Mathematics 145: Calculus I

Fall, 2005
Syllabus

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Office Phone: 438-7597
Office Hours: MWR 11.00 to 1.00 P.M

General Information:

Text: Thomas' Calculus (Early Transcendentals), by Weir, Hass & Giordano

University Withdrawal Policy: A student may withdraw without any record By Sept. 2. A student may withdr with a WX grade by October 14. After that date, no withdrawal except from the university.

Graphing Calculators and Computers: Graphing calculators are required – the TI 89 is strongly recommended. Students may also be using Macintosh computers on occasion, but computer experience is not necessary.

Disability Concerns:

Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 438-5853 (voice), 438-8620 (TDD).

Grading (approximate)

quizzes:	16%
projects, hmwk, class work:	10%
3 tests:	50%
Final Exam (Monday, Dec. 8):	24%

(Quizzes are on homework problems; you may drop your lowest of these quiz scores. There will be no make-ups for quizzes.)

Attendance Policy
Attendance and preparedness is expected. More than 3 unexcused absences will lower your course grade, so let me know if you cannot make class.

Calculus Overview

Calculus involves the mathematical study of motion and change. Calculus was created about 300 years ago independently by Isaac Newton and Gottfried Leibnitz. Although their intention was to solve particular measurement problems in geometry and physics, today the applications of calculus reach far and wide to not only the physical sciences and engineering, but to the social and biological sciences. In fact, rapid large-scale computing has *increased* the role of calculus in solving many of the outstanding problems of science and technology.

Some questions which are commonly studied in calculus courses: in a heart bypass operation, where should the new artery be stitched; given the length of skid marks, how fast was the car traveling before the brakes were applied; what is the best way to fit a line to data; how accurately does a particular model estimate the employment rate of a new industry; at what point in time is an epidemic the most dangerous; …

In this course, you are responsible for learning the course material. This will involve reading, thinking, questioning, and working with others.

Communicating Mathematics

Communicating mathematics is an important theme in this course.
Opportunities to communicate orally will occur when you work in groups, explain problems at the board, work on projects, ask questions, respond to questions, and help your friends understand calculus. Opportunities to communicate in writing will occur as you prepare homework, complete projects, and take exams and quizzes.

General Objectives:

Students will

- see and appreciate the interdisciplinary role of calculus
- gain insight into how calculus can be used to describe the world around us
- learn how to apply the tools of calculus to solve both pure and applied problems
- enhance their critical thinking and reasoning skills
- use technology and see its interaction with pure and applied calculus
- learn to communicate mathematics through writing and oral presentations
- learn the historical background of calculus
- move toward becoming an independent learner

Learning Outcomes:

At the end of the course students will be able to:

- explain the concepts of function, derivative and definite integral, in writing and orally, using graphical, numerical and algebraic ideas.
- determine the derivative of the elementary functions (polynomial, trig, rational, exponential, logarithmic) at a point using numerical, graphical and algebraic techniques.
- determine the definite integral of the elementary functions using numerical, graphical and algebraic techniques.
- interpret the derivative and definite integral in a variety of problem settings.
- algebraically differentiate the elementary functions using the rules for differentiation including the chain rule with a high degree of accuracy.
- find anti-derivatives for some elementary functions directly or using substitution.
- solve min/max problems given a reasonable real world setting and appropriate data.
- apply calculus to solve problems from a variety of fields.
- recognize the need for/use of differentiation or integration in real world settings.
- relate a function to its derivatives and anti-derivative graphically, numerically and algebraically.

Calculus as General Education

Calculus is considered by many to be one of the great intellectual achievements of modern man. It has been a central factor in expanding our knowledge of the universe, and is the key to analyzing systems that *change*. Indeed, change is fundamental to every conceivable human activity; so its study is essential to intellectual development. We use calculus to understand the world around us.

In this course we stress problem solving. We will see how the theme of the analysis of change recurs throughout the course, and study how and when the methods of Calculus can be extended to apply in new problem situations. Part of this process involves developing a feel for situations in which calculus may be appropriate. We will also see some classic applications of calculus to give an appreciation of the scope of the processes of calculus. This background will provide a systematic design for other uses not only of calculus, but other methods of quantitative analysis and reasoning.

The course is designed to show applications not only in physics, the area which generated the problems to which calculus was first applied, but many other areas such as biology and medicine, economics, chemistry, etc. A sample of applications can be seen in the introduction above, and possible projects listed below. Throughout these applications, however, the concept of analysis of change and related principles serve as a unifying theme, providing the foundation for logical approaches for modeling, problem-solving, application and extension of calculus.

Approximate Course Schedule
(Final Exam: Monday, Dec. 12, 8 PM)

Aug. 22 - 26	Intro, 1.1-1.4
Aug. 29 – Sept. 2	1.5, 1.6, 2.1, Quiz 1
Sept. 5 – 9	Labor Day holiday, 2.1, 2.2 (optional 2.3)
Sept. 12 – 16	2.4, 2.5, 2.6, Quiz 2
Sept. 19-23	2.7, 3.1, Test 1
Sept. 26-30	3.2, 3.3, 3.4
Oct. 3 – 7	3.5, 3.6, Quiz 3
Oct. 10 – 14	3.7, 3.8, 3.9
Oct. 17 – 21	3.10, 4.1, Test 2
Oct. 24 – 28	4.2, 4.3, 4.4
Oct. 31 – Nov. 4	4.5, 4.6, Quiz 4
Nov. 7 – 11	4.7, 4.8
Nov. 14 – 18	5.1, 5.2, Quiz 5
Nov. 21 – 25	Thanksgiving Break
Nov. 28 – Dec. 2	Review, 5.3, Test 3
Dec. 5 – 9	5.4, (5.5 optional), Review

Advice on How to Succeed in this Class

You are bright and have done well in mathematics courses. It has been my experience that most people studying mathematics hit a "wall" at some point -- a time when simply attending class is no longer sufficient to learn the material. You probably know people who hit the wall during high school -- and they either stopped taking math courses or else took some time to learn how to study. Those who stopped taking math might claim that they can't "do it", but I propose that many of them could succeed in mathematics if they learned *how to study*. Perhaps you won't hit the wall at all -- each person is different. Many students who arrive at college having found mathematics relatively easy and straightforward in the past might find themselves caught off guard if the material stops coming to them naturally.

If this happens to you, please don't panic! It simply means that you've reached the point where you need to learn how to study mathematics. You don't have to be a "genius" to do well in Calculus, but you might need to teach yourself a few tricks about how to study mathematics. Indeed, I am of the opinion that you can master this material if you put in a consistent effort and keep up with the course material. Come to class, read the textbook, take notes and set up a regular study schedule. Plan to spend a minimum of 8 hours per week for work outside of class. Please come see me during office hours (or set up an appointment via email) if you'd like to discuss "how to study" strategies. I'd be happy to take a look at your class notes and to assist you appropriately.