Syllabus for AP Calculus BC

Underlying Focus:
The emphasis in AP Calculus is on an intuitive understanding of all concepts and the interplay between the geometric and analytic information and on the use of calculus both to predict and to explain the observed local and global behavior of a function. All topics are presented graphically, numerically, and analytically. Students are constantly asked verbally or in writing to explain the meaning of topics, relationships between topics, and problem solutions as well as cite reasons for their responses. Accurate use of terms and complete mathematical notation is stressed. Explanations must be specific to the problem.

Graphing calculators are used throughout the course. Short inserts of graphing calculator instruction on calculator skills and efficient use, as well as reinforcement of the four calculator skills required for the AP Exam, are integrated throughout classroom instruction.

Students (especially athletes, working students, and students on extracurricular overload) are encouraged early in the year to coordinate library study groups and find themselves "study buddies" to work with outside of class and to communicate with if absent in order to stay up to date on lessons and assignments.

The AP Spirit: Throughout classroom instruction, assignments, reviews, and assessments, multiple choice and free-response questions from the College Board are used to enrich the course and prepare students for their final assessment: The AP Test. AP problems are used for class discussions, for students to discuss and complete in group settings, for group assignments over long holidays when "calculus gatherings" are encouraged, and on assessments. Grading is often mirrored after the AP reading.

Assessment: Assessments with and without technology are administered. The following question is asked frequently during problem set discussions: "How do you approach this problem with technology and how would you approach this problem without technology?"
Homework and or activities are assigned daily.
Quizzes are given weekly.
Tests are given approximately every two to three weeks with a total of 6 to 8 per semester.
Tests do not necessarily occur at the end of a unit but are instead more aligned with the school calendar.

AP Calculus BC Course Outline

Unit 1: Review of Precalculus Topics (1 week)

Use of technology
Equations of Lines
Transformations
Functions
Trigonometry
Rational Functions
Piecewise Functions (including Greatest Integer Function)
Exponents

Unit 2: Limits, Unbounded Behavior, and Continuity (3 weeks)

Finding/ Estimating/ Evaluating limits –including one sided limits
- Graphically
- Numerically
- Using tables of data
- Analytically

Infinite Limits -- and their relationship to asymptotes
Limits at Infinity – and their relationship to asymptotes
Continuity
Intermediate Value Theorem
Extreme Value Theorem

Unit 3: Derivatives (3 weeks)

Local Linearity discussion using the graphing calculator
Derivative defined as the limit of the difference quotient
Relationship between differentiability and continuity
The Derivative and the Tangent Line Problem
Derivative at a point, as an instantaneous rate of change
Derivatives from graphs and tables of values
Basic Differentiation Rules and Rates of Change
Product and Quotient Rules and Higher-Order Derivatives
The Chain Rule
Trigonometric Derivatives
Particle Motion
- Use of the graphing calculator and parametric functions to simulate a moving particle and generate a schematic diagram

Implicit differentiation

Related Rates

Unit 4: Applications of Differentiation (3 weeks)

Analysis of Function and Derivative Graphs
Characteristics of f, f', f" and their relationships
Extrema on an Interval
Rolle's Theorem and the Mean Value Theorem
Increasing and decreasing Functions and the First Derivative Test
Concavity and the Second Derivative Test
Limits at Infinity (revisited)
A summary of Curve Sketching
Optimization Problems
Newton's Method
Differentials

Unit 5: Integrals (3 weeks)

Integration as an accumulation Process
Integration using Numerical Approximations:
    Reimann Sums, Trapezoidal Rule, Simpson's Rule
Basic Properties of Definite Integrals
Antiderivatives and Indefinite Integration
Techniques of Integration including change of variables
The Fundamental Theorems of Calculus
Mean Value Theorem
Integration by Substitution
Integration of Trigonometric Functions
Separable Differential Equations

Unit 6: Inverse Functions (2 weeks)

Inverse Functions
The Natural Logarithmic Function: Differentiation
Exponential Functions: Differentiation
The Natural Logarithmic Function: Integration
Exponential Functions: Integration
Bases Other Than *e* and Applications
Inverse Trigonometric Functions: Differentiation
Inverse Trigonometric Functions: Integration

Unit 7: Applications of Integrals (2 weeks)

The average value of a function
Particle Motion (revisited)
Area of a region between two curves
The volume of a solid with known cross sections,
    Volume: The Disk Method
    Volume: The Shell Method
Surfaces of Revolution
Work

Unit 8: Differential Equations (2 weeks)

Slope Fields and Euler's Method
Differential Equations: Growth and Decay
Separation of Variables and the Logistic Equation
Applications of Integrals revisited with Logarithmic and Exponential Functions

Unit 9: Advanced Techniques of Antidifferentiation (3 weeks)

Integration Rules involving substitution
Integration by Parts
Integration by Tables and Other Integration Techniques
Partial Fractions
Indeterminate Forms and L'Hopital's rule
Improper Integrals

Unit 10: Parametric, Polar, and Vector Functions (3 weeks)

Parametric Functions
Derivatives of Parametric Functions
Length of parametrically defined curves
Surface Area of a solid of revolution
Polar coordinates and Polar graphs
Calculus of polar functions, including slope, length, and area
Vectors and vector-valued functions
Calculus of vector functions

Unit 11: Infinite Series (3 weeks)

Sequences
Series and Convergence
The Integral Test and *p*-Series

Comparisons of Series
Alternating Series
The Ratio and Root Tests
Taylor Polynomial and Approximations
Lagrange Error Bound for Taylor Polynomials
Power Series
Representation of Functions by Power Series
Taylor and Maclaurin Series

AP Test Review (2 weeks)

References and Materials

Primary Textbook
Larson, Ron, Robert P. Hostetler, and Bruce H. Edwards. *Calculus of a Single Variable. 8th ed.* Boston: Houghton Mifflin, 2006

Other Resources

AP Calculus Course Description College Entrance Examination Board 2005

AP Calculus summer institute notebooks

AP Released Exams

Web Resources
AP Central (apcentral.collegeboard.com)