Math 1a - Introduction to Calculus

Information and Syllabus, Spring 2001

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Goals: Math 1a is a first semester calculus course covering differentiation, an introduction to integration, and applications. It emphasizes understanding as much as computation. When you leave Math 1a we want you to take with you the ideas that will enable you to use the concepts of calculus later, both in mathematics and in other fields.

Prerequisites: Some of you will have had calculus before, some of you will have not. However, those of you who haven't need not be alarmed - in the past students without a calculus background have done as well as or better than those with this background. Doing well in Math 1a does require a solid background in precalculus, as demonstrated by an 18 on part 1 of the Harvard Math Placement Test. For those of you who are not comfortable with high-school algebra, basic trigonometry and the like, we recommend the sequence Math Xa-Xb.

Classes and Problem Sessions: Class will meet three hours per week. You will be assigned to a problem session which meets once a week for 1 hour and is led by a course assistant (CA). Course Assistants grade homework assignments, attend classes, and hold weekly problem sessions. The problem sessions are an integral part of the course and will be devoted primarily to working problems and amplifying the material. The pace of the course is quite fast, so these sessions should be particularly valuable to you in learning the material. You are strongly urged to attend.

Homework: Homework exercises are an integral part of the course. It's unlikely that you'll understand the material and do well on the exams without working through the homework problems in a thoughtful manner. Don't just crank through computations and write down answers - think about the problems posed, your strategy, the meaning of your computations, and the answers you get. We encourage you to form study groups with other students in the class so that you can discuss the work with each other. (Although all

work submitted must be written up individually.)

Problems will generally be assigned in each class and are due at the next class. Assignments will be graded by your course assistant and will usually be returned at the following meeting.

Finally, a somewhat harsh-sounding rule: we will not accept late homework. It just doesn't work to do so - new homework is given out every class, and it's important to keep current, since each homework assignment is relevant to that class and the next. We understand that occasionally circumstances make it impossible to do a particular assignment, and up to three missed assignments will be ignored, but beyond that it will begin to affect your grade.

Text: *Calculus, Brief Edition* (Sixth Edition) by Howard Anton; John Wiley 1999

Exams: There will be two in class midterms and a final exam. The midterms will be on February 27th and April 10th. **Grading:** The weights of the various parts of the course are as follows (subject to minor modification) - Each midterm : 20% Homework: 20% Final Exam: 40%

Calculators: The use of a graphing calculator can prove helpful in understanding many topics in the course, from limits and successive approximation to graphing. However, we encourage you to not rely too heavily on a graphing calculator as you work through your homework problems. In particular, calculators are not required for the course, and won't be allowed during exams.

Topics to be covered: (in approximate order)

Basics - functions, domain, range, graphs, lines, slope,linear functions, etc.
Introduction to rates of change via examples
Velocity as a rate of change
Definition of the derivative - calculating numerically and algebraically
Tangent lines and linear approximation (part one)
Second derivatives
Limits and successive approximation

Continuity and differentiability
Techniques of differentiation
Derivatives of the trigonometric functions
Derivatives of exponential functions
Rates of change and rectilinear motion
Composite functions and the chain rule
Implicit differentiation
Inverse functions and their derivatives
Related rates
Differentials and linear approximation (part two)
Newton's Method
Extreme values of a continuous function
The Mean Value Theorem
First Derivative Test
Concavity and the second derivative test
Infinite limits and asymptotes
Optimization
L'Hopital's Rule
Antiderivatives
Area as the limit of a sum
Riemann Sums and the definite integral
The Fundamental Theorem of Calculus
The Mean Value Theorem for integrals; average value
Numerical Integration: Trapezoid Rule, Midpoint Rule, and Simpson's Rule
Exponential and logarithmic Functions
The inverse trigonometric functions
Assorted applications