MAT 2442: Calculus 2

Professor: Charles Delman Professor's Office: OM 3216
Email: cidelman@eiu.edu (I do not have an office phone; please use email!)
Office Hours: MWF 11-11:50 a.m., TR 4-5 p.m. Study Session 6:30-8 p.m. (OM Center Tower)

1. Course Content

Brief review of the real number system; integral definition of the natural logarithm; brief review of transcendental functions (exponential, logarithmic, trigonometric) and the relationship between the derivative of a function and that of its inverse; brief review of the Riemann integral and the substitution method of integration; further techniques of integration; further applications of integration (including arc length and surface area); infinite sequences and series; parametric equations and polar coordinates. Optional topic, time permitting: introduction to differential equations and their applications.

2. Objectives

The primary objective of this course is that you truly understand the principle concepts of calculus and the prerequisite mathematical topics which are used in calculus. The word *understand* is quite vague, so let me explain what I mean: you understand a concept when you can explain it in your own words and can apply it to solving problems *substantially different* from those you have previously been given as examples. I hope you have had experience with this expectation in Calculus 1.

The following objectives deal with general themes which make connections between the various related topics we will study. I encourage you to refer back to them repeatedly as we progress. Naturally, you are also expected to understand each topic.

- You will be able to use the relationship between a function and its inverse to compute derivatives and solve applied problems.
- You will be able to use the relationship between differentiation and integration to explain and properly implement various integration techniques.
- You will be able to solve a variety of applied problems by setting up the correct differential form using geometric or physical analysis.
- You will be able to apply limits of sequences to interpret and define a variety of mathematical and physical ideas, such as the approximation of a function by a power series and the distance traveled by a bouncing ball.
- You will be able to use well-chosen coordinate systems, parametrizations, and changes of variables as calculating tools. You will be able to explain the geometry of coordinate transformations.

3. How to Read the Textbook and Do the Homework

Note that not reading the textbook is not a viable option, nor is not doing the homework a viable option!

Read each section two or more times with increasing attention to detail. On the first reading, ascertain the main concepts covered by the section, particularly definitions and theorems, and examine the diagrams. You will get much more out of class if you do this reading *before* the class in which the topics will be covered. On the second reading, be careful and thorough; however, it is not necessary to read every word. A textbook is a reference, not a novel! Study the main ideas and techniques, and don't waste time with material you have already understood from studying your class notes. Reread any sections that require further study as needed.

Try to visualize the ideas for yourself as you read. Make comparisons and analogies to things that are familiar, and think about how the new ideas relate to what you have already learned. Mathematics is difficult to read! Avoid getting bogged down in a swamp of technical details! *The trick is to recognize that the technical details are motivated by simple basic ideas; get a sense of these ideas before verifying the technical details, in order to place them in context.*

When you read the examples, *don't try to memorize the procedure that is used*; instead, *think about the purpose of each step*, and *also think about the overall strategy that motivates the steps and binds them together in a logical sequence*, so that you will understand how to do new problems. Only after doing this should you attempt the homework problems!

Write out your solutions to homework problems neatly and completely in an organized logical fashion, clearly showing and briefly justifying your reasoning. Revise the initial drafts of your homework to create a final draft that you can study from for exams. Doing the homework haphazardly, incompletely, or "in your head" is a sure recipe for poor performance.

4. How to Participate in Class: Some Suggestions

Do not let note-taking distract you from also *thinking* about the material being presented. If you have read the section in advance, you will know what to emphasize in your notes, freeing up your mind to think. In taking down an example, do not struggle to write down every algebraic step: at this point, you should know how to do algebra, so just leave room to fill in any missed steps later.

Always go over your notes as soon after class as possible, before the following class, filling in any missing details, adding marginal notes, and making sure you understand what you have written. If you have questions, come to office hours or ask them at the beginning of the following class. Be neat, organized, and thorough - it really helps a lot!

Finally, *never hesitate to ask a question in class. You would not be taking calculus if you were stupid; therefore, if you don't understand something, your question is not stupid! It is foolish not to ask the question! (And you will be doing a favor for students shyer than yourself who wanted to ask the same question!)*

5. Requirements & Grading

5.1. **Homework & Quizzes.** Homework will regularly be assigned, and questions on the homework will be regularly addressed in class. You may sometimes need to do additional problems for practice. *You must take responsibility for doing the homework thoroughly and on time. I expect you to keep up; therefore, I will not answer questions in class on an assignment after the due date (except during review periods). Come to class prepared with questions at the beginning!*

There will be a short quiz every Friday, except during weeks when we have a comprehensive exam.

The weekly schedule will generally be as follows:

- Monday: homework due; up to 30 minutes of questions on the completed assignment followed by sample quiz question and discussion of its solution.
- Tuesday & Thursday: lecture and discussion of new material. No homework questions, but you can always ask questions about the material covered in the previous class.
- Wednesday: up to 30 minutes of questions on the current homework assignment, followed by lecture and discussion of new material.
- Friday: up to 20 minutes of questions on the current assignment (due Monday of the following week), lecture and discussion as time permits, with a quiz at the end of class. The first quiz question will be the sample question we discussed on Monday.

You are expected to explain the process used to solve each homework problem in clear, grammatical, and logical sentences, organized logically into paragraphs if necessary, using proper English and mathematical notation. The grading of quizzes will reflect this expectation. Solutions to quiz and exam questions must be clearly presented and justified in order to receive credit. You must show the method by which you did the problem. I am VERY STINGY with partial credit. (However, I am forgiving about small careless errors.)

I encourage you to work in groups and discuss the homework problems with your classmates; however, you should write out the solution to each problem completely yourself. Cooperation is far more effective than slogging it out on your own. Also, the experience of explaining things to other people and finding their mistakes will improve your own understanding. *I strongly advise forming a study group of 2-6 people that meets regularly to work on this course. Gobs of research shows that students who belong to a regular study group do better than those who don't.* (It stands to reason, doesn't it?) *I have organized a regular group study session every Tuesday in order to help you study more effectively. I strongly suggest you take advantage of it if you can!*

5.2. **Exams.** There will be *two comprehensive exams during the term* (in addition to the final exam), one near the middle of the term (the *mid-term exam*) and one near the end of the term (the *end-of-term exam*). The mid-term exam will cover all of the material since the beginning of the course; the end-of-term exam will cover all material since the midterm exam.

There will be a *comprehensive final exam*, covering all the material of the course, at the scheduled time during exam period.

Make-up exams will be given only under extraordinary circumstances or in case of serious emergency; prior permission to miss an exam must be obtained from the professor if at all possible.

5.3. **Grading.** The requirements count toward your grade as follows: quizzes, 40%; exams during the term, $2\times 20\% = 40\%$; final exam, 20%. To make it easy for you to keep track of how you are doing, each quiz will be worth 40 points, and I will count the best ten of them, each exam during the term will be worth 200 points, and the final will be worth 200 points. Thus, you can use a total of 1000 points as your benchmark.

I do not grade on a "curve"; an average of at least 90% is required for an A, at least 80% for a B, and so on. Thus, your grade will not depend on how how your fellow students do. If you do a good job of learning the material, you will receive a good grade, regardless of how well the other members of the class perform. Don't forget that the reverse is also true: if you do a poor job of learning the material, you will receive a poor grade, regardless of how poorly everyone else does.

Complete honesty on assignments and exams is expected.