June 2004

High School Mathematics
Calculus

Calculus is an advanced course intended for those students who plan to continue in
a mathematics-based field in college. This course offers much of the topics covered
in a college course, with less focus on the proofs and theory. More focus is put on
calculus applications and moves at a less rigorous pace than that of the Advanced Placement course. The first part of the course covers the concepts of limits, continuity, and derivatives of a variety of functions and their application. During the second part of the course students learn various techniques of integration and their applications to geometry, physics and statistics.. Each student will be
assigned a graphing calculator to use for the year

Learning Opportunities

TI-83 Plus Calculator labs to discover new concepts and their applications.

Standards

Fields of Knowledge: Mathematics, Science, Technology
Inquiry, Experimentation, and Theory
7.2 Investigation: Students design and conduct a variety of their own investigations and projects.

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.
7.9 Statistics and Probability Concepts: Students use statistics and probability concepts.

Mathematical Problem Solving and Reasoning

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

Content Knowledge and Skills

Semester 1:
Limits, continuity, and derivatives of polynomial, trigonometric, logarithmic, and exponential functions. Application of the derivative to sketching curves and in related rates, and maximization problems.

Semester 2:
Calculating areas between curves using geometric, summation, and integration techniques. Determining the integrals of polynomial, trigonometric, logarithmic, and exponential functions. Application of the integral to geometry, physics and statistics.

Assessment Criteria

The student is able to:

- complete a mathematical model of a physical phenomena
- trace the development of a mathematical concept and the people connected with it
- find the domain, range, asymptotes, symmetry and intercepts of a function
- determine how a function will be transformed by certain operations on the equation of the function
- sketch the basic graph of polynomial, trigonometric, logarithmic, exponential, and inverse functions
- demonstrate an understanding of the concept of local linearity of a function
- define and evaluate limits
- define derivative and demonstrate and understanding of its development from secants

- find the derivative of polynomial, trigonometric, logarithmic, and exponential function
- 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 rates, and maximization problems
- demonstrate an understanding of the Mean Value Theorem
- demonstrate an understanding of L'Hopital's Rule
- use Riemann sums on the calculator to approximate the area under curves
- use Sigma notation and summation techniques to find the area undera curve
- 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, surface area, and volume formulas
- use integrals to find arc lengths, centers of mass, and probabilities under a bell curve
- use various integration techniques – e.g., integration by substitution, parts, partial fractions, and tables
- approximate integration using the rectangular approximation methods, trapezoidal rule and Simpson's rule
- evaluate improper integrals
- use a graphing calculator for calculus applications

Resources

Calculus 2nd Edition, Finney, Demara, Waits and Kennedy,
Addison Wesley, 2000

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