

AP CALCULUS AB

COURSE DESCRIPTION

AP Calculus will cover the Essential, Important, and Enhancing standards for Calculus. In addition, students will prepare for the Advanced Placement Calculus AB Test, and will be expected to take the test in the spring. AP Calculus moves at an accelerated pace, which allows for topics to be studied in greater depth and for the inclusion of additional topics. Instruction is student-centered, makes use of open-ended questions, and involves a greater emphasis on self-discovery and self-directed learning. Students are expected to display a greater depth of thought in their written and spoken responses, to analyze and synthesize data, and to interpret, solve, and utilize solutions to real-world problems. In addition, assessments will involve advanced data analysis and multi-layered solutions and applications of those solutions. The text for the course is *Single Variable Calculus Concepts and Contexts, James Stewart, Second Edition, 2001*.

- Chapter 1: Functions and Models
- Chapter 2: Limits and Derivatives
- Chapter 3: Differentiation Rules
- Chapter 4: Applications of Differentiation
- Chapter 5: Integrals
- Chapter 6: Applications of Integration
- Chapter 7: Differential Equations

CONTENT STANDARDS

Essential Standards:

The student can:

1. Apply derivatives to solve optimization problems; and
2. Solve an accumulated change problem using Riemann sums and definite integrals.

Important Standards

5. Functions, Graphs, and Limits
 - a. Graph Analysis: With the aid of technology, students can use calculus both to predict and to explain local and global behavior of functions.
 - b. Limits of Functions: Students can demonstrate an intuitive understanding of the limit process and be able to calculate and estimate limits represented in algebraic, graphical, and tabular form.
 - c. Asymptotic and Unbounded Behavior: Students can determine the existence of asymptotes using limits involving infinity and can

interpret their results graphically. In addition, students can compare relative rates of change of various function types.

- d. Continuity: Students can develop an intuitive understanding of continuity and its relationship to limits and graphs (Intermediate Value Theorem and Extreme Value Theorem).

6. Derivatives

- a. Derivative at a Point: Students can associate the derivative with the following: slope of a curve at a point, tangent line to a curve, local linear approximation, instant rate of change.
- b. Derivative as a Function: Students can determine the relationships between the graphs of f , f' , and f'' . Students can analyze the graphical behavior of a function by examining the following: increasing and decreasing behavior, concavity, inflection points, absolute and relative extrema, and the Mean Value Theorem.
- c. Applications of Derivatives: Students can solve problems involving the following applications: optimization, related rates, implicit differentiation, and motion problems.
- d. Computation of Derivatives: Students can compute derivatives using the power rule, the product/quotient rules, and the chain rule and apply these rules to power, exponential, and trigonometric functions.

7. Integrals

- a. Interpretations and Properties of Definite Integrals: Students can compute Riemann sums using various approximation techniques and be able to interpret the integral of a rate of change as an accumulated change.
- b. Fundamental Theorem of Calculus: Students can develop an understanding of the FTC and use it to evaluate definite integrals. Antidifferentiation Techniques- Students will learn to find antiderivatives using basic power rules, substitution, and integration by parts.
- c. Applications of antidifferentiation: Students can use integrals to calculate areas and volumes, find the average value of a function, and determine the distance traveled by a particle along a line. In addition, students can solve separable differential equations use their findings to model and predict exponential growth.

Enhancing Standards

1. Parametric Functions: Students can use calculus to analyze planar curves given in parametric form.
2. L'Hopital's Rule: Students can use the rule to compute limits and help analyze function behavior.

3. Method of Partial Fractions: Students can use the method to compute appropriate integrals.
4. Improper Integrals: Students can compute improper integrals and interpret them as limits of definite integrals.
5. Slope Fields: Students can describe a geometric interpretation of differential equations via slope fields.

