

# **COURSE OUTLINE**

## **MATH 181 Calculus I**

4 Semester Hours

### **HOWARD COMMUNITY COLLEGE**

#### **Description**

In this course, students will develop skills in the initial content of both differential and integral calculus. Students will be able to find limits of functions, be exposed to the epsilon-delta process, and study continuity. They will be able to find derivatives and integrals of polynomial, rational, radical, trigonometric, inverse trigonometric, exponential, and logarithmic functions. This includes the chain rule, inverse functions, and integration by substitution. Applications dealing with optimization, related rates, Newton's method, L'Hopital's rule, and motion problems will be presented. Properties of the graphs of functions will also be analyzed. Theorems used in the class will include the mean-value theorem for derivatives and integrals, the squeeze theorem and the fundamental theorems of calculus. Implicit differentiation, differentials and summations of area will be used when appropriate. A graphing calculator is required. The use of a computer algebra system will be an integral part of the course. Credit will only be granted for one of the following: MATH 140, MATH 145 or MATH 181. Prerequisite: MATH 153 or MATH 155 or appropriate score on the mathematics placement test. A grade of C or higher in the Precalculus sequence is strongly recommended. (4 hours weekly)

#### **Statement on General Education and Liberal Learning**

A liberal education prepares students to lead ethical, productive, and creative lives and to understand how the pursuit of lifelong learning and critical thinking fosters good citizenship. General education courses form the core of a liberal education within the higher education curriculum and provide a coherent intellectual experience for all students by introducing the fundamental concepts and methods of inquiry in the areas of mathematics, the physical and natural sciences, the social sciences, the arts and the humanities, and composition. This course is part of the general education core experience at Howard Community College.

#### **Overall Course Objectives**

Upon completion of this course, the student will be able to:

1. Calculate limits of elementary functions.
2. Apply the derivative to determine instantaneous rate of change and local linear approximation.
3. Determine derivatives of functions which are given either implicitly or explicitly.
4. Apply the theory of derivatives to graph curves, approximate function values using Newton's method, and solve a variety of problems, such as related rates, optimization, and differentials.
5. Apply the Intermediate and Mean Value Theorems.
6. Apply the definite integral both as a limit of Riemann sums and as the net accumulation of change.
7. Apply the Fundamental Theorems of Calculus.
8. Determine an antiderivative of a function and calculate definite integrals of functions.
9. Communicate solutions to problems in a neat, organized and easy-to-follow way while using correct mathematical notation.
10. Use technology as a means of discovery, to reinforce concepts, and as an efficient problem solving tool.
11. Demonstrate an appreciation of the historic development of calculus in its multicultural context as well as through contributions of Newton and Leibnitz.

## Major Topics

- I. Limits
  - A. Informal Definition of a Limit
  - B. Properties of Limits
  - C. Techniques for Computing Limits
  - D. Continuity and One-Sided Limits
  - E. The Squeeze Theorem
  - F. Infinite Limits and Limits at Infinity
  - G. Intermediate Value Theorem
  - H. Precise Definition ( $\varepsilon$ - $\delta$ ) of a Limit
- II. Differentiation
  - A. Rates of Change and the Tangent Line
  - B. Formal Definition of Derivative
  - C. Basic Differentiation Rules
  - D. Higher Order Derivatives
  - E. The Product and Quotient Rules
  - F. Derivatives of Trigonometric Functions
  - G. Derivatives as Rates of Change
  - H. The Chain Rule
  - I. Implicit Differentiation
  - J. Derivatives of Logarithmic and Exponential Functions
  - K. Derivatives of Inverse Trigonometric Functions
  - L. Related Rates
- III. Applications of Differentiation
  - A. Maxima and Minima
  - B. Increasing and Decreasing Functions and the First Derivative Test
  - C. Concavity and the Second Derivative Test
  - D. Graphing Functions
  - E. Optimization Problems
  - F. Linear Approximation and Differentials
  - G. Mean Value Theorem
  - H. L'Hopital's Rule
  - I. Antiderivatives
  - J. Newton's Method
- IV. Integration
  - A. Approximating Areas under Curves: Riemann Sums
  - B. Definite Integrals
  - C. The Fundamental Theorem of Calculus
  - D. Average Value of a Function
  - E. Mean Value Theorem for Integrals
  - F. Integration by Substitution
  - G. Velocity and Net Change

## Course Requirements

**Grading/Exams:** Grading procedures will be determined by the individual faculty member within the guidelines of the Mathematics Division and will include several unit exams, projects and a comprehensive departmental final exam.

**Required Text:** Calculus: Early Transcendentals, 1st edition, by Briggs & Cochran

**Required Online Homework:** MyMathLab

**Required Calculator:** Programmable Graphing Calculator (TI-83+/84 recommended)

## Other Course Information

This course may be used as a Mathematics core course or as an Arts and Science elective. Check with your transfer institution concerning transferability for your program.