THE UNIVERSITY OF AKRON
The Department of Mathematical Sciences

Article: Miscellaneous Essays

In this file reside remarks that I was unable to fit in anywhere else.

Some Pointers. Should you get lost, press the 'Home' key to return to this menu. Click on Main Menu to return to the main menu, or on tutorials to return to the main tutorial menu.

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Miscellaneous Essays

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1. The Key to Success? It starts with an "A"

Students always find the *concepts* of Calculus easily understood, but still have trouble doing well in Calculus. How so?

The answer is the "A"-word: Algebra. Science revolves about problem solving, and certainly, Calculus is no different. In order to solve a Calculus problem there is usually a certain amount of algebra to wade through. (And, by the way, there may also be a healthy dose of trigonometry and analytic geometry as well.) If you cannot successfully get through the algebraic part of the problem, you cannot successfully solve the problem. If you cannot solve the problem because of your algebra, it doesn't really matter whether you "understand" the concepts of Calculus, now does it?

The answer: *You must constantly and consistently work to improve your algebra.*

As a rule of thumb, if you were an "A" student in algebra, probably you will be an "A" student in Calculus. If you were a "B" student in algebra, then you will most likely be a "B" student in Calculus. And

so on. If you work hard on your algebra, you can perhaps move up one level; however, there seems to be a slight downward trend if the algebra is not worked on at all.

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2. Math Tests: Nothing to Fear

In preparing for a test, there is one fundamental assumption a student should make concerning the instructor:

Axiom. Instructor = fair.

The student should be aware of underlying assumptions the instructor makes concerning the student.

Assumptions Your Instructor Makes.

1. The student in interested in understanding the course material.
2. The student is a conscientious, hard-working student.
3. The student does all homework problems, whether the problems were turned in for credit or not.
4. The student wants to understand the concepts and master the techniques for the long term, not just for the short term.

The instructor is aware that some or all of these assumptions are invalid for some of the students in the class, but makes the assumptions nonetheless.

There are basically four types of questions that are asked on a mathematics test. An awareness of these four types may aid your preparation for the test.

The Composition of a Math Test

1. Definitions.
2. Statements of Theorems.
3. Proofs of Theorems.
4. **Problems**. There are two types of these.
    a. Problems seen before.
    b. Problems not see before.

Depending on the level of the mathematics course, these various components have different emphasis. At the *College Algebra* level, the tests are mostly **Problems seen before**. At the *Calculus* level, there are a few **Definitions**, occasionally **Statements of Theorems**, but mostly, a Calculus test consists of **Problems seen before**.

At the Masters level, there is more emphasis placed on **Definitions**, **Statements of Theorems**, **Proofs of Theorems**, and **Problems seen before**—and to a lesser extent on **Problems not seen before**.

At the Ph.d. level, there is emphasis on more difficult **Proofs of Theorems**, and **Problems not seen before**.

In the next few pages, I give a more detailed discussion of each of the above components—and why you should not fear them.

2.1. Definitions

Questions involving a **Definition** of some term comes under the heading of a "problem whose answer you know in advance." There are only a finite number of definitions and, no doubt, many of the exercises you worked on for homework involved the term to be defined. In the process of reading the textbook and doing the homework exercises you should have gotten an understanding of the term.

Thus, this kind of question is *not to be feared*!

2.2. Statements of Theorems

Of course, the instructor cannot ask you, "State the theorem on page 102." That would violate the underlying Axiom of our system. Many really important theorems, however, have their own names: The Fundamental Theorem of Calculus, the Mean Value Theorem, The Divergence Test, Stokes Theorem, are just a few from *Calculus*.

Questions involving **Statements of Theorems** are "problems whose answers you know in advance." There are only a finite number of theorems with names, no doubt you became familiar with them through lecture, the textbook, and homework. They can be prepared for.

Thus, this kind of question is *not to be feared*!

2.3. Proofs of Theorems

Depending on the level of the course, this component may be nonexistent (in which case, there is nothing to fear from this question), or may be a significant portion of the test (and there is still nothing to fear).

Proofs of Theorems are "questions whose answers you know in advance." If you are in a course involving proofs, you have (mathematically) matured to the point where you know the fundamentals of logic, you can read, study, and understand the main points of the important theorems.

The proofs of some theorems are simple logical manipulations of the definitions—hence the importance of the definitions.

There is no need to "memorize" a proof line by line; that's silly. Very often, a proof consists of one, two, or three original ideas logically connected together. Identify these critical points in the proof and understand them. At test time, just connect these points together in a coherent way.

Hence, the serious, disciplined student *has nothing to fear* from this kind of question.

2.4. Problems seen before

You have nothing to fear from these kinds of questions because you've ... seen these problems before!

Problems that you missed on homework assignments should have been routinely reworked. The instructor will assume you understand your mistakes and have corrected your thinking. Did you? These questions are again "problems whose answers you know in advance."

The conscientious student, therefore, has *nothing to fear* from this kind of question.

2.5. Problems not seen before

Now for **Problems not seen before**. There is really nothing you can do to prepare for this component of the test. If you have prepared for the rest of the test (You know the definitions; you know the statements of the famous theorems; you have studied the proofs of the theorems; and you have done the homework and understood your mistakes.) then all you can do is to rely on your wits.

Because all you can do is to prepare for all the rest of the test (whose "answers you know in advance") there is nothing to fear from this component of the test either—you are prepared!
