Applied Complex Variables - Math 3160
Fall 2020 - Sect 1

Lectures:	TTH 12:25pm-1:45pm - CANVAS
Instructor:	Christel Hohenegger (she/her/hers)
Office:	LCB 333, (801) 585-1637
E-mail:	`choheneg@math.utah.edu`
Office hours:	Wednesday, 10-11am or by appointment
Personal webpage:	`http://www.math.utah.edu/~choheneg`

Accessibility & Support: The best way to contact me is to send me an email at `choheneg@math.utah.edu`. I will do my best to answer emails sent to this address by the end of the next school day. You can also reach me via the email feature on Canvas, however it might take me longer to response. I will be available for help at regularly set office hours (Wednesday 10-11am) or by appointment. Both will be held over Zoom.

Course description: This course is an introduction to the study of functions of one complex variable, with topics including analytic functions, complex integration, the Cauchy integral theorem, Taylor and Laurent series, residues, contour integrals, and the Cauchy residue theorem with applications to computing integrals of real functions.
Prerequisites: "C" or better in Math 2250 or (Math 2270 and Math 2280).
Course type: Interactive Video Conferencing (IVC - synchronous online).
Course designation: Please consult with your departmental adviser to confirm how this fits into your program requirements.
Credit information: 2 credits.

Attendance & Punctuality: Attendance to the online lecture is strongly encouraged but not required. However, there are two components of the class that you are required to attend on time and online. The first one is bi-weekly electronic quizzes (12:30pm-1:00pm, see below for the dates) and the second one is meeting with your group to work on the final project (see below for details). Life happens and if you need to step out of the Zoom session for a short time, you do not need to let me know, however make sure that both your camera and microphone are turned off.

COVID-19 considerations: Students must self-report if they test positive for COVID-19 via `coronavirus.utah.edu`. Remember to maintain social distancing at all times. Face coverings are required for students and faculty.

Course material: All materials for this course are copyrighted. Do not distribute or share course resources without instructor permission.
Textbook: *Complex Variables and Applications*, by Brown and Churchill, 9th edition (ISBN-13: 978-0073383170). The official course text is the 9th edition, but you should feel free to get a less expensive 8th edition: the text is essentially the same, and homework

problems will not refer to section and problem numbers in the text. Whenever referencing a section, I will use the numbering of the 9th edition and include the topic.
Course website: Announcements and material will be posted on Canvas:

`http://utah.instructure.com/courses/631199`

You are responsible for checking Canvas daily or having Canvas sending you an email when something new is posted.

Technical requirements: Knowledge and navigation of Canvas, Zoom (through Canvas) and Gradescope (through Canvas) is critical to access all features and resources of this course. When joining Zoom, you should turn off your microphone to minimize background noise. You might choose to turn on your camera or you might use a picture if keeping the camera off. Either having a picture or turning on the camera will help me matching a name and a face. You can ask questions either by using the microphone and the raise your hand button or by typing it in the chat box. A strong internet connection and adequate bandwidth are needed to join a live Zoom session. For technical assistance, review the Canvas and Gradescope Getting Started Guide for Students and/or contact TLT, Knowledge Commons, etc... If you anticipate any connectivity issues or if you plan to be in a vastly different time zone, you should let me know as soon as possible. It is your responsibility to maintain your computer and related equipment in order to participate in the online portion of the course. Equipment failures will not be an acceptable excuse for late or absent assignments.

Expectations for online learning environment: Respectful participation in all aspects of the course will make our time together productive and engaging. Zoom lectures, discussion threads, emails and Canvas are all considered equivalent to classrooms. Specifically:

- Posting photos or comments that would be off-topic in a classroom are still off-topic in an online posting.
- Disrespectful language and photos are never appropriate.
- Using angry or abusive language is not acceptable, and will be dealt with according to the Student Code. I may remove online postings that are inappropriate.
- Do not use ALL CAPS, except for titles, or overuse certain punctuation marks such as exclamation points and question marks.
- When emailing me keep use a descriptive subject line, avoid "Hey" and always use my proper title: Dr. or Prof., and sign your message with your name and return e-mail address.

Learning Method: The instruction will be delivered as a flipped classroom through Canvas. Short videos together with worksheet questions will be posted on Canvas prior to Zoom lectures. During lecture, you will be able to ask questions on the work you've

done at home, work on the day's assignment using the breakout rooms feature in Zoom and prepare for the next topic. After each lecture segment, you will be asked to complete a short multiple choice quiz on Canvas. You will also turned in homework electronically twice a week. Bi-weekly electronic assessments in the form of a thirty minutes quiz will be administrated on Gradescope. There will be no final comprehensive exam, instead there will be a final project. All material will be accessible through Canvas.

Class schedule & Important dates:
Mandatory online instruction periods: All classes will be online the weeks of September 28-October 9 November 30-December 3.
Exam dates: There will be no comprehensive midterm exams or final.
Bi-Quizzes dates: 12:30pm-1:00pm on **September 1, September 15, September 29, October 13, October 27, November 10, November 24, December 3.**
Important Dates:

Class begins	August 24
Last day to add without a permission code	August 28
Last day to add/drop, elect CR/NC	September 4
Online instruction	September 28-October 9
Last day to withdraw	October 16
Conclusion of in person instruction	November 25
Last day to reverse CR/NC option	November 27
Thanksgiving break	November 26-29
Class resumes online	November 30
Class ends	December 3
Reading day	December 4
Grades due	December 21

Please check the academic calendar for more information pertaining to dropping and withdrawing from a course. Withdrawing from a course and other matters of registration are the student's responsibility.

Learning Objectives
Basic topics: Complex number geometry and algebra, analytic functions, integration in the complex plane, infinite series, residues and poles of complex functions, applications of residues for integration. Applications of complex analysis: Bode plots of transfer functions of linear systems, and harmonic functions for electrostatics and fluid flow, and integration.
Problem solving fluency: In addition to topical content, you will also gain experience and further mastery of complete problem solving fluency. You will be able to read and interpret problem objectives, be able to select and execute appropriate methods to achieve objectives, and finally, be able to interpret and communicate results.

Assessments:
Canvas Quizzes (twice a week): The Canvas quizzes will not be timed, other than

having due dates (11:59pm Tuesday and Thursday) to ensure that you are keeping up with the lectures. You may use any sources to complete these; however I strongly encourage you to attempt them on your own, but you are also welcome to discuss or check your answers with classmates. You may not simply copy a classmate's responses. No make-up quiz will be given and no late or emailed quiz will be accepted. The lowest four quizzes scores will be dropped.

Homework (twice a week): Homework will be collected electronically on Gradescope twice a week: on Friday and on Monday at 11:59pm. Gradescope will be accessible through a link on Canvas. To submit a homework, take a picture or scanned it and then upload it following the directions given online. The following rules apply:

- Unreadable problems or poorly scanned problems will not be graded;
- Make sure there is no shadow when you take the picture of the problems;
- Pen is often easier to read than pencil, and certainly do not erase and then write over text;
- Clearly separate your problems and make your solutions as neat and legible as possible;
- Write solutions as a single column and not all over the page;
- Show your work and use proper mathematical notation;
- Only use techniques discussed in the corresponding section and in this class.
- Unless specifically asked for a numerical answer, keep constants like e, π and expressions involving roots and fractions as is in your answers.

You are welcome to work together on these assignments, but you should write-up the solutions yourself and list any collaborators. Allow enough time to upload your work as you will need to assign each problem to a specific page. The grader and I might choose to only grade a random subset of problems. No paper or emailed homework will be accepted and I will not under upload homework for you. Late homework will be accepted online up to 12 hours past the original deadline with a penalty of 10% and you must still upload it yourself. The lowest four homework scores will be dropped.

Bi-Weekly Quizzes (every other week): At the start of every other Tuesday class, a thirty minutes timed quiz will be given electronically on Gradescope (see above for the dates). No paper or emailed homework will be accepted and I will not under upload homework for you. The quiz will review relevant topics covered since the previous quiz. You must work alone on these quizzes. You can use your notes and textbook, but you must refrain from using any other material or website. Submitting a problem to a website for help and/or emailing it to a friend is an instance of cheating and will result in a zero on the corresponding quiz. Repeated violations will be reported to the Dean of Students. See above for the dates, no make-up quiz will be given unless arrangements have been agreed upon by the previous Thursday's lecture. None of the quizzes score can be dropped. However, you will be able to improve your exam score by submitting a redo of the problems you did wrong with a detailed explanation that demonstrates mastery of the subject. The redo will count for at most 10% of the total number of

points. It will be due one week after the quiz has been returned.

Conflict & Regrading: Any conflict leading to missed deadlines are your responsibility and must be arranged ahead of time. Failure to do so may result in a zero for the corresponding assignment. Regrading inquiries must be submitted electronically on Gradescope or Canvas within a week of the assignment being returned.
Extra credit: No extra credit assignment will be given.

The Americans with Disabilities Act: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

Grading: Grades are determined as an equally weighted average as follows

Canvas Quizzes	Homework	Bi-Weekly Quizzes
30%	25%	45%

Since all 8 quizzes have the same total number of points, each quiz is worth 5% of your grade. Letter grades are determined according to the following grading scale.

A	$94\% \leq N \leq 100\%$	B-	$80\% \leq N < 84\%$	D+	$67\% \leq N < 70$
A-	$90\% \leq N < 94\%$	C+	$77\% \leq N < 80\%$	D	$64\% \leq N < 67\%$
B+	$87\% \leq N < 90\%$	C	$74\% \leq N < 77\%$	D-	$60\% \leq N < 64\%$
B	$84\% \leq N < 87\%$	C-	$70\% \leq N < 74\%$	E	$N < 60\%$

I reserve the right to modify these in special cases and to decide if a curve is needed. It is the student's responsibility to ensure the accuracy of all recorded homework, quizzes, online assignments. If you see any error in your grades on Canvas, reach out to me within two weeks from when the assignment was returned.
Incompletes: According to university policy, to be considered for an incomplete, a student must have 20% or less of the course work remaining and be passing the course with a C or better. You must request an incomplete grade and I will consider giving that grade only under exceptional circumstances.

Student Code: Students are encouraged to review the Student Code for the University of Utah. In order to ensure that the highest standards of academic conduct are promoted and supported at the University, students must adhere to generally accepted standards of academic honesty, including but not limited to refraining from cheating, plagiarizing, research misconduct, misrepresenting one's work, and/or inappropriately collaborating. A student who engages in academic misconduct as defined in Part I.B. may be subject to academic sanctions including but not limited to a grade reduction, failing grade,

probation, suspension or dismissal from the program or the University, or revocation of the student's degree or certificate. Sanctions may also include community service, a written reprimand, and/or a written statement of misconduct that can be put into an appropriate record maintained for purposes of the profession or discipline for which the student is preparing.Incidents of academic misconduct will be subject to penalty per Section V of Policy 6-400, the Student Code. All students are expected to maintain professional behavior in the classroom setting, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

`http://regulations.utah.edu/academics/6-400.php`

Inclusivity Statement: It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: age, color, disability, gender, gender identity, gender expression, national origin, political affiliation, race, religion, sexual orientation, and veteran status, and other unique identities. gender, sexuality, disability, age, socioeconomic status, ethnicity, race, culture, and other unique identities. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that I can make arrangements for you.

Discrimination and Harassment: If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or Office of the Dean of Students, 270 Union Building, 801-581-7066. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS). Please see Student Bill of Rights, section E `http://regulations.utah.edu/academics/6-400.php`. I will listen and believe you if someone is threatening you.

Addressing Sexual Misconduct: If anyone has been harassed or assaulted, students are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building,581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

Campus Safety: The University of Utah values the safety of all campus community members. To report suspicious activity, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit `safeu.utah.edu`.

Wellness Statement: Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with your ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at `www.wellness.utah.edu` or 801-581-7776.

Classroom Social Equity: Canvas allows you to change the name that is displayed and allows you to add your pronouns. Class rosters are provided with your legal name as well as "Preferred first name" (if previously entered in the Student Profile section your CIS account). While CIS refers to this as merely a preference, I will be using the name and pronoun that feels best for each student in class or on assignments. Please advise me of any name or pronoun changes (and update CIS) so I can help create a positive and respectful learning environment. Additionally, you can indicate your pronouns in Zoom.I strive to be ethical, kind, fair, inclusive and respectful in the classroom and expect you to behave likewise. In this regard, I request that:

- If you have any sort of anxiety disorder, TBI, PTSD, C-PTSD, or any other challenge that might cause being called out in class or working in groups psychological harm, then please do tell me, discreetly. I will confidentially accommodate any such request.
- If there is ever a time that you feel this course or the curriculum is not equitable, please email me or meet with me to discuss such concerns.

If you need any assistance or support, please reach out to the LGBT Resource Center. `https://lgbt.utah.edu/campus/faculty_resources.php`

Undocumented Student Support: Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801.213.3697 or visit `dream.utah.edu`.

Student Success Advocates: The mission of Student Success Advocates is to support students in making the most of their University of Utah experience (`ssa.utah.edu`).

They can assist with mentoring, resources, etc. Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact a Student Success Advocate for support (`https://asuu.utah.edu/displaced-students`).

University Counseling Center: The University Counseling Center (UCC) provides developmental, preventive, and therapeutic services and programs that promote the intellectual, emotional, cultural, and social development of University of Utah students. They advocate a philosophy of acceptance, compassion, and support for those they serve, as well as for each other. They aspire to respect cultural, individual and role differences as they continually work toward creating a safe and affirming climate for individuals of all ages, cultures, ethnicities, genders, gender identities, languages, mental and physical abilities, national origins, races, religions, sexual orientations, sizes and socioeconomic statuses.

Office of the Dean of Students: The Office of the Dean of Students is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. Please consider reaching out to the Office of Dean of Students for any questions, issues and concerns. 200 South Central Campus Dr., Suite 270. Monday-Friday 8 am-5 pm.

This syllabus is meant to serve as an outline and guide for our course. I reserve the right to change the policies stated in this syllabus if necessary. I may also modify the course schedule to accommodate the needs of our class. Any changes will be announced in class and posted on Canvas.

I want you to be successful, not only in this class, but in your entire undergraduate career and I am here to help. You should not be shy to ask questions during lectures, to come by office hours or to email me with any concerns, and to be engaged.

Have a great semester !

Tentative Schedule:

Day	Sections	Topics
1 & Tu	1.1-1.4	Sums, products, algebraic properties, vector, moduli
1 & Th	1.5-1.7	Triangle inequality, complex conjugates, exponential form
2 & Tu	1.7-1.10	Exponential form, products, quotients, powers, roots
2 & Th	1.10-1.12	Roots, examples, regions of the complex plane
3 & Tu	2.13-2.14	Functions, mappings, $z = w^2$
3 & Th	2.15-2.17	Limits, point at infinity
4 & Tu	2.18-2.19	Continuity, Derivatives
4 & Th	2.20-2.23	Differentiation, Cauchy-Riemann equations, examples
5 & Tu	2.24-2.26	Polar coordinates, analytic functions, examples
5 & Th	2.26-2.27, 3.30	Examples, harmonic functions, exponential function
6 & Tu	3.31-3.33	Logarithmic function, derivatives, branches, examples
6 & Th	3.35-3.37	Power function, examples, trigonometric functions
7 & Tu	3.38-3.40	Trigonometric, inverse trig and hyperbolic functions
7 & Th	4.41-4.43	Derivatives of $w(t)$, integrals of $w(t)$, contours
8 & Tu	4.44-4.45	Contour integrals, examples
8 & Th	4.46-4.48	Branch cuts, upper bounds, antiderivatives
9 & Tu	4.48, 4.50	Antiderivatives, Cauchy-Goursat theorem
9 & Th	4.52-4.54	Connected domains, Cauchy integral formula
10 & Tu	4.55, 4.57-4.58	Cauchy integral formula, consequences
10 & Th	4.58-4.59	Liouville theorem, Maximum modulus principle
11 & Tu	4.60-4.62	Sequences, series, Taylor series
11 & Th	4.64-4.65	Examples, negative powers of $(z - z_0)$
12 & Tu	4.66, 4.68	Laurent series, examples
12 & Th	6.74-6.75, 6.78	Isolated singular points, residues
13 & Tu	6.76-6.77	Cauchy residue theorem, residue at infinity
13 & Th	6.79-6.81	Residues at poles, examples
14 & Tu	7.85-7.86	Improper integrals, examples
14 & Th	No class	Thanksgiving
15 & Tu	7.87-7.88	Fourier integrals, Jordan's lemma
15 & Th		