot 36$ | $6 \cdot 37$ | $6 \cdot 39$ | $6 \cdot 40$ | $6 \cdot 42$ | $6 \cdot 43$ | 6.44 | $6 \cdot 46$ | $6 \cdot 47$ | $6 \cdot 49$ | $6 \cdot 50$ | $6 \cdot 52$ | $6 \cdot 53$ |
| 29 | $6 \cdot 27$ | $6 \cdot 29$ | $6 \cdot 30$ | $6 \cdot 31$ | $6 \cdot 33$ | $6 \cdot 34$ | $6 \cdot 36$ | $6 \cdot 37$ | $6 \cdot 38$ | $6 \cdot 40$ | $6 \cdot 41$ | $6 \cdot 43$ | $6 \cdot 44$ | $6 \cdot 46$ | $6 \cdot 47$ |
| 30 | $6 \cdot 21$ | $6 \cdot 22$ | $6 \cdot 24$ | $6 \cdot 25$ | $6 \cdot 27$ | $6 \cdot 28$ | $6 \cdot 29$ | $6 \cdot 31$ | $6 \cdot 32$ | $6 \cdot 34$ | $6 \cdot 35$ | $6 \cdot 36$ | 6.38 | $6 \cdot 39$ | $6 \cdot 4 \mathrm{I}$ |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | $52^{\circ} \cdot 6$ | $52^{\circ} \cdot 7$ | $52^{\circ} \cdot 8$ | $52^{\circ} \cdot 9$ | $53^{\circ} 0$ | $53^{\circ} \cdot 1$ | $53^{\circ} \cdot 2$ | $53^{\circ} 3$ | $53^{\circ} \cdot 4$ | $53^{\circ} \cdot 5$ | $53^{\circ} 6$ | $53^{\circ} \cdot 7$ | $53^{\circ} \cdot 8$ | $53^{\circ} \cdot 9$ | $54^{\circ} \cdot 0$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| : | $7 \cdot 41$ | $7 \cdot 43$ | $7 \cdot 45$ | $7 \cdot 46$ | $7 \cdot 48$ | $7 \cdot 49$ | $7 \cdot 51$ | $7 \cdot 53$ | $7 \cdot 54$ | $7 \cdot 56$ | 7.58 | $7 \cdot 59$ | $7 \cdot 61$ | $7 \cdot 63$ | $7 \cdot 64$ |
| 2 | $7 \cdot 41$ | $7 \cdot 42$ | $7 \cdot 44$ | $7 \times 46$ | 7.47 | 7.49 | 7.51 | 7.52 | $7 \cdot 54$ | 7.56 | 7.57 | $7 \cdot 59$ | $7 \cdot 60$ | 7.62 | $7 \cdot 64$ |
| 4 | $7 \cdot 40$ | $7 \cdot 41$ | $7 \cdot 43$ | $7 \cdot 44$ | $7 \cdot 46$ | 7.48 | $7 \cdot 49$ | 7.51 | 7.53 | $7 \cdot 54$ | 7.56 | 7.58 | $7 \cdot 59$ | 7.61 | $7 \cdot 62$ |
| 6 | $7 \cdot 37$ | $7 \cdot 39$ | $7 \cdot 40$ | $7 \cdot 42$ | $7 \cdot 44$ | $7 \cdot 45$ | 7.47 | $7 \cdot 49$ | $7 \cdot 50$ | $7 \cdot 52$ | 7.53 | $7 \cdot 55$ | 7.57 | $7 \cdot 58$ | $7 \cdot 60$ |
| 8 | $7 \cdot 34$ | $7 \cdot 36$ | $7 \cdot 37$ | $7 \cdot 39$ | $7 \cdot 41$ | $7 \cdot 42$ | $7 \cdot 44$ | $7 \cdot 45$ | $7 \cdot 47$ | $7 \cdot 49$ | 7.50 | $7 \cdot 52$ | $7 \cdot 54$ | $7 \cdot 55$ | $7 \cdot 57$ |
| 9 | 7.32 | 7.34 | $7 \cdot 35$ | 7.37 | $7 \cdot 39$ | $7 \cdot 40$ | $7 \cdot 42$ | 7.43 | 7.45 | 7.47 | 7.48 | $7 \cdot 50$ | 7.52 | 7.53 | 7.55 |
| 10 | $7 \cdot 30$ | $7 \cdot 32$ | 7.33 | $7 \cdot 35$ | $7 \cdot 37$ | $7 \cdot 38$ | $7 \cdot 40$ | $7 \times 4$ | $7 \cdot 43$ | $7 \cdot 45$ | $7 \cdot 46$ | $7 \cdot 48$ | $7 \cdot 49$ | $7 \cdot 51$ | $7 \cdot 53$ |
| 11 | $7 \cdot 28$ | 7.29 | 7.31 | 7.33 | $7 \cdot 34$ | $7 \cdot 36$ | 7.37 | $7 \cdot 39$ | $7 \cdot 41$ | $7 \cdot 42$ | $7 \cdot 44$ | 7.45 | 7.47 | $7 \cdot 49$ | $7 \cdot 50$ |
| 12 | $7 \cdot 25$ | 7.27 | $7 \cdot 28$ | $7 \cdot 30$ | $7 \cdot 32$ | $7 \cdot 33$ | $7 \cdot 35$ | $7 \cdot 36$ | $7 \cdot 38$ | $7 \cdot 40$ | $7 \cdot 41$ | $7 \cdot 43$ | $7 \cdot 44$ | $7 \cdot 46$ | $7 \cdot 48$ |
| 13 | $7 \cdot 22$ | 724 | $7 \cdot 25$ | 7.27 | $7 \cdot 29$ | $7 \cdot 30$ | $7 \cdot 32$ | $7 \cdot 33$ | $7 \cdot 35$ | $7 \cdot 37$ | $7 \cdot 38$ | $7 \cdot 40$ | $7 \times 41$ | $7 \cdot 43$ | $7 \cdot 45$ |
| 14 | 7-19 | $7 \cdot 21$ | $7 \cdot 22$ | 7.24 | 7. 26 | 7.27 | $7 \cdot 29$ | $7 \cdot 30$ | $7 \cdot 32$ | $7 \cdot 34$ | $7 \cdot 35$ | $7 \cdot 37$ | $7 \cdot 38$ | $7 \cdot 40$ | $7 \cdot 42$ |
| 15 | $7 \cdot 16$ | $7 \cdot 18$ | $7 \cdot 19$ | 7.21 | $7 \cdot 22$ | $7 \cdot 24$ | $7 \cdot 26$ | $7 \cdot 27$ | $7 \cdot 29$ | 7.31 | $7 \cdot 32$ | $7 \cdot 33$ | $7 \cdot 35$ | $7 \cdot 37$ | $7 \cdot 38$ |
| 16 | $7 \cdot 13$ | $7 \cdot 14$ | 7-16 | $7 \cdot 17$ | $7 \cdot 19$ | 7.20 | $7 \cdot 22$ | $7 \cdot 24$ | $7 \cdot 25$ | 7.27 | $7 \cdot 28$ | $7 \cdot 30$ | $7 \cdot 32$ | $7 \cdot 33$ | $7 \cdot 35$ |
| 17 | 7.09 | $7 \cdot 11$ | $7 \cdot 12$ | $7 \cdot 14$ | $7 \cdot 15$ | $7 \cdot 17$ | 7-18 | 7.20 | $7 \cdot 21$ | 7.23 | $7 \cdot 25$ | $7 \cdot 26$ | $7 \cdot 28$ | 7.29 | $7 \cdot 3 \mathrm{I}$ |
| 18 | $7 \cdot 05$ | $7 \cdot 07$ | 7.08 | $7 \cdot 10$ | $7 \cdot 11$ | 7.13 | $7 \cdot 14$ | $7 \cdot 16$ | $7 \times 17$ | $7 \cdot 19$ | 7.21 | $7 \cdot 22$ | $7 \cdot 24$ | $7 \cdot 25$ | $7 \cdot 27$ |
| 19 | $7 \cdot 01$ | $7 \cdot 03$ | 7.04 | 7.06 | 7.07 | 7.09 | $7 \cdot 10$ | $7 \cdot 12$ | $7 \cdot 13$ | $7 \cdot 15$ | $7 \cdot 16$ | $7 \cdot 18$ | 7.20 | 7.21 | 7.23 |
| 20 | $6 \cdot 97$ | $6 \cdot 98$ | 7.00 | 7.01 | 7.03 | 7.04 | $7 \cdot 06$ | 7.07 | 7.09 | 7.10 | $7 \cdot 12$ | $7 \cdot 14$ | $7 \cdot 15$ | $7 \cdot 17$ | $7 \cdot 18$ |
| 21 | 6.92 | $6 \cdot 94$ | 6.95 | $6 \cdot 97$ | $6 \cdot 98$ | 7.00 |  |  | $7 \cdot 04$ | $7 \cdot 06$ | 7.07 | 7.09 | $7 \cdot 10$ | $7 \cdot 12$ | $7 \cdot 13$ |
| 22 | 6.87 | $6 \cdot 89$ | 6.90 | $6 \cdot 92$ | 6.93 | $6 \cdot 95$ | 6.96 | $6 \cdot 98$ | 6.99 | 7.01 | $7 \cdot 03$ | 7.04 | $7 \cdot 06$ | 7.07 | 7.09 |
| 23 | $6 \cdot 82$ | $6 \cdot 84$ | 8.85 | $6 \cdot 87$ | 6.88 | $6 \cdot 90$ | 6.91 | 6.93 | 6.94 | $6 \cdot 96$ | $6 \cdot 97$ | $6 \cdot 99$ | 7.01 | 7.02 | 7.04 |
| 24 | $6 \cdot 77$ | $6 \cdot 79$ | 6.80 | 6.82 | 6.83 | $6 \cdot 85$ | $6 \cdot 86$ | 6.88 | $6 \cdot 89$ | 6.91 | $6 \cdot 92$ | 6.94 | $6 \cdot 95$ | $6 \cdot 97$ | 6.98 |
| 25 | 6.72 | 6.73 | 6.75 | $6 \cdot 76$ | $6 \cdot 78$ | $6 \cdot 79$ | 6.81 | $6 \cdot 82$ | $6 \cdot 84$ | $6 \cdot 85$ | 6.87 | 6.88 | 6.90 | $6 \cdot 91$ | 6.93 |
| 26 | $6 \cdot 66$ | $6 \cdot 68$ | $6 \cdot 69$ | $6 \cdot 71$ | $6 \cdot 72$ | $6 \cdot 74$ | $6 \cdot 75$ | $6 \cdot 77$ | $6 \cdot 78$ | $6 \cdot 80$ | 6.81 | $6 \cdot 83$ | $6 \cdot 84$ | 6.85 | $6 \cdot 87$ |
| 27 | $6 \cdot 60$ | $6 \cdot 62$ | $6 \cdot 63$ | $6 \cdot 65$ | $6 \cdot 66$ | $6 \cdot 68$ | $6 \cdot 69$ | $6 \cdot 71$ | ${ }^{6 \cdot 72}$ | $6 \cdot 74$ 6.68 | $6 \cdot 75$ | $6 \cdot 77$ | $6 \cdot 78$ | $6 \cdot 79$ | $6 \cdot 81$ |
| 28 | $6 \cdot 55$ | $6 \cdot 56$ | $6 \cdot 57$ | $6 \cdot 59$ | 6.60 | 6.62 6.56 | 6.63 6.57 | $6 \cdot 65$ 6.58 | $6 \cdot 66$ | $6 \cdot 68$ | 6.69 | $6 \cdot 70$ | $6 \cdot 72$ | $6 \cdot 73$ | 6.75 6.68 |
| 32 | 6.48 6.42 | $6 \cdot 50$ $6 \cdot 43$ | $6 \cdot 51$ $6 \cdot 45$ | 6.53 6.46 | 6.54 6.48 | $6 \cdot 56$ $6 \cdot 49$ | 6.57 6.51 | $6 \cdot 58$ 6.52 | $6 \cdot 60$ 6.53 | 6.61 6.55 | 6.63 6.56 | 6.64 6.58 | $6 \cdot 66$ 6.59 | 6.67 6.60 | 6.68 6.62 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $54^{\circ} \cdot 1$ | $54^{\circ} \mathrm{C}$ | $54^{\circ} \cdot 3$ | $54^{\circ} \cdot 4$ | $54^{\circ} \cdot 5$ | $54^{\circ} \cdot 6$ | $54^{\circ} \cdot 7$ | $54^{\circ} \cdot 8$ | $54^{\circ} \cdot 9$ | $55^{\circ} 0$ | $55^{\circ} 1$ | $55^{\circ} \cdot 2$ | $55^{\circ} \cdot 3$ | $55^{\circ} \cdot 4$ | $55^{\circ} \cdot 5$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - | $7 \cdot 66$ | \% 68 | $7 \cdot 69$ | 7.71 | $7 \cdot 73$ | $7 \cdot 74$ | 7.76 | 7.78 | $7 \cdot 79$ | $7 \cdot 81$ | 7.83 | 7.84 | 7.86 | 7.88 | $7 \cdot 89$ |
| 2 | $7 \cdot 65$ | $7 \cdot 67$ | $7 \cdot 69$ | $7 \cdot 70$ | $7 \cdot 72$ | 7.74 | $7 \cdot 75$ | $7 \cdot 77$ | $7 \cdot 79$ | 7.80 | 7.82 | 7.84 | $7 \cdot 85$ | 7.87 | 7.89 |
| 4 | $7 \cdot 64$ | 7.66 | 7.67 | 7.69 | $7 \cdot 71$ | $7 \cdot 72$ | $7 \cdot 74$ | $7 \cdot 76$ | $7 \cdot 77$ | $7 \cdot 79$ | 7.81 | 7.82 | $7 \cdot 84$ | 7.86 | 7.87 |
| ${ }_{8}$ | 7.62 | 7.63 | 7.65 | 7.67 | $7 \cdot 68$ | 7.70 | 7.72 | $7 \cdot 73$ | 7.75 | $7 \cdot 77$ | 7.78 | 7.80 | 7.82 | 7.83 | 7.85 |
| 8 | 7.59 | 7.60 | $7 \cdot 62$ | $7 \cdot 63$ | $7 \cdot 65$ | $7 \cdot 67$ | 7.68 | $7 \cdot 70$ | $7 \cdot 72$ | 7•73 | $7 \cdot 75$ | $7 \cdot 77$ | $7 \cdot 78$ | 7.80 | $7 \cdot 82$ |
| 9 | 7.57 | 7.58 | 7.60 | $7 \cdot 61$ | 7.63 | 7.65 | 7.66 | $7 \cdot 68$ | $7 \cdot 70$ | 7.71 | 7.73 | $7 \cdot 74$ | $7 \cdot 76$ | 7.78 | $7 \cdot 79$ |
| 10 | 7.54 | 7.56 | 7.58 | 7.59 | $7 \cdot 6$ I | 7.63 | $7 \cdot 64$ | 7.66 | 7.67 | 7.69 | 7.71 | $7 \cdot 72$ | $7 \cdot 74$ | $7 \cdot 76$ | 7.77 |
| II | 7.52 | 7.53 | $7 \cdot 55$ | 7.57 | $7 \cdot 58$ | $7 \cdot 60$ | $7 \cdot 62$ | 7.63 | $7 \cdot 65$ | $7 \cdot 67$ | $7 \cdot 68$ | $7 \cdot 70$ | $7 \cdot 71$ | $7 \cdot 73$ | $7 \cdot 75$ |
| 12 | 7.49 | 7.51 | 7.52 | 7.54 | 7.56 | 7.57 | $7 \cdot 59$ | $7 \cdot 61$ | 7.62 | $7 \cdot 64$ | 7.65 | 7.67 | $7 \cdot 69$ | $7 \cdot 70$ | $7 \cdot 72$ |
| 13 | 746 | 7.48 | $7 \cdot 49$ | $7 \cdot 51$ | $7 \cdot 53$ | $7 \cdot 54$ | $7 \cdot 56$ | $7 \cdot 58$ | $7 \cdot 59$ | $7 \cdot 61$ | $7 \cdot 62$ | $7 \cdot 64$ | 7.66 | $7 \cdot 67$ | $7 \cdot 69$ |
| 14 | $7 \cdot 43$ | 7.45 | $7 \cdot 46$ | $7 \cdot 48$ | 7.50 | $7 \cdot 51$ | $7 \cdot 53$ | $7 \cdot 54$ | $7 \cdot 56$ | $7 \cdot 58$ | 7.59 | 7.6I | 7.63 | $7 \cdot 64$ | $7 \cdot 66$ |
| 15 | $7 \cdot 40$ | 7.41 | $7 \cdot 43$ | $7 \cdot 45$ | $7 \cdot 46$ | $7 \cdot 48$ | 7.49 | 7.51 | $7 \cdot 53$ | 7.54 | $7 \cdot 56$ | $7 \cdot 57$ | 7.59 | 7.61 | $7 \cdot 62$ |
| 16 | $7 \cdot 36$ | $7 \cdot 38$ | $7 \cdot 40$ | $7 \cdot 41$ | $7 \cdot 43$ | $7 \cdot 44$ | $7 \cdot 46$ | $7 \cdot 47$ | $7 \cdot 49$ | $7 \cdot 51$ | $7 \cdot 52$ | $7 \cdot 54$ | $7 \cdot 55$ | $7 \cdot 57$ | 7.59 |
| 17 | 7.32 | $7 \cdot 34$ | $7 \cdot 36$ | 7337 | $7 \cdot 39$ | $7 \cdot 40$ | $7 \cdot 42$ | $7 \cdot 44$ | $7 \cdot 45$ | $7 \cdot 47$ | $7 \cdot 48$ | $7 \cdot 50$ | $7 \cdot 51$ | 7.53 | 7.55 |
| 18 | $7 \cdot 28$ | 7.30 | $7 \cdot 32$ | $7 \cdot 33$ | $7 \cdot 35$ | $7 \cdot 36$ | $7 \cdot 38$ | $7 \cdot 39$ | $7 \cdot 41$ | $7 \cdot 43$ | $7 \cdot 44$ | $7 \cdot 46$ | $7 \cdot 47$ | $7 \cdot 49$ | 7.50 |
| 19 | 7.24 | 7.26 | 7.27 | 7.29 | 7.30 | $7 \cdot 32$ | $7 \cdot 34$ | 7.35 | 7.37 | $7 \cdot 38$ | $7 \cdot 40$ | $7 \cdot 41$ | 7.43 | $7 \cdot 45$ | $7 \cdot 46$ |
| 20 | 7.20 | 7.21 | 7.23 | $7 \cdot 24$ | $7 \cdot 26$ | $7 \cdot 27$ | $7 \cdot 29$ | $7 \cdot 31$ | $7 \cdot 32$ | $7 \cdot 34$ | $7 \cdot 35$ | $7 \cdot 37$ | $7 \cdot 38$ | $7 \cdot 40$ | $7 \cdot 42$ |
| 21 | $7 \cdot 15$ | $7 \cdot 17$ | $7 \cdot 18$ | $7 \cdot 20$ | 7.21 | $7 \cdot 23$ | $7 \cdot 24$ | $7 \cdot 26$ | 7.27 | $7 \cdot 29$ | $7 \cdot 30$ | $7 \cdot 32$ | $7 \cdot 34$ | $7 \cdot 35$ | $7 \cdot 37$ |
| 22 | $7 \cdot 10$ | $7 \cdot 12$ | $7 \cdot 13$ | $7 \cdot 15$ | 7.16 | $7 \cdot 18$ | $7 \cdot 19$ | $7 \cdot 21$ | 7.22 | $7 \cdot 24$ | $7 \cdot 25$ | $7 \cdot 27$ | $7 \cdot 29$ | $7 \cdot 30$ | $7 \cdot 32$ |
| 23 | 7.05 | 7.07 | 7.08 | $7 \cdot 10$ | 7•11 | $7 \cdot 13$ | $7 \cdot 14$ | $7 \cdot 16$ | $7 \cdot 17$ | $7 \cdot 19$ | $7 \cdot 20$ | $7 \cdot 22$ | 7.23 | 7.25 | $7 \cdot 26$ |
| 24 | 7.00 | 7 -01 | $7 \cdot 03$ | $7 \cdot 04$ | $7 \cdot 06$ | 7.07 | 7.09 | $7 \cdot 10$ | 7-12 | $7 \cdot 13$ | $7 \cdot 15$ | 7-16 | 7-18 | 7-19 | 7.21 |
| 25 | $6 \cdot 9$ | $6 \cdot 96$ | $6 \cdot 97$ | $6 \cdot 99$ | 7.00 | 7.02 | 7.03 | $7 \cdot 05$ | 7.06 | 7.08 | 7.09 | $7 \cdot 11$ | $7 \cdot 12$ | $7 \cdot 14$ | $7 \cdot 15$ |
| 26 | $6 \cdot 88$ | $6 \cdot 90$ | 6.91 | $6 \cdot 93$ | $6 \cdot 94$ | 6.96 | $6 \cdot 97$ | 6.99 | 7.00 | $7 \cdot 02$ | 7.03 | $7 \cdot 05$ | 7.06 | $7 \cdot 08$ | 7.09 |
| 27 | $6 \cdot 82$ | $6 \cdot 84$ | 6.85 | 6.87 | $6 \cdot 88$ | $6 \cdot 90$ | 6.91 | $6 \cdot 93$ | 6.94 | 6.96 | 6.97 | 6.99 | 7.00 | 7.02 | 7.03 |
| 28 | $6 \cdot 76$ | $6 \cdot 78$ | $6 \cdot 79$ | $6 \cdot 81$ | 6.82 |  | 6.85 | $6 \cdot 87$ | $6 \cdot 88$ | $6 \cdot 89$ | $6 \cdot 91$ |  |  | $6 \cdot 95$ | $6 \cdot 97$ |
| 29 30 | 6.70 6.63 | 6.71 6.65 | $6 \cdot 73$ $6 \cdot 66$ | 6.74 6.68 | $6 \cdot 76$ 6.69 | $6 \cdot 77$ 6.70 | $6 \cdot 79$ $6 \cdot 72$ | 6.80 $7 \cdot 73$ | $6 \cdot 82$ 6.75 | 6.83 6.76 | $6 \cdot 84$ 6.78 | 6.86 6.79 | $6 \cdot 87$ 6.8 I | 6.89 6.82 | 6.90 6.83 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | $55^{\circ} \cdot 6$ | $55^{\circ} \cdot 7$ | $55^{\circ} \cdot 8$ | $55^{\circ} \cdot 9$ | $56^{\circ} \cdot 0$ | $56^{\circ} \cdot 1$ | $56^{\circ} \cdot 2$ | $56^{\circ} \cdot 3$ | $56^{\circ} \cdot 4$ | $56^{\circ} \cdot 5$ | $56^{\circ} \cdot 6$ | 56 ${ }^{\circ} \cdot 7$ | $56^{\circ} .8$ | $56^{\circ} \cdot 9$ | $57^{\circ} \cdot 0$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF $~$ I MN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - | $7 \cdot 91$ | $7 \cdot 93$ | $7 \cdot 94$ | - 96 | $7 \cdot 97$ | \%•99 | 8 8'01 | 8.03 | 8.04 | 8 8.06 | 8.08 | 8.09 | 8 8.11 | $8 \cdot 13$ | $8 \cdot 14$ |
| 2 | $7 \cdot 90$ | 7.92 | 7•94 | $7 \cdot 95$ | $7 \cdot 96$ | $7 \cdot 99$ | $8 \cdot 00$ | 8.02 | 8.04 | 8.05 | 8.07 | 8.09 | $8 \cdot 11$ | 8-12 | $8 \cdot 14$ |
| 4 | 7.89 | 7.91 | 7.92 | 7.94 | $7 \cdot 95$ | 7.97 | $7 \cdot 99$ | 8.01 | 8.02 | 8.04 | 8.06 | 8.07 | 8.09 | $8 \cdot \mathrm{II}$ | $8 \cdot 13$ |
| 6 | $7 \cdot 87$ | 7.88 | 7.90 | 7.91 | 7.92 | 7.95 | 7.97 | 7.98 | 8.00 | 8.02 | 8.03 | $8 \cdot 05$ | 8.07 | $8 \cdot 08$ | $8 \cdot 10$ |
| 8 | $7 \cdot 83$ | 7.85 | $7 \cdot 87$ | 7.88 | 7.89 | 7.92 | $7 \cdot 93$ | 7.95 | 7.96 | $7 \cdot 98$ | $8 \cdot 00$ | 8.02 | 8.03 | $8 \cdot 05$ | 8.07 |
| 9 | $7 \cdot 8 \mathrm{I}$ | 7.83 | 7.84 | 7.86 | 7.87 | 7.89 | 7.91 | 7.93 | 7.94 | $7 \cdot 96$ | 7.98 | 7.99 | 8.01 | 8.03 | 8.04 |
| 10 | 7.79 | $7 \cdot 8$ I | 7.82 | 784 | 7.84 | 7.87 | 7.89 | 7.90 | 7.92 | $7 \cdot 94$ | $7 \cdot 95$ | 7.97 | 7.99 | $8 \cdot 00$ | 8.02 |
| II | $7 \cdot 76$ | $7 \cdot 78$ | 7.80 | 7.81 | 7.82 | 7.85 | 7.86 | 7.88 | 7.90 | 7.91 | $7 \cdot 93$ | 7.95 | 7.96 | 7.98 | 8.00 |
| 12 | $7 \cdot 74$ | $7 \cdot 75$ | 7.77 | 7.78 | 7.79 | 7.82 | 7.83 | 7.85 | $7 \cdot 87$ | $7 \cdot 88$ | 7.90 | 7.92 | 7.93 | $7 \cdot 95$ | 7.97 |
| 13 | 7•71 | $7 \cdot 72$ | $7 \cdot 74$ | 7.75 | $7 \cdot 76$ | $7 \cdot 79$ | 7.80 | 7.82 | $7 \cdot 84$ | $7 \cdot 85$ | 7.87 | 7.89 | 7.90 | 7.92 | 7.94 |
| 14 | $7 \cdot 67$ | $7 \cdot 69$ | 7.71 | $7 \cdot 72$ | $7 \cdot 73$ | $7 \cdot 76$ | 7.77 | $7 \cdot 79$ | 7.80 | 7.82 | 7.84 | 7.85 | 7.87 | 7.89 | 7.90 |
| 15 | $7 \cdot 64$ | 7.66 | $7 \cdot 67$ | 7.68 | $7 \cdot 69$ | $7 \cdot 72$ | 7.74 | $7 \cdot 75$ | 7.77 | 7.78 | 7.80 | 7.82 | 7.83 | 7.85 | $7 \cdot 87$ |
| 16 | $7 \cdot 60$ | $7 \cdot 62$ | 7.63 | 7.65 | 7.66 | 7.68 | 7.70 | 7.72 | 7.73 | $7 \cdot 75$ | $7 \cdot 76$ | $7 \cdot 78$ | 7.80 | $7 \cdot 81$ | 7.83 |
| 17 | $7 \cdot 56$ | $7 \cdot 58$ | $7 \cdot 59$ | 7.61 | 7.63 | 7.64 | 7.66 | 7.68 | 7.69 | 7.71 | $7 \cdot 72$ | $7 \cdot 74$ | $7 \cdot 76$ | $7 \cdot 77$ | $7 \cdot 79$ |
| 18 | 7.52 | $7 \cdot 54$ | $7 \cdot 55$ | $7 \cdot 57$ | 7.59 | 7.60 | $7 \cdot 62$ | 7.63 | 7.65 | $7 \cdot 67$ | 7.68 | 7.70 | 7.71 | 7.73 | 7.75 |
| 19 | $7 \cdot 48$ | $7 \cdot 49$ | 7.51 | $7 \cdot 53$ | 7.54 | $7 \cdot 56$ | 7.57 | 7.59 | 7.60 | 7.62 | $7 \cdot 64$ | 7.65 | 7.67 | $7 \cdot 68$ | $7 \cdot 70$ |
| 20 | $7 \cdot 43$ | $7 \cdot 45$ | $7 \cdot 46$ | $7 \cdot 48$ | $7 \cdot 49$ | 7.51 | 7.53 | 7.54 | $7 \cdot 56$ | $7 \cdot 57$ | 7.59 | $7 \cdot 61$ | 7.62 | $7 \cdot 64$ | 7.65 |
| 21 | 7.38 | 740 | 7.41 | 7.43 | $7 \cdot 45$ | $7 \cdot 46$ | 7.48 | 7.49 | 7.51 | 7.52 | 7.54 | 7.56 | 7.57 | 7.59 | 7.60 |
| 22 | 7.33 | 7.35 | $7 \cdot 36$ | $7 \cdot 38$ | $7 \cdot 40$ | 7.45 | 7.43 | $7 \cdot 44$ | $7 \cdot 46$ | 7.47 | 7.49 | $7 \cdot 50$ | 7.52 | $7 \cdot 54$ | 7.55 |
| 23 | $7 \cdot 28$ | $7 \cdot 29$ | $7 \cdot 31$ | $7 \cdot 33$ | $7 \cdot 34$ | $7 \cdot 36$ | $7 \cdot 37$ | $7 \cdot 39$ | $7 \cdot 40$ | $7 \cdot 42$ | 7.43 | $7 \cdot 45$ | 7.47 | $7 \cdot 48$ | $7 \cdot 50$ |
| 24 | $7 \cdot 22$ | $7 \cdot 24$ | $7 \cdot 25$ | $7 \cdot 27$ | $7 \cdot 29$ | $7 \cdot 30$ | $7 \cdot 32$ | $7 \cdot 33$ | 7•35 | $7 \cdot 36$ | $7 \cdot 38$ | $7 \cdot 39$ | $7 \cdot 41$ | $7 \cdot 42$ | 7.44 |
| 25 | $7 \cdot 17$ | 7.18 | 7.20 | 7.21 | $7 \cdot 23$ | 7.24 | $7 \cdot 26$ | $7 \cdot 27$ | 7.29 | 7.30 | 7.32 | $7 \cdot 33$ | $7 \cdot 35$ | 7.37 | $7 \cdot 38$ |
| 26 | 7.11 | $7 \cdot 12$ | $7 \cdot 14$ | $7 \cdot 15$ | $7 \cdot 17$ | $7 \cdot 18$ | 7.20 | 7.21 | 7.23 | $7 \cdot 24$ | $7 \cdot 26$ | $7 \cdot 27$ | 7.29 | $7 \cdot 30$ | $7 \cdot 32$ |
| 27 | 7.05 | 7.06 | $7 \cdot 08$ | 7.09 | $7 \cdot 11$ | $7 \cdot 12$ | $7 \cdot 14$ | $7 \cdot 15$ | $7 \cdot 17$ | $7 \cdot 18$ | $7 \cdot 20$ | $7 \cdot 21$ | $7 \cdot 23$ | $7 \cdot 24$ | $7 \cdot 26$ |
| 28 29 | 6.98 6.92 | 7.00 6.03 | 7.01 | 7.03 6.96 | $7 \cdot 04$ 6.08 | 7.06 | 7.07 | 7.09 | $7 \cdot 10$ | $7 \cdot 12$ | $7 \cdot 13$ | 7.15 | $7 \cdot 16$ | $7 \cdot 18$ | $7 \cdot 19$ |
| 30 | 6.85 | $6 \cdot 86$ | 6.88 | 6.89 | 6.91 | 6.92 | 6.94 | 6.95 | $6 \cdot 97$ | 6.98 | $6 \cdot 99$ | ${ }^{7} 701$ | $7 \cdot 09$ 702 | $7 \cdot 11$ $7 \cdot 04$ | $7 \cdot 12$ $7 \cdot 05$ |

SHOWING THE REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO AZIMUTHS FROM $1^{\circ}$ TO $60^{\circ}$ FROM THE MERIDIAN.

| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | $57^{\circ} \cdot 1$ | $57^{\circ} 2$ | $57^{10} 3$ | $5{ }^{170} 4$ | 5y ${ }^{\circ} 5$ | $57^{\circ} \cdot 6$ | $57^{0.1 y}$ | 578.8 | $57^{\circ} \cdot 9$ | $58^{\circ} \cdot 0$ | $58^{\circ} \cdot 1$ | $58^{\circ} \cdot 2$ | $58^{\circ} \cdot 3$ | $58^{\circ} \cdot 4$ | $58^{\circ} \cdot 5$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF I MIN. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 8.16 | 8.18 | $8 \cdot 20$ | $8 \cdot 21$ | $8 \cdot 23$ | $8 \cdot 25$ | $8 \cdot 26$ | 8.28 | $8 \cdot 30$ | 8.31 | $8 \cdot 33$ | $8 \cdot 35$ | $8 \cdot 37$ | $8 \cdot 38$ | O |
| 2 | $8 \cdot 16$ | $8 \cdot 17$ | 8-19 | $8 \cdot 21$ | $8 \cdot 22$ | 8.24 | $8 \cdot 26$ | 8.28 | $8 \cdot 29$ | $8 \cdot 31$ | $8 \cdot 33$ | $8 \cdot 34$ | $8 \cdot 36$ | $8 \cdot 38$ | $8 \cdot 40$ |
| 4 | $8 \cdot 14$ | 8.16 | 8-18 | 8-19 | 8.21 | $8 \cdot 23$ | $8 \cdot 24$ | $8 \cdot 26$ | $8 \cdot 28$ | $8 \cdot 29$ | $8 \cdot 31$ | $8 \cdot 33$ | $8 \cdot 35$ | $8 \cdot 36$ | $8 \cdot 38$ |
| 6 | $8 \cdot 12$ | $8 \cdot 13$ | $8 \cdot 15$ | $8 \cdot 17$ | $8 \cdot 18$ | $8 \cdot 20$ | 8.22 | 8.24 | 8.25 | $8 \cdot 27$ | 8.29 | $8 \cdot 30$ | 8.32 | 8.34 | $8 \cdot 35$ |
| 8 | 8.08 | 8.10 | 8.12 | 8.13 | 8.15 | 8.17 | 8.18 | $8 \cdot 20$ | $8 \cdot 22$ | $8 \cdot 23$ | $8 \cdot 25$ | $8 \cdot 27$ | 8.28 | $8 \cdot 30$ | $8 \cdot 32$ |
| 9 | 8.06 | 8.08 | 8.09 | $8 \cdot 1$ | $8 \cdot 13$ | 8.14 | $8 \cdot 16$ | $8 \cdot 18$ | $8 \cdot 20$ | 8.21 | 8.23 | $8 \cdot 25$ | $8 \cdot 26$ | $8 \cdot 28$ | $8 \cdot 30$ |
| 10 | $8 \cdot 04$ | 8.05 | $8 \cdot 07$ | 8.09 | $8 \cdot 10$ | 812 | $8 \cdot 14$ | 8.15 | $8 \cdot 17$ | $8 \cdot 19$ | $8 \cdot 21$ | 8.22 | $8 \cdot 24$ | 8.26 | $8 \cdot 27$ |
| 11 | $8 \cdot 01$ | 8.03 | 8.05 | 8.06 | $8 \cdot 08$ | $8 \cdot 10$ | $8 \cdot 11$ | 8.13 | $8 \cdot 15$ | $8 \cdot 16$ | 8.18 | $8 \cdot 20$ | $8 \cdot 21$ | 8.23 | $8 \cdot 25$ |
| 12 | $7 \cdot 98$ | $8 \cdot 00$ | $8 \cdot 02$ | $8 \cdot 03$ | $8 \cdot 05$ | 8.07 | 8.08 | $8 \cdot 10$ | 8.12 | 8-13 | $8 \cdot 15$ | $8 \cdot 17$ | $8 \cdot 18$ | $8 \cdot 20$ | $8 \cdot 22$ |
| 13 | $7 \cdot 95$ | $7 \cdot 97$ | $7 \cdot 99$ | $8 \cdot 00$ | $8 \cdot 02$ | 8.03 | $8 \cdot 05$ | 8.07 | $8 \cdot 08$ | 8-10 | $8 \cdot 12$ | 8.14 | $8 \cdot 15$ | $8 \cdot 17$ | 8.19 |
| 14 | 7.92 | $7 \cdot 94$ | $7 \cdot 95$ | $7 \cdot 97$ | 7.98 | 8.00 | 8.02 | 8.03 | 8.05 | $8 \cdot 07$ | 8.08 | $8 \cdot 10$ | $8 \cdot 12$ | $8 \cdot 13$ | $8 \cdot 15$ |
| 15 | 7.88 | 7.90 | 7.91 | 7.93 | $7 \cdot 95$ | $7 \cdot 96$ | $7 \cdot 98$ | $8 \cdot 00$ | $8 \cdot 01$ | $8 \cdot 03$ | $8 \cdot 05$ | $8 \cdot 06$ | $8 \cdot 08$ | $8 \cdot 10$ | $8 \cdot 11$ |
| 16 | 7.85 | 7.86 | $7 \cdot 88$ | 7.89 | 7.91 | 7.93 | 7.94 | 7.96 | $7 \cdot 98$ | 7.99 | $8 \cdot 01$ | $8 \cdot 02$ | 8.04 | $8 \cdot 06$ | $8 \cdot 08$ |
| 17 | 7.81 | $7 \cdot 82$ | $7 \cdot 84$ | 7.85 | $7 \cdot 87$ | 7.89 | 7.90 | 7.92 | 7.94 | $7 \cdot 95$ | 7.97 | 7.98 | $8 \cdot 00$ | $8 \cdot 02$ | $8 \cdot 03$ |
| 18 | $7 \cdot 76$ | $7 \cdot 78$ | $7 \cdot 79$ | 7.81 | $7 \cdot 83$ | 7.84 | $7 \cdot 86$ | 7.87 | $7 \cdot 89$ | $7 \cdot 91$ | $7 \cdot 92$ | $7 \cdot 94$ | $7 \cdot 96$ | $7 \cdot 97$ | $7 \cdot 99$ |
| 19 | 7.72 | 7.73 | 7.75 | 7.77 | $7 \cdot 78$ | 7.80 | 7.81 | 7.83 | 7.85 | 7.86 | 7.88 | $7 \cdot 89$ | 7.91 | 7.93 | $7 \bullet 94$ |
| 20 | 7.67 | 7.68 | 7.70 | 7.72 | $7 \cdot 73$ | $7 \cdot 75$ | 7.77 | 7.78 | 7.80 | $7 \cdot 81$ | $7 \cdot 83$ | 7.84 | 7.86 | $7 \cdot 88$ | $7 \cdot 89$ |
| 21 | 7.62 | 7.63 | $7 \cdot 65$ | $7 \cdot 67$ | $7 \cdot 68$ | $7 \cdot 70$ | 7.71 | 7.73 | 7.75 | $7 \cdot 76$ | $7 \cdot 78$ | $7 \cdot 79$ | 7.81 | 7.83 | $7 \cdot 84$ |
| 22 | 7.57 | 7.58 | 7.60 | 7.61 | 7.63 | 7.65 | 7.66 | 7.68 | $7 \cdot 69$ | 7.71 | 7.72 | 7.74 | $7 \cdot 76$ | $7 \cdot 77$ | $7 \cdot 79$ |
| 23 | 7.51 | 7.53 | $7 \cdot 54$ | 7.56 | $7 \cdot 58$ | 7.59 | 7.61 | 7.62 | 7.64 | $7 \cdot 65$ | 7.67 | 7.69 | 7.70 | $7 \cdot 72$ | $7 \cdot 73$ |
| 24 | $7 \cdot 46$ | $7 \cdot 47$ | $7 \cdot 49$ | $7 \cdot 50$ | $7 \cdot 52$ | $7 \cdot 53$ | $7 \cdot 55$ | 7.56 | $7 \cdot 58$ | $7 \cdot 60$ | $7 \cdot 61$ | 7.63 | $7 \cdot 64$ | $7 \cdot 66$ | 767 |
| 25 | 7.40 | 7.41 | $7 \cdot 43$ | 7.44 | 7.46 | 7.47 | 7.49 | 7.50 | 7.52 | $7 \cdot 54$ | 7.55 | $7 \cdot 57$ | 7.58 | $7 \cdot 60$ | 7.61 |
| 26 | $7 \cdot 34$ | $7 \cdot 35$ | 7.37 | $7 \cdot 38$ | $7 \cdot 40$ | 7.41 | 7.43 | 7.44 | $7 \cdot 46$ | $7 \cdot 47$ | $7 \cdot 49$ | 7.50 | 7.52 | $7 \cdot 53$ | $7 \cdot 55$ |
| 27 | 7.27 | $7 \cdot 29$ | $7 \cdot 30$ | 7.32 | 7.33 | 7.35 | 7.36 | $7 \cdot 38$ | $7 \cdot 39$ | $7 \cdot 41$ | $7 \cdot 42$ | $7 \cdot 44$ | $7 \cdot 45$ | 7.47 | $7 \cdot 48$ |
| 28 | $7 \cdot 21$ | $7 \cdot 22$ | $7 \cdot 24$ | 7.25 | $7 \cdot 27$ | 7.28 | 7.30 | 7.31 | $7 \cdot 33$ | $7 \cdot 34$ | $7 \cdot 36$ | 7.37 | $7 \cdot 39$ | $7 \cdot 40$ | $7 \cdot 42$ |
| 29 30 | 7.14 7.07 | 7.15 7.08 | 7-17 | $7 \cdot 18$ $7 \cdot 11$ | $7 \cdot 20$ $7 \cdot 13$ | $7 \cdot 21$ $7 \cdot 14$ | 7.23 7.16 | 7.24 7.17 | 7.26 7.19 | 7.27 7.20 | 7.29 7.22 | $7 \cdot 30$ 7.23 | 7.32 7.25 | 7.33 | $7 \cdot 35$ |
|  | \% |  |  |  | 7 |  |  | \% | 79 |  |  | 7 | 725 | $7 \cdot 26$ | $7 \cdot 27$ |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | $58^{\circ} \cdot 8$ | 580.7 | $58^{\circ} \cdot 8$ | $58^{\circ} \cdot 9$ | $59^{\circ} \cdot 0$ | 59 | $59^{\circ}$ | $59^{\circ} \cdot 3$ | $59^{\circ} \cdot 4$ | $59^{\circ} \cdot 5$ | $59^{\circ} \cdot 6$ | $59^{\circ} \cdot \mathrm{y}$ | $59^{\circ} \cdot 8$ | $59^{\circ} \cdot 9$ | $60^{\circ} \cdot 0$ |
|  | REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF $~ M ~ M I N$. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| : | $8 \cdot 42$ | 8.43 | $8 \cdot 45$ | $8 \cdot 47$ | $8 \cdot 49$ | $8 \cdot 50$ | $8 \cdot 52$ | 8.54 | $8 \cdot 56$ | 8. 57 | 8.59 | 8.61 | $8 \cdot 63$ | 8.64 | $8 \cdot 66$ |
| 2 | $8 \cdot 41$ | $8 \cdot 43$ | $8 \cdot 45$ | $8 \cdot 46$ | $8 \cdot 48$ | $8 \cdot 50$ | $8 \cdot 52$ | $8 \cdot 53$ | $8 \cdot 55$ | $8 \cdot 57$ | $8 \cdot 58$ | $8 \cdot 60$ | $8 \cdot 62$ | 8.64 | $8 \cdot 65$ |
| 4 | 8.40 | 8.41 | $8 \cdot 43$ | $8 \cdot 45$ | 8.47 | $8 \cdot 48$ | $8 \cdot 50$ | $8 \cdot 52$ | $8 \cdot 54$ | $8 \cdot 55$ | $8 \cdot 57$ | $8 \cdot 59$ | 8.6I | $8 \cdot 62$ | $8 \cdot 64$ |
| 6 | $8 \cdot 37$ | $8 \cdot 39$ | $8 \cdot 41$ | $8 \cdot 42$ | $8 \cdot 44$ | $8 \cdot 46$ | $8 \cdot 47$ | $8 \cdot 49$ | $8 \cdot 51$ | $8 \cdot 53$ | $8 \cdot 54$ | $8 \cdot 56$ | $8 \cdot 58$ | $8 \cdot 60$ | $8 \cdot 61$ |
| 8 | $8 \cdot 34$ | $8 \cdot 35$ | 8.37 | $8 \cdot 39$ | $8 \cdot 40$ | $8 \cdot 42$ | $8 \cdot 44$ | $8 \cdot 46$ | $8 \cdot 47$ | 8.49 | 8.51 | 8.52 | 8.54 | $8 \cdot 56$ | $8 \cdot 58$ |
| 9 | $8 \cdot 31$ | $8 \cdot 33$ | $8 \cdot 35$ | $8 \cdot 37$ | $8 \cdot 38$ | 8.40 | $8 \cdot 42$ | 8.43 | 8.45 | 8.47 | 8.48 | $8 \cdot 50$ | 8.52 | 8.54 | $8 \cdot 55$ |
| 10 | $8 \cdot 29$ | $8 \cdot 31$ | $8 \cdot 32$ | $8 \cdot 34$ | $8 \cdot 36$ | $8 \cdot 37$ | $8 \cdot 39$ | $8 \cdot 41$ | $8 \cdot 43$ | 8.44 | 8.46 | $8 \cdot 48$ | 8.49 | $8 \cdot 51$ | 8.53 |
| 11 | 8.26 | $8 \cdot 28$ | $8 \cdot 30$ | $8 \cdot 3 \mathrm{I}$ | $8 \cdot 33$ | $8 \cdot 35$ | $8 \cdot 37$ | $8 \cdot 38$ | $8 \cdot 40$ | $8 \cdot 42$ | $8 \cdot 43$ | $8 \cdot 45$ | 8.47 | $8 \cdot 48$ | $8 \cdot 50$ |
| 12 | 8.23 | $8 \cdot 25$ | 8.27 | $8 \cdot 28$ | 8.30 | $8 \cdot 32$ | $8 \cdot 34$ | $8 \cdot 35$ | $8 \cdot 37$ | $8 \cdot 39$ | $8 \cdot 40$ | $8 \cdot 42$ | $8 \cdot 44$ | $8 \cdot 45$ | $8 \cdot 47$ |
| 13 | 8.20 | 8.22 | 8.23 | 8.25 | 8.27 | 8.29 | 8.30 | 8.32 | $8 \cdot 34$ | $8 \cdot 35$ | $8 \cdot 37$ | $8 \cdot 39$ | $8 \cdot 40$ | $8 \cdot 42$ | $8 \cdot 44$ |
| 14 | 8.17 | $8 \cdot 18$ | $8 \cdot 20$ | $8 \cdot 22$ | $8 \cdot 23$ | 8.25 | 8.27 | $8 \cdot 29$ | $8 \cdot 30$ | $8 \cdot 32$ | $8 \cdot 34$ | $8 \cdot 35$ | $8 \cdot 37$ | 8.39 | $8 \cdot 40$ |
| 15 | $8 \cdot 13$ | $8 \cdot 15$ | $8 \cdot 16$ | $8 \cdot 18$ | $8 \cdot 20$ | 8.21 | $8 \cdot 23$ | $8 \cdot 25$ | $8 \cdot 26$ | $8 \cdot 28$ | $8 \cdot 30$ | $8 \cdot 31$ | $8 \cdot 33$ | $8 \cdot 35$ | $8 \cdot 36$ |
| 16 | 8.09 | 8.11 | $8 \cdot 12$ | $8 \cdot 14$ | 8-16 | $8 \cdot 17$ | $8 \cdot 19$ | 8.21 | $8 \cdot 22$ | 8.24 | 8.26 | $8 \cdot 27$ | $8 \cdot 29$ | 8.31 | $8 \cdot 32$ |
| 17 | 8.05 | $8 \cdot 07$ | 8.08 | 8.10 | $8 \cdot 12$ | $8 \cdot 13$ | $8 \cdot 15$ | $8 \cdot 17$ | $8 \cdot 18$ | 8.20 | 8.22 | 8.23 | $8 \cdot 25$ | $8 \cdot 27$ | $8 \cdot 28$ |
| 18 | $8 \cdot 01$ | $8 \cdot 02$ | $8 \cdot 04$ | 8.05 | 8.07 | 8.09 | 8:10 | $8 \cdot 12$ | $8 \cdot 14$ | $8 \cdot 15$ | $8 \cdot 17$ | $8 \cdot 19$ | $8 \cdot 20$ | $8 \cdot 22$ | $8 \cdot 24$ |
| 19 | 7.96 | $7 \cdot 98$ | $7 \cdot 99$ | 8.01 | 8.02 | 8.04 | 8.06 | 8.07 | $8 \cdot 09$ | 8.11 | $8 \cdot 12$ | $8 \cdot 14$ | $8 \cdot 16$ | $8 \cdot 17$ | 8-19 |
| 20 | $7 \times 91$ | $7 \cdot 93$ | 7.94 | $7 \cdot 96$ | 7.97 | 7.99 | 8.01 | 8.02 | $8 \cdot 04$ | $8 \cdot 06$ | $8 \cdot 07$ | 8.09 | 8.11 | $8 \cdot 12$ | $8 \cdot 14$ |
| 21 | 7.86 | 7.87 | 7.89 | 7.91 | $7 \cdot 92$ | $7 \cdot 94$ | 7.96 | $7 \cdot 97$ | 7.99 | 8.00 | $8 \cdot 02$ | 8.04 | 8.05 | 8.07 | $8 \cdot 08$ |
| 22 | $7 \times 80$ | $7 \cdot 82$ | 7.84 | $7 \cdot 85$ | 7.87 | 7.88 | 7.90 | 7.92 | 7.93 | 7.95 | $7 \cdot 96$ | 7.98 | $8 \cdot 00$ | 8.01 | $8 \cdot 03$ |
| 23 | 7.75 | 7.76 | $7 \cdot 78$ | 7.80 | 7.81 | 7.83 | 7.84 | 7.86 | 7.88 7.8 | 7.89 | 7.91 7.85 | 7.92 7.86 | 7.94 7.88 | 7.96 | 7.97 |
| 24 | $7 \cdot 69$ | 771 | $7 \cdot 72$ | 7.74 | $7 \cdot 75$ | 7.77 | $7 \cdot 78$ | 7.80 | $7 \cdot 82$ | 7.83 | $7 \cdot 85$ | $7 \cdot 86$ | 7.88 | $7 \cdot 90$ | $7 \cdot 91$ |
| 25 | 7.63 | $7 \cdot 64$ | 7.66 | $7 \cdot 68$ | 7.69 | 7.75 | 7.72 | $7 \cdot 74$ | 7.75 | 7.77 | 7.79 | 7.80 | 7.82 | 7.83 | 7.85 |
| 26 | 7.57 | $7 \cdot 58$ | 7.60 | $7 \cdot 61$ | 7.63 | 7.64 | 7.66 | 7.67 | $7 \cdot 69$ | $7 \cdot 71$ | $7 \cdot 72$ | $7 \cdot 74$ | 7.75 | $7 \cdot 77$ | $7 \cdot 78$ |
| 27 | 7.50 | 7.52 | $7 \cdot 53$ | 7.55 | $7 \cdot 56$ | 7.58 | $7 \cdot 59$ | 7.61 | $7 \cdot 62$ | 7.64 | 7.65 | $7 \cdot 67$ | 7.68 | 7.70 | $7 \cdot 72$ |
| 28 | 7.43 | 7.45 | $7 \cdot 46$ | 7.48 | 7.49 | 7.51 | $7 \cdot 52$ | 7.54 | 7.56 | 7.57 | 7.58 | 7.60 | $7 \cdot 61$ | 7.63 | 7.65 |
| 29 30 | $7 \cdot 36$ | $7 \cdot 38$ | $7 \cdot 39$ | 7.41 | 7.42 | 7.44 | 7.45 | 7.47 7.39 | 7.48 | 7.50 7.42 | 7.51 | 7.53 7.45 | 7.54 7.47 | 7.56 7.48 | $7 \cdot 57$ 7.50 |
| 30 | 7.29 | $7 \cdot 30$ | 732 | $7 \cdot 33$ | $7 \cdot 35$ | 7.36 | $7 \cdot 38$ | $7 \cdot 39$ | $7 \cdot 41$ | 742 | $7 \cdot 44$ | $7 \cdot 45$ | $7 \cdot 47$ | 740 | $7 \cdot 50$ |

HOUR-ANGLE LMMTS FOR EX-MERIDIAN TABLES Vma. AND Vmb. the table shows the limits within which the reduction at 1 min., as given IN TABLES VII. AND VIII. WHEN MULTIPLIED BY THE NUMBER OF MINUTES IN TABLE BELOW, WILL NOT GIVE A GREATER ERROR IN REDUCTION THAN $0 \frac{1}{2}$.

|  | LATITUDE AND DECLINATION OF SAME NAME. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | DECLINATION. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $0{ }^{\circ}$ | $2^{\circ}$ | $4^{\circ}$ | $6^{\circ}$ | $8^{\circ}$ | $10^{\circ}$ | $15^{\circ}$ | $20^{\circ}$ | $25^{\circ}$ | $30^{\circ}$ | $35^{\circ}$ | $40^{\circ}$ | $45^{\circ}$ | $50^{\circ}$ | $60^{\circ}$ | $70^{\circ}$ |
| $\stackrel{\square}{\circ}$ | M. | ${ }^{\mathrm{M}}$. | M. | M. | M. | M. | M. | M. | M. | M | M | M. | M. | M. | M. | M. |
| 0 | $\cdots$ | 28 n | 38 g | 37 g | 37 g | 39 g | 42 g | 44 g | 46 g | 48 g | 51 g | 53 g | 55 g | 58 g | 63 g | 71 g |
| 1 | 14 n | 14 n | 30 g | 33 g | 35 g | 35 g | 39 g | 42 g | 45 g | 47 g | 50 g | 51 g | 55 g | 56 g | 62 g | 71 g |
|  | 27 n |  | 25 g | 28 g | 28 g | 33 g | 36 g | 40 g | 43 g | 46 g | 48 g | 50 g | 53 g | 56 g | 62 g | 70 g |
| 3 | 291 | 14 n | 14 n | 23 g | 23 g | 28 g | 34 g | 38 g | 42 g | 46 g | 48 g | 49 g | 52 g | 56 g | 62 g | 69 g |
| 4 | 291 | 231 | .. | 20 g | 23 g | 26 g | 32 g | 35 g | 41 g | 45 g | 47 g | 48 g | 50 g | 55 g | 62 g | 68 g |
| 5 | 301 | 241 | 13 n | 14 g | 20 g | 23 g | 30 g | 34 g | 40 g | 44 g | 46 g | 48 g | 50 g | 54 g | 62 g | 68 g |
| 6 | 301 | 251 | 181 |  | 17 g | 21 g | 28 g | 33 g | 39 g | 43 g | 46 g | 48 g | 50 g | 53 g | 60 g | 67 g |
| 8 | 3 Il | 261 | 201 | 171 |  | 16 g | 23 g | 30 g | 37 g | 41 g | 44 g | 47 g | 48 g | 52 g | 60 g | 66 g |
| 10 | 321 | 271 | 221 | 201 | 161 |  | 19 g | 26 g | 31 g | 39 g | 42 g | 44 g | 48 g | 52 g | 57 g | 66 g |
| 12 | 331 | 291 | 261 | 231 | 191 | 161 | 15 g | 24 g | 28 g | 37 g | 40 g | 44 g | 46 g | 50 g | 57 g | 66 g |
| 15 | 271 | 251 | 221 | 261 | 241 | 201 |  | 18 g | 25 g |  | 39 g | 43 g | 44 g | 48 g | 55 g | 65 g |
| 20 | 281 | 271 | 241 | 231 | 201 | 191 | 181 | $\because$ | 16 g | 24 g | 39 g | 42 g | 42 g | 46 g | 53 g | 63 g |
| 25 | 301 | 281 | 271 | 261 | 241 | 221 | 171 | 181 |  | 131 | 271 | 44 g | 43 g | 46 g | 518 | 61 g |
| 30 35 | 321 | 321 | 291 311 | 381 | 261 | ${ }_{27}^{251}$ | 2 241 | 161 | 91 151 |  | 121 | 271 | 50 g 261 | 46 g | 48 g | 59 g |
| 35 | 341 | 321 | 3Il | 301 | 281 | 271 | 241 | 201 | 151 | 91 |  | 131 | 261 | 59 g | 47 g | 57 g |
| 40 | 351 | 341 | 331 | 321 | 311 | 301 | 271 | 231 | 201 | 161 | 101 |  | III | 261 | 50 g | 56 g |
| 45 | 381 | 361 | 341 | 341 | 321 | 321 | 301 | 271 | 241 | 2 I 1 | 161 | 101 |  | 131 | 65 g | 54 g |
| 50 | 391 | 371 | 351 | 351 | 341 | 351 | 331 | 321 | 281 | 251 | 2 l 1 | 161 | II1 |  | 301 | 54 g |
| 55 | 401 | 401 | 381 | 371 | 371 | 371 | 361 | 341 | 321 | 291 | 251 | 261 | ${ }_{231}^{17}$ | 121 | 151 | 59 g |
| 60 | 421 | 4 II | 401 | 391 | 391 | 391 | 391 | 391 | 351 | 321 | 291 | 261 | 231 | 191 |  | 481 |


| INFERIOR TRANSIT. |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DECLINATION. |  |  |  |  |  |  |  |  |  |
|  | Lat. | $35^{\circ}$ | $40^{\circ}$ | $45^{\circ}$ | $50^{\circ}$ | $55^{\circ}$ | $60^{\circ}$ | $65^{\circ}$ | $70^{\circ}$ |
|  | ${ }^{\circ}$ | м. | м. | м. | m. | м. | м. | м. | $\frac{\mathrm{M}}{8}$ |
| $g$ Signifies that Note. true reduction is | 25 30 | $\cdots$ | $\because$ | $\because$ | $\because$ | $\cdots$ | $\because$ | 103 g | 88 g 95 |
|  | 35 | $\because$ | $\cdots$ | $\because$ | $\because$ | $\because$ | $\because 301$ | 112 g | ${ }^{1078}$ |
| $l$ Signifies that true reduction is less | 40 |  | $\ldots$ | $\because$ | 68 | 801 | 1001 | 1801 |  |
| $n$ than tabular reduction. ${ }^{\text {S }}$ Signifies that thexe will be no error | 45 50 |  |  | 601 | 681 | 751 | ${ }_{801}^{861}$ | 1101 901 | ${ }_{1}^{172 \mathrm{~g}} \mathrm{I}$ |
| $n$ in the reduction within the limits | 55 |  | 961 | 601 | 631 | 681 | 741 | 861 | 1051 |
| given greater than oly. | 60 | 541 | 571 | 591 | 621 | 671 | 701 | 781 | 921 |

LATITUDE AND DECLINATION OF CONTRARY NAME.

| Lat. | DECLINATION. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $0^{\circ}$ | $2^{\circ}$ | $4^{\circ}$ | $6^{\circ}$ | $8^{\circ}$ | $10^{\circ}$ | $15^{\circ}$ | $20^{\circ}$ | $25^{\circ}$ | $30^{\circ}$ | $35^{\circ}$ | $40^{\circ}$ | $45^{\circ}$ | $50^{\circ}$ | $60^{\circ}$ | $70^{\circ}$ |
| $\bigcirc$ | m. | N. | M. | N. | M. | M | 2. | M. | M. | M. | m. | M. | m. | m. | ${ }^{\text {m. }}$ |  |
| 1 2 | 14 n 27 | 48 n | 45 g | ${ }_{51}^{45} \mathrm{~g}$ | 43 g | 42 g | 43 g | 45 g | 48 yg | 50 g | 52 g | 55 g | 57 g | 59 g | 62 g | 77 y |
| 3 | 291 | 381 | 551 | 500 | 62 g | 45 g | ${ }_{50}{ }^{4}$ | ${ }^{40 \mathrm{~g}}$ | 54 g | 54 S | 54. | 57 | 58 g | $60{ }^{\text {c }}$ | 635 | 728 |
| 4 | 291 | 361 | 471 | 561 | 120 n | 66 g | 56 g | 55 g | 56 g | 56 g | 58 | 58 g | 58 g | 61 g | 65 g | 74 |
| 5 | 301 | 361 | 401 | 521 | 701 | 20 n | 62 g | 58 g | 59 g | 59 g | 59 g | 58 g | 60 g | 62 g | 67 g | 74 |
| 6 | 301 | 371 | 391 | 451 | 581 | 701 | 74 g | 60 g | 62 g | 58 g |  |  | 64 g | 64 g | 68 g |  |
|  | 3 x 1 | 361 | 401 | 451 | 521 | 591 | 1101 | 70 g | 66 g | 68 g | 66 g | 63 g | 64 g | 66 g | 69 g | 76 g |
| ${ }_{12}^{10}$ | 321 | 361 | 421 | ${ }_{341}^{421}$ |  | 521 | 721 | ${ }_{581}{ }_{51}$ | 74 n | 80 g | 728 | 68 g | 68 g | 70 g | 70 g | 76 g |
| 12 15 | 331 271 | 301 | ${ }_{331}^{321}$ | ${ }_{341}^{341}$ | ${ }_{361}^{361}$ | ${ }_{391}^{401}$ |  | 531 | 741 601 | ${ }_{741} 90$ | 88 g | 74 g 988 | 74 g 80 g | 7178 | ${ }_{74}^{72 \mathrm{~g}}$ | 77 g 80 g |
| 20 | 281 | 321 | 321 | 351 | 361 | 381 | 441 |  |  | 601 |  |  |  |  |  |  |
| 25 | 301 | 341 | 341 | 351 | 371 | 391 | 431 | 461 | 501 | 561 | 621 | 701 | 861 | 1501 | 90 g |  |
| 30 35 | 321 | 331 | 351 | 331 | 371 | 391 | 431 | 461 | 491 | 531 | 611 | 661 | 721 | 861 |  |  |
| 35 | 341 | ${ }_{361} 31$ | ${ }_{381}^{361}$ | 381 | 391 | 401 | 421 | 451 | 481 | 521 | ${ }_{561} 56$ | 621 | 691 | 781 |  |  |
| 40 | 351 | 361 | 38 | 391 | 401 | 401 | 421 | 441 | 481 | 521 | 561 | 601 | 651 |  |  |  |
| 45 50 | 381 | 381 | 391 | 391 | 41 | 421 | 441 | 461 | 491 | 521 | 551 | 561 |  |  |  |  |
| 50 55 | 401 | 4 41 | 421 | ${ }_{421}^{41}$ | 421 | 431 | 451 | 471 | 491 | 521 | 551 |  |  | $\cdots$ |  |  |
| 60 | 421 | 421 | 441 | ${ }_{44}{ }^{1}$ | 451 | 451 | ${ }_{461}$ | ${ }_{481}^{481}$ | 401 | 52 |  |  |  | $\because$ |  |  |

REDUCTION AT 1 MIN. FROM THE MERIDIAN IN LAT. $0^{\circ}$ CORRESPONDING TO AZIMUTHS FROM $74^{\circ}$ TO $26^{\circ} 36^{\prime}$.


REDUCTION AT 1 MIN. FROM THE MERDIAN IN LAT. $0^{\circ}$ CORRESPONDING TO AZIMUTHS FROM $74^{\circ}$ TO $26^{\circ} 36^{\prime}$.


REDUCTION AT 1 MIN. FROM THE MERIDIAN IN LAT. $0^{\circ}$ CORRESPONDING TO AZIMUTHS FROM $74^{\circ}$ TO $26^{\circ} 36^{\prime}$.

| Azim. | Redn. | Azi | R | Az | dn | Az | Redn. | Az | edn. | Az | edn. | Azim. | Redn |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $42^{\circ} 26^{\prime} 5.823$ |  | $40^{\circ} 10 \cdot 50 \cdot 484$ |  | $37^{\circ} 54{ }^{\circ} 5$ '150 |  | $35^{\circ} 38^{\circ} 4^{\prime} 8821$ |  |  |  | $3{ }^{\circ} 06^{\circ} 4 \times 174$ |  | $\begin{array}{rl} 28^{\circ} & 50^{\prime} \\ 48: 856 \\ 48 & 3 \cdot 851 \end{array}$ |  |
| 24 | 5.818 |  | $5 \cdot 479$ | 52 | $5 \cdot 145$ |  | $4 \cdot 816$ | $\begin{array}{lll}33 & 22 & 4.496 \\ 33 & 20 & 4.491\end{array}$ |  | $\begin{array}{rrr}31 & 06 & 4 \cdot 174 \\ 4 & 4 \cdot 169\end{array}$ |  |  |  |
| 22 | $5 \cdot 813$ | 6 | $5 \cdot 474$ | 3750 | $5 \cdot 141$ | 34 | 4.811 |  | $4 \cdot 48$ |  | $4 \cdot 165$ |  | . 847 |
|  |  |  | $5 \cdot 469$ | 48 | 5.136 | 32 | $4 \cdot 806$ | 16 | $4 \cdot 48$ | 3100 | $4 \cdot 160$ |  | 842 |
|  | $5 \cdot 803$ |  | $5 \cdot 464$ | 46 | $5 \cdot 131$ | 3530 | $4 \cdot 802$ | 14 | $4 \cdot 477$ | 3058 | 4•155 |  | 837 |
| 16 | 5•798 | 40 oo | 5.459 | 44 | 5.126 | 28 | 4.797 |  | 4.472 | 56 | 4.150 | 28 | 33 |
|  | 5 | 3958 | $5 \cdot 455$ 5 | 42 | $5 \cdot 1$ | 26 | $4 \cdot 792$ | 33 | 4.467 | 54 | 4.146 | 38 | 28 |
|  | 5 |  | $5 \cdot 450$ |  | $5 \cdot 1$ | 24 | ${ }^{\cdot} \cdot 787$ |  | 4.462 | 5 | $4 \cdot 141$ | 36 | 823 |
| 42 | 5.783 | 54 | $5 \cdot 445$ | 38 | 5.111 | 22 | 4.782 |  | 4.458 | 3050 | 4.136 | 34 | 819 |
|  | $5 \cdot 778$ | 52 | $5 \cdot 440$ | 36 | 5.106 | 3520 | 4.777 |  | 4.453 | 48 | 4.132 | 32 | 814 |
| $\begin{array}{r}6 \\ 4 \\ 2 \\ \hline\end{array}$ | 50773 | 3950 | 5435 | 34 | $5 \cdot 09$ | 18 | $4 \cdot 76$ |  | 4.448 | 46 | 4.127 | 2830 | 809 |
|  | $5 \cdot 768$ | 48 | 5.430 | 32 | $5 \cdot 097$ | 16 | $4 \cdot 76$ | 3300 | $4 \cdot 443$ | 44 | $4 \cdot 122$ |  | 805 |
|  | 763 | 46 | $5 \cdot 425$ | 3730 | 5.092 | 14 | $4 \cdot 76$ | 3258 | 4.439 | 42 | $4 \cdot 118$ | 26 | 800 |
|  | $5 \cdot 758$ | 44 | $5 \cdot 420$ |  | 5.087 | 12 | $4 \cdot 758$ | 56 | 4.434 | 3040 | $4 \cdot 113$ | 24 | 795 |
|  | $5 \cdot 753$ | 42 | $5 \cdot 415$ | 26 | 5.082 | 3510 | 4.753 | 54 | $4 \cdot 429$ | 38 | 4.108 | 22 | 791 |
|  | 48 | 3940 | 5.410 | 24 | 077 |  | 4'749 | 52 | 4.424 | 36 | 4•104 | 2820 | 786 |
|  | 5.743 |  | $5 \cdot 405$ | 22 | O72 | 6 | 4.744 | 3250 | $4 \cdot 420$ | 34 | 4•099 | 18 | 782 |
|  | 38 | 36 | $5 \cdot 400$ | 3720 | 068 |  | $4 \cdot 739$ | 48 | 4.415 | 32 | $4 \cdot 094$ | 16 | 777 |
| 4 I 50 | 5.733 | 34 | $5 \cdot 395$ | 18 | $5 \cdot 063$ |  | 4•734 | 46 | 4.410 | 3030 | 4.089 |  | 772 |
|  |  | 32 | $5 \cdot 390$ | 6 |  | 3500 | $4 \cdot 729$ | 44 | 4.405 |  | 4.085 | 12 | 68 |
| 46 | $5 \cdot 723$ | 3930 | $5 \cdot 38$ | 14 | 5.053 | 3458 | $4 \cdot 725$ | 42 | 401 | 26 | 4.080 |  | 63 |
|  |  |  | $5 \cdot 38$ | 12 | $5 \cdot 048$ | 56 | 4.720 | 3240 | $4 \cdot 396$ | 24 | 4.075 |  |  |
|  | $5 \cdot 713$ | 26 | $5 \cdot 376$ |  | $5 \cdot 043$ | 54 | 4.715 | 38 | 4.391 | 22 | 4.071 |  | 754 |
| 4140 | $5 \cdot 708$ | 24 | 37 |  | 5.038 | 52 | 4.710 | 36 | $4 \cdot 38$ | 3020 | 4.066 |  | 749 |
|  | 5/703 | 22 | 5.366 |  | 034 | 3450 | $4 \cdot 705$ | 34 |  |  | 4.06I |  | 744 |
| 363432 | 5 | 3920 | 61 |  | 5.029 | 48 | 4•701 | 32 | 4.377 | 16 | 4.0 | 28 | .740 |
|  | $5 \cdot$ | 18 | 356 |  | 5.02 | 4 | $4 \cdot 69$ | 3230 | 43372 | 14 | 4.052 | 275 | -335 |
|  | 5.6 | 16 | 35 | 3700 | $5 \cdot 019$ | 44 | 4.691 |  | 4.367 | 12 | 4.047 | 56 | 731 |
| 413 | 5.6 | 14 | 346 | 3658 | 5.014 | 42 | 4.686 | 26 |  |  | 4.043 | 54 | 726 |
|  |  | 12 | $5 \cdot 341$ |  | 009 | 3440 | $4 \cdot 682$ | 24 |  |  | 4.038 | 52 | 721 |
| 26 |  | 3910 | 336 | 54 | 00 | 38 | 4.677 | 22 | $4 \cdot 353$ |  | 4.033 | 2750 | 3.717 |
| 2422 | 5.668 |  | 5331 | 52 | $5 \cdot 00$ | 36 | 4.672 | 3220 | $4 \cdot 349$ |  | 4.029 | 48 | 3.712 |
|  | $5 \cdot 66$ | 6 | $5 \cdot 327$ 5 | 3650 | 995 | 34 | $4 \cdot 667$ |  | 4344 |  | 4.024 | 46 | 3.707 |
| 4120 | 5 |  | $5 \cdot 322$ | 48 | 990 | 32 | 4.662 | 16 | 4.339 | 3000 | 4.019 |  |  |
|  | 5 |  | 17 | 6 | 985 |  | $4 \cdot 658$ | 14 | 33 | 2958 | $4^{\text {-015 }}$ | 42 | 698 |
| 16 | $5 \cdot 648$ | 3900 | $5 \cdot 312$ | 44 | 4.980 | 28 | $4 \cdot 6$ | 12 | 4.330 | 56 | 4.010 |  |  |
|  | $5 \cdot 64$ | 38 58 56 | $5 \cdot 307$ $5 \cdot 302$ | 3642 | 4.975 | 26 | $4 \cdot 648$ |  | 4.325 | 4 | 4.005 | 38 | . 689 |
|  | 5 | 56 | $5 \cdot 302$ | 3640 | 4.971 | 24 | 4.643 |  | 4.320 | 52 | 4-001 | 36 | . 684 |
| 41 | 633 | 54 | 97 | 38 | 4.966 | 22 | $4 \cdot 638$ |  | $4 \cdot 315$ | 2950 | 3.996 | 34 | 680 |
|  |  | 52 | 292 | 36 |  | 3420 | $4 \cdot 6$ |  | ( | 48 | 3.991 | 32 | 675 |
| 64241 | $5 \cdot 623$ | 3850 | 87 | 34 | -956 | 18 |  |  | $4 \cdot 306$ | 6 | 87 | 27 | \% |
|  | 5 | 48 | $5 \cdot 282$ | ${ }^{32}$ | 4.951 | 16 | $4 \cdot 624$ |  | $4 \cdot 301$ | 44 | 3.982 | 28 |  |
|  | 5 | 46 | $5 \cdot 27$ | $36 \quad 30$ | 4.946 | 14 | $4 \cdot 619$ | 3158 | $4 \cdot 297$ | 42 | 3.977 | 26 | 66I |
|  | 5 | 44 | 27 | 28 | 94 | 12 | $4 \cdot 615$ | 56 | 4.292 | 2940 | 3.972 | 24 | . 657 |
| 41 40 40 | $5 \cdot 603$ | 42 |  | 26 | 4.937 | 3410 |  | 54 | $4 \cdot 287$ | 8 | 3.9 | 22 | 652 |
| 565452 | 598 | 3840 | $5 \cdot 263$ | 24 | 932 |  |  | 5 | 4.282 | 6 |  | 27 | 647 |
|  | 5.58 | 38 | 25 | ${ }^{22}$ | 4.927 |  | $4 \cdot 600$ | 315 | 4 | 34 | 3.958 |  | 643 |
|  | 5.58 |  | $5 \cdot 253$ | 3620 | 4.922 |  | 4.596 |  | 4.273 | 32 | 3.954 |  | 638 |
| 4050 | $5 \cdot 58$ | 34 | 248 | 18 | 4.917 |  | 4.591 | 46 | 4.268 | 2930 | 3.949 | 14 | . 634 |
|  |  | 32 | $5 \cdot 243$ | 16 | 912 |  | $4 \cdot 586$ | 44 | $4 \cdot 264$ | 28 | 3.945 | 12 | 629 |
| 46 | 573 | 38 | 5.238 | 14 | $4 \cdot 908$ | 3358 | $4 \cdot 58 \mathrm{I}$ | 4 | $4 \cdot 259$ | 26 | 3.940 | 27 | . 624 |
|  | $5 \cdot 568$ | 28 | 5.233 | 12 | 4.90 | 56 | 4.576 | 3140 | $4 \cdot 254$ | 24 | 3.935 |  | 3.620 |
|  | 56 | 26 | 229 |  | 8 | 54 | 4.572 | 38 | $4 \cdot 249$ | 22 | 3.931 |  | 3.615 |
| 404 | 109 | 24 | 224 |  | 4.893 | 52 | $4 \cdot 56$ | 36 | 4.245 | 2920 | 3.926 |  | .610 |
|  |  | 2 | 219 |  |  | 33 |  |  | 4.240 |  | 3.921 |  | 6 |
| 3633 | $5 \cdot 549$ | 382 | 5.214 |  | 4.8 | 48 | $4 \cdot 55$ |  | 4.235 | 16 | 3.917 |  | .601 |
|  | $5 \cdot 544$ | 18 | $5 \cdot 209$ |  | 4.879 | 46 | 4.5 | 3130 | $4 \cdot 231$ | 14 | 3.912 | 2658 | . 597 |
|  | 5.539 | 16 | $5 \cdot 204$ | 3600 | 4.87 | 44 | $4 \cdot 548$ | 28 | $4 \cdot 226$ | 12 | 3.907 | 56 | 3.592 |
| 403 | 5.534 | 14 | 199 | 3558 | 4.86 | 42 | $4 \cdot 543$ | 26 | $4 \cdot 221$ |  | 3.903 | 54 | .587 |
|  | 529 | 12 | - |  |  |  | 4.538 | 24 | 4.216 |  | .898 | 52 | 3.583 |
| 26 | 52 | 3810 | ${ }^{5 \cdot 18}$ | 54 | 4.859 |  | 4.53 |  | 4.21 |  |  |  | 3.578 |
|  | 519 | 8 | 18 | 5 | 4.8 | 36 | 4.529 | 3120 | 4.207 |  | 3.889 | 48 | $3 \cdot 573$ |
|  | 5.514 |  | 18 | 3550 | 4.850 | 34 | $4 \cdot 524$ | 18 | $4 \cdot 202$ |  | 3.884 |  | $3 \cdot 569$ |
| 4020 | 5.509 5.504 |  | $5 \cdot 175$ $5 \cdot 170$ |  | 4.845 | 32 | $4 \cdot 519$ | 16 | 4.198 | 2900 | $3 \cdot 879$ | 4 | $3 \cdot 564$ |
|  | $5 \cdot 504$ |  | 5.170 |  |  | 3330 | 4.515 | 14 | 4-193 | 2858 | 3.875 | 42 | 3.560 |
| 161412 | 499 | 3800 | $5 \cdot 165$ | 44 | 4.835 | 28 | 4.510 |  | 4.188 | 56 | 3.870 | 2640 | $3 \cdot 555$ |
|  | 5 |  | $5 \cdot 160$ | 42 | 4.830 | 26 | 4.505 | 3110 | $4 \cdot 183$ | 54 | 3.865 | 38 | 3.550 |
|  | $5 \cdot 489$ | 3756 | 5.155 | 3540 | 4.826 | 3324 | 4.500 | 31 | 4*179 | 2852 | 3.861 | 2636 | $3 \cdot 546$ |

## REDUCTION AT 1 MIN. FROM THE MERDIAN CORRESPONDING TO THE LATIIUDE VARIATION TAKEN FROM THE AZIMUTH TABLE.

| Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | $\begin{aligned} & \text { Lat. } \\ & \text { Var. } \end{aligned}$ | Redn. | $\begin{aligned} & \text { Lat. } \\ & \text { Var. } \end{aligned}$ | Redn. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sec. | 3.541 | $\begin{aligned} & \mathrm{Sec} \\ & 8 \cdot 68 \end{aligned}$ | 3.290 | $9 \cdot 36$ | 3.071 | Sec. 10.04 | 2:879 | Sec. 10.72 | $2 \cdot 708$ | Sec. <br> II 40 | 2.553 | Sec. <br> 12.08 | 2.419 |
| $8 \cdot 01$ | 3.537 | $8 \cdot 69$ | 3.286 | $9 \cdot 37$ | 3.068 | 10.05 | 2.876 | 10.73 | $2 \cdot 705$ | IT.41 | $2 \cdot 553$ | 12.09 | 2.417 |
| $8 \cdot 02$ | 3.533 | $8 \cdot 70$ | 3.283 | 9.38 | 3.065 | 10.06 | $2 \cdot 874$ | 10.74 | $2 \cdot 703$ | 11.42 | $2 \cdot 551$ | 12.10 | 2.415 |
| 8.03 | $3 \cdot 529$ | $8 \cdot 71$ | $3 \cdot 280$ | $9 \cdot 39$ | 3.062 | 10.07 | 2.871 | 10.75 | $2 \cdot 701$ | 11.43 | 2.549 | 12.1 | 2.413 |
| 8.04 | 3.525 | $8 \cdot 72$ | 3.276 | $9 \cdot 40$ | 3.059 | 10.08 | $2 \cdot 868$ | 10.76 | 2.698 | 11.44 | $2 \cdot 547$ | 12 | 2.411 |
| $8 \cdot$ | 3.521 | $8 \cdot 73$ | 3.273 | 9.41 | 3.056 | 10•09 | $2 \cdot 866$ | 10 | 2.696 | 1145 | $2 \cdot 545$ | 12.13 | 2.410 |
| $8 \cdot$ | $3 \cdot 517$ | $8 \cdot 74$ | 3.269 | $9 \cdot 42$ | 3.053 | 10.10 | 2.863 | 10.78 | $2 \cdot 693$ | 1146 | 2.543 | 12.14 | $2 \cdot 408$ |
| 8.07 | $3 \cdot 513$ | 8.75 | 3.266 | 9.43 | 3.050 | $0 \cdot 1$ | $2 \cdot 860$ | 20.79 | 2.691 | 11.47 | $2 \cdot 541$ | 1215 | $2 \cdot 406$ |
| $8 \cdot 08$ | 3.510 | $8 \cdot 76$ | 3.263 | $9 \cdot 44$ | 3.047 | $10 \cdot 12$ | $2 \cdot 858$ | 10.80 | $2 \cdot 689$ | 11.48 | 2.539 | 12.16 | $2 \cdot 404$ |
| 8.09 | $3 \cdot 506$ | $8 \cdot 77$ | $2 \cdot 259$ | 45 | 3.044 | 10 | $2 \cdot 855$ | 10.8 | $2 \cdot 686$ | II 49 | 2.537 | 12.17 | 2.402 |
| $8 \cdot 10$ | $3 \cdot 502$ | $8 \cdot 78$ | 3.256 | $9 \cdot 46$ | 3.042 | 10.14 | 2.852 | 10.82 | 2.684 | I1.5 | $2 \cdot 534$ | 12.18 | $2 \cdot 400$ |
| $8 \cdot 11$ | 3.498 | $8 \cdot 79$ | 3.253 | 947 | 3.039 | $10 \cdot 15$ | $2 \cdot 850$ | 10.83 | $2 \cdot 682$ | 11.5 | 2.532 | 12.19 | $2 \cdot 398$ |
| $8 \cdot 12$ | $3 \cdot 494$ | 8.80 | 3.249 | $9 \cdot 48$ | 3.036 | 10.16 | 2.847 | 10.84 | 2.679 | 11.52 | 2.530 | 12.20 | $2 \cdot 396$ |
| $8 \cdot 13$ | 3.490 | 8.81 | 3.246 | 949 | 3.033 | $10 \cdot 17$ | $2 \cdot 845$ | 10.85 | 2.677 | 11.53 | $2 \cdot 528$ | 12.2 | $2 \cdot 395$ |
| 8.14 | $3 \cdot 486$ | 8.82 | 3.242 | 9.50 | 3.030 | 10.18 | $2 \cdot 842$ |  | $2 \cdot 675$ | 11.54 | $2 \cdot 526$ | 12.22 | $2 \cdot 393$ |
| 8. | 3.483 | 8.83 | 3.239 | 9.51 | 3.027 | 10.19 | $2 \cdot 839$ | 10.87 | 2.672 | 11.55 | $2 \cdot 524$ | 12.23 | $2 \cdot 39 \mathrm{I}$ |
| $8 \cdot 16$ | $3 \cdot 479$ | 8.84 | 3.236 | $9 \cdot 52$ | 3.024 | 10.20 | 2.837 | 10.88 | 2.670 | 11.56 | 2.522 | 12.24 | 2.389 |
| $8 \cdot 17$ | 3.475 | 8.85 | 3.232 | $9 \cdot 53$ | 3.021 | 10 | 2.834 | 10.89 | 2.668 | 11.57 | $2 \cdot 520$ | 12.25 | 2.387 |
| $8 \cdot 18$ | $3 \cdot 471$ | 8.86 | 3.229 | 9.54 | 3.018 | 10.2 | 2.832 | 10.90 | 2.666 | 11.58 | 2.518 | $12 \cdot 26$ | $2 \cdot 385$ |
| 8-19 | 3.467 | 8.87 | 3.226 | $9 \cdot 55$ | 3.015 | $10 \cdot 23$ | $2 \cdot 829$ | 10091 | $2 \cdot 663$ | 11.59 | 2.516 | 12.27 | $2 \cdot 383$ |
| $8 \cdot 20$ | $3 \cdot 463$ | 8.88 | 3.222 | $9 \cdot 56$ | 3.012 | 10. | 2.826 | 10.92 | 2.661 | 11.60 | $2 \cdot 514$ | 12.28 | $2 \cdot 382$ |
| $8 \cdot 2$ | 3.460 | 8.89 | 3.219 | 9157 | 3.009 | 10.25 | $2 \cdot 824$ | 10.93 | $2 \cdot 659$ | 11.6 | 2.512 | 12.29 | $2 \cdot 380$ |
| 8.22 | $3 \cdot 456$ | 8.90 | 3.216 | $9 \cdot 58$ | 3.007 | $10 \cdot 26$ | 2.821 | 10.94 | $2 \cdot 656$ | 11.6 | 2.510 | 12.30 | $2 \cdot 378$ |
| 8.23 | 3.452 | $8 \cdot 91$ | 3.212 | 9.59 | 3.004 | 10.27 | $2 \cdot 819$ | 10.95 | $2 \cdot 654$ | 11.63 | $2 \cdot 508$ | 12.31 | $2 \cdot 376$ |
| 8.24 | $3 \cdot 448$ | $8 \cdot 92$ | 3.209 | $0 \cdot 6$ | $3 \cdot 001$ | 10.28 | $2 \cdot 816$ | 10.9 | $2 \cdot 652$ | II 64 | $2 \cdot 506$ | 12.32 | $2 \cdot 374$ |
| 8.25 | 3.445 | 8.93 | $3 \cdot 206$ | 9.61 | 2.998 | $10 \cdot 29$ | 2.814 | 10.97 | $2 \cdot 650$ | 11.65 | 2.504 | 12.33 | $2 \cdot 372$ |
| 8.26 | $3 \cdot 441$ | $8 \cdot 94$ | $3 \cdot 203$ | $9 \cdot 62$ | 2.995 | 10.30 | $2 \cdot 811$ | 10.98 | 2.647 | 11.66 | 2.502 | 12.34 | $2 \cdot 371$ |
| 8.27 | $3 \cdot 437$ | $8 \cdot 95$ | $3 \cdot 199$ | 9.63 | 2.992 | 10.31 | $2 \cdot 809$ | 1099 | $2 \cdot 645$ | 11.67 | $2 \cdot 500$ | 12.35 | $2 \cdot 369$ |
| $8 \cdot 28$ | 3.433 | 8.96 | 3.196 | 9.64 | 2.989 | $10 \cdot 32$ | $2 \cdot 806$ | IT.00 | $2 \cdot 643$ | 11.68 | $2 \cdot 498$ | 12.3 | $2 \cdot 367$ |
| $8 \cdot 29$ | 3.430 | $8 \cdot 97$ | 3-193 | 9.65 | 2.986 | 10 | $2 \cdot 803$ | ir.or | 2.64 I | 11.69 | 2.496 | 12.37 | $2 \cdot 365$ |
| $8 \cdot 30$ | $3 \cdot 426$ | $8 \cdot 98$ | 3.190 | $9 \cdot 66$ | 2.984 | 10.34 | 2.801 | 11.02 | 2.638 | 11'70 | $2 \cdot 494$ | 12.38 | 2.363 |
| $8 \cdot 31$ | $3 \cdot 422$ | $8 \cdot 99$ | $3 \cdot 186$ | $9 \cdot 67$ | 2.981 | 10.35 | $2 \cdot 798$ | 11.03 | 2.636 | Ir 71 | 2.491 | $12 \cdot 39$ | 2.361 |
| $8 \cdot 32$ | 3.418 | 9.00 | $3 \cdot 183$ | $9 \cdot 68$ | 2.978 | 10.36 | $2 \cdot 796$ | 11.04 | 2.634 | 11.72 | $2 \cdot 489$ | 12.40 | $2 \cdot 360$ |
| $8 \cdot 33$ | $3 \cdot 415$ | 9.01 | $3 \cdot 180$ | 9.69 | $2 \cdot 975$ | 10.37 | $2 \cdot 793$ | 11.05 | $2 \cdot 632$ | Ir ${ }^{\text {P3 }}$ | $2 \cdot 487$ | 12.41 | $2 \cdot 358$ |
| $8 \cdot 34$ | 3.41 I | 9.02 | $3 \cdot 177$ | $0 \cdot 70$ | 2.972 | 10.38 | $2 \cdot 791$ |  | $2 \cdot 629$ | Ir ${ }^{\prime} 4$ | $2 \cdot 485$ | 12.42 | $2 \cdot 356$ |
| $8 \cdot 35$ | $3 \cdot 407$ | 9.03 | 3.174 | $9 \cdot 71$ | 2.969 | 10.39 | $2 \cdot 788$ | 11.07 | 2.627 | 11.75 | 2.484 | 12.43 | $2 \cdot 354$ |
| $8 \cdot 36$ | $3 \cdot 404$ | $9 \cdot 04$ | 3.170 | $9 \cdot 72$ | 2.967 | 10.40 | $2 \cdot 786$ | 11.08 | $2 \cdot 625$ | 11.76 | 2.482 | 12.44 | $2 \cdot 352$ |
| $8 \cdot 37$ | $3 \cdot 400$ | $9 \cdot 05$ | $3 \cdot 167$ | $9 \cdot 73$ | 2.964 | 10.41 | $2 \cdot 783$ | II.09 | 2.623 | 11.77 | 2.480 | $12 \cdot 4$ | $2 \cdot 351$ |
| $8 \cdot 38$ | $3 \cdot 396$ | 9.06 | $3 \cdot 164$ | 9.74 | $2 \cdot 961$ | 10.42 | 2.781 | irio | $2 \cdot 620$ | 11.78 | $2 \cdot 477$ | 12.46 | $2 \cdot 349$ |
| 39 | 3.393 | $9 \cdot 07$ | $3 \cdot 16$ | 75 | 2.958 | 10 | 2.778 | 11.11 | $2 \cdot 6$ | 1179 | $2 \cdot 475$ | 12.47 | $2 \cdot 347$ |
| $8 \cdot 40$ | $3 \cdot 389$ | 9.08 | $3 \cdot 158$ | 9.76 | 2.955 | 10.44 | 2.776 | 11.12 | 2.616 | 11.80 | $2 \cdot 473$ | 12.48 | $2 \cdot 345$ |
| 8.41 | $3 \cdot 386$ | 9.09 | $3 \cdot 155$ | 9.77 | 2.953 | 10.45 | 2.773 | II•I3 | 2.614 | II.81 | 2.472 | 12.49 | $2 \cdot 343$ |
| $8 \cdot 42$ | $3 \cdot 382$ | $9 \cdot 10$ | $3 \cdot 151$ | 9.78 | 2.950 | 10.46 | $2 \cdot 771$ | II-14 | $2 \cdot 612$ | 11.82 | 2470 | 12.50 | $2 \cdot 342$ |
| $8 \cdot 43$ | $3 \cdot 378$ | $9 \cdot 11$ | 3.148 | $9 \cdot 79$ | 2.947 | 10.47 | $2 \cdot 768$ | If15 | $2 \cdot 609$ | II 83 | $2 \cdot 468$ | 12.51 | $2 \cdot 340$ |
| $8 \cdot 44$ | $3 \cdot 375$ | $9 \cdot 12$ | $3 \cdot 145$ | 9.80 | 2.944 | 10.4 | $2 \cdot 766$ | II 16 | $2 \cdot 607$ | II.84 | $2 \cdot 466$ | 12.52 | 2.338 |
| 8.45 | 3.371 | $9 \cdot 13$ | $3 \cdot 142$ | 9.81 | 2.94 I | 10.49 | $2 \cdot 763$ | 11.17 | $2 \cdot 605$ | 11.85 | 2.464 | 12 | 2.336 |
| $8 \cdot 46$ | $3 \cdot 367$ | 9.14 | 3.139 | 9.82 | 2.939 | 10.50 | $2 \cdot 76 \mathrm{r}$ | II•I | 2.603 | If.86 | 2.462 | 12.54 | $2 \cdot 334$ |
| 8 | $3 \cdot 364$ | 9.15 | 3.136 | 9.83 | 2.936 | 10.51 | 2.758 | II•19 | $2 \cdot 601$ | 11.87 | 2.460 | 12.55 | 2.333 |
| $8 \cdot 48$ | $3 \cdot 360$ | 9-16 | 3•133 | 9.84 | 2.933 | 10.52 | 2.756 | II.20 | 2.598 | 11.88 | $2 \cdot 458$ | 12.56 | 2.331 |
| $8 \cdot 49$ | $3 \cdot 357$ | $9 \cdot 17$ | $3 \cdot 129$ | $9 \cdot 85$ | 2.930 | 10.53 | $2 \cdot 754$ | 11.2 | 2.596 | rr 89 | $2 \cdot 456$ | 12.57 | $2 \cdot 329$ |
| 8.50 | $3 \cdot 353$ | $9 \cdot 18$ | 3.126 | 9.86 | 2.928 | 10.54 | $2 \cdot 751$ | 11.22 | 2.594 | 1190 | $2 \cdot 454$ | 12.58 | $2 \cdot 327$ |
| 8.51 | 3.350 | $9 \cdot 19$ | $3 \cdot 123$ | 9.87 | 2.925 | 10.55 | $2 \cdot 749$ | 11.23 | $2 \cdot 592$ | Ir91 | $2 \cdot 452$ | 12.59 | $2 \cdot 326$ |
| 8.52 | $3 \cdot 346$ | 9.20 | 3.120 | 9.88 | 2.922 | 10.56 | $2 \cdot 746$ | 11.24 | 2.590 | 11.93 | 2.450 | 12.60 | $2 \cdot 324$ |
| 8.53 | $3 \cdot 342$ | 9.21 | $3 \cdot 117$ | 9.89 | 2.919 | 10.57 | $2 \cdot 744$ | 11.25 | 2.588 | 11.93 | $2 \cdot 448$ | 12.61 | $2 \cdot 322$ |
| 8.54 | $3 \cdot 339$ | 9.22 | $3 \cdot 114$ | 9.90 | 2.917 | $10 \cdot 5$ | $2 \cdot 741$ | 11.2 | $2 \cdot 585$ | 11.94 | $2 \cdot 446$ | 12.62 | $2 \cdot 320$ |
| 8.55 | $3 \cdot 335$ | 9.23 | 3.111 | 9.91 | 2.914 | 10.59 | $2 \cdot 739$ | 11.27 | $2 \cdot 583$ | 1 c 95 | $2 \cdot 444$ | 12.63 | 2.319 |
| 8.56 | 3.332 | 9.24 | $3 \cdot 108$ | 9.92 | 2.911 | 10.60 | $2 \cdot 736$ | 11.28 | 2.581 | 11.96 | 2.442 | 12.64 | $2 \cdot 317$ |
| 8.57 | $3 \cdot 328$ | 9.25 | $3 \cdot 105$ | $9 \cdot 93$ | $2 \cdot 908$ | 10.61 | $2 \cdot 734$ | 11.29 | $2 \cdot 579$ | 11.97 | $2 \cdot 440$ | 12.65 | 2.315 |
| 8.58 | $3 \cdot 325$ | 9.26 | $3 \cdot 102$ | 9.94 | $2 \cdot 906$ | 10.62 | 2.732 | 11.30 | 2.577 | 11.98 | $2 \cdot 438$ | 12.66 | 2.313 |
| $8 \cdot 59$ | $3 \cdot 32 \mathrm{I}$ | 927 | 3.099 | 9.95 | $2 \cdot 903$ | 10.63 | 2.729 | II•3I | 2.575 | 11.99 | $2 \cdot 436$ | 12.67 | $2 \cdot 312$ |
| 8.60 | $3 \cdot 318$ | 9.28 | 3.096 | $9 \cdot 96$ | 2.900 | 10.64 | $2 \cdot 727$ | 11.32 | $2 \cdot 572$ | 12.00 | 2.434 | 12.68 | 2.310 |
| 8.61 | $3 \cdot 314$ | 9.29 | 3.093 | $9 \cdot 97$ | 2.898 | 10.65 | $2 \cdot 724$ | 11.33 | 2.570 | 12.01 | 2.432 | 12.69 | $2 \cdot 308$ |
| 8.62 | 3.311 | $9 \cdot 30$ | 3.090 | $9 \cdot 98$ | $2 \cdot 895$ | 10.66 | $2 \cdot 722$ | 11.34 | 2.568 | 12.02 | $2 \cdot 43$ I | 12.70 | $2 \cdot 306$ |
| 8.63 | $3 \cdot 307$ | 9.31 | 3.087 | 9.99 | 2.892 | 10.67 | 2.720 | I1.35 | 2.566 | 12.03 | 2.429 | 12.71 | $2 \cdot 305$ |
| $8 \cdot 64$ | $3 \cdot 304$ | $9 \cdot 32$ | 3.084 | 10.00 | 2.890 | 10.68 | $2 \cdot 717$ | 11.36 | 2.564 | 12.04 | 2.427 | 12.72 | $2 \cdot 303$ |
| 8.65 | $3 \cdot 300$ | 9.33 | 3.080 | 10.01 | 2.887 | 10.69 | $2 \cdot 715$ |  | $2 \cdot 562$ | 12.05 | $2 \cdot 425$ | 12.73 |  |
| 8.66 | $3 \cdot 297$ | $9 \cdot 34$ | 3.077 | 10.02 | 2.884 | 10.70 | 2.713 | 11.38 | $2 \cdot 560$ | 12.06 | 2.423 | 12.74 | $2 \cdot 299$ |
| $8 \cdot 67$ | $3 \cdot 293$ | $9 * 35$ | 3.074 | 10.03 | 2.882 | 10.71 | 2.710 | 11.39 | $2 \cdot 558$ | 12.07 | $2 \cdot 42 \mathrm{I}$ | 12.75 | 2:293 |

## REDUCTION AT 1 min．FROM THE MERIDIAN CORRESPONDING TO the LATITODE VARIATION taken from the azimuth table．

| $\begin{aligned} & \text { Lat. } \\ & \text { Var. } \end{aligned}$ | Redn． | Lat． <br> Var． | Redn． | Lat． <br> Var． | Redn． | Lat． <br> Var． | Redn． | Lat． <br> Var． | Redn． | Lat． Var． | Redn． | $\begin{aligned} & \text { Lat. } \\ & \text { Var. } \end{aligned}$ | Redn． |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sec |  | Sec． |  | Sec． |  | Sec． $14 \cdot 80$ |  | Sec． | I．831 | Sec． $10 \cdot 50$ | I． 693 | Sec． I8.86 | 74 |
| $12 \cdot 76$ $12 \cdot 77$ | 2.296 2.294 | 13.44 13.45 | 2.185 2.182 | I4．12 I4．13 | $2 \cdot 084$ | 14.80 14.81 | 1．991 | 16．16 | 1.829 | ${ }_{1} 17.52$ | $1.69{ }^{1}$ | 18.88 | 1.572 |
| 12.78 | $2 \cdot 292$ | 13.46 | 2.181 | 14.14 | 2.081 | 14.82 | I． 989 | $16 \cdot 18$ | I．827 | 17.54 | 1．689 | 18.90 | 1.570 |
| 12．79 | $2 \cdot 291$ | 13.47 | $2 \cdot 180$ | 14.15 | 2.079 | 14.84 | I．986 | 16.20 | 1．824 | 17．56 | 1.687 | 18.92 | 1．563 |
| 12．80 | $2 \cdot 289$ | 13.48 | 2．178 | 14.16 | 2.078 | 14.86 | r．983 | 16 | 1.822 | 1\％．58 | 1.685 | 18.94 | 1．567 |
| 12．81 | $2 \cdot 287$ | I3．49 | 2．177 | 14．17 | 2.077 | 14.88 | 1．98I | 16.24 | I． 820 | 17.60 | I． 683 | 18.96 | 1．565 |
| 12.82 | $2 \cdot 286$ | 13．50 | $2 \cdot 175$ | 14.18 | 2.075 | 14.90 | 1．979 | $16 \cdot 26$ | 1．818 | 17.62 | 1.68 I | 18.98 | 1．563 |
| 12.83 | $2 \cdot 284$ | 13.51 | 2．174 | I4•19 | $2 \cdot 074$ | 14.92 | 1．976 | 16.28 | 1．816 | 17.64 | 1．679 | $19^{\circ} 00$ | 1.562 |
| 12.84 | $2 \cdot 282$ | 13.52 | $2 \cdot 172$ | 14.20 | 2.072 | 14.94 | 1．974 | $16 \cdot 30$ | 1．814 | 17.66 | r．678 | 19.02 | I．560 |
| 12．85 | $2 \cdot 28 \mathrm{I}$ | 13.53 | $2 \cdot 170$ | 14.21 | 2.071 | 14.96 | 1•971 | $16 \cdot 32$ | 1．8II | 17.68 | 1．676 | 19.04 | 1．559 |
| 12.86 | 2.279 | 13.54 | $2 \cdot 169$ | 14.22 | 2.070 | 14.98 | 1．968 | 16.34 | r．809 | 17.70 | 1．674 | 19.06 | 1．557 |
| 12.87 | 2.279 | 13.55 | $2 \cdot 167$ | 14.23 | 2.068 | 15.00 | I．966 | $16 \cdot 36$ | r．807 | 17.72 | 1．672 | 19.08 | 1．555 |
| 12.88 | $2 \cdot 276$ | 13.56 | $2 \cdot 166$ | 14.24 | 2.067 | 15.02 | r．963 | 16.38 | I．805 | 17.74 | r 670 | $19 \cdot 10$ | 1．554 |
| 12.89 | $2 \cdot 274$ | 13.57 | $2 \cdot 164$ | 14.25 | $2 \cdot 066$ | 15.04 | r．96I | 16.40 | 1.803 | 17.76 | 1．668 | 19.12 | I•552 |
| 12.90 | 2.272 | 13.58 | $2 \cdot 163$ | 14.26 | $2 \cdot 064$ | 15.06 | I 958 | 16.42 | 1．801 | 17.78 | 66 | 19.14 | I•531 |
| 12．91 | $2 \cdot 271$ | 13.59 | $2 \cdot 161$ | 14.27 | 2.063 | 15.08 | 1．956 | 16．44 | 1•799 | 17.80 | 1． 665 | $19 \cdot 16$ | I•549 |
| 12.92 | $2 \cdot 269$ | 13.60 | $2 \cdot 160$ | 14.28 | $2 \cdot 061$ | $15 \cdot 10$ | 1．953 | 14.46 | 1•797 | 17.82 | I． 663 | 19.18 | I 548 |
| 12.93 | 2.267 | 13.61 | $2 \cdot 158$ | 14．29 | 2.060 | 15.12 | 1．95 | 16.48 | 1•794 | 17.84 | 1．661 | 19.20 | I．546 |
| 12.94 | $2 \cdot 265$ | 13.62 | $2 \cdot 157$ | 14．30 | 2.059 | 15.14 | 1•948 | 16．50 | 1•792 | 17.86 | 1．659 | 19.22 | $1 \cdot 544$ |
| 12.95 | $2 \cdot 264$ | 13.63 | $2 \cdot 155$ | 14．3I | $2 \cdot 057$ | 15•16 | r．946 | 16.52 | 1．790 | 17.88 | 1．657 | 19.24 | 1．543 |
| 12.96 | $2 \cdot 262$ | 13.64 | $2 \cdot 154$ | 14.32 | $2 \cdot 056$ | 15.18 | 1．943 | 16.54 | 1.788 | 17.90 | 1．656 | 19.26 | 1．541 |
| 12.97 | 2.260 | 13.65 | $2 \cdot 152$ | 14.33 | 2.055 | 15.20 | 1．94I | 16.56 | 1.786 | 17．92 | I． 654 | 19.28 | 1．540 |
| 12.98 | 2.259 | 13.66 | $2 \cdot 151$ | 14.34 | 2.053 | 15.22 | 1．939 | 16.58 | I．784 | 17．94 | r．652 | 19.30 | 1．538 |
| 12.99 | 2.257 | 13.67 | $2 \cdot 149$ | 14.35 | $2 \cdot 052$ | 15.24 | I．936 | 16.60 | $1 \cdot 782$ | 17.96 | 1.650 | 19.32 | I．537 |
| 13.00 | 2.255 | 13.68 | $2 \cdot 148$ | 14.36 | $2 \cdot 050$ | 15.26 | 1．934 | 16.62 | 1．780 | 17.98 | 1．648 | 19.34 | r．535 |
| 13.01 | 2.254 | $13 \cdot 69$ | $2 \cdot 147$ | 14.37 | 2.049 | 15.28 | 1．93I | $16 \cdot 64$ | 1.778 | 18.00 | 1647 | 19.36 | 1．533 |
| 13.02 | 2.252 | 13.70 | $2 \cdot 145$ | 14.38 | $2 \cdot 048$ | 15.30 | I．929 | $16 \cdot 66$ | x 775 | 18.02 | I．645 | 19.38 | 1．532 |
| 13.03 | $2 \cdot 250$ | 13.71 | $2 \cdot 144$ | 14.39 | 2.046 | 15.32 | I．926 | 16.68 | 1.773 | 18.04 | 1．643 | 19.40 | 1.530 |
| 13.04 | $2 \cdot 249$ | 13.72 | $2 \cdot 142$ | 14.40 | $2 \cdot 045$ | 15.34 | I•924 | $16 \cdot 70$ | － 771 | 18.06 | I．64r | 19.42 | 1.529 |
| 13.05 | 2.247 | 13.73 | $2 \cdot 141$ | 14.41 | 2.043 | 15.36 | I．921 | $16 \cdot 72$ | 1．769 | 18.08 | 1．640 | 19.44 | 1.527 |
| 13.06 | $2 \cdot 245$ | 13．74 | $2 \cdot 139$ | 14.42 | $2 \cdot 042$ | 15.38 | 1．919 | 16.74 | 1．767 | 18.10 | 1．638 | 19.46 | 1．526 |
| 13.07 | $2 \cdot 244$ | 13.75 | 2.138 | 14.43 | $2 \cdot 041$ | 15.40 | －916 | $16 \cdot 76$ | 1．765 | $18 \cdot 12$ | r．636 | 19.48 | 1.524 |
| 13.08 | 2.242 | 13.76 | 2.136 | 14.44 | 2.039 | 15.42 | I．914 | 16.78 | － 763 | 18.14 | I． 634 | 19.50 | 1.523 |
| 13.09 | $2 \cdot 240$ | 13.77 | $2 \cdot 135$ | 14.45 | 2.038 | 15.44 | 1.911 | 16.80 | ェ・761 | 18.16 | ז．632 | 19.52 | 1.521 |
| 13．10 | $2 \cdot 239$ | 13.78 | $2 \cdot 133$ | 14.46 | $2 \cdot 037$ | 15.46 | $1 \cdot 909$ | 16 | 1•759 |  | 1．63I | 19.54 | 1.520 |
| 13．11 | 2.237 | 13.79 | $2 \cdot 132$ | 14.47 | $2 \cdot 035$ | 15.48 | 1．907 | 16.84 | 1．757 | 18.20 | 1．629 | 19.56 | 1．5I8 |
| 13.12 | $2 \cdot 235$ | 13.80 | $2 \cdot 130$ | 14.48 | 2.034 | 15.50 | r．905 | 16.86 | 1•755 | 18.22 | 1.627 | 19.58 | 1.517 |
| 13.13 | $2 \cdot 234$ | 13.81 | $2 \cdot 129$ | 14.49 | 2.033 | 15.52 | 1．902 | 16.88 | 1．753 | 18.24 | 1.625 | 19.60 | I．515 |
| 13.14 | $2 \cdot 232$ | 13.82 | 2.127 | 14.50 | 2.031 | 15.54 | 1．900 | 16.90 | 1．751 | 18.26 | r．624 | 19.62 | 1．513 |
| 13．15 | $2 \cdot 231$ | 13.83 | $2 \cdot 126$ | 14.51 | 2.030 | 15.56 | I．897 | 16.92 | 1．749 |  | 1.622 | 19.64 | r．512 |
| 13.16 | 2.229 | 13.84 | $2 \cdot 124$ | 14.52 | 2.028 | 15.58 | I．895 | 16.94 | 1．747 | 18.30 | r．620 | 19.66 | $1 \cdot 510$ |
| 13.17 | $2 \cdot 228$ | 13.85 | $2 \cdot 123$ | 14.53 | 2.027 | 15.60 | I．892 | 16.96 | I．745 | 18.32 | 1.618 | 19.68 | 1.509 |
| 13.18 | 2.226 | 13.86 | $2 \cdot 121$ | 14.54 | 2.026 | 15.62 | r．890 | 16.98 | r．743 | 18.34 | 1.617 | 19．70 | r． 507 |
| 13．19 | $2 \cdot 224$ | 13.87 | $2 \cdot 120$ | 14.55 | 2.025 | 15.64 | I． 888 | 17.00 | 1．741 | $18 \cdot 36$ | 1．615 | 19.72 | 1．506 |
| 13.20 | $2 \cdot 223$ | 13.88 | 2．118 | 14.56 | 2.023 | 15.6 | 1．885 | 17.02 | 1．739 | 18.38 | 1.614 | 19.74 | 1．504 |
| 13.21 | 2.221 | 13.89 | $2 \cdot 117$ | 14.57 | 2.022 | 15.68 | I． 883 | 17.04 | 1．737 | 18.40 | 1．612 | 19.76 | $1 \cdot 503$ |
| 13.22 | $2 \cdot 219$ | 13.90 | $2 \cdot 115$ | 14.58 | 2.021 | 15.70 | 1．88r | 17.06 | 1．735 | 18.42 | 1．610 | 19.78 | $1 \cdot 502$ |
| 13.23 | 2.218 | 13.91 | $2 \cdot 114$ | 14.59 | $2 \cdot 019$ | 15．72 | 1.878 | 1\％．08 | 1．733 | 18.44 | I．608 | 19.80 | 1.500 |
| 13.24 | $2 \cdot 216$ | 13.92 | $2 \cdot 112$ | 14.60 | $2 \cdot 018$ | 15.74 | 1．876 | 17.10 | 1．731 | 18.46 | 1.607 | 19.82 | 1－499 |
| 13.25 | $2 \cdot 214$ | 13.93 | 2－III | 14.61 | $2 \cdot 016$ | 15.76 | 1．874 | 17.12 | 1．729 | 18.48 | 1．605 | 19.84 | I． 497 |
| 13.26 | 2.213 | 13.94 | $2 \cdot 110$ | 14.62 | 2.015 | 15.78 | 1.872 | 17.14 | 1•727 | 18.50 | r．603 | 19.86 | 1.496 |
| 13.27 | 2.211 | 13.95 | 2－108 | 14.63 | 2.014 | 15.80 | 1－869 | $17 \cdot 16$ | $1 \cdot 725$ | 18.52 | $1 \cdot 601$ | 19.88 | I－494 |
| 13.28 | 2.210 | 13.96 | $2 \cdot 107$ | 14.64 | 2.012 | 15.82 | 1．867 | 17．18 | $1 \cdot 723$ | 18.54 | 1．600 | 19.90 | I．493 |
| 13.29 | $2 \cdot 208$ | 13.97 | $2 \cdot 105$ | 14.65 | $2 \cdot 011$ | 15.84 | r．865 | 17.20 | 1．721 | 18.56 | －598 | 19.92 | I．491 |
| 13.30 | $2 \cdot 207$ | 13.98 | $2 \cdot 104$ | 14. | $2 \cdot 010$ | 15.86 | I． 862 | 17.22 | 1．719 | I8．58 | I． 597 | 19．94 | 1.490 |
| 13.31 | 2.205 | 13.99 | $2 \cdot 102$ | 14.67 | 2.009 | 15.88 | I． 860 | 17.24 | ェ・ク1 | 18.60 | 1．595 | 19.96 | 1.488 |
| 13.32 | $2 \cdot 204$ | 14.00 | $2 \cdot 100$ | 14.68 | $2 \cdot 007$ | 15.90 | I． 858 | 17.26 | 1．715 | 18.62 | 1．593 | 19.98 | 1.487 |
| 13.33 | $2 \cdot 202$ | 14.01 | $2 \cdot 099$ | 14.69 | 2.006 | 15.92 | I．856 | 17.28 | 1.713 | 18.64 | 1.591 | 20.00 | 1.485 |
| 13.34 | 2．200 | 14.02 | $2 \cdot 098$ | 14.70 | $2 \cdot 005$ | 15.94 | I．853 | 17.30 | 1．7II | 18.66 | r．590 | 20.02 | 1.484 |
| 13.35 | 2．199 | 14.03 | $2 \cdot 096$ | 14．71 | $2 \cdot 003$ | 15.96 | 1．85I | 17．32 | 1•709 | 18.68 | r 588 | 20.04 | 1.482 |
| 13.36 | $2 \cdot 197$ | 14.04 | 2.095 | 14.72 | $2 \cdot 002$ | 15.98 | 1．849 | 17．34 | 1．707 | 18.70 | 1.587 | 20.06 | $1 \cdot 481$ |
| 13.37 | 2．195 | 14.05 | $2 \cdot 093$ | 14.73 | $2 \cdot 001$ | 16.00 | 1．847 | 17.36 | $1 \cdot 706$ | 18.72 | $1 \cdot 585$ | 20.08 | 1.480 |
| 13.38 | 2．194 | 14.06 | $2 \cdot 092$ | 14.74 | 1•999 | 16.02 | 1．844 | 17.38 | 1．704 | 18.74 | 1．583 | $20 \cdot 10$ | 1.478 |
| 13.39 | $2 \cdot 192$ | I4．07 | 2.091 | 14.75 | － 999 | 16.04 | I． 842 | I7．40 | 1．702 | 18.76 | I．58I | 20.12 | 1.477 |
| 53.40 | $2 \cdot 191$ | 14.08 | 2.089 | 14＊76 | 1－997 | 16.06 | I． 840 | 17.42 | 1．$\% 00$ | 18.78 | 1.580 | 20.14 | 5.476 |
| 13.41 | 2．189 | 14.09 | $2 \cdot 088$ | 14.77 | 1．995 | 16.08 | I． 838 | 17.4 | 1．698 | 18.80 | $1 \cdot 578$ | $20 \cdot 16$ | 1.474 |
| 13.42 | $2 \cdot 188$ | $14 \cdot 10$ | $2 \cdot 086$ | 14.78 | I．994 | 16．10 | I．835 | 1746 | I． 696 | 18.82 | 1．576 | $20 \cdot 18$ | 1.473 |
| 13.43 | 2．186 | I4．11 | 2.085 | 14.79 | － 993 | 16.12 | r．833 | 17.48 | I．694 | 18.84 | 1．575 | 20.20 | 1475 |

## REDUCTION AT 1 MIN. FROM THE MERIDIAN CORRESPONDING TO THE LATITUDE Variations taken from the azimuti table.

| $\begin{aligned} & \text { Lat. } \\ & \text { Var. } \end{aligned}$ | Redn. | $\begin{aligned} & \text { Lat. } \\ & \text { Var. } \end{aligned}$ | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sec. | 6 | 21.58 | 1.378 | Sec. <br> 23.88 | 1.247 | $\underset{26 \cdot 60}{\substack{\text { Sec. }}}$ | I-121 | Sec. 29.32 | I.ór 8 | 32.04 | 33 |  | 860 |
| $20 \cdot 24$ | I. 46 | 21.60 | 1.377 | 23.92 | 1.245 | 26.64 | I.120 | 29.36 | 1-017 | 32.0 | 933 |  | . 85 |
| $20 \cdot 26$ | 1.466 | 21.62 | 1.376 | 23.96 | 1.243 | $26 \cdot 68$ | 1-118 | 29.40 | I-016 | $32 \cdot 12$ | $\cdot 930$ | 34. | . 858 |
| $20 \cdot 28$ | 1.465 | $2 \mathrm{I} \cdot 6$ | 1.375 | 24.00 | 1-24r | 26.72 | 1. | 29.4 | 1-014 | $32 \cdot 16$ | -929 | 34.8 | -857 |
| $20 \cdot 30$ | 1.464 |  | 1.373 | 24.04 | 1.239 | 26.76 | I'I15 | 29.4 | rol 3 | 32.20 | $\cdot 928$ | 34.92 | . 856 |
| $20 \cdot 32$ | 1.462 | 21.68 | 1.372 | 24.08 | 1.237 | 26.80 | r.113 | 29.52 | 1.012 | 32. | -927 | 34.96 | -855 |
| $20 \cdot 34$ | I.461 | 21.70 | 1.371 | $24 \cdot 12$ | 1.235 | 26. | I-112 | 29.56 | $1 \cdot 010$ | 32.2 | -926 | 35.00 | - 854 |
| $20 \cdot 36$ | 1.459 | 21.72 | 1.370 | $24 \cdot 16$ | 1.233 | 26. | 1-110 | 29.6 | 1-009 | $32 \cdot 32$ | $\cdot 925$ | $35 \cdot 1$ | 852 |
| $20 \cdot 38$ | 1.458 | 21.74 | I 368 | 24.20 | 1.231 | 26.92 | 1-108 | 29.64 | 1-007 | $32 \cdot 36$ | -924 | $35 \cdot 2$ | 850 |
| 20.40 | 1.457 | 21.76 | 1.367 | 24.24 | 1-229 | 26.96 | 1-107 | 29.68 | 1.006 | 32.40 | -922 | 35 | 847 |
| 20.42 | 1.455 | 21.78 | 1.366 | 24.28 | 1.227 | 27.00 | r.105 | 29.72 | 1.005 | 32. | -921 | $35 \cdot 40$ | -845 |
| 20.44 | 1.454 | 21.80 | I.365 | 24.32 | 1.225 | 27.04 | r.103 | 29:76 | 1.003 | 32.48 | -920 | 35.50 | $\cdot 842$ |
| 20.46 | 1.452 | 21.82 | 1.363 | 24.36 | 1.223 | 27.08 | I•102 | 29.80 | 1.002 | 32.52 | -919 | 35.60 | - 840 |
| 20.48 | 1451 | 21.84 | $1 \cdot 362$ | 24.40 | 1-221 | $27 \cdot 12$ | I. 100 | 29.8 | 1.001 | 32.56 | -918 | 35.70 | -838 |
| 20.50 | 1.450 |  | 1.361 | 24.44 | 1-219 | $27 \cdot 16$ | r.099 | 29.8 | 999 | $32 \cdot 6$ | -917 | 35.8 | -835 |
| 20.52 | 1.448 | 21.88 | 1.360 | 24.48 | 1.217 | 27.20 | 1.097 | 29.92 | -998 | 32. | -916 | 35.90 | 833 |
| 20 | 1.447 | 21.90 | 1.358 | 24.52 | 1.215 | 27.24 | r.095 | 29.96 | -997 | $32 \cdot 68$ | -914 | 36.00 | .831 |
| $20 \cdot 5$ | $1 \cdot 445$ | 21.92 | 1.357 | 24.56 | 1.213 | 27.2 | 1.094 | 30.00 | -995 | $32 \cdot 7$ | $\cdot 913$ | $36 \cdot 10$ | -828 |
| 20.58 | 1.444 | 21-94 | 1.356 | 24.60 | 1-21I | 27.32 | r.092 | 30. | -994 | 32 | -912 | $36 \cdot 20$ | 26 |
| 20.60 | 1.443 | 21.96 | 1-355 | 24.64 | 1-209 | 2736 | rogr | $30 \cdot$ | -993 | 32 | 911 | $36 \cdot 30$ | -824 |
| 20.62 | 1441 | 21.98 | 1.354 | 24.68 | 1-208 | 27.40 | r.089 | $30 \cdot 12$ | -992 | 32. | -910 | $36 \cdot 40$ | -822 |
| 20.64 | 1.440 | 22.00 | $1 \cdot 352$ | 24.72 | 1.206 | 27.44 | r.088 | $30 \cdot 16$ | -990 | 32. | -909 | 36.50 | -819 |
| 20.66 | 1.439 | 22 | I•350 | 24.76 | 1.204 | 27.48 | r.086 | $30 \cdot 20$ | -98 | 32.9 | 908 | 3660 | -817 |
| 20.68 | r 437 | 22 | I-348 | 24.80 | 202 | 27.52 | r.084 | 30.24 | -988 | 32.9 | -907 | $36 \cdot 70$ | -815 |
| 20.70 | 1.436 | 22 | 1-345 | 24.84 | 1-200 | 27.5 | r.083 | 30 | -986 | 33.0 | -906 |  | .813 |
| 20.72 | 1.435 | $22 \cdot 16$ | I 343 | 24.88 | 1.198 | 27.60 | r.08I | $30 \cdot 3$ | -985 | 33 | 905 | 36.90 | .811 |
| 20.74 | 1.433 | 22.20 | r 340 | 24.92 | 1•96 | $27 \cdot 64$ | I•08 | $30 \cdot 36$ | $\cdot 984$ | 33.0 | $\cdot 903$ | 37.00 | 808 |
| 20.76 | 1.432 | 22.24 | r-338 | 24.96 | 1•194 | $27 \cdot 68$ | r-078 | $30 \cdot 40$ | $\cdot 982$ | $33 \cdot 12$ | -902 | 37.10 | . 806 |
| 20.78 | 1.430 | 22.28 | r.336 | $25 \cdot 00$ | 1•192 | $27 \cdot 72$ | 1.077 | $30 \cdot 44$ | 98 I | $33 \cdot 16$ | -901 | 37.20 | . 804 |
| 80 | 1.429 | $22 \cdot 32$ | r.333 | 25.04 | 1-190 | 27. | 1.075 | 30.4 | -980 | 33.20 | -900 | 37.30 | -802 |
| 20.82 | 1.428 | $22 \cdot 36$ | 1.33I | 25.08 | 1-189 | 27.80 | $1 \cdot 074$ | $30 \cdot 52$ | -979 | 33.2 | -899 | $37 \cdot 40$ | 800 |
| 20.84 | 1.426 | 22.40 | 1.329 | $25 \cdot 12$ | $1 \cdot 187$ | $27 \cdot 84$ | 1.072 | 30.5 | -977 | $33 \cdot 28$ | $\cdot 898$ | 37.50 | $\cdot 798$ |
| 20.8 | 1.425 | 22.44 | I 326 | $25 \cdot 16$ | 1.185 | $27 \cdot 88$ | 1.07x | $30 \cdot 6$ | -976 | 33. | -897 | 37.60 | -796 |
| 20.88 | r.424 | 22 | I 324 | 25.2 | 1.183 | 27.92 | 1.069 | $30 \cdot 6$ | -975 | 33 | -896 | 37 | -793 |
| 20.90 | 1.422 | 22 | 1.322 | 25.2 | 1.18I | 27.96 | 1.067 | 30 | -974 | 33 | - 895 |  | 79 I |
| 20 | 1.421 | 22.56 | 1-319 | $25 \cdot 28$ | 1.179 | 28.00 | 1-066 | $30 \cdot 7$ | -972 | 33 | -894 | 37.90 | $\cdot 789$ |
| 20.94 | 1.420 | 22.60 | 1-317 | 25.32 | $1 \cdot 177$ | 28.04 | I.064 | $30 \cdot 76$ | -971 | 33.4 | -893 | 38.00 | $\cdot 787$ |
| 2096 | 1418 | 22.64 | I-315 | $25 \cdot 36$ | 1.176 |  | r.063 | $30 \cdot 8$ | -970 | 33.52 | $\cdot 892$ | $38 \cdot 10$ | $\cdot 785$ |
| 20.98 | 1.417 | 22.68 | I-313 | 25.40 | 1-174 | 28. | r.06I | 30.8 | -969 | $33 \cdot 5$ | -891 | 38.20 | $\cdot 783$ |
| 21.00 | 1.416 | 22.72 | re3ro | 25.44 | I•172 |  | 06 |  | -967 | $33 \cdot$ | -890 | 38.30 | $\cdot 781$ |
| 21.02 | 1.414 | 22.76 | 1.308 | 25.48 | $1 \cdot 170$ | 28.20 | r.059 | 30.92 | -966 | 33.64 | - 889 | $38 \cdot 40$ | -779 |
| 21 | 1.413 | 22.80 | I.306 | 25.52 | 1-168 | 28.24 | r.057 | $30 \cdot 96$ | -965 | $33 \cdot 68$ | . 888 |  | $\cdot 777$ |
| 21.06 | 1.412 | 22.84 | 1.303 | 25.56 | 1•167 | 28.28 | 1.056 | 31.00 | -964 | $33 \cdot 7$ | -886 | 38.60 | $\cdot 775$ |
| 21.08 | 1.410 | 22.88 | 1.301 | 25.60 | 1•165 | 28.32 | 1.054 | 31.0 | -962 | 33.76 | -885 | 38.70 | $\cdot 773$ |
| 21. | 1.409 | 22.92 | I-299 | 25 | I•163 |  | r.053 | 3 r • | $\cdot 961$ | 33 | -88 |  | -77 |
| $21 \cdot 1$ | r.408 | 22.96 | 1.297 | 25.68 | 1-161 | 28.40 | r.05I | 31.12 | -960 | 33. | - 883 | 38.90 | $\cdot 769$ |
| 21.14 | I 406 | 23.00 | 1-294 | 25.72 | I•159 | 28.4 | 1.050 | 31.16 | 959 | $33 \cdot 88$ | -882 | 39.00 | $\cdot 767$ |
| 21.16 | I. 405 | 23.0 | I. 292 | 25.76 | I-158 |  | r.048 | 31. | -958 | 33.92 | -881 | $39^{10}$ | $\cdot 765$ |
| 21.18 | 1.404 | 23.08 | 1.290 | 25.80 | I•156 | 28.52 | 1.047 | $3 \mathrm{I} \cdot 2$ | -956 | 33.96 | -880 | 39.20 | $\cdot 763$ |
| 21.20 | 1*403 | $23 \cdot 12$ | I-288 | 25.84 | 1-154 | 28.56 | r.045 |  | $\cdot 955$ |  | -879 | 39.3 | $\cdot 761$ |
| 21.22 | 1.401 | $23 \cdot 16$ | 1.286 | 25.88 | 1•152 | 28.60 | r.044 | 31.32 | 954 | $34^{\circ} 0$ | -878 | 39.40 | 759 |
| 21.24 | 1400 | 23.20 | I.284 | 25.92 | 1.150 | 28.64 | I 042 | $31 \cdot 36$ | 953 | 34.0 | -877 | 39.50 | $\cdot 757$ |
| 21.26 | - 399 | 23.24 | I.281 | 25.96 | I•I49 | 28.68 | I.04I | 31.40 | -952 | 34-12 | . 876 | 39.60 | $\cdot 756$ |
| 21.28 | 1.397 | 23.28 | 1.279 | 26.00 | I•147 | 28.72 | r.039 | $3 \mathrm{I} \cdot 44$ | -950 | 34•I6 | . 875 | 39.70 | $\cdot 754$ |
| 2130 | - 396 | 23.32 | 1-27 | 4 | 1.145 | 28 | I.03 | 31 | -949 | 34.20 | -874 |  | $\cdot 752$ |
| 21.32 | 1-395 | 23.36 | I 275 | 26.08 | I-143 | 28.80 | r.037 | 31.52 | $\cdot 948$ | 34.2 | -873 | $39 \cdot 90$ | $\cdot 750$ |
| 21.3 | - 393 | 23.40 | 1.273 | $26 \cdot 12$ | I-142 | 28.84 | 1.035 | 31.56 | $\cdot 947$ | 34.28 | -872 | $40 \cdot 00$ | $\cdot 748$ |
| $21 \cdot 36$ | 1.392 | 23.44 | 1.270 | $26 \cdot 16$ | 1.140 | 28.88 | 1.034 | 31.60 | $\cdot 946$ | $34 \cdot 32$ | -871 | $40 \cdot 10$ | $\cdot 746$ |
| 21.38 | 1-391 | 23.48 | I. 268 | $26 \cdot 20$ | I•138 | 28.92 | I.032 | $3 \mathrm{r} \cdot 64$ | $\cdot 944$ | 34.3 | -870 | $40 \cdot 20$ | $\cdot 744$ |
| 21.40 | 1.390 | 23.52 | . 266 | $26 \cdot 24$ | 1-137 | 28.96 | I-03I | 31.68 | 943 | $34 \cdot 4$ | . 869 | $40 \cdot 30$ | 742 |
| 21.42 | 1.388 | 23.56 | 1.264 | 26.28 | I•I35 | 29.00 | r.030 | 31•72 | 942 | $34 \cdot 44$ | - 868 | $40 \cdot 40$ | -741 |
| 21.44 | $1 \cdot 387$ | 23.60 | I 262 | $26 \cdot 32$ | I.133 | 29.04 | $1 \cdot 028$ | $3 \mathrm{I} \cdot 76$ | $\cdot 941$ | $34 \cdot 48$ | -867 | $40 \cdot 50$ | -739 |
| 21.46 | $1 \cdot 386$ | 23.64 | 1.260 | $26 \cdot 36$ | I-13I | 29.08 | 1.027 | $3 \mathrm{I} \cdot 80$ | -940 | 34.52 | . 866 | $40 \cdot 60$ | $\cdot 737$ |
| $2 \mathrm{P} \cdot 48$ | I.385 | 23.68 | 1.258 | $26 \cdot 40$ | I.130 | 29.12 | 1.025 | 31.8 | -938 | $34 \cdot 56$ | . 865 | $40 \cdot 70$ | $\cdot 735$ |
| 21 | 1.383 | 23 | I 256 | 26.44 | I•128 | 29.16 | $1 \cdot 024$ | $3 \mathrm{~F} \cdot 88$ | 937 | $34 \cdot 60$ | - 864 | $40 \cdot 80$ | $\cdot 733$ |
| 21.52 | 1-382 | 23.76 | 1.254 | 26.48 | I.126 | 29.20 | 1.023 | 31.92 | -936 | 34.64 | -863 | $40 \cdot 90$ | . 732 |
| 2 T .54 | 1.381 | 23.80 | 1.252 | 26.52 | I-125 | 29.24 | I.02I | 31.96 | -935 | $34 \cdot 68$ | . 862 | $4{ }^{1} 00$ | $\cdot 730$ |
| 21.56 | $1 \cdot 380$ | 23.84 | 1.249 | 26.56 | 1-123 | 29.28 | 1.020 | 32. | -934 | $34 \cdot 72$ | 861 | 4r'ro | 728 |

reduction at 1 min. From the meridian corresponding to the latitude VARIATIONS TAKEN FROM THE AZIMUTH TABLE-continued.

| Lat. Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. <br> Var. | Redn. | Lat. Var. | Redn. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sec. 41.20 | $\cdot 726$ | $\begin{aligned} & \text { Sec. } \\ & 48.00 \end{aligned}$ | -624 | Sec. 59.60 | -503 | Sec. 73.20 | -409 | Sec. $86 \cdot 80$ | -345 | Sec. IO2.0 | -294 | Sec. 210 | 43 |
| 41.30 | $\cdot 725$ | $48 \cdot 10$ | . 623 | 59.80 | -501 | 73.40 | $\cdot 408$ | 87.00 | -345 | 103.0 | -291 | 220 | -136 |
| 41.40 | -723 | $48 \cdot 20$ | -62I | $60 \cdot 00$ | -499 | 73.60 | -407 | $87 \cdot 20$ | -344 | 104.0 | -288 | 230 | -130 |
| 41.50 | -72I | $48 \cdot 30$ | -620 | 60.20 | -498 | 73.80 | -406 | 87.40 | -343 | $105^{\circ} 0$ | -286 | 240 | 125 |
| 41.60 | -719 | $48 \cdot 40$ | -619 | $60 \cdot 40$ | -496 | 74.00 | $\cdot 405$ | $87 \cdot 60$ | -342 | 106*0 | $\cdot 283$ | 250 | -120 |
| 41'70 | -718 | $48 \cdot 50$ | .617 | $60 \cdot 60$ | -494 | 74.20 | -404 | 87.80 | -34I | 107.0 | -280 | 260 | -II5 |
| 41.80 | -716 | $48 \cdot 60$ | -616 | 60.80 | -493 | 74.40 | -403 | 88.00 | -341 | 108.0 | -278 | 270 | -III |
| 4190 | .714 | $48 \cdot 70$ | -615 | 61.00 | -491 | 74.60 | -402 | $88 \cdot 20$ | -340 | IO9.0 | -275 | 280 | -107 |
| $42 \cdot 00$ | .713 | $48 \cdot 80$ | -614 | 61.20 | -490 | 74.80 | -401 | $88 \cdot 40$ | -339 | I IO.O | -273 | 290 | - 103 |
| 42.10 | -7II | $48 \cdot 90$ | -612 | 61.40 | -488 | $75 \cdot 00$ | $\cdot 400$ | $88 \cdot 60$ | -338 | III*O | -270 | 300 | -100 |
| 42.20 | -709 | 49.00 | -6II | 61.60 | -486 | $75 \cdot 20$ | -399 | $88 \cdot 80$ | -338 | 112.0 | -268 | 310 | -097 |
| $42 \cdot 30$ | -708 | $49 \cdot 10$ | -610 | 61.80 | $\cdot 485$ | 75.40 | -398 | 89.00 | -337 | 113.0 | -265 | 320 | -094 |
| 42.40 | $\cdot 706$ | $49 \cdot 20$ | -609 | $62 \cdot 00$ | $\cdot 483$ | $75 \cdot 60$ | -397 | 89.20 | -336 | II4.0 | -263 | 330 | -09I |
| 42.50 | $\cdot 704$ | $49 \cdot 30$ | -607 | 62.20 | $\cdot 482$ | 75.80 | -395 | 89.40 | -335 | 115.0 | -261 | 340 | -088 |
| $42 \cdot 60$ | $\cdot 703$ | 49.40 | -606 | 62.40 | -480 | $76 \cdot 00$ | -394 | 89.60 | -335 | II6.0 | -259 | 350 | -086 |
| $42 \cdot 70$ | -701 | 49.50 | -605 | $62 \cdot 60$ | $\cdot 479$ | $76 \cdot 20$ | -393 | 89.80 | -334 | II7.0 | -256 | 360 | -083 |
| $42 \cdot 80$ | -699 | 49.60 | -604 | $62 \cdot 80$ | -477 | 7640 | -392 | $90 \cdot 00$ | -333 | 118.0 | -254 | 370 | -081 |
| 42.90 | -698 | 49*70 | -603 | $63 \cdot 00$ | $\cdot 476$ | $76 \cdot 60$ | -391 | $90 \cdot 20$ | -332 | II9.0 | -252 | 380 | -079 |
| 43.00 | -696 | 49.80 | -601 | 63.20 | 474 | $76 \cdot 80$ | -390 | $90 \cdot 40$ | -332 | 120.0 | -250 | 390 | -077 |
| 43.10 | -694 | 49.90 | -600 | 63.40 | $\cdot 473$ | $77 \cdot 00$ | $\cdot 389$ | $90 \cdot 60$ | 331 | 121 | -248 | 400 | -075 |
| $43 \cdot 20$ | -693 | 50.00 | -599 | $63 \cdot 60$ | -471 | $77 \cdot 20$ | -388 | 90.80 | -330 | 122.0 | - 246 | 410 | -073 |
| $43 \cdot 30$ | -691 | 50.20 | -597 | $63 \cdot 80$ | $\cdot 470$ | 77.40 | $\cdot 387$ | $91 \cdot 00$ | -330 | 123.0 | -244 | 420 | -071 |
| $43 \cdot 40$ | -690 | 50.40 | -594 | 64.00 | $\cdot 468$ | 77.60 | -386 | 91.20 | -329 | 1240 | -242 | 430 | -070 |
| $43 \cdot 50$ | -688 | $50 \cdot 60$ | -592 | 64.20 | -467 | 77.80 | $\cdot 385$ | 91.40 | $\cdot 328$ | $125{ }^{\circ}$ | -240 | 440 | -068 |
| $43 \cdot 60$ | -687 | $50 \cdot 80$ | -590 | $64 \cdot 40$ | $\cdot 465$ | $78 \cdot 00$ | $\cdot 384$ | $91 \cdot 60$ | -327 | 1260 | -238 | 450 | -067 |
| 43.70 | -684 | 51.00 | . 587 | 64.60 | -464 | 78.20 | $\cdot 383$ | 91.80 | -327 | 127.0 | . 236 | 460 | .065 |
| $43 \cdot 80$ | -683 | 51.20 | -585 | $64 \cdot 80$ | $\cdot 462$ | 78.40 | $\cdot 382$ | $92 \cdot 00$ | -326 | 128.0 | -234 | 470 | -064 |
| 43.90 | -682 | 51.40 | -583 | $65 \cdot 00$ | -461 | 78.60 | -381 | 92-20 | -325 | 129.0 | -233 | 480 | -062 |
| $44^{\circ} 00$ | -680 | 51.60 | -580 | $65 \cdot 20$ | $\cdot 460$ | 78.80 | $\cdot 380$ | 92.40 | -325 | 130.0 | -23I | 490 | -06I |
| 44.10 | -679 | 51.80 | -578 | 65.40 | $\cdot 458$ | 79.00 | -379 | $92 \cdot 60$ | -324 | 132.0 | -227 | 500 | -060 |
| 44.20 | -677 | 52.00 | -576 | 65.60 | $\cdot 457$ | 79.20 | $\cdot 378$ | $92 \cdot 80$ | -323 | 134.0 | -224 | 510 | -059 |
| 44.30 | -676 | 52.20 | -574 | 65.80 | $\cdot 455$ | 79.40 | $\cdot 377$ | 93.00 | -322 | 136.0 | -221 | 520 | 058 |
| 44.40 | -674 | 52.40 | -572 | $66 \cdot 00$ | -454 | 79.60 | $\cdot 377$ | $93 \cdot 20$ | -322 | $138 \cdot 0$ | -217 | 530 | -057 |
| 44.50 | -673 | $52 \cdot 60$ | -569 | $66 \cdot 20$ | $\cdot 453$ | 79.80 | $\cdot 376$ | $93 \cdot 40$ | -321 | $140{ }^{\circ} 0$ | -214 | 540 | -056 |
| 44.60 | -671 | 52.80 | -567 | $66 \cdot 40$ | -451 | $80 \cdot 00$ | -375 | $93 \cdot 60$ | $\cdot 320$ | $142{ }^{\circ}$ | -211 | 550 | -055 |
| 44.70 | -670 | 53.00 | -565 | $66 \cdot 60$ | $\cdot 450$ | 80.20 | -374 | $93 \cdot 80$ | -320 | $144^{\circ} 0$ | -208 | 560 | -054 |
| $44 \cdot 80$ | -668 | $53 \cdot 20$ | -563 | $66 \cdot 80$ | -449 | $80 \cdot 40$ | -373 | 94.00 | -319 | 146.0 | - 205 | 570 | -053 |
| 44.90 | -667 | 53.40 | -56I | 67.00 | $\cdot 447$ | $80 \cdot 60$ | $\cdot 372$ | 94.20 | -318 | 148.0 | - 203 | 580 | -052 |
| $45^{\circ} 00$ | -665 | 53.60 | -559 | 67.20 | $\cdot 446$ | $80 \cdot 80$ | 371 | 94.40 | -318 | 1500 | - 200 | 590 | -05I |
| $45 \cdot 10$ | -664 | 53.80 | -557 | 67.40 | -445 | 8I.00 | $\cdot 370$ | $94 \cdot 60$ | -317 | 152.0 | -197 | 600 | -050 |
| 45.20 | -662 | 54.00 | - 555 | 67.60 | 443 | 81-20 | $\cdot 369$ | 94.80 | -316 | $154{ }^{\circ}$ | -195 | 620 | -048 |
| $45 \cdot 30$ | -661 | 54.20 | -553 | 67.80 | -442 | 81.40 | -368 | $95 \cdot 00$ | -316 | 156.0 | -192 | 640 | -047 |
| 45.40 | -659 | 54.40 | -551 | 68.00 | -441 | $8 \mathrm{I} \cdot 60$ | -367 | 95:20 | -315 | 158.0 | - 190 | 660 | -045 |
| $45 \cdot 50$ | . 658 | 54.60 | -549 | $68 \cdot 20$ | -439 | $8 \mathrm{I} \cdot 80$ | $\cdot 366$ | 95.40 | -314 | $160 \cdot 0$ | -187 | 680 | -044 |
| $45 \cdot 60$ | -657 | 54.80 | -547 | $68 \cdot 40$ | -438 | 82.00 | $\cdot 366$ | 95.60 | -314 | 162.0 | - 185 | 700 | -043 |
| 45\%\% | -655 | 55.00 | -545 | 68.60 | -437 | $82 \cdot 20$ | $\cdot 365$ | 95.80 | -313 | $164^{\circ} 0$ | -183 | 720 | -042 |
| 45.80 | -654 | 55.20 | -543 | 68.80 | -436 | 82.40 | -364 | $96 \cdot 00$ | -312 | $166 \cdot 0$ | -181 | 740 | -041 |
| 45.90 | -652 | 55.40 | -54 I | 69.00 | -434 | 82.60 | -363 | 96.20 | -312 | $168{ }^{\circ}$ | - 179 | 760 | -039 |
| $46 \cdot 00$ | -651 | $55 \cdot 60$ | -539 | 69.20 | -433 | $82 \cdot 80$ | $\cdot 362$ | $96 \cdot 40$ | -3II | 170.0 | - 176 | 780 | -038 |
| 46.10 | -649 | 55.80 | -537 | $69 \cdot 40$ | -432 | $83 \cdot 00$ | $\cdot 361$ | 96.60 | -310 | $172{ }^{\circ} 0$ | -174 | 800 | -037 |
| $46 \cdot 20$ | -648 | 56.00 | -535 | $69 \cdot 60$ | -43I | $83 \cdot 20$ | $\cdot 360$ | $96 \cdot 80$ | -310 | $174{ }^{\circ} 0$ | -172 | 850 | -035 |
| $46 \cdot 30$ | -647 | $56 \cdot 20$ | . 533 | $69 \cdot 80$ | -429 | 8340 | $\cdot 360$ | 97.00 | $\cdot 309$ | $176 \cdot 0$ | -170 | 900 | -033 |
| $46 \cdot 40$ | -645 | 56.40 | -531 | 70.00 | -428 | $83 \cdot 60$ | -359 | $97 \cdot 20$ | -308 | I78.0 | -168 | 950 | -032 |
| $46 \cdot 50$ | -644 | 56.60 | -529 | $70 \cdot 20$ | -427 | 83.80 | $\cdot 358$ | $97 \cdot 40$ | $\cdot 308$ | 180.0 | -167 | 1000 | -030 |
| $46 \cdot 60$ | -643 | $56 \cdot 80$ | -527 | $70 \cdot 40$ | -426 | 84.00 | -357 | 97.60 | $\cdot 307$ | $182^{\circ} 0$ | -165 | 1100 | -027 |
| $46 \cdot 70$ | -641 | 57.00 | -526 | $70 \cdot 60$ | -425 | 84.20 | $\cdot 356$ | $97 \cdot 80$ | $\cdot 307$ | 184*0 | -163 | 1200 | -025 |
| $46 \cdot 80$ | -640 | 57.20 | $\cdot 524$ | 70.80 | -423 | 84.40 | $\cdot 355$ | $98 \cdot 00$ | -306 | 186.0 | -161 | 1300 | .023 |
| $46 \cdot 90$ | . 639 | 57.40 | $\cdot 522$ | 71.00 | $\cdot 422$ | 84.60 | $\cdot 354$ | 98.20 | $\cdot 305$ | 188.0 | - 160 | 1400 | -02I |
| $47 \cdot 00$ | -637 | $57 \cdot 60$ | $\cdot 520$ | 71-20 | -421 | 84.80 | -354 | 98.40 | -305 | 190.0 | - 158 | 1600 | -019 |
| 47.10 | -636 | 57.80 | -518 | 71.40 | $\cdot 420$ | 85.00 | -353 | 98.60 | $\cdot 304$ | 192.0 | -156 | 1800 | -017 |
| 47.20 | .634 | 58.00 | $\cdot 517$ | 71.60 | 419 | 85.20 | $\cdot 352$ | 98.80 | $\cdot 304$ | 194.0 | - I5 5 | 2000 | -OI5 |
| $47 \cdot 30$ | -633 | $58 \cdot 20$ | -515 | $7 \mathrm{I} \cdot 80$ | -417 | 85.40 | $\cdot 351$ | 99.00 | $\cdot 303$ | 19600 | - I53 | 2500 | -OI2 |
| 47.40 | -632 | 58.40 | $\cdot 513$ | 72.00 | -416 | 85.60 | $\cdot 350$ | 99.20 | $\cdot 302$ | 198.0 | -152 | 3000 | -010 |
| $47 \cdot 50$ | -630 | $58 \cdot 60$ | '5II | 72.20 | -415 | $85 \cdot 80$ | -349 | 99.40 | $\cdot 302$ | 2000 | -15C | 3500 | -009 |
| $47 \cdot 60$ | -629 | 58.80 | $\cdot 510$ | 72.40 | -414 | $86 \cdot 00$ | -349 | 99.60 | $\cdot 301$ | $202 \cdot 0$ | -149 | 4000 | -007 |
| 47.70 | -628 | 59.00 | $\cdot 508$ | 72.60 | -413 | $86 \cdot 20$ | -348 | 99.80 | $\cdot 300$ | $204{ }^{\circ}$ | -147 | 4500 | -007 |
| 47.80 | -626 | 59:20 | $\cdot 506$ | 72.80 | -412 | $86 \cdot 40$ | $\cdot 347$ | 100.00 | $\cdot 300$ | $206 \cdot 0$ | -146 | 5000 | .006 |
| 4790 | $\cdot 625$ | 59.40 | $\cdot 504$ | 73.00 | -4II | $86 \cdot 60$ | $\cdot 346$ | 101.00 | $\cdot 297$ | 208.0 | -144 | 6000 | -005 |

ERROR IN LATITUDE DUE TO AN ERROR OF 4 SECS．IN TIME OR 1＇OF LONGITUDE．

| -边年等 | LATITUDES． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $0{ }^{\circ}$ | $5^{\circ}$ | $10^{\circ}$ | $15^{\circ}$ | $18^{\circ}$ | $20^{\circ}$ | $22^{\circ}$ | $24^{\circ}$ | $26^{\circ}$ | $28^{\circ}$ | $30^{\circ}$ | $32^{\circ}$ | $34^{\circ}$ | $36^{\circ}$ | $38^{\circ}$ | $40^{\circ}$ |
| $\stackrel{\circ}{2}$ | －03 | －03 | ． 03 | ． 03 | ． 03 | －03 | ． 03 | $\cdot 03$ | －03 | ． 03 | 03 | －03 | －03 | $\cdot 03$ | 03 |  |
| 4 | ． 07 | $\cdot 07$ | ． 07 | －07 | ．07 | ． 07 | ．06 | －06 | ．06 | ．06 | ．06 | －06 | －06 | ．06 | ．06 | 5 |
| 6 | $\cdot \mathrm{II}$ | － 10 | －10 | 0 | 10 | － 10 | －10 | － 10 | －09 | －09 | $\cdot 09$ | －09 | －09 | $\cdot 09$ | －08 | －8 |
| 8 | $\cdot 14$ | － 14 | $\cdot 14$ | 4 | 13 | －13 | －13 | －13 | －13 | － 12 | － 12 | － 12 | $\cdot 12$ | －II | － 1 | －ir |
| 10 | －18 | －18 | －17 | －17 | －17 | $\cdot 17$ | － 16 | －16 | －16 | －16 | －15 | － 15 | $\cdot 15$ | －14 | － 14 | 4 |
| 12 | －2I | －21 | $\cdot 21$ | －2I | 20 | － 20 | － | －19 | －19 | －19 | － 18 | －18 | － 18 | －17 | －17 | － 16 |
| 14 | $\cdot 25$ | $\cdot 25$ | － 25 | $\cdot 24$ | － 24 | $\cdot 23$ | $\cdot 23$ | $\cdot 23$ | － 22 | － 22 | 22 | － 21 | －2I | －20 | － 20 | －19 |
| 16 | $\cdot 29$ | $\cdot 29$ | 28 | －28 | $\cdot 27$ | $\cdot 27$ | $\cdot 27$ | $\cdot 26$ | －26 | －25 | 25 | $\cdot 24$ | $\cdot 24$ | $\cdot 23$ | $\cdot 23$ | 22 |
| 18 | $\cdot 32$ | $\cdot 32$ | $\cdot 32$ | 31 | －31 | －31 | $\cdot 30$ | $\cdot 30$ | $\cdot 29$ | $\cdot 29$ | 28 | － 28 | $\cdot 27$ | $\cdot 26$ | $\cdot 26$ | $\cdot 25$ |
| 20 | $\cdot 36$ | $\cdot 36$ | $\cdot 36$ | 35 | 35 | $\cdot 34$ | －34 | $\cdot 33$ | $\cdot 33$ | $\cdot 32$ | $\cdot 32$ | $\cdot 31$ | $\cdot 30$ | $\cdot 29$ | $\cdot 29$ | 8 |
| 22 | $\cdot 40$ | 40 | 40 | $\cdot 39$ | $\cdot 38$ | $\cdot 38$ | $\cdot 37$ | $\cdot 37$ | $\cdot 36$ | $\cdot 36$ | 35 | $\cdot 34$ | $\cdot 33$ | $\cdot 33$ | 32 | $\cdot 31$ |
| 24 | $\cdot 45$ | －44 | 44 | 43 | 42 | $\cdot 42$ | 41 | $\cdot 41$ | 40 | － 39 | 39 | $\cdot 38$ | $\cdot 37$ | $\cdot 36$ | $\cdot 35$ | －34 |
| 26 | －49 | －49 | $\cdot 48$ | $\cdot 47$ | －46 | $\cdot 46$ | 45 | $\cdot 45$ | －44 | －43 | 42 | $\cdot 41$ | 40 | $\cdot 39$ | $\cdot 38$ | $\cdot 37$ |
| 28 | $\cdot 53$ | $\cdot 53$ | $\cdot 52$ | －51 | $\cdot 51$ | － 50 | －49 | －49 | $\cdot 48$ | －47 | －46 | $\cdot 45$ | －48 | 43 | ${ }^{-42}$ | $\cdot 41$ |
| 30 | $\cdot 58$ | $\cdot 58$ | $\cdot 57$ | $\cdot 56$ | －55 | $\cdot 54$ | －54 | －53 | $\cdot 52$ | －51 | $\cdot 50$ | －49 | 48 | 47 | $\cdot 45$ | 44 |
| 32 | ． 62 | －62 | ． 62 | 60 | －59 | $\cdot 59$ | $\cdot 58$ | 57 | $\cdot 56$ | －5 | $\cdot 54$ | 53 | －52 | －5x | －49 | 48 |
| 34 | $\cdot 67$ | $\cdot 67$ | $\cdot 66$ | ． 65 | －64 | ． 63 | －63 | －62 | ． 61 | －60 | － 58 | $\cdot 57$ | － 56 | $\cdot 55$ | $\cdot 53$ | $\cdot 52$ |
| 36 | $\cdot 73$ | $\cdot 72$ | $\cdot 72$ | $\cdot 70$ | －69 | －68 | $\cdot 67$ | － 66 | $\cdot 65$ | －64 | ． 63 | －62 | －60 | － 59 | $\cdot 57$ | $\cdot 56$ |
| 38 | $\cdot 78$ | $\cdot 78$ | －77 | $\cdot 75$ | $\cdot 74$ | $\cdot 73$ | $\cdot 72$ | $\cdot 71$ | $\cdot 70$ | $\cdot 69$ | $\cdot 68$ | $\cdot 66$ | $\cdot 65$ | －63 | －62 | 60 |
| 40 | $\cdot 84$ | － 84 | －83 | －81 | $\cdot 80$ | $\cdot 79$ | $\cdot 78$ | $\cdot 77$ | $\cdot 75$ | ＇74 | $\cdot 73$ | $\cdot 71$ | $\cdot 70$ | $\cdot 68$ | $\cdot 66$ | 64 |
| 41 | $\cdot 87$ | $\cdot 87$ | 86 | ． 84 | －83 | － 82 | 8 r | $\cdot 79$ | $\cdot 78$ | ． 77 | $\cdot 75$ | $\cdot 74$ | $\cdot 72$ | $\cdot 70$ | $\cdot 69$ | 67 |
| 42 | －90 | －90 | －89 | ． 87 | $\cdot 86$ | －85 | －83 | ． 82 | －81 | $\cdot 79$ | $\cdot 78$ | $\cdot 76$ | $\cdot 75$ | $\cdot 73$ | $\cdot 71$ | 69 |
| 43 | $\cdot 93$ | －93 | －92 | －90 | $\cdot 89$ | $\cdot 88$ | －86 | －85 | $\cdot 84$ | ． 82 | －81 | $\cdot 79$ | $\cdot 77$ | $\cdot 75$ | $\cdot 73$ | 71 |
| 44 | －97 | －96 | 95 | －93 | $\cdot 92$ | 91 | －90 | －88 | $\cdot 87$ | －85 | －84 | －82 | －80 | $\bullet 78$ | $\cdot 76$ | 74 |
| 45 | 1．00 | $1 \cdot 00$ | －98 | －97 | $\cdot 95$ | ＇94 | －93 | －91 | ＇90 | ． 8 | $\cdot 87$ | －85 | －83 | 81 | －79 | $\cdot 77$ |
| 46 | $\underline{1}$ | r．03 | 02 | 00 | $\cdot 98$ | －97 | $\cdot 96$ | －95 | －93 | $\cdot 91$ | $\cdot 90$ | ． 88 | $\cdot 86$ | $\cdot 84$ | ． 82 | 79 |
| 47 | 1.07 | $1 \cdot 07$ | I．06 | I－04 | I．02 | I．OI | －99 | －98 | －96 | ＇95 | －93 | －91 | －89 | $\cdot 87$ | －88 | $\cdot 82$ |
| 48 | I－11 | I－II | I．09 | $1 \cdot 07$ | I．06 | I．04 | 1.03 | I．OI | I．00 | $\cdot 98$ | $\cdot 96$ | －94 | $\cdot 92$ | $\cdot 90$ | －88 | － 85 |
| 49 | I．15 | $1 \cdot 15$ | $1 \cdot 13$ | $1 \cdot 11$ | 1．09 | I．08 | 1.07 | I．05 | I．03 | I．02 | 1．00 | －98 | $\cdot 95$ | $\cdot 93$ | －91 | －88 |
| 50 | I－19 | 1－19 | 1．17 | 1．15 | I＇13 | $1 \cdot 12$ | $1 \cdot 10$ | I．09 | $1 \cdot 07$ | 1.05 | $1 \cdot 03$ | $1 \cdot 01$ | ＇99 | $\cdot 96$ | －94 | 91 |
| 51 | 1.23 | 1.23 | 1.22 | 1－19 | 1.17 | 1•16 | I•14 | 1.13 | 11 | 1.09 | 1.07 | 1.05 | 102 | 1.00 | －97 | 95 |
| 52 | 1.28 | I 28 | I．26 | 1.24 | 1.22 | I 20 | I•19 | $1 \cdot 17$ | $1 \cdot 15$ | I－13 | I－II | 1．09 | 1．06 | 104 | r－01 | $\cdot 98$ |
| 53 | 1．33 | 1.32 | 1.31 | 1.28 | I－26 | 1.25 | 1.23 | 1.21 | $1 \cdot 19$ | $1 \cdot 17$ | 1－15 | I－13 | I•10 | 1.07 | ros | 102 |
| 54 | 1.38 | $1 \cdot 38$ | I 36 | $1 \cdot 33$ | 1.31 | 1.29 | 1.28 | 26 | 1.24 | 1.22 | I． 19 | I． 17 | I－14 | I．II | 1.08 | 1.05 |
| 55 | 1.43 | 1.42 | I．4 | I． $3^{8}$ | I．36 | I．34 | $1 \cdot 32$ | 1.30 | I－28 | 1.26 | 1－24 | 1－21 | I－18 | I•16 | I－13 | 1.09 |
| 56 | 1.48 | 1.48 | 1.46 | 143 | 1.41 | I．39 | $1 \cdot 37$ | I．35 | 1.33 | I．3I | I 28 | I 26 | 1.23 | 1． 20 | ${ }_{1} 17$ | I•14 |
| 57 | $1 \cdot 54$ | 1．53 | I． 52 | I－49 | I． 46 | 1.45 | 1.43 | 1.41 | I 38 | I 36 | I 33 | I．3I | I．28 | 1.25 | 1．21 | 118 |
| 58 | $\underline{1} 60$ |  | I．58 | I 55 | I．52 | I 50 | 1.48 | I 46 | 1.44 | I． 41 | I 39 | I． 36 | 1.33 | I 29 | I 26 | 1.23 |
| 59 60 | I．66 1．73 | 1.66 I 73 | 1.64 1.71 | 1.61 1.67 |  | 1．56 I 63 | 1.54 1.61 | 1.52 1.58 | 1.50 1.56 | I．47 | 1.44 1.50 | 1.41 1.47 | 1.38 1.44 | 1.35 1.40 | I．31 1．36 | 1.27 1.33 |
| 60 | 1.73 | I＇73 | 1．71 | 1．67 | 1．65 | I．63 | I．61 | 1．58 | x 56 | 1－53 | 1.50 | 147 | 144 | 1.40 | 1．36 | $1 \cdot 33$ |
| 61 | 1.80 | 1.80 | 1.78 | $1 \cdot 74$ | 1．72 | I・ワI | 1.67 | I． 65 | 1． 62 | 1－59 | 1．56 | 1．53 | 1.50 | 1.46 | 1.42 | $1 \cdot 38$ |
| 62 | 1．88 | 1．87 | 1.85 | I－82 | 1•79 | 1・フ7 | $1 \cdot 74$ | 1•72 | 1．69 | I－66 | I． 63 | I 59 | I． 56 | I 52 | 1.48 | $1 \cdot 44$ |
| 63 | I．96 | 1.95 | 1.93 | I－90 | 1．87 | I． 84 | 1.82 | r．79 | I．76 | I•3 | r 70 | I． 66 | I－63 | I－59 | I 55 | 1.50 |
| 64 | 2.05 | 2.04 | 2.02 | I－98 | I．95 | $1 \cdot 93$ | 1.90 | 1．87 | I． 84 | I．81 | I．78 | I•74 | I•70 | I． 66 | I．62 | 1.57 |
| 65 | $2 \cdot 14$ | $2 \cdot 14$ | $2 \cdot 11$ | $2 \cdot 07$ | 2.04 | 2.02 | 1－99 | 1．96 | I．93 | 1－89 | I． 86 | 1．82 | $1 \cdot 78$ | 1．74 | I．69 | $1 \cdot 64$ |
| 66 | $2 \cdot 25$ | $2 \cdot 24$ | $2 \cdot 21$ | $2 \cdot 17$ | $2 \cdot 14$ | $2 \cdot 11$ | 2.08 | $2 \cdot 05$ | 2.02 | I． 98 | 1．95 | 1.90 | I 86 | 1.82 | 1．77 | 1．72 |
| 67 | $2 \cdot 36$ | $2 \cdot 35$ | $2 \cdot 32$ | 2.28 | 2.24 | $2 \cdot 2 \mathrm{I}$ | $2 \cdot 18$ | $2 \cdot 15$ | $2 \cdot 12$ | $2 \cdot 08$ | 2.04 | 2.00 | I．95 | 1．91 | 1.86 | 1.80 |
| 68 | 2.48 | 2.47 | 2.44 | $2 \cdot 39$ | $2 \cdot 35$ | 2.33 | $2 \cdot 30$ | $2 \cdot 26$ | $2 \cdot 22$ | 2－19 | $2 \cdot 14$ | $2 \cdot 10$ | $2 \cdot 05$ | 2.00 | 1．95 | 1．90 |
| 69 | 2.61 | $2 \cdot 59$ | $2 \cdot 57$ | $2 \cdot 52$ | $2 \cdot 48$ | 2.45 | 2.42 | $2 \cdot 38$ | $2 \cdot 34$ | $2 \cdot 30$ | $2 \cdot 26$ | 2.21 | $2 \cdot 16$ | 2.11 | $2 \cdot 05$ | $2 \cdot 00$ |
| 70 | $2 \cdot 75$ | $2 \cdot 74$ | 2.71 | $2 \cdot 65$ | $2 \cdot 61$ | 2.58 | $2 \cdot 55$ | 2.51 | 2.47 | 2.43 | $2 \cdot 38$ | $2 \cdot 33$ | $2 \cdot 28$ | 2.22 | $2 \cdot 16$ | 2－10 |
| 71 | 2.90 | 2.89 | 2.86 | 2.81 | $2 \cdot 76$ | 2.73 | 2.69 | 2.65 | 2．61 | $2 \cdot 56$ | 2.51 | $2 \cdot 46$ | 2.41 | $2 \cdot 35$ | 2.29 | 2.22 |
| 72 | 3.08 | 3.07 | 3.03 | 2.97 | $2 \cdot 93$ | 2.89 | 2.85 | 2.85 | 2.77 | $2 \cdot 72$ | 2.67 | 2.61 | $2 \cdot 55$ | 249 | 2.43 | $2 \cdot 36$ |
| 73 | 3.27 | $3 \cdot 26$ | 3.22 | 3．16 | 3．11 | 3.07 | 3.03 | $2 \cdot 99$ | 2.94 | $2 \cdot 89$ | 2.83 | $2 \cdot 77$ | $2 \cdot 71$ | $2 \cdot 65$ | $2 \cdot 58$ | $2 \cdot 51$ |
| 74 | 3.48 | 3.47 | 3.43 | 3.37 | $3 \cdot 32$ | 3.28 | 3.23 | $3 \cdot 19$ | $3 \cdot 13$ $3 \cdot 35$ | $3 \cdot 08$ | 3.02 3.23 | 2.96 3.16 | $2 \cdot 89$ | 2.82 3.02 | 2.75 2.94 | 2.67 2.86 |
| 75 | $3 \cdot 73$ | $3 \cdot 72$ | 3.68 | $3 \cdot 60$ | $3 \cdot 55$ | 3.51 | 3.46 | 3.4 I | $3 \cdot 35$ | $3 \cdot 30$ | 3.23 | $3 \cdot 16$ | $3 \cdot 09$ | 3.02 | $2 \cdot 94$ | $2 \cdot 86$ |
| 76 | 4.01 | 4.00 | $3 \cdot 95$ | 3.87 | 3．81 | 3.77 | 3.72 | 3.66 | 3.60 | 3.54 | 3.47 | $3 \cdot 40$ | 3.33 | 3.24 | $3 \cdot 16$ | 3.07 |
| 77 | $4 \cdot 33$ | 4.31 | 4.27 | 4－18 | $4 \cdot 12$ | 4.07 | 4.02 | 3.96 | $3 \cdot 89$ | $3 \cdot 82$ | 3.75 | 3.67 | $3 \cdot 59$ | 3.50 | 3.41 | $3 \cdot 32$ |
| 78 | 4.70 | $4 \cdot 69$ | 4.63 | 4.54 | 4.47 | 4.42 | $4 \cdot 36$ | $4 \cdot 30$ | 4.23 | $4 \cdot 15$ | 4.07 | 3.99 | $3 \cdot 90$ | 3．81 | 3.71 | 3.60 |
| 79 | $5 \cdot 14$ | $5 \cdot 12$ | 5.07 | 4.97 | $4 \cdot 89$ | 4.83 | $4 \cdot 77$ | $4 \cdot 70$ | $4 \cdot 62$ | 4.54 | $4 \cdot 46$ | 4.36 | 4.27 | 4．16 | 4.05 | $3 \cdot 94$ |
| 80 | $5 \cdot 67$ | $5 \cdot 65$ | $5 \cdot 59$ | $5 \cdot 48$ | 5•39 | $5 \cdot 33$ | $5 \cdot 26$ | $5 \cdot 18$ | $5 \cdot 10$ | 5 | 4.91 | $4 \cdot 81$ | 4．70 | $4 \cdot 59$ | 4.47 | $4 \cdot 34$ |
| 81 | $6 \cdot 31$ | $6 \cdot 29$ | $6 \cdot 22$ | $6 \cdot 10$ | $6 \cdot 00$ |  |  |  |  |  |  | $5 \cdot 35$ | 5.23 | $5 \cdot 11$ | 4.97 | $4 \cdot 84$ |
| 82 | $7 \cdot 12$ | $7 \cdot 09$ | 7.01 | 6.87 | $6 \cdot 77$ | $6 \cdot 69$ | $6 \cdot 60$ | $6 \cdot 50$ | 6.40 | $6 \cdot 28$ | $6 \cdot 16$ | $6 \cdot 03$ | $5 \cdot 90$ | $5 \cdot 76$ 6.59 | $5 \cdot 61$ | 5.45 |
| 83 | $8 \cdot 14$ | $8 \cdot 11$ | 8.02 | $7 \cdot 86$ | $7 \cdot 74$ | 7.65 |  |  |  | $7 \cdot 19$ | $7 \cdot 05$ | 6.91 | $6 \cdot 75$ | $6 \cdot 59$ | 6.42 7.50 | $6 \cdot 24$ 7.29 |
| 84 | 9.51 | $9 \cdot 48$ | 9．37 | $9 \cdot 19$ | 9．05 | 8.94 | 8．82 | 8.69 | $8 \cdot 55$ | 8.40 | 8.24 | 8.07 0.69 | 7.89 0.4 | $7 \cdot 70$ 0.24 | 7.50 0.01 | 7.29 8.75 |
| 85 | 1143 | 11．38 | II－25 | II．04 | 10.87 | $10 \cdot 74$ | 10.60 | $10 \cdot 4$ | 10.27 | $10 \cdot 09$ | 9.90 | $9 \cdot 69$ | $9 \cdot 48$ | 9.24 | $9 \cdot 01$ | $8 \cdot 75$ |

ERROR IN LATITUDE DUE TO AN ERROR OF 4 SECS. IN TIME OR $1^{\prime}$ OF LONGITUDE.

| , | LATITUDES. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| < ${ }_{E}$ | $42^{\circ}$ | $44^{\circ}$ | $46^{\circ}$ | $48^{\circ}$ | $49^{\circ}$ | $50^{\circ}$ | $51^{\circ}$ | $52^{\circ}$ | $53^{\circ}$ | $54^{\circ}$ | $55^{\circ}$ | $56^{\circ}$ | $57^{\circ}$ | $58^{\circ}$ | $59^{\circ}$ | $60^{\circ}$ |
| 2 | $\cdot 03$ | $\cdot 03$ | . 02 | . 02 | . 02 | $\bigcirc$ | $\cdot 02$ | $\bigcirc$ | ${ }^{\circ} \mathrm{O}$ | ${ }^{\circ} \mathrm{O} 2$ | .02 | -2 | $\therefore 2$ | $\therefore$ | . 02 | $\therefore 2$ |
| 4 | $\cdot 05$ | .05 | -05 | . 05 | $\cdot 05$ | $\cdot 04$ | $\cdot 04$ | -04 | . 04 | $\cdot 04$ | $\cdot 04$ | $\cdot 04$ | . 04 | $\cdot 04$ | $\cdot 04$ | -03 |
| 6 | -08 | . 08 | $\cdot 07$ | $\cdot 07$ | $\cdot 07$ | $\cdot 07$ | $\cdot 07$ | .06 | .06 | -06 | .06 | -06 | -06 | -06 | $\bullet 05$ | $\cdot 05$ |
| 8 | - 10 | $\cdot 10$ | - 10 | -09 | -09 | $\bullet 9$ | -99 | $\cdot 09$ | -08 | $\bullet 08$ | $\cdot 08$ | -08 | -08 | $\cdot 07$ | $\cdot 07$ | $\cdot 07$ |
| 10 | - 13 | -13 | 12 | $\cdot 12$ | $\cdot 12$ | -II | 'II | - II | -II | -10 | -10 | - 10 | -10 | -09 | $\cdot 09$ | $\cdot 09$ |
| 12 | -16 | '15 | 'I5 | '14 | - 14 | $\cdot 14$ | -13 | $\cdot 13$ | -13 | $\cdot 12$ | - 12 | 12 | - 12 | -11 | -11 | - II |
| 14 | -19 | -18 | -17 | - 17 | -16 | -16 | -16 | -15 | $\cdot 15$ | $\cdot 15$ | - 14 | - 14 | -14 | - 13 | -13 | $\cdot 12$ |
| 16 | $\cdot 21$ | -21 | - 20 | - 19 | - 19 | -18 | - 18 | -18 | -17 | -17 | - 16 | -16 | - 16 | - 15 | -15 | $\cdot 14$ |
| 18 | $\cdot 24$ | $\cdot 23$ | $\cdot 23$ | $\cdot 22$ | $\cdot 21$ | 21 | 20 | $\cdot 20$ | - 20 | - 19 | -19 | - 18 | - 18 | - 17 | $\cdot 17$ | -16 |
| 20 | . 27 | $\cdot 26$ | $\cdot 25$ | - 24 | $\cdot 24$ | - 23 | - 23 | -22 | - 22 | $\cdot 21$ | $\cdot 21$ | - 20 | -20 | -19 | -19 | 18 |
| 22 | $\cdot 30$ | - 29 | - 28 | $\cdot 27$ | -27 | $\cdot 26$ | 25 | $\cdot 25$ | - 24 | $\cdot 24$ | $\cdot 23$ | $\cdot 23$ | $\cdot 22$ | - 21 | 21 | 20 |
| 24 | $\cdot 33$ | 32 | -31 | $\cdot 30$ | $\cdot 29$ | - 29 | . 28 | $\cdot 27$ | $\cdot 27$ | $\cdot 26$ | $\cdot 26$ | $\cdot 25$ | $\cdot 24$ | $\cdot 24$ | $\cdot 23$ | $\cdot 22$ |
| 26 | $\cdot 36$ | $\cdot 35$ | $\cdot 34$ | -33 | $\cdot 32$ | -31 | $\cdot 31$ | $\cdot 30$ | - 29 | $\cdot 29$ | $\cdot 28$ | $\cdot 27$ | $\cdot 27$ | $\cdot 26$ | $\cdot 25$ | $\cdot 24$ |
| 28 | -40 | $\cdot 38$ | $\cdot 37$ | $\cdot 36$ $\cdot$ $\cdot 39$ | - 35 | -34 | -33 | -33 | -32 | $\cdot 31$ | -30 | -30 | - 29 | $\cdot 28$ $\cdot 31$ | - 27 | -27 |
| 30 | -43 | ${ }^{42}$ | 40 | -39 | ${ }^{38}$ | $\cdot 37$ | $\cdot 36$ | ${ }^{3} 3$ | $\cdot 35$ | -34 | 33 | ${ }^{32}$ | $\cdot 31$ | 31 | '30 | 29 |
| 32 | $\cdot 46$ | 45 | -43 | 42 | 4 4 | $\cdot 40$ | $\cdot 39$ | -38 | $\cdot 38$ | $\cdot 37$ | 36 | $\cdot 35$ | $\cdot 34$ | $\cdot 33$ | $\cdot 32$ | 31 |
| 34 | $\cdot 50$ | - 49 | - 47 | 45 | $\cdot 44$ | $\cdot 43$ | -42 | ${ }^{-42}$ | $\cdot 41$ | -40 | $\cdot 39$ | - 38 | $\cdot 37$ | $\cdot 36$ | $\cdot 35$ | 34 |
| 36 | -54 | - 52 | $\cdot 50$ | $\cdot 49$ | - 48 | -47 | $\cdot 46$ | -45 | $\cdot 44$ | $\cdot 43$ | $\cdot 42$ | -4 4 | -40 | $\bullet 39$ | $\cdot 37$ | 36 |
| 38 40 | - 58 | - 60 | -54 | -52 | $\stackrel{.51}{\cdot 5}$ | - 50 | -49 | - 48 | ${ }_{-51} \cdot \mathbf{4 7}$ | $\stackrel{46}{ } \cdot 4$ | $\cdot 48$ | 44 $\cdot 47$ | $\begin{array}{r}4 \\ \hline 46 \\ \hline 4\end{array}$ | $\stackrel{41}{4}$ | -40 | -39 |
| 41 | . 65 | . 63 | -60 | $\cdot 58$ | - 57 | -56 | $\cdot 55$ | -54 | $\cdot 52$ | $\cdot 51$ | $\cdot 50$ | -49 | $\cdot 47$ | $\cdot 46$ | $\cdot 45$ | 43 |
| 42 | $\cdot 67$ | $\cdot 65$ | -63 | . 60 | 59 | - 58 | . 57 | $\cdot 55$ | $\cdot 54$ | $\cdot 53$ | $\cdot 52$ | $\cdot 50$ | $\cdot 49$ | 48 | 46 | $\cdot 45$ |
| 43 | $\cdot 69$ | $\cdot 67$ | -65 | -62 | $\cdot 61$ | -60 | $\cdot 59$ | - 57 | - 56 | - 55 | -53 | $\cdot 52$ | $\cdot 51$ | -49 | $\cdot 48$ | $\cdot 47$ |
| 44 | $\cdot 72$ | -69 | $\cdot 67$ | $\cdot 65$ | -63 | -62 | -61 | - 59 | - 58 | $\cdot 57$ | $\cdot 55$ | $\cdot 54$ | $\cdot 53$ | $\cdot 51$ | $\cdot 50$ | -48 |
| 45 | $\cdot 74$ | $\cdot 72$ | $\cdot 69$ | $\cdot 67$ | -66 | $\cdot 64$ | $\cdot 63$ | $\cdot 62$ | $\cdot 60$ | -59 | $\cdot 57$ | $\cdot 56$ | -54 | -53 | -52 | $\cdot 50$ |
| 46 | $\cdot 77$ | $\cdot 74$ | $\cdot 72$ | $\cdot 69$ | 68 | $\cdot 67$ | $\cdot 65$ | -64 | - 62 | -61 | $\cdot 59$ | $\cdot 58$ | $\cdot 56$ | -55 | 53 | $\cdot 52$ |
| 47 | -80 | $\cdot 77$ | $\cdot 74$ | $\cdot 72$ | $\cdot 7$ | $\cdot 69$ | . 67 | -66 | - 65 | . 63 | $\cdot 62$ | -60 | $\cdot 58$ | $\cdot 57$ | - 55 | $\cdot 54$ |
| 48 | . 83 | -80 | $\cdot 77$ | $\cdot 74$ | $\cdot 73$ | $\cdot 71$ | $\cdot 70$ | $\cdot 68$ | $\cdot 67$ | . 65 | . 64 | . 62 | -60 | $\cdot 59$ | $\cdot 57$ | 56 |
| 49 50 | .85 .89 | . 83 | .80 | .77 .80 | -75 | -74 | -72 | $\cdot 71$ $\cdot 73$ | $\cdot \cdot 69$ | $\cdot 78$ | . 68 | .64 .67 | -63 | .61 | -59 | . 58 |
| 51 | *92 | $\cdot 89$ | . 86 | - 83 | -81 | -79 | $\cdot 78$ | $\cdot 76$ | $\cdot 74$ | -73 | $\cdot 71$ | -69 | $\cdot 67$ | $\cdot 65$ | -64 | $\cdot 62$ |
| 52 | -95 | $\cdot 92$ | -89 | - 86 | $\cdot 84$ | - 82 | .81 | $\cdot 79$ | $\cdot 77$ | $\cdot 75$ | $\cdot 73$ | $\cdot 72$ | $\cdot 70$ | $\cdot 68$ | - 66 | $\cdot 64$ |
| 53 | -99 | -95 | -92 | -89 | $\cdot 87$ | $\cdot 85$ | $\cdot 84$ | $\cdot 82$ | -80 | $\cdot 78$ | $\cdot 76$ | $\cdot 74$ | $\cdot 72$ | $\cdot 70$ | $\cdot 68$ | $\cdot 66$ |
| 54 | 1.02 | -99 | -96 | -92 | -90 | -88 | -87 | $\cdot 85$ | $\cdot 83$ | -81 | -79 | $\cdot 77$ | $\cdot 75$ | $\cdot 73$ | $\cdot 71$ | $\cdot 69$ |
| 55 | I.06 | 1-03 | -99 | -96 | -94 | $\cdot 92$ | -90 | $\cdot 88$ | -86 | -84 | -82 | -80 | $\cdot 78$ | -76 | $\cdot 74$ | $\cdot 71$ |
| 56 | I•10 | 1.07 | 1.03 | -99 | -97 | -95 | -93 | $\cdot 91$ | -89 | - 87 | -85 | . 83 | . 81 | $\cdot 79$ | $\cdot 76$ | $\cdot 74$ |
| 57 | I-14 | I-II | 1.07 | I-03 | I•OI | $\cdot 99$ | -97 | -95 | -93 | -91 | $\cdot 88$ | -86 | $\cdot 84$ | - 82 | $\cdot 79$ | $\cdot 77$ |
| 58 | I•9 | I 15 | I•II | I-07 | 1.05 | I.03 | I•01 | $\bullet 99$ | -96 | -94 | -92 | $\cdot 89$ | $\cdot 87$ | $\cdot 85$ | -82 | -80 |
| 59 | I. 24 | 1.20 | I•16 | I•II | 1.09 | I.07 | 1.05 | 1.02 | $1 \cdot 00$ | -98 | $\cdot 95$ | $\cdot 93$ | $\cdot 91$ | $\cdot 88$ | -86 | -83 |
| 60 | 1-29 | $1 \cdot 25$ | 1.20 | I•16 | $1 \cdot 14$ | I•II | 1.09 | $1 \cdot 07$ | I.04 | I.02 | -99 | -97 | $\cdot 94$ | -92 | $\cdot 89$ | -87 |
| 61 | 1-34 | 1.30 | 1.25 | I. 21 | 1-18 | I-16 | I-14 | I•II | 1.09 | 1.06 | 1.05 | I-01 | $\cdot 98$ | -96 | -93 | -90 |
| 62 | I.40 | I 35 | I.31 | $1 \cdot 26$ | 1.23 | I21 | 1.18 | I'16 | $1 \cdot 13$ | I-11 | 1.08 | I-05 | I.02 | r $\cdot 00$ | -97 | $\cdot 94$ |
| 63 | 1.46 | I.4I | I-36 | 1.3I | 1.29 | I 26 | I 24 | 1.21 1.26 | I-18 | I. 15 | I•13 | 1-10 | r.07 | I-04 | I•01 | $\cdot 98$ |
| 64 | I. 52 | 1.47 | I. 42 | $1 \cdot 37$ | $1 \cdot 34$ | I.32 | I. 29 | I.26 | 1.23 | 1.21 | 1.18 | $1 \cdot 15$ | 2 | I•09 | 1.06 | 1-03 |
| 65 | 1.59 | I-54 | $1 \cdot 49$ | 143 | 1.41 | $1 \cdot 38$ | I 35 | $1 \cdot 32$ | 129 | 1.26 | 1.23 | 1.20 | 1-17 | I•14 | I-10 | $1 \cdot 07$ |
| 66 | 1.67 | 1.62 | 1.56 | 1.50 | 1.47 | 1.44 | 1.41 | 1-38 | 1.35 | $1 \cdot 32$ | 1.29 | I-26 | 1.22 | I•19 | I•16 | I•12 |
| 67 | 1.75 | 1.69 | 1.64 | I-58 | I 55 | I.5I | 1.48 | $1 \cdot 45$ | 1-42 | 1.38 | 1-35 | 1.32 | 1.28 | I 25 | I 21 | I-18 |
| 68 | $1 \cdot 84$ | I•78 | 1.72 | I•66 | 1.62 | I 59 | I. 56 | I. 52 | I-49 | 1.45 | 1.42 | $1 \cdot 38$ | I. 35 | $1 \cdot 31$ | $1 \cdot 27$ | I. 24 |
| 69 | I. 94 | I. 87 | $\underline{1} \mathrm{Pr}$ | I•74 | I.71 | 1.67 | I. 64 | I. 60 | 1.57 | $1 \cdot 53$ | I 49 | I-46 | I 42 | 1.38 | 1-34 | I-30 |
| 70 | $2 \cdot 04$ | I-98 | 1.91 | I-84 | I.80 | $1 \cdot 77$ | I•73 | 1.69 | 1.65 | 1.6I | 1.58 | $1 \cdot 54$ | I 50 | I 46 | 1.41 | 1.37 |
| 71 | 2.16 | 2.09 | $2 \cdot 02$ | $1 \cdot 94$ | 1.91 | 1.87 | 1.83 | 1•79 | 1.75 | 1-71 | 1.67 | 1.62 | 1.58 | 154 | 1.50 | 1.45 |
| 72 | 2.29 | 2.21 | $2 \cdot 14$ | $2 \cdot 06$ | $2 \cdot 02$ | r-98 | I•94 | 1.89 | 1.85 | I-81 | 1.77 | 1.72 | 1.68 | I. 63 | 159 | I-54 |
| 73 | 2.43 | 2.35 | 2.27 | 2.19 | $2 \cdot 15$ | 2-10 | $2 \cdot 06$ | 2.01 | 1-97 | I.92 | I. 88 | 1.83 | 1.78 | I•73 | 1-68 | I. 64 |
| 74 | $2 \cdot 59$ | 2.51 | 2.42 | $2 \cdot 33$ | 2.29 | $2 \cdot 24$ | $2 \cdot 19$ | $2 \cdot 15$ | 2-10 | $2 \cdot 05$ | $2 \cdot 00$ | I•95 | I.90 | I-85 | 1.80 | I• 74 |
| 75 | $2 \cdot 77$ | $2 \cdot 68$ | 2.59 | $2 \cdot 50$ | 2.45 | $2 \cdot 40$ | $2 \cdot 35$ | $2 \cdot 30$ | $2 \cdot 25$ | $2 \cdot 19$ | $2 \cdot 14$ | $2 \cdot 09$ | $2 \cdot 03$ | I-98 | $1 \cdot 92$ | 1.87 |
| 76 | $2 \cdot 98$ | 289 | 2.79 | $2 \cdot 68$ | 2.63 | $2 \cdot 58$ | 2.52 | 2.47 | 2.41 | $2 \cdot 36$ | 2.30 | 2.24 | $2 \cdot 18$ | $2 \cdot 13$ | $2 \cdot 07$ | $2 \cdot 01$ |
| 77 | 3.22 | 3.12 3.38 | 3.01 | 2.90 | $2 \cdot 84$ | 2.78 | $2 \cdot 73$ | 2.67 | 2.61 | 2.55 | 2.48 | 2.42 | $2 \cdot 36$ | $2 \cdot 30$ | $2 \cdot 23$ | 2.17 |
| 78 | 3.50 3.82 | 3.38 | 3.27 | $3 \cdot 15$ | 3.09 | 3.02 | $2 \cdot 96$ | 2.90 | $2 \cdot 83$ | 2.77 | $2 \cdot 70$ | $2 \cdot 63$ | 2.56 | $2 \cdot 49$ | 2.42 | $2 \cdot 35$ |
| 79 | 3.82 | $3 \cdot 70$ | 3.57 | 3.44 | 3.38 | $3 \cdot 31$ | 3.24 | 3.17 | $3 \cdot 10$ | $3 \cdot 02$ | $2 \cdot 95$ | $2 \cdot 88$ | 2.80 | $2 \cdot 73$ | $2 \cdot 65$ | $2 \cdot 57$ |
| 80 | 4.21 | 4.08 | 3.94 | $3 \cdot 79$ | $3 \cdot 72$ | $3 \cdot 65$ | 3.57 | 3.49 | $3 \cdot 41$ | 3.33 | 3.25 | $3 \cdot 17$ | 3.09 | 3.01 | $2 \cdot 92$ | $2 \cdot 84$ |
| 81 | $4 \cdot 69$ | 4.54 | 4.39 | 4.22 | $4 \cdot 14$ | 4.06 | 3.97 | 3.89 | $3 \cdot 80$ | 3.71 | 3.62 | 3.53 | 3.44 | 3.35 | 3.25 | $3 \cdot 16$ |
| 82 83 83 | 5.29 6.05 | $5 \cdot 12$ 5.86 | 4.94 5.66 | 4.76 | 4.67 5.34 | 4.57 5.23 | 4.48 5.12 | $4 \cdot 38$ $5 \cdot 01$ | $4 \cdot 28$ | 4.18 | 4.08 | 3.98 | 3.87 | $3 \cdot 77$ | $3 \cdot 66$ | $3 \cdot 56$ |
| 83 84 8 | $7 \cdot 05$ | 5.86 6.84 | 5.66 | 5.45 6.37 | 5.34 6.24 | $5 \cdot 23$ $6 \cdot 12$ | $5 \cdot 12$ $5 \cdot 99$ | $5 \cdot 01$ 5.86 | 4.90 | 4.79 5.59 | $4 \cdot 67$ | 4.55 | 4.43 | $4 \cdot 31$ | $4 \cdot 19$ | 4.07 |
| 84 85 | 7.07 8.49 | 6.8 8.22 | 7.94 | $6 \cdot 37$ $7 \cdot 65$ | 6.24 $7 \cdot 50$ | 6.12 7 | 5•99 | $5 \cdot 8$ $7 \times 04$ | 5.73 6.88 | 5.59 6.72 | 5.46 6.56 | 5.32 6.39 | $5 \cdot 18$ 6.22 | 5.04 6.06 | 4.90 5.89 | 4.76 5.71 |

THE MEAN PLACES OF 108 OF THE BRIGHTEST STARS IN ORDER OF RIGHT ASCENSION FOR 1st JANUARY 1914.

| Star's Name. |  | Mag. | Right <br> Ascension. | Annual Change. | Declination. | Annual Change. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| a Andromedx | .. (Alpheratz) | 2.I | $\begin{array}{cccc}\text { H. } \\ \text { M. } & \text { S. } \\ 0 & 3 & 56.4\end{array}$ | S. +3.09 | N. $2883{ }^{\circ} \mathbf{3} 6$ | +20゙・0 |
| $\beta$ Cassiopeix | ( | $2 \cdot 4$ | - 434.9 | $3 \cdot 12$ | N. 584032 | +20.0 |
| a Phœnicis . . | $\cdots$ | 2.4 | - 2222.2 | $2 \cdot 95$ | S. 424623 | $-20.0$ |
| a Cassiopeiæ | . (Schedar) | Var. | - $3537 \cdot \mathrm{r}$ | $3 \cdot 38$ | N. 56357 | +19.8 |
| $\beta$ Ceti . | . (Deneb Kaitos) | $2 \cdot 2$ | - 3916.4 | $3 \cdot 00$ | S. 182730 | - 19.8 |
| y Cassiopeiæ |  | $2 \cdot 3$ | 0513004 | +3.59 | N. 60 I5 5 | +19.5 |
| $\beta$ Andromedæ | . (Mirach) | 2.4 | I 454.7 | 3.34 | N. 35953 | +19.2 |
| $\delta$ Cassiopeiæ |  | $2 \cdot 8$ | I 20 10\% | 3.86 | N. 594720 | +18.8 |
| a Ursæ Minoris | . (Polaris) | $2 \cdot 1$ | I 28 47.1 | 28.26 | N. 885048 | + 18.6 |
| a Eridani .. | .. (Achernar) | $0 \cdot 5$ | $13430 \cdot 7$ | $2 \cdot 23$ | S. 574025 | -18.4 |
| $\beta$ Arietis |  | 2.7 | 149 53.I | $+3.30$ | N. 202317 | + 778 |
| $\boldsymbol{y}^{1}$ Andromedæ | .. (Almach) | $2 \cdot 3$ | I 5836.8 | + 3.67 | N. 4155 | +17.4 |
| a Arietis | . (Hamel) | $2 \cdot 2$ | 2219.3 | $3 \cdot 36$ | N. $23 \quad 323$ | +17.3 |
| a Ceti | .. (Menkar) | $2 \cdot 8$ | $25746 \cdot 9$ | $3 \cdot 13$ | N. 345 II | $+14.3$ |
| a Persei | .. (Mirfak) | $1 \cdot 9$ | $31810 \cdot 5$ | $4 \cdot 27$ | N. 493322 | $+13.0$ |
| a Tauri | .. (Aldebaran) | I•I | 430 59*0 | $+3.44$ | N. 162014 | $+7 \cdot 6$ |
| a Aurigæ .- | . (Capella) | $0 \cdot 2$ | 5 10 $20 \cdot 0$ | $4 \cdot 42$ | N. 455442 | + 4.3 |
| $\beta$ Orionis | .. (Rigel) | $0 \cdot 3$ | 5 10 24.2 | $2 \cdot 88$ | S. 8181 | -4.3 |
| $\gamma$ Orionis | .. (Bellatrix) | $1 \cdot 7$ | $52031 \cdot 1$ | $3 \cdot 22$ | N. 61621 | +3.4 |
| $\boldsymbol{\beta}$ Tauri | . (Nath) | I. 8 | $52051 \cdot 3$ | 3•79 | N. 28329 | + 3.4 |
| a Leporis .. |  | $2 \cdot 7$ | $52856 \cdot 2$ | $+2.65$ | S. 175259 | - 2.7 |
| ${ }^{\text {e }}$ Orionis | . ( Alnilam) | I• 7 | $53150 \cdot 9$ | 3.04 | S. $\quad 1 \begin{array}{lll}15 & 22\end{array}$ | - 2.5 |
| $\zeta$ Orionis . | .. (rst*) | $2 \cdot 0$ | $53625 \cdot 1$ | $3 \cdot 03$ | S. $\quad 15915$ | - 2.1 |
| ${ }^{\text {a }}$ Columbæ | . ${ }^{\text {(Phact) }}$ ( | $2 \cdot 7$ | $53632 \cdot \mathrm{I}$ | $2 \cdot 17$ | S. 34710 | $2 \cdot 0$ |
| $\kappa$ Orionis | .. (Saiph) | $2 \cdot 2$ | $54340 \%$ | $2 \cdot 84$ | S. 94158 | - 1.4 |
| ${ }_{\alpha}$ Orionis | .. (Betelguese) | Var. | $550 \quad 30 \cdot 9$ | +3.25 | N. 72331 | + 0.8 |
| $\beta$ Aurige | . (Menkalinan) | $2 \cdot 1$ | 515313.3 | 4.4 I | N. 445623 | + 0.6 |
| $\theta$ Aurigæ | .. .. | $2 \cdot 7$ | $5535 \mathrm{I} \cdot 4$ | $4 \cdot 09$ | N. 371227 | + 0.5 |
| ${ }^{\beta}$ Canis Majoris |  | $2 \cdot 0$ | 61854.7 | $2 \cdot 64$ | S. 175445 | +1.7 |
| a Argus .. | .. (Canopus) | - $1 \cdot 0$ | $622 \quad 2 \cdot 6$ | I.33 | S. 523854 | + 1.9 |
| $\gamma$ Geminorum | .. (Alhena) | r.9 | 63244.7 | $+3.46$ | N. 162825 | $-2.9$ |
| a Canis Majoris | . . (Sirius) | - $1 \cdot 4$ | $64121 \cdot 3$ | $2 \cdot 68$ | S. I6 3552 | + 3.6 |
| $\tau$ Argus $\quad$. |  | $2 \cdot 8$ | $64748 \cdot 1$ |  | S. 503044 | + 4.2 |
| - Canis Majoris | .. (Adara) | I. 6 | 65514.7 | $2 \cdot 36$ | S. 285116 | + 4.8 |
| $\delta$ Canis Majoris | .. .. | $2 \cdot 0$ | $7 \quad 453 \cdot 6$ | $2 \cdot 44$ | S. 26 I5 22 | $+5.6$ |
| $\pi$ Argus | $\cdots \quad$. | $2 \cdot$ | 7146.3 | +2.12 | S. 365634 | $+6.4$ |
| $\eta$ Canis Majoris |  | 2.4 | $7204 \mathrm{I} \cdot 6$ | 2.37 | S. 29885 | + 6.9 |
| $a^{2}$ Geminorum | .. (Castor) | 2.0 | 7296.9 | $3 \cdot 85$ | N. 32442 | - 7.6 |
| ${ }^{a}$ Canis Minoris | .. (Procyon) | - 5 | $7344^{8 \cdot 0}$ | $3 \cdot 19$ | N. 52645 | $-8.1$ |
| $\beta$ Geminorum | . (Pollux) | $1 \cdot 2$ | $740 \quad 3.3$ | $3 \cdot 72$ | N. 28145 | $-8.5$ |
| $\zeta$ Argus | . | $2 \cdot 3$ | 8 - 33.7 | +2.II | S. 394538 | +10.1 |
| $\gamma$ Argus | . | $1 \cdot 9$ | $8653 \cdot 0$ | 1.85 | S. 47458 | +10.5 |
| - Argus | .. . | $1 \cdot 7$ | $82045 \cdot$ | 1.24 | S. 591357 | $+1.6$ |
| $\delta$ Argus | . | $2 \cdot 0$ | 84219.5 | 1.66 | S. 542335 | +13.0 |
| $\beta$ Argus . ${ }^{\text {a }}$ | .. . | $1 \cdot 7$ | $91215 \% 7$ | - 70 | S. 692146 | +14.9 |
| - Argus | .. (Tureis) | $2 \cdot 2$ | $91447 \cdot 2$ | +1.6I | S. 585450 | +15.1 |
| $\kappa$ Argus |  | $2 \cdot 6$ | 91926.9 | 1.86 | S. 543836 | +15.3 |
| a Hydre | .. (Alphard) | $2 \cdot 2$ | $92321 \cdot 7$ | $2 \cdot 95$ | S. 8177 | +15.5 |
| a Leonis . | .. (Regulus) | $1 \cdot 3$ | 10 $347 \cdot 6$ | $3 \cdot 22$ | N. 122317 | - 178.5 |
| $\gamma^{1}$ Leonis . ${ }^{\text {a }}$ | . (Algeiba) | $2 \cdot 6$ | 10 1514.0 | 3.29 | N. 201637 | -18.0 |
| $v$ Argus | . | $2 \cdot 8$ | 10434.0 | $+2 \cdot 57$ | S. 485757 | +18.9 |
| ${ }_{\boldsymbol{\beta}}{ }^{\text {a }}$ Urse Majoris |  | $2 \cdot 4$ | $105639 \cdot 7$ | 3.63 | N. 565037 | -19.3 |
| ${ }_{\delta}^{\alpha}$ Ursæ Majoris | .. (Dubhe) | $2 \cdot 0$ | $1058 \quad 25.9$ | $3 \cdot 75$ | N. 621256 | -19.3 |
|  | . ${ }^{\text {a }}$ ( Dosma) ${ }^{\text {Denebola) }}$ | $2 \cdot 6$ $2 \cdot 2$ | $\begin{array}{llrl}\text { II } & 9 & 32 \cdot 2 \\ \text { II } & 44 & 40.5\end{array}$ | $3 \cdot 18$ $3 \cdot 10$ |  | -19.6 -20.0 |

THE MEAN PLACES OF 108 OF THE BRIGHTEST STARS-continued.


Nore.-In this table + means add, and - means subtract.
In the column headed "Mag." the adopted unit of brightness is designated $r \cdot 0$. The magnitudes of stars are determined to tenths of a magnitude with reference to this adopted unit : thus the value $-1 \cdot 4$ for Sirius indicates that that star is 2.4 magnitudes brighter than the unit: the value 0.3 for Arcturus indicates that that star is seven-tenths of a magnitude brighter than the unit.

## APPROXIMATE APPARENT TIMES OF THE MERIDIAN PASSAGES OF THE PRINCIPAL FIXED STARS AT GREENWICH ON THE FIRST DAY OF EACH MONTH, 1910.


$\dagger \mathrm{N}$. or $\dagger \mathrm{S}$. - These times relate to the Meridian Passages of Circumpolar Stars at the Inferior Transit, N. or S. denoting the

## approximate apparent times of the meridian passages of the principal FIXED STARS AT GREENWICH ON THE FIRST DAY OF EACH MONTH, 1910-contd.

|  | Nam | Ma | J | Feb. | Mar. |  | y. |  | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| †S. |  |  | H. | M. | H. M. | H. M. | H. M. | H. M. | H. M. | . M. | H. M. | H. M | H. M. | M. |
|  | a Gruis | $1 \cdot 9$ | 15 | I3 | II 14 | 921 | 730 | 528 | 324 |  | 2320 | 2132 | 1936 | I7 33 |
|  | $R$ | $1 \cdot 3$ | I5 16 | I3 4 | II 16 | 922 | 731 | 529 | 325 | 20 | 2321 | 2133 | 1937 | 17 34 |
|  | $\gamma^{1}$ Leonis | $2 \cdot 5$ | 1528 | 13161 | 1127 | 934 | 743 | 540 | $\begin{array}{lll}3 & 36\end{array}$ | I 32 | $23 \quad 32$ | 2 I 44 | 1949 | 1745 |
|  | $\boldsymbol{\beta}$ Gruis | $2 \cdot 1$ | 1550 | I3 38 | II 49 | 956 | 85 | $6 \quad 2$ | $\begin{array}{ll}3 & 59\end{array}$ | I 54 | 2355 | 22 | 20 II | 187 |
|  | $\mu$ Argus | $2 \cdot 8$ | 1555 | I3 44 | I 551 | IO I | 8 10 | 68 | 44 | I 59 | 04 | 22122 | 2016 | 18 I3 |
|  | $\beta$ Ursa |  |  | 13 |  | 1015 |  |  |  | 213 |  |  | 2030 | 1826 |
|  | Du | $2 \cdot$ | 16 II | I3 59 | 12 Io | 1017 | 826 | 623 | 419 | 215 | - I9 | 2228 | 2032 | $18 \quad 28$ |
|  | $\delta$ Leonis | $2 \cdot 6$ | 1622 | I4 10 | 12211 | 1028 | 837 | 634 | 30 | 226 | - 30 | 2239 | 2043 | 1839 |
|  | $\beta$ Leonis | 2.2 | 16 57 | 144511 | 1256 | II 3 | 912 | $\begin{array}{ll} 7 & 9 \end{array}$ | 5 |  | 5 | 2314 | 2118 | 1914 |
|  | $\gamma$ Ursæ Maj | $2 \cdot 5$ | 17 | 14501 | 13 |  | 9 16 | 714 | 510 |  | 1 I | 2318 | 2122 | I9 19 |
| +N. | $\delta$ |  |  | I5 4 | 13 | II | 931 | 729 |  | 320 |  | 23 | 137 | I9 33 |
|  | $\gamma$ | $2 \cdot 7$ | 17 | 15 I2 1 | 13231 | II 29 | 938 | 736 | 532 |  | 132 | 2340 | 2 I 44 | I9 41 |
|  | $a^{1}$ Cruc |  |  | 15221 | I3 33 I | II 40 | 949 | 746 | 543 | 338 | I 42 | 2351 | 2155 | 1951 |
|  | $\gamma$ Crucis | 1.6 | 1738 |  | 13381 | II 44 | 953 | 7 51 | 547 | 343 | I 47 | 2355 | 2159 | 1956 |
|  | $\gamma$ Centau | 2.4 | 1749 | 15 3711 | $134^{8}$ I | II 551I |  | 8 | 5 57 | 353 | 157 |  | 22 10 |  |
|  | $\beta$ |  |  | 15431 | 1354 |  |  |  |  |  |  |  |  | 2012 |
|  | - Ursæ Majoris |  |  | 15001 | 1421 |  | 1017 | 8 I5 |  |  | 2 II | O 23 | 23 | 2019 |
|  | $\gamma$ Cassiopeiæ | $2 \cdot 3$ | 183 | $15 \quad 521$ | $143$ |  | 1018 | 8 16 | 612 |  | 212 | - 24 | 24 | 2021 |
|  | ${ }_{5}^{1}$ Ursæ |  | $18 \quad 32$ | I6 211 | 143211 | 1238 | 1047 | 845 | 641 | 437 | 24 I | - 53 | 53 | 2050 |
|  | Spica | I- | I8 33 | I6 21 1 | 1432 | 12391 | IO 48 | 845 | 64 I | 437 | 241 | - 53 | 253 | $20 \quad 50$ |
| $+\mathbf{N}$ |  |  |  |  |  |  | 1053 |  |  | 443 |  |  |  | 2057 |
|  | Achernar |  | 1846 | I6 351 | 1446 |  |  | 859 | 655 | 45 I | 255 |  |  |  |
|  | - Centauri | $2 \cdot 6$ | 1846 | I6 341 | 14461 | 1252 | II | 859 | 655 | 450 | 255 |  | 23 7 | 214 |
|  | $\eta$ Ursæ Majoris | $1 \cdot 9$ | 1856 | I6 441 | 1455 | $13 \quad 21$ | II II | 96 | $7 \quad 5$ | 5 0 | 34 | I 17 | 2317 | 2113 |
|  | 5 Centauri | 2.8 | 192 | 16501 |  | 13.81 | II 17 | 915 | 711 | 56 | 310 | 122 | 2323 | 2119 |
|  | $\beta$ |  |  | 1 |  |  |  |  |  | 514 |  |  | 2330 | 2 L 27 |
|  | $\theta$ |  |  | 1781 | 15 I3 | 13191 | 1128 | 926 | 722 | 517 | 322 | I 34 | 2334 | 2131 |
|  | A | $0 \cdot 3$ | 19 23 | 17121 | 15231 | 1330 | I I 39 | 936 | $7 \quad 32$ | 528 | $3 \quad 32$ | 144 | 2344 | 2141 |
|  | $\eta$ Ce | $2 \cdot 7$ | 1942 | 17301 | 15411 | 1348 | 1157 | 954 | 750 | 546 | 350 |  |  | 2159 |
|  | $a^{2}$ Centauri | I• | 1945 | I7 34 | 1545 | 1351 | 120 | 958 | 754 | 550 | 354 |  |  | 223 |
| +N. |  |  |  |  |  |  | 12 |  |  |  |  |  |  | 225 |
|  | $\varepsilon^{2}$ Boötis |  |  | 1741 | 15521 | 1359 |  | 106 | $8 \quad 2$ | 557 |  | 213 | - 18 | 22 10 |
|  | $\beta$ Ursæ Minoris | $2 \cdot 2$ | $20 \quad 3$ | 1751 | 1621 | I4 9 | 1218 | IO 15 | 8 I2 | 67 | 4 II | 223 | - 28 | $22 \quad 20$ |
|  | $\beta$ Lup | $2 \cdot 7$ | $20 \quad 4$ | I7 53 | $16 \quad 4$ | 14101 | 12 I9 | 10 I7 | 8 I3 |  | 4 I3 | 225 | - 29 | 2222 |
|  | a Persei | $1 \cdot 9$ | 2030 | 18181 | 16 29\|1 | 14361 | 1245 | ro 42 | 838 | 634 | 438 | 250 | - 55 | 2247 |
|  |  |  |  | 183 I |  |  |  | 1055 | 85 I |  |  |  |  |  |
|  | a Serpe | $2 \cdot 8$ | 2051 | 1840 | 1651 |  |  | II 4 | 90 | 656 |  | 3 I 2 | 16 |  |
|  | $\delta$ |  | 217 | I8 55 | 1761 | 15131 | 1322 | II I9 | 9 I5 | 711 | 515 | 327 | I 32 | 2324 |
|  | $\beta^{\mathfrak{l}} \text { Scorp }$ | $2 \cdot 7$ | 2112 | 19 O 1 | 17 II 1 | 1518 | 1327 | II 24 | 921 | 716 | 520 | 332 | I 37 | 2329 |
|  | Anta | $1 \cdot 3$ | 2135 | I9 24 | 17351 | 1542 | 1350 | II 48 | 944 | 740 | 544 | 356 | 20 | 2353 |
| $\dagger$ N. | ऽ Ophiuchi .. <br> a Tri. Australis <br> - Scorpii <br> $\eta$ Ophiuchi <br> Capella <br> $\beta$ Aræ <br> $\lambda$ Scorpii <br> a Ophiuchi <br> - Scorpii <br> $\kappa$ Scorpii |  |  |  |  |  |  |  |  |  |  |  | $\begin{array}{lr}2 & 9 \\ 2 & 16\end{array}$ | $\begin{array}{ll}0 & 5 \\ 0 & 12\end{array}$ |
|  |  |  |  | I9 39 | 1750 | 15 57 |  |  | 959 |  |  |  | 2 I6 | $\bigcirc 12$ |
|  |  |  | 2156 | 1944 |  |  |  |  |  |  |  |  |  |  |
|  |  | 0.2 | 22 II | 20 IO | 1821 | 1628 | 1436 | I2 24 | 10 30 | 826 | 630 | 442 | 246 | - 43 |
|  |  |  |  | 20 | 1829 | 1635 | 1444 | 1242 | 10 38 | 833 |  |  |  |  |
|  |  | I. 8 | 2239 | 2027 | 18381 | 16451 | 1454 | 1252 | Io $4^{8}$ | 843 | 647 | 5 O | 34 | 1 |
|  |  |  | 2242 | 20301 | 18421 | 16481 | 1457 | 1255 | Io 5 I | 846 | 65 I |  | 37 |  |
|  |  | $2 \cdot 0$ | 2242 | 203011 | 18421 | $164^{8} 1$ | 1457 | I.: 55 | 1051 | 846 | 651 | 53 | 37 |  |
|  |  | $2 \cdot 6$ | 2248 | 20361 | 18471 | 16541 | 153 | 130 | 1056 | 852 | 656 |  | 313 |  |
| ¢N. | $\beta$ Auri |  | 23 | 20 | 194 | 17 IOI | 15 I9 | 1317 | 1113 | 98 | $\begin{array}{ll}7 & 13\end{array}$ | 525 | 329 | 26 |
|  | $\gamma$ Draconis | 2.4 | 236 | 2054 | 19 S | 17121 | I5 2I | 1318 | 1115 | 9 IO | 7 I4 | 526 | 3 II | 28 |
|  | e Sagittarii | I.9 | $23 \quad 29$ | 21181 | I9 29 I | 17361 | 1544 | 1342 | II 38 | 934 | 738 | 550 | 354 | 151 |
|  | Canopus | $-\mathrm{I} \cdot 0$ | 2333 | 2 I 2 I | 19331 | I7 391 | 1548 | 1346 | 1142 | 937 | 742 | 554 | 358 | I 54 |
|  | Vega | $0 \cdot 1$ | 2345 | 2133 | I9 44 I | I7 51 | 16 | 13581 | 1154 | 949 | 753 | 66 | 4 IO | 27 |
| tS. | $\tau$ | 2.8 | 03 |  | 1958 | 18 | 16 I 4 | 14 II |  |  |  | 620 |  | 221 |
|  | $\sigma$ Sagittari |  | 05 | 21492 | 2001 | 187 | 16 I 6 | 1413 | 12 IO | 105 |  | 622 | 426 | 223 |
|  | $\zeta$ Sagit | $2 \cdot 7$ | - I2 | 21562 | 2071 | 18 I4 | 16231 | 14211 | 1217 | IO 12 | 8 16 | 629 | 433 | 230 |
|  | Altair | $0 \cdot 9$ |  | 22462 | 20571 | 193 | 17121 | 15 IO 1 | 136 | II |  | $\begin{array}{lll}7 & 18 \\ 7 & 38\end{array}$ | 522 | 319 |
| tS. | $\gamma$ Argus | 1.9 | I 22 | $23 \quad 62$ | 21171 | 1924 | 17331 | 153011 | 1326 | II 22 | 926 | 738 | 543 | 339 |

$\dagger \mathrm{N}$. or $\dagger \mathrm{S}$.-These times relate to the Meridian Passages of Circumpolar Stars at the Inferior Transit, N. or S. denoting the Declination of the Star.

## APPROXIMATE APPARENT TIMES OF THE MERIDIAN PASSAGES OF THE PRINCIPAL FIXED STARS AT GREENWICH ON THE FIRST DAY OF EACH MONTH, 1910-contd.

|  | Name. | Mag. | Jan. | Feb. | Mar. | April | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | a Pavon | $2 \cdot 0$ | 33 | H. M. | H. M. | 1936 | 1744 | H. M. | 8 | II | 9 | H. M. | H. M. | H. M. |
|  | $\gamma$ Cygni | $2 \cdot 3$ | 134 | 2318 | 2129 | 1936 | 1745 | 1542 | $2{ }^{1} 239$ | II 3 | 9 38 <br> 9 38 | 7 7 7 7 7 | $\begin{array}{lll}5 & 54 \\ 5 & 55\end{array}$ |  |
|  | - Argus | $1 \cdot 7$ | I 36 | 2320 | 21311 | 1938 | 1747 | 1544 | I3 40 | II 36 | 940 | 752 | 556 | 353 |
|  | a Cygni | $1 \cdot 3$ | I 54 | 2337 | 21491 | 1955 |  | 16 | 1358 | II 53 | 958 | 8 10 | 614 | 412 |
|  | $\delta$ Argus | 2.0 | 57 | 234 I | 21531 | 1959 |  |  |  | II 57 |  | 814 | 6 I8 | 415 |
|  | - Cygni | $2 \cdot 6$ | I 58 | 2342 | 2153 |  | 18 |  |  | II 58 | 10 | 8 I 4 | 618 | 415 |
| tS. | $\beta$ Argus | $1 \cdot 7$ | 227 | O 15 | 2222 | $20 \quad 29$ | 1888 | 1636 | 11432 | 1227 | IO 31 | 844 | 648 | 445 |
| tS. | $\checkmark$ Argus | $2 \cdot 2$ | 230 | - 18 | 22.25 | 2032 | 1840 | ${ }^{16} 38$ | 1434 | 1230 | Io 34 | 8 | 650 | 447 |
|  | a Cephei | $2 \cdot 6$ | 231 234 | - | 22272 | 20 33 | 118 <br> 18 <br> 18 | I6 40 | $1 \begin{array}{ll}14 & 36 \\ 1\end{array}$ | 1231 | 10 36 | 848 | 652 | 449 |
| tS | $\kappa$ Argus | 2.6 | 234 | - 22 | 2230 | 2036 | 1845 | I6 43 | 1439 | 1234 | IO 38 | 851 | 655 | 452 |
|  | - Pegasi |  | 255 |  | 22 | 2057 | 19 | 17 | 1459 | 1255 | 10 |  |  | 2 |
|  |  | 1.9 | 317 |  | 2313 | 2119 | 1928 | 1726 | 1522 | 1317 | II | 934 | 738 | 35 |
|  | $\beta$ Gruis | $2 \cdot 1$ | 352 | I 40 | 2347 | 2154 |  | 18 o | 1556 | 1352 | II 56 | Io | 812 | 6 10 |
|  | Fomalhaut | 1.3 | 47 | I 55 | - 6 | 229 | 2018 | 1816 | 1612 | 147 | 1212 | 1024 | 828 | 625 |
|  | $\beta$ Ursæ Majo | $2 \cdot 4$ | 4 II | I 59 | 10 | 2213 | 2022 | 18 19 | 1616 | I4 II | 1215 | IO 28 | 832 | 629 |
|  | Dubhe | 2.0 | 13 | 2 I | 012 | 2215 | 2024 | 1821 | 11617 | 1413 |  | 1029 | 834 | 630 |
|  | a Pegasi . ${ }^{\text {a }}$ | $2 \cdot 6$ | 415 |  | O 14 | 22 I 7 | 2026 | 1823 | 1619 | 1415 | 1219 | 10 31 | 836 | 632 |
|  | $\gamma$ Ursæ Majoris |  | 5 | 252 | 3 | 236 | 6215 | 1912 | 2178 | 154 | 138 | 1120 | 924 | 721 |
| $+S .$ | $\delta$ Centauri <br> $\gamma$ Centauri | 2.8 | 518 | 36 | 117 | 2320 | 2129 | 1927 | I7 23 | 1518 | 1322 | II 35 | 939 |  |
|  | $\gamma$ C | 2.4 | 5 51 | 339 | 50 | 2353 | 222 | 1959 | 1755 | 1551 | 1355 | 127 |  |  |
|  | e Centauri | $2 \cdot 6$ |  | 36 | 247 |  | 2259 | 2057 | 1853 |  | 1453 |  |  |  |
|  | ${ }^{\text {a }}$ Lupi | 2.5 | 750 |  |  |  |  | 2158 | 1954 | 1750 |  |  | 12 II | 10 7 |
|  | ${ }^{\beta}$ Aræ | 2.7 | $\begin{array}{cc}10 & 31 \\ \text { II } \\ 8\end{array}$ | $\begin{array}{ll}8 & 19 \\ 8 & 56\end{array}$ | 30 | 37 |  | o 44 | 42236 | 2031 | 1836 | 1648 | 1452 | 1249 |
|  | $\gamma{ }^{\gamma}$ Draconis | $2 \cdot 4$ | II | 856 |  |  | 323 | 120 | 2312 |  | 1912 | 1725 | 1529 | I3 25 |
|  | Cep | 2.6 | 1429 | 12 I7 | O 28 |  | 644 | 442 | 238 | 33 | 2234 | 2046 | 1850 | 1647 |
| +S. | $\beta$ Cassiopeir | 2.4 | 1717 | $15 \quad 5$ | 1316 | I1 23 | 932 | 729 | 9 525 | 32 I | 25 | 2334 | 2138 | 1934 |
|  | ${ }_{\beta}{ }^{\text {a }}$ Phœnicis | 2.4 | 1734 | 1522 | 1333 | II 40 | 949 |  | 543 | $3{ }^{3} 8$ | 142 | 23 51 | 2155 | 1952 |
|  | ${ }_{\delta}^{\beta}$ Andro | 2.4 | 1817 | I6 5 | 14 I 6 | 1223 | 1032 | 829 | ) 625 | 42 I | 225 | - 37 | 2238 | 2034 |
| +N. | $\gamma^{1}$ Andromeda |  |  | 1620 | 1431 | 12 138 | I |  | $\begin{array}{ll}6 & 41 \\ 7 \\ 7\end{array}$ | 436 | 240 | 53 |  |  |

$\dagger \mathrm{N}$. or $\dagger \mathrm{S}$. - These times relate to the Meridian Passage of Circumpolar Stars at the Inferior Transit, N. or S. denoting the Declination of the Star.

CORRECTION OF THE TIMES IN THE PRECEDING TABLE FOR THE DAY OF THE MONTH
(to be subtracted).

| Days. | Jan. | Feb. | Mar. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | $\begin{array}{cc}\text { H. } & \text { M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. } & \text { M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. } & \text { M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. } & \text { M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. } & \text { M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. } & \text { M. } \\ \text { O } & \end{array}$ | $\begin{array}{cc}\text { H. } & \text { M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. M. } \\ \text { O } & \text { o }\end{array}$ | $\begin{array}{cc}\text { H. M. } \\ \text { O } & \text { O }\end{array}$ | $\begin{array}{cc}\text { H. } & \text { M. } \\ \text { O } & \text { O }\end{array}$ |
| 2 | - 4 | - 4 | - 4 | O 4 | - 4 | O 4 | O 4 | - 4 | 04 | 04 | O 4 | O 4 |
| 3 | - 9 | - 8 | 07 | - 7 | - 8 | O 8 | - 8 | - 8 | 07 | 07 | - 8 | - 9 |
| 4 | $\bigcirc 13$ | - 12 | 0 II | O II | 0 II | 012 | 012 | - 12 | 0 II | 0 II | 012 | - 13 |
| 5 | - 18 | - 16 | 015 | 015 | O 15 | - 16 | - 16 | - 15 | $\bigcirc \mathrm{I}_{4}$ | - I5 | - 16 | - 17 |
| 6 | 022 | 020 | 0 I9 | - 18 | 0 I9 | 021 | 021 | O I9 | - 18 | - 18 | O 20 | O 22 |
| 7 | O 26 | O 24 | - 22 | - 22 | - 23 | O 25 | O 25 | - 23 | O 22 | - 22 | - 24 | - 26 |
| 8 | - 30 | - 28 | - 26 | - 26 | - 27 | - 29 | - 29 | 027 | - 25 | - 25 | - 28 | - 30 |
| 9 | - 35 | - 32 | - 30 | - 29 | - 30 | - 33 | - 33 | 031 | - 29 | - 29 | - 32 | - 35 |
| 10 | - 39 | - 36 | - 33 | - 33 | - 35 | - 37 | - 37 | - 35 | - 32 | - 33 | - 36 | - 39 |
| II | $\bigcirc 43$ | 040 | 037 | - 36 | - 39 | 04 I | 041 | - 38 | - 36 | O 37 | 040 | 044 |
| 12 | - 48 | - 44 | o 41 | - 40 | - 42 | O 45 | O 45 | - 42 | - 40 | - 40 | - 44 | - 48 |
| 13 | - 52 | - 48 | O 44 | O 44 | - 46 | - 49 | - 49 | O 46 | - 43 | O 44 | - 48 | - 52 |
| 14 | - 56 | - 52 | - 48 | - 48 | - 50 | - 54 | - 53 | - 50 | - 47 | O 48 | - 52 | - 57 |
| 15 |  | - 56 | - 52 | - 51 | - 54 | - 58 | - 57 | - 53 | - 50 | 051 | - 56 | I I |
| 16 |  | 10 | - 55 | - 55 | - 58 | I 2 |  | - 57 | O 54 | - 55 | 10 | I 6 |
| 17 |  | I 3 | - 59 | - 59 | 12 | I 6 | 15 | 1 | - 58 | - 59 | I 4 | 110 |
| 18 | I 13 | 17 | I 2 | 12 | I 6 | 110 | I 9 | I 5 | 11 | 13 | I 9 | 115 |
| 19 | 188 | I II | I 6 | I 6 | 1 IO | I 14 | 1 I | I 8 | I 5 | I 6 | 1 I 3 | 19 |
| 20 | I 22 | I 15 | I 10 | 110 | I 14 | 119 | 117 | I 12 | I 8 | 110 | 117 | I 24 |
| 21 | I 26 | I 19 | 114 | 113 | 1 I 8 | I 23 | 121 | I 16 | 112 | 1 I 4 | 121 | I 28 |
| 22 | I 31 | I 23 | 117 | 117 | I 22 | I 27 | I 25 | 119 | I 16 | 118 | I 25 | I 32 |
| 23 | I 35 | I 26 | 121 | I 21 | I 26. | 131 | I 29 | I 23 | I 19 | 121 | I 30 | I 37 |
| 24 | I 39 | I 30 | $\begin{array}{ll}1 & 24 \\ \text { I } & 28\end{array}$ | I 25 | I 30 | I 35 | I 33 | I 27 | I 23 | I 25 | $\begin{array}{ll}\text { I } 34 \\ \text { I } & 38\end{array}$ | I 41 |
| 25 | I 43 | I 34 | I 28 | I 28 | I 34 | I 39 | I 37 | I 31 | I 26 | 129 | I 38 | I 46 |
| 26 | I 47 | I 38 | I 32 | I 32 | I 38 | I 44 | 141 | I 34 | 130 | I 33 | I 42 | I 50 |
| 27 | I 51 | I 42 | I 35 | I 36 | I 42 | 1 48 | I 45 | I 38 | I 34 | 137 | I 47 | I 55 |
| 28 | I 56 | I 45 | I 39 | I 40 | I 46 | I 52 | I 49 | I 42 | I 37 | 141 | I 51 | I 59 |
| 29 30 |  | . | I 43 | I 44 | I 50 | I 56 | I 53 | I 45 | I 41 | I 44 | I 55 | 2 2 |
| 30 31 | $\begin{array}{ll}2 & 4 \\ 2 & 8\end{array}$ |  | 1 1 I 1 | I 47 | 1 I 55 I 59 |  | 1 5 <br> 1 57 <br>   | $\begin{array}{ll}1 & 49 \\ \text { I } & 52\end{array}$ | I 44 | $\begin{array}{ll}1 & 48 \\ \text { I } & 52\end{array}$ | I 59 | $\begin{array}{rr}2 & 8 \\ 2 & 12\end{array}$ |



[^2]Note.-The bearings $\left\{\begin{array}{l}\text { N.E. } \\ \text { S.E. }\end{array}\right\}$ N.W. S.$\}$ etc., mean that the Star will be in the N.E., N.W., etc., quadrant before and after Meridian Passage. If the declination of Star is South of observer's latitude, the Star will of course bear South when passing the Meridian, and North when declination is North of observer.

REDUCIION TO THE MERIDIAN TABLE FOR * POLARIS, YEAR 1915.

AT HOUR-ANGLES FROM UPPER MERIDIAN.
Add Reduction to obtain Meridian Altitude.


Annual Variation.

|  |
| :---: |
| $0^{\circ} \mathrm{OI}$ |
| O.OI |
| 0.02 |
| $0 \cdot 02$ |
| 0.03 |
| 0.03 |
| 0.04 |
| 0.05 |
| 0.05 |
| 0.07 |
| 0.07 |
| 0.08 |
| 0.09 |
| O.IO |
| O'II |
| O. 12 |
| $0 \cdot 13$ |
| $0^{\circ} \mathrm{I} 4$ |
| O-15 |
| $0 \cdot 16$ |
| $0 \cdot 17$ |
| 0.19 |
| $0 \cdot 20$ |
| 0.21 |
| 0.22 |
| 0.24 |
| 0.25 |
| 0.26 |
| 0.28 |
| $0 \cdot 29$ |
| $0 \cdot 31$ |

AT HOUR-ANGLES FROM LOWER MERIDIAN.
Subtract Reduction to obtain Meridian Altitude.

|  | LATITUDES. |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $10^{\circ}$ | $20^{\circ}$ | $80^{\circ}$ | $40^{\circ}$ | $50^{\circ}$ | $60^{\circ}$ |
| H. M. |  | - ${ }^{\text {a }}$ |  | - ${ }^{\prime}$ | - 0.1 |  |
| 010 | $0 \cdot \mathrm{I}$ | $\cdot \mathrm{I}$ | $0 \cdot 1$ | - 1 | I |  |
|  | $0 \cdot 3$ | 0.3 | $0 \cdot 3$ | - 3 | 3 | 3 |
| 30 | 0.6 | $0 \cdot 6$ | $0 \cdot 6$ | $0 \cdot 6$ | $0 \cdot 6$ | 6 |
| 40 | I.0 | I-0 | 1.0 | r ${ }^{\circ}$ | I-0 |  |
| 50 | 6 | 6 | 1.6 | 1.6 | 1.6 | I.6 |
| I 0 | $2 \cdot 3$ | $2 \cdot 3$ | $2 \cdot 3$ | 3 | $2 \cdot 3$ | $2 \cdot 3$ |
| 10 | $3 \cdot 2$ | $3 \cdot 2$ | $3 \cdot 2$ | I | $3 \cdot \mathrm{I}$ | I |
| 20 | 4.I | $4 \cdot 1$ | $4 \cdot \mathrm{I}$ | $4 \cdot \mathrm{I}$ | $4 \cdot 1$ | $4{ }^{\circ}$ |
| 30 | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 2$ | $5 \cdot 1$ | $5 \cdot 1$ |
| 40 | $\stackrel{7}{7} 4$ | $6 \cdot 4$ | $6 \cdot 4$ | $6 \cdot 4$ | $7 \cdot 3$ | $6 \cdot 2$ |
| 50 | $7 \cdot 8$ | $7 \cdot 7$ | $7 \cdot 7$ | $7 \cdot 7$ | 6 | $7 \cdot 5$ |
| II 0 | $9 \cdot 2$ | $9 \cdot 2$ | 9•1 | I | $9 \cdot 0$ | 8.9 |
| 10 | 10.8 | 10.7 | $10 \cdot 7$ | 10 | \% 0.6 | $10 \cdot 5$ |
| 20 | 12.4 | 12.4 | 12.3 | 12.3 | 12.2 | 12.1 |
| 30 | 14.2 | 14.1 | 14.1 | 14.0 | 13.9 | 13.8 |
| 40 | ${ }^{16 \cdot 1}$ | 6.0 | 15.9 | 15.9 | 15.8 | $15 \cdot 6$ |
| 50 | $18 \cdot$ | 18.0 | 17.9 | 17.8 | 17.7 | $\mathrm{r}_{7} \cdot 6$ |
| III o | 20 | 20.0 | $20 \cdot 0$ | 19.9 | 19.8 | $9 \cdot 6$ |
| 10 | $22 \cdot 3$ | 22.2 | 22.1 | $22 \cdot$ | $2 \mathrm{I}^{\circ} 9$ | $21 \cdot 7$ |
| 20 | 24.5 | 24.4 | 24.4 | 24.3 | $24 \cdot 1$ | 23.9 |
| 30 | $26 \cdot 9$ | 26 | $2{ }^{26} 7$ | $26 \cdot 6$ | 26.4 28.9 | . 2 |
| 40 50 | 29.4 <br> 3 r <br> 9 | 29.3 3 I .8 | 29. <br> $3 \mathrm{~F} \cdot 7$ | 29.I | $28 \cdot 9$ | -2 |
|  |  |  | - |  |  |  |
| IV 0 | 34 | $34^{\circ} 4$ | $34 \cdot 3$ | $34^{\circ} 2$ | $34^{\circ} \mathrm{O}$ | 33.7 |
| 10 | $37 \cdot 2$ | $37 \cdot 1$ | $37 \cdot 0$ | $36 \cdot 8$ | $36 \cdot 6$ | $36 \cdot 4$ |
| 20 | $39^{\circ} 9$ | 39.8 | $39 \cdot 6$ | $39 \cdot 5$ | $39 \cdot 3$ | $39^{\circ}$ |
| 30 | $42 \cdot 6$ | $42 \cdot 5$ | $42 \cdot 3$ | $42 \cdot 2$ | 42. | $41 \cdot 7$ |
| 40 | $45 \cdot 4$ | 45.2 | $45 \cdot 1$ | $45^{\circ}$ | $44^{\circ} 7$ | $44^{\circ} 4$ |
| 50 | $48 \cdot 2$ | 48.0 | 47'9 | $47 \cdot 7$ | $47 \cdot 5$ | $47 \cdot 2$ |
| $\nabla$ o | 51.0 | $50 \cdot 9$ | 50. | $50 \cdot 6$ | $50 \cdot 3$ | $50 \cdot 0$ |
| 10. | 53.9 | $53 \cdot 7$ | $53 \cdot 6$ | 53. | 53.2 | $52 \cdot 8$ |
| 20 | 56.8 | 50.6 | $56 \cdot 5$ | $56 \cdot 3$ | 56.1 | $55^{\circ} 7$ |
| 30 | 59.7 | 59.6 | 59.4 | $59 \cdot 3$ | 59.0 |  |
|  | I $2 \cdot 7$ | $2 \cdot 61$ |  |  |  | $\begin{array}{ll}\text { I } & \text { I } 6 \\ \text { I } & 4.6\end{array}$ |
| 50 | I $5 \cdot 7$ | I 5.6 |  |  | 5.0 |  |
| VI OI | I 8.8 I | I $8 \cdot 61$ | I 8.5 | I 8.3 | $8 \cdot 1$ | I 7.7 |

For Azimuths of $\%$ Polaris see page 309.

## Examples in the Use of the above Table.

Example I.-On April 2nd, 1914, at 3 h .30 m. a.m., A.T. Sp. in latitude by D.R. $40^{\circ}$ I5' N., longitude $\mathrm{II}^{\circ} \mathrm{W}$. Required the approximate altitude of $\%$ Polaris for setting the sextant for an observation to obtain the latitude. Height of eye, 42 ft .
н. м.


| Lat' by D.R. $\text { P.D. of } \%$ | $\stackrel{+}{40} \times{ }_{-1}^{\prime} \mathrm{N} .$ | *'s Dl. | $\begin{aligned} & 88 \quad 10.8 \mathrm{~N} . \\ & 90 \quad 0 \% \end{aligned}$ |
| :---: | :---: | :---: | :---: |
| Mer. alt. <br> 42 ft . cor. (p. 4I3) | $\begin{aligned} & 3958 \\ & +\quad 7.5 \end{aligned}$ | P.D. | I $9^{\circ} \mathrm{N}$. |
| Reduction | $\begin{array}{r}3913.3 \\ +\quad 16.8 \\ \hline\end{array}$ |  |  |
| Alt. for sextant | 3930 N. |  |  |

Example 2.-On April 2nd, 1914, at 3 h .35 m. a.m., A.T. Sp. in latitude by D.R. $40^{\circ} 15^{\prime}$ N., longitude $n r^{\circ} \mathrm{W}$. Observed altitude of $*^{\prime}$ Polaris was found to be $39^{\circ} 40^{\circ} \mathrm{N}$. Height of eye, $4^{2} \mathrm{ft}$. Required the latitude.

| Obsd. alt. of $\#$ Eye, 42 ft. (cor. p. 413 ) | 0. <br> 39 <br> -80 |  | Reduction Cor. for year |
| :---: | :---: | :---: | :---: |
| Reduction | 3932.5 $-\quad 177$ | *'s Approx. H.A. (below Pole) 249 gives reduction $17{ }^{\circ} 7$. | True reductio |
| Mer: alt. (below Pole) | 3914.8 |  |  |
| P. dist. in 1914 | I $9^{\circ} 2$ | 长's Sidereal H.A. would be nearly $\frac{7}{2}$ m. greater ; this co may be made from the acceleration table (page 412). | rrection, if req will be nearl |
| Latitude | $4024^{\circ} \mathrm{N}$. | greater for 6 hours. |  |

STAR POLARIS AZIMUTH TABLE FOR YEAR 1915.

| $\begin{aligned} & \text { ※'s Hr. } \\ & \text { Angle. } \end{aligned}$ | LATITUDES. |  |  |  |  |  |  |  |  |  |  | $\begin{aligned} & \text { *'s Hr. } \\ & \text { Angle. } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $0^{\circ}$ | $10^{\circ}$ | $20^{\circ}$ | $30^{\circ}$ | $35^{\circ}$ | $40^{\circ}$ | $45^{\circ}$ | $50^{\circ}$ | $55^{\circ}$ | $60^{\circ}$ | $65^{\circ}$ |  |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |
| H. M. O 0 | $\bigcirc$ | $0 \cdot 0$ | $\bigcirc$ | $0 \cdot 0$ | $0 \cdot 0$ | $0 \cdot 0$ | $0 \cdot 0$ | $0 \cdot 0$ | 00 | $\bigcirc$ | $0 \cdot 0$ | $\begin{array}{lr}\text { H. M. } \\ \text { I2 } & \\ \text { r }\end{array}$ |
| 020 | $0 \cdot 1$ | $0 \cdot 1$ | $0 \cdot 1$ | $0 \cdot 1$ | $0 \cdot 1$ | 0.1 | $0 \cdot 1$ | $0 \cdot 2$ | $0 \cdot 2$ | $0 \cdot 2$ | 0.3 | II 40 |
| 040 | $0 \cdot 2$ | 0.2 | 0.2 | 0.2 | $0 \cdot 2$ | $0 \cdot 3$ | 0.3 | $0 \cdot 3$ | 0.4 | $0 \cdot 4$ | $0 \cdot 5$ | II 20 |
| 10 | 0.3 | $0 \cdot 3$ | $0 \cdot 3$ | $0 \cdot 3$ | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 | $0 \cdot 7$ | II 0 |
| I 20 | 0.4 | $0 \cdot 4$ | $0 \cdot 4$ | $0 \cdot 5$ | 0.5 | $0 \cdot 5$ | 0.6 | 0.6 | 0.7 | 0.8 | $0 \cdot 9$ | 1040 |
| I 40 | $0 \cdot 5$ | $0 \cdot 5$ | 0.5 | 0.6 | 0.6 | 0.6 | $0 \cdot 7$ | 0.8 | 0.8 | I. 0 | I•I | 1020 |
| 20 | 0.6 | 0.6 | 0.6 | $0 \cdot 7$ | 0.7 | 0.7 | 0.8 | 0.9 | I.0 | I. 2 | 1.4 | 100 |
| 220 | 0.7 | 0.7 | $0 \cdot 7$ | 0.8 | 0.8 | 0.9 | 0.9 | I'0 | I•I | I'3 | $5 \cdot 6$ | 940 |
| 240 | $0 \cdot 7$ | 0.8 | 0.8 | 0.9 | 0.9 | I-O | $1 \cdot 0$ | I•I | I•3 | $1 \cdot 5$ | 1•7 | 920 |
| 30 | 0.8 | 0.8 | 0.9 | $0 \cdot 9$ | I'O | I•I | I•I | $1 \cdot 3$ | $1 \cdot 4$ | I. 6 | I•9 | 90 |
| 320 | 0.9 | $0 \cdot 9$ | $0 \cdot 9$ | I-O | I'I | I•I | $1 \cdot 2$ | $1 \cdot 4$ | 1. 5 | I.8 | $2 \cdot 1$ | 840 |
| 340 | $0 \cdot 9$ | I'O | I'0 | I'I | I'I | I-2 | I-3 | $1 \cdot 5$ | I. 6 | I.9 | $2 \cdot 2$ | 820 |
| 40 | 1.0 | I'0 | I'I | I-I | I-2 | I•3 | $1 \cdot 4$ | I. 5 | I'7 | $2 \cdot 0$ | $2 \cdot 4$ | 80 |
| 420 | $1 \cdot 0$ | I•I | I'I | I-2 | $1 \cdot 3$ | $1 \cdot 4$ | I. 5 | 1. 6 | I•8 | $2 \cdot 1$ | $2 \cdot 5$ | 740 |
| 440 | I'I | I•I | I•I | I-2 | I-3 | I.4 | $1 \cdot 5$ | 1•7 | I.9 | $2 \cdot 2$ | $2 \cdot 6$ | 720 |
| 50 | I•I | I•I | I 2 | I-3 | I•3 | $1 \cdot 4$ | I.6 | $1 \cdot 7$ | 1.9 | $2 \cdot 2$ | $2 \cdot 6$ | 70 |
| 520 | I-I | I•I | I-2 | I-3 | I-4 | $1 \cdot 5$ | I. 6 | I.8 | $2 \cdot 0$ | $2 \cdot 3$ | $2 \cdot 7$ | 640 |
| 540 | I'I | I.2 | I-2 | I-3 | I-4 | 1.5 | I. 6 | I. 8 | $2 \cdot 0$ | $2 \cdot 3$ | $2 \cdot 7$ | 620 |
| 60 | I•I | $\mathrm{I} \cdot 2$ | I 2 | I-3 | I 4 | 1.5 | 1.6 | I-8 | $2 \cdot 0$ | $2 \cdot 3$ | $2 \cdot 7$ | 60 |

For the twelve hours before the meridian passage (above the Pole) it is east of north, and for the twelve hours after it is west of north

Diagram to illustrate the Apparent Motion of Star a Ursæ Minoris (Polaris) round the Pole. Declination of Star in 1915, $88^{\circ} 5 \mathrm{I}^{\prime \prime} 6^{\prime \prime} \mathrm{N}$. ; Right Ascension, I h. 29 m . I5s.


| Lat． | ${ }_{4}^{\mathrm{m}}$. | ${ }_{8}^{\text {m．}}$ | $\overline{\mathrm{m} .}$ | $\begin{array}{l\|l\|} \hline 12 \\ 12 \\ 16 \end{array}$ | ${ }_{16}^{\mathrm{m}}$ | ${ }_{20}$ | ${ }_{22}$ | ${ }_{24}^{\text {m．}}$ | ${ }_{26}^{\mathrm{m}}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{30}$. |  | ${ }_{32}$ | ${ }_{34}^{\text {m．}}$ | ${ }_{36}^{\mathrm{m}}$ | ${ }_{38}^{\mathrm{m}}$ | ${ }_{40}^{\mathrm{m}}$ | （ ${ }^{\text {m．}}$ | ${ }_{42}$ | ${ }_{44}^{\mathrm{m}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N．REDUCTIONS． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 28 | $0 \cdot 2$ | x．0 | 2．2 | $2 \cdot 2$ | $4^{\circ}$ | $6 \cdot 2$ | 7.5 | $8 \cdot 9$ | $10 \cdot 5$ | I2＇I |  |  | 15\％8 | 17．9 | $20^{\circ} 0$ | $22 \cdot 3$ |  |  | 27.3 | 29＇9 |
| 24 | 0.3 | r．o | O 2.3 | 2.3 | $4 \cdot 1$ | 6.5 | 78 | $9 \cdot 3$ | 10.9 | 12.7 | 714.5 |  | 16.5 | 18.7 | 20.9 | 23.3 | 25.8 |  | 28.4 | 31．2 |
| 20 16 | 0.3 0.3 | I． |  | $\begin{array}{ll}2.4 \\ 2.5 & 4 \\ 4\end{array}$ | 4.3 4.5 | ${ }_{7} 7.0$ | $8 \cdot 5$ | 10．7 | $\xrightarrow{11.4}$ | 13.2 |  |  | 17．2 | ${ }^{19} 2$ |  | $24 \cdot 3$ | ${ }_{28.0}^{26.9}$ |  | 29．6 | $32 \cdot 5$ 33.8 |
|  |  |  |  |  |  |  | 8.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | 0.3 0.3 | I． | 2.7 | $2 \cdot 6$ 2.7 4 | 4.9 | 76 | $8 \cdot 8$ | ro． 5 | 2．8． | 3 14 <br> 1.3 <br> 14.9 <br> 1  |  |  | 18.7 <br> 19.4 | 21．1 | I $\begin{aligned} & 23 \cdot 6 \\ & 24.6\end{aligned}$ | $27 \cdot 4$ | 29.1 |  | 32.1 33 | 35．2 |
| 4 | 0.3 0.3 | r．3 | 3.2 .9 | 2.9 <br> 3.0 | ${ }_{5}^{5 \cdot 1}$ | 7.9 8.3 | － 9.6 | II．4 | I3．4 | ${ }^{4} 1{ }^{15 \cdot 5}$ | 5 17.8 |  | $20 \cdot 3$ | 22．9 | ${ }^{25 \cdot 6}$ | $2 \cdot 8$ | $3{ }^{1} \cdot 6$ | 6 | $34 \cdot 8$ |  |
| － | $0 \cdot 3$ | 1.3 |  | 3.0 | $5 \cdot 3$ | 8.3 | 10．0 | İ．9 | 14. | － 16.2 | 218.6 |  | 21.2 | 23.9 | $26 \cdot 7$ | 29.8 | $33^{\circ}$ | － $36 \cdot$ | $36 \cdot 3$ | $39 \cdot 9$ |
| 8. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{4}^{4}$ | 0.3 | 1.4 | 5 | 3.15 | $5 \cdot 5$ | $8 \cdot 7$ | $10 \cdot 5$ | 12.5 | 14.6 | －6 17.0 | 019.5 |  | $22 \cdot 1$ | $25^{\circ}$ | $28 \cdot 0$ | I | 34.5 | 5 | 38.0 | 7 |
| 12 | $0 \cdot 4$ | r r － 5 |  | $3 \cdot 3$ <br> $3 \cdot 4$ | 6．${ }^{5 \cdot}$ | ${ }_{9} 9 \cdot 6$ | IT $\begin{aligned} & \text { Ir } \\ & \text { I }\end{aligned}$ | 13． | 15.3 |  | 20 |  | $2{ }^{23.2}$ | 27．5 | 29．3 | 32．4 | 38．0 |  | － | 43．7 |
| 16 | $0 \cdot 4$ | r． 6 | 6 | 3 | 6.5 1 | 10．1 | 12.2 | 14.5 | －1 | I 19.8 | $2 \cdot \%$ |  | $25 \cdot 8$ | $29 \cdot 1$ | $32 \cdot 6$ | $36 \cdot 3$ | $40 \cdot 2$ | 244 | 44.2 | $48 \cdot 5$ |
| 18 | $0 \cdot 4$ | r．7 | 73.8 | $3 \cdot 86$ | 6.7 | ． 4 | 12．6 | 15.0 | 6 | 620.4 | 23 |  | 26.6 | 30．0 | 33.6 | 37.4 | ． 4 |  | 5 | －9 |
| 20 | ${ }^{\circ} \mathrm{O} \cdot 4$ | r 8 |  | 3.96 | 6.9 | $10 \cdot 7$ | 13.0 | 15 |  | I | 24 |  | 27.4 | 30．9 |  |  | $\cdot 7$ |  |  |  |
| 22 24 | 0.5 | r．8 | $8{ }^{4} 8$ | 4.0 4.2 7 | ${ }_{7}^{7 \cdot 4}$ | IT $1 \cdot 5$ | $1{ }_{13.4}^{13.4}$ | 16．6 | I8．7 |  |   <br> 5 24.9 <br> 25.8  |  | 28.3 |  | $35 \cdot 8$ | $39^{\circ}$ | ${ }_{45}^{4 \times}$ |  | $48 \cdot 5$ 50 | 3．2 |
| 26 |  | r－9 |  | 4.3 | $7 \cdot 7$ | 12.0 | 14 | 17.2 | 20.2 | 223.4 | 426.8 |  | $30 \cdot 5$ |  | 38．5 | 42.8 |  |  |  | ． 2 |
| 28 |  | 2.0 | － $4 \cdot 5$ | 4.5 | 88 | 12.5 | $15 \cdot 1$ |  | $2{ }^{2} \cdot$ | 24.3 | 27 |  | $31 \cdot 7$ |  |  | 44.5 | 3 |  |  | － |
| 30 32 3 | － 0.5 | 2．1 |  |  | 8.3 8.7 | 13.0 13. 14 | 15．7 | I9 | ${ }^{22} \times$ | ${ }_{25}^{25.4}$ | 29 30 3 |  | $33 \cdot 1$ | $37 \cdot 3$ | 3188 |  |  |  |  |  |
| 34 | ${ }_{0} 0.6$ | $2 \cdot 3$ |  | 4．2 | $9 \cdot 2$ | 14.4 14 | 17 | 192 | － | ${ }^{-1}$ |  |  | 34.7 36.6 |  | ${ }^{43 \cdot}$ | 48．3 | 53.9 56.7 |  |  | 65. 68.3 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |  |  |  | 45.9 | 47.7 |  | 49.4 |  | 51.2 |  |  | 54.8 | 8 | 56．6 |
| 24 22 | $32 \cdot 6$ $33 \cdot 3$ | ${ }^{34 \cdot \mathrm{I}}{ }^{\text {P }}$ | 35．6 | 637.1 37.9 | I 38.6 | ${ }_{4}^{40} 4$ |  |  | ［4．2 | $4{ }^{46 \cdot 9}$ | 48 |  | 50.4 51 50 | 40 | 52.2 53.3 | 54 |  | ${ }^{55} 5$ | $9{ }^{\circ}$ | 57.8 59.0 |
| 20 | $34 \cdot 0$ | $35 \cdot 53$ | $37 \%$ | － 38.6 | $640 \cdot 2$ | 41.9 |  |  | $\left\|\begin{array}{l} 40 \cdot 1 \\ 47 \cdot 0 \end{array}\right\|$ | 48.8 | $50 \cdot 6$ |  | 52.5 |  | 54.4 | 56：3 |  | 58．2 |  | O．2 |
| 18 |  | 6.2 | 37.8 |  | 1 |  |  |  | 48．0 | ． 8 |  |  | 53 |  |  |  |  |  |  |  |
| 16 |  | 36.93 | －6 | $6{ }^{4} \cdot 2$ | 2419 | $43 \cdot 6$ |  |  | 49 | $50 \cdot 8$ | 52 |  | 54. |  | 56.6 | 58 |  |  |  | 2．6 |
| 14 12 |  | ${ }_{3}^{37} 73$ | ${ }_{40}^{39.1}$ |  | O ${ }^{42 \cdot 7} 4$ | 44．5 | 47.2 |  | 49．9． | 51.8 52 50 | 53．8 |  | ${ }_{56}^{56}$ |  | 57.7 58.9 | $59 \%$ |  |  | $8{ }^{1}$ | 3.9 |
| 10 | ${ }_{37} / 6$ | $39^{-2}$ | － | － $42 \cdot 7$ |  | 46.3 |  | 59 |  | 54.0 |  |  | 58.0 |  |  | 2．2 |  |  |  |  |
| 8 |  |  |  | $8{ }^{43} \cdot 6$ | 45.4 | 47.3 |  |  |  | 55.1 | 57．1 |  | 59．2 |  |  |  |  |  | ${ }^{1}$ | 龶 |
| 6 |  | $\left.\right\|_{4 \times 9} ^{40 \cdot 9} 44_{4}^{4} 4$ | ${ }^{42 \cdot} 7$ | 744.5 | 146 | 48．22 | 50．2 |  | 54．22 | $56 \cdot 2$ | $58 \cdot 3$ |  |  |  | $2 \cdot 6$ 3 3 | $6 \cdot 1$ | 7 |  | ${ }^{1}$ | 9．2 |
| 4 | 40．0 | ${ }_{42}{ }^{1} \cdot 6$ | ${ }^{43 \cdot 6}$ | $5{ }^{45} 4{ }^{45} 4$ | 4783 488 | 49．2 |  |  | 55＊3 | 58．6 | 59．5 |  |  |  | ${ }_{5}^{3.9}{ }^{1} 1$ | 7.1 | ${ }_{5} 1$ |  | ${ }_{8}{ }_{1}^{1}$ | $10 \cdot 7$ |
| － | $4{ }^{1} 7$ | $43 \cdot 54$ | $45^{\prime} 4$ | $44 \% 4$ | $4{ }^{49} 4$ | 5 F 4 | $53^{\prime} 4$ | $55 \cdot 5$ | 57.7 | 59.9 | 62－I |  | $4 \cdot 3$ |  | $6 \cdot 6$ | 9.0 |  | 11.3 |  | 13.7 |
| s． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  | $\left\{\left.\begin{array}{l} 46 \cdot 5 \\ 47 \cdot 5 \end{array}\right\|_{4} ^{4}\right.$ | $\begin{array}{l\|l\|l\|l} 58 \cdot 4 \\ 5 & 49 \cdot 5 \end{array}$ | 450.5 | 52．5 |  |  | 59．0 | $61 \cdot 2$ 62.6 | 63.4 |  | $5 \cdot 7$ |  | 8.1 | 12. |  | ， |  | 15.3 |
| 4 |  | ${ }_{46 \cdot 6}{ }^{4}$ | ${ }_{48}{ }^{4} 7$ | 5 | ${ }^{5} 518$ |  |  |  |  |  | 64．4 |  | ${ }_{8.8}^{7.8}$ |  |  | $12 \cdot 1$ | ${ }_{7}^{1}$ | 14.5 16.2 |  | 1770 |
| 8 |  | $47 \cdot 8$ | $49 \cdot 8$ | $5{ }^{2} \mathrm{O}$ | 54．1 | 56 |  |  |  | $65 \cdot 6$ | 68. |  |  |  | 12．9 | 15．5 |  | 18.1 |  | 20.7 |
| 10 | 46 | 48.95 | 51－1 | I $53 \cdot 2$ | $55 \cdot 3$ | 57• |  |  | $64 \cdot 8$ | 67 | $69 \cdot 7$ |  | $12 \cdot 2$ |  | 14.7 | $17 \cdot 3$ |  | 20.0 |  | 22.7 |
| 12 | 48. | $50 \cdot 2$ | 52．4 | 8 |  |  |  |  |  | 68.9 | $7{ }^{7} \cdot 4$ |  | 14.0 |  | 18.6 | 193 |  | 22.01 |  | －8 |
| ${ }^{1} 4$ | $4{ }^{49} 9$ | 58.5 | 53．8 | 8 | － 580.4 |  |  | ${ }^{65 \cdot 6}$ |  | $7{ }^{7} 7$ | 3 |  | ${ }_{18}^{16.0}$ |  | 20.8 | ＋ 21.4 |  | $2{ }^{2} .5$ |  | $\bigcirc$ |
| ${ }_{18}$ |  | 54.5 | 56 | 959 | 36 |  |  |  |  | 74.8 | 77.5 |  |  |  | 23.2 | ${ }_{26 \cdot 1}$ |  |  |  | 294 |
| 20 | 53 | 56.25 | 58.6 | 6 |  |  |  |  | 74.3 | 771 |  | I | 22.8 |  | $25^{\circ}$ | 28.7 |  | 31.71 |  |  |
| 22 |  | 58.15 | 60.6 | 663 ． 1 |  | $88 \cdot 4$ |  |  |  |  | $82 \cdot 5$ |  | 25.5 |  |  |  |  |  |  | $37 \cdot 8$ |
| 24 25 | 58 |  | 62•7 6 | 765：3 |  | ${ }_{\text {\％}}^{7}$ |  |  |  | 82.3 <br> 83 <br> 8 | ${ }_{85.4}^{8.9}$ |  |  |  | 315 33.2 | 34. 36.4 |  | $33 \cdot 9$ 39.6 |  | $\begin{aligned} & 41 \cdot 1 \cdot 1 \\ & 42 \cdot 1 \end{aligned}$ |
| 26 |  | 63 | ${ }_{5} 6.1$ | I 67.8 | $70 \cdot 6$ | 73.4 |  |  | 82.3 | 85.4 | 88. |  | $3 \mathrm{r} \%$ |  | 34.9 | 38 |  | $4{ }^{1} 4$ |  |  |
| 28 |  | ${ }^{63 \cdot 6}$ | 66．3 | 3 39．1 | I $72 \times 17$ | $74^{\circ}$ |  | 8 | 83．9 | 87.0 88.8 | $90 \cdot 2$ |  | $33 \cdot 4$ 35.3 | ${ }^{1}$ | $36 \cdot 7$ 38.6 | 40 |  | 43.4 |  | ． 8 |
| 28 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  | 6－2 | $70 \cdot 6$ | 673.5 | 576.6 | ， |  |  | 佰 | $92 \cdot 5$ |  |  |  |  | $42 \cdot 8$ |  | $1{ }^{1}$ | 9.8 |  | 53.5 |
| 31 | 66.3 | 69．2 | 72．2 | $2{ }^{75} 2$ | 2 | 8 Cr 4 |  | $7 \cdot 9$ | $\mathrm{Or}^{1 \cdot 2}$ | 94．6 |  |  | $4{ }^{1} \cdot 5$ | 1 | $45^{\circ}$ | 48 |  | 52．3 |  |  |
| 32 <br> 33 | 69.6 | 70．9 | 73.9 | $9787^{7 \%} 9$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 6 |
|  |  | 774 | $177 \cdot 7$ | $780 \cdot 9$ | $984 \cdot 2$ |  |  | 保 |  | IOr 7 | 105．4 |  | $49 \cdot 1$ |  | 52．8 | 56．7 |  | 0.52 |  | $4 \cdot 5$ |

## REDUCIION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES

 FROM UPPER MERIDIAN.* achernar.



## REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERDIAN.

* achernar.



## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

* ACHERNAR.

| Lat. | $\underline{4}$ | $\underline{8}$ | 12 | 18. | m. 20 | m. 24 | $\underline{\mathrm{m}} 2$ | m 28 | m. 30 | 32 | ${ }_{34} 1$ | 36 | m8 | m 40 | m. 42 | $\begin{aligned} & \mathrm{m} \\ & 44 \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | $0 \cdot 9$ | $2 \cdot 1$ | $3 \cdot 7$ | 5.8 | 4 | $9 \cdot 8$ | 4 | 13.0 | 14.8 | 16.8 | 18.8 | 20.9 | $23^{\prime} \cdot 2$ | $25 \cdot 5$ | $28^{\prime} \cdot 0$ |
| 34 38 | $0 \cdot 2$ | $0 \cdot 9$ | $2 \cdot 0$ | $3 \cdot 6$ | $5 \cdot 5$ | $8 \cdot 0$ | $9 \cdot 4$ | 10.9 | 12.4 | 14.2 | 16.0 | $17 * 9$ | 20.0 | $22 \cdot 1$ | 24.4 | $26 \cdot 7$ |
| 42 | 0.2 | 0.8 | $1 \cdot 9$ | $3 \cdot 4$ | $5 \cdot 3$ | $7 \cdot 6$ | $8 \cdot 9$ | 10.4 | II•9 | 13.5 | 15.3 | $17 \cdot 1$ | 19.0 | 21.1 | $23 \cdot 2$ | $25 \cdot 5$ |
| 46 | 0.2 | 0.8 | I. 8 | $3 \cdot 2$ | $5 \cdot 0$ | $7 \cdot 2$ | $8 \cdot 5$ | $9 \cdot 8$ | II.2 | 12.8 | 14.4 | $16 \cdot 2$ | 18.0 | $20 \cdot 0$ | 22.0 | 24. I |
| 50 | 0.2 | 0.8 | 7 | 3.0 | $4 \cdot 7$ | $6 \cdot 8$ | $8 \cdot 0$ | $9 \cdot 3$ | 10.6 | I2.I | 13.6 | 15.3 | 17.0 | 18.8 | $20 \cdot 8$ | 22.8 |
| 54 | 0.2 | $0 \cdot 7$ | I.6 | $2 \cdot 8$ | $4 \cdot 4$ | $6 \cdot 4$ | 7.5 | $8 \cdot 7$ | $10 \cdot 0$ | 11.4 | 12.8 | 14.3 | 16.0 | $17 \times 7$ | 19.5 | 2 I 4 |
| 58 | $0 \cdot 2$ | $0 \cdot 7$ | I. 5 | $2 \cdot 6$ | $4 \cdot 1$ | $5 \cdot 9$ | $7 \cdot 0$ | $8 \cdot 1$ | $9 \cdot 3$ | $10 \cdot 5$ | II•9 | 13.3 | 14.9 | 16.4 | 18.1 | I9.9 |
|  | $0 \cdot 2$ | 0.6 | 1.4 | $2 \cdot 5$ | 4*0 | 5.7 | $6 \cdot 7$ | $7 \cdot 8$ | $8 \cdot 9$ | 10.I | 11.4 | 12.8 | 14.3 | 15.8 | 17.4 | 19.1 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | $30 \cdot 6$ | 31 | 33 | 34*7 | $36 \cdot 1$ | 37.6 | $39 \cdot 1$ | $40 \cdot 6$ | 42.1 | $43 \cdot 7$ | $45 \cdot 3$ | $46 \cdot 9$ | 48.5 | 50.2 | 51.9 |
| 36 | $28 \cdot 6$ | 29.9 | $3 \mathrm{I} \cdot 2$ | $32 \cdot 6$ | 33.9 | $35 \cdot 3$ | 36.7 | $38 \cdot 2$ | $39 \cdot 7$ | $41 \cdot 2$ | 42.7 | $44 \cdot 3$ | $45 \cdot 8$ | $47 \cdot 5$ | 49.1 | $50 \cdot 8$ |
| 38 | $28 \cdot 0$ | $29 \cdot 2$ | $30 \cdot 5$ | $3 \mathrm{I} \cdot 8$ | $33 \cdot 1$ | $34 \cdot 5$ | $35 \cdot 9$ | $37 \cdot 3$ | $38 \cdot 7$ | $40 \cdot 2$ | $4 \mathrm{I} \cdot 7$ | $43 \cdot 2$ | $4.4 \cdot 8$ | $46 \cdot 4$ | $48 \cdot 0$ | $49 \cdot 6$ |
| 40 | 27.3 | $28 \cdot 5$ | $29 \cdot 8$ | 31.0 | $32 \cdot 3$ | $33 \cdot 7$ | $35^{\circ} \mathrm{O}$ | 36.4 | $37 \cdot 9$ | $39 \cdot 3$ | $40 \cdot 7$ | $42 \cdot 2$ | 43.7 | $45 \cdot 3$ | $46 \cdot 9$ | $48 \cdot 4$ |
| 42 | $26 \cdot 6$ | $27 \cdot 8$ | 29.0 | $30 \cdot 3$ | 31.6 | $32 \cdot 9$ | $34 \cdot 2$ | $35 \cdot 5$ | $36 \cdot 9$ | $38 \cdot 3$ | $39 \cdot 7$ | 41.2 | 42.7 | $44^{\cdot 2}$ | $45 \cdot 7$ | $47 \cdot 3$ |
| 44 | 26.0 | $27 \cdot 1$ | $28 \cdot 3$ | 29.5 | $30 \cdot 8$ | $32 \cdot 0$ | $33 \cdot 3$ | $34 \cdot 6$ | $36 \cdot 0$ | 37*3 | $38 \cdot 7$ | $40 \cdot 2$ | 4 $1 \cdot 6$ | 43'1 | $44 * 5$ | $46 \cdot 0$ |
| 46 | $25 \cdot 3$ | 26.4 | $27 \cdot 5$ | $28 \cdot 7$ | 29.9 | $31 \cdot 2$ | $32 \cdot 4$ | $33 \cdot 7$ | $35^{\circ} \mathrm{O}$ | $36 \cdot 3$ | $37 \cdot 7$ | 39'1 | $40 \cdot 5$ | 41.9 | $43 \cdot 4$ | $44 \cdot 8$ |
| 48 | $24 \cdot 6$ | $25 \cdot 7$ | $26 \cdot 8$ | $27 \cdot 9$ | 29'1 | $30 \cdot 3$ | $31 \cdot 5$ | $32 \cdot 8$ | 34.0 | $35 \cdot 3$ | $36 \cdot 7$ | $38 \cdot 0$ | $39 \cdot 3$ | $40 \cdot 7$ | $42 \cdot 2$ | $43 \cdot 6$ |
| 50 | $23 \cdot 8$ | $24^{\circ} 9$ | 26.0 | $27 \cdot 1$ | $28 \cdot 2$ | 29.4 | $30 \cdot 6$ | 31.8 | $33 \cdot 1$ | 34.3 | $35 \cdot 6$ | $36 \cdot 9$ | $38 \cdot 2$ | $39 \cdot 6$ | 40.9 | $42 \cdot 3$ |
| 52 | $23 \cdot 1$ | $24^{\circ} 1$ | $25 \cdot 2$ | $26 \cdot 3$ | 27.4 | $28 \cdot 5$ | $29 \cdot 6$ | $30 \cdot 8$ | $32 \cdot 0$ | $33 \cdot 2$ | $34 \cdot 5$ | $35 \cdot 7$ | $37 \cdot 0$ | $38 \cdot 4$ | $39 \cdot 7$ | 410 |
|  | -22.4 | 23.4 | 24.4 | $25^{\circ} 4$ | $26 \cdot 5$ | $27 \cdot 6$ | $28 \cdot 7$ | 29.8 | 31.0 | $32 \cdot 2$ | 33.4 | $34 \cdot 6$ | $35 \cdot 8$ | 37-1 | $38 \cdot 4$ | $39 \cdot 7$ |
|  | $21 \cdot 6$ | $22 \cdot 6$ | $23 \cdot 5$ | $24 \cdot 6$ | $25 \cdot 6$ | $26 \cdot 6$ | 27•7 | $28 \cdot 8$ | 29.9 | $31 \cdot 1$ | $32 \cdot 2$ | 33.4 | $34^{\cdot 6}$ | $35 \cdot 8$ | $37 \cdot 1$ | $38 \cdot 3$ |
| 58 | $20 \cdot 8$ | $21 \cdot 7$ | $22 \cdot 7$ | $23 \cdot 6$ | $24 \cdot 6$ | $25^{\circ} 7$ | $26 \cdot 7$ | $27 \cdot 7$ | $28 \cdot 8$ | 29.9 | $31 \cdot 0$ | $32 \cdot 2$ | $33 \cdot 3$ | 34.5 | $35 \cdot 7$ | $36 \cdot 9$ |
|  | 19.9 | $20 \cdot 8$ | 21.8 | 22.7 | $23 \cdot 6$ | $24 \cdot 6$ | $25 \cdot 6$ | $26 \cdot 6$ | $27 \cdot 7$ | $28 \cdot 7$. | 29.8 | $30 \cdot 9$ | $32 \cdot 0$ | $33^{\circ} \mathrm{I}$ | 34.3 | $35 \cdot 4$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | ${ }_{13}$ | ${ }_{14} 14$. | m. |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 51•9 | $\cdot 7$ | $55 \cdot 4$ | 57.2 | 59'I | 60.9 | $62 \cdot 8$ | 64.7 | 66.6 | $68 \cdot 6$ | $70 \cdot 6$ | 72.6 | $74 \cdot 6$ | $76 \cdot 7$ | $78 \cdot 8$ | 80.9 |
| 36 | $50 \cdot 8$ | 52.5 | 54.2 | 55.9 | 57.7 | 59.5 | 61.4 | 63.2 | $65 \cdot 1$ | $67 \cdot 0$ | 69.0 | 70.9 | 72.9 | $75^{\circ} \mathrm{O}$ | 77.0 | 79•1 |
| 38 | $49 \cdot 6$ | $51 \cdot 3$ | 53.0 | 54*7 | $56 \cdot 4$ | 58.2 | $60 \cdot 0$ | 6I•8 | $63 \cdot 6$ | $65 \cdot 5$ | 67.4 | $69 \cdot 3$ | $71 \cdot 3$ | $73 \cdot 3$ | $75 \cdot 3$ | $77 \cdot 3$ |
| 40 | $48 \cdot 4$ | $50 \cdot 1$ | $5 \mathrm{I} \cdot 7$ | 53.4 | $55^{\prime}$ I | $56 \cdot 8$ | $58 \cdot 6$ | $60 \cdot 3$ | $62 \cdot 1$ | $64^{\circ} \mathrm{O}$ | $65 \cdot 8$ | $67 \cdot 7$ | $69 \cdot 6$ | 71.5 | 73.5 | $75 \cdot 5$ |
| 42 | $47 \cdot 3$ | $48 \cdot 8$ | $50 \cdot 4$ | $52 \cdot \mathrm{I}$ | 53.7 | $55 \cdot 4$ | $57 \cdot 1$ | $58 \cdot 9$ | $60 \cdot 6$ | 62.4 | $64 \cdot 2$ | $66 \cdot 0$ | $67 \cdot 9$ | 69.8 | $71 \cdot 7$ | 73*7 |
|  | $46 \cdot 0$ | $47 \cdot 6$ | $49 \cdot 2$ | 50.7 | 52.4 | $54^{\circ} \mathrm{O}$ | $55^{\circ} 7$ | 57.4 | 59.1 | 60.8 | $62 \cdot 6$ | 64.4 | $66 \cdot 2$ | $68 \cdot 0$ | 69.9 | 71-8 |
| 46 | $44^{\cdot 8}$ | $46 \cdot 3$ | $47 \cdot 9$ | $49 \cdot 4$ | $51 \cdot 0$ | $52 \cdot 6$ | $54^{\circ} 2$ | $55 \cdot 8$ | $57 \cdot 5$ | $59 \cdot 2$ | $60 \cdot 9$ | $62 \cdot 7$ | $64 * 4$ | $66 \cdot 2$ | $68 \cdot 0$ | $69 \cdot 9$ |
| 47 | $44 \cdot 2$ | $45 \cdot 7$ | $47 \cdot 2$ | $48 \cdot 7$ | $50 \cdot 3$ | 5I•8 | 53:4 | $55 \cdot 1$ | $56 \cdot 7$ | 58.4 | $60 \cdot 1$ | 6I•8 | $63 \cdot 6$ | $65 \cdot 3$ | $67 \cdot 1$ | $69^{\circ}$ |
| 48 | $43 \cdot 6$ | $45^{\circ} \mathrm{O}$ | $46 \cdot 5$ | $48 \cdot 0$ | $49 \cdot 6$ | $51 \cdot 1$ | $52 \cdot 7$ | $54 \cdot 3$ | 55.9 | $57 \cdot 6$ | 59.2 | 60.9 | $62 \cdot 6$ | 64.4 | $66 \cdot 2$ | $68 \cdot 0$ |
| 49 | $43 \cdot 0$ | 44.4 | $45 \cdot 8$ | $47 \cdot 3$ | $48 \cdot 8$ | $50 \cdot 4$ | 51.9 | $53 \cdot 5$ | $55^{\prime}$ I | 56.7 | $58 \cdot 4$ | 60•1 | 6I.8 | 63.5 | $65 \cdot 2$ | $67 \cdot 0$ |
| 50 | $42 \cdot 3$ | $43 \cdot 7$ | $45 \cdot 2$ | $46 \cdot 6$ | $48 \cdot 1$ | $49 \cdot 6$ | 51.2 | $52 \cdot 7$ | 54.3 | 55*9 | $57 \cdot 5$ | 59.2 | $60 \cdot 8$ | $62 \cdot 5$ | $64 \cdot 3$ | $66 \cdot 0$ |
| 51 | 41•7 | $43 \cdot 1$ | 44.5 | $45 \cdot 9$ | $47 \cdot 4$ | $48 \cdot 9$ | $50 \cdot 4$ | $5 \mathrm{I} \cdot 9$ | $53 \cdot 5$ | $55^{\circ} \mathrm{O}$ | $56 \cdot 6$ | $58 \cdot 3$ | 59.9 | $6 \mathrm{I} \cdot 6$ | $63 \cdot 3$ | $65 \cdot 0$ |
| 52 | 41.0 | 42.4 | $43 \cdot 8$ | $45^{\circ} 2$ | $46 \cdot 6$ | 48•1 | $49 \cdot 6$ | $5 \mathrm{I} \cdot \mathrm{I}$ | 52.6 | $54 \cdot 2$ | $55 \cdot 8$ | 57.4 | $59^{\circ} \mathrm{O}$ | $60 \cdot 6$ | $62 \cdot 3$ | $64^{\circ} 0$ |
| 53 | $40 \cdot 3$ | $4 \mathrm{I} \cdot 7$ | $43 \cdot 1$ | 44.5 | $45 \cdot 9$ | 47.3 | $48 \cdot 8$ | $50 \cdot 3$ | 5I•8 | $53 \cdot 3$ | 54.9 | $56 \cdot 4$ | 58.0 | $59 \cdot 7$ | $6 \mathrm{r} \cdot 3$ | $63^{\circ}$ |
| 54 | $39^{\circ} 7$ | 41.0 | $42 \cdot 4$ | 43.7 | $45^{\circ} \mathrm{I}$ | $46 \cdot 6$ | $48 \cdot 0$ | $49 \cdot 5$ | 509 | 52.4 | 54.0 | $55 \cdot 5$ | 57•I | $58 \cdot 7$ | $60 \cdot 3$ | $6 \mathrm{I} \cdot 9$ |
| 55 | $39^{\circ} \mathrm{O}$ | $40 \cdot 3$ | $41 \cdot 6$ | $43 \cdot 0$ | 44.3 | 45•7 | 47.1 | $48 \cdot 6$ | $50 \cdot 0$ | 51•5 | 53.0 | 54.6 | 56.1 | 57*7 | $59 \cdot 3$ | 60.9 |
| 56 | $38 \cdot 3$ | $39 \cdot 6$ | $40 \cdot 9$ | $42 \cdot 2$ | $43 \cdot 6$ | $45^{\circ} \mathrm{O}$ | $46 \cdot 3$ | $47 \cdot 7$ | $49 \cdot 2$ | $50 \cdot 6$ | $52 \cdot 1$ | 53.6 | $55 \cdot 1$ | $56 \cdot 6$ | $58 \cdot 2$ | $59 \cdot 8$ |
| 57 | $37 \cdot 6$ | $38 \cdot 9$ | $40 \cdot 2$ | $41 \cdot 5$ | $42 \cdot 8$ | 44.1 | $45 \cdot 5$ | $46 \cdot 9$ | $48 \cdot 3$ | $49 \cdot 7$ | 5I•I | $52 \cdot 6$ | 54.1 | $55 \cdot 6$ | $57 \cdot 1$ | $58 \cdot 7$ |
| 58 | $36 \cdot 9$ | $38 \cdot 1$ | 39.4 | $40 \cdot 7$ | $42 \cdot 0$ | $43 \cdot 3$ | 44.6 | $46 \cdot 0$ | 47.4 | $48 \cdot 8$ | $50 \cdot 2$ | 51.6 | $53 \cdot 1$ | 54.5 | $56 \cdot 0$ | $57 \cdot 6$ |
| 59 | $36 \cdot 2$ | 37.4 | $38 \cdot 6$ | 39.9 | $41 \cdot 2$ | 42.4 | $43 \cdot 8$ | $45^{\text {I }}$ | $46 \cdot 4$ | 47.8 | $49 \cdot 2$ | $50 \cdot 6$ | $52^{\circ} \mathrm{O}$ | 53.5 | 54.9 | $56 \cdot 4$ |
| 60 | $35 \cdot 4$ | $36 \cdot 6$ | $37 \cdot 8$ | $39^{1} 1$ | $40 \cdot 3$ | 41•6 | $42 \cdot 9$ | $44^{\circ} 2$ | $45 \cdot 5$ | $46 \cdot 8$ | $48 \cdot 2$ | $49 \cdot 6$ | 51.0 | 52.4 | $53 \cdot 8$ | $55 \cdot 3$ |
| I |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat | 4 | 8 | 12 | m. | 20 | m. | m. | 40 | $\mathrm{m}_{50}$ | ${ }_{0} \mathrm{~m}$ | 10 | $\mathrm{m}_{20}$ | m. | m. | $\frac{\mathrm{m}}{50}$ | $\frac{\mathrm{m}}{60}$ |
| s. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | ${ }^{\circ} \cdot 1$ | $\stackrel{0}{\square} 6$ | $2 \cdot 1$ | $2 \cdot 7$ | $3^{\circ} \cdot 2$ | $4^{\circ} \mathrm{O}$ | ${ }_{5}{ }^{\circ} 3$ | $6^{\circ} 7$ | $8{ }^{\circ} \mathrm{O}$ | $9^{\circ} \cdot 3$ | $\stackrel{\circ}{10} 6$ | II $\stackrel{0}{9}$ | $\stackrel{\circ}{1} \cdot{ }^{1}$ | 14** | $\stackrel{\circ}{5} \cdot 6$ |
|  |  | I• | I. 6 | $2 \cdot 2$ | $2 \cdot 7$ | $3 \cdot 2$ | $4^{\circ} \mathrm{O}$ | $5 \cdot 4$ | $6 \cdot 7$ | $8 \cdot 0$ | $9 \cdot 4$ | 10.7 | 12.0 | 13.2 | 14.5 | 15.8 |
| 44 | 0.5 | I•I | I. 6 | $2 \cdot 2$ | $2 \cdot 7$ | $3 \cdot 3$ | $4^{11}$ | $5 \cdot 4$ | $6 \cdot 8$ | $8 \cdot 1$ | $9 \cdot 5$ | $10 \cdot 8$ | 12.1 | 13.4 | 14.8 | $16 \cdot 0$ |
| 48 | 0.6 | I•I | 1•7 | $2 \cdot 2$ | $2 \cdot 8$ | $3 \cdot 3$ | $4 \cdot 2$ | $5 \cdot 5$ | $6 \cdot 9$ | $8 \cdot 3$ | 9.7 | II'O | 12.4 | $13 \cdot 7$ | 15.1 | 6. |
|  | 0.6 | I'I | 1-7 | $2 \cdot 3$ | $2 \cdot 8$ | 3.4 | $4 \cdot 3$ | $5 \cdot 7$ | $7 \cdot 1$ | $8 \cdot 5$ | $9 \cdot 9$ | II•3 | 12.7 | 14.1 | 15.4 | I $6 \cdot 8$ |
| 56 | 0.6 | I. 2 | $1 \cdot 7$ | $2 \cdot 3$ | $2 \cdot 9$ | 3.5 | $4 \cdot 4$ | $5 \cdot 8$ | $7 \cdot 3$ | $8 \cdot 7$ | 10.2 | II. 6 | 13.1 | 14.5 | 15.9 | $17 \cdot 3$ |
| 60 | 0.6 | I'2 | I.8 | 2.4 | $3 \cdot 0$ | 3.6 | $4 \cdot 5$ | $6 \cdot 0$ | $7 \cdot 5$ | $9 \cdot 0$ | 10.5 | 12.0 | 13.5 | $15^{\circ}$ | $16 \cdot 5$ | I $8 \cdot 0$ |

REDUCTION TO THE MERIDIAN TABLE NEAR THE MERIDIAN BELOW THE POLE. * achernar.

| Lat. | HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{16}$ | m. | ${ }_{18}$ | ${ }_{19}^{\text {m. }}$ | ${ }_{20}$ | $\left.\right\|_{21} ^{m}$ | ${ }_{22}$ | ${ }_{23}^{\mathrm{m}}$ | ${ }_{24}$ | ${ }_{25}$ | ${ }_{26}$ | ${ }_{27}$ | ${ }_{28}^{\mathrm{m} .}$ | ${ }_{29}^{\mathrm{m}}$. | ${ }_{30}$ | ${ }_{31}$ |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{34}$ |  | $85 \cdot 3$ | $87 \cdot 5$ | 89.8 | $9^{\cdot 1}$ I | $94 \cdot 4$ | $96 \cdot 7$ | 99\% | 1014 | 10'3.8 | ro6. 2 | 108.7 | rir-2 | 113.7 | 116.2 | 118.8 |
| 35 | $82 \cdot 2$ | ${ }_{84} \cdot 4$ | 86.6 | 88.8 | ${ }_{91}{ }^{\circ} \mathrm{O}$ | ${ }_{93}{ }^{4}$ | $95 \cdot 6$ | 97•9 | 100. 3 | 102.7 | ro5. I | 107.5 | 109.9 | 112.4 |  | 117.5 |
| 36 | $8 \mathrm{8r} \cdot 3$ | 83.4 | $85 \cdot 6$ | 88.8 | $90^{\circ}$ | $92 \cdot 3$ | $94 \cdot 5$ | 96.8 | $99^{2}$ | 101.5 | 103.9 | 106.3 | 108.7 | $11 \mathrm{I} \cdot 2$ | $1{ }_{13}{ }^{1} 7$ | 116 |
| 37 <br> 38 | ${ }^{80 \cdot 4}$ |  | ${ }_{8}^{84 \cdot 6}$ | 86.8 85.8 | 8 |  | 93.5 | 95•7 |  | 100.4 |  | 105.1 103.9 | Y07.5 106.3 | 109.9 |  | 114.9 113.5 |
| 38 | 79.4 | $\begin{aligned} & 8 \mathrm{r} \cdot 5 \\ & 80 \cdot 6 \end{aligned}$ | $83 \cdot 7$ $82 \cdot 7$ | $85 \cdot 8$ 84.8 |  | $90 \cdot 2$ $80 \cdot 1$ | $92 \cdot 4$ <br> 91 <br> 1 | 94.6 | $96 \cdot 9$ 95.8 | 99.2 | 101.5 | 103.9 102.7 10 | 106.3 |  | IIIP 1 | 113.5 112.2 |
| 39 40 | 78.5 | $\begin{aligned} & 80 \cdot 6 \\ & 79 \cdot 6 \end{aligned}$ | ${ }_{81}^{82 \cdot 7}$ | ${ }_{83}^{84} 8$ | 86.9 85.9 | 89.1 88.0 | 913 | 92.5 | 95.8 | 98.0 96.9 | roo. 99 | $102 \cdot 7$ 102 104 | 1050 103.8 | 107.4 | 109.8 | 112.2 <br> 110.9 |
| 4 r |  | 78.6 | 80.7 | 82.8 | 84.9 | 87. | 89 - | ${ }_{9} \mathrm{I} \cdot 3$ | $93 \cdot 5$ | $95 \cdot 7$ | 97.9 | $100 \cdot 2$ | 102.5 | 104.8 | $107 \cdot 2$ | ro9. 5 |
| 42 | $75 \cdot 7$ | $77 \cdot 7$ | $77^{7} 7$ | 88.7 | 83•8 | $85^{\circ} \mathrm{P}$ | 88.0 | 90.2 | $92 \cdot 3$ | $94 \cdot 5$ | $96 \cdot 7$ | $99^{\circ}$ | Ior 2 | 103.5 | 105.9 |  |
| 43 | $74 \cdot 7$ | $76 \cdot 7$ | $78 \cdot 7$ | 80.7 | 82.8 | 84.8 | 86.9 | 89.0 | $9 \mathrm{I}^{2}$ | $93 \cdot 3$ | $95 \cdot 5$ | $97 \cdot 7$ | 100.0 | 102.2 | 104.5 | 10 |
| 44 | 73.7 | 75.7 | 77.7 | 79.7 | 8 r ¢ | $83 \cdot 7$ | 85.8 | 87 | $\bigcirc$ | $92 \cdot 1$ | 94*3 | $96 \cdot 5$ | 98.7 |  | 103.2 | $105 \cdot 5$ |
| 45 |  | 74.7 | $76 \cdot 7$ | $78 \cdot 6$ | $80 \cdot 6$ | 82.6 | $8{ }^{8.7}$ |  | 88.8 | 90.9 | ${ }_{\text {931. }} 9$ | ${ }^{95 \cdot 2}$ | ${ }_{\text {97. }}$ | ${ }^{99} \cdot 6$ | ${ }_{101} 10$ | 104. ${ }^{\text {I }}$ |
|  | 71.8 70.8 | ${ }_{72}^{73}$ | $7{ }^{75 \cdot 6}$ | ${ }_{76}^{77 \cdot 6}$ | ${ }_{78}^{78.5}$ | 81.5 | 83 <br> 182.4 <br> 8 |  | $87 \cdot 6$ 86.4 | 89.7 88.5 | ${ }_{9}^{91.8}$ | 92.7 | ${ }_{948}^{96 \cdot 1}$ | ${ }_{96 \cdot 9}^{98.3}$ | ${ }_{\text {reor }}$ |  |
| 48 | 69.8 | $71 \cdot 7$ | $73 \cdot 5$ | $75 \cdot 4$ | $77 \cdot 3$ | 79-3 | 8 Br 2 | 83.2 | 85.2 | $87 \cdot 2$ | 89.3 | ${ }_{9 r}$ | ${ }_{93}{ }^{94}$ | ${ }_{95 \cdot 6}$ | $99 \cdot 7$ | ${ }^{99.9}$ |
| 49 | 68.8 | 70 | $72 \cdot 5$ | $74 \cdot 3$ | $76 \cdot 2$ | $78 \cdot 1$ | $80 \cdot 1$ | 82.0 | $84^{\circ}$ | $86 \cdot$ | 88.0 | $90 \cdot$ | $92 \cdot 1$ | 94.2 | $96 \cdot 3$ | 98.4 |
|  | 67.8 | 96 | 7 F 4 | 研 | 75•1 | , | 78.9 | $80 \cdot 8$ | 82.7 | $84^{\prime} 7$ | 86.7 | 88.7 | $90 \cdot 7$ | 92.8 | 94.9 | 97.0 |
| 51 | -8 | $68 \cdot 5$ | 70.3 | $72 \cdot 1$ | 74.0 | 75 | $77 \cdot 7$ | 79.6 | 81.5 | 83.4 | 85.4 | 87.4 | 89.4 | 91 | $93 \cdot 5$ | $95 \cdot 5$ |
| 52 | $65^{\circ} 7$ | $67 \cdot 5$ | 69-2 |  | 72.8 | 74.6 | $76 \cdot 5$ | $78 \cdot 3$ | $80 \cdot 2$ | 82. | 84.1 | 86 |  | 90.0 |  |  |



REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* ALDEBARAN.

| Lat. | $\stackrel{\mathrm{m}}{2}$ | m. | ${ }_{6} \mathrm{~m}$ | $\underline{8}$ | m. | 12. | 14 | ${ }_{16}$ | 18 | m. 20 | m 21 | m. 22 | ${ }_{23} \mathrm{~m}$ | m. 24 | m. 25 | $\stackrel{1}{26}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. | REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{0}$ | $0 \cdot 2$ | I•0 | $2 \cdot 2$ | $3 \cdot 8$ | $6 \cdot 0$ | $8 \cdot 6$ | IT•7 | I5.3 | $19 \cdot 3$ | 23.8 | $26 \cdot 2$ | 28.7 | $3 \mathrm{I} \cdot 4$ | 34.1 | 3'00 | - |
| 40 | $0 \cdot 2$ | 1-0 | $2 \cdot 2$ | $3 \cdot 8$ | $6 \cdot 0$ | $8 \cdot 6$ | II•7 | 15.3 | 19.3 | 23.8 | $26 \cdot 2$ | $28 \cdot 7$ | $31 \cdot 4$ | $34^{-1}$ | $37 \cdot 0$ | $40 \cdot 0$ |
| 42 | $0 \cdot 2$ | $0 \cdot 9$ | 1.9 | 3.4 | $5 \cdot 4$ | $7 \cdot 7$ | $10 \cdot 5$ | 13.7 | $17 \% 4$ | $21 \cdot 4$ | $23 \cdot 6$ | $25 \cdot 9$ | $28 \cdot 3$ | $30 \cdot 7$ | 33.3 | $36 \cdot 0$ |
| 44 | $0 \cdot 2$ | $0 \cdot 8$ | 1.8 | 3.1 | $4 \cdot 9$ | $7 \cdot 0$ | $9 \cdot 5$ | 12.4 | 15.7 | 19.4 | $21 \cdot 3$ | 23.4 | $25 \cdot 6$ | $27 \cdot 8$ | $30 \cdot 1$ | $32 \cdot 6$ |
| 46 | 02 | 0.7 | I.6 | $2 \cdot 8$ | $4 \cdot 4$ | $6 \cdot 3$ | $8 \cdot 6$ | II.3 | 14.2 | 17.5 | 19.3 | 21.2 | 23.2 | $25^{\circ} 2$ | $27 \cdot 3$ | 29.6 |
| 48 | 0.2 | $0 \cdot 6$ | 1.4 | $2 \cdot 6$ | 4*0 | $5 \cdot 8$ | $7 \cdot 8$ | 10.2 | 12.9 | 15.9 | 17.6 | 19.3 | $2 \mathrm{I} \cdot \mathrm{I}$ | 22.9 | $24^{\circ} 9$ | $26 \cdot 9$ |
| 50 | O.I | 0.6 | I.3 | $2 \cdot 3$ | $3 \cdot 6$ | $5 \cdot 2$ | $7 \cdot 1$ | $9 \cdot 3$ | I $1 \times 8$ | 14.5 | $16 \cdot 0$ | 17.6 | 19.2 | 20.9 | 22.6 | 24.5 |
| 52 | O.I | $0 \cdot 5$ | 2 | $2 \cdot 1$ | $3 \cdot 3$ | $4 \cdot 8$ | $6 \cdot 5$ | $8 \cdot 5$ | 10.7 | 13.2 | 14.6 | $16 \cdot 0$ | $17 \cdot 5$ | 19.0 | $20 \cdot 6$ | $22 \cdot 3$ |
| 54 | $0 \cdot 1$ | $0 \cdot 5$ | I•I | I-9 | $3 \cdot 0$ | $4 \cdot 3$ | $5 \cdot 9$ | $7 \cdot 7$ | $9 \cdot 8$ | 12.0 | $13 \cdot 3$ | 14.6 | 15.9 | 17.3 | 18.8 | $20 \cdot 3$ |
| 56 | $\bigcirc \cdot 1$ | $0 \cdot 4$ | I.O | I-8 | $2 \cdot 8$ | $4^{\circ} \mathrm{O}$ | $5 \cdot 4$ | $7 \cdot 0$ | $8 \cdot 9$ | II•O | 12.1 | 13.3 | 14.5 | $15 \cdot 8$ | $17 \cdot 1$ | $18 \cdot 5$ |
| 58 | $0 \cdot 1$ | $0 \cdot 4$ | 0.9 | 1.6 | $2 \cdot 5$ | $3 \cdot 6$ | $4 \cdot 9$ | $6 \cdot 4$ | $8 \cdot 1$ | 10.0 | II.O | 12.1 | 13.2 | 14.4 | 15.6 | 16.9 |
| 60 | $0 \cdot 1$ | $0 \cdot 4$ | 0.8 | 1.5 | $2 \cdot 3$ | $3 \cdot 3$ | $4 \cdot 5$ | $5 \cdot 8$ | $7 \cdot 4$ | 9•1 | 10.0 | 11.0 | 12.0 | $13 \cdot 1$ | 14.2 | $15 \cdot 3$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | $0 \cdot 3$ | I•I | $2 \cdot 5$ | $4 \cdot 5$ | $7 \cdot 0$ | 10* | 13.6 | 17.7 | 22.4 | $27 \cdot 6$ | 30.4 | 33.4 | $36 \cdot 4$ | $39 \cdot 6$ | $43 \cdot 0$ | $46 \cdot 4$ |
| 12 | $0 \cdot 3$ | 0 | $2 \cdot 3$ | $4 \cdot 1$ | $6 \cdot 5$ | $9 \cdot 3$ | 12.6 | 16.5 | $20 \cdot 8$ | $25 \cdot 7$ | $28 \cdot 3$ | $3 \mathrm{I} \cdot 0$ | 33.9 | $36 \cdot 9$ | $40 \cdot 0$ | $43 \cdot 2$ |
| 14 | $0 \cdot 2$ | I*O | $2 \cdot 2$ | $3 \cdot 9$ | $6 \cdot 0$ | $8 \cdot 7$ | 11.8 | 15.4 | 19.4 | $24^{\circ} \mathrm{O}$ | $26 \cdot 4$ | $29^{\circ}$ | $3 \mathrm{I} \cdot 6$ | 34.4 | $37 \cdot 3$ | $40 \cdot 3$ |
| 16 | 0.2 | 0.9 | $2 \cdot 0$ | $3 \cdot 6$ | $5 \cdot 6$ | 8.1 | 11.0 | 14.4 | $18 \cdot 2$ | 22.4 | 24.7 | 27-1 | $29 \cdot 6$ | $32 \cdot 2$ | $34 \cdot 9$ | $37 \cdot 8$ |
| 18 | $0 \cdot 2$ | 0.8 | I.9 | 3.4 | $5 \cdot 3$ | $7 \cdot 6$ | 10.4 | 13.5 | $17 \cdot 1$ | 21.1 | 23.2 | $25 \cdot 5$ | $27 \cdot 8$ | $30 \cdot 3$ | $32 \cdot 8$ | $35 \cdot 5$ |
| 20 | $0 \cdot 2$ | 0.8 | I. 8 | $3 \cdot 2$ | $5 \cdot 0$ | $7 \cdot 2$ | $9 \cdot 7$ | 12.7 | 16•I | 19.8 | 21.8 | $24^{\circ} \mathrm{O}$ | $26 \cdot 2$ | $28 \cdot 5$ | 30.9 | 33.4 |
| 22 | 0.2 | 0.7 | 1.7 | $3 \cdot 0$ | $4 \cdot 7$ | $6 \cdot 7$ | $9 \cdot 2$ | 12.0 | 15.2 | $18 \cdot 7$ | $20 \cdot 6$ | $22 \cdot 6$ | $24 \cdot 7$ | $26 \cdot 9$ | $29^{\circ} \mathrm{I}$ | $3 \mathrm{I} \cdot 5$ |
| 24 | $0 \cdot 2$ | 0.7 | I. 6 | $2 \cdot 8$ | 4.4 | $6 \cdot 4$ | $8 \cdot 7$ | II•3 | 14.3 | $17 \times 7$ | 19.5 | 21.4 | $23 \cdot 3$ | $25 \cdot 4$ | $27 \cdot 5$ | $29 \cdot 8$ |
| 26 | 0.2 | $0 \cdot 7$ | I. 5 | $2 \cdot 7$ | $4 \cdot 2$ | $6 \cdot 0$ | $8 \cdot 2$ | 10\%7 | 13.6 | 16.7 | 18.4 | $20 \cdot 2$ | $22 \cdot 1$ | $24^{\circ} \mathrm{O}$ | $26 \cdot 0$ | $28 \cdot 2$ |
| 30 | 0.2 | 0.6 | 1.4 | 2.4 | $3 \cdot 8$ | $5 \cdot 4$ | $7 \cdot 4$ | $9 \cdot 6$ | 12.2 | 15.0 | $16 \cdot 5$ | 18•1 | 19.8 | 21.6 | $23 \cdot 3$ | $25 \cdot 3$ |
| 35 | $0 \cdot 1$ | 0.5 | I 2 | 2.1 | 3*3 | $4 \cdot 7$ | $6 \cdot 5$ | $8 \cdot 4$ | 10.7 | 13.1 | 14.5 | I5.9 | 17.4 | 18.9 | $20 \cdot 5$ | 22.2 |
| 40 | $0 \cdot 1$ | 0.5 | I-0 | I.9 | $2 \cdot 9$ | $4^{\text {¹ }}$ | 5•7 | $7 \cdot 4$ | $9 \cdot 4$ | 11.4 | $12 \cdot 7$ | 14.0 | $15 \cdot 3$ | 16.6 | $18 \cdot 0$ | 19.5 |
| 50 | $0 \cdot 1$ | $0 \cdot 4$ | 0.8 | 1.4 | $2 \cdot 2$ | $3 \cdot 2$ | $4 \cdot 3$ | $5 \cdot 6$ | 7•1 | $8 \cdot 8$ | $9 \cdot 7$ | $10 \cdot 6$ | II. 6 | 12.7 | 13.7 | I 4.9 |
| 60 | O.I | $0 \cdot 3$ | 0.6 | 1*0 | I. 6 | $2 \cdot 3$ | $3 \cdot 2$ | $4^{1} 1$ | $5 \cdot 2$ | $6 \cdot 5$ | $7 \cdot 1$ | 7.8 | $8 \cdot 5$ | $9 \cdot 3$ | 10*I | 10.9 |


| Lat. | $\begin{aligned} & \mathrm{m}_{2} \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 28 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 29 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 30 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 31 \end{aligned}$ | ${ }_{32}$ | ${ }_{33}{ }^{\text {m }}$ | $\mathrm{m}_{34}$ | $\frac{\mathrm{m}}{35}$ | ${ }_{36}$ | $\frac{\mathrm{m}}{37}$ | $\begin{gathered} \mathrm{m} . \\ 38 \end{gathered}$ | $\frac{\mathrm{m}}{39}$ | ${ }_{40}$ | ${ }_{41}$ | ${ }_{42}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 41 | 40 | 43.9 | $47 \cdot 0$ | 50.3 | $53 \cdot 6$ | 57•1 | $60 \cdot 7$ | $64 \cdot 3$ | $68 \cdot 1$ | $7 \mathrm{I} \cdot 9$ | $75 \cdot 8$ |  |  | 88.2 |  |  |
| 41 42 | $40 \cdot 9$ 38.8 | 43.9 41.7 | $47 \cdot 0$ | $50 \cdot 3$ 47.7 | 53.6 50.9 | 57•1 | $60 \cdot 7$ $57 \cdot 6$ | $64 \cdot 3$ $6 \mathrm{I} \cdot \mathrm{I}$ | $68 \cdot 1$ 64.6 | $71 \cdot 9$ 68.3 | $75 \cdot 8$ <br> $72 \cdot 1$ | 79.9 75.9 | 84.0 79.9 | $88 \cdot 2$ 83.9 | ${ }^{92 \cdot 6}$ | $\cdot{ }^{\circ}$ |
| 43 | $36 \cdot 9$ | $39 \cdot 6$ | $42 \cdot 5$ | $45 \cdot 4$ | $48 \cdot 5$ | $5 \mathrm{I} \cdot 6$ | $54 \cdot 8$ | 58.I | $6 \mathrm{I} \cdot 5$ | $65^{\circ}$ | 68.6 | 72.3 | $76 \cdot 0$ | 79.9 | $83 \cdot 8$ | $87 \cdot 9$ |
| 44 | $35^{-1}$ | $37 \cdot 7$ | $40 \cdot 4$ | $43 \cdot 2$ | $46 \cdot 1$ | 49•1 | $52 \cdot 2$ | $55 \cdot 3$ | $58 \cdot 6$ | 6I•9 | $65 \cdot 3$ | 68.8 | 72.4 | 76.I | $79^{\circ} 9$ | 83.7 |
| 45 | 33.4 | 35.9 | $38 \cdot 5$ | 41•2 | $43 \cdot 9$ | $46 \cdot 8$ | $49 \cdot 7$ | $52 \cdot 7$ | $55 \cdot 8$ | 59.0 | $62 \cdot 3$ | $65 \cdot 6$ | 69.0 | $72 \cdot 5$ | $76 \cdot 1$ | $79 \cdot 8$ |
| 46 | 3I-8 | 34.2 | $36 \cdot 7$ | 39 | 41.9 | $44^{\circ} 6$ | $47 \cdot 4$ | 50.3 | 53. | $56 \cdot 2$ | 59 | 62.5 | $65 \cdot 8$ | 69•1 | $72 \cdot 6$ | 76.1 |
| 47 | $30 \cdot 4$ | 32.6 | $35^{\circ}$ | 37.4 | 39.9 | $42 \cdot 5$ | $45 \cdot 2$ | 47.9 | $50 \cdot 8$ | $53 \cdot 6$ | $56 \cdot 6$ | 59.7 | 62.8 | $66 \cdot 0$ | $69 \cdot 3$ | $72 \cdot 6$ |
| 48 | $29^{\circ} \mathrm{O}$ | $3 \mathrm{I} \cdot \mathrm{I}$ | 33.4 | $35 \cdot 7$ | $38 \cdot 1$ | $40 \cdot 6$ | $43^{1} 1$ | $45 \cdot 7$ | 48.4 | $5 \mathrm{I} \cdot 2$ | 54.0 | $56 \cdot 9$ | 59.9 | $63^{\circ}$ | $66 \cdot 1$ | $69 \cdot 3$ |
| 49 | 27.6 | 29.7 | 31.8 | $34^{\circ} \mathrm{O}$ | $36 \cdot 3$ | $38 \cdot 7$ | $4 \mathrm{I} \cdot \mathrm{I}$ | $43 \cdot 6$ | $46 \cdot 2$ | 48.9 | 51.6 | 54.4 | 57.2 | $60 \cdot 1$ | $63 \cdot 1$ | $66 \cdot 2$ |
| 50 | 26 | 28.3 | $30 \cdot 4$ | 32.5 | $34 \cdot 7$ | 36.9 | $39 \cdot 3$ | 41•7 | $44^{\text {I }}$ | $46 \cdot 6$ | $49 \cdot 2$ | 51.9 | 54.6 | $57 \cdot 4$ | $60 \cdot 3$ | 63.2 |
| 51 | 25. | 27 | 29 |  | 33 | 35•3 | 37 | 39. | 42•1 | 44.5 | $47 \cdot 0$ | $49 \cdot 6$ | 52.2 | 54.8 | $57 \cdot 6$ | $\cdot 4$ |
| 52 | $24^{\circ} \mathrm{O}$ | $25 \cdot 8$ | 27.7 | 29 | 31 | $33 \cdot 7$ | 35.8 | 38.0 | $40 \cdot 2$ | $42 \cdot 5$ | 44.9 | $47 \cdot 3$ | $49 \cdot 8$ | 52.4 | 55.0 | $57 \cdot 7$ |
| 54 | 21.9 | 23.6 | $25 \cdot 3$ | 27.0 | 28.8 | $30 \cdot 7$ | 32. | 34.6 | $36 \cdot 7$ | 38.8 | 41.0 | $43 \cdot 2$ | $45 \cdot 5$ | $47 \cdot 8$ | $50 \cdot$ | $52 \cdot 6$ |
| 56 | $20 \cdot 0$ | 21.5 | $23^{\circ} \mathrm{O}$ | 24.6 | $26 \cdot 3$ | 28 | 29.8 | 31.6 | 33.4 | 35.4 | 37.3 | 39.4 | 41.5 | $43 \cdot 6$ | $45 \cdot 8$ | $48 \cdot 0$ |
| 5 | 18.2 | 19.5 | 21.0 | 22.4 | 23.9 | $25 \cdot 5$ | $27 \cdot 1$ | 28.8 | $30 \cdot 5$ | $32 \cdot 2$ | 34.0 | $35 \cdot 9$ | $37 \cdot 8$ | $39 \cdot 7$ | $4 \mathrm{I} \cdot 7$ | $43 \cdot 7$ |
| 60 | 16.5 | 17.8 | 19.0 | $20 \cdot 4$ | 21.8 | 23.2 | 24.6 | $26 \cdot 1$ | 27.7 | 29.3 | 30.9 | $32 \cdot 6$ | $34 \cdot 3$ | $36 \cdot 1$ | 37.9 | $39 \cdot 8$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 | $40 \cdot 7$ | $43 \cdot 7$ | $46 \cdot 9$ | $50 \cdot 1$ | 53.5 | 56.9 | $60 \cdot 5$ | 64.2 | 67.9 | $7 \mathrm{P} \cdot 8$ | $75 \cdot 8$ | 79.8 | $8{ }^{\text {. }}$ - | 88.2 | $92 \cdot 6$ | 97-I |
| 17 | 39.4 | 42.4 | $45^{\circ} 4$ | $48 \cdot 6$ | 51.8 | $55^{\prime} 2$ | $58 \cdot 7$ | 62 | $65^{8} 8$ | $69 \cdot 6$ | $73 \cdot 5$ | 77.4 | $8 \mathrm{I} \cdot 4$ | $85 \cdot 6$ | $89 \cdot 8$ | 94•I |
| 18 | $38 \cdot 2$ | $41 \cdot 1$ | $44^{\circ} \mathrm{C}$ | 47 | $50 \cdot 2$ | 53.5 | $56 \cdot 9$ | $60 \cdot 3$ | 63.8 | $67 \cdot 5$ |  | $75 \cdot 1$ | 79.0 | 83.0 | ${ }^{87} 7^{1}$ |  |
| 19 | $37 \cdot 1$ | 39.9 | $42 \cdot 7$ | $45^{\circ} 7$ | $48 \cdot 8$ | 51.9 50 | $55 \cdot 2$ | 588.6 | 62.0 | $65 \cdot 5$ 63.6 | 69.2 67.1 | 72.9 70.7 | $76 \cdot 7$ | $80 \cdot 6$ 78.2 | 84.6 82.1 | $88 \cdot 7$ $86 \cdot 1$ |
| 20 | 36.0 | $38 \cdot 7$ | $41 \cdot 5$ | 44.3 | $47 \cdot 3$ | $50 \cdot 4$ | $53 \cdot 6$ | $56 \cdot 8$ | $60 \cdot 2$ | $63 \cdot 6$ | $67 \cdot 1$ | $70 \cdot 7$ | 74.4 | $78 \cdot 2$ | 82.1 | 86-1 |
| 22 | 34.0 | $36 \cdot 5$ | $39^{-1}$ | 41-8 | $44 \cdot 7$ | $47 \cdot 6$ |  | 53.6 | $56 \cdot 8$ | $60 \cdot 0$ | $63^{\circ} 4$ | $66 \cdot 8$ | $70 \cdot 3$ | -9 | 77.6 |  |
| 24 | 32.I | 34.5 | $37^{\circ} 0$ | $39 \cdot 5$ | $42 \cdot 2$ | $45^{\circ}$ | $47 \cdot 8$ | $50 \cdot 7$ | 53•7 | 56.8 | 59.9 | 63.2 | $66 \cdot 5$ | 69.9 | 73.4 | $76 \cdot 9$ |
| 26 | 30 | $32 \cdot 6$ | 3.9 | 37.4 | $40 \cdot 0$ | $42 \cdot 6$ | $45^{\circ} 2$ | $48 \cdot 0$ | $50 \cdot 8$ | $53 \cdot 7$ | $56 \cdot 7$ | $59 \cdot 3$ | $62 \cdot 9$ | $66 \cdot 2$ | 69.5 | 72.9 |
| 28 | 28 | 30.9 | 33.2 | 35.5 | $37 \cdot 9$ | $40 \cdot 3$ | $42 \cdot 9$ | $45 \cdot 5$ | $48 \cdot 2$ | $50 \cdot 9$ | 53.8 | $56 \cdot 7$ | 59.7 | $62 \cdot 7$ | 65.9 | $69 \cdot 1$ |
| 30 | 27.3 | 29.3 | 31.4 | $33 \cdot 6$ | $35 \cdot 9$ | $38 \cdot 2$ | $40^{\circ}$ | $43 \cdot 1$ | $45^{\circ}$ | 48 | 51.0 | $53 \cdot 7$ | $56 \cdot 6$ | 59.5 | $62 \cdot 4$ | $65 \cdot 5$ |
| 32 | 25.9 | 27.8 | 29.8 | $3 \mathrm{I} \cdot 9$ | 34 | $36 \cdot 3$ | 38 | $40 \cdot 9$ | - 3 | 45 | $48 \cdot 4$ | 53. | 53•7 | $56 \cdot 5$ | 59*3 | $62 \cdot 2$ |
| 34 | 24.5 | 26.4 | 28 | $30 \cdot 3$ | $32 \cdot 3$ | 34.4 | $36 \cdot 6$ | $38 \cdot 8$ | 41-1 | $43 \cdot 5$ | $45 \cdot 9$ | $48 \cdot 4$ | 51.0 | $53 \cdot 6$ | $56 \cdot 3$ | 59•I |
| 36 | 23.3 | 25.1 | $26 \cdot 9$ | $28 \cdot 7$ | $30 \cdot 7$ | $32 \cdot 7$ | 34.8 | $36 \cdot 9$ | $39^{\prime}$ I | $4 \mathrm{I} \cdot 3$ | $43 \cdot 6$ | $46 \cdot 0$ | $48 \cdot 4$ | $50 \cdot 9$ | $53 \cdot 5$ | 56-1 |
| 40 | 21.0 18.3 | 22.6 | 24.2 | 25.9 | $27 \cdot 7$ | 29.5 | 31.3 | 33.2 | $35 \cdot 2$ | $37 \cdot 2$ | $39 \cdot 3$ | 41.5 | $43 \cdot 7$ | $45 \cdot 9$ | $48 \cdot 2$ | $50 \cdot 6$ |
| 45 | 18.3 16.0 | 19.7 17.2 | $21 \cdot 1$ 18.5 | 22.6 10.8 | $\xrightarrow{24.2}$ | 25.8 22.5 | 27.4 23.9 | $29 \cdot 1$ 25.4 | $30 \cdot 9$ 26.9 | 38.5 | 34.5 | $36 \cdot 3$ | $38 \cdot 3$ | $40 \cdot 2$ | 42.3 | 44.4 |
| 60 | $16 \cdot 0$ 11.8 | 17.2 12.6 | 18.5 13.6 | 19.8 14.5 | 21.1 15.5 | 22.5 16.5 | 23.9 17.5 | 25.4 18.6 | $26 \cdot 9$ 19 | 28.5 20.9 | $30 \cdot 1$ 22.1 | $31 \cdot 7$ $23 \cdot 3$ | $33 \cdot 4$ | $35 \cdot 1$ 25 | 37-1 | $38 \cdot 7$ $28 \cdot 4$ |



TRUE BEARING OR AZIMUTH OF * ALDEBARAN.

|  | $\stackrel{\mathrm{m}}{4} \mathrm{4}$ | 8 | ${ }_{12}$ | ${ }_{16}^{\mathrm{m}}$ | ${ }_{20}^{\text {m. }}$ | ${ }_{24}$ | m. 28 | ${ }_{32} \mathrm{~m}$ | ${ }_{36}^{\mathrm{m}}$ | $\begin{aligned} & \mathrm{m} . \\ & 40 \end{aligned}$ | 44 | ${ }_{48}^{\text {m. }}$ | ${ }_{52} \mathrm{~m}$. | ${ }_{56}$ | ${ }_{60}$ | $\begin{aligned} & \mathrm{m} . \\ & 70 \end{aligned}$ | ${ }_{80}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | 2.4 | $4 \cdot 8$ | $7 \cdot 1$ | 9.5 | II•8 | 14.1 | 16.4 | 18.7 | 20.9 | 23.0 | $25^{\circ} \cdot 2$ | $\cdot 2$ | 2 | $31 \cdot 2$ | $33 \cdot 2$ | $7 \cdot 8$ | 2.0 |
| 42 | $2 \cdot 2$ | 4.4 | $6 \cdot 6$ | 8.8 | II.0 | $13 \cdot 1$ | $15 \cdot 3$ | 17.4 | 19.4 | 21.5 | 23.5 | $25 \cdot 5$ | 27.4 | 29.3 | 3I•I | 35.6 | $39 \cdot 8$ |
| 44 | $2 \cdot 1$ | $4^{-1}$ | $6 \cdot 2$ | $8 \cdot 2$ | $10 \cdot 3$ | $12 \cdot 3$ | 14.3 | $16 \cdot 3$ | 18.2 | 20.2 | 22. 1 | 23.9 | 25.8 | 27.6 | 29.4 | $33 \cdot 7$ | $37 \cdot 7$ |
| 46 | I• | 3.9 | 5.8 | $7 \cdot$ | $9 \cdot 6$ | 11.5 | 13 | 15 | 17 | 19.0 | 20 | 22 | 24.3 | $26 \cdot 1$ | 27.8 | 31.9 | 35.9 |
| 50 | I•7 | 3.5 | $5 \cdot 2$ | $6 \cdot 9$ | $8 \cdot 6$ | $10 \cdot 3$ | 12. | 13.7 | 15.4 | $17 \cdot 1$ | 18.7 | $20 \cdot 3$ | 22.0 | $23 \cdot 6$ | $25 \cdot \mathrm{I}$ | 29.1 | 32.8 |
| 55 | I.5 | 3.1 | $4 \cdot 6$ | 6.1 | $7 \cdot 7$ | $9 \cdot 2$ | $10 \cdot 7$ | $2 \cdot 2$ | 13.7 | 15.2 | 16.7 | 18.2 | :9.7 | $2 \mathrm{I} \cdot \mathrm{I}$ | $22 \cdot 6$ | $26 \cdot 1$ | $29 \cdot 6$ |
| 60 | 1.4 | $2 \cdot 8$ | $4 \cdot 2$ | $5 \cdot 6$ | $6 \cdot 9$ | $8 \cdot 3$ | 9.7 | II•I | 12.4 | 13.8 | 15.2 | 16.5 | 17.9 | 19.2 | 20.6 | 23.9 | $27 \cdot 1$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | $2 \cdot 2$ | $4 \cdot 3$ | $6 \cdot 5$ | $8 \cdot 6$ | 0.7 | 12 | 14.8 | 16.8 | 18.8 | 20. | 22.5 | 24.4 | $26 \cdot 1$ | 27.9 | 29.5 | 5 | 37-1 |
| 12 | $2 \cdot 0$ | $4 \cdot 0$ | $6 \cdot 0$ | $8 \cdot 0$ | $10 \cdot 0$ | 12. | 13.9 | 15.8 | 17.6 | $19 \cdot 5$ | $2 \mathrm{I} \cdot 2$ | $23^{\circ}$ | 24.7 | $26 \cdot 3$ | 28.0 | 31.8 | $35 \cdot 3$ |
| 14 | $1 \cdot 9$ | 3.8 | $5 \cdot 7$ | $7 \cdot 5$ | 9.4 | II 2 | 13.1 | I4.9 | 16.6 | 18.4 | 20.1 | 21.7 | 23.4 | $25^{\circ} \mathrm{O}$ | $26 \cdot 5$ | $30 \cdot 3$ | $33 \cdot 7$ |
| 16 | 1.8 | 3.6 | $5 \cdot 4$ | 7•1 | $8 \cdot 9$ | 10.6 | 12.4 | 14.1 | 15.8 |  | 19•1 | 20.7 | 22.2 | 23.8 | $25 \cdot 3$ | 28.9 | 32 |
| 20 | $1 \cdot 6$ | 3.2 | $4 \cdot 8$ | $6 \cdot 5$ | $8 \cdot 0$ | $9 \cdot 6$ | $11 \cdot 2$ | 12.8 | 14.3 | 15.8 | 17.3 | 18.8 | $20 \cdot 3$ | 21.7 | $23 \cdot 1$ | $26 \cdot 6$ | 29.8 |
| 25 | I.5 | $2 \cdot 9$ | 4.4 | $5 \cdot 8$ | 7.2 | $8 \cdot 7$ | $10 \cdot 1$ | II. 5 | 12.9 | 14.3 | 15.7 | 17.0 | 18.4 | 19.7 | 21.0 | 24.2 | $27 \cdot 3$ |
| 30 | I. 3 | 2.6 | $4 \cdot 0$ | $5 \cdot 3$ | $6 \cdot 6$ | $7 \cdot 9$ | $9 \cdot 2$ | 10.5 | II.8 | 13.1 | 14.4 | 15.6 | 16.9 | $18 \cdot 1$ | 19.3 | 22.4 | 25.3 |
| 40 | I. 2 | $2 \cdot 3$ | $3 \cdot 5$ | $4 \cdot 6$ | $5 \cdot 8$ | 6.9 | $8 \cdot 0$ | 9.2 | 10.3 | 11.4 | 12.6 | 13.7 | 14.8 | 15.9 | 17.0 | $19 \cdot 7$ | 22.4 |
| 50 | I-O | $2 \cdot 1$ | $3 \cdot 1$ | 4.2 | $5 \cdot 2$ | $6 \cdot 3$ | $7 \cdot 3$ | 8.4 | 9.4 | $10 \cdot 4$ | 11.5 | 12.5 | 13.4 | 14.6 | 15.6 | 18.1 | $20 \cdot 6$ |
| 60 | 1.0 | 2.0 | 3.0 | 3.9 | 4.9 | $5 \cdot 9$ | $6 \cdot 9$ | $7 \cdot 9$ | $8 \cdot 9$ | $9 \cdot 9$ | 10.8 | 11.8 | 12.8 | 13.8 | 14.7 | $17 \cdot 2$ | 19.6 |

REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* aldebaran.

| Lat. |  | ${ }_{57}^{\mathrm{m}}$ | ${ }_{58}$ | ${ }_{59}$ | ${ }_{60}$ | 61 |  | 2 | ${ }_{63}^{\mathrm{m}}$ | ${ }_{64}$ | ${ }_{85}^{\mathrm{m}}$ |  | ${ }_{66}$ | ${ }_{67}$ | ${ }_{68}$ | ${ }_{69}^{\mathrm{m}}$ | ${ }_{70}^{\mathrm{m}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. | REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 |  | $2{ }^{46.0}{ }^{2}$ | $51 \cdot 6$ |  |  |  |  |  |  |  |  |  | 38.9 29.0 3 | $45 \cdot 1$ 35 35 | $\begin{aligned} & 5 \mathrm{r} \cdot 43 \\ & 4 \mathrm{r} 0 \end{aligned}$ | $\begin{aligned} & 57 \cdot 8.4 \\ & 47 \cdot 2,3 \end{aligned}$ |  |
|  |  | $38 \cdot 3$ $3 \cdot 1$ 2 | $\begin{aligned} & 43 \cdot 6 \\ & 36 \cdot 2 \end{aligned}$ |  |  |  |  | 57.313 | (12.8 | +7.2 | 4.10 |  | - | $5^{\circ}$ | ${ }^{\circ}$ | 5. | - |
| 45 |  | 24.2 | 29.12 |  |  |  |  | $49 \cdot 4{ }^{2}$ | 24.63 | 0.03 |  |  | 10.83 |  | 2 r 93 | 27.5 |  |
| 46 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $4{ }_{4}^{47}$ |  |  | 16.r ${ }^{1}$ |  |  |  | 234 | 34.72 | $39^{\circ}$ | $4 \cdot 42$ | 4 |  | 6- |  |  |  |  |
|  |  | ${ }^{\circ} \cdot 2$ |  |  | 12. |  | ${ }_{2} 2{ }^{21}$ | 21.4 | 25.8. | 23. |  |  | 39.5 | 42. |  |  |  |
|  |  | I 54.9 I | 58.8 53.61 | $2 \cdot 8$ | 6. |  |  | 15.212 |  |  |  |  | $32 \cdot 6$ |  |  |  |  |
|  |  | $5 \cdot 8 \text { If }$ | 48.61 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | I | $43 \cdot 9$ |  |  | $54 \cdot 6$ | I 58 | 58.32 | $2{ }^{2 \cdot}{ }^{2} 0^{2}$ | 5.8 |  |  | 13.5 |  |  |  |  |
|  |  | I 36.01 |  |  |  |  |  | 53.1 |  |  |  |  |  |  |  | $13 \cdot 12$ |  |
|  |  | $\text { I } 3 \mathrm{I} \cdot 7 \mathrm{~F}$ |  |  |  |  |  | ${ }^{48 \cdot 1}{ }^{1}$ | I 51.51 | $55^{\circ} \mathrm{I}$ |  |  | $2 \cdot 12$ | 5.72 | $9 \cdot 4$ |  |  |
|  |  | I 23.7 I | $26 \cdot 61$ |  |  |  |  | 43.3 | $46 \cdot$ |  |  |  | 5 r | -8 | 2 | I $\cdot 6$ |  |
|  |  | 16.3 |  |  | $2 \cdot$ |  |  | 34.21 | I $37 \cdot 2 \mathrm{I}$ | 40.3 | 43.4 |  | $46 \cdot 5$ | - | 2\% $2 \cdot 1$ I | 56 |  |
| 60 |  | $\begin{aligned} & 16.3 \mathrm{I} \\ & 12.7 \mathrm{I} \end{aligned}$ | $\begin{aligned} & 18.9 \\ & 15 \cdot 3 \end{aligned}$ |  |  |  |  | 29.915 |  | $3{ }^{3} \times$ |  |  | $\begin{aligned} & 40 \cdot 6 \\ & 37 \cdot 6 \end{aligned}$ | $39^{\circ} 9$ |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 T |  | $23 \mathrm{r} \cdot 92$ | 37-1/2 |  | $47 \cdot 72$ |  |  | 58.63 | 3.423 | 983 |  |  | 21. |  |  | 39.313 |  |
|  |  | 2 27.712 |  |  |  |  |  | 53.82 | 2 59.3 |  |  |  | $16 \cdot$ |  |  |  |  |
| 24 |  | $\left.19.9\right\|^{2}$ |  |  |  |  |  | $44 \cdot 7$ | 249.92 |  |  |  | $5.9 \int_{3}^{3}$ | $\mathrm{II} \cdot 33^{3}$ | $\begin{aligned} & 26.93 \\ & 16 \end{aligned}$ |  |  |
|  |  |  |  |  |  |  |  | $40 \cdot 4$ | $25^{4} 512$ | 50.62 |  |  |  |  | 1. |  |  |
|  |  | ${ }^{2}$ | 17 |  |  |  |  | $36 \cdot 2$ | $2 \mathrm{I}^{2} 2$ | $46 \cdot 2$ |  |  | $56 \cdot 4$ |  |  |  |  |
|  |  |  |  |  |  |  |  | 28. | 33. |  |  |  | 47.5 |  |  |  |  |
|  |  | $2 \cdot 7{ }^{2}$ | 6.92 |  |  |  | 224 | $24^{6}{ }^{2}$ | ${ }^{29} 9^{-1}{ }^{2}$ |  |  |  | $43 \cdot 3$ |  |  |  |  |
|  |  |  |  | $2$ |  |  |  | 17.32 | $2{ }_{2}$ | ${ }_{26.1}^{29.9}$ |  |  | 39.22 | 3982 | $4 \cdot 4$ | 49. |  |
| 32 |  | 53.6 | 5 |  |  |  |  |  | 182 | ${ }^{2}$ |  |  | 31.3 | $35.8{ }^{2}$ | $40 \cdot 3$ |  |  |
| $\begin{array}{r}33 \\ 34 \\ \hline\end{array}$ |  |  |  |  |  |  | 10 | 10. | $14 \cdot 72$ | 18. |  |  | $27.5{ }^{2}$ |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 42.6I | $46 \cdot 1$ | $49 \cdot$ | 53.4 | 57.2 |  | $1 \cdot 0$ | $4 \cdot 8.2$ | 8.82 | $12 \cdot 7$ |  | 16.82 | $20 \cdot 8$ | 5.02 |  |  |
| $\begin{aligned} & 37 \\ & 38 \end{aligned}$ |  | $40 \cdot 01$ | 43. | 47\%1 |  |  |  | 58.0 ${ }^{2}$ | ${ }^{1} \begin{array}{r}1.7 \\ 58.7 \\ \hline 1\end{array}$ |  |  |  | 13.32 10.02 102 |  |  |  |  |
| 39 |  |  |  |  |  |  |  | 52-1 | ${ }^{5} 57 \%$ |  |  |  | 6.72 |  |  |  |  |
|  |  | + $32 \cdot 61$ |  |  |  |  |  | $49 \cdot 315$ | 1 $52 \cdot 81$ |  |  |  | $3 \cdot 6$ |  |  |  |  |
| $4 \mathrm{HI}$ |  | + 30.21 | 330.4 | 34 |  |  |  | . 5 | 49.9 | 53.41 |  |  | 57. |  |  |  |  |
| 43 |  |  |  | $3{ }_{3}$ |  |  |  | ${ }_{4 \mathrm{r}}^{1} \mathrm{~T}$ | I4.4 |  |  |  | 54.4. |  |  |  |  |
| 4 |  |  |  |  |  |  |  | 38.51 | $1{ }^{1} 77$ |  |  |  | $5 \mathrm{I} \cdot 4 \mid$ |  |  |  |  |
|  |  |  |  |  |  |  |  | 360 1 | 39.0 1 |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | 33. | $1{ }^{36 \cdot 4} 1$ | 39.51 |  |  | 45 | 48.915 |  |  |  |
|  |  |  |  |  | $23^{\circ}$ |  |  | 28.51 | [ 314 | 34.3 | 37 |  | 40.2 |  | , |  |  |
|  |  | $\left.12.9\right\|^{1}$ |  |  | $20 \cdot 71$ |  | 126 | 26.15 | 28.9 1 |  |  |  |  |  |  |  |  |
|  |  | O.9 | ${ }_{15} 1$ | 1 | 16.31 | 18.8 |  |  | ${ }_{24}{ }^{\circ} \mathrm{I}$ |  |  |  | ${ }_{32 \cdot 1}{ }^{34}$ | 34.9 1 | $3{ }^{\circ}$ |  |  |
|  |  | 1 | 9.3 |  | ${ }^{14} \cdot \mathrm{~T}$ | $6 \cdot 6$ | 119 | $1{ }^{1 / 1}$ | $\mathrm{I} 2 \cdot 7$ | 24.21 |  |  | 29.51 |  | 321 |  |  |
| 53 54 |  | $3 \cdot 01$ |  |  |  | 14.4 |  | 16.81 | $1 \begin{aligned} & 19.31 \\ & \mathrm{r} \\ & 7\end{aligned}$ |  |  |  |  | 29.61 27 |  | ${ }_{32 \cdot 21}{ }^{34}$ |  |
|  |  | $1 \cdot 3$ I | 5 |  |  |  |  | - | I4.7 |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | 隹 |  |  |  | 19. | ${ }^{21} 88$ | $24 \cdot 3$ |  |  |
|  |  | 57.60 | 59.61 |  |  |  |  |  |  |  | 147 |  | 17.01 14.51 1 | 19.31 | ${ }_{10}^{21 \cdot 7}$ |  |  |
|  |  | 53.9 . |  |  |  |  |  |  | 5.81 |  |  |  |  |  |  |  |  |
|  |  | $52 \cdot 10^{\circ}$ | 54.01 | 55.80 | 57.70 |  |  | 1.6 |  |  |  |  | 9.71 |  | 1409 |  |  |


| Lat. | ${ }_{2}$ | m. | ${ }_{8}{ }_{8}$ | ${ }_{8} \mathrm{~m}$ | ${ }_{10}$ | 12 | ${ }_{14} \mathrm{~m}$ | ${ }_{16}^{\mathrm{m}}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{1 8} \end{aligned}$ | $\frac{\mathrm{m}}{20}$ | ${ }_{21}^{\mathrm{m} .}$ | ${ }_{22}$. | $\begin{aligned} & \mathrm{m} . \\ & 23 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 24 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 25 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{2 6} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 | 0.2 | 1.0 | $2 \cdot 2$ | $4^{\circ} \mathrm{O}$ | $6 \cdot 2$ | 9.0 | 12.2 | 15.9 | $20 \cdot 1$ | 24.8 | 27.4 | $30 \cdot 1$ | 32.8 | $35 \cdot 7$ | $38 \cdot 7$ | 41.8 |
| 36 | $0 \cdot 2$ | $0 \cdot 9$ | $2 \cdot 0$ | $3 \cdot 6$ | $5 \cdot 7$ | $8 \cdot 3$ | II.2 | 14.6 | 18.4 | 22.6 | 24.9 | 27.4 | 29.9 | 32.5 | $35 \cdot 3$ | $38 \cdot 1$ |
| 38 | 0.2 | 0.8 | I. 8 | $3 \cdot 3$ | $5 \cdot 2$ | $7 \cdot 5$ | 10.2 | 13.3 | $16 \cdot 8$ | $20 \cdot 7$ | $22 \cdot 8$ | $25^{\circ} 0$ | 27.3 | $29 \cdot 7$ | 32.2 | $34 \cdot 8$ |
| 40 | 0.2 | 0.7 | I'7 | 3.0 | $4 \cdot 7$ | 6.8 | $9 \cdot 3$ | 12.1 | 15.3 | $19^{\circ} 0$ | $20 \cdot 9$ | 22.9 | 25.1 | $27 \cdot 3$ | 29.6 | $32 \cdot 0$ |
| 42 | 0.2 | 0.7 | I. 6 | $2 \cdot 8$ | 4.4 | $6 \cdot 3$ |  | II•I | 14.1 | 17.4 | 19.2 | $21 \cdot 1$ | 23.0 | $25^{\circ} \mathrm{O}$ | 2 | 29.4 |
| 44 | 0.2 | 0.6 | 1.4 | $2 \cdot 6$ | $4 \cdot 0$ | $5 \cdot 8$ | $7 \cdot 8$ | $10 \cdot 3$ | 13.0 | $16 \cdot 0$ | $17 \cdot 7$ | 19.4 | $2 \mathrm{~T} \cdot 2$ | $23 \cdot 1$ | $25^{\circ} \mathrm{O}$ | $27 \cdot 0$ |
| 46 | $\bigcirc \cdot 1$ | 0.6 | $1 \cdot 3$ | $2 \cdot 3$ | $3 \cdot 7$ | $5 \cdot 3$ | 7 | 9.4 | $11 \cdot 9$ | 14 | 16.3 | 17.9 | 19.5 | 21.2 | $23^{\circ}{ }^{\circ}$ | 24.9 |
| 48 | $0 \cdot 1$ | $0 \cdot 5$ | I-2 | $2 \cdot 2$ | 3.4 | $4 \cdot 9$ | $6 \cdot 7$ | $8 \cdot 7$ | 11 | 13.6 | 15.0 | 16.5 | 18 | 19.6 | $2 \mathrm{~T} \cdot 2$ | 23.0 |
| 50 | $0 \cdot 1$ | $0 \cdot 5$ | I•I | $2 \cdot 0$ | $3 \cdot 1$ | 4.5 | $6 \cdot 1$ | $8 \cdot 0$ | $0 \cdot 2$ | 12.5 | 13.8 | 15.2 | $16 \cdot 6$ | 18.7 | 19.6 | $2 \mathrm{I} \cdot 2$ |
| 52 | $0 \cdot 1$ | 0.4 | $1 \cdot 0$ | 1.8 | 2.9 | $4 \cdot 2$ | $5 \cdot 7$ | $7 \cdot 4$ | $9 \cdot 4$ | 11.6 | 12.8 | $14^{\circ} \mathrm{O}$ | 15.3 | $16 \cdot 7$ | 18.1 | $19 \cdot 5$ |
| 54 | O.I | $0 \cdot 4$ | - 09 | 1.7 | $2 \cdot 7$ | $3 \cdot 8$ | $5 \cdot 2$ | $6 \cdot 8$ | $8 \cdot 6$ | 10.7 | II-8 | 12.9 | I4. ${ }^{\text {I }}$ | 15.3 | $16 \cdot 6$ | 18.0 |
| 56 | $0 \cdot 1$ | $0 \cdot 4$ | $\bigcirc \cdot 9$ | 1.6 | $2 \cdot 5$ | 3.5 | $4 \cdot 8$ | $6 \cdot 3$ | 7.9 | $9 \cdot 8$ | 10.8 | II-9 | 13.0 | 14.1 | 15.3 | 16.6 |
| 60 | $0 \cdot 1$ | $0 \cdot 3$ | $0 \cdot 7$ | I 3 | $2 \cdot 1$ | 3.0 | $4^{\circ}$ | $5 \cdot 3$ | $6 \cdot 7$ | $8 \cdot 3$ | $9 \cdot 1$ | 10.0 | 10.9 | 11.9 | 12.9 | 14.0 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | 0.2 | 1.0 | 2.2 2.1 | $4 \cdot 0$ | $6 \cdot 3$ | 9.1 | 12.3 | 16.I | $20 \cdot 4$ | 25.2 | 27.8 25.8 | $30 \cdot 5$ 28.3 | $33 \cdot 3$ | $36 \cdot 2$ 3.6 | $39 \cdot 3$ | 42.4 |
| 22 | 0.2 | $0 \cdot 9$ | $2 \cdot 1$ | $3 \cdot 7$ | $5 \cdot 9$ | $8 \cdot 4$ | 11.4 | 14.9 | 18.9 | 23.4 | $25 \cdot 8$ | $28 \cdot 3$ | $30 \cdot 9$ | $33 \cdot 6$ | $36 \cdot 4$ | $39 \cdot 3$ |
| 24 | 0.2 | 0.9 | I.9 | $3 \cdot 5$ | $5 \cdot 5$ | $7 \cdot 8$ | 10.7 | 13.9 | 17.6 | 21 | $24^{\circ} \mathrm{O}$ | $26 \cdot 3$ | $28 \cdot 8$ | $3{ }^{1} 3$ | 33.9 | $36 \cdot 7$ |
| 26 | $0 \cdot 2$ | $0 \cdot 8$ | I.8 | $3 \cdot 2$ | $5 \cdot 1$ | . 3 | 9.9 | 13.0 | 16.5 | 20.3 | 22.4 | $24^{6}$ | 26.9 | 29.2 | 31.7 | 34.3 |
| 28 | $0 \cdot 2$ | $0 \cdot 7$ | 1.7 <br> 1.6 | 3.0 3.8 | 4.8 | 6.8 6.4 | 88.3 | 12.2 11.4 | 15.4 | $19 \cdot 0$ | 21.0 10 | $23^{2} \cdot 0$ | $25 \cdot 2$ 23 | 27.4 | 29.7 | $32 \cdot \mathrm{I}$ $30 \cdot 1$ |
| 30 | 0.2 | $0 \cdot 7$ | 1.6 | 2.8 | $4 \cdot 5$ | $6 \cdot 4$ | $8 \cdot 7$ | II4 | 14.5 | 17.9 | 19.7 | 21.6 | 23.6 | $25 \cdot 7$ | 27.9 | 30.1 |
| 32 | $0 \cdot 2$ | 0.7 | 1.5 | 2.7 | 4.2 | $6 \cdot 0$ | 8.2 | $10 \cdot 7$ | 13.6 | 16.8 | 18.5 | 20.3 | 22.2 | $24 \cdot 1$ | 26.2 | . 3 |
| 34 | $\bigcirc \cdot \mathrm{I}$ | 0.6 | 1.4 | 2.5 | $3 \cdot 9$ | $5 \cdot 7$ | $7 \cdot 7$ | $10 \cdot 1$ | 12.8 | 15.8 | 17.4 | $19 \cdot 1$ | 20.8 | 22.7 | 24.6 | $26 \cdot 6$ |
| 36 | O-I | $0 \cdot 6$ | I 3 | 2.4 | $3 \cdot 7$ | $5 \cdot 3$ | $7 \cdot 3$ | $9 \cdot 5$ | 12.0 | 14.8 | $16 \cdot 4$ | 18.0 | 19.6 | $25^{4} 4$ | 23.2 | $25^{1} 1$ |
| 40 | - I | $0 \cdot 5$ | $\mathrm{I} \cdot 2$ | $2 \cdot 1$ | $3 \cdot 3$ | $4 \cdot 7$ | $6 \cdot 4$ | $8 \cdot 4$ | $10 \cdot 7$ | 13.2 | 14.5 | 15.9 | I7.4 | 18.9 | $20 \cdot 6$ | $22 \cdot 2$ |
| 50 60 | O.1 | 0.4 0.3 | 0.9 0.6 | 1.I | 2.4 1. | 3.5 2.5 | 3.4 | $6 \cdot 2$ 4.4 | 7.9 | 9.7 6.9 | $10 \cdot 7$ 7.6 | 11 | 12.8 0.2 | 14.0 10.0 | 15.2 10.8 | 16.4 <br> 11. |
| 60 | O.I | $0 \cdot 3$ | 0.6 | I. 1 | I.7 | $2 \cdot 5$ | $3 \cdot 4$ | 4.4 | $5 \cdot 6$ | $6 \cdot 9$ | $7 \cdot 6$ | 8.4 | $9 \cdot 2$ | 10.0 |  | II'7 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $3^{\circ} 6$ | 41.0 | 44'1 | 47\%2 | 50.5 | 53.9 | 57*3 | 60.9 | 64.6 | 68.4 | 72.2 | $76 \cdot 2$ | $80 \cdot 3$ | 84.5 | $88 \cdot 7$ | $93 \cdot 1$ | 97.6 |
| 37 | 39.2 | 42.I | $45 \cdot 2$ | $48 \cdot 3$ | 51.5 | $54 \cdot 8$ | $58 \cdot 3$ | 61.8 | 65.4 | 69.I | 72.9 | $76 \cdot 8$ | $80 \cdot 8$ | 84.9 | 89.I | 93.4 |
| 38 | 37.5 | $40 \cdot 3$ | $43 \cdot 2$ | $46 \cdot 2$ | 49.3 | $52 \cdot 5$ | $55 \cdot 8$ | 59.1 | $62 \cdot 6$ | $66 \cdot 2$ | 69.8 | 73.5 | 77.4 | $8 \mathrm{r} \cdot 3$ | 85.3 | 89.4 |
| 39 | 35.9 | 38.6 | 41.4 | 44.2 | $47^{\circ}$ | $50 \cdot 3$ | 53.4 | 56.6 | 59.9 | 63.4 | $66 \cdot 9$ | 70.5 | 74.1 | 77.9 | ${ }^{81}{ }^{\text {7 }}$ - 8 | $85 \cdot 7$ |
| 40 | 34.4 | $37 \cdot 0$ | $39 \cdot 7$ | $42 \cdot 4$ | $45 \cdot 2$ | $48 \cdot 2$ | $51 \cdot 2$ | 54.3 | $57 \cdot 5$ | 60.7 | 64. 1 | $67 \cdot 6$ | $7 \mathrm{I} \cdot \mathrm{I}$ | $74 \cdot 7$ | $78 \cdot 4$ | $82 \cdot 2$ |
| 4 I | 33.0 | $35 \cdot 5$ | 38.0 | $40 \cdot 6$ | 43.4 | $46 \cdot 2$ | 49.I | 52.0 | $55^{\circ} \mathrm{I}$ | 58.2 | 6I.5 | $64 \cdot 8$ | 68.2 | $71 \cdot 7$ | 75.2 | $78 \cdot 9$ |
| 42 | 31.6 | $34^{\circ} \mathrm{O}$ | $36 \cdot 4$ | $39^{\circ} \mathrm{O}$ | $4 \mathrm{I} \cdot 6$ | 44.3 | 47-1 | 49.9 | $52 \cdot 9$ | $55 \cdot 9$ | $5{ }^{510}$ | $62 \cdot 2$ | $65 \cdot 4$ | 68.8 | 72.2 | $75 \cdot 7$ |
| 43 | $30 \cdot 3$ | $32 \cdot 6$ | $35^{\circ} \mathrm{O}$ | 37.4 | $39^{\circ} 9$ | 42.5 | 45.2 | 47.9 | $50^{\circ} 7$ | 53.6 | 56.6 | 59•7 | $62 \cdot 8$ | $66 \cdot 0$ | $69 \cdot 3$ | $72 \cdot 7$ |
| 44 | 29.1 | 3I•3 | $33 \cdot 6$ | 35.9 | $38 \cdot 3$ | $40 \cdot 8$ | 43.4 | $46 \cdot 0$ | $48 \cdot 7$ | 51.5 | 54.4 | 57.3 | 60.3 | 63.4 | $66 \cdot 5$ | 69.9 |
| 46 | 26.8 | 28.8 | 30.9 | 33'I | 35.3 | 37.6 | $40 \cdot 0$ | 42.4 | 44.9 | $47 \cdot 5$ | 50.1 | $52 \cdot 8$ | $55 \cdot 6$ | 58.5 | 61.4 | $64 \cdot 4$ |
| 48 | 24.8 | 26.6 | 28.5 | $30^{\circ} 5$ | $32 \cdot 6$ | 34.7 | 36.9 | $39^{-1}$ | 41.4 | 43.8 | $46 \cdot 3$ | 48.8 | $51 \cdot 3$ | 54.0 | $56 \cdot 7$ | $59 \cdot 4$ |
| 50 | 22.8 | 24.6 | $26 \cdot 3$ | 28.2 | 30.1 | $32 \cdot 0$ | 34.0 | $36 \cdot 1$ | $38 \cdot 2$ | $40 \cdot 4$ | $42 \cdot 7$ | $45^{\circ}$ | $47 \cdot 4$ | $49^{-8}$ | 52.3 | 54.9 |
| 52 | 21.1 | $22 \cdot 6$ | 24.3 | $26 \cdot 0$ | $27 \cdot 7$ | 29.5 | 31.4 | $33 \cdot 3$ | $35 \cdot 3$ | $37 \cdot 3$ | 39.4 | 41.5 | $43 \cdot 7$ | $46 \cdot 0$ | $48 \cdot 3$ | $50 \cdot 6$ |
| 54 | 19.4 | $20 \cdot 9$ | 22.4 | 23.9 | $25^{6} \cdot 6$ | 27.2 | 28.9 | $30 \cdot 7$ | $32 \cdot 5$ | 34.4 | $36 \cdot 3$ | 38.3 | $40 \cdot 3$ | 42.4 | 44.5 | $46 \cdot 7$ |
| 56 | 17.9 | 19.2 | $20 \cdot 6$ | 22.0 | 23.5 | $25^{1}$ I | $26 \cdot 6$ | 28.3 | 29.9 | $31 \cdot 7$ | $33 \cdot 4$ | $35 \cdot 3$ | $37 \cdot 1$ | 39.0 | 410 | $43^{\circ}$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | $39 \cdot 5$ | $42 \cdot 5$ | $45 \cdot 5$ | $48 \cdot 7$ | 52.0 | 55.3 | 58.8 | $62 \cdot 3$ | $66^{\circ}$ | 69•7 | 73.6 | $77 \cdot 6$ | $8 \mathrm{I} \cdot 6$ | $85 \cdot 8$ | $90 \cdot 0$ | 94.3 |
| 25 | 38.2 | $4 \mathrm{I} \cdot \mathrm{O}$ | $44^{\circ} \mathrm{O}$ | 47.1 | $50 \cdot 2$ | $53 \cdot 5$ | $56 \cdot 8$ | $60 \cdot 2$ | $63 \cdot 8$ | $67 \cdot 4$ | 71.1 | $75^{\circ} \mathrm{O}$ | 78.9 | 82.9 | $87 \cdot 0$ | 91.2 |
| 26 | 36.9 | 39.7 | $42 \cdot 6$ | $45 \cdot 5$ | $48 \cdot 6$ | 51•7 | $55^{\circ}$ | 58.3 | 6I•7 | $65 \cdot 2$ | 68.8 | 72.6 | $76 \cdot 4$ | $80 \cdot 2$ | 84.2 | 88.3 85.5 |
| 27 | $35 \cdot 7$ | 38.4 | 41.2 | $44^{\circ} \mathrm{O}$ | $47^{\circ} \mathrm{O}$ | 50.0 | 53.2 | $56 \cdot 4$ | 59.7 57 | $63 \cdot \mathrm{I}$ $6 \mathrm{I} \cdot \mathrm{I}$ | $66 \cdot 6$ 64.5 | 70.2 68.0 | 73.9 71.6 | $77 \cdot 7$ | $81 \cdot 6$ 79.0 | 85.5 8.8 |
| 28 | 34.6 | 37.2 | 39.9 | $42 \cdot 6$ | $45 \cdot 5$ | $48 \cdot 5$ | 51.5 | 54.6 | $57 \cdot 8$ | 6I•I | 64.5 | 68.0 | 71.6 | 75.2 | $79^{\circ} \mathrm{O}$ | 82 |
| 30 | 32.5 30.5 | 34.9 32.8 | $37 \cdot 4$ $35 \cdot 2$ | $40 \cdot 0$ 37.6 | 42.7 $40 \cdot 1$ | $45 \cdot 5$ 42.7 | $48 \cdot 3$ 45.4 | 51.3 48.2 | $54 \cdot 3$ $5 \mathrm{I} \cdot \mathrm{O}$ | $57 \cdot 4$ 54.0 | $60 \cdot 6$ 57 | 63.9 $60 \cdot 1$ | 67.3 63.2 | $70 \cdot 7$ 66.5 |  | 77.8 73.2 |
| 32 | $30 \cdot 5$ 28.7 | 32.8 30.8 | 35\%2 | $37 \cdot 6$ | $40 \cdot 1$ 37.8 | $42 \cdot 7$ $40 \cdot 2$ | $45 \cdot 4$ 42.7 | $48 \cdot 2$ $45 \cdot 4$ | $51^{\circ} \mathrm{O}$ 48.0 | 54.0 50.8 | $57 \cdot 0$ 53 | $60 \cdot 1$ $56 \cdot 5$ | 63.2 59.5 | $66 \cdot 5$ 62.6 | 69.8 $65 \cdot 7$ | 73.2 68.9 |
| 36 | $27 \cdot 0$ | 29.0 | 3I•I | $33 \cdot 3$ | $35 \cdot 5$ | $37 \cdot 9$ | $40 \cdot 2$ | $42 \cdot 7$ | $45 \cdot 2$ | $47 \cdot 8$ | 50.5 | 53.2 | 56.0 | 58.9 | 61.9 | 64.9 |
| 38 | $25 \cdot 4$ | $27 \cdot 3$ | 29.3 | 31.4 | $33 \cdot 5$ | $35 \cdot 7$ | 37.9 | $40 \cdot 2$ | 42.6 | 45. | $47 \cdot 6$ | 50.2 | 52.8 | $55 \cdot 5$ | $58 \cdot 3$ | $6 \mathrm{I} \cdot 2$ |
| 40 | 24.0 | 25.8 | $27 \cdot 6$ | $29 \cdot 6$ | 3 r 5 | 33.6 | $35 \cdot 7$ | $37 \cdot 9$ | $40 \cdot 2$ | $42 \cdot 5$ | 44.8 | $47 \cdot 3$ | $49 \cdot 8$ | $52 \cdot 3$ | $55^{\circ} \mathrm{O}$ | $57 \cdot 6$ |
| 42 | $22 \cdot 6$ | 24.3 | $26 \cdot 0$ | 27.8 | $29 \cdot 7$ | $3 \mathrm{I} \cdot 7$ | $33 \cdot 7$ | $35 \cdot 7$ | 37.8 | $40 \cdot 0$ | $42 \cdot 3$ | $44 \cdot 6$ | $46 \cdot 9$ | $49 \cdot 3$ | $5 \mathrm{I} \cdot 8$ | 54.3 |
| 44 | 21.3 | $22 \cdot 9$ | 24.5 | $26 \cdot 2$ | $28 \cdot 0$ | 29.8 | $3{ }^{1} \cdot 7$ | $33^{6}$ | $35 \cdot 6$ | $37 \cdot 7$ | $39 \cdot 8$ | $42 \cdot 0$ | 44.2 | $46 \cdot 5$ | $48 \cdot 8$ | $5 \mathrm{I} \cdot 2$ |
| 46 | $20 \cdot 0$ | 21.5 | $23 \cdot 1$ | 24.7 | 26.4 | $28 \cdot 1$ | 29.9 | 31.7 | $33 \cdot 6$ | $35 \cdot 5$ | $37 \cdot 5$ | 39.5 | 41.6 | $43^{\circ}$ | $46 \cdot 0$ | $48 \cdot 2$ |
| 48 | 18.8 | 20.2 | 21.7 | 23.2 | 24.8 | $26 \cdot 4$ | 28.1 | 29.8 | $31^{6} 6$ | 33 | $35 \cdot 3$ | $37 \cdot 2$ | 39.2 | $41 \cdot 2$ | $43 \cdot 3$ | $45 \cdot 4$ |
| 50 | $17 \cdot 7$ 16.6 | 19.0 | 20.4 | 21.8 | $23 \cdot 3$ | 24.8 | $26 \cdot 4$ $2 \cdot 8$ | 28.0 | 29.7 | 31.4 | 33.2 | 35.0 32.8 | $36 \cdot 8$ | $38 \cdot 7$ 36.4 | $40 \cdot 7$ $38 \cdot 2$ | $42 \cdot 7$ $40 \cdot 1$ |
| 54 | 15.6 | 16.7 | 19.2 17.9 | 20.5 19.2 | 21.9 20.5 | $23 \cdot 3$ 21.8 | 24.8 23.2 | $26 \cdot 3$ 24.7 | 27.9 26.1 | 29.5 27.6 | 39.2 | 30.8 | 32.4 | 34.1 | $35 \cdot 8$ | $37 \cdot 5$ |
| 56 | 14.6 | 15.7 | 16.8 | 18.0 | 19.2 | $20 \cdot 4$ | 21.7 | 23.1 | 24.4 | $25 \cdot 8$ | 27.3 | 28.8 | $30 \cdot 3$ | 31.9 | 33.5 | $35 \cdot 1$ |

* altair.


TRUE BEARING OR AZIMUTH OF * ALTAIR.

| Lat. | m. | $\stackrel{\mathrm{m}}{8}$ | 12 | m. | m 20 | m. 24 | 28 | m 32 | ${ }_{36}$ | 40 | 44 | 48 | $\mathrm{m}_{52}$ | m 56 | $\mathrm{m}_{60}$ | ${ }_{70} \mathrm{~m}$ | m. 80 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 |  |  |  |  |  |  |  | I $8 \cdot 0$ |  |  |  |  |  |  | 2. | $6 \cdot 5$ |  |
| 34 | $2 \cdot 3$ | $4 \cdot 6$ | $6 \cdot 9$ | $9 \cdot 2$ | 11.4 | 13.7 | 15.9 | 18 | $20 \cdot 2$ | 22.3 | 24.3 | $26 \cdot 3$ | $8 \cdot 2$ | $30 \cdot 2$ | $32 \cdot 0$ | $36 \cdot 5$ | $40 \cdot 6$ |
| 36 | $2 \cdot 2$ | $4 \cdot 3$ | $6 \cdot 4$ | $8 \cdot 6$ | 10•7 | 12.8 | 14.8 | 16.9 | $18 \cdot 9$ | 20.9 | 22.8 | 24*7 | $26 \cdot 6$ | $28 \cdot 4$ | $30 \cdot 2$ | 34.5 | $38 \cdot 6$ |
| 38 | $2 \cdot 0$ | $4{ }^{\circ}$ | 6.0 | $8 \cdot 0$ | $10 \cdot 0$ | 12 | I $3 \cdot 9$ | 159 | 17.8 | $19 \cdot 7$ | 21.5 | 23*3 | 25'I | $26 \cdot 9$ | $28 \cdot 6$ | $32 \cdot 8$ | $36 \cdot 7$ |
| 40 | I.9 | $3 \cdot 8$ | $5 \cdot 7$ | $7 \cdot 6$ | 9.4 | II•3 | $13 \cdot 2$ | $15{ }^{\circ}$ | 16.8 | $18 \cdot 6$ | $20 \cdot 3$ | $22 \cdot 1$ | $23 \cdot 8$ | $25 \cdot 5$ | 27.2 | $31 \cdot 2$ | $35^{\bullet 1}$ |
| 45 | I•7 | $3 \cdot 3$ | $5 \cdot 0$ | $6 \cdot 7$ | $8 \cdot 3$ | $10 \cdot 0$ | II | 13.2 | 14.8 | 16 | 18.0 | 19.6 | 21.2 | 22.7 | $24^{\circ} 2$ | $28 \cdot 0$ | $3 \mathrm{I} \cdot 6$ |
| 50 | I-5 | $3 \cdot 0$ | $4 \cdot 5$ | $6 \cdot 0$ | $7 \cdot 5$ | $8 \cdot 9$ | $10 \cdot 4$ | II.9 | 13.4 | 14.8 | $16 \cdot 3$ | $17 \cdot 7$ | 19.1 | $20 \cdot 5$ | 22.0 | 25.4 | $28 \cdot 8$ |
| 60 | I. 3 | $2 \cdot 5$ | $3 \cdot 8$ | 5•1 | $6 \cdot 3$ | $7 \cdot 6$ | $8 \cdot 8$ | 10.I | II.3 | 12.6 | 13.8 | I5.1 | $16 \cdot 3$ | 17.6 | 18.8 | 21.9 | 24.9 |
| S. | 2 |  | 6.2 | $8 \cdot 2$ | 10 |  |  | 16.1 | 0 |  |  |  |  |  |  |  |  |
| 22 | I.9 | 3.9 | $5 \cdot 8$ | $7 \cdot 7$ | $9 \cdot 6$ | II•5 | 13.4 | 15.2 | $17 \cdot 0$ | 18.8 | $20 \cdot 6$ | $22 \cdot 3$ | $24^{\circ} \mathrm{O}$ | $25 \cdot 6$ | $27 \cdot 2$ | 3I-I | $34 \cdot 7$ |
| 24 | I. 8 | $3 \cdot 7$ | $5 \cdot 5$ | $7 \cdot 3$ | $9 \cdot 1$ | 10.9 | 12.7 | 14.4 | 16.1 | 17.8 | 19.5 | 21.2 | 22.8 | $24^{\circ} 4$ | 26.0 | $29 \cdot 7$ | $33 \cdot 3$ |
| 26 | $1 \cdot 7$ | $3 \cdot 5$ | $5 \cdot 2$ | $6 \cdot 9$ | $8 \cdot 6$ | $10 \cdot 3$ | 12.0 | 13.7 | 15.4 | 17.0 | 18.6 | $20 \cdot 2$ | 21.8 | $23 \cdot 3$ | 24.8 | $28 \cdot 5$ | 31•9 |
| 30 | I.6 | $3 \cdot 2$ | 4*7 | $6 \cdot 3$ | $7 \times 9$ | $9 \cdot 4$ | 1100 | 12.5 | 14.0 | 15.5 | 17.0 | 18.5 | 20.0 | $2 \mathrm{I} \cdot 4$ | 22.8 | $26 \cdot 3$ | 29.6 |
| 35 | 1.4 | 2.9 | $4 \cdot 3$ | $5 \cdot 7$ | $7 \cdot 1$ | $8 \cdot 6$ | 10.0 | II.4 | 12.8 | 14.1 | 15.5 | 16.9 | 18.2 | 19.5 | 20.9 | $24^{\cdot 1}$ | $27 \cdot 3$ |
| 40 | I. 3 | $2 \cdot 6$ | $3 \cdot 9$ | $5 \cdot 3$ | $6 \cdot 6$ | $7 \cdot 9$ | $9 \cdot 2$ | $10 \cdot 5$ | II* 8 | 13.0 | 14.3 | 15.6 | 16.8 | I8.1 | 19.3 | 22.4 | 25.4 |
| 50 | I-2 | $2 \cdot 3$ | $3 \cdot 5$ | $4 \cdot 6$ | $5 \cdot 8$ | $6 \cdot 9$ | $8 \cdot 1$ | $9 \cdot 2$ | $10 \cdot 4$ | II 5 | 12.6 | 13.8 | 14.9 | $16 \cdot 0$ | 17.2 | $20^{\circ} 0$ | $22 \cdot 7$ |
| 60 | I'I | $2 \cdot 1$ | $3 \cdot 2$ | $4^{\cdot 2}$ | $5 \cdot 3$ | $6 \cdot 4$ | $7 \cdot 4$ | $8 \cdot 5$ | 9.5 | 10.6 | II• 6 | 12.7 | 13.7 | 14.8 | 15.8 | 18.4 | 21.0 |

REDUCTION TO THE MERIDIAN FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* a ANDROMEDe.



## REDUCTION TO THE MERDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* a ANDROMEDIE.


TRUE BEARING OR AZIMUTH OF * a ANDROMEDE.

| Lat. | ${ }_{4}$ | ${ }_{8} \mathrm{~m}$. | 12. | 16 | $\mathrm{m}_{20}$ | ${ }_{24}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{32}$ m. | m. 36 | ${ }_{40}^{\mathrm{m}} \mathrm{4}$ | ${ }_{44} \mathrm{~m}$. | ${ }_{48}$ | $\mathrm{m} .$ | ${ }_{56}{ }^{\text {m. }}$ | ${ }_{60} \mathrm{~m}$. | ${ }_{70} \mathrm{~m}$ | ${ }_{80}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 | I.7 | 3.4 | $5 \cdot 1$ | 6.7 | 8.4 | $10 \cdot 1$ | $1{ }^{\circ} \cdot 7$ | 13.4 | $15^{\circ} \mathrm{O}$ | $16 \cdot 7$ | 18.3 | 19.9 | $21^{\circ} 5$ | $23 \cdot 1$ | $24 \cdot 7$ | $28^{\circ} 5$ | $2 \cdot 3$ |
| 58 | I.8 | 3.4 | $5 \cdot 4$ | 7-1 | 8.9 | 10.7 | 12.4 | $1{ }^{1} \cdot 2$ | 15.9 | $17 \cdot 7$ | 19.4 | 2I.1 | $22 \cdot 7$ | 24.4 | $26 \cdot 1$ | $30 \cdot 5$ | $32 \cdot$ $34 \%$ |
| 56 | I.9 | 3.8 | $5 \cdot 7$ | $7 \cdot 6$ | $9 \cdot 5$ | II 4 | 13.3 | $15 \cdot 1$ | 17.0 | 18.8 | $20 \cdot 6$ | 22.4 | $24^{1} 1$ | 25.9 | $27 \cdot 6$ | 31.8 | 35.9 |
| 54 | 2.0 | 4.1 | 6.I | $8 \cdot 2$ | 10.2 | 12.2 | 14.2 | 16.2 | 18.1 | 20.1 | 22.0 | 23.9 | $25 \cdot 7$ | $27 \cdot 5$ | 29.3 | $33 \cdot 7$ | $37 \cdot 9$ |
| 53 | $2 \cdot 1$ | 4.2 | $6 \cdot 4$ | $8 \cdot 5$ | $10 \cdot 6$ | 12.6 | 14.7 | 16.8 | 18.8 | $20 \cdot 8$ | 22.8 | $24 \cdot 7$ | $26 \cdot 6$ | 28.5 | $30 \cdot 3$ | 34.8 | $39^{\circ}$ |
| 0 | I. 8 | 3.6 | $5 \cdot 5$ | $7 \cdot 3$ | 9.1 | 10.8 | 12.6 | 14.3 | 16.0 | 17.6 | 19.3 | $20 \cdot 8$ | 22.4 | 23.9 | 25.4 | 28.8 | $32 \cdot 1$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | I.7 | 3.4 | $5 \cdot 2$ | $6 \cdot 8$ | $8 \cdot 5$ | 10.2 | 11.9 | 13.5 | $15 \cdot 1$ | 16.7 | $18 \cdot 2$ | $19 \cdot 7$ | 21.2 | $22 \cdot 6$ | $24 \cdot 1$ | 27.4 | $30 \cdot 6$ |
| 4 | 1.6 | $3 \cdot 2$ | 4.9 | $6 \cdot 5$ | $8 \cdot 1$ | $9 \cdot 7$ | $1 \mathrm{I} \cdot 2$ | 12.8 | 14.3 | 15.8 | 17.3 | $18 \cdot 7$ | $20 \cdot 2$ | $2 \mathrm{~T} \cdot 6$ | 22.9 | $26 \cdot 2$ | 29.3 |
| 6 | 1.5 | $3 \cdot 1$ | $4 \cdot 6$ | $6 \cdot 1$ | $7 \cdot 7$ | $9 \cdot 2$ | $10 \cdot 7$ | 12.1 | $13 \cdot 6$ | 15.0 | $16 \cdot 5$ | 17.9 | 19.2 | $20 \cdot 6$ | 21.9 | $25 \cdot 1$ | $28 \cdot 1$ |
| Iо | 1.4 | 2.8 | 4.2 | $5 \cdot 6$ | $7 \times 0$ | $8 \cdot 4$ | $9 \cdot 7$ | II•I | 12.4 | 13.8 | $15 \cdot 1$ | 16.4 | 17.6 | 18.9 | $20 \cdot 1$ | $23 \cdot 1$ | $26 \cdot 0$ |
| 15 | I•3 | $2 \cdot 5$ | 3.8 | $5 \cdot 1$ | $6 \cdot 3$ | $7 \cdot 6$ | 8.8 | $10 \cdot 1$ | II•3 | 12.5 | 13.7 | 14.9 | $16 \cdot 1$ | 17.3 | 18.4 | $21 \cdot 2$ | 23.9 |
| 20 | I. 2 | $2 \cdot 3$ | $3 \cdot 5$ | $4 \cdot 7$ | $5 \cdot 8$ | 7.0 | $8 \cdot 1$ | $9 \cdot 3$ | $10 \cdot 4$ | II. 5 | 12.7 | 13.8 | 14.9 | $16 \cdot 0$ | $17 \cdot 0$ | $19 \cdot 7$ | $22 \cdot 3$ |
| 25 | I.I | $2 \cdot 2$ | 3.3 | 4.4 | $5 \cdot 4$ | $6 \cdot 5$ | 7.6 | $8 \cdot 7$ | 9.7 | 10.8 | II. 8 | I2.9 | 13.9 | 15.0 | 16.0 | 18.5 | 21.0 |
| 30 | $1 \cdot 0$ | $2 \cdot 1$ | 3.1 | $4 \cdot 1$ | $5 \cdot 1$ | $6 \cdot 1$ | 7.2 | 8.2 | $9 \cdot 2$ | 2 | 11.2 | 12.2 | 13.2 | 14.2 | 15.2 | 17.6 | 19.9 |
| 35 | $1 \cdot 0$ | 2.0 | 2.9 | 3.9 | $4 \cdot 9$ | $5 \cdot 9$ | 68 | 7.8 | $8 \cdot 8$ | 9.3 | 10.7 | II• 6 | 12.6 | 13.6 | 14.5 | 16.8 | $19 \cdot 1$ |
| 40 | $1 \cdot 0$ | 1-9 | 2.8 | 3.8 | $4 \cdot 7$ | $5 \cdot 6$ | $6 \cdot 6$ | 7.5 | $8 \cdot 5$ | 9.4 | $10 \cdot 3$ | II.2 | $12 \cdot 1$ | 13.1 | 14*0 | $16 \cdot 3$ | 18.5 |
| 50 | $\bigcirc$ | $\xrightarrow{\text { 1.8 }} \mathrm{C}$ | 2.7 | 3.6 | 4.5 | $5 \cdot 4$ | $6 \cdot 3$ | $7 \cdot 1$ | $8 \cdot 0$ | 8.9 | 9.8 | $10 \cdot 7$ | II• 6 | 12.5 | 13.3 | 15.6 | $17 \cdot 7$ |
| 60 | $0 \cdot 9$ | 1.8 | 2.6 | 3.5 | 4.4 | $5 \cdot 3$ | $6 \cdot 1$ | 7.0 | $7 \cdot 9$ | 8.8 | 9.6 | $10 \cdot 5$ | II.4 | $12 \cdot 3$ | 13.1 | $15 \%$ | 17.5 |

* ANTARES.

|  | ${ }_{2}^{\text {m. }}$ | ${ }_{4}^{\mathrm{m}}$ | ${ }_{6} \mathrm{~m}$. | ${ }_{8}^{\text {m. }}$ |  |  | ${ }_{14}^{\mathrm{m}}$ | ${ }_{16}^{\text {m. }}$ | ${ }_{18}^{\mathrm{m}}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{21}^{\mathrm{m}}$. | ${ }_{22}$ | ${ }_{23}^{\mathrm{m}}$ | $\stackrel{\text { m. }}{24}$ | ${ }_{25}^{\text {m. }}$ | ${ }_{26}^{\text {m. }}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - | $\bigcirc$ | r.o | $\stackrel{1}{2}$ | 4.2 | 6.6 | 9.5 |  |  |  | $26 \cdot 4$ | $29^{\circ}$ | 31.8 | $34 \cdot 8$ | $37 \cdot 8$ | $4 \mathrm{I} \cdot 0$ | $44^{\prime} 2$ |
| 2 | 0.2 | ro | $2 \cdot 2$ | 3.9 | $6 \cdot 2$ | -9 | 12.1 | $15 \cdot 8$ |  | 24.6 | $27 \cdot 1$ | 29.8 | $32 \cdot 5$ | $35 \cdot 3$ | ${ }_{38}{ }^{1}$ | ${ }_{41}{ }^{4} 4$ |
| 6 | 0.2 | $\stackrel{0}{0.9}$ | 2.1 | 3.7 3.5 | 5.8 | . 4 | $1{ }^{1} 4$ | 14.8 | 18.8 | ${ }_{23}^{23} 1$ | 25.5 | 27.9 | $30 \cdot 5$ | 33.2 | 36.0 |  |
| 8 | 0.2 0.2 | $\stackrel{\text { - }}{ } \stackrel{8}{\circ}$ | 1.8 | 3.5 3.3 | 5.5 | 7.9 | ${ }_{10}^{10.7}$ | ${ }_{1}^{14.2}$ | ${ }_{167}^{17.7}$ | 20.6 | 22.7 | $26 \cdot 3$ 24.9 | ${ }_{27}^{28 \cdot 7}$ | 31.3 29 | $33 *$ 32.0 | ${ }_{3+6}$ |
| 10 | 0.2 | 0.8 | 1.7 | 3.1 | 4.9 | 7.0 | 9.6 | 12.5 | 15.8 | 19.5 | 21.5 | 23.6 | $25 \cdot 7$ | 28.0 | $30 \cdot 3$ | $32 \cdot 8$ |
| 12 | 0.2 | $0 \cdot 7$ | 1.6 | $2 \cdot 9$ | $4 \cdot 6$ | $6 \cdot 6$ | 8.9 | 11.8 | $15^{\circ}{ }^{\circ}$ | 18. | 20.4 | 22.4 | 24.4 | $26 \cdot 6$ | 28.8 |  |
| 14 12 | 0.2 0.1 | $0 \cdot 7$ | r r - 6 | 2.8 2.7 | 4.4 4.2 | 6.3 | 8.6 | 11.2 10.7 102 | 14.2 13.6 | 17.6 16.8 | 19.4 18.5 | 21.3 20.2 | ${ }_{22 \cdot 1}^{23.2}$ | ${ }_{24 \cdot 3}^{25}$ | ${ }_{26.4}^{27.4}$ | 29.6 28.2 |
| 18 | O.I | $0 \cdot 6$ | 1.4 | 2.5 | 4.0 | $5 \cdot 7$ | $7 \cdot 8$ | $10 \cdot 2$ | 12.9 | 16. | 17.6 | 19.3 | $2 \mathrm{I} \cdot 1$ | 22.9 | 24.9 | 26.9 |
| 20 | $0 \cdot 1$ | $\bigcirc \cdot 6$ | $1 \cdot 3$ | 2.4 | $3 \cdot 8$ | 5.5 | 7.5 | 9.7 | 12.3 |  | 16.8 | 18.4 | 20.1 |  | 8 | 7 |
| 22 | $\bigcirc \cdot \mathrm{I}$ | 0.6 | $1 \cdot 3$ | $2 \cdot 3$ | 3.6 | 5.2 | $7 \cdot 1$ | $9 \cdot 3$ | İ | $14 \cdot 6$ | $16 \cdot 1$ | 17. | 19.2 | $20 \cdot 9$ | $22 \cdot 7$ | $24 \cdot 5$ |
| 24 26 | $0 \cdot 1$ | - $0 \cdot 5$ | ${ }^{1} \cdot 2$ | $2 \cdot 2$ | $3 \cdot 5$ | $5 \cdot 0$ | 6.8 | 8.9 | $1 \mathrm{x} \cdot 3$ | 13.9 | 15.4 | 16. | 18.4 | $20^{\circ}$ | 21.7 | $23 \cdot 5$ |
| 30 | $\circ \cdot 1$ <br> $0 \cdot 1$ | -0.5 | r. | 2.1. | $3 \cdot 3$ $3 \cdot 1$ | 4.8 4.4 | 6.5 | 8.8 | 10.8 9.9 | 13.3 | $14 \cdot 7$ $13 \cdot 5$ | 16.1 <br> 14.8 | 17.6 16.1 | $\xrightarrow{19.2}$ | 19-1 | 22.5 20.6 |
| 35 | $\bigcirc \cdot 1$ | $0 \cdot 4$ | r.o | r. 8 | $2 \cdot 7$ | 3.9 | $5 \cdot 4$ | 7.0 | 8.9 | rro | $12 \cdot 1$ | 13.3 | 14.5 | 15.8 | 17.1 | 5 |
| 40 | $0 \cdot \mathrm{I}$ | 0.4 | 0.9 0.8 0 | I. 6 | $2 \cdot 5$ | 3.5 | 4.8 | $6 \cdot 3$ | 8.0 | 9.8 | . 8 | 11.9 | ${ }_{13} 3^{\circ} \mathrm{O}$ | ${ }_{1}$ | 15.3 |  |
| 45 <br> 50 | $\stackrel{0 \cdot 1}{0 \cdot 1}$ | - $0 \cdot 3$ | 0.8 | r 1.4 | 2.2 | $3 \cdot 1$ $2 \cdot 8$ | 4 | 5.0 | 7.1 $6 \cdot 3$ | 8.8 | ${ }_{8} 8.6$ | 4 | 3 | 2 | ${ }_{12 \cdot}^{13.7}$ |  |
| 55 | $\bigcirc$ | $\stackrel{0}{0} \mathrm{O}$ | $\stackrel{0}{0.6}$ | 1 I | ${ }^{1} 7$ | 2.4 | 3.3 | $4 \cdot 3$ | $5 \cdot 5$ | 6.8 | 7.5 | . 2 | - | . 8 | 10.6 | II•5 |
|  |  | $0 \cdot 2$ | 0.5 | $0 \cdot 9$ |  |  | $2 \cdot 9$ | $3 \cdot 8$ | $4 \cdot 8$ | $5 \cdot 9$ | 6.5 | $7 \cdot \mathrm{I}$ | $7 \cdot 8$ | B 5 | $9 \cdot 2$ | -9 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ | 4 7 ¢ 6 | 51.2 | 54.8 | 58.6 | 62'5 | 66.5 | 70.6 | 74.9 | 79.2 | $83 \cdot 7$ | 88.3 | 93.0 | $97 \cdot 8$ | 2. 8 | roj 8 | x ${ }^{1} \times$ |
| 1 |  | $49 \cdot 5$ | 53.0 | $56 \cdot 7$ | 60.4 | $64 \cdot 3$ | 68.3 | 72.5 | 76.7 | 81.0 | 85.5 | $90 \cdot 0$ | 94.7 | $99 \cdot 5$ | 10.4 4 | rog. 4 |
| 2 | $4{ }_{4}^{4.6}$ | $47 \cdot 9$ 46.4 | 51.3 | 54.9 53.2 | ${ }_{56.7}^{58}$ |  |  | 70.2 | 74.3 72.0 | ${ }_{76} 78.5$ |  | 87.2 | ${ }_{81} 9$ | 96.4 | I $\cdot$ | 8 |
| 4 | $4 \mathrm{r} \cdot 9$ | $45^{\circ}$ | 48.2 | 51.6 | $55^{\circ}$ | $58 \cdot 6$ | $62 \cdot 2$ | $66^{\circ}$ | $69 \cdot 8$ | $73 \cdot 8$ | 77.9 | 82.0 | 86.3 | 90 | $95 \cdot 2$ | 99.7 |
| 5 | 40.6 | 43.7 | $46 \cdot 8$ | $50 \cdot 0$ 48.6 | 53.4 | 56 | 60 | 64.0 | 67.8 |  | 75.6 | $79 \cdot 7$ | 83.8 | 88.1 | - 4 | $96 \cdot 9$ |
| 7 | 38.5 38.3 | ${ }_{412}^{42.4}$ | $4{ }^{45 \cdot}$ | 47.2 | 5 | 56.2 53.7 | 57.0 | $62 \cdot 2$ 60.5 | $65 \cdot 9$ 64.9 |  | $73 \cdot 5$ | 77.4 | $\xrightarrow{81 \cdot 4}$ | 85.6 | $89 \cdot 8$ 87.4 | ${ }_{91.6}^{94}$ |
| 8 | 37 | $40^{1}$ | $43^{\circ}$ | $45^{\circ} 9$ | $49^{\circ}$ | 52.2 | $55 \cdot 5$ | 58.8 | $62 \cdot 3$ | $65 \cdot 8$ |  | 73.2 | $77 \cdot \mathrm{I}$ | ${ }_{8 \mathrm{r}}$ - 0 | 85.0 | $89 \cdot 1$ |
| 9 | 37 |  | $4{ }_{4} \cdot 8$ | $44^{7} 7$ | $47 \cdot 7$ | 5 | 54.0 | 57.3 | $60 \cdot 6$ | $6_{4} \cdot 1$ | 67.6 | 7 r 3 | $75^{\circ}$ | 78.9 | 82.8 | 㖪 |
| ı0 | $35 \cdot 3$ | 38.0 | $40 \cdot 7$ | $43 \cdot 5$ | $46 \cdot 5$ | $49 \cdot 5$ | 52.6 | $55 \cdot 8$ | 59.0 | $62 \cdot 4$ | $65 \cdot 9$ | 69.4 | $73 \cdot 1$ | 76.8 | 80.6 | 84.6 |
| 1 Ir | 34 | $37 \cdot 0$ <br> $36 \cdot 1$ <br> I | 39 | 42 | 45.3 | 48 |  | 54.3 | $57 \cdot 5$ | 60.8 | 64.2 | 67.7 | ${ }_{71} \cdot 2$ | 749 | $78 \cdot 6$ | , |
| I2 | 33 32 |  |  | $41 \cdot 3$ 40.3 | ${ }_{43}{ }^{44} \mathrm{I}$ |  | 48 | $\xrightarrow{53.0} \begin{aligned} & \text { 5.7 }\end{aligned}$ | 56.1 | $59 \cdot 3$ 57.8 | 62.6 | 66.0 | 69.4 67.8 |  | $76 \cdot 6$ 74.8 | ${ }_{78.4}^{80.4}$ |
| 14 | $3 \mathrm{r} \cdot 9$ | $34 \cdot 3$ | $36 \cdot 8$ | $39 \cdot 3$ | $42 \cdot$ | $44 \cdot 7$ | $47 \cdot 5$ | 50.4 | $53 \cdot 4$ | $56 \cdot 4$ | $59 \cdot 6$ | 62.8 | $66 \cdot \mathrm{r}$ | $69 \cdot 5$ | $73^{\circ} \mathrm{O}$ | $76 \cdot 5$ |
| ${ }^{16}$ | $30 \cdot 4$ | 32 | $35^{\circ}$ | 37.5 | $40 \cdot 0$ | $42 \cdot 6$ | $45 \cdot 3$ | 48.0 | 50.9 | 53.8 | $56 \cdot 8$ | 59.9 | 63.0 | $66 \cdot 3$ | $69 \cdot 6$ |  |
| 18 | 29 | $31 \cdot 2$ 20.8 | 33.4 31.9 | ${ }^{35 \cdot}$ | 38.1 | $40 \cdot 6$ 38.8 | 43.2 | $45 \cdot 8$ <br> 43 <br> 8 | 4 | $5 \mathrm{~S} \cdot 3$ 40.0 | 54:2 | 57.1 | 60.1 | 63.2 |  | 69.6 |
| 22 | $26 \cdot 5$ | 28.4 | $30 \cdot 5$ | ${ }^{32 \cdot 6}$ | $34 \cdot 8$ | $37 \cdot 1$ | 39.4 | $4 \mathrm{4} \cdot 8$ | $44 \cdot 3$ | 46.9 | 49.5 | $52^{2}$ | 54.9 | 60.4 | ${ }^{63.4}$ | ${ }_{63}{ }^{6}$ |
| 24 | $25 \cdot 3$ | $27 \cdot 2$ | 29.2 | $3 \mathrm{I} \cdot 2$ | $33 \cdot 3$ | $35 \cdot 5$ | $37 \cdot 7$ | 40.0 | 42.4 | $44^{-8}$ | 47.3 | $49 \cdot 9$ | 52.6 | $55 \cdot 3$ | 58.0 | $60 \cdot 9$ |
| 26 | 24.2 | 26.0 | 27.9 | 28.9 | 31.9 | 34.0 | 36.1 | $38 \cdot 3$ | $40 \cdot 6$ | $42 \cdot 9$ | $45 \cdot 3$ | 47-8 | $50 \cdot 3$ | 52.9 | $55 \cdot 6$ |  |
| 28 | 23 | 24.9 23.9 | ${ }_{25}^{26.7}$ | 28.6 | $3{ }^{30 \cdot 5}$ | 32.5 | ${ }^{34 \cdot 6}$ | 36.7. | $38 \cdot 9$ | $4{ }^{4}$ | 43.4 | $45 \cdot 8$ | 48.2 | 50.7 | 2 |  |
| 30 32 | ${ }_{21}^{22 \cdot 3}$ | 123.9 | 24.5 | 27.4 | 29.2 | 31.1 | ${ }_{31}^{33 \cdot} \cdot{ }^{3}$ | $35^{\prime}$ 33 3 | 37.2 <br> 35. | 39.4 | $4{ }^{1 \cdot 6}$ 39 | $4{ }^{43}{ }^{3} \mathrm{O}$ | 46.2 | 48.5 | Sİ8 | $53 \cdot 5$ $51 \cdot 2$ |
| 34 | 20.4 | 21.9 | 23.5 | $25 \cdot 1$ | 26.8 | 28.6 | 30.4 | $32 \cdot 2$ | $34 \cdot 2$ | $36 \cdot \mathrm{I}$ | 38.2 | 40 | $42 \cdot 4$ | $44 \cdot 6$ | 46.8 | 49 |
| 36 | 19.5 | 21.0 | 22 | $24^{1 .}$ | $25^{\circ} 7$ | 27 | 29 | 30 | 32 | $34 \cdot 6$ | 36.5 | 5 | $40 \cdot 6$ | $42^{\prime} 7$ | $44^{-8}$ | $47 \%$ |
| 38 | 18.7 | 20.5 | 21.5 | 23.0 | 24.6 | 26.2 | 27.8 | 29.5 | $3 \mathrm{I} \cdot 3$ | $33 \cdot \mathrm{I}$ | $35^{\circ}$ | $36 \cdot 9$ | 38.8 | $40 \cdot 9$ | $42 \cdot 9$ | $45^{\circ}$ |
| 40 42 | 178 | 19.2 18.4 1 | $20 \cdot 6$ | 22.0 | 22.5 |  | ${ }_{25}^{26 \cdot 6}$ |  | 30.0 28.6 | $31 \cdot 7$ | 33.5 | $35 \cdot 3$ 33.7 | $37 \cdot 2$ 35.5 | $39 \cdot 1$ <br> 37.4 | 3 | ${ }_{4}^{43 \cdot 1}$ |
| 44 | I6.3 | 17.5 | 18.8 | $20 \cdot 1$ | 215 | 22.9 | 24.3 | 25.8 | 27.4 | 29.0 | 32. 30.6 | 33.2 32.2 | 34.0 | 37.4 357 | 37.3 | 49.4 39 |
| $4{ }_{4}^{46}$ | ${ }_{15}^{15 \cdot 6}$ | 16.7 | ${ }_{17}^{17.9}$ | 19.2 | $20 \cdot 5$ | 21.8 | $23 \cdot 2$ | $24^{7} 7$ | $26 \cdot 1$ | $27 \cdot 6$ | 29.2 | 30.8 | $32 \cdot 4$ | $34 \cdot \mathrm{I}$ | $35 \cdot 8$ | 37. |
| 48 | 14.8 | 16\% | 17.1 | 18.3 | 19.6 | 20.8 | 22.1 | 23.5 | 24.9 | $26 \cdot 3$ | 27.8 | 29.4 | 30 | $32 \cdot 5$ | 34.2 | 35.8 |
| 50 52 | 14.1 | 15.2 14.4 | 16.3 15.5 | 17.4 16.6 | ${ }_{1}^{18.6}$ | 19.8 r8.8 18 | ${ }_{2}^{21.1}$ | 22.4 | 23.7 | 25.1 23.8 2 | $26 \cdot 5$ | 27.9 | 29.4 | $3{ }^{1.0}$ | $32 \cdot 5$ | . |
| 52 | 13.4 12.7 | 14.4 13.7 | 14.7 | 15.7 | 17.7 16.8 | 18.8 17.9 | 20.0 | 21.3 20.2 | 22.5 | $23 \cdot 8$ $22 \cdot 6$ | 25.2 | ${ }_{25.2}$ | ${ }_{26.5}^{28.0}$ | ${ }_{27}^{29.4}$ | 39.93 | 32.4 30.8 |
| 56 58 58 | 12. | 12.9 | ${ }^{3} 3.9$ | 14.9 | 15.9 | 16.9 | 18.0 | 19.1 | 20 | 21. | $22 \cdot 6$ | 23.8 | 25 | 26.4 | 27.8 | . |
| (58 | ${ }^{4}$ | I2.2. | 13.1 12.3 | + $\begin{array}{r}\text { + } \\ 3 \\ 3\end{array}$ | I5 | 126.0 | 17.0 16.0 | 18.0 17.0 | 19.1 18.0 | $90^{\circ}$ | 21.3 | 5 | 22 | 24.9 23.5 | 6 | 5 |

# REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN. 

* antares.



## TRUE BEARING OR AZIMUTH OF * ANTARES.

| Lat | ${ }_{4}$ | m. | 12 | 16 | 20 | m. 24 | m. 28 | m. | m. 36 | m. 40 | ${ }_{4} \mathrm{~m}$ | $\mathrm{m}_{48}$ | m 52 | $\mathrm{m}_{56}$ | ${ }_{60} 6$ | ${ }_{70} \mathrm{~m}$ | m0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ | $2 \cdot 0$ | $4^{\circ} 0$ | $6^{\circ} 1$ | 8.1 | $0 \cdot 0$ |  |  |  |  |  |  |  |  | $6 \cdot$ |  | $\stackrel{\circ}{1} \cdot 4$ |  |
| 2 | I.9 | $3 \cdot 8$ | $5 \cdot 7$ | $7 \cdot 5$ | $9 \cdot 4$ | II.2 | 13.0 | 14.8 |  | 18.2 |  |  | I |  | $27 \cdot 7$ 26.2 | 8 | 7 |
| 4 | I-8 | 3.6 | $5 \cdot 3$ | 7-1 | $8 \cdot 8$ | 10.5 | 12.2 | 13.9 | 15.6 | $17 \cdot 2$ | 18.8 | $20 \cdot 4$ | 21.9 | 23.4 | 24.8 | $28 \cdot 3$ | 3I• 5 |
| 6 | $1 \cdot 7$ | $3 \cdot 4$ | $5 \cdot 0$ | $6 \cdot 7$ | $8 \cdot 3$ | 100 | II•6 | 13.2 | 14.8 | 16.3 | 17.8 | $19 \cdot 3$ | $20 \cdot 8$ | $22 \cdot 2$ | 23.6 | $27 \cdot 0$ | $30 \cdot 1$ |
| 8 | I•6 | $3 \cdot 2$ | $4 \cdot 8$ | $6 \cdot 3$ | $7 \cdot 9$ | 9.5 | II.O | 12.5 | 14.0 | I5.5 | 17.0 | I $8 \cdot 4$ | 19.8 | $2 \mathrm{I} \cdot 2$ | 22.6 | $25 \cdot 8$ | $28 \cdot 9$ |
| 10 | I•5 | 3.0 | $4 \cdot 5$ | $6 \cdot 0$ | $7 \cdot 5$ | $9^{\circ} 0$ | 10.5 | II•9 | 13.4 | 14.8 | 16.2 | I7. 6 | $19^{\circ} 0$ | $20 \cdot 3$ | $2 \mathrm{I} \cdot 6$ | $24 \cdot 8$ | $27 \cdot 8$ |
| 12 | $1 \cdot 4$ | $2 \cdot 9$ | $4 \cdot 3$ | $5 \cdot 8$ | $7 \cdot 2$ | $8 \cdot 6$ | $10 \cdot 0$ | II.4 | 12.8 | 14.2 | 15.5 | 16.9 | $18 \cdot 2$ | 19.5 | $20 \cdot 8$ | $23 \cdot 8$ | $26 \cdot 8$ |
| 14 | I-4 | $2 \cdot 8$ | $4 \cdot 2$ | $5 \cdot 5$ | $6 \cdot 9$ | $8 \cdot 3$ | $9 \cdot 6$ | II.O | $12 \cdot 3$ | $13 \cdot 6$ | 14.9 | 16.2 | $17 \cdot 5$ | $18 \cdot 7$ | 20.0 | $23 \cdot 0$ | 25.9 |
| 16 | I•3 | 2.7 | $4 \cdot 0$ | $5 \cdot 3$ | $6 \cdot 6$ | $8 \cdot 0$ | $9 \cdot 3$ | $10 \cdot 6$ | II•8 | 13.1 | 14.4 | 15.6 | 16.9 | 18.1 | 19.3 | $22 \cdot 2$ | $25^{\circ} \mathrm{O}$ |
| 18 | I•3 | 2.6 | $3 \cdot 8$ | $5 \cdot 1$ | $6 \cdot 4$ | $7 \cdot 7$ | $8 \cdot 9$ | 10.2 | II*4 | $12 \cdot 6$ | I 3.9 | 15*I | $16 \cdot 3$ | 17*5 | 18.6 | 2I•5 | 24.2 |
| 20 | I-2 | $2 \cdot 5$ | $3 \cdot 7$ | $5 \cdot 0$ | $6 \cdot 2$ | $7 \cdot 4$ | $8 \cdot 6$ | $9 \cdot 8$ | II•O | $12 \cdot 2$ | I 3.4 | 14.6 | $15 \cdot 8$ | $16 \cdot 9$ | $18 \cdot 1$ | $20 \cdot 9$ | 23.5 |
| 22 | $1 \cdot 2$ | 2.4 | $3 \cdot 6$ | $4 \cdot 8$ | $6 \cdot 0$ | $7 \cdot 2$ | $8 \cdot 4$ | $9 \cdot 5$ | $10 \cdot 7$ | II.9 | I 3.0 | $\mathrm{I}_{4} \cdot 2$ | 15.3 | 16.4 | 17.5 | $20 \cdot 3$ | $22 \cdot 9$ |
| 26 | I•I | $2 \cdot 3$ | $3 \cdot 4$ | $4 \cdot 5$ | $5 \cdot 6$ | $6 \cdot 8$ | $7 \cdot 9$ | $9 \cdot 0$ | 10.1 | II•2 | 12.3 | 13.4 | 14.5 | 15.6 | 16.6 | 19*2 | $2 \mathrm{I} \cdot 8$ |
| 30 | I•I | $2 \cdot 2$ | 3.2 | $4 \cdot 3$ | $5 \cdot 4$ | $6 \cdot 5$ | $7 \cdot 5$ | $8 \cdot 6$ | $9 \cdot 6$ | 10•7 | II*7 | 12.8 | 13.8 | 14.9 | I5.9 | 18.4 | 20.9 |
| 35 | I•O | $2 \cdot 1$ | $3 \cdot 1$ | $4 \cdot 1$ | 5.1 | $6 \cdot 1$ | $7 \cdot 1$ | $8 \cdot 1$ | $9 \cdot 1$ | 10.2 | 11.2 | 12.2 | $13 \cdot 1$ | 14.I | 15.1 | 17.5 | $19 \cdot 9$ |
| 40 | I•O | $2 \cdot 0$ | 2.9 2.8 | 3.9 | $4 \cdot 9$ | $5 \cdot 9$ | $6 \cdot 8$ | $7 \cdot 8$ | $8 \cdot 8$ | $9 \cdot 7$ | 10.7 | II•7 | $12 \cdot 6$ | I $3 \cdot 6$ | 14.5 | 16.9 | 19.2 |
| 50 60 | 0.9 0.9 | I.9 I. 8 | 2.8 2.7 | 3.7 3.6 | $4 \cdot 6$ | $5 \cdot 5$ | $6 \cdot 4$ | $7 \cdot 4$ | $8 \cdot 3$ 8.1 | $9 \cdot 2$ | 10.1 | II•O | II•9 | 12.9 | 13.8 | 16.0 | 18.3 |
| 60 | $0 \cdot 9$ | I•8 | $2 \cdot 7$ | $3 \cdot 6$ | $4 \cdot 3$ | $5 \cdot 4$ | $6 \cdot 3$ | $7 \bullet 2$ | 8-1 | 9.0 | 9.9 | 10.8 | 11*7 | 12.5 | 13.4 | ப5.7 | 17.9 |

* arcturus.

| Lat. | ${ }_{2}$ | ${ }_{4}$ | ${ }_{6}{ }_{6}$ | ${ }_{8} \mathrm{~m}$ | ${ }_{10}$ | ${ }_{12}$ | ${ }_{14}$ | ${ }_{16} \mathrm{~m}$ | 18 | ${ }_{20}$ | ${ }_{21}^{\mathrm{m} .}$ | ${ }_{2} \mathrm{~m}$. | ${ }_{23}$ | ${ }_{24}$ | ${ }_{25}^{\mathrm{m}}$. | ${ }_{26}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| R |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 44 | 0.2 | 0.8 | $1 \cdot 9$ | 3.4 | $5 \cdot 4$ | $7 \cdot 7$ | Ió 5 | $13 \cdot 7$ | $17 \cdot 3$ | $21 \cdot 3$ | 23.5 | $25 \cdot 8$ | $28 \cdot 2$ | 30.6 | 33.2 | 35.9 |
| 46 | 0.2 | 0.8 | $1 \cdot 7$ | $3 \cdot 1$ | $4 \cdot 8$ | $6 \cdot 9$ | $9 \cdot 4$ | 12.3 | 15.5 | 19.1 | 21.1 | 23.2 | $25 \cdot 3$ | 27.5 | 29.8 | $32 \cdot 2$ |
| 48 | 0.2 | $0 \cdot 7$ | 1.6 | $2 \cdot 8$ | $4 \cdot 3$ | $6 \cdot 2$ | $8 \cdot 4$ | 11.0 | 14.0 | 17.3 | 19.0 | 20.9 | 22.8 | 24.8 | 26.9 | 29.I |
| 50 | $0 \cdot 1$ | 0.6 | 1.4 | 2.5 | 3.9 | $5 \cdot 6$ | 7.6 | 10.0 | 12.6 | 15.6 | 17.2 | 18.9 | $20 \cdot 6$ | 22.4 | $24 \cdot 3$ | $26 \cdot 3$ |
| 52 | O.I | 0.6 | 1-3 | $2 \cdot 3$ | $3 \cdot 5$ | 51 | $6 \cdot 9$ | $9 \cdot 0$ | 11.4 | 14.1 | 15.6 | 17.1 | 18.6 | $20 \cdot 3$ | 22.0 | 23.8 |
| 54 | $0 \cdot$ | 0.5 | I. | $2 \cdot 0$ | 3.2 | $4 \cdot 6$ | $6 \cdot 3$ | $8 \cdot 2$ | $10 \cdot 3$ | 12.8 | I4. 1 | 15.5 | 16.9 | 18.4 | 19.9 | 21.6 |
| 56 | O.I | 0.4 | 1.0 | 1-8 | 2.9 | 4.2 | $5 \cdot 7$ | $7 \cdot 4$ | $9 \cdot 4$ | 11.6 | 12.8 | 14.0 | $15 \cdot 3$ | $16 \cdot 7$ | 18.1 | 19.5 |
| 58 | $0 \cdot 1$ | $0 \cdot 4$ | 0.9 | 1.7 | $2 \cdot 6$ | $3 \cdot 8$ | $5 \cdot 1$ | $6 \cdot 7$ | $8 \cdot 5$ | 10.5 | 11.6 | 12.7 | 13.9 | 15.1 | 16.4 | $17 \cdot 7$ |
| 60 | $0 \cdot 1$ | $0 \cdot 4$ | 0.8 | I.5 | 2.4 | 3.4 | $4 \cdot 6$ | $6 \cdot 1$ | $7 \cdot 7$ | 9.5 | 10.5 | II•5 | I2.5 | $13 \cdot 7$ | 14.8 | 16.0 |
| 62 | 0.1 | $0 \cdot 3$ | 0.8 | 1.4 | $2 \cdot 1$ | 3.1 | $4 \cdot 2$ | $5 \cdot 5$ | $6 \cdot 9$ | $8 \cdot 6$ | $9 \cdot 4$ | 10.4 | 11.3 | 12.3 | 13.4 | 14.5 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | 0.2 | 1.0 | 2.2 | 3.9 | $6 \cdot 1$ | 8.8 | 12.0 | 15.7 | 19.8 | 24.4 | $26 \cdot 9$ | 29.5 | $32 \cdot 3$ | $35^{1}$ I | 38.0 | $4 \mathrm{r} \cdot \mathrm{I}$ |
| 12 | 0.2 | $0 \cdot 9$ | $2 \cdot 1$ | $3 \cdot 7$ | $5 \cdot 7$ | $8 \cdot 3$ | 11.2 | 14.7 | 18.6 | 22.9 | $25 \cdot 2$ | 27.7 | $30 \cdot 3$ | $32 \cdot 9$ | 35•7 | $38 \cdot 5$ |
| 14 | . 2 | $0 \cdot 9$ | $1 \cdot 9$ | 3.4 | $5 \cdot 4$ | 7.8 | $10 \cdot 6$ | 13.8 | 17.4 | 21.5 | 23.7 | $26 \cdot 0$ | $28 \cdot 4$ | $30 \cdot 9$ | $33 \cdot 5$ | $36 \cdot 2$ |
| 16 | . 2 | 0.8 | 1.8 | 3.2 | $5 \cdot 1$ | $7 \cdot 3$ | 9.9 | 13.0 | 16.4 | $20 \cdot 3$ | 22.4 | 24.5 | $26 \cdot 8$ | 29.1 | $3 \mathrm{I} \cdot 6$ | $34 \cdot 2$ |
| 18 | $\cdot 2$ | 0.8 | $1 \cdot 7$ | $3 \cdot 1$ | $4 \cdot 8$ | 6.9 | $9 \cdot 4$ | 12.3 | 15.5 | 19'1 | 21.1 | 23.2 | $25 \cdot 3$ | 27.5 | 29.9 | $32 \cdot 3$ |
| 20 | $\cdot 2$ | 0.7 | - 6 | 2.9 | $4 \cdot 5$ | $6 \cdot 5$ | $8 \cdot 9$ | II• 6 | 14.7 | $18 \cdot 1$ | 20.0 | 21.9 | 23.9 | $26 \cdot 1$ | 28.3 | $30 \cdot 5$ |
| 22 | 0.2 | $0 \cdot 7$ | 1.5 | 2.7 | $4 \cdot 3$ | $6 \cdot 2$ | $8 \cdot 4$ | $11^{\circ} \mathrm{O}$ | 13.9 | 17.2 | 18.9 | $20 \cdot 8$ | $22 \cdot 7$ | $24^{\circ} 7$ | 26.8 | $29^{\circ}$ |
| 24 | 0.2 | $0 \cdot 6$ | 1.5 | 2.6 | 4.1 | $5 \cdot 9$ | $8 \cdot 0$ | $10 \cdot 4$ | 13.2 | 16.3 | 18.0 | $19 \cdot 7$ | 2 P 5 | 23.4 | 25.4 | $27 \cdot 5$ |
| 26 | $0 \cdot 1$ | $0 \cdot 6$ | 1.4 | 2.5 | 3.9 | $5 \cdot 6$ | 7.6 | 9.9 | 12.5 | 15.5 | 17.0 | 18.7 | 20.5 | 22.3 | 24.2 | 26.1 |
| 28 | $0 \cdot 1$ | 0.6 | 1.3 | 2.4 | $3 \cdot 7$ | $5 \cdot 3$ | $7 \cdot 2$ | $9 \cdot 4$ | II.9 | 14.7 | 16.2 | 17.8 | 19.4 | 21.2 | 23.0 | 24.8 |
| 30 | $\bigcirc \mathrm{I}$ | $0 \cdot 6$ | $1 \cdot 3$ | 2.2 | -3.5 | $5 \cdot 0$ | 6.9 | 9.0 | 11.3 | 14.0 | 15.4 | 16.9 | 18.5 | 20.1 | 21.8 | 23.6 |
| 34 | $0 \cdot 1$ | $0 \cdot 5$ | I-1 | 2.0 | 3.2 | $4 \cdot 6$ | $6 \cdot 2$ | $8 \cdot 1$ | $10 \cdot 3$ | 12.7 | $14^{\circ} \mathrm{O}$ | $15 \cdot 3$ | 16.7 | 18.2 | 19.8 | $2 \mathrm{I} \cdot 4$ |
| 40 | $0 \cdot 1$ | $0 \cdot 4$ | 1.0 | $1 \cdot 7$ | $2 \cdot 7$ | 3.9 | $5 \cdot 4$ | 7.0 | 8.9 | 10•9 | 12.0 | 13.2 | 14.5 | 15.7 | 17.1 | 18.5 |
| 50 | $\bigcirc \cdot 1$ | $0 \cdot 3$ | 0.8 | 1.3 | $2 \cdot 1$ | 3.0 | $4 \cdot 1$ | $5 \cdot 4$ | $6 \cdot 8$ | $8 \cdot 4$ | $9 \cdot 3$ | 10.2 | $1{ }^{1} \cdot 2$ | 12.2 | 13.2 | 14.3 |
| 60 | $0 \cdot 1$ | $0 \cdot 2$ | 0.6 | 10 | 1.6 | 2.2 | $3 \cdot$ | 4.0 | $5 \cdot 1$ | $6 \cdot 3$ | $6 \cdot 9$ | $7 \cdot 6$ | $8 \cdot 3$ | $9 \cdot$ | $9 \cdot 8$ | 10.6 |


| $\left.\right\|_{\text {2\% }}$ | ${ }_{28}$ | ${ }_{29} \mathrm{~m}$ | ${ }_{30}$ | ${ }_{31}$. | ${ }_{32}$. | ${ }_{33}{ }_{3}$ | ${ }_{34}$ | $\bar{m}$ | $\mathrm{m}_{36}$ | $\mathrm{m}_{37}$ | $\begin{aligned} & \mathrm{m} . \\ & 38 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 99 \end{aligned}$ | ${ }_{40}$ | $\overline{\mathrm{m} .}$ | m. |
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REDUCTIONS

## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* ARCTURUS.

|  | ${ }_{43}^{\mathrm{m}}$ |  |  | ${ }_{46}$ |  |  |  |  |  |  |  |  |  |  | ${ }_{56}$ |
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|  | 18.3 |  |  | $29 \cdot 3$ |  |  |  |  |  |  | , |  |  |  |  |
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|  | 4 |  |  |  |  | $1{ }^{12} 5{ }^{1}$ | ( 5 |  |  |  | $24 \cdot 8$ |  | 3 r - |  |  |
|  | 53 | 58.21 |  |  |  |  | 12.0 | I 14.9 | 17.8 |  | 20.81 |  |  |  |  |
|  | 53. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  |  | $35 \cdot 31$ | $39 \cdot 5$ |  |  |  |  |  |  | 4 |  |  |  |  |
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|  | 12 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | I $14 \cdot 4$ |  | $2 \mathrm{~T} \cdot 4$ |  |  | I $32 \cdot 4$ |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | 127.9 |  |  |  |  |  |  |  |  |  |
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|  | - $58 \cdot 2$ |  |  |  |  |  |  |  |  | 124 | 4* |  |  |  |  |
|  | - 53.4 | 58.01 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | ${ }^{6}{ }^{1}$ |  |  |  |  |  |  |  |  |  |
|  | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned} 50 \cdot 3$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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TRUE BEARING OR AZIMUTH OF * ARCTURUS.

| Lat. | ${ }_{4}$ | ${ }_{8}$ | ${ }_{12}$ | ${ }_{16}$ | ${ }_{20}$ | $\stackrel{\mathrm{m}}{24}$ | ${ }_{28}^{\mathrm{m}}$ | 32 | 36 | 40 | 44 | 48 | ${ }_{52}$ | 58 | ${ }_{60} 6$ | ${ }_{70}$ | $\mathrm{m}_{80}$ |
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| N. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 65 | 1-3 | $2 \cdot 6$ | $4{ }^{\circ}$ | $5 \cdot 3$ | 6.6 | $7 \cdot 9$ | $9 \cdot 2$ | $10 \cdot 5$ | $11 \cdot 9$ | $13 \cdot 2$ | 14.5 | $1{ }^{\circ} \cdot 8$ | $\underline{1} \times 1$ | 18.4 | $19 \cdot 7$ | 22.8 | 26․ |
| 55 | I.6 | $3 \cdot 3$ | 4.9 | $6 \cdot 5$ | 8.1 | $9 \cdot 7$ | $11 \cdot 3$ | 12.9 | 14.5 | 16. 1 | 17.6 | 19.2 | 20.7 | 22.3 | 23.8 | 27.5 | 31.2 |
| 50 | 1.9 | 3.7 | $5 \cdot 6$ | $7 \cdot 4$ | $9 \cdot 3$ | III | 12.9 | $14^{\circ} 7$ | 16.5 | 18.3 | 20.0 | 21.8 | 23.5 | $25 \cdot 2$ | $26 \cdot 9$ | 30.9 | 34.9 |
| 47 | $2 \cdot 0$ | 4.I | $6 \cdot 1$ | $8 \cdot 1$ | 10.2 | 12.2 | 14.2 | 16-1 | 18.1 | 20.0 | 21.9 | 23.8 | $25 \cdot 6$ | $27^{\circ} 4$ | 29.2 | 33.5 | $37 \cdot 6$ |
| 45 | 2.2 | $4 \cdot 4$ | $6 \cdot 6$ | 8.7 | 10.9 | 13.0 | 15.1 | 17.2 | 19.3 | 21.3 | 23.3 | $25 \cdot 3$ | 27.2 | 29.1 | $3{ }^{\circ} \mathrm{O}$ | 35.4 | $39 \cdot 7$ |
| S. | 2. | $4 \cdot 4$ | $6 \cdot 5$ | 8.7 | $10 \cdot 8$ | 12.9 | 14.9 | 16.9 | 18.9 | 20.8 | 22.7 | 24.5 | $26 \cdot 3$ | 28.0 | $29 \cdot 6$ | 33.5 | 37.1 |
| 8 | $2 \cdot$ | $4^{\text {I }}$ | 6. 1 | $8 \cdot 1$ | 10.1 | 12.0 | 14.0 | 15.8 | $17 \cdot 7$ | 19.5 | 21.3 | 23.1 | $24^{\prime} 7$ | $26 \cdot 4$ | $28 \cdot 0$ | 31.8 | 35.3 |
| 10 | I-9 | $3 \cdot 8$ | $5 \cdot 7$ | $7 \cdot 6$ | 9.5 | 11.3 | 13.1 | 14.9 | $16 \cdot 7$ | 18.4 | $20 \cdot 1$ | 21.8 | 23.4 | $25^{\circ} \mathrm{O}$ | $26 \cdot 5$ | $30 \cdot 2$ | $33 \cdot 6$ |
| 12 | I-8 | $3 \cdot 6$ | $5 \cdot 4$ | $7 \cdot 2$ | $8 \cdot 9$ | 10.7 | 12. | $14^{1} \mathrm{I}$ | 15.8 | 17.4 | 19•1 | $20 \cdot 7$ | $22 \cdot 2$ | $23 \cdot 7$ | $25 \cdot 2$ | 28.8 | $32 \cdot 2$ |
| 14 | 1.7 | 3.4 | 5.I | $6 \cdot 8$ | $8 \cdot 5$ | $10 \cdot 1$ | II.8 | 13.4 | 15.0 | 16.6 | 18.1 | 19.7 | 21.2 | $22 \cdot 6$ | $24^{1}$ Y | 27.6 | $30 \cdot 8$ |
| 16 | $1 \cdot 6$ | 3.2 | $4 \cdot 8$ | $6 \cdot 4$ | $8 \cdot 0$ | $9 \cdot 6$ | $1 \mathrm{I} \cdot 2$ | 12.7 | 14.3 | 15.8 | 17.3 | 18.8 | 20.2 | 21.6 | $23 \cdot 0$ | 26.4 | 29.6 |
| 20 | I.5 | 3.0 | $4 \cdot 4$ | 5.9 | $7 \cdot 4$ | $8 \cdot 8$ | 10.2 | 11•7 | $13 \cdot 1$ | 14.5 | : 5.9 | 17.3 | 18.6 | $20 \cdot 0$ | $21 \cdot 3$ | $24 \cdot 5$ | $27 \cdot 5$ |
| 25 | 1.3 | $2 \cdot 7$ | $4 \cdot 0$ | $5 \cdot 4$ | $6 \cdot 7$ | $8 \cdot 0$ | $9 \cdot 3$ | 10.6 | II'9 | 13.2 | 14.5 | r 5.8 | 17.0 | 18.3 | 19.5 | 22.5 | 25.4 |
| 30 | $\mathrm{r} \cdot 2$ | $2 \cdot 5$ | 3.7 | 4.9 | $6 \cdot 2$ | $7 \cdot 4$ | $8 \cdot 6$ | $9 \cdot 8$ | II•0 | 12.2 | 13.4 | 14.6 | 15.8 | 17.0 | 18.1 | $21^{\circ} \mathrm{O}$ | 23.7 |
| 40 | I 1 | $2 \cdot 2$ | 3.3 | 4.4 | $5 \cdot 4$ | $6 \cdot 5$ | 7.6 | $8 \cdot 7$ | 9.8 | 10.8 | II9 | 13.0 | 140 | $15 \cdot 1$ | 16.2 | 18.7 | 2 F 3 |
| 50 | - | $2 \cdot 0$ | 3.0 | $4^{\circ} \mathrm{O}$ | $5{ }^{\circ}$ | $6 \cdot 0$ | 7.0 | $8 \cdot 0$ | ${ }^{\circ} \mathrm{O}$ | 10.0 | II.0 | I2.O | 13.0 | $14^{\circ} \mathrm{O}$ | 15.0 | 17.4 | 19.8 |
| 55 | 1.0 | $2 \cdot$ | $2 \cdot 9$ | $3 \cdot 9$ | 4.9 | 5.9 | $6 \cdot 8$ | $7 \cdot 8$ | $8 \cdot 8$ | 9.8 | $10 \cdot 7$ | II•7 | 12.7 | 13.6 | 14.6 | 17.0 | 19.4 |

REDUCTION TO THE MERIDIAN FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* $\beta$ ARGUS.

| Lat. | ${ }_{4} \mathrm{~m}$. | m. | ${ }_{12}$ | ${ }_{16}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{22}$ | ${ }_{24}$ | $\frac{\mathrm{m}}{26}$ | $\begin{aligned} & \mathrm{m} . \\ & 28 \end{aligned}$ | ${ }_{30}$. | ${ }_{32}$ | ${ }_{34}$ | ${ }_{36}$. | ${ }_{38}$ | ${ }_{40}$ | ${ }_{42}$ | ${ }_{4} \mathrm{~m}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | 0.2 | $0 \cdot 7$ | I.6 | $2 \cdot 8$ | $4 \cdot 3$ | $5 \cdot 2$ | $6 \cdot 2$ | $7 \cdot 3$ | $8 \cdot 5$ | $9 \cdot 7$ | IİI | 12. 5 | 14.0 | 15.6 | $17 \cdot 3$ | $9^{\circ}$ | 0.9 |
| 10 | 0.2 | 0.7 | $1 \cdot 7$ | $2 \cdot 9$ | $4 \cdot 6$ | $5 \cdot 6$ | $6 \cdot 6$ | $7 \cdot 8$ | 9.0 | 10.4 | II 8 | 13.3 | 14.9 | 16.6 | 18.4 | 20.3 | $22 \cdot 3$ |
| - | 0.2 | 0.8 | I. 8 | $3 \cdot 1$ | $4 \cdot 9$ | 5.9 | $7 \cdot 1$ | $8 \cdot 3$ | $9 \cdot 6$ | II• | 12.6 | 14.2 | 15.9 | 17.7 | 19.6 | 21.6 | 23.7 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | 0.2 | 0.8 | r-9 | 3. | $5 \cdot 3$ | $6 \cdot 4$ | $7 \cdot 6$ | $8 \cdot 9$ | $10 \cdot 3$ | II.8 | 13. | 15.2 | 17.0 | 19.0 | 21.0 | 23.2 | $25 \cdot 4$ |
| 20 | $0 \cdot 2$ | 0.9 | $2 \cdot 0$ | $3 \cdot 6$ | $5 \cdot \%$ | $6 \cdot 9$ | $8 \cdot 2$ | $9 \cdot 6$ | 11.2 | 12.8 | 14.6 | 16.4 | 18.4 | 20.5 | 22.7 | $25^{\circ}$ | $27 \cdot 4$ |
| 24 | $0 \cdot 2$ | - 9 | $2 \cdot 1$ | 3.8 | 5.9 | $7 \cdot 1$ | $8 \cdot 5$ | 10.0 | II-6 | 13.3 | 15.1 | 17.0 | $19 \cdot 1$ | 21. | 23.5 | $25^{\circ} 9$ | 28. |
| 28 | $0 \cdot 2$ | I-0 | 2.2 | 3.9 | $6 \cdot 1$ | $7 \cdot 4$ | $8 \cdot 8$ | 10.4 | 12.0 | $13 \cdot 8$ | 15.7 | 17.7 | 19.8 | 22 | 24.5 | $27^{\circ}$ | -6 |
| 32 | $0 \cdot 3$ | 1.0 | $2 \cdot 3$ | 4.I | $6 \cdot 4$ | $7 \cdot 8$ | $9 \cdot 2$ | 10.8 | 12.5 | 14.4 | 16.4 | 18.5 | $20 \cdot 7$ | $23 \cdot 1$ | 25.6 | 28.2 | $30 \cdot 9$ |
| 36 | 0.3 | I•I | $2 \cdot 4$ | $4 \cdot 3$ | $6 \cdot 7$ | $8 \cdot \mathrm{I}$ | $9 \cdot 7$ | 11. | 13.2 | 15.1 | 1, 2 | 19.4 | $2 \mathrm{I} \cdot 8$ | $24 \cdot 3$ | $26 \cdot 9$ | 29.6 | $32 \cdot 5$ |
| 38 | $0 \cdot 3$ | I-I | 2.5 | 4.5 | $6 \cdot 9$ | 8.4 | 10.0 | $11 \cdot 7$ | 13.6 | 15.6 | 17.7 | $20^{\circ} 0$ | 22.4 | $25^{\circ}$ | $27 \cdot 6$ | $30 \cdot 4$ | 33.4 |
| 40 | $0 \cdot 3$ | I.I | $2 \cdot 6$ | $4 \cdot 6$ | $7 \cdot 2$ | $8 \cdot 7$ | $10 \cdot 3$ | $12 \cdot 1$ | $14^{\circ} \mathrm{O}$ | $16 \cdot 1$ | 18.3 | $20 \cdot 6$ | $23 \cdot 1$ | $25 \cdot 7$ | 28.5 | 31.4 | 34.4 |
| 42 | $0 \cdot 3$ | I $\cdot 2$ | $2 \cdot 7$ | $4 \cdot 8$ | $7 \cdot 4$ | 9.0 | $10 \cdot 7$ | 12.5 | 14.5 | r6. 6 | 18.9 | 21.3 | $23^{\circ} 9$ | $26 \cdot 6$ | 29.5 | $32 \cdot 4$ | 5.6 |
| 43 | 0.3 | $1 \cdot 2$ | $2 \cdot 7$ | 4.8 | $7 \cdot 6$ | 9.2 | $10 \cdot 9$ | 12.8 | 14.8 | 16.9 | 19.3 | 21-7 | 24.3 | 27.1 | $30 \cdot 0$ | $33^{\circ}$ | $36 \cdot 2$ |
| 44 | $0 \cdot 3$ | I | 2.8 | 4.9 | $7 \cdot 7$ | 9.3 | II•I | 13.0 | 15.1 | $17 \cdot 3$ | $19 \cdot 6$ | 22.1 | 24.8 | $27 \cdot 6$ | $30 \cdot 5$ | $33 \cdot 6$ | 36.9 |
| 45 | $0 \cdot 3$ | I. 3 | 2.8 | $5 \cdot 0$ | 7.9 | $9 \cdot 6$ | II• 3 | $13 \cdot 3$ | 15.4 | 17.6 | 20.0 | $22 \cdot 6$ | $25 \cdot 3$ | $28 \cdot 2$ | $3 \mathrm{I} \cdot 2$ | 34.3 | $37 \cdot 6$ |
| 46 | $0 \cdot 3$ | 1.3 | $2 \cdot 9$ | $5 \cdot 1$ | $8 \cdot 0$ | 9.8 | II• 6 | I3.6 | $15 \%$ | 18.0 | $20 \cdot 5$ | $23 \cdot 1$ | $25^{\circ} 9$ | 28.8 | 31-8 | $35^{\circ}$ |  |
| 47 | $0 \cdot 3$ | 1.3 | 3.0 | $5 \cdot 3$ | 8.2 | 10.0 | II• 8 | 13.9 | 16.1 | $18 \cdot 4$ | 21.0 | 23.6 | 26.4 | 29.4 | $32 \cdot 6$ | $35 \cdot 8$ | 39.3 |
| 48 | $0 \cdot 3$ | I 3 | $3 \cdot 0$ | $5 \cdot 4$ | $8 \cdot 4$ | $10 \cdot 2$ | 2.1 | 14.2 | 16.5 | 18.9 | 21.4 | 24.2 | $27 \cdot 1$ 27.8 | 30.1 | $33 \cdot 3$ | $36 \cdot 7$ | $40 \cdot 2$ |
| 39 | $0 \cdot 3$ | I 4 | $3 \cdot 1$ | $5 \cdot 5$ | 8.6 | 10.5 | 12.4 | 14.6 | 16.9 | 19.3 | 22.0 22.6 | 24.8 25.5 | $27 \cdot 8$ 28.5 | $30 \cdot 9$ 31 | 34.2 35.1 | 37.6 38.6 | 41.2 $42 \cdot 3$ |
| 50 | $0 \cdot 4$ | $1 \cdot 4$ | 3.2 | $5 \cdot 7$ | $8 \cdot 9$ | 10.8 | 12.9 | 15.0 | 17.4 | 19.9 | 23.6 |  |  | 31 | $35^{1}$ | 30.6 | 42.3 |


| L | 46 | 48 | 50 | $\stackrel{\mathrm{m}}{52}$ |  | ${ }_{56}$ | 58 | 60 | 62 | 64 | ${ }_{66}$ |  |  | 0 |  | ${ }_{72}$ |  | 4 |  | ${ }_{76}{ }^{\text {m }}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 |  | $25 \cdot 5$ | $27 \cdot 7$ |  | 32.2 | $4 \cdot 7$ | $37 \cdot 2$ | 39.8 | $42 \cdot 4$ | 45.2 | $48 \cdot 0$ |  | 51.0 | - 54.0 |  | 57.I | $10$ | $0 \cdot 3$ |  | , |
| 12 | $24^{\circ} \mathrm{O}$ | 26.1 | 28.4 | 30.7 | $33^{\circ}$ | $35 \cdot 5$ | $38 \cdot 1$ | $40 \cdot 7$ | $43 \cdot 5$ | $46 \cdot 3$ | $49 \cdot 2$ | - | $52 \cdot$ | - 55.3 |  | 58.5 | ${ }_{i}^{*}$ | $1 \cdot 8$ | I |  |
| 8 | 24.6 | $26 \cdot 8$ | $29 \cdot 1$ | 31.4 | 33.9 | $36 \cdot 4$ | $39 \cdot 1$ | $4 \mathrm{I} \cdot 8$ | $44^{\circ} 6$ | $47 \cdot 5$ | $50 \cdot 5$ | - | $53 \cdot 6$ | $56 \cdot 7$ |  | $0 \cdot 0$ |  | $3 \cdot 3$ | I |  |
| 4 | 25.3 | 27.5 | 29.8 | $32 \cdot 2$ | 34.7 | 37.4 | $40 \cdot 1$ | 42 | $45^{\circ} 7$ | $48 \cdot 7$ | 51.8 |  | 54.9 | $58 \cdot 2$ |  | I.5 |  |  | I | $8 \cdot 5$ |
| - | 25.9 | 28.2 | $30 \cdot 6$ | $33 \cdot 1$ | 35.7 | $38 \cdot 3$ | 41-1 | 44.0 | $46 \cdot 9$ | $50 \cdot 0$ | $53^{\prime} \mathrm{I}$ | - | $56 \cdot 3$ | 59 |  | $3 \cdot 1$ |  |  | I | 10.2 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 26 | $28 \cdot 6$ | 3 | 335 | $36 \cdot 1$ | 38 | 41.6 | $44 \cdot 5$ | 47.5 | $50 \cdot 6$ | $53 \cdot 8$ | - | 7•1 | 5 |  | 3.9 |  |  | I | I•I |
| 4 | 26 | $29^{\circ} \mathrm{O}$ | 3 I 4 | 34.0 | $36 \cdot 6$ | $39 \cdot 3$ | $42 \cdot 2$ | $45^{\text {P }}$ | $48 \cdot 2$ | $51 \cdot 3$ | 54.5 | - | $57 \cdot 8$ I | 1 I 3 |  | $4 \cdot 8$ |  | $\cdot 3$ | I | 2.0 |
| 6 | $27 \cdot 0$ | $29^{\circ} 4$ | 31.8 | 34.4 | 37-1 | 39.9 | $42 \cdot 7$ | $45 \cdot 7$ | $48 \cdot 8$ | $52^{\circ} \mathrm{O}$ | 55.2 | - | 58.6 I | $2 \cdot 1$ |  | $5 \cdot 6$ |  | $9 \cdot 2$ | I | $3^{\circ}$ |
| 8 | $27 \cdot 4$ | $29 \cdot 8$ | $32 \cdot 3$ | 34.9 | $37 \cdot 6$ | $40 \cdot 4$ | $43 \cdot 3$ | $46 \cdot 4$ | $49 \cdot 5$ | $52 \cdot 7$ | 56.0 | - | 59.41 | 12.9 |  | $6 \cdot 5$ |  | $10 \cdot 1$ | 1 | $14^{\circ}$ |
| 10 | 27.7 | $30 \cdot 2$ | $32 \cdot 7$ | $35 \cdot 4$ |  | 41.0 | $43 \cdot 9$ | $47 \cdot 0$ | 50.2 | 53.4 | 56•8 | I | $0 \cdot 21$ | I |  | $7 \cdot 4$ |  | $1 \cdot 1$ | 1 | $5 \cdot 0$ |
| 12 | 28 | $30 \cdot 6$ | 33.2 | $35 \cdot 9$ | $38 \cdot 7$ | $41 \cdot 6$ | 44.6 | 47•7 | 50.9 | 54.2 | 57 |  |  |  |  | 8. |  | $2 \cdot 2$ |  | $16 \cdot 0$ |
| 14 | 28 | $3{ }^{\circ}$ | $33 \cdot 7$ | $36 \cdot 4$ | 39.3 | $42 \cdot 2$ | 45.2 | $48 \cdot 4$ | $51 \cdot 6$ | $55^{\circ}$ |  | I | $2 \cdot 1$ | $15 \cdot 6$ |  | 9.4 |  | 3.2 | 1 | $7 \cdot 2$ |
| 16 | 29.0 | 31 | 34.2 | 37.0 | $39^{\circ} 9$ | $42 \cdot 8$ | 45.9 | $49^{1}$ I | $52 \cdot 4$ | 55 | $59 \cdot 3$ | I | $2 \cdot 9$ | 16.6 |  | 10.4 |  | 14.3 | I | 8.3 |
| 18 | 29.5 | 32 | 34 | 37 | 40 | 43 | $46 \cdot 7$ | $49^{\circ} 9$ | $53 \cdot 3$ | $56 \cdot 7$ | $60 \cdot 2$ |  | 3.91 | 17.6 |  | 11.5 |  | $5 \cdot 5$ | 1 | 19.5 |
| 20 | 300 | $32 \cdot 6$ | $35^{\circ}$ | 38 | $41 \cdot 2$ | 44 | $47 \cdot 5$ | $50 \cdot 7$ | 54.I | 57.6 | $61 \cdot 2$ |  | $4 \cdot 91$ |  |  | 12.7 |  | 16.7 | 1 |  |
| 22 | 30 | 33 |  |  | 41 | 45 | $48 \cdot 3$ |  | $55 \cdot 1$ | 58.6 | 3 | 1 | I | 19.9 |  | 13.9 |  | - | 1 | 22.2 |
| 24 | $3 \mathrm{I} \cdot \mathrm{I}$ | 33. | 36 | $39 \cdot 6$ | $42 \cdot 7$ | 45 | $49 \cdot 2$ | 52 | $56 \cdot \mathrm{I}$ | $59^{\circ} 7$ | $63 \cdot 4$ |  | $7 \cdot 21$ | 11 l 2 |  | 15.2 | I | 9.4 | I | $23 \cdot 6$ |
| 26 | 31•7 | $34^{\circ} 4$ | 37 | $40^{\circ}$ | 43 | 46 | 50•I | 53 | 57.1 |  | $64 \cdot 6$ |  | . 51 | 112.5 |  | 16.6 |  | 20.8 |  | 25 |
| 28 | 32.3 | $35^{\circ} \mathrm{I}$ | $38 \cdot \mathrm{I}$ | 41.2 | 44.3 | 47 | $51 \cdot 1$ | 54.6 | 58.3 | 62 | 65.9 |  | $9 \cdot 81$ | $1 \begin{array}{ll}13.9\end{array}$ |  | 18.1 | I | 22.4 | I | 26.8 |
| 30 | 33.0 | $35 \cdot 9$ | $38 \cdot 9$ | $42 \cdot 0$ | $45 \cdot 3$ | 48 | 52.1 | $55 \%$ | 59.4 | 63.3 | $67 \cdot 2$ | 1 | II.3 | 115.5 | 1 | 19.8 | I | 24.2 | 1 | $8 \cdot 6$ |
| 3 |  | $36 \cdot 7$ | $39 \cdot 8$ | 43 | $46 \cdot 3$ |  |  | $57 \cdot 0$ | $60 \cdot 8$ | 64.7 | $68 \cdot 7$ |  | 121 |  |  | 21.5 |  | 26.0 |  | $3 \cdot 6$ |
| 34 | 34.6 | 37.6 | $40 \cdot 7$ | $44^{\circ}$ | $47 \cdot 4$ | 50.9 | 54.6 | 58.3 | 62.2 | $66 \cdot$ | $70 \cdot 4$ | 1 | 14.61 | 119.0 |  | 23. | I | 28.0 | 1 | $32 \cdot 7$ |
| 35 | $35^{\circ} \mathrm{O}$ | $38 \cdot 1$ | 41.3 | 44.6 | 48 | 51 | 55.3 | $59^{1}$ | 63.0 | $67 \cdot 1$ | 71.2 | 1 | 15.51 | 119.9 |  | 24.4 | I | $29 \cdot 1$ | 1 | $33 \cdot 8$ |
| 3 | $35 \cdot 5$ | 38 | 41 | 4 |  | 5 | 56.8 | 59 | 6. |  | $72 \cdot$ | 1 | 16.51 | I $20 \cdot 9$ |  | $25 \cdot 5$ | I | $30 \cdot 2$ | I | 35.0 |
| 37 | 35 | 39 | 42 |  | 49 | $53^{\circ}$ | $56 \cdot 8$ | $60 \cdot 7$ | 64 |  | $73 \cdot 1$ | 1 | 17.5 | 122.0 | 1 | 26.6 | I | 31.4 | I | $36 \cdot 2$ |
| 38 | $36 \cdot 4$ | $39^{\circ} 7$ | 43.0 | $46 \cdot 4$ | 50.0 | 53.7 | $57 \cdot 5$ | 6I.5 | 65.6 | $69 \cdot 8$ | 74.I |  | 18.61 |  |  | $27 \cdot 8$ |  | $32 \cdot 6$ | 1 | . 5 |
| 39 | 37 | $40 \cdot 2$ | $43^{\circ} 6$ | $47 \cdot 1$ | 50•7 | 54.5 | $58 \cdot 4$ | 62 | 66 | 70 | $75^{2}$ | 1 | 19.71 | 124.3 | I | 29.1 | I | 33.9 | I |  |
| 40 | 37 | $40 \cdot 9$ | 44 | 47 | 52.4 | 5 | 59.3 | 63.4 | 68 | 7 | 77.5 | 1 | $20 \cdot 9$ | $125 \cdot 6$ | I | 3 | I | $35 \cdot 3$ | I | 40 |
| 4 4 | ${ }^{38 .}$ | 41.5 | $45^{\circ} \mathrm{O}$ | 48.6 | 52.4 | 57. | 60.2 | 64.4 |  | 73 |  |  | $22 \cdot 1$ | 9-9 |  | 31.8 | I | $36 \cdot 8$ | I | - |
| 42 | 38.8 | $42 \cdot$ | 45 | $49 \cdot 4$ | $53 \cdot 3$ | $57 \cdot 2$ | $6 \mathrm{I} \cdot 2$ | $65^{\circ}$ | 69 | 74 |  |  | $23 \cdot 5$ | 128.3 | I | $33 \cdot 3$ | I | 38.3 | 1 |  |
| 43 | 39.5 | 43.0 | $46 \cdot 6$ | 50 | 54.2 | 58.2 | 62. | $66 \cdot 6$ | $71 \cdot 0$ |  | 81 |  | 4.91 | 1 |  | 34.9 | I | $40 \cdot 0$ | I | 45* |
| 44 | 40•3 | $43 \cdot 8$ | 47.5 | $51 \cdot 3$ | 55.3 | 59.3 | 63.5 | $67 \cdot 8$ | 72.2 | - | 81 | 1 | 26.4 I | $1 \begin{aligned} & 1 \\ & \text { I } \\ & \text { I }\end{aligned}$ | I | $36 \cdot 5$ | I | $4 \mathrm{I} \cdot 8$ | I | 47 |
| 45 | 4I•I | $44^{\circ} 7$ | $48 \cdot 4$ | $52 \cdot 3$ 53 | $56 \cdot 3$ | 6 | ${ }^{64 \cdot} \cdot$ | 69•1 | $73 \cdot 6$ | 78 | $83 \cdot \mathrm{I}$ 8.8 |  | $28 \cdot 1$ | 33.1 | I | $38 \cdot 3$ | I | 43.7 |  | 49 |
| 46 | 4 |  | $49^{*} 4$ | $53 \cdot 3$ | 57 | 61.6 | $66 \cdot 0$ | $70 \cdot 5$ | $75^{\text {•1 }}$ | 79 |  |  |  |  | I |  | 1 |  |  |  |
| 47 | 42.9 | $46 \cdot 6$ | $50 \cdot 5$ | 54.5 55.8 | $58 \cdot 7$ | 63.0 | $67 \cdot 4$ | 72.0 | 76.8 | $8 \mathrm{I} \cdot 6$ | $86 \cdot 6$ |  | 31.81 | 137.0 |  | 42.4 |  | 47.9 | I | 53. |
| 48 | 43.9 | 47.7 | $51 \cdot 7$ | 55.8 | 60.0 | 64.4 | 69.0 | 73.7 | 78.5 | 83.5 85.5 | $88 \cdot 6$ | I | $33 \cdot 8$ I | 139.2 |  | $44 \cdot 7$ |  | $50 \cdot 3$ |  | 56.0 |
| 49 | $45 \cdot 0$ | $48 \cdot 9$ | 52.9 | 57. | $6 \mathrm{~L} \cdot 5$ | $66^{\circ} \mathrm{O}$ | $70 \cdot 7$ | 75.4 | 8 | 85.5 | $90 \cdot 7$ | 1 | \%.0 | 14 I 5 | I | 47.1 | I | 52.9 |  | 58.7 |
| 50 | 46 | 50 | 54 | 58 | $63^{\cdot 1}$ | 67 | 72 | 77.4 | 82 | $87 \cdot 7$ | 93.0 | 13 | $\cdot 4$ | $44^{\circ}$ | I | $49 \cdot 8$ | I | $55 \cdot 6$ |  | I.6 |

REDUCTION TO THE MERIDIAN FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* $\beta$ ARGUS.


TRUE BEARING OR AZIMUTH OF $*$; ARGUS.

| t. | ${ }_{4}^{\text {m. }}$ | ${ }_{8}^{\text {m. }}$ | ${ }_{12}^{\mathrm{m} .}$ | ${ }_{16}$ | ${ }_{20}^{\text {m. }}$ | ${ }_{24}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{32}$ | $\stackrel{\mathrm{m}}{36}$ | $40$ | ${ }_{44}^{\mathrm{m} .}$ | ${ }_{48}^{\mathrm{m}}$ | ${ }_{52}^{\mathrm{m}}$ | ${ }_{60}$. | ${ }_{70}^{\text {m. }}$ | ${ }_{80}^{\mathrm{m} .}$ | ${ }_{90}^{\mathrm{m}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. AZIMUTHS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | $0^{\circ} 4$ | 0.7 | $\mathrm{r}^{\circ} \mathrm{I}$ | $\mathrm{r}^{\circ} 4$ | I. 8 | $2 \cdot 1$ | 2.5 | 2.8 | $3 \cdot 2$ | $\stackrel{\circ}{3} 5$ | $\stackrel{\circ}{3} 9$ | $\stackrel{\circ}{4} 2$ | $4 \cdot 5$ | ${ }_{5} \cdot 2$ | 6.1 | 6.9 | 8 |
| 10 | 0.4 | $0 \cdot 7$ | I | 1.4 | 1.8 | $2 \cdot \mathrm{I}$ | 2.5 | 2.8 | 3.2 | ${ }^{3} \cdot 6$ | 3.9 | $4 \cdot 3$ | $4 \cdot 6$ | $5 \cdot 3$ | $6 \cdot 2$ | 7.0 | $2 \cdot 8$ |
| - | 0.4 | 0.7 | $\mathrm{I} \cdot \mathrm{I}$ | I-5 | I.9 | 2.2 | 2.6 | 3.0 | 3.4 | 3.7 | $4 \cdot \mathrm{I}$ | 4.5 | 4.8 | $5 \cdot 6$ | 6.5 | $7 \cdot 3$ | 8.2 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | 0.4 | 0.8 0.9 | r-2 | r. 6 | 2.0 2.2 | $2 \cdot 6$ | $3 \cdot 0$ | 3.2 3.4 3 | 3.7 | $4 \cdot 1$ | 4.5 | 4.9 | 5.2 | $6 \cdot 0$ | $7 \cdot 0$ | 7.9 | 8.8 |
| 20 | 0.5 | $0 \cdot 9$ | $1 \cdot 4$ | I.8 | $2 \cdot 3$ | $2 \cdot 8$ | $3 \cdot 2$ | $3 \cdot 7$ | 4. ${ }^{\text {I }}$ | $4 \cdot 6$ | 5-1 | 5.5 | 5.5 | $6 \cdot 4$ | 7 | ${ }_{8.9} 8$ | $9 \cdot$ |
| 24 | 0.5 | roo | r.5 | 2.0 | $2 \cdot 5$ | 3.0 | 3.4 | $3 \cdot 9$ | $4 \cdot 4$ | $4 \cdot 9$ | $5 \cdot 4$ | 5.8 | $6 \cdot 3$ | $7 \cdot 2$ | 8.4 | $9 \cdot 5$ | 10.6 |
| 28 | $0 \cdot 5$ | I-I | I.6 | $2 \cdot \mathrm{~T}$ | 2.7 | 3.2 | $3 \cdot 7$ | 4.2 | $4 \cdot 8$ | $5 \cdot 3$ | 5.8 | $6 \cdot 3$ | $6 \cdot 8$ | 7.8 | $9 \cdot 0$ | $10 \cdot 2$ | Ir |
| 32 36 | ${ }_{0}^{0.6}$ | r. 1.3 1 | 1.9 | ${ }_{2.6}$ | 2.9 3.2 | 3.8 | 4.0 | ${ }_{5 \cdot}^{4 \cdot}$ | 5.2 | 5.7 6.3 | $6 \cdot 3$ $6 \cdot 9$ | 6.8 | ${ }_{8}^{7} 4$ | 8.4 9.3 | 9.8 107 | ${ }_{12}^{11} \cdot$ | 13.4 |
| 38 | $0 \cdot 7$ | $1 \cdot 3$ | $2 \cdot 0$ | $2 \cdot 7$ | 3.4 | 4.0 | 4.7 | $5 \cdot 4$ | 6.0 | 6.7 | $7 \cdot 3$ | 7.9 | 8.6 | 9.8 | ${ }_{11} 1$ | 12.7 | $\mathrm{I}_{13.4}^{13}$ |
| 42 | 0.7 | 1.4 | $2 \cdot 15$ | 2.9 3.1 | 3.6 |  | 5.0 | ${ }^{5 \cdot 7}$ | 6.4 | 7.1 | 7.7 | 8.4 | 9.1 | 10.4 | 11.9 | 13.4 | 14.9 |
| 44 | 0.8 0.8 | ${ }_{1}^{1.5}$ | 2.3 2.5 | $3 \cdot 1$ 3.3 | 3.8 | 4.6 | 5.3 | 6.1 6.5 |  | 8.5 | 8.2 8.8 | 8.9 0.6 | 9.6 | $1{ }^{11.0}$ | 12.7 | 14.2 | 15.7 15.8 1 |
| 46 | $\bigcirc 9$ | I.8 | 2.7 | $3 \cdot 5$ | $4 \cdot 4$ | ${ }_{5} \cdot 3$ | 6 -1 | 7.0 | 7.8 | 8.7 | 9.5 | ${ }_{10}{ }^{\text {c }}$ | IT. | 12.7 | ${ }_{14}^{13.5}$ | 15.3 | 18.9 |
| 48 | I.0 | I.9 | $2 \cdot 9$ | 3.8 | 4.8 | 5.7 | $6 \cdot 7$ | 7.6 | 8.5 |  | $10 \cdot 3$ | II.2 | 12.0 | $3 \cdot 7$ | 15.7 | 17.6 | 19.3 |
| 49 50 | $\xrightarrow{\text { r }} \mathrm{r}$ | ${ }_{2 \cdot 1}^{2 \cdot 0}$ | 3.0 3.2 | ${ }_{4}^{4}{ }^{\circ} \mathrm{O}$ | 5.0 5.3 | 6.0 6.3 | $7 \times 0$ | 8.0 8.3 | 8.9 9.3 | $\begin{gathered} 9.8 \\ 0 \end{gathered}$ | 10.8 | 2 | $\begin{array}{r}12.6 \\ 1.1 \\ \hline 1\end{array}$ | 14.3 $15 \%$ | 16.4 |  | $20 \cdot 1$ |

REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERDIAN BELOW THE POLE.

* $\beta$ ARGUS.

| Lat. | $\stackrel{4}{4}$ | ${ }^{\mathrm{m}} \mathrm{8}$. | ${ }_{12}$. | ${ }_{1}^{\mathrm{m}} 18$ | $\stackrel{\mathrm{m}}{20}$ | ${ }_{24}$ | $\stackrel{\mathrm{m}}{26}$ | ${ }_{28}$ | ${ }_{30}$. | ${ }_{32}$. | ${ }_{34}$. | ${ }_{36}$. | ${ }_{38}$ | ${ }_{40}{ }_{4}$ | ${ }_{42} \mathrm{~m}$. | ${ }_{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{24}$ | $0 \cdot 2$ | $0 \cdot 7$ | 1.5 | $2 \cdot 7$ | $4 \cdot 2$ | $6 \cdot 1$ | $7 \cdot 1$ | $8 \cdot 3$ | $9 \cdot 5$ | 10.8 | 12.2 | $13 \cdot 7$ | 15.2 | 16.9 | 18.6 | 20.4 |
| 30 | $0 \cdot 2$ | 0.6 | 1.4 | $2 \cdot 6$ | $4 \cdot 1$ | 5.8 | $6 \cdot 8$ | $7 \cdot 9$ | $9 \cdot \mathrm{I}$ | 10.4 | II•7 | $13 \cdot 1$ | 14.6 | 16.2 | 17.8 | 19.6 |
| 35 | $0 \cdot 2$ | 0.6 | $1 \cdot 4$ | $2 \cdot 5$ | 3.9 | $5 \cdot 6$ | $6 \cdot 6$ | $7 \cdot 6$ | 8.8 | 10.0 | 11.3 | 12.6 | 14.1 | 15.6 | 17.2 | 18.8 |
| 40 | $0 \cdot \mathrm{I}$ | 0.6 | $1 \cdot 3$ | $2 \cdot 4$ | 3.7 | $5 \cdot 4$ | $6 \cdot 3$ | $7 \cdot 3$ | $8 \cdot 4$ | $9 \cdot 6$ | 10.8 | 12.1 | 13.5 | $15^{\circ} 0$ | 16.5 | 18.1 |
| 45 | O-I | $0 \cdot 6$ | 1.3 | $2 \cdot 3$ | $3 \cdot 6$ | $5 \cdot 2$ | $6 \cdot \mathrm{r}$ | $7 \cdot 0$ | $8 \cdot 0$ | $9 \cdot 2$ | 10.3 | 11.6 | 12.9 | 14.3 | 15.7 | $17 \cdot 3$ |
| 50 | $0 \cdot 1$ | $0 \cdot 5$ | 1.2 | $2 \cdot 2$ | $3 \cdot 4$ | 4.9 | $5 \cdot 8$ | $6 \cdot 7$ | $7 \cdot 6$ | $8 \cdot 7$ | 9.8 | 1r.0 | $12 \cdot 3$ | 13.6 | $15^{\circ} \mathrm{O}$ | $16 \cdot 4$ |
| 55 | $0 \cdot 1$ | $0 \cdot 5$ | I. 2 | - | 3.2 | $4 \cdot 6$ | $5 \cdot 4$ | $6 \cdot 3$ | 7.2 | 8.2 | $9 \cdot 3$ | 10.4 | 11.6 | 12.8 | 14.2 | $15 \cdot 5$ |
| 60 | o. I | $0 \cdot 5$ | I. 1 | $1 \cdot 9$ | 3.0 | $4 \cdot 3$ | 5.1 | $5 \cdot 9$ | $6 \cdot 7$ | $7 \cdot 6$ | $8 \cdot 6$ | $9 \cdot 7$ | 10.8 | $1 \mathrm{I} \cdot 9$ | 13.2 | 14.4 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | 21.3 | $22 \cdot 3$ | $23^{\prime} 3$ | 24.3 | $25 \cdot 3$ | 26.3 | 27.4 | 28.4 | $29 \cdot 5$ | $30 \cdot 7$ | $3{ }^{\prime} \cdot 8$ | $33^{\circ} 0$ | 34.2 | $35 \cdot 4$ | 36.6 | 3'78 |
| 28 | $20 \cdot 7$ | $2 \mathrm{I} \cdot 7$ | 22.6 | 23.6 | $24 \cdot 6$ | $25 \cdot 6$ | $26 \cdot 6$ | 27.7 | 28.7 | 29.8 | $3{ }^{1 \cdot}$ | $32 \cdot 1$ | $33 \cdot 2$ | 34.4 | $35 \cdot 6$ | $36 \cdot 8$ 35.8 |
| 32 | $20 \cdot 2$ | $2 \mathrm{~F} \cdot \mathrm{x}$ | 22.0 | 22.9 | $23^{\circ} 9$ | 24.9 | $25^{\circ} 9$ | $26 \cdot 9$ | $27 \cdot 9$ | $29^{\circ}{ }^{\circ}$ | $30 \cdot 1$ | 31.2 | $32 \cdot 3$ | 33.4 | 34.6 | $\cdot 8$ |
| 36 | 19.6 18.9 | $20 \cdot 4$ 19.8 | 21.3 20.6 | 22.2 21.5 | 23.2 22.4 | $24 \cdot 1$ 23.4 | $25 \cdot 1$ 24.3 | $26 \cdot 1$ 25.3 | 27.1 | 28.1 | 29.2 28.2 | 30.2 | 31.3 | 32.4 31.4 | 6 | $\cdot 7$ |
| 40 | 8.9 | 19.8 | 0.6 | 21.5 | 22.4 | 23.4 | 24.3 | $25 \cdot 3$ |  |  |  | 29.3 | 30 | 31.4 | $32 \cdot 5$ | . 6 |
| 44 | 18.3 | $19 \cdot 1$ | 19.9 | 20.8 | $21 \cdot 7$ | 22.5 | 23.5 | 24.4 | $25 \cdot 3$ | $26 \cdot 3$ | 27.3 | $28 \cdot 3$ | $29 \cdot 3$ | $30 \cdot 3$ | 31.4 | 32.4 |
| 46 | 17.9 | 18.7 | 19.6 | $20 \cdot 4$ | 21.2 | $22 \cdot 1$ | 23.0 | 23.9 | 24.8 | $25 \cdot 8$ | $26 \cdot 8$ | 27.7 | 28.7 | $29 \cdot 7$ | 30.8 | $3 \mathrm{r} \cdot 8$ |
| 48 | $17 \cdot 6$ | 18.4 | 19.2 | $20 \cdot 0$ | 20.8 | $21 \cdot 7$ | $22 \cdot 6$ | 23.4 | 24.4 | $25 \cdot 3$ | $26 \cdot 2$ | 27.2 | 28.2 | $29^{\circ} 2$ | 30.2 | 31.2 |
| 50 | 17.2 16.8 | 18.0 | 18.8 | 19.6 | $20 \cdot 4$ | 21.2 | ${ }^{22 \cdot 1}$ | 22.9 | $23 \cdot 8$ | 24.7 | $25^{\circ} 7$ | $26 \cdot 6$ | 27.6 | 28.5 | 29.5 | $30 \cdot 5$ |
| 52 | 16.8 | 17.6 | 18.3 | 19'I | 19.9 | 20.8 | 21.6 | 22.4 | $23 \cdot 3$ | 24.2 | $25 \cdot 1$ | $26 \cdot 0$ | $27 \cdot 0$ | $27 \cdot 9$ | 28.9 | 29.9 |
| 54 | 16.4 | 17.2 | 17.9 | 18.7 | $19 \cdot 5$ | $20 \cdot 3$ | $21 \cdot 1$ | 21.9 | 22.8 | 23.6 | 24.5 | 25.4 | $26 \cdot 3$ | 27.2 | 28.2 | 29.2 |
| 56 | 16.0 | 16.7 | 17.4 | 18.2 | $19^{\circ} \mathrm{O}$ | 19.7 | $20 \cdot 5$ | 21.3 | 22.2 | 23.0 | 23.9 | 24.8 | $25^{\circ} 7$ | $26 \cdot 6$ | $27 \cdot 5$ | 28.4 |
| 58 | 15.6 | 16.3 | 17.0 | 17.7 | 18.4 | 19.2 | 20.0 | 20.8 | 21.6 | 22.4 | 23.2 | 24.I | 24.9 | 25.8 | $26 \cdot 7$ | $27 \cdot 6$ |
| 60 | 15.1 | 15.8 | 16.5 | 17.2 | 17.9 | 18 | 19.4 | $20 \cdot 2$ | 20.9 | 21.7 | $22 \cdot 5$ | $23 \cdot 4$ | 24.2 | $25 \cdot 1$ | 25.9 | 26.8 |
| I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 0 | 1 | 2 | 3 | 4. | 5. | ${ }_{8} 8$ | ${ }_{7} \mathrm{~m}$. | ${ }_{8} \mathrm{~m}$ | ${ }_{9}$. | $\mathrm{m}_{10}$ | ${ }_{11}$ | ${ }_{12}$ | ${ }_{13}$. | ${ }_{14}$. | ${ }_{15}$ |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | $37 \cdot 8$ | $39^{\prime} \mathrm{I}$ | $40 \cdot 4$ | $4 \mathrm{I} \cdot 7$ | $43 \cdot 0$ |  |  | 47.I | $48 \cdot 5$ | $49^{\circ} 9$ |  | 52.8 |  | $55 \cdot 8$ |  |  |
| 26 | $37 \cdot 3$ | 38.6 | $39 \cdot 8$ | 41.1 | $42 \cdot 4$ | $43 \cdot 8$ | 45• 1 | $46 \cdot 5$ | $47 \cdot 9$ | $49 \cdot 3$ | 50\% | 52.1 | $53 \cdot 6$ | ${ }_{55 \cdot 1}$ | 56.6 | 58•I |
| 28 | 36.8 | 38.0 | $39 \cdot 3$ | $40 \cdot 6$ | $4 \mathrm{I} \cdot 8$ | $43 \cdot 2$ | $44 \cdot 5$ | $45 \cdot 8$ | $47 \cdot 2$ | $48 \cdot 6$ | $50 \cdot 0$ | 51.4 | $52 \cdot 9$ | 54.4 | $55 \cdot 8$ | 57.4 |
| 30 | $36 \cdot 3$ | $37 \cdot 5$ | $38 \cdot 7$ | $40 \cdot 0$ | 41.3 | $42 \cdot 6$ | $43 \cdot 9$ | $45^{\prime} 2$ | $46 \cdot 5$ | 47.9 | $49 \cdot 3$ | 50.7 | $52 \cdot 2$ | $53 \cdot 6$ | 55•1 | $56 \cdot 6$ |
| 32 | $35 \cdot 8$ | $37 \cdot 0$ | 38.2 | $39^{\circ} 4$ | $40 \cdot 7$ | $42 \cdot 0$ | 43.2 | $44 \cdot 6$ | 45.9 | $47 \cdot 2$ | 48.6 | 50•0 | 51.4 | $52 \cdot 8$ | 54.3 | 55.7 |
| 34 | 35.2 | 36.4 | 37.6 | 38 | 40•I | 41.3 | $42 \cdot 6$ | $43 \cdot 9$ | $45 \cdot 2$ | $46 \cdot 5$ | $47 \cdot 9$ | $49 \cdot 3$ | 50.7 | 52.1 | 53.5 | 54.9 |
| 36 | 34.7 | 35.9 | 37.0 | $38 \cdot 2$ | 39.5 | $40 \cdot 7$ | $42 \cdot 0$ | 43.2 | 44.5 | $45 \cdot 8$ | $47 \cdot 2$ | $48 \cdot 5$ | 49.9 | 51.3 | $52 \cdot 7$ | 54•r |
| 38 | 34.2 | $35 \cdot 3$ | $36 \cdot 5$ | $37 \cdot 6$ | $38 \cdot 8$ | $40 \cdot 1$ | $4 \mathrm{I} \cdot 3$ | $42 \cdot 6$ | $43 \cdot 8$ | $45^{1} \mathrm{I}$ | $46 \cdot 4$ | $47 \cdot 8$ | 49.1 | $50 \cdot 5$ | 5r.8 | 53.3 |
| 40 | $33 \cdot 6$ | $34 \cdot 7$ | 35.9 | 37.0 | $38 \cdot 2$ | 39.4 | $40 \cdot 6$ | $4 \mathrm{r} \cdot 9$ | $43 \cdot 1$ | 44.4 | $45 \cdot 7$ | 47.0 | $48 \cdot 3$ | $49 \cdot 6$ | $5 \mathrm{r} \cdot \mathrm{O}$ | 52.4 |
| 42 | 33.0 | 34.1 | $35 \cdot 3$ | $36 \cdot 4$ | $37 \cdot 6$ | $38 \cdot 7$ | 39.9 | $4 \mathrm{I} \cdot \mathrm{r}$ | 42.4 | $43 \cdot 6$ | 44.9 | $46 \cdot 2$ | $47 \cdot 5$ | $48 \cdot 8$ | $50 \cdot 1$ | $51 \cdot 5$ |
| 44 | 32.4 | $33 \cdot 5$ | 34.6 | $35 \cdot 8$ | 36.9 | $38 \cdot 1$ | 39.2 | $40 \cdot 4$ | $4 \mathrm{r} \cdot 6$ | $42 \cdot 8$ | 44. ${ }^{\text {I }}$ | $45 \cdot 4$ | $46 \cdot 6$ | 47.9 | $49 \cdot 2$ | $50 \cdot 6$ |
| 46 | $3 \mathrm{x} \cdot 8$ | 32.9 | 34.0 | $35 \cdot 1$ | $36 \cdot 2$ | $37 \cdot 3$ | $38 \cdot 5$ | $39 \cdot 6$ | $40 \cdot 8$ | $42 \cdot 0$ | $43 \cdot 3$ | 44.5 | $45 \cdot 8$ | $47^{\circ}$ | $48 \cdot 3$ | $49 \cdot 6$ |
| 48 | 31.2 | 32.2 | $33 \cdot 3$ | 34.4 | $35 \cdot 5$ | $36 \cdot 6$ | $37 \cdot 7$ | $38 \cdot 9$ | $40 \cdot 0$ | $4 \mathrm{I} \cdot 2$ | $42 \cdot 4$ | $43 \cdot 6$ | 44.9 | $46 \cdot \mathrm{r}$ | 47.4 | $48 \cdot 7$ |
| 50 | $30 \cdot 5$ | $3 \mathrm{I} \cdot 6$ | $32 \cdot 6$ | $33 \cdot 7$ | $34 \cdot 7$ | $35 \cdot 8$ | $36 \cdot 9$ | $38 \cdot 1$ | 39.2 | $40 \cdot 3$ | 41.5 | $42 \cdot 7$ | 43.9 | $45 \cdot \mathrm{r}$ | $46 \cdot 4$ | $47 \cdot 6$ |
| 52 | 29.9 | $30 \cdot 9$ | $3 \mathrm{I} \cdot 9$ | 32.9 | 34.0 | $35^{\circ}$ | $36 \cdot 1$ | $37 \cdot 2$ | $38 \cdot 3$ | $39 \cdot 5$ | $40 \cdot 6$ | $4 \mathrm{I} \cdot 8$ | $42 \cdot 9$ | $44^{\prime}$ I | $45 \cdot 4$ | $46 \cdot 6$ |
| 54 | 29.2 | $30 \cdot 1$ | 3I•I | 32.1 | 33.2 | 34.2 | $35 \cdot 3$ | $36 \cdot 3$ | 37.4 | 38.5 | $39 \cdot 6$ | $40 \cdot 8$ | $4 \mathrm{r} \cdot 9$ | 43-1 | 44.3 | $45 \cdot 5$ |
| 56 | 28.4 | 29.4 | $30 \cdot 3$ | 31.3 | $32 \cdot 3$ | 33.3 | 34.4 | $35 \cdot 4$ | $36 \cdot 5$ | 37.5 | $38 \cdot 6$ | 39.7 | $40 \cdot 9$ | $42 \cdot 0$ | $43 \cdot 1$ | $44 \cdot 3$ |
| 57 | $28 \cdot 0$ | $29^{\circ} \mathrm{O}$ | 29.9 | $30 \cdot 9$ | $3 \mathrm{I} \cdot 9$ | 32.9 | 33.9 | 34.9 | $36 \cdot 0$ | $37 \cdot 0$ | $38 \cdot 1$ | 39.2 | $40 \cdot 3$ | 41.4 | $42 \cdot 6$ | $43 \cdot 7$ |
| 58 59 | 27.6 27.2 | 28.6 28.1 | $29 \cdot 5$ | $30 \cdot 4$ $30 \cdot 0$ | $31 \cdot 4$ $3 \mathrm{I} \cdot 0$ | 32.4 3 | $33^{\circ} 4$ | 34.4 3.9 | $35 \cdot 5$ | $36 \cdot 5$ | $37 \cdot 6$ | 38.6 | $39 \cdot 7$ | $40 \cdot 8$ | $42 \cdot 0$ | $43 \cdot 1$ |
| 59 60 | 27.2 26.8 | 28.1 | $29 \cdot 1$ 28.6 | $30 \cdot 0$ $20 \cdot 5$ | $31 \cdot 0$ 30.5 | $3 \mathrm{I} \cdot 9$ | 32.9 | 33.9 | 34.9 | $36 \cdot 0$ | 37.0 | $38 \cdot 1$ | 39•1 | $40 \cdot 2$ | 41.4 | $42 \cdot 5$ |
| 60 | $26 \cdot 8$ | $27 \cdot 7$ | 28.6 | $29 \cdot 5$ | $30 \cdot 5$ | 3 F 4 | $32 \cdot 4$ | $33^{\circ} 4$ | 34.4 | $35 \cdot 4$ | 36.4 | $37 \cdot 5$ | 38.5 | $39 \cdot 6$ | 40•7 | $4 \mathrm{r} \cdot 8$ |
|  |  |  |  |  | $\bigcirc \mathrm{HO}$ | OR. |  |  |  |  |  |  | HO | UR. |  |  |
|  | m. | ${ }_{8} 8$ | ${ }_{12}$ | 16 | ${ }_{20}$ | ${ }_{24}$ | ${ }_{30}$. | $\begin{aligned} & \mathrm{m} . \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 50 \end{aligned}$ | $\mathrm{m}_{60}$ | 10 | $\mathrm{m}_{20}$ | ${ }_{30}$. | ${ }_{40}$. | ${ }_{50}$ | $\mathrm{m}_{60}$ |
| S. |  |  |  |  |  |  |  | MU | THS. |  |  |  |  |  |  |  |
| 24 | $0 \cdot 4$ | $0 \cdot 7$ | $\stackrel{-1}{1}$ | $\stackrel{\circ}{1}$ | $\stackrel{\circ}{\text { I }} 8$ | ${ }_{2}{ }^{\circ} \mathrm{I}$ | ${ }^{2} \cdot 6$ | $3 \cdot 5$ | 4.4 | $5^{\circ} 2$ | $6 \cdot 1$ | 6.9 | $\stackrel{\circ}{7} 8$ | 8.6 | $9 \cdot 4$ | $10^{\circ} \cdot 2$ |
| 30 | 0.4 | $0 \cdot 7$ | I- 1 | r.4 | -8 | $2 \cdot 1$ | $2 \cdot 7$ | $3 \cdot 6$ | $4 \cdot 4$ | $5 \cdot 3$ | $6 \cdot 2$ | $7 \cdot 0$ | $7 \cdot 9$ | $8 \cdot 7$ | $9 \cdot 5$ | 10.4 |
| 40 | 0.4 | $0 \cdot 7$ | I•I | 1.5 | 1.9 | $2 \cdot 2$ | $2 \cdot 8$ | 3.7 | $4 \cdot 6$ | $5 \cdot 6$ | $6 \cdot 5$ | $7 \cdot 4$ | $8 \cdot 3$ | $9 \cdot 2$ |  | 10.9 |
| 50 | $0 \cdot 4$ | 0.8 | I. 2 | - 6 | $2 \cdot 0$ | 2.4 | $3 \cdot 0$ | $4 \cdot 0$ | $5 \cdot 0$ | $6 \cdot 0$ | $7 \cdot 0$ | $8 \cdot 0$ | $9 \cdot 0$ | 10.0 | 11.0 | If.9 |
| 56 60 | 0.4 | $0 \cdot 9$ | $1 \cdot 3$ | r. 7 | $2 \cdot 2$ | $2 \cdot 6$ | $3 \cdot 2$ | 4.3 | 5.4 | $6 \cdot 5$ | $7 \cdot 5$ | $8 \cdot 6$ | $9 \cdot 6$ | 10\%7 | 11.7 | 12.8 |
| 60 | 0.5 | $0 \cdot 9$ | 14 | I.8 | $2 \cdot 3$ | $2 \cdot 7$ | $3 \cdot 4$ | $4 \cdot 6$ | $5 \cdot 7$ | $6 \cdot 8$ | $8 \cdot 0$ | $9 \cdot 1$ | 10.2 | II•3 | 12.4 | 13.5 |

REDUCTION TO THE MERIDIAN TABLE FOR HOUR－ANGLES FROM MERIDIAN BELOW THE POLE．
＊$\beta$ ARGUS．

| Lat． | I HOUR． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{m}_{16}$ | $\mathrm{m}_{17}$ | ${ }_{18} \mathrm{~m}$ | ${ }_{19} 19$ | ${ }_{20}$ | ${ }_{21} \mathrm{~m}$ | ${ }_{22}$ | ${ }_{23}^{\mathrm{m}}$ | ${ }_{24}$ | m． 25 | m． <br> 26 | $\mathrm{m}_{2}$ | ${ }_{28}$ | 29 | ${ }_{30}$ | ${ }_{31}$ |
| REDUCTIONS． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | 60.4 | 62．0 | 63.6 | $65 \cdot 2$ | 66＇8 | 68．5 | $70 \cdot 2$ |  | 73.6 | 75.4 | 77•1 | $78 \cdot 9$ | $80 \cdot 7$ | $82 \cdot 5$ | 84.4 | 86́． 2 |
| 26 | $59 \cdot 6$ | 61－1 | $62 \cdot 7$ | $64 \cdot 3$ | $66 \cdot 0$ | 67.6 | $69 \cdot 3$ | $70 \cdot 9$ | $72 \cdot 6$ | 74.4 | $76 \cdot 1$ | $77 \cdot 9$ | $79 \cdot 6$ | 8 r 4 | $83 \cdot 3$ | $85 \cdot 1$ |
| 28 | 58.8 | $60 \cdot 3$ | $6 \mathrm{I} \cdot 9$ | 63.5 | $65 \cdot 1$ | 66.7 | $68 \cdot 3$ | $70 \cdot 0$ | 71.7 | 73.4 | 75.1 | 76.8 | 78.6 | $80 \cdot 4$ | $82 \cdot 2$ | $84^{\circ} \mathrm{O}$ |
| 30 | 58．0 | 59.5 | $6 \mathrm{r} \cdot \mathrm{O}$ | $62 \cdot 6$ | $64 \cdot 2$ | 65.8 | 67.4 | 69.0 | $70 \cdot 7$ | $72 \cdot 4$ | $74^{-1}$ | 75.8 | 77.5 | $79^{\circ} 3$ | $8 \mathrm{r} \cdot 0$ | $82 \cdot 8$ |
| 32 | 57－I | 58.6 | $60 \cdot 2$ | 6I•7 | 63.3 | $64 \cdot 8$ | $66 \cdot 4$ | $68 \cdot 0$ | $69 \cdot 7$ | 71.3 | 73.0 | $74^{\circ} 7$ | $76 \cdot 4$ | $78 \cdot 1$ | 79.9 | $81 \cdot 7$ |
| 34 | $56 \cdot 3$ | 57.8 | 593 | $60 \cdot 8$ | $62 \cdot 3$ | 63.9 | $65 \cdot 5$ | $67 \cdot 1$ | $68 \cdot 7$ | $70 \cdot 3$ | 71.9 | $73 \cdot 6$ | $75 \cdot 3$ | 77.0 | 78.7 | $80 \cdot 5$ |
| 36 | 55.4 | 56.9 | $58 \cdot 4$ | 59.9 | 61.4 | 62.9 | 64.5 | $66 \cdot 0$ | $67 \cdot 6$ | 69.2 | $70 \cdot 9$ | $72 \cdot 5$ | 74.2 | $75 \cdot 8$ | $77 \cdot 5$ | $79 \cdot 3$ |
| 38 | 54．6 | $56 \cdot 0$ | $57 \cdot 5$ | 58.9 | $60 \cdot 4$ | $6 \mathrm{r} \cdot 9$ | $63 \cdot 5$ | $65 \cdot 0$ | $66 \cdot 6$ | 68.2 | 69.8 | 71.4 | 73.0 | 74.7 | $76 \cdot 3$ | $78 \cdot 0$ |
| 40 | 53.7 | $55 \cdot 1$ | $56 \cdot 5$ | $58 \cdot 0$ | 59.5 | $60 \cdot 9$ | 62.4 | $64 \cdot 0$ | $65 \cdot 5$ | $67 \cdot 1$ | $68 \cdot 6$ | $70 \cdot 2$ | $71 \cdot 8$ | $73 \cdot 5$ | $75 \cdot \mathrm{I}$ | $76 \cdot 8$ |
| 42 | 52. | 54.2 | $55 \cdot 6$ | $57 \cdot 0$ | 58.4 | 59.9 | $61 \cdot 4$ | 62.9 | 64.4 | 65.9 | 67．5 | 69.0 | $70 \cdot 6$ | $72 \cdot 2$ | 73.8 | $75 \cdot 5$ |
| 44 | $5 \mathrm{I} \cdot 8$ | 53.2 | 54．6 | $56 \cdot 0$ | 57.4 | 58.8 | $60 \cdot 3$ | 6I•8 | 63.3 | $64 \cdot 8$ | $66 \cdot 3$ | 67.8 | 69.4 |  | $72 \cdot 5$ | $74 \cdot 1$ |
| 46 | 50.9 | $52 \cdot 2$ | $53 \cdot 6$ | 54.9 | $56 \cdot 3$ | 57.7 | 59.2 | $60 \cdot 6$ | $62 \cdot \mathrm{I}$ 60.8 | 63.5 | $65^{\circ}$ | $66 \cdot 6$ | $68 \cdot \mathrm{I}$ | 69.6 | 71.2 | $72 \cdot 8$ |
| 48 50 | 49.9 48.8 | 51．2 | 52.5 51.4 | 53.9 52.7 | $55 \cdot 2$ | $56 \cdot 6$ | 58.0 | 59.4 | 60．8 | $62 \cdot 3$ | $63 \cdot 8$ 62.4 | $65^{2} 2$ | $66 \cdot 7$ | 68.3 | $69 \cdot 8$ | $7 \mathrm{r} \cdot 3$ |
| 50 | $48 \cdot 8$ | 50.1 | 51.4 | $52 \cdot 7$ | 54－I | 55.4 | 56.8 | 58.2 | 59.6 | 61．0 | ${ }^{62.4}$ | 63.9 | $65 \cdot 4$ | $66 \cdot 8$ | $68 \cdot 3$ | 69.9 |
| 52 | 47.7 | $49^{\circ}$ | $50 \cdot 3$ | 51．6 | $52 \cdot 9$ | 54 | $55 \cdot 5$ | $56 \cdot 9$ | $58 \cdot 3$ | 59.7 | 6I•I | $62 \cdot 5$ | 63.9 | $65 \cdot 4$ | $66 \cdot 8$ | $68 \cdot 3$ |


|  | 32 | ${ }_{38}$ | 34 |  | 36 | $137$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S． | REDUCTIONS． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | 88．1 | 90．0 | 9r＊9 |  | 95．8 | \％ 8 |  |  | ro3 | $105 \cdot 9$ | I | $48 \cdot 0$ | 1 | $50 \cdot 1$ |  | $52 \cdot 2$ |  | $54 \cdot 3$ | 1 | $56 \cdot 5$ |
| 26 | 7－0 | 88.8 | $90 \cdot 7$ | － | $94 \cdot 6$ | $96 \cdot 5$ | $93 \cdot 5$ | $100 \cdot 5$ | IO2． | 104.6 | I | $46 \cdot 6$ | 1 | $48 \cdot 7$ |  | $50 \cdot 8$ |  | $52 \cdot 9$ |  | $55^{\circ}$ |
| 28 | 85.8 | $87 \cdot 7$ | $89 \cdot 5$ | 91.4 | $93 \cdot 3$ | $95 \cdot 3$ | $97 \cdot 2$ | $99 \cdot 2$ | 101． 2 | 103.2 | I | $45 \cdot 2$ |  | $47 \cdot 2$ |  | $49 \cdot 3$ |  | $5 \mathrm{I} \cdot 4$ |  | $53 \cdot 5$ |
| 30 | 84.6 | 86 | 88.3 | $0 \cdot 2$ | 92. | $94 \cdot 0$ | 95.9 | 97.8 | 99.8 | 101．8 | I | $43 \cdot 8$ | I | $45 \cdot 8$ |  | 47 |  | $49 \cdot 9$ |  | 51.9 |
| 32 | 83.4 | $85^{2}$ | 87．1 | 88 |  | $92 \cdot 6$ | $94 \cdot 5$ |  |  | $100 \cdot 3$ | I | $42 \cdot 3$ | I | 44.3 | 1 | $46 \cdot 3$ |  | $48 \cdot 3$ |  | $50 \cdot 4$ |
| 34 | $82 \cdot 2$ | 84 | 85 | 8 |  | $91 \cdot 3$ | 93.2 | $95^{\circ} \mathrm{I}$ | 97 | $8 \cdot 9$ | I | $40 \cdot 8$ |  | －8 |  | $44 \cdot 8$ |  | 46.8 |  | $48 \cdot 8$ |
| 36 | $8 \mathrm{I}^{\circ} \mathrm{O}$ | $82 \cdot 7$ | 84.5 | $86 \cdot 3$ | 88 | 89 |  | 93 | 95 |  | I | $39 \cdot 3$ | I | 4 I 3 |  | 43.2 |  | $45 \cdot 2$ |  | $47 \cdot 2$ |
| $3^{8}$ | 79.7 | $8 \mathrm{I} \cdot 5$ | 83.2 | 85.0 | $86 \cdot 7$ | 88 | $90 \cdot 4$ | 92 | $94^{\circ} \mathrm{O}$ | $95 \cdot 9$ | 1 | $37 \cdot 8$ | I | $39 \cdot 7$ |  | 4 I 6 |  | $43 \cdot 6$ |  | 45 |
| 40 | 78.4 | 80 | $8 \mathrm{I} \cdot 9$ 80.5 | 83.6 |  |  |  | $90 \cdot 7$ | $92 \cdot 5$ | 94.4 | I | $36 \cdot 2$ | 1 | $38 \cdot 1$ |  | $40^{\circ}$ |  | 41.9 |  | 43 |
| 42 | 77• | 78 | 80 | 8 | 83.9 | 85 | 8 | 89.2 | $9 \mathrm{I} \cdot 0$ |  |  |  |  | $36 \cdot 4$ |  | 8. |  | $40 \cdot 2$ |  |  |
| 43 |  | 78.1 | $79 \cdot 8$ |  | 83.2 | $84 \cdot 9$ | 86.6 | 88 | $90 \cdot 2$ | $92 \cdot 0$ | I | $33 \cdot 8$ | I | $35 \cdot 6$ |  | － 5 |  | 3 |  | $1 \cdot 2$ |
| 44 | 75.8 | $77^{\circ}$ | 79 | 80 | 82 | 84 | 85.9 | 8 | 89.4 | 91.2 | I | $33^{\circ} \mathrm{O}$ | I | $34 \cdot 8$ |  | $36 \cdot 6$ |  | 38.4 |  | 40 |
| 45 | 75.1 | 76 |  | 80 | 81 |  | 85.1 | 86 | 88.6 |  | 1 | 32． 1 | I | 33.9 |  | $35 \cdot 7$ |  | 37．5 |  | $39 \cdot 4$ |
| 46 |  | 76. | 77 | 79 | 80 |  | 84.3 | 86．0 | $87 \cdot 7$ | 88 | I | 31．2 | I | $33^{\circ}$ |  | $34 \cdot 8$ |  | $36 \cdot 6$ |  | 38. |
| 47 |  | 75 |  | 78 |  |  | 83.5 | $85 \cdot 2$ | 86 |  |  | $30 \cdot 3$ | I |  |  |  |  | 7 |  | $37 \cdot 5$ |
| 48 |  | 74.5 | $76 \cdot 1$ |  | $79 \cdot 3$ | $8 \mathrm{I} \cdot 0$ | 82.6 | 84.3 | $86 \cdot 0$ | 87.7 | 1 | $29 \cdot 5$ | I | 31.2 |  | $33^{\circ} \mathrm{O}$ |  |  |  | $36 \cdot 5$ |
| 49 |  | 73.7 | $75 \cdot 3$ | $76 \cdot 9$ | 78.5 | $80 \cdot 1$ | $8 \mathrm{I} \cdot 8$ | 83.4 | $85 \cdot \mathrm{I}$ | 86.8 |  | $28 \cdot 5$ | I | $30 \cdot 3$ |  | $32^{\circ} \mathrm{O}$ |  | 33.8 |  | 35. |
| 50 |  | $72 \cdot 9$ | $74 \cdot 5$ | $76 \cdot 1$ | 77.7 | 79.3 | 80.9 | $82 \cdot 6$ | $8{ }^{8.2}$ | 85.9 | I | 27.6 | I | 29.3 |  | $31^{\circ}$ |  | $32 \cdot 8$ |  | 3 |
| 51 |  | $72 \cdot 1$ | $73 \cdot 7$ | $75 \cdot 3$ | 76.8 |  | $80 \cdot 0$ | $8 \mathrm{I} \cdot 7$ | 83.3 | $85^{\circ}$ | I | 26．7 | I | 28.3 |  | $30 \cdot 1$ |  | 3 P 8 | 1 | 33 |
| 52 | $69 \cdot 8$ | 71.3 | $72 \cdot 9$ | 74.4 | 76 | $77 \cdot 6$ | － 1 | 80.8 | 82.4 | 84 |  | 25 |  |  |  |  |  |  |  |  |


| Lat． | $\begin{aligned} & \mathrm{m} \\ & 47 \end{aligned}$ | $\mathrm{m}_{48}$ | $49$ | ${ }_{50}$ | $51$ | $\begin{aligned} & \mathrm{m} . \\ & 52 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 53 \end{aligned}$ | ${ }_{54}^{\mathrm{m}}$ | ${\underset{55}{ }}_{\mathrm{m}_{+}}$ |  | $\begin{aligned} & \mathrm{m} \\ & 56 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 57 \end{aligned}$ | $\frac{\mathrm{m}}{58}$ | $\begin{aligned} & \mathrm{m} \\ & 59 \end{aligned}$ | 60 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 58.7 | 00．9 ${ }^{2}$ | $03 \cdot 12$ | $205 \cdot 32$ | 207 | ${ }^{2}$ 09． | 12. | 14.4 .2 | ${ }^{16 \cdot 7}$ |  | 19．1．${ }^{\prime}$ | $21 \cdot 4$ | $23^{\prime} \cdot 8 .{ }_{2}^{\circ}$ | 26. | $28 \cdot 6$ |
|  | 57.1 I |  | 201.52 | 203.72 | 205 |  |  | 12.7 | 15 |  | 17．32 | $19 \cdot 6$ | $22 \cdot 12$ | 24 | 26.7 |
|  | 55.6 I | 57.71 | I 59．92 | $202 \cdot 12$ | 20.42 | $206 \cdot 4$ | 08. | 10.92 | 13.2 |  | 15.52 | $17 \cdot 812$ | $20 \cdot 12$ | 22. | $24 \cdot 8$ |
| 30 | 54.01 | 56．1 | I $58.3{ }^{2}$ |  | $202 \cdot 6$ | 204.72 | $06^{\circ}$ | $209.2{ }^{2}$ | II．4 |  | 13.612 | 15.92 |  | 20. | 9 |
|  | 52.41 | $54 \cdot 5$ I |  | $58 \cdot 72$ | 200.9 | 203.02 | $05 \cdot 2$ | $207 \cdot 4$ | 09．6 |  | Ir 18.8 | 14.02 | 2 | 28 | 9 |
|  |  |  |  | 57.01 | I | 2 O1． 22 | 03. | $5 \cdot 5$ | $07 \cdot 7$ |  | 09．9 | 12．12 | 2 | 2 | 9 |
|  | 49.21 48.31 | $1$ | I | $\begin{aligned} & 55 \cdot 3 \\ & 54 * 4 \end{aligned}$ | I | 59.42 | Or | $3 \cdot 72$ | 05.8 |  | 08．0 2 | 10．22 | 2 | 2 | 16.8 |
| 38 | I 47.51 | \％ 5 | I $5 \mathrm{I} \cdot 5 \mathrm{I}$ | I 53.51 | I | I 57.61 | $9 \cdot$ | Or． 82 | 03.9 |  | ${ }^{0} 6$ | 08.22 |  |  |  |
| 39 | I 46.61 | $8 \cdot 61$ | 1 $50 \cdot 6$ | I $52 \cdot 6$ | I 54.6 | I 56.71 | 8.8 | $200 \cdot 82$ | $202 \cdot 9$ |  | 05．02 | 07．2 |  | － |  |
| 40 | I 45.81 | $7 \cdot 71$ | I 49.7 I | 151.71 | 153.7 | I 55.71 | $7 \cdot$ | 9.92 | or．9 |  | 0.4 .02 | $6 \cdot 2$ |  | 10 |  |
|  | 44.9 I | $46 \cdot 8$ I | I 48.8 I | I 50.8 I | I 52.8 | I 54.8 | $56 \cdot 8$ | 58.92 | $200 \cdot 9$ |  | 03.02 |  |  | 2 | 5 |
| 42 | $44^{\circ} \mathrm{O}$ | $45^{\circ} 91$ | I 47.9 I | I $49 \cdot 8$ I | $15 \mathrm{I} \cdot 8$ | I 53.8 | 55.8 | 57.9 | 59.9 |  | $02 \cdot 02$ | $04 \cdot 12$ |  | 2 |  |
| 43 | 43.11 | $4{ }^{\circ}$ | I $46 \cdot 9$ I | I 48.9 I | 15 | 52.8 51.8 | 54.8 | 56.8 | I 58.9 |  | 00.92 | $0^{0.0}{ }^{1}$ | $5 \cdot 12$ | 07．2 | $9 \cdot 3$ |
|  | 42.21 | $44^{11} 1$ | $1{ }^{46} 0$ I | I 47.9 I | 149 | 1 | 53 | $5 \cdot 8$ | 578 |  | 59.82 | OI•92 | 9．02 | －06．022 | 08．I |
| 45 | 41.21 | $43^{1} \mathrm{I}$ | I $45{ }^{\circ} \mathrm{O}$ | I $46 \cdot 9$ I |  | 50 | $52 \cdot 8$ | $4 \cdot 7$ | 仡 |  | 58.8 | $0 \cdot 8$ | $2 \cdot 8$ | －04．912 | $7 \cdot 0$ |
|  | 1 |  |  | 91 |  | I 49.8 I | 51 | 1 53.71 |  |  | 57.61 | 5973 ${ }^{2}$ | I－7 2 | 03．7 | 8 |
| 47 | I 39.31 <br> I 38.31 |  | $42.01$ |  | I $46 \cdot 8$ | I 48.7 I | $50 \cdot 6$ | I 52.61 |  |  | $56 \cdot 5$ | $8 \cdot 52$ |  | 20.5 | 6 |
| 49 | $37 \cdot 31$ | 39－1 | $42 \cdot 01$ |  | I | $\begin{aligned} & 47 \cdot 6 \\ & 46 \cdot 5 \end{aligned}$ | $\begin{aligned} & 49 \cdot 5 \\ & 48 \cdot 4 \end{aligned}$ | $\begin{array}{ll} 1 & 515 \\ 1 & 50 \cdot 3 \end{array}$ |  |  | $55^{\circ}$ | 1 |  |  |  |
| 50 | 36.31 | 38－1 1 | I 39.9 I | I 4 「「 ${ }^{\text {I }}$ | I $43 \cdot 6$ | $45 \cdot 4$ | I $47 \cdot 3$ |  |  |  | 53.01 | 54．9＇1 | ，91 | I 58.92 | 00．3 |
| 51 | 35.3 I | $37^{\circ} \mathrm{O}$ | I 38.8 I | I 40.6 | I 42.4 | 44.31 | $46 \cdot 1$ | I $48 \cdot 01$ |  |  | 53.8 | 53．7 1 | 55.61 | 57．6 I | 59．5 |
| 52 | 3 |  | 37.71 | I 39.5 I | 14 I | 43.11 | 44.9 | I $46 \cdot 8$ |  |  | I | 1 |  | 1 56.3 I |  |

## REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

 * E ARGUS AND a CRUCIS.| Lat. | ${ }_{4}$ | ${ }_{8} \mathrm{~m}$. | ${ }_{12}$ | ${ }_{16}$ | ${ }_{20} \mathrm{~m}$ | ${ }_{22} \mathrm{~m}$ | ${ }_{24}^{\mathrm{m}} \mathrm{H}$ | ${ }_{26}^{\mathrm{m}}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{30}$. | ${ }_{32} \mathrm{~m}$ | ${ }_{34} \mathrm{~m}$. | $\begin{aligned} & \mathrm{m} \\ & 36 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 38 \end{aligned}$ | ${ }_{40}$. | $\begin{aligned} & \mathrm{m} . \\ & 42 \end{aligned}$ | ${ }_{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | 0.2 | 1.0 | $2 \cdot 2$ | $3 \cdot 9$ | $6 \cdot 2$ | $7 \cdot 4$ | $8 \cdot 9$ | $10 \cdot 4$ | $12 \cdot 0$ | 13.8 | $15 \cdot 7$ | $15 \cdot 8$ | 19.9 | 22.2 | $24 \cdot 6$ | $27 \cdot 1$ |  |
| 20 | $0 \cdot 3$ | $1 \cdot 0$ | $2 \cdot 3$ | 4-I | $6 \cdot 4$ | $7 \cdot 7$ | $9 \cdot 2$ | 10.8 | 12.5 | 14.4 | 16.4 | $18 \cdot 5$ | $20 \cdot 7$ | $23 \cdot 0$ | 25.5 | $28 \cdot 1$ | $30 \cdot 9$ |
| 16 | $0 \cdot 3$ | I•I | $2 \cdot 4$ | $4 \cdot 3$ | $6 \cdot 6$ | $8 \cdot 0$ | 9.6 | II 2 | 13.0 | 14.9 | 17.0 | 19.2 | 21.5 | 23.9 | 26.5 | 29.2 | $32 \cdot 1$ |
| 12 | $0 \cdot 3$ | I-I | $2 \cdot 5$ | $4 \cdot 4$ | $6 \cdot 9$ | $8 \cdot 3$ | $9 \cdot 9$ | II• 6 | 13.5 | $15 \cdot 5$ | $17 \cdot 7$ | 19.9 | 22.3 | 24.9 | 27.5 | $30 \cdot 4$ | 33.3 |
| 8 | $0 \cdot 3$ | I• | 2.6 | $4 \cdot 6$ | $7 \cdot 2$ | $8 \cdot 7$ | 10.3 | 12.1 | $14^{\circ} \mathrm{O}$ | ${ }^{16 \cdot 1}$ | 18.3 | $20 \cdot 7$ | $23 \cdot 2$ | $25 \cdot 8$ | 28.6 | 31.5 | $34^{\circ} 6$ |
| 4 | $0 \cdot 3$ | I-2 | $2 \cdot 7$ | $4 \cdot 8$ | 7.5 | $9 \cdot 0$ | $10 \cdot 7$ | 12.6 | 14.6 | $16 \cdot 7$ | 19.1 | 21.5 | $24^{\text {I }}$ | $26 \cdot 9$ | 29.8 | $32 \cdot 8$ | $36 \cdot 0$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| o | $0 \cdot 3$ | $1 \cdot 2$ | $2 \cdot 8$ | 5.0 | $7 \cdot 8$ | 9.4 | II. 2 | 13.1 | 15.2 | 17.4 | 19.9 | 22.4 | $25 \cdot 1$ | 28.0 | 31.0 | 34.2 | 37.5 |
| 4 | $0 \cdot 3$ | $1 \cdot 3$ | $2 \cdot 9$ | $5 \cdot 2$ | $8 \cdot 1$ | 9.8 | 6 | 13.7 | 15.8 | 18.2 | 20.7 | 23.4 | 26.2 | 29.2 | 32.3 | $35 \cdot 6$ | $39 \cdot 1$ |
| 8 | $0 \cdot 3$ | I-4 | 3.1 | $5 \cdot 4$ | $8 \cdot 5$ | $10 \cdot 3$ | 12.2 | 14.3 | $16 \cdot 6$ | 19.0 | $21 \cdot 7$ | $22^{\circ} 4$ | 27.4 | $30 \cdot 5$ | 33.8 | $37 \cdot 2$ | $40 \cdot 8$ |
| 12 | 0.4 | I. 4 | 3.2 | $5 \cdot 7$ | $8 \cdot 9$ | $10 \cdot 7$ | 12.8 | $15^{\circ} \mathrm{O}$ | 17.4 | 19.9 | 22.7 | $25 \cdot 6$ | $28 \cdot 7$ | 32.0 | 35.4 | $39^{\circ} \mathrm{O}$ | $42 \cdot 8$ |
| 16 | 0.4 | 1.5 | 3.4 | $6 \cdot 0$ 6.3 | 9.4 | 11.3 | 13.5 | 15.8 | 18.3 | 21.0 | 23.9 25.3 | 27.0 28.5 | $30 \cdot 2$ | 33.6 35.6 | 37.2 30.4 | $4{ }^{\circ} \mathrm{O}$ | $45 \cdot 0$ |
| 20 | 0.4 | 1.6 | 3.6 | $6 \cdot 3$ | 9.9 | 12.0 | 14.2 | $16 \cdot 7$ | 19.4 | 22. | $25 \cdot 3$ | $28 \cdot 5$ | $32 \cdot 0$ | $35 \cdot 6$ | $39 \cdot 4$ | $43 \cdot 4$ | $47 \cdot 6$ |
| 22 | 0.4 | 1.6 | 3.7 | $6 \cdot 5$ | 10.3 | 12.4 | 14.7 | 17.2 | 20.0 | 22.9 | $26 \cdot 1$ | 29.4 | 32.9 | $36 \cdot 7$ | $40 \cdot 6$ | $44 \cdot 7$ | $49^{\circ}$ |
| 24 | 0.4 | 1-7 | $3 \cdot 8$ | $6 \cdot 7$ | $10 \cdot 5$ | 12. | $15 \cdot 2$ | 17.8 | $20 \cdot 6$ | $23 \cdot 6$ | $26 \cdot 9$ | $30 \cdot 4$ | $34^{\circ}$ | 37.9 | 41.9 | $46 \cdot 2$ | $50 \cdot 6$ |
| 26 | 0.4 | 1.8 | 3.9 | $7 \cdot 0$ | 10.9 | 13.2 | $15 \cdot 7$ | 18.4 | 21.3 | 24.5 | 27.9 | 31.4 | $35^{2}$ | $39 \cdot 2$ | 43.4 | 47•7 | 52.3 |
| 28 | 0.5 | I.8 | $4 \cdot 1$ | 73 | 11.3 | 13.7 | $16 \cdot 3$ | 19•1 | $22 \cdot 1$ | $25 \cdot 4$ | $28 \cdot 9$ | $32 \cdot 6$ | $36 \cdot 5$ | $40 \cdot 6$ | $45^{\circ}$ | $49 \cdot 5$ | $54 \cdot 3$ |
| 30 | 0.5 | I.9 | $4 \cdot 3$ | $7 \cdot 6$ | 11.8 | 14.3 | 17.0 | 19.9 | $23^{\circ} \mathrm{O}$ | 26.4 | $30 \cdot 1$ | $33 \cdot 9$ | 38.0 | $42 \cdot 3$ | $46 \cdot 8$ | 51.5 | $56 \cdot 4$ |
| 32 | $0 \cdot 5$ | $2 \cdot 0$ | 4.5 | $7 \cdot 9$ | 12.3 | 14.9 | 17.7 | 20.8 | $24^{-1}$ | 27.6 | 31.4 | 35.4 | $39 \cdot 6$ | $44^{1} 1$ | $48 \cdot 8$ | 53.7 | $58 \cdot 8$ |
| 34 | 0.5 | - | 4.7 | $8 \cdot 3$ | 12.9 | $15 \cdot 6$ | 18.6 | 21.8 | $25 \cdot 2$ | 28.9 | $32 \cdot 9$ | $37 \cdot 1$ | 41.5 | $46 \cdot 2$ | 51. | $56 \cdot 2$ | $6 \mathrm{r} \cdot 6$ |
| 36 | 0.5 | 2.2 | 4.9 | $8 \cdot 7$ | 13.6 | 16.5 | 19.6 | 22.9 | $26 \cdot 6$ | $30 \cdot 5$ | 34.7 | $39^{\text {I }}$ I | $43 \cdot 7$ | $48 \cdot 6$ | 53.7 56.8 | 59.2 62.5 | $64 \cdot 8$ 68.5 |
| 38 40 | 0.6 0.6 | 2.3 2.5 | 5.2 | 9.3 9.9 | 14.4 15.4 | 17.5 18.6 | $20 \cdot 7$ 22.1 | 24.3 26.0 | 28.1 30.0 | $32 \cdot 3$ 34.4 | $36 \cdot 7$ $39 \cdot 1$ | $41 \cdot 4$ 44 | $46 \cdot 3$ 49 | $51 \cdot 4$ 54.8 | $56 \cdot 8$ 60.5 | 62.5 66.6 | $68 \cdot 5$ $72 \cdot 9$ |



## N.

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| :---: |
| 24 |
| 20 |
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| 8. |}



REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* $s \in$ ARGUS AND $\beta$ CRUCIS.


| L | ${ }_{4}$ | 8 | ${ }_{12}$ | ${ }_{16} \mathrm{~m}$ | ${ }_{20}^{\mathrm{m}}$. | ${ }_{24}$ | 28. | ${ }_{32} \mathrm{~m}$ | $\begin{aligned} & \mathrm{m} . \\ & 36 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 40 \end{aligned}$ |  | $\mathrm{m}$ | $\begin{aligned} & \mathrm{m} \\ & 52 \end{aligned}$ | $\mathrm{m} .$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 80 \end{aligned}$ | $\begin{aligned} & \mathrm{n} 1 . \\ & 90 \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{30}^{\circ}$ | $\bigcirc$ | I•O | ${ }^{\circ} \cdot 5$ | $2 \cdot 0$ | 2.6 | $3 \cdot 1$ | $3 \cdot 6$ | 1 | $4 \cdot 6$ | $5 \cdot 1$ | $5 \cdot 6$ | ${ }^{\circ} \cdot 1$ | $\stackrel{\circ}{6} \cdot 6$ | $\bigcirc \cdot 6$ | 8.8 | $\stackrel{\circ}{\circ} \mathrm{I}$ | I.3 |
| 20 | 0.5 | I.O | 1.6 | $2 \cdot 1$ | 2.6 | $3 \cdot 1$ | $3 \cdot 6$ | $4 \cdot 1$ | $4 \cdot 7$ | 5.2 | $5 \cdot 7$ | $6 \cdot 2$ | $6 \cdot 7$ | $7 \cdot 7$ | $9 \cdot 0$ | $10 \cdot 2$ | II. 4 |
| 10 | 0.5 | I•I | I. 6 | $2 \cdot 2$ | 2.7 | $3 \cdot 3$ | 3.8 | 4.4 | 49 | 5.4 | $6 \cdot 0$ | $6 \cdot 5$ | $7 \cdot 0$ | $8 \cdot 1$ | $9 \cdot 4$ | $10 \cdot 7$ | II•9 |
| - | 0.6 | 1.2 | I. 8 | $2 \cdot 4$ | 3.0 | 3.6 | $4 \cdot 1$ | $4 \cdot 7$ | $5 \cdot 3$ | $5 \cdot 9$ | $6 \cdot 5$ | 7.1 | $7 \cdot 6$ | $8 \cdot 7$ | IO•I | II- | 12.8 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | $0 \cdot 6$ | I. 2 | $1 \cdot 9$ | $2 \cdot 5$ | $3 \cdot 1$ | $3 \cdot 7$ | 4.3 | $4 \cdot 9$ | $5 \cdot 6$ | $6 \cdot 2$ | $6 \cdot 8$ | 7.4 | $8 \cdot 0$ | 9 | 10.6 | 12. | 13.3 |
| 12 | $0 \cdot 7$ | 1.3 | $2 \cdot 0$ | 2.6 | 3.3 | $3 \cdot 9$ | 4.6 | $5 \cdot 2$ | $5 \cdot 8$ | $6 \cdot 5$ | 7.1 | 7.7 | $8 \cdot 4$ | 9.6 | $1 \mathrm{I} \cdot$ | 12.6 | 14.0 |
| 12 | $0 \cdot 7$ | 1.4 | $2 \cdot 1$ | $2 \cdot 8$ | $3 \cdot 5$ | 4.2 | $4 \cdot 8$ | $5 \cdot 5$ | $6 \cdot 2$ | $6 \cdot 9$ | $7 \cdot 5$ | 8.2 | $8 \cdot 9$ | 10. | II | 13.3 | 14.8 |
| 16 | $0 \cdot 7$ | 1.5 | 2.2 | 3.0 | $3 \cdot 7$ | 4.5 | $5 \cdot 2$ | 5.9 | 6.6 | $7 \cdot 4$ | $8 \cdot \mathrm{I}$ | 8.8 | 9.5 | $10^{\circ}$ | 12. | 14. | 15.7 |
| 20 | 0.8 | ${ }_{\text {I }} \mathrm{I}$. | 2.4 2.5 | 3.2 3.3 | 4.0 | 4.8 | $5 \cdot 6$ | $6 \cdot 4$ | 7.2 7.5 | 8.0 | $8 \cdot 7$ 0.1 | 9.5 | 10.2 | 11. | 13.5 | $15 \cdot 2$ | $16 \cdot 9$ |
| 22 | 0.8 | I• | $2 \cdot 5$ | $3 \cdot 3$ | $4 \cdot 2$ | $5 \cdot 0$ | $5 \cdot 9$ | $6 \cdot 7$ | 7.5 | $8 \cdot 3$ | $9 \cdot 1$ | 9.9 | 10 | 12. | 14.1 | 15.8 | 17.5 |
| 24 | - | I.8 | 2. | $3 \cdot 5$ | 4. | $5 \cdot 3$ | $6 \cdot 1$ | 7.0 |  |  | 9.5 | 10.4 | 11.2 | 12.8 | 14.7 | $16 \cdot 5$ | 18.3 |
| 26 | $0 \cdot 9$ | - 9 | $2 \cdot 8$ | $3 \cdot 7$ | $4 \cdot 6$ | $5 \cdot 6$ | $6 \cdot 5$ | $7 \cdot 4$ | $8 \cdot 3$ | $9 \cdot 1$ | $10 \cdot 0$ | 10.9 | 11 | 13 | 15.4 | 17.3 | $19 \cdot 1$ |
| 27 | 1.0 | I.9 | 2.9 | $3 \cdot 8$ | $4 \cdot 8$ | $5 \cdot 7$ | $6 \cdot 6$ | 7.6 | 8.5 | 9.4 | $10 \cdot 3$ | $1 \mathrm{I} \cdot 2$ | 12. | $13^{\circ} 7$ | $15 \cdot 8$ | 17.7 | 19.5 |
| 28 | $\pm 0$ | $2 \cdot 0$ | 3.0 | $3 \cdot 9$ | 4.9 | $5 \cdot 9$ | $6 \cdot 8$ | 7.8 | $8 \cdot 7$ | $9 \cdot 6$. | $10 \cdot 6$ | II 5 | 12 | 14.1 | 16.2 | 18.2 | $20 \cdot 0$ |
| 29 | I. | 2.1 | 3.1 | 4. | 5. | $6 \cdot 0$ | $7{ }^{7} 0$ | $8 \cdot 0$ | $9^{\circ} \mathrm{O}$ | 9.9 | $10 \cdot 9$ | II.8 | 12. | 14.5 | 16.6 | $8 \cdot 6$ | $20 \cdot 5$ |
| 30 | 1.0 | $2 \cdot 1$ | $3 \cdot 1$ | 4.2 | $5 \cdot 2$ | $6 \cdot 2$ | $7 \cdot 2$ | $8 \cdot 2$ | $9 \cdot 2$ | 10.2 | 11.2 | 12 | 13.1 | 14.9 | 17.1 | 19•1 | 21. |
| 31 | I. | $2 \cdot 2$ | $3 \cdot 2$ | 4.3 | $5 \cdot 4$ |  | 7.5 | 8 | $9 \cdot 5$ | 10.5 | 11.5 | 12.5 | 13.5 | $15 \cdot 3$ | 17.6 | $19 \cdot 7$ | 2 x 6 |
| 32 | I•I | 2.2 | $3 \cdot 3$ | 4.4 | $5 \cdot 5$ | $6 \cdot 6$ | 7.7 | $8 \cdot 8$ | $9 \cdot 8$ | $10 \cdot 9$ | 11.9 | 12.9 | 13.9 | $15 \cdot 8$ | $18 \cdot 1$ | 20.2 | 22.2 |
| 33 | 1.2 | 2.3 | 3.5 3.6 | $4 \cdot 6$ | $5 \cdot 7$ | $6 \cdot 9$ | $8 \cdot 0$ | $9 \cdot 1$ | 10.2 | 112 150 | 12.3 | 13.3 | 14.4 | $16 \cdot 3$ | $18 \cdot 7$ | $20^{\circ}$ | 22.9 |
| 34 35 | I 22 $\mathrm{I} \cdot 2$ | 2.4 2.5 | 3.6 3.7 | $4 \cdot 8$ $4 \cdot 9$ | $5 \cdot 2$ | 7.1 | 8.3 8.6 | 9.4 | $10 \cdot 5$ | 11.6 | 12.7 | 13.8 | 14.8 | $16 \cdot 9$ | $19 \cdot 3$ | $2 \mathrm{I} \cdot 5$ | 23.5 |
| 35 36 | I•2 | 2.5 2.6 | 3.7 3.9 | 4.9 5.2 | 6.2 6.4 | 7.4 7.7 | 8.6 8.9 | 9.8 10.1 | 10.9 | 12.1 | 13.2 13.7 | 14.3 14.8 | 15.4 15.9 | 17.5 18.1 | 19 <br> 209 <br>  | 22.2 23.0 | 24.3 $25^{\prime} \mathrm{I}$ | BELOW THE POLE.

* $\operatorname{s}$ ARGUS AND $\beta$ CRUCIS.

|  | ${ }_{4} \mathrm{~m}$. |  | $\frac{12}{12}$ |  |  |  |  |  |  | ${ }_{32}$ | ${ }_{34}^{\text {m. }}$ |  |  |  |  | ${ }_{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{0}{4}$ | $0 \cdot 2$ | $0 \cdot$ | 2.0 | $3 \cdot 6$ |  | 8.0 |  |  |  |  | - | 18.0 |  |  |  |  |
|  |  |  | $1 \cdot 9$ |  |  | 7.5 |  |  |  |  |  | I6.8 |  |  |  |  |
| 45 |  |  |  |  |  |  |  |  |  |  |  | 5 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | 14.8 | $5 \cdot$ | I8.2 |  |  |
| 55 60 | 0.2 0.2 | 0.6 | r. |  | 4.2 <br> 3.8 |  |  |  | 8.6 |  |  |  | 15.2 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ}$ | $28 \cdot 1$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 | 27.5 |  |  |  |  | 33.9 | $35 \cdot 3$ |  |  |  |  | 42 | $44^{\circ}$ | $45 \cdot 6$ | . |  |
| 38 |  | 28 |  |  | $3 \mathrm{r} \cdot 8$ |  |  | 35.8 |  |  |  |  | $43^{\circ} \mathrm{O}$ |  |  |  |
|  | $26 \cdot 3$ | $27 \cdot 4$ |  | 29.9 |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 | $25^{25}{ }^{\circ}$ | ${ }_{26 \cdot 1}^{26.8}$ | 28.0 |  |  |  | 32.9 | $3{ }^{3} \cdot 2$ |  |  |  |  | $4 \mathrm{~T} \cdot \mathrm{I}$ <br> $40 \cdot \mathrm{r}$ | 42.5 |  |  |
| 4 |  |  | 26 |  |  |  | 31 |  |  |  | , |  |  | 41.5 |  |  |
| 4 |  |  |  |  | 28. |  | $30^{4} 4$ |  | $32 \cdot 9$ | 34.1 | $35^{\circ} 4$ | 36 |  | $39^{\circ}$ | 40 |  |
|  | 23.0 | $24 \cdot 1$ | 25 | 26. | $27 \cdot 3$ | 28.4 | 29 | 30.7 |  | ${ }_{33} \cdot \mathrm{I}$ |  | 5 |  | 38.2 | 39 |  |
|  |  |  | 24. |  |  |  | 28 |  | 31.0 | 2 | 4 | $34 \cdot 6$ $33 \cdot 5$ | 35.8 | $33^{3}$ | - 4 |  |
|  |  |  | 22.8 |  | 24 |  | 26 |  |  |  |  |  | 334. | 34 |  |  |
|  |  |  |  |  |  |  | 25. | 26. |  |  |  |  |  |  | $34 \cdot 6$ |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


S.


REDUCTIONS.
6'.2 $6^{\prime} \cdot 0|63.0|$

## REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM MERIDIAN BELOW THE POLE.

* s a ARGUiS and $\beta$ CRUCIS.


REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* BETELGUESE.

| Lat | ${ }_{2}^{\mathrm{m}}$ | $\mathrm{m}_{4}$ | ${ }_{6}$. | ${ }_{8} \mathrm{~m}$. | ${ }_{10}$ | 12 | 14 | 16 | 18 |  | 21 | ${ }_{22}$ | 23 | ${ }_{24}$ | ${ }_{25}$ | ${ }_{26}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 | $0 \cdot 2$ | $0 \cdot 9$ | $2 \cdot 1$ | $3 \cdot 8$ | 6.0 | 8.6 | 11.7 | 15.3 | 19.3 | $23 \cdot 8$ | 26.3 | 28.8 | 31.5 | 34.2 | $37 \cdot 1$ | \% 1 |
| 36 | 0.2 | $0 \cdot 9$ | -9 | $3 \cdot 5$ | $5 \cdot 5$ | $7 \cdot 9$ | 10.7 | 14.0 | $17 \cdot 7$ | 21.8 | 24.0 | $26 \cdot 3$ | 28.8 | $3 \mathrm{r} \cdot 3$ | $33 \cdot 9$ | $36 \cdot 7$ |
| 38 | 0.2 | 0.8 | I. 8 | $3 \cdot 2$ | 5.0 | $7 \cdot 2$ | 9.8 | 12.8 | 16.2 | 20.0 | 22.0 | $24 \cdot \mathrm{I}$ | 26.4 | 28.7 | $3 \mathrm{I} \cdot \mathrm{I}$ | $33 \cdot 6$ |
| 40 | $0 \cdot 2$ | $0 \cdot 7$ | 1.6 | 2.9 | $4 \cdot 6$ | $6 \cdot 6$ | - | II. 8 | 14.9 | 18.4 | 20. | 22.2 | 24.2 | 26.4 | 28.6 | $30 \cdot 9$ |
| 42 | 0.2 | 0.7 | $1 \cdot 5$ | $2 \cdot 7$ | $\cdot 2$ | $6 \cdot 1$ | $8 \cdot 3$ | 10.8 | 13.7 | 16.9 | 18. | 20.4 | $22 \cdot 3$ | 24.3 | $26 \cdot 4$ | 28.5 |
| 44 | $\bigcirc \cdot 1$ | 0.6 | 1•4 | $2 \cdot 5$ | $3 \cdot 9$ | 5.6 | 7.6 | $0 \cdot 0$ | 12.6 | 15.6 | 17.2 | 18.9 | 20.6 | 22. | $24 \cdot 3$ | $26 \cdot 3$ |
| 46 | O. I | 0.6 | I•3 | $2 \cdot 3$ | $3 \cdot 6$ | $5 \cdot 2$ | - | 9.2 | 11.7 | 14.4 | 15 | 17.4 | 19.0 | $20 \cdot 7$ | 22. | $24 \cdot 3$ |
| 48 | O.I | $0 \cdot 5$ | $1 \cdot 2$ | $2 \cdot 1$ | $3 \cdot 3$ | $4 \cdot 8$ | $6 \cdot 5$ | $8 \cdot 5$ | 10.8 | 13.3 | 14.7 | - | 17.6 | 19.1 | $20 \cdot 7$ | $22 \cdot 4$ |
| 50 | O. 1 | 0.5 | I• I | $2 \cdot 0$ | $3 \cdot 1$ | $4 \cdot 4$ | $6 \cdot 0$ | $7 \cdot 9$ | $9 \cdot 9$ | 12.3 | 13.5 | 14 | 16.2 | 17.7 | 19.2 | $20 \cdot 7$ |
| 52 | O.I | $0 \cdot 4$ | roo | I. 8 | $2 \cdot 8$ | $4 \cdot 1$ | 5.6 | $7 \cdot 3$ | 9.2 | $1 \cdot 3$ | 12. | 13.7 | 15.0 | 16.3 | 17.7 | 19.1 |
| 54 | 0. | 0.4 | - | $1 \cdot 7$ | $2 \cdot 6$ | $3 \cdot 8$ | $5 \cdot 1$ | $6 \cdot 7$ | $8 \cdot 5$ | 10.5 | 11.5 | 12.7 | 13.8 | 1591 | 16.3 | 17.7 |
| 56 | $\bigcirc \cdot \mathrm{I}$ | $0 \cdot 4$ | $0 \cdot 9$ | 1.5 | $2 \cdot 4$ | $3 \cdot 5$ | $4 \cdot 7$ | $6 \cdot 2$ | $7 \cdot 8$ | $9 \cdot 6$ | 10.6 | II•7 | 12.8 | 13.9 | $15 \cdot 1$ | 16.3 |
| 60 | $0 \cdot \mathrm{I}$ | $\bigcirc \cdot 3$ | 0.7 | $1 \cdot 3$ | $2 \cdot 0$ | $2 \cdot 9$ | $4^{\circ} 0$ | $5 \cdot 2$ | $6 \cdot 6$ | $8 \cdot 1$ | $9 \cdot 0$ | 9.9 | 10.8 | II•7 | 12.7 | 13.8 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 22 | 0.2 0.2 | 0 | $2 \cdot 3$ $2 \cdot 2$ | 4.2 3.9 | 6.1 | 9.5 8.8 | 12. | 15.6 | $19 \cdot 7$ | 24.3 | 26.8 | 29.4 | $34 \cdot 7$ $32 \cdot 1$ | 37.7 35.0 | $\begin{array}{r}0.9 \\ \hline 7.9\end{array}$ | $\cdot{ }^{2}$ |
| 24 | $0 \cdot 2$ | 0.9 | $2 \cdot 0$ | $3 \cdot 6$ | $5 \cdot 7$ | 8.2 | II'I | 14.5 | 18.3 | 22.6 | 24.9 | 27.3 | 29.9 | 32.5 | $35^{2}$ | $38 \cdot 1$ |
| 26 | $\cdot 2$ | 0.8 | r9 | 3.4 | $5 \cdot 3$ | 7.6 | $10 \cdot 3$ | 13.5 | 17.1 | 21.1 | 23.2 | 25 | 27.8 | $30 \cdot 3$ | $32 \cdot 8$ | 35.5 |
| 28 | 0.2 | 0.8 | 1・ク | $3 \cdot 1$ | $4 \cdot 9$ | $7 \cdot 1$ | $9 \cdot 7$ | 12.6 | 16.0 | 19.7 | 21. | 23.8 | 26.0 | 28.3 | 7 | 33.2 |
| 30 | 0.2 | $0 \cdot 8$ | I• 7 | $2 \cdot 9$ | $4 \cdot 6$ | $6 \cdot 6$ | $9 \cdot 0$ | II. 8 | 14.9 | 18.4 | $20 \cdot 3$ | $22 \cdot 3$ | $24 \cdot 3$ | $26 \cdot 5$ | 28.7 | $31 \cdot 1$ |
| 32 | $0 \cdot 2$ | $0 \cdot 7$ | 1.5 | $2 \cdot 7$ | $4 \cdot 3$ | $6 \cdot 2$ | $8 \cdot 5$ | II• 1 | 14.0 | $17 \cdot 3$ | $19 \cdot 1$ | 20.9 | 22.8 | 24.8 | $26 \cdot 9$ | 29.1 |
| 35 | $0 \cdot \mathrm{I}$ | $0 \cdot 6$ | 1.4 | $2 \cdot 5$ | $3 \cdot 9$ | $5 \cdot 7$ | 7.7 | $10 \cdot 1$ | 12.7 | 15.7 | 17.3 | 19.0 | 20 | 22.6 | 24.5 | $26 \cdot 5$ |
| 40 | $0 \cdot \mathrm{I}$ | $0 \cdot 5$ | I-2 | $2 \cdot 1$ | $3 \cdot 4$ | $4 \cdot 8$ | 6.6 | 8.6 | 10.9 | 13.5 | 14.9 | 16 | 17.8 | 19.4 | $2{ }^{\circ} \mathrm{O}$ | 22.7 |
| 45 | O.I | $0 \cdot 4$ | 10 | 1.8 | 2.9 | $4 \cdot 2$ | $5 \cdot 7$ | $7 \cdot 4$ | $9 \cdot 4$ | $1{ }^{1} \cdot 6$ | 12.7 | 14 | 15.3 | r6. | 18 | 19.5 |
| 50 | $0 \cdot$ | $0 \cdot 4$ | $0 \cdot 9$ | 1.6 | $2 \cdot 5$ | $3 \cdot 5$ | $4 \cdot 8$ | $6 \cdot 3$ |  | 9.9 | 10.9 | 1199 | 13. | 14 | 15. | 16.7 |
| 55 | O.I | $0 \cdot 3$ | 0.7 | $1 \cdot 3$ | $2 \cdot 1$ | 3.0 | 4.I | $5 \cdot 4$ | $6 \cdot 8$ | $8 \cdot 4$ | 9.2 | $10 \cdot 1$ | II•I | 12. | $13 \cdot 1$ | 14.2 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{27}$ | ${ }_{28}$ | ${ }_{29}$ | 30 | 31 | ${ }_{32}{ }^{2}$ | $33$ | $34$ | $35$ | $36$ | $\begin{aligned} & \mathrm{m}_{37} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 38 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 9 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 40 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline \end{aligned}$ | $\mathrm{m}_{42}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 |  | $42 \cdot 5$ | $45 \cdot 5$ | $48 \cdot 7$ | 51.9 | $55 \cdot 3$ | 58.7 | $62 \cdot 3$ | 65.9 | 59.6 | 73.5 | 77.4 | 4 | $85 \cdot 6$ |  |  |
| 37 | 37.8 | $40 \cdot 6$ | $43 \cdot 6$ | $46 \cdot 6$ | $49 \cdot 7$ | $52 \cdot 9$ | $56 \cdot 2$ | 59.6 | $63 \cdot 1$ | $66 \cdot 7$ | 70.4 | 74.2 | 78.0 | 82.0 | 86.I |  |
| 38 | $36 \cdot 2$ | 38.9 | $4 \mathrm{r} \cdot 7$ | $44 \cdot 6$ | 47.6 | $50 \cdot 7$ | 53.9 | $57 \cdot 2$ | $60 \cdot 5$ | $64 \cdot 0$ | $67 \cdot 5$ | $7 \mathrm{I} \cdot \mathrm{I}$ | 74.8 | 78.7 | 82.6 |  |
| 39 | 34.7 | 37-3 | $40^{\circ} 0$ | 428 | 45.7 | $48 \cdot 6$ | 51.7 | 54.8 | $58 \cdot 0$ | 61.4 | $64 \cdot 7$ | 68.2 | 71.8 | $75 \cdot 5$ | 79.2 | $83 \cdot 0$ |
| 40 | $33 \cdot 3$ | 35 | $38 \cdot 4$ | $41 \cdot 1$ |  | $46 \cdot 7$ | 49.6 | 52.6 | 55.7 | 58.9 | 62.1 | $65 \cdot 5$ | 68.9 | 72.4 | $76 \cdot 0$ | $79 \cdot 7$ |
| 4 I | 32.0 | 34 | $36 \cdot 9$ | $39^{\circ} 4$ | 42 | $44^{-8}$ | $47 \cdot 6$ | $50 \cdot 5$ | 53.5 | $56 \cdot 5$ | 59.7 | 62.9 | $66 \cdot 2$ | 69.6 | 73.0 | $76 \cdot 6$ |
| 42 | 30.7 | 33.0 | $35 \cdot 4$ | 37.9 | $40 \cdot 4$ | $43^{\circ}$ | $45 \cdot 7$ | $48 \cdot 5$ | 51.4 | 54.3 | 57.3 | $60 \cdot 4$ | 63.6 | 66.8 | $70 \cdot 2$ | $73 \cdot 6$ |
| 43 | 29.5 | 3 I | 34.0 | $36 \cdot 4$ | 38 | $41 \cdot 3$ | 43.9 | $46 \cdot 6$ | $49 \cdot 3$ | $52 \cdot 2$ | $55 \cdot 1$ | 58.0 | 6I•I | $64 \cdot 2$ | $67 \cdot 4$ | $70 \cdot 7$ |
| 44 | $28 \cdot 3$ | 30 | 32 | 34.9 | $37 \cdot 3$ | $39 \cdot 7$ 38.2 | $42 \cdot 2$ | $44 \cdot 8$ | $47 \cdot 4$ | $50 \cdot 1$ 48.2 | $52 \cdot 9$ | $55 \cdot 8$ | $58 \cdot 7$ | 6r•7 | $64 \cdot 8$ $62 \cdot 3$ | $68 \cdot 0$ 6.4 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 65.4 |
| 47 | 25 |  | 29.0 | 31 |  |  |  | $4{ }^{\circ}$ | $43 \cdot 8$ | 46 | $48 \cdot 9$ | 51.6 | 54.3 | 57.1 | $59^{\circ} 9$ | 62.8 |
| 48 |  | 26 |  | 20.8 |  | 35 | 37. | $3{ }^{4}$ | $42 \cdot 1$ | 44 | $47^{\circ}$ | $49^{6}$ | 52 | 54.9 | $57 \cdot 6$ | 60. |
| 50 | $22 \cdot 3$ | 24 | 25.8 | 27.6 | 29.4 | 31 |  |  |  |  | 4 | 47.7 | 5 | 52.81 | 55.4 | $58 \cdot 1$ $53 \cdot 8$ |
| 52 | 20.6 | 22.2 | 23.8 | 25.5 | $27 \cdot 2$ | 29.0 | $30 \cdot 8$ | 32.7 | $34 \cdot$ | $36 \cdot$ | 38 | $40 \cdot 7$ | $42 \cdot 9$ | $45 \cdot 1$ | $\cdot 4$ | 49 |
| 54 | 19.1 | $20 \cdot 5$ | 22 | 23.5 | 25.1 | $26 \cdot 7$ | 28.4 | 30.2 | $3 \mathrm{I} \cdot 9$ | 33.8 | $35 \cdot 7$ | $37 \cdot 6$ | $39 \cdot 6$ | 41.7 | $43 \cdot 7$ | 45.9 |
| 56 | 17.6 | 18.9 | $20 \cdot 3$ | $2 \mathrm{I} \cdot 7$ | $23 \cdot 1$ | 24.6 | $26 \cdot 2$ | 27.8 | 29.5 | 31.2 | 32.9 | $34 \cdot 7$ | $36 \cdot 5$ | 38.4 | $40 \cdot 3$ | $42 \cdot 3$ |
| 5 | 16.2 | 17.4 | 18.6 | 19.9 | 21.3 | 22.7 | 24. | 25.6 | $27 \cdot 1$ | $28 \cdot 7$ | $30 \cdot 3$ | 31.9 | $33 \cdot 6$ | $35 \cdot 4$ | $37 \cdot 1$ | $39 \cdot 0$ |
| 60 | 14.8 | I5.9 | 17.1 | 18.3 | 19.5 | 20.8 | $22 \cdot 1$ | 23.5 | 24.9 | $26 \cdot 3$ | 27.8 | $29 \cdot 3$ | 30.9 | $32 \cdot 5$ | $34^{-1}$ | $35 \cdot 8$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25 | 39.6 | $42 \cdot 6$ | $45 \cdot 6$ | $48 \cdot 8$ | $52 \cdot 1$ | $55 \cdot 4$ | 58.9 | $62 \cdot 5$ | $66 \cdot 1$ | 69.9 | $73 \cdot 7$ | $77 \cdot 7$ | 81.8 | 85.9 | 90.2 | 94.5 |
| 26 | $38 \cdot 3$ | $4 \mathrm{I} \cdot \mathrm{I}$ | $44 \cdot 1$ | $47 \cdot 1$ | $50 \cdot 3$ | $53 \cdot 6$ | $56 \cdot 9$ | $60 \cdot 4$ | $63 \cdot 9$ | $67 \cdot 5$ | $7 \mathrm{I} \cdot 3$ | $75 \cdot 1$ | $79 \cdot 0$ | 83.1 | $87 \cdot 2$ | ${ }^{91} 4$ |
| 27 28 | $37 \cdot 0$ | 39.7 38.4 | $42 \cdot 6$ | $45 \cdot 6$ | $48 \cdot 6$ | 51.8 | $55^{\circ} \mathrm{O}$ | $58 \cdot 3$ | $6 \mathrm{I} \cdot 8$ | $65 \cdot 3$ | $68 \cdot 9$ | $72 \cdot 6$ | $76 \cdot 4$ | $80 \cdot 3$ | 84.3 | $88 \cdot 4$ |
| 28 | $35 \cdot 7$ | $38 \cdot 4$ | $4 \mathrm{I} \cdot 2$ | $44 \cdot 1$ | 47.0 | $50 \cdot 1$ | 53.2 | 56.4 | 59.7 | 63.2 | $66 \cdot 7$ | $70 \cdot 3$ | 73.9 | 77.7 | $8 \mathrm{I} \cdot 6$ | 85.5 |
| 29 | $34 \cdot 6$ | $37 \cdot 2$ | $39 \cdot 8$ | $42 \cdot 6$ | 45.5 | $48 \cdot 4$ | $51 \cdot 5$ | $54 \cdot 6$ | $57 \cdot 8$ | $6 \mathrm{I} \cdot \mathrm{I}$ | $64 \cdot 5$ | $68 \cdot 0$ | $7 \mathrm{I} \cdot 6$ | 75.2 | $79^{\circ}$ | 82.8 |
| 30 | $33 \cdot 5$ | $36 \cdot 0$ | $38 \cdot 6$ | $4 \mathrm{r} \cdot 3$ | $44^{\circ} \mathrm{O}$ | $46 \cdot 9$ | 49.8 | $52 \cdot 9$ | $56 \cdot 0$ | 59.2 | 62.5 | $65 \cdot 8$ | $69 \cdot 3$ | 72.9 | $76 \cdot 5$ | 80.2 |
| 32 | 31.4 | $33 \cdot 7$ | $36 \cdot 2$ | $38 \cdot 7$ | 41.3 | $44^{\circ}$ | $46 \cdot 8$ | $49 \cdot 6$ | $52 \cdot 5$ | $55 \cdot 5$ | 58.6 | $6 \mathrm{I} \cdot 8$ | $65^{\circ}$ | $68 \cdot 4$ | 71.8 | $75 \cdot 3$ |
| 34 | 29.5 | $31 \cdot 7$ 20.8 | $34 \cdot 0$ | $36 \cdot 3$ | 38.8 | $4{ }^{1} \cdot 3$ | 43.9 | $46 \cdot 6$ | 49.3 | 52.2 | 55.1 | 58.1 | 6I•I | $64 \cdot 3$ | 67.5 | $70 \cdot 8$ |
| 36 38 | 27.7 26.0 | 29.8 | $31 \cdot 9$ $30 \cdot 0$ | $34 \cdot 2$ | $36 \cdot 5$ | 38.8 | 41.3 | $43 \cdot 8$ | $46 \cdot 4$ | 49.0 | $5 \mathrm{I} \cdot 8$ | $54 \cdot 6$ | 57-5 | $60 \cdot 4$ | 63.5 | $66 \cdot 6$ |
|  |  | 28 |  | $32 \cdot 1$ | $34 \cdot 3$ | $36 \cdot 5$ | 38 | $4{ }^{1 \cdot 2}$ | 43 | $46 \cdot 1$ | $48 \cdot 7$ | 5 r 4 | $54 \cdot 1$ | $56 \cdot 9$ | $59^{\circ} 7$ | $62 \cdot 6$ |
| 40 | 24.5 23.1 | 26 | $28 \cdot 3$ 26.6 | $30 \cdot 2$ 28.4 | 32.3 | 34.4 | $36 \cdot 5$ | $38 \cdot 8$ | $4 \mathrm{I} \cdot \mathrm{I}$ | $43 \cdot 4$ | 45.9 | $48 \cdot 3$ | $50 \cdot 9$ | 53.5 | $56 \cdot 2$ | 59.0 |
| 42 | 23.1 21.7 | $24 \cdot 8$ $23 \cdot 3$ | $26 \cdot 6$ $25^{\circ} \mathrm{O}$ | 28.4 26.8 | 30.4 28.6 | $32 \cdot 3$ $30 \cdot 4$ | 34.4 32.3 | $36 \cdot 5$ $34 \cdot 3$ | $38 \cdot 6$ 36.4 | $40 \cdot 9$ $38 \cdot 5$ | $43 \cdot 2$ 40.6 | 45.5 42.8 | 47.9 45.1 | $50 \cdot 4$ | 52.9 | $55 \cdot 5$ |
| 46 | 20.4 | 21.9 | $23 \cdot 5$ | $25^{\circ}$ | $26 \cdot 9$ | $28 \cdot 6$ | $30 \cdot 4$ | 32.3 | $34^{\circ} 2$ | $36 \cdot 2$ | 38.2 | $40 \cdot 3$ | 42.4 | $47 \cdot 6$ | $49 \cdot 8$ 46.8 | $52 \cdot 2$ $49 \cdot \mathrm{I}$ |
| 50 | 18.0 | 19.3 | 20.7 | 22.2 | 23.7 | $25 \cdot 3$ | 26. | $28 \cdot 5$ | $30 \cdot 2$ | 31.9 | 33 | 35 | $37 \cdot 4$ | - | 41.4 | 43. |

## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* BETELGUESE.


TRUE BEARING OR AZIMUTH OF * BETELGUESE.

| Lat. | $\stackrel{\mathrm{m}}{4} \mathrm{H}$ | m. | m. | ${ }_{16}$ | m. 20 | m. 24 | ${ }_{28}^{\mathrm{m}} \mathrm{L}$ | m. 32 | 36 | 40 | 44 | 48 | m. | $\frac{\mathrm{m}}{56}$ | $\mathrm{m}_{60}$ | 70 | m. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 | $2 \cdot 6$ | $5 \cdot 2$ | $7 \cdot 7$ | 10.2 |  | 15.2 | 17.6 | $20^{\circ} \mathrm{O}$ | $22 \cdot 3$ | , | $26 \cdot 8$ |  | $1 \cdot 0$ | .0 | 9 |  | -碞 |
| 32 | $2 \cdot 4$ | $4 \cdot 8$ | 7•1 | $9 \cdot 5$ | 11.8 | If.I | $16 \cdot 3$ | $18 \cdot 5$ | $20 \cdot 7$ | 22.9 | $24^{\circ} 9$ | 27.0 | 29.0 | $30 \cdot 9$ | 32.8 | 7•3 | 41.4 |
| 34 | $2 \cdot 2$ | $4 \cdot 4$ | 6.6 | $8 \cdot 8$ | II.O | 13.1 | 15.2 | $17 \cdot 3$ | 19.4 | 21.4 | 23.4 | $25 \cdot 3$ | $27 \cdot 2$ | 29•I | $30 \cdot 9$ | $35^{\circ} 2$ | $39 \cdot 3$ |
| 36 | $2 \cdot 1$ | $4 \cdot 1$ | $6 \cdot 2$ | $8 \cdot 2$ | $10 \cdot 3$ | 12.3 | 14.3 | $16 \cdot 3$ | I $8 \cdot 2$ | 201 | $22 \cdot 0$ | 23.9 | $25 \cdot 7$ | $27 \cdot 5$ | $29 \cdot 2$ | 33.4 | $37 \cdot 4$ |
| 40 | I.8 | $3 \cdot 7$ | $5 \cdot 5$ | $7 \cdot 3$ | $9 \cdot 2$ | II*O | 12.8 | 14.6 | $16 \cdot 3$ | $18 \cdot 0$ | 19.7 | 21.4 | 23.1 | $24 \cdot 8$ | $26 \cdot 4$ | $30 \cdot 3$ | $34^{\circ} \mathrm{I}$ |
| 45 | I. 6 | $3 \cdot 2$ | $4 \cdot 9$ | $6 \cdot 5$ | $8 \cdot 1$ | $9 \cdot 7$ | II.3 | $12 \cdot 9$ | 14.5 | $16 \cdot 0$ | $17 \cdot 6$ | I9•I | $20 \cdot 6$ | $22 \cdot 1$ | $23 \cdot 6$ | 27.3 | $30 \cdot 8$ |
| 50 | I-5 | $2 \cdot 9$ | $4 * 4$ | $5 \cdot 8$ | $7 \cdot 3$ | $8 \cdot 8$ | 10.2 | II. 6 | 13.1 | 14.5 | 15.9 | 17.3 | 18.7 | 20.1 | 21.5 | $24^{\circ} 9$ | $28 \cdot 2$ |
| 60 | I.2 | $2 \cdot 5$ | $3 \cdot 7$ | $5 \cdot 0$ | $6 \cdot 2$ | $7 \cdot 5$ | $8 \cdot 7$ | 10.0 | 11.2 | 12.4 | 13.7 | 14.9 | I6.I | 17.3 | $18 \cdot 5$ | 21.6 | $24 \cdot 5$ |
| S. |  |  |  |  |  |  |  | 16.8 | 18. |  |  |  |  |  |  |  |  |
| 22 | 2.0 | 4.0 | $6 \cdot 0$ | $8 \cdot 0$ | $10 \cdot 0$ | 12.0 | 13.9 | 15.8 | 17. | 19.5 | 21.4 | 24.5 | $26 \cdot 3$ 24.9 | $26 \cdot 6$ | 29.3 28.2 | 33.9 32.2 | $37 \cdot 7$ $35 \cdot 9$ |
| 24 | I.9 | $3 \cdot 8$ | $5 \cdot 7$ | $7 \cdot 6$ | 9.5 | II. 3 | $13 \cdot 1$ | 15.0 | 16.7 | 18.5 | $20 \cdot 2$ | 21.9 | $23 \cdot 6$ | $25^{-2}$ | $26 \cdot 8$ | $30 \cdot 7$ | $35 \cdot 9$ $3+\cdot 3$ |
| 26 | I-8 | $3 \cdot 6$ | $5 \cdot 4$ | $7 \cdot 2$ | 9.0 | $10 \cdot 7$ | 12.5 | 14.2 | 15.9 | I7.6 | 19.2 | 20.9 | $22 \cdot 5$ | $24^{1} 1$ | $25 \cdot 6$ | $29 \cdot 3$ | 32.9 |
| 30 | I. 6 | $3 \cdot 3$ | 4.9 | $6 \cdot 5$ | $8 \cdot \mathrm{I}$ | $9 \cdot 7$ | 11.3 | 12.9 | 14*5 | 16.0 | 17.6 | I9*I | $20 \cdot 6$ | $22 \cdot 0$ | $23 \cdot 5$ | 2\%.1 | $30 \cdot 4$ |
| 35 | I. 5 | $2 \cdot 9$ | $4 \cdot 4$ | $5 \cdot 9$ | $7 \cdot 3$ | $8 \cdot 8$ | $10 \cdot 2$ | II•7 | $13 \cdot 1$ | 14.5 | 15.9 | 17*3 | 18.7 | $20 \cdot 1$ | $21 \cdot 4$ | $24^{\circ} 7$ | $27 \cdot 9$ |
| 45 | I•3 | 2.5 | $3 \cdot 8$ | $5 \cdot 0$ | $6 \cdot 2$ | $7 \cdot 5$ | $8 \cdot 7$ | IO•O | II•2 | 12.4 | 13.6 | 14.9 | $16 \cdot 1$ | 17.3 | 18.5 | $21 \cdot 4$ | $24 \cdot 3$ |
| 55 | I•I | 2.2 | 3.4 | $4 \cdot 5$ | $5 \cdot 6$ | $6 \cdot 7$ | $7 \cdot 8$ | $8 \cdot 9$ | 10*0 | II•2 | $12 \cdot 3$ | 13.4 | 14.5 | 15.6 | 16.6 | 19.4 | 22.1 |

REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN. * CANOPUS.


REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

## * canopus.



TRUE BEARING OR AZIMUTH OF * CANOPUS.

| at. | ${ }_{4}$ | ${ }_{8}^{\text {m. }}$ | ${ }_{12}$ | ${ }_{16}^{\text {m. }}$ | ${ }_{20}^{\text {m. }}$ | ${ }_{24}^{\text {m. }}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{32}$ | ${ }_{36}^{\mathrm{m}}$ | ${ }_{40}$ | $\begin{aligned} & \mathrm{m}_{4} \\ & \hline \end{aligned}$ | ${ }_{48}^{\mathrm{m}}$ | $52$ | $\frac{\mathrm{m}}{\mathrm{mo}}$ | ${ }_{70}$. | ${ }_{80} \mathrm{~m}$ | ${ }_{90}^{\mathrm{m}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{N}$. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{34}$ | ${ }_{0}^{\circ} \cdot 6$ | $\mathrm{I}^{\circ} 2$ | r.8 | 2.4 | $3 \cdot 0$ | 3.6 | $\stackrel{\circ}{4} 2$ | $\stackrel{\circ}{4} 9$ | ${ }_{5} \times$ | 6.1 |  | 7.3 | $\bigcirc \cdot 9$ | $9 \cdot 0$ | $10 \cdot 5$ | 12.0 | 3.4 |
| 30 | 0.6 | I. 2 | I. 8 | $2 \cdot 4$ | $3 \cdot 1$ | $3 \cdot 7$ | 4.3 | 4.9 | $5 \cdot 5$ | $6 \cdot 1$ | 6.7 | 7.3 | 7.9 | $9 \cdot 1$ | 10.6 | 12.0 | 13.5 |
| 20 | $0 \cdot 6$ | I. 3 | r.9 | $2 \cdot 5$ | 3.2 | 3.8 | 4.4 | 5.0 | $5 \cdot 7$ | $6 \cdot 3$ | $6 \cdot 9$ | 7.6 | 8.2 | $9 \cdot 4$ | 10.9 | 12.4 | 8 |
| 10 | 0.7 | 1.4 | $2 \cdot \mathrm{I}$ | $2 \cdot 7$ | $3 \cdot 4$ | $4^{\text {I }}$ | 4.8 | $5 \cdot 4$ | $6 \cdot 1$ | 6.8 | $7 \cdot 4$ | $8 \cdot 1$ | 8.8 | $10 \cdot 1$ | Ir 7 | 13.2 | 8 |
| 5 | 0.7 | 14 | $2 \cdot 2$ | 2.9 | $3 \cdot 6$ | 43 | 5.0 | 5.7 | $6 \cdot 4$ | $7 \cdot 1$ | $7 \cdot 8$ | 8.5 | 9.2 | 10.6 | 12.2 | 13.8 | 15.4 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - | 0.8 | 1.5 | $2 \cdot 3$ | 3.0 | 3.8 | $4 \cdot 6$ | $5 \cdot 3$ | $6 \cdot 1$ | $6 \cdot 8$ | 7.5 | 8.3 | $9 \cdot 0$ | 9.7 | $11 \cdot 2$ | 12.9 | 14.6 | 16.3 |
| 10 | 0.8 0.9 | r. r - 8 | 2.5 2.7 | 3.3 3.6 | 4.1 4.5 | 4.9 5.3 | 5.7 6.2 | ${ }_{7} 6 \cdot 5$ | 78.3 | 8.1 | 8.9 9.7 | 9.7 10.5 | $\xrightarrow{10.4}$ | 12.0 13.0 | 13.8 15.0 | 15.6 16.9 | 17.4 18.7 |
| 14 | I.O | 1.9 | $2 \cdot 9$ | 3.9 | 4.8 | $5 \cdot 8$ | 6.7 | 7.7 | 8.6 | 9.5 | 10.5 | II.4 | 12.3 | $14^{\circ} \mathrm{O}$ | T | 18.1 | - |
| 16 | I. 0 | 2.0 | 3.0 | $4 \cdot 1$ | $5 \cdot 1$ | $6 \cdot 1$ | 7.0 | 8.0 | 9.0 | 9.9 | 10.9 | II.9 | 12.8 | 14.6 | 16.8 | 18.9 | 20.8 |
| 18 | I'I | $2 \cdot 1$ | 3.2 | $4 \cdot 3$ | $5 \cdot 3$ | 6.4 | 7.4 | $8 \cdot 4$ | 9.4 | 10.4 | ${ }_{11}^{15} 4$ | 12.4 | 13.4 | 15.3 | 17.5 | 19.7 |  |
| 22 | ¢ $1 \cdot 2$ | 2.4 | 3.6 3.6 | 4.7 | 5.9 | ${ }_{7} 7$ | 8.2 | ${ }^{8 \cdot 9}$ | 10.5 | $1{ }^{11} 6$ | 12.6 | 13.1 | 14.8 | 16.9 | 1894 | 21.6 | 23.8 |
|  | 1.3 | 2.5 | 3.8 | $5{ }^{\circ}$ | 6.3 |  | $8 \cdot 7$ |  | II. 1 | $12 \cdot 3$ | 13.4 | $14 \cdot 6$ | 15.7 | 17.8 | 20.4 | 22.8 | $25^{\circ}$ |
| 26 28 | $1 \cdot 4$ | 2.7 2.9 | $44^{4 .}{ }^{\circ}$ | 5.4 5 | ${ }_{7} 6.7$ | 8.0 8.6 | 8.3 10.0 | ${ }_{10}^{10 \cdot 6}$ | 11.9 12.7 | 13.1 | 14.3 | 15.5 16.6 | 16.7 15.8 | 18.9 20.2 | 23.0 | ${ }_{25}^{24.5}$ | 3 |
| 30 | I. 6 | 3.1 | 4.7 | $6 \cdot 3$ | 7.8 | $9 \cdot 3$ | 10\% | 1 | 13.7 | 14 | 15 | 17.8 | 17. | 2 l | 24.6 | 27.2 | 29.6 |

* CANOPUS.

| Lat. | ${ }_{4}^{\mathrm{m}}$ | ${ }_{8}^{\text {m. }}$ | ${ }_{12}$. | ${ }_{16}^{\mathrm{m}}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{24}^{\mathrm{m}}$ | ${ }_{26}^{\mathrm{m}}$. | 28 | ${ }_{30}^{\mathrm{m}}$ | ${ }_{32}$ | $\mathrm{m}_{34}^{\mathrm{m}}$ | $\mathrm{m}_{36}$ | ${ }_{38}^{\mathrm{m}}$ | ${ }_{40}^{\mathrm{m}}$ | ${ }_{42}$ | ${ }_{44}^{\mathrm{m}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| s. REDUCTIONS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 | 0.2 | roo | $2 \cdot 2$ | 4.0 | $6 \cdot 3$ | 9.0 | 10.6 | $12 \cdot 3$ | 14.1 | 16.0 | 18.1 | $20 \% 2$ | $22 \cdot 5$ | $25^{\circ}$ |  |  |
| 40 | 0.2 | $1 \cdot 0$ | 2.2 | 3*9 | 6.I | $8 \cdot 8$ | 10.3 | II•9 | 13.7 | 15.5 | 17.5 | 19.7 | ${ }_{21}{ }^{2} 9$ | $24 \cdot 3$ | 26.8 | $2{ }^{\circ}$ |
| 42 | 0.2 | $0 \cdot 9$ | $2 \cdot \mathrm{I}$ | $3 \cdot 8$ | $5 \cdot 9$ | $8 \cdot 5$ | $10 \cdot 0$ | II.6 | 13.3 | 15.2 | 17 | I9 | 21.3 | 23.7 | $26 \cdot 1$ | 28.6 |
| 44 | 0.2 | $0 \cdot 9$ | 2-I | $3 \cdot 7$ | $5 \cdot 7$ | $8 \cdot 3$ | $9 \cdot 6$ | Ir 3 | 12.9 | 14.7 | 16. | 18.6 | 20.7 | $23^{\circ} \mathrm{O}$ | $25 \cdot 3$ | 27 |
| 46 | 0.2 | $\bigcirc \cdot 9$ | 2.0 | 36 | $5 \cdot 6$ | $8 \cdot 0$ | $9 \cdot 4$ | 10.9 | 12.6 | 14.3 | 16.1 | 18.1 | $20^{\prime}$ | $22 \cdot 3$ | $4 \cdot 6$ | 27.0 |
| 48 | 0.2 | $\bigcirc \cdot 9$ | 2.0 | $3 \cdot 5$ | $5 \cdot 4$ | $7 \cdot 8$ |  | $10 \cdot 6$ | 12.2 | 13.8 | 15.6 | $17 \cdot 5$ | 19.5 | 21.6 | 23.8 | $26 \cdot \mathrm{I}$ |
| 50 52 | 0.2 0.2 | 0.8 | I.9 | 3.3 | $5 \cdot 1$ | $7 \cdot 5$ | 8.9 | 10.3 9.9 | ${ }_{\text {II }}^{17} 4$ | ${ }_{13} 3_{3}{ }^{\circ} \mathrm{H}$ | $15 \cdot 1$ | $17{ }^{\circ}$ | 18.9 | 21.0 | $23 \cdot 1$ | 25. |
| 54 | $0 \cdot 2$ | 0.8 | 1.7 |  |  | $7 \cdot$ | 8.2 | $9 \cdot 5$ | Ir.o | $12 \cdot 5$ | 14.1 | 15.8 | -6 |  |  | . 6 |
| 56 | 0.2 | $0 \cdot 8$ | 1. |  | $4 \cdot 7$ | 6. | 7.9 | 92 | $10 \cdot 5$ | ${ }_{12}{ }^{\text {2 }}$ | I3.5 | 15.2 |  |  |  |  |
| 588 | 0.2 0.2 | 0.7 0.7 |  | 2.9 2.8 | 4.5 4.3 | 6.5 6.2 | $7 \cdot 3$ | $8 \cdot 5$ | $10 \cdot 1$ <br> 9.7 | II• | 13.0 |  | 16.3 | $\begin{aligned} & \left.\begin{array}{l} 18 \cdot 0 \\ 17 \cdot 2 \end{array}\right) \end{aligned}$ | 19.9 19.9 | 21.8 20.8 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $56 \cdot 0$ |
| 40 | $3{ }^{30} 7$ | ${ }^{32 \cdot 1}$ | 33.5 |  | $36 \cdot 4$ 35 | 37.9 | 39.4 |  |  | 44.2 |  | 4775 | $49 \cdot 2$ |  |  |  |
| 4 | $29^{29}{ }^{2} 9$ | 3130 | 3 | ${ }^{344^{\circ}}$ | $35 \cdot 4$ 34 | $3{ }^{36 \cdot 8}$ | 37* | 39.9 38.7 | $4{ }_{4}^{41} 4$ | ${ }_{41}^{43.8}$ | ${ }_{43 \cdot 3}$ | $46 \cdot 2$ | 4779 $46 \cdot 5$ | ${ }_{4}^{49}{ }^{49}$ | 51.3 49.8 | $53^{\circ}$ |
| 46 | 28.2 | 29.4 | $30 \cdot 7$ | 32.0 | $33 \cdot 4$ | 34.8 | 36.2 | $37 \cdot 6$ | 39.1 | $40 \cdot 5$ | 42 | $43 \cdot 6$ | $45^{\circ}$ | $46 \cdot 7$ | 48 | 50 |
| 48 | $27 \cdot 3$ 26.4 | 28 | 29.8 28.8 | ${ }_{31}$ I | $\underset{\substack{32 \cdot 3 \\ 3 \text { 2.3 }}}{ }$ | 33.7 32.6 | 35.0. | $36 \cdot 4$ 35. | 37.8 36.6 | 39.3 38.0 | $40 \cdot 7$ 30.4 | 2 | 43.7 42.3 | 45•3 | $46 \cdot$ |  |
| 5 | 25 | ${ }_{26}^{27}$ | 27.8 | ${ }^{30^{\circ}}$ | 31.3 $30 \cdot 3$ | 32 | 33.8 | 35-3 | ${ }_{35} 36.4$ | 36.7 | 39.4 <br> 38.1 | $40^{\prime} \cdot 9$ 39 | $42 \cdot 3$ 40.9 | ${ }_{4}^{43 \cdot 8}$ | $45^{\circ} 3$ |  |
| 54 | 24 | 25 | 26.9 | 28. | 29.2 | $30 \cdot 4$ | $3 \mathrm{P} \cdot 6$ | $32 \cdot 8$ | 34• | $35 \cdot 4$ | 36 | $38 \cdot 1$ | 39.4 | $40 \cdot 8$ | $42^{2}$ | 3.\% |
| 58 | 23.7 | 24. | $25 \cdot 8$ 24.8 | $26 \cdot 9$ |  |  | $30 \cdot 4$ | $3{ }^{1} \cdot 6$ | 32.8 | 34 | 35 | $36 \cdot 6$ |  | $39 \cdot 3$ |  |  |
| 6 | 22.7 | 23 |  | 25.9 24 | ${ }_{25}^{26}$ |  | 27 | $30 \cdot 3$ 20.0 | 31.5 30.1 | $32 \cdot 7$ 31.3 |  | $35^{\circ} 2$ | ${ }_{8}^{4}$ |  | $39{ }^{\circ}$ 37.3 | - $0 \cdot 6$ |
| Lat. | 1 HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $\mathrm{m}_{0}$ | ${ }_{1}^{\mathrm{m}}$. | $\frac{\mathrm{m}}{2}$ | ${ }_{3}{ }^{\text {m }}$ | ${ }_{4}$. | ${ }_{5}$ | ${ }_{6}^{\mathrm{m}}$. | 7. | ${ }_{8}$ | ${ }_{9}$ | 10 | ${ }_{11}$ | ${ }_{12}^{\mathrm{m}}$ | 13 | ${ }_{14}^{\text {m. }}$ | ${ }_{15}^{\mathrm{m}}$ |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{3} 8$ | 56.0 | 57.9 | 59.8 | $6{ }^{1} \cdot 7$ | $63 \cdot 7$ | $65 \cdot 7$ | 6\%.7 | 69.8 | 7 t . 8 |  | 76.1 | $78 \cdot 3$ | $80 \cdot 5$ | $82 \cdot 7$ | 85.0 |  |
| 40 | 54.5 | 56.3 | 58.2 | $60 \cdot 1$ |  | 63.9 | 65.9 | 67. | 69.9 | 72.0 | 74.1 | $76 \cdot 2$ | 78.3 | 80.5 | 82.7 |  |
| 4 | 53 | 54.8 | 56.6 | 56.8 | Co.3 | 62.2 60.4 | - 6 | 66 | 68 | - 7 70.0 |  | 74. ${ }^{7}$ |  | 78.3 | 8.4 |  |
| 45 | 50 | 52.5 | 54.2 | 55.9 | 57.7 | 59.5 | 61.4 | $63^{\circ} 2$ | $65 \cdot \mathrm{I}$ | 67.0 | 69 | 70.9 | $72 \cdot 9$ | $75^{\circ}$ | 硡 |  |
| 46 | 50.0 | 51 | $53^{\prime} 4$ | 55. | 56.8 | 58.6 | $60 \cdot 4$ | $62 \cdot 3$ | 64.1 | 66.0 | 67.9 | 69.9 | 71.8 | 73.8 | 75 |  |
| 47 | 48 | 50.9 50.1 |  | 54.3 53.4 | 56•0. | 57.7 56.8 | 59.5 | 61.3 60.4 | 63.2 62.2 | $65^{\circ}$ <br> $64^{\circ}$ | 66 |  | $70 \cdot 7$ 60.6 | ${ }^{72 \cdot} 7$ | 74.7 |  |
| 49 |  | $49 \cdot 3$ | 50.9 | 52.3 | 54.2 | 53.9 | 54.6 | 59.4 | ${ }_{6} \mathbf{1} \cdot 2$ | ${ }_{6}{ }^{\text {c }}$. 0 | 64.8 | 66.7 | 68.5 | ${ }_{70.4}^{7}$ | 72.4 |  |
| 50 | 46 | 48 | 50 | 5 5 | 53.3 | 55 | $56 \cdot 7$ | 58.4 | $60 \cdot 2$ | 6 I | $63 \cdot 7$ | 65.6 | $67 \cdot 4$ | $69 \cdot 3$ | $7 \mathrm{r} \cdot 2$ | 73 |
| $5 \mathrm{5r}$ | 46.1 | $47 \cdot 6$ | 49.2 | 50.8 | 52.4 | 54•1 | $55 \cdot 7$ | ${ }_{56} 574$ | 59.2 | $60 \cdot 9$ | 62.7 | $66^{6} 4$ | ${ }_{6}^{66 \cdot 3}$ |  | 70.0 |  |
| 53 | $4{ }^{45}$ | 46 | 48.4 47 | 49.9 | 51.5 50.6 | 53'1 | 53.8 | $56 \cdot 4$ $55 \cdot 4$ | $58 \cdot \mathrm{I}$ <br> $57 \cdot \mathrm{I}$ | 58.8 | $60 \cdot 5$ | 63.3 62.2 | 65.1 64.0 | $66 \cdot 9$ 65.7 | 68.8 $67 \cdot 5$ |  |
| 54 | 43 | $45 \cdot 1$ | $46 \cdot 6$ | 48.1 | 49.7 | 51.2 | 52.8 | 54.4 | 56.I | 57. | 59.4 | ${ }^{61} \cdot 1$ | ${ }^{62.8}$ | $64 \cdot 5$ | $66 \cdot 3$ |  |
| 55 | 42 | 44 | $45^{\circ} 8$ | 47 | 48.7 | 50.3 |  | 53.4 | 55 | 56 |  | 59.9 | 6 r . | $63 \cdot 3$ | $65 \cdot \mathrm{r}$ |  |
| 56 | 42. | 43 | 44.9 | $46 \cdot 3$ | 47.8 | 49.3 | 50.8 | 52.4 | 53 | $55 \cdot 5$ | 57.1 | 58.8 | 60.4 | 62. I | 3.8 |  |
| 58 | $4{ }^{4} 10$ | 42 | $44^{\circ} \mathrm{O}$ | 45.4 | $46 \cdot 8$ 45 | $48 \cdot 3$ | 498 48.8 | $51 \cdot 3$ $50 \cdot 3$ | $52 \cdot 9$ 51.8 | $54 \cdot 4$ | 54.8 | 57.6 56.4 | 59.2 | $59 \cdot 6$ | $62 \cdot 5$ 61.2 | 2. |
| 59 |  | $40 \cdot 8$ | , | 43.5 | 44.9 | 46.3 | 47 |  | 50.7 | 52 | 53.7 | 55.2 | 56.8 | 58.3 | 59 | 6 r . |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  | 55.5 | 57 |  |  |
| Lat | - HOUR. |  |  |  |  |  |  |  |  | 1 HOUR. |  |  |  |  |  |  |
|  | ${ }_{4}^{\mathrm{m}}$ | 8 | ${ }_{12}$ | ${ }_{16}$ | ${ }_{20}$ | ${ }_{24}$ | ${ }_{30}$ | ${ }_{40}$ | ${ }_{50}$ | ${ }_{00}$ | ${ }_{10}^{\mathrm{m}}$ | ${ }_{20}$ | ${ }_{30}^{\mathrm{m}}$ | ${ }_{40}^{\mathrm{m}}$ | ${ }_{50}$ | $\mathrm{m}_{60}$ |
| s. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{8} 8$ | ${ }^{0} \mathrm{O} 6$ | $\mathrm{I}^{\circ} 2$ | r. 8 | $2 \cdot 4$ | $3^{\circ}$ | $3 \cdot 6$ | $4 \cdot 5$ | $6^{\circ}{ }^{\text {r }}$ | 7.6 | 9.0 | 10.5 | 12.0 | 13.4 | 14.9 | 16.3 |  |
| 42 46 46 | ${ }_{0}^{0.6}$ | I.2 | r r.8 | 2.4 2.5 | $\underset{\substack{3 \cdot 1 \\ 3 \cdot 1}}{ }$ | 3.7 | 4.6 | ${ }_{6 \cdot 1} 6$ | $7 \cdot 6$ | ${ }_{9} \cdot 1$ | 10.6 | 12.1 | 13.5 | 15.0 | 16.4 |  |
| 46 50 | ${ }_{0}^{0.6}$ | r.2 | I. 8 | $2 \cdot 5$ $2 \cdot 5$ | $3 \cdot 1$ | 3.7 | $4 \cdot 6$ | ${ }_{6}^{6 \cdot 1}$ | $7 \cdot 7$ | ${ }_{9.3}^{9.2}$ | 10.7 |  | $13.7$ | $15 \cdot 1$ | 16.6 |  |
|  | 0.6 | 1.3 |  |  | 3.2 | 3.8 | 4.7 |  |  |  | II. | $12 \cdot 6$ | 14*I |  |  | 18.8 |
| 58 60 | 0.6 0.7 | r. 31 <br> r | r. <br> 2 <br> 0 | 2.6 2.6 | 3.2 $3 \cdot 3$ | 3.9 4.0 | 4.9 <br> 4.9 | 6.6 | 8.1 | ${ }_{9} 9$ | II•3 | 12 | I4.5 | r6. 16.4 | $3$ | 19.3 19.6 |

REDUCTION to the meridian table for hour-angles from meridian BELOW THE POLE.

* CANOPUS.

| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{16}$. | ${ }_{17}$ | m. | ${ }_{19}$ | ${ }_{20}$ | ${ }_{21}$ | ${ }_{22}$ | ${ }_{23}{ }^{2}$ | ${ }_{24}$ | ${ }_{25}$ | $\stackrel{\mathrm{m}}{26}$ | ${ }_{27}$ | ${ }_{28}$ | ${ }_{29}$ | ${ }_{30}$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 39 | 88.4 | $90 \cdot 7$ | $93^{\circ} \mathrm{O}$ | 95.4 | 97.8 | 100.3 | 02.7 | 105.2 | 107.8 | 110.3 | I12.9 | 115.5 | 118.I | 120.8 | 123.5 |
| 40 | 87.2 | 89.5 | $9 \mathrm{I} \cdot 8$ | 94•1 | 96.5 | $98 \cdot 9$ | 1014 | 103.8 | $106 \cdot 3$ | 108.8 | III4 | 114.0 | 1166 | 119.2 | 121.9 |
| $4^{1}$ | 86.0 | 88.3 | $90 \cdot 5$ | 92.9 | $95^{2}$ | $97 \cdot 6$ | 100.0 | 102.4 | 104.9 | $107 \cdot 3$ | 109.9 | 112.4 | $115^{\circ}$ | 117.6 | 120.2 |
| 42 | 84.8 | $87 \cdot 0$ | $89 \cdot 3$ | 91.6 | $93^{\circ} 9$ | $96 \cdot 2$ | 98.6 | 1010 | 103.4 | 105.9 | 108.3 | 110.8 | 113.4 | 115.9 | 118.5 |
| 43 | 83.6 | 85.8 | 88.0 | $90 \cdot 3$ | $92 \cdot 6$ | 94.9 | $97 \cdot 2$ | $99^{\circ} 6$ | $102 \cdot 0$ | 104.4 | 106.8 | 1093 | 111.8 | 114.3 | $116 \cdot 9$ |
| 44 | 82.4 | 84.6 | $86 \cdot 8$ | 89.0 | 91-2 | $93 \cdot 5$ | 95.8 | $98 \cdot 1$ | $100 \cdot 5$ | 102.9 | 105.3 | 107.7 | 110.2 | 112.7 | 115.2 |
| 45 | $8 \mathrm{I} \cdot 2$ | 83.3 | 85.5 | 87.7 | 89.9 | $92 \cdot \mathrm{I}$ | 94.4 | $96 \cdot 7$ | $99^{\circ}$ | 101.4 | 103.8 | 106.2 | 108.6 | 11100 | 113.5 |
| 46 | 80.0 | $82 \cdot 1$ | 84.2 | $86 \cdot 4$ | 88.6 | 90.8 | $93^{\circ}$ | $95 \cdot 3$ | $97 \cdot 5$ | $99^{\circ} 9$ | 102.2 | 104.6 | 107.0 | $109 \cdot 4$ | 111.8 |
| 47 | 78.8 | $80 \cdot 8$ | 82.9 | $85 \cdot 1$ | 87.2 | 89.4 | $9 \mathrm{~T} \cdot 6$ | $93 \cdot 8$ | $96 \cdot$ I | $98 \cdot 3$ | $100 \cdot 6$ | 103.0 | 105.3 | 107.7 | 110.1 |
| 48 | 77.5 | $79 \cdot 6$ | $8 \mathrm{I} \cdot 6$ | $83 \cdot 7$ | 85.8 | 88.0 | $90 \cdot 1$ | $92 \cdot 3$ | $94 \cdot 6$ | $96 \cdot 8$ | $99^{9} 1$ | 101.4 | 103.7 | $106 \cdot 0$ | 108. |
| 49 | $76 \cdot 3$ | $78 \cdot 3$ | $80 \cdot 3$ | 82.4 | 84.5 | $86 \cdot 6$ 85.2 | $88 \cdot 7$ 8.7 | $90 \cdot 9$ 80.4 | 93.0 | $95 \cdot 3$ | 97.5 | $99 \cdot 8$ $98 \cdot 1$ | $102 \cdot$ | 104.4 | 1067 1050 |
| 50 | $75^{\circ} \mathrm{O}$ | 77.0 | $79^{\circ}$ | $81 \cdot 0$ | $83 \cdot 1$ | 85.2 | $87 \cdot 3$ | $89^{\circ} 4$ | $91 \cdot 5$ | 93.7 | 95.9 | $98 \cdot 1$ | $100 \cdot 4$ | 102.7 | 105. |
| 51 | $73 \cdot 8$ | 75.7 | $75 \cdot 7$ | 79.7 | $8 \mathrm{r} \cdot 7$ | 83.7 | 85.8 | 87.9 | $90 \cdot 0$ | 92.I | 94.3 | $96 \cdot 5$ | $98 \cdot 7$ | $100 \cdot 9$ | 103.2 |
| 52 | 72.5 | 74.4 | $76 \cdot 3$ | $78 \cdot 3$ | $80 \cdot 3$ | 82.3 | 84.3 | $86 \cdot 4$ | 88.4 | $90 \cdot 6$ | $92 \cdot 7$ | 94.8 | $97 \cdot 0$ | $99^{\circ} 2$ | 101.4 |
| 53 | 71.2 | 73.1 | $75^{\circ} \mathrm{O}$ | $76 \cdot 9$ | 78.9 | $80 \cdot 8$ | 82.8 | 84.8 | $86 \cdot 9$ | 88.9 | $9{ }^{1} \cdot 0$ | 93.2 | 95.3 | $97 \cdot 4$ | 99.6 |
| 54 | 69.9 | 71.8 | 73.6 | $75^{\circ} 5$ | 77.4 | 79.4 | $8 \mathrm{I} \cdot 3$ 7 | 83.3 | $85 \cdot 3$ | 87.3 85 | 89.4 87.7 | $9 \mathrm{~F} \cdot 5$ | 93.6 | $95^{\prime} 7$ | $97 \cdot 8$ 96.0 |
| 55 56 | $68 \cdot 6$ $67 \cdot 3$ | $70 \cdot 4$ 69.1 | 72.2 70.8 | 74.1 72.7 | 76.0 74.5 | 77.9 76.4 | 79.8 78.2 | $8 \mathrm{I} \cdot 7$ $80 \cdot \mathrm{I}$ | 83.7 $82 \cdot 1$ | 85 <br> 84 | $87 \cdot$ 86.0 | 89.7 88.0 | 91.8 90.0 | 93.9 92.1 | 96.0 94.1 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{31}$. | ${ }_{32}$ | ${ }_{33}$. | ${ }_{34}$. | ${ }_{35}$ | ${ }_{38}$ | ${ }_{3}{ }^{\text {y }}$ | ${ }_{38}$ | ${ }_{39}$ | m. | ${ }_{41}$ | m. | ${ }_{43}^{\mathrm{m}}$. | ${ }_{44}$ | ${ }_{45}$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 | 127.9 | $130 \cdot 7$ | 133.5 | 136.4 | 139.3 | 42.2 | 145. ${ }^{\text {I }}$ | 148.1 | $151^{\circ}$ | 154. 1 | 157•1 | $160 \cdot 2$ | 163.3 | 166.4 | 169.6 |
| 39 | 126.2 | 129.0 | 131.8 | I34.6 | 137.4 | $140 \cdot 3$ | 143.2 | $146 \cdot 1$ | 149'I | 152.1 | ${ }_{155}$ I | $158 \cdot 1$ | $161 \cdot 2$ | 164.3 | 167.4 |
| 40 | 124.5 | 127.3 | $130 \cdot 0$ | 132.8 | 135.6 | 138.4 | 141.3 | 144.2 | 147. 1 | $150 \cdot 0$ | 153.0 | 156.0 | 159*0 | 162.I | 硣 |
| 41 | 122.9 | 125.5 | 128.3 | 1310 | 133.8 | 136.6 | 139.4 | 142.2 | $145 \cdot 1$ | 148.0 | $150 \cdot 9$ | 153.9 | 156.9 | 159.9 | $162 \cdot 9$ |
| 42 | 121.2 | 123.8 | 126.5 | 129.2 | 13 I.9 | 134.7 | 137.5 | $140 \cdot 3$ | 143.1 | 146.0 | 148.9 | 151.8 | 154.7 | 157.7 | 160 |
| 43 | 119.5 | 12 | 124.7 | 127.4 | $130 \cdot 1$ | 132.8 | 135.5 | $138 \cdot 3$ | I4I'I | 143.9 | 146.8 | 149.7 | 152.6 | 155.5 | 158.5 |
| 44 | 117.7 | $120 \cdot$ | 122.9 | 125.6 | 128.2 | $130 \cdot 9$ | $133 \cdot 6$ | $136 \cdot 3$ | 139.I | 14.9 | 144.7 | $147 \cdot 5$ | $150 \cdot 4$ | 153.3 | $156 \cdot 2$ |
| 45 | $116 \cdot 0$ | 118.6 | $12 \mathrm{~F} \cdot 1$ | $123{ }^{\circ} 7$ | 126.3 | $129^{\circ}$ | 13177 | $134{ }^{\circ} 4$ | $137{ }^{1}$ | 139.8 | 142.6 | 145.4 | 148.2 | 151 İ | $154^{\circ}$ |
| 46 | 114.3 | 116.8 | 119.3 | 121.9 | 124.5 | 127.1 | 129.7 | 132.4 | $135^{\circ}$ | $137 \cdot 8$ | $140 \cdot 5$ | 143.2 | 146.0 | 148.8 | 151.7 |
| 47 | 112.6 | $115{ }^{\circ}$ | 117.5 | $120 \cdot 0$ | 122 | 125.1 | 127.7 | $130 \cdot 3$ | 133.0 | 135.7 | 138.3 | 141.1 | 143.8 | 146.6 | 149.4 |
| 48 | $110 \cdot 8$ | 113.2 | 115.7 | 118.2 | $120 \cdot 7$ | 123.2 | 125.7 | 128.3 | $130 \cdot 9$ | 133.6 | 136.2 | 138.9 | 141.6 | 144.3 | 147.1 |
| 49 | 109.1 | 1114 | 113.9 | 116.3 | 118.7 | 121.2 | 123.7 | $126 \cdot 3$ | 128.8 | 131.4 | 134.0 | $136 \cdot 7$ | 139.3 | 142.0 | 144.7 |
| 50 | 107.3 | $109 \cdot 6$ | $112{ }^{\circ} \mathrm{O}$ | 114.4 | 116 | 119.3 | 121.7 | 124.2 | $126 \cdot 7$ | 129.3 | 131.9 | 134.5 | 137.1 | 139.7 | $142 \cdot 4$ |
| 51 | 105.5 | 107.8 | $110 \cdot 1$ | 112.5 | 114.9 | 117.3 | 119.7 | 122.1 | 124.6 | $127 \cdot 1$ | 129.7 | 132.2 | 134.8 | 137.4 | 140.0 |
| 52 | 103.7 | 105.9 | 108.2 | 110.5 | 112.9 | 115.3 | 117.6 | 120.1 | - 5 | 1250 | 127.4 | 129.9 | 132 | $135^{\circ}$ | - |
| 53 | roi. 8 | 104. 1 | 106.3 | 108.6 |  | 113.2 | 115.6 | 117.9 | $120 \cdot 3$ | 122.8 | 125.2 | 127.7 | 130.1 | 132.7 | 135.2 |
| 54 | 100.0 | 102.2 | 104.4 | $106 \cdot 6$ | 108.9 | 111.2 | 113.5 | 115.8 | 118.2 | $120 \cdot 5$ | 122.9 | $125 \cdot 3$ | 127.8 | $130 \cdot 3$ | 132.7 |
| 55 | $98 \cdot 1$ | $100 \cdot 3$ | 102.4 | 104.6 | 106.8 | $109 \cdot 1$ | 1113 | ${ }_{113}{ }^{6}$ | 115.9 | 118.3 | 120.6 | $123^{\circ}$ | 125.4 | 127.8 | $130 \cdot 3$ |
| 56 | $96 \cdot 2$ | $98 \cdot 3$ | $100 \cdot 5$ | 102.6 | 104.8 | 107.0 | 109.2 | III.4 | 113.7 | 116.0 | II 8.3 | 120.6 | 123.0 | 125.4 | 127 |


| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{48}$ | ${ }_{47}$ | m. | ${ }_{49} \mathrm{~m}$. | $\mathrm{m}_{50}$ | $\mathrm{m}_{51}$ | ${ }_{52}$. | ${ }_{53}^{\mathrm{m}}$ | ${ }_{54}$ | $\mathrm{m}_{55}$ | $\left.\right\|_{56}$ | ${ }_{5}{ }_{5}$ | ${ }_{58} \mathrm{~m}$. | ${ }_{59}{ }_{5}$ | $\mathrm{m}_{60}$ |

s

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 173.7 |  | 182.5 | 185.8 | 18 |  | 193 | 1 |  |  |  | ${ }_{210}^{213.3}$ | 216.8 | ${ }^{220 \cdot 4} 21$ |
|  |  |  | $174 \cdot 6$ | 177 |  |  |  |  | 194 | 1975 |  | 2043 |  | 21 | $214 . \%$ |
| 41 |  | 169.1 <br> $166 \cdot 8$ | 172.2 | $1755^{1.4}$ | ${ }^{178.6}$ |  |  | 188 | 19 | 19 | 198 |  | $205{ }^{\circ}$ |  |  |
| 42 | 163.7 |  | 169.9 | 173.0 | $176 \cdot 1$ | 179.3 | $182 \cdot 5$ | 185.7 | 188 | 192 | 19 | 19 |  | 2056 | - |
| 43 | 161 | $164 \cdot 5$ | 167.5 | $170 \cdot 6$ |  | 17 | 18 | 18 | 186:3 | 189 | 192.8 | 196•1 |  |  | I |
|  |  | 159 | $165 \cdot 1$ 162.7 |  |  |  | 17 | 18 | 18 |  |  | 1933 | 193.7 | 199.8 |  |
| 45 | 154 | $\xrightarrow{159.8}$ | ${ }_{1}^{162}$ |  |  |  |  | 177.9 | 178.4 |  |  | 18 |  | ${ }_{197}^{197}{ }^{19}$ |  |
| 47 | ${ }_{152}$ | 155.0 | 157.9 | 16 | 163.7 | 166.7 | $172 \cdot$ 169 | 172.6 | ${ }_{175} 17$ | 188.7 |  | ${ }_{184}^{187}$ |  | 19 |  |
| 48 | I4 | $152 \cdot 6$ | $155 \cdot 5$ | 158.3 | 2 | - | 167.0 |  | 173.0 | $176 \cdot 0$ |  | 182.0 | $185 \cdot \mathrm{I}$ |  |  |
| 4 | 147.5 | $150 \cdot 2$ | 153 | $155 \cdot 8$ | 158.7 | 1615 | 164.4 | $167 \cdot 3$ | $170 \cdot 2$ | 173.2 |  | 17 | $182 \cdot 2$ | 185.2 |  |
|  | I45 | 1478 | 150 | 153.3 | 156.I | 15 | 161.7 | 16 | $167 \cdot 5$ |  | 17 |  |  | 182.2 |  |
|  |  |  | 148 |  |  |  |  | 16 | $164^{\circ}$ |  |  | 173.3 |  |  |  |
|  | $140 \cdot 2$ | 142 | 145 | 14 | 15 | 153 | 15 | 159.1 | 161.0 | $164 \cdot 7$ | 167.5 | $170 \cdot 4$ | I | 1 | $179 \cdot 1$ |
|  | 137.7 |  | 142.9 | 145.6 | 148.2 | 150.9 | 153.6 | 156.3 | 15 | 16 r 8 | $164 \cdot 6$ | 167.4 |  |  |  |
|  |  | 137.8 135.2 |  | 142.9 140.3 |  | $148 \cdot 1$ |  |  | 156.2 | 158 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| Lat. | 2 HOURS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{1} \mathrm{~m}$ | 2 | $\stackrel{\mathrm{m}}{3}$ | ${ }_{4}$. | ${ }_{5}{ }^{\text {m. }}$ | $1{ }_{6}^{\mathrm{m}}$. | ${ }_{7} \mathrm{~m}$ | ${ }_{8} \mathrm{~m}$. | ${ }_{9}^{\mathrm{m}}$. | ${ }_{10}$ | $\mathrm{m}_{11}$ | ${ }_{12}$ | ${ }_{13}^{\mathrm{m}}$ | ${ }_{14}$ | ${ }_{15}$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 | 220.8 | 233.5 | 237.3 | 241.0 | $244{ }^{\circ}$ | 248.7 | 52.6 | 256.5 | $260 \cdot 4$ | 26 | $268 \cdot 3$ |  | 6 3 | $280 \cdot 4$ | $4 \cdot 5$ |
| 37 | 226.9 | $230 \cdot 6$ | $234 \cdot 3$ | 238.0 | $24{ }^{+8}$ | $245 \cdot 6$ | $249 \cdot 4$ | $253 \cdot 3$ | 257-1 | 261.0 | 26 | 268 | 272 | $276 \cdot 9$ |  |
| 38 | 224.0 | $227 \cdot 7$ | $23{ }^{2} \cdot$ | $235^{\circ}$ |  | 242 |  | 250 | ${ }^{253} 3$ | 257.7 |  | $265 \cdot 5$ |  | 273.4 | $277 \cdot 4$ |
| 39 40 | ${ }_{218}^{221}$ | 221 | 228 | 2320. | ${ }_{232}^{235}$ | 239 $236 \cdot 2$ | $243{ }^{1} 1$ 239 | 243.8 | $250 \cdot 6$ <br> 247 <br> 1 | 254.4 | 258.3 | ${ }^{262}$ 25-7 |  | 2696 26.9 | 273.9 |
| 41 | 215 | 218.8 | 222 | 225.9 | 22 | $233 \cdot 1$ | $236 \cdot 7$ | $240 \cdot 4$ | 244 I | 247.8 | 25 | $255 \cdot 3$ |  | $262 \cdot 9$ | $266 \cdot 7$ |
| 42 | 212 | 215.8 | 219.3 |  |  |  | $233 \cdot 5$ | $237 \cdot 1$ |  | 244 | 248 |  | $255 \cdot 6$ | 259.3 |  |
| 43 | $200 \cdot 5$ | 212.9 |  | ${ }_{219}^{219} 8$ | ${ }_{22}^{223^{\prime 2}}$ |  |  | 233.9 | ${ }^{237} 4$ | 241.1 | $244 \cdot 7$ | 248.4 | ${ }^{252} \times 1$ | ${ }^{2555}$ | 259.5 |
| 44 | $206 \cdot 5$ $203 \cdot 5$ | 209.9 206.8 | ${ }_{210 \cdot 2}^{213}$ | ${ }_{213 \cdot 5}^{215}$ | ${ }_{216.9}^{2201}$ | $223 \cdot 6$ $220 \cdot 4$ | 1223.8 | ${ }_{227}^{230 \cdot 6}$ | $\begin{aligned} & 234 \cdot 1 \\ & 230 \cdot 8 \end{aligned}$ | $237 \cdot 7$ 234 | 241.3 237 2 | 244.9 | ${ }_{245}^{248}$ | 252 248 24 | 255.9 |
| 46 | $200 \cdot 5$ | 203.8 | 207•1 | 210 | 213 | 217 | 220 | 223.9 | 2274 | $230 \cdot 8$ | $234 \cdot 3$ | $237 \cdot 8$ | $245^{4} 4$ | $245^{\circ}$ | 5 |
| 48 | 197.5 | 2007 | 204.0 | 2073 | 210.5 20.3 | 213.9 210.6 | $215 \cdot 2$ | 22.6 | 224.0 | 227.4 | 230.8 | 234.3 | $237 \cdot 8$ | 2415 |  |
| 48 | $194 \cdot 5$ | 1977 <br> 194.5 <br> 18 | 200•8 | ${ }^{204 \cdot 1}$ | 207.3 | 21076 |  | 217.2 | 220 |  | 22 |  |  |  |  |
| 50 | 188 | $19 \mathrm{~T} \cdot 4$ | 194.5 | 197 |  | 203.9 | $207 \cdot 1$ | $210 \cdot 3$ | ${ }_{213}{ }^{21} 6$ | 21 | 22 | $223 \cdot 4$ | ${ }_{22}$ | ${ }_{23}^{23 \cdot 9}$ | $233 \cdot 5$ |
| 51 | 185.2 | 188 | 191.3 | 194.3 | 197.4 | $200 \cdot 5$ | $203 \cdot 7$ | 206.9 | $210 \cdot 0$ | $213 \cdot 3$ | 21 | 219.7 | 223.0 | $226 \cdot 3$ | 229.6 |
| 52 | 182 | 185 |  | 19 |  | ${ }^{197} 7$ |  | $203 \cdot 3$ |  |  |  |  | 219.2 |  |  |
| 53 54 5 |  |  |  | 184 | 18 |  |  | 196.2 | 199 |  | 209.1 <br> 205 |  | 215.4 | ${ }_{214.7}^{218.6}$ |  |
| 55 |  | 175.2 | 17 |  |  | $186 . \%$ |  | 192 | 195 | 198 |  | 204.6 | 207 |  | 213.8 |
| 56 |  |  |  | $177 \cdot 4$ |  | 183.1 |  | 188.9 | 191.8 |  |  |  | 203.7 |  | 2097 |
| Lat. | 2 HOURS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{16} \mathrm{~m}$ | ${ }_{17}$ | ${ }_{18}^{\mathrm{m}}$ | ${ }_{19}^{\mathrm{m}}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{21}$ | $\frac{\mathrm{m}}{22}$ | ${ }_{23}^{\mathrm{m} .}$ | ${ }_{24}^{\mathrm{m}}$ | 25 | 26 | ${ }_{2}{ }_{2}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{29}^{\mathrm{m}}$ | ${ }_{30}$ |
| s. ${ }^{1}$ REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ} 6$ | $288 \cdot 6$ |  | 296.9 | $301 \cdot 1$ | 30'5. | 309 | ) | $3{ }^{18} 81$ | $322 \cdot 4$ | $326 \cdot 8$ |  | 5 | O-0 | 4.4 | 8.9 |
| 37 38 38 | $285 \cdot 0$ 28.4 |  |  | 2974 |  | 305.7 |  |  |  |  |  |  |  |  |  |
| 38 39 | $281 \cdot 4$ <br> 277 <br> 1 | $285 \cdot 5$ 281.8 | $289 \cdot 5$ $285 \cdot 8$ | 293.6 289.9 | ${ }^{297} 9$ | 301.9 |  | 310.3 | 314.5 310.5 | ${ }^{318.7}$ | 323.0 318.9 | 327.3 | 331.6 | $336 \cdot 0$ <br> 331 | $340 \cdot 4$ $336 \cdot 1$ |
| 40 | $274 \cdot 2$ | 278 | 282 -I | 286 | $290 \cdot 1$ | $294 \cdot 2$ | 298.3 | $302 \cdot 4$ | $306 \cdot 5$ | 310.6 | 314.8 | $3 \times 9$ | 323.2 | $327 \cdot 5$ | $33 \mathrm{r} \cdot 7$ |
| 41 | $270 \cdot 6$ | 274.5 | 278.4 | $282 \cdot 3$ | $286 \cdot 3$ | $290 \cdot 3$ | 294:3 | $298 \cdot 4$ | $302 \cdot 4$ | $306 \cdot 5$ | 3 ro 7 | 314.8 | $319 \cdot 0$ | 323.2 | 327.4 |
| 42 | 266 | ${ }_{267 \cdot 1}^{270 \cdot 8}$ | 27 | 278.6 |  |  |  | 29 | 29 |  |  |  | 31 | - |  |
| 44 | 25 | $263 \cdot 3$ | $267 \cdot 1$ |  | $274 \cdot 7$ | 278.6 | 282.4 | $286 \cdot 3$ | 29 | $294 \cdot 2$ | 298-1 |  |  |  |  |
| 45 | $255 \cdot 9$ | $259 \cdot 6$ | 263.3 | $267 \cdot 0$ | $270 \cdot 8$ | $274 \cdot 6$ | 4 | $282 \cdot 2$ | $286 \times$ | $290^{\circ}$ | 293.9 | $297 \cdot 8$ | 3 | 305.8 | 309.8 |
| 46 | 25 | 255.8 | 259 | 263 . | 26 |  | $274 \cdot 3$ | 278.1 | $28 \mathrm{r} \cdot 9$ | 285.8 | $289 \cdot 6$ |  |  |  |  |
| 47 | 24 | 25 | ${ }^{251}$ | 259 | 26 | 266 |  |  | 27 | 281.5 |  | 289.1 |  |  |  |
| 49 | 240 |  |  | ${ }_{251}$ | $254 \cdot 8$ | ${ }_{258}{ }^{26.5}$ | 262. ${ }^{266}$ | 269 $265 \cdot 6$ | $273 \cdot 5$ 269.2 |  | 281.0 276.6 | 28 | 284 | $292 \cdot 3$ $28 \cdot 8$ |  |
| 50 | 236 | 2403 | $243 \cdot 8$ | $247 \cdot 2$ | $250 \cdot 7$ | $254 \cdot 2$ | 2578 | 261.3 | 264.9 | 26 | $272 \cdot 2$ | $275 \cdot 8$ | 279.5 | $283 \cdot 2$ | $286 \cdot 9$ |
| 51 | 233 | $236 \cdot 4$ | $239 \cdot 8$ | 243.2 | $246 \cdot 6$ | $250 \cdot \mathrm{I}$ | $253 \cdot 6$ | 257.0 | $260 \cdot 6$ | $264 \cdot \mathrm{I}$ | $267 \cdot 7$ | - 3 | 274 | 278.6 | $282 \cdot 2$ |
| 5 | ${ }_{225}^{22 \cdot}$ | $232 \cdot 4$ 228.3 | $235 \cdot 7$ 231.6 | 239. ${ }^{234}$ | $242 \cdot 4$ 238.2 | ${ }_{24}^{245}$ | ${ }^{244}{ }^{\circ}{ }^{\circ}$ | 252.7 | 256 | 259 |  |  | $270 \cdot 3$ 265.6 | 273.9 | 277 |
| 53 | $\xrightarrow{2251}$ | 228.3 | ${ }_{22}^{231.6}$ | $234 \cdot 9$ $230 \cdot 7$ | $238 \cdot 2$ 234 | $241 \cdot 6$ |  | $248 \cdot 3$ 243 | ${ }_{24}^{251} \cdot 2$ | 255.2 $250 \cdot 6$ | 258.6 | ${ }_{257 \cdot 4}^{26 \cdot 1}$ | 265 | 269.1. |  |
| 55 | 216 | $22 \cdot 1$ | 223.2 | 226.4 | 229.6 | $232 \cdot 8$ | $236 \cdot 1$ | 23 | 24 | 2460 | 24 | 252.7 | $256 \cdot 0$ | 25 | $262 \cdot 9$ |
| 56 | 212 | 215 | 219. | 22 | $225 \cdot 2$ | 228.4 | 231.6 | 234.8 | 238 | 2413 | 24 | 247.8 | 251 | $254 \cdot 5$ |  |

TRUE BEARING OR AZIMUTH OF * CANOPUS.

| Lat. | 2 HOURS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{2} \mathrm{~m}$ | ${ }_{4}^{\mathrm{m}}$. | ${ }_{6} \mathrm{~m}$ | ${ }_{8} \mathrm{~m}$. | ${ }_{10}^{\mathrm{m}}$ | ${ }_{12}^{\mathrm{m}}$ | 14 | 16 | ${ }_{18}^{\mathrm{m}}$ | ${ }_{20}$ | ${ }_{22}^{\mathrm{m}}$ | 24 | ${ }_{26}^{\text {m }}$ | ${ }_{28}^{\mathrm{m} .}$ | ${ }_{30}$ |
| s. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ} 6$ | 180.0 | 18.3 | 18.5 | I8.8 | $\stackrel{\circ}{19}$ | $19 \cdot 3$ | 19.6 | 19.9 | $20^{\circ} \mathrm{I}$ | $20^{\circ} \cdot 4$ | $20^{\circ} 7$ | $20^{\circ} 9$ | $2{ }^{\circ} \cdot 2$ | 21.5 | 21.7 |
| 38 | 18.0 |  | 18.5 |  | $19 \cdot 1$ | 19.4 | $19 \cdot 6$ | 19.9 | 20.2 | 20.5 | 20.7 | $2{ }^{2} \cdot$ | $2 \mathrm{~F} \cdot 3$ | 21.5 | $2 \mathrm{x} \cdot 8$ |
| 40 | 18.0 18.1 | 18.3 | 18.6 18.7 | 18.9 10.0 | 19.2 | 19.4 | 19.7 | $20 \cdot 0$ | $20 \cdot 3$ | 20.5 | 20 | 21 | 21.4 | 21.6 | 21.9 |
|  |  |  | 18 | 19.0 | $19^{\prime 2}$ | 19.5 | 19.8 | 20.1 | $20 \cdot 4$ | $20 \cdot 6$ | 20 | 2 T | 21.5 | 2 I .8 | 22.0 |
| 44 | 18.2 | 18.5 | 18.8 18.9 | ${ }_{1}^{19.1}$ | 19.4 | 19.6 | 19.9 | 20.2 | 20.5 | 20.8 | $21 \cdot 1$ | 21.3 | 21.6 | 21.9 | 22.2 |
| 48 | 18.5 | 18.8 | 19.1 | 19.4 | 19.6 | 19.8 | 20.1 20.2 |  | 20.6 20.8 | 20.9 | 21.2 |  | 21 |  | 22.3 |
| 50 | 18 | 19.0 | 19.3 | 19.5 | 19.8 | 20.1 | 20.4 | 20.7 | $2 \mathrm{I} \cdot 0$ | 21.3 | 2 r 2 6 | ${ }_{21}^{21.9}$ | 22.2 | 22.5 | 22.8 |
| 52 | 18.8 | 19 | 19.5 | 19.7 | 20.0 | $20 \cdot 3$ | $20 \cdot 7$ | $2 \mathrm{~F} \cdot 0$ | 21.3 | $2 \mathrm{~F} \cdot 6$ | 21.8 | $22 \cdot 1$ | 22.4 | 22.7 | 3.0 |
| 54 | 18. | 19.4 | 19.7 | 20.0 | 20.3 | $20 \cdot 6$ | 20.9 | 21.2 | 21.5 | 21.8 | $22 \cdot \mathrm{I}$ | 22.4 | $22 \cdot 7$ | 23.0 | $23 \cdot 3$ |
| 56 | 19.3 | 19.6 | 20.0 | $20 \cdot 3$ | 20.6 | 20. | 21.2 | 21.5 | 21.8 | $22 \cdot 1$ | 22.4 | $22 \cdot 7$ | 23.0 | 23.3 | $23 \cdot 6$ |

## REDUCTION to the meridian and azimuth table near the merdian BELOW THE POLE.

* CANOPUS.

| Lat. | 2 HOUR |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 31 | 32 | 33 |  | 35 | ${ }_{36}$ | 37 | 38 | 39 | 40 | 41 | ${ }_{4}{ }_{4}$ | 43 | 44 | ${ }_{45}$ |
| s. RE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 | 3'4 |  | $362 \cdot 5$ | 367 | 37.7 | , | 381.0 | $385 \%$ |  |  |  |  |  |  |  |
| 37 | $349{ }^{\text {I }}$ | $353 \cdot 6$ |  |  |  |  |  |  |  |  |  |  |  | 409.4 |  |
| 388 |  | 349.2 | $353 \cdot 7$ 349 |  |  |  | 36 |  | $380 \cdot 9$ $376 \cdot 1$ | 38 |  | 394.9 389.9 |  | 404.3 |  |
| 40 | 33 | 34 | $344 \cdot 7$ | $349 \cdot 1$ | $353 \cdot 5$ | 357.9 | 362.4 | $366 \cdot 8$ | $371 \cdot 3$ | 375 | -4 | 385.0 | 389.6 | 394.2 | 398.8 |
| 4 I | $33 \mathrm{r} \cdot 6$ | $335 \cdot 9$ | $340 \cdot 2$ | $344 \cdot 5$ | 34 | 353.2 | $357 \cdot 6$ | -1 | $366 \cdot 5$ | $371 \cdot 0$ | $375 \cdot 5$ | 380.0 | $384 \cdot 5$ | 389.1 |  |
| 4 |  | 33 | $335 \cdot 7$ 331. | $339 \cdot 9$ $335 \cdot 3$ | 34 |  |  | $357 \cdot 3$ $352 \cdot 4$ | 361.6 356.8 | 361 -I |  | $375 \cdot$ 369.9 |  | 384.0 378.8 |  |
| 43 |  |  |  | 335.3 $330 \cdot 7$ |  |  | ${ }_{343 \cdot 3}^{348}$ | $352 \cdot 4$ <br> 347 |  | ${ }_{366 \cdot \mathrm{r}}$ |  | 364.8 | 374.2 369.2 |  |  |
| 45 | 31 | 3 x |  | 326.0 | $330 \cdot 1$ | 334-3 | 338.5 | $342 \cdot 7$ | $346 \cdot 9$ | 351 - | $355 \cdot 4$ | $359 \cdot 7$ | 364.0 | 368.3 | 372 |
| 46 | 309 | 31 |  |  | 325 | 329 | 333.6 | 337 |  | 344. I | 350.3 | $354 \cdot 5$ | 358.8 | 363.0 | 367.3 |
| 48 |  |  |  |  |  |  |  | 332 |  |  |  |  |  | 357.7 |  |
| 49 |  |  |  | 306.9 |  |  |  | $322 \cdot 6$ | $326 \cdot 6$ |  | 334.6 | 338 | 硅 | $346 \cdot 9$ |  |
| 50 | $290 \cdot 7$ | 294.4 | 29 | $2 \cdot 0$ | 30 | $309 \cdot 7$ | $3 \times 3.6$ | $317 \cdot 5$ | 32 | $325 \cdot 4$ | 329*3 | $333 \cdot 3$ | 337 | 34 | 345 |
| 51 |  | $289 \cdot 6$ |  | 297-1 |  | $304 \cdot 7$ | 308.5 | 312.3 | $316 \cdot 2$ | 32 | $324^{\circ}$ | 327 | 331.8 | $335 \cdot 8$ |  |
| 52 |  |  |  |  | 295 | 29 |  |  |  | 314 |  |  | $326 \cdot 3$ 320.6 | $330 \cdot 2$ |  |
| 5 | 27 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 28 | 283.8 |  |  |  |  |  |  |  |  |  |
| 56 |  | 26 |  | 27 |  | 278 |  | $285 \cdot 4$ |  | $292 \cdot 5$ | 296.x | $299 \cdot 7$ | 303.3 | $306 \cdot 9$ |  |


| Lat. | 2 HOURS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 46 | ${ }_{47}$ | ${ }_{48} \mathrm{~m}$. | 49 | 50 | $\mathrm{m}_{51}$ | ${ }_{52}$ | 53 | ${ }_{54}^{\mathrm{m}}$ | ${ }_{55}$ | 56 | $\begin{aligned} & \hline \mathrm{m} . \\ & 5 \% \end{aligned}$ | $\begin{aligned} & \hline \mathrm{m} . \\ & 58 \end{aligned}$ | $\begin{aligned} & \hline \mathrm{m} . \\ & \mathbf{5 9} \\ & \hline \end{aligned}$ | 30 |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 | + | 429.1 | - | $439 \cdot 0$ | ${ }^{\circ}{ }^{\circ}$ | 449.0 | $54^{\circ}$ | 459. | $464 \cdot 2$ | 469.3 | 474.4 | 479.6 | 484.7 | $9 \cdot 9$ |  |
| 37 | $419^{\circ} \mathrm{O}$ | 423.9 | 428.8 | $433 \cdot 7$ | 438.6 | $443 \cdot 6$ | $44^{8 \cdot 5}$ | $453 \cdot 6$ | 458.6 | $463 \cdot 6$ | 468.7 | 473.8 | $479^{\circ} \mathrm{O}$ | $484 \cdot \mathrm{I}$ | 489.3 |
| 38 | 413.9 | 418.7 | $423 \cdot 5$ | 428.4 | 433.2 | $438 \cdot \mathrm{I}$ | $443 \cdot 1$ | $44^{8.0}$ | 453.0 | 458.0 | 463.0 | $468 \cdot \mathrm{I}$ | $473 \cdot 1$ | $478 \cdot 2$ | 483.4 |
| 39 | 408. | 413.5 | 418.2 | 423.0 | $427 \cdot 9$ | $432 \cdot 7$ | 437.6 | $442 \cdot 5$ | $447 \cdot 4$ | $452 \cdot 3$ | 4573 | $462 \cdot 3$ | $467 \cdot 3$ | 472.3 | $477 \cdot 4$ |
| 40 | $403 \cdot$ |  | 412.9 | 417.7 | $422 \cdot 4$ | $427 \cdot 2$ | 432.0 |  | $441 \cdot 7$ |  | 451.5 | $456 \cdot 5$ | 461.4 |  | 471.4 |
| 4 I | 398.3 | 402 | $407 \cdot 6$ | 412 | $417 \cdot 0$ | 42 P 7 | $426 \cdot 5$ | $43 \mathrm{I} \cdot 2$ | $436 \cdot 1$ | $440 \cdot 9$ | $445 \cdot 7$ | $450 \cdot 6$ | 455.5 | $460 \cdot 4$ | $465 \cdot 4$ |
| 42 | 39 | $397 \cdot 6$ | $402 \cdot 2$ | $406 \cdot 8$ | $4 \mathrm{IX} \cdot 5$ | 416.2 | $420 \cdot 9$ | 425.6 | $430 \cdot 3$ | $435 \cdot 1$ | 439.9 | $444^{7} 7$ | $449 \cdot 5$ | 454.4 | 459.3 |
| 43 |  | $392 \cdot 3$ | $396 \cdot 8$ | 401.4 | 406 | $410 \cdot 6$ | 415.2 | 419.9 | 424.6 | 429.3 | $434^{\circ}$ | $43^{8.8}$ | $443 \cdot 5$ | 448 | $453 \cdot$ |
| 44 | 38 | $386 \cdot 9$ | 391.4 | 395.9 |  | $405 \cdot 0$ | $409 \cdot 6$ | 414.2 | 418.8 | $423 \cdot 4$ | 428.1 | $432 \cdot 8$ | $437 \cdot 5$ | $442 \cdot 2$ |  |
| 45 | 377 |  | 崖 | 39 | 39 | 39 | 403 |  | 412.9 | 417.5 | 422. 1 |  | $43 \mathrm{I} \cdot 4$ | I |  |
| 46 | 37 | $376 \cdot 0$ | $380 \cdot 4$ | $384 \cdot 8$ | 389.2 |  | $398 \cdot \mathrm{I}$ |  | $407^{\circ}$ | 4 | $416 \cdot 1$ | $420 \cdot 7$ | $425 \cdot 3$ | 429.9 | $434 \cdot 5$ |
| 47 48 | 36 | $370 \cdot 5$ $364 \cdot 9$ | $374 \cdot 8$ 360.2 | $379 \cdot 1$ 373.4 | 383.5 377.7 | 387.8 382.0 | $392 \cdot 2$ 386.4 | $396 \cdot 7$ | $401 \cdot 1$ | $405 \cdot 6$ | $410{ }^{\circ}$ | 414.5 | 419.1 | $423 \cdot 6$ |  |
| 48 | 36 | $364 \cdot 9$ 359 | 369.2 363.5 |  | $377 \cdot 7$ | $382 \cdot 0$ | $386 \cdot 4$ $380 \cdot 4$ |  | 39 | $399 \cdot 5$ | $403 \cdot 9$ | 408.4 | 412.8 | 417.3 | 42 I |
| 50 | 35 | 35 | 363.5 357 |  | 3 | $376 \cdot 1$ $370 \cdot 2$ | 3 | 37 | 389.0 382.9 | 393.4 387 | $397 \cdot 7$ 391.4 | $402 \cdot 1$ $395 \cdot 7$ | $406 \times 1$ | $410 \cdot 9$ 404 |  |
| 51 |  | $347 \cdot 8$ | 351.9 | 356.0 | $360 \cdot 1$ |  | $368 \cdot 3$ | 372.5 | 376.7 | $380 \cdot 9$ | 385.1 | 389.3 | $393 \cdot 6$ | 397*9 | 402.2 |
| 52 | 338 | $342{ }^{\circ} \mathrm{O}$ | $346 \cdot 0$ | $350 \cdot 0$ | $354 \cdot \mathrm{I}$ | $358 \cdot 1$ | $362 \cdot 2$ | $366 \cdot 3$ | $370 \cdot 4$ | $374 \cdot 5$ | $378 \cdot 7$ | 382.9 | $387 \cdot 1$ | 391.3 | $395 \cdot 5$ |
| 53 | 33 | $336 \cdot 1$ | $340 \cdot 1$ | 344 | $348 \cdot 0$ | $351 \cdot 9$ | $356 \cdot 0$ | $360 \cdot 0$ | $364^{\circ}$ | 361 | $372 \cdot 2$ | $376 \cdot 3$ | $380 \cdot 4$ | 38.6 | $388 \cdot 7$ |
| 54 | $326 \cdot 3$ $320 \cdot 3$ |  | $334^{\circ} \mathrm{O}$ | 337 3319 | 341.8 335.5 | $345 \cdot 7$ | $349 \cdot 6$ | $353 \cdot 6$ | $357 \cdot 6$ |  | 365.6 | $369 \cdot 6$ | $373 \cdot 7$ | $377 \cdot 8$ | $38 \mathrm{I} \cdot 9$ |
| 55 56 | $320 \cdot 3$ $314 * 3$ | 32 | 327 325 | $33 \mathrm{I} \cdot 7$ $325 \cdot 4$ | $335 \cdot 5$ 329.2 | 339.4 333.0 | 343.2 336.8 | $347 \cdot 1$ 340.6 | $351 \cdot 0$ 344.4 | 348.3 | $358 \cdot 9$ $352 \cdot 1$ | 362.9 356 | 366.9 3600 | $370 \cdot 9$ 363.9 | 8 |
|  | - |  | 32 | 32 | 329 | 333. | 336 | $340 \cdot 6$ | 344.4 | 348 | 352.1 | 356. | 360 | 363.9 | $367 \cdot 8$ |

TRUE BEARING OR AZIMUTH OF $*$ CANOPUS.

| Lat. | 2 HOURS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{32}$ | ${ }_{34}^{\text {m. }}$ | ${ }_{36}^{\mathrm{m}}$ | ${ }_{38}^{\mathrm{m}}$ | ${ }_{40}^{\mathrm{m} .}$ | ${ }_{42}$ | ${ }_{44}$ | ${ }_{46}$ | ${ }_{48}$ | ${ }_{50}$ | ${ }_{52} \mathrm{~m}$. | ${ }_{54}$ | ${ }_{56}$. | ${ }_{58}$ | ${ }_{60} \mathrm{~m}$. |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ} 6$ | $2{ }^{\circ} \mathrm{O} \cdot 1$ | 22.3 | 22.5 | 22.8 | $23^{\circ} \mathrm{O}$ | 23.3 | $23^{\circ} \cdot 5$ | $23^{\circ} \cdot 9$ | $24^{\circ} \mathrm{I}$ | $24^{\circ} \cdot 4$ | 24.6 | $24^{\circ} 9$ | $25^{\circ} \mathrm{I}$ | $25^{\circ} \cdot 4$ | $25^{\circ} 6$ |
| 38 | ${ }^{22.1}$ | 22.3 | 22.6 | $22 \cdot 8$ | ${ }_{23}{ }^{3} \cdot 1$ | 23.4 23.5 | 23.7 | 23.9 | $24^{2}$ | 24.4 | $24^{7}$ | ${ }^{24.9}$ | $25 \cdot 2$ | 25.4 | ${ }^{25 \cdot 7}$ |
| 40 | 22.2 22.3 | 22.5 22.6 | 22.7 22.8 | $23 \cdot 0$ 23.1 | 23.2 $23^{\prime} 4$ | 23.5 23.7 | 23.8 23.9 | $24 \cdot \mathrm{~T}$ <br> 24 <br> 1 | $24 \cdot 3$ 24.5 | $24 \cdot 6$ $24 \cdot 7$ | 24.8 25.0 | ${ }^{25 \cdot 1}$ | $25 \cdot 3$ $25 \cdot 5$ | 25.6 25.8 | 25.9 26.0 |
| 44 | 22.4 | $22 \cdot 7$ | $23^{\circ}$ | 23.3 | $23 \cdot 5$ | 23.8 | $24^{1}$ I | $24^{3}$ | $24^{6}$ | $24 \cdot 9$ | 25.2 | $25 \cdot 4$ | $25 \cdot 7$ | $26 \cdot 0$ | $26 \cdot 3$ |
| 46 | $22 \cdot 6$ <br> 22.8 | 22.9 | 23.2 | $23 \cdot 5$ | 23.7 | $24^{\circ}$ | 24.3 | 24.6 | $24^{2} 8$ | $25 \cdot 1$ | 25.4 | 25.7 | 25.9 | 26.2 | 26.5 |
| 48 50 | 22.8 | 23.1 | 23.4 | 23.7 | $24^{\circ} \mathrm{O}$ | 24.2 | 24.5 | 24.8 | ${ }^{25 \cdot 1}$ | 25.4 25.6 | $25 \cdot 6$ | 25.9 | 26.2 | 26.5 | $26 \cdot 7$ |
| 50 | 23.1 | 23.3 | 23.6 | 23.9 | 24.2 | $24 \cdot 5$ | 24.8 | 25.1 | 25.4 | $25 \cdot 6$ | 25.9 | $26 \cdot 2$ | $26 \cdot 5$ | 26.8 | 27.1 |
| 52 54 | 23.3 23.6 | 23.6 | 23.9 | 24.2 | 24.5 | 24.8 | 25.1 | 25.4 | 25.7 | 25.9 | 26.2 | 26.5 | 26.8 | 27.1 |  |
| 54 56 | 23.6 23.9 | 23.9 24.2 | ${ }_{24 \cdot 5}^{24}$ | 24.5 24.9 | ${ }_{24} 2.8$ | ${ }_{25}^{25.5}$ | 25.4 25.8 | $25 \%$ 26.1 | 26.0 | ${ }_{26 \cdot 3}^{26 \cdot 3}$ | $26 \cdot 6$ | 26.9 | 27.2 | 27.5 | 27.8 28.2 |
|  |  |  |  | , | 2, | 25 | 25 |  | , | , | 27 | $27 \cdot 3$ | $27 \cdot 6$ | 27 |  |

REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* CAPELLA.

| Lat. | ${ }_{4}^{\text {m. }}$ | ${ }_{8}^{\mathrm{m}}$. | ${ }_{12}$ | ${ }_{16}^{\mathrm{m}}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{22}^{\mathrm{m}}$ | ${ }_{24}$ | ${ }_{26}^{\mathrm{m}}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{30}^{\mathrm{m}}$ | ${ }_{32}$ | ${ }_{34}$ | ${ }_{36}$. | ${ }_{38}^{\mathrm{m}}$ | ${ }_{40}^{\mathrm{m}}$ | ${ }_{42} \mathrm{~m}$. | ${ }_{44}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{20}$ | 0.8 | $3 \cdot 1$ | 7.0 | 12.5 | $19 \cdot 5$ | $23 \cdot 5$ | 28.0 | 32'8 | 37.9 | $43 \cdot 4$ | 49•3 | 55'6 | 62'. | 69'1 | 76.4 | 84.0 | 9r'9 |
| 18 | 0.8 | 2.9 | 6.7 | 11.9 | 18.4 | $22 \cdot 3$ | $26 \cdot 5$ | $3{ }^{1} \cdot$ | 35.9 | $4{ }^{1} \cdot 1$ | $46 \cdot 7$ | $52 \cdot 6$ | 58.9 | $65 \cdot 4$ | 72.4 | 79.6 | 87.2 |
| 16 | $0 \cdot 7$ | 2.8 | 6.3 | 11.3 | 17.5 | ${ }_{21}^{21.1}$ | 25. | 29.4 | 34.1 | 39.0 | 44.4 | 50.0 |  | 62.2 | 68.8 | $75 \cdot 7$ | 82.9 |
| ${ }_{12} 12$ | $\stackrel{0}{0.7}$ | 2.7 2.5 | 6.0 5.8 | 10.7 10.2 | 16.7 15.9 | 20.1 19.2 | 23.9 | 26.8 | 32.5 | 37.2 | 42.3 | $47 \cdot 7$ 45.6 | 53.4 | 59.4 | $65 \cdot 7$ 62.8 | $72 \cdot 3$ 69.2 | 79.2 75.8 |
| го | 0.6 | 2.4 | $5 \cdot 5$ | 9.8 | 15.2 | 18.4 | 21.9 | $25 \cdot 7$ | 29.7 | $34^{1}$ | 38.9 | $43 \cdot 7$ | 48.9 | $54 \cdot 5$ | $60 \cdot 3$ | $66 \cdot 3$ |  |
| 8 | $0 \cdot 6$ | $2 \cdot 3$ | $5 \cdot 3$ | $9 \cdot 4$ | $14 \cdot 6$ | $17 \cdot 7$ | 21.0 | $24 \cdot 7$ | 28.6 | $32 \cdot 8$ | $37 \cdot 2$ | 42.0 | $47^{\circ}$ | 52.3 | 57.9 | $63 \cdot 8$ |  |
| 6 | 0.6 | $2 \cdot 3$ | $5 \cdot 1$ | 8.7 | I4. 1 | $17^{\circ}$ | 20.2 | 23.7 22.9 | $27 \cdot 5$ 26.5 | $31 \cdot 5$ 30.4 | $35 \cdot 8$ 34.6 | 40.4 30.0 | $45 \cdot 3$ <br> 43 | 50.4 48.6 | $55 \cdot 8$ <br> 53.8 <br> 8 | 6r.4 | 67 |
| ${ }_{0}^{4}$ | - 0.5 | 2.2 2.0 | 4.6 | ${ }_{8.1}^{8.7}$ | 12.6 | ${ }_{15}^{16 \cdot 4}$ | 18.2 | 22.9 | 24.7 | 28.4 | $34 \cdot 6$ $32 \cdot 3$ | 30.0 | 43.7 40.8 | ${ }_{45}^{4 \cdot}$ | 53.8 | 59.2 | . 6 |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{8}^{4}$ | 0.5 0.4 | r. <br> 1 <br> P |  | 7.6 | 11.8 | 14.3 | 17\% | 20.0 18.8 18 | 23.2 21.8 | $2{ }^{26.6}$ | $30 \cdot 2$ 28.4 | 34. ${ }^{\text {I }}$ | 38.2 35.9 | $42 \cdot 5$ | 47.1 | $5 \mathrm{5r}{ }^{5}$ | 56.9 |
| 12 | ${ }_{0}^{0.4}$ | 1.7 | + ${ }^{4.8}$ | 7.1 6.7 | 11.1 | 13.5 | ${ }_{15}^{16.0}$ | $1 \begin{aligned} & 18.8 \\ & 17.7\end{aligned}$ | 20.5 | 23.0 | ${ }_{26.8}^{28.4}$ | $32 \cdot$ $30 \cdot 2$ | $35 \cdot 9$ 33.9 | $4{ }^{40 \cdot}$ | 44.3 | 46 | $53 \cdot 5$ 50.5 |
| 16 | 0.4 | - ${ }_{\text {r }} \times 1$ | $3 \cdot 6$ | 6.3 | 9.9 | 12.0 | 14.2 | $15 \cdot 7$ | 19.4 | $22 \cdot 2$ | $25 \cdot 3$ | 28.6 |  | 35.6 | $39 \cdot 5$ | $43 \cdot 5$ | 47.7 |
| 20 | 0.4 | 1.5 | $3 \cdot 4$ | 6.0 | $9 \cdot 3$ | 11.3 | 13.5 | 15.8 | 18.3 | 21.0 | 23.9 | $27^{\circ}$ | 30.2 | 33•7 | $37 \cdot 3$ | 41-1 | ${ }^{4} \cdot 1$ |
| 24 | 0.4 | I.4 | $3 \cdot 2$ | $5 \cdot 7$ | 8.8 | $10 \cdot 7$ | 12.7 | 14.9 | 17.3 | 19.9 | $22 \cdot 6$ | 25.5 | 28.6 | $3 \mathrm{~T} \cdot 8$ | $35 \cdot 3$ | 38.9 | $42 \cdot 6$ |
| 28 | 0.3 | I.4 | 3.0 <br> 2.8 | 5.3 | 8.3 | - 1 | 12.0 | ${ }_{\text {14 }}^{14} 1$ | ${ }_{15}^{16.4}$ | 18.8 | 21.4 20.2 | 24. | 27.0 25.5 | 30.1 | 33.3 | $36 \cdot 7$ <br> 34 <br> 1 | 40:3 |
| 32 36 | $\stackrel{0}{0 \cdot 3}$ | I.3 | $2 \cdot 8$ | 4.80 | $7{ }^{7} \cdot 9$ | 9.5 | 11.4 10.7 | 13.3 | ${ }_{14}^{15.5}$ | 17.7 | 20.2 19 |  | 25.5 | 26.8 | 29.6 |  | ${ }_{35}^{38.8}$ |
| 40 | $0 \cdot 3$ | I• | $2 \cdot 5$ | $4 \cdot 5$ | 7.0 | 8.5 | Io'I | Ir-8 | 13.7 | 15.7 | 17.9 | 20.2 | $22 \cdot 6$ | $25^{2}$ | 27.9 | 30.7 | $33 \cdot 7$ |


| Lat. | m. 45 | 8 |  |  | 49 | 50 |  | $\begin{aligned} & \mathrm{m} . \\ & 52 \end{aligned}$ | $\begin{aligned} & n \\ & \hline \end{aligned}$ | $\mathrm{m}_{54}$ | $\begin{aligned} & \mathrm{m} \\ & 55 \end{aligned}$ | $\mathrm{m}_{56}$ | $\mathrm{m}_{57}$ | ${ }_{58}$ | $\mathrm{m}_{59}$ | $\mathrm{m}_{60}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  | R | UCT | IONS |  |  |  |  |  |  |  |
| $20$ | 96.0 | $100 \cdot 2$ | 104.5 | $108 \cdot 8$ | 113.2 | 117.7 | 122.3 | $127^{\circ} 0$ | 131.7 | $136 \cdot 5$ | 141.4 | $146 \cdot 3$ | 15 I 4 | 156.5 | 161.6 | 166.9 |
| 19 | $93 \cdot 5$ | $97 \cdot 6$ | 10I•7 | 105*9 | 110.3 | 114.6 | 119.1 | 123.7 | I 28.3 | $133^{\circ} \mathrm{O}$ | 137.7 | 142.6 | $147 \cdot 5$ | 152.5 | 157.5 | $162 \cdot 7$ |
| 18 | 91-I | $95^{\circ} \mathrm{O}$ | 99* 1 | 103.2 | 107.4 | 111.7 | II6.I | $120 \cdot 5$ | $125{ }^{\circ}$ | 129.6 | I 34.3 | 139.0 | I 43.8 | $148 \cdot 7$ | I53.6 | 158.7 |
| 17 | 88.8 | $92 \cdot 7$ | $96 \cdot 7$ | $100 \cdot 7$ | 104.8 | 109 0 | II3. | II7.6 | $122{ }^{\circ}$ | 126.5 | 131*0 | $135 \cdot 7$ | 140.4 | $145{ }^{\circ} \mathrm{I}$ | $150 \cdot 0$ | I54*9 |
| 16 | $86 \cdot 7$ | $90 \cdot 5$ | $94 \cdot 3$ | $98 \cdot 3$ | 102.3 | $106 \cdot 4$ | $110 \cdot 6$ | II 4.8 | 119.1 | 123.5 | I28.0 | 132.5 | $137 \cdot 1$ | 141.8 | I $46 \cdot 5$ | $15 \mathrm{I} \cdot 3$ |
| 15 | $84 \cdot 7$ | $88 \cdot 4$ | $92 \cdot 1$ | 96.0 | 99.9 | 104.0 | 108.0 | II2.2 | 116.4 | 120.7 | 125'1 | 129.5 | 134.0 | I38.6 | 143.2 | $147 \cdot 9$ |
| 14 | 82 | 86.4 | 90'1 | 93.9 | 97*7 | 101.6 | $105 \cdot 6$ | 109*7 | II3.8 | 118.0 | 122.3 | 126.6 | 131.1 | 135.5 | $140^{\circ} 1$ | 144*7 |
| 13 | 80.9 | $84 \cdot 5$ | $88 \cdot 1$ | 91.8 | 95-6 | 99.4 | 103.3 | 107.3 | III*4 | II 5.5 | 119.7 | 123.9 | 128.3 | 132.6 | $137 \cdot 1$ | 141.6 |
| 12 | $79^{2} 2$ | 82.7 | $86 \cdot 2$ | 89.9 | $93 \cdot 6$ | $97 \cdot 3$ | IOI• 2 | 105•I | 109*0 | II3. 1 | II7.2 | 1213 | 125.6 | 129.9 | I 34.3 | $138 \cdot 7$ |
| II | 77 | $81^{\circ} 0$ | 84.5 | 88.0 | 91.6 | $95 \cdot 3$ | 99*1 | IO2.9 | 106.8 | $110 \cdot 8$ | II 4.8 | II 8.9 | 123.0 | 127.3 | 131.5 | I 35.9 |
| 10 | 76 | 79.3 | $82 \cdot 8$ | $86 \cdot 2$ | $89 \cdot 8$ | 93.4 | 97•I | IOO.9 | 104.7 | 108.6 | 112.5 | 116.5 | $120 \cdot 6$ | 124.7 | 129.0 | 133.2 |
| 9 | 74 | $77 \cdot 8$ | $8 \mathrm{I} \cdot \mathrm{I}$ | 84.6 | $88 \cdot 0$ | $9 \mathrm{I} \cdot 6$ | $95 \cdot 2$ | $98 \cdot 9$ | 102.6 | $106 \cdot 5$ | $110 \cdot 3$ | I14.3 | 118.3 | 122.4 | 126.5 | $130 \cdot 7$ |
| 8 | 73 |  | 79.6 | 82.9 | 86.4 | 898 | 93* | $97^{\circ} 0$ | 1007 | 104.4 | $108 \cdot 3$ | II2.I | II6.1 | $120^{\circ} \mathrm{I}$ | $124^{\circ} \mathrm{I}$ | $128 \cdot 3$ |
| 7 | 71 | 74.8 | $78 \cdot 1$ | 8 I 4 | 84.7 | $88 \cdot 2$ | $91 \cdot 7$ | $95^{\circ} 2$ | $98 \cdot 8$ | $102 \cdot 5$ | $106 \cdot 2$ | IIOPI | 113.9 | II7.9 | 12I.8 | 125.9 |
| 6 | 70.4 | 73.5 | $76 \cdot 6$ | 79.9 | $83 \cdot 2$ | $86 \cdot 6$ | $90^{\circ} 0$ | $93 \cdot 5$ | $97^{\circ} 0$ | $100 \cdot 6$ | $104 \cdot 3$ | 108.1 | 111.9 | $115{ }^{\circ} 7$ | 119.7 | 123.6 |
| 4 | 67 | $70 \cdot 9$ | $73 \cdot 9$ | $77 \cdot 1$ | $80 \cdot 3$ | 83.5 | $86 \cdot 8$ | 90.2 | 93.6 | 97. I | $100 \cdot 7$ | $104 \cdot 3$ | 108.0 | III•7 | 115.5 | II9.4 |
| 2 | $65 \cdot 6$ | $68 \cdot 5$ | 71.4 | 74.5 | $77 \cdot 5$ | $80^{\circ} 7$ | 83.9 | $87 \cdot 2$ | $90 \cdot 5$ | 93.9 | $97 \cdot 3$ | $100 \cdot 8$ | 104.4 | 108.0 | III•7 | 1154 |
| 0 | 63.4 | $66 \cdot 2$ | 69.1 | 72.0 | $75^{\circ} \mathrm{O}$ | $78 \cdot 1$ | 81.2 | 84.3 | $87 \cdot 5$ | $90 \cdot 8$ | $94 \cdot 2$ | $97 \cdot 6$ | IOI.O | 104.5 | 108-1 | III•7 |
| S. |  |  |  |  | 72.6 | $75 \cdot 6$ | $78 \cdot 6$ | 81•7 |  | 88.0 |  |  | $7 \cdot 8$ | IOI.2 | $104 \cdot 7$ | 108.2 |
| 2 | 59 | 62 | $64 \cdot 8$ | 67.6 | 70.4 | 73.3 | $76 \cdot 2$ | 79.1 | 82.2 | $85 \cdot 3$ | 88.4 | 91.6 | $94 \cdot 8$ | 98.I | 101.5 | 104.9 |
| 6 | 57 | $60 \cdot$ | $62 \cdot 9$ | $65 \cdot 5$ | $68 \cdot 3$ | 71.0 | $73 \cdot 9$ | $76 \cdot 8$ | $79 \cdot 7$ | $82 \cdot 7$ | $85 \cdot 7$ | 88.8 | $92 \cdot 0$ | $95 \cdot 2$ | $98 \cdot 5$ | IOI. 8 |
| 8 | 56.0 | $58 \cdot 5$ | 61.0 | 63.6 | $66 \cdot 2$ | $68 \cdot 9$ | 71.7 | 74.5 | $77 \cdot 4$ | $80 \cdot 3$ | 83.2 | $86 \cdot 2$ 83 | 89.3 | 92.4 | $95 \cdot 6$ | $98 \cdot 8$ |
| 10 | 54.3 | $56 \cdot 8$ | $59 \cdot 2$ | 6I.8 | $64 \cdot 3$ | $67 \cdot 0$ | $69 \cdot 6$ | 72.4 | $75 \cdot 1$ | $78 \cdot 0$ | 80.8 | $83 \cdot 8$ | $86 \cdot 7$ | 89.8 | 92.9 | $96 \cdot 0$ |
| 12 | 5 | 55.I | $57 \cdot 5$ | $60 \cdot 0$ |  | $65^{1} 1$ |  | $70 \cdot 3$ | 73.0 | 75.8 | 78.6 | 81.4 | 84.3 | 87.2 | 90•2 | 93.3 |
| 14 | $51 \cdot 3$ | $53 \cdot 6$ | $55^{\circ} 9$ | $58 \cdot 3$ | 60.7 | $63 \cdot 2$ | $65 \cdot 8$ | $68 \cdot 3$ | 71.0 | 73.6 | $76 \cdot 4$ | $79 \cdot 1$ | $8 \mathrm{I} \cdot 9$ | 84.8 | $87 \cdot 7$ | $90 \cdot 7$ |
| 16 | 49. | $52 \cdot 1$ | 54.4 | $56 \cdot 7$ | 59'I | 6 I 5 | 63.9 | $66 \cdot 4$ | 69.0 | $71 \cdot 6$ | $74 \cdot 2$ | $76 \cdot 9$ | $79 \cdot 7$ | 82.5 | 85.3 | $88 \cdot 2$ |
| 18 | $48 \cdot 5$ | $50 \cdot 7$ | $52 \cdot 9$ | $55^{\circ} \mathrm{I}$ |  |  | $62 \cdot 2$ | 64.6 | $67 \cdot 1$ | $69 \cdot 6$ | $72 \cdot 2$ | 74.8 | 77.5 | $80 \cdot 2$ | 83.0 | 85.8 |
| 20 | $47 \cdot 2$ | $49 \cdot 3$ | 51.4 | $53 \cdot 6$ | $55 \cdot 8$ | $58 \cdot 1$ | 60.5 | $62 \cdot 8$ | $65 \cdot 3$ | $67 \cdot 7$ | $70 \cdot 2$ | $72 \cdot 8$ | $75 \cdot 4$ | $78 \cdot 0$ | $80 \cdot 7$ | 83.4 |
| 22 | 45 | $47 \cdot 9$ | $50^{\circ} 0$ | 52.1 | 54.3 | 56.5 | 58.8 | 6I•I | 63.5 | $65^{\circ} 9$ | 68.3 | $70 \cdot 8$ | $73 \cdot 3$ | 75.9 | $78 \cdot 5$ | I'I |
| 24 | 44.6 | $46 \cdot 6$ | $48 \cdot 6$ | $50 \cdot 7$ | $52 \cdot 8$ | $55^{\circ} \mathrm{O}$ | $57 \cdot 2$ | 59.5 | 61.7 | $64^{\circ} \mathrm{I}$ | $66 \cdot 4$ | $68 \cdot 9$ | 7 I 3 | $73 \cdot 8$ | $76 \cdot 3$ | -9 |
| 26 | 43.4 | $45 \cdot 3$ | $47 \cdot 3$ | $49 \cdot 3$ | $5 \mathrm{I} \cdot 4$ | 53.5 | 55.6 | 57.8 | $60 \cdot 0$ | $62 \cdot 3$ | $64 \cdot 6$ | $67 \cdot 0$ | 69.4 | $7 \mathrm{7} \cdot 8$ | 74.3 | $76 \cdot 8$ |
| 28 | $42 \cdot 2$ | $44^{\circ} \mathrm{O}$ | $46 \cdot 0$ | $47 \cdot 9$ | 49.9 | $52 \cdot 0$ | 54.1 | $56 \cdot 2$ | 58.4 | $60 \cdot 6$ | $62 \cdot 8$ | $65 \cdot 1$ | 67.4 65.5 | 69.8 | 72.2 | 74.6 |
| 30 | 41.0 | $42 \cdot 8$ | $44^{\circ} 7$ | $46 \cdot 6$ | $48 \cdot 5$ | $50 \cdot 5$ | 52.5 | $54 \cdot 6$ | $56 \cdot 7$ | $58 \cdot 9$ | 6I.0 | 63.3 | $65 \cdot 5$ | $67 \cdot 8$ | 70.2 | $72 \cdot 6$ |
| 32 | $39 \cdot 8$ | 41.6 | 43.4 | $45^{\prime 2}$ | $47^{\circ} \mathrm{I}$ | $49^{\circ} \mathrm{I}$ | 51.0 | 53.0 | 55.1 | $57 \cdot 2$ | $59 \cdot 3$ | $6 \mathrm{I} \cdot 5$ | $63 \cdot 7$ | 65.9 | $68 \cdot 2$ | $70 \cdot 5$ |
| 34 | $38 \cdot 6$ | $40 \cdot 3$ | $42 \cdot 1$ | 43.9 | $45 \cdot 8$ | $47 \cdot 6$ | $49 \cdot 6$ | $5 \mathrm{I} \cdot 5$ | 53.5 | 55.5 | $57 \cdot 6$ | $59 \cdot 7$ | 6I•8 |  | $66 \cdot 2$ | $68 \cdot 5$ |
| 36 | 37 | $39^{\circ} 2$ | $40 \cdot 9$ 39.7 | 42 | $44^{\circ} 4$ | $46 \cdot 2$ | $48 \cdot 1$ | $50 \cdot 0$ | $5 \mathrm{I} \cdot 9$ | 53.9 | $55^{\circ} 9$ | $57 \cdot 9$ |  | $6 \cdot$ | $64 \cdot 3$ | $66 \cdot 5$ |
| 38 | $36 \cdot 4$ | $38 \cdot 0$ | $39 \cdot 7$ | $41 \cdot 4$ | $43 \cdot 1$ | 44.9 | $46 \cdot 7$ | $48 \cdot 5$ | $50 \cdot 4$ | $52 \cdot 3$ | 54.2 | $56 \cdot 2$ | $58 \cdot 2$ | $60 \cdot 3$ 58.5 | $62 \cdot 4$ | $64 \cdot 5$ |
| 40 | $35 \cdot 3$ | $36 \cdot 8$ | $38 \cdot 5$ | 40'I | 41.8 | 43.5 | $45 \cdot 3$ | 47.0 | $48 \cdot 9$ | $50 \cdot 7$ | $52 \cdot 6$ | 54.5 | $56 \cdot 5$ | $58 \cdot 5$ | $60 \cdot 5$ | $62 \cdot 5$ |

REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES
FROM UPPER MERDIAN.

* CAPELLA.

| Lat. |  | ${ }_{61}^{\text {m. }}$ | ${ }_{62}$ | ${ }_{63}$ | ${ }_{64}$ | ${ }_{65}$ | 66 | 6 | ${ }_{67}$ | ${ }_{68}$ | $\mathrm{m}_{69}$ |  |  | ${ }_{71}$ | ${ }_{72}$ | ${ }_{73}^{\mathrm{m}}$ | $\mathrm{m}_{4}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 |  | 52.2 |  |  |  | $14^{\prime} 2$ |  |  |  |  |  |  |  |  |  | ${ }^{4} \mathrm{I}$ |  |
| 19 |  |  |  |  |  |  |  | 14.933 | 15 |  |  |  | 析 32.63 | 3 38.3 |  | 355.5 |  |
| 16 |  | $3{ }^{3} \cdot 8$ | 44.92 | 250. | 55.13 |  |  | $5 \cdot 5$ |  | [ $12.1 / 3$ |  |  |  | 28.6 | 3 34.2 |  |  |
| 16 |  | $36 \cdot 2$ 32.72 |  |  |  |  |  |  |  | $12 \cdot 1$ 3 |  |  |  | 28.6 | 334.2 | $39 \cdot 8$ | 345.5 <br> 340.7 |
|  |  | $29 \cdot 42$ |  | 38.9 | 43.7 | 48.7 |  | 53.72 | 58.8 |  |  |  | 14.43 | I5 |  |  |  |
| 13 |  | 26.2 | . 8. | $235 \cdot 5$ | $40 \cdot 3$ |  |  |  | 55 |  |  |  |  | 15 | [10.93 | $326 \cdot 33$ | 3 |
| $\begin{aligned} & \text { I2 } \\ & \text { II } \end{aligned}$ |  | 23.22 |  | 2 $32 \cdot 4$ | 37.02 |  |  | 436 | $2{ }^{2} 8.12$ | 53 |  |  | $2 \cdot 9$ | 38.0 | 3 I 3 | 18.2 | 4 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 |  | 1 | 19.2 | 23.6 | 1.12 |  |  | 37.22 |  | 46 |  |  |  |  |  |  |  |
|  |  | ${ }_{1}^{12.42}$ |  | $22{ }^{\circ}$ | ${ }_{22.72}^{25.3}$ |  |  |  |  |  |  |  |  | 25 |  |  |  |
|  |  |  |  | $\left.\begin{array}{lll} 2 & 15 & 4 \end{array}\right\|_{2} ^{2}$ |  |  |  |  |  | $\left\|\begin{array}{ll} 2 & 37 \% \end{array}\right\|^{2}$ |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 3.32 | - $7 \cdot 2$ | $2{ }^{2} 11.3$ |  |  |  | 23 |  |  |  |  |  |  |  |  |  |
|  |  | 122 59.22 |  | $6 \cdot 9$ | 10.92 |  |  | 19. | $2{ }^{2} \cdot 1$ |  |  |  |  |  |  |  |  |
|  |  | 55.31 | 59.1 ${ }^{2}$ | 22.82 | $6 \cdot 72$ |  |  | $14 \cdot 5{ }^{2}$ | 18.5 | 22. |  |  | $30 \cdot 9$ | $35^{15}$ | 39 | 3.8 |  |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | $48 \cdot 4$ |  |  | $\dot{5 \cdot 8} \cdot{ }_{5}^{2}$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 45.1 |  |  | $55 \cdot 5$ I | 59 |  |  |  | . | 13.9 |  |  | $22 \times 6$ |  |  |  |
|  |  | 42.II | $45 \cdot 4$ |  | I | + |  |  |  |  |  |  |  | 2 1 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I |  | 33.7 | 36.8 | I 39.9 | 43.01 | $46 \cdot 2$ |  | 494 | I2 |  |  |  |  |  |  |  |  |
|  |  | 38. ${ }_{2}$ | ${ }_{31}^{34} \cdot 5$ | 37.1 | ${ }_{3} \cdot 21$ | I $43 \cdot 3$ |  | 46.4 | I 499.61 |  |  |  |  |  |  |  |  |
|  |  | $26 \cdot 2$ I |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 20.71 |  |  |  |  |  |  |  |  |  | I 53.2 |  |  |
| 26 |  | 19.31 1 | 1 | 24.6 | 27.2 |  |  | 32.71 | 35.5 | 138 |  |  | 441 | 1 |  | 1 |  |
| 28 30 |  | 15.01 |  |  | 24.81 | $\bigcirc$ |  |  | $130 \cdot 31$ |  |  |  |  |  |  | $\begin{array}{ll} 1 & 500 \\ 147^{\circ} \end{array}$ |  |
|  |  | $15.01$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 10.81 |  | 15.5 | , | 20.3 |  |  |  |  |  |  | 33. | I 35.6 | I 38.3 |  |  |
|  |  | 8.71 |  | 13.3 | 15.61 |  |  |  |  | 25 |  |  |  |  |  |  |  |
| 4 |  | 4.61 |  |  |  |  |  | 8.61 5 | 20 | 120.21 |  |  | [4.9 ${ }^{27.61}$ |  |  | 13231 | 1 |

TRUE BEARING OR AZIMUTH OF * CAPELLA.

| Lat. | $\stackrel{4}{4}$ | m. | ${ }_{12}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{1 6} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 20 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 24 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 28 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 32 \end{aligned}$ | $\begin{gathered} \mathrm{m} . \\ \hline 6 \end{gathered}$ | $\frac{\mathrm{m}}{40}$ | $\begin{aligned} & \mathrm{m} \\ & \mathbf{4 4} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{4 8} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 52 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 60 \end{aligned}$ | $\mathrm{m}_{70} .$ | $\begin{aligned} & \mathrm{m} . \\ & 80 \end{aligned}$ | $\begin{aligned} & 90 \\ & 90 \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |

N.

|  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | 1.6 | $3 \cdot 2$ | 4.8 | $6 \cdot 3$ | $7 \cdot 9$ | $9 \cdot 4$ |
| 19 | I. 5 | $3 \cdot 1$ | $4 \cdot 6$ | 6.1 | $7 \cdot 6$ | $9 \cdot 1$ |
| 18 | 1.5 1.5 | 3.0 | 4.4 |  | ${ }_{7}^{7} 1$ | 8.8 8.5 |
| 16 | I•4 | 2.8 | 4.2 | 5.6 | $6 \cdot 9$ | 8.3 |
| 14 | r.3 | 2.6 | $3 \cdot 9$ | 5.2 | 6.5 | 7.8 |
| 12 | r ${ }^{2}$ | 2.5 | $3 \cdot 7$ | $5 \cdot 0$ | $6^{6 \cdot 2}$ | $7 \cdot 4$ |
| ${ }^{10} 8$ | I 2 | 2.4 2.3 | 3.6 | $4 \cdot 7$ | $5 \cdot 6$ | 7.1 6.7 |
|  | I. $\begin{aligned} & \text { I. } \\ & \text { I }\end{aligned}$ | 2.3 | ${ }^{3} 1.4$ | 4.2 | $5_{5 .}{ }^{\circ}$ |  |
| $\stackrel{4}{0}$ | r.o | I-9 | $2 \cdot 9$ | 3.9 | 4.8 | 5.8 |
| S. |  |  |  |  |  |  |
| \% | ${ }_{0}^{0.9}$ | ${ }_{1} 18$ | 2.7 2.5 | $3 \cdot 6$ | 4.5 | $5{ }_{5}^{5 \cdot}$ |
| 10 20 | 0.8 | 1.7 1.5 1 | 2.5 2.3 | 3.4. | ${ }_{3}^{4.2}$ | $5^{5 \cdot}{ }^{\circ}$ |
| 30 | 0.7 | $1 \cdot 4$ | $2 \cdot 2$ | $2 \cdot 9$ | $3 \cdot 6$ | $4 \cdot 3$ |
| 40 | 0.7 | $1 \cdot 4$ | $2 \cdot 1$ | 2.8 | $3 \cdot 5$ | 4.2 |

## AZIMUTHS.

|  | 12.5 | 13.9 | $15 \cdot 3$ | $16 \cdot 7$ | $18 \cdot 1$ |  | 22.0 | -0 | . 8 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 12.0 | I3 | 5 | 16.2 | 17.5 |  | $2{ }^{1} 4$ | $24 \cdot 3$ | 27.0 |  |
|  | 11.6 |  | 14.4 | 15.7 |  | 18.3 | 20.7 | $23 \cdot 6$ |  |  |
| 9.6 | I1.3 | 12.6 | 13.9 | 15.20 | 16 | 17.8 | 20.2 | 23.0 | $25 \cdot 6$ |  |
| 9.6 | 10.9 | $12 \cdot 3$ | 13.5 | 14.8 | 16 | 17.3 | 19.6 | $22 \cdot 4$ | $25^{\circ}$ | $27 \cdot 4$ |
|  | 10. | 11.6 | 12.8 |  |  |  | 18.6 |  |  | $2 \cdot 2$ |
|  | 9.8 | 11.0 | 12.2 | I3 |  | It | 17.7 | $20 \cdot 3$ |  |  |
| 8.2 7.8 | 8.4 | 10.5 | ${ }_{\text {IT }}^{11} 1$ | 12.2 |  | 14.9 | I6.2 | ${ }_{18}^{19}$ | 21.8 21.0 |  |
|  | 8.2 | 9.2 | 10.2 | 11.2 | $12 \cdot 2$ | 13.2 | 15.2 | 17 |  | 21.6 |
| $6 \cdot 7$ | 7.7 | 8.6 | 9.5 | 5 | ${ }^{11} 4$ | $12 \cdot 3$ | ${ }^{14.1}$ | 16 | 18.3 |  |
|  |  | 8.0 |  | 9 | 10.6 | 114 | 13 | 15.1 | 16 |  |
|  | $6 \cdot 1$ | 6.8 | 8.3 |  | ${ }_{0}^{9.9}$ | 10.7 |  | 14.3 | 16.2 |  |
|  |  | $6 \cdot 4$ |  | 7.8 | 8.5 | $9 \cdot 2$ | 10.6 |  | 14 | 15 |
| $4 \cdot 9$ | 5.6 | $6 \cdot 3$ | 6.9 | 7.6 | $8 \cdot 3$ | $9{ }^{\circ} \mathrm{O}$ | $10^{\circ} 4$ | 12 | 13.8 | 15.4 |

* CAPELLA.

| Lat. | ${ }_{4} \mathrm{~m}$. | ${ }_{8} \mathrm{~m}$. | ${ }_{12}$ | ${ }_{16}$ | ${ }_{20}$ | ${ }_{24}$ | $\mathrm{m}_{26}$ | $\begin{aligned} & \mathrm{m} . \\ & 28 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 0 \end{aligned}$ |  | $\frac{\mathrm{m}}{\mathrm{~m}}$ | $\frac{\mathrm{m}}{36}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 40 \end{aligned}$ | 42 | $\begin{aligned} & \mathrm{m} \\ & \mathbf{4 4} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ} 6$ | $0 \cdot 3$ | roo | $2 \cdot 3$ | $4^{\cdot 1}$ | $6 \cdot 3$ |  | 10.7 | 12.4 | 14.2 | 16. 2 | 18.3 | 20.5 | 22.8 | $25 \cdot 3$ | 27.9 | . 6 |
| 48 | $0 \cdot 2$ | - | $2 \cdot 2$ | 3.9 | $6 \cdot 1$ | 8.8 | $10 \cdot 3$ | 12.0 | 13.7 | 15.6 | $17 \cdot 7$ | 19.8 | 22.1 | 24.5 | 27*0 | $29 \cdot 6$ |
| 50 | $0 \cdot 2$ | $\bigcirc \cdot 9$ | $2 \cdot \mathrm{I}$ | $3 \cdot 8$ | $5 \cdot 9$ | $8 \cdot 5$ | 10.0 | $\mathrm{Ir}_{5} 5$ | 13.2 | I5.1 | 17.0 | I9. 1 | 21.2 | 23.5 | $25^{\circ} 9$ | 28.4 |
| 52 | 0.2 | $0 \cdot 9$ | $2 \cdot 0$ | 3.6 | $5 \cdot 7$ | $8 \cdot 2$ | 9.6 | II.I | 12.7 | 14.5 | 16.4 | 18.4 | $20 \cdot 5$ | 22.7 | 25.0 | 27.4 |
| 54 | $0 \cdot 2$ | $\bigcirc \cdot 9$ | I-9 | $3 \cdot 5$ | $5 \cdot 4$ | 7.8 | $9 \cdot 2$ | 10.6 | 12.2 | 13.9 | $15 \cdot 7$ | 17.6 | 19.6 | 21•7 | 23.9 | $26 \cdot 2$ |
| 56 | 0.2 | $0 \cdot 8$ | 1-9 | $3 \cdot 3$ | $5 \cdot 2$ | $7 \cdot 5$ | $8 \cdot 8$ | 10.2 | IIP7 | 13.3 | $15 \cdot 1$ | 16.9 | 18.8 | $20 \cdot 9$ | $23^{\circ}$ | 25.2 |
| 58 | $0 \cdot 2$ | $0 \cdot 8$ | r. 8 | 3.2 | 5.0 | $7 \cdot 2$ | $8 \cdot 4$ | $9 \cdot 7$ | 11.2 | 12.7 | 14.4 | $16 \cdot 1$ | 17.9 | 19.8 | 21.9 | $24^{\circ}$ |
| 60 62 | 0. | 0.8 | 1.7 | 3.0 | $4 \cdot 7$ | $6 \cdot 8$ | $8 \cdot 0$ | 9.3 8.8 | $10 \cdot 7$ | 12.2 | 13.7 | 15.4 | 17.1 16.2 | $19^{\circ} \mathrm{O}$ | 20.9 19 | 23.0 $2 r^{\circ} \cdot$ |
| 62 64 | 0.2 0.2 | 0.7 0.7 | r.5 | 2.9 2.7 | 4.5 4.2 | $6 \cdot 5$ | $7 \cdot 6$ | $8 \cdot 3$ | 10.1 9.5 | 12.5 10.9 | 13.0 12.3 | 14.6 13.7 | 16.2 $15 \%$ | 17.0 | 19.8 18.7 | $21 \cdot 7$ $20 \cdot 5$ |
| Lat. | ${ }_{45}$. | ${ }_{48}$ | ${ }_{47}$ | ${ }_{48} \mathrm{~m}$. | ${ }_{49}{ }_{4}$ | 50 | 51 | $52$ | $53$ | ${ }_{54}{ }_{5}$ | $\begin{gathered} \mathrm{m} . \\ 55 \end{gathered}$ | $\frac{\mathrm{m}}{\mathrm{~m}}$ | $\mathrm{m}_{5 \%}$ | $\begin{gathered} \mathrm{m} . \\ 58 \end{gathered}$ | $\begin{gathered} \mathrm{m} . \\ 59 \end{gathered}$ | $\mathrm{m}_{60}$ |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{8}{46}$ | 32.0 | $33^{\prime} \cdot 4$ | 34.9 | 36.4 | 37.9 | 39.4 | $4{ }^{\circ} \mathrm{O}$ | $42 \cdot 6$ | 44.3 | 46́o | $47 \cdot 7$ | $49 \cdot 4$ | $5 \mathrm{I} \cdot 2$ | $53^{\circ} \mathrm{O}$ | 54.8 | 56.7 |
| 48 | 30.8 | $32 \cdot 2$ | $33 \cdot 6$ | $35 \cdot \mathrm{I}$ | $36 \cdot 5$ | $38 \cdot \mathrm{r}$ | $39 \cdot 6$ | 41.2 | $42 \cdot 7$ | 44.4 | $46 \cdot 0$ | $47 \cdot 7$ | 49.4 | $5{ }^{\text {P }}$ I | 52.9 | 54.7 |
| 50 | 29.7 | $3 \mathrm{I} \cdot \mathrm{I}$ | 32.4 | 33.8 | $35 \cdot 2$ | $36 \cdot 7$ | 38.I | $3{ }^{6} 6$ | $4{ }^{1} 2$ | $42 \cdot 7$ | 44.3 | $46 \cdot 0$ | $47 \cdot 6$ | $49 \cdot 3$ | $51 \cdot 0$ | $52 \cdot 7$ |
| 52 | 28.6 | 29.9 | $3 \mathrm{I} \cdot 2$ | 32.5 | 33.9 | $35 \cdot 3$ | 36•7 | 38.1 | $39 \cdot 6$ | 41. 1 | $42 \cdot 7$ | $44^{2}$ | $45 \cdot 8$ | $47 \cdot 4$ | $49^{\circ}$ | $50 \cdot 7$ |
| 54 | 27.5 | $28 \cdot 7$ | 29.9 | 31.2 | $32 \cdot 5$ | 33.9 | 35.2 | $36 \cdot 6$ | $38 \cdot 0$ | $39 \cdot 5$ | 41.0 | $42 \cdot 5$ | $44^{\circ}$ | $45 \cdot 5$ | 47.1 | $48 \cdot 7$ |
| 56 | 26.3 | 27.5 | 28.7 | 29.9 | $3 \mathrm{r} \cdot 2$ | 32.4 | 33.7 | 35. 1 | $36 \cdot 4$ | $37 \cdot 8$ | 39.2 | $40 \cdot 7$ | $42^{\prime} \mathrm{I}$ | $43 \cdot 6$ | $45 \cdot \mathrm{I}$ | $46 \cdot 7$ |
| 58 | $25 \cdot 1$ | $26 \cdot 2$ | 27.4 | 28.6 | $30^{\circ} \mathrm{O}$ | $3 \mathrm{I} \cdot 0$ | 32.2 | 33.5 | 34.8 | 36.1 | 37.5 | $38 \cdot 8$ | $40 \cdot 2$ | $4{ }^{1} 6$ | $43 \cdot 1$ | 44.6 |
| 59 | 24.5 | $25 \cdot 6$ | $26 \cdot 7$ $26 \cdot 1$ | 27.9 | 29.0 28.3 | $30 \cdot 2$ 20.5 | 31.5 | $32 \cdot 7$ | $34^{\circ} \mathrm{O}$ | $35 \cdot 3$ 34 | $36 \cdot 6$ | 37.9 | 39.3 | $40 \cdot 7$ | $42 \cdot \mathrm{I}$ | 43.5 |
| 60 | 23.9 | $25^{\circ}$ | $26 \cdot 1$ | $27 \cdot 2$ | $28 \cdot 3$ | $29 \cdot 5$ | $30 \cdot 7$ | 3r.9 | $33^{\prime}$ I | 34.4 | $35 \cdot 7$ | $37 \cdot 0$ | $38 \cdot 3$ | 39•7 | $4{ }^{\circ}$ | $42 \cdot 5$ |
| 61 | 23.3 | 24.3 | 25.4 | 26. | $27 \cdot 6$ | 28.8 | 29.9 | 3I•I | $32 \cdot 3$ | $33 \cdot 5$ | $34 \cdot 8$ | $36 \cdot 0$ | $37 \cdot 3$ | 38.7 | $40 \cdot 0$ | 41.4 |
| 62 | 22.7 | 23.7 | $24^{-8}$ | 25.8 | $26 \cdot 9$ | 28 | $29 \cdot 1$ | $30 \cdot 3$ | $31 \cdot 5$ | 32.7 | $33^{\circ} 9$ | $35^{\prime} \mathrm{I}$ | $36 \cdot 4$ | 37.7 | $39^{\circ}$ | $40 \cdot 3$ |
| 63 | 22.1 | 23.0 | 24.1 23.4 | $25^{1} \mathrm{I}$ | $26 \cdot 2$ | $27 \cdot 2$ | 28.3 | 29.4 | $30 \cdot 6$ | 31.8 | 32.9 | $34^{\prime}$ I | 35.4 | 36.6 | 37.9 | $39^{2} 2$ |
| 64 | 21.5 | 22.4 | 23.4 | 24.4 | 25.4 | 26.5 | 27.5 | 28.6 | 29.7 | $30 \cdot 9$ | $32^{\circ} \mathrm{O}$ | 33.2 | 34.4 | $35 \cdot 6$ | $36 \cdot 8$ | 38.1 |
| Lat. | $\pm$ HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{0} \mathrm{~m}$. | ${ }_{1}$. | ${ }_{2}$ | ${ }_{3}{ }_{3}$ | ${ }_{4}$ | m. | ${ }_{6}$. | m. | m. <br> 8 | ${ }_{9}$. | ${ }_{10}$ | ${ }_{11}$ | ${ }_{12}$. | ${ }_{13}$ | ${ }_{14}$ | ${ }_{15}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 46 | 56.7 | 58́6 | $60 \cdot 5$ | 62.4 | 64.4 | 66. 4 | 68.5 | 70.6 | 72.7 | $74 \cdot 8$ | $77 \times 0$ | $79 \cdot 2$ | 8 I 4 | $83 \cdot 7$ | 86.0 | 88.3 |
| 47 | $55 \cdot 7$ | $57 \cdot 5$ | 59.4 | $6 \mathrm{I} \cdot 3$ | $63 \cdot 3$ | $65 \cdot 3$ | $67 \cdot 3$ | $69 \cdot 3$ | $7 \mathrm{I} \cdot 4$ | $73 \cdot 5$ | 75.6 | 77.8 | $80 \cdot 0$ | $82 \cdot 2$ | 84.5 | $86 \cdot 7$ |
| 48 | 54.7 | 56.5 | $58 \cdot 4$ | $60 \cdot 3$ | $62 \cdot 2$ | $64 \cdot 1$ | $66 \cdot 1$ | 68.1 | $70 \cdot 2$ | $72 \cdot 2$ | 74.3 | $76 \cdot 5$ | $78 \cdot 6$ | $80 \cdot 8$ | $83^{\circ}$ | 85.2 |
| 49 | $53 \cdot 7$ | 55.5 | $57 \cdot 3$ | $59^{\circ} 2$ | $61^{\circ} \mathrm{O}$ | $63^{\circ} \mathrm{O}$ | 64.9 | $66 \cdot 9$ | $68 \cdot 9$ | $70 \cdot 9$ | $73^{\circ}$ | $75^{\circ}$ | 77.1 | 79.3 | $8 \mathrm{r} \cdot 5$ | 83.7 |
| 50 | $52 \cdot 7$ | 54.5 | $56 \cdot 3$ |  | 59.9 | 6I•8 | $63 \cdot 7$ | $65 \cdot 6$ | $67 \cdot 6$ | $69 \cdot 6$ | 71.6 | $73 \cdot 7$ | $75 \cdot 7$ | $77 \cdot 8$ | 80\% | 82.2 |
| 51 | $5 \mathrm{I} \cdot 7$ | 53.4 | 55.2 | 57.0 | 58.8 | $60 \cdot 6$ | 62.5 | 64.4 | $66 \cdot 3$ | $68 \cdot 3$ | $70 \cdot 3$ | 72.3 | $74^{3} 3$ | 76.4 | 78.4 | $80 \cdot 6$ |
| 52 | $50 \cdot 7$ | 52.4 | 54'1 | 55.9 | 57.7 | 59.5 | $61 \cdot 3$ | 63.2 | $65 \cdot 1$ | $67 \cdot 0$ | $68 \cdot 9$ | 70.9 | 72.9 | 74.9 | $77^{\circ} \mathrm{O}$ | 79.0 |
| 53 | $49 \cdot 7$ | $5 \mathrm{I} \cdot 4$ | 53'I | 54.8 | $56 \cdot 5$ | $58 \cdot 3$ | $60 \cdot 1$ | $61 \cdot 9$ | 63.8 | $65 \cdot 7$ | $67 \cdot 6$ | $69 \cdot 5$ | 71.4 | 73.4 | 75.4 | 77.5 |
| 54 | $48 \cdot 7$ | $50 \cdot 3$ | $52 \cdot 0$ | $53 \cdot 7$ | 55.4 | 57.1 | 58.9 | 60.6 | $62 \cdot 5$ | $64 \cdot 3$ | $66 \cdot 2$ | 68.0 | $69 \cdot 9$ | 71.9 | $73 \cdot 8$ | $75 \cdot 8$ |
| 55 | 47•7 | $49 \cdot 3$ | 50.9 | 52 | 5 | 55.9 | 57.6 | 59.4 | $6 \mathrm{I} \cdot 2$ | $63^{\circ}$ | 64.8 | $66 \cdot 6$ | 68.5 | $70 \cdot 4$ | $72 \cdot 3$ | 74.3 |
| 56 | $46 \cdot 7$ | $48 \cdot 2$ | $49 \cdot 8$ | 51.4 | 53.0 | 54.7 | $56 \cdot 4$ | 58.1 | 59.8 | 6r.6 | 63.4 | 65.2 | $67 \cdot 1$ | $68 \cdot 9$ | $70 \cdot 8$ | 72.7 |
| 57 | $45 \cdot 6$ | 47-1 | $48 \cdot 7$ | $50 \cdot 3$ | 51.9 | 53.5 | $55 \cdot 1$ | 56.8 | $58 \cdot 5$ | 60.2 | $62 \cdot 0$ | 63.8 | 65.6 | $67 \cdot 4$ | 69.2 | $71 \cdot 1$ |
| 58 | $44 \cdot 6$ | $46 \cdot 1$ | $47 \cdot 6$ | $49 \cdot 1$ | $50 \cdot 7$ | $52 \cdot 3$ | 53.9 | 55.5 | 57.2 | 58.8 | $60 \cdot 6$ | $62 \cdot 3$ | $64^{\circ} \mathrm{O}$ | $65 \cdot 8$ | $67 \cdot 6$ | 69.4 |
| 59 | $43 \cdot 5$ | $45^{\circ}$ | $46 \cdot 4$ | $47 \cdot 9$ | $49 \cdot 5$ | $5 \mathrm{I}^{\circ} \mathrm{O}$ | $52 \cdot 6$ | 54.2 | $55 \cdot 8$ | $57 \cdot 5$ | 59•1 | $60 \cdot 8$ | $62 \cdot 5$ | 64.3 | $66 \cdot 1$ | $67 \cdot 8$ |
| 60 | $42 \cdot 5$ | 43.9 | $45^{\circ} 3$ | 46 | $48 \cdot 3$ | $49 \cdot 8$ | $51 \cdot 3$ | 52.9 | 54.5 | $56 \cdot 1$ | $57 \cdot 7$ | 59.3 | 61.0 | $62 \cdot 7$ | 64.4 | $66 \cdot 2$ |
| 61 | $41 \cdot 4$ | 42•8 | $44^{2}$ | $45 \cdot 6$ | $47^{\circ} \mathrm{O}$ | $48 \cdot 5$ | 50.0 | $5 \mathrm{r} \cdot 5$ | 53.1 | $54 \cdot 6$ | $56 \cdot 2$ | $57 \cdot 8$ | 59.5 | 61.I | $62 \cdot 8$ | 64.5 |
| 62 | $40 \cdot 3$ | $4 \mathrm{r} \cdot 6$ | $43^{\circ} \mathrm{O}$ | 44.4 | $45 \cdot 8$ | $47^{\circ} 3$ | $48 \cdot 7$ | 50.2 | $5 \mathrm{I} \cdot 7$ | 53.2 | $54 \cdot 8$ | $56 \cdot 3$ | 57*9 | 59.5 | $6 \mathrm{r} \cdot \mathrm{I}$ | 62.8 |
| 63 | $39^{\prime 2}$ | $40 \cdot 5$ | 41.8 | 43.2 | $44^{6} 6$ | $46 \cdot 0$ | 47.4 | 48.8 | $50 \cdot 3$ | 51.8 | 53.3 | $54 \cdot 8$ | $56 \cdot 3$ | 57.9 | 59.5 | 6I•r |
| 64 | 38.1 | $39^{\circ} 4$ | $40 \cdot 6$ | 42 | $43 \cdot 3$ | $44 \cdot 6$ | $46 \cdot 0$ | $47 \cdot 4$ | $48 \cdot 8$ | $50 \cdot 3$ | $5 \mathrm{I} \cdot 8$ | 53.3 | 54.8 | $56 \cdot 3$ | $57 \cdot 8$ | 59.4 |
| La | - HOUR. |  |  |  |  |  |  |  |  | I HOUR. |  |  |  |  |  |  |
|  | ${ }_{4} \mathrm{~m}$. | ${ }_{8} 8$ | ${ }_{12}$ | $\begin{aligned} & \mathrm{m} \\ & 16 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 20 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 24 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 30 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{4 0} \end{aligned}$ | $\frac{\mathrm{m}}{50}$ | $\begin{aligned} & \mathrm{m} . \\ & 00 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{1 0} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 20 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 30 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 40 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 50 \end{aligned}$ | $\mathrm{m}_{60}$ |
| N |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{46}$ | $0 \cdot 7$ | ${ }^{\circ}{ }_{4}$ | $2 \cdot 1$ | $2 \cdot 8$ | $3 \cdot 5$ | $4^{\circ} 2$ | $5 \cdot 2$ | $6{ }^{\circ} 9$ | $8^{\circ} 7$ | 10.4 | $12 \cdot 1$ | 13.8 | 15.5 | $17 \cdot 1$ | 18.8 | $20^{\circ} 5$ |
| 50 | $0 \cdot 7$ | r 4 | $2 \cdot 1$ | 2.8 | $3 \cdot 5$ | $4 \cdot 2$ | $5 \cdot 2$ | $7 \cdot 0$ | $8 \cdot 7$ | 10.4 | 12.2 | r3*9 | 15.6 | 17.3 | 19.0 | $20 \cdot 6$ |
| 54 | 0.7 | 1.4 | $2 \cdot 1$ | 2.8 2.8 | $3 \cdot 5$ | $4 \cdot 2$ | $5 \cdot 3$ | $7 \cdot 0$ | 8.8 | $10 \cdot 6$ | 12.3 | 14.2 | 15.8 | 17.5 | 19.2 | $20 \cdot 9$ |
| 56 | $0 \cdot 7$ | 1.4 | $2 \cdot 1$ | $2 \cdot 8$ | $3 \cdot 6$ | $4 \cdot 3$ | $5 \cdot 3$ | $7 \cdot 1$ | $8 \cdot 9$ | $10 \cdot 6$ | 12.4 | 14.2 | 15.9 | 17.6 | 19.4 | 25.5 |
| 58 | $0 \cdot 7$ | 1.4 | - 1 | $2 \cdot 9$ | $3 \cdot 6$ | $4 \cdot 3$ | $5 \cdot 4$ | $7 \cdot 2$ | $8 \cdot 9$ | 10.7 | 12.5 | 14.3 | 16.0 | 17.8 | 19.6 | $2 \mathrm{I} \cdot 3$ |
| 60 62 | $0 \cdot 7$ | 1.4 | 2.2 2.2 | 2.9 | 3.6 3.7 | $4 \cdot 3$ | $5 \cdot 4$ | $7 \cdot 2$ | $9 \cdot 0$ | 10.8 | 12.6 | 14.4 | 16.2 | 18.0 | $19 \cdot 8$ | 21.5 |
| 62 64 | 0.7 0.7 | r.5 r. | 2.2 2.2 | 2.9 3.0 | 3.7 3.7 | 4.4 4 | 5.5 5.6 | $7 * 3$ $7 \times 4$ | $9 \cdot 1$ $9 \cdot 2$ | II.O <br> II | 12.8 12.9 | 14.0 14.8 | $16 \cdot 4$ $16 \cdot 6$ | 18.2 18.5 | $20 \cdot 0$ $20 \cdot 3$ | 21.8 22.2 |

## REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM MERIDIAN BELOW THE POLE.

## * CAPELLA.

| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{16}$ | ${ }_{17}$ | ${ }_{18}^{\mathrm{m}}$ | m. 19 | ${ }_{20}$ | ${ }_{21}$ | ${ }_{22}$ | ${ }_{23}{ }^{\text {m }}$ | ${ }_{24}$ | ${ }_{25}$ | ${ }_{26}$ | ${ }_{27}$ | ${ }_{28}$. | ${ }_{29}$. | ${ }_{30}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | 4.6 |  | róg. 7 | II2.4 | 115.0 | 117.7 | 120'5 | 123.2 | 126.0 | 128.8 |
| 45 | 92.2 90.6 | ${ }^{94}{ }^{\circ} \mathrm{6}$ | $97 \cdot 0$ $95 \cdot 4$ | $99 \cdot 5$ 97.8 | 102.0 100.3 | 2. ${ }^{\circ}$ | $7 \cdot 1$ | 107.9 | $110 \cdot 5$ | 113.I | 115.7 | 118.4 | $12 \mathrm{I} \cdot \mathrm{I}$ | 123.9 | 126.6 |
| 47 | 89.0 | 91.4 | 93.7 | 96. 1 | $98 \cdot 6$ | Ior* | 103.5 | 1060 | 108.6 | III•I | 113.7 | 116.4 | 11900 | 121.7 | 124.5 |
| 48 | 87.5 | 89.8 | 92.1 | 94.4 | $96 \cdot 8$ | $99^{2}$ | ror' 7 | 104.2 | 106.7 | $109 \cdot 2$ | 1117 | 114.3 | 116.9 | 119.6 | 122.3 |
| 49 | 85.9 | $88 \cdot 1$ | $90 \cdot 4$ | $92 \cdot 7$ | $95^{1} 1$ | 97.5 | $99^{\circ} 9$ | 102.3 | 104.7 | $107 \cdot 2$ | $109 \cdot 7$ | 112.3 | 114.8 | 117.4 | 120.1 |
| 50 | 84.3 | $86 \cdot 5$ | 88.8 | 91.0 | 93.3 | 95.7 | 98.0 | $100 \cdot 4$ | 102.8 | 105.3 | 107.7 | 110.2 | 112.7 | 115*3 | 117.9 |
| 5 I | 82.7 | 84.9 | 87.1 | 89.3 | 91.6 | $93 \cdot 9$ | $96 \cdot 2$ | 98.5 | 100.9 | 103.3 | 105.7 | 10 | $110 \cdot 6$ | 113.1 | 115.7 |
| 52 | 81.1 | 83.2 | 85.4 | 87.6 | 89.8 | $92 \cdot \mathrm{I}$ | 943 | $96 \cdot 6$ | $98 \cdot 9$ | $101 \cdot 3$ | 103.7 | 10 | 108.5 | 110.9 | 113.4 |
| 53 | $79 \cdot 5$ | $8 \mathrm{r} \cdot 6$ | 83.7 | 85.9 | 88.0 | $90 \cdot 2$ | 92.5 | $94^{\prime 7}$ | $97^{\circ}$ | 99.3 | 101.6 | $104{ }^{\circ} 0$ | $106 \cdot 4$ | 108.8 | 1112 |
| 54 | 77.9 | 79.9 | $82 \cdot 0$ | $84 \cdot 1$ | $86 \cdot 3$ | 88.4 | 90.6 | $92 \cdot 8$ | $95^{\circ}$ | $97 \cdot 3$ | 99.6 | 101.9 | 104.2 | 106.6 | 108.9 |
| 55 | $76 \cdot 3$ | 78 | $80 \cdot 3$ | 82.4 | 84.5 | $86 \cdot 6$ | $88 \cdot 7$ | $90 \cdot 9$ | 93.0 | $95 \cdot 2$ | 97:5 | 99.7 | 102.0 | 104.3 | 106.7 |
| 56 | 74.6 | 76 | 78.6 | 80.6 | 82.6 | $84^{\prime} 7$ | 86.8 | 88.9 | 91.0 | $93 \cdot 2$ | $95 \cdot 4$ | $97 \cdot 6$ | 99.8 | 102.I | LO4.4 |
| 57 | 73.0 | 74.9 | $76 \cdot 8$ | 78.8 | $80 \cdot 8$ | $82 \cdot 8$ | 84.9 | 86.9 | 89.0 | $9 \mathrm{I} \cdot 1$ | $93 \cdot 3$ | 95.4 | 97.6 | 99.8 | 102. 1 |
| 58 | 71.3 | $73 \cdot 2$ | $75 \cdot 1$ | 77.0 | $79^{\circ} \mathrm{O}$ | 80.9 | 82.9 | 84.9 | $87 \cdot 0$ | 89.1 | 91.I | $93 \cdot 3$ | 95.4 | $97 \cdot 6$ | 99.8 |
| 59 | 69.6 | 71.5 | $73 \cdot 3$ | 75.2 | $77 \cdot 1$ | $79^{\circ}$ | $8 \mathrm{I}^{\circ} \mathrm{O}$ | $82 \cdot 9$ | 84.9 | 87.0 | $89^{\circ} \mathrm{O}$ | ${ }^{91} \times 1$ | 93.2 | $95 \cdot 3$ | $97 \cdot 4$ |
| 60 | 67.9 | 69.7 | 7 r 5 | 73.4 | 75.2 | $77 \cdot 1$ | $79^{\circ}$ | $8{ }^{8 \cdot 9}$ | 82.9 | $84^{8} 8$ | 86.8 | $88 \cdot 9$ | $90^{\circ}$ | $92 \cdot 9$ | $95^{\circ} \mathrm{O}$ |
| 61 | $66 \cdot 2$ | $68 \cdot 0$ | $69^{\circ} 7$ | $71 \cdot 5$ | 73.3 | 75.2 | $77^{\circ}$ | $78 \cdot 9$ | 80.8 | 82.7 | 84.6 82.4 |  | 88.6 86.3 | 98.6 | $92 \cdot 6$ |
| 62 | 64.5 | $66 \cdot 2$ | 67.9 | 69.6 | 714 | $73 \cdot 2$ | $75{ }^{\circ}$ | 76 | $78 \cdot 7$ | 80.5 | 82 | 3 | $86 \cdot 3$ |  | $90 \cdot 2$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| L | ${ }_{31}$ | ${ }_{32}$ | ${ }_{33}$ | ${ }_{34}$ | ${ }_{35}$ | ${ }_{36}$. | ${ }_{37}$ | ${ }_{38}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline \end{aligned}$ | $\mathrm{m}_{40}$ | $\frac{\mathrm{m}}{\mathrm{~m}}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 1 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 43 \end{aligned}$ | $\frac{\mathrm{m}}{44}$ | ${ }_{45}$. |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 44 | 3.9 | 136.8 |  |  | 45.7 | 48.8 | 151.8 | 154.9 |  | 161.2 |  | 167.6 |  | 4.2 | $7 \cdot 5$ |
| 45 | $13 \mathrm{I} \cdot 6$ | 134.5 | 137.4 | $140 \cdot 4$ | $143 \cdot 3$ | 146.3 | 149.3 | 152.4 | 155.5 | 158.6 | $161 \cdot 7$ | 164.9 | 168.1 | 171.3 | 174.6 |
| 46 | 129.4 | 132.3 | 135.1 | 138.0 | 140.9 | $143 \cdot 8$ | 146.8 | 149.8 | $152 \cdot 8$ | 155.9 | 159.0 | 162.I | 165.3 | 168.4 | 171.6 |
| 47 | 127.2 | $130 \cdot 0$ | $132 \cdot 8$ | 135.6 | 138.5 | 1414 | 144.3 | $147 \cdot 2$ | $150 \% 2$ | 153.2 | $156 \cdot 3$ | 159.3 | 162.4 | 165.5 | 168.7 |
| 48 | 125.0 | 127.7 | $130 \cdot 5$ | 133.2 | $136 \cdot 1$ | 138.9 | 141.8 | 144.7 | $147 \cdot 6$ | 150.6 | 153.5 | 156.5 | 159.6 | 162.7 | 165.7 |
| 49 | 122.7 | 125.4 | 128.1 | $130 \cdot 9$ | 133.6 | 136.4 | 139.2 | 142.I | 145.0 | 147.9 | $150 \cdot 8$ | 153.8 | 156.7 | 159.8 | 162.8 |
| 50 | $120 \cdot 5$ | $123 \cdot 1$ | 125.8 | 128.5 | 131.2 | 133.9 | 136.7 | 139.5 | 142.3 | 145.2 | 148.0 | $150 \cdot 9$ | 153.9 | 156.8 | 159.8 |
| 5 I | 118.2 | 120.8 | 123.4 | $126 \cdot 1$ | 128.7 | $13 \mathrm{r} \cdot 4$ | 134.1 | 136.9 | 139.6 | 142.4 | $145 \cdot 3$ | 148.1 | 1510 | 153.9 | 156.8 |
| 52 | 115.9 | 118.5 | 121.0 | 123.6 | 126.2 | 128.9 | 131.5 | 134.2 | 137.0 | 139.7 | $142 \cdot 5$ | 145.3 | 148.1 | $150 \cdot 9$ | $153 \cdot 8$ |
| 53 | 113.6 | 116.1 | 118.6 | 121.2 | 123.7 | 126.3 | $129^{\circ}$ | 131.6 | 134.3 | 137.0 | 139.7 | 142.4 | 145.2 | 148.0 | $150 \cdot 8$ |
| 54 | III 3 | 113.8 | 116.2 | 118.7 | 121.2 | 123.8 | 126.3 | 128.9 | 131.5 | 134.2 | 136.8 | 139.5 | $142 \cdot 3$ | $145^{\circ}$ | 1478 |
| 55 | 109.0 | 111.4 | 113.8 | 116.3 | 118.7 | 121.2 | 123.7 | $126 \cdot 3$ | 128.8 | 131.4 | I 34.0 | 136.6 | $139 \cdot 3$ | 142.0 | 144.7 |
| 56 | 106.7 | 109.0 | 1114 4 | 113.8 | 116.2 | 118.6 | 121.1 | 123.5 | 126.I | $128 \cdot 6$ | 131.1 | 133.7 | $136 \cdot 3$ | 138.9 | 141.6 |
| 57 | 104.3 | 106.6 | 108.9 | 11 l 3 | 113.6 | 116.0 | 118.4 | 120.8 | 123.3 | 125.8 | 128.2 | $130 \cdot 8$ | 133.3 | 135.9 | 138.5 |
| 58 | 102.0 | 104.2 | $106 \cdot 4$ | 108.7 | $1 \cdot$ | 113.4 | 115.7 |  | $120 \cdot 5$ | 122.9 | 125.3 | 127.8 | $130 \cdot 3$ | 132.8 | 135.3 |
| 59 | 99.6 | 1017 | 103.9 | 106.2 | 108.4 | $110 \cdot 7$ | 113 | 115.3 | 117.6 | $120 \cdot 0$ | 122.4 | 124.8 | 127.2 | 129.7 | 132.2 |
| 60 | $97 \cdot 1$ | $99 \cdot 3$ | 1014 | 103.6 | $105 \cdot 8$ | 108.0 | 1108 | 112.5 | 114.8 | 117.I | 1194 | 121.8 | 124.1 | 126.5 | 128.9 |
| 6 I | 94.7 | $96 \cdot 8$ | $98 \cdot 9$ | 1010 | 103•1 | 1053 | 107.5 | $109 \cdot 7$ | 1159 | I14.1 | 116.4 | 118.7 | $121^{\circ} \mathrm{O}$ | 123.3 | 125.7 |
| 62 | $92 \cdot 2$ | $94 \cdot 2$ | $96 \cdot 3$ | $98 \cdot 3$ | $100 \cdot 4$ | 102.5 | 104.6 | 106.8 | 109.0 | III ${ }^{2}$ | 113.4 | 115.6 | 117.8 | 120.1 | 122.4 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 46 | $\mathrm{m}_{47}$ | 48 | 49 | 50 | $\frac{\mathrm{m}}{51}$ | 52 | $53$ | $\frac{\mathrm{m}}{54}$ | $55$ | $56$ | $57$ | $58$ | $59$ | $\mathrm{m}_{\mathrm{gn}}$ |
| $\mathbf{N}$. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{4}$ | $180^{\circ} \cdot 8$ | $184^{\prime} \cdot 2$ | 187.6 | 191.0 | 194.5 | 198.0 | $201 \cdot 5$ | 205.0 | 208.6 | 212.2 | 215.8 | 219.5 | 223.2 | $226 \cdot 9$ |  |
| 45 | 177.8 | 181.2 | 184.5 | 187.9 | 191.3 | 194*7 | 198.2 | 201.7 | 205.2 | $208 \cdot 7$ | 212.3 | $215 \cdot 9$ | 219.5 | $223 \cdot 2$ | $226 \cdot 9$ |
| 46 | 174.9 | 178.1 | 181.4 | 184.7 | 188.1 | 191.4 | 194.8 | 198.3 | $201 \cdot 7$ | 205.2 | $208 \cdot 7$ | $212 \cdot 3$ | 215.9 | 219.5 | 223•1 |
| 47 | 171.9 | 175.1 | 178.3 | 181.6 | 184.9 | $188 \cdot 2$ | 191.5 | 194.9 | 198.3 | 201.7 | 205.2 | 208.7 | 212.2 | $215 \cdot 7$ | 219.3 |
| 48 | 168.9 | 172.0 | 175.2 | 178.4 | 181.6 | 184.9 | 188.2 | $19 \mathrm{I} \cdot 5$ | 194.9 | 198.2 | 2016 | 205.0 | 208.5 | 212.0 | 215.5 |
| 49 | 165.9 | 169.0 | 172.1 | 175.2 | 178.4 | 181.6 | 184.8 | 188.1 | 1914 | 194.7 | 198.0 | 201.4 | 204.8 | $208 \cdot 2$ | 211.7 |
| 50 | 162.8 | $165{ }^{1} 9$ | 168.9 | $172^{\circ}$ | 175.2 | 178.3 | $18 \mathrm{I} \cdot 5$ | 184.7 | 187.9 | 191.2 | 194.4 | 197.7 | 201.1 | 2044 | $207 \cdot 8$ |
| 51 | 159.8 | $162 \cdot 8$ | 165.8 | 168.8 | 171.9 | $175{ }^{\circ}$ | 178.1 | $18 \mathrm{I} \cdot 2$ | 184*4 | 187.6 | 190.8 | 194.1 | $197 \cdot 3$ | $200 \cdot 6$ | 204.0 |
| 52 | 156.7 | 159.7 156.5 | 162.6 | $165 \cdot 6$ | 168.6 | $171 \cdot 6$ | 174.7 | 177.8 | 180.9 | $184^{\circ}$ | 187.2 | 1904 | 193.6 | 196.8 | $200 \cdot 1$ |
| 53 | 153 | 156.5 | 159.4 | 162.3 | 165.3 | 168.3 | 171.3 | 174.3 | $177 \cdot 3$ | 180.4 | 183.5 | 186.6 | 189.8 | 193.0 | 196.2 |
| 54 | $150 \cdot 5$ | 153.4 | 156.2 | 159.1 | 162.0 | 164.9 | 167.8 | $170 \cdot 8$ | 173.8 | 176.8 | 179.8 | 182.9 | 186.0 | 189.1 | 192.2 |
| 55 | 1474 | $150 \cdot 2$ | 153.0 | 155.8 | 158.6 | 161.5 | 164.3 | 167.2 | $170 \cdot 2$ | $173 \cdot 1$ | 176.I | 179.1 | 182.1 | 185.2 | 188.3 |
| 56 | 144.3 | 147.0 | 1497 | 152.4 | 155.2 | 158.0 | 160.8 | 163.7 | 166.5 | 169.4 | 172.3 | 1753 | 178.2 | 18t.2 | 184.2 |
| 57 | 141.1 137.9 | 143.7 140.5 | 146.4 143.1 | 149.1 145.7 | 151.8 | 154.5 | 157.3 553.7 | $160 \cdot 1$ | 162.9 159 | $165 \cdot 7$ | 168.6 | 1714 | 174.3 | 1772 | 180.2 |
| 58 | 137.9 | $140 \cdot 5$ | 143.1 | 145.7 | 148.4 | 151.0 | 153.7 | 156.4 | 159.2 | - | 164.7 | 167.5 | $170 \cdot 4$ | 573.2 | 176.1 |
|  | 1344 | 137.2 | $139 \cdot 7$ | 142.3 | 144.9 | $147 \cdot 5$ | $150 \cdot 1$ | 152.8 | 155.5 | 158.2 | $160 \cdot 9$ | 163.6 | 166.4 | 169.2 | 172.0 |
| 60 | 131.4 128.1 | 133.8 130.5 | 136.3 | 138.8 | 141.4 | 143.9 | 146.5 | 149.1 | 151.7 | 154.3 | 157.0 | 159.7 | 162.4 | $165 \cdot 1$ | ${ }^{167.8}$ |
| 62 | 124.7 | 127.1 | 1329 1294 | 131.8 | 134.2 | 1403 136.6 |  | 145.3 14.5 | 147.9 144.0 | 150.4 146.5 | 153 ${ }^{1} 49^{\circ} \mathrm{O}$ | 155.6 151.6 | 158.3 154.1 | 160.9 156.7 | 163.6 159.3 |

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \multirow[b]{2}{*}{Lat.} \& \multicolumn{15}{|c|}{2 HOURS.} <br>
\hline \& ${ }_{1} \mathrm{~m}$ \& \& ${ }_{3}{ }^{\text {m }}$ \& $\mathrm{m}_{4}$ \& ${ }_{5}{ }_{5}$ \& ${ }_{6} 6$ \& ${ }_{7} \mathrm{~m}$. \& ${ }_{8} 8$ \& ${ }_{9} \mathrm{~m}$ \& ${ }_{10}$ \& ${ }_{11}$ \& 12 \& 13 \& $\mathrm{m}_{14}$ \& ${ }_{15}$ <br>
\hline \multicolumn{16}{|l|}{N.} <br>
\hline 44 \& \& 238.2 \& $242 \cdot 1$ \& $5 \cdot 9$ \& $249 \cdot 8$ \& 253.7 \& 257•7 \& 26x. 6 \& $265 \cdot 6$ \& 269.7 \& -7 \& $277 \cdot 8$ \& 281.9 \& $286 \cdot 1$ \& $0 \cdot 3$ <br>
\hline 45 \& $230 \cdot 6$ \& 234.3 \& $238 \cdot 1$ \& $241 \cdot 9$ \& $245 \cdot 7$ \& $249 \cdot 6$ \& 253.5 \& 257.4 \& $261 \cdot 3$ \& $265 \cdot 3$ \& \& 273.3 \& $277 \cdot 4$ \& 281.4 \& $5 \cdot 5$ <br>
\hline 46 \& 226.7 \& $230 \cdot 4$ \& 234*I \& 237.9 \& 24 1.6 \& 245.4 \& 249.3 \& 253' \& 257.0 \& $260 \cdot 9$ \& $264 \cdot 8$ \& 268.8 \& 272.8 \& 276.8 \& $280 \cdot 8$ <br>
\hline 47 \& 222.9 \& 226.5 \& $230 \cdot 2$ \& $233 \cdot 8$ \& 237.5 \& 2413 \& $245 \cdot 0$ \& $248 \cdot 8$ \& $252 \cdot 6$ \& $256 \cdot 5$ \& $260 \cdot 3$ \& 264.2 \& 268.2 \& $272 \cdot 1$ \& $276 \cdot 1$ <br>
\hline 48 \& 2190 \& . \& 226.2 \& 229.8 \& 233.4 \& 237.1 \& $240 \cdot 8$ \& 244.5 \& $248 \cdot 3$ \& 252.1 \& 255.9 \& $259 \cdot 7$ \& 263.5 \& $267 \cdot 4$ \& $271 \cdot 3$ <br>
\hline 49 \& 2151 \& 18.6 \& 22 \& 225.7 \& 229.3 \& 232.9 \& $236 \cdot 5$ \& $240 \cdot 2$ \& $243 \cdot 9$ \& $247 \cdot 6$ \& $251 \cdot 3$ \& $255 \cdot 1$ \& 258.9 \& $262 \cdot 7$ \& $266 \cdot 6$ <br>
\hline 50 \& 211.2 \& 214.7 \& 218.1 \& 221.6 \& $225 \cdot 2$ \& 228.7 \& $232 \cdot 3$ \& 235.9 \& $239 \cdot 5$ \& $243 \cdot 1$ \& $246 \cdot 8$ \& $250 \cdot 5$ \& 254.2 \& 258.0 \& 261.7 <br>
\hline 51 \& 2073 \& $210 \cdot 7$ \& 214.1 \& 217.5 \& $221{ }^{\circ}$ \& 224.5 \& $228 \cdot 0$ \& 231.5 \& $235{ }^{\circ} \mathrm{O}$ \& $238 \cdot 6$ \& 2422 \& $245 \cdot 9$ \& $249 \cdot 5$ \& 253.2 \& $256 \cdot 9$ <br>
\hline 52 \& 203.4 \& $206 \cdot 7$ \& - \& 213.4 \& 216.8 \& $220 \cdot 2$ \& 223.6 \& 227.1 \& $230 \cdot 6$ \& $234 \cdot 1$ \& $237 \cdot 6$ \& 241.2 \& 244.8 \& 248.4 \& $252 \cdot 0$ <br>
\hline 53 \& 199.4 \& $202 \cdot 6$ \& 205.9 \& $209 \cdot 2$ \& 212.5 \& 215.9 \& 219.3 \& 222.7 \& 226.1 \& 229.5 \& 233.0 \& 236.5 \& $240 \cdot 0$ \& $243 \cdot 6$ \& 247•1 <br>
\hline 54 \& 195.4 \& 198.6 \& 20 \& 205.0 \& $208 \cdot 3$ \& $21 \times 6$ \& 214.9 \& $2 \times 8$ \& 221 \& 224.9 \& 228.3 \& 231.8 \& $235 \cdot 2$ \& 238.7 \& -2 <br>
\hline 55 \& 191.3 \& 194.5 \& $197 \cdot 6$ \& $200 \cdot 8$ \& 204 \& $207 \cdot 2$ \& 21004 \& 213.7 \& 217.0 \& $220 \cdot 3$ \& $223 \cdot 6$ \& $227 \cdot 0$ \& $230 \cdot 4$ \& 233.8 \& $237 \cdot 2$ <br>
\hline 56 \& 187.3 \& $190 \cdot 3$ \& 193.4 \& 196.5 \& 199.6 \& $202 \cdot 8$ \& $206 \cdot 0$ \& 209.2 \& 2124 \& 215.6 \& $218 \cdot 9$ \& 22 \& 225.5 \& 22 \& $232 \cdot 2$ <br>
\hline 57 \& 183.2 \& $186 \cdot \mathrm{I}$ \& 189.2 \& 192.2 \& 195.3 \& 198.3 \& 201.4 \& 204.6 \& 207•7 \& $210 \cdot 9$ \& $214 \cdot 1$ \& 217.3 \& $220 \cdot 5$ \& 223.8 \& 227•1 <br>
\hline 58 \& 179.0 \& 181.9 \& 184.9 \& 187.8 \& $190 \cdot 8$ \& 193.9 \& 196.9 \& 199.9 \& 203.0 \& 20 \& $209 \cdot 3$ \& 212.4 \& 215.6 \& 218.8 \& 222.0 <br>
\hline 59 \& 174.8 \& 177.7 \& $180 \cdot 5$ \& 183.4 \& 18 \& 189.3 \& 192.3 \& 195.3 \& 198.3 \& 20 \& 204 \& $207 \cdot 4$ \& 21 \& 213.6 \& 216.8 <br>
\hline 60 \& 170.6 \& 173.4 \& $176 \cdot 2$ \& 179.0 \& 181.9 \& 184.7 \& 187.6 \& $190 \cdot 5$ \& 193.5 \& $196 \cdot 4$ \& $199 \cdot 4$ \& 202.4 \& 205.4 \& $208 \cdot 5$ \& 2115 <br>
\hline 61 \& $166 \cdot 3$ \& 169.0 \& 171.8
1629 \& 174.5 \& 177.3 \& 18 \& 182.9 \& 185.8 \& \& 1915 \& 1944
180.4 \& $197 \cdot 3$ \& $200 \cdot 3$ \& 203.3 \& $206 \cdot 2$ <br>
\hline 62 \& 162.0 \& 164.6 \& 167.3 \& 170.0 \& 172.7
168.0 \& 17 \& 178.2 \& 180.9
176.0 \& 183.7
178.7 \& \& 189.4
184.2 \& 192.2
187.0 \& 195.1
188.8

188 \& \& $200 \cdot 9$ <br>
\hline 63
64 \& \& 155.6 \& 158.1 \& 160.7 \& 163 \& \& 168.4 \& $17 \mathrm{I} \cdot \mathrm{O}$ \& 173.7 \& 176.3 \& 179.0 \& 181.7 \& 184.4 \& 187.2 \& 9.9 <br>
\hline \multirow[b]{2}{*}{Lat.} \& \multicolumn{15}{|c|}{2 HOURS.} <br>

\hline \& 16 \& $$
\begin{aligned}
& \mathrm{m} . \\
& 17
\end{aligned}
$$ \& \[

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\begin{aligned}
& \mathrm{m} \\
& 18
\end{aligned}
$$

\] \& ${ }_{19}^{\mathrm{m}}$. \& \[

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\begin{aligned}
& \mathrm{m} \\
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\mathrm{m}_{21}

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& \mathrm{m} . \\
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& \mathrm{m} . \\
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& \mathrm{m} . \\
& 24
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25

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& \mathrm{m} \\
& 28
\end{aligned}
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\begin{aligned}
& \mathrm{m} . \\
& 27
\end{aligned}
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\begin{aligned}
& \mathrm{m} . \\
& 28
\end{aligned}
$$
\] \& 29 \& m. <br>

\hline \multicolumn{16}{|l|}{N.} <br>
\hline \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline 44 \& 28 \& $298 \cdot 7$ \& 22.9 \& $307 \cdot 2$ \& $311 \cdot 5$ \& 315.9 \& $320 \cdot 2$ \& 324.6 \& 329*0 \& 333.5 \& 337.9 \& $342 \cdot 4$ \& $347 \cdot 0$ \& 351.5 \& $356 \cdot 1$ <br>
\hline 45 \& $289 \cdot 7$ \& $293{ }^{\circ}$ \& 298.0 \& $302 \cdot 2$ \& $306 \cdot 5$ \& \& 315.0 \& 319.4 \& 323.7 \& \& $332 \cdot 5$ \& \& 341
3
3 \& $345 \cdot 9$ \& $350 \cdot 4$ <br>
\hline 46 \& 28 \& $289^{\circ} \mathrm{O}$
284 \& 293.1
288.2 \& 297.3
292.3 \& $301 \cdot 4$
296.4
2 \& \& 309.9
304.7 \& 314
3088 \& 318.4
313.1 \& \& 3270

321.6 \& | 3314 |
| :--- |
| 325 | \& \& . 5 \& 9 <br>

\hline 48 \& $275 \cdot 3$ \& $279 \cdot 2$ \& 283.2 \& $287 \cdot 2$ \& $291 \cdot 3$ \& $295 \cdot 3$ \& $299 \cdot 4$ \& 303.5 \& 307.7 \& 311.8 \& 316.0 \& $320 \cdot 3$ \& 324.5 \& 328.8 \& 333•I <br>
\hline 49 \& \& 274 \& 278.2 \& 282.2 \& $286 \cdot 2$ \& 290. 1 \& 294.2 \& 298.2 \& $302 \cdot 3$ \& $306 \cdot 4$ \& 310.5 \& 314.7 \& 318.8 \& 323.0 \& $327 \cdot 3$ <br>
\hline 50 \& 265.5 \& 269.4 \& 273.2 \& 277.1 \& 281.0 \& 284.9 \& 288.9 \& 292.9 \& $296 \cdot 9$ \& $300 \cdot 9$ \& 304.9 \& 309.0 \& 313.1 \& $317 \cdot 2$ \& 3214 <br>
\hline 51 \& $260 \cdot 6$ \& $264 \cdot 4$ \& 268.2 \& $272 \cdot 0$ \& 275.8 \& $279 \cdot 7$ \& 283.6 \& $287 \cdot 5$ \& 291.4 \& 295.3 \& 299.3 \& 303.3 \& 307.4 \& 311.4 \& 315.5 <br>
\hline 52 \& 255.7 \& 259.4 \& $263^{\circ} \mathrm{I}$ \& 266 \& $270 \cdot 6$ \& 274.4 \& $278 \cdot 2$ \& $282 \cdot 0$ \& 285.9 \& 289.8 \& $293 \cdot 7$ \& $297 \cdot 6$ \& 301.6 \& 305.5 \& 309.5 <br>
\hline 53 \& 25 \& 254.3 \& 25 \& 26 \& 265 \& 26 \& 272.8 \& $276 \cdot 6$ \& \& 284.1 \& 288 \& 291.8 \& $295 \cdot 7$ \& 299.6 \& 303 <br>
\hline 54 \& 245.7 \& $249 \cdot 3$ \& 252.8 \& $256 \cdot 4$ \& $260 \cdot 0$ \& $263 \cdot 7$ \& $267 \cdot 3$ \& 271.0 \& $274 \cdot 7$ \& 278.5 \& 282.2 \& $286 \cdot 0$ \& $289 \cdot 8$ \& $293 \cdot 7$ \& 297 <br>
\hline 55 \& $240 \cdot 7$ \& 244.1 \& $247 \cdot 6$ \& 2512 \& $254 \cdot 7$ \& 258.3 \& 261.9 \& $265 \cdot 5$ \& $269 \cdot \mathrm{I}$ \& $272 \cdot 8$ \& $276 \cdot 5$ \& $280 \cdot$ \& 283.9 \& $287 \cdot 6$ \& 291.4 <br>
\hline 56 \& 235.5 \& $239 \cdot 0$ \& 242.4 \& $245 \cdot 8$ \& 2493 \& $252 \cdot 8$ \& $256 \cdot 3$ \& 259.9 \& 263.4 \& 267.0 \& $270 \cdot 6$ \& 274.2 \& 277.9 \& 281.6 \& 285.3 <br>
\hline 57 \& $230 \cdot 4$ \& $233 \cdot 7$ \& 237.1 \& $240 \cdot 5$ \& $243 \cdot 9$ \& $247 \cdot 3$ \& $250 \cdot 7$ \& 254.2
248.5 \& $257 \cdot 7$ \& $261 \cdot 2$ \& 264.7
258 \& $268 \cdot 3$ \& 271.8 \& 275.4 \& $279 \cdot 1$ <br>
\hline 5.8 \& 225.2 \& 228.5 \& $23 \times 7$ \& $235 \cdot 0$ \& 238.4 \& $241 \cdot 7$ \& $245 \cdot 1$ \& 248.5 \& 251.9 \& $255 \cdot 3$ \& $258 \cdot 7$ \& $262 \cdot 2$ \& 265.7 \& 269.2 \& 27 <br>
\hline 59 \& 21 \& $223 \cdot 1$ \& 226.3 \& 229.6 \& $232 \cdot 8$ \& $236 \cdot 1$ \& 239.4 \& $242 \cdot 7$ \& $246 \cdot 0$ \& 2493 \& 252.7 \& 256. 1 \& 259.5 \& 263.0 \& 266 <br>
\hline 60 \& 214.6 \& 217.7 \& $220 \cdot 9$ \& $224^{\circ}$ \& $227 \cdot 2$ \& $230 \cdot 4$ \& $233 \cdot 6$ \& $236 \cdot 8$ \& $240 \cdot 1$ \& 243.3 \& $246 \cdot 6$ \& $249 \cdot 9$ \& 253.3 \& 256.6 \& $260 \cdot$ <br>
\hline 61 \& 209.2 \& 212.3 \& $215 \cdot 3$ \& 218.4 \& 221.5 \& 224.6 \& $227 \cdot 7$ \& $230 \cdot 9$ \& $2344^{\circ}$ \& $237 \cdot 2$ \& $240 \cdot 5$ \& $243 \cdot 7$ \& $246 \cdot 9$ \& $250 \cdot 2$ \& 253.5 <br>
\hline 62 \& 203.8 \& $206 \cdot 8$ \& $209 \cdot 7$ \& $212 \cdot 7$ \& $215 \cdot 7$ \& 218.8 \& \& 224.9 \& 228.0 \& $231 \cdot 1$
22.8 \& 234.2 \& 237.3 \& $240 \cdot 5$ \& $243 \cdot 7$ \& $246 \cdot 9$ <br>
\hline 63 \& 198.3 \& $201 \cdot 1$ \& $204^{\circ}$ \& 207.0 \& 209.9 \& 212.8 \& 215.8 \& 218.8 \& 221. \& 224.8
218.5 \& 227.9 \& $230 \cdot 9$ \& 234.0 \& $237 \cdot 1$ \& $240 \cdot 2$ <br>
\hline 64 \& $192 \cdot 7$ \& 195.5 \& 198.3 \& 201•I \& 204*0 \& $206 \cdot 8$ \& 2097 \& 212.6 \& 215.5 \& 218 \& 22 \& $224{ }^{\circ}$ \& $227 \cdot$ \& 30 \& 233.5 <br>
\hline
\end{tabular}

TRUE BEARING OR AZIMUTH OF * CAPELLA.

| Lat. | 2 HOURS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\stackrel{\mathrm{m}}{2}$ | $\underset{4}{4}$ | $\mathrm{m}_{6}$ | m. 8 | m. | $\mathrm{m}_{12}$ | m. | ${ }_{16}$ | $\begin{aligned} & \mathrm{m} . \\ & 18 . \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 20 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 22 \end{aligned}$ | ${ }_{24}$ | 26 | ${ }_{28}$ | $\begin{aligned} & \mathrm{m} \\ & 30 \end{aligned}$ |
| N. | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 44 | 20.7 | $2 \mathrm{I} \cdot \mathrm{I}$ | 21.4 | $2 \mathrm{I} \cdot 7$ | 22.0 | 22.4 | 22.7 | $23^{\circ} \mathrm{O}$ | $23 \cdot 3$ | $23^{\circ} 6$ | $23^{\circ} 9$ | $24^{\circ} 2$ | $24^{\circ} 6$ | $24^{\circ} 8$ | $25^{\circ} \cdot$ |
| 46 | $20 \cdot 8$ | 21.1 | 21.4 | 21.8 | 22.1 | 22.4 | $22 \cdot 7$ | $23^{1} 1$ | 23.4 | 23.7 | $24^{\circ} \mathrm{O}$ | 24.3 | $24^{\circ} 7$ | $25^{\circ} 0$ | $25 \cdot 3$ |
| 48 | 20.9 | 21.2 | 21.5 | 21.9 | 22.2 | 22.5 | 22.8 | $23 \cdot 2$ | $23 \cdot 5$ | 23.8 | 24.1 | 24.5 | 24.8 | $25 \cdot 1$ | 25.4 |
| 50 | $21^{\circ} \mathrm{O}$ | 2I•3 | 21.6 | 22.0 | 22.3 | 22.6 | 23.0 | $23 \cdot 3$ | $23 \cdot 6$ | 23.9 | $24 \cdot 3$ | $24^{\cdot 6}$ | 24.9 | $25 \cdot 3$ | $25 \cdot 6$ |
| 52 | 21'I | 21.4 | $2 \mathrm{I} \cdot 8$ | 22.1 | 22.4 | 22.8 | $23 \cdot 1$ | 23.4 | $23 \cdot 8$ | 24'1 | 24.4 | $24^{-8}$ | $25^{1} 1$ | 25.4 | $25 \cdot 8$ |
| 54 | $21 \cdot 3$ | 21.6 | 21.9 | $22 \cdot 3$ | 22.6 | $23^{\circ} \mathrm{O}$ | $23 \cdot 3$ | $23 \cdot 6$ | $24^{\circ} \mathrm{O}$ | 24.3 | $24 \cdot 6$ | $25^{\circ} \mathrm{O}$ | 25.3 | $25 \cdot 7$ | $26 \cdot 0$ |
| 56 | 21.4 | 21-8 | $22 \cdot 1$ | 22.5 | 22.8 | 23.2 | 23.5 | 23.9 | $24^{\circ} 2$ | 24.5 | 24.9 | $25 \cdot 2$ | $25 \cdot 6$ | 25.9 | $26 \cdot 2$ |
| 58 | 21•7 | $22 \cdot 0$ | 22.4 | $22 \cdot 7$ | 23.1 | 23.4 | 23.7 | 24. ${ }^{\text {I }}$ | 24.4 | $24^{\cdot 8}$ | $25^{1} 1$ | $25 \cdot 5$ | $25 \cdot 8$ | $26 \cdot 2$ | $26 \cdot 5$ |
| 60 | 21.9 | $22 \cdot 3$ | 22.6 | $23^{\circ} \mathrm{O}$ | 23.3 | 23*7 | $24^{\circ} 0$ | $24^{*} 4$ | 24.7 | $25^{\prime}$ I | 25.4 | $25 \cdot 8$ | $26 \cdot 1$ | $26 \cdot 5$ | $26 \cdot 8$ |
| 62 | 22.2 | $22 \cdot 5$ | 22.9 | 23.2 | $23 \cdot 6$ | $24^{\circ} \mathrm{O}$ | $24^{\circ} 3$ | 24.7 | $25^{\circ} \mathrm{O}$ | $25 \cdot 4$ | $25 \cdot 8$ | $26 \cdot 1$ | $26 \cdot 5$ | $26 \cdot 8$ | $27 \cdot 2$ |
| 64 | 22.5 | $22 \cdot 8$ | $23 \cdot 2$ | $23 \cdot 6$ | 23.9 | 24.3 | 24.7 | $25^{\circ} 0$ | $25 \cdot 4$ | $25 \cdot 8$ | $26 \cdot 1$ | $26 \cdot 5$ | $26 \cdot 8$ | $27 \cdot 2$ | $27 \cdot 6$ |

REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

* CAPELLA.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \multirow[b]{2}{*}{Lat.} \& \multicolumn{15}{|c|}{HOUR} \\
\hline \& \({ }_{31}^{\mathrm{m}}\) \& \({ }_{32}\). \& \({ }_{33}{ }_{3}\) \& \({ }_{34}\) \& \({ }_{35}{ }_{3}\) \& \({ }_{36} \mathrm{~m}\). \& 37 \& 38 \& \({ }_{39}\) \& \({ }_{40}\) \& \({ }_{41}^{\mathrm{m}}\) \& \({ }_{42}^{\mathrm{m}}\) \& \({ }_{43}^{\mathrm{m}}\) \& \({ }_{44}\) \& \({ }_{45}^{\mathrm{m}}\) \\
\hline \multicolumn{16}{|l|}{N. REDUCTIONS.} \\
\hline 44 \& - \& 36's 3 \& 370.0 \& 374.7 \& 379'4 \& \& \& 303.7 \& 3988.5 \& \(403 \cdot 4\) \& 408.2 \& \(4{ }^{\prime} 3^{\prime} \cdot 1\) \& 418.1 \& \(42^{\prime} 3^{\circ}\) \& 428.0 \\
\hline 45 \& 354.9 \& 359.5 \& \({ }^{364.1}\) \& 36 \& \& \& \& \(387 \cdot 4\) \& \& 396.9 \& 401 \& \(406 \cdot 6\) \& 4114 \& 416.3 \& \(42 \mathrm{I} \cdot 2\) \\
\hline 46 \& \(349 \cdot \mathrm{I}\)
\(343 \cdot 3\) \& 353.6 \& \begin{tabular}{l}
\(358 \cdot \mathrm{I}\) \\
352.1 \\
\hline
\end{tabular} \& \& \& \& \& \({ }^{387 \cdot 1}\) \& 385 \& \& \& \(399 \cdot 9\) \& 404
308

08 \& $402 \cdot 5$ \& 41 <br>
\hline ${ }_{48}^{48}$ \& 337.4 \& $34 \mathrm{~T} \cdot 8$ \& 346.I \& 350 \& 354. \& 359 \& ${ }_{363.9}$ \& 368.4 \& $3772 \cdot 9$ \& 3774 \& 382.0 \& 386.6 \& $39 \mathrm{r} \cdot 2$ \& 395 \& $400 \cdot 5$ <br>
\hline 49 \& 33 \& 335.8 \& $340 \cdot 1$ \& 344.4 \& 348.8 \& $353 \cdot 1$ \& 357.5 \& $36 \mathrm{r} \cdot 9$ \& $366 \cdot 4$ \& $370 \cdot 9$ \& \& 379

37 \& 384.4 \& - \& -6 <br>
\hline 5 \& 319 \& 329 \& ${ }^{334}$ \& \& 342.5 \& \& 34 \& ${ }^{3549}$ \& \& \& \& \& \& \& 379 <br>
\hline 52 \& 313 \& 31 \& 321 \& 325.8 \& 329. \& \& \& $342 \cdot 4$ \& \& \& 355-1 \& $359 \cdot 4$ \& \& \& <br>
\hline 53 \& 307 \& 311 \& 315 \& 319.5 \& $323 \cdot 5$ \& 327 \& $3{ }^{1} 7$ \& $335 \cdot 8$ \& 34 \& 344 \& \& $352 \cdot 5$ \& $356 \cdot 7$ \& 361.0 \& 36 <br>
\hline 54 \& 30 \& 305 \& 30 \& \& 31 \& $321 \cdot 1$ \& 325.1 \& - \& 333.2 \& 337 \& $341 \cdot 4$ \& 345'5 \& $349 \cdot 7$ \& 3538 \& 358.0 <br>
\hline 5 \& 295 \& 292 \& 296 \& $3106 \cdot 7$
$300 \cdot 3$ \& 310 \& \& \& $\stackrel{4}{ }$ \& $326 \cdot 4$
319.5 \& 330 \& \& 338.5
331.4 \& $342 \cdot 5$
335 \& $346 \cdot 6$
$339 \cdot 3$ \& <br>
\hline 5 \& 28 \& 28 \& 29 \& $293 \cdot 7$ \& 297 \& 301 \& $305{ }^{\circ}$ \& \& \& \& $320 \cdot 3$ \& 32 \& \& \& <br>
\hline 5 \& 276 \& 279 \& 28 \& 28 \& 290 \& 294 \& \& \& 305 \& 309 \& 313 \& 31 \& $320 \cdot 7$ \& 324.5 \& <br>
\hline 59 \& 26 \& 27 \& 276.9 \& 28 \& ${ }^{284} \cdot 0$ \& $287 \cdot 6$ \& \& 294.8 \& $298 \cdot 5$ \& 302 \& \& 309•5 \& 313.3 \& - \& $320 \cdot 8$ <br>

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60
$$ \& 26 \& \[

$$
\begin{aligned}
& 266 \\
& 260
\end{aligned}
$$
\] \& 270 \& 273 \& $277 \cdot 2$

$270 \cdot 3$ \& $280 \cdot 7$ \& ${ }^{284}{ }^{28} \cdot{ }^{2}$ \& 2877
$280 \cdot 6$ \& 291.3
284 \& 294 \& \& \& \& \& <br>
\hline 62 \& \& \& 256 \& 25 \& \& 26 \& 269.9 \& 273 \& \& 280 \& \& \& $290 \cdot 4$ \& \& <br>
\hline 63 \& \& \& \& \& \& 25 \& $262 \cdot 6$ \& \& \& \& \& $279 \cdot 2$ \& \& \& <br>
\hline 6 \& \& \& \& \& \& \& 255.2 \& \& \& \& \& 271.3 \& 274.6 \& \& $281 \cdot 2$ <br>
\hline \multirow[b]{2}{*}{Lat.} \& \multicolumn{14}{|c|}{2 HOURS.} \& <br>

\hline \& 46 \& 47 \& 48 \& 49 \& 50 \& $$
\overline{\mathrm{m}}
$$ \& \[

$$
\begin{aligned}
& \mathrm{m} . \\
& 52
\end{aligned}
$$

\] \& \[

\frac{\mathrm{m} .}{53}

\] \& \[

\frac{\mathrm{m}}{54}

\] \& 55 \& \[

$$
\begin{aligned}
& \mathrm{m} . \\
& 56
\end{aligned}
$$

\] \& \[

{ }_{57}
\] \& 58 \& ${ }_{59}^{\mathrm{m}}$ \& 60 <br>

\hline \multicolumn{16}{|l|}{\multirow[t]{2}{*}{| N. |
| :--- |
| REDUCTIONS. |}} <br>

\hline \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline 44 \& 43 \& \& ${ }_{436 \cdot 0}^{443}$ \& \& 453.2 \& \& \& 468 \& 73.9 \& 479 \& \& 489 \& \& \& <br>
\hline 46 \& 41 \& 42 \& 42 \& 43 \& \& \& \& \& 458 \& \& \& \& $479 \cdot 3$ \& - 5 \& <br>
\hline 47 \& \& 417.0 \& 421.9 \& 426 \& 43 \& $436 \cdot 5$ \& 441 \& \& 451-3 \& $45^{6}$ \& 461.3 \& \& \& \& 48r <br>
\hline 48 \& 40 \& 4100 \& 414.7 \& 419.5 \& 42 \& 429.1 \& $433 \cdot 9$ \& 438 \& $443 \cdot 7$ \& 448 \& 453.5 \& 45 \& 463.5 \& 468.5 \& 473 <br>
\hline 49 \& $398 \cdot 2$ \& 3 \& 40 \& 42.2 \& 416.9 \& 421.7 \& 426.4 \& 43 \& 436.0 \& $440 \cdot 9$ \& 44 \& $450 \cdot 6$ \& $455 \cdot 5$ \& $460 \cdot 4$ \& 46 <br>

\hline $$
\begin{aligned}
& 50 \\
& 50 \\
& 51
\end{aligned}
$$ \& \& 39 \& 40 \& 39 \& 409.5 \& 414.2

406.6 \& 418.9 \& 42 \& $428 \cdot 3$
420.5 \& $43 \cdot 1$
$425 \cdot 2$ \& \& $442 \cdot 6$ \& 4374 \& $452 \cdot 3$ \& <br>
\hline 52 \& \& 381.2 \& 38 \& \& \& ${ }^{499} \cdot 1$ \& $403 \cdot 6$ \& 40 \& 412.7 \& $417 \cdot 3$ \& 421 \& 426 \& 4312 \& 435 \& <br>
\hline 53 \& \& 373 \& 378 \& \& \& $391 \cdot 4$ \& $395 \cdot 8$ \& \& \& 409.3 \& \& 1 \& \& 42 \& 432 <br>
\hline 54 \& 36 \& 366 \& $370 \cdot 8$ \& 375.0 \& 379 \& 383.7 \& 388.0 \& $392 \cdot 4$ \& 3968.8 \& $40 \mathrm{I} \cdot 2$ \& $405 \cdot 6$ \& 41 \& 414.6 \& 19. \& $423 \cdot 6$ <br>
\hline 55 \& \& 359 \& 363.2 \& 367.4
359 \& \& \& 380•I \& \& \& \& 3974 \& 401.8 \& \& \& <br>
\hline \& 339 \& 34 \& 347 \& 351.9 \& 355 \& $360 \cdot$ \& 364 \& 36 \& $372 \cdot 3$ \& 376 \& $380 \cdot 7$ \& 384.9 \& $389 \cdot 1$ \& 393.3 \& <br>
\hline 58 \& 33 \& 33 \& $340 \cdot 1$ \& 344 \& 34 \& 3520 \& 356.0 \& \& 364.0 \& $368 \cdot 1$ \& $372 \cdot 2$ \& 376 \& $380 \cdot 4$ \& 384.5 \& 388.7 <br>
\hline \& \& 328.4 \& $332 \cdot 2$ \& 336 \& 339 \& $343 \cdot 8$ \& 347.7 \& 351.6 \& $355 \cdot 6$ \& 359.6 \& $363 \cdot 6$ \& $367 \cdot 6$ \& $371 \cdot 6$ \& $\cdot 6$ \& <br>
\hline \& \& \& 324.2
316.1 \& \& 33 \& \& 339.4 \& 343.2 \& \& 35 \& \& 358.7 \& 362.7 \& \& <br>
\hline 6 \& \& \& \& ${ }_{311}^{319}$ \& \& \& \& ${ }_{32} 33$ \& \& 34 \& \& \& \& \& <br>
\hline 63 \& \& \& \& 303 \& \& \& \& \& \& \& \& 331.6 \& \& \& <br>
\hline 6 \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline \multicolumn{16}{|c|}{TRUE BEARING OR AZIMUTH OF * CAPELL} <br>
\hline \multirow[b]{2}{*}{Lat} \& \multicolumn{15}{|c|}{2 HOURS} <br>

\hline \& 32 \& 34 \& 36 \& $$
38
$$ \& \[

40

\] \& \[

42

\] \& \[

44

\] \& \[

46

\] \& 48 \& \[

50

\] \& \[

\frac{1}{52}
\] \& 54 \& 56 \& 5 \& 60 <br>

\hline \multicolumn{16}{|l|}{N. AZIMUTHS.} <br>
\hline - \& $125^{\circ} \cdot 5$ \& 25.9 \& 26.2 \& $\bigcirc{ }^{-}$ \& 26.8 \& 2\%‥ \& $22^{\circ} \cdot 4$ \& 27.7 \& 28. \& $28 \cdot 3$ \& 28.6 \& 28.9 \& $2{ }^{\circ} \cdot 2$ \& $29 \cdot 5$ \& <br>
\hline 46 \& $25 \cdot 6$ \& 25.9 \& $26 \cdot 2$ \& \& $26 \cdot 9$ \& 27. \& 27.5 \& 27 \& $28 \cdot 1$ \& \& \& 29.1 \& 29.4 \& $29 \cdot 7$ \& <br>
\hline 48 \& 25.7 \& \& 26.4 \& \& 27 \& 27.3 \& \& \& 28.3 \& \& \& 29 \& \& 29.9 \& 30.2 <br>
\hline 50 \& 25.9 \& $26 \cdot 2$ \& \& 26.9 \& 27.2 \& $27 \cdot 5$ \& 27 \& 28.2 \& 28. \& 28.8 \& $29 \cdot 1$ \& 29.4 \& 29.8 \& \& $30 \cdot 4$ <br>
\hline \& $26 \cdot 1$ \& 26.4 \& $26 \cdot 8$ \& 27.1 \& 27 \& \& 28.1 \& \& 28.7 \& 29. \& \& 29.7 \& 30.0 \& \& <br>
\hline \& \& $26 \cdot 7$ \& 27.0 \& 27.3 \& 27 \& \& \& \& \& \& \& 30.0 \& \& \& <br>
\hline 58 \& 9 \& 27.2 \& 27. \& 27.9 \& 28.2 \& \& - \& 293 \& $29 \cdot 6$ \& 29.9 \& $3{ }^{\circ}$ \& $3{ }^{\circ}$ \& 30 \& $3{ }_{3} 1 \cdot 0$
3 - \& 3 I 7 <br>
\hline 60 \& \& 27.5 \& \& 28.2 \& 28.6 \& 28.9 \& 29 \& 29 \& 30.0 \& \& $30 \cdot 7$ \& $3{ }^{1.0}$ \& \& \& 32-1 <br>
\hline 62
64 \& \& 28. \& \& $28 \cdot 6$ \& $29^{\circ}$ \& \& 29.7 \& 30 \& \& \& \& \& 31.8 \& \& <br>
\hline \& \& 28. \& \& 29.0 \& $29^{\circ} 4$ \& 29. \& $30^{\circ}$ \& $30 \cdot 4$ \& 30.8 \& $3 \mathrm{I} \cdot 2$ \& 31.6 \& 31.9 \& $32 \cdot 3$ \& $32 \cdot 7$ \& <br>
\hline
\end{tabular}

REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* a CENTAURI.

| Lat. | $\mathrm{m}_{4}$ | ${ }_{8} \mathrm{~m}$. | ${ }_{12}$ | ${ }_{16}$ | ${ }_{20}$ | ${ }_{22}$ | ${ }_{24}$. | ${ }_{26}$ |  | $\stackrel{\mathrm{m}}{28}$ | m. <br> 30 |  |  | ${ }_{36}^{\mathrm{m} .}$ | ${ }_{38}$ | ${ }_{40} \mathrm{~m}$. | ${ }_{42}$ | $\mathrm{m}_{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | $0 \cdot 2$ | 0.9 | 2.1 | 3.8 | $5 \cdot 9$ | $7 \cdot 1$ | 8.5 | $10 \cdot$ |  | 12.6 13 | 13.315 | 15.1 | $17 \cdot 1$ | 19'1 | $21 \cdot 32$ | 23.6 | 26.0 | 28.5 |
| 20 | 0.2 | $1 \cdot 0$ | $2 \cdot 2$ | 3.9 | $6 \cdot 1$ | $7 \cdot 4$ | 8 | 10 |  | 12.0 | 13.8 I5 | 15.7 | 17.7 | 19.8 | $22 \cdot \mathrm{I}$ | 24.5 | 27.0 | $29 \cdot 6$ |
| 16 | $0 \cdot 3$ | I•O | $2 \cdot 3$ | 4.1 | 6. | $7 \cdot 7$ | $9 \cdot 2$ | 210 |  | 12.51 | 14.316 | 16.3 | 18.4 | $20 \cdot 6$ | 22.925 | 25.4 | 28.0 | $30 \cdot 7$ |
| 12 | $0 \cdot 3$ | I•I | $2 \cdot 4$ | 4.2 | $6 \cdot 6$ | $8 \cdot 0$ | $\cdot 5$ | 5 II |  | 12.9 I | 14.8 16 | 16.9 | 19.0 | 2I.3 | $23.8 \quad 26$ | 26.3 | 29.0 | 3 F 9 |
| 8 | $0 \cdot 3$ | I'I | $2 \cdot 5$ | $4 \cdot 4$ | $6 \cdot 8$ | 8.6 | $9 \cdot 9$ | 9 |  | 13.4 | 15.417 | 17.5 | 19.8 | 22.1 | $24^{\circ} 7$ | 27.3 | $30 \cdot 1$ | $33^{\circ} 0$ |
| 4 | $0 \cdot 3$ | I•I | 2.6 | $4 \cdot 6$ | $7 \cdot 1$ | $8 \cdot 6$ | 10.2 | 212. | 0 I3 | 13.9 r | 16.0 | 18.2 | $20 \cdot 5$ | 23.0 | $25^{6} 6$ | 28.4 | 31.2 | $34 \cdot 3$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| . | $0 \cdot 3$ | 1.2 | 2.7 | $4 \cdot 7$ | 7.4 | 8.9 | $10 \cdot 6$ | 12 |  | 14.5 | 618 | 18.9 | 21.3 | 23.9 | 26.629 | $29 \cdot 5$ | 32.5 | 35.6 |
| 4 | $0 \cdot 3$ | $1 \cdot 2$ | 2.8 | 4.9 | $7 \cdot 7$ | $9 \cdot 3$ | II•I | $1{ }^{13}{ }^{\circ}$ |  | 15.I 1 | 17.319 | 19.7 | 22 | $24^{\prime} 9$ | $27 \cdot 7$ | $30 \cdot 7$ | 33.8 | 37.1 |
| 8 | $0 \cdot 3$ | $\pm 3$ | $3 \cdot 0$ | $5 \cdot 2$ | $8 \cdot 0$ | $9 \cdot 7$ | II. 6 | $13^{\circ}$ |  | 15.718 | 18.0 | 20.5 | 23.1 | $25 \cdot 9$ | $28 \cdot 9$ | $32 \cdot 0$ | 35.2 | $38 \cdot 7$ |
| 12 | $0 \cdot 3$ | I 3 | $3 \cdot 0$ | 5.4 | 8.4 | 10.2 | I2.I | $1{ }^{1} 4$ |  | 16.4 | 21 | 21.5 | 24.2 | $27 \cdot 1$ | 30.2 | 33.4 | 36.8 | $40 \cdot 4$ |
| 16 | $0 \cdot 4$ | $1 \cdot$ | 3.2 | $5 \cdot 6$ | . 8 | $\cdot 7$ | 12.7 | 7 |  | 17.31 | 19.82 | 22.5 | 25.4 | 28.4 | $3 \mathrm{I} \cdot 7$ | 35.1 | $38 \cdot 6$ | 42.4 |
| 20 | 0.4 0.4 | 1.5 1.5 | 3.4 3.4 | $6 \cdot 0$ | 9.3 | 11.2 | 13.4 | 415 | $7$ | 18.2  <br> 18.7 2 | 20.923 | $23^{\circ} 7$ | $26^{-8}$ | $30 \cdot 0$ | 33.4 | 37.0 | $40 \cdot 7$ | $44^{\circ} 7$ |
| 22 | 0.4 | 1.5 | 3.4 3.6 | $6 \cdot 1$ $6 \cdot 3$ | $9 \cdot 6$ | II.6 | 13.8 | $81{ }^{16}$ |  | 18.72 | 21.5 | 24.4 | 27.6 | $30 \cdot 9$ 31.8 | $33^{*} 4$ | 38.0 | $4 \mathrm{I} \cdot 9$ | $46 \cdot 0$ |
| 24 | $0 \cdot 4$ | 1.6 | $3 \cdot 6$ | $6 \cdot 3$ | 9.9 | 1.9 | 14.2 | 216 |  | 19.3 | 22.125 | $25 \cdot 2$ | 28.4 | 31.8 | $35 \cdot 439$ | $39^{\circ} 2$ | 43.2 | $47 \cdot 4$ |
| 26 | $0 \cdot 4$ | $\times 6$ | $3 \cdot 7$ | $6 \cdot 5$ | 10.2 | $12 \cdot 3$ | 14.7 | 717. |  | 19.92 | 22.92 | $26 \cdot 0$ | 29.3 | $32 \cdot 8$ | 36.64 | $40 \cdot 5$ | $44 \cdot 6$ | $48 \cdot 9$ |
| 28 | $0 \cdot 4$ | 1.7 | 3.8 | $6 \cdot 8$ | 10.5 | $2 \cdot 8$ | 15.2 | 217 |  | $20 \cdot 6$ | 23.726 | $26 \cdot 9$ | $30 \cdot 4$ | 34.0 | 37.8 | $4 \mathrm{I} \cdot 9$ | $46 \cdot 1$ | $50 \cdot 5$ |
| 30 | $0 \cdot 4$ | 1.8 | $3 \cdot 9$ | 7.0 | 10.9 | 13.3 | 15.8 | 18. |  | 21.4 | 24.6 | $27 \cdot 9$ | $31 \cdot 5$ | 35.3 | 39.24 | $43 \cdot 4$ | 47.8 | $52 \cdot 4$ |
| 32 | 0.5 | 1.8 | 4. 1 | $7 \cdot 3$ | 4 | 13.8 | 4 | 4 19 |  | $22 \cdot 3$ | 25.629 | $29^{\circ}$ | $32 \cdot 7$ | $36 \cdot 7$ | $40 \cdot 8$ | $45 \cdot 2$ | $49 \cdot 7$ | $54 \cdot 5$ |
| 34 | $0 \cdot 5$ | 1.9 | $4 \cdot 3$ | $7 \cdot 6$ | I199 | 14.4 | I | 220 |  | 23.32 | 73 | 30 | 34.2 | $38 \cdot 3$ | $42 \cdot 6$ | $47 \cdot 1$ | 51.9 | .8 |
| 36 | 0.5 | $2 \cdot 0$ | $4 \cdot 5$ | 8.0 | 12.5 | 15.1 | 18.0 | - 21 |  | 24.4 | - 3 | 31 | 35.9 | $40 \cdot 1$ | $44 \cdot 6$ | 49.4 | 54.3 | . 6 |
| 38 | 0.5 | $2 \cdot 1$ | 4.8 | 8.5 | 13.2 | 16 | 19.0 | - |  | 25.72 | 29.533 | 33 | 8 | 42 | 47.0 | $52^{\circ}$ | 2 | 62.7 |
| 40 | $0 \cdot 6$ | $2 \cdot 3$ | $5 \cdot 1$ | $9 \cdot 0$ | 14 | 17.0 |  | 223 |  | 27.3 | 31.3 | 35 | 40 | 44.8 | 49.8 | $55^{1}$ | 6 | $66 \cdot 4$ |
|  | ${ }_{45}$ | ${ }_{46}$ | ${ }_{4}{ }_{4}$ | ${ }_{48}$ | $\begin{aligned} & 49 \\ & \hline \end{aligned}$ | $\mathrm{m} .$ | $\mathrm{m} .$ | $5$ | $\begin{aligned} & \mathrm{m} . \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 54 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 55 \\ & \hline \end{aligned}$ |  | $56$ | $\begin{aligned} & \mathrm{m} \\ & 57 \\ & \hline \end{aligned}$ | $\mathrm{m} .$ |  |  | $\begin{aligned} & \hline \mathrm{m} . \\ & 60 \end{aligned}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{24}{ }^{\circ}$ | 29.8 | . 2 | $32 \cdot 5$ | 33.9 | $35 \cdot 3$ | 36.8 | $8 \cdot 3$ | 3.8 | $1 \cdot 3$ | , | $4 \cdot 5$ |  |  | $\bigcirc{ }^{\circ} \mathrm{4} 7 \times 8$ | ${ }^{\circ} \mathrm{4} 49^{\prime} \cdot$ |  |  | 52.9 |
| 20 | $3 \mathrm{I} \cdot$ | $32 \cdot 3$ | $33 \cdot 8$ | $35 \cdot 2$ | 36.7 | 38.2 | $39 \cdot 7$ | $4 \mathrm{I} \cdot 3$ | $42 \cdot 9$ | $94 \cdot 5$ | 546 |  |  | - 49.6 | - $51 \cdot 3$ |  |  | - 54.9 |
| 16 | $32 \cdot 1$ | $33 \cdot 5$ | $35^{\circ}$ | $36 \cdot 5$ | $38 \cdot 0$ | $39^{6} 6$ | $41 \cdot 2$ | 42.8 | $44 \cdot 5$ | $546 \cdot 2$ | 277.9 | 9 | $49 \cdot 6$ | - 51.4 | - 53.2 | - 5 | $55^{\circ}$ | - $56 \cdot 9$ |
| 12 | 33.3 | 34.8 | $36 \cdot 3$ | 37.9 | $39 \cdot 5$ | $41 \cdot 1$ | $42 \cdot 7$ | 44.4 | 46•1 | I 47.9 | 949 | - | 51.4 | - 53.3 | - $55^{2}$ | - 5 |  | - 59.0 |
| 8 | 34.5 | 36. 1 | $37 \cdot 7$ | 39.3 | $40 \cdot 9$ | $42 \cdot 6$ | 44.3 | $46 \cdot 0$ | $47 \cdot 8$ | 849.6 | $5 \mathrm{5I} \cdot 5$ |  | 53.3 | - 55.3 | - 57.2 |  |  | 1.2 |
| 4 | 35 | 37.4 38.2 | $39^{\circ}$ | $40 \cdot 8$ 4 I 5 | 42.5 43.3 | 44.5 | $46 \cdot 0$ $46 \cdot 8$ | 47.8 48.7 | $49 \cdot 6$ | $6{ }^{6} 51 \cdot 5$ | 53.4 54.4 | 4 - | $55 \cdot 4$ 56.4 | -O | $\begin{array}{ll}0 & 59.3 \\ \text { I } & 0.5\end{array}$ | I | 1.4 2.5 | $3 \cdot 5$ |
| - | 37.2 | $38 \cdot 2$ 38 | $39 \cdot 8$ 40.6 | $41 \cdot 5$ $42 \cdot 3$ | 43.3 | $45^{4 .} 9$ | $46 \cdot 8$ 47 | $48 \cdot 7$ 49 | $50 \cdot 6$ 51.5 | 52.5  <br> 5 53.5 |  | $5{ }^{\circ}$ |  | (1) | $\begin{array}{ll}1 & 0.5 \\ 1 & 1.6\end{array}$ | I |  | 7 |
| 8. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 38.0 | $39 \cdot 7$ | 41.4 | 43.2 | 45.0 | $46 \cdot 8$ | $48 \cdot 7$ | $50 \cdot 6$ | $52 \cdot 6$ | 654.6 | 56.6 |  | 58.6 | 10.7 | 12.8 |  |  | $7 \cdot 2$ |
| 4 | $3^{8}$ | $40 \cdot 5$ | $42 \cdot 2$ | $44^{\prime} \mathrm{I}$ | 45.9 | 47.8 | $49 \cdot 7$ | $51 \cdot 6$ | 53.6 | 655.6 | 857.7 | 7 - | 59.8 | I 10.9 | $1{ }^{1} 4.1$ | I | $6 \cdot 3$ | 8.5 |
| 8 | 3 | 41•3 | 43.1 | $45^{\circ}$ | $46 \cdot 9$ | - 8 | 50.7 | $52 \cdot 7$ $53 \cdot 8$ | 54.7 | 7568 <br> $58 \cdot 0$ | $58 \cdot 9$ <br> $60 \cdot 1$ | I | 1.0 | I 3.2 | $\begin{array}{ll}1 & 5.4 \\ \text { I } & 6.8 \\ \end{array}$ | 41 | 7.7 0.1 | 9.9 11.4 |
| 10 | $4 \mathrm{I} \cdot 3$ | $43 \cdot 1$ | 45.0 | $46 \cdot 9$ | $48 \cdot 9$ | 50.9 | 52.9 | $55^{\circ}$ | 57•1 | 159 | $6 \mathrm{r} \cdot 5$ | 5 | 3.7 | I 6.0 | $8 \cdot 3$ | 1 | 10.6 | ${ }^{4}$ |
| 12 | $42 \cdot 3$ | 44. | $46 \cdot 0$ | $48 \cdot 0$ | $50 \cdot 0$ | 52.0 | 54.I | $56 \cdot 2$ | 58.4 | $460 \cdot 6$ | 62.8 | 8 | $5^{\circ} \mathrm{I}$ | 1704 | 19.8 | 11 | 12.2 | 14.6 |
| 14 | 43.2 | 45.2 | $47 \cdot 1$ | $49^{-1}$ | 51.2 | 53.3 | $55^{*} 4$ | $57 \cdot 6$ | $59 \cdot 8$ | 8 62.0 | - 64.3 | 3 | $6 \cdot 6$ | $19^{\circ} 0$ | 1 II 4 | 1 | 13.9 | 16.3 |
| 16 18 | 44.3 | $46 \cdot 3$ | 48.3 | $50 \cdot 3$ $5 \times$ 5 | 52.4 53.8 | 54.6 | $56 \cdot 7$ 58.2 | 59.0 60.5 | 61.2 62.8 | 23.5  <br> 8 65.2 | $\begin{array}{lll}5 & 65 \cdot 9\end{array}$ | 9 | $8 \cdot 2$ | $1 \begin{array}{ll}1 & 10.7 \\ 1 & 12.5\end{array}$ | $1{ }^{1} 12 \cdot 1$ | 1 | 15.6 17.6 | 18.2 20.2 |
| 18 | $45 \cdot 5$ | 47.5 | 49.5 | 51.6 | 53.8 | 56.0 | 58 | $60 \cdot 5$ | $62 \cdot 8$ | $8{ }^{65 \cdot 2}$ | $267 \cdot 6$ | 6 | 10.0 | 112.5 | $1{ }^{15}{ }^{\circ}$ | 1 | 17.6 | 20.2 |
| 20 | $46 \cdot 7$ | $48 \cdot 8$ | 50.9 | 53 | 55.2 | $57 \cdot 5$ | $59 \cdot 8$ | $62 \cdot 1$ | 64.5 | $56^{66 \cdot 9}$ | $8{ }^{69} 4$ | 4 | 11*9 | 114.4 | 1170 | I | 19.6 | 22.3 |
| 22 24 | $48 \cdot \mathrm{I}$ | $50^{\circ} 2$ | $52 \cdot 3$ | 54.5 | $56 \cdot 8$ 58.5 | 59.1 | $61 \cdot 5$ | 63.9 65.8 | 66.3 | 368.8 | 8713 | 3 | 13.9 | 1 | $1{ }^{1} 19.1$ | 1 | 2 P 8 | 24.6 |
| 24 | $49 \cdot 5$ | 51-7 | 53.9 |  | $58 \cdot 5$ | $60 \cdot 9$ | 63.3 | 65.8 | $68 \cdot 3$ | 3 70'9 | $973 \cdot 5$ | 5 |  | 1 | 121.5 | I 2 | 24.3 | $27 \cdot 1$ |
| 25 | - 3 | $52 \cdot 5$ 53.3 | 54.8 55.6 | $57 \cdot 1$ 58.0 | 59.4 $60 \cdot 4$ | $6 \mathrm{x} \cdot 8$ | $64 \cdot 3$ $65 \cdot 3$ | $66 \cdot 8$ | $69 \cdot 3$ | 371.9 | 974.6 | 6 | 17.3 | 120.0 | 22.7 | 7 | $25 \cdot 6$ | 28.4 |
| 27 | $5 \mathrm{5} \cdot 9$ | 53.3 | 55.6 | $50^{\circ}$ 5 | 60.4 61 | $62 \cdot 8$ 63.9 | $65^{3}$ 66.4 | 69.0 | 7 l |  | 1 <br> $75^{\circ} 8$ <br> 770 |  |  | I 22.6 | I 224.1 I 25.4 |  |  | 29.8 |
| 28 | 52.8 | $55 \cdot 2$ | $57 \cdot 5$ | $60 \cdot$ | 62.5 | $65 \cdot$ | $67 \cdot 5$ | $70 \cdot 2$ | 72.8 | 875 | 578.3 | 1 | $2 \mathrm{I} \cdot \mathrm{T}$ | 123.9 | 126.9 | I | $29 \cdot 8$ | 32.8 32 |
| 29 | 53.8 | $56 \cdot \mathrm{I}$ | 58.6 | 61.0 | 63.6 | $66 \cdot 1$ | 68.7 | 71.4 | $74 \cdot 1$ | 176.9 | $979 \cdot 7$ | 7 | 22.5 | 125.4 | I 28.4 | I | 31.4 | 34.4 |
| 30 | 54.8 | 57.2 | 59.7 | $62 \cdot 2$ | 64.7 | $67 \cdot 3$ | $70 \cdot 0$ | $72 \cdot 7$ | $75 \cdot 5$ | 578 | 3 8I-I | 1 | $24^{\circ} \mathrm{O}$ | 127.0 | 13000 | 13 | $33^{\circ}$ | $36 \cdot 1$ |
| 31 | 55.8 | $58 \cdot 3$ | 60.8 | 63.4 | $66 \cdot 0$ | 68.6 | $71 \cdot 3$ | $74^{1}$ | $76 \cdot 9$ | 979.8 | 882.7 |  | $25^{6} 6$ | 128.6 | 131.7 |  | 34.8 | 37.9 |
| 32 33 | 57.0 58.1 | 59.5 60.7 | 62. 63.3 | $64 \cdot 6$ $66 \cdot 0$ | 67.3 | $70 \cdot 0$ | $72 \cdot 7$ | $75 \cdot 6$ | 78.4 | $4{ }^{81} \cdot 3$ | 384.3 | 3 | 27.3 | $130 \cdot 4$ | $1 \begin{array}{ll}1 & 33.5 \\ \text { I }\end{array}$ |  | $36 \cdot 6$ | 39.8 |
| 33 34 | $58 \cdot \mathrm{I}$ 59 | $60 \cdot 7$ $62 \cdot$ | $63 \cdot 3$ 64.7 | 66.0 | $68 \cdot 7$ $70 \cdot 2$ | 71.4 73.0 | 74.2 | 77.1 78.8 | $80 \cdot 0$ 8.8 |  |   <br> 8 $86 \cdot 0$ | - 1 | 29.1 $3 \mathrm{I} \cdot$ | $\begin{array}{ll}1 & 32 \cdot 1 \\ 1 & 34.2\end{array}$ | $\begin{array}{ll}1 & 35.4 \\ \text { I } & 37.4\end{array}$ |  | $38 \cdot 6$ 40.7 | 41.8 |
| 34 | 59.4 60.8 | $62 \cdot$ 63 | $64 \cdot 7$ $66 \cdot 2$ | 67.4 68.9 | $70 \cdot 2$ 71.8 | 73.0 74.6 | 75.9 77.6 | $78 \cdot 8$ 80.6 | 81.8 83.6 | 8 <br> 84.8 <br> 86.7 |  |  | $31^{\circ}$ $33^{\circ}$ | 1134.2 | I 37.4 I 39.6 |  | $40 \cdot 7$ $42 \cdot 9$ | 44.0 46.3 |
| 36 | 62.2 | $65^{\circ}$ | $67 \cdot 7$ | $70 \cdot 6$ | $73 \cdot 5$ | $76 \cdot 4$ | 79.4 | 82.5 | 85.6 | 688.8 | $8 \quad 92 \cdot 0$ |  | $35^{\prime 2}$ | 138.5 | 1 41.9 |  | $45 \cdot 3$ | $48 \cdot 8$ |
| 37 38 | $63 \cdot 8$ | $66 \cdot 6$ 68.3 | 69.4 | $72 \cdot 3$ | 75.3 | 78.3 | 81.4 | 84.5 | 87.7 | $7190 \cdot 9$ | 9 94.2 |  | $37 \cdot 5$ | $140 \cdot 9$ | I 44.4 |  | 47.8 | 51.4 |
| 38 39 | 67 | $68 \cdot 3$ $70 \cdot 2$ | $71 \cdot 3$ 73.2 | 74.2 $76 \cdot 3$ | $77 \cdot 3$ 70.4 | $80 \cdot 4$ 82.6 | 83.5 85.8 |  | $90 \cdot 0$ | - 93.3 | 3 96.6 |  |  | $\begin{array}{lll}1 & 43.5 \\ \text { I } & 46.3\end{array}$ | $147^{\circ} \mathrm{O}$ |  | 50 | 54.2 |
| 40 | $69 \cdot 3$ | $72 \cdot 3$ | 7 | 78.5 | $8 \mathrm{I} \cdot 7$ | $8_{4} \cdot 9$ | 88.3 | $9{ }^{1} 6$ | 95.1 | $1{ }^{\text {1 }}$ | $5{ }^{\text {IO2. }}$ |  | $4{ }^{4 \cdot 7}$ | I 449.3 | I 4930 | 9 | 53.5 56.7 | 57.3 0.5 |

* a Centauri.

| Lat. |  | 1 |  |  |  |  |  | $66$ |  |  |  |  |  |  | $72$ | $73$ | 74 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  | RED | DUCTI |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 11741 | I 19.5 ${ }^{\circ}{ }^{\text {I }}$ | I |
| 20 |  | $56 \cdot 70$ | 58.61 |  | I 2.41 | 14.3 |  |  | 18.31 | I 10.4 | 1 I 2.4 |  | 14.5 I | I 16.6 | 118.81 | 1210 | I |
| 18 |  | 57.80 | $59 \cdot 6$ I | I | 13.51 |  |  | - 5.51 | 19.61 | $1 \mathrm{II} \cdot 6 \mid$ | 113. |  | $15.9 \text { I }$ | 118.01 | 120.2 I | I 22.4 I | I |
| 16 |  | 58.8I | 0.71 | 71 | 14.3 | I $6 \cdot 7$ |  | $\cdot 1$ | 110.8 | 112.91 | 1 |  | I $7 \cdot 21$ | 119.4 | I 21.71 | I 23.9 I | 1 |
| 14 |  | 59.9 I | 1.9 I | I 3.81 | I 5\%9 | I | 1 | $10.0 \mid$ | $1{ }_{12} 1$ | 4 | I |  | 18.61 | 120.91 | 123.1 I | I $25^{\circ} 4$ I | I |
| 12 |  | 1 | 3.01 |  |  | I |  | II3 3 | 113.4 | I 15.6 | 1 |  | 20.11 | 122.3 I | 124.6 I | 127.01 | 1 |
| 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 |  | 3 | I 5.31 |  | $9 \cdot 51$ | I 1177 |  | 13.9 I | $1{ }^{16 \cdot 1}$ | $1{ }^{1} 8.4$ I | 120.7 |  | 23.0 I | I 25.31 | I 27.71 | I 30.2 ${ }^{\text {I }}$ | I |
| 6 |  | 4.41 |  |  | 10.81 | 113.0 |  | $5 \cdot 21$ | 11751 |  | 122 |  | 24.51 | I 26.91 | 129.3 I | I 31.81 | 1 |
| 4 |  |  | 1 | 1 | $1{ }^{1}$ | I |  | 6.6 | 1 | 121.31 | 123.7 |  | II | 128.51 | 131.01 | I 33.51 | 1 |
| 2 |  |  |  |  | ${ }^{5}$ | 1 |  |  | I | I |  |  | 27.7 I | I | 132.71 | I 35.3 I | 1 |
|  |  |  | 1 |  | I | 1 |  | I | I | I |  |  | 9.4 | I 3109 | 134.5 I | I 37.1 1 | 1 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{array}{ll} 1 & 36 \cdot 3 \\ I & 28 \cdot 2 \end{array}$ |  |  |
| 4 |  | 10 |  | $1{ }^{15} 5.51$ | $0 \cdot \mid I$ | $I$ |  | $22 \cdot 71$ | $\left.\begin{array}{ll} 1 & 25^{\circ} \\ 1260 \end{array}\right]$ | $\begin{array}{ll} I & 27.7 I \\ I & 29^{\circ} 5 I \end{array}$ | $\begin{aligned} & I \\ & I \end{aligned}$ |  | $0 \cdot 8 \left\lvert\, \begin{aligned} & 1 \\ & \hline \end{aligned}\right.$ | $\begin{array}{lll} 1 & 35 \cdot 5 \\ \mathrm{I} & 37 \cdot 4 \\ \mathrm{I} \end{array}$ | $\begin{array}{ll} 1 & 38.211 \\ 1 & 40.21 \end{array}$ | $\begin{array}{ll\|l} 1 & 40.9 \\ I & 42.9 & I \end{array}$ | $I 43.6$ |
| 8 |  | $13 \cdot 1$ | 116.21 |  | $1{ }^{1} \mathrm{I} \cdot 1 \mathrm{I}$ | $123 \cdot 6$ |  |  | 128.8 | 1295 | 1 |  | $\begin{array}{lll} \text { I } & 34 \cdot 8 \\ I & 36 \cdot 7 \\ I \end{array}$ | 1375 | I 42.3 I | I $45^{\circ} \mathrm{I}$ | $1{ }^{1} 4{ }^{\text {l }}$ |
| 10 |  | 15.41 | 117.81 |  | 22.9 I | I 25.4 |  | 28.01 | $130 \cdot 7$ | I 33.4 I |  |  | I 38.8 I | $1{ }^{1} 1 \cdot 6$ | $1{ }^{1} 44^{1}$ I | $147 \cdot 31$ | 150.2 |
| 12 |  | $17 \cdot 11$ | $110 \cdot 6$ |  | , 7 | I 27.3 |  | 30.01 | 132.7 | I $35 \cdot 4$ I |  |  |  | I 43 | I $46 \cdot 71$ | 149.71 | I $52 \cdot 6$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 20.8 I | 123 | I 26.11 | I | 1 |  |  | $37 \cdot 1$ | 14001 | I 42.9 |  | 5 |  | I 51.8 I | I 54.81 | 1 |
| 18 |  | 22.8 I | I |  | 1 | 133.8 |  | I | I 39.5 | 142 | 4 |  | $8 \cdot 4$ | 1515 | I 54.51 | $\left.157.7\right\|^{2}$ | 2 |
| 20 |  | $25^{\circ} \mathrm{I}$ I | I 27.81 | I 30.51 |  |  |  | , |  | $145^{1 / 1}$ |  |  |  |  |  | 20.72 | $24^{\circ} \mathrm{O}$ |
| 22 |  |  |  |  |  |  |  | $\cdot 91$ | 144.9 | $1{ }^{1} 8.0$ |  |  |  |  |  | 24.0 |  |
| 24 |  | 30.01 | I 32.9 I |  |  | I |  | 91 | 148.0 | 15121 |  |  |  |  | - 4 |  |  |
| 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 |  |  |  |  |  | 45 |  | 1 | I | I $54 \cdot 6$ I |  |  | 21.2 | 26 | $8 \cdot 02$ | $215 \cdot 5$ | $5^{\circ}$ |
| 27 |  |  |  | $10^{\circ} 4$ | 43.51 | I $46 \cdot 7$ |  | 9.91 | $153 \cdot 1$ | 8. |  |  |  | $26 \cdot 6$ | $21000$ | 213.512 | $217 \cdot 1$ |
| 28 |  |  | 38.9 | 42.1 | $45^{\circ} 11$ | $1 \begin{array}{ll} 1 \\ 7 & 4804 \\ \hline \end{array}$ |  | $51.7 \mathrm{I}$ | $\text { I } 55^{\circ} 0$ | $158.32$ |  |  |  |  |  | 215.72 | 21903 |
| 29 |  | 37.51 |  | .8. | $47.0 \text { II }$ | $\text { I } 50.3$ |  | $53.6 \mathrm{I}$ | $\text { I } 5700$ | $120.42$ |  |  | $\left.\right\|_{2} ^{2}$ | $\left\|\begin{array}{ll} 2 & 10 \cdot 8 \\ 2 & 13 \cdot 1 \end{array}\right\|$ | 2 14.4 <br> 2 16.8 | 8.0 42 | $\begin{array}{ll}2219 \\ 2 & 24^{\circ} \mathrm{I}\end{array}$ |
| 30 |  |  |  |  |  | $\begin{aligned} & 152 \cdot 3 \\ & I 54 \cdot 3 \end{aligned}$ |  |  |  |  |  |  |  |  | 19.2 |  |  |
| 32 | 4 | $43 \cdot 1$ I | I | I | $3 \cdot 1$ | I |  | ${ }^{2}$ | 2 | $7 \cdot 112$ | $210 \cdot 7$ |  | 14.4 | 2 | 21.92 | $225^{\circ} 2$ | 229.5 |
| 33 | 4 | 45. |  | I | 5.4 | 2 |  | 42 | $2 \quad 6.0$ | $\mathrm{l}_{2} \quad 9 \cdot 6{ }^{2}$ | 2 |  | 17 | $220 \cdot 8$ | 2 | 288.5 | - |
| 34 |  | 40.7 | I 53.2 I |  | 57.82 | 2 I 3 |  | ${ }^{1} 2$ | 28.6 | $\begin{array}{ll}2 & 12.32\end{array}$ | $216 \cdot 1$ |  | 12. | 2 26.8 | 27.6 | 23 F 5 | 8 |
| 35 |  |  |  |  | 42 |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 |  |  |  |  |  |  |  | 6 | 2 |  |  |  |  |  | 2 |  |  |
| 37 |  | 57 |  |  | 2 | $2{ }^{2}$ |  | 13.72 | 2 | 15 | $225 \cdot 4$ |  | 29 | $33 \cdot 5$ | 37.6 | 2 | $246 \cdot 0$ |
| 39 |  | 2 |  |  | 21.6 | 213.1 |  | 17.02 | $2 \quad 20 \cdot 9$ | ${ }^{2} \quad 24.92$ | $229^{\circ} 0$ |  | $33^{\circ} \mathrm{I}$ | $2{ }^{2}$ | $2{ }^{2} 5$ | $24^{4} 7$ | $5{ }^{\circ}$ |
| 39 |  |  |  | $2 \quad 8 \cdot 72$ | $\begin{array}{lll} 2 & 12.62 \\ 2 & 16.2 & 2 \end{array}$ | $\begin{array}{ll} 2 & 16 \cdot 5 \\ 2 & 20 \cdot 3 \end{array}$ |  | 20.5 | 224.6 | $\begin{array}{ll}2 & 28.72 \\ 2 & 32.72\end{array}$ |  |  | $7 \cdot 0$ | 2 | 2 45.6 <br> 2 50 <br> 0.0  | 249.9 | $54 \cdot 3$ |

TRUE BEARING OR AZIMUTH OF $*$ a CENTAURI.

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AZIMUTHS.

| Lat. | ${ }_{4}^{\mathrm{m}}$. | ${ }_{8}^{\text {m. }}$ | ${ }_{12}$ | ${ }_{16}^{\text {m. }}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{24}^{\mathrm{m}}$ | ${ }_{26}^{\mathrm{m}}$ | ${ }_{28}^{\mathrm{m}}$. | ${ }_{30}$ | ${ }_{32} \mathrm{~m}$. | ${ }_{34}$ | ${ }_{36}^{\mathrm{m}}$ | ${ }_{38}$. | ${ }_{40}$ | ${ }_{42}$ | ${ }_{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $3{ }^{\circ}$ | ${ }^{\prime} \cdot 2$ | ${ }^{\circ}{ }^{\prime} 9$ | $2^{\prime} 0$ | 3'6 | 5'6 | $8{ }^{\text {\% }}$ ' | $9^{\prime} 4$ | ró. 9 | I2'6 | $14 \cdot 3$ | 16́' 1 | I8́.r | $20 \cdot 1$ | $22 \cdot 3$ | 24.6 | \% |
| 35 | 0.2 | $\bigcirc \cdot 9$ | r.9 | $3 \cdot 4$ | $5 \cdot 4$ | $7 \cdot 7$ | $9^{\circ}$ | 10.4 | Ir.9 | 13.6 | 15.3 | 17.2 | 19.1 | $2 \mathrm{P} \cdot 2$ | $23 \cdot 3$ |  |
| 40 | $0 \cdot 2$ | 0.8 | I. 8 | $3 \cdot 2$ | $5 \cdot$ | $7 \cdot 2$ | 8.5 | $9 \cdot 9$ | Ir 3 | 12.8 | 14.5 | 16.2 | 18.1 | $2{ }^{20.1}$ | $22 \cdot 1$ | $24 \cdot 3$ |
| 45 | 0.2 | $0 \cdot 8$ | r $/ 7$ | $3 \cdot 1$ | 4.8 | $6 \cdot 9$ | 8.0 | $9 \cdot 3$ | 10.6 | 12. | $13 \cdot 7$ | 15.3 | 17.1 | 18.9 | 20.9 | 9 |
| 50 | $0 \cdot 2$ | $0 \cdot 7$ | r. 6 | 2.8 | 4.4 | $6 \cdot 4$ | $7 \cdot 5$ | 8.7 | roo | 1 | 12.8 | 14.3 | 16.0 | 17.7 | 5 | 21.4 |
| 50 60 | O.2 0.1 | 0.7 0.6 | r. 1.3 | 2.6 <br> 2.4 | 4.1 $3 \cdot 7$ | 5.9 | $6 \cdot 9$ $6 \cdot 3$ | 8.0 | 9.2 8.4 | 10.5 9.6 | I1.9 10.8 | $13 \cdot 3$ $12 \cdot 1$ | 14.8 |  | 18.1 |  |
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| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 | $27 \cdot 6$ | 28.9 | $30^{\circ}$ | 31.4 | 32.8 | $34^{1}$ | $35 \cdot 5$ | $36 \cdot 9$ | 38.3 | $39 \cdot 8$ | $4{ }^{1} 2$ | $42 \cdot 7$ | $44 \cdot 3$ | $45 \cdot 8$ | $47 \cdot 4$ | $49^{\circ}$ 480 |
| 34 36 | $27 \cdot 1$ 26.5 | 28.3 27.7 | 29.5 28.9 | 30.8 30.2 | 32.I | $33 \cdot 4$ $32 \cdot 7$ | 34.8 | $36 \cdot 1$ $35 \cdot 4$ | 37.5 36.7 | 39.0 38.1 | 40.4 39.6 | ${ }_{41}^{41} \cdot 0$ | $4{ }^{43} \cdot$ | $4{ }^{4 \cdot} 4.9$ | 45 | $4{ }_{4}^{4}{ }^{4.0}$ |
| ${ }_{3} 8$ | 26.0 | ${ }_{27 \cdot \mathrm{I}}^{2}$ | 28.3 | 29.5 | 30.8 | $32 \cdot$ | ${ }_{33} 3$ | $34 \cdot 6$ | 36.0 | 37.3 | 38.7 | $40^{-1}$ | $4 \mathrm{x} \cdot 6$ | $43^{\text {I }}$ | 44.5 | $46 \cdot x$ |
| 40 | 25.4 | 26.5 | $27 \cdot 7$ | 28.9 | $30 \cdot 1$ | $31 \cdot 3$ | $32 \cdot 6$ | $33 \cdot 8$ | $35^{2}$ | $36 \cdot 5$ | $37 \cdot 9$ | 39.2 | $40 \cdot 6$ | 42 I | $43 \cdot 5$ | $45^{\circ}$ |
| 42 | 24.8 | 25.9 | 27.1 | 28.2 | 29.4 | $30 \cdot 6$ | 31.8 | 33.1 | 34.4 | $35 \cdot 7$ | 37.0 | 38.4 | 39.7 | $4 \mathrm{I} \cdot \mathrm{I}$ | $4{ }^{2 \cdot 6}$ | $44^{\circ}$ |
| 44 | 24.2 | $2{ }^{25} 3$ | $26 \cdot 4$ | 27.5 | 28.7 | $22 \cdot 9$ | 31. | 32.3 | 33.5 | 34.8 | $36 \cdot 1$ | 37.4 |  | 40.2 |  | 43 |
| $4{ }_{48}^{46}$ | 23.6 23.0 | 24.7 24.0 | 25.7 | ${ }_{26 \cdot 1}^{26.9}$ | $28 \cdot 0$ $27 \cdot 2$ | 29.1 28.4 | $30 \cdot 3$ $29 \cdot 5$ | 31.5 30 | $32 \cdot 7$ <br> 3 r | ${ }^{34}{ }^{3} \cdot{ }^{\text {I }}$ | 35.2 | 36.5 $35 \cdot 6$ | 37.8 36.8 | 39.2 | 40.5 | . 9 |
| 50 | 22. | 23. | 24.4 | 25.4 | 26.5 | 27.6 | 28.7 | 29.8 | $35^{\circ}$ | $32 \cdot 2$ | 33.4 | 34.6 | $35 \cdot 8$ | $37 \cdot 1$ | 38.4 | 39.7 |
| 52 | 21.7 | 22.7 | 23.7 | $24 \cdot 7$ | 25.7 | 26.8 | 27.9 | $29^{\circ}$ | $30^{\prime}$ | 31.2 | 32.4 | 33.6 | $34 \cdot 8$ | $36^{\circ}$ | 37.3 | 38.6 |
| 54 | 21.1 | $22^{\circ} \mathrm{O}$ | 23.0 | $24^{\circ}$ | 25.0 | $26^{\circ}$ | 27.0 | $28 \cdot 1$ | 29.2 | $3{ }^{30} 3$ | $3{ }^{31} 4$ | 32.6 | 33.7 | 34.9 | 36.1 | 37.4 |
| 56 | $20 \cdot 4$ | 21.3 | 22 | ${ }_{22.2}^{23.2}$ | 24.1 | $25^{1}$ | 26.2 | 27.2 |  | 29.3 | $3{ }^{\circ} 4$ | 3 x 5 | 32 | 33 | 35.0 | 36.2 |
| 60 | 18.9 | 19.8 | 20 | 22.4 <br> 2 r | 22.4 | 24.3 23.3 | ${ }_{24}^{25}$ | 25.2 | 26.2 | 27.2 | 28.2 | 30.4 29.3 | $30 \cdot 3$ | 31. | $33 \cdot 5$ <br> 32.5 | 34.9 <br> 33.6 |
| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $\underset{0}{\mathrm{~m}}$ | ${ }_{1}$. | $\stackrel{\mathrm{m}}{2}$ | ${ }_{3}{ }^{\text {m }}$ | ${ }_{4}^{\mathrm{m}}$. | ${ }_{5}^{\mathrm{m}}$. | ${ }_{6}^{\mathrm{m}}$. | $\frac{\mathrm{m}}{7}$ | $\frac{\mathrm{m}}{8}$ | ${ }_{9}^{\mathrm{m}}$ | $\begin{aligned} & \mathrm{m} . \\ & 10 \end{aligned}$ | $\frac{\mathrm{m}}{11}$ | ${ }_{12}$ | $\frac{\mathrm{m}}{13}$ | ${ }_{14}^{\mathrm{m}}$ | ${ }_{15}$ |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{30}$ | 50́o | 5r'7 | 53.4 | 55'I | 56.9 | 58.6 | 6ó4 | 62'3 | 64'ㅈ․ | 66́.0 | 6\%'9 | 69.9 | $7{ }^{\text {r }}$ - 8 | 73'8 | $75 \cdot 9$ | $\cdots$ |
| 32 | $49^{\circ}$ | 50.7 | 52.3 | $54^{\circ}$ | 55.8 | 57.5 | 59.3 | 6r ${ }^{\text {r }}$ | 62.9 | 64:7 | $66 \cdot 6$ | 68.5 | $7{ }^{70} 4$ | 72.4 | 74.4 | 76.4 |
| 34 <br> 36 | 4 | 49 48 48 | 51.3 $50 \%$ |  | $54 \cdot 6$ 53 | $56 \cdot 3$ 55.2 | 58*. | 59:8 | 61.6 | 63.4 | 65.3 | 67. ${ }^{67}$ | - 69.6 | 71.0 | 72.9 754 | $74 \cdot 9$ $73 \cdot 3$ |
| 38 | $4{ }^{\text {4 }}$ I | $47 \cdot 6$ | $49^{\circ}$ | 50.8 | $52 \cdot 4$ | $54^{\circ}$ | 55.7 | 57.4 | 59.1 | $60 \cdot 8$ | 62 | 64.4 | $66 \cdot 2$ | 68.0 | 69.9 | . 8 |
| 40 | $45^{\circ}$ | $46 \cdot 5$ | $48 \cdot \mathrm{x}$ | 49.6 | 51.2 | 52.8 | 54.4 | 56. | 57.8 | 59.5 | 61.2 | 63.0 | $64 \cdot 7$ | $66 \cdot 5$ | 68.4 | 70.2 68.6 |
| 42 | ${ }^{44^{\circ} \mathrm{O}}$ | 44.5 | ${ }^{47} 7^{\circ} \mathrm{O}$ | + 48.5 | 50.1 | ${ }_{5}^{51 \cdot 6}$ | 53.2 52.0 | 54.8 | 56.5 | $58 . \mathrm{x}$ <br> 56.8 | 59 | ${ }^{61.5}$ | $63 \cdot 3$ $6 T \cdot 8$ |  | $66 \cdot 8$ $65 \cdot 2$ | 68.6 67.0 |
| 44 | ${ }_{41}^{43}{ }^{\circ} \mathrm{O}$ | 44.4 | 45.9 44.7 | $\xrightarrow{47.4} 4$ | ${ }_{47}^{48} 7$ | 50.1 | 52\% | 53.5 | 55.r | 56.8 | 57 |  | 61.8 $60 \cdot 2$ | 63.5 6 r .9 | 65.2 63.6 | $67 \%$ $65 \cdot 3$ |
| 47 | $4{ }^{1} 4$ | $42 \cdot 7$ | $44^{2}$ | $45 \cdot 6$ | $47^{\circ}$ | $48 \cdot 5$ | $50^{\circ}$ | 51.5 | 53.1 | 54.6 | $56 \cdot 2$ | 57.8 | $59 \cdot 5$ |  | 62.8 | $64 \cdot 5$ |
| 48 | $40 \cdot 8$ | $42 \cdot 2$ | $43 \cdot 6$ | $45^{\circ}$ | $46 \cdot 4$ | 47.9 | 49.4 | 50.9 | 52.4 | 53.9 | $55 \cdot 5$ | 57.1 | $58 \cdot 7$ | 60.3 | 62.0 | 63.6 |
| 49 | $40 \cdot 3$ 39 | $4 \times 6$ $4 \cdot$ $4 \cdot 0$ | ${ }^{43}{ }^{3} \mathrm{O}$ | 44.4 <br> 43 | $45^{\prime} 8$ $45^{\circ} 2$ | 47.2 46.6 | 4 | 50.2 | 51.7 | 53.2 52.5 | 54 | $56 \cdot 3$ $55 \cdot 5$ | $57 \cdot 9$ $57 \cdot 1$ | 59.5 | 61.1 | 62.8 |
| 5 | ${ }^{39} 1$ | $4{ }^{4} 5$ | ${ }_{41}^{42} \cdot 8$ | ${ }_{43}{ }^{\text {I }}$ | ${ }_{44}{ }^{4} 5$ | $45 \cdot 9$ | $47 \cdot 3$ | 48 | 50.2 | 51.7 | $53 \cdot 2$ | 54.7 | ${ }_{56 \cdot 3}$ | 57.8 | 59.4 | $6 \mathrm{x} \cdot{ }^{\circ}$ |
| 52 | 38 | 39.9 | $4 \mathrm{I} \cdot 2$ | $42 \cdot 5$ | $43 \cdot 9$ | 45.2 | 46 | 48 | $49 \cdot 5$ | 50.9 | 52.4 | 53.9 | $55^{4} 4$ | $57^{\circ}$ | 58.5 |  |
| 53 | 38.0 | 39.3 | $40 \cdot 5$ | $4 \mathrm{I} \cdot 9$ | 43.2 | $44 \cdot 5$ | $45 \cdot 9$ | 47.3 | $48 \cdot 7$ | $50 \cdot 2$ | 51.6 | 53.1 | 54.6 | 56. | 57.7 | 59.2 |
| 54 55 5 | 33.4 36.8 | 38.6 38.0 | 39.9 | 41.2 40.5 | ${ }_{4}^{42} 5$ | 43.9 | 45.2 44.5 | $46 \cdot 6$ 45 | 48.0 | 49.4 | $50 \cdot 8$ 50.0 | 52.3 | $53 \cdot 8$ 52.9 | 55.2 |  | 58.3 <br> 57.4 |
| 55 <br> 56 | ${ }_{36.2}^{36.8}$ |  | $39 \cdot 3$ $38 \cdot 6$ | 40.5 39.9 | ${ }_{41}{ }^{1} \cdot{ }^{\text {- }}$ | 43. 4 | ${ }^{44 \cdot 5}$ | ${ }^{45 \cdot 8}$ | ${ }_{46.4}^{47.2}$ | ${ }_{47}^{48} 8$ | $49 \cdot 2$ | 51.4 50.6 | (1) $\begin{aligned} & 52 \cdot 9 \\ & 52.0\end{aligned}$ | 54.4 | 54.9 | 574 56.4 |
| 57 | $35 \cdot 5$ | $36 \cdot 7$ | 38.0 | 39.2 | 40.4 | 4 r 7 | $43^{\circ} \mathrm{O}$ | 44*3 | $45 \cdot 6$ | $47^{\circ}$ | $48 \cdot 3$ | 49.7 | ${ }_{51}$ - 1 | 52.5 | $54^{\circ}$ | 55.4 |
| 58 | 34. | 36.1 |  | 38.5 | 39.7 | $4{ }^{1} \cdot$ | 42.2 | $43 \cdot 5$ | $44^{\circ} 8$ | 46•1 | 47.5 | $48 \cdot 8$ | $50 \cdot 2$ | $5{ }_{5} 5$ | 53.0 | 54.5 |
| 59 60 |  | $35 \cdot 4$ | 36.6 | 37 | 39.0 38.2 | 40.2 39.4 | 41 $40 \cdot 6$ 4 | $42 \cdot 7$ | $44 \cdot 0$ 43 | $45 \cdot 3$ | 45 | $47 \cdot 9$ 47 | $49 \cdot 3$ 48.3 | $50 \cdot 7$ 49.7 |  | 53.4 52.4 |
| Lat.o HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | $\stackrel{\text { m. }}{\substack{\text { m }}}$ | $\left\lvert\, \frac{\mathrm{m}}{8}\right.$ | ${ }_{12}^{\mathrm{m} .} \mid$ | ${ }_{16}^{\mathrm{m}}$ | ${ }_{20}^{\mathrm{m}}$ | $\mid{ }_{24}^{\mathrm{m}}$, | ${ }_{30}{ }_{3}$ | ${ }_{40}^{\mathrm{m}}$ | m. 50 | \% ${ }^{\text {m. }}$ | $\left\|\frac{\mathrm{m}}{10}\right\|$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{30}$ | ${ }_{40}^{\mathrm{m}}$ | $1 \begin{aligned} & \text { m. } \\ & 50\end{aligned}$ | ${ }_{60}$ |
| S. AZIMUTHS. ${ }^{\text {S }}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 | $0^{\circ} \cdot 5$ | roo | - ${ }^{\circ}$ | $2 \%$ | 2.5 |  |  |  | 6.1 | $7 \times$ | 8.5 | $\stackrel{\circ}{9} 7$ | $\stackrel{\circ}{1} 9$ | ${ }^{1}{ }^{\circ} \mathrm{I}$ | 13.2 | 14.3 |
| 40 | 0.5 | I.O | 1.5 | - | 2.5 | 3.0 | 3.8 | 5.0 | $6 \cdot 2$ | $7 \cdot 5$ | $8 \cdot 7$ | $9 \cdot 9$ | Ir. ${ }_{\text {I }}$ | I2.3 | 13.5 | 14.7 |
| 50 56 | 0.5 | $\stackrel{\text { r }}{\text { r }}$ | r.6 | 2.1 2.2 | 2.6 | 3.2 3.3 3 | 3.9 <br> $4 \cdot 1$ | 5.3 | 6.6 | 7.9 8.2 | $\stackrel{9.2}{9}$ | 10.4 | 11.7 | $13^{13.0}$ | 3 | 15.3 |
| 56 | - 0.6 | r-1 | r | 2.2 | 2.8 | 3.3 3.4 | 4.1 4.3 | 5.7 | ${ }_{7}{ }_{7} 9$ | 8.2 8.6 | $9 \cdot 6$ | II. ${ }_{\text {IT }}$ | 12 | 13'7 | 15.6 | 3 |

## REDUCIION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM MERIDIAN BELOW THE POLE.

* $a^{2}$ CENTAURI.

| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  | ${ }_{16}^{\text {m. }}$ | \| $\mathrm{m}_{17}$ |  | ${ }_{19}$ |  |  | ${ }_{22}$ | $\left.{ }_{23}^{\mathrm{m}}\right\|^{\mathrm{m}}$ | $\left.4\right\|_{25} ^{\mathrm{m}}$ | $1{ }_{26}^{\mathrm{m}}$ | ${ }_{2 j}{ }_{2}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{29}^{\text {m. }}$ | $\mathrm{m}_{30}$ | ${ }_{31}^{\mathrm{m}}$ |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{32}$ |  |  |  |  |  |  |  |  |  |  |  |  | 104.7 | 107. 1 |  |  |
| 32 <br> 34 |  | ${ }_{7} 78.3$ | 78.8 |  | 82.0 |  |  |  |  |  |  | $100 \cdot 3$ | I22.6 | 104.9 | 107.3 | 7 |
| 36 38 |  | $7^{75}{ }^{2}$ | 77.2 75.5 | 79.2 |  |  | $85 \cdot 3$ | ${ }_{85} 8.4$ | $89 \cdot 5$ 87.6 89 | 93 |  | ${ }_{96 \cdot 2}$ | 100. ${ }^{8}$ | 102.6 |  |  |
| 40 |  | $72^{\circ}$ | 73.9 | 75 | $77 \cdot 7$ | $79 \cdot 7$ | $8 \mathrm{I} \cdot 7$ | $83 \cdot 7$ | $85 \cdot 7$ | 89.9 | $92 \cdot$ | 94- | $96 \cdot 3$ | 98.5 | 100.7 | 102.9 |
| 41 |  |  | 73.0 | 74.9 | $76 \cdot 8$ | 78.8 | $80 \cdot 8$ | 82.8 | 84.8 | 88 |  | $93 \cdot 1$ | $95 \cdot 2$ | 97.4 |  | $8$ |
| 42 |  | 70 | $72 \cdot 2$ 71.4 | $74 \cdot 1$ | ${ }^{76 \cdot 0}$ |  | $7{ }^{79} 8$ | 81.8 | 83.8 | 86 | 88.9 | 92. | ${ }_{93}{ }^{\text {P }}$ - | 95'I |  | 99.4 |
| 44 |  |  | 70.5 | 72.3 | 74.2 | 76.1 | 78.0 | 79.9 | 8r.8 | . 8.85. | 87.8 | 88.8 | $9 \mathrm{~F} \cdot 8$ | 94 | 96. |  |
| 45 |  |  | $69 \cdot 6$ | 71 | $73 \cdot 3$ | 75•1 | $77^{\circ}$ | 78.9 | 80.8 | -8 84 | 86.7 | 88.7 | $90 \cdot 8$ |  | 9 | $97^{\circ}$ |
| 46 |  | ${ }^{67} \cdot 0$ | 68.8 | $70 \cdot 5$ | $72 \cdot 3$ | 74.2 | $76 \cdot 0$ | 77.9 | 79.8 | 83. | $85 \cdot 6$ | 87.6 | 89.6 88.5 | 9 | 7 | $95 \cdot 8$ |
| 47 |  |  | 67.9 |  | 71.4 | $73 \cdot 2$ | 75'I |  |  |  |  | ${ }^{86.5}$ |  | ${ }^{90}$ |  | ${ }_{93 \cdot 3} 9$ |
| 4 |  |  | ${ }_{66.1}$ |  | 70.5 | 7 r | ${ }_{73 \cdot \mathrm{I}}^{7}$ | 75 | $76 \cdot 778$ | . 680 | 82.3 | $84 \cdot 2$ | $86 \cdot 2$ | 88. |  |  |
| 50 |  | 63 | $65 \cdot 2$ | 66 | 68.6 | $70 \cdot 3$ | 72-I | 73.8 | $75 \cdot 6$ | - 5 79 ${ }^{\circ}$ |  | $83 \cdot 1$ | $85^{\circ}$ | 86.9 |  |  |
| 51 |  | $62 \cdot 6$ | $6_{4} 2$ | 65.9 | 67.6 | $69 \cdot 3$ | $7 \mathrm{r} \cdot \mathrm{I}$ | 72.8 | $74 \cdot 676$ | 6.4 78.2 | - 0 | 9 | 83.8 | $85 \cdot 7$ |  | $\cdot 5$ |
| $\begin{aligned} & 52 \\ & 53 \end{aligned}$ |  |  | 63.3 | $64 \cdot 9$ |  |  |  | 71.7 | $73 \cdot 575$ |  | - 78.9 |  |  |  |  |  |
| 53 <br> 54 |  | 59 | $6 \mathrm{r} \cdot 4$ | $63^{\circ} \mathrm{O}$ | 64.6 | $66 \cdot 2$ | 67.9 | 69.6 | 7 ra 73 <br> 7  | 74 | $7{ }^{76} 5$ | 78.2 | 80. | ${ }_{81} 9$ | $83 \cdot 7$ | $85 \cdot 6$ |
|  | 1 HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 号 |  | ${ }_{32}$ | ${ }_{33}$. | ${ }_{34}$ | ${ }_{35}$. | $\frac{\mathrm{m}}{36}$ | ${ }_{37}$ | $\overline{\mathrm{m} .}$ | ${ }_{39} \mathrm{~m}$ | ${ }_{40}^{\mathrm{m} .}$ |  | $\frac{\mathrm{m}}{42}$ | $\frac{\mathrm{m} .}{43}$ | $\frac{\mathrm{m} .}{44}$ | ${ }_{45}$ |  |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | 114.6 | I17 | 119.5 |  | I24.5 | I26.9 | ${ }^{129.5}$ | 132.1 | 134.7 | 217.42 | 20.012 | 22.7 | 25 | $28 \cdot 2$ |
| $\left.\begin{aligned} & 35 \\ & 36 \end{aligned} \right\rvert\,$ |  | 10.9 00.8 | I13.3 |  | 11818.2 |  | $\xrightarrow{123.1}$ | $1 \begin{aligned} & 125 \cdot 7 \\ & 124.4\end{aligned}$ | ${ }_{4} 120.2$ | $\xrightarrow{130^{\circ} 8}$ | 133.4 | ${ }_{2} 18.6{ }_{2}$ | ${ }_{17} 18.2$ | 2r.3 | 22. |  |
| 37 |  | 08.6 | IITO | II3.3 | Ir5\%7 |  | 120.6 | 123.1 | $125 \cdot 6$ | 128.1 | ${ }^{1} 3{ }^{\circ} 6$ | 13.22 | 15.82 | 18.4 | $22^{\circ}$ | $23^{\circ} 7$ |
| 38 |  | 07.5 | 109.8 | I12 | II4.5 |  | I19.3 | 121.8 | 124.2 | 126.7 | 129.2 | $2 \mathrm{Ir} \cdot 82$ | 14.32 | 16.9 | 19.5 | $22 \cdot 2$ |
|  |  | 06 | Io8 | 110 | 113.3 |  | I18.0 | $120 \cdot 5$ |  | 125.4 | 127.8 | $\mathrm{IO}_{8} \mathrm{H}_{4}$ | 12.9 | $15 \cdot 5$ | 18. | $20 \cdot 6$ |
| 40 |  | 05. ${ }^{\text {a }}$ | IO7.4 | rog ros. c |  |  | ${ }_{115}^{115 \cdot 7}$ | (19.1 | 1215 | ${ }_{124}^{124.0}$ | ${ }_{125}^{126.4}$ | 8.92 |  |  |  |  |
| 4 |  | - ${ }^{\text {O2. }}$ |  | $\begin{array}{\|l\|} \text { 108 } \\ \text { 107 } \end{array}$ | 110.8 to 5 |  |  |  | $\begin{aligned} & 120.2 \\ & \mathrm{I} 18.8 \end{aligned}$ |  | ${ }_{123}^{125}$ | ${ }^{7} 7.5$ | ${ }_{8}^{10.5}{ }^{1}$ | $\left.{ }_{\text {II }}^{12} \mathrm{O}\right\|_{2}$ | 15.0 <br> 13.5 <br> 1 |  |
|  |  |  | 103 | 106 | 108.2 |  |  | 1151 |  | 119.8 | 122.2 | $4 \cdot 62$ | 7.02 | $9 \cdot 4$ | $1{ }^{1}$ |  |
| 44 |  | 00. | 102 | 104•7 | 106.9 | 109.2 | III4 | $1113 \%$ | 116.0 | 118.4 | 120.7 | $3 \cdot 12$ | $5 \cdot 52$ | 7.9 | 10.4 |  |
| 45 |  | 99 | 101 | 103.5 | 105.6 |  |  | ${ }_{1}^{12 \cdot 3}$ | $114 \cdot 6$ | 116 |  | ${ }^{1} 162$ |  |  |  |  |
| 4 |  |  |  | 1 | Io4.3 |  |  |  | 1 | 115.5 | 117 116.3 | - ${ }^{0.12}$ | 2.42 0.92 |  |  |  |
| 47 |  | 96 | 98.7 | 100.9 |  |  |  |  |  | 11 |  | 58.6 | ${ }^{\circ} 9.9$ |  |  |  |
| 48 |  | 9 | $97 \cdot 5$ | 5 |  | 103. 8 |  |  | 11 | 112.5 | 114.8 | 57.01 |  | ${ }^{1} 6$ | 3. |  |
| 49 |  |  |  |  |  |  |  |  |  |  |  | 55.5 |  |  |  |  |
| 50 |  |  | 94 |  | 9 |  |  |  | $2107 \cdot 3$ | 109.5 | 11 F 7 | 53.9 | $56 \cdot$ | 58. |  |  |
| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | ${ }_{47}$. | ${ }_{48}$ | ${ }_{49}$ | 95 |  | ${ }_{51}^{\mathrm{m}} 1$ | ${ }_{52}$ | ${ }_{53}^{\mathrm{m}}$ | $\overline{\mathrm{m}_{1}}$ | $\frac{\mathrm{m}}{55}$ | $\begin{aligned} & \hline \mathrm{m} . \\ & 56 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 57 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 58 \end{aligned}$ | $\frac{\mathrm{m}}{59}$ | $\begin{gathered} \mathrm{m} \\ 60 \end{gathered}$ |
| s. RED |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | $\stackrel{\circ}{2}$ |  | ${ }_{2}$ |  |  |  | $48^{\prime}$ | 51.4 |  |  |  |  | 6. |  | I2 28 |
| 34 |  | $230{ }^{\circ}$ | .92 23 | $3 \cdot 72$ | 35.5 | 39.42 | $42 \cdot 2$ | 45.12 | 2488.0 | $\mathrm{r}_{1} \cdot{ }^{\text {a }}$ | 53.9 | 56.92 | 59.9 | $3 \cdot$ | $4 \cdot$ |  |
| 35 36 |  | $\begin{array}{ll}229 \\ 2 & 27 \\ 2\end{array}$ | 9.923 | -6 62 | 35'42 |  |  |  | ${ }_{2}^{2} 46 \cdot 4.4$ | 9.3 $5 \cdot 2$ |  | 55'r ${ }^{2}$ |  |  |  |  |
| 37 |  | 226 | ${ }_{4}{ }^{2} 29$ | -1 23 | ${ }^{1} \mathrm{r} 82$ | $34 \cdot 6$ | $37 \cdot 32$ | $240 \cdot 1$ | 243.0 | 45.8 | $48 \cdot 7$ | 251.62 | $54 \cdot 5$ | $57 \cdot 4$ | ${ }^{\circ} \mathrm{O} 4$ |  |
|  |  | 224. | 8.827 | 552 | 30.22 | 32.92 | 35.72 | $\begin{array}{lll}2 & 38.512\end{array}$ | 241.22 | 44.12 | $46 \cdot 9$ | 249.82 | 52.72 | $55 \cdot 6$ | 288.5 |  |
| 39 |  | $2{ }^{2} 23$. | 3.325 | $5 \cdot 92$ | 28.6, ${ }^{2}$ | 31.32 | $3{ }^{3+0}{ }^{2} \cdot{ }^{2}$ | $\begin{array}{ll}2 & 36 \cdot 8 \\ 2\end{array}$ | $\begin{array}{ll}2 & 39 \cdot 5 \\ 2 \\ 3 & 7 \\ 7\end{array}$ | $42 \cdot 32$ |  | 48.02 | 50.82 | 53.72 | $56 \cdot 6$ |  |
| $4{ }_{41}$ |  | 2 2 20. 20. 20 | I $1{ }^{2} 2$ | $4.72{ }_{2}^{2}$ | 27.32 | 28.0. 2 | $32 \cdot 3$ <br> $30 \cdot 6$ | 2 $35 \cdot 0$ <br> 2 $33^{\prime}$ | $\begin{array}{ll}2 & 37 \cdot 8 \\ 2 & 36 \cdot 0\end{array}$ | 40.5 | 43.3 | ${ }_{44}^{46 \cdot 3}{ }^{4}{ }^{2}$ | ${ }^{49}{ }^{\circ} \mathrm{I} 2^{2}$ | 41.92 | 24. |  |
| 42 |  | 218. | 5221 | -12 2 | 3.72 | $26 \cdot 32$ | 28.92 | $23{ }^{15} 6$ | $234 \cdot 32$ | 37.02 | $39^{\circ} 7$ |  |  | 48.0 | 50.8 | 7 |
| 43 |  | 216. | 9.92 | 52 | 2.02 | $24 \cdot 6$ | 27.2 | 229.82 | 232.52 | 35.22 | $37 \cdot 9$ | 40.62 | $43 \cdot 32$ | $46 \cdot 1$ | 48. |  |
|  |  | $2{ }^{2} 15$ | 321 | 8.8 | 20.32 | 22.92 | $25 \cdot 52$ | 288.1 | 230.72 | 3, | S4. | 238.72 | $4{ }^{4}$ | ${ }^{4} \cdot{ }^{4} \cdot 1.15$ | 4. |  |
| 45 | 2 | 2 2 2 2 12 | \% 72 | ${ }_{5}^{1} 2{ }_{2}$ | 6.92 | 21.24 19.4 | ${ }_{21}^{23.7}{ }_{2}^{2}$ | 2 226.312 | $\begin{array}{ll}2 & 28 \cdot 9 \\ 2 & 27.0 \\ 2\end{array}$ | ${ }_{20}{ }_{2} 1.512$ | 34.7 | $\begin{array}{lll}2 & 36.8 \\ 2 & 34.82 \\ 2\end{array}$ | ${ }^{39.4}{ }^{2}$ | 42.12 | 44.9 |  |
| 47 |  | 2 10 <br> 2 10 <br>   |  | 2.82 | $5 \cdot 2$ | 17.72 | 20.1 | 222.6 |  |  |  | 2 32.92 |  |  |  |  |
| 48 | 2 | 8. | 3.612 | 1.02 | 13.42 | 15.92 | $18 \cdot 3$ | 220.82 | 233.32 | 25.82 | 28.3 | 30.92 | $33 \cdot 5$ | $36 \cdot 1$ | 38 |  |
|  |  | $\begin{array}{ll}2 & 6 \\ 2 & 5\end{array}$ | $5 \cdot 922^{2} \quad 9$ | $5{ }^{2}$ | 9.92 | ${ }_{12}^{14.15}$ | $16 \cdot 5$ <br> 14.6 | $17 \%$ | ${ }_{2}{ }^{2} \mathrm{I} 9.42$ |  | $24 \cdot 4$ | 6.82 | 29.4 | 31.9 |  |  |


N.

| 24 | $0^{\prime} 2$ | $\bigcirc{ }^{\circ} 9$ | $2: 0$ | 3'5 | $5^{\prime} \cdot 5$ | $6 \cdot 7$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $0 \cdot 2$ | 0.9 | $2 \cdot 0$ | 3.6 | 5.7 | $6 \cdot 9$ |
|  | $0 \cdot 2$ | $0 \cdot 9$ | $2 \cdot 1$ | $3 \cdot 8$ | 5.9 | $7 \cdot 1$ |
| 12 | 0.2 | 1.0 | 2.2 | 3.9 | $6 \cdot 1$ | 7.4 |
| 8 | $0 \cdot 2$ | 1.0 | $2 \cdot 3$ | 4.0 | $6 \cdot 3$ | $7 \cdot 6$ |
| 4 | $0 \cdot 3$ | I\% | $2 \cdot 3$ | 4.2 | 6.5 | 7.9 |
| S. |  |  |  |  |  |  |
| - | $0 \cdot 3$ | $1 \cdot 1$ | $2 \cdot 4$ | $4 \cdot 3$ | $6 \cdot 8$ | 8.2 |
| 4 | 0.3 0.3 | 1 l | $2 \cdot 5$ 2.6 | 4.5 | 7.0 | 8.5 |
| 12 | 0.3 | 1.2 | 2.7 | $4 \cdot 9$ | 7.6 | 9.2 |
| 16 | $0 \cdot 3$ | I.3 | $2 \cdot 9$ | $5 \cdot 1$ | 7.9 | $9 \cdot 6$ |
| 20 | $0 \cdot 3$ | $1 \cdot 3$ | 3.0 | $5 \cdot 3$ | $8 \cdot 3$ | $10 \cdot 1$ |
| 24 | ${ }_{0} 0.3$ | 1.4 | $3 \cdot 2$ | 5.6 | 8.8 | $10 \cdot 6$ |
| 28 | 0.4 0.4 | I.4 | 3.3 3 | 5.0 | 9.0 | -9 |
| 30 | 0.4 | I.5 | $3 \cdot 5$ | $6 \cdot 2$ | $9 \cdot 6$ | 11.6 |
| 32 | $0 \cdot 4$ | I.6 | $3 \cdot 6$ | $6 \cdot 4$ | 10.0 | 12.0 |
| 34 | 0.4 0.4 |  | 3.7 | 6.6 | 10.4 | 12.5 |
| 38 | ${ }_{0}^{0.4}$ | I.8 | -3.9 | 7.9 | Iİ3 | ${ }_{13}^{13 \cdot}$ |
| 40 | 0.5 | I.9 | $4 \cdot 3$ | $7 \cdot 6$ | II.9 | 14.4 |
| 42 | $0 \cdot 5$ | $2 \cdot 0$ | $4 \cdot 5$ | 8.1 | 12.6 | 15.2 |

## REDUCTIONS.





| 9 | $17 \cdot$ |
| :--- | :--- |
| 4 | 18 |
| 0 | 19 |
| 6 | 19 |
| 2 | 20 |
| 8 | 21 |
|  |  |
| 5 | 21 |
| 2 | 22 |
| 0 | 23 |
| 9 | 24 |
| 0 | 25 |
| 2 | 26 |
| 0 | 29 |
| 8 | 30 |
| $\cdot$ | 31 |
| 7 | 32 |
|  | 33 |
| $\cdot$ | 3 |

 19
20
2
2

2 | $19 \cdot 8$ | 21 |
| :--- | :--- |
| $20 \cdot 5$ | 22 |
| $21 \cdot 2$ | $23 \cdot$ |
| $21 \cdot 9$ | $24 \cdot$ |
| $22 \cdot 7$ | 25 |
| $23 \cdot 5$ | 26 |
|  |  |
| $24 \cdot 3$ | 26 |
| $25 \cdot 2$ | 27 |
| $26 \cdot 2$ | 29 |
| $27 \cdot 3$ | 30 |
| $28 \cdot 5$ | 31 |
| $29 \cdot 9$ | 33 |
| $31 \cdot 5$ | 34 |
| $32 \cdot 4$ | 35 |
| $33 \cdot 4$ | 37 |
| $34 \cdot 5$ | 38 |
| $35 \cdot 7$ | 39 |
| $37 \cdot 1$ | 41 |
| $38 \cdot 6$ | 42 |
| $40 \cdot 4$ | 44 |
| $42 \cdot 4$ | 46 |
| $44 \cdot 8$ | 49 | $1 \cdot 9$

$2 \cdot 7$
$23 \cdot 5$
$24 \cdot 3$
$25 \cdot 1$
$26 \cdot 0$

$26 \cdot 9$
$27 \cdot 9$
$29 \cdot 0$
$30 \cdot 2$
$31 \cdot 6$
$33 \cdot 1$
$34 \cdot 9$
$35 \cdot 9$
$37 \cdot 0$
$38 \cdot 2$
$39 \cdot 5$
$41 \cdot 0$
$42 \cdot 7$
$44 \cdot 7$
$46 \cdot 9$
$49 \cdot 6$
 $26 \cdot 5$
$27 \cdot 5$
$28 \cdot 4$
$29 \cdot 4$
$30 \cdot 4$
$3 I \cdot 5$

$32 \cdot 6$
$33 \cdot 8$
$35 \cdot I$
$36 \cdot 5$
$38 \cdot 2$
$39 \cdot 9$
$42 \cdot 1$
$43 \cdot 3$
$44 \cdot 6$
$46 \cdot 1$
$47 \cdot 7$
$49 \cdot 5$
$5 I \cdot 6$
$53 \cdot 9$
$56 \cdot 6$
$59 \cdot 7$


| $\circ$ |
| ---: | ---: |
| 22 |
| 18 |
| 14 |
| 14 |
| 10 |
| 6 |
| 2 |
| 2 |
| S |







 V


REDUCTIONS.

# REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN. 

* a CRUCIS.


| Lat. | m. 4 | ${ }_{8} \mathrm{~m}$. | 12 | ${ }_{16}$ | ${ }_{20} \mathrm{~m}$ | ${ }_{24}{ }_{2}$ | 28. | ${ }_{32} \mathrm{~m}$. | m. 36 | ${ }_{40}$ | ${ }_{4} \mathrm{~m}$. | ${ }_{48} \mathrm{~m}$. | ${ }_{52}$ | m0 | ${ }_{70}$ | m. | m 90 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25 | 0.5 | $0 \cdot 9$ | I-4 | r.8 | $2 \cdot 3$ | $2 \cdot 8$ | $3 \cdot 2$ | $3 \cdot 7$ | $4 \cdot 1$ | ${ }^{\circ} \cdot 6$ | $\stackrel{\circ}{5} 0$ | $5 \cdot 5$ | $\stackrel{\circ}{5} \cdot 9$ | 6.8 | $7 \cdot 9$ | $9 \cdot 0$ | $1{ }^{\circ} \cdot 1$ |
| 20 | 0.5 | 0.9 | I-4 | $1 \cdot 9$ | $2 \cdot 3$ | $2 \cdot 8$ | $3 \cdot 2$ | 3.7 | I | $4 \cdot 6$ | $5 \cdot \mathrm{I}$ | 5.5 | $6 \cdot 0$ | $6 \cdot 9$ | 8.0 | $9 \cdot 1$ | 10.2 |
| 10 | 0.5 | 1.0 | $1 \cdot 4$ | r.9 | 2.4 | 2.9 | 3.4 | $3 \cdot 8$ | $4 \cdot 3$ | $4 \cdot 8$ | $5 \cdot 3$ | $5 \cdot 7$ | $6 \cdot 2$ | $7 \cdot 1$ | $8 \cdot 3$ | $9 \cdot 4$ | 10.5 |
| - | 0.5 | I.0 | I.6 | $2 \cdot 1$ | $2 \cdot 6$ | 3.1 | 3.6 | $4^{-1}$ | $4 \cdot 6$ | $5 \cdot 1$ | $5 \cdot 6$ | $6 \cdot 1$ | $6 \cdot 6$ | $7 \cdot 6$ | 8.8 | 10.0 | II-2 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | 0.6 | 1.2 | 1•7 | $2 \cdot 3$ | 2.9 | $3 \cdot 5$ | 4*0 | $4 \cdot 6$ | $5 \cdot 2$ | $5 \cdot 7$ | $6 \cdot 3$ | $6 \cdot 8$ | $7 \cdot 4$ | $8 \cdot 5$ | 9.8 | II'I | 12.4 |
| 15 | $0 \cdot 6$ | $\mathrm{I} \cdot 2$ | I.9 | $2 \cdot 5$ | $3 \cdot 1$ | $3 \cdot 7$ | $4 \cdot 3$ | $4 \cdot 9$ | $5 \cdot 5$ | $6 \cdot 1$ | $6 \cdot 7$ | $7 \cdot 3$ | 7.9 | $9 \cdot 1$ | 10.5 | 11.9 | 13.2 |
| 20 | $0 \cdot 7$ | 1.4 | $2 \cdot 0$ | $2 \cdot 7$ | 3.4 | 4.0 | 4.7 | $5 \cdot 4$ | $6 \cdot 0$ | $6 \cdot 7$ | $7 \cdot 3$ | $8 \cdot 0$ | $8 \cdot 6$ | 9.9 | II. | 12.9 | 14.3 |
| 24 | 0.7 0.8 | I.5 | 2.2 | 2.9 | $3 \cdot 7$ | 4.4 | 5.1 | $5 \cdot 8$ | $6 \cdot 5$ | $7 \cdot 2$ | 7.9 | $8 \cdot 6$ | $9 \cdot 3$ | 10.7 | 12.3 | I3.9 | 15.4 |
| 28 30 | 0.8 0.8 | 1.6 | 2.4 2.5 | 3.2 | 4.0 | 4.8 | 5.6 | $6 \cdot 4$ | 7.2 | $7 \cdot 9$ | $8 \cdot 7$ | $9 \cdot 5$ | $10 \cdot 2$ | $1 \mathrm{I} \cdot 7$ | 13.4 | $15^{\prime}$ I | $16 \cdot 7$ |
| 30 | 0.8 | I•7 | $2 \cdot 5$ | 3.4 | $4 \cdot 2$ | 5.I | 5.9 | $6 \cdot 7$ | $7 \cdot 5$ | $8 \cdot 4$ | $9 \cdot 2$ | 9.9 | 10.7 | 12.2 | $14^{*}$ | 15.8 | 17.5 |
| 32 | 0.9 | I.8 | 2.7 | 3.6 | 4.5 | $5 \cdot 4$ | $6 \cdot 2$ | 7.1 | $8 \cdot 0$ | $8 \cdot 8$ | 9.7 | 10. 5 | 11.3 | 12.9 | 14.8 | 16.7 | 18.4 |
| 34 | I.0 | I.9 | $2 \cdot 9$ | 3.8 | $4 \cdot 8$ | $5 \cdot 7$ | $6 \cdot 6$ | $7 \cdot 6$ | $8 \cdot 5$ | 9.4 | 10.3 | II•I | 12.0 | 13.7 | 15.7 | 17.6 | 19.4 |
| 36 | $1 \cdot 0$ | $2 \cdot 0$ | 3.1 | $4 \cdot 1$ | $5 \cdot 1$ | 6.1 | $7 \cdot 1$ | $8 \cdot 1$ | $9 \cdot 0$ | 10.0 | $10 \cdot 9$ | II•9 | 12.8 | 14.6 | $16 \cdot 7$ | 18.7 | $20 \cdot 5$ |
| 38 | I•I | 2.2 | 3.3 | 4.4 | 5.5 | $6 \cdot 5$ | 7.6 | $8 \cdot 7$ | $9 \cdot 7$ | $10 \cdot 7$ | 11.7 | $12 \cdot 7$ | 13.7 | 15.6 | 17.8 | 19.9 | 21.8 |
| 40 | I. 2 | 2.4 | 3.6 | 4.7 | 5.9 | $7 \cdot 1$ | 8.2 | $9 \cdot 4$ | $10 \cdot 5$ | 11.6 | 12.6 | 13.7 | 14.7 | $16 \cdot 7$ | 19.1 | 2 I 3 | 23.3 |
| 42 | I 3 | 2.6 | 3.9 | $5 \cdot 2$ | 6.4 | $7 \cdot 7$ | 9.0 | 10 | 11.4 | 12.6 | 13.7 | 14.9 | 16.0 | I | 20.6 | 22.9 | $25^{\circ}$ |

# REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE. 

* a CRUCIS.

|  | ${ }_{4}{ }_{4}$ | ${ }_{8}$ | ${ }_{12}$ | ${ }_{16}$ | $\begin{aligned} & \mathrm{m} . \\ & 20 \end{aligned}$ | $\begin{aligned} & { }_{24}^{m} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 2 \end{aligned}$ | $\begin{aligned} & \mathrm{m} .0 \\ & 28 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 2 \end{aligned}$ | $\begin{gathered} \mathrm{m} \\ \hline 34 \\ \hline \end{gathered}$ | $\overline{\mathrm{m}} .$ | $\begin{aligned} & \mathrm{m} . \\ & 38 \end{aligned}$ | $\frac{\mathrm{m}}{40}$ | $\begin{aligned} & \mathrm{m} . \\ & 42 \end{aligned}$ | ${ }_{44}^{\mathrm{m}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{30}$ | 0.2 | 0. 8 | $1 \cdot 9$ | $3 \cdot 3$ | $5 \cdot 3$ | 7.5 | 8.8 | $10 \cdot 2$ | İ.8 | 13.4 | $15 \cdot 1$ | 16.8 | 18.9 | $20 \cdot 9$ | $23^{\circ}$ | $25^{\prime} \mathrm{I}$ |
| 35 | 0.2 | 0.8 | r. 8 | 3.2 | 5.0 | 7.2 | $8 \cdot 4$ | $9 \cdot 7$ | 11.2 | 12.7 | I4.4 | $16 \cdot 1$ | $17 \cdot 9$ | 19.9 |  | $24^{\circ}$ |
| 40 | 0.2 | 0.8 | I.7 | 3.0 | 4.7 | 6.8 6.4 | 8.0 7.6 | 8.3 | 10.6 10.0 | ${ }_{11}^{11.9}$ | 13.7 12.0 | 15.3 14.5 | ${ }_{17}^{17.1}$ | 18.9 | $20 \cdot 8$ | $22 \cdot 9$ |
| 45 | 0.2 | $0 \cdot 7$ | 1.6 | $2 \cdot 9$ | $4 \cdot 5$ | $6 \cdot 4$ | $7 \cdot 6$ | 8.8 | 10.0 | 11.4 | 12.9 | 14.5 | 16.1 | 17.9 | 19.7 | . 6 |
| 5 | $\stackrel{0.2}{0.2}$ | 0.7 | 1.5 | $2 \cdot 7$ | 4.2 | 6.0 | 7.1 6.6 6.1 | 8.2 7.6 | 8.4 | $10 \cdot 8$ | I2•I | 13.6 | 15.2 | 16.8 15.6 1 | 18.5 | 0.4 |
| 55 60 | O. $\begin{aligned} & 0.2 \\ & 0.1\end{aligned}$ | -0.6 | 1.4 | 2.5 2.3 | 3.9 3.6 | 5.1 | ${ }_{6 \cdot 1}{ }^{6 \cdot 6}$ | 7.6 7.0 | 8.0 | 10.0 9.2 | 1133 | [ 16 | 14.1 13.0 |  | 17.2 | 1899 |
| Lat | $\begin{aligned} & \mathrm{m} . \\ & 45 \\ & \hline \end{aligned}$ | $\begin{gathered} \mathrm{m} . \\ \hline 1 \end{gathered}$ | ${ }_{47} \mathrm{~m}$. | ${ }_{48}^{\mathrm{m}}$ | ${ }_{49}$ | $50$ | $\overline{\mathrm{m}_{1}}$ | $\begin{aligned} & \hline \mathrm{m} . \\ & 52 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 53 \end{aligned}$ | $\begin{aligned} & \hline \mathrm{m} \\ & 54 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 55 \end{aligned}$ | ${ }_{56}^{\mathrm{m}}$ | $\begin{gathered} \mathrm{m} \\ \mathbf{5 7} \end{gathered}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{5 8} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 59 \end{aligned}$ | ${ }_{60}$ |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ} 8$ | 26́8 | $28 \cdot 1$ | $29 \cdot 3$ | $30 \cdot 5$ | 31.8 | $33 \cdot 1$ | $34 \cdot 4$ | $35 \cdot 8$ | $37 \cdot 2$ | $38 \cdot 6$ | $40^{\circ} 0$ | 4í5 | $43^{\circ}$ | $44 \cdot 5$ | $46 \cdot 0$ | 4 $4 \cdot 6$ |
| 32 | 25.9 | $27^{\circ}$ | 28.2 | 29.4 | 30.6 | $3 \mathrm{r} \cdot 9$ | 33.2 | 34.5 | $35 \cdot 8$ | 37.2 | $38 \cdot 6$ | $40 \cdot 0$ | $4 \mathrm{~T} \cdot 4$ | 42.9 | 44.4 | 45.9 |
| 36 40 | 24.9 23.9 | $26^{\circ}$ | $27 \cdot 2$ 26.1 | ${ }_{27 \cdot 2}^{28.3}$ | 29.4 | 30.7 | ${ }_{30}^{31.9}$ | 31-2 | ${ }_{33} 3$ [5 | $35 \cdot 8$ 34.3 | $37 \cdot \mathrm{I}$ <br> 35.6 | $38 \cdot 5$ 36.9 | 39.9 38.2 | $41 \cdot 3$ 39 | $4{ }_{4}^{42 \cdot}$ | 44.2 |
| 44 | 22.9 | 23.9 | 24 | $26 \cdot 0$ | $27 \cdot 1$ | 28.2 | 29.3 | $30 \cdot 5$ | $31 \cdot 7$ | $32 \cdot 9$ | 34 | $35 \cdot 3$ | $36 \cdot 6$ | 37.9 | $39^{2}$ | $40 \cdot 5$ |
| 48 | 21 | $22 \cdot 7$ | 23.7 | 24.8 | 25.8 | 26.8 | $27 \cdot 9$ | $29^{\circ}$ | $3{ }^{3} 2$ | 31.3 | $32 \cdot 5$ | $33 \cdot 7$ | $34 \cdot 9$ | , | 374 |  |
| 5 | 20 | 21.5 | 22.5 21.8 | 23.5 | $24^{\circ} 4$ | 25.4 | 26.5 | ${ }_{26}^{27.5}$ | 28.6 | 29.7 28.8 | 30.8 | ${ }_{31}{ }^{3} \mathrm{~F}$. 9 | 33.0 | 34.2 $33 \cdot 2$ | 35.4 34.4 | 36.6 |
| 56 |  | $20 \cdot 9$ $20 \cdot 3$ |  | $22 \cdot 1$ | $23 \cdot 7$ 23.0 |  | $25^{\prime} 7$ | $25^{\circ} 9$ | $26 \cdot 9$ | 27.9 | 28.9 | - | $31 \cdot 1$ | $32 \cdot 2$ |  |  |
| 58 | 18 | 19 | 20.5 | ${ }_{21}^{22}$ | 22.2 | $23^{1}$ | ${ }_{24 \cdot 1}^{24}$ | 25.0 | 26.0 | 27.9 | 28.0 | 29 | $30^{\circ}$ | ${ }_{31}$ | 32.2 | 34.4 |
| 60 | 18.2 | 18.9 | 19.8 | 20.6 | 21.5 | 22.3 | 23.2 | 24. I | $25 \cdot 1$ | 26.0 | 27. | 28.0 | $29^{\circ}$ | 30.0 | 3r.0 | 32-I |
| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{0}$ | ${ }_{1}^{\mathrm{m}}$. | ${ }_{2}^{\text {m. }}$ | ${ }_{3}{ }^{\text {m }}$ |  | ${ }_{5}$ | ${ }_{6}^{\mathrm{m}}$. | 7 | ${ }_{8}^{\text {m. }}$ | ${ }_{9} \mathrm{~m}$ | 10 | ${ }_{11}^{\text {m. }}$ | ${ }_{12}^{\mathrm{m}}$. | ${ }_{13}^{\mathrm{m}}$. | ${ }_{14}$ | ${ }_{15}$ |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 28 | 4خ̇6 | 49.2 | $50 \cdot 8$ | $52 \cdot 4$ | 54* | 55.8 | 57.5 | 59.3 | 6r.o | 62.8 | $64 \cdot 6$ | 66́5 | $68^{\prime} .4$ | $70 \cdot 3$ | $72 \cdot 2$ | -1 |
| 30 | $46 \cdot 7$ | 48.3 | $49 \cdot 9$ | 51.5 | ${ }_{53}$ 'I | 54.8 | 56.5 | 58.2 | 59.9 | $6 \mathrm{r} \cdot 7$ | $63 \cdot 5$ | 65.3 | $67 \cdot 2$ | $69^{\circ}$ |  | 72.8 |
| 32 34 3 | 45.9 | 47.4 | 48. ${ }_{4}$ | 50.5 40.6 | 52.2 | 53.8 | 55.5 | 57'1 |  | 60.6 | 62.3 | ${ }^{64}{ }^{\text {4 }}$. | 65.9 | ${ }^{67 \cdot 7}$ | 69.6 68.3 | 71.5 |
| 34 36 | 44.2 | ${ }_{45}{ }^{46}$ | 47.1 | 48 | 51.2 | 52.8 | 54.4 | 55* | 56.6 | 59.4 | 60.0 | 6r.7 | ${ }_{6} 6$ | $65 \cdot 2$ | 67.0 | 78.8 |
| 38 | 43.3 | 44.7 | 46.2 | 47.7 | $49^{\circ} 2$ | $50 \cdot 7$ | $52 \cdot 3$ | 53.9 | 55.5 | 57.1 | 58.8 | $60 \cdot 5$ | 62.2 | 63.9 | $65 \cdot 7$ | ${ }^{67} \cdot{ }^{6} \cdot 4$ |
| $4{ }_{42}^{40}$ | ${ }_{4}^{42}$ | 43.8 42.9 | ${ }_{44 \cdot 3}^{45}$ | ${ }_{45}^{46 \cdot 7}$ | ${ }_{47}^{48 \cdot 2}$ | 49.7 48.6 | $51 \cdot 2$ $50 \cdot 1$ | 52.8 51.6 | 54.4 53.2 |  | 57.6 | 59.2 58.0 | $60 \cdot 9$ 50.6 | $62 \cdot 6$ $6 \mathrm{r} \cdot 3$ |  | ${ }^{66 \cdot \mathrm{I}}$ |
| 44 | 40 | 4 t .9 | 43.3 | $44 \cdot 7$ | ${ }_{46 \cdot \mathrm{I}}$ | $47 \cdot 5$ | 49.0 | $50 \cdot 5$ | 52.0 | 53.5 | 55•- | $56 \cdot 7$ | 58.3 | $59 \cdot 9$ | $6 \mathrm{r} \cdot 5$ | 63.2 |
| 46 | 39 | 40.9 | $42 \cdot 2$ | $43 \cdot 6$ | $45^{\circ}$ | 46 | $47^{\circ} 9$ | $49 \cdot 3$ | 50.8 | 52.3 | 53.8 | $55 \cdot 4$ | 56 | 58.5 |  | $61 \cdot 7$ |
| 48 | 38.6 | 39.9 | 412 | $42 \cdot 6$ | $43 \cdot 9$ | $45 \cdot 3$ | $46 \cdot 7$ | $4^{8 \cdot 1}$ | $49 \cdot 5$ | $55^{\circ}$ | $52 \cdot 5$ | $54^{\circ}$ | 55.5 | 57•1 | 58.6 | 60.2 |
| 49 | $38 \cdot \mathrm{I}$ <br> 37.6 | 39.4 38.9 | $4{ }^{40}$ | ${ }_{4}^{42 \cdot 0}$ | 43.4 42.8 4 | $44 \cdot 7$ $44 \cdot \mathrm{r}$ | $46 \cdot 1$ $45 \cdot 5$ | 47.5 46.9 | 48.9 48.3 | $49 \cdot 7$ | 5 | 53.3 52.6 | ${ }_{54 \cdot 1}^{54}$ | $56 \cdot 3$ 55 | 57.9 | 59.5 |
| 5 | ${ }_{37 \cdot 1}$ | 38.3 | 39.6 | 4 | ${ }_{42 \cdot 2}^{42 \cdot 8}$ | ${ }_{43.5}^{44.1}$ | $4{ }_{4}^{45 \cdot 5}$ | ${ }_{46 \cdot 2}^{46.9}$ | 47 | $4{ }^{49}{ }^{\circ}$ |  | 52•6 | $54 \cdot 1$ $53 \cdot 4$ | $\stackrel{55 \cdot 8}{54}$ |  | 58.7 |
| 52 | 36 | $37 \cdot 8$ | 39.1 | $40 \cdot 3$ | $4{ }^{1} 6$ | $42 \cdot 9$ | $44 \cdot 2$ | $45 \cdot 6$ | 47.0 | $48 \cdot 3$ | $49 \cdot 8$ | 51.2 | 52.6 | 54-1 | $55 \cdot 6$ | 57.1 |
| 53 | $36 \cdot 1$ 35.5 | 37 | 38.5 | $39 \cdot 7$ | $41^{\circ} \mathrm{O}$ | 42.3 | $43 \cdot 6$ | 44.9 | $46 \cdot 3$ | $47 \cdot 6$ | $49^{\circ}$ | $50^{\circ} 4$ | 5 5 5. | 53.3 | 54.8 | $56 \cdot 3$ |
| 54 | 35.5 <br> 35.0 | 36.7 36.2 | 37.9 | 39.2 38.6 | 40.4 | $4 \mathrm{I} \cdot 7$ | 43 | $44 \cdot 3$ | $45 \cdot 6$ 44.9 | $46 \cdot 9$ 46.2 | 48.3 | $49^{\prime} 7$ | $5 \mathrm{~S} \cdot$ | 52.5 | . | 54.6 |
| 56 | $34 \cdot 4$ | $35 \cdot 6$ | $36 \cdot 7$ | $37 \cdot 9$ | $39 \cdot 1$ | 40.4 | $4 \mathrm{t} \cdot 6$ | $42 \cdot 9$ | 44.2 | 45.5 | 46.8 | 48.2 | 49.5 | $50 \cdot 9$ | $52 \cdot 3$ | 53•7 |
| 57 | 33 | 35 | $36 \cdot$ I | $37 \cdot 3$ | 38 | 39.7 | $40 \cdot 9$ | $42 \cdot 2$ | $43 \cdot 4$ | $44^{\prime} 7$ | $46 \cdot 0$ | $47 \cdot 4$ | 48.7 | $50 \cdot \mathrm{I}$ | $5 \mathrm{r} \cdot 4$ | 52.8 |
| 58 | 33 |  | $35 \cdot 5$ |  | 37.9 | $39^{\circ}$ | $40 \cdot 2$ | 4 I | $42 \cdot 7$ | $44^{\circ}$ | $45 \cdot 3$ | $46 \cdot 6$ | 47.9 |  |  |  |
| 59 60 | $32 \cdot 7$ $32 \cdot 1$ | $\begin{aligned} & 33 \cdot 8 \\ & 33 \cdot 2 \end{aligned}$ | 34.9 34.2 | $\begin{aligned} & 36 \cdot 0 \\ & 35 \cdot 4 \end{aligned}$ | 37.2 36.5 | 38.3 37.6 | 39.5 38.8 | 40 |  |  | 4. | $45 \cdot 7$ 44.9 | $47 \cdot 0$ $46 \cdot 1$ | $48 \cdot 3$ 47.4 | $49 \cdot 6$ 48.7 | 515. |
|  | HOUR. |  |  |  |  |  |  |  |  | I HOUR. |  |  |  |  |  |  |
| Lat. | ${ }_{4}^{\mathrm{m}}$. | m. | ${ }_{12} \mathrm{~m}$. | ${ }_{16}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{24}^{\mathrm{m}}$ | $\underset{30}{ }$ | $\begin{aligned} & \mathrm{m} . \\ & 40 \end{aligned}$ | $\frac{\mathrm{m}}{50}$ | ${ }_{00}$ | ${ }_{10}$ | ${ }_{20}^{\mathrm{m}}$. | ${ }_{30}$. | ${ }_{40}^{\mathrm{m}}$ | ${ }_{50}$. | ${ }_{60}$ |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{30}$ | $\bigcirc$ | $\bigcirc{ }^{\circ} 9$ | r ${ }_{4}$ | I:8 | $2 \cdot 3$ | 2.8 | $3 \cdot 5$ | $4 \cdot 6$ | $5 \cdot 7$ | 6.9 | 8.0 | $\bigcirc$ | $10 \cdot 2$ | $1{ }^{1} \cdot 3$ | $12 \cdot 3$ |  |
| 36 | 0.5 | - 09 | I.4 | I. 9 | $2 \cdot 3$ | 2.8 | 3.5 | $4 \cdot 7$ | $5 \cdot 8$ | 6.9 | $8 \cdot 0$ | 9.2 | 10.3 | II. 4 | 12.5 | 13 |
| 40 | - $0 \cdot 5$ | - 0 | r.4 | r.9 | 2.4 | 2.8 | 3.5 | $4 \cdot 7$ | 5.9 | $7 \cdot 0$ | 8.2 | $9 \cdot 3$ | 10.5 | İ.6 | $12 \cdot 7$ | 13.8 |
| 44 | 0.5 | roo | I.5 | r.9 | $2 \cdot 4$ | $2 \cdot 9$ | $3 \cdot 6$ | 4.8 | $6 \cdot 0$ | $7 \cdot 2$ | 8.3 | 9.5 | 10.7 | 11.9 | 13.0 | 14.1 |
| 48 | 0.5 | r.0 | 1.5 | 2.0 | $2 \cdot 5$ | 3.0 |  |  | $6 \cdot \mathrm{I}$ | $7 \cdot 3$ | 8.6 | 9.7 | Ir. | 12. | 13.3 | 14.5 |
| [52 | $\stackrel{0.5}{0.5}$ | $\xrightarrow{\text { r }} \mathrm{r}$ - | r r 1.5 | $\stackrel{2 \cdot 1}{2 \cdot 1}$ | 2.5 2.6 | 3.1. | 3.8 3.9 | ( $5 \cdot 1$ | 6.3 6.5 | 7.5 7.8 | ${ }_{9}^{8.8}$ | $\xrightarrow{10 \cdot 1}$ | ${ }_{11} 1.3$ | 12.5 13.0 2 | 13.7 14.3 | 15.0 |
| 56 | 0.5 0.5 | ${ }_{\text {r }}^{1}$ | res | $2 \cdot 1$ $2 \cdot 2$ | 2.6 2.7 | 3.1 | $3 \cdot 9$ 4.1 | 5.2 5.5 | $6 \cdot 5$ | 7.8 | 9.1. | 10.4 | 11'ク | 13 | 14 | 15.6 16.3 |

## REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM MERIDIAN BELOW THE POLE.

* a CRUCIS.

| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{16}$. | ${ }_{17}$ | 18. | m. | ${ }_{20}$ | ${ }_{21}^{\mathrm{m}}$. | ${ }_{22}$ | ${ }_{23}$ | ${ }_{24}$ | $\mathrm{m}_{25}$ | ${ }_{26}$ | ${ }_{27}$ | 28 | ${ }_{29} \mathrm{~m}$ | ${ }_{30}$. | ${ }_{31}$ |
| S. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 28 | $75^{\circ} 9$ | 77.9 | 79.9 | $82^{\circ} \mathrm{O}$ | $84^{\circ} \mathrm{O}$ | 86'I | $88 \cdot 3$ | $90 \cdot 4$ | 92.6 | 94•8 | 97.0 | 99.2 | 101.5 | 103.8 | 10'6.r | 108.4 |
| 30 | 74.5 | 76.5 | 78.5 | 80.5 | 82.5 | 84.6 | $86 \cdot 7$ | 88.8 | 90.9 | 93-1 | 95.3 | $97 \cdot 5$ | $99 \cdot 7$ | 101.9 | 104.2 | 106.5 |
| 32 | 73.2 | 75.1 | 77-1 | $79^{\circ} \mathrm{O}$ | $8 \mathrm{I} \cdot 0$ | $83 \cdot 1$ | $85 \cdot 1$ | 87.2 | $89 \cdot 3$ | 91.4 | $93 \cdot 5$ | $95 \cdot 7$ | 97.9 | 100.I | 102.3 | 104.6 |
| 34 | $7 \mathrm{I} \cdot 8$ | 73.7 | $75 \cdot 6$ | $77 \cdot 6$ | $79 \cdot 5$ | $8 \mathrm{I} \cdot 5$ | 83.5 | 85.5 | 87.6 | $89^{\circ} 7$ | 91.8 | 93.9 | $96 \cdot 1$ | $98 \cdot 2$ | $100 \cdot 4$ | $102 \cdot 7$ |
| 36 | $70 \cdot 4$ | $72 \cdot 3$ | 74.2 | $76 \cdot 1$ | 78.0 | 79.9 | 81.9 | 83.9 | $85^{\circ} 9$ | 88.0 | $90 \cdot 0$ | 92-I | 94.2 | 96.4 | 98.5 | $100 \cdot 7$ |
| 38 | $69^{\circ}$ | $70 \cdot 9$ | $72 \cdot 7$ | 74.6 | $76 \cdot 5$ | 78.4 | $80 \cdot 3$ | 82.3 | 84.2 | 86.2 | 88.3 | $90 \cdot 3$ | 92.4 | 94.5 | $96 \cdot 6$ | 98.7 |
| 40 | $67 \cdot 6$ | 69.4 | 71.2 | $73 \cdot 0$ | 74.9 | $76 \cdot 8$ | $78 \cdot 6$ | 80.6 | $82 \cdot 5$ | 84.5 | $86 \cdot 4$ | 88.5 | $90 \cdot 5$ | $92 \cdot 5$ | 94.6 | $96 \cdot 7$ |
| 42 | $66 \cdot 2$ | 67.9 | 69.7 | 7 r 5 | 73.3 | $75^{-1}$ | $77^{\circ}$ | 78.8 | 80.7 | $82 \cdot 7$ | 84.6 | $86 \cdot 6$ | 88.6 | $90 \cdot 6$ | $92 \cdot 6$ | 94.6 |
| 44 | $64^{\circ} 7$ | 66.4 | 68.1 | 69.9 | $7 \mathrm{~F} \cdot 7$ | 73.4 | 75.3 | 77.1 | $79^{\circ}$ | 80.8 | 82.7 | $84^{\circ} 7$ | $86 \cdot 6$ | 88.6 | $90 \cdot 5$ | $92 \cdot 6$ |
| 46 | 63.3 | $64 \cdot 9$ | $66 \cdot 5$ | $68 \cdot 3$ | $70 \cdot 0$ | $7 \times 1$ | $73 \cdot 5$ | $75 \cdot 3$ | $77 \cdot 1$ | 79.0 | 80.8 | 82.7 | $84 \cdot 6$ | 86.5 | 88.4 | $90 \cdot 4$ |
|  | $6 \mathrm{I} \cdot 7$ | 63.3 | $64 * 9$ | 66.6 | 68.3 | $70 \cdot 0$ | 71.7 | 73.5 | 75.2 | $77 \cdot 0$ | 78.8 | $80 \cdot 7$ | 82.5 | 84.4 | $86 \cdot 3$ | 88.2 |
| 50 | 60•I | 6r.6 | 63.3 | $64^{\circ} 9$ | $66 \cdot 5$ | 68.2 | $69 \cdot 9$ | 7 r 6 | $73 \cdot 3$ | $75 \cdot 1$ | $76 \cdot 8$ | $78 \cdot 6$ | 80.4 | 82.2 | $84 \cdot \mathrm{I}$ | $86 \cdot$ |
| 52 | 58.4 | $60 \cdot 0$ | 61.5 | $63 \cdot 1$ | $64 \cdot 7$ | $66 \cdot 3$ | 68.0 | 69.6 | $71 \cdot 3$ | 73.0 | 74.7 | $76 \cdot 5$ | 78.2 | $80 \cdot 0$ | $8 \mathrm{I} \cdot 8$ | 83.6 |
|  | $56 \cdot 7$ | 58.2 | 59.8 | 6r.3 | $62 \cdot 8$ | 64.4 | $66^{\circ}$ | 67.6 | $69 \cdot 3$ | 70.9 | $72 \cdot 6$ | 74.3 | $76 \cdot 0$ | $77 \cdot 7$ | 79.4 | $8 \mathrm{r} \cdot 2$ |
| 56 | $55^{\circ}$ | $56 \cdot 4$ | 57.9 | 59.4 | $60 \cdot 9$ | 62.4 | $64^{\circ}$ | $65 \cdot 5$ | 67. 1 | $68 \cdot 7$ | $70 \cdot 3$ | 72.0 | $73 \cdot 6$ | $75 \cdot 3$ | 77.0 | $78 \cdot 7$ |
| - | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{32}$. | ${ }_{33}$. | ${ }_{34}$ | ${ }_{35} \mathrm{~m}$. | ${ }_{36}$ | $\frac{\mathrm{m}}{3}$ |  |  | m9 | 40 | $\mathrm{m}_{41}$ | ${ }_{42}$ | ${ }_{43}$. | ${ }_{44}$ | ${ }_{45}$. | $\begin{aligned} & \mathrm{m} . \\ & 46 \end{aligned}$ |

S.


## REDUCTIONS.

123.0
120.8
118.7
II6.5
II 4.3
I12.0
IO9.7
107.4
105.0
IO2.6
IOO.I
97.6
94.9
92.2
89.4 $125 \cdot 5$
$123 \cdot 3$
$121 \cdot 1$
$118 \cdot 9$
$116 \cdot 6$
$114 \cdot 3$
$112 \cdot 0$
$109 \cdot 6$
$107 \cdot 2$
$104 \cdot 7$
$102 \cdot 2$
$99 \cdot 6$
$96 \cdot 9$
$94 \cdot 1$
91.2 $128^{\circ}$
$1255^{\circ}$
$123^{\circ}$
$12 I^{\circ}$
II $9^{\circ}$
$116^{\circ}$
II $4^{\circ}$
III.
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 $\begin{array}{cc}\text { 2 } & \text { I } 5 \\ 2 & 13 \\ 2 & 1 \\ 2 & 8 \\ 2 & 6 \\ 2 & 3 \\ 2 & 1 \\ I & 58 \\ I & 56 \\ I & 53 \\ I & 5 \\ I & 4 \\ I & 4 \\ I & 4 \\ I & 3\end{array}$ '.8
$5 \cdot 8$
$3 \cdot 4$
$1 \cdot 0$
$8 \cdot 6$
$6 \cdot 2$
$3 \cdot 7$
$1 \cdot 2$
$58 \cdot 6$
$56 \cdot 0$
$53 \cdot 4$
$50 \cdot 6$
$47 \cdot 8$
44.9
41.

$\begin{array}{ll}2 & 18^{\prime} \\ 2 & 16 \cdot \\ 2 & 13 \\ 2 & 1 \\ 2 & 8 \\ 2 & 6 \\ 2 & 3 \\ 2 & I \\ I & 58 \\ I & 55 \\ I & 52 \\ I & 49 \\ I & 46 \\ I & 43 \\ I & 40\end{array}$

 | 5 | 2 | 21 |
| :---: | :---: | :---: |
| 0 | 2 | 18 |
| 6 | 2 | 16 |
| 2 | 2 | 13 |
| $\cdot 6$ | 2 | 1 |
| $\cdot 1$ | 2 | 8 |
| 6 | 2 | 5 |
| 0 | 2 | 3 |
| 3 | 2 | 0 |
| 6 | 1 | 57 |
| 8 | 1 | 55 |
| 9 | 1 | 5 |
| 9 | 1 | 49 |
| 9 | $I$ | 45 |
| 7 | 1 | 4 |

 | 10 |  |
| :--- | :--- | :--- |
| $1 \cdot 12$ |  |
| $8 \cdot 62$ |  |
| $6 \cdot 1$ | 2 |
| $3 \cdot 6$ | 2 |
| $1 \cdot 1$ | 2 |
| $8 \cdot 5$ | 2 |
| $5 \cdot 9$ | 2 |
| $3 \cdot 3$ | 2 |
| 0.6 | 2 |
| 7.8 | 2 |
| $5 \cdot 0$ | 1 |
| $2 \cdot 0$ | 1 | $\begin{array}{ll}1 \\ 2 & 2 \\ 2 & 2 \\ 2 & 18 \\ 2 & 1 \\ 2 & 1 \\ 2 & 1 \\ 2 & 1 \\ 2 & 5 \\ 2 & 2 \\ 2 & 0 \\ 1 & 5 \\ 1 & 5 \\ 1 & 5 \\ 1 & 4 \\ 1 & 4\end{array}$ $23 \cdot 8$

$21 \cdot 3$
$18 \cdot 7$
$16 \cdot 2$
$13 \cdot 6$
$1 I \cdot 0$
$8 \cdot 3$
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2.9
$0 \cdot 1$
$57 \cdot 2$
$54 \cdot 2$
$5 I \cdot 1$
$47 \cdot 9$
$44 \cdot 6$ $\begin{array}{ll}\circ \\ 2 & 26 \\ 2 & 23 \\ 2 & 21 \\ 2 & 18 \\ 2 & 16 \\ 2 & 13 \\ 2 & 10 \\ 2 & 8 \\ 2 & 5 \\ 2 & 2 \\ I & 59 \\ I & 56 \\ I & 53 \\ I & 49 \\ I & 46\end{array}$

S. 28
28
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HHHHHHMN NNNNN NNNNN NNNNNO HHHH HHMN NNNNN NNNNN NNNNNO $29^{\prime}$
$26^{\circ}$
$24^{\circ}$
$2 I^{\prime}$
18
16
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$10^{\circ}$
9.
7
6.
4
3
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0.
58
56
55
53
 $\begin{array}{ll}2 & 32 \\ 2 & 29 \\ 2 & 26 \\ 2 & 2 \\ 2 & 2 \\ 2 & I \\ 2 & 1 \\ 2 & 1 \\ 2 & 1 \\ 2 & I \\ 2 & \\ 2 & 8 \\ 2 & \\ 2 & 5 \\ 2 & 3 \\ 2 & 2 \\ 2 & 0 \\ I & 59 \\ I & 5 \\ I & 55 \\ I & 54 \\ I & 52 \\ I & 50\end{array}$


 $34 \cdot 8$
$32 \cdot 1$
$29 \cdot 3$
26.6
23.8
$21 \cdot 0$
$18 \cdot 2$
$16 \cdot 7$
15.3
13.8
12.3
10.8
9.3
7.7
6.1
4.6
2.9
1.3
59.6
57.9
56.2

## REDUCTIONS.

$\square$
$37^{\prime} \cdot 6{ }^{\circ} 20^{\prime} \cdot 4 \stackrel{\circ}{2}_{2}$

| $\circ$ |  |
| :--- | :--- |
| 2 | 4 |
| 2 | 4 |



|  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 54.9 | $257 \cdot 83$ |  |  |  |  |  |
|  | $254 \cdot 8$ | $257 \cdot 7$ |  |  |  |  |
| 48.8 | $251 \cdot 72$ | 254.5 | 2 | 57 |  |  |
| 45 | $48 \cdot 5$ | 51.4 |  | 54 |  |  |
| $42 \cdot 6$ | $2 \quad 45 \cdot 42$ | 2 48.I | 2 | 51 |  | 53 |
|  | $242 \cdot 12$ |  |  |  |  |  |
|  | $2 \quad 38 \cdot 92$ | 241 | 2 | $44^{\circ} 3$ |  | 4 |
| $34 \cdot 6$ | $2{ }^{2} 37 \cdot 2$ | 239.9 | 2 | $42 \cdot 6$ | 2 | $45^{\circ}$ |
| 32 | $235 \cdot 5$ | $38 \cdot 2$ | 2 | 40 |  | $4{ }^{\circ}$ |
| 31.3 | $\left.{ }^{2} 33.9\right\|^{2}$ | $236 \cdot 5$ | 2 | 39•1 | 2 | 41'7 |
|  | $232 \cdot 1$ | 34 |  | 37•3 |  |  |
| 27 | $30 \cdot 4$ | $233 \cdot 0$ | 2 | $35 \cdot 5$ | 2 |  |
| 26 | $2 \quad 28 \cdot 72$ | 231.2 |  | $33 \cdot 7$ | 2 | 36 |
|  | $2 \quad 26.92$ | $2 \quad 29.4$ | 2 | $31 \cdot 9$ |  | 34 |
| 22 | $25^{2} 1{ }^{2}$ | $227 \cdot 6$ | 2 | $30 \cdot 0$ | 2 |  |
|  | 23.3 |  |  |  | $2$ |  |
|  | 21.42 | $223 \cdot 8$ |  | $26 \cdot 2$ |  |  |
| 17.2 | 2 19*5 2 | 2 21.9 | 2 | 24.3 | 2 | 26• |
| I5.3 | $217 \cdot 62$ | 19.9 | 2 | 22 | 2 | 24 |
| 1 | 15.72 | 18. |  |  |  |  |
| $11 * 4$ | $213 \cdot 72$ | 2 16 | 2 | 18.2 | 2 | $20 \cdot$ |
|  | II•72 | 13.9 |  | $16 \cdot 1$ | 2 | I 8. |
|  | 29.612 | 2 II ${ }^{\text {P }}$ |  | 14.0 |  |  |

* a CYGNI.



# REDUCTION TO TEE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN. 

* a CYGNI.


TRUE BEARING OR AZIMUTH OF $* a_{a}$ CYGNI.

| L.at. | $\underline{\mathrm{m}}$. | m. 8 | m 12 | m. 16 | m 20 | m. 24 | m. 28 | m. 32 | m 36 | m. | m. | 4. | $\mathrm{m}$ | $\begin{aligned} & \mathrm{m} . \\ & 60 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 70 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 80 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 90 \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N |  |  |  |  |  |  | A2I | U' | HS. |  |  |  |  |  |  |  |  |
| 20 | $1 \cdot 7$ | $3 \cdot 3$ | $5 \cdot 0$ | $6^{\circ} \cdot 7$ | $8 \cdot 3$ | $9 \cdot 9$ | II• 5 | 13.0 | $14^{\circ} \cdot 6$ | 16.1 | $17 \cdot 5$ | 19.0 | $20 \cdot 4$ | $23^{\circ} \mathrm{O}$ | $26^{\circ} \mathrm{I}$ | $\stackrel{\circ}{\circ} \mathrm{O}$ | $\stackrel{\circ}{1} 5$ |
| 19 | I. 6 | $3 \cdot 2$ | $4 \cdot 8$ | $6 \cdot 4$ | $8 \cdot 0$ | $9 \cdot 5$ | II•I | I2.6 | 14.I | 15.5 | 17.0 | I8.4 | $19 * 7$ | 22.3 | $25 \cdot 3$ | $28 \cdot 1$ | $30 \cdot 7$ |
| 18 | I. 6 | $3 \cdot 1$ | $4 \cdot 7$ | $6 \cdot 2$ | $7 \cdot 7$ | $9 \cdot 2$ | 10.7 | 12.2 | 13.6 | 15.0 | 16.4 | I7.8 | 19.1 | 21.6 | 24.6 | 27.4 | $29 \cdot 9$ |
| 17 | I•5 | 3.0 | $4 \cdot 5$ | $6 \cdot 0$ | $7 \cdot 5$ | $8 \cdot 9$ | 10.4 | II.8 | 13.2 | 14.6 | I5.9 | $17 \cdot 2$ | $18 \cdot 5$ | 21.0 | $23 \cdot 9$ | $26 \cdot 7$ | 29*I |
| 16 | I. 5 | $2 \cdot 9$ | 4.4 | $5 \cdot 8$ | $7 \cdot 2$ | $8 \cdot 6$ | 10.1 | II.4 | 12.8 | 14.1 | 15.4 | 16.7 | $18 \cdot 0$ | 20.4 | 23.3 | 26.0 | $28 \cdot 4$ |
| 14 | $1 \cdot 4$ | $2 \cdot 7$ | $4 \cdot 1$ | $5 \cdot 5$ | $6 \cdot 8$ | $8 \cdot 2$ | $9 \cdot 5$ | 10. 8 | 12 | 13.4 | I4.6 | 15.8 | 17.0 | 19.4 | 22.1 | $24^{\circ} 7$ | 27-1 |
| 12 | I•3 | $2 \cdot 6$ | $3 \cdot 9$ | $5 \cdot 2$ | $6 \cdot 5$ | $7 \cdot 7$ | $9 \cdot 0$ | 10.2 | 11.4 | 12.7 | I3.9 | 15.0 | 16.2 | $18 \cdot 4$ | 21.1 | $23 \cdot 6$ | $26 \cdot 0$ |
| 10 | $1 \cdot 2$ | $2 \cdot 5$ | $3 \cdot 7$ | $4 \cdot 9$ | $6 \cdot 1$ | $7 \cdot 3$ | $8 \cdot 5$ | $9 \cdot 7$ | 10.9 | 12.0 | 13.2 | 14.3 | 15.4 | 17.6 | $20 \cdot 2$ | $22 \cdot 6$ | 24.9 |
| 8 | I.2 | $2 \cdot 3$ | 3.5 | $4 \cdot 7$ | $5 \cdot 9$ | $7 \cdot 0$ | $8 \cdot 1$ | $9 \cdot 3$ | 10.4 | II• 5 | 12.6 | 13.7 | 14.7 | 16.8 | 19.3 | 21*7 | 23.9 |
| 6 | I•I | $2 \cdot 2$ | 3.4 | $4 \cdot 5$ | $5 \cdot 6$ | $6 \cdot 7$ | $7 \cdot 8$ | $8 \cdot 9$ | $10 \cdot 0$ | II*O | $12 \cdot 1$ | $13 \cdot 1$ | $14 \cdot 1$ | $16 \cdot 2$ | $18 \cdot 6$ | 20.9 | 23.1 |
| 4 | I•1 | $2 \cdot 2$ | 3.2 3.0 | $4 \cdot 3$ | $5 \cdot 4$ | $6 \cdot 4$ | $7 \cdot 5$ | $8 \cdot 5$ | $9 \cdot 6$ | $10 \cdot 6$ | 11.6 | $12 \cdot 6$ | 13.6 | 15.6 | 17.9 | $20 \cdot 2$ | $22 \cdot 3$ |
| 0 | I.O | $2 \cdot 0$ | $3 \cdot 0$ | $4^{\circ} \mathrm{O}$ | $5^{\circ} 0$ | $6 \cdot 0$ | $6 \cdot 9$ | $7 \bullet 9$ | $8 \cdot 9$ | $9 \cdot 9$ | 10.8 | II'7 | 12.7 | 14.5 | 16.7 | 18.9 | 20.9 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 | 0.9 | I.9 | 2.8 | $3 \cdot 7$ | $4 \cdot 6$ | $5 \cdot 5$ | 64 | $7 \cdot 3$ | $8 \cdot 2$ | $9^{\circ} 1$ | 10.0 | $10 \cdot 9$ | II•7 | 13.5 | 15.6 | 17.6 | $19 \cdot 6$ |
| 10 | $0 \cdot 9$ | I•7 | 2.6 | $3 \cdot 5$ | 4.3 | $5 \cdot 2$ | $6 \cdot 0$ | $6 \cdot 9$ | $7 \cdot 7$ | $8 \cdot 5$ | 9.4 | $10 \cdot 2$ | II-O | 12.7 | $14^{\circ} 7$ | $16 \cdot 6$ | $18 \cdot 5$ |
| 15 | 0.8 | 1.6 | $2 \cdot 4$ | $3 \cdot 3$ | $4 \cdot 1$ | $4 \cdot 9$ | $5 \cdot 7$ | $6 \cdot 5$ | $7 \cdot 3$ | 8.1 | $8 \cdot 9$ | $9 \cdot 7$ | 10.5 | 12.0 | 13.9 | I5.8 | 176 |
| 20 | $0 \cdot 8$ | I.6 | $2 \cdot 3$ | $3 \cdot 1$ | 3.9 | 4.7 | $5 \cdot 4$ | $6 \cdot 2$ | 7.0 | $7 \cdot 7$ | $8 \cdot 5$ | $9 \cdot 3$ | 10.0 | II.5 | 13.4 | 15.2 | 16.9 |
| 30 | $0 \cdot 7$ | $1 \cdot 5$ | $2 \cdot 2$ | 3.9 2.8 | $3 \cdot 6$ | $4 \cdot 4$ | $5 \cdot 1$ | $5 \cdot 8$ | $6 \cdot 6$ | $7 \cdot 3$ | $8 \cdot 0$ | $8 \cdot 7$ | 9.4 | 10.9 | 12.6 | 14.4 | $16 \cdot 1$ |
| 40 | $0 \cdot 7$ | 1.4 | $2 \cdot 1$ | $2 \cdot 8$ | $3 \cdot 5$ | $4 \cdot 3$ | $5 \cdot 0$ | $5 \cdot 7$ | 6.4 | $7 \cdot 1$ | $7 \cdot 8$ | $8 \cdot 5$ | $9 \cdot 2$ | 10.6 | 12.3 | I4.0 | $15 \%$ |

* a CYGNI.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \& \({ }_{4}^{\mathrm{m}}\). \& \({ }_{8} \mathrm{~m}\) \& \& \& \& \& \& \& \& 32 \& \& \[
\begin{aligned}
\& \mathrm{m} . \\
\& 36
\end{aligned}
\] \& \& \[
\begin{aligned}
\& \mathrm{m} . \\
\& \hline
\end{aligned}
\] \& \({ }_{42}\) \& 44 \\
\hline \multicolumn{17}{|l|}{} \\
\hline \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& \\
\hline 46 \& 0.3 \& \(1 \cdot 0\) \& 2.3
2.2 \& \begin{tabular}{l}
4.1 \\
3.8 \\
\hline
\end{tabular} \& 6.0 \& 8.3 \& 10.9 \& 12.6 \& 14.5

13.4 \& 16.4 \& 18.6 \& 20.8 \& 23.2 \& $25^{2 \cdot 7}$ \& $28 \cdot 3$ \& $38 \cdot 8$ <br>
\hline 50 \& 0.2
0.2 \& $0 \cdot 0$ \& 2.2

2.0 \& | 3.8 |
| :--- |
| 3.5 | \& 6.0

5.5 \& $7 \cdot 9$ \& $10 \cdot 1$ \& $11 \cdot$
10.8 \& 13.4
12.4 \& 15.3
14 \& 17.2
15.0 \& 19. \& 21.5 \& 23.9
22.0 \& $26 \cdot 3$
24 \& $28 \cdot 8$ <br>
\hline 54 \& 0.2 \& 0. \& 2.0
1.8 \& $3 \cdot 5$ \& $5 \cdot 5$ \& $7 \cdot 9$ \& $9 \cdot$ \& 10 \& 12. \& $\mathrm{r}_{4} \cdot 1$ \& 15.9 \& 17 \& 19.9 \& 22.0 \& 24.3 \& 26. <br>
\hline \& \& \& \& \& $4 \cdot 8$ \& \& 8.5 \& \& 10.8 \& 12.2 \& 13.8 \& 15. \& \& \& \& <br>
\hline 62 \& 0.2 \& 0.7 \& r.6 \& $2 \cdot 9$ \& $4 \cdot 5$ \& \& $7 \cdot 7$ \& \& 10 \& II \& 13. \& 14.7 \& 15 \& \& $20^{\circ}$ \& 21 <br>
\hline 64 \& 0.2 \& $0 \cdot 7$ \& 1.5 \& $2 \cdot 7$ \& $4 \cdot 3$ \& $6 \cdot 2$ \& $7 \cdot 3$ \& 8. \& 9. \& 11.0 \& 12 \& 13.9 \& 15 \& $17 \cdot$ \& 18 \& 20 <br>
\hline \multicolumn{17}{|l|}{} <br>
\hline \multicolumn{17}{|l|}{$\mathbf{N} . \quad$ REDUCTIONS.} <br>
\hline 46 \& 32 \& 33 \& 35 \& $36 \cdot 9$ \& . 5 \& -1 \& 4 I \& 43 \& 0 \& $46 \cdot 7$ \& $48 \cdot 4$ \& 50.2 \& 52.0 \& 53.8 \& -7 \& \% 6 <br>
\hline 48 \& $31 \cdot 3$ \& $32 \cdot 7$ \& 34. \& $35 \cdot 6$ \& $37 \cdot 1$ \& $38 \cdot 6$ \& $40 \cdot 2$ \& $4 \mathrm{r} \cdot 8$ \& $43 \cdot 4$ \& 45. 1 \& $46 \cdot 7$ \& $48 \cdot 4$ \& $50 \cdot 2$ \& 5 I 9 \& $53 \cdot 7$ \& 55.6 <br>
\hline 50 \& 30.2 \& 31.5 \& 32.9 \& 34.3 \& $35 \cdot 7$ \& 37.2 \& 38.7 \& $40^{\circ}$ \& 41.8 \& 43.4 \& $45^{\circ} \mathrm{O}$ \& $46 \cdot 7$ \& $48 \cdot 3$ \& $50 \cdot 0$ \& 5 I \& 53.5 <br>
\hline 52 \& $29^{\circ} \mathrm{O}$ \& $30 \cdot 3$ \& $31 \cdot 6$ \& 33 \& 34.4 \& $35 \cdot 8$ \& 37.2 \& 38 \& 402 \& $41 \cdot 7$ \& $43 \cdot 3$ \& $44^{\circ} 9$ \& 4 \& 48.1 \& \& 51.5 <br>
\hline 54 \& 27.8 \& 29 \& $30^{\circ}$ \& 31 \& 31 \& 34.3 \& $35 \%$ \& 3\% \& \& , \& 41.5 \& , \& 44. \& \& 7 8 \& $49 \cdot 4$ <br>
\hline 55 \& 27 \& \& 29.7 \& 3 r \& \& $33 \cdot 6$ \& $35^{\circ} \mathrm{O}$ \& 36 \& \& 39 \& $40 \cdot 6$ \& $42 \cdot 1$ \& $43 \cdot 6$ \& 45.2 \& 46 \& $48 \cdot 3$ <br>
\hline 56 \& 26.6 \& 27.8 \& $29^{1}$ \& \& 31. \& 32.9 \& 34.2 \& $35 \cdot 5$ \& $36 \cdot 9$ \& $38 \cdot 3$ \& 39 \& 4 r \& $42 \cdot 7$ \& 44.2 \& 45 \& $47 \cdot 3$ <br>
\hline 57 \& 26.0 \& 27.2 \& 28.4 \& 29.6 \& 30.9 \& $32 \cdot 1$ \& 33.4 \& 34.7 \& $36 \cdot 1$ \& $37 \cdot 5$ \& 38.8 \& $40 \cdot 3$ \& $4 \mathrm{r} \cdot 7$ \& $43 \cdot 2$ \& \& $46 \cdot 2$ <br>
\hline 58 \& 25. \& 26. \& 27.7 \& 28 \& $30 \cdot 2$ \& 3 I \& $32 \cdot 7$ \& 33.9 \& $35 \cdot 3$ \& $36 \cdot 6$ \& $38 \cdot$ \& 39.4 \& $40 \cdot 8$ \& 42. \& 43 \& 45.1 <br>
\hline 59 \& 24 \& 25 \& 27-1 \& 28.2 \& 29.4 \& $30 \cdot 6$ \& $3 \mathrm{I} \cdot 9$ \& \& 34.4 \& 35 \& 37.0 \& \& $39 \cdot 8$ \& $4 \mathrm{I} \cdot 2$ \& \& <br>
\hline 60 \& 24 \& \& $26 \cdot 4$ \& 27 \& 28 \& 29.9 \& $3 \mathrm{I} \cdot \mathrm{I}$ \& $32 \cdot$ \& $33 \cdot 6$ \& 34.8 \& 36•1 \& $37 \cdot 5$ \& 38.8 \& $40 \cdot 2$ \& 41.6 \& $43 \cdot 0$ <br>
\hline 61 \& 23.6 \& $24 \cdot 6$ \& $25 \cdot 7$ \& $26 \cdot 8$ \& 28.0 \& 29 \& 30.3 \& 3 I \& 32.7 \& 33.9 \& 35.2 \& $36 \cdot 5$ \& $37 \cdot 8$ \& $39 \cdot 1$ \& $40 \cdot 5$ \& 41.9 <br>
\hline 62 \& 23.0 \& $24^{\circ} \mathrm{O}$ \& 25.1 \& 26 \& 27. \& 28 \& \& $30 \cdot 6$ \& 3r-8 \& $33^{\circ} \mathrm{O}$ \& $34 \cdot 3$ \& $35 \cdot 5$ \& 36.8 \& $38 \cdot \mathrm{I}$ \& 39.4 \& $40 \cdot 8$ <br>
\hline 63 \& 22.3 \& $23 \cdot 3$ \& 24.3 \& 25.4 \& $26 \cdot 5$ \& $27 \cdot 6$ \& 28.7 \& 29.8 \& 30.9 \& $32 \cdot 1$ \& $33 \cdot 3$ \& 34.5 \& 35.8 \& $37^{\circ}$ \& 38.3 \& $39^{6}$ <br>
\hline 64 \& 21.7 \& $22 \cdot 7$ \& 23.7 \& 24.7 \& $25 \cdot 7$ \& $26 \cdot 8$ \& $27 \cdot 8$ \& 28.9 \& $30 \cdot 1$ \& 31.2 \& 32.4 \& 33.6 \& 34.8 \& 36.0 \& $37 \cdot 2$ \& 88 <br>
\hline
\end{tabular}

| Lat. | 1 HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | m. 0 | m 1 | ${ }_{2} \mathrm{~m}$. | ${ }_{3} \mathrm{~m}$. | 4. | $\stackrel{\text { m. }}{5}$ | 6 | ${ }_{7} \mathrm{~m}$. | ${ }_{8} \mathrm{~m}$. | ${ }_{9}^{\mathrm{m}}$. | 10 | 11 | 12 | ${ }_{13}$. | 14. | $\stackrel{\mathrm{m}}{15}$ |
| N. REDUCTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 46 | 57.6 | 59'5 | 6I'5 | 63.5 | 65.5 | $67 \cdot 5$ | 69.6 | $7 \times 7$ | 73.9 | 76.0 | $78 \cdot 2$ | 80.5 | 82.7 | 85.0 | $87 \cdot 4$ | $89 \cdot 7$ |
| 47 | $56 \cdot 6$ | 58.5 | $60 \cdot 4$ | $62 \cdot 3$ | $64 \cdot 3$ | $66 \cdot 3$ | 68.4 | $70 \cdot 4$ | 72.6 | $74 \cdot 7$ | 76.9 | 79.1 | $8 \mathrm{I} \cdot 3$ | 83.5 | 85.8 | 88.1 |
| 48 | $55 \cdot 6$ | 57.4 | $59 \cdot 3$ | $6 \mathrm{I} \cdot 2$ | $63 \cdot 2$ | 65. | $67 \cdot 2$ | $69 \cdot 2$ | 7x 3 | $73 \cdot 4$ | $75 \cdot 5$ | $77 \cdot 6$ | $79 \cdot 8$ | $82 \cdot 0$ | 84.3 | $86 \cdot 6$ |
| 49 | 54.5 | $56 \cdot 4$ | $58 \cdot 2$ | $60 \cdot 1$ | $62 \cdot 0$ | 63.9 | 65.9 | 67.9 | 69.9 | $72 \cdot 0$ | $74 \cdot \mathrm{I}$ | $76 \cdot 2$ | 78.4 | 80.5 | $82 \cdot 7$ | $85^{\circ} 0$ |
| 50 | 53.5 | $55 \cdot 3$ | $57 \cdot 1$ | $59^{\circ}$ | $60 \cdot 8$ | $62 \cdot 8$ | $64 \cdot 7$ | $66 \cdot 7$ | $68 \cdot 6$ | $70 \cdot 7$ | $72 \cdot 7$ | 74.8 | $76 \cdot 9$ | $79 \cdot 0$ | $8 \mathrm{I} \cdot 2$ | 83.4 |
| 5 I | $52 \cdot 5$ | $54 \cdot 2$ | 56.0 | $57 \cdot 8$ | 59.7 | 6I.5 | 63.5 | $65 \cdot 4$ | $67 \cdot 3$ | $69 \cdot 3$ | 71.3 | $73 \cdot 4$ | $75 \cdot 4$ | 77.5 | 79.6 | 81.8 |
| 52 | 51.5 | 53.2 | $54 \cdot 9$ 53 | $56 \cdot 7$ | ${ }_{5}^{58 \cdot 5}$ | 60.3 | $62 \cdot 2$ | $64 \cdot 1$ | $66^{\circ}$ | 68.0 | 69.9 | $71 \cdot 9$ | 73.9 | $76 \cdot 0$ | $78 \cdot 1$ | 80.2 78.6 |
| 53 | $50 \cdot 4$ | 52.1 | $53 \cdot 8$ | $55^{6}$ | 57.3 | $59 \cdot 1$ | $6{ }^{1} 0$ | $62 \cdot 8$ | $64 \cdot \%$ | $66 \cdot 6$ | $68 \cdot 5$ | $70 \cdot 5$ | 72.5 | $74 \cdot 5$ | $76 \cdot 5$ | $78 \cdot 6$ |
| 54 | 49.4 | $51^{\circ} \mathrm{O}$ | $52 \cdot 7$ | 54.4 | 56.2 | $57 \cdot 9$ | $59^{\circ} 7$ | $6{ }^{1} 5$ | $63 \cdot 3$ | $65 \cdot 2$ | $67 \cdot 1$ | $69^{\circ}$ | 71.0 | 72.9 | 74.9 | $77^{\circ} \mathrm{O}$ |
| 55 | $48 \cdot 3$ | $49 \cdot 9$ | $51 \cdot 6$ | $53 \cdot 3$ | $55^{\circ}$ | $56 \cdot 7$ | $58 \cdot 4$ | $60 \cdot 2$ | $62 \cdot 0$ | $63 \cdot 8$ | $65 \cdot 7$ | $67 \cdot 6$ | 69.5 | 71.4 | $73 \cdot 3$ | $75 \cdot 3$ |
| 56 | 47.3 | 48.9 | $50 \cdot 5$ | 52.I | $53 \cdot 8$ | 55.4 | $57 \cdot 1$ | $58 \cdot 9$ | $60 \cdot 6$ | 62.4 | $64 \cdot 3$ | $66 \cdot 1$ | 67.9 | $69 \cdot 8$ | 71.8 | 737 |
| 57 | $46 \cdot 2$ | $47 \cdot 8$ | $49 \cdot 3$ | $50 \cdot 9$ | $52 \cdot 5$ | 54.2 | $55^{\prime} 9$ | $57 \cdot 6$ | $59 \cdot 3$ | $6 \mathrm{I}^{\circ}$ | $62 \cdot 8$ | $64 \cdot 6$ | $66 \cdot 4$ | $68 \cdot 3$ | $70 \cdot 1$ | $72 \cdot 0$ |
| 58 | $45^{\circ} \mathrm{I}$ | $46 \cdot 7$ | $48 \cdot 2$ | $49 \cdot 8$ | $51 \cdot 3$ | 52.9 | 54.6 | $56 \cdot 2$ | $57 \cdot 9$ | $59^{6}$ | 61.4 | $63 \cdot 1$ | 64.9 | $66 \cdot 7$ | 68.5 | $70 \cdot 4$ |
| 59 | $44^{\cdot 1}$ | $45 \cdot 5$ | $47^{\circ} \mathrm{O}$ | $48 \cdot 6$ | 50'I | $5 \mathrm{x} \cdot 7$ | $53 \cdot 3$ | 54.9 | $56 \cdot 5$ | 58.2 | $59^{\circ} 9$ | $6 \mathrm{I} \cdot 6$ | $63 \cdot 3$ | $65^{\prime} \mathrm{I}$ | $66 \cdot 9$ | $68 \cdot 7$ |
| 60 | $43^{\circ} 0$ | 44.4 | $45 * 9$ | $47 \cdot 4$ | $48 \cdot 9$ | $50 \cdot 4$ | $5 \mathrm{I} \cdot 9$ | $53 \cdot 5$ | 55.1 | $56 \cdot 8$ | $58 \cdot 4$ | $60 \cdot 1$ | 61 | 63.5 | $65 \cdot 2$ | $67 \cdot 0$ |
| 6 x | $4{ }^{1} \cdot 9$ | $43 \cdot 3$ | $44 \cdot 7$ | $46 \cdot 1$ | $47 \cdot 6$ | 49. I | $50 \cdot 6$ | 52.2 | 53.7 | 55.3 | $56 \cdot 9$ | $58 \cdot 5$ | 60.2 | 6I.9 | 63.6 | $65 \cdot 3$ |
| 62 | $40 \cdot 8$ | $42 \cdot \mathrm{I}$ | $43 \cdot 5$ | 44.9 | $46 \cdot 4$ | $47 \cdot 8$ | $49 \cdot 3$ | $50 \cdot 8$ | $52 \cdot 3$ | $53 \cdot 8$ | $55 \cdot 4$ | $57 \cdot 0$ | $58 \cdot 6$ | $60 \cdot 2$ 58.5 | $61 \cdot 9$ | $63 \cdot 5$ |
| 63 | $3{ }^{39} 6$ | $4 \mathrm{I} \cdot \mathrm{O}$ | $42 \cdot 3$ | $43^{\circ} 7$ | $45 \cdot 1$ | $46 \cdot 5$ | 47.9 | 49.4 | 50.8 | $52 \cdot 3$ | $53 \cdot 8$ | 55.4 | 57.0 | 58.5 | $60 \cdot 2$ | 6r.8 |
| 64 | 38.5 | 39.8 | 41.I | 42 | $43 \cdot 8$ | $45 \cdot \mathrm{I}$ | $46 \cdot 5$ | 47*9 | $49 \cdot 4$ | 5c.8 | $52 \cdot 3$ | $53 \cdot 8$ | $55^{\circ} 3$ | $56 \cdot 9$ | 58 | $60 \cdot 0$ |


| Lat. | - HOUR. |  |  |  |  |  |  |  |  | I HOUR. |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{m}_{4}$ | ${ }_{8} \mathrm{~m}$ | ${ }_{12}$ | ${ }_{16} 1$ | ${ }_{20}$ | m. | ${ }_{30}$ | ${ }_{40}$ | ${ }_{50}$ | ${ }_{00} \mathrm{~m}$ | ${ }_{10} 10$ | ${ }_{20}$ | m. 30 | ${ }_{40}$ | ${ }_{50}$ | m. |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{4}^{\circ} 6$ | $0 \cdot 7$ | ${ }^{\circ} \cdot 4$ | $\stackrel{\circ}{2 \cdot 1}$ | $2 \cdot 8$ | $3 \cdot 5$ | $4 \cdot 2$ | $5 \cdot 3$ | $7 \cdot 1$ | 8.8 | $1{ }^{\circ} \cdot 6$ | $12 \cdot 3$ | $14^{\circ} \mathrm{O}$ | $15 \cdot 7$ | 17.4 | 19‥ | $20^{\circ} 8$ |
| 50 | $0 \cdot 7$ | 1.4 | $2 \cdot 1$ | 2.8 | 3.6 | $4 \cdot 3$ | $5 \cdot 3$ | $7 \cdot 1$ | $8 \cdot 9$ | 10.6 | 12.4 | 14.I | 158 | 17.5 | 19.3 | 21.0 |
| 54 | $0 \cdot 7$ | 1.4 | 2.2 | 2.9 | 3.6 | $4 \cdot 3$ | $5 \cdot 4$ | $7 \cdot 2$ | 8.9 | 10.7 | 12.5 | 14.2 | 16.0 | ${ }_{17}^{17} 7$ | 19.5 | $2 \mathrm{I} \cdot 2$ |
| 56 | $0 \cdot 7$ | $1 \cdot 4$ | 2.2 | $2 \cdot 9$ | 3.6 | $4 \cdot 3$ | $5 \cdot 4$ | $7 \cdot 2$ | 9.0 | 10.8 | 12.6 | 14.3 | r6.r | 17.9 | 19.6 | 21.4 |
| 58 | $0 \cdot 7$ | r.5 | 2.2 | $2 \cdot 9$ | $3 \cdot 6$ | $4 \cdot 4$ | $5 \cdot 4$ | $7 \cdot 3$ | $9 \cdot 1$ | 10.9 | 12.7 | 14.5 | 16.2 | 18.0 | 19.8 | 21.6 |
| 60 | 0.7 | 1.5 | 2.2 | 2.9 | $3 \cdot 7$ | $4 \cdot 4$ | $5 \cdot 5$ | $7 \cdot 3$ | 9.I | IT.O | 12.8 | 14.6 | $16 \cdot 4$ | $18 \cdot 2$ | $20 \cdot 0$ | $2 \mathrm{I} \cdot 8$ |
| 62 | $0 \cdot 7$ | 1.5 | 2.2 | $2 \cdot 9$ | 3.7 | $4 \cdot 4$ | 5.5 | $7 \cdot 3$ | 9.2 | II•I | 12.9 | $14^{\circ} 7$ | 16.6 | ${ }_{18} 18$ | 20.2 | 22.1 |
| 64 | 0.8 | 1.5 | $2 \cdot 3$ | $3 \cdot 0$ | 3.8 | $4 \cdot 5$ | $5 \cdot 6$ | $7 \cdot 5$ | $9 \cdot 3$ | 2 | 13.1 | 14.9 | 16.8 | 18.7 | $20 \cdot 5$ | 22.4 |



* a URS压 MAJORIS (DUBHE).

| Lat. ${ }^{\text {a }}$ | $\mathrm{m}_{4}$ | m. 8 | m. | 16 | $\mathrm{m}_{20}$ | 22. | 24 | $\mathrm{m}_{26}$ | m. 28 | m. 30 | ${ }_{3} \mathrm{~m}$. | m. | 36 | 38 | 10 | m. 42 | m. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. | REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 |  | $2 \cdot 1$ | $4 \cdot 7$ | $8 \cdot 4$ | 13.1 | 15.8 | 18.8 | $22 \cdot 0$ | $25 \cdot 5$ | 29*2 | $33 \cdot 2$ | $37 \cdot 4$ | $4 \mathrm{I} \cdot 8$ | $46^{\prime} \cdot 5$ | 51.4 | 56́6 | $62^{\circ} \mathrm{O}$ |
| 40 | 0.5 | $2 \cdot 0$ | 4.4 | $7 \cdot 9$ | 12.3 | 14.9 | 17•7 | $20 \cdot 8$ | $24^{\circ} 0$ | $27 \cdot 6$ | 31•3 | $35 \cdot 3$ | 39.5 | $43 \cdot 9$ | $48 \cdot 6$ | 53.5 | $58 \cdot 6$ |
| 38 | 0.5 | 1.9 | $4 \cdot 2$ | $7 \cdot 5$ | 11.7 | $14 \cdot 1$ | 16.8 | $19 \cdot 7$ | 22.8 | 26.2 | $29 \cdot 7$ | $33 \cdot 5$ | $37 \cdot 5$ | 4I•7 | $46 \cdot 2$ | $50 \cdot 8$ | 55'7 |
| 36 | $0 \cdot 4$ | I. 8 | 4.0 | $7 \cdot 1$ | IIII | 13.5 | 16.0 | 18.8 | 2I•8 | $25^{\circ} \mathrm{O}$ | 28.4 | $32 \cdot 0$ | $35 \cdot 8$ | $39 \cdot 9$ | 44* 1 | $48 \cdot 5$ | $53 \cdot 2$ |
| 34 | $0 \cdot 4$ | I•7 | $3 \cdot 8$ | $6 \cdot 8$ | $10 \cdot 7$ | 12.9 | I5.3 | $18 \cdot 0$ | $20 \cdot 9$ | 23.9 | $27^{2}$ | 30.7 | $34 \cdot 3$ | $38 \cdot 2$ | $42 \cdot 3$ | $46 \cdot 6$ | $5 \mathrm{I} \cdot \mathrm{O}$ |
| 32 | 0.4 | 1.6 | 3.7 | $6 \cdot 6$ | 10.3 | 12.4 | 14.8 | 17.3 | 20'1 | $23^{\circ} \mathrm{O}$ | $26 \cdot 1$ | $29 \cdot 5$ | $33^{\circ} 0$ | $36 \cdot 8$ | 40'7 | 44.8 | $49^{\circ} \mathrm{I}$ |
| 30 | $0 \cdot 4$ | I. 6 | $3 \cdot 6$ | $6 \cdot 3$ | 9.9 | 12.0 | 14.2 | 16.7 | 19.3 | $22 \cdot 2$ | $25 \cdot 2$ | $28 \cdot 5$ | $31 \cdot 9$ | $35 \cdot 5$ | $39 \cdot 3$ | $43 \cdot 2$ | $47 \cdot 4$ |
| 28 | $0 \cdot 4$ | 1.5 | $3 \cdot 4$ | $6 \cdot 1$ | $9 \cdot 6$ | II•6 | 13.8 | 16.I | $18 \cdot 7$ | 21.5 | $24^{\circ} 4$ | $27 \cdot 5$ | 30.8 | $34 \cdot 3$ | $38 \cdot 0$ | 41.8 | $45 \cdot 9$ |
| 26 | $0 \cdot 4$ | 1.5 | $3 \cdot 3$ | $5 \cdot 9$ | $9 \cdot 3$ | II. 2 | 13.3 | 15.6 | 18.1 | $20 \cdot 8$ | 23.7 | $26 \cdot 7$ | 29.9 | $33 \cdot 3$ | $36 \cdot 8$ | $40 \cdot 6$ | 44.5 |
| 24 | $0 \cdot 3$ | 1*4 | $3 \cdot 2$ | $5 \cdot 8$ | $9^{\circ} 0$ | 10.9 | 12.9 | $15 \cdot 2$ | 17.6 | 20.2 | $23^{\circ} \mathrm{O}$ | 25.9 | $29^{\circ}$ | $32 \cdot 3$ | $35 \cdot 8$ | 39.4 | $43^{2}$ |
| 20 | $0 \cdot 3$ | I*4 | $3 \cdot 1$ | $5 \cdot 5$ | $8 \cdot 5$ | 10.3 | $12 \cdot 3$ | 14.4 | $16 \cdot 7$ | 19*1 | 21.8 | $24 \cdot 6$ | $27 \cdot 5$ | $30 \cdot 6$ | 33.9 | $37 \cdot 4$ | 41.0 |
| 16 | $0 \cdot 3$ | I•3 | $2 \cdot 9$ | $5 \cdot 2$ | $8 \cdot 1$ | $9 \cdot 8$ | II•7 | 13.7 | $15 \cdot 9$ | $18 \cdot 2$ | $20 \cdot 7$ | 23.4 | $26 \cdot 2$ | 29.2 | $32 \cdot 3$ | $35 \cdot 6$ | $39^{\circ}$ |
| 12 | $0 \cdot 3$ | I•2 | $2 \cdot 8$ | $5 \cdot 0$ | $7 \cdot 8$ | $9 \cdot 4$ | II'2 | $13 \cdot 1$ | 15.2 | $17 \cdot 4$ | 19.8 | 22.4 | $25^{\prime}$ I | 27.9 | $30 \cdot 9$ | $34^{\cdot 1}$ | $37 \cdot 4$ |
| 8 | $0 \cdot 3$ | 1.2 | $2 \cdot 7$ | $4 \cdot 8$ | 7.4 | $9 \cdot 0$ | 10.7 | $12 \cdot 6$ | 14.6 | $16 \cdot 7$ | 19.0 | $21 \cdot 5$ | $24^{\circ} \mathrm{O}$ | 26.8 | $29 \cdot 7$ | $32 \cdot 7$ | $35 \cdot 8$ |
| 4 | $0 \cdot 3$ | I•I | $2 \cdot 6$ | $4 \cdot 6$ | $7 \cdot 2$ | $8 \cdot 7$ | $10 \cdot 3$ | 12.1 | 14.0 | $16 \cdot 1$ | $18 \cdot 3$ | $20 \cdot 6$ | $23 \cdot 1$ | $25 \cdot 8$ | $28 \cdot 5$ | 31.4 | 34.5 |
| 0 | $0 \cdot 3$ | I'I | 2.5 | $4 \cdot 4$ | $6 \cdot 9$ | $8 \cdot 3$ | $9 \cdot 9$ | II•6 | 13.5 | 15.5 | $17 \cdot 6$ | 19.9 | $22 \cdot 3$ | 24.8 | $27 \cdot 5$ | $30 \cdot 3$ | $33 \cdot 2$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | $0 \cdot 3$ | 1 | $2 \cdot 3$ | 4 | 6.4 | $7 \cdot 7$ | $9 \cdot 2$ | 10.8 | 12.6 | 14.4 | 16.4 | 18.5 | 20.8 | 23.1 | $25 \cdot 6$ | 28.2 | $32 \cdot 1$ 310 |
| 12 | 0.2 | I.0 | $2 \cdot 2$ | $4^{\circ} 0$ | $6 \cdot 2$ | $7 \cdot 5$ | $8 \cdot 9$ | $10 \cdot 5$ | $12 \cdot 1$ | 13.9 | 15.8 | I7.9 | $20 \cdot 0$ | 22:3 | $24^{\circ} 7$ | $27 \cdot 3$ | $29 \cdot 9$ |
| 16 | $0 \cdot 2$ | 1.0 | 2.I | 3 | $6 \cdot 0$ | $7 \cdot 2$ | $8 \cdot 6$ | 10.1 | 11.7 | 13.5 | 15.3 | 17.3 | 19.4 | 21.6 | $23 \cdot 9$ | $26 \cdot 4$ | $28 \cdot 9$ |
| 20 | $0 \cdot 2$ | 0.9 | $2 \cdot 1$ | $3 \cdot 7$ | $5 \cdot 8$ | $7 \cdot 0$ | $8 \cdot 3$ | $9 \cdot 8$ | I I•3 | 13.0 | $\mathrm{I}_{4} \cdot 8$ | $16 \cdot 7$ | $18 \cdot 7$ | 20.9 | $23^{\cdot 1}$ | $25^{\circ} 5$ | $27 \cdot 9$ |
| 24 | $0 \cdot 2$ | 0.9 | $2 \cdot 0$ | $3 \cdot 6$ | $5 \cdot 6$ | $6 \cdot 8$ | $8 \cdot 0$ | $9 \cdot 4$ | 10.9 | 12.6 | 14.3 | 16 | 18.1 | $20 \cdot 1$ | $22 \cdot 3$ | 24.6 | $27 \cdot 0$ |
| Lat. | 45 | m. 46 | 4. | 48 | 49 | 5015 | 15 | $\begin{array}{l\|l} 2 \\ 28 \\ \hline \end{array}$ | $54$ | 55 |  |  | 5 | m. 58 |  |  | m. |


|  |  | 67.6 |  |  | $76 \cdot 4$ |  | $82 \cdot 5$ |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  | 83.3 | $86 \cdot 4$ | 92.1 |  | 38.8 |  | 2.8 | 'I |  |
|  |  |  |  |  |  | $75 \cdot 1$ |  | $8 \mathrm{I} \cdot \mathrm{I}$ | 84 | 87 |  | 6 |  | I 40.1 | 143 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  | I 34.4 |  |  |  |
| 38 |  |  | 63.3 |  |  |  | 743 |  |  |  |  | I 29.1 | I $32 \cdot 2$ | I $35 \cdot 3$ |  |  |
|  | 56.8 |  | 61.9 |  |  |  |  | $75 \cdot 4$ | $78 \cdot 3$ | $8 \mathrm{r} \cdot \mathrm{I}$ | $84 \cdot \mathrm{X}$ | 127.1 | $1{ }^{1} 30 \times 1$ | $1{ }^{1} 33 \cdot 2$ | $6 \cdot 3$ |  |
|  |  |  |  |  |  |  |  |  |  |  |  | I I 25.2 23.5 | I |  |  |  |
|  |  | 55 |  | $60 \cdot 5$ |  |  |  |  | 73 |  | 79 |  | 124. |  |  |  |
| 33 | 52 | 54 | 57 | 59.4 |  | $64 \cdot 3$ | 66.9 | $69 \cdot 5$ | 72 | $74 \cdot 8$ | $77 \cdot 5$ | I 20.3 | $123 \cdot 1$ | $26 \cdot$ | I 28.9 |  |
| 32 |  |  | $55^{\circ} 9$ | 58.3 |  |  | $65 \cdot 6$ | 68.2 | $70 \cdot 8$ | 73.4 |  | 18.8 | 121.6 |  |  |  |
| 31 |  |  |  |  |  |  |  |  |  |  |  | I 16 | 1 |  |  |  |
|  |  |  | 53-1 | 55 |  |  |  |  |  |  |  | 1 |  | I 20.2 | 1 |  |
| 28 | 47 |  | 52 | 54 | 56 |  |  | 63 | $66 \cdot 2$ | $68 \cdot 6$ |  | 113 |  | I 19.0 |  |  |
| 27 | 47 | 8 |  | $53 \cdot 6$ | 55 |  | $60 \cdot 4$ | 62.8 | $65 \cdot 2$ | 67.6 |  | 1 | $1{ }^{1} 15.2$ | . 6 | $1{ }^{1} 20.4$ |  |
|  |  |  |  |  | 55 |  |  |  |  |  |  | I 115 |  |  |  |  |
| $24$ |  |  |  |  | 53 |  |  |  |  |  |  |  |  |  |  |  |
| 20 | 42.8 | $44^{\prime} 7$ | 46 | $48 \cdot 7$ | 50\% | 52.8 | 54.9 | $57 \%$ | 59.2 | $6 \mathrm{r} \cdot 4$ | $63 \cdot 7$ |  |  | $1{ }_{1} 10 \cdot 7$ | $1{ }_{1}{ }^{1} \mathrm{I}$ | I 15.6 |
| 18 | 4 r 8 | $43 \cdot 6$ | $45 \cdot 5$ | $47 \cdot 5$ | $49 \cdot 5$ |  | 53.5 | $55 \cdot 6$ | 57.8 | 59.9 | $62 \cdot 1$ | I 4.4 |  |  | 1119 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 | 39 | 41 | ${ }_{42}$ | 44 | 46 |  |  |  |  | 56 |  | $1 \quad 0.2$ | I $3 \cdot 4$ <br> 1  | 11 <br> 1 | 6 |  |
| Io | 38 | 40 | 4 L | 43 | 45 |  |  |  |  |  | 56 | - $59^{\circ}$ |  | 13.2 | $5 \cdot 4$ | $7 \cdot 6$ |
|  |  |  |  | $42 \cdot 6$ |  | $46 \cdot 2$ | $48 \cdot 1$ |  |  |  | 55 | 78 |  |  |  |  |
|  |  | 38.4 | 40 | $4{ }^{1} 8$ | 43 | $45 \cdot 3$ |  |  |  |  |  |  |  |  |  |  |
|  |  | 37.7 | 39 38.6 |  |  |  |  |  |  |  |  |  |  | 5 |  |  |
| - | 34 | 36 | 37 | 39 | 11 |  |  | 46.3 | 48.1 | 49 |  | - $53 \cdot 6$ | $5 \cdot 6$ | - 57.5 | $59 \cdot 5$ | I $1 \times 5$ |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | $34^{*}$ | $35^{\circ}$ |  |  |  |  | 43 | 45 | 47 | 49.1 |  | - $52 \cdot 7$ |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |  |  | - 49.2 |  | - 52.7 |  |  |
| $\begin{aligned} & \mathrm{I} \\ & \hline \end{aligned}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | - $44 \cdot 4$ |  |  |  |  |

# REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN. 

* a URSE MAJORIS (DUBHE).



## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

* a URS\& MAJORIS (DUBHE).

|  | ${ }_{0}^{\mathrm{m}}$ | ${ }_{4}^{\mathrm{m}}$ | ${ }_{8}^{\text {m. }}$ | 12 | 16 | 20 | ${ }_{24}^{\mathrm{m}}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{30}$ | ${ }_{32}$ | ${ }_{34}^{\text {m. }}$ | $\mathrm{m}_{36}$ | $\begin{aligned} & \mathrm{m} . \\ & 38 \end{aligned}$ | ${ }_{40}^{\mathrm{m}}$. | ${ }_{42}$ | m4 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ} \mathrm{O}$ | \% | 0.2 | 0.8 | r'9 | $3 \cdot 4$ | $5 \cdot 3$ | $7 \cdot 6$ | 3 | Ir9 | 13.5 | 15.3 | $12 \cdot 1$ | 19.0 | $21 \cdot 1$ | 23.2 | $5 \cdot 5$ |
| 35 | - | 0.2 | 0.8 | I. 8 | $3 \cdot 2$ | $5 \cdot$ | 7.2 | 0.8 | IT.3 | 12.9 | I4.5 | 16.3 | 18.1 | 20.1 | $22 \cdot \mathrm{I}$ |  |
| 45 | - | -0.2 | - 0.8 | 1.6 | 2.9 2.9 | $4 \cdot 5$ | 6.5 | 8.8 | 10.2 | IT.5 | ${ }_{1}^{13 \cdot}{ }^{1}{ }^{\circ}$ | $15 \cdot 5$ 14.6 | 17.3 | 19.1 180 16 | 19.9 | . 8 |
| 50 | - | 0.2 | 0.7 | 1.5 | $2 \cdot 7$ | $4 \cdot 2$ | $6 \cdot 1$ | $8 \cdot 3$ | - | $10 \cdot 8$ | $12 \cdot 3$ | 13.8 | 15.3 | 16.9 | 18.7 | $20 \cdot 5$ |
| 60 | - | $0 \cdot 1$ | 0.6 | $1 \cdot 4$ | $2 \cdot 5$ | 3.9 3.6 3 | $5 \cdot$ | $7{ }^{7} 7$ |  | $10 \cdot 1$ | $1{ }^{1} 4$ | 12.7 | 14.2 | $15 \cdot 7$ | 17.3 |  |
| 64 | - | - 0 ¢ | 0.5 | I.2 | $2 \cdot 1$ | $3 \cdot 3$ | 4.8 | 6.5 | $7 \cdot 5$ | 8.5 | 9.6 | 10.8 | 12.0 | 3 3 | ${ }_{\text {I4 }}$ |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6.6 48.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 | 26.2 | 27.3 | 28.5 |  |  |  | 33.6 | 34.9 | 36.3 | 37.6 | 39.0 | $40 \cdot 5$ | 4 4 9 | 43.4 | 44.9 |  |
| 36 | 25.2 | $26 \cdot 3$ 25.2 | 27.4 26.3 | 28.6 | 29.8 28.6 |  | $32 \cdot 3$ | $33 \cdot 6$ | $34 \cdot 9$ $33 \cdot 4$ | $36 \cdot 2$ | 37.5 36.0 |  | 40.3 | $4 \mathrm{r} \cdot 7$ | 43.2 |  |
| 44 | 23 | $24 \cdot 1$ | $25 \cdot 2$ | 26 | $27 \cdot 3$ | 28 | 29.6 | $3{ }^{\circ}$ | 32.0 | $33^{2}$ | 34.4 | $35 \cdot 7$ | $37^{\circ}$ | 38.3 | 39 | 41 |
| 46 | 22.5 | 23.5 | 24 | 25 | 26.7 | 27.8 | 28.9 | $30 \cdot 1$ | $3 \mathrm{~T} \cdot 2$ | $32 \cdot 4$ | $33 \cdot 6$ | $34 \cdot 8$ | $36 \cdot \mathrm{I}$ | $37 \cdot 4$ | 38.7 | $40^{\circ}$ |
| 48 |  | 23.0 | $24^{\circ} \mathrm{O}$ | $25^{\circ}$ |  | 析 | . 2 | 29.3 | 30.5 |  | 32.8 | $34^{\circ} \mathrm{O}$ | $35 \cdot 2$ | 36.4 |  | $39^{\circ}$ |
| 50 | 21.4 | 22.3 | 23.3 | 24.3 | 25:3 | 26.4 | 27.5 | 27.8 | 28.6 | $30 \cdot 8$ | 31.9 | 33'1 | 34.3 | 35.5 |  |  |
| 52 <br> 54 |  | ${ }_{21 \cdot 1}^{21 \cdot 7}$ | 22.7 22.0 | 23.7 | 24.6 23.9 | 25.7 | ${ }_{25 \cdot 9}^{26.7}$ | 27.8 26.9 | 28 | 29.9 29.0 | 31.0 | $32 \cdot 2$ $3 \mathrm{r} \cdot 2$ | $33 \cdot 3$ | $34 \cdot 5$ | 35 | 36.98 |
| 56 | 19.6 | 20.4 | 21 | 22 | 23.2 | $24^{\text {I }}$ | $25 \cdot 1$ | $26 \cdot 1$ | 27.1 | $28 \cdot 1$ | 29.2 | $30 \cdot 3$ | 31.3 | $32 \cdot 5$ | 33.6 |  |
| 58 |  | 19.7 | 20 | 21.5 | $22 \cdot 4$ | $23 \cdot 3$ | 24.3 | $25^{25}$ | $26 \cdot 2$ | $27 \cdot 2$ | 28.2 | 2 |  | 31 |  |  |
|  |  |  |  |  |  | ${ }_{21}^{22 \cdot 5}$ | ${ }_{22}^{23.4}$ | 24.3 | $25 \cdot 3$ $24 \cdot 3$ | 25.2 | $27 \cdot 2$ 26.1 |  |  |  |  |  |
| 64 |  |  |  |  |  |  |  | 22 | 23.2 | ${ }_{24.1}$ |  |  |  | 27.8 |  |  |
| Lat. | HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{0} \mathrm{~m}$ | ${ }_{1} \mathrm{l}$ | ${ }_{2}$ | ${ }_{3}$. |  | $\frac{1}{5}$ | $\underset{8}{\mathrm{~m} .}$ | $\mathrm{m}_{\mathrm{F}} .$ | $\underset{8}{\mathrm{~m} .}$ |  |  | 11 | 2 | 1. |  | m. |
| N. ${ }^{\text {a }}$ REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{8}$ | 48 8́ | 49 | $5{ }^{1}$ | 53'1 | 54'8 | 56.5 | 58́2 | 60 | 6ŕ•8 | 63'6 |  |  | 69'2 |  |  | -0 |
| 30 | 47.3 | 48.9 | 50.5 | $52 \cdot \mathrm{I}$ | 53.8 | 55.5 | 57.2 | 58.9 | 60.7 | 62.5 | 64.3 | $66 \cdot \mathrm{r}$ | 68.0 | 69.8 | 71.7 | 号 |
| 32 | 46.4 | 48 | 49.5 | 51.2 | 5 | 54.4. | $55^{56}$ | 57 | 59 | 61.3 | ${ }^{63}{ }^{\text {a }}$. | 64.9 | ${ }^{67 .}$ | 68.5 | ${ }^{70 \cdot 4}$ | $72 \cdot 3$ |
| 34 36 36 | $45 \cdot 5$ 44.6 | ${ }_{46 \cdot 1}^{47}$ | 478 | 49 | 5 | 53*4.4 | $55^{\circ}$ 54 | $56 \cdot 7$ $55 \cdot 6$ | 58. | $60 \cdot 1$ | 6r.9 | $63 \cdot 6$ $62 \cdot 4$ | $65 \cdot 4$ 64.2 | $67 \cdot 2$ 65.9 | 699.1 | $7 r^{10}$ 69.6 |
| 38 | $43 \cdot 7$ | 45.2 | 46 | $48 \cdot 2$ | $49 \cdot 8$ | $5 \mathrm{~F} \cdot 3$ | 52. | $54 \cdot 5$ | 56.1 | $57 \cdot 8$ | $59^{\prime} 4$ | $61 \cdot 1$ | 62.9 | $64 \cdot 6$ | $66 \cdot 4$ | 68.2 |
| 40 | 42 | 44:3 | $45 \cdot 7$ | $47 \cdot 2$ 46.8 | 48.7 | $50^{2}$ | 5 | 53.3 | 54 | 56.6 |  | 59.9 | 6rs | 63.2 | $6{ }^{\circ}$ | 66.8 |
| 42 | $4 \mathrm{4I}$ | $43 \cdot 3$ $42 \cdot 3$ | $4{ }_{4}^{4 \cdot 7}$ | ${ }_{4}^{46 \cdot 8}$ | $47 \cdot 6$ 46.6 | 49. ${ }^{\text {a }}$ |  |  | 53.8 52.5 | $55 \cdot 3$ 54.1 | $55^{\circ}$ | 58.6 57.3 | 60.2 58.9 | $6 \times 1.9$ 60.5 | $63 \cdot 6$ $62 \cdot 2$ | 63.8 |
| 46 |  | $4{ }^{1} 3$ | 42.7 | 44 | 45 | $46 \cdot 9$ | 48 | $49^{\circ} 8$ | 51 | 52.8 | $54 \cdot 4$ | $5{ }^{\circ}$ | $57 \cdot 5$ | $59 \cdot \mathrm{I}$ |  | 62.3 |
| 48 |  | 40 | $4 \mathrm{~T} \cdot 6$ | $43^{\circ}$ | 44 | $45 \cdot 7$ | 47.1 | 48.6 | 50 | 51.5 | $53^{5}{ }^{\circ}$ | 54.5 | - | 57.6 | $59^{5}$ | 60.8 |
| 50 52 |  | 39 |  |  | 43 | 44 | 45 | 47.3 | 48 |  |  | $\xrightarrow{53.1}$ | 54.6 | $56 \cdot \mathrm{I}$ | $57 \cdot 7$ |  |
| 54 | 35 | 371 | 38.3 | 39 | 4 | - | 43 | 44.7 | $46 \cdot 0$ | $47 \cdot 4$ | 48.7 |  | 5 | 54.6. |  | 57.6 |
| 56 | 34•7 | $35^{\prime} 9$ | $37 \cdot \mathrm{I}$ | 38.3 | $39 \cdot 5$ | $40 \cdot 7$ | $4{ }^{2}$ | $43 \cdot 3$ | 44.6 | 45 | $47 \cdot 2$ | $4{ }^{2} 6$ | 49.9 | 51.3 | 52.7 | $54 \cdot 2$ |
| 58 | 33 | 74 | 35.8 | 37.0 | 38 |  | $40 \cdot 6$ | $4{ }^{1} 8$ | $43 \cdot 1$ | 44.3 | 45.6 | $46 \cdot 9$ | $48 \cdot 3$ |  | 51 |  |
|  | 3I | 32 |  | $35 \cdot 7$ 34.3 |  |  |  | 48.7 | 41.5 | $42 \cdot 7$ |  |  | $46 \cdot 5$ | 47.8 | 49.2 | 50.5 48.5 |
| 62 64 |  |  |  |  |  |  |  | 38. | 39 | $41 \cdot 1$ 39.3 |  |  |  |  | 47 | 48 |


| Lat. | o HOUR. |  |  |  |  |  |  |  |  | I HOUR. |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{4}$ | ${ }_{8}^{\mathrm{m}}$. | ${ }_{12}$ | ${ }_{16}^{\text {m. }}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{30}^{\mathrm{m}}$ | ${ }_{40}$. | ${ }_{40}$ | ${ }_{50}^{\mathrm{m} .}$ | ${ }_{0} \mathrm{~m}$. | ${ }_{10}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{30}$ | ${ }_{40}^{\mathrm{m}}$ | ${ }_{50}$ | ${ }_{60}$ |
| N. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $3{ }^{\circ}$ | $\bigcirc$ | $\bigcirc$ | $\mathrm{I}^{\circ} 4$ | r.9 | $2 \cdot 3$ | 2.8 | 3.5 | $4 \cdot 6$ | 5.8 | $6{ }^{\circ} 9$ | $8 \cdot \mathrm{I}$ | $\stackrel{\circ}{9}$ | $10 \cdot 3$ | IT ${ }^{\circ} 4$ | $12 \cdot 5$ | 13.5 |
| 40 | 0.5 | r.0 | I. 4 | I.9 | 2.4 | 2.9 | 3.6 | ${ }_{4}^{4.8}$ | 5.9 |  | 8.8 | 9.4 | $10 \cdot 6$ | IT. 7 | 12.8 | 13.9 |
| 50 <br> 54 | ${ }_{0}^{0.5}$ | $\xrightarrow{\text { I }} \mathrm{r}$ - | I. 5 | ${ }_{2}^{2 \cdot 1}$ | 2.5 | 3.1. | 3.8 3.9 | 5.0 | $6 \cdot 3$ | 7.5 | 8.8 | 10.0 10.3 | IT 12 Ir 6 | 12.4 12.9 | ${ }_{1}^{13 \cdot 6}$ | 14.8 <br> 15.4 <br> 1 |
| 58 | $0 \cdot 5$ | $1 \cdot 1$ | r.6 | 2.2 | 2.7 | 3.2 | 4.0 | $5 \cdot 3$ | $6 \cdot 7$ | 8.0 |  | 10.7 | 12.I | 13.4 | 14.7 | 16.0 |
| 60 62 | ${ }_{0}^{0.5}$ |  | r r ¢ | 2.2 2.3 | 2.8 2.8 | 3.3 3.4 | $4 \cdot 1$ | 5.5.6 | 6.9 | 8.2 8.4 | ${ }_{9}^{9.6}$ | $\xrightarrow[\text { Ir }]{1} \mathrm{O}$ | 12.3 12.6 | 13.7 14.0 14 | 15.0 | 16.4 |
| 64 | ${ }_{0} 0.6$ | 1.2 | $1 \cdot 7$ | $2 \cdot 3$ | $2 \cdot 9$ | 3.5 | 4.3 | ${ }_{5}^{5 \cdot 8}$ | $7 \cdot 2$ | 8.7 | 9. | II.5 | 13.0 | 14.4 | I5.8 | 17.2 |

REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM MERIDIAN BELOW THE POLE.

* a URSE MAJORIS (DUBHE).

| HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{16}$ | ${ }_{17}^{\text {m }}$ |  | $\left.\right\|_{19} ^{\text {m. }}$ |  | $1{ }_{21}^{\mathrm{m}}$ | ${ }_{22}^{\mathrm{m}}$ |  |  |  | $\mid{ }_{26}^{\mathrm{m}}$ \| |  |  |  |  | ${ }_{3 i}^{\mathrm{m}}$ |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 75 | 77.8 | $7{ }^{9} \cdot 8$ |  |  |  |  | ${ }^{9} \mathrm{O} \cdot 2$ |  | 94'6 |  |  |  |  |  | 2 |
|  | cis | ${ }_{74}^{76}$ | ${ }_{7}^{78.8}$ | 80:3 | $\begin{aligned} & 82 \cdot=3 \\ & 80 \cdot 8 \end{aligned}$ | 3 ${ }^{8}{ }_{8}^{84.4}$ | 86.5 | 886.9 |  |  |  |  |  |  |  |  |
| $3^{8}$ | ${ }_{\text {crer }}^{\substack{715 \\ 70.1}}$ | ${ }_{71}^{73}$ | 75:3 | ${ }_{757}^{77}$ | 79\%2 | ${ }_{6}{ }_{6}{ }^{81} 8$ | 83:5 | 85.2. | 887.5 | $89 \cdot 3$ <br> $87 \cdot 5$ <br> 8 <br> 8 | 91.4. | 5 | ${ }_{93}^{95 \%}$ | 97.8 |  |  |
|  | 68 | $7{ }^{\circ}$ | 72:3 | ${ }_{74}{ }_{2}$ | -o | - 78.9 | 79.8 | 88.8 | $8{ }_{8}^{8.7}$ | 85.78 | 87.7 85.8 8 | 89.8. | 9r:8.8 | 93:9 |  | 98.1 |
|  |  | 68 | ${ }_{69}^{72 \cdot 7}$ | \% $\begin{aligned} & 72.5 \\ & 7009\end{aligned}$ | - 4 | $476 \cdot 2$ | ${ }_{76 \cdot 3}^{78 \cdot 1}$ | - | ${ }_{80}^{80.1}$ |  |  |  |  |  |  | $8 \left\lvert\, \begin{aligned} & 9 \\ & 8 \end{aligned} \frac{96 \cdot 0}{93 \cdot 9}\right.$ |
| 48 | ${ }_{\text {cher }}^{64}$ | 65 | 67.8 | ${ }^{69.2}$ | 7ri. | - ${ }^{2}$ | $\begin{aligned} & 3.5 \cdot 5 \\ & 72.7 \end{aligned}$ | ${ }_{74 \cdot 5}^{76 \cdot 4}$ |  | ${ }_{88 \cdot 1}^{80}$ | ${ }_{79} 79.98$ | $\begin{aligned} & 83 \cdot 8 \\ & 8 \mathrm{rr} \cdot 8 \end{aligned}$ |  | ${ }_{85}^{87.5}$ |  | ${ }^{9} 9$ |
|  | 60. | 62 | 64. | 65 | 674 | 69.1 | 70.8 | 72:3 | 74 | 76-1 | 77.8 | 79 |  | ${ }^{83} 3$ |  | $87 \cdot$ |
|  |  | 60.8 |  |  |  |  |  |  |  |  |  |  |  |  |  | ${ }_{8}^{84}$ |
|  | 53 | ${ }_{5}^{57}$ | 56 | ${ }_{58}$-r | cri. 59 59 | 7 ${ }^{\text {chi }}$ | ${ }_{62} 6$ | ${ }_{64+1}^{6.4}$ |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. $\left\|\frac{\mathrm{m}}{32}\right\|$ |  | $\left.\right\|_{33} ^{\text {m. }}$ | ${ }_{34}^{\text {m. }}$ | ${ }_{35}^{\text {m }}$ | 36 | ${ }_{3 \%}$ | ${ }_{38}$ | $\frac{\bar{m}}{\frac{19}{39}}$ | ${ }_{40}{ }^{\text {m }}$ | $\begin{aligned} & \frac{\mathrm{m}}{4 \mathrm{i}} \\ & \hline \end{aligned}$ | $1{ }_{42}^{\text {m }}$ |  | ${ }_{43}^{\text {m. }}$ | ${ }_{44}^{\text {m }}$ | ${ }_{45}^{\mathrm{m}}$ | 46 |
|  | REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 6 |  |  |  |  | . 6212 | . 6 |  |  |  |  |  |
| 36 38 |  |  | 109.8 | ${ }_{\text {rog. }}^{\text {r17.3 }}$ |  | ${ }^{\text {I }}$ |  |  |  |  |  |  |  | ${ }_{\substack{13.5 \\ \text { ro } 5.5 \\ 2}}$ |  |  |
|  |  | ro2:4 | ro4:6 | 106.8 | T | ${ }_{\text {I }}^{51}$ |  | 55.9 | 55 | .22 2.6 | 62 | - |  |  | 2 r |  |
|  |  | 10\%2 | ${ }_{\text {roid }}^{\text {roi }}$ |  |  | I 188.9 |  |  | H5 | - | ${ }_{4}{ }^{2}$ | 3 |  | .o |  |  |
|  |  | 93.3 | ${ }^{97.7}$ | 99\%8 | 101.9 | $1{ }^{4} 4^{\circ}$ | ${ }_{1}{ }^{46}$ | ${ }_{4}^{48 \cdot 7}$ | ${ }^{\text {a }}$ |  |  |  |  |  |  |  |
|  | 9 T | $93 \cdot 3$ | 95*3 | 97-4 | 99.4 |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{50}^{49}$ | ${ }^{\circ}{ }^{\circ}$ | 92:1. | 94. | ${ }_{\text {a }}^{\substack{96 \cdot 7 \\ 94.8}}$ | ${ }_{96}^{98 \cdot 8}$ | ¢ | I $40 \cdot 9$ | ${ }_{42}^{42}$ | ${ }^{\text {P }}$ | ${ }^{4} 4 \mathrm{~T} \mathrm{~T}^{47 \cdot 5}$ | ${ }^{\text {I }}$ | $0 \cdot 71$ | 52:81 | 55: |  |  |
|  | ${ }^{86} 5$ | 88. | ${ }_{9}{ }^{\text {P }}$. 6 | ${ }_{93}^{93}$ | 95:5 | T T \% 7.5 |  |  |  | $6{ }^{1}$ T 456 | $6{ }^{1}$ | 7 |  |  |  |  |
| $\begin{aligned} & 52 \\ & 53 \\ & 53 \end{aligned}$ | ${ }_{85}{ }_{8}^{86 \cdot 6}$ | ${ }_{8}{ }_{8}^{88 \cdot} \cdot$ |  | 920.2 | 94:28 | ${ }_{\text {I }}^{\text {I }}$ | ${ }_{36}^{38.1}$ | (1) | \% 1 |  | $7{ }^{2}$ |  |  |  |  |  |
|  |  |  | 87.7 | 89.6 | $9{ }^{1}$ | I $33 \cdot 3$ |  |  | r 39.2 |  |  |  |  |  |  |  |
|  | $8{ }^{82}$ | $84 \cdot 5$ | 86.3 | 88.2 |  |  | $33^{\circ}$ | $3{ }^{\prime}$ | 37.6 | ${ }^{6} \mathrm{~T}$ T 38.6 |  | 1.51 | $3 \cdot 5$ |  |  |  |
|  |  | - ${ }^{\text {3 }}$ 8.8 |  |  |  |  |  | I $32 \cdot 6$ |  | . 5 T 36 |  |  |  |  |  |  |
| 58 | ${ }_{8} 8$ | ${ }_{80 \cdot 4}$ | 82 -T | 83.9 | ${ }_{85}{ }^{\text {c/6 }}$ | ${ }^{1}$ | ${ }_{1}{ }^{1} 29.2$ | I | OII 32.9 |  | $7{ }_{7}{ }^{1}$ | 56.6\| | ${ }_{38}^{40} 5$ | ${ }^{1}$ | 12 |  |




* FOMALHAUT.



# REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN. 

* FOMALHAUT.


TRUE BEARING OR AZIMUTH OF * FOMALHAUT.

| Lat. | $\stackrel{\mathrm{m}}{4}$ | ${ }_{8}^{\text {m. }}$ | 12 | ${ }_{16}^{16}$ | $\stackrel{\mathrm{m}}{20}$ | $\stackrel{\mathrm{m}}{24}$ | $\stackrel{\mathrm{m}}{28}$ | $\mathrm{m}_{32}$ | $\begin{aligned} & \mathrm{m} . \\ & 36 \end{aligned}$ | ${ }_{40} \mathrm{~m}$. | ${ }_{44}$ | $\stackrel{1}{\text { m. }}$ | ${ }_{52}$ | ${ }_{56}$ | ${ }_{60}$ | ${ }_{70} \mathrm{~m}$ | ${ }_{80} \mathrm{~m}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $6{ }^{\circ}$ | $0 \cdot 9$ | $1 \cdot 7$ | $2 \cdot 6$ | $3 \cdot 5$ | $4 \cdot 3$ | $5 \cdot 2$ | ${ }^{\circ} \mathrm{F}$ 1 | $6 \cdot 9$ | 7.8 | 8.6 | $9 \cdot 5$ | 10.4 | IT 2 | $12 \cdot 1$ | 13.0 | $15 \cdot 1$ | 17̊.2 |
| 50 | $0 \cdot 9$ | 1.8 | 2.6 | 3.5 | 4.4 | $5 \cdot 3$ | 6.1 | $7 \cdot 0$ | 7.9 | $8 \cdot 8$ | 9.6 | $10 \cdot 5$ | 114 | 12.2 | $13 \cdot 1$ | 15.3 | 174 |
| 40 | 0.9 | I 8 | $2 \cdot 8$ | 3.7 | $4 \cdot 6$ | $5 \cdot 5$ | $6 \cdot 4$ | 7.3 | $8 \cdot 2$ | $9 \cdot 2$. | 10.1 | Ir ${ }^{\circ}$ | .1199 | 12.8 | 13.7 | 15.9 | 18.1 |
| 30 | I.O | $2 \cdot 0$ | 3.0 | $4^{\circ}$ | $5 \cdot 0$ | $6 \cdot 0$ | $7 \cdot 0$ | $8 \cdot 0$ | $8 \cdot 9$ | $9 \cdot 9$ | 10.9 | II 9 | 12.8 | 13.8 | 14.7 | 17.1 | 19.4 |
| 20 | I• | $2 \cdot 3$ | 3.4 | 4.5 | 5.6 | $6 \cdot 7$ | $7 \cdot 9$ | 9.0 | 10.1 | 11.2 | 12.2 | $13 \cdot 3$ | 14.4 | 15.4 | $16 \cdot 5$ | $19 \times 1$ | 2 F 6 |
| 15 | I. 2 | 2.4 | 3.7 | 4.9 | $6 \cdot 1$ | $7 \cdot 3$ | $8 \cdot 5$ | $9 \cdot 7$ | 10.9 | 12.0 | 13.2 | 14.4 | 15.5 | $16 \cdot 6$ | 17•7 | $20 \cdot 5$ | 23.1 |
| 10 | I. 3 | $2 \cdot 7$ | $4 \cdot 0$ | $5 \cdot 4$ | $6 \cdot 7$ | $8 \cdot 0$ | $9 \cdot 3$ | $10 \cdot 6$ | $1 \mathrm{I} \cdot 9$ | 13.2 | 14.5 | 15.7 | 16.9 | 18.I | 19.3 | $22 \cdot 2$ | $25^{\circ}$ |
| 8 | 1.4 | 2.8 | $4 \cdot 2$ | $5 \cdot 6$ | $7 \cdot 0$ | $8 \cdot 4$ | $9 \cdot 7$ | II 1 | 12.4 | 13.7 | 15.1 | $16 \cdot 4$ | 17.6 | I8.9 | 20.1 | 23.1 | 25.9 |
| 6 | 1.5 | $2 \cdot 9$ | 4.4 | 5.9 | $7 \cdot 3$ | $8 \cdot 7$ | 10.2 | II. 6 | 13.0 | 14.4 | 15.7 | 17.1 | 18.4 | 19.7 | 20.9 | $24^{\circ}$ | 26.9 |
| 4 | 1.6 | $3 \cdot 1$ | $4 \cdot 6$ | $6 \cdot 2$ | $7 \cdot 7$ | 9.2 | 10.7 | 12.2 | 13.6 | 15.1 | 16.5 | 17.9 | 19.2 | $20 \cdot 6$ | 21.9 | $25^{\circ}$ | $28 \cdot 0$ |
| 2 | $\underline{1.6}$ | $3 \cdot 3$ | $4 \cdot 9$ | $6 \cdot 5$ | $8 \cdot 1$ 8.6 | 9 | $1 \mathrm{IF}^{2}$ | 12.8 | 14.3 | ${ }_{15} 5$ | 17.3 | 18.8 | $2 \mathrm{O} \cdot 2$ | 21.6 | 22.9 | $26 \cdot 2$ | 29:2 |
| 0 | 1.7 | 3.5 | $5 \cdot 2$ | $6 \cdot 9$ | $8 \cdot 6$ | 10.2 | II.9 | 13.5 | $15 \cdot 1$ | $16 \cdot 7$ | 18.3 | 19.8 | 21.3 | $22 \cdot 7$ | $24^{\text {I }}$ | 27.5 | $30 \cdot 6$ |
| S. | 1.8 | $3 \cdot 7$ | $5 \cdot 5$ | $7 \cdot 3$ | $0 \cdot 1$ | 10.9 | 12.6 | 14.4 | 16.1 | 17*7 | 19 | $20 \cdot 9$ | 22.5 | $24^{\circ} \mathrm{O}$ |  | $28 \cdot 9$ | 32.1 |
| 4 | 2.0 | $3 \cdot 9$ | 5.9 | 7.8 | 9.7 | 11•6 | 13.5 | $15 \cdot 3$ | $17 \cdot 1$ | 18.9 | 20.6 | $22 \cdot 2$ | 23.9 | $25 \cdot 4$ | $26 \cdot 9$ | $30 \cdot 5$ | $33 \cdot 8$ |
| 6 | $2 \cdot 1$ | $4 \cdot 2$ | $6 \cdot 3$ | $8 \cdot 4$ | 10.5 | 12.5 | 14.5 | 16.4 | 18.3 | $20 \cdot 2$ | $22^{\circ} \mathrm{O}$ | $23 \cdot 7$ | $25 \cdot 4$ | $27 \cdot 1$ | $28 \cdot 6$ | $32 \cdot 3$ | $35^{\circ} 7$ |
| 8 | $2 \cdot 3$ | $4 \cdot 6$ | $6 \cdot 9$ | $9 \cdot 1$ | 11.3 | 13.5 | 15.7 | 17.7 | 19.8 | $21 \cdot 7$ | 23.6 | $25 \cdot 5$ | $27 \cdot 2$ | 28.9 | $30 \cdot 5$ | $34 \cdot 3$ | 37.7 |
| 9 | 2.4 | $4 \cdot 8$ | $7 \cdot 2$ | $9 \cdot 5$ | 11.8 | $14 \cdot 1$ | 16.3 | 18.5 | 20.6 | 22.6 | 24.5 | $26 \cdot 4$ | 28.2 | $30 \cdot 0$ | 31.6 | 35.4 | 38.9 |
| 10 | $2 \cdot 5$ | $5 \cdot 0$ | $7 \cdot 5$ | 10.0 | 12.4 | 14.7 | 17.1 | 19.3 | 21.5 | $23 \cdot 5$ | 25.5 | $27 \cdot 5$ | 29.3 | 3I'r | $32 \cdot 8$ | $36 \cdot 6$ | $40^{1}$ |

REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* a PAVONIS.


|  | $1{ }_{45}^{\mathrm{m}}$ | ${ }_{46}$ | ${ }_{47}$ | ${ }_{48}$ | 49 |  | $\left\lvert\, \begin{aligned} & \mathrm{m} . \\ & \hline \end{aligned}\right.$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 2 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & \hline \end{aligned}$ | ${ }_{54}^{\mathrm{m}}$ |  |  |  | 58 |  | ${ }_{60}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  | DUC | IONS |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 28 26 |  |  |  |  | ${ }_{3}^{37.6}$ | 30.3 |  |  | ${ }_{45 \cdot 1}$ |  | 775 |  |  | 4.0 | 8 |  |
| 24 | 33.2 | 34 |  | 37.8 | $39 \cdot 4$ |  | , |  |  |  |  |  |  | 1 |  |  |
| 20 |  | 35 |  |  |  |  |  | 45 | $47^{\circ}$ |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 |  | $39 \cdot 3$ | 41.0 |  |  | $46 \cdot$ |  |  |  |  |  |  |  |  |  |  |
| ro |  | 40 | 41 | 43 |  | 47 |  |  | 53.2 | $55^{\circ}$ |  |  |  |  |  |  |
| 8 |  |  | 42.8 | $44^{6} \cdot 6$ | 46 | 48 |  |  |  |  |  |  |  |  |  |  |
|  |  | 41.8 | $43 \cdot 7$ | $45 \cdot 5$ |  | 49 |  |  |  |  |  |  |  |  |  |  |
|  | 4 4 |  |  |  |  |  |  |  | $56 \cdot 6$ 57.8 |  |  |  | 5.4 |  |  |  |
| - | $42 \cdot 7$ | 44 | 46 | 48 | 50 | 52 | 54 |  | . 1 | $6 \mathrm{x} \cdot 3$ | $63 \cdot 6$ | I 59 | I $8 \cdot 3$ | $110 \%$ |  |  |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | 48.8 | $50 \cdot 8$ | $53^{\circ}$ |  |  |  |  |  |  |  | 8 |  |  |  |
|  |  | 47 | 49.9 |  |  |  |  |  | 63 |  |  | I 10.6 | $1{ }^{1} 13 \cdot 1$ | 5 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | 12 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | 72.8 |  |  |  |  |  |  |
| 1 | 52 |  |  |  |  |  |  |  |  |  |  | 12 |  |  |  |  |
| 18 |  |  |  |  |  |  |  |  |  | 70.6 |  |  | I 25.8 |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  | 79.6 |  |  | 128.5 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | 64.9 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |  |  |  | 88.4 | ${ }_{91}$ - 6 |  | I 38.3 | I 41 |  |  |
| 27 |  |  |  |  |  |  |  |  |  | $90 \cdot 2$ | $93 \cdot 5$ |  | I 40.2 | , |  |  |
| 28 |  |  | $70^{\circ}$ |  |  |  |  |  |  |  | $95 \cdot 4$ |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |  |  |  |  | - |  |  |
|  |  |  |  |  | 79 |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | 97.1 |  |  | I 48 | I |  | I 59.4 |  |
|  |  |  |  |  |  |  |  |  | ${ }_{\text {roz }} 99$ |  | 107\% | I $50 \cdot 7$ I 53.7 | (1) $\begin{aligned} & \text { I } 54.6 \\ & \text { I } \\ & 57.6\end{aligned}$ |  | $\begin{array}{ll}2 & 2.4 \\ 2 & 5.6\end{array}$ |  |

## * a PAVONIS.



| Lat. | ${ }_{4}$ | ${ }_{8} \mathrm{~m}$ | ${ }_{12}$. | ${ }_{16}$ | ${ }_{20}$ | ${ }_{24}$ | ${ }_{28} \mathrm{~m}$ | ${ }_{32}^{\mathrm{m}}$. | ${ }_{36}$ | ${ }_{40}$ | $\begin{aligned} & \hline \mathrm{m} . \\ & 44 \end{aligned}$ | 48. | ${ }_{52}$ | ${ }_{60}$ | ${ }_{70}$. | ${ }_{80}$. | m 90 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{30}$ | $0 \cdot 9$ | $\stackrel{\circ}{\text { P }}$ | $\stackrel{1}{\text { ¢ }}$ - 6 | $2 \cdot 2$ | $2 \cdot 7$ | $3 \cdot 3$ | $3 \cdot 8$ | $4 \cdot 4$ | $4 \cdot 9$ | $\stackrel{\circ}{5} 4$ | 6.0 | $6 \cdot 5$ | $\bigcirc$ | $8 \cdot 1$ | $\stackrel{\circ}{9} 4$ | $10 \cdot 7$ | $2 \cdot$ |
| 20 | 0.6 | $1 \cdot 1$ | $1 \cdot 7$ | $2 \cdot 2$ | $2 \cdot 8$ | 3.4 | $3 \cdot 9$ | $4 \cdot 5$ | $5 \cdot 0$ | 5.6 | $6 \cdot 1$ | $6 \cdot 7$ | $7 \cdot 2$ | $8 \cdot 3$ | 9.6 | 10.9 | 12.3 |
| 10 | 0.6 | 1.2 | 1.8 | $2 \cdot 4$ | 2.9 | $3 \cdot 5$ | $4 \cdot \mathrm{I}$ | $4 \cdot 7$ | $5 \cdot 3$ | $5 \cdot 9$ | $6 \cdot 4$ | $7 \cdot 0$ | $7 \cdot 6$ | $8 \cdot 7$ | $10 \cdot 1$ | II. 5 | 12.9 |
| 5 | $0 \cdot 6$ | 1.2 | 1.8 | $2 \cdot 5$ | $3 \cdot 1$ | $3 \cdot 7$ | $4 \cdot 3$ | 4.9 | $5 \cdot 5$ | 6.I | $6 \cdot 7$ | $7 \cdot 3$ | $7 \cdot 9$ | $9 \cdot 1$ | 10.5 | 12.0 | $13 \cdot 3$ |
| - | 0.6 | $1 \cdot 3$ | 1.9 | 2.6 | $3 \cdot 2$ | 3.9 | $4 \cdot 5$ | $5 \cdot 2$ | $5 \cdot 8$ | $6 \cdot 4$ | 7•I | $7 \cdot 6$ | $8 \cdot 3$ | 9.5 | II.O | 12.5 | 13.9 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 | $0 \cdot 7$ | 1.4 | $2 \cdot 1$ | 2.8 | 3.4 | 4•I | $4 \cdot 8$ | $5 \cdot 5$ | $6 \cdot 2$ | $6 \cdot 8$ | $7 \cdot 5$ | $8 \cdot 2$ | $8 \cdot 8$ | 10•I | 11•7 | 13.3 | $14 \cdot 7$ |
| 10 | 0.7 | I•5 | $2 \cdot 2$ | 3.0 | 3.7 | 4.4 | $5 \cdot 2$ | $5 \cdot 9$ | $6 \cdot 6$ | $7 \cdot 3$ | $8 \cdot 1$ | 8.8 | $9 \cdot 5$ | 10.9 | $12 \cdot 5$ | 14.2 | $15 \cdot 7$ |
| 14 | 0.8 | r.6 | 2.4 | $3 \cdot 2$ | $4 \cdot 0$ | $4 \cdot 8$ | $5 \cdot 5$ | $6 \cdot 3$ | 7.1 | 7.9 | $8 \cdot 6$ | $9 \cdot 4$ | Io. 1 | 11.6 | 13.4 | 15.1 | $16 \cdot 7$ |
| 18 | $0 \cdot 9$ | r 7 | $2 \cdot 6$ | 3.4 | $4 \cdot 3$ | $5 \cdot 2$ | $6 \cdot 0$ | $6 \cdot 8$ | $7 \cdot 7$ | $8 \cdot 5$ | $9 \cdot 3$ | Io•I | 10.9 | 12.5 | 14.4 | 16.2 | $18 \cdot 0$ |
| 20 | $0 \cdot 9$ | I.8 | $2 \cdot 7$ | 3.6 | $4 \cdot 5$ | $5 \cdot 4$ | $6 \cdot 3$ | $7 \cdot 1$ | $8 \cdot 0$ | 8.9 | 9.7 | $10 \cdot 6$ | 11.4 | 13.0 | 15.0 | 16.9 | 18.7 |
| 22 | $0 \cdot 9$ | I.9 | 2.8 | $3 \cdot 8$ | $4 \cdot 7$ | $5 \cdot 6$ | $6 \cdot 6$ | $7 \cdot 5$ | $8 \cdot 4$ | $9 \cdot 3$ | $10 \cdot 2$ | II•I | II-9 | 13.6 | $15 \cdot 7$ | 17.6 | 19.4 |
| 24 | I•O | $2 \cdot 0$ | 3.0 | 4.0 | $5 \cdot 0$ | 5.9 | $6 \cdot 9$ | 7.9 | $8 \cdot 8$ | $9 \cdot 8$ | $10 \cdot 7$ | II• 6 | $12 \cdot 5$ | 14.3 | 16.4 | 18.4 | $20 \cdot 3$ |
| 26 | I•I | $2 \cdot 1$ | $3 \cdot 2$ | $4 \cdot 3$ | $5 \cdot 2$ | $6 \cdot 3$ | $7 \cdot 3$ | $8 \cdot 3$ | $9 \cdot 3$ | 10.3 | 11.3 | $12 \cdot 3$ | 13.2 | 15.0 | 17.2 | $19 \cdot 3$ | 21.2 |
| 28 | I'I | $2 \cdot 2$ | $3 \cdot 4$ | 4.5 | $5 \cdot 6$ | $6 \cdot 7$ | $7 \cdot 7$ | 8.8 | 9.9 | $10 \cdot 9$ | 12.0 | 13.0 | 14.0 | 15.9 | 18.3 | 20.4 | 22.4 |
| 30 | $1 \cdot 2$ | 2.4 | 3.6 | 4.8 | $5 \cdot 9$ | $7 \cdot 1$ | $8 \cdot 3$ | 9.4 | $10 \cdot 5$ | 11.6 | 12.7 | 13.8 | 14.9 | 16.8 | 19.3 | $21 \cdot 6$ | 23.7 |
| 32 | I. 3 | 2.6 | 3.9 | 5.1 | $6 \cdot 4$ | $7 \cdot 6$ | $8 \cdot 9$ | $10 \cdot 1$ | II•3 | 12.5 | 13.6 | $14 \cdot 7$ | 15.8 | 18.0 | 20.5 | 22.9 | 25.1 |
| 34 | 1.4 | $2 \cdot 8$ | 4.2 | 5.6 | $6 \cdot 9$ | $8 \cdot 2$ | 9.5 | 10.9 | 12.2 | 13.4 | 14.7 | 15.9 | 17.1 | 19.3 | 21.9 | 24.3 | $26 \cdot 4$ |

# REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE. 

* $\alpha$ PAVONIS.

| Lat. | ${ }_{4}$ | ${ }_{8}^{\mathrm{m}} 8$. | ${ }_{12} \mathrm{~m}$ | ${ }_{16}$ | ${ }_{20}^{\mathrm{m}}$. | ${ }_{24}$ | ${ }_{26}$ | $\begin{aligned} & \mathrm{m} . \\ & 28 \end{aligned}$ | $\begin{aligned} & \hline \mathrm{m} . \\ & \mathbf{3 0} \end{aligned}$ | ${ }_{3} \mathrm{~m}$. | $\begin{aligned} & \mathrm{m} . \\ & 34 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{3 6} \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{3 8} \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 40 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 42 \\ & \hline \end{aligned}$ | mi <br> 44 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 | $0 \cdot 2$ | $\bigcirc{ }^{\circ} 9$ | $2 \cdot 0$ | $3 \cdot 6$ | 5.6 | $8 \cdot 1$ |  | II.O | 12.7 | 14.4 | $16 \cdot 3$ | 18.2 | 20.3 | $22^{\prime} 5$ | $24 \cdot 8$ | $2{ }^{2} \cdot 2$ |
| 42 | 0.2 | $0 \cdot 9$ | I.9 | $3 \cdot 4$ | $5 \cdot 4$ | 77.7 | . 1 | 10.5 | 12.0 | 13.7 | 15.5 | 17.3 | 19.3 | 21.4 | 23.6 | 25.9 |
| 46 | 0.2 | 0.8 | I.8 | $3 \cdot 3$ | $5 \cdot 1$ | $7 \cdot 3$ |  | $9 \cdot 9$ | 11.4 | $13^{\circ} 0$ | 14.7 | 16.4 | 18.3 | $20 \cdot 3$ | 22.4 | 24.5 |
| 50 | $0 \cdot 2$ | 0.8 | $1 \cdot 7$ | 3.1 | $4 \cdot 8$ | $6 \cdot 9$ | $8 \cdot 1$ | 9.4 | 10.8 | 12 | 13 | 15 | 17.2 | 19.1 | 21 | 23.1 |
| 54 | $0 \cdot 2$ | $0 \cdot 7$ | 1.6 | $2 \cdot 9$ | $4 \cdot 5$ | $6 \cdot 5$ | 7.6 | $8 \cdot 8$ | $10 \cdot 1$ | 11.5 | 12.9 | 14.5 | 16. | 17.9 | $19 \cdot 7$ | $2 \mathrm{~F} \cdot 7$ |
| 58 | 0.2 | 6 | 1.5 | $2 \cdot 7$ | $4 \cdot 2$ | 6.0 5.8 | 7.0 6.8 | 8.2 | $9 \cdot 4$ | 10.6 | 12.0 | 13.5 | 15. | 16.6 | 18.3 | $20 \cdot$ |
| 60 | $0 \cdot 2$ | 0.6 | 1.4 | $2 \cdot 6$ | $4{ }^{\circ} \mathrm{O}$ |  |  | $7 \cdot 8$ | 9.0 | 10.2 | 11.5 | 12. | $14^{\circ}$ |  | 17.6 | 19 |
| Lat. | $\mathrm{m}_{45}$ | $\mathrm{m}_{46}$ | $\mathrm{m}_{47}$ | $\begin{aligned} & \mathrm{m} . \\ & 48 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 9 \end{aligned}$ | $\mathrm{m}_{50}$ | $51$ | $\begin{aligned} & \mathrm{m} \\ & 52 \end{aligned}$ | $\overline{\mathrm{m}} .$ | $\mathrm{m}_{54}$ | $\frac{\mathrm{m}}{55}$ | $\underbrace{56}$ | $\mathrm{m}_{57}$ | $\begin{aligned} & \mathrm{m} . \\ & 58 \end{aligned}$ | $\mathrm{m}_{5 \mathrm{~g}}$ | $\begin{aligned} & \mathrm{m} . \\ & 60 \end{aligned}$ |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $42 \mathrm{~L} 27 \cdot \mathrm{I}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 46 |  | $26 \cdot 8$ | 28.0 | 29.2 | 30.4 | 31.7 | 32.9 | 34.2 | 35.6 | $36 \cdot 9$ | $38 \cdot 3$ | $39 \cdot 7$ | 41•I | $42 \cdot 6$ | $44^{\circ}$ | $45 \cdot 5$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 54 | 22 | 23.7 | $24 \cdot 7$ | $25 \cdot 8$ | $26 \cdot 9$ | 28.0 | 29•1 | $30 \cdot 3$ | 31.4 | $32 \cdot 6$ | $33 \cdot 8$ | $35 \cdot 1$ | $36 \cdot 3$ | $37 \cdot 6$ | $38 \cdot 9$ | 40.3 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{0} \mathrm{~m}$. | $\stackrel{1}{1}$ | 2 | 3 |  | ${ }_{5}$ | 6 | 7 | 8 |  | 0 | 11 | 12 | 13 | 14 | ${ }_{15}$. |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 | $50 \cdot 5$ | $52 \cdot 2$ | 53.9 | $55 \cdot 6$ | 57.4 | 59.2 | 61.0 | 62.8 | $64 \cdot 7$ | $66 \cdot 6$ | 68.6 | $70 \cdot 5$ | 72.5 | 74.5 | $76 \cdot 6$ | 78.6 |
| 40 | $49 \cdot 3$ | 50.9 | $52 \cdot 6$ | $54 \cdot 3$ | $56 \cdot 0$ | 57.8 | $59 \cdot 5$ | 6I•3 | $63 \cdot 2$ | $65 \cdot 0$ | 66.9 | 68.8 | 70.8 | $72 \cdot 7$ | $74 \cdot 7$ | $76 \cdot 8$ |
| 42 | $48 \cdot 0$ | $49 \cdot 6$ | 51•3 | $52 \cdot 9$ | 54.6 | $56 \cdot 3$ | $58 \cdot 1$ | $59 \cdot 8$ | 6I.6 | 63.4 | $65 \cdot 3$ | $67 \cdot 1$ | $69^{\circ}$ | 70.9 | 72.9 | 74.8 |
| 44 | $46 \cdot 8$ | $48 \cdot 4$ | $50 \cdot 0$ | 51.6 | 53.2 | $54 \cdot 9$ | $56 \cdot 6$ | $58 \cdot 3$ | $60 \cdot 0$ | 6I•8 | $63 \cdot 6$ | 65.4 | $67 \cdot 2$ | $69 \cdot 1$ | $7 \mathrm{I} \cdot 0$ | $72 \cdot 9$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 46 | $45 \cdot 5$ | 47.1 | $48 \cdot 6$ | 50.2 | $5 \mathrm{I} \cdot 8$ | $53 \cdot 4$ | $55^{\circ}$ | $56 \cdot 7$ | 58.4 | $60 \cdot 1$ | 6I.9 | 63.6 | $65 \cdot 4$ | $67 \cdot 2$ | 69-1 | 71.0 |
| 47 | 44.9 | $46 \cdot 4$ | $47 \cdot 9$ | $49 \cdot 5$ | $51 \cdot 1$ | $52 \cdot 6$ | $54 \cdot 3$ | 55.9 | $57 \cdot 6$ | 59.3 | $6 \mathrm{I} \cdot 0$ | $62 \cdot 8$ | $64 \cdot 5$ | $66 \cdot 3$ | $68 \cdot 1$ | $70 \cdot 0$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $5 I$ |  |  |  | $46 \cdot 6$ | $48 \cdot 1$ | $49 \cdot 6$ | $5 \mathrm{I} \cdot \mathrm{I}$ | 52.7 | $54 \cdot 3$ | $55 \cdot 8$ | $57 \cdot 5$ | 59.1 | 60.8 | $62 \cdot 5$ | 64.2 | $65^{9} 9$ |
| 53 L |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $54 \mathrm{4O} \cdot 3 \mathrm{4I} \cdot 6$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 56 | 38. | $40 \cdot 1$ | $41 \cdot 5$ | $42 \cdot 8$ | 44.2 | $45 \cdot 6$ | $47 \cdot 0$ | 48.4 | $49 \cdot 8$ | $51 \cdot 3$ | 52.8 | 54.3 | 55.8 | 57.4 | $59^{\circ}$ | $60 \cdot 6$ |
| 57 58 | $38 \cdot 1$ | 39.4 | $40 \cdot 7$ | $42 \cdot 0$ | 43.4 | $4{ }^{4} \cdot 7$ | $46 \cdot 1$ | $47 \cdot 5$ | $48 \cdot 9$ | $50 \cdot 4$ | 51.8 50.8 | 53.3 | 54.8 5.8 | $56 \cdot 3$ | ${ }_{5}^{57.9}$ | 59.4 |
| 58 |  | 38.6 | 39.9 30.1 | $41 \cdot 2$ 40.4 | $42 \cdot 5$ | 43.8 | $45 \cdot 2$ | $46 \cdot 6$ | $48 \cdot 0$ | 49.4 48.4 | 50.8 40.8 | $52 \cdot 3$ 51.2 | 53.8 | $55^{\prime 2}$ | 56.8 | $58 \cdot 3$ |
| 59 | $36 \cdot 6$ 35.9 | $37 \cdot 9$ $37 \cdot 1$ | $39 \cdot 1$ $38 \cdot 3$ | $40 \cdot 4$ $39 \cdot 5$ | $41 \cdot 7$ $40 \cdot 8$ | $43^{\circ} \mathrm{O}$ $42^{\prime} \mathrm{I}$ | $44 \cdot 3$ $43 \cdot 4$ | $45 \cdot 7$ 44 | $47^{\circ} \mathrm{O}$ 460 | $48 \cdot 4$ $47 \cdot 4$ | 49.8 48.8 | 51.2 | $52 \cdot 7$ 51.6 | 54.2 | 55.6 54.5 | $57 \cdot 2$ $56 \cdot 0$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| L, at. | 4 | 8 | 12 | ${ }_{16}$ | ${ }_{20}$ | $\begin{aligned} & \mathrm{m}_{24} . \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 30 \end{aligned}$ | ${ }_{40}$ | $\frac{\mathrm{m}}{50}$ | $\mathrm{m}_{00}$ | $\begin{aligned} & \mathrm{m}, \\ & 10 \end{aligned}$ | $\mathrm{m}_{20}$ | $\begin{aligned} & \mathrm{m} . \\ & 30 \end{aligned}$ | $\mathrm{m}_{40}$ | $\begin{gathered} \mathrm{m} . \\ 50 \end{gathered}$ | $\mathrm{m}_{60}$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ} 6$ | $0 \cdot 5$ | I•I | 1.6 | $2 \cdot 2$ | $2 \cdot 7$ | $3 \cdot 3$ | $4 \cdot 1$ | $5 \cdot 4$ | 6.8 | $8 \cdot 1$ | $9 \cdot 4$ | 10.8 | $12 \cdot 1$ | 13.4 | 14.6 | $5 \cdot 9$ |
| 40 | 0.5 | I | $1 \cdot 6$ | $2 \cdot 2$ | $2 \cdot 7$ | $3 \cdot 3$ | $4 \cdot \mathrm{I}$ | $5 \cdot 5$ | $6 \cdot 8$ | $8 \cdot 2$ | $9 \cdot 5$ | 10.8 | 12.2 | 13.5 | 14.8 | 16.I |
| 44 | $0 \cdot 6$ | - 1 | I.7 | 2.2 | 2.8 | $3 \cdot 3$ | $4 \cdot 2$ | $5 \cdot 5$ | $6 \cdot 9$ | $8 \cdot 3$ | 9.6 | II.O | $12 \cdot 3$ | 13.7 | 15.0 | $16 \cdot 3$ |
| 48 | 0.6 | I•I | 1.7 | $2 \cdot 3$ | . | 3.4 | 4.2 | $5 \cdot 6$ | $7 \cdot 0$ | $8 \cdot 4$ | 9.8 | II 2 | 12.6 | 13.9 | 15.3 | 16.6 |
| 52 | $0 \cdot 6$ | $1 \cdot 1$ | 1.7 | $2 \cdot 3$ | . 8 | 3.4 | $4 \cdot 3$ | $5 \cdot 8$ | $7 \cdot 2$ | $8 \cdot 6$ | $10 \cdot 0$ | 11.4 | 12.9 | 14.3 | 15.7 | $17 \cdot 0$ |
| 56 | 0.6 | $1 \cdot 2$ | r.8 | $2 \cdot 4$ | 3.0 | 3.5 | $4 \cdot 4$ | 5.9 | 7.4 | $8 \cdot 8$ | $10 \cdot 3$ | II-8 | 13.2 | 14.7 | $16 \cdot 1$ | $17 \cdot 6$ |
| 60 | 0.6 | $1 \cdot 2$ | I. 8 | $2 \cdot 4$ | $3 \cdot 1$ | $3 \cdot 7$ | $4 \cdot 6$ | $6 \cdot 1$ | $7 \cdot 6$ | $9 \cdot 1$ | $10 \cdot 7$ | 12.2 | 13.7 | 15.2 | 16.7 | 18.2 |

reduction to the merdian table near the meridian below the pole.

* a PAVONIS.

| I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | ${ }_{16}$ |  | m. | m. | m. 20 | m. 21 | m.  <br>   <br> 22  | m. | m.1 | m. 25 | ${ }_{26}$ | $\frac{\mathrm{m}}{27}$ | m |  | m. |  | 3. | m. 31 |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 | 8 |  | 87•I | $89 \cdot 3$ | 91.6 | 93.8 | 96.2 9 |  | 100.9 I | 103.2 | 05.7 | 108.1 | 110 |  | II3 |  | II 5.6 | II'8.2 |
| 37 | $8 \mathrm{I} \cdot 8$ | 83.9 | $86 \cdot 1$ | 88.3 | 90.5 | $92 \cdot 8$ | $95^{\circ} \mathrm{O} 9$ | $97 \cdot 4$ | $99^{\prime} 7$ | 102.1 | 104.4 | $106 \cdot 9$ | 10 |  | III |  | 114.3 | 116.8 |
| 38 | 80.8 | 82.9 | $85^{\prime}$ I | 87.2 | 89.4 | 91-7 | 93.9 | $96 \cdot 2$ | $98 \cdot 5$ I | $100 \cdot 9$ | 103.2 | 105.6 | 10 |  | 110 |  | I12.9 | II5*4 |
| 39 | 79.8 | 81.9 | $84^{\text { }}$ I | $86 \cdot 2$ | $88 \cdot 4$ | $90 \cdot 6$ | $92 \cdot 8$ | 95'I | $97 \cdot 3$ | $99^{\circ} 7$ | 102.0 | 104.4 | 10 |  | 109. |  | III. 6 | II4.I |
| 40 | $78 \cdot 9$ | $80 \cdot 9$ | 83.0 | 85.2 | $87 \cdot 3$ | 89.5 | $9 \mathrm{I} \cdot 7 \quad 9$ | 93.9 | $96 \cdot 2$ | $98 \cdot 5$ | $100 \cdot 8$ I | 103.1 | 10 |  | 107. |  | I10.3 | 112.7 |
| 4 I | 77.9 | 79.9 | 82.0 | $84^{\text {. }}$ I | $86 \cdot 2$ | $88 \cdot 4$ | $90 \cdot 6$ | $92 \cdot 8$ | $95^{\circ} \mathrm{O}$ | $97 \cdot 2$ | 99.5 | IOT. 8 |  |  | $106 \cdot$ |  | 108.9 | III•3 |
| 4 | $76 \cdot 9$ | $78 \cdot 9$ | $8 \mathrm{I} \cdot 0$ | $83^{\circ} 0$ | $85^{\prime}$ I | $87 \cdot 3$ | 89.49 | 91.6 | $93 \cdot 8$ | $96 \cdot 0$ | $98 \cdot 3$ I | IOO. 5 | 10 |  | 105. |  | 107.5 | 109*9 |
| 43 | $75 \cdot 9$ | $77 \cdot 9$ | $79^{\circ} 9$ | $82^{\circ} 0$ | $84^{\circ} \mathrm{O}$ | $86 \cdot 1$ | $88 \cdot 39$ | $90 \cdot 4$ | $92 \cdot 6$ | $94 \cdot 8$ | 97.0 | $99^{\circ} 3$ | 10 |  | $103 \cdot 8$ |  | 106.2 | $108 \cdot 5$ |
| 44 | 74.9 | $76 \cdot 9$ | $78 \cdot 9$ | 80.9 | 83.0 | 85.0 | $87 \cdot 1$ | $89^{\circ} 2$ | 91•4 | $93 \cdot 6$ | $95 \cdot 8$ | $98 \cdot 0$ | 10 |  | 102 |  | 104.8 | 107*1 |
| 45 | 73.9 | $75 \cdot 9$ | $77 \cdot 8$ | $79 \cdot 8$ | 81.9 | 83.9 | 86.0 8 | $88 \cdot 1$ | 90.2 | $92 \cdot 3$ | 94.5 | $96 \cdot 7$ |  |  | 101.I |  | 103.4 | 105*7 |
| 46 | $72 \cdot 9$ | 74.8 | $76 \cdot 8$ | $78 \cdot 7$ | $80 \cdot 7$ | 82.8 | 84.88 | $86 \cdot 9$ | $88 \cdot 9$ | 91•1 | 93.2 | 95.4 |  |  | 99 |  | 102.0 | 104.2 |
| 47 | 71.9 | $73 \cdot 8$ | $75 \cdot 7$ | 77.6 | $79 \cdot 6$ | 81.6 | 83.6 | $85 \cdot 6$ | $87 \cdot 7$ | 89.8 | 9I•9 | $94^{\circ} \mathrm{O}$ |  |  | $98 \cdot 4$ |  | $100 \cdot 6$ | $102 \cdot 8$ |
| 48 | $70 \cdot 9$ | $72 \cdot 7$ | $74 \cdot 6$ | $76 \cdot 5$ | 78.5 | $80 \cdot 4$ | 82.4 | 84.4 | $86 \cdot 5$ | $88 \cdot 5$ | $90 \cdot 6$ | $92 \cdot 7$ | 94 |  | $97 \cdot 0$ |  | 99*1 | 101*3 |
| 49 | 69.8 | $7 \mathrm{I} \cdot 7$ | $73 \cdot 5$ | $75 \cdot 4$ | $77 \cdot 3$ | $79^{\circ} 3$ | $8 \mathrm{I} \cdot 2{ }^{8}$ | $83 \cdot 2$ | $85 \cdot 2$ | $87 \cdot 2$ | $89 \cdot 3$ | $9 \mathrm{I} \cdot 3$ | 93 |  | $95 \cdot 6$ |  | $97 \cdot 7$ | $99^{\circ} 9$ |
| 50 | $68 \cdot 8$ | $70 \cdot 6$ | $72 \cdot 4$ | 74.3 | $76 \cdot 2$ | $78 \cdot 1$ | 0 | - | 83.9 | 85.9 | $87 \cdot 9$ | $90 \cdot 0$ | 92 |  | $94^{\circ}$ |  | $96 \cdot 2$ | $98 \cdot 4$ |
| 51 | $67 \cdot 7$ | 69.5 | 71.3 | $73 \cdot 1$ | $75^{\circ}$ | $76 \cdot 9$ | $78 \cdot 8$ | $80 \cdot 7$ | $82 \cdot 6$ | 84.6 | $86 \cdot 6$ | $88 \cdot 6$ |  |  | 92 |  | $94 \cdot 8$ | $96 \cdot 9$ |
| 52 | $66 \cdot 7$ | $68 \cdot 4$ | $70 \cdot 2$ | 72.0 | $73 \cdot 8$ | $75 \cdot 7$ | $77 \cdot 5$ | 79.4 | $8 \mathrm{I} \cdot 3$ | 83.3 | 85.2 | $88 \cdot 2$ $85 \cdot 8$ |  |  | $91 \cdot 2$ |  | $93 \cdot 3$ | $95 \cdot 3$ |
| 53 | 65.6 | $67 \cdot 3$ | $69 \cdot 0$ | $70 \cdot 8$ | 72.6 | 74.4 | $76 \cdot 37$ | $78 \cdot 1$ | $80 \cdot 0$ | $8 \mathrm{r} \cdot 9$ | 83.8 | $85 \cdot 8$ |  |  | $89 \cdot 7$ |  | $91 \cdot 7$ | $93 \cdot 8$ |
| 54 | 64.5 | $66 \cdot 2$ | $67 \cdot 9$ | 69.6 | 71.4 | 73.2 | $75^{\circ} \mathrm{O}$ | $76 \cdot 8$ | $78 \cdot 7$ | $80 \cdot 5$ | 82.4 | $84 \cdot 3$ |  |  | 88 |  | 90*2 | $92 \cdot 2$ |
| 1 at |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | ${ }_{32} \mathrm{~m}$ | 3. | 34 | 35 | 36 | 37 | 38. | m. | 4. | 41 | 42 | 43 | 3 |  | 44 |  | ${ }_{45}$ | m. |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $3{ }^{\circ}$ | $20 \cdot 7$ | $123 \cdot 3$ | $26 \cdot 0$ |  | 131.3 | $4^{\circ} 0$ | I36́•8 | $8139{ }^{\circ} 5$ | $5142 \cdot 3$ |  | ${ }^{\circ} 2888.0$ | 0 | $30 \cdot 9$ |  | ${ }^{\prime} \cdot 8$ |  | $3^{\prime} 6 \cdot 7$ | ${ }^{\circ} 2{ }^{2} 36 \cdot 6$ |
| 37 | II9.3 | 121.9 |  | $12 \%$ | 129.8 | 13 | 5135.2 | 2137.9 | $9140 \cdot 7$ | 143.5 | $226 \cdot 3$ | 32 | $29^{\prime} 1$ | 2 | $32 \cdot 0$ | 2 | $34^{\circ} 9$ | $237 \cdot 8$ |
| 38 | II $8 \cdot 0$ | $120 \cdot 5$ | 123.1 | $125^{\circ} 7$ | 128.3 | 131.0 | - 133.6 | $6136 \cdot 3$ | $3139^{\circ} \mathrm{I}$ | 1418 | 224.6 | 22 | 27.4 | 2 | $30 \cdot 2$ | 2 | $33 \cdot 1$ | $236 \cdot 0$ |
| 39 | 116.6 | 119.1 | 121.6 | 124.2 | $126 \cdot 8$ | 129.4 | 4 132.1 | 1134.7 | 7137.4 | $140 \cdot 2$ | 222.9 | 22 | 25.7 | 2 | $28 \cdot 5$ | 2 | $31 \cdot 3$ | $234 \cdot 2$ |
| 40 | II5.I | II7.6 | $120 \cdot 1$ | 122.7 | 125.3 | 127.8 | $8130 \cdot 5$ | $5133 \cdot 1$ | 1135.8 | 138.5 | $22 \mathrm{I} \cdot 2$ | 22 | 23.9 | 2 | $26 \cdot 7$ | 2 | 29.5 | $232 \cdot 3$ |
| 41 | II3.7 | 116.2 | 118.7 | 121.2 | 123.7 | I $26 \cdot 3$ | 3.128 .9 | 9 13I 5 | 5 134.I | 136.8 | 219.5 | 52 | 22.2 |  | 24.9 | 2 | $27 \cdot 7$ | $230 \cdot 5$ |
| 42 | II $2 \cdot 3$ | $114 \%$ | $117 \times 2$ | $119{ }^{\circ}$ | $122 \cdot 2$ | 124.7 | 7127.3 | 3129.8 | 8132.4 | I35.1 | $217 \cdot 7$ | 2 | 20.4 |  | $23 \cdot 1$ | 2 | $25 \cdot 8$ | $228 \cdot 6$ |
| 43 | IIO.9 | 113.3 | II $5^{\circ} 7$ | 118.2 | $120 \cdot 6$ | 123.1 | I 125\%\% | $7128 \cdot 2$ | 2130.8 | I 33.4 | 216.0 | 21 | $8 \cdot 6$ | 2 | 2I•3 | 2 | $24^{\circ} \mathrm{O}$ | $226 \cdot 7$ |
| 44 | $109 \cdot 4$ | 11 | 114.2 | I16.6 | II9* | I 21.5 | 5124.0 | - 126.5 | 5129.1 | 131.6 | 214.2 | 21 | 16.8 |  | 19.5 | 2 | 22.1 | 224.8 |
| 45 | 108.0 | $110 \cdot 3$ | 112.7 | I15.I | $117 \cdot 5$ | $1{ }^{19} 9$ | ${ }^{122} 4$ | 124.9 | 127*4 | 129.9 | 212.4 | 421 | $5 \cdot 0$ | 2 | $17 \cdot 6$ | 2 | $20 \cdot 2$ | 222.9 |
| 46 | 106.5 | 108.8 | 1112 | 113.5 | $115{ }^{\circ} 9$ | ${ }^{1} 118 \cdot 3$ | 3120.7 | 7123.2 | 2125.6 | 128-1 | $210 \cdot 7$ | 72 | 3.2 |  | 15.8 | 2 | $18 \cdot 4$ | 221.0 |
| 47 | 105 0 | $107 \cdot 3$ | 109.6 | III*9 | $114{ }^{\circ} 3$ | I16.7 | 71190 | - 121.5 | 5123.9 | 126.4 | 28 | 2 I | I 14 | 2 | 13.9 | 2 | $16 \cdot 4$ | 219.0 |
| 48 | 103.6 | $105 \cdot 8$ | 108.1 | $110 \cdot 3$ | II2.7 | 1150 | - 1174 | $4119{ }^{\circ} 7$ | 7122.1 | 124.6 | 27.0 | 2 | $9 \cdot 5$ | 2 | 12.0 | 2 | 14.5 | 2 17.1 |
| 49 | 102* | 104.3 | $106 \cdot 5$ | 108.7 | III「O | $113 \cdot 3$ | $3115 \%$ | $7118 \cdot 0$ | O 120.4 | $122 \cdot 8$ | $2 \quad 5 \cdot 2$ | 2 | 7.6 | 2 | $10 \cdot 1$ | 2 | 12.6 | 2 15.1 |
| 50 | 100. 5 | 102.7 | 104.9 | 107•I | 109.4 | III'6 | 6113.9 | 9 II6.2 | 2118.6 | $120 \cdot 9$ | $2 \quad 3 \cdot 3$ | 3 | $5 \cdot 7$ | 2 | 8.1 | 2 | 0 | 213.1 |
| 5 I | $99^{\circ}$ | IOI'I | $103 \cdot 3$ | 105.5 | 107.7 | 109*9 | 9 II2.2 | 2 II4.5 | 5 I 16.8 | 119*I | $2 \quad 1.4$ | 42 | 3.8 | 2 | $6 \cdot 2$ | 2 | $8 \cdot 6$ |  |
| 52 | $97 \cdot 4$ | 99.5 | 101*7 | $103 \cdot 8$ | 106.0 | $108 \cdot 2$ | $2110 \cdot 4$ | 4 II $2 \cdot 7$ | 7 II4.9 | $117 \times 2$ | I 59.5 |  | 1.9 | 2 | $4 \cdot 2$ | 2 | $6 \cdot 6$ | 29.0 |
| 53 | $95 \cdot 8$ | 97.9 | $100 \cdot 0$ | $102 \cdot 1$ | 104.3 | $106 \cdot 4$ | $4108 \cdot 6$ | 6 I $10 \cdot 8$ | 8 II3•1 | II5.3 | I $57 \cdot 6$ | I 5 | 59.9 | 2 | $2 \cdot 2$ | 2 | $4 \cdot 5$ | $2 \quad 6.9$ |
| 54 | 94.2 | $96 \cdot 3$ | $98 \cdot 3$ | $100 \cdot 4$ | 102.5 | 1047 | $7106 \cdot 8$ | 811090 | ( III.2 | ${ }^{1} 11304$ | I 55.6 | \| 15 | 57.9 | 2 | 0.2 | 2 | 2.4 | 24.8 |


| $\stackrel{\rightharpoonup}{\underset{\sim}{\leftrightarrows}}$ | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{47}$ | ${ }_{48}$. | ${ }_{49}$. | ${ }_{50}$ | ${ }_{51}$ | ${ }_{5} \mathrm{~m}$. | ${ }_{53}$ | ${ }_{54}$ | ${ }_{5}{ }_{5}$ | ${ }_{56}$ | ${ }_{5} \mathrm{~m}$ | ${ }_{58} \mathrm{~m}$ | ${ }_{59}$ | ${ }_{60}$. |
| R |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 | $42 \cdot 6$ | $245 \cdot 6$ | $248 \cdot 6$ | $25 \mathrm{I} \cdot 7$ | 54.8 | 257.9 |  |  |  | 3 10.6 | $313 \cdot 8$ | $317 \cdot 1$ | $320 \cdot 4$ | $323 \cdot 7$ |
| 37 | $40 \cdot 8$ | $243 \cdot 7$ | $246 \cdot 7$ | $249 \cdot 8$ | $252 \cdot 8$ | $255 \cdot 9$ | $259 \cdot 0$ | $3 \quad 2 \cdot 1$ |  | 38. | 3 II | 314.9 | 318.1 | 32 I 4 |
| 38 | 238.9 | 241.8 | $244 \cdot 8$ | $247 \cdot 8$ | $250 \cdot 8$ | $\begin{array}{ll}2 & 53 \cdot 8\end{array}$ | $256 \cdot 9$ | $3 \quad 0 \cdot 0$ |  | $\begin{array}{ll}3 & 6 \cdot 3 \\ 3 & 4\end{array}$ |  | 312 | $\begin{array}{lll}3 & 15.8 \\ 3\end{array}$ | 3 19.1 |
| 39 | 237.0 | 229 | $242 \cdot 9$ | $245 \cdot 8$ | $248 \cdot 8$ | $25 \mathrm{I} \cdot 8$ | $254 \cdot 8$ | 257.9 |  | 34. |  | 310 | $\begin{array}{ll}3 & 13.5\end{array}$ | 3 |
| 40 | $235 \cdot 2$ | $238 \cdot 0$ | $240 \cdot 9$ | $243 \cdot 8$ | $246 \cdot 8$ | $249 \cdot 8$ | $252 \cdot 8$ |  |  | 3 |  | 3 | 3 II 2 | 314.4 |
| 4 I | 233.3 | $236 \cdot 1$ | $239^{\circ}$ | 241.8 | $244 \cdot 8$ | $247 \cdot 3$ | $250 \cdot 7$ | $253 \cdot 6$ | $256 \cdot 6$ | $259 \cdot 7$ |  | 3 5.8 | 3889 | 3 |
| 42 | 231.4 | $234 \cdot 2$ | $237 \cdot 0$ | $239 \cdot 8$ | $242 \cdot 7$ | $245 \cdot 6$ | 248.5 | 251.5 | $254 \cdot 5$ | $257 \cdot 5$ |  |  | $3 \quad 6 \cdot 6$ | 9 |
| 43 | 229.5 | 232.2 | 2350 |  | $240 \cdot 7$ | $243 \cdot 5$ | $2{ }^{2} 46 \cdot 4$ |  |  | $255 \cdot 2$ |  |  | $4 \cdot 3$ | 37 |
| 44 | 227.5 | $230 \cdot 3$ | $233 \cdot 0$ | $235 \cdot 8$ | 238.6 | 2415 | 2443 | $247 \cdot 1$ | $25^{5} \cdot 0$ | ${ }^{2} 53{ }^{\circ}$ |  |  | 31.9 |  |
| 45 | 225.6 | $228 \cdot 3$ | $23 \mathrm{I} \cdot 0$ | $233 \cdot 7$ | $36 \cdot 5$ | $239 \cdot 3$ | $42 \cdot 1$ | $245 \cdot 0$ | $247 \cdot 8$ | $250 \cdot 7$ | 253 | 256 | 259.5 |  |
| 46 | 223.6 | $226 \cdot 3$ | 229.0 | $231 \cdot 7$ | 234.4 | $237 \cdot 2$ | 239.9 | $242 \cdot 7$ | $245 \cdot 6$ | 248.4 | $251 \cdot 3$ | 254.2 | $257 \cdot 1$ |  |
|  | 221.6 | $224 \cdot 3$ | $226 \cdot 9$ | $229 \cdot 6$ | $232 \cdot 3$ | 235.0 | $237 \cdot 7$ | $240 \cdot 5$ | $243 \cdot 3$ | $246 \cdot 1$ | $248 \cdot 9$ | 251 | 254.7 | $57 \cdot 6$ |
| 48 | ${ }_{2}^{2} 19.6$ | 222.2 | $224 \cdot 8$ | $227 \cdot 5$ | $230 \cdot 1$ | $\begin{array}{ll}2 & 32 \cdot 8 \\ 2 & 3\end{array}$ | $235 \cdot 5$ | $238 \cdot 2$ | $241 \cdot 0$ | $243 \cdot 7$ | $246 \cdot 5$ | $2{ }^{2} 49^{\circ} 4$ | 252.2 | $255 \cdot$ 2 2 $5 \cdot 5$ |
| 49 | $\begin{array}{ll}2 & 17.6 \\ 2 & 15.6\end{array}$ | $\begin{array}{ll}2 & 20.2 \\ 2 & 18.1\end{array}$ | $\begin{array}{ll}2 & 22 \cdot 7 \\ 2 & 20.6\end{array}$ | $\begin{array}{ll}2 & 25.3 \\ 2 & 23.2\end{array}$ | $\begin{array}{ll}2 & 28.0 \\ 2 & 25\end{array}$ | 2 3 <br> 2 28.6 | $\begin{array}{ll}2 & 33 \cdot 3 \\ 2 & 31 \cdot 0\end{array}$ | $\begin{array}{ll}2 & 35 \cdot 9 \\ 2 & 33.6\end{array}$ | $\begin{array}{ll}2 & 38 \cdot 7 \\ 2 & 36 \cdot 3\end{array}$ | $\begin{array}{ll}2 & 41.4 \\ 2 & 30.0\end{array}$ | $\begin{array}{ll}2 & 44 \cdot 1 \\ 2 & 41 \\ 1\end{array}$ | $246 \cdot 9$ $244 *$ |  | $252 \cdot 5$ |
| 5 |  |  |  | 223 |  |  |  |  |  |  |  |  |  |  |
|  | (1) $\begin{array}{ll}2 & 13.5 \\ 2 & 11.4\end{array}$ | 213.8 | $216 \cdot 3$ | ${ }_{18} 1^{\circ} 8$ | $\begin{array}{lll}2 & 23.5 \\ 2 & 21.3\end{array}$ | $\begin{array}{ll}2 & 26 \cdot 1 \\ 2 & 23.8\end{array}$ | $26 \cdot 3$ | $\begin{array}{ll}2 & 31.3 \\ 2 & 28.9\end{array}$ |  | $234^{\circ} \mathrm{I}$ | $\left\|\begin{array}{ll} 2 & 39 \cdot 2 \\ 2 & 36 \cdot 8 \end{array}\right\|$ |  | $\left\|\begin{array}{lll} 2 & 44^{\circ} \\ 2 & 42 \cdot 1 \end{array}\right\|_{2}^{2}$ | $247 \cdot 4$ |
| 53 | 29.3 | 2 II「 | $214 \cdot 1$ | 216.5 | 219.0 | 221.5 | 224.0 | $226 \cdot 5$ | 229.1 | 231.6 | 234 | 236 | 239.5 | $242 \cdot \mathrm{I}$ |
| 54 | 7 | 129 | 2 11.8 | 214.3 | 216.7 | $2 \mathrm{IO} \cdot \mathrm{I}$ | $221 \cdot 6$ | 224.1 | 6 | 229.1 | 231.7 | 234.2 | $236 \cdot 8 / 2$ | 39.4 |

## REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* a PERSEI (MIRFAK).

|  | ${ }_{4}$ | 8 | 12 | 16 | 20 | 22 | 24 | 26 | 28 |  | 32 |  | 36 | 38 | 40 | 42 | ${ }_{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 | - | 3.0 | $6 \cdot 8$ | 1 |  | .9 | 27.2 | $3{ }^{\circ} 9$ |  | $42 \cdot 3$ | $48 \cdot 0$ | - | 3 | 67.2 |  |  |  |
| 24 |  | $2 \cdot$ | $6 \cdot$ |  |  | 21.6 | $25 \cdot 6$ |  | $34 \cdot 8$ | $39 \cdot 9$ | $45 \cdot 3$ | - | I | 63.5 |  |  |  |
| 22 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 18 |  | $2 \cdot 5$ | $5 \cdot 5$ |  | 15.3 |  |  |  |  | $34 \cdot 3$ | $39^{\circ}$ |  | $49 \cdot 3$ |  |  |  |  |
| 16 |  |  |  |  | 14.7 | 17.8 |  | 24.8 | 28.7 |  | $37 \cdot 4$ |  | $47 \cdot 2$ |  |  |  |  |
| I4 |  | 2.3 2.2 |  |  | 14.1 | 17.1 | $20 \cdot 3$ | 23.8 | $27 \cdot 5$ |  |  |  | 45:3 |  |  |  |  |
| I2 |  |  | - |  |  | 15.8 | 19.5 | 22.9 | $25 \cdot 6$ | 29 |  |  |  |  |  |  |  |
| 8 |  |  | $4 \cdot 5$ |  |  | $15 \cdot 3$ | 18.2 | $21 \cdot 3$ | $24 \cdot 7$ |  | 32 |  | $40 \cdot 7$ | $45 \cdot 3$ |  |  |  |
| 4 | 0.5 | $1 \cdot 9$ | $4 \cdot 3$ | $7 \cdot 6$ |  | 14.3 | 17.0 | 20.0 | $23 \cdot 1$ | 26 | 硅 | 34.0 |  | $42 \cdot 4$ | $47^{\circ}$ |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ |  | r.8 | $3 \cdot 8$ | 7.1 | 11. | 13.5 | 16.0 | 18.8 | 20.5 | 25.0 | 28.4 |  | $\left\|\begin{array}{l} 35.9 \\ 32.0 \end{array}\right\|$ | 39.9 | 44.2 | $48 \cdot 7$ |  |
| ${ }_{8}^{4}$ | O. ${ }^{0.4}$ | r $\mathrm{r} \cdot 7$ | ${ }_{3.6}^{3.8}$ |  | $10 \cdot 5$ |  |  | 17 | $20 \cdot 5$ | 23.6 | 26.8 | 30.2 28.6 | $33.9$ |  |  | 46 |  |
| ${ }_{12}$ | O.4 | r.5 | $3 \cdot 4$ |  | ${ }_{9} 9.4$ | Ir-4 | 13.6 | 15.9 | 18.4 | $2 \mathrm{r} \cdot 2$ | $24^{\text {I }}$ |  |  | 33 | $37 \cdot 6$ | 43 |  |
| 16 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | 16.6 |  |  | 24.5 | 27.5 |  | .9 |  |  |
| 23 |  | r $\begin{aligned} & \text { r } \\ & \text { r } \\ & \text { 2 }\end{aligned}$ | 2.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 析 |  |  |  | $4 \cdot 6$ |  |  | 10.5 |  | 14.2 | 16.3 | 18.6 | 21.0 | 23.5 |  | 29. |  |  |
| 36 | $0 \cdot 3$ |  | $2 \cdot 5$ |  | 6.9 | , | 9.9 |  | 13.5 | 15.5 | 17.6 | 19.9 | 22.3 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 93.3 | $97 \cdot 4$ |  | T0 | T06 | $\mathrm{Ir}_{14.4}$ | I18.8 | 123.3 |  | I32.6 | 137.3 | $\begin{array}{llllll}2 & 22 \cdot 1 & 2 & 26.9\end{array}$ | $\begin{array}{lll}2 & 31.9 \\ 2 & \\ 2 & 2.8\end{array}$ | 236.9 |  |
|  |  | $94 \cdot 7$ | $96 \cdot$ | 102 |  | (1112 | 11515 | 119.9 | ${ }_{\text {I21.I }}^{124}$ | 128.9 | $\xrightarrow{\text { Y } 33.6}$ | $\begin{array}{ll}2 & 18.2 \\ 2 & 2 \\ 23.0\end{array}$ | $227 \cdot 8$ | $232 \cdot 7$ | $\begin{array}{ll}2 & 37 \cdot 7 \\ 2 & 33.6\end{array}$ |
|  |  | $89 \cdot 7$ | $93 \cdot 6$ | $97 \cdot 5$ | ror-4 | ro5.5 | 109.6 | T13.8 | I18.I | 122.4 | I26.8 | $2 \mathrm{Ir} 32 \begin{array}{lll}15 & 8\end{array}$ | 220.4 | 225 |  |
|  | 3.8 | $87 \cdot 5$ | $9 \mathrm{I}^{2}$ | $95^{\circ}$ | 98.9 | 102.9 | 106.9 | 1110 | 115.2 | II9.4 | $123 \cdot 7$ |  | $217 \cdot 0$ | 221.6 | . 2 |
|  | 8 r 8 | 85.4 | 89.0 |  | $96 \cdot 6$ | $100 \cdot 4$ | 104.4 | 108.4 | I12.5 | 116.6 |  |  | 213.8 | 218.3 | 22.8 |
|  |  |  |  |  |  |  |  |  |  |  |  | $2 \cdot 2$ |  |  |  |
|  |  |  | $85^{\circ} \mathrm{O}$ | 88.6 | 92.2 | $96 \cdot 0$ | $99 \cdot 7$ | Io3. 6 | 107.5 | III 4 | 115.5 | I 59.62 | $8 \cdot$ | 12 | 6 |
|  |  | 79 | 83.2 | $86 \cdot 7$ | $9{ }^{\circ} 3$ | 93.9 | $97 \cdot 6$ | roi 3 | 105.2 | 109•1 | II3.0 | $1{ }^{1} 57 \cdot 0 \mid 218$ | $5 \cdot 3$ | 9.5 | 213 |
|  |  | 78 | 81.4 | 84.9 | 88. | $9 \mathrm{r} \cdot 9$ | 95.5 | 99.2 | 103.0 | 106.8 | $110 \cdot 7$ | I $54 \cdot 6 \mid I 58$ | 2 | 26.8 |  |
|  | $73 \cdot 3$ | $76 \cdot 5$ | 79 | $83 \cdot 1$ | $86 \cdot 6$ |  | $93 \cdot 6$ | 97.2 | 100 | 104.7 |  | I 52.315 | $\begin{array}{ll}2 & 0.3 \\ 1\end{array}$ | $4 \cdot 3$ | $8 \cdot 4$ |
|  |  | 73.5 | $76 \cdot 7$ | $79^{\circ} 9$ | 83.2 |  | 90.0 | $93 \cdot 5$ | 97•1 | $100 \cdot 7$ | IO | $1{ }_{4} 8$-1 1 | x 55.7 |  | 3.6 |
|  | 67 | 70.8 | 73.9 | 77.0 | $80 \cdot 2$ | 83 | $86 \cdot 7$ | $90 \cdot 1$ | $93 \cdot 5$ | $97^{\circ}$ | 100.6 | 2157 | 5 | 55 |  |
|  |  | 68 |  |  | 77.4 |  | 83.7 | 87.0 | $90 \cdot 3$ |  | 97*1 | I $40 \cdot 6$ I 44.1 | I $47 \cdot 7$ | 151 | 55.1 |
|  | 63 | 66 |  |  |  | 77.9 | $80 \cdot 9$ | $84 \cdot \mathrm{I}$ | $87 \cdot 3$ | 90 | $93 \cdot 9$ | x 37.3 I 40 | I 44.2 | I 47 |  |
|  |  | 63 |  | $69 \cdot 5$ |  | $75 \cdot 4$ | $78 \cdot 4$ | 81.4 | 84.5 | 87.7 |  | I $34 \cdot 2$ I 37 | 40.9 | 14 | I $47 \cdot 8$ |
|  | 59 |  | $64 \cdot 6$ | $67 \cdot 4$ |  |  | 75.9 |  | $8 \mathrm{I} \cdot 9$ | $85^{\circ}$ | 88•1 | I 31.3134 | 13 | 14 |  |
|  | 57 | 60 | 62.7 | $65 \cdot 4$ |  | $70 \cdot$ | $73 \cdot 7$ | $76 \cdot 6$ | 79.5 | 82.5 | 85.5 | $128.61{ }^{1} \times 1.7$ | I 34.9 | 38 | $4 \mathrm{I} \cdot 5$ |
|  |  |  |  |  | $66 \cdot$ | 68.8 |  |  |  | $80 \cdot 1$ |  |  |  |  |  |
|  |  | $56 \cdot 7$ | $59 \cdot 2$ |  | 64.2 | 66 | $69 \cdot 5$ | $72 \cdot 3$ | $75^{\circ} \mathrm{O}$ | 77.9 |  |  | I 29.6 | I $32 \cdot 7$ |  |
|  |  | $55^{\prime}$ |  | 60 |  |  | $67 \cdot 6$ | 3 | 73 | 75. | 78.5 | I $21.4{ }^{\text {r }} 24.3$ | I 27.2 |  | I 33.2 |
|  | 51.4 | 53.7 |  |  |  |  | $65 \cdot 8$ |  |  | 73.8 | 76.4 | $\begin{array}{llllll}1 & 19.2 & 1 & 22.0\end{array}$ | I 24.9 I 2 | 27.8 | 30.8 |
|  |  | $52 \cdot 2$ | 54 | $56 \cdot 8$ | 59 |  | $64 \cdot 1$ | $66 \cdot 6$ | 69 | 71.8 |  | I 17.1119 .9 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | 15181 |  |  | 6.1 |
|  | 47 | 49 | $5 \times 7$ | 53 |  | 58 | 60 | 63.2 | $65 \cdot 7$ |  | $70 \cdot 7$ |  |  |  |  |
|  | 45 | 48.3 | 50.4 | 51.2 | 53 | $55^{\circ}$ |  | ${ }_{60 \cdot 5}^{6 \cdot 1}$ | $64^{\circ}$ 62.4 | $66 \cdot 4$ 64.9 | $67 \cdot 1$ |  | I 16.5 I 14.6 I | I 19.1 | I 212.8 I 19.8 I |
|  | 43 | $45^{\circ} 9$ | 47.9 | 50.0 |  | $54 \cdot 2$ | $56 \cdot 4$ | $58 \cdot 6$ | $60 \cdot 8$ | $63 \cdot 1$ | $65 \cdot 5$ | 7.81180 | I $12 \cdot 7$ |  | 17.8 |
|  | 42 |  | $46 \cdot 7$ | $48 \cdot 7$ |  |  |  |  |  | 61 | 6 | I 6.2 1 | $0 \cdot 9$ | 13. |  |
|  | 41 | 43 | $45 \cdot 5$ | $47 \cdot 5$ | $49 \cdot 5$ | $51 \cdot 5$ | $53 \cdot 6$ | 55.7 |  | 60 | 6 | $\begin{array}{lllll}\text { I } & 4.5 & \text { I } 6.8\end{array}$ | $9 \cdot 2$ | $1{ }^{1} 5$ | $14^{\circ} \mathrm{O}$ |
|  | 40 | 42. | $44^{\circ}$ | 46 | $48 \cdot 2$ | $50 \cdot 2$ | $52 \cdot 2$ | $54 \cdot 3$ | 56 | 58.5 | $60 \cdot 7$ | $\begin{array}{lll}1 & 2 \cdot 9 & \text { I } \\ \text { 5 }\end{array}$ |  | $9 \cdot 7$ | $1{ }^{12} 1$ |
|  | 39 | 41.5 | $43 \cdot 3$ | 45 | 47. | $48 \cdot 9$ | $50 \cdot 9$ | $52 \cdot 9$ | 54 | 57.0 | 59.1 | $\begin{array}{llll}1 & 1.3 & 1 & 3.5\end{array}$ | $15 \%$ | 8.0 |  |
|  |  | 40 | $42 \cdot 2$ | $44^{\circ}$ | $45 \cdot 8$ | $47 \cdot 7$ | 49 | 5 r . 6 | $53 \cdot 6$ | 55.6 |  | - $59.7{ }^{\text {x }}$ | $1{ }^{\text {P }}$ I |  |  |
|  |  | $39^{\circ} 4$ |  | $42 \cdot 8$ | $44^{6}$ | $46 \cdot 5$ | $48 \cdot 3$ | $50 \cdot 2$ |  | 54.2 | 56.2 | - 58.2 I 10.3 | $2 \cdot 4$ | $4 \cdot 6$ | 6.8 |
|  |  | $38 \cdot 3$ | 40 | 41 | $43 \cdot 5$ | $45^{\circ}$ | 47. | 48.9 | $50 \cdot 8$ | $52 \cdot 7$ | $54^{\circ}$ | - 56.7 O 58.7 | 0.8 | $2 \cdot 9$ | I. $5 \cdot 0$ |
|  | 35 | 37 | 38 | 4 | 42 |  | 45.8 | 47 | 49 | 51.3 | 53.2 | - 55.20 - 57.2 | - 59 | I 1.2 |  |
|  | 34 | $36 \cdot 3$ | 37 | 39 | $41^{\circ}$ | $42 \cdot 8$ | $44^{6} 6$ | $46 \cdot 3$ | 48 | 49.9 | 51.8 | - $53.70{ }^{\text {a }} 5 \times 6$ | - 57 | - 59.6 | $1 \quad 1.6$ |

## REDUCTIONS.



TRUE BEARING OR AZIMUTH OF * a PERSEI.

|  | ${ }_{4}$ | ${ }_{8}^{\mathrm{m}}$ | 12 | ${ }_{16}^{\text {m. }}$ | 20 |  | 28 | 32 | 36 | 40 | 44 | ${ }_{48}^{\mathrm{m}}$ | 52 | $\mathrm{m}_{60}$ | ${ }_{70}$ | 80 | ${ }_{90}^{\mathrm{m}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. AZIMUTH |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{26}{ }^{\circ}$ | I:6 | $3 \cdot 2$ | 4.8 | $6^{\circ} \cdot$ | $8 \cdot 0$ | ${ }^{9} \cdot 6$ | ${ }_{\text {i }}$ | 12.6 | $14^{\circ} \mathrm{I}$ | 15.6 | $17 \%$ | 18.4 | 19•7 | $22^{\circ}$ | $25 \cdot 3$ | 28.0 | $3{ }^{\circ} \cdot 5$ |
| 25 |  | $3 \cdot 1$ | $4 \cdot 7$ | 6.2 | $7 \cdot 7$ | 9.2 | 10.7 | 12.2 | 13.6 |  | 16.4 | 17.7 | 19.0 | 21.5 | 24.5 | 27.1 | ${ }^{9.6}$ |
| 24 23 | 1.5 | 3. | 4.5 | 5.8 | 7.4 | ${ }_{8}^{8.6}$ |  |  | ${ }_{\text {I3 }}^{12 \cdot}$ | 14.5 |  | -1 | $1{ }_{1}^{18.4} 1$ |  | 23.7 | $5 \cdot 6$ | -8 |
| 22 | I.4 | $2 \cdot 8$ | 4.2 | $5 \cdot 6$ | 6.9 | $8 \cdot 3$ | ${ }_{9} \cdot 7$ | Ir. | I2.3 | 13.6 | 14.8 |  | 17.3 |  | 22.4 | 2. | $27 \cdot 3$ |
|  |  |  |  |  |  |  | . 1 | 10.3 |  | 12.8 | 14.0 | 15.1 | 16.3 | 18.5 | $\cdot 2$ | 23.6 | 25 |
| ${ }^{18}$ |  | 2.5 | 3. | $4 \cdot 9$ |  | $7 \cdot 4$ |  | $9 \cdot 7$ | -9 | $12 \cdot 1$ | 13.2 |  | 15.4 | 17.6 | $20 \cdot 1$ | 22.5 |  |
| 1 |  | 2.3 2.2 | 3.5 3.3 | $4{ }^{4 \cdot 7}$ | $5{ }_{5}^{5 \cdot 5}$ | 7.6. | $8 \cdot \mathrm{r}$ | ${ }_{8}{ }^{9} 8$ | $10 \cdot 4$ 9.9 | 11.5 10.9 | I2.5 | $13 \cdot 6$ 13.0 | 14.7 14.0 | ${ }^{16 \cdot 7}$ | 19.2 | 21.5 | ${ }_{22}^{23.7}$ |
| 12 |  |  | 3. | $4 \cdot 2$ | 5 |  | $7 \cdot 4$ | 8.4 | -4 | 10.4 | 4 | 12.4 | 13.4 | $15 \cdot 3$ | 17.6 | 19.7 | 1.8 |
| ${ }_{8}^{10}$ | r.0 | $2 \cdot 0$ | $3 \cdot$ | $4 \cdot 1$ |  | ${ }_{5}^{6.1}$ | ${ }^{7} 7$ |  | - 0 |  | 10.9 | 1r.9 |  | 1-1 | . | . |  |
| 4 | $0 \cdot 9$ | 1.8 | 2.7 | $3 \cdot 6$ | 4. | 5. | 6.3 | 77. | 8.1 | 9.0 | $9 \cdot 8$ | 10\% | $1{ }^{5}$ | 13.2 | 15.2 | 17 | $20 \cdot 3$ 19 |
| - | $0 \cdot 9$ | r•7 | $2 \cdot 6$ | $3 \cdot 4$ | $4^{2}$ | $5 \cdot 1$ | 5.9 | 6.8 | 7.6 | $8 \cdot 4$ | 9.2 | 10.0 | 10 | 12.4 | 14.4 | 16 | 18. |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ro | 0.8 | $1 \cdot 5$ | $2 \cdot 3$ | 3.0 | 3.8 |  | 5.2 | $6 \cdot 0$ |  |  | $8 \cdot 2$ |  | $\cdot 6$ | Ir 1 | 12.8 |  | $16 \cdot 2$ |
| 20 |  | $1 \cdot 4$ | $2 \cdot$ | 2.8 | 3. | 4. 1 | $4 \cdot 8$ | 5.5 | 6.2 |  |  | $8 \cdot 2$ | 3.9 | 1 | II | 13.5 | $15 \cdot 1$ |
| 30 | 0.7 0.7 | r-3 | 2.0 | 2.6 2.6 | $3 \cdot 3$ $3 \cdot 3$ | 3.9 | $4 \cdot 6$ 4.6 | 5.2 |  |  | $\xrightarrow{7 \cdot 2}$ |  |  | 9.8 9/7 | 3 |  | 5 |

* a PERSEI (MIRFAK).

| Lat. |  | m. | m. | m. 16 | 20 | m. | 26 | 28 | 30 | 32 | 34 | m. 36 | 38 | 40 | $\frac{\mathrm{m}}{42}$ | $\stackrel{1}{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | I6.1 | 18.2 | 20.4 | $22^{\prime} 8$ | $25^{\prime} \cdot 2$ | $27^{\prime} 8$ | $30 \cdot 5$ |
| 42 | 0.2 | 1.0 | $2 \cdot 3$ | $4^{\circ} \mathrm{O}$ | $6 \cdot 3$ | 9*1 | 10.7 | I2.4 | 14.2 | 16.1 15.2 | $18 \cdot 2$ 17.1 | 20.4 | $22 \cdot 8$ 21.4 | $25 \cdot 2$ 23.7 | $27 \cdot 8$ $26 \cdot 1$ | $30 \cdot 5$ |
| 46 | $0 \cdot 2$ | 1.0 | $2 \cdot 0$ |  | 5 | $8 \cdot$ | $10 \cdot 0$ 9.4 |  | 13.3 12.4 | 15.2 14.2 | 16.0 | 19.2 17.8 | + 1.4 | 23.7 22.2 | $26 \cdot 1$ 24.4 | $26 \cdot 7$ |
| 54 | $0 \cdot 2$ | $0 \cdot$ | 1.8 | $3 \cdot 3$ | 5•1 | $7 \cdot$ |  | IO'I | II•6 | 13.2 | 14.9 | 16.7 | 18.6 | $20 \cdot 6$ | $22 \cdot 6$ | 24.8 |
| 58 | $0 \cdot 2$ | 0.8 | $1 \cdot 7$ | $3 \cdot 0$ | $4 \cdot 7$ | $6 \cdot 8$ | $8 \cdot 0$ | $9 \cdot 3$ | 10.7 | 12.1 | 13.7 | 15.3 | 17.1 | $18 \cdot 9$ | $20 \cdot 8$ | 22.8 |
| 62 | 0.2 | 0.7 | 1.5 | $2 \cdot 7$ | 3 | $6 \cdot 2$ | $7 \cdot 3$ | $8 \cdot 4$ | $9 \cdot 6$ | 11.O | 12.4 | 13.9 | 15.5 | 17.1 | 18.9 | 20.7 |
| 64 | $0 \cdot 2$ | $0 \cdot 6$ | 1.5 | $2 \cdot 6$ | $4^{-1}$ | $5 \cdot 8$ | $6 \cdot 9$ | $8 \cdot 0$ | $9 \cdot 1$ | 10.4 | II・ク | 13.1 | 14 | 16.2 | 17•9 | 19.6 |
| Lat. m |  | 46 | m 47 | $\mathrm{m} .$ | $\frac{\mathrm{m}}{49}$ | $\begin{gathered} \mathrm{m} . \\ 50 \\ \hline \end{gathered}$ | $\mathrm{m}_{51}$ | $\frac{\mathrm{m}}{5} \mathrm{i}$ | m. | m. 54 | m. 55 | m. 56 | m. 5 | m 58 | m. 59 | $\begin{aligned} & \mathrm{m} . \\ & 60 \\ & \hline \end{aligned}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | $36 \cdot 2$ | 8 |  |  |  | 44.2 | 45.8 | $47 \cdot 5$ | $49^{\prime} \cdot 2$ | 51́o | 52.8 | $54 \cdot 7$ | 56́•5 |
| 44 | 30.9 | $32 \cdot 3$ | $33 \cdot 7$ | $35 \cdot 1$ | $36 \cdot 6$ | 38-I | $39 \cdot 6$ | $41 \cdot 2$ | $42 \cdot 8$ | 44.4 | $46 \cdot 1$ | $47 \cdot 8$ | $49 \cdot 5$ | $51 \cdot 2$ | 53.0 | $54 \cdot 8$ |
| 46 | 29.9 | $31 \cdot 3$ | $32 \cdot 6$ | $34^{\circ} \mathrm{O}$ | $35 \cdot 5$ | $36 \cdot 9$ | $38 \cdot 4$ | $39^{\circ} 9$ | 41-5 | $43^{\circ} \mathrm{O}$ | $44 \cdot 6$ | $46 \cdot 2$ | $47 \cdot 9$ | $49 \cdot 6$ | 51.4 | 53.1 |
| 48 | $28 \cdot 9$ | 30.2 | 31.6 | 32.9 | 34 | $35 \cdot 7$ | 37.1 | $38 \cdot 6$ | $40 \cdot 1$ | 41.6 | $43 \cdot 2$ | $44^{\circ} 7$ | $46 \cdot 4$ | $48 \cdot 0$ | $49 \cdot 7$ | $51 \cdot 3$ |
| 50 | 27 | 29 | $30 \cdot 5$ | 3I•8 | $33^{\prime} 1$ | $34 \cdot 5$ | 35 | $37 \cdot 3$ | $38 \cdot 7$ | $40 \cdot 2$ | 41•7 | $43 \cdot 2$ | $44 \cdot 8$ | $46 \cdot 4$ | $48 \cdot 0$ | $49 \cdot 6$ |
| 52 | $26 \cdot 9$ | $28 \cdot 2$ | 29.4 | 30.7 | 3I•9 | $33 \cdot 3$ | $34 \cdot 6$ | $36 \cdot 0$ | 37.3 | $38 \cdot 8$ | $40 \cdot 2$ | 41'7 | $43 \cdot 2$ | $44^{\prime} 7$ | $46 \cdot 2$ | $47 \cdot 8$ |
| 54 | 25.9 | 27.1 | $28 \cdot 3$ | 29.5 | $30 \cdot 7$ | 32 | $33 \cdot 3$ | $34 \cdot 6$ | $35 \cdot 9$ | $37 \cdot$ | $38 \cdot 7$ | $40^{\circ} \mathrm{I}$ | 41•6 | $43^{\circ} 0$ | $44 \cdot 5$ | $46 \cdot 0$ |
| 56 | 24.9 | 26.0 | $27 \cdot 2$ | $28 \cdot 3$ | $29 \cdot 5$ | $30 \cdot 7$ | $32 \cdot 0$ | $33 \cdot 2$ | $34^{\circ} 5$ | $35 \cdot 8$ | 37'1 | $38 \cdot 5$ | $39 \cdot 9$ | $4 \mathrm{I} \cdot 3$ | $42 \cdot 7$ | $44^{\prime 2}$ |
| 5 | $23 \cdot 8$ | 24.9 | 26.0 | 27*1 | $28 \cdot 2$ | 29.4 | 30.6 | 31-8 | $33^{\circ} 0$ | 34.3 | $35 \cdot 6$ | $36 \cdot 9$ | $38 \cdot 2$ | $39 \cdot 6$ | 4 ${ }^{\circ} 0$ | $42 \cdot 3$ |
| 60 | 22.8 | $23 \cdot 8$ | 24.8 | 25.9 | $27^{\circ}$ | $28 \cdot 1$ | $29 \cdot 2$ | $30 \cdot 4$ | 31.6 | $32 \cdot 8$ | 34.0 | $35^{\circ} 2$ | $36 \cdot 5$ | $37 \cdot 8$ | $39^{\prime}$ I | $40 \cdot 4$ |
| 62 | 21.6 | 22.6 | $23 \cdot 6$ | 24.6 | $25^{\circ} 7$ | $26 \cdot 7$ | $27 \cdot 8$ | $28 \cdot 9$ | $30 \cdot 0$ | $31 \cdot 1$ | $32 \cdot 3$ | 33.5 | $34 \cdot 7$ | $35 \cdot 9$ | $37 \cdot 2$ | $38 \cdot 4$ |
| 64 | $20 \cdot 5$ | 21.4 | 22.4 | $23 \cdot 3$ | $24^{\circ} 3$ | $25 \cdot 3$ | $26 \cdot 3$ | $27 \cdot 4$ | $28 \cdot 4$ | $29 \cdot 5$ | $30 \cdot 6$ | $31 \cdot 7$ | $32 \cdot 9$ | $34^{\circ} 0$ | $35 \cdot 2$ | $36 \cdot 4$ |


| Lat. | HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | m. | $\stackrel{\mathrm{m}}{1}$ | ${ }_{2} \mathrm{~m}$. | ${ }_{3}{ }_{3}$ | $\stackrel{\mathrm{m}}{4}$ | ${ }_{5}^{\mathrm{m}} \mathrm{5}$ | ${ }_{6} \mathrm{~m}$. | m. ${ }^{\text {m }}$ | m. | ${ }_{9}^{\mathrm{m}} \mathrm{m}$ | ${ }_{10}^{\text {m. }}$ | ${ }_{11}$ | 12 | ${ }_{13}^{\mathrm{m}}$ | ${ }_{14}^{\text {m. }}$ | ${ }_{15}^{\text {m. }}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 | 56.5 | 58.4 | 60.3 | 62.3 | $64 \cdot 3$ | 66́.3 | $68 \cdot 3$ | 70.4 | 72.5 | $74 \cdot 6$ | 76.8 | 79.0 | $8 \mathrm{I} \cdot 2$ | $83^{\prime} \cdot 5$ | 85.7 | 88.0 |
| 43 | 55.7 | 57.5 | 59.4 | 6r.3 | 63.3 | 65.3 | 67-3 | 69.3 | 71.4 | 73.5 | 75.6 | 77.8 | 1 | 82.2 | 84.4 | 86.7 |
| 44 | 54.8 | 56.6 | 58.5 | $60 \cdot 4$ 50.4 | 62.3 | ${ }_{6} 6.3$ | ${ }^{66 \cdot 3}$ | 68.3 | 70.3 69.2 | ${ }^{72 \cdot 4}$ | 74.5 73.3 | ${ }^{76 \cdot 6}$ | 78.8 | $80 \cdot 9$ $70 \cdot 7$ | 83.2 8 r .8 | $85 \cdot 4$ 8.4 8.4 |
| 45 | $53 \cdot 9$ | 55'\% | $57 \cdot 6$ | 59.4 | $6 \mathrm{I} \cdot 3$ | $63 \cdot 3$ | $65 \cdot 2$ | $67 \cdot 2$ | $69 \cdot 2$ | 7 I | 73.3 | 75.4 | $77 \cdot 5$ | $79 \cdot 7$ | - 8 | r |
| 46 | 53. | 54.9 | $56 \cdot 7$ | $58 \cdot 5$ | $60 \cdot 4$ | 62.3 | $64 \cdot 2$ | 66.1 | 68.1 | 1 | 2.1 | 74.2 | $76 \cdot 3$ | 78.4 | $80 \cdot 5$ | + |
| $4{ }_{4}^{47}$ | 52.2 | $54^{\circ} \mathrm{O}$ | $55 \cdot 7$ 54.8 | $57 \cdot 5$ 56.6 | 59.4 | 61.2 | 63.1 | 65.0 | 67.0 | 69.0 | 71.0 69.8 | 73.0 | 73.0 73 | $77 \cdot 1$ 75.8 7 | 79.2 | 4 |
| 49 | 50.5 | 52 | 53.9 | $55 \cdot 6$ | $57 \cdot 4$ |  |  | $62 \cdot 9$ | $64 \cdot 8$ | $66 \cdot 7$ | 68.6 | 70.6 | 72.5 | $74 \cdot 6$ | 76.6 | 78. |
| 50 | $49 \cdot 6$ | 51.3 | 52 | 54.7 | 6.4 | 58.2 | 60.0 | . 8 | $\cdot 6$ | $65 \cdot 5$ | 67.4 | $69 \cdot 3$ | $71 \cdot 3$ | 73.3 | 3 |  |
| 51 | 48 | $50 \cdot 3$ | 52 | 53.7 52.7 | 55.4 | 57.1 | 58.9 | 60.7 | $62 \cdot 5$ $6 \times 4$ | 64.4 6.2 |  |  | 70.0 68. 6 |  | 73.9 |  |
| 52 53 | $4{ }_{4}^{47} 9$ | 48.5 | 50.1 | 51.7 | 53.4 | 55\% | 56.7 | 58.5 | 60.2 | 62.0 | 63.8 | $65 \cdot 6$ | 67.5 | 69.3 |  |  |
| 54 | $46 \cdot 0$ | $47 \cdot 6$ | $49 \cdot 1$ | 50.7 | $52 \cdot 3$ | 54.0 | 55 |  | 59.1 | 60.8 | $62 \cdot 6$ | 64.4 | . 2 | 68.0 | 69.9 | 71 |
| 55 | ${ }^{45}$ I | $46 \cdot 6$ | 48.2 | $49 \cdot 7$ | 51.3 | 52.9 | $54 \cdot 6$ | $56 \cdot 2$ | 57.9 | 59.6 | $6 \mathrm{~T} \cdot 3$ | 63.1 | ${ }^{64.9}$ | 66.7 |  | 68 |
| 56 | 44.2 | $45 \cdot 7$ | $47 \cdot 2$ | 48.7 | $50 \cdot 3$ | $5{ }^{51} \cdot 8$ | 53.4 | $55^{1}$ | $56 \cdot 7$ | 58.4 |  | ${ }_{6} 6.8$ | 63.5 | 65.3 | ${ }^{67 \cdot 1}$ | 68.9 |
| 57 | $43 \cdot 3$ | 44•7 | $46 \cdot 2$ | $47 \cdot 7$ | $49^{\circ} 2$ | 50.7 | $52 \cdot 3$ | 53.9 | $55 \cdot 5$ | 57.2 | 58.8 | $60 \cdot 5$ | $62 \cdot 2$ | $63 \cdot 9$ | 65'\% | $67 \cdot 5$ |
| 58 | $42 \cdot 3$ | 43.7 | 45.2 | $46 \cdot 6$ | $4{ }^{8.1}$ | 49.6 | 51.2 | 52.7 | $54 \cdot 3$ | $55^{\circ} 9$ | $57 \cdot 5$ | 59.2 | $60 \cdot 9$ | $62 \cdot 6$ | 64:3 | $66 \cdot 0$ |
| 59 | $4{ }_{4}^{15} 4$ | 42.8 | ${ }_{4}^{4 \cdot 2}$ | $45^{4} \cdot 6$ | 47'1 | 48.5 | 50.0 | 51.5 50 | 53.1 | 5 |  | 57-8 | 59.5 | ${ }^{61 \cdot 1}$ |  |  |
| 6I | 39.4 | 4 | ${ }_{42 \cdot 1}^{43 \cdot 1}$ | ${ }_{43} 4.5$ | $46 \cdot 0$ | ${ }_{46 \cdot 3}^{47}$ | 47.7 | 490.1 | 50.6 | 52.1 | 54.6 | 55-1 | 56.7 | 58.3 58 | 15 59 | 61 |
| 62 | 38 | 39.7 | $41^{\circ}$ | $42 \cdot 4$ | 43.7 | $45 \cdot \mathrm{I}$ | $46 \cdot 5$ | 47 | 49 | $50 \cdot 8$ | $52 \cdot 3$ | 53.8 | $55 \cdot 3$ | $56 \cdot 8$ | 58.4 |  |
| 64 | 37.4 36.4 | $37 \cdot 6$ | ${ }_{3} 8$ | 41 | 42 | 43.9 | $45 \cdot 3$ 44.0 | 46 | $\begin{aligned} & 48 \\ & 46 \end{aligned}$ | 49 |  | 52.4 50.9 | 53.9 | 55.4 53.9 |  |  |
|  | o HOUR. |  |  |  |  |  |  |  |  | 1 HOUR. |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{4}{ }_{4}$ | ${ }_{8} \mathrm{~m}$ | ${ }_{12}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{1 6} \end{aligned}$ | $\frac{\mathrm{m}}{20}$ | ${ }_{24}^{\mathrm{m}_{2}}$ | 30 | $\mathrm{m}_{40}$ | $\overline{50}$ | $\begin{aligned} & \mathrm{m} . \\ & 00 \end{aligned}$ | $\overline{10}$ | ${ }_{20}^{\mathrm{m} .}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 0 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{4 0} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 50 \end{aligned}$ | $\mathrm{m}_{60}$ |
| N . AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{4}{ }^{2}$ | ${ }^{\circ} \mathrm{O} .6$ | - ${ }^{\circ}$ | ${ }^{\circ} 9$ | $2 \cdot 6$ | 3.2 | $3 \cdot 9$ | 4.9 | 6.5 | $8{ }^{\circ} \mathrm{I}$ | $\stackrel{\circ}{9} \cdot 7$ | 1i.3 | 12.8 | 14.4 | 15.9 |  | 19\% |
| 46 | $0 \cdot 7$ | I. 3 | 2.0 | $2 \cdot 6$ | $3 \cdot 3$ | $3 \cdot 9$ | 4.9 | 6. | 8 8.1 | 9.7 | Ir. 3 | 12.9 | 14.5 | ${ }_{16}^{16.1}$ | $17 \cdot 6$ | $19 \cdot 2$ |
| 50 | $\stackrel{\circ}{\circ} 7$ | 1.3 | $2 \cdot 0$ | $2 \cdot 6$ | $3 \cdot 3$ | $4{ }^{\circ}$ | 4.9 | $6 \cdot 6$ | 8.2 | 9.8 | $1{ }^{15} 4$ | I3.1 | 14.7 | 16.3 | 17.8 | 19.4 |
| 54 | $0 \cdot 7$ | I. 3 | $2 \cdot 0$ | $2 \cdot 7$ | $3 \cdot 3$ | $4^{\circ}$ | $5 \cdot$ | $6 \cdot 7$ | $8 \cdot 3$ | 10.0 | 11.6 | 13.3 | 14.9 | $16 \cdot 5$ | 18.2 | 19 |
| 58 60 | 0.7 | 1.44 | 2. 2.1 | 2.7 2.8 | 3.4 | 4.I | $5 \cdot 1$ | 6.8 6.9 | 8.5 8.6 |  | 9 | $1 \begin{aligned} & 13.6 \\ & 13\end{aligned}$ | $\xrightarrow{15.2}$ | 16.9 | 18.6 18.8 18 | 20.2 20.5 |
| 62 | 0.7 | 1.4 | 2 | 2 | 5 | 4.2 | 5.2 | \% 8.0 |  | 1034 | 12.2 | 13.9 | $\xrightarrow{15 \cdot 6}$ | $17 \% 4$ | 19 | 8 |
| 64 | 0.7 | 14 | $2 \cdot 1$ | 2.8 | 3.5 | 4.2 | $5 \cdot 3$ | 7•1 | 8.8 | 10. | 12.4 | $14 \cdot \mathrm{I}$ | 15.9 | 17.7 | 19.4 | 21 |

* a PERSEI (MIRFAK).

| Lat. | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 16 | 17 | 18 | 19 | 20 | ${ }_{21}$ | 22 | ${ }_{23}^{\mathrm{m}}$ | 24 | ${ }_{25}^{\text {m. }}$ | ${ }_{28}^{\text {m }}$ | ${ }_{27}^{\mathrm{m}}$ | $\stackrel{\mathrm{m}}{28}$ | ${ }_{29}^{9}$ | ${ }_{30}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{42}$ |  |  | $95 \cdot \mathrm{I}$ |  |  | 10'2. 5 |  |  |  | [12\% 7 | 115.4 | ris.0 | 120.7 |  |  |
| 43 |  |  |  |  | $8 \cdot 5$ | $0 \cdot 9$ | 103.4 | ro5'9 | 108.5 | 111.0 | II3.6 | 116.3 | 188 |  |  |
| 4 | 87.6 |  |  |  |  | 99.4 |  |  |  |  |  | 114 | 1171 | - |  |
| $4 \begin{aligned} & 45 \\ & 4 \\ & 4\end{aligned}$ |  |  | 89 | $93 \cdot \mathrm{I}$ | 95'5 |  | $100 \cdot 3$ | 101. | ${ }_{103}{ }^{\text {ros }}$ | ros.9 | 1108.4 | 112.7 | ${ }_{115} 5$ | 116.0 |  |
| 47 | 83.5 |  |  |  |  |  |  | 4 | - 8 | 104'2 | 106.7 | 109.2 | ITIP |  |  |
| 48 |  |  |  |  |  |  |  |  |  |  |  | 3 |  |  |  |
| 49 | 80.7 |  |  |  |  | 91.6 |  | ${ }_{94}{ }^{\text {P/5 }}$ | ${ }^{6} \cdot 7$ |  | Io3.2 | 105•3 | ${ }^{106 \cdot 1}$ |  |  |
| 5 |  |  |  | ${ }_{84}{ }^{\text {- }}$ | 86.3 | 88 | 920.6 | ${ }_{92}{ }^{2} 8$ | 95. | 97.3 | 99.6 | I. 9 | $4 \cdot 2$ |  | 109.0 |
| 52 |  |  |  |  |  | 86.8 |  |  | 93 |  |  | 100\% |  | $104 \cdot 6$ | 27\% |
| 53 |  | 77.0 |  |  |  | 83.6 | 85.6 |  |  | 93.7 | 94 | ${ }_{96 \cdot 3} 9$ |  |  |  |
|  |  |  |  |  |  | ${ }_{81}{ }^{3} \cdot$ | ${ }_{8}{ }^{\circ} \cdot{ }^{\circ}$ |  |  |  | ${ }_{92}{ }^{2}$ | $94 \cdot$ |  |  |  |
| 56 | $70 \cdot 7$ |  | 74.4 |  |  |  |  | 84.2 |  |  |  |  | $94 \cdot 6$ |  |  |
| 57 | 69 |  |  |  | 76.6 | 78.6 |  |  |  |  |  |  | ${ }^{22 \cdot 6}$ |  | 96.8 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 69 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 |  | $13 \mathrm{P} \cdot 8$ |  | $137 \cdot 6$ |  | 143.4 | 463 |  |  |  | 158.5 | 161.6 |  |  |  |
| 43 | 127 | 129.9 | $132 \cdot 7$ | 135.5 | 138.4 | I41 | 144.2 | I47. | $150 \cdot 1$ | 153 | ${ }_{156.1}$ | 159.2 | $162 \cdot 3$ | 165.4 |  |
| 44 | 125 | 127.9 | 130 | 133.4 | 136 | 139 | $1{ }^{12}{ }^{\circ}$ | $1{ }^{144.9}$ | 147 | 15 | 153.8 | 156 | 159.8 |  |  |
| 45 | 12 | 12 |  | 131 | ${ }^{1314 .}$ |  | $139 \cdot 8$ |  | I45'5 | 14 |  | 154.4 | 157.4 | 160.4 |  |
| 46 | 12 | 12 |  | 129 3 |  |  |  | 140 | 14 |  |  |  |  |  |  |
| 47 |  | 121.9 | 124.6 | 127.2 | 129 | $132 \cdot 6$ | 135'4 | 138 |  | I43 | 146.6 | 149.5 |  |  |  |
|  |  | 119.9 IT 7.9 | ${ }_{122}^{122}$ | ${ }_{\text {I2 }}^{125.1}$ | ${ }_{127}^{127}$ | 130.4 | ${ }_{1} 13$ | ${ }_{13}^{135}$ | 13 |  | I4 | 14 | ${ }_{1} 14$ |  |  |
| 50 | Ir | Ir | II8 |  |  |  | 128.6 | $131 \cdot 3$ | 133 |  |  | I42 |  |  |  |
| 51 | II | II | 116.3 |  | 121.3 | 123.8 | 6. | 129.0 | 131 | 13 | 13 | 139 | $142 \cdot 3$ |  |  |
| 52 |  | III | 114.2 | 116.6 | II | 121.6 | 124.1 | 126.6 | 12 | 13 | I34.4 | $137 \cdot 1$ | 7 |  |  |
| 53 |  |  |  | 11 |  |  |  | 12 |  | 129 |  |  |  |  |  |
| 54 55 |  | Io | 10 |  |  |  | ${ }_{\text {III }}^{119} 1$ |  | 124 |  | 12 | 13 |  |  |  |
| 56 |  | 103.3 |  |  |  | 112.4 | 7 | $117 \cdot 1$ | 119.5 |  | 124.3 |  | 129 | 131 | I34 |
|  |  | ror-I | ro |  |  |  |  | II | 117. |  | 12 T | $124 \times$ |  |  |  |
|  |  |  |  |  | ${ }_{105}^{105}$ |  | 1 | 11 | ${ }_{\text {II }}^{11}$ |  |  |  |  |  |  |
| $\begin{array}{r}59 \\ 60 \\ \hline\end{array}$ |  | $9 \cdot 7$ |  |  |  |  | 1 | 109 | M11.9 |  |  |  |  | 123 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{42}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 |  | 174.9 | 178 |  |  |  |  |  |  | 201 | $205 \cdot$ | $208 \cdot 5$ | 212 | 215.5 |  |
| 4 | - |  | 175 | 178 | ${ }^{18}$ | $185^{\circ} 2$ |  |  | 195.1 | 198.5 |  | $205 \cdot 3$ | 208 | 21 |  |
| 45 | ${ }_{163} 166$ |  | 172 | 17 |  |  |  |  | 192-I | 195.5 |  |  | .6 |  |  |
|  |  |  |  |  |  | 176 |  | 182.9 | 18 |  |  |  |  | 202.5 |  |
| 4 |  |  |  |  |  | 173.7 |  |  | 183 | 18 |  |  |  | 19 |  |
| 49 | 156.0 | 158. | 16 | $1{ }^{1} 6$ | 157.8 | I7 | 17 | 17 |  | ${ }^{183}{ }^{\circ}$ |  | 4 | 192.6 | $195{ }^{19}$ | 199 |
| 50 | 153.3 150.6 | ${ }_{153}{ }^{556}$ | 159 | 15 |  | 1167. <br> 164. <br> 1 | 170.9 1679 | 17 | ${ }_{173}^{176}$ |  | ${ }_{1}^{18} 1$ | 82 | $189 \cdot 3$ 186.0 | $192 \cdot 5$ 189 18 | 19 |
| 52 |  | 150 | 15 | 156.2 |  | 1619 | 164.8 | 16 |  |  | 176 | 179.6 | 182 | 185 | 188.8 |
|  | 145's | 147.8 | $150 \cdot 6$ | 1534 | ${ }^{156}$ I | 159.0 | 161. | 164. | 1675 | 17.4 | 173.4 | $176 \cdot 3$ | 179*3 |  |  |
|  |  | $145^{\circ}$ | 142\%\% | ${ }_{1}^{150.4}$ | 153.2 | 155'9 | 1158.8 <br> 155 <br> 1 |  | ${ }_{1}^{164.3}$ |  |  |  | 175.9 | 178.8 <br> 175.3 <br> 1 |  |
| 56 | 136 | 139.3 | 141 |  |  | 14 |  | 5 | 15 |  | 163 | ז66 | 169 |  | 17 |
|  |  | 136.4 | 138 | 14 |  | 144 |  |  | I5 |  |  | 162.7 |  |  |  |
|  |  | 133.5 | 135.9 132.9 |  |  | 143•5 | $14$ | 14 |  |  |  |  |  |  |  |
|  |  | 127 |  |  |  |  |  |  |  |  |  |  |  |  |  |


|  | $\stackrel{\mathrm{m}}{2}$ |  | $\left.{ }_{4}^{\mathrm{m} .}\right\|_{\text {m }} ^{\text {m }}$ | ${ }_{6}^{\mathrm{m}}$. | ${ }_{8}^{\mathrm{m}}$. | ${ }_{10}^{\mathrm{m}}$. | ${ }_{12}^{\mathrm{m}}$ | ${ }_{14}^{\mathrm{m}}$ | ${ }_{16}^{\mathrm{m}}$ | ${ }_{18}^{\mathrm{m}}$ | \% ${ }^{\text {\% }}$ | ${ }_{20}^{\mathrm{m}}$ | $\begin{aligned} & \mathrm{m}_{21} \end{aligned}$ | $\left\|\operatorname{man}_{22}\right\|$ | ${ }_{23}^{\mathrm{m}}{ }^{\text {¢ }}$ | ${ }_{24}^{\mathrm{m}}$ | $\stackrel{\mathrm{m}}{25}$ | ${ }_{26}^{\mathrm{m}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 53 | $0 \cdot 2$ | 20 | $0 \cdot 7$ | I'5 | $2 \cdot 6$ | $4^{\prime} \mathrm{I}$ | $5 \cdot 9$ | $8 \cdot \mathrm{r}$ | 0.6 | 13. |  | 16.5 | $5{ }^{18}$ | I I9.9 | 21.723 | $23 \cdot 6$ | $25 \cdot 6$ | 27.7 |
| 54 | $0 \cdot 2$ |  | 0.6 | ${ }^{15}$ | 2.5 | 3.9 | $5 \cdot 6$ | $7 \cdot 6$ | 9.9 |  |  | 15.5 | $5{ }^{17} 1$ | I 18 | 20.5 |  |  |  |
| 55 56 | - ${ }_{\text {Or }}$ | ${ }^{0}$ | 0.6 0.5 I I | r.3 | $2 \cdot 3$ 2.2 | 3.7 3.5 | 5.3 | $7 \cdot 2$ 6.8 | 9.4 8.8 | II.8 | İ | I4.6 | $8{ }^{6}$ | 17 $17 \cdot 7$ <br> 16.6  | $\begin{array}{cc}19.3 & 21 \\ 18.2 \\ 19\end{array}$ | - $11^{10^{\circ}}$ | 8 | 24.6 |
| 57 | 0.1 |  |  | 1-2 | $2 \cdot 1$ | $3 \cdot 3$ | 4.7 | 6.4 | 8.3 | $10 \cdot 5$ | 0.513 | 13.0 | -14.3 |  | 17.2 | 18.7 |  | 21.9 |
| 58 59 |  |  | 0.5 <br> 0.5 <br> 0.5 | I. | $\stackrel{2.0}{1.9}$ | $3 \cdot 1$ $2 \cdot 9$ $2 \cdot 9$ |  | $6 \cdot 6$ | 7.9 |  | 9.9 |  | $3{ }^{13}$ |  | 16.2 15.3 15 |  | I |  |
| 60 | $\bigcirc \cdot 1$ | I 0 | ${ }_{0} 0^{4}$ | 1.0 | 1.7 | $2 \cdot 7$ | 3.9 | 5.4 | 7.0 |  | 8.4 8 | Ir IO.9 | $9{ }^{\text {c }}$ | - | 15*3 ${ }_{14} 1$ | $15 \cdot 6$ 15.7 | $1{ }_{1}^{18.0}$ | [19.5 |
| 8. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | O.3 |  | 2 | 2. | $3 \cdot 9$ | $6 \cdot \mathrm{I}$ | 8.8 | 119 | 5 |  | . 24 | 24.2 | 226.7 | 729.3 | $32 \cdot 0$ | $34 \cdot 8$ | $37 \cdot 7$ | 40.7 |
| 2 | - $\begin{aligned} & 0.2 \\ & 0.2\end{aligned}$ | 0 |  <br> 0.9 <br> 0.9 <br> 0 | 2.1 2.0 1 | 3.7 3 3 | 5.7 | 8.3 7.8 | 11.2 | 14.6 |  | - 5 | $22 \cdot 7$ 21.5 | $\begin{array}{ll}7 & 25.1 \\ 5 \\ 23.6\end{array}$ | $\begin{array}{ll}1 & 27 \cdot 5 \\ 65\end{array}$ |  | $32 \cdot 7$ $30 \cdot 8$ |  | ${ }^{3} \begin{aligned} & 38 \cdot 3 \\ & 36 \cdot \text { I }\end{aligned}$ |
| ${ }^{4}$ | $0 \cdot 2$ |  | 1 | r.9 | $3 \cdot 3$ | ${ }_{5}{ }^{1}$ | $7 \cdot 4$ | -0.0 | 13.0 |  | 6. 5 | 20.3 | $3{ }^{22 \cdot 4}$ | $4{ }^{24 \cdot 5}$ | 2 | $29 \cdot 2$ | . 6 | 34-2 |
| 8 | $0 \cdot 2$ | - | 0.8 I | r.8 | $3 \cdot 1$ | 4.8 | $7{ }^{\circ} \mathrm{O}$ | - 5 | 12.3 | 15.6 | 15.6 | 19.2 | $2{ }^{21.2}$ | $2{ }^{23} 3$ | $25 \cdot 4$ | $27 \cdot 7$ | 30.0 | 32.4 |
| זо | 0.2 |  | 0.8 I | 1.7 | 3.0 | $4 \cdot 6$ | $6 \cdot 6$ | $9 \cdot 0$ | II• |  | 1.818 | 18.3 | $3{ }^{20} 1$ | 1 | 26 | 26.3 | 5 | 30.8 |
| 12 | 0.2 0.2 |  | 0.7 | 1.6 | $2 \cdot 8$ | $4 \cdot 4$ | $6 \cdot 3$ | 8.6 |  |  | 4. ${ }^{1}$ | $17 \cdot 4$ | 419.2 |  | 23.0 | 25.0 |  | ${ }^{29} 3$ |
| 15 20 | 020 |  | 0.7 0.6 I I | 1.5 1.3 | 2.6 2.4 | $4 \cdot 1$ 3 | 5.9 $5 \cdot 3$ | $8{ }_{8} 8.1$ | - 3 |  | 3.1 1 | 16.2 | $2{ }^{2} \begin{aligned} & 17.9 \\ & 16.0\end{aligned}$ | $9{ }^{\text {c }}$ |  | 23 | $25 \cdot 3$ $22 \cdot 6$ | 37.3 24.5 |
| 25 | $0 \cdot 1$ |  | 0.51 | I.2 | 2.1 | $3 \cdot 3$ | $4 \cdot 7$ | 6.4 | 93 |  | . 6 | $1{ }_{1} 1.0$ | - 14.4 | ${ }_{4}{ }^{17 \%} 17$ | $\begin{array}{ll}19.2 \\ 17.2 & 2 \\ 1 \\ 1\end{array}$ | 18.7 | $22 \cdot 6$ 20.3 |  |
| 30 | $0 \cdot 1$ |  | 1 | 1 |  | 3.0 |  | $5 \cdot 8$ |  |  |  |  |  |  |  | 16.9 |  |  |
| 35 | $\bigcirc$ |  | 0.4 | 1 | 1.7 | $2 \cdot 7$ <br> 2 | $3 \cdot 8$ | $5 \cdot 2$ |  |  | 7.7 | 10.6 | 6 | 712.8 | 14.0 | $15 \cdot 2$ |  | 17.8 |
| 40 | $\bigcirc \cdot 1$ |  | 0.4 0.4 0 | -0.9 | I.6 | 2.4 | 3.4. | 4.7 4.2 | $6 \cdot 1$ |  | $7 \cdot 7$ | 8.5 | $5{ }_{5} 12 \cdot 5$ | $\begin{array}{lll}5 & 11.5 \\ 10.3\end{array}$ | $\begin{array}{ll}12 \cdot 6 \\ 12 & \text { I } \\ \text { I }\end{array}$ | $13 \cdot 7$ 12.2 |  | 16.0 |
| 5 |  |  | $0.3{ }^{0}$ | $0 \cdot 7$ | I. 2 | - 8 | $2 \cdot 7$ | $3 \cdot 4$ | 4.8 |  | 6.9 | 7.6 | ${ }^{5}$ | ${ }_{3}^{4}{ }^{10 \cdot 3}$ | 11.2 10.0 1 |  | 13.3 | ${ }^{14.4}$ |
| 55 | O•I |  | 0.3 | 0.6 | I•I | 1.7 | 2.4 | $3 \cdot 3$ | $4 \cdot 3$ |  | $5 \cdot$ | $6 \cdot 6$ | 6 7.3 | 388 | 8 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\mathrm{N} . \quad$ REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 54 55 | ${ }_{26 \cdot 5}^{28 \cdot 1}$ | 38.5 | $32 \cdot 4$ | $34 \cdot 7$ | 37. 34.9 | 39.4 37.1 3 |  | 44.4 $4 \mathrm{I} \cdot 9$ | 44.3 | 49.7 |  |  | $55 \cdot 2$ $52 \cdot \mathrm{I}$ | - 58.1 |  |  | $4 \cdot 1$ |  |
| 56 | 25.0 | $26 \cdot 9$ | $8 \cdot 8$ | $30 \cdot 8$ | $32 \cdot 9$ | $35^{\circ}$ | 37.2 | 39.5 | 4 |  |  |  | 49.2 | Ir8 | - 54.4 | - 5 |  | 59.9 |
|  |  | $25 \cdot 4$ | 27.2 | 29.1 | $3 \mathrm{r}^{\circ}$ | $33 \cdot 1$ | $35 \cdot 1$ | $37 \cdot 3$ | $39 \cdot 5$ | $4{ }^{\circ} \mathrm{y}$ |  |  | $46 \cdot 4$ | - 48.9 | - 51.4 |  | 53.9 | - $56 \cdot 5$ |
| 58 | 22 | $23 \cdot 9$ $22 \cdot 6$ | 25• | $27 \cdot 5$ 25.9 | 29.3 | $3{ }^{1} 2$ | $33 \cdot 2$ | 35.2 | 37.3 | 39.4 |  | - | 43.8 | - ${ }^{\circ}$ |  |  | 50.9 |  |
| 60 | 19.8 | 22.3 | 24.9 | 24.9 | 27. 2 | 29.8 | (39.6 | ${ }_{31}^{33} \cdot 4$ |  | 37'2 | 39 |  | 41.4 30.1 | - ${ }^{0}$ |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I | 42 | $45 \cdot 7$ | $49^{\circ}$ | $52 \cdot 4$ | 55.9 | $59 \cdot 5$ | 63.2 | 67.0 |  | 74.9 |  | 1 | 23.3 |  | 22 |  | 36.6 | 44 |
|  | 4 I | 44*3 | 47 | 50.8 | 54.2 |  |  | $65^{\circ}$ | 68.8 | $72 \cdot 7$ |  |  | 20.9 | ${ }^{25}{ }^{\text {P1 }}$ | 26. |  | 33.8 | I 38.3 |
| 4 | 48 | 4 4 | 44.8 | $49 \cdot 3$ <br> 47 | $5{ }_{51}^{52}$ | 54 | ${ }_{5 \%}^{59}$ | 61.4 | ${ }_{65}^{6 \cdot 9}$ | $70 \cdot 7$ 68.7 |  | I | 18.6 | 22.7 | I 26 |  | $33^{\circ} 2$ |  |
|  |  |  | $43 \cdot$ | $46 \cdot 6$ |  |  |  | $59 \cdot 7$ | 63.2 |  |  |  |  |  |  |  |  |  |
|  | 36 | 39 | $42 \cdot 4$ | $45 \cdot 4$ | 48.4 |  | 54.8 | 58.1 | 6r.5 | ${ }^{6} 5^{\circ}$ |  |  | 12.3 | 18.1 | $1{ }^{1} 20.0$ |  | 24.0 | I 38.1 |
|  | 34 | 37 | ${ }^{4} 48.3$ | 43 | 46 | 48 |  | 52.2 |  | ${ }_{58} 6.7$ | 65.2 |  |  | 8.8 | $\begin{array}{ll}1 & 16.0 \\ \text { I } \\ \text { I } 2 \cdot 3\end{array}$ |  | 19.8 15.9 1 |  |
| 12 | $3{ }^{3} \cdot 6$ | $34^{\circ}$ | 36.5 | $39^{\circ}$ | $4{ }^{4} \cdot 6$ | $44 \cdot 3$ | $44^{\circ} \mathrm{I}$ | $50 \cdot 0$ | $52 \cdot 9$ | 55 | 59-1 | I |  | $5 \cdot 5$ |  |  |  | 9 |
| $14$ | 28 | 32.4 | $34 \cdot 8$ | 37.2 | 39.7 | $42 \cdot 3$ | 44.9 | $47 \cdot 7$ | $5{ }^{5} 5$ | 53.4 | $56 \cdot 4$ |  | 59.4 | 11 2.6 <br> 0  <br> 0.8  |  |  |  |  |
| 18 | 28 |  | ${ }_{3}^{33}$ | 35.5 | $37 \cdot 9$ $36 \cdot 3$ | 40 |  | $45 \cdot 6$ 43.6 | 48.2 |  | 53.9 | - | 56.8 | O- 59.8 | 2.8 0.8 5 |  | $3 \cdot 1$ |  |
| 2 | 26 | 28 | $30 \cdot 4$ | 32.5 | 34•4 | $37 \cdot 0$ |  | $4{ }_{4}^{41}$ | ${ }_{44 \cdot 2}^{44}$ | $46 \cdot 4$ |  | - | 52.0 | - 54.7 | - |  | ${ }_{0} \times 1$ |  |
| 22 | $25 \cdot 2$ | 27 | 29.1 | $3{ }^{1 \cdot 1}$ | 33 | 35.4 | 37 | $39^{\circ} 9$ | 2. | $4^{\cdot}$ |  | 2 - | - |  | - $55 \cdot 1$ |  | 5 |  |
| 24 | $2{ }^{24.2}$ | $26 \cdot 0$ | 27.9 | 29.8 | 31.9 | 33.9 | $36 \cdot \mathrm{I}$ | 38.3 | $40^{\circ} 6$ | 42.9 |  |  | - 47.8 | - $50 \cdot 3$ | - 52 |  | 55.5 | - 58.2 |
| $\left\lvert\, \begin{aligned} & 26 \\ & 28 \end{aligned}\right.$ | 23.2 | 24. | 26.8 | 27.6 |  |  |  | $36 \cdot 7$ $35 \cdot 2$ |  |  | $4{ }^{43} 4$ | $\bigcirc$ | - 45.8 | (1) ${ }^{\circ}$ | - |  | 53.3 | - 5 |
| 30 | 21.3 | 22 | 24 | 26.3 | $28 \cdot \mathrm{I}$ |  | 33 | $33 \cdot 8$ | 35.8 | 37. | $40 \cdot$ |  | - $42 \cdot 2$ | - $44 \cdot 4$ | - 46 |  | $49^{\circ}$ | - $51 \cdot 4$ |
| ${ }^{32}$ | $20 \cdot 5$ | 22 | 23 | $25^{3}$ | $27^{\circ}$ |  | $30 \cdot 6$ | $32 \cdot 4$ | $34 \cdot 3$ | $36 \cdot 3$ | 38.4 | 40 | -40.4 | - 42 | - 44 |  | $47^{\circ}$ | $49 \cdot 4$ |
| 5 | 18 | 18 |  | 23 | 22.8 | $26 \cdot 4$ | $28 \cdot \mathrm{I}$ <br> 25.8 | 29.8 | $3{ }^{31} 6$ | 33.4 | $35 \cdot 3$ |  | - 37.2 | 39.20 | $\bigcirc 412$ |  | 43.3 <br> 40.8 | - 45.4 |
|  | I5 | 18.0 | ${ }^{\circ} \mathrm{l}{ }^{20 .} 18$ |  |  | $22 \cdot 2$ | $22^{2} \cdot 7$ | ${ }_{25}{ }^{27}{ }^{\text {P }}$ | 26. | 28.1 |  | $4{ }^{\circ}$ |  | $-36 \cdot$ <br>  <br> 0 <br> $33^{\circ}$ <br>  <br> 0 | - $\begin{aligned} & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0\end{aligned}$ | 70 <br> 0 <br> 0 | 39.8 |  |
|  | 14 | 15.5 |  | 17.8 | 19.0 | 20.3 |  | $22 \cdot 9$ | 24.3 | 25.7 | 27. |  |  | 30.1 | - 31 |  | 33.3 | 34.9 |
| 56 | 1 | 12 | I3.6 | 14 | 15.5 | 16.6 | 17.6 | 18.7 | 2 |  |  | ${ }_{1}{ }^{\circ}$ | - | ${ }^{\circ}$ | - |  | 27.2 | 28 |

## REDOCIION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* POLLUX.


TRUE BEARING OR AZIMUTH OF * POLLUX.

| m |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lat. | m. | m | m. | m. | m |

N. | 0 |
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| 53 |
| 54 |
| 56 |
| 58 |
| 60 |
| S |
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| 25 |
| 30 |
| 35 |
| 40 |
| 50 |
| 60 |

| 3 |  |
| :--- | :--- |
| 3 |  |
| 4 |  |
| 6 |  |
| 8 |  |
| 0 |  |
| 0 |  |

## AZIMUTHS.

| ${ }_{2}{ }^{\circ} \mathrm{I}$ | $4{ }^{\circ} \mathrm{L}$ | $6^{\circ} \cdot 3$ | $8{ }^{\circ} \cdot$ | ${ }^{\circ} \mathrm{O} \cdot 4$ | 12.5 | $1{ }^{\circ} \cdot 5$ | -160.6 | 18.6 | $20 \cdot 5$ | $22^{\circ} \cdot 5$ | $24^{\circ} 4$ | $25^{\circ} \cdot 3$ | $28 \cdot 2$ | $30^{\circ} 0$ | $34^{\circ} 4$ | $38 \cdot 7$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $2 \cdot 0$ | $4 \cdot 1$ | 6.1 | $8 \cdot 1$ | $10 \cdot 1$ | 12.1 | 14.1 | 16.0 | 17.9 | 19.8 | $21 \cdot 7$ | $23 \cdot 6$ | $25 \cdot 5$ | $27 \cdot 3$ | 29.0 | $33 \cdot 4$ | $37 \cdot 5$ |
| I 9 | $3 \cdot 8$ | $5 \cdot 7$ | $7 \cdot 5$ | 9.4 | Ir 3 | $13 \cdot 1$ | 15.0 | 16.8 | 18.6 | $20 \cdot 4$ | 22.2 | 23.9 | $25 \cdot 6$ | $27 \cdot 3$ | $31 \cdot 5$ | $35 \cdot 5$ |
| I.8 | $3 \cdot 5$ | $5 \cdot 3$ | $7 \cdot 1$ | $8 \cdot 8$ | 10.6 | $12 \cdot 3$ | $14^{\circ} \mathrm{I}$ | 15.8 | 17.5 | $19^{\circ} 2$ | 20.9 | $22 \cdot 5$ | 24.2 | $25 \cdot 8$ | 29.9 | 33-7 |
| 1.7 | $3 \cdot 3$ | $5 \cdot 0$ | $6 \cdot 7$ | $8 \cdot 3$ | 10.0 | II 6 | $13 \cdot 3$ | 14.9 | 16. 6 | 18.2 | 19.8 | 21.4 | 22.9 | 24.5 | 28.3 | $32 \cdot 1$ |
| 1.9 | 3.7 | $5 \cdot 6$ | $7 \cdot 4$ | $9 \cdot 2$ | 11.0 | 2.8 | 14.5 | $16 \cdot 3$ | 17•9 | 19.6 | 21 | $22 \cdot 7$ | 24.3 | 25.7 | 3 | $32 \cdot 5$ |
| r.8 | $3 \cdot 5$ | $5 \cdot 2$ | $7 \cdot 0$ | $8 \cdot 7$ | 10.4 | $12 \cdot 1$ | 13.7 | $15 \cdot 3$ | $16 \cdot 9$ | 18.5 | $20^{\circ}$ | 21.5 | $23^{\circ}$ | 24.4 | 27.8 | 31.0 |
| 1.7 | 3.3 | $5 \cdot 0$ | $6 \cdot 6$ | $8 \cdot 2$ | 9.8 | 11.4 | 13.0 | 14.5 | $16 \cdot 0$ | 17.5 | 19.0 | 20.4 | 21.9 | $23^{2}$ | $26 \cdot 5$ | $29 \cdot 6$ |
| 1.6 | 3.1 | $4 \cdot 7$ | $6 \cdot 2$ | $7 \cdot 8$ | $9 * 3$ | 10.8 | 12.3 | 13.8 | 15*3 | $16 \cdot 7$ | 18.1 | $19 \cdot 5$ | $20 \cdot 9$ | 22.2 | $25 \cdot 4$ | 28.4 |
| 1-4 | . | $4 \cdot 3$ | $5 \cdot 7$ | $7 \cdot 1$ | 8.5 | 9.9 | II-2 | 12.6 | 13.9 | 15.3 | 16.6 | 17*9 | $19 \cdot 1$ | $20 \cdot 4$ | $23 \cdot 4$ | $26 \cdot 3$ |
| r 3 | 2.6 | 3.9 | 5.I | $6 \cdot 4$ | $7 \cdot 7$ | $8 \cdot 9$ | 10.2 | II4 4 | $12 \cdot 7$ | 13.9 | 15.1 | $16 \cdot 3$ | 17.5 | 18.6 | 21.5 | 24.2 |
| 1.2 | 2.4 | $3 \cdot 5$ | $4 \cdot 7$ | 5.9 | $7 \cdot 1$ | $8 \cdot 2$ | $9 \cdot 4$ | 10.5 | $11 \cdot 7$ | 12.8 | $13 \cdot 9$ | $15 \cdot 0$ | 16.I | 17.2 | 19.9 | $22 \cdot 5$ |
| $1 \cdot$ | 2.2 | $3 \cdot 3$ | 4.4 | $5 \cdot 5$ | $6 \cdot 6$ | 7.7 | $8 \cdot 7$ | $9 \cdot 8$ | $10 \cdot 9$ | $12 \cdot 0$ | $13^{\circ} \mathrm{O}$ | I $4 \cdot 1$ | 15.1 | 16.1 | 18.7 | 21.2 |
| I. 0 | $2 \cdot 1$ | $3 \cdot 1$ | $4^{1}$ | $5 \cdot 2$ | $6 \cdot 2$ | $7 \cdot 2$ | $8 \cdot 2$ | $9 \cdot 3$ | $10 \cdot 3$ | II•3 | $12 \cdot 3$ | 13.3 | 14.3 | 15.3 | 17.8 | $20 \cdot 1$ |
| $1 \cdot 0$ | $2 \cdot 0$ | 3.0 | $3 \cdot 9$ | 4.9 | $5 \cdot 9$ | $6 \cdot 9$ | $7 \cdot 9$ | $8 \cdot 8$ | $9 \cdot 8$ | 10.8 | 11•7 | 12.7 | 13.6 | 14.6 | 16.9 | 19.3 |
| $0 \cdot 9$ | 1.9 | 2.8 | $3 \cdot 8$ | $4 \cdot 7$ | $5 \cdot 7$ | $6 \cdot 6$ | $7 \cdot 6$ | $8 \cdot 5$ | 9.4 | 10.4 | II•3 | 12.2 | 13.2 | 14.1 | 16.4 | 18.6 |
| $0 \cdot 9$ | 1.8 | 2.7 | $3 \cdot 6$ | $4 \cdot 5$ | $5 \cdot 4$ | $6 \cdot 3$ | 7.2 | $8 \cdot 1$ | 9.0 | 9.9 | 10.8 | 11.6 | 12.5 | 13.4 | 15.6 | 17.8 |
| 0.9 | 1.8 | 2.6 | $3 \cdot 5$ | $4 \cdot 4$ | $5 \cdot 3$ | $6 \cdot 2$ | 7.0 | $7 \cdot 9$ | $8 \cdot 8$ | $9 \cdot 7$ | 10.6 | Ir 4 | 12.3 | 13.2 | 15.4 | 17.5 |

## REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* PROCYON.

|  | m | d |  | 8 | 10 |  | 14 | 16 |  |  | ${ }_{21}{ }^{\text {m }}$ |  |  | m. | ${ }_{25}$ | ${ }_{26}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 | 0.2 | r.0 | $2 \cdot 2$ | 3.9 | $6 \cdot 2$ | $8 \cdot 9$ | 12.1 | $15 \%$ | 19.9 | 24.5 | $27^{\circ}$ | 29.6 | 32.3 | $35 \cdot 2$ | $8 \cdot 1$ | I. 2 |
| 34 | $0 \cdot 2$ | $0 \cdot 9$ | - | $3 \cdot 6$ | $5 \cdot 6$ | $8 \cdot 1$ | 11 | $14^{*} 4$ | 18.2 | 22.4 | 24.7 | $27 \cdot 1$ | 29.6 | $32 \cdot 2$ | 34.9 | $37 \cdot 8$ |
| 36 | $0 \cdot 2$ | 0.8 | 1.9 | $3 \cdot 3$ | $5 \cdot 2$ | $7 \cdot 4$ | 10.1 | $13^{2}$ | $16 \cdot 7$ | $20 \cdot 6$ | 22.7 | 24.9 | 27.2 | 29.6 | $32 \cdot \mathrm{I}$ | $34^{\prime} 7$ |
| 38 | 0.2 | 0.8 | 1.7 | 3.0 | $4 \cdot 8$ | $6 \cdot 9$ | $9 \cdot 3$ | 12.2 | 15.4 | 19.0 | 20.9 | 22.9 | $25^{\prime} \mathrm{I}$ | $27 \cdot 3$ | 29.6 | $32^{\circ} \mathrm{O}$ |
| 40 | 0.2 | $0 \cdot 7$ | I.6 | $2 \cdot 8$ | 4.4 | $6 \cdot 3$ |  | 11.2 | $14^{\circ}$ | 17.5 | 19.3 | $2 \mathrm{I} \cdot 2$ | $23^{\circ}$ | 25.2 | 27.3 | $29 \cdot 5$ |
| 42 | $0 \cdot 2$ | $0 \cdot 6$ | $x \cdot 5$ | $2 \cdot 6$ | 4.0 | $5 \cdot 8$ | 7.9 | ro. | $3 \cdot$ | $16 \cdot 2$ | 17 | 19 | 2 P 4 | 23 | 25.2 | $27 \cdot 3$ |
| 44 | 0.1 | $0 \cdot 6$ | r 3 | $2 \cdot 4$ | $3 \cdot 7$ | $5 \cdot 4$ | $7 \cdot 4$ | $9 \cdot 6$ | $2 \cdot$ | 15.0 | 16.5 | 18. | 19.8 | 21.5 | 23.4 | 25.3 |
| 46 | $\bigcirc \cdot 1$ | $\bigcirc \cdot 6$ | $1 \cdot 2$ | $2 \cdot 2$ | $3 \cdot 5$ | $5 \cdot 0$ | $6 \cdot 8$ | 8.9 | II. 2 | 13.9 | 15.3 | 16.8 | 18.3 | $20 \cdot 0$ | 21.6 | 23.4 |
| 48 | $\bigcirc \cdot 1$ | $0 \cdot 5$ | I. 1 | $2 \cdot 1$ | 3.2 | $4 \cdot 6$ | $6 \cdot 3$ | $8 \cdot 2$ | 10.4 | 12.8 | 14.2 | 15.5 | 17.0 | $18 \cdot 5$ | 20 | $2 \mathrm{r} \cdot 7$ |
| 50 | $0 \cdot 1$ | $0 \cdot 5$ | 1.1 | $\times \cdot 9$ | $3 \cdot 0$ | $4{ }^{3}$ | $5 \cdot 8$ | 7.6 | 9.6 | II.9 | $13 \cdot 1$ | 14.4 | 15.7 | 17•1 | 18.6 | $20 \cdot 1$ |
| 52 | $0 \cdot 1$ | $0 \cdot 4$ | $1 \cdot 0$ | r.8 | $2 \cdot 7$ | 4.0 | $5 \cdot 4$ | $7 \cdot 1$ | $8 \cdot 9$ | II.O | 12.1 | 13.3 | 14.6 | 15.9 | 17.2 | . 6 |
| 54 | $0 \cdot 1$ | $0 \cdot 4$ | $0 \cdot 9$ | 1.6 | $2 \cdot 5$ | $3 \cdot 7$ | $5{ }^{\circ}$ | . 5 | $8 \cdot 3$ | 10 | II 2 | 12.3 | 13.5 | 14.7 | 15.9 | 17.2 |
| 56 | $\bigcirc \cdot 1$ | $0 \cdot 4$ | 0.8 | - 5 | $2 \cdot 3$ | $3 \cdot 4$ | $4 \cdot 6$ | $6 \cdot 0$ | $7 \cdot 6$ | $9 \cdot 4$ | $10 \cdot 4$ | Ir 4 | 12.4 | 13.5 | 14.7 | 15.9 |
| 60 | O.I | $0 \cdot 3$ | 0.7 | I 3 | $2 \cdot 0$ | $2 \cdot 9$ | $3 \cdot 9$ | $5 \cdot 1$ | $6 \cdot 5$ | $8 \cdot 0$ | $8 \cdot 8$ | $9 \cdot 7$ | $10 \cdot 6$ | 11.5 | 12.5 | 13.5 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | $0 \cdot 2$ | 1.0 | $2 \cdot 2$ | 3.9 | $6 \cdot 0$ | 8.7 | II.8 | 15.4 | 19.5 | $24^{\circ} 0$ | $26 \cdot 5$ | $29 \cdot 1$ | 31.8 | 34.5 | 37.5 | $\cdot 7$ |
| 26 | 0.2 | $0 \cdot 9$ | $2 \cdot 0$ | $3 \cdot 6$ | $5 \cdot 6$ | $8 \cdot 1$ | Ir.O | 14.3 | 18.I | 22.3 | 24 | $27 \cdot 0$ | $29 \cdot 5$ | $32 \cdot 1$ | $34 \cdot 8$ | 37 |
| 28 | $0 \cdot 2$ | 0.8 | 1•9 | $3 \cdot 3$ | $5 \cdot 2$ | $7 \cdot 5$ | 10.2 | 13.3 | 16.8 | 20.8 | 22.9 | $25 \cdot 1$ | $27 \cdot 4$ | 29.9 | 32.4 | $35^{\circ} 0$ |
| 30 | $0 \cdot$ | 0.8 | 1.7 | $3 \cdot 1$ |  | $7 \cdot 0$ | $9 \cdot 5$ | 12. | 15 | 19.4 | 21.4 | 23 | 25.6 | 27.9 | 2 | $\cdot 6$ |
| 32 | 0 | $0 \cdot 7$ | 1.6 | $2 \cdot 9$ | $4 \cdot 5$ | $6 \cdot 5$ | $\cdot 9$ | II• 6 | 14.7 | 18.1 | 20 | 21 | 23.9 | 26.0 | 28.2 | $30 \cdot 5$ |
| 34 | 0 | $0 \cdot 7$ | 1.5 | $2 \cdot 7$ | $4 \cdot 2$ | $6 \cdot 1$ | $8 \cdot 3$ | 10.9 | 13.7 | 16.9 | 18.7 | $20 \cdot 5$ | 22.4 | 24.4 | 26.4 | 28.6 |
| 36 | 0.2 | $0 \cdot 6$ | 1.4 | $2 \cdot 5$ | $4 \cdot 0$ | $5 \cdot 7$ | $7 \cdot 8$ | $0 \cdot$ | 12.9 | 15.9 | 17. | 19 | 21 | $22 \cdot 8$ | $24 \cdot 8$ | 8 |
| 40 | $0 \cdot 1$ | $0 \cdot 6$ | 1.3 | 2.2 |  | $5{ }^{\circ}$ |  |  | 1.3 | 14.0 | 15.4 | 16.9 | 8.5 |  | 21.8 | $23 \cdot 6$ |
| 45 | $0 \cdot 1$ | $0 \cdot 5$ | I-1 | r9 | 3 | 4 |  |  | $9 \cdot 7$ | $1 \mathrm{I} \cdot$ | 13 | 14.4 | 15.8 | 17.2 | 18.6 | 20 |
| 50 | $0 \cdot 1$ | $0 \cdot 4$ | 0.9 |  | $2 \cdot 5$ | $3 \cdot 7$ | $5 \cdot 0$ |  | $8 \cdot 2$ | 10. | II | 12.3 | 13.4 | 14.6 | 15.8 | 7.1 |
| 55 | O.1 | $0 \cdot 3$ | 0.8 | 14 | $2 \cdot 1$ | $3 \cdot 1$ | $4 \cdot 2$ | $5 \cdot 5$ | $6 \cdot 9$ | . 6 | $9 \cdot$ | $10 \cdot 4$ | If.3 | 12.4 | 13.4 | 14.5 |
| La | $\begin{aligned} & \mathrm{m} . \\ & 27 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 28 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 29 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 30 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 31 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 32 \\ & \hline \end{aligned}$ | $33$ | ${ }_{34}$ | $35$ | $36$ | $\begin{aligned} & \mathrm{m}_{3}^{1} \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 8 \end{aligned}$ | $39$ | $\begin{aligned} & \mathrm{m} . \\ & 40 \\ & \hline \end{aligned}$ | $\frac{\mathrm{m}}{41}$ | ${ }_{42}$ |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $39^{\circ} \mathrm{O}$ | 4 | 44.9 | $48 \cdot 0$ | $5 \mathrm{I} \cdot 2$ | 54.5 |  | $6 \mathrm{I} \cdot$ |  | $68 \cdot 7$ |  | 76.4 | 80.4 | 84.5 | 88.6 |  |
| 36 | $37 \cdot 4$ | $40 \cdot 2^{\circ}$ | $43 \cdot 1$ | $46 \cdot 1$ | 49. | 52.3 | $55 \cdot 6$ | $58 \cdot 9$ | 62.4 | $66 \cdot 0$ | 69.6 | $73 \cdot 3$ | $77 \cdot 2$ | 8 r -I | $85 \cdot 1$ | 89.2 |
| 37 | 35.9 | 38.6 | 41.3 | 44.2 | $47 \cdot 2$ | 50.2 | 53.4 | $56 \cdot 6$ | 59.9 | $63 \cdot 3$ | 66.8 | $70 \cdot 4$ | 74.1 | 77.9 | 8r・ク | 85.7 |
| 38 | $34 \cdot 5$ | 37.0 | $39 \cdot 7$ | 42.4 | $45 \cdot 3$ | $48 \cdot 2$ | 5I•2 | 54.4 | 57•5 | 60.8 | $64 \cdot 2$ | $67 \cdot 6$ | 71.2 | $74 \cdot 8$ | $78 \cdot 5$ | $82 \cdot 3$ |
| 39 | $33^{-1}$ | 35.6 | $38 \cdot 1$ | $40^{\circ}$ | $43 \cdot 5$ | $46 \cdot 3$ | $49 \cdot$ | $52 \cdot 2$ | $55 \cdot 3$ | $58 \cdot 5$ | $61 \cdot 7$ | 65.0 | 68.4 | 71.9 | $75 \cdot 5$ |  |
| 40 | $3 \mathrm{r} \cdot 8$ | 34.2 | 36.7 | 39. | 41.8 | 44. | 47.3 | 50 | 53.2 | $56 \cdot 2$ | 59.3 | 62.5 | $65 \cdot 8$ | 69 | $72 \cdot 6$ | $76 \cdot 1$ |
| 41 | $30 \cdot 6$ | 32.9 | 35.3 | $37 \cdot 7$ | $40 \cdot 2$ | 42 | 45.5 | $48 \cdot 3$ | 51 | 54. ${ }^{\text {I }}$ | 57-1 | 60.2 | 63 | $66 \cdot 5$ | 69.9 | $73 \cdot 3$ |
| 42 | 29.4 | 31 | 33. | $36 \cdot 3$ | $38 \cdot$ | $4 \mathrm{I} \cdot 2$ | $43 \cdot 8$ |  | $49^{\circ} 2$ | $52^{\circ}$ | 54.9 | 57.9 | $60^{\circ}$ | $64^{\circ}$ | $67 \cdot 2$ | $70 \cdot 5$ |
| 43 | 28.3 | $30 \cdot 4$ | $32 \cdot 6$ | 34 | $37 \cdot 2$ | 39 | 42.I | $44^{\circ} 7$ | 47.3 | $50 \cdot 1$ | $52 \cdot 8$ | $55 \cdot 7$ | 58 | $61 \cdot 6$ | $64 \cdot 7$ | $67 \cdot 9$ |
| 44 | 27.2 | 29.3 | 31 | 33 |  | 38.2 | $40 \cdot 6$ |  | $45 \cdot 6$ |  | $50 \cdot 9$ | 53. | 56 | $59 \cdot 3$ | $62 \cdot 3$ | $65 \cdot 3$ |
| 45 | 26.2 | 28.2 | 30.2 | 32 | 34 | $36 \cdot 7$ | 39.0 | 41.4 | 43.9 | $46 \cdot 4$ | $49^{\circ}$ | 51.6 | 54.3 | 57.1 | $60 \cdot 0$ | $2 \cdot 9$ |
| 46 | 25.2 | $27 \cdot 1$ | $29 \cdot 1$ | $31 \cdot \mathrm{I}$ | 33.2 | 35.4 | $37 \cdot 6$ | 39.9 | $42 \cdot 2$ | 44.7 | 47-1 | 49.7 | $52 \cdot 3$ | $55^{\circ}$ | $57 \cdot 8$ | $60 \cdot 6$ |
| 48 | 23.4 | $25 \cdot$ | $26 \cdot 9$ | 28.8 | $30 \cdot 8$ | 32 | $34 \cdot 8$ | $37^{\circ} \mathrm{O}$ | $39^{\circ} 2$ | 41-4 | $43 \cdot 7$ | $46 \cdot \mathrm{I}$ | $48 \cdot 5$ | - | $53 \cdot 6$ | $56 \cdot 2$ |
| 50 | 21.7 | 23.3 | $25^{\circ}$ | $26 \cdot 7$ | $28 \cdot 5$ | 3 | $32 \cdot 3$ | 34. | 3 | 38 | 40'5 | 42.7 | $45^{\circ}$ | $47 \cdot 3$ | $49 \cdot 7$ | 52.1 |
| 52 | $20 \cdot 1$ | 21 | $23 \cdot 1$ | $24^{\prime} 7$ | $26 \cdot 4$ | 28 | 29.9 | 31 | 33 |  | 37 | 39.6 | $4 \mathrm{I} \cdot 7$ | $43 \cdot 8$ | $46 \cdot 0$ | 48.3 |
| 54 | 18.6 | 19 |  | 22. |  | $26 \cdot 0$ | 27 | $29^{\circ} 4$ | $3 \mathrm{I} \cdot \mathrm{I}$ | 32 | 34*7 | $36 \cdot 6$ | 38.6 | $40 \cdot 5$ | $42 \cdot 6$ | $44 \cdot 7$ |
| 56 | 17.1 | 18.4 | 19.8 | 21. | $22 \cdot 6$ | $24^{\circ} \mathrm{O}$ | 25.6 | 27-1 | $28 \cdot 7$ | 30 | $32 \cdot 1$ | $33^{8}$ | $35 \cdot 6$ | 37.5 | $39 \cdot 3$ | $4 \mathrm{I} \cdot 3$ |
| 58 | 15.8 | 17.0 | 18.2 | 19.5 | $20 \cdot 8$ | 22. | 23.6 | $25^{\circ} \mathrm{O}$ | $26 \cdot 5$ | $28 \cdot 0$ | $29^{\prime} 6$ | $3{ }^{3} \mathrm{~F} \cdot 2$ | 32.9 | 34.6 | $36 \cdot 3$ | $38 \cdot 1$ |
| 60 | 14.5 | 15.6 | 16.8 | 17.9 | 19.1 | $20 \cdot 4$ | 21.7 | $23^{\circ} 0$ | 24.4 | $25 \cdot 8$ | 27.2 | 28.7 | 30.2 | 31.8 | $33^{4} 4$ | 35 |
| S. |  |  |  | 48 |  |  | 58 | $61 \cdot 6$ | 65.2 |  |  | 76.6 | $80 \cdot 6$ |  | $88 \cdot 9$ | 2 |
| 28 | $37 \cdot 7$ | $40 \cdot 5$ | 43.4 | $46 \cdot 4$ | 49.6 | 52.8 | $56 \cdot \mathrm{r}$ | 59.5 | 63.0 | $66 \cdot 5$ | $70 \cdot 2$ | 74.0 | 77.9 | 8 r .8 | $85 \cdot 9$ | $90 \cdot \mathrm{r}$ |
| 29 | $36 \cdot$ | $39^{\circ}$ | $42 \cdot 0$ | 44.9 | 47.9 | 51 | 54.2 | 57.5 | $60 \cdot 8$ | 64.3 | 67 | 71.5 | 75.3 | 79.1 | $83^{\circ} 0$ | $87^{\circ}$ |
| 30 | $35 \cdot 2$ | 37 | $40 \cdot 5$ | $43 \cdot 4$ | $46 \cdot 3$ | 49.3 | 5 | $55 \cdot 5$ | 58.8 | 62 | $65 \cdot 6$ | $69 \cdot 1$ | 72.8 | $76 \cdot 5$ | $80 \cdot 3$ | $84^{\circ} 2$ |
| 31 | 34 |  | $39^{-2}$ | 41 | $44^{\circ}$ | 47 | 50 | 55 | 56.9 |  | 63.4 | $66 \cdot 9$ | 70.4 | $74{ }^{\circ}$ | 77.6 | 8 I |
| 32 | 32. | 35.4 | 37.9 | 40 | 43. | $46 \cdot 1$ | 49.0 |  | $55^{\circ} 0$ | 58.1 | 61.4 | 64.7 | $68 \cdot 1$ | $7 \mathrm{7} \cdot 6$ | $75 \cdot 1$ | 78.8 |
| 34 | $30 \cdot 8$ | $33 \cdot 1$ | $35 \cdot 5$ | $38 \cdot 0$ | $40 \cdot 5$ | $43 \cdot 1$ | $45 * 9$ | $48 \cdot 6$ | 51.5 | 54.5 | 57*5 | 60.6 | 63.8 | $67 \cdot 1$ | $70 \cdot 4$ | 73.8 |
| 36 | 28.9 | $31^{\circ} \mathrm{O}$ | $33 \cdot 3$ | $35 \cdot 6$ | 38.0 | $40 \cdot 5$ | $43^{\circ} \mathrm{O}$ | 45.6 | $48 \cdot 3$ | 51.1 | 53.9 | 56.8 | 59.8 | $62 \cdot 9$ | $66 \cdot 1$ | $69 \cdot 3$ |
| 38 | $27 \cdot 1$ | 29.1 | 31.2 | 33.4 | $35 \cdot 6$ | 38.0 | $40 \cdot 3$ | $42 \cdot 8$ | $45 \cdot 3$ | 47.9 | 50 | 53.4 | $56 \cdot 2$ | $59^{\circ} \mathrm{O}$ | 62.0 | $65^{\circ} \mathrm{O}$ |
| 40 | $25 \cdot 4$ | 27.3 | 29.3 | 3 I | 33 | $35 \cdot 6$ | $37 \cdot 9$ | $40 \cdot$ | $42 \cdot 6$ | 45 | $47 \cdot 5$ | 50.I | $52 \cdot 7$ | $55 \cdot 5$ | 58 |  |
| 42 | 23.9 | 25.7 | $27 \cdot 5$ | 29.4 | $3 \mathrm{I} \cdot 4$ | $33 \cdot 5$ | $35 \cdot 6$ | $37 \cdot 7$ | $40 \cdot 0$ | $42 \cdot 3$ | $44 \cdot 6$ | 47-1 | $49 \cdot 5$ | $52 \cdot 1$ | $54^{\circ} 7$ | $57 \cdot 4$ |
| 44 | 22.4 | $2{ }^{24.7}$ | $25^{\circ} 8$ | $27 \cdot 6$ | 29.5 | 31.4 20 | 33.4 | 35.4 | $37 \cdot 5$ | $3{ }^{3 \cdot 7}$ | 41.9 | 44.2 | $46 \cdot 5$ | 48.9 | 51.4 | 53.9 |
| 46 | 21.0 19 | $22 \cdot 6$ 21.2 | 24.2 22.7 | $25 \cdot 9$ 24.3 | 27.7 26.0 | 29.5 27.7 | 31.4 20.4 | $3{ }^{3} \cdot 3.2$ | 35.2 33.1 | 35. | 39.4 36.9 | $41 \cdot 5$ 38.9 | 43.7 41.0 | 45.9 43.1 | $48 \cdot 2$ $45 \cdot 3$ | 50 |
| 50 | 18.5 | 19.9 | 21 | 22.8 | 24.3 | 25.9 | 27.6 | $39 \cdot 3$ | $3 \mathrm{I} \cdot 0$ | ${ }_{32}{ }^{3} 8$ | 34. | 36.5 | 38. | 4 | 45 | 47 |

## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* PROCYON.


TRUE BEARING OR AZIMUTH OF $*$ PROCYON.

| Lat. | ${ }_{4}$ | ${ }_{8} \mathrm{~m}$. | ${ }_{12}$ | ${ }_{16}$ | ${ }_{20}$ | ${ }_{24}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{32} \mathrm{~m}$. | ${ }_{36}$. | ${ }_{40} \mathrm{~m}$. | ${ }_{44}$ | ${ }_{48}$. | ${ }_{52} \mathrm{~m}$. | $\begin{aligned} & \hline \mathrm{m} . \\ & 56 \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 60 \end{aligned}$ | ${ }_{70} \mathrm{~m}$. | 80 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 | 2.4 | $4 \cdot 8$ | $7 \cdot 2$ | 9.5 | ri. 8 | $14 \cdot 1$ | I6.4 | 18.6 | 20.8 | $23^{\circ} \mathrm{O}$ | $25^{\circ} \mathrm{O}$ | 27-1 | $29^{\circ} \mathrm{I}$ | $3 \mathrm{r} \cdot 0$ | $32 \cdot 9$ | $77 \cdot 3$ | - 5 |
| 32 | $2 \cdot 2$ | $4 \cdot 4$ | $6 \cdot 7$ | 8.8 | II• | $13 \cdot 2$ | 15.3 | 17.4 | 19.5 | 2I. 5 | $23 \cdot 5$ | $25 \cdot 4$ | $27 \cdot 3$ | 29.2 | 3 Br - | 35.3 | 39.4 |
| 34 | $2 \cdot 1$ | $4 \cdot 2$ | $6 \cdot 2$ | $8 \cdot 3$ | $10 \cdot 3$ | 12.4 | 14.4 | $16 \cdot 3$ | 18.3 | $20 \cdot 2$ | $22 \cdot 1$ | $23 \cdot 9$ | 25.8 | $27 \cdot 5$ | $29 \cdot 3$ | $33 \cdot 5$ | $37 \cdot 5$ |
| 36 | 2.0 | $3 \cdot 9$ | $5 \cdot 9$ | 7.8 | 9.7 | II•6 | I3. 5 | $15 \cdot 4$ | 17.3 | 19 I | 20.9 | $22 \cdot 7$ | 24.4 | 26•I | 27.8 | $3 \mathrm{r} \cdot 9$ | $35 \cdot 8$ |
| 40 | I. 8 | $3 \cdot 5$ | $5 \cdot 3$ | $7 \cdot 0$ | $8 \cdot 7$ | 10.5 | 2 | 13.9 | $15 \cdot 6$ | 17.2 | 18.9 | $20 \cdot 5$ | 22 | $23 \cdot 7$ | $25 \cdot 3$ | 29.1 | 32.8 |
| 45 | 1.6 | $3 \cdot 7$ | $4 \cdot 7$ | $6 \cdot 2$ | $7 \cdot 8$ | $9 \cdot 3$ | 10.9 | $12 \cdot 4$ | 13.9 | 15.4 | 16.9 | 18.4 | 19.9 | 21.3 | 22.8 | $26 \cdot 3$ | 29.8 |
| 50 | 1.4 | 2.8 | $4 \cdot 3$ | $5 \cdot 7$ | $7 \cdot 1$ | $8 \cdot 5$ | 9.9 | II•3 | 12.7 | 14.1 | 15.4 | 16.8 | I8.2 | $19 \cdot 5$ | $20 \cdot 9$ | 24.2 | $27 \cdot 5$ |
| 60 | 1.2 | $2 \cdot 4$ | 3.7 | 4.9 | 6.1 | $7 \cdot 3$ | 8.5 | $9 \cdot 8$ | Ir 0 | $12 \cdot 2$ | 13.4 | 14.6 | 15.8 | $17^{\circ} \mathrm{O}$ | $\mathbf{1 8 . 2}$ | $21 \cdot 1$ | 24.I |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | 2.3 | $4 \cdot 6$ | 6.9 | 9.2 8.6 | 11.5 $10 \cdot 7$ | 13.7 12.8 | 15.9 14.8 | 18.0 | $20 \cdot 1$ 18.8 | 22.2 | 24.2 | $26 \cdot 1$ | 28.0 | 29.9 | $3 \mathrm{I} \cdot 7$ | 35.9 | ${ }^{39 \cdot 8}$ |
| 22 | $2 \cdot 2$ | $4 \cdot 3$ | $6 \cdot 5$ | $8 \cdot 6$ | $10 \cdot 7$ | 12.8 | 14.8 | $16 \cdot 9$ | 18.8 | $20 \cdot 8$ | $22 \cdot 7$ | $24 \cdot 6$ | $26 \cdot 4$ | $28 \cdot 2$ | 29.9 | $34^{\circ}$ | 37.8 |
| 24 | 2.0 | 4.0 | 6.1 | $8 \cdot 1$ | 10.0 | 12.0 | 14.0 | 15.9 | 17.8 | 19.6 | 21.4 | 23.2 | $25^{\circ}$ | $26 \cdot 7$ | 28.3 | 32.4 | $36 \cdot \mathrm{r}$ |
| 26 | -9 | 3.8 | $5 \cdot 7$ | $7 \cdot 6$ | $9 \cdot 5$ | Ir 3 | 13.2 | 15.0 | 16.8 | 18.6 | $20 \cdot 3$ | $22^{\circ}$ | $23 \cdot 7$ | $25 \cdot 3$ | $27^{\circ}$ | $30 \cdot 8$ | 34.5 |
| 30 | r.7 | 3.4 | 5.I | 6.8 | $8 \cdot 5$ | 10.2 | 11.9 | 13.6 | 15.2 | 16.8 | 18.4 | 20.0 | 21.5 | $23 \cdot 1$ | $24 \cdot 6$ | $28 \cdot 3$ | $3 \mathrm{I} \cdot 8$ |
| 35 | I. 5 | $3 \cdot 1$ | $4 \cdot 6$ | $6 \cdot 1$ | $7 \cdot 6$ | $9 \cdot 2$ | 10.7 | 12.2 | 13.6 | 15. ${ }^{\text {r }}$ | $16 \cdot 6$ | 18.0 | $19 \cdot 5$ | 20.9 | $22 \cdot 3$ | $25 \cdot 7$ | $29^{\circ}$ |
| 45 | r 3 | $2 \cdot 6$ | 3.9 | $5 \cdot 2$ | $6 \cdot 4$ | $7 \cdot 7$ | 90 | $10 \cdot 3$ | II•5 | 12.8 | 14. 1 | 15.3 | $16 \cdot 6$ | 17.8 | $19 \cdot 9$ | 22. | $25^{\prime} 1$ |
| 55 | I•I | $2 \cdot 3$ | $3 \cdot 4$ | $4 \cdot 5$ | $5 \cdot 7$ | 6.9 | $8 \cdot 0$ | 9.1 | $10 \cdot 3$ | 11.4 | 12.5 | 13.7 | 14.8 | 15.9 | 17.0 | 19.8 | 22.5 |


| Lat. | $\frac{\mathrm{m}}{2}$ | m. | ${ }_{8}^{\text {m. }}$ | ${ }_{8}^{\text {m. }}$ | ${ }_{10}^{\mathrm{m} .}$ | ${ }_{12}^{\text {m. }}$ | ${ }_{14}^{\text {m }}$ | ${ }_{16}^{m}$ | ${ }_{18}^{\mathrm{m}}$ |  | ${ }_{21}^{\mathrm{m}}$ | $\frac{m}{22}$ | ${ }_{23}^{\mathrm{m}}$ | ${ }_{24}^{\text {m. }}$ | ${ }_{25}^{m}$ | ${ }_{26}^{\text {m. }}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | $0 \cdot 2$ | 0.8 | IT9 | $3 \cdot 4$ | 5:3 | \% 76 | 1o:3 | 13.4 | 1 7 \% 0 | $2{ }^{2} \cdot$ | ${ }^{23}$ 31 | $25 \cdot 3$ | $27 \cdot 7$ | ${ }_{30} \cdot 1$ | 32.7 |  |
| 42 44 4 | - ${ }_{0}^{0.2}$ | $\stackrel{0}{0} \%$ | ri-7 | 2.8. | 4.4 | - 6.9 | 90.6 | 12:2 | It, |  |  |  | 25.20 | 27: |  | , |
| ${ }_{48}^{46}$ | - | ${ }_{0}^{0.6}$ | ${ }_{1}^{1.4}$ | ${ }_{2}^{2 \cdot 5}$ | ${ }^{4} 17$ | ${ }_{5}^{5 \cdot 3}$ | 7. |  | $\xrightarrow{\text { rin }}$ | ${ }_{\text {I }}^{1}$ - 6 | ${ }^{1}$ | ${ }_{19}^{19.3}$ |  | 21.0 | 24:9 | 9 |
| 50 | $0 \cdot 1$ | $0 \cdot 5$ | 1.2 | 2.1 | 3/3 | $4 \cdot 8$ | 6.6 | $8 \cdot 6$ | 10.9 | 13.4 | 14.8 | $16 \cdot 2$ | I7.7 | $19 \cdot 3$ | $20^{\circ} 9$ | 22.6 |
| ${ }_{54}^{52}$ | $\xrightarrow{\circ} \mathrm{o}$ | -0.5 | ${ }_{\text {r }}^{1} \mathrm{I}$ I | 2:0 | 3.8 | ${ }_{4}^{4.4}$ | 6.0 5.5 | 7.9 | ${ }_{\text {coser }}^{\text {\% }}$ | I2:3 | I3.6 |  | 16.3 | (17\% | 9\% ${ }^{2}$ | -8 |
| 568 | ${ }_{0}$ | ${ }^{0.4}$ | $\stackrel{1}{\circ} \mathrm{O}$ | ${ }_{1}^{1} .6$ | 2.6 | $3 \cdot 7$ | 5. ${ }_{5}$ | $6 \cdot 6$ | $8 \cdot 4$ | ro: 3 | ${ }_{1}^{11}$ | 12:5 |  | ${ }^{14} 9$ |  | 4 |
| ¢88 | ${ }_{0}^{\circ} \mathrm{O}$ | - 0.4 | -0.8 | $\xrightarrow{\text { r. }} \mathrm{r}$ | 2.4 | 3 | $4 \cdot 6$ | 6.5 | 77.7 | ${ }_{8} 9.5$ | ro.4 | ${ }_{\substack{\text { ITO. } \\ \text { IT. }}}$ | I2.5 | 13.6 | 14, ${ }_{1} 1$ | ${ }_{\text {14, }}^{15}$ |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $1 \begin{aligned} & 15 \\ & 16\end{aligned}$ | ${ }_{0}^{0.3}$ | rix | 2.4. | ${ }_{4}^{4} \cdot{ }^{\text {a }}$ | 6.7. 6 | ${ }_{9}^{9 \cdot 7}$ |  | 77. | ${ }_{2}^{21.6}$ | ${ }_{25}^{26 \cdot 7}$ | 29.4 | $32 \cdot 2$ <br> $3 \mathrm{~s} \cdot \mathrm{O}$ | 35:2, | $38 \cdot 3$ 36.9 | 41.5 | ${ }_{4}^{4} \cdot{ }_{4} \cdot 8$ |
| 18 | 0.2 | $\bigcirc$ | $2 \cdot 1$ | ${ }_{3}^{4.8}$ | 6.0. | 8 | 11.7 | S |  | $23: 9$ | 20.3 | 38. 28.9 | 35.6 | - |  | 速 40.2 |
| 22 | -0.2 | 0.8 | - | ${ }_{3}{ }_{3}$ | $5 \cdot 2$ | ${ }_{7} 8.5$ | ¢10.3 | 1434 | 16.9 | 20.9 | ${ }_{23}^{24 .}$ | ${ }_{25 \cdot 3}^{27.0}$ | 29,6 |  | 32.6 | $35^{2}$ |
| 24 | 0. | 0.8 | + | ${ }^{3}$ | $4 \cdot 9$ | 76 | 9.6 | 12.6 | $15 \cdot 9$ | 18.6 | $2{ }^{2} \cdot 6$ | 23.7 | 25.9 | 28.2 | 30.6 |  |
| 28 | $\bigcirc$ | $\stackrel{0}{0} \mathrm{O}$ | +1.5 | 2:8 |  | - ${ }_{\text {c. }}^{6.3}$ | 8.5 |  | 14.9 |  | I9, | 22:3 | 24.9 | 25.5 | 28.8 | 31. |
| 30 32 30 | - 0.1 | ${ }_{0}^{0.6}$ | ${ }_{\text {r }}^{1} \mathrm{I} \cdot \mathrm{L}$ | ${ }_{2}^{2.6}$ | 4.9 | 5.9 | ${ }_{8}^{8.6}$ | 10.5 |  | 16.4 | I8.1 | 19.88 18.7 | ${ }^{22} \times 1.6$ | 23:6 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 35 40 50 | -1. | $\stackrel{\text { O. }}{0.5}$ | cir | 2.38 | $3 \cdot 3$ | ${ }_{4}^{5 \cdot 4}$ | 7\% | $9 \cdot 9$ | 115.5 | ${ }^{2 \cdot 3}$ | I5.7 | IT 17.2 | IR.8 |  | 22.2. |  |
| 50 | $\stackrel{\text { or }}{0 \cdot 1}$ | ${ }^{0.4}$ | -0.6 | $\xrightarrow{\text { r. }} \mathrm{r}$ |  | ${ }^{3} 3$ | ${ }_{3}^{4 \cdot 5}$ | 5.9 |  | 9.3 |  | 11.2 | +12:9 | 3:6 |  | 6 |


|  | ${ }_{27}^{\mathrm{m}}$ | ${ }_{28}^{\mathrm{m}}$ | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | ${ }_{38} \mathrm{~m}$ | 39 |  | 1 | 42 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTI |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| O |  | $40^{\circ} 9$ | 43.8 | $46 \cdot 8$ | 50.0 |  |  |  |  |  | $70 \cdot 7$ |  | $8 \cdot 4$ | $22 \cdot 4$ | . |  |
| 41 | $36 \cdot 3$ | 39.0 | 41.8 | $44 \cdot 7$ | $47 \cdot 7$ |  |  |  |  | $64 \cdot 0$ |  | 1 I I.2 | I4.9 | 18.7 | $22 \cdot 6$ |  |
| +2 |  |  |  |  |  |  |  |  | 57.9 |  |  |  |  | I5 | I 18.9 |  |
| 43 |  |  |  |  |  |  |  |  |  | 56 |  |  |  |  | I 1815.5 | I 19.2 <br> I I 5.8 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | $45 \cdot 8$ |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | $43 \cdot 9$ | 46.4 | 49-1 |  |  |  |  |  |  |
|  |  |  | $30^{\circ} 6$ |  | $35^{\circ}$ | 37 |  |  | 44 |  | 49 | - 52:3 | - 55 | $57 \cdot 9$ |  |  |
|  | 24.4 | 26 | $28 \cdot 1$ | $3{ }^{\circ} \mathrm{I}$ | $32 \cdot 1$ |  |  | 38.5 |  | 43 | 45 |  | - $50 \cdot 6$ | - $53 \cdot 2$ | - 55.8 |  |
|  |  |  |  | $27 \cdot 6$ |  |  |  |  |  | 39.6 | 41.8 | - $44 . \mathrm{I}$ | - 46.4 | - 48.8 | - $51 \cdot 3$ | - 53.8 |
|  | 20.5 |  | 23 | 25 |  |  |  |  |  |  |  | - 40.5 |  |  |  |  |
|  | $17 \cdot 2$ | 18. | 19.8 | 21.2 | $22 \cdot 7$ |  | $25 \cdot 7$ | $27 \cdot 2$ |  |  | 32 | 34.0 | 35 | - |  |  |
|  | $15 \cdot 7$ | 16.9 | 18.1 | 19.4 | $20 \cdot 7$ | $22^{\circ}$ | 23.4 | 24.9 | $26 \cdot 4$ | 27 | $29^{\prime} 4$ | - 31. | 32. | 4.4 | - 36.1 | - $37 \cdot 9$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 42•5 | ${ }_{45}^{46 \cdot 6}$ | 49.9 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 37 | 40.8 | $43 \cdot 7$ | 46 |  | 53 |  |  |  |  |  | 14 | 18 |  |  |  |
| 23 |  | 1 | 42 | $45 \cdot 3$ |  |  |  |  |  |  |  | - | 116. | 1 I 9.8 | 123.8 |  |
|  | 35 | 38 |  | 43 |  | 49 | 5 |  | $59 \cdot 5$ |  |  | 1100 |  | 1 I7\% | I 21.3 |  |
|  | 34 |  |  | 42 | 45 | $48 \cdot 4$ |  |  |  |  |  |  | $1{ }_{1}^{15} 5$ | 15.1 |  |  |
|  | $33 \cdot 5$ 31.6 |  | $\begin{aligned} & 38 . \\ & 36 . \end{aligned}$ | 41 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 32.0 | $34 \cdot$ | 36 |  |  |  | 4 | 4 |  |  | 58.6 |  |  |  | $1 \mathrm{II} \cdot 5$ |
|  |  | 30 | $32 \cdot 4$ | 34 | 37 |  |  |  | 47 |  |  |  | - 58.3 |  |  |  |
|  | 26.6 | 28.6 |  | 32.8 |  |  |  |  |  |  |  | - | 55 | - 58.0 |  |  |
|  | 25 | ${ }^{27} 5$ | 29.0 |  | 33. | $35 \cdot 2$ |  |  |  | 44.5 |  |  | - 52.2 | - 54.8 | - 57.6 |  |
|  |  |  |  |  | 29 |  |  |  |  |  |  |  | - 49 |  |  |  |
|  |  |  |  |  |  | $\left[\begin{array}{l} 31 \\ 29 \end{array}\right.$ |  |  |  |  | - | - 0 | - $44 \cdot 2$ |  |  | - $51 \cdot \mathrm{I}$ |
|  |  |  |  | 2 | $26 \cdot 4$ |  |  |  |  |  |  | - 39.6 | - 4r.7 |  | - $46 \cdot \mathrm{I}$ | O 48.4 |
|  |  |  |  |  |  |  |  |  |  |  |  | 35 | \| | - ${ }^{\circ} \begin{aligned} & 41.5 \\ & 0 \\ & 0\end{aligned}$ |  |  |
|  | $16^{\circ} 9$ | 18.1 | 19.4 | 20.8 | $22 \cdot 2$ | $23 \cdot 7$ | $25^{2}$ | 26.7 | $28 \cdot 3$ | 29.9 | ${ }_{31}{ }^{\text {r }}$ | - 33.3 | - $35 \cdot \mathrm{x}$ | - 36.9 | - 38.8 | $\bigcirc{ }^{\circ} 40$. |

## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* REGULUS.


TRUE BEARING OR AZIMUTH OF $*$ REGULUS.

| Lat. | ${ }_{4}$ | ${ }_{8} \mathrm{~m}$ | ${ }_{12}$. | ${ }_{16}^{\mathrm{m}}$. | ${ }_{20}^{\mathrm{m}}$ | ${ }_{24}$ | ${ }_{28}$ | ${ }_{32} \mathrm{~m}$. | m. 36 | m. 40 | ${ }_{4}^{\mathrm{m}} 4$ | ${ }_{48}$ | ${ }_{52}$ | ${ }_{56}$. | ${ }_{60}$. | $\frac{\mathrm{m}}{70}$ | ${ }_{80}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | $2 \cdot 0$ | 4.0 | 6.0 | $7 \cdot 9$ | 9.9 | $\mathrm{II}^{1} 8$ | 13.8 | $15 \cdot 7$ | 17.5 |  | $2 \mathrm{I} \cdot 2$ | $23 \cdot 0$ | $24^{\circ} \cdot 8$ | $20^{\circ} \cdot 6$ | $28^{\circ} \cdot 3$ | $\stackrel{\circ}{2} 5$ | ${ }^{\circ} \cdot$ |
| 42 | I.9 | $3 \cdot 7$ | $5 \cdot 6$ | $7 \cdot 5$ | $9 \cdot 3$ | 11.2 | 13.0 | 14.8 | 16.6 | 18.4 | 20.1 | 21.8 | $23 \cdot 5$ | $25^{2}$ | $26 \cdot 9$ | $30 \cdot 9$ | 34.8 |
| 44 | I.8 | $3 \cdot 5$ | $5 \cdot 3$ | 7-1 | $8 \cdot 8$ | 10.6 | $12 \cdot 3$ | $14^{\circ} \mathrm{O}$ | 15.8 | 17.4 | 19•I | 20.8 | 22.4 | $24^{\circ} \mathrm{O}$ | $25 \cdot 6$ | $29 \cdot 5$ | 33.3 |
| 46 | I.7 | 3.4 | $5 \cdot 1$ | 6.7 | $8 \cdot 4$ | $10 \cdot 1$ | II•7 | 13.4 | 15.0 | $16 \cdot 6$ | 18.2 | 19.8 | 21.4 | 23.0 | $24 \cdot 5$ | 28.3 | $3 \mathrm{I} \cdot 9$ |
| 50 | I. 5 | 3.1 | 4.6 | $6 \cdot 2$ | $7 \cdot 7$ | 9.2 | 10.7 | 12.2 | 13.8 | 15.2 | 16• | 18.2 | $19 \cdot 7$ | $2 \mathrm{I} \cdot 1$ | 22.6 | $26 \cdot 1$ | $29 \cdot 6$ |
| 55 | 1.4 | $2 \cdot 8$ | $4 \cdot 2$ | $5 \cdot 6$ | 7.0 | $8 \cdot 4$ | 9.8 | I | 12.5 | 13.9 | I5.3 | 16.6 | $18 \cdot 0$ | 19.3 | $20 \cdot 7$ | $24^{\circ}$ | $27 \cdot 2$ |
| 60 | 1.3 | 2.6 | 3.9 | 5.2 | $6 \cdot 4$ | $7 \times 7$ | 9.0 | $10 \cdot 3$ | 11.6 | $12 \cdot 8$ | 14. 1 | 15.4 | 16.6 | 17.9 | 19•1 | $22 \cdot 3$ | $25 \cdot 3$ |
| S. |  | $4 \cdot 6$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 | 2.2 | 4 | 6.9 6.6 | 9.1 8.8 | 11.3 | 13.5 13.1 | $15 \%$ 15.2 | 17.8 17.2 | 19.9 19.2 | 21.9 21.2 | $23 \cdot 9$ 23.1 | $25 \cdot 8$ $25^{\circ} \mathrm{O}$ | 27.7 26.9 | 29.5 28.6 | $31 \cdot 3$ $30 \cdot 4$ | 35.4 34.4 | 39.2 38.2 |
| 18 | 1 | $4 \cdot 1$ | $6 \cdot 2$ | $8 \cdot 2$ | 10.3 | 12.3 | 14.2 | $16 \cdot 2$ | $18 \cdot 1$ | 19.9 | $2 \mathrm{I} \cdot 8$ | 23.6 | $25 \cdot 3$ | $27 \cdot 1$ | 28.7 | $32 \cdot 7$ | 36.4 |
| 20 | I'9 | 3.9 | $5 \cdot 8$ | 7.6 | $9 \cdot 7$ | II 5 | 13.4 | 15.3 | $17 \cdot 1$ | I 8. | 20.6 | $22 \cdot 3$ | $24^{\circ}$ | 25.7 | $27 \cdot 3$ | $31 \cdot 1$ | 34.7 |
| 25 | 1.7 | $3 \cdot 4$ | 5.1 | $6 \cdot 8$ | $8 \cdot 5$ | 10.1 | II 8 | 13.4 | 15.0 | 16.6 | 18.2 | 19.7 | 21.3 | 22.8 | $24 \cdot 3$ | 27.9 | 3I•3 |
| 30 | 1.5 | 3 | $4 \cdot 5$ | 6.1 | $7 \cdot 6$ | 9.1 | 10.5 | 12.0 | 13.5 | 14.9 | $16 \cdot 4$ | 17.8 | 19.2 | $20 \cdot 6$ | $22^{\circ}$ | $25 \cdot 3$ | 28.6 |
| 35 | 1.4 | 2.8 2.6 | 4.1 | 5.5 | $6 \cdot 9$ | $8 \cdot 3$ | $9 \cdot 6$ | II•O | 12.3 | $13 \cdot 7$ | $15^{\circ} \mathrm{O}$ | 16.3 | 17.6 | 18.9 | $20 \cdot 2$ | 23.3 | $26 \cdot 4$ |
| 40 | I.3 | $2 \cdot 6$ | 3.8 | $5 \cdot 1$ | $6 \cdot 4$ | $7 \cdot 6$ | $8 \cdot 9$ | 10.2 | II 4 | $12 \cdot 7$ | 13.9 | $15 \cdot 1$ | 16.4 | $17 \cdot 6$ | 18.8 | 21.8 | $24 \cdot 7$ |
| 45 | I.2 | 2.4 | 3.6 | $4 \cdot 8$ | $6 \cdot 0$ | 7.2 | $8 \cdot 3$ | $9 \cdot 5$ | $10 \cdot 7$ | II•9 | 13.0 | 14.2 | 15.4 | 16.5 | 17.7 | 20.5 | 23.3 |
| 50 60 | r. 0 | $2 \cdot 3$ $2 \cdot 1$ | 3. | $4 \cdot 5$ | $5 \cdot 7$ | $6 \cdot 8$ | 7.9 | $9 \cdot 0$ | $10 \cdot 1$ | II 3 | 12.4 | 13.5 | 14.6 | 15.7 | 16.8 | 19.5 | 22.2 |
|  | I. 0 | $2 \cdot 1$ | $3 \cdot 1$ | $4 \cdot 2$ | $5 \cdot 2$ | $6 \cdot 3$ | $7 \cdot 3$ | $8 \cdot 3$ | $9 \cdot 4$ | $10 \cdot 4$ | 11.5 | 12.5 | 13.5 | 14.6 | 15.6 | 18.2 | 20.7 |

## reduction to the merdian table for hour-angles from upper meridian.

* RIGEL.

| Lat. | ${ }_{2} \mathrm{~m}$. | m. 4 | ${ }_{8}$. | ${ }_{8} \mathrm{~m}$. | 10 | 1 m. | ${ }_{14}$ | 16 | $\mathrm{m}_{18}$ | ${ }_{20}$ | ${ }_{21}$ | m. | ${ }_{23} \mathrm{~m}$ | ${ }_{24}$ | $\mathrm{m}_{25}$ | ${ }_{26}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N - REDUCTIONS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 0.2 | r.0 | $2 \cdot 3$ | $4 \cdot \mathrm{I}$ | $6 \cdot 4$ | $9 \cdot 2$ | 12.5 | 16.3 | $20 \cdot 7$ | $25 \cdot 5$ | $28 \cdot 1$ | $30 \cdot 8$ | . 7 | 36.6 | -7 | 2.9 |
| 22 | 0.2 | 0.9 | $2 \cdot 1$ | $3 \cdot 8$ | $5 \cdot 9$ | $8 \cdot 5$ | $1 \mathrm{I} \cdot 6$ | 15.2 | 19.2 | 23.6 | $26 \cdot 1$ | 28.6 | $3 \mathrm{I} \cdot 2$ | 34.0 | $36 \cdot 9$ | $39 \cdot 8$ |
| 24 | 0.2 | $0 \cdot 9$ | 2.0 | $3 \cdot 5$ | $5 \cdot 5$ | $7 \times 9$ | 10.8 | $14 \cdot 1$ | 17.9 | $22 \cdot 0$ | 24.3 | $26 \cdot 6$ | $29 \cdot 1$ | 31.7 | $34 \cdot 3$ | $37 \cdot 1$ |
| 26 | 0.2 | 0.8 | r.8 | $3 \cdot 3$ | $5 \cdot 2$ | $7 \cdot 4$ | 10.1 | 13.2 | 16.7 | $20 \cdot 6$ | $22 \cdot 7$ | 24.9 | 27.2 | 29.6 | $32 \cdot \mathrm{r}$ | $34^{6}$ |
| 28 | 0.2 | $0 \cdot 8$ | I.7 | $3 \cdot 1$ | $4 \cdot 8$ | $6 \cdot 9$ | 9.4 | $12 \cdot 3$ | 15.6 | 19.2 | $2 \mathrm{I} \cdot 2$ | 23.3 | 25.4 | 27.7 | $30^{\circ} 0$ | 32.4 |
| 30 | 0.2 | $0 \cdot 7$ | I.6 | $2 \cdot 9$ | $4 \cdot 5$ | $6 \cdot 5$ | 8.8 | İ 5 | 14.6 | 18.0 | 19.9 | 2 F .8 | 23.8 | 25.9 | $28 \cdot 1$ | $30 \cdot 4$ |
| 32 | 0.2 | $0 \cdot 7$ | r.5 | $2 \cdot 7$ | $4 \cdot 2$ | $6 \cdot 1$ | $8 \cdot 3$ | ro. 8 | 13.7 | 16.9 | r8.6 | $20 \cdot 5$ | 22.4 | 24.3 | 26.4 | 28.5 |
| 34 | $0 \cdot 2$ | $\bigcirc$ | $\mathrm{r} \cdot 4$ | $2 \cdot 5$ | $4{ }^{\circ} \mathrm{O}$ | $5 \cdot 7$ | $7 \cdot 8$ | 10.2 | 12.9 | 15.9 | 17.5 | 19.2 | $21^{\circ} \mathrm{O}$ | $22 \cdot 9$ | 24.8 | 26.8 |
| 36 | $\bigcirc \cdot 1$ | $0 \cdot 6$ | I. 3 | 2.4 | $3 \cdot 7$ | 5.4 | $7 \cdot 3$ | $9 \cdot 6$ | 12.I | 15.0 | 16.5 | 18.1 | 19.8 | $2 \mathrm{~F} \cdot 5$ | 23.4 | 25.3 |
| 40 | $\bigcirc$ | $0 \cdot 5$ | I. 2 | $2 \cdot \mathrm{I}$ | $3 \cdot 3$ | $4 \cdot 8$ | $6 \cdot 5$ | $8 \cdot 5$ | $10 \cdot 8$ | 13.3 | 14.6 | 16.0 | 17.5 | 19.1 | $20 \cdot 7$ | 22.4 |
| 50 | O.I | $0 \cdot 4$ | $0 \cdot 9$ | r.6 | 2.4 | $3 \cdot 5$ | $4 \cdot 8$ | $6 \cdot 2$ | $7 \cdot 9$ | $9 \cdot 7$ | 10.7 | II.8 | 12.9 | 14.0 | 15.2 | r6.5 |
| 60 | O.I | $0 \cdot 3$ | $0 \cdot 6$ | $\mathrm{x} \cdot \mathrm{I}$ | I•7 | $2 \cdot 5$ | 3.4 | 4.4 | $5 \cdot 6$ | $6 \cdot 9$ | $7 \cdot 7$ | $8 \cdot 4$ | $9 \cdot 2$ | ro.o | 10.9 | Ir 8 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 | $0 \cdot 2$ | $1 \times 0$ | $2 \cdot 2$ | 3.9 | $6 \cdot 2$ | $8 \cdot 9$ | 12.1 | 15.7 | 19.9 | $24 \cdot 6$ | 27.1 | 29.7 | 32.4 | $35 \cdot 3$ | $38 \cdot 2$ | $4 \mathrm{x} \cdot 3$ |
| 36 | 0.2 | 0.9 | $2 \cdot 0$ | $3 \cdot 6$ | $5 \cdot 6$ | $8 \cdot 1$ | - | 14.4 | 18.2 | 22.4 | $2{ }^{24.7}$ | 27.1 | $29^{\circ} 6$ | $32 \cdot 2$ | 34.9 | $37 \cdot 7$ |
| 38 | $0 \cdot 2$ | 0.8 | 1.8 | $3 \cdot 3$ 3.0 | $5 \cdot 1$ | $7 \cdot 4$ | $10 \cdot 1$ | 13.1 | $16 \cdot 6$ | $20 \cdot 5$ | $22 \cdot 6$ | 24.8 | $27 \cdot 1$ | 29.4 | 31.9 | $34 \cdot 5$ |
| 40 | $0 \cdot 2$ | $0 \cdot 7$ | 1.7 | 3.0 2.8 | $4 \cdot 7$ | $6 \cdot 8$ | 9.2 | 12.0 | 15.2 | 18.8 | $20 \cdot 7$ | 22.7 | 24.8 | $27^{\circ}$ | $29 \cdot 3$ | $3 \mathrm{I} \cdot 6$ |
| 42 | 0.2 | 0.7 | 1.6 | 2.8 2.5 | $4 \cdot 3$ | $6 \cdot 2$ | $8 \cdot 5$ 7 | IITI | 14.0 | 17.3 | $19^{\circ} \mathrm{O}$ | 20.9 | 22.8 | 24.8 | $26 \cdot 9$ | $29 \cdot \mathrm{r}$ |
| 44 | 0.2 | 0.6 | 1.4 | $2 \cdot 5$ | $4 \cdot 0$ | $5 \cdot 7$ | $7 \cdot 8$ | 10.2 | 12.9 | 15.9 | 17.5 | 19.2 | 21.0 | 22.9 | 24.8 | 26.8 |
| 46 | $0 \cdot 1$ | 0.6 | $1 \cdot 3$ | $2 \cdot 3$ | 3.7 | $5 \cdot 3$ | 7.2 | $9 \cdot 4$ | Ir.9 | 14.7 | 16.2 | 17.7 | 19.4 | 21.1 | 22.9 | 24.7 |
| 48 | O. I | $0 \cdot 5$ | $1 \cdot 2$ | 2.2 | $3 \cdot 4$ | $4 \cdot 9$ | $6 \cdot 6$ | $8 \cdot 7$ | Ir.O | 13.5 | 14.9 | 16.4 | 17.9 | 19.5 | $21 \cdot 1$ | $22 \cdot 8$ |
| 50 | $\bigcirc \cdot 1$ | 0.5 | I.I | $2 \cdot 0$ | $3 \cdot 1$ | $4 \cdot 5$ | $6 \cdot 1$ | $8 \cdot 0$ | $10 \cdot 1$ | 12.5 | 13.8 | 15.1 | 16.5 | 18.0 | $19 \cdot 5$ | $2 \mathrm{I} \cdot \mathrm{I}$ |
| 52 | $\bigcirc \cdot 1$ | 0.5 | 1.0 | 1.8 | 2.9 | $4 \cdot 1$ $3 \cdot 8$ | $5 \cdot 6$ | 7.4 | 8.3 | 11.5 | 12.7 | 13.9 | 15.2 | $16 \cdot 6$ | ${ }^{18 \cdot 0}$ | $19 \cdot 4$ |
| 54 56 | O.1 | 0.4 0.4 | 0.9 0.9 | r-7 $\times 6$ | 2.7 2.4 | 3.8 3.5 | $5 \cdot 2$ $4 \cdot 8$ | $6 \cdot 8$ $6 \cdot 3$ | 8.6 7.9 | 10.6 0.8 | 12.7 10.8 | 12.8 | $14^{\circ} \mathrm{O}$ | $15 \cdot 3$ | 16.6 | 17.9 |
| 56 | $0 \cdot 1$ | $0 \cdot 4$ | - 09 | $1 \cdot 6$ | 2.4 | $3 \cdot 5$ | $4 \cdot 8$ | $6 \cdot 3$ | $7 \cdot 9$ | 9.8 | 10. | II | 12.9 | 14.0 | 15.2 | 16.5 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | 400 | $42 \cdot 9$ | $46 \cdot 0$ | 49.2 | $52 \cdot 5$ | 5.9 | 59.4 | 63.0 | 66́.7 | $70 \cdot 5$ | 74.4 | 78 | 82.5 | 86.6 | 20.9 | $5 \cdot 3$ |
| 25 | 38.6 | $41 \cdot 5$ | $44 \cdot 5$ | $47 \cdot 5$ | $50 \cdot 7$ | 54.0 | $57 \cdot 4$ | 60.9 | $64 \cdot 5$ | $68 \cdot \mathrm{I}$ | $7 \mathrm{I} \cdot 9$ | $75 \cdot 8$ | $79 \cdot 7$ | 83.8 | $87 \cdot 9$ | $92 \cdot 2$ |
| 26 | $37 \cdot 3$ | $40 \cdot \mathrm{I}$ | $43^{\circ} \mathrm{O}$ | $46 \cdot 0$ | $49^{\circ}$ | $52 \cdot 2$ | $55 \cdot 5$ | $58 \cdot 9$ | $62 \cdot 3$ | 65.9 | $69 \cdot 5$ | 73.3 | $77 \cdot 1$ | $8 \mathrm{I} \cdot 0$ | 85•1 | 89.2 |
| 27 | $36 \cdot \mathrm{r}$ | 38.8 | $4 \mathrm{I} \cdot 6$ | 44.5 | $47 \cdot 5$ | $50 \cdot 5$ | 53.7 | $57 \cdot 0$ | $60 \cdot 3$ | $63 \cdot 8$ | $67 \cdot 3$ | $70 \cdot 9$ | $74 \cdot 6$ | $78 \cdot 4$ | 82.3 | $86 \cdot 3$ |
| 28 | 34.9 | $37 \cdot 5$ | $40 \cdot 2$ | $43^{\circ}$ | 45.9 | $48 \cdot 9$ | 52.0 | 55.1 | $58 \cdot 4$ | 6I•7 | $65 \cdot 1$ | $68 \cdot 7$ | $72 \cdot 3$ | $75 \cdot 9$ | $79 \cdot 7$ | $83 \cdot 6$ |
| 30 | $32 \cdot 8$ | $35 \cdot 2$ | $37 \cdot 7$ | $40 \cdot 4$ | $43 \cdot 1$ | 45.9 | $48 \cdot 7$ | $51 \cdot 7$ | 54.8 | 57.9 | $6 \mathrm{r} \cdot \mathrm{I}$ | 64.4 | 67.8 | $71 \cdot 3$ | 74.8 | 78.5 |
| 32 | 30.8 | $33^{\cdot 1}$ | 35.5 | 37.9 | $40 \cdot 5$ | $43 \cdot 1$ | $45 \cdot 8$ | $48 \cdot 6$ | $5 \mathrm{I}^{-5}$ | 54.4 | 57.4 | $60 \cdot 5$ | $63 \cdot 7$ | 67.0 | $70 \cdot 3$ | $73 \cdot 8$ |
| 34 | 28.9 | 3I'r | 33.3 | $35 \cdot 6$ | $38 \cdot 0$ | $40 \cdot 5$ | $43 \cdot 1$ | $45 \cdot 7$ | $48 \cdot 4$ | $51^{\circ} 2$ | $54^{\circ}$ | 57.0 | $60 \cdot 0$ | 63.0 | $66 \cdot 2$ | $69 \cdot 4$ |
| 36 | 27.2 25.6 | 29.3 | 31.4 29 | 33.6 | $35 \cdot 8$ | $38 \cdot 1$ | $40 \cdot 5$ | $43^{\circ} \mathrm{O}$ | $45 \cdot 6$ | $48 \cdot 2$ | $50 \cdot 9$ | 53.6 | 56.4 | 59.3 | 62.3 | $65 \cdot 4$ |
| 38 | 25.6 | $27 \cdot 5$ | 29.5 | $3 \mathrm{I} \cdot 6$ | 33.7 | $35 \cdot 9$ | $38 \cdot 2$ | $40 \cdot 5$ | $42 \cdot 9$ | $45 \cdot 4$ | $47 \cdot 9$ | $50 \cdot 5$ | $53 \cdot 2$ | 55.9 | $58 \cdot 7$ | 6 |
| 40 | $24^{.1}$ | 25.9 | 27.8 | $29 \cdot 7$ | 3x-8 | 33.8 | 36.0 | $38 \cdot 1$ | $40 \cdot 4$ | 42.7 | $45^{-1}$ | $47 \cdot 6$ | 50.1 | $52 \cdot 7$ | $55 \cdot 3$ | $58 \cdot 0$ |
| 42 | 22.7 | 24.4 | $26 \cdot 2$ | 28.0 | 29.9 | $3{ }^{1} \cdot 9$ | 33.9 | 35.9 | 38-I | $40 \cdot 3$ | $42 \cdot 5$ | $44 \cdot 8$ | 47.2 | $49 \cdot 6$ | $52 \cdot \mathrm{I}$ | $54 \cdot 7$ |
| 44 | 21.4 | $23^{\circ} \mathrm{O}$ | $24^{2} 7$ | 26.4 | $28 \cdot 2$ | $30^{\circ}$ | $3 \mathrm{I} \cdot 9$ | $33 \cdot 8$ | $35 \cdot 8$ | $37 \cdot 9$ | $40 \cdot 0$ | $42 \cdot 2$ | 44.4 | $46 \cdot 7$ | $49 \cdot 1$ | 51.5 |
| 46 | $20 \cdot 1$ | 21.6 | 23.2 | 24.8 | $26 \cdot 5$ | 28.2 | $30 \cdot 0$ | $3 \mathrm{I} \cdot 9$ | $33 \cdot 7$ | $35 \cdot 7$ | $37 \cdot 7$ | $39 \cdot 7$ | $4 \mathrm{r} \cdot 8$ | $44^{\circ}$ | $46 \cdot 2$ | 48.5 |
| 48 | 18.9 | $20 \cdot 3$ | 2 r 8 | $23 \cdot 3$ | 24.9 | $26 \cdot 6$ | 28.2 | $30 \cdot 0$ | 3r•7 | $33 \cdot 6$ | $35 \cdot 5$ | $37 \cdot 4$ | $39 \cdot 4$ | 41.4 | $43 \cdot 5$ | $45 \cdot 6$ |
| 50 | 17.8 | 19.1 | 20.5 | 21.9 | 23.4 | 25.0 | $26 \cdot 5$ | $28 \cdot 2$ | 29.8 | $3 \mathrm{r} \cdot 5$ | $33 \cdot 3$ | $35^{\prime}$ I | 37.0 | 38.9 | $40 \cdot 9$ | $42 \cdot 9$ |
| 52 | 16.7 | 17.9 16.8 | 19.2 | $20 \cdot 6$ | $22 \cdot 0$ | 23.4 | 24.9 | $26 \cdot 4$ | $28 \cdot 0$ | $29 \cdot 6$ | $3 \mathrm{r} \cdot 3$ | $33^{\circ}$ | $34 \cdot 7$ | $36 \cdot 5$ | 38.4 | $40 \cdot 2$ |
| 54 | 15.6 | 16.8 | $18 \cdot 0$ | 19.3 | $20 \cdot 6$ | 21.9 20.5 | $23 \cdot 3$ | $24^{\circ} 7$ | 26 | 27.7 | 29.3 | $30 \cdot 9$ | 32.5 | 34.2 | 35.9 | $37 \cdot 7$ |
| 56 60 | 14.6 12.7 | 1507 13.6 | 16.9 14.6 | 18.0 15.6 | 19.3 16.7 | 20.5 17.8 | $2 \mathrm{I} \cdot 8$ | $23 \cdot 1$ | 24.5 | 25.9 | 27.4 | $28 \cdot 9$ | $30 \cdot 4$ | $32 \cdot 0$ | $33 \cdot 6$ | $35 \cdot 3$ |
|  | 12. | - | 14 | 156 |  |  | 1 | $20 \cdot 1$ | 2 F 3 | $22 \cdot 5$ | 23. | 25.1 | 26.4 | $27 \cdot 8$ | $29 \cdot 2$ | 30.6 |
| 36 | $40 \cdot 6$ | $43 \cdot 6$ | $46 \cdot 7$ | $49^{\circ} 9$ | 53.3 | $56 \cdot 7$ | 60.2 | 63.9 | $67 \cdot 6$ | 71.5 | $75 \cdot 4$ | 79.4 | 83.6 | $87 \cdot 8$ | $92 \cdot 1$ | $96 \cdot 5$ |
| 37 | $38 \cdot 8$ | $4 \mathrm{I} \cdot 7$ | $44 \cdot 7$ | $47 \cdot 8$ | $5 \mathrm{I}^{\circ} \mathrm{O}$ | 54.3 | 57.6 | $6 \mathrm{r} \cdot \mathrm{r}$ | $64 \cdot 7$ | 68.4 | $72 \cdot 1$ | 76.0 | $80 \cdot 0$ | $84^{\circ} \mathrm{O}$ | 88.2 | 92.4 |
| 38 | 37.2 | 39.9 | $42 \cdot 8$ | $45 \cdot 7$ | $48 \cdot 8$ | $52 \cdot 0$ | $55^{\circ} 2$ | $58 \cdot 5$ | $62 \cdot 0$ | $65 \cdot 5$ | $69 \cdot 1$ | $72 \cdot 8$ | 76.6 | $80 \cdot 5$ | 84.5 | $88 \cdot 6$ |
| 39 | $35^{3} \cdot 6$ | 38 | 41.0 | $43 \cdot 8$ | $46 \cdot 7$ | 49.8 | $52 \cdot 9$ | $56 \cdot \mathrm{I}$ 53.8 | 59.4 | 62.8 | $66 \cdot 2$ | 69.8 | 73.4 | $77 \cdot 2$ | $8 \mathrm{Ir}^{\circ} \mathrm{O}$ | $84 \cdot 9$ |
| 40 | 34. 1 | $36 \cdot 6$ | $39 \cdot 3$ | $42 \cdot 0$ | $44 \cdot 8$ | $47 \cdot 7$ | 50•7 | 53.8 | 56.9 | $60 \cdot 2$ | $63 \cdot 5$ | 66.9 | $70 \cdot 4$ | $74^{\circ}$ | $77 \cdot 7$ | 8I.5 |
| 41 | 32.7 | 35.2 | $37 \cdot 7$ | $40 \cdot 3$ | $43^{\circ} \mathrm{O}$ | $45 \cdot 8$ | $48 \cdot 6$ | 51.6 | 54.6 | 57•7 | $60 \cdot 9$ | 64.2 | 67.6 | 71.0 | 74.6 | 78.2 |
| 42 | 31.4 | $33^{3} 7$ | $36 \cdot 1$ | $38 \cdot 6$ | $4 \mathrm{x} \cdot 2$ | 43.9 | $46 \cdot 7$ | $49 \cdot 5$ | 52.4 | 55.4 | $58 \cdot 5$ | $6 \mathrm{I} \cdot 6$ | 64.9 | 68.2 | $7 \mathrm{I} \cdot 6$ | $75 \cdot 0$ |
| 43 | $30 \cdot 1$ | 32.4 | $34^{\circ} 7$ | $37 \cdot 1$ | $39^{6} 6$ | $42 \cdot \mathrm{I}$ | $44 \cdot 8$ | $47 \cdot 5$ | $50 \cdot 3$ | 53.2 | $56 \cdot 1$ | 59.2 | $62 \cdot 3$ | $65^{\circ} 5$ | $68 \cdot 7$ | $72 \cdot 1$ |
| 44 | 28.9 26.6 | $38 \cdot \mathrm{r}$ 28 | $33 \cdot 3$ 30.7 | $35 \cdot 6$ 32.8 | $33^{3} \cdot 1$ | $40 \cdot 5$ | $43^{\circ} \mathrm{O}$ | $45 \cdot 6$ | $48 \cdot 3$ | $5 \mathrm{x} \cdot \mathrm{I}$ | 53.9 | 56.8 | 59.8 | 62.9 58. | $66 \cdot 0$ $65 \cdot 0$ | $69 \cdot 2$ |
| 46 | 26.6 | 28.6 | $30 \cdot 7$ | $32 \cdot 8$ | $35^{\circ} \mathrm{I}$ | $37 \cdot 3$ | $39^{\circ} 7$ | 42.I | 44.6 | $47 \cdot \mathrm{r}$ | $49 \cdot 8$ | $52 \cdot 5$ | 55.2 | $58 \cdot \mathrm{I}$ | $6 \mathrm{I} \cdot 0$ | $63 \cdot 9$ |
| 48 | 24.6 | 26.4 | $28 \cdot 3$ | $30 \cdot 3$ | $32 \cdot 4$ | 34.5 | $36 \cdot 6$ | 38.9 | $41 \cdot 2$ | $43 \cdot 5$ | $46 \cdot 0$ | $48 \cdot 4$ | 5r.0 | $53 \cdot 6$ | 56.3 | 59•1 |
| 50 | 22.7 | 24.4 | $26 \cdot 2$ | $28 \cdot 0$ 25 | $29 \cdot 9$ | $3 \mathrm{r} \cdot 8$ | $33 \cdot 8$ | $35 \cdot 9$ | $38 \cdot 0$ | $40 \cdot 2$ | 42.4 | $44 \cdot 7$ | $47 \cdot 1$ | 49.5 | $52 \cdot 0$ | 54.5 |
| 52 54 | 20.9 19.3 | 22.5 20.8 | 24.1 22.3 | $25 \cdot 8$ 23.8 | $27 \cdot 6$ 25.4 | $29 \cdot 4$ $27 \cdot 1$ | 31.2 28.8 | $33 \cdot 1$ <br> $30 \cdot 6$ | $35 \cdot 1$ $32 \cdot 1$ | 37-1 | $39 \cdot 2$ | $4 \mathrm{I} \cdot 3$ | $43 \cdot 5$ | $45^{\circ} 7$ | $48 \cdot 0$ | $50 \cdot 4$ |
| 54 56 | 19.3 17.8 | $20 \cdot 8$ 19 | $22 \cdot 3$ 20.5 | 23.8 21.9 | 25.4 23.4 | $27 \cdot 1$ 24.9 | 28.8 26.5 | 30.6 | 32.4 29.8 | $34 \cdot 2$ $3 \times 1$ | $36 \cdot 1$ $33 \cdot 3$ | $38 \cdot \mathrm{I}$ $35 \cdot \mathrm{I}$ | $40 \cdot 1$ 37 | 42.2 38.9 | 44.3 40.8 | $46 \cdot 5$ $42 \cdot 8$ |
|  |  | 9 | $2 \cdot 5$ | 2 F | 234 |  | 26.5 | $20^{1}$ | 29.6 | $3 \times 5$ | $33 \cdot 3$ | $35^{\prime}$ I | $37 \cdot 0$ | $38 \cdot 9$ | $40 \cdot 8$ | $42 \cdot 8$ |



TRUE BEARING OR AZIMUTH OF * RIGEL.

| Lat. | ${ }_{4} \mathrm{~m}$. | ${ }^{\text {m. }} 8$ | 12. | ${ }_{16}$ | ${ }_{20} \mathrm{~m}$ | ${ }_{24}$. | $\stackrel{\mathrm{m}}{28}$ | $\begin{aligned} & \mathrm{m} \\ & 32 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 36 \end{aligned}$ | $\mathrm{m}$ | $\mathrm{m} .$ | $\begin{aligned} & \mathrm{m} . \\ & 48 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 52 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 56 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 60 \end{aligned}$ | ${ }_{70}$ | ${ }_{8} \mathrm{~m}$. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 | I. 1 | $2 \cdot 1$ | $3 \cdot 2$ | $4 \cdot 3$ | 5•3 | $6 \cdot 4$ | $7 \cdot 4$ | 8.5 | $9 \cdot 6$ | 10.6 | 11・ワ | $12 \cdot 7$ | 13.8 | 14.8 | $15 \cdot 9$ | $18 \cdot 5$ | $21 \cdot 1$ |
| 50 | I | $2 \cdot 3$ | $3 \cdot 5$ | $4 \cdot 6$ | $5 \cdot 8$ | $7 \cdot 0$ | 8.1 | 9.3 | 10.4 | II•6 | 12.7 | 13.8 | 15.0 | $16 \cdot 1$ | 17.2 | 20.0 | 22.8 |
| 40 | I. 3 | $2 \cdot 6$ | 4.0 | $5 \cdot 3$ | $6 \cdot 6$ | 7.9 | $9 \cdot 2$ | $10 \cdot 5$ | 11.8 | 13.1 | 14.4 | $15^{\circ} 7$ | 16•9 | 18.2 | 19.5 | $22 \cdot 5$ | $25 \cdot 6$ |
| 35 | 1.4 | 2.9 | 4.3 4.8 | 5.8 | 7.2 | 8.6 | $10 \cdot 0$ | 11.4 | 12.8 | 14.2 | 15.6 | 17.0 | 18.3 | 19.7 | $21^{\circ} \mathrm{O}$ | 24.3 | $27 \cdot 4$ |
| 30 | 1.6 | 3.2 | $4 \cdot 8$ | $6 \cdot 4$ | - | 9.6 | II'I | 12.6 | 14.2 | 15.7 | 17.2 | 18.7 | $20 \cdot 1$ | $21 \cdot 6$ | 23.1 | $26 \cdot 5$ | 29.9 |
| 26 | I. 8 | $3 \cdot 5$ | $5 \cdot 3$ | 7.0 | $8 \cdot 7$ | 10.4 | 12.I | 13.8 | 15.5 | I7•I | 18.8 | 20.4 | 2 I 9 | 23.5 | $25^{\circ}$ | 28.7 | $32 \cdot 2$ |
| 24 | $1 \cdot 9$ | $3 \cdot 7$ | $5 \cdot 5$ | $7 \cdot 4$ | 9.2 | $1{ }^{1} 0$ | 12.8 | 14.6 | $16 \cdot 3$ | 18.0 | 19.7 | 21.4 | $23^{\circ} \mathrm{O}$ | 24.6 | $26 \cdot 2$ | $30 \cdot 0$ | 33.6 |
| 22 | 2.0 | $3 \cdot 9$ | $5 \cdot 9$ | 7.8 | $9 \cdot 7$ | II. 6 | 13.5 | 15.4 | 17.2 | $19^{\circ}$ | $20 \cdot 8$ | 22.5 | 24.2 | $25^{\circ} 9$ | 27.5 | 31.4 | 35•1 |
| 20 | $2 \cdot 1$ | $4 \cdot 2$ | $6 \cdot 2$ | $8 \cdot 3$ | $10 \cdot 3$ | 12.4 | 14.3 | $16 \cdot 3$ | 18.2 | $20 \cdot 1$ | 22.0 | 23.8 | 25.6 | 27.3 | $29^{\circ} \mathrm{O}$ | 33.0 | $36 \cdot 7$ |
| S. 34 | $2 \cdot 3$ | $4 \cdot 6$ | $6 \cdot 8$ | $9 \cdot 1$ | 11 | 13 |  | 17.8 |  | 22.0 |  | $26 \cdot 0$ |  |  |  |  |  |
| 36 | $2 \cdot 1$ | $4 \cdot 3$ | $6 \cdot 4$ | $8 \cdot 5$ | 10.6 | 12.6 | $14 \cdot 7$ | 16.7 | 18.7 | 20.6 | $22 \cdot 6$ | 24.5 | $26 \cdot 3$ | $28 \cdot 1$ | 29.9 | $34 \cdot 2$ | 48.2 |
| 38 | $2 \cdot 0$ | 4.0 | 6.0 | $8 \cdot 0$ | $9 \cdot 9$ | ${ }_{1 r} \cdot 9$ | 13.8 | $15^{\circ} 7$ | $17 \cdot 6$ | 19.5 | 21.3 | 23.1 | $24^{\circ} 9$ | $26 \cdot 6$ | 28.3 | $32 \cdot 5$ | 36.4 |
| 40 | I•9 | $3 \cdot 8$ | $5 \cdot 6$ | $7 \cdot 5$ | 9.4 | II 2 | 13.0 | 14.8 | 16.6 | 18.4 | $20 \cdot 2$ | 21.9 | 23.6 | $25^{\circ} 3$ | $26 \cdot 9$ | 31.0 | 34.8 |
| 45 | I• | 3.3 | $5 \cdot 0$ | $6 \cdot 6$ | $8 \cdot 3$ | $9 \cdot 9$ | II• 5 | 13.1 | 14.7 | 16.3 | 17.9 | 19.5 | 21.0 | 22.5 | 24.1 | 27.8 | $3 \mathrm{~F} \cdot 4$ |
| 50 | I. 5 | 3.0 | $4 \cdot 5$ | $5 \cdot 9$ | $7 \cdot 4$ | $8 \cdot 9$ | 10.4 | 1 I .8 | 13.3 | 14.7 | 16.2 | 17.6 | $19^{\circ}$ | 20.4 | 21.8 | $25 \cdot 3$ | $28 \cdot 6$ |
| 55 | I.4 | $2 \cdot 7$ | $4 \cdot 1$ | 4 | $6 \cdot 8$ | $8 \cdot \mathrm{I}$ | $9 \cdot 5$ | 10.8 | $2 \cdot 2$ | 13.5 | 14.8 | 16.2 | 17.5 | 18.8 | 20.1 | $23 \cdot 3$ | $26 \cdot 5$ |


| Lat. |  | 4 | 6 |  | 10 |  | 14 | 16 |  |  |  |  | m. | $\begin{aligned} & \mathrm{m} . \\ & 24 \end{aligned}$ | 25 | $\begin{aligned} & \mathrm{m} . \\ & 26 \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  | I•I | $2 \cdot 5$ | $4 * 4$ | $6 \cdot 9$ |  | 13 |  | $22 \cdot 2$ |  |  | 33'. 1 | $36 \cdot 1$ | 39́3 | 6 | 0 |
| 12 |  | I*O | $2 \cdot$ | 4'I | $6 \cdot 4$ | $9 \cdot 2$ | I2. | I6 | 20.6 |  | 28. | 30 | 33.6 | 36 | $39 \cdot 6$ | - 7 |
| 14 | 0 | 1.0 | $2 \cdot 2$ | $3 \cdot 8$ | $6 \cdot 0$ | $8 \cdot 6$ | 11*7 | 15. | $19 * 3$ | 23.7 | $26 \cdot 2$ | $28 \cdot 7$ | $3 \mathrm{r} \cdot 4$ | $34 \cdot 2$ | $37 \cdot 0$ | $40 \cdot 0$ |
| 16 | $0 \cdot$ | $0 \cdot 9$ | 2 | $3 \cdot 6$ | $5 \cdot 6$ | $8 \cdot 0$ | 10.9 | 14. | $18 \cdot 1$ | $22 \cdot 2$ | 24.5 | $26 \cdot 9$ | 29.4 | $32 \cdot 0$ | $34 \cdot 7$ | $37 \cdot 5$ |
| I 8 | 0.2 | 0.8 | I•9 | $3 \cdot 4$ | $5 \cdot 2$ | $7 \cdot 5$ | $10 \cdot 3$ | 13 | 16.9 | $20 \cdot 9$ | $23 \cdot 1$ | $25 \cdot 3$ | $27 \cdot 6$ | $30 \cdot 0$ | $32 \cdot 6$ | $35 \cdot 2$ |
| 20 | 0.2 |  |  | 3 |  | $7 \cdot 1$ | $9 \cdot 7$ | 12 | $16 \cdot 0$ |  | 2 I | $23 \cdot 8$ | $26 \cdot 0$ | $28 \cdot 3$ | $30 \cdot 7$ | $33 \cdot 2$ |
| 22 | $0 \cdot 2$ | - | I•7 | $3 \cdot 0$ | $4 \cdot 7$ | $6 \cdot 7$ | $9 \cdot 1$ | II•9 | I5.1 | I8.6 | 20.5 | $22 \cdot 5$ | $24 \cdot 5$ | $26 \cdot 7$ | $29^{\circ} \mathrm{O}$ | $3 \mathrm{I} \cdot 3$ |
| 24 | 0.2 | $0 \cdot 7$ | 1.6 | $2 \cdot 8$ | 4.4 | $6 \cdot 3$ | $8 \cdot 6$ | II•2 | 14.2 | I7. 5 | 19.3 | $2 \mathrm{I} \cdot 2$ | 23.2 | 25.2 | 27.4 | $29 \cdot 6$ |
| 26 | 0.2 | 0.7 | I. 5 | $2 \cdot 7$ | $4 \cdot 2$ | $6 \cdot 0$ | $8 \cdot 1$ | 10 | I3.5 | 16.6 | $18 \cdot 3$ | 2 | 2I.9 | 23.9 | 25.9 | $28 \cdot 0$ |
| 30 | O.I | 0.6 | I*4 | $2 \cdot 4$ | $3 \cdot 7$ | $5 \cdot 4$ | $7 \cdot 3$ | $9 \cdot$ | 12.1 | 14.9 | 16.4 | 18.0 | $19 \cdot 7$ | $2 \mathrm{I} \cdot 4$ | $23 \cdot 3$ | $25^{\prime} \mathrm{I}$ |
| 35 | O.I | 0.5 |  | $2 \cdot 1$ | $3 \cdot 3$ | $4^{* 7}$ |  |  | 10.6 | 13 | 14. | 15.8 | 17*3 | 18.8 | $20 \cdot 4$ | 22.1 |
| 40 | 0 | $0 \cdot 5$ | 0 | I.8 | 9 | $4 \cdot 2$ | $5 \cdot 6$ | $7 \cdot$ | $9 \cdot 3$ | II•5 | 12.7 | 13.9 | 15.2 | $16 \cdot 5$ | 17.9 | 19.4 |
| 50 | 0.1 | 0.4 | - 0.8 | I 4 | 2 | $3 \cdot 2$ | $\cdot 3$ | 5 | $7 \cdot 1$ | $8 \cdot 8$ | $9 \cdot 7$ | 10.6 | II•6 | 12.6 | 13.7 | 14.8 |
| 60 | 0 | 0.2 | 0.6 | $1 \cdot 0$ | I•6 | $2 \cdot 3$ | $3 \cdot 2$ | $4 \cdot 1$ | $5 \cdot 2$ | . 4 | $7 \cdot 1$ | 7.8 | $8 \cdot 5$ | $9 \cdot 3$ | $10 \cdot 0$ | 10.9 |
| 65 | O'I | 0.2 | 0*5 | $0 \cdot 9$ | I•3 | I-9 | $2 \cdot 6$ | $3 \cdot$ | $4 \cdot 3$ | $5 \cdot 4$ | $5 \cdot 9$ | $6 \cdot 5$ | $7 \cdot 1$ | $7 \cdot 7$ | $8 \cdot 4$ | $9 \cdot 1$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | 0.2 | 1.0 |  | 3.9 |  |  | II | 15 | 19.5 | $24^{\circ} \mathrm{O}$ |  | $29^{\circ} 0$ | $31 \cdot 7$ | 34.5 | 37.4 | $40 \cdot 4$ |
| 42 | Q. 2 | 0 | $2 \cdot 0$ | $3 \cdot 5$ | $5 \cdot 4$ | $7 \cdot 8$ | $10 \cdot 6$ | I3. | 17.5 | 21 | 23.8 | $26 \cdot 1$ | $28 \cdot 5$ | $3 \mathrm{I} \cdot 0$ | $33 \cdot 6$ | $36 \cdot 3$ |
| 44 | 0.2 | 0.8 | ェ.8 | $3 \cdot 1$ | 9 | 0 | $9 \cdot 6$ | 12 | 15.8 | 19* | 21.5 | $23 \cdot 6$ | $25^{\circ} 8$ | $28 \cdot 0$ | $30 \cdot 4$ | $32 \cdot 8$ |
| 46 | $0 \cdot$ | 0.7 | I•6 | 2. | 4.4 | $6 \cdot 4$ | $8 \cdot 7$ | II•3 | 14.3 | 15 | 19.5 | 21.4 | $23 \cdot 3$ | 25.4 | $27 \cdot 5$ | 29.8 |
| 48 | $0 \cdot 2$ | - | I•5 | $2 \cdot 6$ | 0 | $5 \cdot 8$ | $7 \cdot 9$ | IO | I $3 \cdot 1$ | 16 | 17*7 | 19.4 | 21.2 | $23 \cdot 1$ | $25^{\circ} \mathrm{O}$ | $27 \cdot 0$ |
| 50 | O.I | 0.6 | I•3 | $2 \cdot 3$ | $3 \cdot 7$ |  | $7 \cdot 1$ |  |  | 14 |  |  | 19.3 | 21 | $22 \cdot 8$ | 24.6 |
| 52 | O.I | $0 \cdot 5$ | I'2 | $2 \cdot 1$ | $3 \cdot 3$ | 4.8 | $6 \cdot 5$ |  | 10.8 | 13.3 | 14. | I |  | $19 \cdot 1$ | 7 | 22.4 |
| 54 | 0 | $0 \cdot 5$ | I•I | I.9 | $3 \cdot 0$ | $4 * 4$ | 5*9 | 7 | $9 \cdot 8$ | 12 | 13. | 14.6 | $16 \cdot 0$ | 17.4 | $18 \cdot 9$ | $20 \cdot 4$ |
| 56 | $0 \cdot 1$ | 0.4 | I*O | I•8 | $2 \cdot 8$ | $4^{\circ} 0$ | $5 \cdot 4$ | $7 \cdot$ | $8 \cdot 9$ | II'O | 12.2 | 13.3 | 14 | 15*9 | $17 \cdot 2$ | 18.6 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{\circ}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  | -8 |  |
| 15 | 41'7 | 44.8 | $48 \cdot 0$ | 51'3 | $54 \cdot 8$ | $56 \cdot 5$ | 6 |  |  | 73.5 | $77 \cdot 6$ | 81•7 |  | $90 \cdot 3$ | $94 \cdot 8$ | 99.4 |
| 16 | $40 \cdot 4$ | $43 \cdot 4$ | $46 \cdot 5$ | 49*7 | 53.1 | $56 \cdot 5$ | $60 \cdot 0$ | 63 | 67.4 | 71•2 | $75 \cdot 2$ | 79.2 | 83.3 | $87 \cdot 5$ | 9I•9 | $96 \cdot 3$ |
| 17 | $39 \cdot 1$ | $42 \cdot 1$ | $45^{\text {I I }}$ | $48 \cdot 2$ | $5 \mathrm{I} \cdot 4$ | $54 \cdot 8$ | $58 \cdot 2$ | 61.7 | 65.4 | 69•1 | $72 \cdot 9$ | $76 \cdot 8$ | $80 \cdot 8$ | 84.9 | $89 \cdot 1$ | 93.4 |
| 18 | $38 \cdot 0$ | $40 \cdot 7$ | $43 \cdot 7$ | $46 \cdot 7$ | $49 * 9$ | $53 \cdot 1$ | $56 \cdot 5$ | 59 | 63.4 | 67.0 | $70 \cdot 7$ | 74.5 | $78 \cdot 4$ | $82 \cdot 4$ | $86 \cdot 5$ | $90 \cdot 7$ |
| 19 | $36 \cdot 8$ | $39 \cdot 6$ | $42 \cdot 4$ | $45 \cdot 3$ | $48 \cdot 4$ | 5I•5 | $54 \cdot 8$ | 58 | $6 \mathrm{I} \cdot 5$ | $65^{\circ}$ | $68 \cdot 6$ | $72 \cdot 3$ | $76 \cdot 1$ | $80 \cdot 0$ | 84.0 | $88 \cdot 1$ |
| 20 | $35 \cdot 7$ | $38 \cdot 4$ | 41.2 | 44 | 47.0 | $50^{\circ} 1$ | $53 \cdot 2$ | 56.4 | $59 \cdot 7$ | 63 | 6 | $70 \cdot 2$ | 73.9 | $77 \cdot 7$ | 8I•6 | 85.5 |
| 22 | $33 \cdot 7$ | $36 \cdot 2$ | $38 \cdot 8$ | $4 \mathrm{I} \cdot 6$ | 44.4 | $47 \cdot 2$ | $50 \cdot 2$ | 53.3 | $56 \cdot 4$ | $59 \cdot 6$ | $62 \cdot 9$ | $66 \cdot 3$ | $69 \cdot 8$ | 73.4 | 77•1 | 80.8 |
| 24 | $31 \cdot 9$ | 34.3 | $36 \cdot 7$ | $39 \cdot 3$ | $41 \cdot 9$ | $44^{\circ} 7$ | $47 \cdot 5$ | $50 \cdot 4$ | 53.4 | $56 \cdot 4$ | $59 \cdot 5$ | $62 \cdot 7$ | 66. 1 | 69.4 | $72 \cdot 9$ | $76 \cdot 5$ |
| 26 | $30 \cdot 2$ | $32 \cdot 4$ | $34 \cdot 8$ | $37 \cdot 2$ | $39 \cdot 7$ | $42 \cdot 3$ | $45^{\circ} \mathrm{O}$ | 47*7 | $50 \cdot 5$ | 53.4 | $56 \cdot 4$ | 59.4 | $62 \cdot 6$ | $65 \cdot 8$ | $69 \cdot 1$ | 72.4 |
| 28 | $28 \cdot 6$ | $30 \cdot 7$ | 33.0 | $35 \cdot 2$ | $37 \cdot 6$ | $40 \cdot 1$ | $42 \cdot 6$ | $45 \cdot 2$ | $47 \cdot 9$ | $50 \cdot 6$ | $53 \cdot 5$ | $56 \cdot 4$ | $59 \cdot 3$ | 62.4 | 65.5 | $68 \cdot 7$ |
| 30 | 27-1 | 29* | 31 | 33' | 35*7 |  | $40 \cdot 4$ |  | $45 * 4$ |  | $50^{\circ} 7$ | 53. | $56 \cdot 3$ | $59 \cdot 2$ | $62 \cdot 1$ | $65 \cdot 2$ |
| 32 | $25 \cdot 7$ | $27 \cdot 7$ | $29 \cdot 7$ | $3 \mathrm{I} \cdot 7$ | $33 \cdot 9$ | $36 \cdot 1$ | $38 \cdot 4$ |  | $43 \cdot 1$ | $45 \cdot 6$ | $48 \cdot 1$ | $50 \cdot 7$ | 53.4 | $56 \cdot 2$ | $59^{\circ} 0$ | $6 \mathrm{I} \cdot 9$ |
| 34 | 24.4 | $26 \cdot 3$ | $28 \cdot 2$ | $30 \cdot 1$ | $32 \cdot 2$ | $34 \cdot 3$ | $36 \cdot 4$ | 38 | $40 \cdot 9$ | $43 \cdot 3$ | $45 \cdot 7$ | $48 \cdot 2$ | $50 \cdot 7$ | $53 \cdot 3$ | $56 \cdot 0$ | $58 \cdot 8$ |
| 36 | $23 \cdot 2$ | $24 * 9$ | $26 \cdot 8$ | $28 \cdot 6$ | $30 \cdot 5$ | $32 \cdot 5$ | $34 \cdot 6$ | $36 \cdot 7$ | $38 \cdot 9$ | 41-1 | $43 \cdot 4$ | $45 \cdot 8$ | $48 \cdot 2$ | $50 \cdot 7$ | $53 \cdot 2$ | $55 \cdot 8$ |
| 40 | $20 \cdot 9$ | 22.5 | $24^{-1}$ | $25 \cdot 8$ | $27 \cdot 5$ | 29.3 | 3I'2 | $33 \cdot 1$ | $35^{\prime}$ I | $37 \cdot 1$ | $39 \cdot 2$ | 4I•3 | $43 \cdot 5$ | $45 \cdot 7$ | $48 \cdot 0$ | $50 \cdot 4$ |
| 45 | $18 \cdot 3$ | 19.7 | 21.1 | 22.4 |  | 25.6 | 273 | $29^{\circ} 0$ | $30 \cdot 7$ | $32 \cdot 5$ | $34 * 4$ | 36 | $38 \cdot 2$ | $40 \cdot 2$ | $42 \cdot 2$ | $44 * 3$ |
| 50 | 16.0 | $17 \cdot 2$ | 18.4 | 19.7 | 2I•I | 22.4 | $23 \cdot 8$ | 25 | $26 \cdot 8$ | $28 \cdot 4$ | 30.0 | 31.6 | $33 \cdot 3$ | $35^{\circ} \mathrm{O}$ | $36 \cdot 7$ | $38 \cdot 5$ |
| 60 | II•7 | 12.6 | 13.5 | 14.5 | 15.5 |  | 17.5 | 18.6 | $19 \cdot 7$ | $20 \cdot 8$ | 22 | 23.2 | $24^{\circ} 4$ | $25 \cdot 7$ | 27*0 | $28 \cdot 3$ |
| 65 | $9 \cdot 8$ | 10.5 | I I. 2 | 12.1 | 12.9 | 13.8 | 14.7 | 15.6 | I6.5 | 17.4 | 18.4 | 19.4 | $20 \cdot 3$ | 21.4 | 22.4 | $23 \cdot 6$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | $43 \cdot 5$ | $46 \cdot 7$ | $50 \cdot 0$ | 53.4 | 57.0 | $60 \cdot 7$ | $64 \cdot 4$ | $68 \cdot 3$ | $72 \cdot 3$ | $76 \cdot 3$ | $80 \cdot 5$ | $84 \cdot 8$ | $89 \cdot 2$ | $93 \cdot 6$ | $98 \cdot 2$ | $102 \cdot 9$ |
| 41 | $41 \cdot 2$ | $44 \cdot 3$ | $47 \cdot 4$ | $50 \cdot 7$ | $54^{*}$ I | $57 \cdot 6$ | $61 \cdot 2$ | 64.8 | $68 \cdot 6$ | $72 \cdot 5$ | 76.5 | $80 \cdot 5$ | $84 \cdot 7$ | 88.9 | $93 \cdot 3$ | $97 \cdot 8$ |
| 42 | $39 \cdot 1$ | $42 \cdot 0$ | $45^{\circ} \mathrm{O}$ | $48 \cdot 1$ | 51.4 | $54 \cdot 7$ | 58.1 | $6 \mathrm{I} \cdot 6$ | $65 \cdot 2$ | $68 \cdot 9$ | $72 \cdot 6$ | $76 \cdot 5$ | $80 \cdot 5$ | 84.5 | $88 \cdot 7$ | 93.0 |
| 43 | $37 \cdot 2$ | 39.9 | $42 \cdot 8$ | $45 \cdot 8$ | $48 \cdot 8$ | $52 \cdot \mathrm{O}$ | $55 \cdot 2$ | $58 \cdot 6$ | $62 \cdot 0$ | $65 \cdot 5$ | $69 \cdot 1$ | 72.8 | $76 \cdot 6$ | $80 \cdot 4$ | 84.4 | $88 \cdot 5$ |
| 44 | $35 \cdot 4$ | $38 \cdot 0$ | $40 \cdot 7$ | $43 \cdot 5$ | $46 \cdot 5$ | 49.5 | $52 \cdot 6$ | 55.7 | 59.0 | $62 \cdot 3$ | $65 \cdot 8$ | $69 \cdot 3$ | 72.9 | $76 \cdot 6$ | $80 \cdot 4$ | 84.3 |
| 45 | $33 \cdot 7$ | $36 \cdot 2$ | $38 \cdot 8$ | 41*4 | $44^{\circ} 2$ | 47*1 | 50.1 | 53.1 | 56.2 | $59^{\circ} 4$ | $62 \cdot 7$ | $66 \cdot 0$ | $69 \cdot 5$ | 73.0 | $76 \cdot 6$ | $80 \cdot 3$ |
| 46 | $32 \cdot 1$ | $34 \cdot 5$ | $36 \cdot 9$ | $39 \cdot 5$ | $42 \cdot 1$ | $44 \cdot 9$ | $47 \cdot 7$ | $50 \cdot 6$ | $53 \cdot 6$ | $56 \cdot 6$ | 59・ク | $62 \cdot 9$ | $66 \cdot 2$ | 69.6 | $73 \cdot \mathrm{r}$ | $76 \cdot 6$ |
| 47 | $30 \cdot 6$ | $32 \cdot 8$ | $35^{\circ} 2$ | $37 \cdot 6$ | $40 \cdot 2$ | $42 \cdot 8$ | $45 \cdot 5$ | $48 \cdot 2$ | $5 \mathrm{I} \cdot 1$ | 54.0 | 57.0 | $60^{\circ} 0$ | $63 \cdot 2$ | $66 \cdot 4$ | $69 \cdot 7$ | $73 \cdot 1$ |
| 48 | $29 \cdot 1$ | $31 \cdot 3$ | $33 \cdot 6$ | $35 \cdot 9$ | $38 \cdot 3$ | $40 \cdot 8$ | $43 \cdot 4$ | $46 \cdot 0$ | $48 \cdot 7$ | 51.5 | 54.3 | $57 \cdot 3$ | $60 \cdot 3$ | $63 \cdot 3$ | $66 \cdot 5$ | $69 \cdot 7$ |
| 49 | 27.8 | 29.9 | $32 \cdot 0$ | $34 \cdot 2$ | $36 \cdot 5$ | $38 \cdot 9$ | $4 \mathrm{r} \cdot 4$ | 43.9 | $46 \cdot 5$ | 49•1 | $5 \mathrm{I} \cdot 9$ | 54.7 | $57 \cdot 5$ | $60 \cdot 4$ | $63 \cdot 5$ | $66 \cdot 6$ |
| 50 | $26 \cdot 5$ | $28 \cdot 5$ | $30 \cdot 6$ | $32 \cdot 7$ | 34*9 | 37-1 | $39 \cdot 5$ | 4I'9 | $44 * 4$ | $46 \cdot 9$ | $49 \cdot 5$ | 52.2 | 54.9 | 57.7 | $60 \cdot 6$ | $63 \cdot 5$ |
| 5 I | $25 \cdot 3$ | $27 \cdot 2$ | $29^{-2}$ | $3 \mathrm{I} \cdot 2$ | $33 \cdot 3$ | $35 \cdot 5$ | $37 \cdot 7$ | $40 \cdot 0$ | $42 \cdot 3$ | $44 \cdot 8$ | 47.3 | $49 \cdot 8$ | 52.4 | $55^{\circ} \mathrm{I}$ | 57.9 | $60 \cdot 7$ |
| 52 | $24^{\circ} 2$ | $26 \cdot 0$ | $27 \cdot 8$ | 29.8 | $3 \mathrm{I} \cdot 8$ | $33 \cdot 9$ | $36 \cdot 0$ | $38 \cdot 2$ | $40 \cdot 4$ | $42 \cdot 7$ | $45 \cdot 1$ | $47 \cdot 6$ | $50 \cdot 1$ | $52 \cdot 6$ | $55 \cdot 3$ | $58 \cdot 0$ |
| 54 | 22.0 | 23.7 | $25^{\circ} 4$ | $27 \cdot 1$ | 29.0 | $30^{\circ} 9$ | $32 \cdot 8$ | $34 \cdot 8$ | $36 \cdot 9$ | $39^{\circ} \mathrm{O}$ | 4I•I | 43.4 | $45 \cdot 7$ | $48 \cdot 0$ | $50 \cdot 4$ | $52 \cdot 9$ |
| 56 | 20.1 | 21.6 | $23 \cdot 1$ | 24.7 | $26 \cdot 4$ | $28 \cdot 1$ | $29 \cdot 9$ | $3 \mathrm{I} \cdot 7$ | $33 \cdot 6$ | $35 \cdot 5$ | $37 \cdot 5$ | 39.5 | 4I•6 | $43 \cdot 8$ | $46 \cdot 0$ | $48 \cdot 2$ |

## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* SIRIUS.


TRUE BEARING OR AZIMUTH OF * SIRIUS.

| Lat. | m. 4 | m. 8 | m. | m. 16 | m 20 | m. | 28 | 32 | m. 36 | m. | 44 | 48 | m2. | 56 | 60 | ${ }_{70}$. | m. 80 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Io | $2 \cdot 1$ | $4 \cdot 3$ | $6^{\circ} 4$ | $8^{\circ} \cdot 5$ | $10 \cdot 6$ | 12.6 |  | 16.6 | I $8 \cdot 6$ | $20 \cdot 5$ | 22.4 |  |  | 7.6 | -3 | 32.2 | $36^{\circ} \cdot 8$ |
| 12 | 2.0 | $4{ }^{\circ}$ | $6 \cdot 0$ | $8 \cdot 0$ | 9.9 | 11.8 | 13.7 | 15.6 | 17.5 | $19 \cdot 3$ | 21.0 | 22.8 | $24 \cdot 5$ | $26 \cdot 1$ | $27 \cdot 7$ | $31 \cdot 5$ | $35 \cdot 1$ |
| 14 | I•9 | 3.8 | $5 \cdot 6$ | $7 \cdot 5$ | $9 \cdot 3$ | II.2 | 13.0 | 14.7 | I6.5 | 18.2 | 19.9 | 21.6 | 23.2 | 24.8 | $26 \cdot 3$ | $30 \cdot 0$ | $33 \cdot 5$ |
| 16 | I.8 | $3 \cdot 6$ | $5 \cdot 3$ | $7 \cdot 1$ | $8 \cdot 8$ | 10.6 | 12.3 | 14.0 | 15.6 | 17.3 | 18.9 | 20.5 | 22.1 | $23 \cdot 6$ | $25^{1} 1$ | $28 \cdot 7$ | $32 \cdot 1$ |
| 20 | I. 6 | $3 \cdot 2$ | $4 \cdot 8$ | $6 \cdot 4$ | $8 \cdot 0$ | 9.6 | II'I | 12.7 | 14.2 | 15.7 | 17.2 | $18 \cdot 7$ | $20 \cdot 1$ | 21.6 | $23^{\circ} 0$ | $26 \cdot 4$ | $29^{\circ} 6$ |
| 25 | I.5 | $2 \cdot 9$ | $4 \cdot 3$ | $5 \cdot 8$ | $7 \cdot 2$ | $8 \cdot 6$ | $10 \cdot 0$ | II.4 | 12.8 | $14 * 2$ | 15.6 | 16.9 | 18.3 | $19 \cdot 6$ | 20.9 | 24* | 27.1 |
| 30 | I. 3 | $2 \cdot 6$ | $4^{\circ} \mathrm{O}$ | $5 \cdot 3$ | $6 \cdot 6$ | $7 \cdot 9$ | $9 \cdot 2$ | 10.5 | II.8 | 13.0 | 14.3 | 15.5 | 16.8 | 18.0 | 19.3 | 22.2 | $25 \cdot 2$ |
| 40 | I•I | $2 \cdot 3$ | 3.4 | $4 \cdot 6$ | $5 \cdot 7$ | $6 \cdot 9$ | $8 \cdot 0$ | $9 \cdot 1$ | $10 \cdot 3$ | II.4 | 12.5 | $13 \cdot 6$ | 14.7 | 15.8 | $16 \cdot 9$ | $19 \cdot 7$ | $22 \cdot 3$ |
| 50 | I.O | $2 \cdot 1$ | $3 \cdot 1$ | $4 \cdot 2$ | $5 \cdot 2$ | $6 \cdot 2$ | $7 \cdot 3$ | $8 \cdot 3$ | 9.4 | 10.4 | II.4 | 12.5 | 13.5 | 14.5 | $15 \cdot 5$ | 18.1 | $20 \cdot 6$ |
| 60 | I'O | $2 \cdot 0$ | $3 \cdot 0$ | 3.9 | $4 \cdot 9$ | $5 \cdot 9$ | $6 \cdot 9$ | $7 \cdot 9$ | 8.8 | 9.8 | 10.8 | II•8 | 12.8 | I3.7 | 14.7 | $17 \cdot 1$ | $19 \cdot 6$ |
| 65 | 0 | I•9 | $2 \cdot 9$ | $3 \cdot 9$ | $4 \cdot 8$ | $5 \cdot 8$ | 6.8 | $7 \cdot 7$ | $8 \cdot 7$ | $9 \cdot 7$ | 10.6 | II.6 | 12.6 | 13.5 | 14.5 | 16.9 | 19.3 |
| S. |  |  |  |  |  |  |  | 18 |  |  |  |  |  |  |  |  |  |
| 42 | $2 \cdot 2$ | 4 | $6 \cdot 7$ | 8.9 | 11 I 1.9 | 14.3 | 15.4 | 1 | 19.6 | 23.7 | 25.4 | 25.6 | 27.6 | $31 \cdot 5$ $29 \cdot 5$ | $33 \cdot 4$ 3 | 35.8 | 42.3 |
| 44 | $2 \cdot 1$ | 4.2 | $6 \cdot 2$ | $8 \cdot 3$ | 10.3 | 12.4 | 14.4 | 16.4 | 18.3 | 20.3 | 22.2 | 24.1 | 25.9 | $27 \cdot 8$ | 29.6 | 33.9 | $38 \cdot 0$ |
| 46 | $2 \cdot 0$ | $3 \cdot 9$ | $5 \cdot 8$ | $7 \cdot 8$ | $9 \cdot 7$ | II• 6 | 13.5 | 15.4 | 17.3 | $19 \cdot 1$ | $20 \cdot 9$ | 22.7 | 24.5 | 26.2 | $27 \cdot 9$ | $32 \cdot 1$ | $36 \cdot 1$ |
| 50 | 1.7 | $3 \cdot 5$ | $5 \cdot 2$ | $7 \cdot 0$ | $8 \cdot 7$ | 10.4 | 12.1 | 13.8 | 15.5 | 17.1 | 18.8 | $20 \cdot 4$ | 22.1 | 23.7 | $25^{\prime} 3$ | $29^{\circ} 2$ | 32.9 |
| 54 | I•6 | $3 \cdot 2$ | $4 \cdot 7$ | $6 \cdot 3$ | $7 \cdot 9$ | $9 \cdot 4$ | II'O | 12.5 | $14^{\circ} \mathrm{I}$ | 15.6 | 17. 1 | $18 \cdot 7$ | 20.2 | 2I. 6 | $23 \cdot 1$ | $26 \cdot 3$ | 30•3 |
| 58 | 1.4 | 29 | $4 \cdot 3$ | $5 \cdot 8$ | $7 \cdot 2$ | $8 \cdot 7$ | $10 \cdot 1$ | I $1 \cdot 5$ | 13.0 | 14.4 | 15.8 | I7. 2 | 18.6 | 20*0 | 21.4 | 24.8 | 28.2 |

REDUOTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* SIRIUS.


|  | ${ }_{2}$ | 4 | 6 | 8 | ${ }_{10}^{\mathrm{m}}$ | ${ }_{12}^{\mathrm{m}}$ | ${ }_{14}^{\text {m. }}$ | ${ }_{16}^{\mathrm{m}}$ | 18 | ${ }_{20}^{\mathrm{m}}$ | 21 | ${ }_{22}^{\mathrm{m}}$ | ${ }_{23}^{\mathrm{m}}$ | ${ }_{24}^{\text {m. }}$ | ${ }_{25}^{\mathrm{m}}$ | ${ }_{26}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }^{\circ} 6$ | $0 \cdot 3$ | If | $2 \cdot 5$ | $4 \cdot 4$ | $6 \cdot 8$ | 9.9 | 23.4 | 17.5 | $22^{\prime}$ I | 27.2 | 30.0 | 32.9 | $35^{\circ} 9$ | 39.1 | $42 \cdot 4$ | 45•8 |
| 18 | $0 \cdot 3$ |  | $2 \cdot 3$ | $4 \cdot 1$ | 6.3 |  |  | $16 \cdot 2$ | $20 \cdot 5$ | $25^{2}$ | $27 \cdot 8$ | $30 \cdot 5$ | $33 \cdot 3$ | $36 \cdot 2$ | 39.3 | 42.4 |
| 20 | 0.2 | $\bigcirc$ | 2.1 | 3.8 3.5 3 | 5.9 | $8 \cdot 5$ | II.6 | 15 | 19.1 | 23.5 | 25.9 24.2 | 28.4 | $\xrightarrow{38.0}$ | ${ }^{33 \cdot 7} 3$ |  | 39.5 36.9 |
| 22 24 24 | - ${ }_{0}^{0} 2$ | - $0 \cdot 9$ | 2.0 | $3 \cdot 5$ $3 \cdot 3$ | 5•5 | $7 \cdot 9$ | ${ }_{\text {ro }}^{10.8}$ | 14.1 13.2 1 | 17.8 16.6 | ${ }_{20}^{21.9}$ | 24.2 22.6 | $26 \cdot 5$ | 28.9 | 31.5 | 32.0 | $36 \cdot 9$ $34 \cdot 6$ |
| 26 | 0.2 | 0.8 |  | 3. | 4 |  |  |  | 15.6 |  | 21. |  | $25 \cdot 4$ | 27.7 | 30.0 | 2 4 |
| 28 | $0 \cdot 2$ | 0.7 | 1.6 | $2 \cdot 9$ | $4 \cdot 5$ | 6.5 |  |  | 14.6 |  | 19909 |  | 23.9 | 26.0 | 28.2 |  |
| 30 | $\bigcirc \cdot 2$ | 0.7 | r.5 | $2 \cdot 7$ | $4 \cdot 3$ | 6. ${ }^{8.8}$ | $8 \cdot 3$ | 10.9 | 13.8 | 17.0 | 18.7 | $20 \cdot 6$ | 22.5 | 24.4 | 5 | ${ }_{27}^{28 \cdot 7}$ |
| 32 |  | 0.6 | ${ }^{\mathrm{r}} \mathrm{r} 4$ | $2 \cdot 6$ | 3.8 | 5.8 5.4 | 7.9 | 10.3 | 13.0 12.2 | ${ }_{\text {I }}^{16.0}$ | 17.7 16.6 | 19.4 | 21.2 | 23.0 | ${ }^{25 \cdot 6}$ | ${ }_{25}^{27.5}$ |
| 34 | $0 \cdot \mathrm{I}$ | $0 \cdot 6$ | r 4 | $2 \cdot 4$ | 3.8 | $5 \cdot 4$ | $7 \cdot 4$ | $9 \cdot 7$ | 12.2 | $15 \cdot 1$ |  | 18.3 | $20^{\circ}$ | $21 \cdot 7$ | $23 \cdot 6$ |  |
| 36 | $\bigcirc \cdot 1$ | $0 \cdot 6$ | r.3 | $2 \cdot 3$ | $3 \cdot 6$ |  | 7.0 | 9.1 | $1{ }^{\text {r }}$ | 14.2 | 15.7 | 2 | I8.8 | $20 \cdot 5$ |  |  |
| 40 | $\bigcirc \cdot 1$ | 0.5 | r.I | $2 \cdot 0$ | 3.2 | $4 \cdot 6$ | $6 \cdot 2$ | $8 \cdot \mathrm{~T}$ | $10 \cdot 3$ | $12 \cdot 7$ |  | 15.4 | 16.8 | 18.3 | 19.8 |  |
| 45 50 | $O1$ | 0.4 0.4 | r.0. | ¢r. <br> 1.5 | 2. 2.4 2 | 4. ${ }^{\circ}$ | 5.4 4.6 | 7. ${ }^{7}$ | 7.7 | 9 | 12.1 | IT ${ }_{\text {IT }}$ | 14.5 | $1 \begin{aligned} & 15.8 \\ & 13.6\end{aligned}$ | ${ }_{14}^{17} 1$ |  |
| 6 | O.I | ${ }_{0}{ }^{2}$ | 0.6 | $\underline{1}$ | r. | ${ }_{2 \cdot 4}$ | $3 \cdot 3$ | $4 \cdot 4$ | 5.5 | 6.8 | 7.5 | 8.2 | \% 0 | 9.8 | 10.6 | Ir.5 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 35 | ${ }_{0}^{0.3}$ |  | 2.2 | 4. |  |  | 12.5 | 15.5 | 10.6 | 25.4 24.2 |  |  | ${ }_{31}^{33} 5$ | $36 \cdot 5$ |  | . 7 |
| 38 | $0 \cdot 2$ | 0.9 | 2.2 2.0 | $3 \cdot 9$ $3 \cdot 5$ | $5 \cdot 5$ | 8.0 | 11.9 |  | ${ }_{1}^{19} 7$ |  | 24. | $26 \cdot 6$ |  | $34 \cdot 7$ 3 1.6 | 34.2 | 37.0 |
| 40 | 0.2 | 0.8 | I. 8 | $3 \cdot 2$ | 5. | 7.2 | $9 \cdot 9$ | 12.9 | 16.2 | $20 \cdot 0$ | $22 \cdot 1$ | $24^{2}$ | $26 \cdot 5$ | 28.8 | $3{ }^{1}$ | 33 |
| 42 | $0 \cdot 2$ | $0 \cdot 7$ | -7 | $2 \cdot 9$ | $4 \cdot 6$ | $6 \cdot 6$ | 9.0 | 11.8 | 14 | 18. | 20.2 | $22 \cdot 2$ | $24^{2}$ | $26 \cdot 3$ | 28.6 |  |
| 44 | 0.2 |  | \% |  |  |  | 8.2 | 0.8 | 13.6 | 16 | 18 |  | $22 \cdot 2$ | I | $26 \cdot 2$ | $28 \cdot 3$ |
| 46 | $\stackrel{0}{0.2}$ | ${ }^{0.6}$ | r ${ }^{\text {¢ }}$ | 2.5 | 3.9 | $5 \cdot 6$ | 7.6 | 9.9 | I2.5 | 15.4 | 17.0 |  | ${ }_{20}^{20.4}$ | 22.2 | 24 |  |
| 48 | $\bigcirc$ | $0 \cdot 6$ | r.3 | 2.3 <br> 2.1 | $3 \cdot 5$ | 5.1 | 7.0 | 9.1 | T0.6 | 14. | 15.6 | ${ }_{17}^{17} 1$ | 18.7 | 20.4 | 20 | 23.9 |
| 50 52 | $\stackrel{\square}{\circ \cdot 1}$ | 0.5 0.5 | r- r - | ${ }^{\circ} 9$ | 3.3 3.0 | 4. 4.3 | 5.9 | 8.3 7 | 10.6 | 12.0 | 14.4 13.2 | 15.7 14.5 | 17.2 |  | 20 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{1}{20}$ | 42'6 | $45 \cdot 8$ | $49^{\circ}$ | $52 \cdot 4$ | 55'9 | 59'6 | $63 \cdot 3$ | $67 \cdot 1$ | $7{ }^{\text {7 }}$ - | $75^{\prime} \mathrm{I}$ | $7{ }^{\text {a }}$ | 83.4 | 87.8 | $2 \cdot 2$ | 96•8 | - 5 |
| 21 | $4 \mathrm{I} \cdot \mathrm{I}$ | $44^{2} 2$ | $47 \cdot 4$ | 50.7 | 54.1 | $57 \cdot 6$ | $6 \mathrm{r} \cdot 2$ | 64.8 | ${ }^{68.6}$ | 72.6 | $76 \cdot 6$ | 80.7 | 84.9 | 89.2 | $93 \cdot 6$ | $98 \cdot \mathrm{x}$ |
| 22 | 39.8 37.2 | $42 \cdot 7$ 40.0 | 45 | ${ }^{49}{ }^{\circ}$ | $52 \cdot 3$ | 5 | 55. | 58 | ${ }_{62 \cdot 4}^{66.4}$ | 65.8 |  | 78.0 |  | 86.3 |  |  |
| 24 26 | 37.2 34.9 | $4{ }^{40.0}$ | $42 \cdot 9$ 40.3 | $43^{4}{ }^{\circ}$ | $4{ }^{49}{ }^{\circ} \mathrm{O}$ | 52.1 <br> 48 | 55.4 | 55.1 | $62 \cdot 2$ 58.4 | 6 r | 65.2 | 73.7 | ${ }_{72 \cdot 3}$ | 80 | 4 | 3.6 |
| 28 | 32.8 |  |  |  | 43.2 | $46 \cdot 0$ | 48.9 |  | 54.9 |  |  | 64.6 | 68.0 |  |  | $8 \cdot 7$ |
| 30 | 20.9 | 33.2 | 37 | ${ }^{38 \cdot 1}$ | $40 \cdot 7$ 38.7 | 43 | $4{ }^{4}$ | 48 | 518.7 | 54.7 | 54 |  | $60^{\circ} 4$ | 63.5 |  | $4 \cdot 1$ |
| 32 | 1 | 31.3 | 33.6 | 35.9 33.9 | $36 \cdot \mathrm{I}$ |  | $43 \cdot 4$ |  | $4{ }^{48 \cdot 7}$ | $48 \cdot 6$ |  | 57. ${ }^{54}$ | 60.4 | 63.5 59.0 | $62 \cdot 9$ | 66.0 |
| 34 36 | 27.5 25.9 | 27.9 | 29 | ${ }_{3} 3$ | $36 \cdot 1$ | 36 | ${ }_{38}^{40 \cdot 6}$ | 43 | $46^{\circ}$ | 48.6 | Sr ${ }_{48}$ |  | 53.8 | 59.9 56.6 | $62 \cdot 9$ 59 | $66^{\circ}$ |
| 38 | 24.5 | 26 | \% | 30.2 | 32.2 |  | $36 \cdot 5$ | 38.7 | 4 | $43 \cdot 3$ | $45^{-8}$ |  | 50.8 |  | 56.1 | 8 |
| 40 | 23 | 24.8 | 26.6 | 28.5 | 30.4 |  | 34 | 36 | $38 \cdot 7$ $36 \cdot 6$ | 38.7 |  |  |  |  | 53.0 <br> 50 <br> 0 |  |
| 44 | $20 \cdot 6$ | $22 \cdot 1$ | 23.7 | 25.4 | $27 \cdot 1$ | 28.9 | 30.7 | 32 | $34 \cdot 5$ | $36 \cdot 5$ | 5 | $4{ }^{4} \cdot 6$ | 42 | $45^{\circ}$ | 473 |  |
| 46 | 19.4 | $20 \cdot 9$ | $22 \cdot 4$ | 23.9 | $25 \cdot 6$ | $27 \cdot 2$ | 29 | $3{ }^{\circ}$ | $32 \cdot 6$ | $34^{4} 4$ |  | 38.3 | $40 \cdot 4$ | $42 \cdot 4$ | $44 \cdot 6$ |  |
| 48 | 18.3 | 19 |  | $22 \cdot 6$ | $24 \cdot 1$ | 25 | 27 | 29.0 |  |  | $34 \cdot 3$ | $36 \cdot 1$ | 38.1 | 40.0 |  | $4 \cdot 1$ |
| 50 | 17 | 18 | 19.9 | 21.2 | $22 \cdot 7$ | 24 | 25.7 | $27 \cdot 3$ | 28.9 | 30.6 | 32.3 | 34 | $33^{3} \cdot 8$ | 37.7 | $3{ }^{39} 6$ |  |
| 54 | 1 | 17.4 16.3 | 17 | 18.7 |  | 2 l 3 | 24.2 | ${ }_{24 \cdot}{ }^{25}$ | $25 \cdot 5$ | $27^{\circ}$ | , |  | 33.7 31.6 |  | 37 | $39 \cdot 1$ $36 \cdot 7$ |
| 56 | 14.2 | 15.3 | 16.4 | 17.6 | 18.7 | $20 \cdot 0$ | 21.2 | 22.5 | 23.9 | $25 \cdot 3$ | 26 | 28.1 | 29.6 | $3{ }^{1} \cdot 2$ | $32 \cdot 7$ | $34 \cdot 3$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 39 | 38 | $40 \cdot 9$ | $43 \cdot 8$ | 46.8 | - | 53.2 | 56.5 | 62.7 59.9 | 63.4 | $67^{\circ}$ |  | $74 \cdot 5$ | 78.4 |  |  |  |
| 40 | 36 | 39.1 | 4 I | 44 | $47 \cdot 8$ |  | $54^{\circ}$ | 5 | $60 \cdot 7$ | ${ }^{64 \cdot 1}$ | 67 |  | 750 | 8.8 | - |  |
| 41 | $34 \cdot 8$ | 37.4 | 40 | 42.8 | $45 \cdot 7$ | 48 | $5{ }^{5}$ | 54.8 | 58.0 | 61.3 58.7 | 64 | 68.2 65.3 | ${ }^{71}$ | 75 | 79.2 <br> 75.8 <br> 8 | 83 |
| 42 | $33 \cdot 3$ | $35^{\prime} 7$ | 38.3 | $41^{\circ}$ | 43 | 46 | $49 \cdot 5$ | $52 \cdot 5$ | $55 \cdot 6$ |  |  |  |  |  |  | 79 |
| 43 | 31.8 30.5 | 34.2 | $36 \cdot 7$ <br> 35. | 39.2 | $4{ }_{4}^{4} \cdot 9$ | $4{ }_{4}^{4 \cdot 6}$ | 47.4 |  | 53.2 $5 \times 0$ | ${ }_{53}{ }^{3} \cdot 9$ | 55.4 | $\begin{aligned} & 62 \cdot 6 \\ & 60 \cdot 0 \end{aligned}$ | $\begin{aligned} & 5 \cdot 8 \\ & 3 \cdot 1 \end{aligned}$ |  |  | -2 |
| 4 |  |  | $35 \cdot 1$ 33.7 | $37 \cdot 6$ 36.0 | ${ }_{3}^{48 \cdot 4}$ |  | 43.5 | 46 | $48 \cdot 9$ | $5 \mathrm{r} \cdot 7$ | 54.5 | 57.5 | $60 \cdot 5$ | $63 \cdot 6$ | 66.8 | - |
| 46 | 28.0 |  | 32 | 34.5 | 36.9 | 39 | 4 I | 44 | 6 | 49. | 52 | 55 | 58. |  | 64 | 67. |
| 48 | $25 \cdot 8$ | 27.7 | 29.7 | $3 \mathrm{r} \cdot 7$ | 33.9 | 36-I | 38.4 | $40 \cdot 7$ | $43 \cdot$ | $45 \cdot 6$ | 48 |  | 53 | 56.1 | 58.9 | $6 \mathrm{I} \cdot 8$ |
| 50 | 23.7 21.8 | 25 | $27 \cdot 3$ |  |  | 33.2 30.5 | 35 | 37.4 | $33 \cdot 7$ 36.5 | ${ }_{38}^{41}$ | $44 \cdot 3$ | 42 | 49.1 | - 6 | 54.2 | 56.9 |
| 54 | $20 \cdot 0$ | 21.5 | $23^{2 \cdot 1}$ | 24.7 | 26.4 | 28. | 29.8 | 3 3 7 |  |  | 37.5 | 42.5 |  | 43.7 | $45^{49}$ | ${ }_{48}{ }^{2}$ |

* SPICA.

| Lat | ${ }_{43}^{\mathrm{m}}$ | ${ }_{44}$ | ${ }_{45}^{\mathrm{m}}$ | ${ }_{46}$ | ${ }_{47}$ | ${ }_{48}$ | ${ }_{49}$ | ${ }_{50}^{\mathrm{m}}$ | ${ }_{51}$ | ${ }_{52}$ | 2 | ${ }_{53}^{\mathrm{m}}$ | ${ }_{54}^{\mathrm{m}}$ | ${ }_{55}^{\mathrm{m}}$ | 56 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  | UCTIO | ONS |  |  |  |  |  |  |  |
| 22 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 24 | I 1333 | $3{ }_{34} 37.51$ | 4 r | 43 | 50.9 | $\begin{array}{ll}\text { I } & 55 \\ \mathrm{r} & 5 \\ 5\end{array}$ | $56 \cdot 6$ |  |  |  |  |  |  |  |  |
|  | I 27 |  | $35 \cdot 7$ | $39^{\circ}$ |  | I 48 8 |  | $57 \cdot 6$ |  |  |  | Ir ${ }^{\text {¢ }}$ |  |  |  |
| 27 | 1 | 28.91 |  |  |  | I |  | 54 |  |  |  |  |  |  |  |
| 28 29 |  |  | $\xrightarrow{30} 2$. | ${ }_{34}^{34}$ |  | 1 |  | 50 |  |  |  |  |  | 213. |  |
| 3 | 1817 |  | 124.9 |  |  | 36 |  |  |  |  |  |  |  |  |  |
| 3 | $1{ }^{1} 54{ }^{1}$ | 18.91 | $22 \cdot 4$ |  |  | 133.6 | 37. | 4 r | 45.4 |  | $49 \cdot 5$ | $53 \cdot 71$ | 57 |  |  |
| 32 | $1{ }_{1} 13.21$ | 16.61 | 20.1 | 23.6 | 27.2 |  |  | I 38.5 |  |  | 46.4 | $50 \cdot 4$ | 54. | 58. |  |
| $\begin{aligned} & 34 \\ & 36 \end{aligned}$ |  | 12 8.3 | 15.6 11.4 | 18.01 |  | $1 \begin{array}{ll}1 & 25 \\ \mathrm{I} & 21 . \\ \text { 21 }\end{array}$ |  |  |  |  |  |  |  |  |  |
|  | 1 I |  |  | $\begin{aligned} & 1 \\ & \text { I } 140.04 \end{aligned}$ |  | 1 I 16.61 |  |  |  |  | 寿 |  |  |  |  |
|  | - ${ }^{88.2}$ | 1 | $3{ }^{\circ} \mathrm{y}$ | ${ }^{1}$ |  | $1{ }^{12} 124$ | 15.4 | 18.5 |  |  | 24.81 | 8.0 | 13 | $1{ }^{3}$ |  |
| 42 | - 55.0 | 57.61 | 56 | 2.91 |  |  | ${ }^{11}$ | 14 | 17.1 |  | $20 \cdot 11$ | 23. | ${ }^{26}$ |  |  |
| $\begin{aligned} & 44 \\ & 46 \end{aligned}$ | O-5190 | ${ }_{54}^{54.4}{ }^{\text {5 }}$ | $53^{56}$ | 59. |  | ${ }_{\text {I }}^{1} \mathrm{l}$ |  |  |  |  | 15 |  |  |  |  |
| 48 | - 46.2 | 48 | 50.6 | 52 | $55 \cdot 1$ | - 57 |  |  |  |  |  |  |  |  |  |
|  | O $43 \cdot 5$ |  | $47 \cdot 6$ |  |  | O 5 |  |  |  |  | $3 \cdot 5$ |  |  |  |  |
|  | $\bigcirc$ | 42.80 | 44.8 |  |  | OO <br> O |  |  |  |  | 59\% ${ }^{\text {Pr }}$ | ${ }_{\text {2.01 }} \times 1$ | ${ }_{0}{ }^{4} \cdot 4$ | $6 \cdot$ |  |
| $\begin{aligned} & 54 \\ & 56 \end{aligned}$ | O | - |  |  |  | O ${ }^{\circ}$ |  |  |  |  |  |  |  |  |  |
| 60 |  | $\begin{array}{lll} 0 & 35 \cdot 2 \\ 0 & 0 & 0 \end{array}$ |  |  |  | $\left\lvert\, \begin{aligned} & 4 \\ & 0 \\ & 0 \end{aligned}\right.$ |  |  |  |  |  |  |  |  |  |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 39 | I 34.9 | I 3.9 .21 | $13^{\circ} 6$ | 48.21 |  | I $57 \cdot 4$ |  | 2712 |  |  | ${ }_{1}$ | 20 |  |  |  |
| 40 |  |  | 139. |  | $47 \cdot 9$ | I 5 |  |  |  |  |  |  |  |  |  |
| 42 | 1 |  | $1{ }^{35}{ }^{3}{ }^{\circ} \mathrm{O}$ |  |  | $1{ }_{1}^{1} 473$ | $47^{\circ} 4$ | $5{ }^{\circ} 7$ |  |  |  |  |  | $14 \cdot 3$ |  |
| 43 | 1 x 19.8 | 20 | 22. | I. |  | 138.0 |  |  |  |  |  |  |  |  |  |
|  | I |  |  |  |  | 1348 |  |  |  |  |  |  |  |  |  |
|  | 1 |  |  | 1 | 23.7 | I 27.3 <br> 18 |  |  |  |  |  |  |  | $53 \cdot 81$ |  |
| 47 | I $7 \cdot 5$ <br> $\mathrm{I}^{1}$  <br> 1  <br> 1  | ${ }^{10} 6{ }^{1}$ | 13.8 | 7.01 |  | $123 \cdot 7$ | 27. | $130 \cdot 7$ | 343 |  | 37.9 ${ }^{\text {I }}$ | $4{ }^{1} 61$ |  |  |  |
| 48 | I |  |  | 13.91 | 17.1 | $1 \begin{array}{ll}1 & 20 \cdot 3 \\ 1 \\ 1\end{array}$ |  |  |  |  |  |  |  |  |  |
|  | 1r ${ }^{1}$ |  |  |  |  | ${ }_{1} 181{ }^{\circ}$ |  |  |  |  |  |  |  |  |  |
|  | 57 |  |  |  |  | ${ }^{1} \mathrm{Ir}$ |  |  |  |  |  |  |  |  |  |
| 5 | - 54.8 \| | - 57.41 I |  | $12 \cdot 71$ |  | I $8 \cdot \mathrm{TIT}$ |  |  | I 16.8 |  |  |  |  |  |  |

TRUE BEARING OR AZIMUTH OF * SPICA.

N.

1
18
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## AZIMUTHS

REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* SPICA.

* a TRIANGULI AUSTRALIS.

| Lat | $\underset{4}{ }$ | m 8 | . ${ }_{1}^{\mathrm{m}}$ | m. m <br> 12 1 |  | 2 | 22 | 4 |  |  |  | $32 \cdot 3$ |  |  |  |  | 42 | 4. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | O |  |  | 1.6 2 | $2 \cdot 8$ | $4 \cdot 4$ | $5 \cdot 4$ |  | $7 \cdot 5$ | $\cdot 7$ | $\cdot 9$ | I $1 \cdot 3$ I | 12.8 | $4 \cdot 3$ | 16.0 | 1\%* | 9•5 | I.4 |
| 10 | $0 \cdot 2$ | $0 \cdot$ |  | 1.7 | $3 \cdot 0$ | $4 \cdot 7$ |  | -8 | \% | $9 \cdot 3$ | 10.6 | 12.I 13 | 13.6 | $15 \cdot 3$ | $17 \cdot 0$ | 18.9 | 20.8 | $22 \cdot 8$ |
| 0 | $0 \cdot 2$ | 0.8 |  | $\mathbf{1} 8$  | $3 \cdot 2$ | $5 \cdot 0$ | $6 \cdot 1$ | $\cdot 2$ | $8 \cdot 5$ | $9 \cdot 9$ | II•3 | 12.91 | 14.6 | 16.3 | 18.2 | 20.1 | 22.2 | 24.3 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | $0 \cdot$ | 0 |  | 3 | 3 | $5 \cdot 4$ | $6 \cdot 5$ | $7 \cdot 8$ | $9 \cdot 2$ |  | 12.2 | I3.8 I | 15 | 17*5 | 19.5 | $2 \mathrm{I} \cdot 6$ | $23 \cdot 8$ | $26 \cdot 1$ |
| 20 | $0 \cdot 2$ | $0 \cdot 9$ |  | $2 \cdot 1$ | 3 | $5 \cdot 9$ | I |  | 9.9 | II•5 | 13 | $15{ }^{\circ} \mathrm{O}$ | 16. | 19*0 | $2 \mathrm{I} \cdot \mathrm{I}$ | 23.4 | $25 \cdot 8$ | $28 \cdot 3$ |
| 2 | $0 \cdot$ | I-O |  | 3 | 3.9 | $6 \cdot 1$ | 7.4 | $8 \cdot 8$ | $10 \cdot 3$ | II•9 | $13 *$ | 15.6 I | $17 \cdot$ | 19.7 | 2 | 24.3 | $26 \cdot 7$ | $29 \cdot 3$ |
| 28 | $0 \cdot 3$ | O |  | $2 \cdot 3 \quad 4$ | $4^{\cdot 1}$ | $6 \cdot 3$ | $7 \cdot 7$ | $9 \cdot 1$ | 10.7 | 12.4 | 14.2 | 16.2 I | $18 \cdot 3$ | $20 \cdot 5$ | 22.8 | $25 \cdot 2$ | $27 \cdot 8$ | $30 \cdot 5$ |
| 3 | $0 \cdot 3$ | I•I |  |  | 4 | $6 \cdot 6$ |  | 9 | II.2 | 13 |  | 1 | 19.2 | , | 23.9 | 26.4 | 29.I | $32 \cdot 0$ |
| 36 | $0 \cdot 3$ | I-I |  | $2 \cdot 5 \quad 4$ | $4 \cdot 5$ | 0 | $8 \cdot 5$ | Io | II•9 | 13.7 |  | 17.92 | $20 \cdot 2$ | 22.6 | $25 \cdot 2$ | $27 \cdot 9$ | $30 \cdot 7$ | $33 \cdot 6$ |
| 38 | $0 \cdot 3$ | 2 |  | $2 \cdot 6$ | $4 \cdot 6$ | $7 \cdot 2$ | $8 \cdot 7$ | 10 | 12 | 14 | $16 \cdot 2$ | 18.4 | $20 \cdot 8$ | $23 \cdot 3$ |  | $28 \cdot 7$ | $3 \mathrm{I} \cdot 6$ | $34 \cdot 7$ |
| 40 | $0 \cdot 3$ | 2 |  | $2 \cdot 7 \quad 4$ | $4 \cdot 8$ | $7 \cdot 5$ | 900 | 10.7 | 12.6 | 14.6 | 16.7 | $19 \cdot 0$ | 21.5 | $24^{\circ} 0$ | 26 | $29 \cdot 6$ | $32 \cdot 6$ | $35 \cdot 8$ |
| 42 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $30 \cdot 6$ |  | $37^{\circ} \mathrm{O}$ |
| 43 | $0 \cdot 3$ | 1 | 2 | $2 \cdot 8$ | $5 \cdot 0$ | $7 \cdot 9$ | 5 | II | 13 | 15.4 | $17 \cdot 7$ | $20^{\circ} \mathrm{I}$ | $22 \cdot 6$ | $25 \cdot 4$ | $28 \cdot 2$ | 3I•2 | 34 | $37 \cdot 7$ |
| 44 | 3 | I-3 | 2 | $2 \cdot 9$ | 5 | 8 | 7 | I | 13 | 15.7 | 18*0 | $20 \cdot 5$ | $23 \cdot 1$ | 25.9 | $28 \cdot 8$ | 31 | 35 | $38 \cdot 4$ |
| 45 | $0 \cdot 3$ | 1 | 3 | $3 \cdot 0$ | $5 \cdot 3$ | $8 \cdot 2$ | $9 \cdot 9$ | II. 8 | I3.8 | $16 \cdot 0$ | 18 | $20 \cdot 9 \quad 2$ | $23 \cdot 6$ | $26 \cdot 4$ | 29.4 | $32 \cdot 5$ | 35 | $39 \cdot 2$ |
| 46 |  |  |  | $3 \cdot 0$ |  |  |  |  |  |  |  | 4 | 2 | 27.0 | 30 | 33 |  | $40^{\circ} \mathrm{I}$ |
| 47 | 3 | I*4 | 43 |  |  | $8 \cdot 6$ | 10.4 | 12 | I4.5 | 16.8 | 19 | $2 \mathrm{I} \cdot 9$ | $24^{\circ} 7$ | $27 \cdot 6$ | $30 \cdot 7$ | $34^{\circ} \mathrm{O}$ | 37 | $4 \mathrm{I} \cdot 0$ |
| 48 | $0 \cdot 4$ | I*4 | 3 | 3 | 5.6 | $8 \cdot 8$ | 10 | 12 | 14.9 | 17.2 | 19.7 | 22.4 | $25 \cdot 3$ | $28 \cdot 3$ | 3I•5 | 34.8 | 38 | 42.0 |
| 49 | 0.4 |  |  | $3 \cdot 3$ | $5 \cdot 8$ | $9 \cdot 0$ | 10.9 | 13.0 | $15 \cdot 3$ | 17.7 | $20 \cdot 3$ | 23.0 | $26 \cdot 0$ | 29.1 | $32 \cdot 3$ | $35 \cdot 8$ | 39 | 43.2 |
| 50 | 0.4 | 5 | 5 3 | $3 \cdot 4$ | 6 | $9 \cdot 3$ | II.3 | 13.4 | 15.7 | 18.2 | 20 | $23 \cdot 7$ | $26 \cdot 7$ | 29.9 | $33 \cdot 3$ |  | 4 | $4 * 4$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 2.4 | 23.4 | 24.4 | 25.4 | $26 \cdot 5$ | $27 \cdot 6$ | 28.7 | 29.8 | 31.0 | $32 \cdot 1$ | $33 \cdot 3$ | - $34 \cdot 6$ | 6 O | $35 \cdot 8$ | $\therefore \quad 37 \cdot 1$ | - | '8.3 | 3'́6 |
| 16 | 23.0 | $24^{\circ} 0$ | $25^{\circ} \mathrm{O}$ | $26 \cdot 1$ | $27 \cdot 2$ | $28 \cdot 3$ | $29 \cdot 5$ | $30 \cdot 6$ | 3I•8 | $33^{\circ} \mathrm{O}$ | $34 \cdot 2$ | - $35 \cdot 5$ | 50 | $36 \cdot 8$ | - 38.1 | 0 | $39 \cdot 4$ | $40 \cdot 7$ |
| 12 | $23 \cdot 6$ | 24.6 | $25 \cdot 7$ | $26 \cdot 8$ | $27 \cdot 9$ | $29^{-1}$ | 30.2 | 31.4 | $32 \cdot 6$ | 33.9 | $35^{\circ} \mathrm{I}$ | - 36.4 | 40 | $37 \cdot 7$ | - 39.0 | 0 | $40 \cdot 4$ | 41.8 |
| 8 | 24.2 | $25 \cdot 3$ | 26.4 | $27 \cdot 5$ | $28 \cdot 6$ | 29.8 | 31.0 | $32 \cdot 2$ | 33.5 | 34.7 | $36 \cdot 0$ | - 37.4 | 40 | $38 \cdot 7$ | 0 40•I | 0 | 41.4 | $42 \cdot 8$ |
| 4 | 24.8 | 25.9 | $27 \cdot 0$ | $28 \cdot 2$ | 29 | $30 \cdot 6$ | $3 \mathrm{~S} \cdot 8$ | $33 \cdot 1$ | 34.3 | $35 \cdot 6$ | $37 \cdot 0$ | - 38.3 | 30 | $39^{\circ} 7$ | - 4I•I | 0 | $42 \cdot 5$ | $44^{\circ}$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 |  | $26 \cdot 6$ | $27 \cdot 8$ | 29.0 | $30 \cdot 2$ | $3 \mathrm{I} \cdot 4$ | 32.7 | $34^{\circ} \mathrm{O}$ | $35 \cdot 3$ | $36 \cdot 6$ | $38 \cdot 0$ | - 39.3 | 3 | 40•7 | $42 \cdot 2$ | 0 | $3 \cdot 6$ | 45. 1 |
| 2 | $25 \cdot 8$ | 27.0 | $28 \cdot 2$ | 29.4 | $30 \cdot 6$ | $3 \mathrm{I} \cdot 8$ | $33 \cdot 1$ | 34.4 | $35 \cdot 8$ | $37 \cdot 1$ | $38 \cdot 5$ | - 39.9 | 90 | $4 \mathrm{I} \cdot 3$ | - $42 \cdot 8$ | - | 44.2 | $45 \cdot 7$ |
| 4 | $26 \cdot 2$ | 27.4 | $28 \cdot 6$ | 29.8 | 31.0 | $32 \cdot 3$ | $33 \cdot 6$ | 34.9 | $36 \cdot 2$ | $37 \cdot 6$ | $39^{\circ} \mathrm{O}$ | $\circ 40 \cdot 4$ | $40$ | $4 \mathrm{I} \cdot 8$ | - $43 \cdot 3$ | 0 | $44 \cdot 8$ | $46 \cdot 3$ |
| 6 | $26 \cdot 5$ | $27 \cdot 7$ | $28 \cdot 9$ | 30.2 | 31.4 | $32 \cdot 7$ | $34^{\circ} 0$ | $35 \cdot 4$ | $36 \cdot 7$ | $38 \cdot 1$ | $39 \cdot 5$ | $041 \cdot 0$ | $\begin{array}{l\|l} 0 & 0 \end{array}$ | $42 \cdot 4$ | - $43 \cdot 9$ | 0 | $45 \cdot 4$ | $47^{\circ} \mathrm{O}$ |
| - | $26 \cdot 9$ | $28 \cdot 1$ | 29.3 | 3 | 31.9 | 33.2 | 34.5 | $35 \cdot 9$ | 37.2 | $38 \cdot 7$ | $40 \cdot 1$ | O 41.5 | $5$ | $43 \cdot 0$ | - 44.5 | O | $46 \cdot 1$ | $47 \cdot 6$ |
| 10 | $27 \cdot 3$ | $28 \cdot 5$ | $29 \cdot 8$ | 3I•I | 32.4 | $33 \cdot 7$ | 35.0 | $36 \cdot 4$ | $37 \cdot 8$ | 39.2 | $40 \cdot 7$ | O 42.2 | 20 | $43 \cdot 7$ | - 45.2 | O | $46 \cdot 8$ | $48 \cdot 3$ |
| 12 | 27* 7 | $28 \cdot 9$ | $30 \cdot 2$ | 31.5 | 32 | 34.2 | 35.6 | $37^{\circ} \mathrm{O}$ | 38.4 | $39 \cdot 8$ | 4I•3 | - $42 \cdot 8$ | 8 | $44 \cdot 3$ | - $45 \cdot 9$ |  | $7 \cdot 5$ | $49^{\text {I }}$ |
| 14 | 28•1 | $29^{*} 4$ | $30 \cdot 7$ | 32.0 | $33 \cdot 3$ | $34 \cdot 7$ | 36.1 | 37.5 | 39.0 | $40 \cdot 4$ | $41 \cdot 9$ | O $43 \cdot 5$ | $50$ | $45^{\circ} \mathrm{O}$ | - $46 \cdot 6$ | $\bigcirc$ | $48 \cdot 2$ | $49 \cdot 8$ |
| 16 | $28 \cdot 6$ | $29^{\circ} 9$ | 3I•2 | 32.5 | 33.9 | $35^{\circ} 2$ | $3{ }^{3} \cdot 7$ | $38 \cdot 1$ | $39 \cdot 6$ | 4I•I | $42 \cdot 6$ | - $44^{\prime} \mathrm{I}$ | $I$ | $45 \cdot 7$ | - $47 \cdot 3$ | $\bigcirc$ | $48 \cdot 9$ | $50 \cdot 6$ |
| 18 | 29.1 | $30 \cdot 4$ | 31.7 | 33.0 | 34.4 | $35 \cdot 8$ | $37 \cdot 3$ | $38 \cdot 7$ | $40 \cdot 2$ | 41.7 | $43 \cdot 3$ | - 44.8 | $80$ | $46 \cdot 4$ | - $48 \cdot 1$ | $\bigcirc$ | $49 \cdot 7$ | $51 \cdot 4$ |
| 20 | 29.6 | 30.9 | 32.2 | 33.6 | $35^{\circ} \mathrm{O}$ | $36 \cdot 4$ | 37.9 | 39.4 | $40 \cdot 9$ | 42.4 | $44^{\circ} \mathrm{O}$ | O $45^{\circ} 6$ | 6 | $47 \cdot 2$ | - $48 \cdot 9$ | 0 | $50 \cdot 6$ | $52 \cdot 3$ |
| 22 | $30 \cdot 1$ | $3 \mathrm{I} \cdot 4$ | $32 \cdot 8$ | 34.2 | $35 \cdot 6$ | $37 \cdot 1$ | 38.6 | $40 \cdot 1$ | 41.6 | 43.2 | $44 \cdot 8$ | - 46.4 | 40 | $48 \cdot 1$ | - $49 \cdot 8$ | O 5 | 51.5 | $53 \cdot 2$ |
| 24 | 30•7 | 32 | 33.4 | $44^{\circ} 9$ | $36 \cdot 3$ | $37 \cdot 8$ | $39 \cdot 3$ | 40 | 42.4 | $44^{\circ} \mathrm{O}$ | $45 \cdot 6$ | O $47^{\circ} 3$ | 3 | $49^{\circ} \mathrm{O}$ | $50 \cdot 7$ |  | 52.4 | $54 \cdot 2$ |
| 26 | 31 | $32 \cdot 7$ | $34 \cdot 1$ | I $35 \cdot 5$ | $37 \cdot 0$ | $38 \cdot 5$ | 40•1 | $4 \mathrm{I} \cdot 7$ | $43 \cdot 3$ | 44.9 | $46 \cdot 5$ | - $48 \cdot 2$ | 20 | $49 \cdot 9$ | - 51.7 | O | 53.5 | $55 \cdot 3$ |
| 28 | 31.9 | $33 \cdot 3$ | $34 \cdot 8$ | $36 \cdot 3$ | 37 | $39 \cdot 3$ | $40 \cdot 9$ | 42.5 | $44^{\prime 2}$ | $45 \cdot 8$ | $47 \cdot 5$ | - 49.2 | $2$ | $5 \mathrm{I} \cdot \mathrm{O}$ | - 52.8 | 0 | 54.6 | $56 \cdot 4$ |
| 30 | $32 \cdot 6$ | $34^{-1}$ | $35 \cdot 6$ | $637 \cdot 1$ | $38 \cdot 6$ | $40 \cdot 2$ | $4 \mathrm{I} \cdot 8$ | 43.4 | $45 \cdot 1$ | $46 \cdot 8$ | $48 \cdot 5$ | - 50.3 | 30 | $52 \cdot 1$ | - 53.9 | - | 55.8 | $57 \cdot 6$ |
| 32 | $33 \cdot 4$ | 34.9 | 36.4 | 438.0 | $39 \cdot 5$ | 4I•2 | $42 \cdot 8$ | $44 \cdot 5$ | $46 \cdot 2$ | 47*9 | $49 \cdot 7$ | - 5I.5 | 50 | $53 \cdot 3$ | - $55 \cdot 2$ | 0 | 57.1 | 59.0 |
| 34 | 34.3 | $35 \cdot 8$ | $37 \cdot 3$ | $38 \cdot 9$ | $40 \cdot 5$ | $42 \cdot 2$ | 43.9 | $45 \cdot 6$ | $47 \cdot 3$ | $49^{\text {I }}$ | $50 \cdot 9$ | - 52.8 | 8 O | $54 \cdot 6$ | - $56 \cdot 5$ | 0 | $58 \cdot 5$ | 0.4 |
| 36 | 35.2 | 36 | $38 \cdot 4$ | $44^{\circ} \mathrm{O}$ | 4 | $43 \cdot 3$ | $45^{\circ} \mathrm{I}$ | $46 \cdot 8$ | $48 \cdot 6$ | $50 \cdot 4$ | $52 \cdot 3$ | O 54*2 | 2 | 56•1 | - $58 \cdot 0$ |  | $0 \cdot 0$ | 2.0 |
| 37 | $35 \cdot$ | $37 \cdot 3$ | $38 \cdot 9$ | 90•5 | $42 \cdot 2$ | $43 \cdot 9$ | 45.7 | $47 \cdot 5$ | $49 \cdot 3$ | $5 \mathrm{I} \cdot \mathrm{I}$ | 53.0 | - 54.9 | 90 | $56 \cdot 9$ | - 58.8 | 1 | 0.8 | $2 \cdot 9$ |
| 38 | $36 \cdot 2$ | $37 \cdot 9$ | 39.5 | $54 \mathrm{I} \cdot 2$ | $42 \cdot 9$ | $44^{\cdot 6}$ | $46 \cdot 4$ | $48 \cdot 2$ | $50 \cdot 0$ | $51 \cdot 9$ | $53 \cdot 8$ | - $55^{\circ} 7$ | 70 | $57 \cdot 7$ | - $59 \cdot 7$ | 1 | I•7 | $3 \cdot 8$ |
| 39 | $36 \cdot 8$ | $38 \cdot 4$ | $40 \cdot 1$ | I $41 \cdot 8$ | $43 \cdot 5$ | $45 \cdot 3$ | $47 \cdot 1$ | $48 \cdot 9$ | 50.8 | $52 \cdot 7$ | $54 \cdot 6$ | - 56.6 | 60 | $58 \cdot 6$ | $0 \cdot 6$ | 1 | $2 \cdot 7$ | 4 |
| 40 | $37 \cdot 4$ | $39^{\circ} 0$ | $40 \cdot 7$ | $742 \cdot 5$ | $44^{\prime} 2$ | $46 \cdot 0$ | $47 \cdot 8$ | $49 \cdot 7$ | $5 \mathrm{I} \cdot 6$ | 53.5 | 55.5 | - 57.5 | 50 | $59 \cdot 5$ | I•6 | I | 3.6 | 5.8 |
| 41 | $38 \cdot 0$ | $39^{\circ} 7$ | 41*4 | $43^{\circ} 2$ | $45^{\circ} \mathrm{O}$ | $46 \cdot 8$ | $848 \cdot 6$ | $50 \cdot 5$ | 52.4 | 54.4 | $56 \cdot 4$ | - 58.4 | 4 | 0.5 | 12.6 |  | $4 * 7$ | $6 \cdot 9$ |
| 42 | $38 \cdot 7$ | $40 \cdot 4$ | $42 \cdot 2$ | $23^{-9}$ | $45 \cdot 8$ | $47 \cdot 6$ | $49 \cdot 5$ | $51 \cdot 4$ | 53.4 | 55.4 | $57 \cdot 4$ | O $59 \cdot 5$ | 5 | $1 \cdot 5$ | I $3 \cdot 7$ |  | $5 \cdot 8$ | $8 \cdot 0$ |
| 43 | $39^{\circ} 4$ | $4 \mathrm{I} \cdot 2$ | 42.9 | 44*7 | $46 \cdot 6$ | $48 \cdot 5$ | $550 \cdot 4$ | $52 \cdot 4$ | 54.4 | $56 \cdot 4$ | $58 \cdot 4$ | $0 \cdot 5$ | 5 | $2 \cdot 7$ | $4 \cdot 8$ |  | $7 \cdot 0$ | $9 \cdot 3$ |
| 44 | $40 \cdot 2$ | $42 \cdot 0$ | $43 \cdot 8$ | $845 \cdot 6$ | $47 \cdot 5$ | $49 \cdot 4$ | 51 | 53.4 | $55 \cdot 4$ | 57.5 | $59 \cdot 6$ | 1 I 7 | 7 | $3 \cdot 9$ | I $6 \cdot 1$ | I | $8 \cdot 3$ | $10 \cdot 6$ |
| 45 | 41.0 | $42 \cdot 8$ | 44.7 | $746 \cdot 6$ | $48 \cdot 5$ | $50 \cdot 4$ | 452.4 | $54 \cdot 5$ | $56 \cdot 5$ | $58 \cdot 6$ | $60 \cdot 8$ | I 2.9 | 9 | $5 \cdot 2$ | I $7 \cdot 4$ |  | $9 \cdot 7$ | 12 |
| 46 | 4I'9 | $43 \cdot 8$ | $45 \cdot 7$ | $7{ }^{47} 6$ | $49^{\circ} 5$ | 51•5 | 53.6 | 55*7 | 57.8 | 59.9 | $62 \cdot 1$ | $\text { I } 4 \cdot 3$ | 3 | $6 \cdot 6$ | I ${ }^{\text {c }} 8.9$ |  | II.2 | 13.5 |
| 47 | $42 \cdot 9$ | $44 \cdot 8$ | $46 \cdot 7$ | $748 \cdot 7$ | $50 \cdot 7$ | $52 \cdot 7$ | 54.8 | $56 \cdot 9$ | $59 \cdot 1$ | $6 \mathrm{I} \cdot 3$ | 63.5 | I $5 \cdot 8$ | 8 | $8 \cdot 1$ | I 10.4 | I | 12.8 | 15.2 |
| 48 | 43.9 | $45 \cdot 9$ | $47 \cdot 8$ | $849 \cdot 9$ | $51 \cdot 9$ | $54^{\circ}$ | $56 \cdot 1$ | $58 \cdot 3$ | $60 \cdot 5$ | $62 \cdot 8$ | $64 \cdot 9$ | $17 \cdot 3$ | 3 | $9 \cdot 7$ | $112 \cdot$ |  | 14.5 | 17.0 |
| 49 | $45^{\cdot 1}$ | $47 \cdot 1$ | $49 \cdot 1$ | 151 | $53 \cdot 3$ | $55 \cdot 4$ | 57.6 | $59 \cdot 8$ | $62 \cdot 1$ | 64.4 | $66 \cdot 7$ | $9 \cdot 1$ | I | II•5 | $1 \begin{array}{ll}13.9\end{array}$ |  | 16.4 | 18.9 |
| 50 | $46 \cdot 4$ | $48 \cdot 4$ | 50.5 | $5152 \cdot 6$ | $54 \%$ | $56 \cdot 9$ | \| 59.2 | 61.4 | $63 \cdot 8$ | $66 \cdot 1$ | $68 \cdot 5$ | I 10.9 | 9 | 13.4 | I $15 \%$ |  | 18.4 | 21.0 |

# REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN. 

* a TRIANGULI AUSTRALIS.

|  | 61 | 62 | 63 | 64 | 65 | 66 |  |  |  |  |  |  |  |  | 5 |
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| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I6 |  |  |  |  | 48 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  | I 2.4 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | 1.5 |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |  | II |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $49 \cdot 2$ |  |  |  |  | - | ${ }^{1} 1$ | 1 |  |  |  |  |  |  |  |
|  | $49^{\prime} 9$ |  |  |  |  | - 58.4 | $1{ }^{1} \mathrm{O} .11$ |  |  |  |  | $9 \cdot 3$ |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | 1 | I | I |  |  |  |  |  |  |  |
|  |  |  |  |  |  | I 3.1 | 1 | I | $8 \cdot 9$ |  | 112.9 |  | 6.9 |  |  |
|  |  |  |  |  |  | $\begin{array}{ll}1 & 4.2 \\ \text { I } & 5 \\ 5\end{array}$ |  |  | 10 |  |  |  |  |  |  |
|  |  |  |  |  |  | 6.71 | 8.71 | 118 <br> 10.7 |  |  |  |  | 121.2 |  |  |
|  |  | 60 |  |  |  | 8.01 | 10.11 | 112.1 | 2 |  |  |  |  |  |  |
|  |  |  |  |  |  | $1{ }^{1} 9 \cdot 5$ | $\mathrm{x}_{11} 1.6$ | $1{ }^{1} 13 \cdot 7$ | $1{ }_{1} 15.8$ I |  | I | 22.4 |  |  |  |
|  |  |  |  |  |  |  | 113.21 | 115.4 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  | I |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | ${ }^{1}$ |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | 1818.0 |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | I 24.31 | 126.81 | 1 |  |  |  | I 39.51 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $72 \cdot 9$ | $75^{\circ}$ |  |  |  | 124.91 | 127.4 |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | $\begin{aligned} & 1 \begin{array}{l} 28.4 \\ \text { I } \end{array} 30.4 \end{aligned}$ |  | $\begin{array}{lll} 1 & 33 \cdot 6 \\ 1 & 35 \cdot 7 \\ \hline & 5 & 1 \end{array}$ |  |  | $\left\lvert\, \begin{array}{ll} 1 & 417 \\ \text { I } & 43.9 \end{array}\right.$ |  | 19 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  | 55.1 |  |
|  |  |  |  |  |  |  |  | I | I |  |  |  | 11 <br> I | .9 |  |

TRUE BEARING OR AZIMUTH OF * a TRIANGULI AUSTRALIS.


## N.

| 20 | $\mathrm{O}^{\circ} \cdot 4$ | $\bigcirc$ | - $\mathrm{ra}_{1}$ | - ${ }^{\circ} 5$ | I.8 | $2 \cdot 2$ | $2 \cdot 5$ | $2 \bigcirc$ | 3.2 | 3.6 | $4{ }^{\circ} \mathrm{O}$ | $4^{\circ} \cdot{ }^{3}$ | $4^{\circ} \cdot 6$ | 4 | $6^{\circ} \cdot 2$ | I |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 | 0.4 | 0.7 | $1 \cdot 1$ | 1.5 | 1.8 | $2 \cdot 2$ | 2.6 | $2 \cdot 9$ | $3 \cdot 3$ | 3.6 | $4{ }^{\circ}$ | 4.4 | $4 \cdot 7$ | 5.5 | 6.3 | 7.2 | 8.0 |
| - | 0.4 | 0.8 | 1.2 | 1.6 | r9 | $2 \cdot 3$ | $2 \cdot 7$ | $3 \cdot 1$ | $3 \cdot 5$ | 3.8 | $4 \cdot 2$ | $4 \cdot 6$ | $5{ }^{\circ}$ | 5.7 | $6 \cdot 6$ | 7.5 | 8.4 |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | $0 \cdot 4$ | - 0.9 | ${ }_{1} 1.3$ | I'7 | 2.1 | 2.5 | 2.9 | 3.3 3.5 | 3.8 4.0 | 4.2 | 4.6 | 5.0 | $5 \cdot 4$ | 6.2 6.6 | 7.2 | 8.2 8.6 | 9.1 |
| 15 20 | -0.4 | - | 1.4 | I.9 | $2 \cdot 4$ | $2 \cdot 9$ | 3.3 | $3 \cdot 8$ | $4 \cdot 3$ | 4.7 | $5 \cdot 2$ | $5 \cdot 7$ | $6 \cdot 1$ | 7.0 | 8.1 | 9.2 | 10.2 |
| 24 | 0.5 | roo | $1 \cdot 5$ | 2.0 | $2 \cdot 5$ | $3 \cdot 1$ | 3.6 | $4 \cdot 1$ | $4 \cdot 6$ | 5.0 | $5 \cdot 5$ | $6 \cdot 0$ | $6 \cdot 5$ | 7.5 | 8.6 | 9.8 | 10.9 |
| 28 | $0 \cdot 6$ | ${ }_{1} \cdot$ | 1.6 | 2.2 | 2.7 | 3.3 | 3.8 | $4 \cdot 4$ | 4.9 | 5.4 | 6.0 | $6 \cdot 5$ | 7.0 | 8.0 | $9 \cdot 3$ | 10.5 | Ir 7 |
| 32 | 0.6 | 1.2 | $1{ }^{1.8}$ | 2.4 | 3.0 | 3.6 | 4.2 | 4.8 | 5.3 | 5.9 | $6 \cdot 5$ | 7.18 | $\stackrel{7}{8.6}$ | 8.7 0.6 | $\xrightarrow{10 \cdot 1}$ | I14 | 12.6 |
| 36 38 | 0.7 0.7 | I.3 | 2.I | 2.8 | 3.3 | $4{ }_{4}{ }^{\circ}$ | $4 \cdot 9$ | $5 \cdot 6$ | 6.2 | 6.9 | 7.6 | 8.2 | 8.9 | 10.2 | 11.7 | 12.5 13.2 | 13.9 14.6 |
| 40 | $0 \cdot 7$ | 1.5 | 2.2 | 3.0 | $3 \cdot 7$ | $4 \cdot 4$ | $5 \cdot 2$ | 5.9 | 6.6 | 7.3 | 8.0 | 8.7 | $9 \cdot 4$ | 10.8 | 12.4 | 13.9 | 15.4 |
| 42 | 0.8 | I.6 | 2.4 2.6 | 3.2 3.4 | 4.8 | ${ }^{4 \cdot 7}$ | 5.5 | 6.3 6.8 | ${ }_{7}^{7 \cdot 1}$ | 78.8 | 8.6 | 9.3 |  | ${ }_{11}^{115}$ | 13.2 |  | 15.3 |
| 44 | -0.9 | 1.7 1.9 | 2.8 | 3.4 |  | 5.5 | 5.4 | ${ }_{7}{ }^{6 \cdot 3}$ | ${ }_{8.2}$ | 9.1 | 9.2 9.9 | 10.8 | 10.6 | $12 \cdot 3$ 13.2 | $1{ }_{1}{ }^{14}$ | ${ }_{15}{ }^{15} 9$ | ${ }_{18.6}^{17}$ |
| 48 | 1.0 | $2 \cdot 0$ | 3.0 | $4 \cdot 0$ | $5{ }^{\circ}$ | 6.0 | 7.0 | 8.0 | $8 \cdot 9$ | 9.8 | 10.8 | 7 | 12.6 | 14:3 | $16 \cdot 4$ | 18.3 | 1 |
| 49 | $\xrightarrow[\text { I-I }]{1}$ | 2.1 | 3.2 3.3 | 4.2 4.4 | $5 \cdot 3$ 5.5 | 6.3 6.6 | 7.3 7.7 | 8.3 8.7 | 9.3 9.8 |  |  |  | 13.1 13.8 | $15 \cdot 0$ 15.7 | 17.1 | $18 \cdot 1$ 19.9 | 20.98 |

* a TRIANGULI AUSTRALIS.

| Lat. | $\frac{\mathrm{m}}{4}$ | $\stackrel{\mathrm{m}}{8}$ | m. | ${ }_{16}$ | m. | ${ }_{24}$ | ${ }_{26}$ | m 28 | 30 | ${ }_{3} \mathrm{~m}$. | 34 | 36 | m. 38 | m. | m. | 44 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | $0 \cdot 2$ | $0 \cdot 7$ | I. 6 | $2 \cdot 8$ | $4 \cdot 3$ | $6 \cdot 2$ | $7 \cdot 3$ | $8 \cdot 5$ | $9 \cdot 7$ | I'0 | I2.5 | $4^{\circ} \mathrm{O}$ | 15.6 | -2 | 9́o | \% 6 |
| 30 | $0 \cdot 2$ | 0.7 | I*5 | $2 \cdot 6$ | $4^{*} 1$ | 5.9 | $7 \cdot 0$ | $8 \cdot 1$ | $9 \cdot 3$ | 10.6 | II*9 | 13.4 | 14.9 | 16.5 | 18.2 | $20 \cdot 0$ |
| 35 | 0.2 | 0.6 | 1.4 | $2 \cdot 5$ | $4^{\circ} \mathrm{O}$ | $5 \cdot 7$ | $6 \cdot 7$ | $7 \cdot 8$ | $9^{\circ} \mathrm{O}$ | 10.2 | II•5 | 12.9 | 14.3 | I 5.9 | 17.5 | 19.2 |
| 40 | $0 \cdot 2$ | 0.6 | r*4 | $2 \cdot 4$ | $3 \cdot 8$ | $5 \cdot 5$ | $6 \cdot 5$ | $7 \cdot 5$ | $8 \cdot 6$ | $9 \cdot 8$ | II'O | 12.4 | 13.8 | $15 \cdot 3$ | I6.8 | 18.4 |
| 45 | O.I | $0 \cdot 6$ | I•3 | $2 \cdot 3$ | $3 \cdot 6$ | $5 \cdot 2$ | $6 \cdot 2$ | $7 \cdot 1$ | $8 \cdot 2$ | $9 \cdot 3$ | 10.5 | I 1.8 | 13.1 | 14.6 | 16.0 | I7.6 |
| 50 | $0 \cdot 1$ | 0.6 | 1.2 | $2 \cdot 2$ | 3.5 | $5 \cdot 0$ | $5 \cdot 8$ | $6 \cdot 8$ | $7 \cdot 8$ | $8 \cdot 9$ | $10 \cdot 0$ | II.2 | 12.5 | 13.8 | 15.2 | r6•7 |
| 55 | $0 \cdot 1$ | 0.5 | I•2 | $2 \cdot 1$ | $3 \cdot 3$ | $4 \cdot 7$ | $5 \cdot 5$ | $6 \cdot 4$ | $7 \cdot 3$ | $8 \cdot 3$ | $9 \cdot 4$ | 10.6 | 11.8 | 13.0 | 14.4 | I5.8 |
| 60 | $0 \cdot 1$ | 0.5 | I•I | 1.9 | 3.0 | $4 \cdot 3$ | $5 \cdot 1$ | $5 \cdot 9$ | $6 \cdot 8$ | $7 \cdot 7$ | $8 \cdot 7$ | $9 \cdot 8$ | 10.9 | 12.1 | $13 \cdot 3$ | 14.6 |


S.


 s. | $\circ$ |  |
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| 24 | 3 |
| 26 | 3 |
| 28 | 3 |
| 30 | 3 |
| 32 | 3 |
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| 36 | 3 |
| 38 | 3 |
| 40 | 3 |
| 42 | 33 |
| 44 | 3 |
| 46 | 3 |
| 48 | 3 |
| 50 | 3 |
| 52 | 3 |
| 54 | 2 |
| 56 | 2 |
| 57 | 2 |
| 58 | 2 |
| 59 | 2 |
| 60 | 2 |

 $38 \cdot 6$
$38 \cdot 1$
37.6
$37 \cdot 1$
36.5
36.0
35.4
34.8
34.3
33.7
33.0
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31.8
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29.6
28.9
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27.6
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## REDUCTIONS

 $26 \cdot 1$25.4
24.6
23.8
23.0
22.5
22.1
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$20^{\circ} .1$
19.5

18.9 | $27 \cdot 2$ | $28 \cdot 3$ | $20^{\prime} .4$ |
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 1.6
$3 \cdot 7$
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\end{tabular} 36

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3 $6 \cdot 3$
$35 \cdot 3$
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26.3 | $3 y^{\prime} \cdot 6$ |
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| 36.5 |
| 35.4 |
| 34.3 |
| 33.0 |
| 32.4 |
| 31.8 |
| $3 \mathrm{I} \cdot \mathrm{I}$ |
| 30.4 |
| 29.6 |
| 28.9 |
| 28.1 |
| 27.2 | REDUCTIONS.

| Lat. | - HOUR. |  |  |  |  |  |  |  |  |  | I HOUR. |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{4} \mathrm{~m}$. | $\stackrel{\mathrm{m}}{8}$ | ${ }_{12}$ | ${ }_{16}$ | ${ }_{20}$ | ${ }_{24}{ }_{2}$ | ${ }_{30}$ | ${ }_{40}$ | ${ }_{50}$ | m0 | ${ }_{10}$ | ${ }_{20}$ | ${ }_{30}$ | ${ }_{40}$ | m. 50 | $\mathrm{m}_{60}$ |
| s. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{24}$ | $0 \cdot 4$ | $0 \cdot 7$ | $\stackrel{0}{1} \cdot$ | $\stackrel{0}{\mathrm{I}} 4$ | I -8 | $\stackrel{0}{2}$ | $2 \cdot 7$ | $3^{\circ} \cdot 6$ | $\stackrel{\circ}{4} 5$ | $5^{\circ} 4$ | $6^{\circ} \cdot 2$ | 7.1 | $8{ }^{8} \mathrm{O}$ | $\stackrel{8}{8} 8$ | $9 \cdot 6$ | $10 \cdot 4$ |
| 30 | 0.4 | 0.7 | I•I | I. 5 | I.8 | $2 \cdot 2$ | 2.7 | 3.6 | 4.5 | 5.4 | $6 \cdot 3$ | $7 \cdot 2$ | $8 \cdot \mathrm{r}$ | 8.9 | ${ }_{9} 9$ | 10.6 |
| 40 | 0.4 | 0.8 | I. I | 1.5 | I.9 | $2 \cdot 3$ | $2 \cdot 9$ | 3.8 | 4.7 | $5 \cdot 7$ | 6.6 | $7 \cdot 5$ | $8 \cdot 4$ | 9.4 | 10.3 | II•I |
| 50 | 0.4 | 0.8 | 1.2 | 1.6 | $2 \cdot 1$ | $2 \cdot 5$ | $3 \cdot 1$ | $4 \cdot 1$ | 5.1 | $6 \cdot 1$ | $7 \cdot 2$ | $8 \cdot 2$ | $9 \cdot 2$ | 10.2 | Ir 1 | 12.1 |
| 56 | 0.4 | 0.9 | $1 \cdot 3$ | 1.8 | $2 \cdot 2$ | $2 \cdot 6$ | 3.3 | $4 \cdot 4$ | $5 \cdot 5$ | $6 \cdot 6$ | $7 \cdot 7$ | $8 \cdot 7$ | $9 \cdot 8$ | 10.9 | Ir.9 | 13.0 |
| 60 | 0.5 | 0.9 | 1.4 | I'9 | $2 \cdot 3$ | $2 \cdot 8$ | $3 \cdot 5$ | $4 \cdot 6$ | $5 \cdot 8$ | $6 \cdot 9$ | 8.1 | 9.2 | 10.4 | I1.5 | 12.6 | 13.8 |

reduction to the meridian table near the meridian below the pole.

* a TRIANGULI AUSTRALIS.

|  | 1 HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  | 16 | 17 | 18 | 19 |  | 21 | 22 | 23 | 24 |  |  |  | 28 |  | 30 | ${ }_{31}$ |
| s. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 6. 6 |  | $70 \cdot 0$ |  | $73 \cdot 5$ |  |  |  |  |  |  |  |  |
|  |  |  | $64 \cdot \mathrm{I}$ |  |  | $69 \cdot 1$ |  | $72 \cdot 5$ | $74 \cdot 2$ | 6.0 |  | $79 \cdot 6$ |  |  | $85 \cdot 1$ |  |
| 28 | $60 \cdot 1$ | $6 \mathrm{r} \cdot 6$ | 6 | 64.9 |  |  | 69 | 71.5 | 73.2 | $75^{\circ}$ |  |  |  |  | 4.0 |  |
| 30 | 59.2 | 60.8 | 6 | 64.0 |  | 67.2 | 68. | $70 \cdot 5$ | 72.2 | 73.9 | $5 \cdot 7$ |  |  |  | 82.8 |  |
| 32 |  |  |  |  |  |  | 67 |  |  |  |  |  |  |  |  |  |
|  |  |  |  | $62 \cdot 1$ |  | $65^{\circ}$ | $66 \cdot 8$ | $68 \cdot 5$ |  | 71.8 |  |  |  | 78.6 |  |  |
|  |  |  |  |  |  | 64.2 | 65. | 67 | $69^{\circ}$ | $70 \cdot 7$ | $72 \cdot 3$ |  |  | $77 \cdot 4$ | $79 \cdot 2$ |  |
|  |  | $57 \cdot 2$ |  | 60.26 |  | 63.2 | 64. | 66 |  |  | $7 \mathrm{r} \cdot 2$ |  | 74 | 76 | 77.9 |  |
| 4 |  |  | 57.7 5 | $59 \cdot 2$  <br> $58 \cdot 1$ 5 |  |  | 63. |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | $55 \cdot 7$ 5 <br> 54.6 5 |  |  |  |  |  |  |  | 66 |  |  |  |  |  |
| 4 |  |  |  | $\begin{aligned} & 56 \cdot 0 \\ & 54 \cdot 9 \end{aligned}$ | 57. | 58.9 | $60^{\circ}$ 59 | 6I | 63. 62. | 64 | 65 | $67 \cdot 8$ $66 \cdot 5$ |  | 61 |  |  |
|  |  |  |  |  |  |  | 57 | 59 | 60.7 |  | 63.6 | $65 \cdot 1$ |  |  |  |  |
| 52 |  |  |  | 52.5 | 53.8 | 55 | 56 | 57 | 59 |  | 62.2 | 63 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| s. - REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  | $91 \cdot 3$ |  | 95•1 |  |  |  |  | 3.0 | I $45^{\circ} \mathrm{O}$ |  |  | - |  |
|  |  |  |  |  |  |  |  |  |  | I 4 |  | I 43.4 |  |  | $7 \cdot 4$ |  |
|  |  |  | ${ }^{86} 7$ | $88 \cdot 5$ |  |  |  |  |  | 1 |  | I |  |  | $5 \cdot 7$ |  |
|  |  |  |  |  |  |  |  |  |  | 13 |  | I $40 \cdot 1$ |  |  | 4.0 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | I |  | I |  |  |  | 43 |
|  | $\begin{array}{ll}77.2 & 78.9 \\ 76.5\end{array}$ | 988 | 82.3 | 83.2 |  |  |  |  |  | I 1 |  | I 36 |  |  | $\stackrel{4}{4}$ |  |
|  | $\begin{array}{ll}76.5 & 78.2 \\ 75.8 & 77.4\end{array}$ | $2{ }_{4} 770 \cdot 8$ |  | 83.2 | 85.0 8.2 | 86.7 |  |  |  | I 1 |  | 135 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | 1 |  | I 32.9 |  |  | -5 |  |
|  | 73 | 176.7 | $78 \cdot 3$ | $80 \cdot 0$ |  | 83.3 | 850 |  |  | 13 | 0.2 | 3 |  |  | $5 \cdot 5$ |  |
|  | $72 \cdot 774 \cdot 3$ | $375 \cdot 9$ |  | $79^{\prime}$ I |  |  |  |  |  | 1 |  | 131.0 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | I |  |  |  |  |  |  |
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| EDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 42 I |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 5 |  |  |  |  |  |  |  | $6 \cdot 8$ |  |  |  | 52.51 |  |  |  |  |

REDOCTION TO THE MERIDIAN TABLE FOR HOUR－ANGLES FROM UPPER MERIDIAN．
＊є URSE MAJORIS．


| REDUCTIONS． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $34^{\circ}$ | 0．6 | $2 \cdot 5$ | $5 \cdot 7$ | 10＇1 | $15 \cdot 7$ | 18：9 | $22^{\prime} \cdot 5$ | 26.4 | $30^{\prime} \cdot 5$ | $35 \%$ | 39．7 | $44^{\prime} 8$ | 50＇1 | 55．7 | 6x＇6 | 6\％＇3 | $74^{1}$ |
| 32 | 6 | 2.4 | $5 \cdot 3$ | $9 \cdot 5$ | 14.8 | 17.9 | 21.3 | 24.9 | 28.9 | 33.1 | $37 \cdot 6$ | $42^{\circ} 3$ | 47.4 | 52．7 | 55.3 | 64．1 |  |
| －30 | － 0.6 | 2．3 | 5．1 | 9．0． | I $14^{\circ} \mathrm{O}$ | （17．0 | 20．2 | 23.7 22.6 | 27．4 | 31．4 | 35• | $40^{\circ} 2$ | $45^{\circ}$ | 50．1 | 55．4 | 6r．o | $66 \cdot 8$ |
| 26 | 0.5 | $2 \cdot 1$ | $4 \cdot 6$ | 8.2 | 12．8 | 15.5 | 18.4 | 21.6 | $25^{\circ}$ | $28 \cdot 7$ | ${ }_{32}{ }^{3} 6$ | 36．8 | 4 I | $45 \cdot 8$ | 50.7 | $55 \cdot 8$ | $6 \mathrm{r} \cdot 2$ |
| 24 | $\bigcirc \cdot 5$ | 2.0 | 4.4 | 7.9 | $12 \cdot 3$ | 14.9 | $17 \cdot 7$ | $20 \cdot 8$ | $24^{\circ}$ | $27 \cdot 6$ | 4 | $35 \cdot 4$ | $30^{6}$ | 44． x | $48 \cdot 7$ | 53.7 | 58.8 |
| 22 |  | r．9 | $4 \cdot 3$ | 7.6 |  | 14：3 | 17．0 |  | ${ }^{23 \cdot 2}$ |  |  |  |  | $42 \cdot 4$ | $47^{\circ}$ |  | 56．7 |
| 20 18 | O．5 | $\xrightarrow{1.8}$ | $4{ }^{4 .} 1$ | $7 \cdot 3$ | IT•1 | 13.4 | 16.5 15.9 | 18．7 | 2r．6 | 24.8 24.8 | 28．2 | 31．8 | 35．6 | 39•\％ | $4{ }^{45 \cdot 4}$ | 58．4 | $53^{\circ}$ |
| 16 | － | $1 \cdot 7$ | $3 \cdot 9$ | 6.9 | 10．7 | 13.0 | 15.4 | $18 \cdot 1$ | $21^{\circ}$ | $24^{\circ} \mathrm{O}$ | $27 \cdot 3$ | $30 \cdot 8$ | $34 \cdot 5$ | 38.5 | $42 \cdot 6$ | $46 \cdot 9$ | 1. |
| ${ }^{12}$ | $0 \cdot 4$ | 1.6 | $3 \cdot 6$ | $6 \cdot 5$ | ${ }^{10 \cdot 1}$ | 12．2 | 14．5 | 17．1 | 19.8 | $22 \cdot 7$ | $25 \cdot 8$ | $29 \cdot 1$ | $32 \cdot 6$ | 36.3 | $40^{\circ} 2$ | $44 \cdot 3$ | 5 |
| 4 | $0 \cdot 4$ | 1．5 | 3.2 | $5 \cdot 8$ | 9•1 | II． | I3．1 | 154 | 18．8 | 20．4 | 24．3 | $27 \cdot 6$ | 29．4 | 34．4 | $3{ }_{3}^{38.2}$ | $39 \cdot 9$ | $46 \cdot 8$ 43 |
| S． |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{4}$ |  | 1.4 1.3 | $3 \cdot 0$ | $5 \cdot 6$ | 8.7 | ． 5 | 12.5 11.9 | 14．7 | 17.0 16.3 | 19.5 | 22．2 | 25．0 | 28.0 26.8 | 31．2 | $34 \cdot 6$ 33.7 | －1 | 41 |
| ${ }_{8}^{4}$ | － $0 \cdot 3$ | r 1.3 | 3．9 | 5．4． | $8 \cdot 3$ | － $0 \cdot 6$ | H1．9 | $1{ }_{13} 14.0$ | 16．3 | 18．8 |  | 23．9 | 25 | 28．6 | ${ }_{31}^{33}$＇\％ |  | ${ }_{38}^{40}{ }^{40}$ |
| 12 | $0 \cdot 3$ | 1－2 | $2 \cdot 7$ | 4.9 | $7 \cdot 6$ | 9.2 |  | 124 | I ${ }^{1}$ | 17.1 | 19.5 | $22 \cdot 0$ | 24.6 | $27 \cdot 4$ | － 4 | －5 | 36 |
| 16 |  | I． 2 | $2 \cdot 6$ | $4 \cdot 7$ | $7 \cdot 3$ | 8.8 | $0 \cdot 5$ | $12 \cdot 3$ | 14.3 | 16.4 | 18.7 | $2 \mathrm{~T} \cdot \mathrm{I}$ | $23 \cdot 6$ | $26 \cdot 3$ | 1 |  |  |
| 20 |  | $1 \cdot 1$ | 2.5 | $4 \cdot 5$ | ${ }^{6}$ | 8. | O． 1 | Ir． 8 | 13.7 | $15 \cdot 7$ | 18 | $20 \cdot 2$ |  | 2 | 26 | $30 \cdot 8$ | 33.8 |
| 24 <br> 28 | O．3 0.3 | rid | 2.4 2.3 | 4．15 | ${ }^{6 \cdot 7}$ | $8 \cdot 1$ | 9．7 | 11．3 | I3．${ }^{\text {I }}$ | 15.1 | 17．2 | 19.4 18.5 | 21．7 | $23 \cdot 1$ | $26 \cdot 8$ 25 | － 5 | $32 \cdot 4$ |
| tat． | $\mathrm{m}_{46}$ | ${ }_{47}^{\mathrm{m}}$ | ${ }_{48}^{\text {m．}}$ | $\overline{\mathrm{m} .}$ | $\frac{\mathrm{m}}{50}$ | $\begin{aligned} & \mathrm{m} . \\ & 51 \end{aligned}$ | ${ }_{52}$ |  |  | 54 | ${ }_{55}{ }^{\text {m．}}$ | ${ }_{56}$ | ${ }_{57}$ |  |  | 59 | ${ }_{60} \mathrm{~m}$. |


|  | REDUCTIONS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 34 | $77 \cdot 4$ | 80.8 | $84 \cdot 3$ | $8 \% 8$ | 9r•3 | $95^{\circ}$ | 98．7 | $102 \cdot 4$ | 106．3 | 110＇1 | 114.1 | 118．1 | 122：1 | 126：3 | ． 5 | 134.7 |
| 34 |  |  | 82.0 | 85.4 | 88.9 | 95 | $96 \cdot 0$ | 997 |  | 10\％．2 |  | 115.0 | 118.9 | 123.0 | I2\％ 0 | $131 \cdot 2$ |
| 32 | $73 \cdot 4$ | 76.6 | 79.8 | 83.2 | $86 \cdot 6$ | 90 | $93 \cdot 5$ | $97 \cdot 1$ | 100．8 | 1045 | 108.2 | II2．0 | 1159 | 199．9 | 123．9 | 127.9 |
| 31 |  | $74 \cdot 6$ | 77.8 | $8{ }^{1} \cdot$ | $84 \cdot 4$ | 87 | 91 | 94•7 | 98.3 | 1019 | 105．6 | 109 | 113.1 | 117.0 | 120．9 | 124 |
|  |  |  | 76 |  |  |  | $89 \cdot 1$ | 92－5 | － | 99.5 | r03． | 106．8 |  | 114.3 | 118.1 | 122. |
| 29 |  | 71.2 | 74 | 77.4 | 80 | 83 | 87•1 | $90 \cdot 4$ | $93 \cdot 8$ | $97 \cdot 3$ | 100．8 | 04.4 |  | III＇7 | $15 \cdot 5$ | 119.3 |
| 28 | $66 \cdot 7$ | 69.6 | 72 | $75 \cdot 7$ | 78.8 | $8 \mathrm{r} \cdot 9$ |  | 88.5 | 91．8 | $95 \cdot 2$ | ． | 102•1 | 105• | 109•3 | 113.0 | $116 \cdot 3$ |
| 27 |  |  | 71 | 74 | $77 \cdot 1$ |  |  |  |  | 93 | $96 \cdot 6$ |  | 103.5 |  |  |  |
|  |  |  |  | 72 | $75 \cdot 6$ | 78.6 | $8 \mathrm{Br} \cdot 7$ | 84.9 | 88.1 | 9r．3 | $94 \cdot 7$ | $98^{\circ} \mathrm{O}$ | 1015 | 104.9 |  | $112 \cdot 1$ |
| 25 |  | $65 \cdot 4$ | 68.3 | 硣 | 74 | 77.1 | $80 \cdot 1$ | 83.2 8.6 | 86 | $80 \cdot 6$ | 92．8 | $96 \cdot 1$ | ． 5 | 102．9 | 106．4 | 109．9 |
| 22 | 61 |  | 64 | 69.8 67.3 | 70 | $75 \cdot 6$ 72.9 | $75 \cdot 8$ | 81.6 78.8 | 84．7 | 87.9 84.8 | $8 \%$ | $94 \cdot 3$ | ${ }_{94.7}^{97}$ |  | － 3 ＋4．4 | 10\％．9 |
| 22 | 50 |  |  |  |  |  |  |  |  |  |  |  | 94.2 | 97.5 |  |  |
| 20 | $57 \cdot 3$ | 59 | 62 | 65 | 67 |  | 73.2 | $76 \cdot 1$ | $79^{\circ}$ | 81.9 | $84^{\circ} 9$ | 88.0 |  | 94.2 | $97 \cdot 4$ | 100．7 |
| 18 | 55 | 57.9 | 60 | 62 | 65 6 |  | 68 | $73 \cdot 7$ | 76.5 | 79.4 |  |  |  | 91．3 |  | ． 6 |
| 12 | 52 | 54 | 56.9 | $59 \cdot 3$ | ${ }_{6 \mathrm{I}} \cdot 7$ |  | 66．8 | 69.4 | 72•I | 74.8 | 77.5 | 80 | 83.2 | $86 \cdot$ | 89.0 |  |
| 12 | $50 \cdot 7$ | 53.0 | $55 \cdot 3$ | 57.6 | 60.0 | 62 | $65^{\circ}$ | 67.5 | $70 \cdot 1$ | $72 \cdot 7$ | 75.4 | 78.1 |  | $83 \cdot 7$ |  |  |
| 10 |  | $5 \times 6$ | 53．8 | 56．I | 58.4 | 60.8 |  |  |  |  |  | $6 \cdot 1$ | 8 | $8 \mathrm{I} \cdot 5$ |  |  |
|  |  |  | 52 | 54．7 |  |  |  |  |  |  |  |  | 76.8 |  |  |  |
| 6 |  | 49.8 |  |  | 55 |  | 60．1 | 62.5 61.0 |  | 67．3 |  |  |  |  |  | 82.9 80.9 |
| 2 | $44 \cdot 7$ | 46.7 | 48.7 | 50.8 | 53.0 | ${ }_{55 \cdot 1}$ | 57＊3 | 59.6 | 6 r 9 | 64.2 |  | 69.0 | 71.4 | 73.9 | 76.5 | $79 \cdot 1$ |
| s． |  | $45 \cdot 6$ |  |  | 51.8 |  | 56 | 58.2 | 60 |  |  |  |  |  |  |  |
| 2 | 4 | 44 | 46 | $48 \cdot 6$ | $50 \cdot 6$ | 5 | $54 \cdot 8$ | 56 | $5 \cdot$ | 61. | $63 \cdot 6$ | 65 |  | $70 \cdot 7$ |  |  |
| 4 | $4{ }^{1.8}$ | 43 | $45 \cdot 6$ | $47 \cdot 5$ | 49.5 | 51.5 | $53 \cdot 6$ | 55.7 | ${ }_{56}^{57}$ | 60．0 |  | 64 | 66． | 69．1 | 71.5 |  |
| 8 | $4{ }^{40.0}$ | ${ }_{4}^{42}$ | ${ }_{43}^{44} 7$ | $45 \cdot 5$ | 47.4 | 49 | 51－3 | 54．4 |  | 57 |  | 61 | $64^{\circ} \mathrm{O}$ | 66．3 | 68．5 |  |
| ro | 39.2 | 40 | $42 \cdot$ | 44 | $46 \cdot 4$ | $48 \cdot 3$ | 50．2 | $52 \cdot 2$ | 54.2 | 56 | 58.4 | $60 \cdot 5$ | 62. | 64.9 |  |  |
| ${ }_{12}$ | 38.4 | 40 | 4 I | $43 \cdot 6$ | $45 \cdot 5$ | 47 | 49．2 | 51．2 | 53 | 55．1 | 56 | 58. | 61.4 | 63.2 |  |  |
| 14 | 37．6 | 39 |  | $4{ }_{4}^{42} \cdot 8$ | 44 | 45 |  |  | 52． |  |  | $5{ }_{56.8}^{58}$ | 60．3 | 62.2 60.9 | ${ }_{63}{ }_{6}$. | $65 \cdot 2$ |
| 18 |  |  | 39 |  | $42 \cdot 7$ |  | $46 \cdot 2$ | 4 | 49.9 |  | 53．7 | $55 \cdot$ | $57 \%$ | 59.7 |  | 63.9 |
| 20 | $35 \cdot 3$ | $36 \cdot 9$ | 38.5 | $40 \cdot 1$ | $4 \mathrm{~T} \cdot 8$ | 43 | 45 |  | $48 \cdot 9$ |  | $52 \cdot 6$ | 54 | 56 | 5 |  |  |
| 22 |  |  |  |  |  |  | 44 |  | 帾 |  |  | 兂 | $55 \cdot 3$ | 56 |  | $6 \mathrm{r} \cdot 3$ |
| $\begin{aligned} & 24 \\ & 26 \end{aligned}$ |  | 35．4 |  |  |  |  | 42.5 | $4{ }_{4}^{4 \cdot 1}$ |  |  |  |  |  |  | 56.8 |  |
| 28 | $32 \cdot 4$ | $33 \cdot 9$ | $35 \cdot 4$ | 36.9 | 38.4 | 40.0 | $4 \mathrm{I} \cdot 6$ | $43 \cdot 2$ | 44.9 | $46 \cdot 6$ | 48.3 | $50 \cdot 1$ | $5 \times 1$ | 53.7 | $55 \cdot 6$ | $57 \cdot 5$ |

REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* є URS历 MAJORIS.

| Lat. | $\mathrm{m}_{61}$ | m. | ${ }_{63}$ | ${ }_{64}$ | $\mathrm{m}_{65}$ | ${ }_{66}$ | $\begin{aligned} & \mathrm{m}_{67} \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 68 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 69 \end{aligned}$ | $\mathrm{m} .$ | $\begin{aligned} & \mathrm{m} . \\ & 71 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline \end{aligned}$ |  | $\begin{aligned} & \mathrm{m} . \\ & 7 \end{aligned}$ | ${ }_{75} \mathrm{~m}$ | ${ }_{76}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 | $132 \cdot 01$ | $136 \cdot 2$ | $140 \cdot 4$ | 144.7 | 149.0 | 153.4 | 157.8 | $162 \cdot 3$ | 166.9 | $171 \cdot 5$ | 176.1 | 180.8 | 185.6 |  | $190 \cdot 4$ | 195.2 | $200 \cdot 1$ |
| 31 | 128.91 | 132.9 | $137 \cdot 1$ | 141 | 145.5 | 149.8 | 154•I | $158 \cdot 5$ | $163 \cdot$ | $167 \cdot 5$ | $172{ }^{\circ}$ | 176.7 | 181.3 |  | 186.0 | $190 \cdot 8$ | 195.6 |
| 30 |  | $129^{\circ} 9$ | 133.9 | $138 \cdot 0$ | 142.2 | $146 \cdot 4$ | $150 \cdot 7$ 147 | 155 151.6 | 159.3 155.9 | 163.8 160.2 | 168.2 | 172.7 160.1 | 177.3 173.6 |  | 181.9 178.1 | 186.6 182.7 | 191.3 187.3 |
| 29 28 | 123.1  <br> 120.5 1 | $127^{\circ} 12$ | ${ }_{128.2}^{131}$ | 135.0 132.2 | $139 \cdot 1$ 136.2 | 143.2 140.2 | 147.4 144.3 | ${ }_{148}^{151.5}$ | 155.9 152.7 | 156 | 161.2 | 169.1 165.6 | 173.6 170.0 |  | 178.1 174.5 | 182.7 179.0 | 187.3 183.5 |
| 27 | $118 \cdot 1$ | 121 | 125.6 | 129.5 | 133.4 | 37.4 | 141 | 145.5 | 149.6 | 153.8 | 158.0 | 162.3 | $166 \cdot 6$ |  | 171.0 | 175.4 |  |
| 26 | 115.7 | 119.4 | 123.2 | 127.0 | $130 \cdot 8$ | 134.7 | $138 \cdot 7$ | 142.7 | $146 \cdot 7$ | $150 \cdot 8$ | 155.0 | 159.2 | 163.5 |  | 167.8 | 172.1 | 1>6.5 |
| 25 | II3.5 | $117 \cdot 1$ | $120 \cdot 8$ | 124.6 | 128.4 | $132 \cdot 2$ | $136 \cdot 1$ | $140 \cdot 0$ | $144^{\circ} \mathrm{O}$ | 148.0 | $152 \cdot 1$ | 156.3 | $160 \cdot 4$ |  | 164.7 | 168.9 | 173.3 |
| 24 | 111.4 | $115{ }^{\circ}$ | 118 | $122 \cdot 3$ | $126 \cdot 0$ | $129 \cdot 8$ | 133.6 | 137.5 | 141.4 | 145.4 | 149.4 | 153.5 | 157.6 |  | $161 \cdot 7$ | 165.9 | $170 \cdot 2$ |
| 23 | 109.4 | 112.9 | I16.5 | 120'1 | 123.8 | 127.5 | 131.2 | $135 \cdot 1$ | $138 \cdot 9$ | 142.8 | $146 \cdot 8$ | 150.8 | 154.8 |  | 158.9 | 163.1 | 167.3 |
| 22 | 107.5 | 1 | 1145 | 118. | 121.7 | 125.3 | 12 | 132.8 | $136 \cdot 6$ | 14 | 1443 | 148.2 | 152.2 |  | 156.3 | $160 \cdot 3$ | 164.5 |
| 21 | $105 \cdot 7$ | 109.1 | 112.6 | $116 \cdot 1$ | 119.6 | 123.2 | $126 \cdot 9$ | $130 \cdot 5$ | $134 \cdot 3$ | 138. | 141.9 | 145.8 | 149.7 |  | $153 \cdot 7$ | $157 \cdot 7$ | 161.8 |
| 20 | 104.0 | 107.3 | $110 \cdot 7$ | 114.2 | 1177 | 121.2 | 124.8 | 128.4 | 132.1 | $135 \cdot 8$ | $139 \cdot 6$ | 143.5 | 147.3 |  | $151 \cdot 3$ | 155.2 | 159.2 156.8 |
| 19 | $102 \cdot 3$ | 105.6 | $109 \cdot 0$ | 112.4 | $115 \cdot 8$ | 119.3 | 122.8 | ${ }^{126 \cdot 4}$ | $130 \cdot 1$ | $133 \cdot 7$ | 137.5 | 141.2 | $145{ }^{\circ}$ |  | $148 \cdot 9$ | 152.8 | $156 \cdot 8$ |
| 18 | $100 \cdot 8$ | 104.0 | 107.3 | 110.6 | $114{ }^{\circ}$ | 117.5 | 121.0 | 124.5 | 128.1 | 1317 | $135 \cdot 4$ | 139.1 | 142.9 |  | $146 \cdot 7$ | $150 \cdot 5$ | 154.4 |
| 17 | 99.2 | 102.4 | 105•7 | 109.0 | 112.3 | 115.7 | 119.2 | 122.6 | 12 | 129. | 133.4 | 137.0 | 140.8 |  | 144.5 | 148.3 | 152.1 |
| 16 | 97.8 | $100 \cdot 9$ | 104.I | 107.4 | $110 \cdot 7$ | 114.0 | 117.4 | $120 \cdot 8$ | 12 | 127.8 | 131.4 | 135.0 | $138 \cdot 7$ |  | 142.4 | $146 \cdot 2$ | $150 \cdot 0$ |
| 15 | $96 \cdot 4$ | $99 \cdot 5$ | $102 \cdot 6$ | 105.8 | 109•1 | 112.4 | 115\% | $119 \cdot 1$ | 122.6 | 126.0 | 129.6 | 133.1 | 136.8 |  | $140 \cdot 4$ | I44. 1 | 147.9 |
| 14 | $95^{\circ}$ | $98 \cdot 1$ | 101.2 | 104.4 | $107 \cdot 6$ | 110.8 | II4. 1 | 117.5 | 120.9 | 124.3 | 127.8 | 131.3 | 134.9 |  | 138.5 | $142 \cdot 1$ | $145 \cdot 8$ |
| 12 | 92.4 | $95 \cdot 4$ | $98 \cdot 5$ | 101.5 | 1047 | 107.8 | 111 | II4.3 | 117.6 | 121.0 | 124.4 | 127.8 | 131.3 |  | 134.8 | 138.4 | 142.0 |
| 10 | 90 | 92 | 95.9 | 98.9 | 102.0 | 105. 1 | 108.2 | 1114 | 114.6 | 117.9 |  | 124.5 | 12 |  | 131.4 | 134.8 | 138.4 |
| 8 | 87.7 | $90 \cdot 6$ | $93 \cdot 5$ | 96.4 | 99.4 | $102 \cdot 4$ | $105 \cdot 5$ | $108 \cdot 6$ | III• | II4.9 | 118.2 | 121.4 | 124.8 |  | $128 \cdot \mathrm{I}$ | 1315 | $135{ }^{\circ}$ |
| 6 | 85.6 | 88.4 | 91.2 | 94•1 | $97 \cdot$ | $100 \cdot 0$ | 102.9 | 106.0 | 109•1 | 112.2 | 115.3 | 118.5 | 121.8 |  | 125.1 | 128.4 | $131 \cdot 7$ |
| 4 | 83.6 | $86 \cdot 3$ | $89^{1} \mathrm{I}$ | $9 \mathrm{I} \cdot 9$ | 94'7 | $97 \cdot 6$ | $100 \cdot 5$ | $103 \cdot 5$ | $106 \cdot 5$ | 109.6 | 112.6 | 115.8 | 119.0 |  | 122.2 | 125.4 | 128.7 |
| 2 | $8 \mathrm{I} \cdot 7$ | 84.3 | 87.0 | $89 \cdot 8$ | $92 \cdot 6$ | 95.4 | 98.2 | IOI•I | 104.1 | $107 \cdot 1$ | 110.1 | 113.2 | 116.3 |  | 119.4 | 122.6 | 125.8 |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | $78 \cdot 1$ | $80 \cdot 6$ | $83 \cdot 2$ | 85.8 | 88.5 | 91.2 | 93.9 | $96 \cdot 7$ | $99 \cdot 5$ | 102. | $105 \cdot 3$ | 108.2 | III 2 |  | 114.2 | $117 \cdot 3$ | $120 \cdot 4$ |
| 4 | $76 \cdot 4$ | $78 \cdot 9$ | 8 I 4 | $84^{\circ}$ - | $86 \cdot 6$ | 89.2 | 91.9 | $94 \cdot 7$ | $97 \cdot 4$ | 100 | 103• | 105.9 | 108.8 |  | III.8 | 114.8 | 117.8 |
| 6 | 74.8 | $77 \cdot 2$ | 79.7 | $82 \cdot 2$ | $84 \cdot 8$ | 87.4 | $90 \cdot 0$ | $92 \cdot 7$ | $95^{\circ} 4$ | 98-I | $100 \cdot 9$ | 103.7 | $106 \cdot 6$ |  | 109.5 | 112.4 | 115.3 |
| 8 | $73 \cdot 2$ | $75 \cdot 6$ | $78 \cdot 0$ | 80.5 | 83.0 | 85.5 | $88 \cdot 1$ | 90•7 | $93 \cdot 4$ | $96 \cdot 1$ | 98.8 | 101.6 | 104.4 |  | 107.2 | 110.1 | 113.0 |
| 10 | 71 | $74^{\circ}$ | $76 \cdot 4$ | 78.8 | 81.3 | $83 \cdot 8$ | $86 \cdot 3$ | 88.9 | 91 | 94•I | 96.8 | 99.5 | 102.2 |  | 105.0 | 107.8 | $110 \cdot 6$ |
| 12 | $70 \cdot 2$ | $72 \cdot 5$ | $74 \cdot 8$ | 77.2 | $79 \cdot 6$ | $82 \cdot 1$ | 84.5 | 87.0 | 89.6 | 92.2 | 94.8 | $97 \cdot 4$ | $100 \cdot 1$ |  | 102.8 | $105 \cdot 6$ | 108.4 |
| 14 | 68.8 | 71.0 | $73 \cdot 3$ | $75 \cdot 6$ | 78.0 | $80 \cdot 4$ | $82 \cdot 8$ | $85 \cdot 3$ | 87.8 | $90 \cdot 3$ | 92.9 | $95 \cdot 5$ | $98 \cdot 1$ |  | $100 \cdot 8$ | 103.5 | $106 \cdot 2$ |
| 16 | $67 \cdot 4$ | 69.6 | 71.8 | $74 \cdot 1$ | 76.4 | 78.7 | $8 \mathrm{I} \cdot \mathrm{I}$ | 88.5 | $86 \cdot$ | $88 \cdot 5$ | 91.0 | 93.5 | 96•I |  | $98 \cdot 7$ | $101 \cdot 4$ | 104.1 |
| 18 | $66^{\circ}$ | $68 \cdot 1$ | $70 \cdot 3$ | 72.6 | 74.8 | 77-1 | $79 \cdot 5$ | $8 \mathrm{I} \cdot 8$ | 84.2 | $86 \cdot 7$ | 89.1 | 91.6 | 94 |  | $96 \cdot 7$ | $99 \cdot 3$ | 102.0 |
| 20 | $64 \cdot 6$ | $66 \cdot 7$ | 68.9 | $71 \times$ | $73 \cdot 3$ | $75 \cdot 6$ | $77 \cdot 8$ | $80 \cdot 1$ | $82 \cdot$ | 84.9 | 87.3 | 89.7 | $92 \cdot$ |  | 94.7 | 97.3 | 100.0 |
| 22 | $63 \cdot 3$ | $65 \cdot 4$ | $67 \cdot 5$ | $69 \cdot 6$ | 71.8 | $74^{\circ} \mathrm{O}$ | $76 \cdot 2$ | $78 \cdot 5$ | 80.8 | 83.2 | 85.5 | 87.9 | 90.4 |  | 92.8 | $95 \cdot 3$ | $97 \cdot 8$ |
| 24 | $62 \cdot 0$ | $64^{\circ} \mathrm{O}$ | $66 \cdot 1$ | $68 \cdot 2$ | $70 \cdot 3$ | $72 \cdot 5$ | $74 \cdot 7$ | $76 \cdot 9$ | $7{ }^{7 \cdot 1}$ | 81.4 | 83.8 | $86 \cdot 1$ | 88 |  | 90.9 | 93.4 | $95 \cdot 8$ |
| 26 28 | $60 \cdot 7$ $50 \cdot 4$ | $62 \cdot 7$ $61 \cdot 3$ | $64 \cdot 7$ $63 \cdot 3$ | $66 \cdot 7$ $65 \cdot 3$ | 68.8 67.4 | 70.9 60.4 | $73 \cdot 1$ 71.6 | $75 \cdot 3$ 73. | $77 \cdot 5$ 75.9 |  | 82.0 80.3 | 84.3 82.5 | 86 |  | 89 $87 \cdot$ | 91.4 89.5 | 93.8 91.0 |
| 28 | 59.4 | 3 | $63 \cdot 3$ | $65 \cdot 3$ | $67 \cdot 4$ | 69.4 | 71.6 | 73.7 | 75.9 | 78.0 | 80.3 | 82.5 |  |  | $87 \cdot 1$ | $89 \cdot 5$ | $91 \cdot 9$ |
| TRUE BEARING OR AZIMUTH OF * $*$ URS $A^{*}$ MAJORIS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| L | ${ }_{4}$ | . ${ }_{\text {m }}^{\mathbf{8}}$ | $1 \begin{aligned} & \text { m. } \\ & 12\end{aligned}$ | 1 m | ${ }_{20}^{\mathrm{m} .}$ | ${ }_{24}$ | m. | $\mathrm{m} .$ | $\begin{aligned} & \mathrm{m} . \\ & 36 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 40 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & 44 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 48 \end{aligned}$ | $\mathrm{m} .$ | $\begin{aligned} & \mathrm{m} . \\ & \hline \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 70 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & 80 \end{aligned}$ | $\mathrm{m}_{90}$ |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 | $\stackrel{\circ}{1} 5$ | $\begin{array}{l\|l} 5 & \circ \cdot 9 \end{array}$ | 4 | $\stackrel{\circ}{5} 8$ | $\stackrel{\circ}{7} \cdot 2$ | 8.6 | 10\% | IIP4 | 12.7 | $1{ }^{\circ} \mathrm{O}$ | $15 \cdot 3$ | - ${ }^{6} \cdot 5$ | $1{ }^{\circ} \cdot 8$ | $\stackrel{\circ}{0} 1$ | I $22 \cdot 8$ | $8{ }^{\circ} \cdot{ }^{\circ}$ | $27 \cdot 6$ |
| 32 | $1 \cdot 3$ |  $2 \cdot 7$ | 4.0 | $5 \cdot 3$ | $6 \cdot 6$ | $7 \cdot 9$ | 9.2 | $10 \cdot 5$ |  | $13^{\circ}$ | 14.2 | $15 \cdot 3$ | $16 \cdot 5$ | $8 \cdot 7$ | 721.3 | $323 \cdot 7$ | $26 \cdot 0$ |
| 30 | $1 \cdot 2$ | 2.5 2.5 | 3.7 | 4.9 | 6•2 | $7 \cdot 4$ | 8.6 | $9 \cdot 8$ | $10 \cdot 9$ | $12 \cdot 1$ | 13.2 | 14.3 | 15.4 | 77.5 | 5 20•0 | - $22 \cdot 3$ | 24.5 |
| 28 | I 2 | $2 \cdot 3$ | 3.5 | $4 \cdot 6$ | $5 \cdot 8$ | $6 \cdot 9$ | 8.0 | 9.2 | $10 \cdot 3$ | $11 \cdot 3$ | 12.4 | 13.4 | 14.5 | $6 \cdot 5$ | 518.9 | 9 2I•I | 23.2 |
| 26 | 1-1 | 1 | 3.3 | $4 \cdot 4$ | $5 \cdot 4$ | $6 \cdot 5$ | 7.6 | $8 \cdot 6$ | 9.7 | 10.7 | 11•7 | $12 \cdot 7$ | 13.7 | $5 \cdot 6$ | 617.8 | 8 20.0 | 22.0 |
| 24 | I.O | O 2.1 | I $3 \cdot 1$ | $4 \cdot 1$ | $5 \cdot 1$ | 6.1 | 7.2 | $8 \cdot 1$ | $9 \cdot 1$ | 10.1 | II•I | $12 \cdot 0$ | 12.9 | 4.8 | $8{ }^{16.9}$ | $919^{\circ}$ | 21.0 |
| 22 | - | ${ }^{2 \cdot} 1$ | 2.9 2.8 | 3.9 | 4.9 | 5.8 | 6.8 6.5 | $7 \cdot 7$ | $8 \cdot 7$ | $9 \cdot 6$ | $10 \cdot 5$ | 11.4 | 12.3 | 1.1 | $116 \cdot 2$ | 218.2 | $20 \cdot 0$ |
| 20 | $0 \cdot 9$ | 9 $1 \cdot 9$ | - 2.8 | $3 \cdot 7$ | $4 \cdot 6$ | $5 \cdot 6$ | $6 \cdot 5$ | $7 \cdot 4$ | $8 \cdot 3$ | $9 \cdot 2$ | $10 \cdot 0$ | $10 \cdot 9$ | 11.8 | 3.4 | $415 \cdot 4$ | 41704 | 19.2 |
| 16 | $0 \cdot 9$ | 9 1•7 | 7 $2 \cdot 6$ | 6 3.4 | $4 \cdot 3$ | $5 \cdot 1$ | $5 \cdot 9$ | $6 \cdot 8$ | $7 \cdot 6$ | $8 \cdot 4$ | 9.2 | $10 \cdot 0$ | 10.8 | 2.4 | 4 14.3 | 3 16-1 | 17.8 |
| 12 | $0 \cdot 8$ | 8 1.6 | $\begin{array}{ll}6 & 2.4 \\ & 2.4\end{array}$ | 43.2 | $3 \cdot 9$ | $4 \cdot 7$ | $5 \cdot 5$ | $6 \cdot 3$ | $7 \cdot 0$ | $7 \cdot 8$ | $8 \cdot 6$ | $9 \cdot 3$ | $10 \cdot 0$ | 1.5 | 513.3 | 315.0 | 16.6 |
| 8 | $0 \cdot 7$ | 7 1.5 | 5 2.2 | (1.0 | $3 \cdot 7$ | 4.4 | $5 \cdot 2$ | $5 \cdot 9$ | $6 \cdot 6$ | $7 \cdot 3$ | $8 \cdot 0$ | $8 \cdot 7$ 8.3 | 9.4 | 10.8 | 8 12.5 | 514.1 | $15 \cdot 7$ |
| 4 | $0 \cdot 7$ | $7{ }^{7} 4$ | 4 | $2 \cdot 8$ | $3 \cdot 5$ | $4 \cdot 2$ | $4 \cdot 9$ | 5.6 | $6 \cdot 2$ | $6 \cdot 9$ | $7 \cdot 6$ | $8 \cdot 3$ | 8.9 |  | 11.8 | 8113 | 14.9 |
| 8. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | \% | 7 1.3 | $32 \cdot 0$ | $2 \cdot 7$ | 3.3 | 4.0 | $4 \cdot 6$ | $5 \cdot 3$ | 5.9 | $6 \cdot 6$ | $7 \cdot 2$ | 7.9 | $8 \cdot 5$ | $9 \cdot 8$ | 8 11•3 | 312 | 14.3 |
| 4 | . 6 | 6 I•3 | I-9 | $2 \cdot 5$ | $3 \cdot 2$ | $3 \cdot 8$ | 4.4 | $5 \cdot 1$ | $5 \cdot 7$ | $6 \cdot 3$ | $6 \cdot 9$ | 7.5 | $8 \cdot 2$ | $9 \cdot 4$ | 4 10.9 | 912 | 13.7 |
| 10 | . 6 |  | I $1 \cdot 8$ | 2.4 <br> 2.3 | 3.0 2.8 | $3 \cdot 4$ | 4.2 | 4.8 | $5 \cdot 4$ $5 \cdot 1$ | $5 \cdot 7$ | $6 \cdot 6$ | 7.2 6.8 | 7.8 | 8.9 8.4 | 9 $10 \cdot 3$ |  | 13.1 12.5 |
| 30 | 0.6 | ${ }^{\text {a }}$ | - $1 \times 7$ | 2.2 | 2.8 | $3 \cdot 3$ | 3.9 | 4.4 | $5{ }^{\circ}$ | $5 \cdot 5$ | . | 6.6 | 7.2 | 8.2 | 4 9.8 | 6 | 12.5 12.2 |

REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

## * є URS压 MAJORIS.

|  | $\left.\right\|_{77} ^{\mathrm{m}} \mathrm{l}^{\mathrm{m}} \mathrm{m}$ | ${ }_{79}$ | ${ }_{80}^{\mathrm{m}}$ | 81 | ${ }_{82}$ | 83 | 84 |  |  | 87 | ${ }_{88}^{\mathrm{m}}$ | $89$ | 90 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $16 \cdot 13$ | - | - |  |  |  |  | 55.9 |  | 46.3 | 4 |  |  |
|  | 12.03 6 |  | $326 \cdot 3$ |  |  |  |  |  |  |  |  |  |  |
|  |  | 3 | (ers |  | 7 | $332 \cdot 5$ | 3 |  |  |  | ${ }_{3}^{4}$ |  | I2.I <br> 7 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 257.63 |  | $3 \mathrm{Ir}^{\circ} \mathrm{O}{ }^{3}$ |  |  |  |  |  |  |  |  |  |  |
| 24 |  | 3 3.2 <br> 3 0.1 | 37 |  |  |  |  |  | 3 |  | 3 |  | $54 \cdot 5$ |
|  | , | 257 |  |  |  | 3 14.6 | 319.13 |  |  |  |  |  |  |
|  | $45^{\circ} 92{ }^{2} 5 \cdot \mathrm{I}$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | 8 |  | 53.0 |  |  |  | 10 |  |  |  |  |  |  |
|  | $36.0 \mid 240$ |  | 248.0 |  | $2{ }^{2} 5 \cdot \mathrm{r}$ |  | 4 |  |  |  |  |  |  |
|  | 33.823 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | $243 \cdot 32$ |  |  |  |  |  |  |  |  |  |  |
|  | 6 |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | ${ }_{25 \cdot 6}^{27.6}$ | 2 $35 \cdot$ <br> 2 $33^{\circ}$ | $\begin{array}{ll}2 & 38 \cdot 9 \\ 2 & 36 \cdot 8 \\ 2\end{array}$ |  |  | $2{ }^{2} 8$ |  |  |  |  |  |  |  |
|  | 72 |  |  |  |  |  |  |  |  |  |  | 310 | $4 \cdot 4$ |
|  | 221.9 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | r 8 |  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{aligned} & 7 \\ & 6 \end{aligned}$ |  |  | 227.3 225.6 2 |  |  | -2 <br> 2 <br> $286 \cdot 4$ |  |  |  |  |  |  | - |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 12.01215 |  |  |  |  | 22 | 236 |  | $243 \cdot 8$ |  | 251 | 255 |  |
|  | 10.55 ${ }^{2} 1 \mathrm{I}^{3} 9$ | $2 \begin{array}{ll}2 & 17.22\end{array}$ | . 12 |  |  | $31 \cdot$ |  |  |  |  |  |  |  |
|  | ${ }_{7} 9.612$ |  | ${ }_{2} 19.5$ |  |  | - 229 | 2 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $\begin{array}{lllll}2 & 6.2 & 2 & 9.4\end{array}$ |  | $216 \cdot 0$ |  |  |  |  |  |  |  |  |  |  |
|  | 2 |  | $\begin{array}{ll}2 & 14.5 \\ 2 & 13.1\end{array}$ |  |  |  |  |  |  |  |  |  |  |
|  | 2 |  | 11.72 |  |  |  | 224.92 |  |  |  |  |  |  |
|  | $0^{0.9}{ }^{2} \quad 4.0$ |  | $0 \cdot 32$ | 13.5 |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 2 | $\begin{array}{lll}2 & 4.5 \\ 2 & 4.5 \\ 3\end{array}$ | $2{ }_{2}{ }_{2} 7.62$ |  | 2 |  |  |  |  |  | $233^{\circ}$ |  |  |
| 8 | 57.915 |  | 4.9 |  |  |  |  |  |  |  |  |  |  |
|  | 54.7 I $57 \cdot 7$ |  |  |  |  |  |  |  |  |  | 220.1 |  |  |
|  | 53.5156 |  | $2 \cdot 4$ |  |  |  |  |  |  |  |  |  |  |
|  | 52.4 55.3 | I | 1 |  |  |  | 2 |  | 2 |  | $226 \cdot 1$ |  |  |
|  |  | I 57.01 |  |  | 2 $5 \cdot 9$ <br> 2 4.6 <br>   |  | $210 \cdot 62$ |  |  |  |  |  |  |
|  |  |  | $5 \cdot 2$ |  |  |  | $9 \cdot 32$ |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 46.81 | I $52 \cdot 3$ | $55 \cdot 1$ |  |  |  | $6 \cdot 7$ |  | $212 \cdot 7$ |  |  |  |  |
|  | I | I $51 \cdot 2$ | T | 5 | I 59.6 | $22 \cdot 5$ | $2{ }^{2} 5 \cdot 42$ |  | $2{ }^{2}$ |  |  |  |  |
|  |  |  | I | 5 |  |  | 2 $2{ }^{2}$ |  | ${ }^{2} \mathrm{I}$ 10.1 | ${ }_{2}^{2} \mathrm{I} 3 \cdot \mathrm{~F}$ |  | 219 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 4 |  | 4 |  |  | 1 57.6 | 2 |  |  | ${ }_{2}^{210.4}$ |  |  |  |
|  | 4 | I 45.6 I | 1 | ${ }^{51}{ }^{\circ} \mathrm{O}$ | I 53.7 | 5. | I 59.2 |  |  |  |  | 2 | 216.6 |
|  |  | I 43.5 I |  |  |  | $5 \cdot 2$ | 1 |  |  |  |  | 2 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | - |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $35 \cdot 31$ <br> 34.3 <br> 1 <br> 1 |  | 81 | $45 \cdot 3$ |  |  |  |  | $\begin{array}{ll}\text { I } & 58.5 \\ \text { I } & 57.3\end{array}$ | $\begin{array}{lll}2 & 1.3 \\ 2 & 0.0\end{array}$ | 2 | 2 <br> 2 | 8.7 |

## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

## * $\in$ URSE MAJORIS.



## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

* $\epsilon$ URSÆ MAJORIS.

| Lat. | HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }_{16}$. | ${ }_{17}{ }_{17}$ | ${ }_{18}^{\mathrm{m}}$ | ${ }_{19}$ | ${ }_{20}$ | ${ }_{21}$ | ${ }_{22}^{\text {m. }}$ | $\left.{ }_{23}^{\mathrm{m}}\right\|^{\mathrm{n}}$ | ${ }_{24}^{\text {m. }}$ | ${ }_{25}^{\mathrm{m}}$ \| | ${ }_{26}^{\mathrm{m}}$ | ${ }_{27}^{\mathrm{m}}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{29}$. | ${ }_{30}$ |
| N . REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $40^{\circ}$ |  |  | $84 \cdot 2$ | 86.4 | 88.6 | 90.8 | 93.0 | $95 \cdot 3$ | $97 \cdot 6$ | $99^{\prime} 9$ | 102.2 | 104*6 | 10\% 0 | 109.4 | Irr.9 |
| 4 4 |  | 8 SI I | 83.2 | 85.3 | 87.5 | 89.7 88.5 | $9 \mathrm{y} \cdot 9$ | ${ }_{94}{ }^{\text {P }}$ - 9 | ${ }^{96 \cdot 4}$ | 98.6 | 1010 ${ }^{\circ}$ | $1{ }^{103.3}$ | ros.7 | 108.1 | 110.5 |
| $4{ }_{4}^{42}$ |  | $80 \cdot 0$ | $82 \cdot \mathrm{r}$ $8 \mathrm{r} \cdot \mathrm{I}$ | 84.2 | 86.4 |  | ${ }^{90 \cdot} 9$ | ${ }_{91}{ }^{2 \cdot} \cdot 7989$ | ${ }_{93}{ }^{9} \cdot 1$ | ${ }_{96}^{97}{ }^{\text {9/4 }}$ | ${ }_{98}^{98}{ }^{9}$ | ${ }_{102}^{102}$ | Y04.3 | 106•7 105 | Yo9.1 ro7.7 |
| 44 |  | 78. | 80.0 |  | ${ }_{84}$ - |  | 88.3 | $90 \cdot 5$ | $92 \cdot 7$ | $94 \cdot 9$ | $97 \cdot 1$ | 993 | 101.6 | 103.9 | 106.2 |
| 45 |  | $76 \cdot 9$ | 78.9 | 80.9 | 83.0 | $85^{\circ}$ | 87.1 | 89.39 | 91.4 | $93 \cdot 6$ | 95.8 | 98.0 | 100. 2 | 102.5 | ${ }^{8}$ |
| 46 | 73.9 72.9 | 75 | 77.8 | 79.8 78.7 | 81.8 80.7 | 82 | 85.9 | $\begin{array}{ll}88.0 \\ 86.8 & 88\end{array}$ | 90.1 | 92:3 | ${ }_{93}^{94} 5$ | 96.6 | ${ }_{97}^{98.9}$ | Yor- ${ }^{\text {r }}$ | Y03.4 101. |
| ${ }_{48}^{48}$ |  | 73.7 | $75 \cdot 6$ | 77.5 | 79.5 | $8 \mathrm{I} \cdot 5$ | ${ }_{83}{ }^{5}$ | 85.58 | 87.6 | $89 \cdot 7$ | ${ }_{9 r} \mathrm{r} \cdot 8$ | ${ }_{93}{ }^{\text {P }}$ | ${ }_{96 \cdot 1}$ | 98.2 | 100.4 |
| 49 |  | 72.6 | 74.5 | 76.4 | $78 \cdot 3$ | $80 \cdot 3$ | $82 \cdot 3$ | 84.38 | $86 \cdot 3$ | 88.3 | $90 \cdot 4$ | 92.5 | $94 \cdot 6$ | $96 \cdot 8$ | $99^{\circ}$ |
| 50 | 69.7 68.6 | $7 \mathrm{7r} 5$ | 73.4 | 75.2 | 77.1 | 79.1 | ${ }^{8} \mathrm{I} \cdot \mathrm{O}$ | $\begin{array}{cc}83.0 \\ 8 \mathrm{ra} & 8\end{array}$ | ${ }_{8}^{85}{ }^{\circ}$ | ${ }_{8}^{87.0}$ | 889.1 | 91.1 | 93.2 | 95.3 | 97.5 |
| 51 <br> 52 | 68.6 | 70.4 69.3 | $\xrightarrow{72 \cdot 2}$ | 74.1 72.9 | 75.9 74.7 | $77 \cdot 8$ $76 \cdot 6$ | 79.8 <br> 78.5 <br> 8 | $8 r \cdot 7$ 8 <br> $80 \cdot 4$ 8 <br>   | $83 \cdot 7$ $82 \cdot 3$ | $85 \cdot 7$ 84.3 | $87 \cdot 7$ 86.3 | 89.7 88.3 | 9 r 8 | ${ }_{92}^{93}{ }^{9}$ | $95 \cdot 9$ 94.4 |
| 53 |  | $68 \cdot \mathrm{I}$ | 69.9 | 7 r 7 | 73.5 | $75 \cdot 3$ | 77.2 | 79.1 | $8 \mathrm{r} \cdot$ | 82.9 | $84 \cdot 8$ | 86.8 | 88.8 |  | 92.9 |
| 54 |  | 67.0 | 68 | $70 \cdot 5$ | $72 \cdot 2$ | 74.0 | 75.9 | $77 \cdot 7$ | 79.6 | $8 \mathrm{r} \cdot 5$ | 83.4 | 85.3 | 87.3 | 89.3 | $9 \mathrm{r} \cdot 3$ |
| 55 |  | $65 \cdot 8$ | 66 | 69.2 |  | 72.8 | 74.5 | 76.4 | 76.8 | 78.6 | 882.0 | 83.9 | 85.8 | 87.7 | 88.7 |
| 56 57 57 |  | $64 \cdot 6$ $63 \cdot 4$ | 66.3 65.0 | 68.7 | 69 68.4 | 71 | $\xrightarrow{73 \cdot 2} 7$ | $75 \cdot$ 73.6 7 | $76 \cdot 4$ 75 | ${ }_{77}^{78 \cdot 6}$ | 80.5 79.0 | 80 | 84.2 | $86 \cdot \mathrm{I}$ 84 | ${ }_{86.4}^{88.1}$ |
| 58 | 60.6 | 62 | 63.8 | 65 | 67-1 | 68 | $70 \cdot 4$ | 72.2 | 73.9 | $75^{\circ} 7$ | 77.4 | 79.2 | $8 \mathrm{r} \cdot \mathrm{x}$ | 88.9 | $84 \cdot 8$ |
| 59 60 | - ${ }^{\text {3 }}$ | 60.9 59 | $62 \cdot 5$ $6 \mathrm{r} \cdot 2$ | 64 | $65 \cdot 7$ $64 \cdot 3$ |  | 69 67.6 | $70 \cdot 7$ 69.2 | 72.4 70.9 | + $\begin{gathered}74.1 \\ 72 \cdot 6\end{gathered}$ | 75.9 74.3 | 77.6 76.0 | 79.4 77.8 | $81 \cdot 2$ 79.5 | $83 \cdot 1$ 81.3 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{31}$ | ${ }_{32}$ | ${ }_{33}{ }^{\text {m }}$ | ${ }_{34}{ }_{34}$ | ${ }_{35}$ | ${ }_{38}{ }_{38}$ | ${ }_{37}{ }^{\text {m }}$ | $\frac{\mathrm{m}}{\mathbf{3 8}}$ | $\frac{\mathrm{m}}{39}$ | ${ }_{40}$ | ${ }_{41}$ | ${ }_{42}$ | ${ }_{43}$. | ${ }_{44}$ | ${ }_{45}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | II4.3 ${ }^{\text {d }}$ | 16́8 81 | 119.4 | 121.9 | 124.5 | 12\%'91 | 129'7 | ${ }_{13}{ }^{\prime} \cdot 4$ | r3s'r $^{1}$ | 1 $137 \cdot 8$ | $8110 \cdot 5$ | 143:3 | 146́o | ${ }_{1488} 8$ |  |
| 4 I | 112.9 | 115.4 | 1179 | 120.4 | Y22.9 | 125.5 | ${ }^{1288}$ | $130 \cdot 7$ | 133.4 | $4{ }_{1} 136$ | $1{ }^{1} 38$ | $1{ }^{141} 5$ | $144 \cdot 2$ | $147{ }^{\circ}$ | 149 ${ }^{8}$ |
| 42 | Mr. 5 |  | II6.4 |  | 122.4 | 123.9 122.3 | 126.5 | ${ }_{129}^{129}$ | $\xrightarrow{132} 1$ | $7{ }^{1344}$ | $3{ }^{137 \%}$ | ${ }^{139}{ }^{\circ}$ | ${ }_{142}$ | r45.2 | 14779 |
| 44 | 108.6 | 111.0 | 113.4 | 1158 | 118.2 18 | $\left\lvert\, \begin{aligned} & 122 \cdot 3 \\ & 120.7 \end{aligned}\right.$ | $\begin{aligned} & 124.9 \\ & 123.2 \end{aligned}$ | $\begin{aligned} & 127 \% 4 \\ & 125 \% \end{aligned}$ | $\begin{aligned} & 1300 \\ & 128.3 \end{aligned}$ |  | ${ }_{9}^{183.5}$ | $\begin{aligned} & 137.9 \\ & 136.1 \end{aligned}$ | $\begin{aligned} & 1406 \\ & 138.4 \end{aligned}$ | $\begin{aligned} & 143.3 \\ & 14{ }^{1 \times 4} \end{aligned}$ | ${ }_{\text {144- }}^{\text {r }}$ |
| 45 | 107 | ro9 | xII 8 | 1 | 11 | II | 12 | ${ }^{124} \times$ | 8 | ${ }^{129} 1{ }^{1}$ | $1{ }^{131} 7$ |  | $136 \cdot 9$ | r39.5 | $142 \cdot 2$ |
| $\begin{aligned} & 46 \\ & 47 \end{aligned}$ | Y05.7 104.2 | $\xrightarrow{\text { ro8.0 }}$ 106.5 | 110.3 10888 | 112 | 115.0 | $117 \%$ 115.8 | 119.9 | 122.4 120.6 | I24.8 |  | $3{ }^{1} 129.9$ | $132 \cdot 4$ 1306 | 133.0 |  |  |
| 48 | 102.7 | 104.9 | $107 \cdot 2$ | 109.5 | x11.8 | II4 ${ }^{\text {I }}$ | 116.5 | IX8.9 | 121.3 | 123.7 | $7126 \cdot 2$ | I28.7 | ${ }_{131}$ | 133 | $136 \cdot 3$ |
| 49 | ror-x | 1034 | 105.6 | 107 | 11 | 1 | 114.8 | 117.1 | 119.5 | 512 | 12 | 126.8 | 129 | $13 \mathrm{r} \cdot 8$ | 134.3 |
| 50 | $99^{6}$ | Yor 8 | 104.0 | 106.2 | $108 \cdot 5$ | roo 8 | $\mathrm{rr3}^{12}$ | Y15.4 | 1177 | $7120 \cdot 1$ | $1{ }^{122} \cdot 5$ | 124.9 | 127.3 | r2988 | $132 \cdot 3$ |
| 5 5 | ${ }_{96 \cdot 5}^{98}$ | 100.2 | 102.4 | 104.6 | ${ }^{106}$ | 109.0 | 117.3 | 113.6 | I15.9 | ${ }^{118}$ | $2{ }^{120 \cdot 6}$ | ${ }^{122.9}$ | ${ }^{125 \cdot 3}$ | I27.8 | 130.2 |
| 53 | 94 | $97 \cdot$ | 1991 | ror-2 | 103.4 | 105.5 | 107.7 | 109.9 | $1 \mathrm{H} \mathrm{I}^{12}$ | ${ }_{2} 114.4$ | $4{ }^{18159}$ | $1{ }_{19} 120$ | 12 l | 123.7 | 126.0 |
| 54 | $93 \cdot 3$ | $95 \cdot 4$ | 97.4 | 99.5 |  | ro3.8 | 105.9 | 108. 1 | $1{ }^{1} \cdot 3$ | $3112 \cdot 5$ | $5114.7$ | $717 \%$ | 1193 | 121.6 | 123.9 |
| 55 | $9 \mathrm{r} \cdot 7$ | 93•7 | $95 \cdot 7$ | 97.8 | 99.8 | ror | 104. Y | 106.2 | 108.4 | $4110 \cdot 5$ | 5 II2.7 | 7115 | 117.2 | r19.5 | 121.7 |
| 56 |  | 92.0 | 94.0 | 96.0 | ${ }^{98 \cdot 0}$ | roo' 1 | Y02. 2 | 104.3 | $106 \cdot 4$ | 410 | 11 | 112 | M | r17.3 | 129 |
| 57 58 | 886 | 90.3 | 920.2 | 94.2 | ${ }_{94 \cdot 4}$ | ${ }_{96.3}^{98}$ | roo. 98 | 1023 $100 \cdot 4$ | $\xrightarrow{104.4}$ | $\begin{array}{ll}4 & 106 \cdot 5 \\ 4 \\ \text { ro4.5 }\end{array}$ | $5{ }^{108}$ | 1108 108.6 | ${ }_{\text {II }}$ | H15. ${ }_{\text {IT } 2.9}$ | M17.3 |
| 5 |  | 86.8 | 88.6 |  | $92 \cdot 5$ | 94.4 | $96 \cdot 4$ | 98.4 | roo-4 | $4{ }_{4}$ | 4 104.4 | $4{ }^{1}$ | 108.6 | 110.7 | X12.8 |
| 60 |  | 85.0 | 86.8 |  | 925 | 94 | 94.4 | $96 \cdot 3$ | 98.3 | 3100 |  | 2 104.3 |  | 108.4 |  |
| TRUE BEARING OR AZIMUTH OF $* \in$ URS e MAJORIS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | 1 HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ${ }_{18}^{\text {m. }}$ | \| ${ }_{18}$ | ${ }_{20} \mathrm{~m}$ | ${ }_{2} \mathrm{~m}$. | ${ }_{24}{ }_{4}$ | ${ }_{28}{ }_{28}$ | ${ }_{28}$ | ${ }_{30}^{\mathrm{m}}$. | ${ }_{32}$ | ${ }_{34}{ }_{4}$ |  | ${ }_{38}$ | ${ }_{40}^{\mathrm{m}}$ | ${ }_{42}$. | ${ }_{44}$ |
| N. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 14.2 |
| 44 | 6 | $\xrightarrow{10.9}$ | $\xrightarrow{\text { rr. }}$ | Ir. 4 | 11.7 | ${ }^{12.0}$ | ${ }^{2} 2$. | 12.5 | I2.8 | $8{ }^{13}{ }^{\circ}$ | - 13.3 | $3{ }^{13} 3.6$ | 13.9 | 14.1 | 14.4 |
|  |  | Ir. | ${ }_{1 \times 3}$ | Ir. 6 | 9 | 12.2 | 12.4 | 4 12.7 | 13.0 | - 13.3 | $3{ }^{1}$ | 13.8 | $\times 4$ | 14.4 | 14.7 |
|  |  |  | ${ }^{11.6}$ | 9 | 2 |  | 12.7 | 13.0 | 13.3 | 313.6 | 13 |  | 14.4 | 4 |  |
| 56 60 |  | I1.6 | 11.9 | 12.2 | 12.5 | 12.8 | 13.1 | I 13.4 | 4 $\begin{aligned} & 13.7 \\ & 14.9\end{aligned}$ | . 7 |  | ${ }^{1} 18$ | 14.9 15.4 | 15.1 | 15.4 16.0 |
|  |  |  |  |  |  |  |  | 5 13.8 | ${ }_{14} \times$ |  | . 514.8 | 15.1 | 15.4 | 15.7 |  |

# REDUCTION TO THE MERDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE. 

* $\in$ URS $£$ MAJORIS.

| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{m}_{46}$ | ${ }_{47}{ }_{4}$ | ${ }_{48}$ | ${ }_{49}$ | $\mathrm{m}_{50}$ | ${ }_{51}$ | ${ }_{52}$. | ${ }_{53}$ | ${ }_{54}$ | ${ }_{55}$ | ${ }_{56}$. | $\mathrm{m}_{57}$ | ${ }_{58}$ | ${ }_{59}$ | $\mathrm{m}_{60}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | 154.5 | 157.4 | $160 \cdot 3$ | 163.3 | $166 \cdot 2$ | 169.2 | 172.2 | 175.3 | 178.3 | $18 \mathrm{I} \cdot 4$ | 184.5 | 187.7 | 190.8 | 194.0 | 197.2 |
| 4 I | 152.6 | $155 \cdot 5$ | 158.4 | $16 \mathrm{I} \cdot 3$ | 164.2 | 167.1 | 170.I | 173.1 | 176.r | 179.2 | 182.3 | 185.4 | 188.5 | $19 \mathrm{r} \cdot 6$ | 194.8 |
| 42 | $150 \cdot 7$ | 153.5 | $156 \cdot 4$ | 159.2 | $162 \cdot 1$ | 165.0 | 168.0 | 170•9 | 173.9 | 176.9 | 180.0 | 183.0 | 186. 1 | 189.2 | 192.4 |
| 43 | 148.8 | 151.6 | 154.4 | 157.2 | $160 \cdot 0$ | 162.9 | 165.8 | 168.7 | 171.7 | 174.7 | 177.7 | 180.7 | 183.8 | 186.6 | 189.9 |
| 44 | I46.8 | 149.6 | $152 \cdot 3$ | 155.r | 157.9 | 160.8 | $163 \cdot 7$ | $166 \cdot 5$ | 169.5 | 172.4 | 175.4 | 178.3 | 181.4 | 184.4 | 187.5 |
| 45 | 144.9 | 147.6 | $150 \cdot 3$ | 153.1 | 155.8 | 158.6 | 161.5 | 164.3 | 167.2 | 170.1 | 173.0 | 176.0 | 178.9 | 181.9 | 185.0 |
| 46 | 142.9 | 145.5 | 148.2 | $15 \mathrm{I} \cdot 0$ | 153.7 | 156.5 | 159.3 | $162 \cdot 1$ | 164.9 | 167.8 | 170.7 | 173.6 | $176 \cdot 5$ | $179 \cdot 5$ | 182.4 |
| 47 | 140.9 | 143.5 | 146.2 | 148.8 | 15I.6 | 154.3 | 157*0 | 159.8 | $162 \cdot 6$ | 165.4 | 168.3 | 171.2 | 174-I | $177 \cdot 0$ | 179.9 |
|  | 138.9 | 141.5 | I44.1 | 146.7 | 149.4 | 152.1 | 154.8 | 157.5 | $160 \cdot 3$ | 163.1 | 165.9 | $168 \cdot \%$ | 175.6 | 174.5 | $177 \cdot 4$ |
| 49 | 136.8 | 139.4 | 142.0 | 144.6 | $147 \cdot 2$ | 149.9 | 152.5 | 155.2 | 158.0 | $160 \cdot 7$ | 163.5 | 166.3 | 169. 1 | 171.9 | 174.8 |
| 50 | 134.8 | $137 \cdot 3$ | 139.8 | 142.4 | 145.0 | 147.6 | 150.2 | 152.9 | 155.6 | 158.3 | 16I.0 | 163.8 | 166.5 | $169 \cdot 3$ | 172.1 |
|  | 132.7 | $135 \cdot 2$ | $137 \cdot 7$ | $140 \cdot 2$ | 142.7 | 145.3 | 147.9 | $150 \cdot 5$ | 153.2 | 155.8 | 158.5 | $16 \mathrm{I} \cdot 2$ | 164.0 | $166 \cdot 7$ | 169.5 |
|  | $130 \cdot 6$ | 133.0 | 135.5 | 138.0 | $140 \cdot 5$ | 143.0 | 145.6 | 148.1 | $150 \cdot 7$ | 153.4 | 156.0 | 158.7 | 161.4 | 164•I | 166.8 |
| 53 | 128.4 | 130.8 | 133.2 | 135.7 | 138.2 | $140 \cdot 7$ | 143.2 | 145.7 | 148.3 | 150*9 | 153.5 | 156. 1 | 158.7 | 161.4 | 164•1 |
| 54 | 126.3 | 128.6 | 131.0 | 133.4 | 135.8 | 138.3 | 140.8 | 143.3 | 145.8 | 148.3 | 150.9 | 153.5 | 156. 1 | 158.7 | 161.3 |
|  | 124. ${ }^{\text {I }}$ | 126.4 | 128.7 | 13I•I | 133.5 | 135.9 | 138.3 | 140.8 | 143.2 | 145.7 | 148.3 | $150 \cdot 8$ | 153.3 | 155.9 | 158.5 |
| 56 | 121.8 | 124.I | 126.4 | 128.7 | 13 I. 1 | 133.5 | 135.8 | $138 \cdot 2$ | $140 \cdot 7$ | 143.1 | 145.6 | 148.I | $150 \cdot 6$ | 153.1 | $155 \cdot 7$ |
| 57 | 119.5 | 121.8 | 124.1 | 126.3 | 128.6 | 131.0 | 133.3 | 135.7 | $138 \cdot \mathrm{I}$ | $140 \cdot 5$ | 142.9 | 145.3 | 147.8 | $150 \cdot 3$ | 152.8 |
|  | 117.2 | 119.4 | 121.7 | 123.9 | 126.2 | 128.4 | $130 \cdot 7$ | 133.1 | 135.4 | 137.8 | $140 \cdot 1$ | 142.5 | $145^{\circ}$ | $147 \cdot 4$ | 149.9 |
|  | 114.9 | 117.1 | 119.2 | 121.4 | 123.7 | 125.9 | 128.1 | 130.4 | 132.7 | $135{ }^{\circ}$ | 137.3 | 139.7 | $142 \cdot 1$ | 144.5 | 146.9 |
|  | 112.5 | 114.6 | 116 |  | 121.1 | 123.3 | 125.5 | 127.7 | $130 \cdot 0$ | 132.2 | 134.5 | 136.8 | 139.1 | 141.5 | 143.8 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 1 | 2 | ${ }_{3} \mathrm{~m}$ | m. |  | m. | ${ }^{7}$ | ${ }_{8} \mathrm{~m}$ | ${ }_{9} \mathrm{~m}$ | ${ }_{10}$ | 11 | 12 | ${ }_{13}$ | ${ }_{14}$ | ${ }_{15}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 200. 5 | 203.7 | 207.0 | 210•3 | 213.7 | 17.0 | $20 \cdot 4$ | $223 \cdot 8$ | $227 \cdot 3$ | $230 \cdot 7$ | 234.2 | $237 \cdot 7$ | $24 \mathrm{I} \cdot 3$ | $244 \cdot 8$ | $8 \cdot 4$ |
|  | 198.0 | 201.2 | 204.5 | 207.8 | $21 \mathrm{r} \cdot \mathrm{I}$ | 214.4 | 217.7 | $22 \mathrm{I} \cdot \mathrm{I}$ | 224.5 | $227 \cdot 9$ | 231.4 | 234.8 | $238 \cdot 3$ | 241.8 | $245 \cdot 4$ |
| 42 | 195.5 | 198.7 | 201.9 | $205 \cdot 2$ | 208.4 | 21r.7 | 215.0 | 218.3 | 22 r 7 | 225.1 | 228.5 | 231.9 | $235{ }^{\circ}$ | 238.8 | $242 \cdot 3$ |
|  | 193.0 | $196 \cdot 2$ | 199.4 | $202 \cdot 6$ | $205 \cdot 8$ | $209 \cdot 0$ | $212 \cdot 3$ | $215 \cdot 6$ | 218.9 | 222.2 | 225.6 | 229.0 | $232 \cdot 4$ | $235 \cdot 8$ | $239 \cdot 3$ |
|  | 190.5 | 193.6 | 196.8 | 199.9 | 203. 1 | $206 \cdot 3$ | $209 \cdot 5$ | $212 \cdot 8$ | $216 \cdot \mathrm{I}$ | 219.4 | 222.7 | 226.0 | 229.4 | $232 \cdot 8$ | $236 \cdot 2$ |
| 45 | 188.0 | 191.I | 194.2 | 197.3 | $200 \cdot 4$ | $203 \cdot 6$ | $206 \cdot 8$ | $210 \cdot 0$ | 213.2 | 216.5 | 219.7 | 223.0 | $226 \cdot 4$ | 229.7 | $233 \cdot 1$ |
|  | 185.5 | 188.5 | 191.5 | 194.6 | 197.7 | $200 \cdot 8$ | 204.0 | 207. 1 | $210 \cdot 3$ | 213.5 | 216.8 | $220 \cdot 0$ | 223.3 | $226 \cdot 6$ | 229.9 |
|  | 182.9 | $185{ }^{\circ} 9$ | 88.9 | 191.9 | $195{ }^{\circ}$ | 198.0 | 201.1 | 204.3 | $207 \cdot 4$ | $210 \cdot 6$ | 213.8 | $217{ }^{\circ}$ | $220 \cdot 2$ | 223. | 226.7 |
|  | $180 \cdot 3$ 177.6 | 183.2 180.5 | 186.2 <br> 183.5 | 189.2 186.4 | 192.2 180.4 | 195.2 192.4 | 198.3 195.4 | 201.4 198.4 | 204.5 | $207 \cdot 6$ | $210 \cdot 7$ | 213.9 | $217 \cdot 1$ | $220 \cdot 3$ | 223.5 |
| 49 |  | 18 |  |  |  |  |  |  | 201.5 | 204 | $207 \cdot 7$ | $210 \cdot 8$ | 213.9 | 217 | $220 \cdot 3$ |
| 50 | 175.0 | 1778 | $180 \cdot 7$ | 183.6 | 186.5 | 189.5 | 192.5 | 195.5 | $198 \cdot 5$ | 2015 | 204.6 | 207.6 | $210 \cdot 7$ | 213.9 | 217.0 |
| 51 | 172.3 | 175.1 | 177.9 | 180 | $183 \cdot 7$ 180.8 | 186.6 | 189.5 | 192.5 | 195.4 | 198.4 | $201 \cdot 4$ | $204 \cdot 5$ | $207 \cdot 5$ | $210 \cdot 6$ | 213.7 |
| 52 | 169.5 | 172.3 | 175.1 | 177.9 | $180 \cdot 8$ | 183.6 | 186.5 | 189.4 | 192.3 | 195.3 | 198.2 | 201.2 | 204.2 | 2073 | $210 \cdot 3$ |
| 53 | 166.8 | 169.5 | 172.3 | $175{ }^{\circ}$ | 177.8 | $180 \cdot 6$ | 183.5 | $186 \cdot 3$ | 189.2 | $192 \cdot 1$ | 195.0 | 198.0 | $200 \cdot 9$ | 203.9 | 206.9 |
| 54 | 164.0 | $166 \cdot 7$ | 169.4 | 172.1 | 174.8 | 177.6 | 180.4 | 183.2 | 186.0 | 188.9 | 191.8 | 194.6 | 197.6 | $200 \cdot 5$ | $203 \cdot 4$ |
|  | I6I•I | 163.8 | 166.4 | 169 | 171.8 | 174.5 | 177.3 | 180.0 | 182.8 | 185.6 | 188.4 | 191.3 | 194. 1 | 197.0 | 199.9 |
|  | 158.2 | $160 \cdot 8$ | 163.4 | 166.r | $168 \cdot 7$ | 1714 | 174-I | $176 \cdot 8$ | 179.5 | 182.3 | 185.1 | 187.9 | 190.7 | $193 \cdot 5$ | $196 \cdot 4$ |
| 57 | 155.3 | 157.9 | $160 \cdot 4$ | 163.0 | $165{ }^{\circ} 6$ | 168.2 | 170.9 | 173.5 | 176.2 | 178.9 | 181.6 | 184.4 | 187.1 | 189.9 | $192 \cdot 7$ |
| 58 | 152.3 | 154.8 | 157.3 | 159.9 | 162.4 | 165.0 | $167 \cdot 6$ | 170.2 | 172.8 | 175.5 | 178.2 | 180.9 | 183.6 | 186 | 189.0 |
| 59 | $149 \cdot 3$ | $151 \cdot 7$ | 154.2 | 156.7 | 159.2 | 161.7 | 164.3 | $166 \cdot 8$ | 169.4 | $172{ }^{\circ} \mathrm{O}$ | 174.6 | 177.3 | 179.9 | 182.6 | 185.3 |
| 60 |  | 148.6 | 151.0 | 153.4 | 155.9 | 158.4 | 160.9 | 163.4 | 165.9 | 168.4 | 171.0 | 173.6 | 176.2 | 178.8 | 181.4 |
| TRUE BEARING OR AZIMUTH OF $* \in$ URSA MAJORIS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| La | I HOUR. 2 HOURS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 46 | ${ }_{48}$ | 50 | ${ }_{52}$ | ${ }_{54}$. | ${ }_{56}^{\mathrm{m}}$ | ${ }_{58}^{\mathrm{m}}$. | m. | ${ }_{2}$ | ${ }_{4}$. | ${ }_{6}$. | 8. | 10 | m. | 14. |
| N. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | ${ }^{\circ} \mathrm{P} \cdot 5$ | 14.7 | $\stackrel{\circ}{5}$ | 15.3 | 15.5 | ${ }^{\circ} \mathrm{S} \cdot 8$ | 16.0 | r6.3 | r6.6 | r 6.8 | I ${ }^{\circ} \cdot 1$ | - $7 \cdot 3$ | 1 $¢ \cdot 6$ | $\stackrel{\circ}{7} \cdot 8$ | 18.r |
| 44 | $14 \cdot 7$ | 14.9 | 15.2 | 15.5 | 15.7 | 16.0 | 16.3 | 16.5 | 16.8 | 17.1 | ${ }^{17} 3$ | 17.6 | 17.8 | 18.1 | 18.4 |
| 48 | 14.9 | 15.2 | 15.5 | 15.8 | 16.0 | $16 \cdot 3$ | $6 \cdot 6$ | 16.8 | 17.1 | 17.4 | 17.7 | 17.9 | 18.2 | 18.5 | 18.7 |
| 52 | 15.3 | 15.6 | 15.8 | $16 \cdot 1$ | 16.4 | 16.7 | 17.0 |  | 17.5 | 17.8 | 18.1 | 18.4 | 18.7 | 18.9 | 19.2 |
| 56 | 15.7 | 16.0 | $16 \cdot 3$ | 16.6 | 16.9 | 17.2 | 17.5 | 17.8 | I8.I | 18.4 | 18.6 | 18.9 | 19.2 | 19.5 | 19.8 |
| 60 | $16 \cdot 3$ | 16.6 | $16 \cdot 9$ | 17.2 | 17.5 | 17.8 | 18.1 | I 8.4 | 18.7 | $19^{\circ} 0$ | 19.3 | 19.6 | 19.9 | $20 \cdot 2$ | $20 \cdot 5$ |

* $\eta$ URS $\Phi$ MAJORIS.

|  | ${ }_{4}$ | 8 | 12 | 16 | 20 | ${ }_{22} \mathrm{~m}$ I | 24 | ${ }_{20}^{\mathrm{m}}$ |  |  |  | 34 | $\mathrm{m}_{30}$ |  |  | $\begin{aligned} & \mathrm{m} . \\ & 42 \end{aligned}$ | ${ }_{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $2{ }^{\circ}$ | 0.8 | $3 \cdot 0$ | 6.8 | 12'1 | 18.8 | $22 \cdot 7$ | 2\%\%0 | $3{ }^{1} 6$ | $36 \cdot 6$ | 41.9 | 47\%6 | 53'6 | 60.0 | $66 \cdot 7$ |  | 8 I - | 8 |
| 24 | $0 \cdot 7$ | 2.8 | $6 \cdot 4$ | 2, | $17 \cdot 7$ | 21.4 | 25.5 | 29.8 | $34 \cdot 5$ | 39.6 | 44.9 |  | 56.7 | $63^{\circ} \mathrm{O}$ | 60.6 |  |  |
| 22 |  |  | $6 \cdot 1$ |  |  |  | $24^{1}$ | $28 \cdot 3$ | $32 \cdot 7$ | $37 \cdot 5$ |  |  | 51.2 | 59.8 |  |  |  |
| 18 | ${ }_{0} 0.6$ | $2 \cdot 4$ | $5 \cdot 5$ | 9.8 | 15.2 |  |  | 5.7 | 29.8 | 34 | 48.8 | $43 \cdot 7$ |  | 54.5 | 60.2 |  |  |
| ${ }^{1} 6$ |  |  | $5 \cdot$ | $9 \cdot 4$ | 14.6 |  |  | $24 \cdot 6$ | 28.5 | $32 \cdot 7$ | $37 \cdot 2$ | $4{ }^{1} 9$ | 46.9 | 2 | - 8 | $\cdot 6$ |  |
| 14 |  | 2.3 2.2 | $5{ }^{5 \cdot}$ |  | $1{ }^{14.0}$ | 17.0 |  | $23 \cdot 6$ 22.8 | 27.4 26.4 | 31.4 | 35.7 | 38. | 45.1 | . 2 | 5.5 |  |  |
| + |  | $2 \cdot 0$ | 4.5 | 8.0 | $12 \cdot 6$ | 15.2 | 18.1 | 21.2 | 24.6 | 28.2 | 32. | 36. | $40 \cdot 5$ | $45^{\circ}$ | 46 | 54. |  |
| 4 | 0.5 | $1 \cdot 9$ | $4 \cdot 2$ | $7 \cdot 5$ | II.8 | 14.2 | 16.9 | 19.9 | $23^{\circ}$ | 26.4 |  | 33.9 | 37.9 | $42 \cdot 2$ | $46 \cdot 7$ | $51 \cdot 5$ |  |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 |  |  | $3 \cdot 8$ | 7.1 6.7 |  |  |  |  |  | ${ }_{2}^{24.8}$ |  |  |  |  | $4 \cdot 6$ | 45.5 |  |
| 8 |  | I.7 | $3 \cdot 6$ |  | $10 \cdot 5$ 9 |  | 15.0 | $17 \cdot 7$ 16.7 |  | 22.2 | $25 \cdot 3$ | 38.1 28.5 | 33.7 |  |  | $43 \cdot 4$ |  |
| ${ }_{12}^{12}$ | ${ }^{0.4}$ | 1.5 | , | 6.0 | 98.4 | 11.4 |  | 15.9 | 18.4 | 121.1 | 24.0 22.8 | 27.1 | 30.3 | 33.8 | 37.4 | 41.2 |  |
| 16 | $0 \cdot 4$ | $1 \cdot 4$ | 3.2 | $5 \cdot 7$ | 8.9 |  | 12.8 | $15 \cdot 1$ | 17 | 20.0 |  | 25 | 28.8 |  | 35 | $39^{\circ}$ |  |
|  |  |  | $3 \cdot 1$ | 5.2 | 8.5 | 10.2 |  |  | 16.6 |  | 21.6 |  | 27.4 |  | 33.8 | $37 \cdot 2$ |  |
| 28 | - $\begin{aligned} & 0.3 \\ & 0.3\end{aligned}$ | 12 | 2.9.8 | $5 \cdot 2$ | ${ }_{7} 8.6$ | $9 \cdot 7$ 9.2 |  | $13 \cdot 6$ | 15.8 |  |  |  |  |  |  | 33 |  |
|  | $\stackrel{0}{0.3}$ |  | $2 \cdot 6$ | 4.6 | $7 \cdot 2$ | 8 | 10.4 | 12.2 | 14.2 | 16.3 | 18 | $20 \cdot 9$ | $23 \cdot 4$ | $26 \cdot \mathrm{I}$ | 28. |  | 35 |
| 36 | 0.3 | I | $2 \cdot 5$ | $4 \cdot 4$ | 6.9 | $8 \cdot 3$ | 0.9 | 11.6 | 13.4 |  | 17.6 | 19.8 | 22 | 24. | $27 \cdot 4$ | 30.2 |  |
|  | $\begin{aligned} & \mathrm{m} \\ & 45 \end{aligned}$ | $\begin{aligned} & \mathrm{m} . \\ & \mathbf{4 0} \\ & \hline \end{aligned}$ | $47$ | $48$ | $49$ | $50$ | ${ }_{51}^{110}$ | $\begin{aligned} & \mathrm{m} . \\ & 52 \\ & \hline \end{aligned}$ |  |  | $54$ | $55$ | $56$ | $57$ | 58 | 59 |  |

N.

| ${ }_{2}{ }^{\circ} 6$ |
| :---: |
| 25 |
| 24 |
| 24 |
| 23 |
| 22 |
| 21 |
| 20 |
| 20 |
| 19 |
| 18 |
| 18 |
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| 16 |
| 15 |
| 15 |
| 14 |
| 12 |
| 10 |
| 8 |
| 8 |
| 6 |
| 4 |
| 2 |
| 2 |
| 0 |



## REDUCTION TO THE MERDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* $\eta$ URS e MAJORIS.

|  |  |  |  |  | ${ }_{65}$ |  |  |  | $9$ |  |  |  | $3$ | $44$ | $\underset{75}{\mathrm{~m} .}$ | ${ }_{6}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  | EDU |  |  |  |  |  |  |  |  |  |
| 26 |  |  | $176 \cdot 3$ | 181.6 | $187^{\circ}$ |  |  |  | 209•1 | 214.8 | $220 \cdot 6$ |  | $32 \cdot 2$ | $38 \cdot 2$ |  |  |
| 25 |  | $66 \cdot 6$ |  | 176.9 | 182.I |  |  | 198.3 | $203 \cdot 8$ | $209 \cdot 3$ | 215.0 | $22 \cdot 6$ | $226 \cdot 4$ | $232 \cdot 2$ | 238.0 | $44^{\circ}$ |
| 24 | 157.4 | $162 \cdot 3$ | 167.4 | 172.4 | 177.6 | $182 \cdot 8$ |  | 193.3 |  | 204.2 | $209 \cdot 7$ | 215.2 | $220 \cdot 9$ | $226 \cdot 6$ | $232 \cdot 3$ |  |
| 23 | 153.5 | 158.4 | 163.3 | 168.2 | 173.3 | 178.3 | 183.5 |  | $194 \cdot 0$ | 199.3 | 204.7 | $210 \cdot 2$ | $215 \cdot 7$ | 221 | 226.9 | $232 \cdot 6$ |
| 23 | 149.9 | $154 \cdot 6$ | 159.4 | 164.3 | 169.2 | 174-2 | 179.2 | 184.3 | 189.5 | 194.7 | $200 \cdot 0$ | 4 | O. | 216.2 | 22 | 227.3 |
| 2 |  |  |  |  |  |  |  |  |  |  |  |  | 206•1 | . 5 |  |  |
| 20 | 143.2 | I 47.8 | 152. | 157 |  |  | 171 |  |  | r8 | 1914 | 196.5 |  | 207. | 212 | 217.7 |
| 19 | $140 \cdot 1$ | 144.6 | 149. | $153 \cdot 7$ | 15 | 163.0 | $167 \cdot$ | 172.6 | 177.5 | 182.4 | 187.4 | 192.5 | 197.6 | 202 | 20 | 13.2 |
| 18 | 13 | $14{ }^{6} 6$ | 146 | $150 \cdot 5$ | 155.1 | 159.7 | 164.3 | $169 \cdot 1$ | I73.9 | 178.7 |  |  | 193.6 | 198 | 2 | ${ }^{\circ}$ |
| 17 16 |  | 138.8 | 143.1 | 147.5 | 152.0 | $156 \cdot 5$ 153.5 | $161 \cdot 1$ 158.0 | 165.7 162.5 | $170 \cdot 4$ $167 \cdot 2$ | 175.2 171.8 | I 178.0 |  | . 8 | 194.8 | 199.8 | $204 \cdot 9$ $201 \cdot 1$ |
| 16 |  | I36.0 | $140 \cdot 3$ | 144 | 149.0 | $153 \cdot 5$ |  | 162.5 | 167.2 | 171.8 | 176.6 |  |  | 191.1 | 196.0 | 201•1 |
| 15 |  |  | 137 |  | $146 \cdot 2$ |  | , | 159.5 | 164.0 | 1 | 173.3 |  | 182.8 | 187.6 | 192.4 |  |
| 14 | 120 | $131^{\circ} \mathrm{O}$ | 135 | 13 | 143 | 147.8 | $152 \cdot 1$ | $156 \cdot 6$ | 161.0 | 165 | $170 \cdot 1$ | 17 | $179 \cdot 4$ | 184.2 |  | $193 \cdot 8$ |
| 13 | 124.6 | 128.6 | 132 |  |  | $145 \cdot 1$ | 149.4 | ${ }^{153}{ }^{\text {P }}$ | $158 \cdot 1$ | 162 | 167 | 17 |  |  | 185.7 |  |
| 12 | 122.4 | 12 | 130 | 134.3 |  | $142 \cdot 6$ |  | 151-1 | 155.4 | 159 | 164.2 |  | 3.2 | 17 | 182.5 |  |
| 11 | $120 \cdot 3$ | 124.1 | 12 | 132.0 | $136 \cdot 1$ | $140 \cdot 2$ | 144.3 |  | 152.7 | 157.1 |  |  | $170 \cdot 3$ | $174{ }^{\circ}$ | 4 |  |
| 10 |  | 122.0 | 125 | 129.8 | 133.8 | 137.8 | 141.9 | $146 \cdot 0$ | 150.2 | 154.4 | 158.7 | $163 \cdot 1$ | $167 \cdot 5$ | 172.0 | . |  |
|  |  |  |  |  |  |  |  |  |  |  |  | $160 \cdot 5$ | 164.8 |  | 173.6 | I |
| 8 | 114.4 |  | 12 | 125.6 | I2 | 13 | 137 | 3 | 145.4 | I49 | 153.7 | 157.9 | $2 \cdot 2$ | $166 \cdot 5$ |  |  |
|  |  |  |  | 123.6 | $127 \cdot 4$ | 131.3 | 135.2 | $139 \cdot 1$ | $143 \cdot 1$ | $147 \cdot 2$ | 151.3 | 15 | 159.7 | 163.9 |  | $172 \cdot 6$ I70.0 |
| 6 |  |  |  |  |  | 129.2 | $133 \cdot 1$ | $137 \cdot 0$ | $140 \cdot 9$ |  | I49.0 |  | $157 \cdot 2$ | 161. |  |  |
| 4 | 107.5 |  | 11 | 1 | 12 | 125.4 | 129.1 | 132.9 120.0 |  |  | 144.5 I 40.4 |  | 152.6 | $156 \cdot 7$ $152 \cdot 2$ | - 2 |  |
| 2 | 104.3 | 107.7 | III• |  |  |  |  |  | 132 |  | $140 \cdot 4$ |  |  | 2 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  | 147.9 |  |  |
| 2 | 98.6 | Ior 8 | 105 | 108.3 | 111.7 | $115 \cdot 1$ | 118.5 | 122.0 | 125.5 | 129.1 | 132 | 136 | $140 \cdot 2$ | 143.9 |  | $5 \mathrm{I} \cdot 6$ |
|  |  | $99^{\circ}$ | 102. 2 | 105.4 | 108 | I12.0 | $115 \cdot 3$ | 118.7 | 122.2 | $125^{\circ}$ | 129.2 | $132 \cdot 8$ | 136.4 | $140 \cdot 1$ | 143 | 147.6 |
|  |  | $96 \cdot 4$ | 99 | 10 | 10 |  | II | 115.6 | 119.0 | 12 | 125.8 |  | 132.9 | I 36 | I | 143.8 |
|  |  | 93 | 96. |  |  |  |  | 112.6 | 15 |  |  |  |  | 133 | 136 |  |
| 10 |  | 91.5 | 94.4 |  | IO | Io |  | 109.8 |  |  | 119.5 |  |  | 129 |  |  |
| 12 |  |  |  |  |  |  | 103.9 |  | 110. 1 | 113.3 |  |  |  | 126 |  | . 2 |
| 14 |  | 8 | 89 | 9 | $95 \cdot 5$ |  | - |  |  |  | 110 | $116 \cdot 8$ |  | 123 | , |  |
| 16 | $82 \cdot \mathrm{I}$ $80 \cdot 1$ | 84.8 82.7 | 87.5 85.4 | 88 |  |  | 8 | 1 | 104.7 102.2 | 107. |  | 113.9 | $117 \cdot 0$ |  |  |  |
| 20 | 78 | $80 \cdot 7$ | 83.2 |  | 88.6 | 91 | $4 \cdot 0$ | 96. | $99^{\circ}$ | $102 \cdot 5$ |  | 108 | IIIP4 | II4 |  | 120.6 |
| 22 | $76 \cdot 2$ | 78. | $8 \mathrm{I} \cdot 2$ | 83.8 | 86 | 89.0 | 91•7 | $94^{\circ}$ | $97 \cdot 2$ |  | 102.8 |  | 108.6 | III 6 |  |  |
|  |  | 7 | 79.2 | 81 | $8{ }^{2}$ |  | 89 |  | 94 | 975 |  | 103. | 106.0 | 108 | III-8 | 147 |
| 26 |  | 74.8 | $77 \cdot 2$ | 79. | 82.1 | $84 \cdot 6$ | $87 \cdot 2$ | 89 | 92.4 | 95 | $97 \cdot 8$ | 100 | 103.3 | Io6 | 109.0 | II•9 |
| 28 |  | $72 \cdot 9$ | $75 \cdot 2$ | $77 \cdot 6$ | $80 \cdot 1$ | 82.5 | $85^{\circ}$ |  | - | 92 | 95 | 98 | $100 \cdot 7$ | 103 | $106 \cdot 3$ |  |
| 30 |  | 7 | $73 \cdot 3$ | ${ }^{75} 7$ | $78 \cdot 0$ | ${ }^{80}{ }^{\circ} 4$ | 82.8 | 85.3 | 87.8 | $90 \cdot 3$ |  | 95.5 | $98 \cdot 2$ | 00 |  |  |
| 32 34 | 65 | $69 \cdot 2$ 67.4 |  | 71 | 74 | $78 \cdot 3$ $76 \cdot 3$ |  | 83.1 80.9 | 85.5 83.3 |  | ${ }_{88 \cdot 5} 9$ | $93 \cdot 1$ 90.6 | 95.6 | $95 \cdot 7$ | 00.9 | 103.6 100.9 |
| 34 | 65 | 67.4 | 69 | 71 | 74 |  |  | 80 | 83.3 | 85 | $88 \cdot 1$ |  | $93^{\circ}$ | 957 | 98.2 | 100.9 |


| Lat. | m. | m <br> 8 | 12 | $\frac{\mathrm{m}}{16}$ | m. 20 | m. 24 | m. 28 | ${ }_{3} \mathrm{~m}$. | ${ }_{36}$ | m. 40 | ${ }_{4} \mathrm{~m}$ | 48 | $\begin{aligned} & \mathrm{m} . \\ & 52 \\ & \hline \end{aligned}$ | m 60 | m 70 | $\begin{aligned} & \mathrm{m} . \\ & 80 \end{aligned}$ | $\begin{aligned} & \hline \mathrm{m} . \\ & 90 \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $26^{\circ}$ | I. 6 | $3 \cdot 2$ | $4 \cdot 8$ | $6 \cdot 4$ | $8 \cdot 0$ |  | II•O | 12.5 | $14^{\circ} \mathrm{O}$ | 15.4 | 16.8 | 18.2 | 19.6 | $22^{\circ} \mathrm{I}$ | $25^{\circ} \mathrm{I}$ | $27^{\circ} \cdot 8$ | $30^{\circ} \cdot 3$ |
| 25 | $1 \cdot 5$ | $3 \cdot 1$ | $4 \cdot 6$ | $6 \cdot 2$ | $7 \cdot 7$ | $9 \cdot 2$ | 10.6 | $12 \cdot 1$ | 13.5 | 14.9 | $16 \cdot 3$ | 17.6 | I $8 \cdot 9$ | 21.4 | $24^{\circ} 3$ | $27^{\circ} 0$ | 29.4 |
| 24 | 1.5 | 3.0 | $4 \cdot 5$ | $5 \cdot 9$ | $7 \cdot 4$ | $8 \cdot 8$ | 10.3 | $11 \cdot 7$ | 13.0 | 14.4 | $15 \cdot 7$ | $17 \cdot 0$ | $18 \cdot 3$ | 20.7 | $23 \cdot 6$ | $26 \cdot 2$ | $28 \cdot 6$ |
| 23 | $1 \cdot 4$ | $2 \cdot 9$ | $4 \cdot 3$ | $5 \cdot 7$ | $7 \cdot 1$ | $8 \cdot 5$ | 9.9 | 11.3 | 12.6 | 13.9 | 15.2 | $16 \cdot 5$ | 17.7 | 20.1 | $22 \cdot 9$ | $25 \cdot 4$ | 27.8 |
| 22 | I*4 | $2 \cdot 8$ | $4 \cdot 2$ | $5 \cdot 5$ | 6.9 | $8 \cdot 3$ | $9 \cdot 6$ | 10.9 | 12.2 | 13.5 | $14 \cdot 7$ | 16.0 | 17.2 | 19.5 | $22 \cdot 2$ | 24.8 | 27-1 |
| 20 | I.3 | $2 \cdot 6$ | 3.9 | $5 \cdot 2$ | $6 \cdot 5$ | $7 \cdot 8$ | $9 \cdot 0$ | 10.2 | 11.5 | 12.7 | 13.9 | 15.0 | 16.2 | $18 \cdot 4$ | 21.0 | 23.5 | $25 \cdot 8$ |
| 18 | I-2 | $2 \cdot 5$ | 3.7 | 4.9 | $6 \cdot 1$ | $7 \cdot 3$ | $8 \cdot 5$ | $9 \cdot 7$ | 10.8 | 12.0 | $13 \cdot 1$ | 14.2 | $15 \cdot 3$ | 17.5 | 20.0 | 22.4 | $24 \cdot 6$ |
| 16 | I. 2 | $2 \cdot 3$ | $3 \cdot 5$ | $4 \cdot 6$ | $5 \cdot 8$ | $6 \cdot 9$ | 8-1 | $9 \cdot 2$ | $10 \cdot 3$ | II* 4 | 12.5 | 13.5 | 14.6 | $16 \cdot 6$ | 19.0 | 21.4 | $23 \cdot 5$ |
| 14 | I'I | $2 \cdot 2$ | $3 \cdot 3$ | $4 \cdot 4$ | $5 \cdot 5$ | $6 \cdot 6$ | $7 \cdot 7$ | $8 \cdot 7$ | 9.8 | 10.8 | II•9 | 12.9 | 13.9 | 15.9 | $18 \cdot 2$ | 20.4 | 22.6 |
| 12 | I' | $2 \cdot 1$ | $3 \cdot 2$ | $4 \cdot 2$ | $5 \cdot 3$ | $6 \cdot 3$ | $7 \cdot 3$ | $8 \cdot 4$ | $9 \cdot 4$ | 10.4 | II* 4 | $12 \cdot 3$ | $13 \cdot 3$ | 15.2 | 17.5 | 19.6 | $21 \cdot 7$ |
| 8 | 1.0 | I.9 | $2 \cdot 9$ | 3.9 | $4 \cdot 8$ | $5 \cdot 8$ | $6 \cdot 7$ | $7 \cdot 7$ | $8 \cdot 6$ | $9 \cdot 6$ | $10 \cdot 5$ | II.4 | $12 \cdot 3$ | 14.1 | $16 \cdot 2$ | 18.2 | $20 \cdot 2$ |
| 4 | 0.9 | 1.8 | $2 \cdot 7$ | $3 \cdot 6$ | $4 \cdot 5$ | $5 \cdot 4$ | $6 \cdot 3$ | $7 \cdot 2$ | $8 \cdot 0$ | $8 \cdot 9$ | $9 \cdot 8$ | 10.6 | II 5 | 13.1 | 15.2 | I7.1 | 19.0 |
| S. | 0.8 | 1.7 | $2 \cdot 5$ | $3 \cdot 4$ | $4 \cdot 2$ | $5 \cdot 1$ | $5 \cdot 9$ | $6 \cdot 7$ | $7 \cdot 6$ | $8 \cdot 4$ | $0 \cdot 2$ | 10.0 | $10 \cdot 8$ |  |  | 16.2 | $18 \cdot 0$ |
| 4 | 0.8 | 1. 6 | $2 \cdot 4$ | $3 \cdot 2$ | 4.0 | $4 \cdot 8$ | $5 \cdot 6$ | $6 \cdot 4$ | $7 \cdot 2$ | $7 \cdot 9$ | $8 \cdot 7$ | $9 \cdot 5$ | 10.2 | I I 8 | 13.6 | 15.4 | 17.1 |
| 10 | $0 \cdot 7$ | 1.5 | $2 \cdot 2$ | $3 \cdot 0$ | $3 \cdot 7$ | $4 \cdot 5$ | $5 \cdot 2$ | $6 \cdot 0$ | $6 \cdot 7$ | $7 \cdot 4$ | $8 \cdot 2$ | $8 \cdot 9$ | $9 \cdot 6$ | II'O | 12.8 | 14.5 | 16. 1 |
| 20 | $0 \cdot 7$ | 1.4 | 2.I | 2.8 | 3.4 | $4 \cdot 1$ | $4 \cdot 8$ | $5 \cdot 5$ | $6 \cdot 2$ | $6 \cdot 9$ | $7 \cdot 5$ | $8 \cdot 2$ | $8 \cdot 9$ | 10.2 | 11.8 | 13.5 | 15.0 |
| 30 | $0 \cdot 7$ | I-3 | $2 \cdot 0$ | $2 \cdot 6$ | $3 \cdot 3$ | $4 \cdot 0$ | $4 \cdot 6$ | $5 \cdot 2$ | $5 \cdot 9$ | $6 \cdot 5$ | $7 \cdot 2$ | $7 \cdot 8$ | $8 \cdot 5$ | $9 \cdot 8$ | 11.3 | 12.9 | 14.5 |

## REDUCTION TO THE MERDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* $\eta$ URSÆ MAJORIS.



## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

* $\eta$ URS压 MAJORIS

|  | ${ }_{4}^{\mathrm{m}}$ | ${ }_{8}^{\mathrm{m}}$. | ${ }_{12}$ | ${ }_{16}^{\mathrm{m} .}$ | ${ }_{20} \mathrm{~m}$ | ${ }_{24}^{\mathrm{m}}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{30}$. | ${ }_{32}$ | ${ }_{34}$ | ${ }_{36}^{\text {m. }}$ | $\overline{38}$ | $\begin{aligned} & \mathrm{m} . \\ & \hline 0 \end{aligned}$ | ${ }_{42}^{\mathrm{m}}$ | ${ }_{44}^{\text {m. }}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 |  | ro | $2 \cdot 3$ | 4.0 |  |  | 10.6 | 12-3 | 14'r | 16.1 | $18{ }^{1} 1$ | $20 \cdot 3$ | $22^{\prime} \cdot 6$ |  | 27.6 | 30.3 |
| $4{ }_{46}^{42}$ | - $\begin{aligned} & 0.2 \\ & 0.2\end{aligned}$ | - | ${ }_{2} 2.1$ | 4.8 |  | 8.5 | 10.0 | 1 | 13.3 | ${ }_{15}{ }^{1}$ | $17 \%$ | ${ }^{19} \mathrm{I}$ | 21.3 | ${ }_{23}{ }^{2} \cdot 6$ | 26.0 | 38.5 |
| 50 | $0 \cdot 2$ | $0 \cdot 9$ | $\stackrel{2 \cdot 0}{1.8}$ | $3 \cdot 5$ | 5.5 | 8.0 | 9.3 | 10.8 | I2.4 | ${ }_{\text {I }}{ }^{\text {P }}$ I | 15.9 | 17.8 | 19.9 | 22.0 | $24 \cdot 3$ | 6 |
|  |  |  | r.8 | $3 \cdot 3$ |  | $7 \cdot 4$ |  |  | 12.5 | $13 \cdot \mathrm{I}$ | 14.7 | 16 |  |  | 22.5 | 24.7 |
| 58 | 0.2 | 0.8 | 1.7 | 3.0 | 4.7 | 6.8 | 2.2 | 8.2 | 10.6 | 22 | 13.6 | 15.2 15.8 | 17.0 | 18.8 | 20.7 18.8 | . 6 |
| 68 64 | $0 \cdot 2$ | 0.7 0.6 | 1.5 1.5 | 2.7 2.6 | ${ }_{4}^{4 \cdot 3}$ | 6.2 | 7.2 6.9 | $8{ }_{8}^{8.4}$ | ${ }_{9}^{9 \cdot 6}$ | ${ }_{\text {10.9 }}^{10}$ | IT $12 \cdot 3$ | 13. | 15.4 | 17.1 | 188 | $20 \cdot 6$ 19.6 |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | $\bigcirc$ | ¢ 3 | $\stackrel{\circ}{\text { i }} 9$ | $\stackrel{\circ}{2} 6$ | $3 \cdot 2$ | $\stackrel{\circ}{3} 9$ | ${ }_{4} \cdot 2$ | 4.5 | 4.8 | $\stackrel{\circ}{5} 2$ | $5 \cdot 5$ | $\stackrel{\circ}{5}$ | ${ }^{6} \cdot 1$ | 6.5 | ¢. 8 | -1 |
| 50 60 | -0.7 | I. 3 | 2.0 | 2.6 | 3.3 <br> 3.4 | 3.9 | 4.3 | 4.6 | ${ }_{5}^{4.9}$ | 5.2 | 5.6 | 5.9 | 6.2 | 6.5 | 6.9 | . 2 |
| 60 64 | - $0 \cdot 7$ | 1.4 | 2.1 | 2.8 | $3 \cdot 4$ $3 \cdot 5$ | ${ }_{4 \cdot 2}$ | 4.5 4.6 | 4.89 | $5 \cdot 1$ $5 \cdot 3$ | 5.5 | 5.8 | $6 \cdot 2$ 6.3 | 6.5 6.7 | - 9 | 7.2 | 7.5 7.8 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\mathbf{N} . \quad$ REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $4^{\circ}$ |  | 33'1 | 34'6 | ${ }^{36} \cdot 1$ | 3)'6 |  | $40^{\circ} \cdot 7$ |  | $44^{\circ}$ | 45'6 | 47:3 | 49'1 | 50.8 | 52:6 | 54.4 | 56.3 |
|  | 29.8 27.8 | ${ }_{\text {ckir }}^{31}$ | 32.5 30.4 | 33.9 |  |  | 38.2 35.7 |  | 41.3 38.6 | 40.9 | ${ }_{4}^{44.5}$ | ${ }_{43 \cdot 1}^{46 \cdot 1}$ | $4{ }_{4}^{47 \cdot 6}$ | 4994 | 51.1 $47 \cdot 8$ | 52.9 49.4 |
| 54 | 25.8 | 27.0 | 28.2 | 29.4 | ${ }_{30}{ }^{\circ}$ | $3 \mathrm{~F} \cdot 9$ | 33.2 | 34.5 | 35.8 | $37 \cdot 2$ | 38.6 | $40^{\circ}$ | 41.4 | $42 \cdot 9$ | $44 \cdot 4$ | $45 \cdot 9$ |
| 58 |  | 24.8 |  | 27 | 28. | 3 | 30.5 | $3{ }^{1 \cdot} 7$ | 32.9 | 34.2 | 35.5 | 36.8 | 38.1 | 39.4 | $40 \cdot 8$ | 2 |
| 60 62 |  | 23.7 | 24.7 | 25•8 | ${ }_{25 \cdot 6}^{26 \cdot 9}$ | ${ }^{28 \cdot 6}$ | ${ }_{29}^{29.7}$ | 30.3 | $31 \cdot 5$ 29.9 | ${ }_{\text {cki }}^{\substack{32 \cdot 6 \\ 3 \mathrm{I} \cdot \mathrm{I}}}$ | 32.2 | ${ }_{3}^{35 \cdot}$ | $36 \cdot 4$ 34.6 | $37 \cdot 6$ 35.8 | $39^{\circ} \mathrm{O}$ 3 3 | $40 \cdot 3$ $38 \cdot 3$ |
| 64 | ${ }_{20.5}$ | ${ }_{21} \cdot 4$ | $22 \cdot 3$ | $2{ }^{2} 3$ | ${ }_{24}{ }^{2}$ | 25.2 | 26.3 | 27.3 | ${ }_{28} 8$. | 29.4 | 30.5 | 33'4 | 32.8 | 33.9 | $35 \cdot 1$ | 36.3 |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $9 \cdot 2$ | $7 \cdot 4$ | \% 96 | $7 \cdot 7$ | $7 \cdot 9$ | 8.0 | 8.2 | 8.4 | 8.5 | 8 | 8.8 | $\stackrel{\circ}{9} \cdot$ | $\stackrel{\circ}{9} 2$ | ) |  | . 6 |
| 50 60 | 77.4 | 7.5 7.9 | 7.7 <br> 8.1 | 78.8 | 8.0 | 8.2 8.6 | 8.3 8.7 | 88.5 | ${ }_{9}^{8 \cdot}$ I | 8.8 9.3 | ${ }_{9} 9.4$ | $9 \cdot 1$ $9 \cdot 6$ | 9.3 9.8 | 9.5 9.9 | 9 6 | -8 |
| 64 | 78 | 8.1 | 8.3 | 8.5 | 8.6 | 8.8 |  | 9.2 | $9 \cdot 3$ | 9.5 | 9.7 | 9.9 | 10.1 | 10.2 |  | 边 |
| I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | ${ }_{0} \mathrm{~m}$ | ${ }_{1}^{\mathrm{m}}$ | ${ }_{2}^{\text {m }}$ | 3 | 4 | 5 | ${ }_{6} \mathrm{~m}$. | ${ }_{7}^{\mathrm{m}}$. | ${ }_{8}^{\mathrm{m}}$. | ${ }_{9}^{\mathrm{m}}$. | ${ }_{10}^{\mathrm{m} .}$ | ${ }_{11}^{\mathrm{m}}$ | ${ }_{12}^{\text {m. }}$ | ${ }_{13}^{\mathrm{m}}$ | ${ }_{14}$ | ${ }_{15}^{\text {m. }}$ |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $4{ }^{\circ}$ | 56'3 | 58.2 | 60'. | 62'0 | 64.0 | 66.0 | 68.0 | 7ór | 72:2 | 74.3 | 76\%.4 | 78.6 | 80.8 | $8{ }^{\prime} \cdot \mathrm{I}$ | 85.4 | \% |
| 44 |  | $56 \cdot 4$ 54.6 | $58 \cdot 3$ 56.4 | 60•I | ${ }^{62 \cdot}$ | 64. <br> 62. <br> 2 | ${ }^{66 \cdot 0}$ | 68.0 65.8 | 70.0 67.8 | $72 \cdot \mathrm{I}$ <br> $60 \cdot 8$ | ${ }^{74} 72$ | $76 \cdot 3$ 73.9 | ${ }_{76.0}^{78.4}$ | $80 \cdot 6$ 78.1 | 82.8 80.2 |  |
| 48 | 51.2 | 52.9 | 54.6 | ${ }_{56 \cdot 4}$ | 58.2 | 60.0 | ${ }_{6 \times} 8$ | $6{ }^{6} \cdot 7$ | $65 \cdot 6$ | 67.6 | 69.5 | 71.5 | 73.5 | ${ }_{75 \cdot 6}$ | $77 \cdot$ |  |
| 50 | $49 \cdot 4$ | ${ }_{51 \cdot 1}$ | 52'7 | $54 \cdot 4$ | $56 \cdot 2$ | 58.0 | 59.7 | $6 \mathrm{I} \cdot 6$ | 63.4 | $65 \cdot 3$ | $67 \cdot 2$ | $69 \cdot 1$ | 71.0 | $73^{\circ}$ | $75^{\circ}$ | 77.0 |
| 52 | 47.7 | 49.2 | 50.9 | $52 \cdot 5$ | 54.2 | 55.9 | 57.6 | 59.4 | ${ }^{61.1}$ | $\begin{aligned} & 62 \cdot 9 \cdot 9 \\ & 6 x \cdot 8 \end{aligned}$ | 64.8 | $66 \cdot 6$ | $68 \cdot 5$ | 70.4 | 3 | 74.3 |
| 53 <br> 54 | 46.8 45 | ${ }_{4}^{48 \cdot 3}$ | 49.9 | $51 \cdot 5$ 50.6 | 53.2 | 54.8 53.8 | $56 \cdot 5$ $55 \cdot 5$ | 58.3 | 60.0 58.9 | 61.8 60.6 |  | $\begin{aligned} & 654 \\ & 64 . \\ & 64 . \end{aligned}$ | $\begin{array}{r} 67 \cdot 2 \cdot 2 \\ 65 \cdot 9 \end{array}$ | $69 \cdot \mathrm{I}$ <br> 67.8 | 71.0 69.6 | $72 \cdot 9$ 71.5 |
| 55 | $44 \cdot 9$ | $46 \cdot 5$ | 48.0 | $49 \cdot 5$ | $51 \cdot \mathrm{I}$ | $52 \cdot 7$ | 54.4 | 56.0 | 57.7 | 59.4 | 61.1 | 62.9 | 64.6 | ${ }^{66 \cdot 4}$ | 68.3 66.8 | ${ }^{7} 78.1$ |
| 56 | $44^{\circ}$ | $45 \cdot 5$ | $47^{\circ}$ | $48 \cdot 5$ | 50'I | 51.7 | $53 \cdot 3$ | 54 | 56-5 | 58.2 | 59.9 | $6 \mathrm{~T} \cdot 6$ | $63 \cdot 3$ | $65 \cdot 1$ | $66 \cdot 9$ | 68.7 |
| 57 | $43 \cdot \mathrm{I}$ | $44 \cdot 6$ | $46 \cdot 0$ | 47.5 | $49^{\circ}$ | $50 \cdot 6$ | ${ }_{5}^{52.1}$ | 53.7 | $55 \cdot 3$ | 57\% | 58.6 | 60.3 | 62.0 | 63.7 | 65.5 | 2 |
| 58 59 | $42 \cdot 2$ $41 \cdot 2$ | 42.6 | $4^{45}{ }^{\circ} \mathrm{O}$ | $46 \cdot 5$ $45 \cdot 5$ |  | 49.5 |  | 52:6 |  |  | 57.3 | 59 <br> $57 \%$ <br> 7.7 |  | $62 \cdot 3$ $60 \cdot 9$ |  |  |
| 60 | $40 \cdot 3$ | $4 \mathrm{I} \cdot 6$ | $43^{\circ}$ | $44 \cdot 4$ | $45 \cdot 8$ | $47 \cdot 3$ | 48.7 | $50 \cdot 2$ | 51.7 | $53 \cdot 2$ | 54.8 | 56.3 | 57.9 | $59 \cdot 5$ | $6 \mathrm{r} \cdot 2$ | 62.8 |
| 61 | $39 \cdot 3$ | $40^{\circ} 6$ | $42^{\circ} \mathrm{O}$ | $43 \cdot 3$ | 44'7 | 46. ${ }^{\text {I }}$ | $47 \cdot 5$ | $49^{\circ}$ | $50 \cdot 5$ | $5{ }^{1 \cdot 9}$ | 53.4 | $55^{\circ}$ | 56.5 | 58.I | 59 | 61.3 |
| 62 | 38.3 | 39.6 | $40 \cdot 9$ | $42 \cdot 3$ | $43 \cdot 6$ | $45 \cdot 0$ | $46 \cdot 4$ | 47.8 | 49.2 | 50.7 | 52. <br> 50 | 53.6 | 55. | 56.7 | 58.2 | 59.8 |
| 63 64 | $\left\lvert\, \begin{aligned} & 37 \cdot 3 \\ & 36 \cdot 3\end{aligned}\right.$ | ${ }_{3}^{38 \cdot 5}$ | 39.9 38.8 | $4{ }^{1} 2$ | 42:5 | 43:8 | $45 \cdot 2$ 43.9 | ${ }_{45 \cdot 3}^{46 \cdot 5}$ | 47.9 | 49:3 | $50 \cdot 8$ 49.4 | $52 \cdot 2$ 50.8 | 53.7 | 55.2 | $56 \cdot 7$ $55 \cdot 2$ | 58.2 56.7 |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | $\stackrel{\circ}{9} \cdot 6$ | 9.8 | $\stackrel{\circ}{9} 9$ | $1{ }^{\circ} \mathrm{I}$ | 10․ 3 | 10 ${ }^{\circ}$ | 10.6 | 10ㄱ | 10.9 | I ${ }^{\circ} \cdot 1$ | Ir ${ }^{\circ}$ | 1 F 4 | II•5 | $11 \cdot 7$ | İ-8 | $\stackrel{\circ}{1} \cdot 0$ |
| 46 50 | 9.7 9.8 | 9.8 10.0 | $\xrightarrow{\text { 10.0 }}$ | 10.2 | 10.3 | $10 \cdot 5$ | Io.6 | 10.8 | Ir.o | 1 | II.3 | Ir.4 | II. 6 | I1.8 | 11.9 | I2•I |
| 50 | $9 \cdot 8$ | 200 | $10 \cdot 1$ | $10 \cdot 3$ | 10.4 | 10.6 | 10.8 | 10.9 | II'I | 11.2 | 114 4 | II.6 | II• 7 | II.9 | $12 \cdot 1$ | 12.2 |
| 54 |  | $10 \cdot 1$ | 10.3 | 10.4 | 10.6 | 10.8 | 10.9 | II•I | 11.3 | II | IT.6 | Ir 8 | Ir.9 | 12•I | 12.2 | 12.4 |
| 58 <br> 62 |  | 10.3 <br> 10.6 | 10.5 10.8 | $10 \cdot 7$ 10.9 | $\mathrm{II}^{\text {I }}$ | 11.3 | IT.2 | 11.3 | II.5 | 11.7 | I1.8 | 12.0 12.3 | 12.2 | $1 \begin{aligned} & 12.3 \\ & 12.7 \\ & 12\end{aligned}$ | 12.5 12.8 12.8 | $12 \cdot 7$ 13.0 13 |
| 64 64 |  | 10.7 | 10.8 | It | $1 \mathrm{I} \cdot \mathrm{I}$ |  | 115 | 1 | Ir 8 | 12.0 | 12 | 12:3 | I2.5 | 12.7 | 12.8 | 13.0 |

## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

* $\eta$ URSE MAJORIS.


REDUCTION TO THE MERDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

* $\eta$ URSE MAJORIS.

| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 46 | ${ }_{47}$ | ${ }_{48}$ | m. | 50 | ${ }_{51}$. | ${ }_{52}$ | ${ }_{53}$ | ${ }_{54}{ }_{5}$ | ${ }_{5} \mathrm{~m}$. | ${ }_{56}$ | $\mathrm{m}_{5 \%}$ | ${ }_{58} \mathrm{~m}$. | ${ }_{59}$. | $\mathrm{m}_{60}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $44$ | 68.7 |  | 175.0 | 178.2 | 181.4 | 184.7 | 188.0 | 191.3 | 194.6 | 198.0 | 201.4 | 204.8 | 208.3 | 211.8 | $215 \cdot 3$ |
|  | 166.I | 169.2 | 172.3 | 175.5 | $178 \cdot 7$ | 181.9 | 185.1 | 188.4 | 191.7 | 195.0 | 198.3 | 201.7 | 205.I | 208.5 | 212.0 |
| 46 | 163.5 | $166 \cdot 6$ | 169.6 | $172 \cdot 7$ | 175.9 | 1790 | 182.2 | 185.4 | 188.7 | 191.9 | 195.2 | 198.6 | 201.9 | 205.3 | $208 \cdot 7$ |
|  | 160.9 | 163.9 | 166.9 | 1700 | 173.1 | $176 \cdot 2$ | 179.3 | 182.5 | 185.7 | 188.9 | $192 \cdot \mathrm{I}$ | 195.4 | 198.7 | $202 \cdot 0$ | 205.4 |
| 48 | 158.3 | $161 \cdot 2$ | 164.2 | 167.2 | 170.2 | 173.3 | $176 \cdot 4$ | 179.5 |  | 185.8 | 189.0 | 192.2 | 195.5 | 198.7 | 202.0 |
| 49 | 155.6 | 158.5 | 161.4 | 164.4 | 167.4 | $170 \cdot 4$ | 173.4 | 176.5 | 179.6 | 182.7 | 185.8 | 189.0 | 192.2 | 195.4 | 198.7 |
| 50 | 152.9 | 155.8 | 158.7 | 161.6 | 164.5 | 167.5 | $170 \cdot 5$ | 173.5 | $176 \cdot 5$ | 179.6 | 182.7 | 185.8 | 188.9 | $192 \cdot 1$ | 195.3 |
| 51 | 150.3 | 153.1 | 155.9 | 158.8 | $161 \cdot 6$ | 164.6 | 167.5 | $170 \cdot 4$ | 173.4 | 176.4 | 179.5 | 182.5 | 185.6 | 188.7 | I91.9 |
| 52 | 14775 | $150 \cdot 3$ | ${ }^{153} 3.1$ | $155^{\circ} 9$ | 158.7 | 161.6 | 164.5 | 167.4 | $170 \cdot 3$ | 173.3 | 176.2 | 179.3 | 182.3 | 185.3 | 188.4 |
| 53 | 144.8 | 147.5 | $150 \cdot 3$ | $153{ }^{\circ}$ | 155.8 | 158.6 | 161.4 | 164.3 | 167.2 | 170.I | $173{ }^{\circ}$ | 176.0 | 178.9 | 181.9 | 184.9 |
| 54 | I42.1 | $144 \cdot 7$ | 147.4 | 150.1 | 152.8 | 155.6 | 158.4 | 161.2 | 164.0 | 166.8 | 169.7 | 172.6 | 175.5 | 178.5 | 181.4 |
| 55 | 139.3 | 141.9 | 144.5 | 147.2 | 149.8 | 152.6 | 155.3 | 158.0 | $160 \cdot 8$ | 163.6 | 166.4 | 169.2 | 172.1 | 175.0 | 177.9 |
| 56 | ${ }^{1} 36.5$ | 139.0 | 141.6 | 144.2 | $146 \cdot 8$ | $149 \cdot 5$ | $152 \cdot 1$ | 154.8 | 157.6 | $160 \cdot 3$ | 163.1 | 165.8 | 168.6 | 171.5 | $174 \cdot 3$ |
| 57 | ${ }_{\text {I }} 33.6$ | 136.1 | 138.7 | $141^{2} 2$ | 143.8 | 146.4 | 149.0 | 151.6 | 154.3 | 157.0 | 159.7 | 162.4 | 165.1 | 167.9 | $170 \cdot 7$ |
|  | $130 \cdot 7$ | 133.2 | 135.7 | 138.2 | 140.7 | 143.2 | 145.8 | 148.4 | 151.0 | 153.6 | 156.2 | 158.9 | 161.6 | 164.3 | 167.0 |
| 59 | 127.8 | $130 \cdot 2$ | 132.6 | 135.1 | 137.5 | $140 \cdot 0$ 136.8 | 142.5 130.2 | 145.1 141 | $147 \cdot 6$ | 150.2 146.7 | 152.8 140.2 | 155.4 151.8 | 158.0 154.4 | $160 \cdot 6$ | 163.3 150.6 |
|  | 124.9 121.9 | 127.2 | 129.6 126.5 | 132.0 128.8 | 134.4 131.2 | 136.8 133.5 | 139.2 135.9 | 1418 138.3 | 144.2 140.8 | $146 \cdot 7$ 143.2 | 149.2 145.7 | 151.8 148.2 | 154.4 150.7 | 157.0 153.2 | 159.6 155.7 |
| 62 | II | 121 | 123.3 | 125.6 | 127.9 | I 30.2 | 132.5 | 134.9 | $137 \cdot 3$ | 139.6 | $142 \cdot 0$ | 144.5 | 146.9 | 149.4 | 151.9 |
| 63 | 115.8 | 118.0 | $120 \cdot 1$ | 122.4 | 124.6 | 126.8 | 129.1 | 131.4 | 133.7 | 136.0 | 138.4 | $140 \cdot 7$ | 143.1 | 145.5 | 147.9 |
|  | 12.7 | 114.8 | 116.9 | 119.0 | 121.2 | 123.4 | 125.6 | 127.8 | $130 \cdot 1$ | $132 \cdot 3$ | 134.6 | I36.9 | 139.3 | 141.6 | $144{ }^{\circ}$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 1. | ${ }_{2}$ | m. | ${ }_{4}$. | m. | 6 | m. | m. | m. | m. | m. | 12 | ${ }_{13}$. | 14. | m. |
| N. ${ }^{\text {REDUCTIONS. }}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 218.8 | $222 \cdot 3$ | 225.9 | 229.5 | 233.2 | 236.8 | $240 \cdot 5$ | 244.3 | $248 \cdot 0$ | 25 İ8 | $255 \cdot 6$ | 259.4 | 263.2 | \% 1 |  |
|  | 215.4 | 219.0 | 222.5 | $226 \cdot 0$ | 229.6 | 233.2 | $236 \cdot 9$ | $240 \cdot 5$ | 244.2 | $248 \cdot 0$ | $25 \mathrm{I} \cdot 7$ | $255 \cdot 5$ | 259.3 | $263 \cdot 1$ | 266.9 |
| 46 | 212.1 | 215.6 | $219^{\circ} \mathrm{O}$ | 222.5 | $226 \cdot 1$ | 229.6 | 233.2 | 236.8 | $240 \cdot 5$ | 244•1 | $247 \cdot 8$ | 251.5 | 255.2 | 259.0 | $262 \cdot 8$ |
|  | $208 \cdot 7$ | 212.1 | 215.6 | 219.0 | 222.5 | $226 \cdot 0$ | 229.5 | $233 \cdot 1$ | 236.6 | $240 \cdot 2$ | 243.9 | $247 \cdot 5$ | 251.2 | 254.9 | 258.6 |
|  | $205 \cdot 3$ | 208.7 | 212.1 | 215.4 | 218.9 | $222 \cdot 3$ | 225.8 | 229.3 | $232 \cdot 8$ | $236 \cdot 4$ | 239.9 | $243 \cdot 5$ | 247.1 | $250 \cdot 8$ | $254 \cdot 5$ |
| 49 | 201.9 | 205.2 | $208 \cdot 5$ | 211.9 | 215.2 | 218.6 | 222.0 | 225.5 | 229.0 | $232 \cdot 4$ | $236 \cdot 0$ | $239 \cdot 5$ | $243 \cdot 1$ | $246 \cdot 7$ | $250 \cdot 3$ |
| 50 | 198.5 | $201 \cdot 7$ | $205 \cdot 0$ | $208 \cdot 3$ | 211.6 | 214.9 | 218.3 | 221.7 | 225.1 | 228.5 | 232.0 | $235 \cdot 4$ | 238.9 | $242 \cdot 5$ | $246 \cdot 0$ |
| 51 | $195{ }^{\circ}$ | 198.2 | 201.4 | 204.6 | 207.9 | 211.2 | 214.5 | 217.8 | 221.1 | 224.5 | 227.9 | $23 \mathrm{~F} \cdot 3$ | $234 \cdot 8$ | 238.3 | 241.7 |
|  | 191.5 | 194.6 | $197 \cdot 8$ | 201.0 | 204.2 | $207 \cdot 4$ | $210 \cdot 6$ | 213.9 | 217.2 | $220 \cdot 5$ | $223 \cdot 8$ | $227 \cdot 2$ | $230^{\circ} 6$ | $234{ }^{\circ}$ | $237 \cdot 4$ |
| 53 |  | 191.I | 194*2 | 197.3 | 20 | $203 \cdot 6$ | $206 \cdot 8$ | 210 | 213.2 | 216.5 | 219.7 | 223.0 | $226 \cdot 4$ | 229.7 | $233 \cdot 1$ |
| 54 | 184.4 | 187.4 | $190 \cdot 5$ | 193.5 | 196.6 | 199.7 | 202.8 | 206.0 | 209.2 | 212.4 | 215.6 | 218.8 | $222 \cdot 1$ | $225 \cdot 4$ | $228 \cdot 7$ |
| 55 | 180.8 | 183.8 | 186.8 | 189.8 | 192.8 | 195.8 | 198.9 | 202.0 | 205.1 | 208.2 | 2114 | 214.6 | 217.8 | 221.0 | $224 \cdot 2$ |
| 56 | 177.2 | $180 \cdot 1$ | 183.0 | $185{ }^{1} 9$ | 188.9 | 191.9 | 194.9 | 197.9 | $201 \cdot 0$ | 204.1 | 207.1 | $210 \cdot 3$ | 213.4 | 216.6 | 219.7 |
| 57 | 169.8 | 176.3 | 179.2 | ${ }_{1782.1}^{17}$ | 185.0 | 187.9 183.9 | $190 \cdot 9$ 186.8 | ${ }_{1}^{193.8}$ | 196.8 | 199.8 | 202.9 198.5 | 205.9 | 209.0 | 212.1 | 215.2 |
| 58 | 16.8 | 172.6 | 175.4 | 178.2 | 181.0 | 183.9 | 186.8 | 189.7 | 192.6 | $195 \cdot 5$ | 198.5 | 201.5 | $204 \cdot 5$ | $207 \cdot 5$ | $210 \cdot 6$ |
|  | 166.0 | 168.7 | 171.5 | 174.2 | 177.0 | $179 \cdot 8$ | 182.6 | 185.5 | 188.3 | 191.2 | 194.1 | 197.0 | 200.0 | $202 \cdot 9$ | 205.9 |
|  | 158.3 | $164 \cdot 8$ | $167 \cdot 5$ | $170 \cdot 2$ | 172.9 | $175 \cdot 7$ | 178.4 | 181.2 | 184.0 | 186.8 | 189.6 | 192.5 | 195.4 | 198 | 201.2 |
|  | 158.3 | 160.9 I56.9 | 163.5 | 166. 1 | 168.8 | 171.5 | 174.2 | 176.9 172.5 | ${ }^{179}{ }^{\circ} 6$ | 182.4 | 185.1 | 187.9 | $190^{\circ} 7$ | 193.6 | $196 \cdot 4$ |
| 62 | 154.4 150.4 | 156.9 | 159.5 | $162 \cdot 0$ 157.8 | 1 | 16 | 169.8 165.4 | 172.5 168.0 | ${ }^{175}{ }^{\text {.1 }}$ | $177 \cdot 8$ 173.2 | 180.5 | 183.3 |  |  | $191 \cdot 5$ |
| 64 |  | I48 | 15I-I | ${ }_{153}{ }^{1} 6$ | 156.0 | I58.5 | 16 I -0 | 163.5 | 166.0 | 1738 168.6 | 175.9 171 | 173.7 | 181.2 176.3 | 178.9 | 186.6 181.6 |
| TRUE BEARING OR AZIMUTH OF * $\quad$ URSÆ MAJORIS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lat. | I HOUR. |  |  |  |  |  |  | 2 HOURS. |  |  |  |  |  |  |  |
|  | 46 | ${ }_{48}$ | $\begin{aligned} & \mathrm{m} . \\ & 50 \end{aligned}$ | $\overline{\mathrm{m}} .$ | ${ }_{54}$ | $\stackrel{\mathrm{m}}{\mathbf{5 6}}$ | $\overline{\mathrm{m}} .$ | $\underset{0}{\mathrm{~m} .}$ | $\frac{\mathrm{m}}{\mathbf{2}}$ | $\begin{gathered} \mathrm{m} . \\ 4 \end{gathered}$ | $\underset{\mathbf{6}}{\mathrm{m}} .$ | $\mathrm{m} .$ | $\begin{aligned} & \mathrm{m} . \\ & 10 \end{aligned}$ | ${ }_{12}$ | ${ }_{14}$ |
| N. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{4}$ | $16_{9}^{\circ} 9$ | $1 \gg \cdot 2$ | $17 \times 5$ | 17.8 | $18^{\circ} \cdot \mathrm{I}$ | ${ }_{18} 8^{\circ}$ | $18^{\circ} \cdot 7$ | $19^{\circ} \mathrm{O}$ | $19 \cdot 3$ | $19^{\circ} \cdot 6$ | I9.9 | $20^{\circ} \cdot 2$ | $2 \cdot 5$ | $20^{\circ} \cdot 8$ | $2 \mathrm{I}^{\circ} \mathrm{I}$ |
| 48 |  | 17.4 | $17 \times 7$ | 18.0 | 18.3 | 18.6 | 18.9 | 19.2 | 19.5 | 19.8 | 20.2 | 20.5 | $20 \cdot 8$ | 21.1 | 21.4 |
|  | 17.3 | 17.6 | 17.9 | 18.3 | 18.6 | $8 \cdot 9$ | 19.2 | 19.5 | 19.9 | 20.2 | 5 | $20 \cdot 8$ | $21 \cdot 1$ | 21 | 21.7 |
| 56 |  | 18.0 | 18.3 | 6 | 19.0 | 19.3 | 19.6 | 19.9 | $20 \cdot 3$ | $20 \cdot 6$ | 20.9 |  | 1.6 | 21.9 | 22.2 |
| 60 | I8.1 | 18.4 | I8.8 | 19.1 | 19.4 | 19.8 | $20 \cdot 1$ | 20.5 | 20.8 | 21.1 | $21 \cdot 5$ | $2 \mathrm{I} \cdot 8$ | 22.1 | $22 \cdot 5$ | 22.8 |
| 64 | 18.7 | 19. | $9 \cdot 4$ | 7 | I | $20 \cdot 4$ | $20 \cdot 7$ | $21 \cdot 1$ | 21.5 | $2 \mathrm{I} \cdot 8$ | $22 \cdot 1$ | 22.5 | 22 | 23.2 | $23 \cdot 5$ |

## REDUCTION TO THE MERIDIAN TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* VEGA.

| t. | $\frac{\mathrm{m}}{2}$ | ${ }_{4} \mathrm{~m}$ | ${ }_{8}^{\mathrm{m}}$ | ${ }_{8}^{\text {m. }}$ | ${ }_{10}^{\mathrm{m}}$ | ${ }_{12}$ | ${ }_{14}^{\text {m. }}$ | ${ }_{16}^{\text {m. }}$ | ${ }_{18}^{\mathrm{m}}$ | ${ }_{20}^{\mathrm{m}}$ | ${ }_{21}^{\mathrm{m}}$ | $\stackrel{\mathrm{m}}{22}$ | ${ }_{23}^{\mathrm{m}}$ | ${ }_{24}^{\text {m }}$ | ${ }_{25}^{\mathrm{m}}$ | $\stackrel{\mathrm{m}}{26}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{14}$ | 0.2 | $0 \cdot 9$ | $2 \cdot 1$ | $3 \cdot 8$ | $5 \cdot 9$ | 8.5 | İ.6 | $15 \cdot 1$ | 19'1 | $23 \cdot 5$ | 25.9 | $28 \cdot 4$ | $3 \mathrm{I} \cdot \mathrm{I}$ | $33 \cdot 8$ | $36 \cdot 6$ | 39.6 |
| 12 | 0.2 | 0.9 | 2.0 | 3.5 | $5 \cdot 5$ | 8.0 | 10.8 | $14 \cdot \mathrm{~T}$ | 17.9 | 22.1 | 24.3 | 26.7 | 29.2 | 31.7 | $34 \cdot 4$ | 37.1 |
| 18 | ${ }_{0}^{0.2}$ | $\stackrel{0}{0} 8$ | I.9 | 3.3 | 5.2 | 7.5 | 10.2 | 13.3 |  | 20.8 | $22 \cdot 9$ | 25.2 23.8 | 27.5 | 29.9 28.3 | $32 \cdot 4$ | $35^{\circ}$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | $0 \cdot 2$ | 0.7 | 1.7 | 3.0 | 47 | 6.7 | 8.2 | ${ }^{12}{ }^{\circ}$ | 15.1 14.4 18 | 1\%.8 | 10.6 | 22.6 21.6 | 24.7 23.6 | 26.9 25.6 | 29.2 | . 5 |
| 4 | 0.2 | 0.7 0.7 | $\xrightarrow{1.6}$ | 2.9 2.7 | 4.5 | ${ }_{6.1}^{6.4}$ | 8.7 8.3 | 11.4 10.9 | 14.4 | 17\%8 | ${ }_{18}^{19.6}$ | 21.6 | ${ }_{22 \cdot 5}^{23 \cdot 6}$ | 24.6 | ${ }_{26.5}^{27.8}$ | 38.7 |
| $\bigcirc$ | 0.2 | 0.6 | 1.5 | $2 \cdot 6$ | $4 \cdot 1$ | 5.9 | 8.0 | 10.4 | 13.2 | 16.3 | 17.9 | 19.7 | 21.5 | 23.4 | 25.4 | 27.4 |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | $\bigcirc \cdot 1$ | $\bigcirc \cdot 6$ | $1 \cdot 4$ | 2.5 | 3.9 | $5 \cdot 6$ | 7.6 | 10.0 | 12.6 | $15 \cdot 6$ | 17.2 | 18.9 | $20 \cdot 6$ 10.8 | 22.4 | 24.3 | $26 \cdot 3$ |
| 4 | - 0.1 | -0.6 | 1.3 1.3 | 2.4 2.3 | 3.7 3.6 | 5.4 5.2 | 7.3 | 9.6 | 12.1 | 15.0 14.4 | 16.5 15.9 | 18.1 | $1{ }^{19.8}$ | 21.5 | ${ }_{22}^{23.4}$ | $25 \cdot 3$ 24.3 |
| 10 | $\bigcirc \cdot 1$ | $\stackrel{0}{0} 5$ | I.2 | 2-I | $3 \cdot 3$ | 4.8 | $6 \cdot 5$ | 8.6 | 10.8 | 13.4 | $14 \cdot 7$ | 16.2 | 17.7 | 19.2 | 20.9 | 22.5 |
| 14 | 0.1 | $\bigcirc \cdot 5$ | $\mathrm{r} \cdot$ | 2.8 | $3 \cdot 1$ | $4 \cdot 5$ | 6.1 | 7.9 | 0.1 | 12.4 | 13.7 | $15^{\circ}$ | 16.4 | 17.9 | 19.4 | $\bigcirc$ |
| 18 | ${ }^{\circ} \mathrm{O}$ - 1 | 0.5 0.4 | I. | I.8 | 2.9 <br> 2.9 <br> 2 | 4.2 | $5 \cdot 7$ | 7.4 | 9.4 | 11.6 | I2.8 | 14.0 | 15.3 | 16.7 | 18.1 | . 6 |
| 22 26 | ${ }_{0}^{0 \cdot 1}$ | 0.4 0.4 | $\xrightarrow{1.0}$ | 1.7 1.6 | $2 \cdot 7$ $2 \cdot 5$ | 3.9 3.7 | 5.3 5.0 | 6.9 | 8.8 8.2 | 10.8 10.1 | 11.9 11.2 | 13.1 | 14.3 | $15 \cdot 6$ 14.6 | 16.9 15.8 | - ${ }^{1}$ |
| 30 | $0 \cdot 1$ | 0.4 | 0.8 | 1.5 | $2 \cdot 4$ | $3 \cdot 4$ | 4.6 | 6.1 | 7.7 | $9 \cdot 5$ | $10 \cdot 4$ | 11.5 | 12.5 | 13.6 | 14.8 | - |
| 38 | -1.1 | 0.3 0.3 | 0.8 | I. 4 | 2.2 | 3.2 | 4.3 | $5 \cdot 7$ | 7.2 | 8.9 | $9 \cdot 8$ | 10.8 | $11 \cdot 7$ | 12.7 | 13.8 | $15^{\circ}$ |
| 38 42 4 | $\stackrel{0}{0} \mathrm{O}$ | - 0.3 | 0.7 0.7 | $1 \cdot 3$ 1.2 | 2.1 1.9 | 3.0 2.8 | + ${ }^{4.1}$ | 5.3 4.9 | 6.7 6.2 | 8.3 7 | ${ }_{8} \cdot \underline{1}$ | $10 \cdot 0$ 9.3 | 10.9 10.2 | II'9 | 12.9 | 13.9 13.0 |
| 46 | ${ }^{\circ} .1$ | 0.3 | 0.6 | I.1 | 1.8 | $2 \cdot 6$ | 3.5 | 4.6 | 5.8 | $7 \cdot 1$ | $7 \cdot 8$ | 8.6 | 9.4 | 10.2 | I | ${ }_{12}{ }^{1}$ |
| Lat. | $\frac{{ }_{2 j}^{m}}{m_{i}}$ | ${ }_{28}^{\mathrm{m}}$ | ${ }_{29}^{\mathrm{m}}$ | $\frac{\mathrm{m}}{30}$ | $\frac{\mathrm{m}}{31}$ | $\frac{\mathrm{m}}{32}$ | $\begin{aligned} & \mathrm{m} \cdot \\ & 33 \end{aligned}$ | $\begin{aligned} & \mathrm{m} \\ & \hline 1 \end{aligned}$ | $\frac{\mathrm{m}}{35}$ | $\overline{\mathrm{m}_{36}}$ | $\begin{aligned} & \mathrm{m}_{37} \\ & \hline \end{aligned}$ | ${ }_{38}$. | $\begin{aligned} & \mathrm{m} . \\ & 39 \end{aligned}$ | ${ }_{40}^{m .}$ | $\begin{aligned} & \frac{\mathrm{m}}{41} \end{aligned}$ | ${ }_{42}$ |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ${ }_{1}$ | 42.6 | 45.7 | 49'0 | 52.4 | 55'9 | 59.5 | 63.2 | 6\%\% | 70.9 | 74.9 | 79.0 | $83^{\prime} \cdot 2$ | $8{ }^{\prime} \cdot 5$ | 9ŕ9 | $96 \cdot 4$ | -I |
| 13 | 41.3 40.0 | ${ }_{43}^{44} 0$ | 47.5 46.0 | $50 \cdot 7$ 49.2 | 54.2 | 57\% 5 | $6 \mathrm{I} \cdot 3$ 59.4 | $65^{\circ}$ 63.0 | ${ }^{68 \cdot 7}$ |  | $76 \cdot 6$ 74.3 | $80 \cdot 7$ 78.3 | 84.8 $82 \cdot 3$ | ${ }_{86.5}^{89}$ | 93.5 | 98.0 95.2 |
| ${ }_{12}$ | 40.0 38.8 | ${ }_{41}^{43}{ }^{4} \mathrm{P}$ | 44.7 | 47 | 52.5 | 55.9 | 59.4 | $63^{\circ}$ $6 \mathrm{I}^{\circ} 2$ | 64.8 | 70.4 | 74.3 | ${ }_{76.0}^{78.3}$ | 82.3 79.9 | $8{ }_{8}{ }^{\circ} \mathrm{F}$ | ${ }^{90} 8$ | 95. ${ }_{9}$ |
| 10 | $37 \cdot 7$ | $40 \cdot 6$ | 43.5 | $46 \cdot 5$ | $49 \cdot 6$ | 52 | 56. | 59.5 | $63^{\circ}$ | 66.5 | 70.2 | $74^{\circ}$ | $77 \cdot 8$ | 81.8 | 85.8 |  |
| 9 | 36. | 39 | 42 | $45^{2}$ | 48.2 | 51.4 | 54.6 | 57.9 | 61.3 | 64.8 63.1 | $68 \cdot 3$ 66.6 | 72.0 | 7 | 79.6 | $83 \cdot 5$ 8.5 | 7.6 |
| 7 | 35'7 | 387 | $4{ }_{4}^{41}$ | 44'0 | ${ }_{45}^{47} 8$ | 50.0 | 53.18 |  | 59 58.7 | $63 \cdot 1$ 61.5 | $68 \cdot 6$ 64.9 | $70 \cdot 1$ 68.4 | 73:8 | 775 |  |  |
| 6 | $34^{\circ}$ | $36 \cdot 5$ | $39 \cdot 1$ | $4 \mathrm{~T} \cdot 8$ | $44^{6}$ | $47 \cdot 5$ | 50.5 | $53 \cdot 6$ | $56 \cdot 7$ | $60 \cdot 0$ | $63 \cdot 3$ | $66 \cdot 7$ | $70 \cdot 2$ | 73.8 | 77.4 | $8 \mathrm{I} \cdot 2$ |
| 5 | 33'1 | $35 \cdot 6$ | 38 | $40 \cdot 8$ | $43 \cdot 6$ | $46 \cdot 4$ | $49 \cdot 3$ | $52 \cdot 3$ | $55 \cdot 4$ | 58.5 | $6 \mathrm{~T} \cdot 8$ | $65^{1}$ | 68.5 | 72. | $75^{\circ} 6$ | - |
|  | 32 | 34.8 | 37.3 | 39.9 | $42 \cdot 6$ | $45 \cdot 3$ | 48.2 | $51 \cdot 1$ | 54.1 | 57.2 | $60 \cdot 4$ | 63.6 | 66.9 | 70.4 68.8 | 73.9 | . 5 |
| 3 2 | $31 \cdot 7$ 30.9 |  | $36 \cdot 5$ 35 | 38. |  | $44 \cdot 3$ $43 \cdot 3$ | 4 | $4{ }^{49} 9$ | 52•9 | 55.9 | 59.7 | $62 \cdot 2$ 60.8 | 65.4 64.0 | 68.3 |  |  |
| - | 29.6 | ${ }_{3}^{1} \cdot 8$ | $34 \cdot \mathrm{I}$ | 36.5 | 38.9 | 41.4 | $44 \cdot 1$ | $46 \cdot 7$ | $49 \cdot 5$ | 52.3 | ${ }_{55}{ }^{\text {T}}$ | 58.2 | 6 r 3 | 64.4 | $6 \% \cdot 6$ | ${ }^{9}$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 28.4 | 30.5 | 32.7 | 35.0 | 37.3 | 39.7 | $42 \cdot 2$ | $44 \cdot 8$ | $47 \cdot 5$ | 50.2 | 53.0 | 55.8 | 58.8 | 61.8 | 64.9 | 68.1 |
| 4 | 27.2 | 29.3 28.2 | 31 | $33 \cdot 6$ $32 \cdot 3$ | $35 \cdot 8$ | $38 \cdot 2$ 36.7 |  | $43 \cdot 1$ 41.4 | $45 \cdot 6$ 43.9 | 48.2 46.4 | $50 \cdot 9$ 49.0 | $53 \cdot 7$ 51.6 | $56 \cdot 5$ 54 | 59.4 | . 4 |  |
| 8 | ${ }_{25 \cdot 2}^{26.2}$ | 27 | 29.1 | ${ }_{3}$ | $33^{2}$ | 35-3 | 37 | 49.9 39 |  | 44.7 | $47 \cdot 2$ | $49 \cdot 7$ | 52:3 | $55^{\circ}$ | 57.8 | 9 |
| Io | 24.3 | $26 \cdot 1$ | 28.0 | $30 \cdot 0$ | $32 \cdot 0$ | 34 | 36.2 | 38.4 | $40 \cdot 7$ | $43 \cdot 1$ | $45 \cdot 5$ | $47 \cdot 9$ | 5 | $53 \cdot 1$ |  | 58.4 |
| 12 | 23.4 22.6 | 25 | 27.0 | 28.9 | $30 \cdot 9$ 20.8 | $32 \cdot 9$ 31.9 | 34.9 33.7 | $37 \cdot 1$ 35.8 3 | 39.3 | 41.5 | 43.9 | - | 47.7 | $55^{\prime 2}$ | 53.8 |  |
| 16 | 21.8 | 24.3 | $26 \cdot 1$ $25 \cdot 2$ | 27.9 26.9 | 28.8 | $31 \cdot 7$ 30.6 | ${ }_{3}^{33 .}{ }^{3}$ | 35.8 <br> 34 | $37 \cdot 9$ $36 \cdot 6$ | ${ }_{3}^{40 \cdot}$ | 42.4 40.9 | 44'7 | 47** | 49.4 | 51.9 50.2 | 54.5 |
| 18 | 21.1 | 22. | 24.3 | 26.0 | 27.8 | 29.6 | 31.5 | $33 \cdot 4$ | 35.4 | 37.5 | $39 \cdot 6$ | $4{ }^{1} 7$ | 43.9 | $46 \cdot 2$ | 48.5 | $50 \cdot 9$ |
| 20 | 20.4 19.7 | $\xrightarrow{21.9}$ | 23.5 22.7 | $25 \cdot 2$ 24.3 | ${ }_{26.9}^{26}$ | $28 \cdot 6$ $27 \cdot 5$ | 30.4 | $33 \cdot 3$ $31 \cdot 2$ | 34.2 33.1 | 36.2 35.0 |  | $40 \cdot 3$ | 42.4 41.0 | $44 \cdot 6$ 43.2 | $46 \cdot 9$ $45 \cdot 3$ | $49 \cdot 2$ 47.6 |
| 24 | $\xrightarrow{19.1}$ | 10 | 22.0 | 23.5 | $25^{\text {. }}$ | 26.8 | 28.5 | $30^{\circ}$ | $32^{\circ}$ | 33.9 | 35.8 | 37.7 | 39.7 | 41.8 | $43 \cdot 9$ | 46.0 |
| 26 | 18.5 | 19 | I | 22.8 | 24.3 | 25.9 | $27 \cdot 5$ | $29^{2}$ | - | 32 | $34^{6}$ | 36.5 | 38.4 | $40 \cdot 4$ | $4{ }^{\circ} 4$ | $44 \cdot 5$ |
| 28 | 17.9 | 19. | $20 \cdot 6$ | $22^{\circ} \mathrm{O}$ | 23.5 | $25 \cdot 1$ | 26.6 | 28.3 | $30 \cdot 0$ | $3{ }^{1} 7$ | $33 \cdot 5$ | $35 \cdot 3$ | 37.2 | $39^{\prime}$ | $4{ }^{\circ} \mathrm{O}$ | $43 \cdot 1$ |
| 32 | 17.3 16.7 |  | 19 | $21 \cdot 3$ 20.6 | $22 \cdot 7$ | 24 | 25.8 | $27 \cdot 3$ 26.4 | 29.0 28.0 |  | $32 \cdot 4$ 31.3 | 34. | 354.9 | $37 \cdot 8$ 36.5 | 39 38 38 | $4{ }^{417}$ |
| 34 | 16.7 | 17. | 18.6 | 19.9 | 21.3 | 22.6 | ${ }_{24 \cdot 1}^{24}$ | 26.4 25.6 | ${ }_{27}{ }^{28}$ | 28.6 | $31 \cdot 3$ $30 \cdot 2$ | 31.0. | 34. 33 | 35.3 | ${ }_{3} 3 \cdot 1$ | $40 \cdot 3$ 38 |
| 36 | 15 | 16. | 18.0 | 19.2 | 20.5 | 27.9 | 23.3 | 24.7 | $26 \cdot 2$ | 27.7 | $29^{2}$ | $30 \cdot 8$ | $32 \cdot 5$ | $34^{\text {I }}$ | $35^{\circ} 9$ | 37 |
| 38 | 15.0 | 16.2 | 17.3 | 18.6 | 19.8 | 21.1 | 22.4 | 23.8 | $25^{2}$ | 26.7 | 28.2 | 29.8 | $\cdot 3$ | $33^{\circ}$ | $34^{6}$ | $36 \cdot 3$ |
| 42 | 14.5 | 15.6 |  | 17.9 | 19.1 | 20.4 | 21.7 | $23^{\circ}{ }^{\circ}$ | 24.4 | $25^{8}$ | $27 \cdot 2$ | 28.7 | $30 \cdot 2$ | 31.8 | 33.4 | $35 \cdot 1$ |
| 42 | $\xrightarrow{14.0} 1$ | 15\% | ${ }_{\text {I }}^{16.5}$ | 17.3 <br> 16.6 | 18.4 | 19.6 18.9 | 20.9 20.1 |  | 23.5 22.6 | 24.9 23.9 | $26 \cdot 2$ $25 \cdot 3$ | 27.7 | 29.2 28.1 |  |  | . 6 |
| 46 | 13. | 13 | 15.0 | 16. | 17.1 | 18 | 19.4 | , | 21.8 | $23^{\circ}$ | $24 \cdot 3$ | 7 | 27.0 |  | 29.9 | 31.3 |


| La | ${ }_{43}^{\mathrm{m}}$ | ${ }_{44}$ | ${ }_{45}$ | ${ }_{46}$ | ${ }_{47}^{\text {m. }}$ | ${ }_{48}$ | ${ }_{49}$ | ${ }_{50}$ | ${ }_{51}$ | ${ }_{52} \mathrm{~m}$. | ${ }_{53}^{\mathrm{m}}$ | $\stackrel{m}{54}$ | $\begin{aligned} & \hline \mathrm{m} . \\ & 55 \end{aligned}$ | ${ }_{56}^{\mathrm{m} .}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 |  |  |  |  |  | $210 \cdot 72$ |  |  |  |  |  |  |  |  |
| I3 |  |  |  | 56.9 |  |  |  |  | $22 \cdot 5$ |  |  |  |  |  |
|  | I | ${ }_{4}{ }^{4} 2$ | $45 \cdot 8$ | 53.4 | 55 | 2 3.2 <br> 1 39.8 <br>   |  |  |  | 2 21. | 25 |  |  |  |
|  | $34 \cdot 2$ | 38.5 | $42 \cdot 91$ | $47 \cdot 4$ |  | I 56.62 |  | 2 |  | 216.1 | $2 \mathrm{2r} 2$ | 26.3 |  |  |
|  |  |  |  |  |  | 53.61 | 58.2 | 2 | $7 \cdot 7$ | 212.6 | 1\% |  |  |  |
|  | 1 |  |  | $3{ }^{4 .}$ |  |  | I 58.2 | 90-82 | ${ }^{4.5}$ | 2 | 214 | 19.72 |  |  |
|  | I $25^{\circ}$ |  |  |  |  | 45 | 49 |  |  | - $0 \cdot$ |  |  |  |  |
| 5 | 123.01 | 26.81 | $30 \cdot 71$ | 34.7 ${ }^{1}$ |  | $1{ }^{1} 4291$ | $47 \cdot 1$ | 514 | 55.8 | $2 \quad 0 \cdot 3$ |  |  | $14^{-1}{ }^{2}$ |  |
|  |  | 24. |  | $32 \cdot 6$ | $36 \cdot 6$ | $1{ }^{1} 40$ |  |  |  | I 57. | $\begin{array}{ll}2 & 2.012 \\ 1 \\ 50\end{array}$ |  | I•I2 |  |
| 3 |  | ${ }_{2}^{23.01}$ | $26 \cdot 7$ 24 I I | 38.51 | 34 | $1{ }^{1} 38$ |  |  |  | 52 | I 59.3 |  |  |  |
|  | 1 I 15 | 19.4 |  | 26. |  | ${ }_{1}{ }^{1} 34$. | $3{ }^{\circ}$ | 42 - |  | I $50 \cdot 1$ I |  |  |  |  |
| s | $\left\|\begin{array}{lll} \mathrm{I} & 1 & 4.3 \end{array}\right\| \mathrm{I}$ |  |  |  |  |  |  |  |  | I 47 |  |  |  |  |
|  | I $11 \times 3$ | 14.6 ${ }^{1}$ |  |  |  | I | 132. | 35.9 |  | I 43 |  |  |  |  |
|  | I 18.9 | I3'1 | 16.4 | 19 18.3 | 23.2 |  | 38.3 | 32 | 337. | 1 | $43^{\circ}$ |  |  |  |
|  | $7 \cdot 2$ | $10.3{ }^{1}$ | $13 \cdot 5$ |  |  | I 23.5 | 26. | $30 \cdot 4$ | $34^{\circ} \mathrm{O}$ | 3 | $4{ }^{\text {P }}$ | 45:21 | 49.01 |  |
|  | I 5.9 | 9.01 |  |  | 18.6 | 121.0 | 125.3 | 28.71 | $32 \cdot 3$ | 35 | 39.51 | I 43.2 |  |  |
|  | I 3.5 |  |  |  | 157 | 1 |  |  |  | 1 |  |  |  |  |
|  |  |  |  | ${ }_{10.0}^{10}$ | $13^{\circ}$ | ${ }^{1} \mathrm{I}$ | ${ }^{2}$ |  | $25 \cdot 8$ 22.8 | I <br> I <br> I <br> 26.1 <br> 1 |  |  |  |  |
| 14 | - $57 \cdot \mathrm{I}$ O | 59.71 | $4{ }^{1}$ | $5 \cdot 2 \mid$ |  | x 10.9 ${ }^{1}$ | 13.9 | 16.9 r |  | 123.1 | $26 \cdot 3$ | 90 |  |  |
|  | - 55 |  |  |  | $5 \cdot 8$ |  | 1 Ir 4 | I 14.3 |  |  |  |  |  |  |
| 18 | - 53.30 |  | 58 |  |  | I $6 \cdot 3$ I |  |  |  | $1{ }_{1}^{17}$ | 8. |  |  |  |
|  | - 49.8 |  |  |  |  |  |  |  |  | 1 I 2.7 |  |  |  |  |
| 24 | - 48.20 | $50 \cdot 5$ | 52.80 | $55^{\circ}$ | $57 \cdot 5$ | 10.01 | 2.5 | 501 |  | 110.3 | 13.0 | 15.81 |  |  |
| 26 | - 46 | 48.8 |  |  | 55.7 | - $58 \cdot 01$ | - $\cdot 5$ I | $2 \cdot 9$ I | $5 \cdot 5$ | 8. |  | $13.3{ }^{1}$ |  |  |
| 28 |  |  |  |  |  | - 56 |  |  |  |  |  |  |  |  |
|  | 4 |  |  |  |  | - | - |  | 59 |  |  |  | ¢ |  |
| 34 | - 40.80 | $42 \cdot 7$ | 44.70 | 46.70 |  |  |  | $55^{1}$ | 573 | - 59.5 |  | $4 \cdot$ | $6 \cdot 5$ |  |
| 36 |  |  |  |  |  | - $49 \cdot 10$ |  |  |  | - 57.50 |  |  |  |  |
|  | - 36.70 |  |  |  |  | - 45. |  |  |  |  |  |  |  |  |
| 4 | - 35.40 |  | 38 |  | 42 |  |  | $46 \cdot 10$ |  |  |  |  |  |  |

TRUE BEARING OR AZIMUTH OF $*$ VEGA.

| Lat. | $\mathrm{m}_{4}$ | $\stackrel{m}{8}$ | 12. | ${ }_{16}$ | m. 20 | m. ${ }_{24}$ | 28. | ${ }_{32}{ }^{2}$ | $\mathrm{m}_{36}$ | m. | $\mathrm{m}_{4}$. | $\mathrm{m}_{48}$. | m. | m0 | ${ }_{70}$ | m0. | m. 90 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\square}{\circ}$ |  |  |  |  | $0 \cdot 2$ | II'O |  |  |  |  |  | $2{ }^{\circ} \mathrm{O}$ | $2{ }^{\circ} \cdot 6$ |  | 28.8 | $3{ }^{\circ}$ | 34.6 |
| 14 | I*9 | $3 \cdot 7$ | $5 \cdot 6$ | $7 \cdot 4$ | $9 \cdot 2$ | II'O | I2.8 | I 4.5 | 16.2 | 17.8 | 19.5 | 21.0 | $22 \cdot 6$ | 25.4 | 28.8 | $3{ }^{1} 9$ | $34 \cdot 6$ |
| 12 | 1.7 | $3 \cdot 5$ | $5 \cdot 2$ | $6 \cdot 9$ | $8 \cdot 6$ | 10.3 | II.9 | 13.5 | $15^{\circ} \mathrm{I}$ | 16.7 | 18.2 | 19.7 | 21.2 | 23.9 | $27 \cdot 2$ | $30 \cdot 2$ | 32.9 |
| 10 | r. 6 | $3 \cdot 2$ | 4.9 | $6 \cdot 5$ | 8.1 | 9.6 | II.2 | 12.7 | 14.2 | 15.7 | 17.1 | $18 \cdot 6$ | 19.9 | 22.6 | $25 \cdot 7$ | $28 \cdot 6$ | 3r.3 |
| 8 | I 5 | $3 \cdot 1$ | $4 \cdot 6$ | $6 \cdot 1$ | $7 \cdot 6$ | 9.1 | $10 \cdot 5$ | 12.0 | 13.4 | I4.8 | I6.2 | 17.6 | I $8 \cdot 9$ | 21.4 | $24 \cdot 5$ | 27.3 | 29.9 |
| 6 | 1.4 | $2 \cdot 9$ | $4 \cdot 3$ | $5 \cdot 7$ | $7 \cdot 2$ | $8 \cdot 6$ | 10.0 | II.3 | 12.7 | 14.0 | 15.4 | $16 \cdot 7$ | 17.9 | 20.4 | 23.3 | 26. I | $28 \cdot 7$ |
| 4 | I.4 | $2 \cdot 7$ | 4. 1 | $5 \cdot 5$ | $6 \cdot 8$ | $8 \cdot 1$ | $9 \cdot 5$ | 10.8 | 12.1 | 13.4 | I4.6 | I5.9 | 17.1 | 19.5 | $22 \cdot 3$ | $25^{\circ} \mathrm{O}$ | 27.5 |
| 2 | I•3 | $2 \cdot 6$ | $3 \cdot 9$ | $5 \cdot 2$ | $6 \cdot 5$ | $7 \cdot 8$ | $9 \cdot 0$ | $10 \cdot 3$ | II*5 | 12.8 | I 4.0 | 15.2 | 16.3 | 18.6 | 21.4 | 24.0 | $26 \cdot 5$ |
| 0 | I-2 | 2.5 | $3 \cdot 7$ | $5 \cdot 0$ | $6 \cdot 2$ | $7 \cdot 4$ | $8 \cdot 6$ | $9 \cdot 9$ | II.O | 12.2 | 13.4 | 14.6 | 1507 | 17.9 | $20 \cdot 6$ | $23 \cdot 1$ | $25 \cdot 5$ |
| S. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | I. 2 | $2 \cdot 4$ | $3 \cdot 6$ | 4.8 | $6 \cdot 0$ | $7 \cdot 1$ | $8 \cdot 3$ | $9 \cdot 5$ | $10 \cdot 6$ | 11・ク | 12.9 | 14.0 | I5.1 | 17.2 | 19.8 | $22 \cdot 3$ | 24.7 |
| 4 | I•I | $2 \cdot 3$ | $3 \cdot 4$ | $4 \cdot 6$ | $5 \cdot 7$ | $6 \cdot 8$ | $8 \cdot 0$ | $9 \cdot 1$ | $10 \cdot 2$ | II•3 | 12.4 | 13.5 | 14.5 | $16 \cdot 6$ | 19.I | 21.6 | $23 \cdot 9$ |
| 6 | $1 \cdot \mathrm{I}$ | $2 \cdot 2$ | $3 \cdot 3$ | $4 \cdot 4$ | $5 \cdot 5$ | $6 \cdot 6$ | $7 \cdot 7$ | $8 \cdot 8$ | $9 \cdot 9$ | $10 \cdot 9$ | $12 \cdot 0$ | 13.0 | $14^{\circ} \mathrm{O}$ | 16•1 | $18 \cdot 5$ | 20.9 | $23 \cdot 2$ |
| 8 | 1 | $2 \cdot 1$ | $3 \cdot 2$ | 4.3 | $5 \cdot 4$ | $6 \cdot 4$ | $7 \cdot 5$ | $8 \cdot 5$ | $9 \cdot 6$ | 10.6 | II•6 | 12.6 | 13.6 | 15.6 | $18 \cdot 0$ | $20 \cdot 3$ | 22.5 |
| 10 | I•0 | $2 \cdot 1$ | $3 \cdot 1$ | $4 \cdot 1$ | $5 \cdot 2$ | $6 \cdot 2$ | $7 \cdot 2$ | $8 \cdot 2$ | $9 \cdot 2$ | 10.2 | 11.2 | 12.2 | 13.2 | I5.1 | 17.5 | 19.8 | 2I•9 |
| 12 | I'0 | $2 \cdot 0$ | $3 \cdot 0$ | $4^{\circ} \mathrm{O}$ | $5 \cdot 0$ | $6 \cdot 0$ | $7 \cdot 0$ | $8 \cdot 0$ | $9 \cdot 0$ | $10 \cdot 0$ | 10.9 | II.9 | I2.8 | 14.7 | 17.0 | 19.3 | 21.4 |
| 16 | $1 \cdot 0$ | $1 \cdot 9$ | $2 \cdot 9$ | 3.8 | 4.8 | $5 \cdot 7$ | $6 \cdot 7$ | $7 \cdot 6$ | $8 \cdot 5$ | 9.5 | 10.4 | II•3 | 12.2 | $14^{\circ} \mathrm{O}$ | 16.2 | 18.4 | 20.5 |
| 20 | 0.9 | I.8 | $2 \cdot 7$ | $3 \cdot 6$ | $4 \cdot 6$ | $5 \cdot 5$ | 6.4 | $7 \cdot 3$ | $8 \cdot 2$ | 9.1 | 9.9 | 10.8 | II•7 | 13.4 | 15.6 | 17.7 | 19.7 |
| 30 | 0.8 | $1 \cdot 7$ | $2 \cdot 5$ | $3 \cdot 3$ | 4.2 | $5 \cdot 0$ | $5 \cdot 8$ | $6 \cdot 7$ | $7 \cdot 5$ | $8 \cdot 3$ | 9•1 | 10.0 | 10.8 | 12.4 | 14.4 | 16.4 | $18 \cdot 3$ |
| 40 | 0.8 | I-6 | $2 \cdot 4$ | $3 \cdot 2$ | $4 \cdot 0$ | $4 \cdot 8$ | $5 \cdot 6$ | $6 \cdot 3$ | $7 \cdot 1$ | $7 \cdot 9$ | $8 \cdot 7$ | $9 \cdot 5$ | 10.3 | II.8 | 13.8 | 15.7 | 17.6 |
| 50 | 0.8 | I. 6 | $2 \cdot 3$ | $3 \cdot 1$ | $3 \cdot 9$ | $4 \cdot 7$ | $5 \cdot 5$ | $6 \cdot 2$ | $7 \cdot 0$ | $7 \cdot 8$ | $8 \cdot 6$ | $9 \cdot 3$ | Io'I | 11.6 | 13.6 | 15.5 | 17.4 |



## REDUCTION TO THE MERDIAN AND AZIMUTH TABLE FOR HOUR-ANGLES FROM UPPER MERIDIAN.

* VEGA.

|  |  |  |  |  | ${ }_{74}{ }_{4}$ |  |  |  |  |  |  |  | $82$ |  | $34$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | $32 \cdot 0$ |  |  |  |  |  |
| I |  | 29 |  | 43.6 | $450 \cdot 34$ | $458 \cdot 0$ | $5{ }_{5}{ }^{5}$ | $5 \mathrm{I} 2 \cdot 7$ | 5 20•1 | 27.6 | 535 | ${ }^{5} 424$ | 5 50.5 | 5 58.3 |  |
|  |  | $25 \cdot 8$ |  |  |  | $44^{\circ} 0$ |  |  | $5 \cdot 9$ | 23 | 530 | 88 | 46 | $53^{\circ} 7$ |  |
|  |  | 22.34 |  |  |  |  | $57 \cdot 35$ 53.55 |  | $5 \quad 7.95$ | 5 | 526 | 34 |  |  |  |
|  |  |  | 425.6 | 54 |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 12.2 |  |  |  |  |  |  |  | $5{ }^{5} 74$ | 5 |  |  |  | $4{ }^{\circ} \mathrm{O}$ |
|  |  | $9 \cdot 1$ |  |  |  |  |  |  |  |  | 5 I |  |  |  |  |
|  |  | $6 \cdot 0$ 3.04 |  | $\begin{array}{ll}4 & 19.14 \\ 4 & 15.9\end{array}$ |  | 4 | 4 |  | $\mathrm{lll}_{4}^{4} 53.05$ |  | 5 | ${ }_{5}^{5} 184.2$ |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | 10 |  | 524.8 |  |
| 9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 54.4 |  |  |  | $419 \cdot 8$ |  |  |  | 4463 | 4 |  |  |  |  |
| $\begin{aligned} & 7 \\ & 6 \end{aligned}$ |  | $49^{\circ} \mathrm{O}$ | $55$ |  |  | 4 I3.9 |  |  |  | 4 39.9 <br> 4  <br> 4  |  |  |  |  | 513.7 |
| 5 |  |  |  |  | 356.8 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 |  | 29.73 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  | 59** |  | $4 \mathrm{Ir}{ }^{\text {¢ }}$ |  |  |  |  |  |
|  |  | $2 \mathrm{I} \cdot 3$ |  |  |  | 3 |  |  |  | $4 \quad 6 \cdot 7$ | 4 |  |  |  |  |
| 0 |  | I\% 3 |  |  |  |  |  | 4 | 4 |  |  |  |  |  |  |
| s. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $26 \cdot 7$ |
| 2 |  | ${ }^{9} \cdot 7$ | $314{ }^{\circ} 9$ |  |  |  | ${ }_{3}^{3} \quad 36 \cdot 2$ | 3 $41 \times 7$ | 3 |  | 3 |  |  |  |  |
| 3 |  | , |  | 316.33 |  | 326.8 |  |  |  | $\begin{array}{ll}3 & 48 \cdot 5\end{array}$ |  |  |  | 411 |  |
| 4 |  | ${ }^{2 \cdot 6}$ |  | - $0 \cdot 2$ |  | - $0 \cdot 3$ |  |  |  |  | $3$ |  |  |  | $\cdot 2$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 |  | $52 \cdot 9$ |  | $3 \quad 2 \cdot 53$ |  |  |  |  |  |  | 337 | - |  |  |  |
|  |  | $49 \cdot 8$ | 254.5 |  |  |  |  |  |  |  | 334 | ${ }^{\circ}$ |  | $34^{4} \cdot 7$ | 5.0 |
|  |  |  |  |  |  |  |  |  |  | $\begin{array}{ll}3 & 25.2\end{array}$ |  |  |  | $345 \cdot 7$ | $351 \cdot 0$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 41.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 2 | 2 |  |  |  | 2 |  | 53 |  |  |  |  |  |  |
|  |  | $33^{3} \cdot 2$ | 2 |  |  |  | 2 |  |  |  | 3 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 23.4 | 2 |  |  | 2 | 2 |  | $252 \cdot 3$ |  |  |  |  |  |  |
|  |  |  |  |  |  | 2 |  |  |  | $253 \cdot 8$ | $258 \cdot 1$ |  |  | 3 Ir-4 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 14.32 | $2{ }^{2}$ | 2 | 2 | 229 |  |  | 2 | 2 | $249 \cdot$ | 253.9 | 2 |  |  |
| $\begin{aligned} & 23 \\ & 24 \end{aligned}$ |  | 12.2 |  | 2 İ |  |  |  |  |  |  | 2 |  |  |  |  |
|  |  | ${ }^{\circ} 2$ | $2 \mathrm{I}_{3} 72$ | 217.32 |  | $2 \begin{array}{ll}24.8\end{array}$ |  | - |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  | $251 \cdot 0$ | $25^{\circ} \mathrm{I}$ |
|  |  | I |  |  |  |  |  |  | 3280.0 |  | 2 |  |  |  | 25.3 |
|  |  | $1 \cdot 8$ |  |  | 12.2 |  |  |  |  | $230 \cdot 3$ | 2 |  |  |  |  |
|  |  | 59.9 57.9 |  |  |  |  |  |  | 221.92 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 |  | $54^{\text {I I }}$ I | I ${ }^{\text {a }}$ | 20 |  |  | 2 | 213.9 | 217032 | 220.8 | 224 | 9 |  |  |  |
| 33 |  | 52.2 I | 55.4 | ${ }^{1} 58.5{ }^{2}$ | $1 \cdot 82$ |  | 2 | $2 \mathrm{II} \cdot 7$ |  | 2 | 222.0 | 25.5 | 229.0 | 232.6 | $36 \cdot 3$ |
|  |  | 50.3 I | $53 \cdot 4$ | I | 159.72 |  |  |  | $\mathrm{ll}_{2} 12 \cdot 82$ | 216.2 | 219.6 | 23.1 |  | $230 \cdot 1$ | 33.7 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 |  |  |  |  |  |  |  |  |  |  | 215.0 |  |  | 251 | $8 \cdot 6$ |
|  |  | $4 \cdot 8$ | - | 8 | I 53.8 | -8 | ${ }_{1} 1859.92$ |  | $2 \begin{array}{ll}2 & 6.2\end{array}$ | 2 | 212. | $2 \mathrm{I} \cdot 0$ | 219.3 | 2 | $26 \cdot 1$ |
|  |  | ${ }^{\circ} \mathrm{O}$ | 矿 | 1 | I | I 54.8 |  |  | $2_{2}^{2} \quad 4 \cdot 1 / 2$ |  | 10 | 3 7 | $216 \cdot 9$ | 2 | $3 \cdot 6$ |
|  |  | 5 | $44^{\text {I I }}$ I | - 1 | I | 52.8 50.9 | I 515.81 I |  |  |  |  | $0 \cdot 1$ | 12 | $217 \cdot 8$ | I'I |
|  |  |  |  |  |  |  |  |  | I $59.8{ }^{2}$ |  |  |  |  |  |  |
| 42 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 43 |  | 2 | 36.8 I | - | $2{ }^{2} 1$ |  |  |  | $53 \cdot 5$ | 5 | 59 | 2 | . 2 | $2{ }^{2}$ |  |
|  |  | 32.5 I | I $35^{\circ} \mathrm{I}$ I | $37 \cdot 71$ | $40 \cdot 3 \mathrm{I}$ | $3 \cdot 1$ |  |  | I 51.4 |  | I $57 \cdot 1$ |  |  |  |  |

* VEGA.

| Lat. | ${ }_{4}$ | 8 | 12 | 16 | ${ }_{20}$ | ${ }_{24}$ | 26 | ${ }_{28} \mathrm{~m}$. | ${ }_{30}$ | ${ }_{32}$ | $\mathrm{m}_{34}$ | ${ }_{36}$. | m. | m. | ${ }_{42}$ | ${ }_{44}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 54 | 0.2 | 0 | $2 \cdot 2$ | $3 \cdot 8$ | $6 \cdot 0$ | $8 \cdot 6$ | 10.1 | Ir.8 | 13.5 | 15.4 | 17.4 | 19.4 | $21 \cdot 7$ | $24^{\circ} \mathrm{O}$ | $26^{\prime} 5$ | $29^{\circ} \mathrm{O}$ |
| 56 | 0.2 | $\bigcirc$ | 2, | $3 \cdot 7$ | $5 \cdot 7$ | 8.2 | 9.7 | II. 2 | 12.9 | 14.7 | 16.5 | 18.5 | $20 \cdot 7$ | 22.9 | $25 \cdot 2$ | 27.7 |
| 58 | 0.2 | 0.9 | $2 \cdot 0$ | 3.5 | $5 \cdot 4$ | $7 \cdot 8$ | $9 \cdot 2$ | 10.7 | 12.3 | 13.9 | 15.7 | 17.6 | 19.6 | 2x.8 | $24^{\circ} \mathrm{O}$ | $26 \cdot 3$ |
| 60 | $0 \cdot$ | $0 \cdot 8$ | x- | 3.3 | $5 \cdot 2$ | $7 \cdot 4$ | $\cdot 7$ | 10. 1 | II. 6 | 13.2 | 14.9 | 16.7 | 18.6 | 20.6 | 22.7 | $25 \cdot 0$ |
| 62 | $0 \cdot$ | $0 \cdot 8$ | I. | $3 \cdot \mathrm{I}$ | 4.9 | 7.0 | $8 \cdot 2$ | $9 \cdot 6$ | IT0 | 12.5 | 14.I | 15.8 | 17.6 | $19 \cdot 5$ | 21.5 | 23.6 |
| 64 | 0.2 | $0 \cdot 7$ | 1.7 | $2 \cdot 9$ | $4 \cdot 6$ | $6 \cdot 6$ | 7.7 | $9 \cdot 0$ | $10 \cdot 3$ | 11.7 | 13.3 | 14.9 | 16.6 | $18 \cdot 3$ | $20 \cdot 2$ | 22.2 |
| AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{54}$ | $\bigcirc$ | ${ }^{1} \cdot 6$ | $2 \cdot 3$ | $3 \cdot 1$ | $3 \cdot 9$ | $4 \cdot 7$ | $5 \cdot 1$ | $5 \cdot 5$ | $5 \cdot 9$ | $6 \cdot 2$ | $6^{\circ} \cdot 6$ | 7.0 | $7 \cdot 4$ | 7.8 | $8 \cdot 2$ | -6 |
| 56 | 0.8 | I. 6 | $2 \cdot 3$ | 3.I | 3.9 | 4.7 | 5.1 | $5 \cdot 5$ | 5.9 | $6 \cdot 3$ | $6 \cdot 7$ | 7.0 | $7 \cdot 4$ | $7 \cdot 8$ | $8 \cdot 2$ | $8 \cdot 6$ |
| 58 | 0.8 | 1.6 | $2 \cdot 3$ | $3 \cdot 1$ | 3.9 | 4.7 | $5 \cdot 1$ | $5 \cdot 5$ | $5 \cdot 9$ | $6 \cdot 3$ | $6 \cdot 7$ | 7.1 | 7.5 | 7.8 | $8 \cdot 2$ | $8 \cdot 6$ |
|  | 0.8 | $1 \cdot 6$ | $2 \cdot 4$ | $3 \cdot 2$ | 4 | $4{ }^{\circ}$ | $5 \cdot 1$ | $5 \cdot 5$ | $5 \cdot 9$ | $6 \cdot 3$ | $6 \cdot 7$ | $7 \cdot 1$ | $7 \cdot 5$ | 7.9 | $8 \cdot 3$ | 7 |
| 62 | 0.8 | 1.6 | $2 \cdot 4$ | 3.2 | 4.0 | 4. | $5 \cdot 2$ | 5.6 | $6 \cdot 0$ | $6 \cdot 4$ | $6 \cdot 7$ | 7.1 | $7 \cdot 5$ | $7 \cdot 9$ | $8 \cdot 3$ | 7 |
| 64 | 0.8 | 1.6 | 2.4 | 3.2 | 4.0 | $4 \cdot 8$ | $5 \cdot 2$ | $5 \cdot 6$ | $6 \cdot 0$ | $6 \cdot 4$ | $6 \cdot$ | $7 \cdot 2$ | 7.6 | $8 \cdot 0$ | $8 \cdot 4$ | 8 |
| Lat. | ${ }_{45}$. | 48 | $\mathrm{m}_{47}$ | 48 | ${ }_{49}$. | ${ }_{50}$ | ${ }_{51}{ }^{\text {m }}$ | 52 | 53 | 54 | 55 | $36$ | ${ }_{5}{ }_{5}$ | $\frac{\mathrm{m}}{58}$ | m. | m. |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 54 | 30 | $3 \mathrm{x} \cdot 7$ | $33^{\prime}$ I | 34.5 | 36́0 | 37.4 | 38.9 | $40 \cdot 5$ | 42.0 | $43^{\prime} \cdot 6$ | $45 \cdot 3$ | $46 \cdot 9$ | 48.6 | 50.3 | 52.1 | $53 \cdot 8$ |
| 5 | 29.6 | $3 \mathrm{I} \cdot \mathrm{O}$ | $32 \cdot 3$ | $33 \cdot 7$ | $35 \cdot 1$ | 36.6 | 38.0 | $39 \cdot 5$ | $4 \mathrm{I} \cdot \mathrm{I}$ | $42 \cdot 6$ | $44 \cdot 2$ | $45 \cdot 8$ | $47 \cdot 5$ | 49•1 | 50.8 | 53.6 |
| 56 | 28.9 | 30.2 | 31.6 | 32.9 | $34 \cdot 3$ | $35 \cdot 7$ | 37.1 | 38.6 | $40 \cdot 1$ | $4 \mathrm{I} \cdot 6$ | 43.2 | 44:7 | $46 \cdot 3$ | 48.0 | $49 \cdot 6$ | $51 \cdot 3$ |
| 57 | 28.2 | 29.5 | 30.8 | 32.1 | $33 \cdot 5$ | $34 \cdot 8$ | $36 \cdot 2$ | $37 \cdot 7$ | $39 \cdot 1$ | $40 \cdot 6$ | $42^{\text {I }}$ | $43 \cdot 6$ | $45 \cdot 2$ | $46 \cdot 8$ | $48 \cdot 4$ | $50 \cdot 1$ |
| 58 | 27.5 | 28.8 | 30.0 | 31-3 | $32 \cdot 6$ | 33.9 | 35.3 | 36.7 | $38 \cdot 1$ | 39.6 | 41'1 | $42 \cdot 6$ | 44. I | $45 \cdot 6$ | 47.2 | $48 \cdot 8$ |
| 59 | $26 \cdot 8$ | $28 \cdot 0$ | $29^{2}$ | $30 \cdot 5$ | $3 \mathrm{I} \cdot 8$ | $33 \cdot 1$ | 34.4 | $35 \cdot 8$ | $37 \cdot 2$ | 38.6 | $40 \cdot 0$ | $41 \cdot 5$ | 42.9 | $44 \cdot 5$ | $46 \cdot 0$ | $47 \cdot 6$ |
| 60 | $26 \cdot 1$ | 27.3 | 28.5 | $29 \cdot 7$ | 30.9 | 32.2 | 33.5 | 34.8 | 36.2 | $37 \cdot 5$ | 38.9 | $40 \cdot 3$ | $4 \mathrm{I} \cdot 8$ | $43 \cdot 3$ | $44^{8}$ | $46 \cdot 3$ |
| 61 | 25.4 | 26.5 | 27.7 | 28.9 | 30 | 31.3 | 32 | 33.8 | 35 | $36 \cdot 5$ | $37 \cdot 8$ | 39.2 | 40 | $42 \cdot \mathrm{x}$ | $43 \cdot 5$ | $45^{\circ} 0$ |
| 62 | 24*7 | 25.8 | $26 \cdot 9$ | 28.0 | 29.2 | 30.4 | 31.6 | 32.9 | 34.2 | $35 \cdot 5$ | 36.8 | 38• | $39 \cdot 5$ | $40 \cdot 9$ | $42 \cdot 3$ | $43 \cdot 7$ |
| 63 | 23.9 | 25.0 | $26 \cdot 1$ | $27 \cdot 2$ | 28.3 | 29.5 | 30.7 | 31.9 | 33.1 | 34.4 | $35 \cdot 7$ | $37 \cdot 0$ | $38 \cdot 3$ | $39 \cdot 7$ | 41.0 | 42.4 |
| 64 | 23.2 | 24.2 | 25.3 | 26.4 | 27.5 | 28.6 | 29.8 | $30 \cdot 9$ | $32 \cdot 1$ | 3 | 34.6 | 35*9 | $37 \cdot 1$ | 38.4 | 39.8 | $4 \mathrm{I} \cdot \mathrm{I}$ |

## AZIMUTHS.

| 54 | 8.8 | $9{ }^{\circ} \mathrm{O}$ | $9 \cdot 2$ | 9.4 | $9 \cdot 5$ | $9 \cdot 7$ | 9.9 | - 1 | $1{ }^{\circ} \mathrm{O} 3$ | $10 \cdot 5$ | $\stackrel{\circ}{10} 7$ | 10*9 | ${ }_{\text {I }}^{1} \mathrm{i} \cdot \mathrm{I}$ | $1 \cdot 3$ |  | 汭 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 56 | $8 \cdot 8$ | $9 \cdot 0$ | $9 \cdot 2$ | $9 \cdot 4$ | 9.5 | $9 \cdot 7$ | 10\% | IO | 10.4 | 10.5 | 10.7 | 10.9 | II•I | $1 \mathrm{t} \cdot 3$ |  |  |
| 58 | $8 \cdot 8$ | 9.0 | $9 \cdot 2$ | $9 \cdot 4$ | $9 \cdot 6$ | $9 \cdot 8$ | $10 \cdot 0$ | 10.2 | $10 \cdot 4$ | 10. | 10.8 | 11.0 | 11 | II. 4 | Ir |  |
| 60 | 8.9 | $9 \cdot 1$ | $9 \cdot 3$ | $9 \cdot 5$ | $9 \cdot 7$ | 9.9 | $0 \cdot 0$ | $10 \cdot 2$ | 10 | $10 \cdot 6$ | 10.8 | $1{ }^{1} \mathrm{O}$ | II2 | 11.4 | I. | II.8 |
| 62 | $8 \cdot 9$ | $9 \cdot 1$ | $9 \cdot 3$ | 9.5 | $9 \cdot 7$ | $9 \cdot 9$ | 10.1 | $10 \cdot 3$ | $10 \cdot 5$ | 10.7 | 10.9 | II'I | $1{ }^{1}$ | 11-5 | $11 \cdot 7$ | II.9 |
| 64 | 9.0 | 9.2 | $9 \cdot 4$ | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10. | IIO | II.2 | II.4 | II. 6 | I 1.8 | 12.0 |



## N. <br> REDUCTIONS

| $\stackrel{\circ}{54}$ | 53.8 | 55.6 | 57*5 | 59.3 | 61•2 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 55 | $52 \cdot 6$ | $54 \cdot 3$ | 56-1 | 57.9 | $59 \cdot 8$ |
| 56 | $5 \mathrm{I} \cdot 3$ | 53.1 | 54.8 | 56.6 | 58.4 |
| 57 | $50 \cdot 1$ | 51.8 | $53 \cdot 5$ | $55 \cdot 2$ | $56 \cdot 9$ |
| 58 | 48.8 | 50.5 | 52•1 | 53.8 | 55.5 |
| 59 | $47 \cdot 6$ | 49.2 | 50.8 | 52.4 | $54 \cdot 1$ |
| 60 | $46 \cdot 3$ | $47 \cdot 8$ | $49 \cdot 4$ | $5{ }^{\circ} \mathrm{O}$ | $52 \cdot 6$ |
| 61 | $45^{\circ} \mathrm{O}$ | $46 \cdot 5$ | $48 \cdot 1$ | $49 \cdot 6$ | $5 \mathrm{I} \cdot 2$ |
| 62 | $43 \cdot 7$ | $45^{\circ} 2$ | $46 \cdot 7$ | $48 \cdot 2$ | 49.7 |
| 63 | $42 \cdot 5$ | $43^{\circ} 9$ | $45^{*} 3$ | $46 \cdot 8$ | 48.2 |
| 64 | I | 42 | 教 | $45 \cdot 3$ | $46 \cdot 8$ |


| 5 | AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ri•\% | 11.9 | I2.1 | $12 \cdot 3$ | $12 \cdot 5$ | I2.6 | 12.8 | $13^{\circ} \mathrm{O}$ | $1{ }^{\circ} \cdot 2$ | 13.4 | - ${ }^{\circ} \cdot 6$ | 13.8 | ${ }^{\circ}{ }^{\circ} \mathrm{O}$ | 14.2 | $14^{\circ} 4$ | ${ }^{1}{ }^{\circ} \cdot 6$ |
| 56 | 11.7 | II-9 | $12 \cdot 1$ | $12 \cdot 3$ | 12.5 | 12.7 | I2.9 | I3.1 | 13.3 | 13.5 | $13 \cdot 7$ | ז3.8 | $14^{\circ}$ | $1{ }^{1} 2$ | 14.4 | 14.6 |
| 58 | 11.8 | 12.0 | 12.1 | 12.3 | 12.5 | 12.7 | 12.9 | I3.1 | 13.3 | 13.5 | I3.7 | I 3.9 | $14^{\prime} \mathrm{I}$ | 14.3 | 14.5 | 14.7 |
| 60 | Ix.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | ${ }^{1} 4^{\circ} \mathrm{O}$ | 14.2 | $14^{*}+$ | 14.6 | 14.8 |
| 62 | 11.9 | $12 \cdot 1$ | 12.3 | 12.5 | 12.7 | 12.9 | ${ }_{13} \cdot \mathrm{I}$ | $13 \cdot 3$ | 13.5 | $13 \cdot 7$ | 13.9 | T4. I | 14.3 | 14.5 | 14.7 | 14.9 |
| 64 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | $1{ }^{3} 4$ | 13.6 | $1{ }^{1} 8$ | 14.0 | 14.2 | 14.4 | $\mathrm{r}_{4} \cdot 6$ | 14.8 | $15^{\circ} \mathrm{O}$ |

## reduction to the meridian and azimuth table near the meridian BELOW THE POLE.

* VEGA.

| Lat. | I HOUR. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{m}_{16}$ | ${ }_{17}$ | ${ }_{18}$ | ${ }_{19}$. | ${ }_{20}$ | 21 | 22 | ${ }_{23}$. | ${ }_{24}$ | ${ }_{25}$ | ${ }_{26}$ | ${ }_{27}$ | ${ }_{28} \mathrm{~m}$ | ${ }_{29}$. | ${ }_{30} \mathrm{~m}$. |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T25.8 |
| 52 | 888 | 92.4 | 94.8 | 97.2 95.1 | $99 \cdot 6$ 97.5 | O2.1 | 104.6 102.3 | 1072 104.8 | $109 \cdot 7$ 107 | 112.3 109.9 | 115.0 112.5 | 117.6 115.1 | $120 \cdot 3$ 117.7 | 123.0 120.3 | 125.8 123.0 |
| 53 | $88 \cdot 0$ |  | 92.7 90.6 | 95.1 92.9 | $97 \cdot 5$ 95.3 | 99.9 | 102.3 100.0 | 104.8 102.5 | 107.3 104.9 | 109.9 107 | 112.5 109.9 | 115.1 112.5 | 1177 1150 | 120.3 117.6 | 123.0 120.3 |
| 55 | $84 \cdot \mathrm{I}$ | $86 \cdot 3$ | 88.5 | $90 \cdot 8$ | $93 \cdot 1$ | 95.4 | $97 \cdot 7$ | $100 \cdot 1$ | $102 \cdot 5$ | 104.9 | 107.4 | 109.9 | 112.4 | 114.9 | 117.5 |
| 56 | $82 \cdot 1$ | 84.2 | $86 \cdot 4$ | 88.6 | $90 \cdot 9$ | $93 \cdot 1$ | $95 \cdot 4$ | 97.7 | 100.1 | $102 \cdot 5$ | 104.9 | 107.3 | 109.8 | 112.2 | 114*7 |
| 57 | $80 \cdot 1$ | $82 \cdot 2$ | 84.3 | 86.5 | $88 \cdot 7$ | $90 \cdot 9$ | 93'1 | $95 \cdot 4$ | $97 \cdot 7$ | 10 | 3 | 1047 | 107.1 | 109.5 | 112.0 |
| 58 | $78 \cdot 1$ | $80 \cdot 1$ | $82 \cdot 2$ | 84.3 | $86 \cdot 5$ | $88 \cdot 6$ | $90 \cdot 8$ | $93 \cdot 1$ | 95.2 | $97 \cdot 5$ | $99^{-8}$ | 1021 | 104.4 | $106 \cdot 8$ | 109.2 |
| 59 | $76 \cdot 1$ | 78.1 | $80 \cdot 1$ | $82^{-1}$ | 84.2 | $86 \cdot 3$ | 88.4 | $90 \cdot 6$ | 92.8 | $95^{\circ}$ | $97 \cdot 2$ | $99^{\circ} 5$ | 1017 | 104*0 | 106.4 |
| 60 | $74^{\circ} \mathrm{O}$ | $76 \cdot 0$ | $78 \cdot 0$ | -0 | $82 \cdot$ | $84^{\circ} \mathrm{O}$ | $86 \cdot 1$ | 88.2 | $90 \cdot 3$ | $92 \cdot 5$ | 94.6 |  | $99^{\circ} \mathrm{O}$ | 101.3 | $103 \cdot 5$ |
| 61 | 72 | 73 | 75.8 | 77.8 | $79 \cdot 7$ | $8 \mathrm{I} \cdot 7$ | $83 \cdot 7$ | 85.8 | 87.8 | $89 \cdot 9$ | $92 \cdot 0$ | 94.2 | $96 \cdot 3$ | $98 \cdot 5$ | $100 \cdot 7$ |
| 62 | $70^{\circ} 0$ | 71.8 | 73.7 | 75.6 | 77.5 | 79.4 | $8 \mathrm{~B} \cdot 4$ | $83 \cdot 3$ | 85.3 | 87.4 | 89.4 | 91.5 | 93.6 | $95 \cdot 7$ | $97 \cdot 8$ |
| 63 | 67.9 | $69 \cdot 7$ | 71.5 | 73.3 | 75.2 | $77^{\circ}$ | 78.9 | $8{ }^{8} \cdot 9$ | 82.8 | $84 \cdot 8$ | $86 \cdot 8$ | 88.8 | $90 \cdot 8$ | 92.9 | $95^{\circ}$ |
| 64 | $65 \cdot 8$ | 67.5 | 69.3 | $7 \mathrm{~F} \cdot \mathrm{I}$ | $72 \cdot 9$ | 74.7 | $76 \cdot 5$ | 78.4 | $80 \cdot 3$ | $82 \cdot 2$ | 84.1 | $86 \cdot 1$ | $88 \cdot 0$ | $90 \cdot 0$ | $92^{\circ}$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 52 | -5 | 1314 | 134.2 | 137.1 |  | , | 45.8 | 148.8 | 51.8 | 154.8 | 9 | 161.0 | 164.1 |  |  |
| 53 | 125.7 | 128.5 | I31.3 | I34.1 | 136.9 | $139 \cdot 7$ | 142.6 | 145.5 | 148.5 | 151.5 | $154 \cdot 5$ | 157.5 | $160 \cdot 5$ | 163.6 | 166.7 |
| 54 | 122.9 | 125.6 | 128.3 | 131-1 | 133.8 | $136 \cdot 6$ | 139.4 | 142.3 | 145.2 | 148 -I | 1510 | $154{ }^{\circ}$ | 157.0 | $160^{\circ}$ | 163.0 |
| 55 | 120.1 | 122.7 | 125.4 | 128.1 | $130 \cdot 8$ | 133.5 | 136.3 | 139.0 | 141.8 | 144.7 | 147.6 | $150 \cdot 5$ | r 53.4 | $156 \cdot 3$ | 159.3 |
| 56 | 117.3 | 119.8 | 122.4 | $125{ }^{\circ}$ | 127.7 | $130 \cdot 4$ | 133.0 | 135.8 | 138.5 | 141.3 | 144* 1 | 146.9 | 149.8 | 152.7 | 155.6 |
| 57 | 114.4 | 116.9 | 119.5 | 12 | 124.6 | 127.2 | 129.8 | 132.5 | 135.2 | 137.9 | $140 \cdot 6$ | 143.4 | $146 \cdot 1$ | 149.0 | 151.8 |
| 58 | 111.6 | $114^{\circ} \mathrm{O}$ | 116.5 | 119.0 | 121.5 | 124.0 | 126.6 | 129.2 | 131.8 | 134.4 | 137.1 | $139 \cdot 8$ | 142.5 | 145.3 | 148.0 |
| 59 60 | 10 | III'I | 113.5 110.5 | II 5.9 I 2.8 | 118.4 115.2 | 120.8 117.6 | 123.3 | 125.9 | 128.4 | $13 \mathrm{I}^{\circ} \mathrm{O}$ | 133.6 | 136.2 | 138.9 | 141.5 | 144.2 |
|  |  |  | 110.5 |  | 115.2 | 117.6 |  | 122.5 | $125{ }^{\circ} \mathrm{O}$ | 127.5 | 130.1 | 132.6 | 135.2 | 137.8 | $140 \cdot 4$ |
| 61 | $2 \cdot 9$ | 105.2 | 107.4 | $109 \cdot 7$ | 112.1 | 14.4 | 116.8 | 119.2 | 121.6 | 124.0 | 126.5 | $129^{\circ} 0$ | 131.5 | 134.0 | 136.6 |
| 6 | 100.0 | 102.2 | 104.4 | $106 \cdot 6$ | 108.9 | 111.2 | 113.5 | 115.8 | 118.1 | 120.5 | 122.9 | 125.3 | 127.7 | 130.2 | $132 \cdot 7$ |
| 63 | 97•1 | 99.2 | 101.3 | 103.5 | 1057 | 107.9 | 110.1 | 112.4 | 114.7 | 117.0 | I19.3 | 121.6 | 124.0 | 126.4 | 128.8 |
| 6 | 94 | 96.I | 98.2 | 100.3 | 102.4 | 104.6 | $106 \cdot 8$ | 108.9 | III 2 | I13.4 | 115.6 | 117.9 | 120.2 | 122.5 | 124.9 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. REDUCTIONS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 176.9 | $80 \cdot 2$ | 183.4 | 86.8 |  |  | 96.9 |  |  |  |  |  |  |  |
|  | 169.9 | 173.0 | $176 \cdot 2$ | 179.5 | $182 \cdot 7$ | 186.0 | 189.3 | 192.6 | 196.0 | 199.4 | 202.8 | $206 \cdot 2$ | 209.7 | 213.2 | 2216.7 |
| 54 | 166.I | 169.2 | 172.3 | 175.5 | $178 \cdot 7$ | 181.9 | 185.1 | 188.3 | 191.6 | 195.0 | 198.3 | $201 \cdot 7$ | 205.1 | $208 \cdot 5$ | $2 \mathrm{II}{ }^{\text {d }}$ |
|  | 162.3 | 165.3 | 168.4 | 171.5 | 174.6 | 177•7 | 180.9 | 184.1 | 187.3 | $190 \cdot 5$ | 193.8 | 197.1 | $200 \cdot 4$ | $203 \cdot 7$ | 207.r |
|  | 158.5 | 16 | 164.4 | 167.4 | $170 \cdot 5$ | 173.5 | 176 | 179.7 | 182.9 |  | 189.2 | 192.5 | 195.7 | 199.0 | $202 \cdot 3$ |
| 57 | 154.7 | 157.5 | $160 \cdot 5$ | 163.4 | 166.4 | 169.3 | 172.4 | 175.4 | 178.5 | 181.6 | 184.7 | 187.8 | 191.0 | 194.2 | $197 \cdot 4$ |
|  |  | 153.6 | 156.5 | 159.3 | 162.2 | 165. 1 | 168.I | 171.1 | 174.0 | $177 \cdot 1$ | 180.1 | 183.2 | 186.2 | 189.4 | 192.5 |
|  | 146.9 | $149 \cdot 7$ | $152 \cdot 5$ | 155.3 | 158.1 | $160 \cdot 9$ | 163.8 | $166 \cdot 7$ | 169.6 | 172.5 | 175.5 | 178.5 | 181.5 | 184.5 | 187.6 |
|  |  | 145.7 | 148.4 | 151.1 | 153.9 | 156.7 | 159.4 | $162 \cdot 3$ | 165.1 |  |  | 173.8 | 176.7 | I79.6 | 182.6 |
|  | I | 141.7 | 144.4 | $147 \cdot 0$ | 149.7 | 152.4 | 155.1 | 157.8 | $160 \cdot 6$ | 163.4 | 166.2 | 169.0 | 171.9 | 174.7 | 177.6 |
|  | 35.2 | 137.7 | I $40 \cdot 3$ | $142 \cdot 8$ | 145.4 | 148.I | $150 \cdot 7$ | 153.4 | 156.0 | $158 \cdot 7$ | 161.5 | 164.2 | $167 \cdot 0$ | 169.8 | 172.6 |
| 63 | F2 | 133.7 | 136.I | 138.6 | 141.2 | 143.7 | 146.3 | 148.8 | 151.5 | 154.1 | $156 \cdot 7$ | 159.4 | 162.1 | 164.8 | 167.5 |
|  |  | 12 | 132.0 | 134.4 | $136 \cdot 9$ | 139.3 | 141.8 | 144.3 | 146.8 | 149.4 | 151.9 | 154.5 | 157.1 | 159.8 | 162.4 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N. AZIMUTHS. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{\circ}{52}$ | ${ }^{\circ} \mathrm{P} \cdot 7$ | 15.1 | 15.5 | 15.9 | $16 \cdot 2$ | 16.6 | $17 \times 0$ | 17.8 | 18.5 | $19 \cdot 3$ | $20^{\circ} 0$ | $20 \cdot 8$ | $21 \cdot 5$ | $22 \cdot 3$ | 23.0 |
| 53 | 14.7 | 15.1 | 15.5 | 15.9 | $16 \cdot 3$ | $16 \cdot 6$ | 17.0 | 17.8 | 18.5 | 19.3 | $20 \cdot 1$ | 20.8 | $2 \mathrm{~T} \cdot 6$ | 22.3 | $23 \cdot 1$ |
| 54 | 14.8 | 15.1 | 15.5 | 15.9 | $16 \cdot 3$ | $16 \cdot 7$ | 17.1 | 17.8 | 18.6 | 19.3 | $20 \cdot 1$ | 20.9 | 21.6 | 22.4 | $23 \cdot 1$ |
| 55 | 14.8 | 15.2 | 15.5 | 15.9 | $16 \cdot 3$ | $16 \cdot 7$ | $17 \cdot 1$ | 17.8 | 18.6 | 19.4 | $20 \cdot 1$ | 20.9 | 21.6 | 22.4 | 23.2 |
| 56 | 14.8 | 15 | 15.6 | 16.0 | $16 \cdot 3$ | $16 \cdot 7$ | 17•1 | 17.9 | 18.6 | 19.4 | $20 \cdot 2$ | 20.9 | 21.7 | 22.4 | 23.2 |
| 57 | 14.8 | 15.2 | 15.6 | $16 \cdot 0$ | 16.4 | 16.8 | $17 \cdot 1$ | 17*9 | 18.7 | 19.5 | 20.2 | 21.0 | 2r•7 | 22.5 | $23 \cdot 3$ |
| 58 | 14.9 | 15.2 | $15 \cdot 6$ | 16.0 | $16 \cdot 4$ | 16.8 | 17.2 | 18.0 | 18.7 | 19.5 | $20 \cdot 3$ | 21.1 | 21.8 | 22.6 | 23.3 |
| 59 | 14.9 | 15.3 | $15^{\circ} 7$ | 16 | 16.4 | $16 \cdot 8$ | $17 \cdot 2$ | 18.0 | 18.8 | 19.6 | 20.3 | $2 \mathrm{I} \cdot$ | 21.9 | $22 \cdot 6$ | 23.4 |
| 60 | I | 15.3 | 15.7 | $16 \cdot 1$ | $16 \cdot 5$ | 16.9 | 17.3 | 18 | 8 | 19 | 20.4 | 2 I 2 | -9 | 22 | 23.5 |
| 6 r | 15.0 | 15.4 | 15.8 | 16.2 | $16 \cdot 5$ | 16.9 | $17 \cdot 3$ | $18 \cdot 1$ | 18.9 | 19.7 | $20 \cdot 5$ | 2 I 3 | $22 \cdot 0$ | $22 \cdot 8$ | $23 \cdot 6$ |
| 62 | $15^{\circ} \mathrm{O}$ | 15.4 | 15.8 | 16.2 | $16 \cdot 6$ | 17.0 | 17.4 | 18.2 | 19.0 | 19.8 | $20 \cdot 5$ | 21.3 | $22 \cdot 1$ | $22 \cdot 9$ | 23.7 |
| 63 | ${ }_{15}{ }^{15}$ | 15.5 | 15.9 | $16 \cdot 3$ | 16.7 | 17.1 | 17.5 | 18.3 | $19^{\circ}$ | 19.8 | $20 \cdot 6$ | 21.4 | 22.2 | 23.0 | 23.8 |
| 64 | $15^{\circ}$ | 15.6 | 16.0 | 16.4 | 16.7 | 17.1 | 17.5 | 18.3 | 19.1 | 19.9 | $20 \cdot 7$ | 21.5 | 22.3 | 23.1 | 23.9 |

# REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE. 

* VEGA.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \multirow[b]{2}{*}{Lat.} \& \multicolumn{17}{|c|}{2 HOURS.} <br>
\hline \& ${ }_{1}^{\mathrm{m}}$. \& ${ }_{2}^{\text {m }}$ \& ${ }_{3}{ }_{3}$ \& ${ }_{4}$ \& ${ }_{5}$ m. \& $\mathrm{m}_{6}$. \& \& ${ }_{7}$ \& 8 \& ${ }_{9}^{\mathrm{m}}$ \& \& \& ${ }_{12}$ \& ${ }_{13}$ \& ${ }_{14}$ \& ${ }_{15}$ \& <br>
\hline \multicolumn{17}{|l|}{N. REDUCTIONS.} \& <br>
\hline \multicolumn{17}{|l|}{} \& <br>
\hline \multirow[t]{2}{*}{} \& \& 223 \& $227 \cdot 5$ \& $231 \cdot 1$ \& \& \& \& $242 \cdot 2$ \& $245 \cdot 9$ \& $249 \cdot 7$ \& 253.5 \& 257.3 \& $261 \cdot 1$ \& 265.0 \& 268.9 \& \& <br>
\hline \& $215 \cdot 4$ \& \& ${ }_{2174}^{2224}$ \& $226 \cdot 0$
$220 \cdot 8$ \& ${ }_{224 \cdot 6}^{229}$ \& \& \& \& $240^{\circ} 4$
235

2 \& 244.1
238.6 \& 244 \& \& 255 \& 259.1 \& $262 \cdot 9$
$25 \cdot 0$ \& \& <br>
\hline 56 \& 20 \& 20 \& 212.3 \& 215.7 \& 219 \& \& \& 236.0 \& ${ }^{239} 5$ \& 238 \& ${ }_{236}^{242}$ \& 240.9 \& $249 \cdot 6$
243 \& 253.3 \& ${ }^{257}{ }^{257}$ \& \& <br>

\hline \multirow[t]{3}{*}{$$
\begin{aligned}
& 57 \\
& 58 \\
& 59 \\
& 60
\end{aligned}
$$} \& \& 20 \& 207.2 \& 210.5 \& $2 \mathrm{3} \cdot 8$ \& $217 \cdot$ \& \& $20 \cdot 6$ \& $224^{\circ} \mathrm{O}$ \& 227 \& $230 \cdot 9$ \& \& 237.9 \& 2414 \& $245^{\circ}$ \& 248 \& <br>

\hline \& 195 \& 19 \& 202.0 \& 205.3
$200 \cdot 0$ \& $208 \cdot 5$
203.2 \& \& \& 215.1 \& \& \& 225.2 \& \& \& 235.5 \& \& \& <br>
\hline \& 18 \& 188 \& ${ }_{\text {I9 }} 19$ \& 194.8 \& 197.9 \& 92 \& 20 \& 24'I \& 207.3 \& 210.5 \& 219.4
213.7 \& -9 \& 22 \& 229.5 \& 22 \& 230 \& <br>

\hline \multirow[t]{4}{*}{$$
\begin{aligned}
& 61 \\
& 62 \\
& 63 \\
& 64
\end{aligned}
$$} \& I80 \& I8 \& I86.5 \& 189.4 \& $192 \cdot 5$ \& 519 \& \& 98.5 \& 201.6 \& \& $207 \cdot 8$ \& $21{ }^{\circ} \mathrm{O}$ \& $214 \cdot 1$ \& 217.3 \& $220 \cdot 5$ \& \& <br>

\hline \& 175.4 \& 178 \& I81.2 \& 184.1 \& 187.0 \& \& \& 92.9 \& 195.9 \& \& \& 20 \& \& \& \& \& <br>
\hline \& 1 \& $1 \begin{aligned} & 173 \\ & 167\end{aligned}$ \& İ75 \& \& \& \& \& \& \& \& \& \& \& 205 \& \& \& <br>
\hline \& \& \& \& \& \& \& \& \& \& \& \& \& 195 \& \& 201 \& \& <br>
\hline \multirow[b]{3}{*}{Lat.} \& \multicolumn{16}{|c|}{\multirow[t]{2}{*}{2 HOURS.}} \& <br>
\hline \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline \& 16 \& 17 \& ${ }_{18}^{\mathrm{m}}$ \& ${ }_{19}$ \& 20 \& 21 \& \& 22 \& 23 \& 24 \& \& \& 27 \& 28 \& 29 \& \& <br>
\hline \multicolumn{17}{|l|}{N. REDUCTIONS.} \& <br>
\hline \multicolumn{2}{|l|}{\multirow[t]{4}{*}{}} \& 286.9 \& $29 \mathrm{r}^{\circ}$ \& \& \& \& \& \& \& \& \& \& 329.0 \& \& \& \& <br>
\hline \& \& 283.8 \& $287 \cdot 9$ \& 291.9 \& $296 \cdot$ \& \& \& \& $308 \cdot 5$ \& \& $316 \cdot 9$ \& \& 325.4 \& $329 \cdot 7$ \& \& \& <br>
\hline \& \& 280 \& $284 \cdot 7$ \& 28 \& $292 \cdot 8$ \& \& \& \& $3{ }^{305} 1$ \& 309.3 \& 313.5 \& 17.7 \& ${ }^{3215} 9$ \& 32 \& 33 \& \& <br>
\hline \& \& 274 \& ${ }_{278}^{281.5}$ \& 282.4 \& - 2886.4 \& \& \& \& -8 \& \& 3 T \& \& 318.4 \& 322.6 \& 323.2 \& \& <br>

\hline \multirow[t]{4}{*}{$$
\begin{aligned}
& 54 \frac{1}{2} \\
& 55 \\
& 55 \frac{1}{2} \\
& 566 \\
& 56 \frac{1}{2}
\end{aligned}
$$} \& 26.6 \& $275 \cdot 4$ \& 275.3 \& 279.2 \& 283 . \& \& \& 2 T - \& $295 \cdot 1$ \& $299 \cdot 1$ \& $303 \cdot 1$ \& \& 31 \& 315.4 \& 31 \& \& <br>

\hline \& ${ }^{264} 4$ \& 268 \& 272 ${ }^{27}$ \& $276 \cdot 0$
272.8 \& 279.9
276.6 \& \& \& \& \& \& 2997 \& \& 30 \& \& \& \& <br>
\hline \& 261.4 \& 262 \& 26 \& \& $273 \cdot 4$ \& \& \& \& \& 292.2 \& 292.2 \& \& 304. \& 304.6 \& 312.3
308.6 \& \& <br>

\hline \& $255 \cdot 3$ \& 258 \& \& \& $270 \cdot 1$ \& \& \& $$
278 \cdot 7
$$ \& $28 \mathrm{r} \cdot 5$ \& $285 \cdot 3$ \& $289 \cdot 2$ \& 293•1 \& 29 \& \& 30 \& \& <br>

\hline \multirow[t]{4}{*}{$$
\begin{aligned}
& 57 \\
& 57 \frac{1}{2} \\
& 58 \\
& 58 \frac{1}{2} \\
& 59
\end{aligned}
$$} \& 25 \& $255 \cdot 8$ \& $259 \cdot 5$ \& 263 . \& 266.8 \& \& \& \& $278 \cdot \mathrm{I} 2$ \& 281.9 \& 2857 \& \& \& 2973 \& 3012 \& \& <br>

\hline \& \& 25 \& $256 \cdot 3$ \& 259.9 \& $263 \cdot 6$ \& \& \& \& $274 \cdot 7$ \& 278.4 \& $282 \cdot 2$ \& \& 28 \& 293.7 \& 297.5 \& \& <br>
\hline \& 245
$242 \cdot 9$
24 \& $249 \cdot 5$ \& ${ }^{2533^{\text {P }}}$ \& \& \& \& \& \& 271.2 \& \& 278.7 \& 282.4 \& 286.2 \& 286 \& 293.8 \& 29 \& <br>

\hline \& $239 \cdot 4$ \& 243 - 1 \& 246 \& $250 \cdot 1$ \& $253 \cdot 6$ \& 6 \& \& \& ${ }_{264}$ \& 268.0 \& \& \& $$
\begin{aligned}
& 282 \\
& 278
\end{aligned}
$$ \& 28 \& $290^{\circ}$ \& \& <br>

\hline \multirow[t]{2}{*}{$59 \frac{1}{2}$} \& $236 \cdot 5$ \& 23 \& $243 \cdot 4$ \& $246 \cdot 8$ \& $250 \cdot 3$ \& \& \& 57.3 \& $260 \cdot 9$ \& 264.4 \& 268.0 \& \& \& 278.9 \& $282 \cdot 6$ \& 28 \& <br>
\hline \& 23 \& 236. \& ${ }_{236}^{24.1}$ \& 243.5 \& 247
24.6
24.6 \& \& \& 53.9 \& 257.4 \& ${ }^{260 \cdot 9}$ \& 26.5 \& \& 27 \& $275 \cdot 2$ \& 27 \& \& <br>

\hline $$
\begin{aligned}
& 60 \frac{1}{6} \\
& 6 \mathrm{I}
\end{aligned}
$$ \& \& \& ${ }_{233} 23.6$ \& \& \& \& \& \& \& 25 \& \& \& 267.9 \& 27r.5 \& \& \& <br>

\hline ${ }_{61} 61$ \& 223.8 \& 22 \& 230 \& 23 \& 236.9 \& \& \& 43.5 \& 246.9 \& 250 \& $253 \cdot 6$ \& ${ }_{257}$ - \& 260.5 \& 264 \& 267.5 \& \& <br>

\hline \multirow[t]{5}{*}{$$
\begin{aligned}
& 62 \\
& 62 \frac{1}{2} \\
& 63 \\
& 63 \frac{1}{2} \\
& 644
\end{aligned}
$$} \& $220 \cdot 6$ \& 223.8 \& $227 \cdot 0$ \& $230 \cdot 2$ \& $233 \cdot 5$ \& 5236 \& \& \& \& $246 \cdot 7$ \& $250 \cdot 0$ \& \& 256.8 \& $260 \cdot 2$ \& $263 \cdot 6$ \& 267 \& <br>

\hline \& $217 \cdot 4$ \& \& $223 \cdot 7$ \& $226 \cdot 9$ \& \& \& \& \& \& $243 \cdot$ I \& \& \& $253 \cdot$ \& $256 \cdot 4$ \& \& \& <br>
\hline \& \& 21 \& \& 22 \& \& \& \& \& $236 \cdot 2$ \& \& $242 \cdot 7$ \& \& 249 \& \& $255 \cdot 9$ \& \& <br>
\hline \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline \& \& \& 213 \& \& \& \& \& 25.9 \& \& 232 \& $235 \cdot 3$ \& \& 21 \& \& \& \& <br>
\hline \multicolumn{17}{|c|}{TRUE BEARING OR AZIMU} \& <br>
\hline \multirow[b]{2}{*}{Lat.} \& \multicolumn{16}{|c|}{2 HOURS.} \& <br>
\hline \& $\mathrm{m}_{0}$ \& $\underset{4}{\mathrm{~m}}$. \& ${ }_{8}^{\mathrm{m}}$ \& ${ }_{12}$ \& ${ }_{18}^{\text {m. }}$ \& ${ }_{20}^{\mathrm{m}}$ \& ${ }_{24}^{\text {m }}$ \& ${ }_{28}^{\text {m. }}$ \& ${ }_{32}$. \& ${ }_{36}{ }^{\text {m }}$ \& m0. \& \& ${ }_{48}$ \& ${ }_{52}$ \& ${ }_{56}$ \& ${ }_{60}$ \& <br>
\hline \multicolumn{17}{|l|}{N. AZIMUTHS.} \& <br>
\hline \multirow[t]{5}{*}{52

53
54
54
55
56} \& $23^{\circ} \mathrm{O}$ \& $23^{\circ} \cdot 8$ \& $24^{\circ} \cdot 5$ \& $25^{\circ} \cdot 3$ \& $26^{\circ} \mathrm{O}$ \& \& $2{ }^{2} \cdot 5$ \& \& \& \& \& \& $\stackrel{\circ}{1} \cdot 8$ \& \& $33^{\circ}$ \& \& <br>
\hline \& $23 \cdot 1$ \& $23 \cdot 8$ \& \& $25 \cdot 3$ \& 26.0 \& \& 27. \& 28.2 \& 2 \& 29.7 \& 7 \& \& \%-9 \& $32 \cdot 6$ \& 硣 \& \& <br>
\hline \& $23 \cdot 1$ \& 23.9 \& 24.6 \& $25 \cdot 3$ \& 26.1 \& \& 27.6 \& 28.3 \& $3{ }^{3} 9^{\circ} \mathrm{O}$ \& - 29.8 \& $830 \cdot 5$ \& $3{ }^{1} \cdot 2$ \& $32 \cdot 0$ \& $32 \cdot 7$ \& $33 \cdot 4$ \& \& <br>
\hline \& 23.2 \& 23.9 \& 24.6 \& $25^{\circ} 4$ \& $26 \cdot 1$ \& 26.9 \& $27 \cdot 6$ \& 28.4 \& -4 29.1 \& 129.8 \& 830 \& $3 \mathrm{I} \cdot 3$ \& - \& 32.8 \& $33 \cdot 5$ \& $34 \cdot$ \& <br>

\hline \& 23.2 \& 24.0 \& $24 \cdot 7$ \& $25 \cdot 5$ \& $26 \cdot 2$ \& 27.0 \& 27.7 \& $728 \cdot 5$ \& |  | 29.2 |
| :--- | :--- | :--- | \& 229.9 \& 930 \& ${ }^{1} \cdot 4$ \& 32.2 \& 32 \& $33 \cdot 6$ \& \& <br>

\hline \multirow[t]{3}{*}{\[
$$
\begin{aligned}
& 57 \\
& 58 \\
& 59 \\
& 50
\end{aligned}
$$

\]} \& $23 \cdot 3$ \& $24^{\circ}$ \& 24 \& $25 \cdot 5$ \& 26.3 \& $27 \cdot 0$ \& 27.8 \& 28.6 \& | 6 | $29 \cdot 3$ |
| :--- | :--- | :--- | \& 330.0 \& - 30.8 \& \& 3 \& $3 \cdot 0$ \& 33.8 \& \& <br>

\hline \& 23.3 \& 24.1 \& 24.8 \& 25 \& $26 \cdot 4$ \& 27.1 \& 27.9 \& 6 \& ${ }^{6}$ \& 4 \& 30.9 \& \& $\cdot 4$ \& $33 \cdot 1$ \& 33.9 \& \& <br>
\hline \& 23.4
23.5 \& 24.2 \& 24.9 \& 25 \& $26 \cdot 5$ \& 27.2
27.3 \& \& 8 \& 29.5 \& 30 \& $3 \mathrm{3I}$ \& \& 32-5 \& $33 \cdot 3$ \& \& \& <br>

\hline \multirow[t]{4}{*}{$$
\begin{aligned}
& 61 \\
& 62 \\
& 63 \\
& 64
\end{aligned}
$$} \& \& 24 \& 25 \& \& \& \& \& \& \& 30.4 \& \& \& \& $33^{\prime} 4$ \& $34^{\circ}$ \& \& <br>

\hline \& \& 24.4 \& 25.2 \& \& $26 \cdot 8$ \& 27.6 \& ${ }_{28.3}^{28.2}$ \& \& $\begin{array}{ll}.0 & 29.7 \\ .1 & 29.7\end{array}$ \& \& 31.3 \& \& \& 3.5 \& 34.3 \& \& <br>
\hline \& 23.8 \& \& 25 \& \& 26.9 \& \& 28.4 \& \& \& \& ${ }_{3}^{31}$ \& \& . I \& \& \& \& <br>
\hline \& 23.9 \& 24.7 \& 25 \& $26 \cdot 2$ \& 27.0 \& \& $28 \cdot 6$ \& 29.4 \& $4{ }^{4} \mathbf{3 0 \cdot 2}$ \& $2{ }^{30 \cdot 9}$ \& \& - 32.5 \& \& \& \& \& <br>
\hline
\end{tabular}

## REDUCTION TO THE MERIDIAN AND AZIMUTH TABLE NEAR THE MERIDIAN BELOW THE POLE.

\author{

* VEGA.
}


CORRECTIONS OF ALTITUDE OF THE SUN AND STARS.
(Involving Dip, Refraction, ©'s Semidiameter, and Parallax.)
Add the Cor. to the Alt. of the $\odot$ 's Lower Limb.

| Sun's Obs. Alt. | Height of the Eye, in Feet. |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 6 ft . | 8 ft . | 10 ft . | 12 ft . | 14 ft . | 16 ft . | 18 ft . | 20 ft . | 22 ft . | 24 ft . |
| $5$ | $3 \cdot 9$ | $3 \cdot 5$ | 3•1 | $2 \cdot 8$ | $2 \cdot 5$ | $2 \cdot 2$ | 1'9 | 1.7 | 1.5 | I-3 |
| 6 | $5 \cdot 2$ | $4 \cdot 8$ | $4 \cdot 5$ | $4 \cdot 2$ | 3.9 | 3.7 | 3.4 | $3 \cdot 2$ | 2.9 | $2 \cdot 7$ |
| 7 | $6 \cdot 4$ | $5 \cdot 9$ | $5 \cdot 6$ | $5 \cdot 3$ | 5.0 | $4 \cdot 8$ | $4 \cdot 5$ | $4 \cdot 3$ | 4.0 | $3 \cdot 8$ |
| 8 | $7 \cdot 2$ | $6 \cdot 8$ | $6 \cdot 5$ | $6 \cdot 2$ | $5 \cdot 9$ | $5 \cdot 6$ | $5 \cdot 4$ | $5 \cdot 2$ | 4.9 | $4 \cdot 7$ |
| 9 | $7 \cdot 9$ | $7 \cdot 5$ | $7 \cdot 2$ | $6 \cdot 8$ | $6 \cdot 6$ | $6 \cdot 3$ | $6 \cdot 1$ | $5 \cdot 8$ | $5 \cdot 6$ | $5 \cdot 4$ |
| 10 | $8 \cdot 4$ | $8 \cdot 0$ | $7 \cdot 7$ | $7 \cdot 4$ | $7 \cdot 1$ | $6 \cdot 9$ | $6 \cdot 6$ | $6 \cdot 4$ | $6 \cdot 2$ | $6 \cdot 0$ |
| II | $8 \cdot 9$ | $8 \cdot 5$ | $8 \cdot 2$ | $7 \cdot 9$ | $7 \cdot 6$ | $7 \cdot 4$ | $7 \cdot 1$ | $6 \cdot 9$ | $6 \cdot 7$ | $6 \cdot 5$ |
| 12 | $9 \cdot 3$ | $8 \cdot 9$ | $8 \cdot 6$ | $8 \cdot 3$ | $8 \cdot 0$ | $7 \cdot 8$ | $7 \cdot 5$ | $7 \cdot 3$ | 7-1 | $6 \cdot 9$ |
| 13 | $9 \cdot 6$ | $9 \cdot 2$ | $8 \cdot 9$ | $8 \cdot 6$ | $8 \cdot 4$ | $8 \cdot 1$ | $7 \cdot 9$ | $7 \cdot 6$ | $7 \cdot 4$ | $7 \cdot 2$ |
| 14 | $9 \cdot 9$ | $9 \cdot 5$ | $9 \cdot 2$ | $8 \cdot 9$ | $8 \cdot 6$ | $8 \cdot 4$ | $8 \cdot 1$ | $7 \cdot 9$ | $7 \cdot 7$ | $7 \cdot 5$ |
| 15 | 10.2 | $9 \cdot 8$ | $9 \cdot 5$ | $9 \cdot 2$ | $8 \cdot 9$ | $8 \cdot 6$ | $8 \cdot 4$ | $8 \cdot 2$ | $8 \cdot 0$ | $7 \cdot 8$ |
| 16 | 10.4 | 10.0 | $9 \cdot 7$ | $9 \cdot 4$ | $9 \cdot 1$ | $8 \cdot 9$ | $8 \cdot 6$ | $8 \cdot 4$ | $8 \cdot 2$ | $8 \cdot 0$ |
| 17 | $10 \cdot 6$ | 10.3 | $9 \cdot 9$ | $9 \cdot 6$ | $9 \cdot 4$ | 9.1 | $8 \cdot 9$ | $8 \cdot 6$ | $8 \cdot 4$ | $8 \cdot 2$ |
| 18 | 10.8 | $10 \cdot 4$ | $10 \cdot 1$ | $9 \cdot 8$ | $9 \cdot 5$ | $9 \cdot 3$ | 9.0 | $8 \cdot 8$ | $8 \cdot 6$ | $8 \cdot 4$ |
| 19 | 10.9 | $10 \cdot 6$ | $10 \cdot 3$ | 9.9 | 9.7 | $9 \cdot 4$ | $9 \cdot 2$ | $8 \cdot 9$ | $8 \cdot 7$ | $8 \cdot 5$ |
| 20 | II•I | 10.7 | 10.4 | 10.1 | $9 \cdot 8$ | $9 \cdot 6$ | $9 \cdot 3$ | 9*1 | $8 \cdot 9$ | $8 \cdot 7$ |
| 22 | 11•3 | II.O | 10.7 | 10.3 | $10 \cdot 1$ | $9 \cdot 8$ | $9 \cdot 6$ | $9 \cdot 4$ | $9 \cdot 2$ | $9{ }^{\circ}$ |
| 24 | II•6 | II.2 | 10.9 | $10 \cdot 6$ | $10 \cdot 3$ | 10.0 | $9 \cdot 8$ | $9 \cdot 6$ | $9 \cdot 4$ | $9 \cdot 2$ |
| 26 | II•7 | II.4 | II'I | 10.7 | 10.5 | 10.2 | 10.0 | $9 \cdot 8$ | $9 \cdot 5$ | $9 \cdot 3$ |
| 28 | II•9 | II• 5 | II*2 | 10.9 | 10.6 | 10.4 | 10.2 | 9.9 | $9 \cdot 7$ | $9 \cdot 5$ |
| 30 | $12 \cdot 1$ | 11.7 | II.4 | II•I | 10.8 | $10 \cdot 5$ | $10 \cdot 3$ | 10.1 | $9 \cdot 9$ | $9 \cdot 7$ |
| 35 | 12.4 | $12 \cdot 0$ | II'\% | II•3 | II•I | 10.8 | $10 \cdot 6$ | $10 \cdot 4$ | 10.I | $9 \cdot 9$ |
| 40 | 12.6 | $12 \cdot 2$ | II•9 | II•6 | II•3 | II•O | 10.8 | $10 \cdot 6$ | $10 \cdot 4$ | 10.2 |
| 45 | 12.8 | 12.4 | 12.1 | IT•8 | 11.5 | II•2 | II•O | 10.8 | $10 \cdot 5$ | $10 \cdot 3$ |
| 50 | 12.9 | 12.5 | 12.2 | I 1.9 | II•6 | II.4 | II•2 | 10.9 | 10.7 | $10 \cdot 5$ |
| 55 | $13 \cdot 1$ | 12.7 | 12.4 | $12 \cdot 1$ | Ir.8 | II•5 | IT•3 | IT•I | 10.9 | $10 \cdot 7$ |
| 60 | 13.2 | 12.8 | 12.5 | 12.2 | I1.9 | II•6 | 11.4 | II•2 | IT0 | 10.8 |
| 65 | I3.3 | 12.9 | 12.6 | 12.3 | 12.0 | II•8 | II•5 | IT3 | II•I | 10.9 |
| 70 | 13.4 | 13.0 | 12.7 | 12.4 | 12.1 | II.9 | II•6 | 11.4 | II•2 | II.O |
| 80 | 13.6 | 13.2 | 12.9 | $12 \cdot 6$ | 12.3 | 12.0 | 11.8 | IT•6 | II.4 | II.2 |
| 90 | 13.7 | 13.4 | 13.0 | $12 \cdot 7$ | 12.5 | 12.2 | 12.0 | 11.7 | II.5 | II.3 |

CORRECTION OF A STAR'S ALITTUDE. (Subtract.)

| $\begin{aligned} & \text { Star's } \\ & \text { Alt. } \end{aligned}$ | Height of the Eye, in Feet. |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 6 ft . | 8 ft . | 10 ft . | 12 ft . | 14 ft . | 16 ft . | 18 ft . | 20 ft . | 22 ft . | 24 ft . |
| 5 | I2.3 | 12.6 | $13 \cdot 1$ | 13.4 | 13.7 | 13.9 | 14.2 | 14.4 | 14.6 | 14.8 |
| 6 | $10 \cdot 9$ | 11.3 | Ir.6 | 12.0 | 12.3 | 12.5 | 12.8 | $13^{\circ} 0$ | 13.2 | 13.4 |
| 7 | $9 \cdot 7$ | 10.2 | 10.5 | 10.9 | $12 \cdot 1$ | 11.4 | 11.6 | II.9 | 12.1 | 12.3 |
| 8 | $9 \cdot 0$ | $9 \cdot 3$ | $9 \cdot 7$ | 10.0 | $10 \cdot 3$ | 10.5 | 10.8 | 11.0 | 11.2 | $\underline{1154}$ |
| 9 | 8.3 | $8 \cdot 7$ | $9 \cdot 0$ 8.4 | $9 \cdot 3$ | $9 \cdot 6$ | $9 \cdot 8$ | $10 \cdot 1$ | 10.3 | 10.5 | 10.7 |
| 10 | $7 \cdot 7$ | $8 \cdot \mathrm{I}$ | $8 \cdot 4$ | $8 \cdot 7$ | $9 \cdot 0$ | $9 \cdot 3$ | 9.5 | $9 \cdot 7$ | 10.0 | $10 \cdot 2$ |
| 11 | $7 \cdot 3$ | $7 \cdot 6$ | $7 \cdot 9$ | $8 \cdot 3$ | 8.5 | $8 \cdot 8$ | $9 \cdot{ }^{\circ}$ | $9 \cdot 3$ | 9.5 | $9 \cdot 7$ |
| 12 | $6 \cdot 9$ $6 \cdot 5$ | $7 \cdot 2$ $6 \cdot 9$ | $7 \cdot 5$ | 7.9 7.5 | $8 \cdot 8$ | $8 \cdot 4$ 8.0 | $8 \cdot 6$ 8.3 | $8 \cdot 9$ 8.5 | $9 \cdot 1$ $8 \cdot 7$ 8. | $9 \cdot 3$ |
| 14 | $6 \cdot 2$ | ${ }_{6}^{6.6}$ | $7 \cdot 2$ $6 \cdot 9$ | $7 \cdot 5$ $7 \cdot 2$ | $7 \cdot 5$ | $8 \cdot 0$ $7 \cdot 8$ | $8 \cdot 3$ 8.0 | $8 \cdot 5$ 8.2 | $8 \cdot 7$ $8 \cdot 5$ | $8 \cdot 9$ $8 \cdot 7$ |
| 15 | $6 \cdot 0$ | $6 \cdot 3$ | $6 \cdot 6$ | 7.0 | 7.2 | $7 \cdot 5$ | $7 \cdot 7$ | $8 \cdot 0$ | $8 \cdot 2$ | $8 \cdot 4$ |
| 16 | $5 \cdot 8$ | $6 \cdot 1$ | $6 \cdot 4$ | $6 \cdot 8$ | $7 \cdot 0$ | $7 \cdot 3$ | $7 \cdot 5$ | $7 \cdot 7$ | $8 \cdot 0$ | $8 \cdot 2$ |
| 17 | $5 \cdot 5$ | $5 \cdot 9$ | $6 \cdot 2$ | $6 \cdot 5$ | $6 \cdot 8$ | $7 \cdot 0$ | $7 \cdot 3$ | $7 \cdot 5$ | $7 \cdot 7$ | $7 \cdot 9$ |
| 18 | 5.4 | $5 \cdot 7$ | $6 \cdot 0$ | $6 \cdot 4$ | $6 \cdot 6$ | $6 \cdot 9$ | $7 \cdot 1$ | $7 \cdot 3$ | $7 \cdot 6$ | $7 \cdot 8$ |
| 19 | 5-2 | $5 \cdot 6$ | $5 \cdot 9$ | $6 \cdot 2$ | $6 \cdot 5$ | $6 \cdot 7$ | $7 \cdot 0$ | $7 \cdot 2$ | $7 \cdot 4$ | $7 \cdot 6$ |
| 20 | $5 \cdot 0$ | $5 \cdot 4$ | $5 \cdot 7$ | $6 \cdot 0$ | $6 \cdot 3$ | $6 \cdot 6$ | $6 \cdot 8$ | $7 \cdot 0$ | $7 \cdot 3$ | $7 \cdot 5$ |
| 22 | 4.8 | 5-2 | $5 \cdot 5$ | $5 \cdot 8$ | $6 \cdot \mathrm{I}$ | $6 \cdot 3$ | $6 \cdot 5$ | $6 \cdot 8$ | $7 \cdot 0$ | $7 \cdot 2$ |
| 24 | $4 \cdot 6$ | 4.9 | $5 \cdot 3$ | $5 \cdot 6$ | $5 \cdot 8$ | $6 \cdot 1$ | $6 \cdot 3$ | $6 \cdot 6$ | $6 \cdot 8$ | $7 \cdot 0$ |
| 26 | 4.4 | $4 \cdot 8$ | $5 \cdot 1$ | $5 \cdot 4$ | $5 \cdot 7$ | 5.9 | $6 \cdot 1$ | $6 \cdot 4$ | $6 \cdot 6$ | $6 \cdot 8$ |
| 28 | $4 \cdot 2$ | $4 \cdot 6$ | $4 \cdot 9$ | $5 \cdot 2$ | $5 \cdot 5$ | $5 \cdot 7$ | $6 \cdot 0$ | $6 \cdot 2$ | $6 \cdot 4$ | $6 \cdot 6$ |
| 30 35 | $4 \cdot 1$ $3 \cdot 8$ | $4 \cdot 4$ | $4 \cdot 8$ | $5 \cdot \mathrm{I}$ | $5 \cdot 3$ | $5 \cdot 6$ | $5 \cdot 8$ | $6 \cdot \mathrm{I}$ | $6 \cdot 3$ | $6 \cdot 5$ |
| 35 | $3 \cdot 8$ | $4 \cdot 2$ | $4 \cdot 5$ | $4 \cdot 8$ | $5 \cdot 1$ | $5 \cdot 3$ | $5 \cdot 5$ | $5 \cdot 8$ | $6 \cdot 0$ | $6 \cdot 2$ |
| 40 | $3 \cdot 6$ | 3.9 | $4 \cdot 3$ | $4 \cdot 6$ | $4 \cdot 8$ | $5 \cdot 1$ | $5 \cdot 3$ | $5 \cdot 6$ | $5 \cdot 8$ | $6 \cdot 0$ |
| 45 | 3.4 | $3 \cdot 8$ | 4.I | $4 \cdot 4$ | $4 \cdot 6$ | $4 \cdot 9$ | $5 \cdot 1$ | $5 \cdot 4$ | $5 \cdot 6$ | $5 \cdot 8$ |
| 50 | 3.2 | $3 \cdot 6$ | 3.9 | $4 \cdot 2$ | $4 \cdot 5$ | $4 \cdot 7$ | $5 \cdot 0$ | $5 \cdot 2$ | $5 \cdot 4$ | $5 \cdot 6$ |
| 55 60 | 3.1 3.0 | 3.4 3.3 | $3 \cdot 8$ $3 \cdot 7$ | $4 \cdot \mathrm{I}$ $4 \cdot 0$ | 4.4 4.2 | 4.6 4.5 | $4 \cdot 8$ | $5 \cdot 1$ $5 \cdot 0$ | $5 \cdot 3$ $5 \cdot 2$ | $5 \cdot 5$ |
| 65 | 2.9 | 3.2 | $3 \cdot 6$ | $3 \cdot 9$ | $4 \cdot \mathrm{I}$ | 4.5 | 4.7 | 5.0 4.9 | $5 \cdot 2$ $5 \cdot 1$ | 5.4 $5 \cdot 3$ |
| 70 | $2 \cdot 8$ | $3 \cdot 1$ | $3 \cdot 5$ | $3 \cdot 8$ | $4 \cdot 0$ | $4 \cdot 3$ | $4 \cdot 5$ | 4.8 | $5 \cdot 0$ | 5.2 |
| 80 | 2.6 | 2.9 | $3 \cdot 3$ | $3 \cdot 6$ | $3 \cdot 9$ | $4 \cdot \mathrm{I}$ | $4 \cdot 3$ | $4 \cdot 6$ | $4 \cdot 8$ | $5 \cdot 0$ |
| 90 | 2.4 | $2 \cdot 8$ | $3 \cdot 1$ | 3.4 | 3.7 | 3.9 | $4 \cdot 2$ | $4 \cdot 4$ | $4 \cdot 6$ | $4 \cdot 8$ |

TABLE XVI $a$.


## CORRECTIONS OF ALTITUDE OF THE SUN AND STARS．

 （Involving Dip，Refraction，©＇s Semidiameter，and Parallax．）Add the Cor．to the Alt．of the $\odot$＇s Lower Limb，except where marked－（minus）．

| 我范 | Height of the Eye，in Feet． |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 26 ft ． | 28 ft ． | 30 ft ． | 35 ft ． | 40 ft ． | 45 ft ． | 50 ft ． | 55 ft ． | 60 ft ． | 70 ft ． | 80 ft ． |
| $\stackrel{\circ}{5}$ |  | 0.9 | $0 \cdot 7$ | 0.3 | －0．1 | －0．5 | －0．8 | －1．2 | －${ }^{\prime} \cdot 6$ | －2．8 | $-3^{\prime} \cdot 3$ |
| 6 | $2 \cdot 5$ | $2 \cdot 4$ | $2 \cdot 2$ | 1．7 | $1 \cdot 3$ | 0.9 | 0.6 | 0.2 | －0．1 | －0．7 | －1•3 |
| 7 | 3.6 | $3 \cdot 5$ | 3.3 | $2 \cdot 8$ | $2 \cdot 4$ | $2 \cdot 1$ | 1．7 | $1 \cdot 3$ | $1 \cdot 0$ | 0.4 | －0．2 |
| 8 | 4.5 | $4 \cdot 3$ | $4 \cdot 2$ | 3.7 | $3 \cdot 3$ | 3.0 | 2.6 | $2 \cdot 2$ | $1 \cdot 9$ | $1 \cdot 3$ | 0.7 |
| 9 | 5.2 | $5 \cdot 0$ | 4.8 | $4 \cdot 4$ | 4.0 | 3.6 | $3 \cdot 3$ | $2 \cdot 9$ | $2 \cdot 6$ | 2.0 | 1.4 |
| 10 | $5 \cdot 8$ | 5.6 | $5 \cdot 4$ | $5 \cdot 0$ | 4.6 | 4.2 | 3.8 | 3.5 | 3.2 | 2.5 | 2.0 |
| 11 | $6 \cdot 3$ | $6 \cdot 1$ | $5 \cdot 9$ | $5 \cdot 5$ | 5.0 | $4 \cdot 7$ | $4 \cdot 3$ | 4.0 | 3.6 | 3.0 | $2 \cdot 5$ |
| 12 | $6 \cdot 7$ | $6 \cdot 5$ | $6 \cdot 3$ | 5.9 | $5 \cdot 5$ | $5 \cdot \mathrm{I}$ | $4 \cdot 7$ | 4.4 | $4 \cdot \mathrm{I}$ | $3 \cdot 5$ | 2.9 |
| 13 | 7.0 | $6 \cdot 8$ | $6 \cdot 6$ | $6 \cdot 2$ | $5 \cdot 8$ | $5 \cdot 4$ | $5 \cdot 1$ | $4 \cdot 7$ | 4.4 | $3 \cdot 8$ | 3.2 |
| 14 | $7 \cdot 3$ | $7 \cdot 1$ | $6 \cdot 9$ | $6 \cdot 5$ | 6•I | $5 \cdot 7$ | $5 \cdot 4$ | $5 \cdot 0$ | $4 \cdot 7$ | $4 \cdot 1$ | $3 \cdot 5$ |
| 15 | 7.6 | $7 \cdot 4$ | $7 \cdot 2$ | $6 \cdot 8$ | $6 \cdot 4$ | $6 \cdot 0$ | $5 \cdot 6$ | $5 \cdot 3$ | $5 \cdot 0$ | 4.4 | 3.8 |
| 16 | $7 \cdot 8$ | $7 \cdot 6$ | 7.4 | $7 \cdot 0$ | $6 \cdot 6$ | 6.2 | $5 \cdot 9$ | $5 \cdot 5$ | $5 \cdot 2$ | $4 \cdot 6$ | 4.0 |
| 17 | 8.0 | $7 \cdot 8$ | 7.6 | $7 \cdot 2$ | $6 \cdot 8$ | $6 \cdot 4$ | $6 \cdot 1$ | $5 \cdot 7$ | 5.4 | $4 \cdot 8$ | $4 \cdot 2$ |
| 18 | $8 \cdot 2$ | $8 \cdot 0$ | $7 \cdot 8$ | $7 \cdot 4$ | $7 \cdot 0$ | $6 \cdot 6$ | $6 \cdot 3$ | $5 \cdot 9$ | 5.6 | $5 \cdot 0$ | 4.4 |
| 19 | $8 \cdot 3$ | $8 \cdot 2$ | $8 \cdot 0$ | 7.5 | $7 \cdot 1$ | $6 \cdot 8$ | $6 \cdot 4$ | $6 \cdot 1$ | $5 \cdot 8$ | $5 \cdot 1$ | $4 \cdot 6$ |
| 20 | $8 \cdot 5$ | $8 \cdot 3$ | 8．1 | $7 \cdot 7$ | $7 \cdot 3$ | $6 \cdot 9$ | $6 \cdot 5$ | $6 \cdot 2$ | $5 \cdot 9$ | $5 \cdot 3$ | $4 \cdot 7$ |
| 22 | $8 \cdot 7$ | $8 \cdot 6$ | 8.4 | 7.9 | $7 \cdot 5$ | $7 \cdot 2$ | $6 \cdot 8$ | $6 \cdot 5$ | $6 \cdot 2$ | $5 \cdot 5$ | $5 \cdot 0$ |
| 24 | 9.0 | $8 \cdot 8$ | $8 \cdot 6$ | $8 \cdot 2$ | 7.8 | 7.4 | 7.0 | $6 \cdot 7$ | $6 \cdot 4$ | $5 \cdot 8$ | $5 \cdot 2$ |
| 26 | $9 \cdot 1$ | 9.0 | $8 \cdot 8$ | $8 \cdot 3$ | $7 \cdot 9$ | 7.6 | $7 \cdot 2$ | 6.9 | $6 \cdot 6$ | $5 \cdot 9$ | $5 \cdot 4$ |
| 28 | $9 \cdot 3$ | 9．1 | $8 \cdot 9$ | $8 \cdot 5$ | $8 \cdot 1$ | $7 \cdot 7$ | $7 \cdot 4$ | 7.0 | $6 \cdot 7$ | $6 \cdot 1$ | $5 \cdot 5$ |
| 30 | 9.5 | $9 \cdot 3$ | 9．1 | $8 \cdot 7$ | $8 \cdot 3$ | $7 \cdot 9$ | 7.5 | 7.2 | 6.9 | $6 \cdot 3$ | $5 \cdot 7$ |
| 35 | $9 \cdot 7$ | $9 \cdot 6$ | 9.4 | $8 \cdot 9$ | $8 \cdot 5$ | $8 \cdot 2$ | 7.8 | 7.5 | $7 \cdot 2$ | $6 \cdot 5$ | $6 \cdot 0$ |
| 40 | 10.0 | 9.8 | $9 \cdot 6$ | $9 \cdot 2$ | $8 \cdot 8$ | $8 \cdot 4$ | $8 \cdot 0$ | 7.7 | $7 \cdot 4$ | $6 \cdot 8$ | $6 \cdot 2$ |
| 45 | $10 \cdot 1$ | $10 \cdot 0$ | $9 \cdot 8$ | $9 \cdot 4$ | $9 \cdot 0$ | $8 \cdot 6$ | $8 \cdot 2$ | 7.9 | $7 \cdot 6$ | 7.0 | $6 \cdot 4$ |
| 50 | 10.3 | $10 \cdot 1$ | $9 \cdot 9$ | $9 \cdot 5$ | $9 \cdot 1$ | $8 \cdot 7$ | $8 \cdot 4$ | $8 \cdot 0$ | $7 \cdot 7$ | 7．1 | $6 \cdot 5$ |
| 55 | $10 \cdot 5$ | $10 \cdot 3$ | $10 \cdot 1$ | $9 \cdot 7$ | $9 \cdot 3$ | $8 \cdot 9$ | $8 \cdot 5$ | $8 \cdot 2$ | $7 \cdot 9$ | $7 \cdot 3$ | $6 \cdot 7$ |
| 60 | 10.6 | 10.4 | $10 \cdot 2$ | 9.8 | $9 \cdot 4$ | 9.0 | $8 \cdot 6$ | $8 \cdot 3$ | 8.0 | $7 \cdot 4$ | $6 \cdot 8$ |
| 65 | 10.7 | 10.5 | $10 \cdot 3$ | 9.9 | 9.5 | $9 \cdot 1$ | $8 \cdot 7$ | $8 \cdot 4$ | $8 \cdot 1$ | 7.5 | $6 \cdot 9$ |
| 70 | $10 \cdot 8$ | 10.6 | $10 \cdot 4$ | $10 \cdot 0$ | 9.6 | $9 \cdot 2$ | $8 \cdot 8$ | $8 \cdot 5$ | $8 \cdot 2$ | $7 \cdot 6$ | $7 \cdot 0$ |
| 80 | 11.0 | 10.8 | $10 \cdot 6$ | 10.2 | $9 \cdot 8$ | $9 \cdot 4$ | 9.0 | $8 \cdot 7$ | $8 \cdot 4$ | 7.8 | $7 \cdot 2$ |
| 90 | II．I | 10.9 | 10.8 | $10 \cdot 3$ | 9.9 | 9.6 | $9 \cdot 2$ | 8.9 | $8 \cdot 5$ | 7.9 | 7.4 |

SUPPLEMENTARY TABLES FOR LOW ALTITUDES．

Correction for Small Altitudes．

|  |  | 2nd Correction， Various Heights． |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | Add to |  |
|  |  | － | $\left.\begin{array}{l}\begin{array}{l}\text { Subt．} \\ \text { from }\end{array}\end{array}\right\}$ |  |
|  |  | Ft． |  |  |
| $\begin{array}{rrr}3 & 0 \\ 3 & 10 \\ 3\end{array}$ | －4．9 | 6 | $+3 \cdot 8$ |  |
|  | $4 \cdot 4$ | 8 | 3.4 |  |
| 320 | 3.9 | 10 | 3.1 |  |
| 330 | 3.4 | 12 | $2 \cdot 8$ |  |
| 340 | 3.0 | 14 | 2.5 |  |
| 350 | 2.5 | 16 | $2 \cdot 3$ |  |
| 4 O | 2.1 | 18 | $2 \cdot 1$ |  |
| 410 | 1．8 | 20 | 1．8 |  |
| 420 | 1.4 | 22 | $1 \cdot 6$ |  |
| 430 | 1.0 | 24 | 1.4 |  |
| 440 | 0.8 | 26 | 1.2 |  |
| 5 o | 0.2 | 28 | $1 \cdot 0$ |  |
| 520 | ＋0．4 | 30 | 0.8 |  |
| 540 | 0.9 | 32 | $0 \cdot 7$ |  |
| 6 0 | $1 \cdot 3$ | 34 | $0 \cdot 5$ |  |
| 620 | $1 \cdot 7$ | 36 | $0 \cdot 3$ |  |
| 640 | $2 \cdot 1$ | 38 | $0 \cdot 2$ |  |
| 7 0 | $2 \cdot 4$ | 40 | $0 \cdot 0$ |  |
| 720 | $2 \cdot 7$ | 42 | －0．2 |  |
| 740 | 3.0 | 44 | $0 \cdot 3$ |  |
| 8 8 | $3 \cdot 3$ | 46 | $0 \cdot 5$ |  |
| 820 | 3.5 | 48 | 0.6 |  |
| 840 | 3.8 | 50 | $0 \cdot 7$ |  |
| 850 | －3．9 | 52 | 0.9 |  |
| 9 o | 4.0 | 54 | $1 \cdot 0$ |  |
| 920 | 4.2 | 56 | $1 \cdot 1$ |  |
| 940 | 4.4 | 60 | 1.4 |  |
| 10 O | $4 \cdot 6$ | 65 | $1 \cdot 7$ |  |
| 1030 | $4 \cdot 8$ | 70 | $2 \cdot 0$ |  |
| II 0 | 5.0 | 75 | $2 \cdot 3$ |  |

CORRECTION OF A STAR＇S ALIITUDE．（Subtract．）

|  | Height of the Eye，in Feet． |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 尔 | 26 ft .2 | 28 ft. | 30 ft ． | 35 ft .4 | 40 ft ． | 45 ft ． | 50 ft ． | 55 ft .6 | 60 ft ． | 70 ft ． | 80 ft ． |
| ${ }^{\circ} 5$ | 15．0 | 15.2 | 15.4 | 15.8 | $16 \cdot 3$ | 16．6 | 17.0 | 17.4 | 17・ク | 18.4 | 18．9 |
| 6 | I3．6 | $13^{\circ} 8$ | $14^{\circ} \mathrm{O}$ | 14.4 | 14.8 | 15.2 | 15.6 | 15．9 | $16 \cdot 3$ | 16.9 | 17.5 |
| 7 | 12.5 | 12.7 | 12.9 | $13 \cdot 3$ | 13.7 | 14.1 | $14^{\circ} 6$ | 14.8 | $15 \cdot 1$ | 15.8 | 16.3 |
| 8 | 11．6 | 11.8 | 12.0 | 12.4 | 12.8 | 13.2 | 13.6 | 13.9 | 14.3 | $14^{\circ} 9$ | 15.4 |
| 9 | 10.9 | II＇I | II•3 | II•7 | 12.1 | 12.5 | 12.9 | 13.2 | 13.5 | 14.2 | 14．7 |
| 10 | $10 \cdot 4$ | 10.6 | $10 \cdot 7$ | 11.2 | II•6 | II•9 | 12.3 | 12.6 | 13.0 | $13^{\circ} 6$ | 14.2 |
| 11 | 9.9 | $10 \cdot 1$ | $10 \cdot 3$ | 10.7 | II•I | II．5 | 11．9 | 12.2 | 12.5 | 13.1 | 13.7 |
| 12 | $9 \cdot 5$ | $9 \cdot 7$ | 9.8 | 10.3 | $10 \cdot 7$ | Ir 0 | IIP4 | II． 8 | 12.1 | 12.7 | 13.3 |
| 13 | $9 \cdot 1$ | $9 \cdot 3$ | $9 \cdot 5$ | $9 \cdot 9$ | $10 \cdot 3$ | $10 \cdot 7$ | II•I | II．4 | II＇7 | $12 \cdot 3$ | 12.9 |
| 14 | 8.9 | 9.0 | $9 \cdot 2$ | $9 \cdot 7$ | $10 \cdot 1$ | 10.4 | 10.8 | II• 1 | II• 4 | $12 \cdot 1$ | 12.6 |
| 15 | $8 \cdot 6$ | 8.8 | $8 \cdot 9$ | $9 \cdot 4$ | 9.8 | $10 \cdot 1$ | 10.5 | 10.8 | II．2 | 11.8 | 12.3 |
| 16 | $8 \cdot 4$ | $8 \cdot 5$ | $8 \cdot 7$ | $9 \cdot 2$ | $9 \cdot 6$ | 9.9 | $10 \cdot 3$ | $10 \cdot 6$ | 10.9 | II．6 | $12 \cdot \mathrm{I}$ |
| 17 | $8 \cdot 1$ | $8 \cdot 3$ | $8 \cdot 5$ | $8 \cdot 9$ | $9 \cdot 3$ | $9 \cdot 7$ | 10.1 | 10.4 | $10 \cdot 7$ | 11.4 | II．9 |
| 18 | 7.9 | $8 \cdot 1$ | $8 \cdot 3$ | $8 \cdot 8$ | $9 \cdot 2$ | $9 \cdot 5$ | 9.9 | 10.2 | $10 \cdot 5$ | II 2 | II• 7 |
| 19 | $7 \cdot 8$ | $8 \cdot 0$ | $8 \cdot 2$ | $8 \cdot 6$ | 9.0 | 9.4 | $9 \cdot 7$ | 101 | 10.4 | II．0 | II• 6 |
| 20 | $7 \cdot 7$ | 7.8 | $8 \cdot 0$ | $8 \cdot 5$ | $8 \cdot 9$ | $9 \cdot 2$ | 9.6 | 9.9 | 10.2 | $10 \cdot 9$ | II．4 |
| 22 | $7 \cdot 4$ | $7 \cdot 6$ | $7 \cdot 8$ | $8 \cdot 2$ | 8.6 | 9.0 | $9 \cdot 3$ | $9 \cdot 7$ | $10 \cdot 0$ | 10.6 | II． 2 |
| 24 | 7.2 | 7.4 | 7.5 | $8 \cdot 0$ $7 \cdot 8$ | $8 \cdot 4$ | $8 \cdot 7$ | $9 \cdot 1$ | $9 \cdot 4$ | 9.8 | $10 \cdot 4$ | $10 \cdot 9$ |
| 26 | $7 \cdot 0$ 6.8 | $7 \cdot 2$ | $7 \cdot 4$ | $7 \cdot 8$ | $8 \cdot 2$ | $8 \cdot 6$ | 8.9 | $9 \cdot 3$ | 9.6 | 10.2 | 10.8 |
| 28 |  | 7.0 | 7.2 | $7 \cdot 6$ | $8 \cdot 0$ | $8 \cdot 4$ | $8 \cdot 8$ | $9 \cdot 1$ | 9.4 | $10 \cdot 0$ | $10 \cdot 6$ |
| 30 35 | $6 \cdot 7$ 6.4 | 6.9 6.6 | 7.0 6.8 | $7 \cdot 5$ $7 \cdot 2$ | 7.9 7.6 | 8.2 8.0 | 8.6 8.3 | 8.9 8.7 | 9.3 0.0 | 9.9 9.6 | 10.4 10.2 |
| 40 | $6 \cdot 2$ | $6 \cdot 4$ | $6 \cdot 5$ | $7 \cdot 0$ | $7 \cdot 4$ | $7 \cdot 7$ | $8 \cdot \mathrm{I}$ | $8 \cdot 4$ | 8.8 | $9 \cdot 4$ | 9．9 |
| 45 | $6 \cdot 0$ | 6.2 | $6 \cdot 4$ | $6 \cdot 8$ | $7 \cdot 2$ | 7.6 | 7.9 | $8 \cdot 3$ | $8 \cdot 6$ | $9 \cdot 2$ | 9.8 |
| 50 | $5 \cdot 8$ | $6 \cdot 0$ | $6 \cdot 2$ | $6 \cdot 6$ | $7 \cdot 0$ | $7 \cdot 4$ | $7 \cdot 8$ | $8 \cdot \mathrm{I}$ | $8 \cdot 4$ | 9.0 | 9.6 |
| 55 | $5 \cdot 7$ | $5{ }^{5} 9$ | 6•I | $6 \cdot 5$ | $6 \cdot 9$ | $7 \cdot 3$ | $7 \cdot 6$ | 7.9 | $8 \cdot 3$ | 8.9 | 9.5 |
| 60 | $5 \cdot 6$ | $5 \cdot 8$ | 5.9 | 6.4 | $6 \cdot 8$ | $7 \cdot 1$ | 7.5 | $7 \cdot 8$ | $8 \cdot 2$ | 8.8 | $9 \cdot 3$ |
| 65 | $5 \cdot 5$ | $5 \cdot 7$ | $5 \cdot 8$ | $6 \cdot 3$ | $6 \cdot 7$ | 7.0 | $7 \cdot 4$ | $7 \cdot 7$ | $8 \cdot 1$ | $8 \cdot 7$ | $9 \cdot 2$ |
| 70 80 | 5.4 5.2 | 5.6 5.4 | $5 \cdot 7$ 5.6 | $6 \cdot 2$ $6 \cdot 0$ | $6 \cdot 6$ 6.4 | 6.9 6.8 | 7.3 | 7.6 | 8.0 7.8 | 8.6 8.4 | $9 \cdot 1$ |
| 80 | 5.2 5.0 | $5 \cdot 4$ $5 \cdot 2$ | 5.6 5.4 | $6 \cdot 0$ 5.8 | $6 \cdot 4$ 6.2 | 6.8 6.6 | 7.1 6.9 | $7 \cdot 5$ | 7.8 7.6 | 8.4 8.2 | 9.0 <br> 8.8 |


|  |  | 2nd Correction， Various Heights． |  |
| :---: | :---: | :---: | :---: |
|  |  |  | Add to） |
|  |  | － | $\left.\begin{array}{l}\text { Subt．} \\ \text { from }\end{array}\right\}$ |
|  | 21． | Ft． |  |
| 30 | $21 \cdot 1$ | 6 | $+3 \cdot 8$ |
| 310 | $20 \cdot 6$ | － 8 | 3.4 |
| 320 | 20.0 | 10 | $3 \cdot 1$ |
| 330 | 19.5 | 12 | $2 \cdot 8$ |
|  | $19 \cdot 1$ | 14 | $2 \cdot 5$ |
| 350 | 18.7 | 16 | $2 \cdot 3$ |
|  | 18.3 | 18 | $2 \cdot 1$ |
| 410 | 17.9 | 20 | 1．8 |
| 420 | 17.5 | 22 | 1．6 |
| 430 | 17.2 | 24 | 1.4 |
| 440 | 16.9 | 26 | $1 \cdot 2$ |
| 50 | $16 \cdot 3$ | 28 | $1 \cdot 0$ |
| 520 | 15.8 | 30 | 0.8 |
| 540 | 15.3 | 32 | $0 \cdot 7$ |
| 6 o | 14.8 | 34 | 0.5 |
| 620 | 14.4 | 36 | $0 \cdot 3$ |
| 640 | 14＊1 | 38 | $0 \cdot 2$ |
| 7 o | $13 \cdot 7$ | 40 | 0.0 |
| 720 | 13.4 | 42 | －0．2 |
| 740 | $13 \cdot 1$ | 44 | $0 \cdot 3$ |
| 8 o | 12.8 | 46 | $0 \cdot 5$ |
| 820 | 12.6 | 48 | 0.6 |
| 840 | 12.4 | 50 | 0.7 |
| 850 | $12 \cdot 3$ | 52 | 0.9 |
| 9 o | 12.1 | 54 | $1 \cdot 0$ |
| 920 | II•9 | 56 | I• |
| 940 | 11．7 | 60 | $1 \cdot 4$ |
| 10 O | 11．6 | 65 | $1 \cdot 7$ |
| 1030 | II•3 | 70 | 2.0 |
| II 0 | If1 | 75 | $2 \cdot 3$ |

# RULE OF THE ROAD FOR SALLING-SHIPS 

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[The United Service Gazette, London, October 15 th, 1914.j


#### Abstract

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[^3][^4]
# TABLES FOR AZIMUTHS, GREAT-CIRCLE SAILING 

AND

# REDUCTION TO THE MERIDIAN. 


#### Abstract

[From the Lyttelton Times, 24th June 1905.] "The author's new method of dealing with the 'Sumner' problem is fully discussed, and his method compared and contrasted on pages 49, 75, 80, and 81 with the method prescribed by the Board of Trade for candidates seeking a certificate. The simplicity, availability, and greater accuracy of this new method should shortly lead to the Board of Trade prescribing it in their syllabus, instead of the older, more cumbrous, and less accurate method, which has done service for so many years. In the second example of the contrasted methods the older method shows an error of no less than $4 \frac{1}{2}^{\prime}$ in latitude and $5^{\prime}$ in longitude. "Only a very few of the points of excellence contained in this work are noticed. It should be in the hands of all having to do with the sea. Every phase of practical, up-todate navigational method is here clearly explained with a master touch, and the work forms an invaluable addition to the literature of the sea."


## [From the Auckland Star, 8th July 1905.]

" A very valuable work for mariners has just been published by Captain Blackburne entitled 'A, B, and C Azimuth Tables.' The azimuth tables are brief, yet compendious enough for sun, moon, and stars under all ordinary circumstances, while the improved Sumner's method is a valuable acquisition, and will certainly supersede the older and longer method now in vogue. The examples of the various subjects dealt with are beautifully worked out with a clearness, briefness, and accuracy that creates admiration; indeed, the book is replete with all that is required in working out those vital problems so necessary in this present age of steam and speed for reliable and correct navigation-i.e., the position of the vessel and the correct course to steer-and confers a boon on the rising generation of navigators that their predecessors never dreamt of."

## [From the New Zealand Times, 8th July 1905.]

" Another feature of the work is Captain Blackburne's method of dealing with the popular 'Sumner' problem. This has been favourably commented upon in all reviews of the 'New Zealand Nautical Almanac,' in which the method first appeared. Captain Blackburne summarises the advantages of it over the method at present encouraged in Board of Trade examinations, as follows (page vi): (1) Greater accuracy; (2) fewer figures, and consequently less time required for the work; (3) one chart does for any navigable latitude; and (4) many observations which would be considered useless for the ordinary "Sumner" give excellent results with even fewer figures by combining ex-meridian and chronometer observations together, as illustrated in this book by various examples. The book abounds with notes of great practical value to mariners."

## [From the Syren and Shipping, 23rd August 1905.]

"Captain Blackburne's labour-saving aids for navigators are known all over the world by his brethren who keep themselves posted in up-to-date methods; and this collection of tables now published leaves nothing to desire by the navigator wishful of finding his ship's geographical position, or the error of her compass, with the least possible chance of error, and in the shortest possible interval of time, anywhere within the usual limits of navigation. There is one point in connection with these tables which is deserving of the close consideration of the Board of Trade. Although the practical seaman will almost invariably use such data at sea, yet the Board compels the candidates for certificates to plod along in a way which gives admittedly erroneous results under certain conditions. . . . That the Board of Trade should examine along one line-that of antiquity-and that practical navigators should work along quite another line-that of labour-saving tablesis surely ludicrous. The New Zealand Government requested the Board of Trade to allow the use in the examination-room of tables like those of Captain Blackburne's, together with improved methods of working, but the request has not been granted. We sincerely trust that the Board of Trade will see fit to adopt modern methods by allowing the candidates permission to use the A, B, C Azimuth Tables of Blackburne, or any similar laboursaving work."

## EXTRACTS FROM PAPER REVIEWS-Continued.

## [From the Nautical Magazine, September 1908.]

"In the new edition of his well-known A, B, C, and D Tables, Captain Blackburne must surely have cut all existing records."

## [From the Nautical Magazine, December 1908, on the latest edition.]

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## [From Syren and Shipping Illustrated, London, 4 th November 1908.]

"We have only praise for the one-hundred-and-sixty-page volume of 'Tables for Azimuth, Great-circle Sailing, and Reduction to the Meridian,' by Captain H. S. Blackburne. The tables are comprehensive, yet concise, and practical navigators will find that the 7 s .6 d spent on acquiring them is certain to save a lot of mistake-inviting figure-manipulation at a critical moment. ... More convenient in form or more utilitarian in application these tables could not be."

## [From Shipping Illustrated, New York, 5th December 1908.]

" These tables, as set forth in the present edition, are the most complete and comprehensive Azimuth and Ex-meridian Tables for practical work yet published."

## [From the Shipping World, 9th December 1908.]

"The new issue of his $\mathrm{A}, \mathrm{B}$, and C Tables for Azimuth, etc., which has reached us from the New Zealand Government's Marine Department, through the High Commissioner, in London, is undoubtedly the most complete and comprehensive volume on this subject yet published."
[From the United Service Magazine, December 1908.]
"These tables now make it possible to determine the position of the ship more readily at any time, and with less trouble than ever before."

## [From the Mariner, 15 th December 1908.]

"Sufficient is it to say that the various navigation tables, rules and examples, including a new and improved 'Sumner' method, make the volume on all counts one of the most complete and authoritative that we know in nautical literature."

## [The Press, Christchurch, 24th January 1912.] <br> VALUABLE NAUTICAL PUBLICATION.-CAPTAIN BLACKBURNE'S TABLES.

"The 'Tables for Azimuths, Great-circle Sailing, and Reduction to the Meridian," compiled by Captain H. S. Blackburne, Nautical Adviser to the New Zealand Government, have been published in a third and much improved edition by the Marine Department. This work, which is comprised in a compact and neatly bound volume, is published at 6 s ., and is highly spoken of by navigators. . . .
"The most valuable addition to this new edition of Blackburne's tables is Table M, on pages 150 and 15 I . The error of latitude to 4 seconds of error in the time is seen at a glance from the table for any ex-meridian observation, and the same table is used for facilitating the work of finding the latitude and longitude from a Sumner or double-altitude observation, either from the ex-meridians or from one ex-meridian combined with a chronometer observation.
"The great beauty of these tables and the methods presented by Captain Blackburne for position-finding from two observations is that the navigator need never concern himself about either of the bodies being too near the meridian or the prime vertical, or too high in altitude for a Sumner or double-altitude position, as even such well-known writers as the late Captain Lecky would consider a bar to reliable results; but he impresses on the navigator that the only necessary condition of importance to ensure good results is that the two observations should be sufficiently far apart in bearing to give a good cut."

# EXTRACTS FROM LETTERS re THE A, B, and C "AZIMUTH AND REDUCTION TABLES." 

[From Captain Squire T. S. Lecky, R.N.R.]

"I intend shortly to tackle a new edition of 'Wrinkles,' and will try to make it as perfect as possible. Now, I have so much admiration for your A and B tables that I consider my book incomplete without them, etc.-Neyland House, Neyland, R.S.O., Wales, 3rd November 1890."

## [From Admiral William R. Lang, R.N.]

"Your very simple and most useful azimuth tables will be a great boon to many navigators. What labour you will save them by your splendid work. . . . ! What a very useful book for navigators you have compiled !-Harrogate, 27th April I903."

## [From Lieutenant Alexander G. Wright, R.N.]

" I think it is a most excellent book indeed, and quite the best of its kind that I ever came across. Your A and B tables are old friends of mine. I had the good fortune to meet with them when I was on the China Station in 1897.-H.M.S. Brilliant, Cruiser Squadron, 2 rst June 1903."
[From Captain T. S. Angus, Nautical Inspector, P. \& O. S. N. Company.]
"Your latest A and B tables are certainly the most concise for practical work I have seen.-London, 14th September 1903."
[From Captain Thomas Liddle, s.s. Kurrachee.]
"I consider them the most complete and comprehensive azimuth tables published. Having used them for over twenty years I can speak with confidence as to their utility and accuracy, and have no hesitation in recommending them to navigators. The plane charts for the use of the 'Sumner' problem are available for any latitude, and are in themselves a boon to navigators.-Hamburg, Germany, 25th September 1905."
[From Captain Robert W. Ferguson, Brisbane, Queensland, rst July r906.]
"You indeed deserve the gratitude of seamen for the publication of these valuable tables. I have long held that every other method should give place to this. Personally, I have used Lecky's tables and the skeleton tables 27 A and B and 28 C of Norie for many years, but I shall discard them in future for your excellent tables. I do not understand why the Board of Trade continue the old cumbersome Sumner method in the examinations in preference to the graphic methods of Pagel, Johnson, and yourself."
[From Captain Thomas Mincham, Teacher of Navigation, Auckland, New Zealand, 7 th December 1908.]
"The A, B, C Azimuth Tables I have used from the start of their publication. I prefer them to all others as more simple, and much easier to learn."
[From Mr W. H. Sweny, Chief Officer, P. \& O. s.s. Moolton, Adelaide, 23rd January rgog.]
"I have now had your new edition of Azimuth and Reduction to the Meridian Tables in use for one Australian voyage, using them almost daily for stellar observation. The results obtained have been surprising, and so satisfactory that I have discarded all other books on these problems."
[From Captain John Owen, Teacher of Navigation, Cardiff, 25th January 1909.]
"Your method of solving the Time Azimuth problem by the A, B, C Tables is concise, and easy of solution. If these tables were more generally known, I think seafarers would use them in preference to Burdwood's or any other special tables employed at present."
[From Mr John Blencowe, late Second Officer, B.I. s.s. Shivala, Auckland, New Zealand, 9th February 1909.]
" In Lyttelton I obtained a copy of your new Azimuth and Ex-meridian Tables, and on showing them to my brother officers they were so taken with them that they all bought a copy themselves. I think the tables are splendid, and for the sake of the profession will do all I can to make them more widely known."
[From Mr S. C. Warner, Chief Officer, P. \& O. s.s. Socotra, off Minikoi Island, 13th September 1910.]
" I should like to add my humble testimonial to the new A, B, C Book you have brought out, and to tell you how much it is appreciated here on board. I certainly think it is the very best book of navigation ever printed."

## EXTRACTS FROM LETTERS-Continued.

[Firom Captain George Burton, Instructor of Cadets, Ocean Training-Ship Port Jackson, off Australia, 26th November 19ro.]
"I have shown your book to all our senior cadets, and advised them to procure copies. The book is certainly altogether the most complete education in modern navigation yet published."
[From Captain J. King Davis, commanding the Australasian Antarctic Expedition, s.y. Aurora, Macquarie Island, I6th December I9II.]
" We have already several copies of the previous edition, as I use nothing else, and have insisted on my officers learning to use them, as they are the only suitable tables for our work, and are much handier, in my opinion, for any latitude. I hope that they will become very widely known, as I am sure you make matters much simpler than many of the bulky and expensive tables which seem to be of much less value."
[From Mr H. Rochford Hughes, Navigating Officer, H.M. Cable Steamer Iris, Auckland, 8th February 1912.]
" I have tried ' new navigation ' methods, and all the principal tables of the day, during my search for the shortest and most accurate methods, and have come to the conclusion that for our work your tables and system generally are the best."
[From Commander Irving B. Miles, R.N., Officer in charge of Survey on Atlantic Coast of the Dominion of Canada, Department of the Naval Service Hydrographic Survey, Ottawa, 18th January 1912.]
"You may be interested to know that on my recommendation the Department here is providing all ships with your latest edition of tables. I have still your 'third edition,' 1886, which has been everywhere with me from New Zealand to Hudson Bay and Strait."
[From Commander Richard Hyde, R.N., Navigation School, Portsmouth, 12th April I9I2.]
"I have just returned from a cruise with our gunboats the Dryad and Harrier, when I used your tables exclusively for finding azimuths, and personally I prefer them to Burdwood or Weir's diagram."
[From Lieutenant Edward R. G. R. Evans, R.N., who Commanded the British Antarctic Expedition R.Y.S. Terra Nova from England to Antarctic in 19ıo. Christchurch, 17th April 1912.]
" I shall endeavour to bring your tables into more general use in the Navy, as I consider them facile princeps of their kind. Burdwood and Davis are so cumbersome. I think you will be pleased to hear that on the southern journey I used your tables exclusively, and worked out all magnetic variations and true bearings by means of them up to latitude $85^{\circ}$ and hence to $88^{\circ}$ almost by exterpolation."

## [From Captain L. B. Bennett Gillman, s.s. Matatua, London, 30th April 1912.]

" Before leaving Wellington on our last homeward voyage I procured a 1911 edition of your tables for azimuth and reduction to the meridian. I think it is the cheapest and best book on practical navigation ever offered to the seafaring community. Had the price been two guineas instead of six shillings it would have been nearer the intrinsic value of the book. The tables are absolutely the last word in modern and up-to-date navigation."
[From Lieutenant Harry Pennell, R.N., commanding the British Antarctic Expedition R.Y.S. Terra Nova, Lyttelton, 3rd June 1912.]
"I have used your A, B, C and Ex-meridian Tables whenever the Terra Nova has made a voyage south, and have found them invaluable. In parts of Ross Sea the variation changes $I^{\circ}$ for every four miles run at right angles to the lines of equal variation, and the large number of azimuths that it is necessary to take during the twenty-four hours would mean a prohibitive amount of work if your all-embracing tables were not at hand."
[From Captain Thomas Liddre, 3I Argyle Square, Sunderland, 3oth December i9i2.]
"Your last I9II edition is undoubtedly the best book published for navigation, and the cheapest."

From Lieut.-Col. W. A. Tilney, commanding 17 th Lancers, Sialkot, India, 29th July 19 I3, to Captain Blackburne.]
"Your tables have practically enabled us to revolutionise night marching, as you see by the enclosed report."

# TABLES OF CALCULATED HOUR-ANGLES 

AND

# ALTITUDE AZIMUTH TABLE, ETC. 

[Extract from Shipping Illustrated, New York, U.S.A., April 3rd, 1915.]
" The main purpose of these tables is to make as easy as possible the problem of finding the ship's position from combined altitudes of the sun, moon, or stars, and especially to facilitate the much-neglected practice of determining the ship's position from two or three stars at twilight, a few minutes before sunrise, and a few minutes after sunset. By the aid of the calculated star reduction and azimuth tables in this book a latitude and position line can be obtained at any time when the stars are visible almost as easily as by meridian altitude of a star. This method is the simplest yet brought forth for quickly and accurately solving the problem of determining position from stellar observations out of the meridian, or for determining latitude and position line from a single observation, which may be used in connection with a sounding, or the bearing of some mountain peak or light."

## [Extract from Shipping and Commerce, Wellington, N.Z., March IIth, 1915.]

" This publication again shows the author's extraordinary faculty and grasp of the art of condensation in applied navigation. The tables comprise over a quarter of a million tabulations of calculated hour-angles, azimuths, reductions, and variations for the hour angles to I degree of latitude, altitude, and declination. The calculated reductions and azimuths of 27 bright stars from one hour to three hours from the meridian, some of them for hour-angles from the meridian below the Pole as well as above, have been made for the actual declination of the stars for the year 1920. This does away with the need for any interpolation for the declination, and these tables will be in this respect perfectly accurate for many years. The tables have been computed to an extreme degree of accuracy, and are especially helpful for determining the ship's position from combined altitude of the sun or stars. By these tables the problem of finding the ship's position from two or three stellar observations out of the meridian or for the numerous adaptations in conjunction with fixed shore objects and soundings in obtaining ' a fix' is copiously explained. The great advantage of these tables for daylight or twilight observations is that the ready determination of the altitude and azimuth from the table prevents the possibility of a wrong star being taken, and an observation may be obtained by setting the approximate altitude to the sextant before the star is visible to the naked eye."
[Extract from Evening Post, Wellington, N.Z., March 29th, 1915.]
" Nothing, it is understood, has ever before been published for so readily and accurately finding the latitude by stellar observations, as the reduction to the meridian is taken out at sight, for 27 of the brightest stars, for one hour on each side of the meridian, and up to 2 and 3 hours from the meridian below the Pole for all the brightest circumpolar stars. The true bearings of these stars are also taken out more simply and accurately than by any other tables, as the calculation has been made for the actual declination of the star, thus saving the interpolation required with other azimuth tables. The bearings given of the circumpolar stars supplement the omissions of Davis's Star Azimuth Tables, as no bearings are given in these tables within 3 hours of the meridian below the Pole, when the altitude is low and in the most suitable position for compass bearings.
"By combining observations from two stars within the limits of the Reduction and Azimuth Tables, when about $30^{\circ}$ from the meridian, the latitude and longitude may be obtained in a very simple way. In this work Captain Blackburne has once again drawn attention to the value of double altitude observations for a 'Sumner' position in low latitudes, as well as in high, and in his effort to remove the wrong impression which exists among many officers in the merchant service in this direction he has given two or three convincing examples with altitudes not more than $2^{\circ}$ from the zenith.
"The completeness and conciseness of the calculations, which greatly facilitate the task of navigation, make the book very valuable to all mariners in responsible positions."

# EXTRACTS FROM LETTERS RECEIVED re "TABLES OF CALCULATED HOUR-ANGLES," Etc. 

The late Commander Harry Pennell, R.N., H.M.S. Duke of Edinburgh, wrote :" These hour-angle and azimuth tables reduce sights now to the minimum of work conceivable when they fall within its limits."

Captain Herbert H. Edmonds, Teacher of Navigation, Sydney, writes :-_" Received my copy of your book, with which I am greatly pleased. I have tested a few critical cases and find results all that can be desired, both with hour-angle and azimuths. What a boon to have all you want with a position-line in one act!"

Commander Edward R. G. R. Evans, R.N., H.M.S. Viking, writes :-" Very many thanks for 'Tables of Calculated Hour-Angles, Star Reductions, and Azimuth Tables.' Like all your works this is excellent, and simple enough for any navigator who will read the explanation and work a few examples until he is familiar with their use-then they are a pleasure."

Lieut. E. B. Dalby, R.N.R., H.M.S. Carmania, writes :-" I have purchased a copy of your new book, and hasten to say how much I like it. The printing is good, the arrangement could not be bettered, the explanations are copious, and the whole book a marvel of cheapness. I have checked the hour-angles in Table I by working out quite a number of sights in the usual way, and then working the same sights by this table. In no case did I get a difference of over a second, and in most cases the error was under half a second. The facility and accuracy with which the azimuth is obtained through the latitude variation (with a little mental interpolation in some cases) is certainly remarkable. For your star reduction and azimuth tables I have nothing but admiration. For stellar navigation I know of nothing to equal these incomparable tables."

Captain Robert W. Ferguson, of Brisbane, Queensland, writes:-"The tables are magnificent, and the most singular part of them is the truly graphic Altitude Azimuth Table No. IV, it being the best and most ingenious I have ever seen. . . . These tables are of inestimable value to the science of navigation, and your methods supersede all others in accuracy and brevity."

Captain Walter Lumsden, C.V.O., R.N., Director Royal Indian Marine, writes, saying :-" I am obtaining copies of this publication for supply to Royal Indian Marine seagoing vessels."

Captain John J. K. Konghan, commanding R.M.S. Sierra, writes :-" I use your books in preference to all other books on navigation. They give me entire satisfaction. . . . Your books are very popular with the Japanese. They know a good thing when they see it. .. Have read and used nearly all the new books on navigation. Your books are the best I have seen up to this date. I intend to introduce it into the United States."

Later, Captain Konghan writes :-" Five copies of 'Calculated Hour-Angles' and eight of the small books, 'Azimuths,' have been purchased by the officers of this steamer for themselves and friends. I believe every voyage they purchase some."

Sub-Lieut. T. Konishi, of H.I.J.MS. Azuma, Japanese Navy, writes:-" I tried your new book, and found it very good-very simple and very accurate. I tried (I) by logarithms; (2) Ball's Altitude Table ... most used; (3) The Newest Navigation, Altitude and Azimuth Tables, by Lieut. Radler de Aquino, Brazilian Navy; and your table I think the best."

Sub-Lieut. Konishi took very high honours at the Naval College in Japan. His opinion, therefore, is much valued.

Naval Instructor S. F. Card, B.A., R.N., Head of the Navigation Department, and Lecturer in Navigation at the Royal Naval College, Greenwich, writes :-" Personally, I am a great admirer of your latest tables, and have brought it to the notice of the sixty new Naval Instructors that I have been training here at the R.N. College. The Azimuth Table I prefer to Burdwood's," etc.

Sir E. Lionel Fletcher, Manager Oceanic Steam Navigation Co., Ltd. (White Star Line), writes:-" We think it well to advise you that we have ordered 40 copies of your new Navigation Table, for use by the commanders in this Company's service."

The P. \& O.S.N. Company, the N.Z.S.S. Company, the White Star Line, and the U.S.S. Company of New Zealand supply copies of the work to their steamers. The New Zealand Government are also supplying each of H.M.N.Z. transport steamers with a copy of the book.

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[^0]:    "I have examined your specimen leaf, and as far as I can see the tables will simplify and shorten the work of finding the hour-angle to a great extent; the Azimuth Table will add much to their value. From your well-known conscientious care, there can be no doubt as to the accuracy of the tables when completed."

[^1]:    Wellington, New Zealand, June 1914.

[^2]:    $\dagger$ Denotes the Inferior Meridian Passage of Circumpolar Stars.

[^3]:    Captain T. L. Evans, F.R.G.S., Manager, Donald Steamship Company, Bristol, writes:-
    "I am convinced that the book 'Modern Up-to-Date Navigation' is one of the best auxiliaries to the navigator that I have yet perused. . . . I must congratulate you on the very excellent methods which you have published in your book."

[^4]:    Published by Marine Department, New Zealand Government, Wellington, New Zealand.
    Sold in New Zealand at the Shipping Offices, and by Booksellers.
    Sole Agents tn United Kingdom: James Brown \& Son, $52-53$ Darnley Street, Glasgow.

