June 2004

High School Mathematics
Advanced Placement Calculus

Calculus is valuable course for students who eventually want to major in mathematics, science, engineering, or computer science. During the first part of the course students study limits, continuity, and derivatives and differentials of algebraic and functions. Then students apply the derivative to sketching and to problems in related rates, maxima and minima, and curvature. During the second part of the course students learn various techniques and applications of integration. Students in the course are required to take the Advanced Placement Examination in Calculus (Calculus AB) which is given in May of each year. Each student will be required to have a graphing calculator (TI 83 Plus) to use for the ye*ar*.

Learning Opportunities

TI-83 Calculator labs to discover new concepts and their applications, history of Calculus projects.

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Standards

Fields of Knowledge: Mathematics, Science, Technology

Inquiry, Experimentation and Theory

7.4 History of Math: Students understand the history of math and technology.

Mathematical Understanding

7.7 Geometric and Measurement Concepts: Students use geometric and measurement concepts

7.8 Function and Algebra Concepts: Students use function and algebra concepts

Mathematical Problem Solving and Reasoning

Applications: Students use concrete, formal, and informal strategies to solve mathematical problems, apply the process of mathematical modeling, and extend and generalize mathematical concepts.

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Content Knowledge and Skills

Semester 1:
Limits, continuity, and derivatives and differentials of algebraic and transcendental functions
Application of the derivative to sketching and to problems in related rates, maxima and minima, and curvature.
Semester 2:
techniques and applications of integration.

Assessment Criteria

The student is able to:

- find the domain, range, asymptotes, symmetry and intercepts of a function solve equations and inequalities involving absolute values
- sketch the basic graph of algebraic, transcendental, and other functions
- demonstrate an understanding of the concept of local linearity of a function define and evaluate limits
- find functions, given their rate-of-change function, using tables and the calculator
- define derivative and demonstrate and understanding of its development from secants
- find the derivative of algebraic, transcendental, and hyperbolic functions
- find the derivative of a function, inverse functions, and implicit functions
- find the equations of tangent and normal lines to a graph
- demonstrate an understanding of the relationship between the graph of a function and its derivatives
- apply derivatives to solve velocity, acceleration, related rate, and max-min problems
- demonstrate an understanding of Rolle'sTheorem and the Mean Value Theorem and can find values of the function which satisfy these theorems
- demonstrate an understanding of the difference between a derivative and a differential and can use differentials in solving error problems

- use Riemann sums on the calculator to approximate the area under curves
- demonstrate an understanding of the Fundamental Theorem of Calculus and state the relationship between a derivative and an integral
- demonstrate and understanding of the relationship between integrals and the area under a curve
- use integrals to find areas, and volume
- use various integration techniques – e.g., integration by parts, trig substitution, and tables
- approximate integration using the trapezoidal rule and Simpson's rule evaluate improper integrals
- use a graphing calculator for calculus applications
- use slope fields to determine the family of slopes of a function

Resources

Calculus: Concepts and Contexts, James Stewart, Brooks/Cole Publishing Company, 1998