

**MOREHOUSE COLLEGE
DEPARTMENT OF MATHEMATICS**

**CALCULUS I
MATH 161**

Prerequisite: Precalculus (Math 120, formerly Math 154) with a grade of “C” or better

Text: Calculus, First Ed., by Jon Rogawski (W.H. Freeman, 2008)

Coverage: Chapters 2, 3, 4, 5, and 6

COURSE OUTLINE

CHAPTER 2. Limits

- 2.1 Limits, Rates of Change, and Tangent Lines
- 2.2 Limits: A Numerical and Graphical Approach
- 2.3 Basic Limit Laws
- 2.4 Limits and Continuity
- 2.5 Evaluating Limits Algebraically
- 2.6 Trigonometric Limits
- 2.7 Intermediate Value Theorem

CHAPTER 3. Differentiation

- 3.1 Definition of the Derivative
- 3.2 The Derivative as a Function
- 3.3 Product and Quotient Rules
- 3.4 Rates of Change
- 3.5 Higher Derivatives
- 3.6 Trigonometric Functions
- 3.7 The Chain Rule
- 3.8 Implicit Differentiation
- 3.9 Related Rates

CHAPTER 4. Applications of the Derivative

- 4.1 Linear Approximation and Applications
- 4.2 Extreme Values
- 4.3 The Mean Value Theorem and Monotonicity
- 4.4 The Shape of a Graph
- 4.5 Graph Sketching and Asymptotes
- 4.6 Applied Optimization
- 4.7 Newton’s Method
- 4.8 Antiderivatives

CHAPTER 5. The Integral

- 5.1 Approximating and Computing Area
- 5.2 The Definite Integral
- 5.3 The Fundamental Theorem of Calculus, Part I
- 5.4 The Fundamental Theorem of Calculus, Part II
- 5.5 Net or Total Change as the Integral of a Rate
- 5.6 Substitution Method

CHAPTER 6. Applications of the Integral

- 6.1 Area Between Two Curves
- 6.2 Setting Up Integrals: Volume, Density, Average Value
- 6.3 Volumes of Revolution
- 6.4 The Method of Cylindrical Shells

6.5 Work and Energy

BEHAVIORAL OBJECTIVES

After successfully completing this course, the students should be able to perform the following tasks:

Limits and Continuity

- Discuss the behavior of certain algebraic functions as the variable approaches a certain number
- Define the concepts of limit and continuous function
- Find indicated limits by using limit theorems

Differentiation

- Define and interpret the derivative of a function
- Compute the derivative by definition
- Compute the slope of and write the equation of a line tangent to a given curve at a given point by differentiation
- State and apply the differentiation formulas
- Determine the derivative of a function which is given implicitly by an equation
- Find derivatives of higher order
- Discuss the instantaneous rate of change of a quantity
- Understand the role of differentials

The Mean-Value Theorem and Applications

- State, illustrate, and prove Rolle's Theorem and the Mean Value Theorem
- Determine when a function is increasing or decreasing
- Determine if a curve is concave upward or downward at a point
- Discuss and sketch a curve
- Determine the maximum and minimum values of a function
- Discuss the motion of a particle on a straight line
- Discuss the motion of free-falling objects

Integration

- Define the indefinite and definite integral of a function
- State and apply the integration formulas
- State and apply the Fundamental Theorem of Calculus
- Find the area under a curve
- Compute certain integrals by u -substitution

Applications of the Integral

- Compute the area between two curves
- Compute the volume of a solid of revolution
- Compute the work done by a force