AP Calculus BC Course and Exam Description

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 multi-representational 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.

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

RECOMMENDED 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, $\pi/6$, $\pi/4$, $\pi/3$, $\pi/2$, 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.

AP CALCULUS BC COURSE AND EXAM CONTENT

Course Content

The course content is organized into ten commonly taught units, which have been arranged in the following suggested, logical sequence:

- Unit 1: Limits and Continuity
- Unit 2: Differentiation: Definition and Fundamental Properties
- Unit 3: Differentiation: Composite, Implicit, and Inverse Functions
- Unit 4: Contextual Applications of Differentiation
- Unit 5: Analytical Applications of Differentiation
- Unit 6: Integration and Accumulation of Change
- Unit 7: Differential Equations
- Unit 8: Applications of Integration
- Unit 9: Parametric Equations, Polar Coordinates, and Vector-Valued Functions
- Unit 10: Infinite Sequences and Series

Big Ideas

The following big ideas serve as the foundation of the course, enabling students to create meaningful connections among concepts and develop deeper conceptual understanding:

- Change: Using derivatives to describe rates of change of one variable with respect to another or using definite integrals to describe the net change in one variable over an interval of another allows students to understand change in a variety of contexts.
- Limits: Beginning with a discrete model and then considering the consequences of a limiting case allows us to model real-world behavior and to discover and understand important ideas, definitions, formulas, and theorems in calculus.
- Analysis of Functions: Calculus allows us to analyze the behaviors of functions by relating limits to differentiation, integration, and infinite series and relating each of these concepts to the others

AP Calculus BC Course and Exam	
	UNIT 1 LIMITS AND CONTINUITY
1.1	Introducing Calculus: Can Change Occur at an Instant?
1.2	Defining Limits and Using Limit Notation
1.3	Estimating Limit Values from Graphs
1.4	Estimating Limit Values from Tables
1.5	Determining Limits Using Algebraic Properties of Limits
1.6	Determining Limits Using Algebraic Manipulation
1.7	Selecting Procedures for Determining Limits

	UNIT 3 DIFFERENTIATION: COMPOSITE, IMPLICIT, AND INVERSE FUNCTION
3.1	The Chain Rule
3.2	Implicit Differentiation
3.3	Differentiating Inverse Functions
3.4	Differentiating Inverse Trigonometric Functions
3.5	Selecting Procedures for Calculating Derivatives
3.6	Calculating Higher-Order Derivatives
	UNIT 4 CONTEXTUAL APPLICATIONS OF DIFFERENTIATION
4.1	Interpreting the Meaning of the Derivative in Context
4.2	Straight-Line Motion: Connecting Position, Velocity, and Acceleration
4.3	Rates of Change in Applied Contexts Other Than Motion
4.4	Introduction to Related Rates
4.5	Solving Related Rates Problems
4.6	Approximating Values of a Function Using Local Linearity and Linearization
4.7	Using L´Hospital´s Rule for Determining Limits of Indeterminate Forms
	UNIT 5 ANALYTICAL APPLICATIONS OF DIFFERENTIATION
5.1	Using the Mean Value Theorem
5.2	Extreme Value Theorem, Global Versus Local Extrema, and Critical Points
5.3	Determining Intervals on Which a Function Is Increasing or Decreasing
5.4	Using the First Derivative Test to Determine Relative (Local) Extrema

5.5	Using the Candidates Test to Determine Absolute (Global) Extrema
5.6	Determining Concavity of Functions over Their Domains
5.7	Using the Second Derivative Test to Determine Extrema
5.8	Sketching Graphs of Functions and Their Derivatives
5.9	Connecting a Function, Its First Derivative, and Its Second Derivative
5.10	Introduction to Optimization Problems
5.11	Solving Optimization Problems
5.12	Exploring Behaviors of Implicit Relations
	UNIT 6 INTEGRATION AND ACCUMULATION OF CHANGE
6.1	Exploring Accumulations of Change
6.2	Approximating Areas with Riemanns Sums
6.3	Riemann Sums, Summation Notation, and Definite Integral Notation
6.4	The Fundamental Theorem of Calculus and Accumulation Functions
6.5	Interpreting the Behavior of Accumulation Functions Involving Area
6.6	Applying Properties of Definite Integrals
6.7	The Fundamental Theorem of Calculus and Definite Integrals
6.8	Finding Antiderivatives and Indefinite Integrals: Basic Rules and Notation
6.9	Integrating Using Substitution
6.10	Integrating Functions Using Long Division and Completing the Square
6.11	Integrating Using Integrations by Parts
6.12	Using Linear Partial Fractions
6.13	Evaluating Improper Integrals

6.14	Selecting Techniques for Antidifferentiation
	UNIT 7 DIFFERENTIAL EQUATIONS
7.1	Modeling Situations with Differential Equations
7.2	Verifying Solutions for Differential Equations
7.3	Sketching Slope Fields
7.4	Reasoning Using Slope Fields
7.5	Approximating Solutions Using Eulerś Method
7.6	Finding General Solutions Using Separation of Variables
7.7	Finding Particular Solutions Using Initial Conditions and Separation of Variables
7.8	Exponential Models with Differential Equations
7.9	Logistic Models with Differential Equations
	UNIT 8 APPLICATIONS OF INTEGRATION
8.1	Finding the Average Value of a Function on an Interval
8.2	Connecting Position, Velocity, and Acceleration of Functions Using Integrals
8.3	Using Accumulation Functions and Definite Integrals in Applied Contexts
8.4	Finding the Area Between Curves Expressed as Functions of x
8.5	Finding the Area Between Curves Expressed as Functions of y
8.6	Finding the Area Between Curves That Intersect at More Than Two Points
8.7	Volumes with Cross Sections: Squares and Rectangles
8.8	Volumes with Cross Sections: Triangles and Semicircles
8.9	Volume with Disc Method: Revolving Around the x- or y-Axis

8.10	Volume with Disc Method: Revolving Around Other Axes
8.11	Volume with Washer Method: Revolving Around the x- or y-Axis
8.12	Volume with Washer Method: Revolving Around Other Axes
8.13	The Arc Lenght of a Smooth, Planar Curve and Distance Traveled
	UNIT 9 PARAMETRIC EQUATIONS, POLAR COORDINATES, AND VECTOR-VALUED FUNCTIONS
9.1	Defining and Differentiating Parametric Equations
9.2	Second Derivatives of Parametric Equations
9.3	Finding Arc Lengths of Curves Given by Parametric Equations
9.4	Defining and Differentiating Vector-Valued Functions
9.5	Integrating Vector-Valued Functions
9.6	Solving Motion Problems Using Parametric and Vector-Valued Functions
9.7	Defining Polar Coordinates and Differentiating in Polar Form
9.8	Find the Area of a Polar Region or the Area Bounded by a Single Polar Curve
9.9	Finding the Area of the Region Bounded by Two Polar Curves
	UNIT 10 INFINITE SEQUENCES AND SERIES
10.1	Defining Convergent and Divergent Infinite Series
10.2	Working with Geometric Series
10.3	The Nth Term Test for Divergence

10.4	Integral Test for Convergence
10.5	Harmonic Series and p-Series
10.6	Comparison Tests for Convergence
10.7	Alternating Series Test for Convergence
10.8	Ratio Test for Convergence
10.9	Determining Absolute or Conditional Convergence
10.10	Alternating Series Error Bound
10.11	Finding Taylor Polynomial Approximations of Functions
10.12	Lagrange Error Bound
10.13	Radius and Interval of Convergence of Power Series
10.14	Finding Taylor or Maclaurin Series for a Function
10.15	Representing Functions as Power Series

AP CALCULUS BC EXAM: 3 HOURS 15 MINUTES

The AP Calculus BC Exam assesses student understanding of the mathematical practices and learning objectives outlined in the course framework. The exam is 3 hours and 15 minutes long and includes 45 multiple-choice questions and 6 free-response questions.

Další informace:

AP Calculus BC Course Overview – 2 stránky
https://apcentral.collegeboard.org/pdf/ap-calculus-bc-course-overview.pdf?course=ap-calculus-bc

AP Calculus BC Course at a glance – 4 strany
https://apcentral.collegeboard.org/pdf/ap-calculus-ab-bc-course-a-glance-0.pdf?course=ap-calculus-bc

AP Calculus AB and BC Course and Exam Description – 256 stran
https://apcentral.collegeboard.org/pdf/ap-calculus-ab-bc-course-and-exam-description-0.pdf?course=ap-calculus-ab

Příklady zkouškových otázek
https://apcentral.collegeboard.org/pdf/ap21-frq-calculus-ab.pdf?course=ap-calculus-ab

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