



## Online Courses for High School Students

1-888-972-6237

### AP Calculus BC

#### Course Description:

This course is the equivalent of an introductory college-level calculus course. In this course, students study functions, limits, derivatives, integrals, and infinite series. Calculus helps scientists, engineers, and financial analysts understand the complex relationships behind real-world phenomena. Students learn to evaluate the soundness of proposed solutions and apply mathematical reasoning to real-world models. Students also learn to understand change geometrically and visually (by studying graphs of curves), analytically (by studying and working with mathematical formulas), numerically (by seeing patterns in sets of numbers), and verbally. Students prepare for the AP Exam.

**Prerequisites:** Success in Geometry, Algebra II, Pre-Calculus and Trigonometry

**Course Length:** Two Semesters

**Required Text:** Calculus Problem Sets (eBook included in course)

**Required Text:** *In addition, students should have this required (printed) textbook:* Larson, Ron, and Bruce H. Edwards. Calculus of a Single Variable, AP Edition (9th ed.), Belmont, CA: Brooks/Cole, Cengage Learning, 2010. [ISBN: 0547212909]

**Materials List:** A Texas Instruments TI-83 or TI-84 Plus graphing calculator

### SEMESTER I

#### Course Outline:

##### Unit 1: The Basics

- Pre-Calculus Review
- Introduction to Calculus
- Using a Graphing Calculator
- Combining Functions
- Composite and Inverse Functions
- Graphical Symmetry
- Patterns in Graphs

##### Unit 2: Limits and Continuity

- Finding Limits Analytically
- Asymptotes as Limits
- Relative Magnitudes for Limits
- When Limits Do and Don't Exist
- Continuity
- Intermediate and Extreme Value Theorems

### **Unit 3: The Derivative**

- Slope and Change
- Derivative at a Point
- The Derivative
- The Power Rule
- Sums, Differences, Products, and Quotients
- Graphs of Functions and Derivatives
- Continuity and Differentiability
- Rolles and Mean Value Theorems
- Higher-Order Derivatives
- Concavity
- Chain Rule
- Implicit Differentiation

### **Unit 4: Rates of Change**

- Extrema
- Optimization
- Tangent and Normal Lines
- Tangents to Polar Curves
- Tangent Line Approximation
- Rates and Derivatives
- Related Rates
- Rectilinear Motion
- Motion with Vector Functions

### **Unit 5: The Integral, Part 1**

- Riemann Sums
- Area Approximations
- The Definite Integral
- Properties of Integrals
- Graphing Calculator Integration
- Applications of Accumulated Change
- Antiderivatives
- Composite Functions

### **Unit 6: Semester 1 Review and Test**

- Students review the semester content and take an exam.

## **SEMESTER II**

### **Course Outline:**

### **Unit 1: The Integral, Part 2**

- The Fundamental Theorems of Calculus
- Definite Integrals of Composite Functions
- Analyzing Functions and Integrals

## **Unit 2: Applications of Integrals**

- Area Between Curves
- More Areas and Averages
- Volumes of Revolution
- Cross Sections
- Arc Length
- More Rectilinear Motion
- Other Applications of the Definite Integral

## **Unit 3: Transcendental and Parametric Functions**

- Derivatives of Inverses
- Inverse Trigonometric Functions
- Logarithmic and Exponential Review
- Transcendentals and  $1/x$
- Derivatives of Logarithms and Exponentials
- L'Hopital's Rule
- Analysis of Transcendental Curves
- Integrating Transcendental Functions
- Partial Fractions
- Integration by Parts
- Improper Integrals
- Applications of Transcendental Integrals
- Derivatives of Parametric Functions
- Integrating Parametric and Polar Functions

## **Unit 4: Simple ODEs**

- Slope Fields
- Differential Equations as Models
- Euler's Method
- Exponential Growth and Decay
- Logistic Growth
- More Applications of Differential Equations

## **Unit 5: Sequences and Series**

- Sequences
- Series
- Convergence Tests
- Radius of Convergence
- Functions Defined by Power Series
- Taylor and Maclaurin Series
- Taylor's Theorem and Lagrange Error

**Unit 6: AP Exam Prep and Final Exam**

- Exam Strategies
- Review of Topics
- Practice Exams
- Final Exam

**Unit 7: Post-Exam Project**

- Project Days