

MATH 251

Calculus I

4 Credits

Community College of Baltimore County
Common Course Outline

Description

MATH 251 – Calculus I: covers functions, limits, continuity, derivatives, derivative algorithms, linear approximations, optimization and other applications, area under a curve, definite integrals, the Fundamental Theorem of Calculus, Mean Value Theorem, Rolle's Theorem, Intermediate Value Theorem.

Pre-requisites: MATH 165 with a grade of C or better

Overall Course Objectives

Upon completion of this course, students will be able to:

1. evaluate limits of functions;
2. determine continuity and differentiability;
3. sketch the graph of the derivative function given the graph of the original function;
4. determine the derivative of a function from the limit definition;
5. determine the derivative of a function by rules;
6. sketch a function, using appropriate information (increasing/decreasing functions, concavity, max/min points, points of inflection);
7. determine extreme values;
8. apply the following theorems appropriately: Mean Value Theorem, Rolle's Theorem, and Intermediate Value Theorem;
9. determine the area under a curve using Riemann sums;
10. evaluate definite integrals using the Fundamental Theorem of Calculus;
11. evaluate definite and indefinite integrals using substitution;
12. determine antiderivatives;
13. apply the Second Fundamental Theorem of Calculus;
14. use linear approximations;
15. examine the mathematical contributions made by people from diverse cultures throughout history and their cultural and social significance;
16. articulate a solution to mathematical problems;
17. apply appropriate technological tools to analyze and solve mathematical problems and their applications accurately and efficiently;
18. demonstrate ethical responsibility and professional integrity in the use and communication of technology-based mathematical solutions; and
19. find, evaluate, use, and cite appropriate academic resources when completing their written assignments.

Major Topics

- I. Precalculus review

The Common Course Outline (CCO) determines the essential nature of each course.
For more information, see your professor's syllabus.

- a. Functions (definition, domain and range)
- b. Transformations and compositions of functions
- c. Trigonometric functions
- II. Limits and continuity
 - a. The concept of the epsilon-delta definition of a limit
 - b. Numerical, graphical and algebraic evaluation of limits
 - c. One-sided limits
 - d. Squeezing Theorem
 - e. Definition of continuity
 - f. Intermediate Value Theorem
- III. Introduction to the Derivative
 - a. Tangent line and Instantaneous Rate of Change
 - b. Limit definition of the derivative at a point and the derivative function
 - c. Differentiability
 - d. Second derivative as concavity
 - e. Higher order derivatives
 - f. Rolle's Theorem and Mean Value Theorem
- IV. Rules of Differentiation
 - a. Derivative rules (constant, scalar multiple, sum, product and quotient)
 - b. Derivatives of algebraic and transcendental functions
 - c. The Chain Rule
 - d. Implicit differentiation
- V. Using the Derivative
 - a. Linear approximation and differentials
 - b. Critical points, extrema and inflection points
 - c. First and Second Derivative Tests
 - d. Curve sketching
 - e. Application of position, velocity and acceleration functions
 - f. Optimization
 - g. Related rates
 - h. Application to real world problems
- VI. Indefinite Integral
 - a. Antiderivatives
 - b. Definition of the Indefinite Integral
 - c. Integrals of algebraic and transcendental functions
 - d. Indefinite Integrals by substitution
- VII. Definite Integral
 - a. Intuitive notion of a definite integral as area under a curve
 - b. Definition of the definite integral as limit of a Riemann sum
 - c. Computation of Riemann sums
 - d. Determine the area under a curve using Riemann sums
 - e. Evaluate definite integrals using the Fundamental Theorem of Calculus
 - f. Evaluate definite integrals by substitution
 - g. Apply the Second Fundamental Theorem of Calculus

Course Requirements

Grading will be determined by the individual faculty member, but shall include the following, at minimum:

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- two exams and a cumulative final exam.
- four graded assignments
- activities which allow students to demonstrate the General Education Program outcomes (10% of final grade)

Written assignments and research projects: Students are required to use appropriate academic resources in their research and cite sources according to the style selected by their professor.

Other Course Information

This course is an approved 4-credit General Education course in the Mathematics category.

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