About the AP Calculus AB and BC Courses

AP Calculus AB and AP Calculus BC focus on students' understanding of calculus concepts and provide experience with methods and applications. Through the use of big ideas of calculus (e.g., modeling change, approximation and limits, and analysis of functions), each course becomes a cohesive whole, rather than a collection of unrelated topics. Both courses require students to use definitions and theorems to build arguments and justify conclusions.

The courses feature a multirepresentational approach to calculus, with concepts, results, and problems expressed graphically, numerically, analytically, and verbally. Exploring connections among these representations builds understanding of how calculus applies limits to develop important ideas, definitions, formulas, and theorems. A sustained emphasis on clear communication of methods, reasoning, justifications, and conclusions is essential. Teachers and students should regularly use technology to reinforce relationships among functions, to confirm written work, to implement experimentation, and to assist in interpreting results.

College Course Equivalent

AP Calculus AB is designed to be the equivalent of a first semester college calculus course devoted to topics in differential and integral calculus. AP Calculus BC is designed to be the equivalent to both first and second semester college calculus courses. AP Calculus BC applies the content and skills learned in AP Calculus AB to parametrically defined curves, polar curves, and vector-valued functions; develops additional integration techniques and applications; and introduces the topics of sequences and series.

Prerequisites

Before studying calculus, all students should complete the equivalent of four years of secondary mathematics designed for college-bound students: courses that should prepare them with a strong foundation in reasoning with algebraic symbols and working with algebraic structures. Prospective calculus students should take courses in which they study algebra, geometry, trigonometry, analytic geometry, and elementary functions. These functions include linear, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric, and piecewise-defined functions. In particular, before studying calculus, students must be familiar with the properties of functions, the composition of functions, the algebra of functions, and the graphs of functions.

Students must also understand the language of functions (domain and range, odd and even, periodic, symmetry, zeros, intercepts, and descriptors such as increasing and decreasing). Students should also know how the sine and cosine functions are defined from the unit circle and know the values of the trigonometric functions at the numbers $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}$, and their multiples. Students who take AP Calculus BC should have basic familiarity with sequences and series, as well as some exposure to parametric and polar equations.

Course at a Glance

Plan

The Course at a Glance provides a useful visual organization of the AP Calculus AB and AP Calculus BC curricular components, including:

- Sequence of units, along with approximate weighting and suggested pacing. Please note, pacing is based on 45-minute class periods, meeting five days each week for a full academic year.
- Progression of topics within each unit.
- Spiraling of the big ideas and mathematical practices across units.

Teach

MATHEMATICAL PRACTICES

Mathematical practices spiral throughout the course.

- 1 Implementing Mathematical Processes
- 2 Connecting Representations
- 3 Justification
- 4 Communication and Notation

BIG IDEAS

Big ideas spiral across topics and units.

- CHA Change
- LIM Limits
- FUN Analysis of Functions

BC ONLY

The purple shading represents BC only content.

Assess

Assign the Personal Progress Checks—either as homework or in class—for each unit. Each Personal Progress Check contains formative multiple-choice and free-response questions. The feedback from the Personal Progress Checks shows students the areas where they need to focus.

UNIT 1 Limits and Continuity

AP EXAM WEIGHTING: 10–12% AB 4–7% BC

CLASS PERIODS: ~22–23 AB ~13–14 BC

CHA 2	1.1	Introducing Calculus: Can Change Occur at an Instant?
LIM 2	1.2	Defining Limits and Using Limit Notation
LIM 2	1.3	Estimating Limit Values from Graphs
LIM 2	1.4	Estimating Limit Values from Tables
LIM 1	1.5	Determining Limits Using Algebraic Properties of Limits
LIM 1	1.6	Determining Limits Using Algebraic Manipulation
LIM 1	1.7	Selecting Procedures for Determining Limits
LIM 3	1.8	Determining Limits Using the Squeeze Theorem
LIM 2	1.9	Connecting Multiple Representations of Limits
LIM 3	1.10	Exploring Types of Discontinuities
LIM 3	1.11	Defining Continuity at a Point
LIM 1	1.12	Confirming Continuity over an Interval
LIM 1	1.13	Removing Discontinuities
LIM 3	1.14	Connecting Infinite Limits and Vertical Asymptotes
LIM 2	1.15	Connecting Limits at Infinity and Horizontal Asymptotes
FUN 3	1.16	Working with the Intermediate Value Theorem (IVT)

Personal Progress Check 1

Multiple-choice: ~45 questions
Free-response: 3 questions (partial)

UNIT 2 Differentiation: Definition and Basic Derivative Rules

AP EXAM WEIGHTING: 10–12% AB 4–7% BC

CLASS PERIODS: ~13–14 AB ~9–10 BC

CHA 2	2.1	Defining Average and Instantaneous Rates of Change at a Point
CHA 1 4	2.2	Defining the Derivative of a Function and Using Derivative Notation
CHA 1	2.3	Estimating Derivatives of a Function at a Point
FUN 3	2.4	Connecting Differentiability and Continuity: Determining When Derivatives Do and Do Not Exist
FUN 1	2.5	Applying the Power Rule
FUN 1	2.6	Derivative Rules: Constant, Sum, Difference, and Constant Multiple
FUN LIM 1	2.7	Derivatives of cos x, sin x, e^x, and ln x
FUN 1	2.8	The Product Rule
FUN 1	2.9	The Quotient Rule
FUN 1	2.10	Finding the Derivatives of Tangent, Cotangent, Secant, and/or Cosecant Functions

Personal Progress Check 2

Multiple-choice: ~30 questions
Free-response: 3 questions (partial)

NOTE: Partial versions of the free-response questions are provided to prepare students for more complex, full questions that they will encounter on the AP Exam.

UNIT 3 Differentiation: Composite, Implicit, and Inverse Functions

AP EXAM WEIGHTING: 9–13% AB 4–7% BC

CLASS PERIODS: ~10–11 AB ~8–9 BC

- FUN 1 — 3.1 The Chain Rule
- FUN 1 — 3.2 Implicit Differentiation
- FUN 3 — 3.3 Differentiating Inverse Functions
- FUN 1 — 3.4 Differentiating Inverse Trigonometric Functions
- FUN 1 — 3.5 Selecting Procedures for Calculating Derivatives
- FUN 1 — 3.6 Calculating Higher-Order Derivatives

Personal Progress Check 3

Multiple-choice: ~15 questions
Free-response: 3 questions (partial/full)

UNIT 4 Contextual Applications of Differentiation

AP EXAM WEIGHTING: 10–15% AB 6–9% BC

CLASS PERIODS: ~10–11 AB ~6–7 BC

- CHA 1 — 4.1 Interpreting the Meaning of the Derivative in Context
- CHA 1 — 4.2 Straight-Line Motion: Connecting Position, Velocity, and Acceleration
- CHA 2 — 4.3 Rates of Change in Applied Contexts Other Than Motion
- CHA 1 — 4.4 Introduction to Related Rates
- CHA 3 — 4.5 Solving Related Rates Problems
- CHA 1 — 4.6 Approximating Values of a Function Using Local Linearity and Linearization
- LIM 3 — 4.7 Using L'Hospital's Rule for Determining Limits of Indeterminate Forms

Personal Progress Check 4

Multiple-choice: ~15 questions
Free-response: 3 questions

UNIT 5 Analytical Applications of Differentiation

AP EXAM WEIGHTING: 15–18% AB 8–11% BC

CLASS PERIODS: ~15–16 AB ~10–11 BC

- FUN 3 — 5.1 Using the Mean Value Theorem
- FUN 3 — 5.2 Extreme Value Theorem, Global Versus Local Extrema, and Critical Points
- FUN 2 — 5.3 Determining Intervals on Which a Function Is Increasing or Decreasing
- FUN 3 — 5.4 Using the First Derivative Test to Determine Relative (Local) Extrema
- FUN 1 — 5.5 Using the Candidates Test to Determine Absolute (Global) Extrema
- FUN 2 — 5.6 Determining Concavity of Functions over Their Domains
- FUN 3 — 5.7 Using the Second Derivative Test to Determine Extrema
- FUN 2 — 5.8 Sketching Graphs of Functions and Their Derivatives
- FUN 2 — 5.9 Connecting a Function, Its First Derivative, and Its Second Derivative
- FUN 2 — 5.10 Introduction to Optimization Problems
- FUN 3 — 5.11 Solving Optimization Problems
- FUN 1 3 — 5.12 Exploring Behaviors of Implicit Relations

Personal Progress Check 5

Multiple-choice: ~35 questions
Free-response: 3 questions

UNIT 6 Integration and Accumulation of Change

AP EXAM WEIGHTING: 17–20% AB 17–20% BC

CLASS PERIODS: ~18–20 AB ~15–16 BC

- CHA 4 — 6.1 Exploring Accumulations of Change
- LIM 1 — 6.2 Approximating Areas with Riemann Sums
- LIM 2 — 6.3 Riemann Sums, Summation Notation, and Definite Integral Notation
- FUN 1 — 6.4 The Fundamental Theorem of Calculus and Accumulation Functions
- FUN 2 — 6.5 Interpreting the Behavior of Accumulation Functions Involving Area
- FUN 3 — 6.6 Applying Properties of Definite Integrals
- FUN 3 — 6.7 The Fundamental Theorem of Calculus and Definite Integrals
- FUN 4 — 6.8 Finding Antiderivatives and Indefinite Integrals: Basic Rules and Notation
- FUN 1 — 6.9 Integrating Using Substitution
- FUN 1 — 6.10 Integrating Functions Using Long Division and Completing the Square
- FUN 1 — 6.11 **Integrating Using Integration by Parts** BC ONLY
- FUN 1 — 6.12 **Using Linear Partial Fractions** BC ONLY
- LIM 1 — 6.13 **Evaluating Improper Integrals** BC ONLY
- FUN 1 — 6.14 Selecting Techniques for Antidifferentiation

Personal Progress Check 6

Multiple-choice:
- ~25 questions (AB)
- ~35 questions (BC)

Free-response: 3 questions

UNIT 7 Differential Equations

AP EXAM WEIGHTING: 6–12% AB 6–9% BC

CLASS PERIODS: ~8–9 AB ~9–10 BC

- FUN 2 — 7.1 Modeling Situations with Differential Equations
- FUN 3 — 7.2 Verifying Solutions for Differential Equations
- FUN 2 — 7.3 Sketching Slope Fields
- FUN 4 — 7.4 Reasoning Using Slope Fields
- FUN 1 — 7.5 **Approximating Solutions Using Euler's Method** BC ONLY
- FUN 1 — 7.6 Finding General Solutions Using Separation of Variables
- FUN 1 — 7.7 Finding Particular Solutions Using Initial Conditions and Separation of Variables
- FUN 3 — 7.8 Exponential Models with Differential Equations
- FUN 3 — 7.9 **Logistic Models with Differential Equations** BC ONLY

Personal Progress Check 7

Multiple-choice:
- ~15 questions (AB)
- ~20 questions (BC)

Free-response: 3 questions

UNIT 8 Applications of Integration

AP EXAM WEIGHTING: 10–15% AB 6–9% BC

CLASS PERIODS: ~19–20 AB ~13–14 BC

- CHA 1 — 8.1 Finding the Average Value of a Function on an Interval
- CHA 1 — 8.2 Connecting Position, Velocity, and Acceleration of Functions Using Integrals
- CHA 3 — 8.3 Using Accumulation Functions and Definite Integrals in Applied Contexts
- CHA 4 — 8.4 Finding the Area Between Curves Expressed as Functions of x
- CHA 1 — 8.5 Finding the Area Between Curves Expressed as Functions of y
- CHA 2 — 8.6 Finding the Area Between Curves That Intersect at More Than Two Points
- CHA 3 — 8.7 Volumes with Cross Sections: Squares and Rectangles
- CHA 3 — 8.8 Volumes with Cross Sections: Triangles and Semicircles
- CHA 3 — 8.9 Volume with Disc Method: Revolving Around the x- or y-Axis
- CHA 2 — 8.10 Volume with Disc Method: Revolving Around Other Axes
- CHA 4 — 8.11 Volume with Washer Method: Revolving Around the x- or y-Axis
- CHA 2 — 8.12 Volume with Washer Method: Revolving Around Other Axes
- CHA 3 — 8.13 **The Arc Length of a Smooth, Planar Curve and Distance Traveled** BC ONLY

Personal Progress Check 8

Multiple-choice: ~30 questions
Free-response: 3 questions

UNIT 9 Parametric Equations, Polar Coordinates, and Vector-Valued Functions BC ONLY

AP EXAM WEIGHTING	N/A AB	11–12% BC
CLASS PERIODS	N/A AB	~10–11 BC

CHA 2	**9.1** Defining and Differentiating Parametric Equations
CHA 1	**9.2** Second Derivatives of Parametric Equations
CHA 1	**9.3** Finding Arc Lengths of Curves Given by Parametric Equations
CHA 1	**9.4** Defining and Differentiating Vector-Valued Functions
FUN 1	**9.5** Integrating Vector-Valued Functions
FUN 1	**9.6** Solving Motion Problems Using Parametric and Vector-Valued Functions
FUN 2	**9.7** Defining Polar Coordinates and Differentiating in Polar Form
CHA 3	**9.8** Find the Area of a Polar Region or the Area Bounded by a Single Polar Curve
CHA 3	**9.9** Finding the Area of the Region Bounded by Two Polar Curves

Personal Progress Check 9

Multiple-choice: ~25 questions
Free-response: 3 questions

UNIT 10 Infinite Sequences and Series BC ONLY

AP EXAM WEIGHTING	N/A AB	17–18% BC
CLASS PERIODS	N/A AB	~17–18 BC

LIM 3	**10.1** Defining Convergent and Divergent Infinite Series
LIM 3	**10.2** Working with Geometric Series
LIM 3	**10.3** The nth Term Test for Divergence
LIM 3	**10.4** Integral Test for Convergence
LIM 3	**10.5** Harmonic Series and p-Series
LIM 3	**10.6** Comparison Tests for Convergence
LIM 3	**10.7** Alternating Series Test for Convergence
LIM 3	**10.8** Ratio Test for Convergence
LIM 3	**10.9** Determining Absolute or Conditional Convergence
LIM 1	**10.10** Alternating Series Error Bound
LIM 3 2	**10.11** Finding Taylor Polynomial Approximations of Functions
LIM 1	**10.12** Lagrange Error Bound
LIM 2	**10.13** Radius and Interval of Convergence of Power Series
LIM 2	**10.14** Finding Taylor or Maclaurin Series for a Function
LIM 3	**10.15** Representing Functions as Power Series

Personal Progress Check 10

Multiple-choice: ~45 questions
Free-response: 3 questions