

COURSE OUTLINE

MATH 140
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 learn about continuous and discontinuous functions. They will be able to find derivatives and integrals of polynomial, rational, radical, trigonometric, exponential, and logarithmic functions. This includes the chain rule, the rules dealing with operations, u-substitution and both definite and indefinite integrals. Applications dealing with optimization, related rates, distance, velocity and acceleration will be presented. Graphing (asymptotes, increasing, decreasing, concavity, maximum, minimum) will also be discussed. 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 recommended. 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 or MATH 145. Prerequisite: MATH 135, MATH 133, or equivalent. (4 hours weekly)

Overall Course Objectives

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

1. Calculate limits of elementary functions at a point.
2. Use ϵ - δ notation and squeeze theorem in the proofs of limits.
3. Calculate derivatives of functions given either implicitly or explicitly.
4. Calculate integrals of functions.
5. Apply the theory of derivatives to the graphing of curves and to solving related rate, optimization, differential problems, and estimation of zeros of a function with Newton's method .
6. Apply the theorems of calculus to given functions.
7. Solve problems in a neat, organized and easy-to-follow way while using correct mathematical notation.
8. Calculate limits of logarithmic and exponential functions at a point.
9. Calculate derivatives and integrals of logarithmic and exponential functions.
10. Use the computer algebra system, DERIVE, 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 and Their Properties
 - A. An Introduction to Limits
 - B. Properties of Limits
 - C. Techniques for Evaluating Limits
 - D. Continuity and One-Sided Limits
 - E. Infinite Limits

- II. Differentiation
 - A. The Derivative and the Tangent Lines Problem
 - B. Basic Differentiation Rules and Rates of Change
 - C. The Product and Quotient Rules and Higher-Order Derivatives
 - D. The Chain Rule
 - E. Implicit Differentiation
 - F. Related Rates

- III. Applications of Differentiation
 - A. Extrema on an Interval
 - B. Rolle's Theorem and the Mean Value Theorem
 - C. Increasing and Decreasing Functions and the First Derivative Test
 - D. Concavity and the Second Derivative Test
 - E. Limits at Infinity
 - F. A Summary of Curve Sketching
 - G. Optimization Problems
 - I. Newton's Method

- IV. Integration
 - A. Antiderivatives and Indefinite Integration
 - B. Area
 - C. Definite Integrals
 - D. The Fundamental Theorem of Calculus
 - E. Integration by Substitutions

- V. Logarithms and Exponential Functions
 - A. The Natural Logarithmic Function and Differentiation
 - B. The Natural Logarithmic Function and Integration
 - C. Exponential Functions: Differentiation and Integration
 - D. Bases Other than e and Applications

Course Requirements

Grading/Exams: Grading procedures will be determined by the individual faculty member but will be based on several unit exams and a comprehensive final.

A graphing calculator such as the TI83+ is required.

Other Course Information

This course may be used as a Mathematics core course or as a Mathematics elective and will transfer to a four-year university.

Weather-Related Cancellations

Weather-related class cancellations due to weather emergencies will be published on the HCC website. Cancellations will also be aired on local radio and television stations affiliated with the three major networks between 6:00 a.m. and 9:00 a.m. When Howard County public schools are closed because of weather emergencies, the HCC classes held at these schools are automatically canceled. Special attention should be paid to confirm whether closing decisions apply to the county school system or HCC, credit, non-credit, day and/or evening courses. If classes are cancelled any time after school opens, announcements will be made in the same manner. A recorded message will be played on the college's main telephone number, 410-772-4800.