

A.P. CALCULUS

This course is an introduction to limits and the basic techniques and applications of the differentiation and the integration of algebraic functions and elementary transcendental functions. A multi-representational approach (graphical, numerical, analytical and verbal) emphasizes a conceptual understanding of principles involved rather than formal, rigorous proofs. The graphing calculator is used for demonstration, approximations and problem-solving. This college-level course adequately prepares students for the AB level of the advanced placement examination.

OBJECTIVES

1. To develop an intuitive understanding of limits and continuity
2. To find derivatives of algebraic and transcendental functions;
3. To solve problems involving applications of the derivatives;
4. To study methods of integration and applications of integrals;
5. To understand the utility and limitations of mathematical tools.

SCOPE

I. Functions Review

- A. Types of functions: linear, polynomial, rational, absolute value, exponential, logarithmic, trigonometric, inverse trigonometric and piece-wise
- B. Notation, terminology, and representations of functions
- C. Properties of functions
- D. Operations on functions (+, -, *, \div , and composition)
- E. Graphs of functions

II. Limits

- A. Intuitive definition of limit
- B. Computational techniques
- C. Estimating limits from graphs or tables
- D. One-sided limits
- E. Intermediate Value Theorem
- F. Continuity, asymptotes, infinite limits
- G. Trigonometric limits

III. Derivatives

- A. Derivative defined as limit of difference quotient
- B. Derivatives of polynomials and functions with fractional and negative exponents
- C. Product and quotient rules
- D. Chain rule
- E. Higher-order derivatives
- F. Implicit differentiation
- G. Derivatives of trigonometric functions

H. “nDeriv(“ on graphing calculator

IV. Applications of Derivatives

- A. Tangent line to a curve at a point and local linear approximation
- B. Instantaneous and average rates of change
- C. Approximate rate of change from graphs and tables of values
- D. Comparing graph of function with graph of derivative
- E. Related rates
- F. Extrema (absolute and relative), maximum/minimum problems
- G. Rolle’s Theorem, Mean Value Theorem
- H. Applications to graphing (monotonocity, concavity)
- I. Limits at infinity
- J. Horizontal motion, free-falling objects

V. Integration

- A. Antiderivatives
- B. Rewriting integrands to fit fundamental formulas
- C. Substitution
- D. Solving differential equations with initial conditions
- E. Slope fields

VI. Logarithmic, Exponential and Inverse Trigonometric Functions

- A. Differentiation of inverse functions
- B. Differentiation of logarithmic, exponential and inverse trigonometric functions
- C. Logarithmic differentiation
- D. Integration using logarithmic, exponential and inverse trigonometric functions

VII. Applications of Integration

- A. Summation, area under curve, upper and lower sums, Reimann sums
- B. Fundamental Theorem of Calculus
- C. Area of a region
- D. Trapezoidal rule
- E. Second Fundamental Theorem of Calculus
- F. Average value of a function
- G. Volume of a solid of revolution using the disk or washer methods
- H. Volume of a solid with known cross-section
- I. Motion along a line
- J. Exponential growth
- K. Numerical value of definite integral on graphing calculator

VIII. Summary: Preparation for the AP Exam

TEXT: Calculus of a Single Variable, Fifth Edition, Larson, Hostetler and Edwards