Syllabus - Math 161 - Calculus I

Department of Mathematics
Millersville University

Description

An introduction to the concepts and techniques of calculus, beginning with limits; theory and applications of derivatives, antiderivatives, and definite integrals; calculus of trigonometric, exponential, and logarithmic functions. (4 credits)

This course may be taken for general education credit (G2).

Prerequisites

A C- or better in Math 160 or Math Placement.

Objectives

Students will learn the theory and techniques of calculus, and its applications. In light of this, students will be able to:

- Compute derivatives (including derivatives of trigonometric and inverse trigonometric, exponential, and logarithmic functions), compute limits (algebraically, and using L'Hopital's Rule), and use limits to compute derivatives.
- Use derivatives to find slopes of curves and rates of change.
- Explain and apply the fundamental formulas and techniques of differential calculus.
- Explain the definite integral and its relationship to limits, and apply it to finding areas.
- Explain some of the theoretical underpinnings of calculus: The notions of limits and continuity, derivations of the key formulas of calculus, and proofs of some major theorems.
- Apply the techniques of calculus to problem-solving situations, such as optimization, root finding, approximation by differentials, and curve sketching.

Assessment

Students will demonstrate their understanding through work in class, homework, and examinations.

Use of Technology

Students are required to have access to a graphing calculator for this course. The department currently supports the TI 83, 84, and 86.

Calculators (and technology in general) should enhance learning, and students should learn to use them appropriately. Instructors may at times prohibit the use of calculators with symbolic math capabilities, such as the TI-89 or TI-92. Instructors may prohibit the use of calculators on exams, as they deem appropriate.

• Graphical and numerical evidence should be presented as an aid to conjecture and comprehension. They should not substitute for rigorous proof, nor should they replace the acquisition of appropriate symbolic manipulation skills.

• Students should understand the limitations of technology (for example, by seeing situations in which graphical or numerical evidence is unreliable or inconclusive).

In MATH 161, students will:

• Graph functions in rectangular coordinates.

• Explore functional relationships through the use of numerical tables (e.g. using the Table function on the TI calculators).

• Approximate finite sums (e.g. using the Sum Seq function on the TI calculators).

• Approximate integrals numerically (e.g. using the fnint function on the TI calculators).

• Approximate solutions to non-linear equations in one variable (including the use of Newton's Method)

Topics

1. Limits

The Concept of Limit
Computation of Limits
Continuity and Its Consequences
Limits Involving Infinity; Asymptotes

2. Derivatives

Tangent Lines and Velocity
The Derivative
Computation of Derivatives: The Power Rule
The Product and Quotient Rules
The Chain Rule
Derivatives of Trigonometric Functions
Derivatives of Exponential and Logarithmic Functions
Implicit Differentiation and Inverse Trigonometric Functions

3. Applications of Differentiation

The Mean Value Theorem
Linear Approximations and Newton's Method
Indeterminate Forms and L'Hopital's Rule
Maximum and Minimum Values
Increasing and Decreasing Functions
Concavity and the Second Derivative Test
Overview of Curve Sketching
Optimization
Related Rates

4. Integration

Antiderivatives
Sums and Sigma Notation
Area
The Definite Integral
The Fundamental Theorem of Calculus
Integration by Substitution
The Natural Logarithm as an Integral

5. Applications of Integration

Exponential Growth
Separation of variables

Textbooks

Robert Smith and Roland Minton, *Calculus* (4th edition, early transcendentals). New York: McGraw-Hill, 2012.

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