



Online Courses for High School Students

1-888-972-6237

Calculus

Course Description:

This course provides a comprehensive survey of differential and integral calculus concepts, including limits, derivative and integral computation, linearization, Riemann sums, the fundamental theorem of calculus, and differential equations. Content is presented across ten units and covers various applications, including graph analysis, linear motion, average value, area, volume, and growth and decay models. In this course students use an online textbook, which supplements the instruction they receive and provides additional opportunities to practice using the content they've learned.

Course Length: Two Semesters

Prerequisites: Pre-Calculus/Trigonometry (or equivalent)

Materials List: TI-83/84 Graphing Calculator

Course Outline

Semester 1

Unit 1: Limits and Continuity

Students learn to use limits to describe the continuity of functions at a point. They evaluate a limit graphically, numerically, and analytically. They also learn the conditions and conclusions of the Intermediate Value Theorem.

- Concept of a Limit
- Algebraic Computation of a Limit
- Limits Involving Infinity
- Continuity
- Intermediate Value Theorem

Unit 2: Derivatives

Students learn to find the derivative and define the differentiability of functions. They use tangent lines to approximate function values, describe linear motion using derivatives, and learn the relationship between a graph of a function and its derivative.

- Concept of a Derivative
- Differentiability
- Graphs of f and f'
- Motion Along a Line
- Tangent Line Approximation

Unit 3: Differentiation

Students find the derivative of functions, calculate high-order derivatives, and calculate derivatives of inverse functions.

- Basic Computation Rules
- Higher Order Derivatives
- Product, Quotient, and Chain Rules
- Implicit Differentiation
- Derivatives of Inverse Functions

Unit 4: Graph Behavior

Students use limits to describe the asymptotes, end-behavior, concavity, and absolute extreme values of a function. They also use graph analysis to sketch a function.

- Asymptotes and End-Behavior
- Increasing/Decreasing Behavior and Concavity
- Relative Extreme Values and Points of Inflection
- Absolute Extreme Values and Extreme Value Theorem
- Graph Analysis

Unit 5: Derivative Applications

Students use the mean value and Rolle's theorems. They use derivatives to model situations that involve rates of change and solve problems involving related rates and optimization.

- Mean Value and Rolle's Theorems
- Rates of Change
- Related Rates
- Optimization

Semester 2

Unit 6: Antidifferentiation

Students learn antiderivatives and indefinite integrals. They find the antiderivative of various functions, create and use slope fields for differential equations, and solve initial value problems.

- Antiderivatives and Definite Integrals
- Slope Fields
- Basic Computation Rules
- Substitution Rule
- Initial Value Problems

Unit 7: The Definite Integral

Students learn the relationship between area and Riemann sums. They learn to approximate and evaluate definite integrals and use the Fundamental Theorem of Calculus.

- Area and the Riemann Sums
- Approximation Methods
- Fundamental Theorem of Calculus, Part 1
- Computation of Definite Integrals
- Fundamental Theorem of Calculus, Part 2

Unit 8: Integral Applications

Students learn to find the total change in quantities using integrals. They also calculate the average value of functions, use integral functions to define position, and calculate displacement and distance travelled by an object.

- Total Change
- Average Value of a Function
- Motion Along a Line Revisited

Unit 9: Area and Volume

Students learn to find area bounded by two curves, volume of a solid using cross sections, and volume of a solid generated by revolving a region about an axis.

- Area Between Two Curves
- Volume of Solids Using Cross Sections
- Volume of Solids of Revolution

Unit 10: Differential Equations and Their Applications

Students learn to recognize and solve separable differential equations. They also model and solve problems with differential equations, including exponential growth and decay problems.

- Separable Differential Equations
- Modeling Using Differential Equations
- Growth and Decay Models