UNITS

The course content is organized into commonly taught units. The units have been arranged in a logical sequence frequently found in many college courses and textbooks.

The eight units in AP Calculus AB and ten units in AP Calculus BC, and their weighting on the multiple-choice section of the AP Exam, are listed on the following page.

Pacing recommendations at the unit level and on the Course at a Glance provide suggestions for how teachers can teach the required course content and administer the Personal Progress Checks.

The suggested class periods are based on a schedule in which the class meets five days a week for 45 minutes each day. While these recommendations have been made to aid planning, teachers are of course free to adjust the pacing based on the needs of their students, alternate schedules (e.g., block scheduling), or their school's academic calendar.

TOPICS

Each unit is broken down into teachable segments called topics. The topic pages (starting on p. 35) contain the required content for each topic. Although most topics can be taught in one or two class periods, teachers should pace the course to suit the needs of their students and school.

Exam Weighting for the Multiple-Choice Section of the AP Exam

Units	Exam Weighting (AB)	Exam Weighting (BC)
Unit 1: Limits and Continuity	10–12%	4–7%
Unit 2: Differentiation: Definition and Fundamental Properties	10–12%	4–7%
Unit 3: Differentiation: Composite, Implicit, and Inverse Functions	9–13%	4–7%
Unit 4: Contextual Applications of Differentiation	10–15%	6–9%
Unit 5: Analytical Applications of Differentiation	15–18%	8–11%
Unit 6: Integration and Accumulation of Change	17–20%	17–20%
Unit 7: Differential Equations	6–12%	6–9%
Unit 8: Applications of Integration	10–15%	6–9%
Unit 9: Parametric Equations, Polar Coordinates, and Vector-Valued Functions BC ONLY		11–12%
Unit 10: Infinite Sequences and Series BC ONLY		17–18%

Spiraling the Big Ideas

The following table shows how the big ideas spiral across units.

Big Ideas	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
	Limits and Continuity	Differentiation: Definition and Fundamental Properties	Differentiation: Composite, Implicit, and Inverse Functions	Contextual Applications of Differentiation	Analytical Applications of Differentiation
Change CHA	✓	✓		✓	
Limits LIM	✓	✓		✓	
Analysis of Functions FUN	✓	✓	✓		✓

Spiraling the Big Ideas *(cont'd)*

Big Ideas	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
	Integration and Accumulation of Change	Differential Equations	Applications of Integration	Parametric Equations, Polar Coordinates, and Vector-Valued Functions BC ONLY	Infinite Sequences and Series BC ONLY
Change CHA	✓		✓	✓	
Limits LIM	✓				✓
Analysis of Functions FUN	✓	✓		✓	

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	**3**	Justification
2	Connecting Representations	**4**	Communication and Notation

BIG IDEAS
Big ideas spiral across topics and units.

CHA	Change	**FUN**	Analysis of Functions
LIM	Limits		

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