

## MTH U241

## Calculus I

Spring2005

Instructor: Dr. R.Bai

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Office: 541LA

Office Hours: MWTH 12 – 1PM

### Required Materials:

Text: *Calculus* by Johnston and Mathews

Calculator: scientific, graphing calculator (recommend TI83 or higher)

### Course Objectives:

To have students understand the concept of the derivative and to enable students to display that understanding through a variety of applications; to have students understand the concept of the integral and to introduce integration techniques. Specific and measurable manifestations of your understanding that will be tested during the semester include your ability to:

- Parameterize curves in the plane and motion along a straight line.
- Describe velocities as rates of change analytically, graphically and numerically.
- Analyze more general rates of change, including acceleration.
- Apply the definition of the derivative to algebraically and analytically derive instantaneous rates of change as limits of average rates of change.
- Visualize and interpret derivatives via slopes of tangent lines to graphs.
- Derive, memorize, and apply the rules for differentiation to calculate derivatives of given functions, including polynomials, exponential and logarithmic functions, trigonometric and inverse trigonometric functions, and combinations of such functions by using the product rule, the quotient rule, and the chain rule.
- Sketch graphs of functions by analyzing the first and second derivatives.
- Model, by using derivatives, physical problems involving rates of change, including velocity and acceleration problems, exponential growth and decay, and simple oscillations.
- Solve, via derivatives, optimization problems (maximum-minimum problems) which arise in a wide variety of situations involving physics, engineering, and economics.
- Calculate the linearization of a function.
- Approximate changes using differentials.
- Estimate roots of equations using Newton's method.
- Calculate antiderivatives of algebraic, trigonometric, and transcendental functions.
- Calculate antiderivatives using substitution, integration by parts, and partial fractions.
- Approximate definite integrals using finite sums.

### Course Policies:

(1) There will be weekly quizzes, a one-hour midterm, and a two-hour cumulative departmental final exam. There will be no make-up quizzes, but your lowest quiz grade will be dropped. There will be no make-up for the midterm except extreme circumstances with an official verification. No student will be granted a special final exam unless it is due to a Registrar-created conflict. Your course grade will be determined as follows:

Weekly quizzes -- 30% ;    One-Hour Midterm -- 30%;    Final Examination -- 40%

(2) It is essential that you attend class regularly. The easiest way for you to learn the material and to know what material has been covered is to come to class each day. Students are responsible for finding out what materials have been covered or what announcements have been made on days that they miss class.

(3) In addition to the Instructor's office hours, you may receive extra help for the course from Engineering tutors in 222 Snell Engineering, tutoring by appointment (sign up in the Media Center in the library), and from tutoring center at 102 Cahners Hall. Please seek help as soon as you experience any difficulty; do not wait until just before an exam.

(4) If you have concerns/problems about the course that cannot be resolved by discussing with the instructor, you should contact the Vice-Chairman of the Mathematics Department:

Prof. Donald King,                    447 LA,                    x5679,                    donking@neu.edu.

**Schedule of Topics and Homework Assignments (Tentative):**

Rates of Change, Limits, and the Derivative

Week 1 (1/5 -- 1/7)

- §1.1 Functions 1,4,6,7,8,9,14,16,17,23,31
- §1.2 Composition of Functions 1,3,4,5,7,9,11
- §1.3 Slopes as a Rate of Change 1,3,5,7

Week 2 (1/10 -- 1/14)

- §1.4 Calculating Rates of Change 1,7,9,14,21
- §1.5 Limits 1,3,5,7,9,10,15,18,19,21,30,31
- §1.6 More Work with Limits 1(a), 2(a), 3(a),5(a),8(a),11(a),21,22
- §1.7 The Derivative 3,4,6,11,14,15,25,27,29(a)

**1/17 Martin Luther King, Jr.'s Birthday: Univ. Closed**

Finding the Derivatives

Week 3 (1/17 -- 1/21)

- §2.1 Derivatives of Polynomials 1,3,4,7,9,13,15,17,24,27,28
- §2.2 Derivatives of Products and Quotients 1,4,5,6,11,13,15,17,19,21,31
- §2.3 Differentiating Compositions 1,2,3,5,7,9,13,17,19,22,33,35,37

**Wed. Jan 19<sup>st</sup> :**                   **Last day to file a final exam conflict form**  
**Friday, January 21<sup>st</sup> :**           **Last day to drop without a W grade**

Week 4 (1/24 -- 1/28)

- §2.4 Implicit Differentiation 1,4,5,11,15,17,25,29,31
- §2.5 Trigonometric Functions 1,2,3,7,10,13,15,16,17,20,21,25,27,31,33,35
- §2.6 Exponential Functions 1,5,6,7,9,12,15-  
21(odd),22,25,26,28,31,33,35,43,56(a),58

Week 5 (1/31 -- 2/4)

- §2.7 Logarithms 1,4,5,7,9,11,13,15,17,19
- §2.8 Inverse Functions 1,3,5,7,9,11,17,20
- §2.9 Inverse Trigonometric Functions 1,2,6,11,15,17,18,19,29,33(a),35(a)

Week 6 (2/7 -- 2/11)

- §2.10 Modeling 4,9,11

Motion, Vectors, and Parametric Equations

- §3.1 Motion along a Line 1,3,5,9,11,13,19,21
- §3.2 Vectors 1,3,7,11,15,17,23,25,33,35,39,41,51

Week 7 (2/14 -- 2/18)

- §3.3 Parametric Equations 1,3,7,9,13,15,17,19

Review

\*\*\*\*\* Midterm \*\*\*\*\*

Week 8 (2/21 -- 2/25)

§3.4 Velocity and Tangent Vectors

1,3,5,7,9,13,17,21,25,27,31,33,35,37,43,49,51,55,  
57,63,65,67

§3.6 Newton's Laws 1,3,7

Applications of Derivatives

§4.1 The Tangent Line Approximation 1,3,5,8,9,11,13,17

**The week, of 2/28 to 3/4 is spring break.**

Week 9 (3/7-- 3/11)

§4.2 Newton's Method 1,3,7,9,10

§4.3 Increasing/Decreasing; Concavity

2,3,9,13,15,17,21,23,25,27,29,31,35,47,52,53,55

§4.4 Horizontal/Vertical Asymptotes 1,3,4,5,9,11,17,19,21,27,29,30,31,35,41

Week 10 (3/15-- 3/18)

§4.5 Tools for Optimization 7,9,11,19,23,25,29,39

§4.6 Optimization Problems 1,3,9,11,19,23,29

§4.7 Related Rates 1,3,7,9,11,17,25

The Integral

Week 11 (3/21 -- 3/25)

§5.1 Summation Notation 1,5,13,17,19,21,23,29,33,41,42

§5.2 The Definite Integral 1,3,5,9,15,18,19

§5.3 The Fundamental Theorem of Calculus 1-31(odd),35-45(odd)

**Friday, March 25<sup>th</sup> Last day to drop with a W grade**

Week 12 (3/28 -- 4/1)

§5.4 The Indefinite Integral 1-21(odd)

§5.5 Integration by Substitution 1-29(odd)

Week 13 (4/4 -- 4/8)

§5.5 Integration by Substitution (continued)

33-45(odd),49,55,59,61,65-71(odd),75

Week 14 (4/11 -- 4/13)

Review

Week 15 (4/15 -- 4/22)

Final Exam