

# MATH 161 – CALCULUS I – SYLLABUS

Department of Mathematics  
Millersville University

## Description

An introduction to the concepts and techniques of calculus, beginning with limits. Major emphasis on the theory and application of limits, continuity, derivatives, antiderivatives, and the definite integral. Includes introductory calculus of trigonometric, inverse trigonometric, exponential and logarithmic functions. (4 credits)

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

## Prerequisites

C- or better in MATH 160 or math placement testing/evaluation before registration

## Course Objectives

Students will learn the theory and techniques of calculus and its applications. By the conclusion of this course the successful student will be able to:

- Compute limits algebraically.
- Use the limit definition of derivative to compute derivatives.
- Compute the derivatives of functions including, but not limited to, polynomial, rational, trigonometric, inverse trigonometric, exponential, and logarithmic functions.
- Use the derivative to find the slopes of functions and determine rates of change.
- Compute limits using L'Hospital's rule.
- 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 of its major theorems.
- Apply the techniques of calculus to problem-solving situations such as optimization, root finding, approximation by differentials, and curve sketching.
- Use appropriate mathematical notation and symbols throughout their work.

## Assessment

Assessment of student achievement of the course objectives will vary from one instructor to another. Typical assessment will be made 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. Additionally, Millersville University students have access to the mathematical software, *Mathematica*, which may be used at the instructor's discretion.

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.

## Topics

1. Limits
  - a. The concept of a limit
  - b. Computation of limits
  - c. Continuity and its consequences
  - d. Limits involving infinity; asymptotes
2. Derivatives
  - a. Tangent lines and velocity
  - b. The derivative
  - c. Computation of derivatives: The power rule
  - d. The product and quotient rules
  - e. The chain rule
  - f. Derivatives of trigonometric functions
  - g. Derivatives of exponential and logarithmic functions
  - h. Implicit differentiation and inverse trigonometric functions
3. Applications of differentiation
  - a. The mean value theorem
  - b. Linear approximations and Newton's method
  - c. Indeterminate forms and L'Hospital's rule
  - d. Maximum and minimum values
  - e. Increasing and decreasing functions
  - f. Concavity and the second derivative test
  - g. Overview of curve sketching

- h. Optimization
- i. Related rates
- 4. Integration
  - a. Antiderivatives
  - b. Sums and sigma notation
  - c. Area
  - d. The definite integral
  - e. The fundamental theorem of calculus
  - f. Integration by substitution
  - g. The natural logarithm as an integral
- 5. Applications of integration
  - a. Exponential growth
  - b. Separation of variables