

# AP CALCULUS AB SYLLABUS

(Syllabus is subject to change)

St. Augustine High School  
Room C-116

Charles A. Whitfield  
Mathematics Teacher  
[charles\\_whitfield@st-augustine.org](mailto:charles_whitfield@st-augustine.org)

## COURSE DESCRIPTION

Calculus is a two-semester course, which presents calculus concepts through application and technology. The AP Calculus AB course emphasizes a multi-representational approach to calculus, with concepts, results, and problems being expressed geometrically, numerically, analytically, and verbally. The major components of the course are behavior of functions, limits, differentiation, and integration. A variety of instructional methods, supplementary materials, manipulatives, and technology and software will be used to develop and maintain calculus skills. Appropriate activities will be used to reinforce and sharpen math skills and to build math confidence.

## PREREQUISITES

Algebra I & II, Geometry, and Pre-Calculus

## TEXTBOOK and SUPPLIES

**Text:** Larsen, Roland, et al. Calculus with Analytic Geometry (6<sup>th</sup> edition). D.C. Heath and Company, 1998. Students should have a TI-83, TI-84 and/or TI 89 graphing calculator.

## COMMUNICATION-Reading/Writing/Verbal Component

Since the AP Calculus test requires written solutions, students will be trained to be clear and concise in communicating their solutions. Some application problems will require group work. Students will need to present their solutions with oral and written presentations.

## GRADING POLICY

For each quarter grade:

Daily assignments will count for 10% of the grade.

Quizzes will count for 30% of the grade.

Tests will count for 60% of the grade.

The semester grade is 40% for each quarter and 20% for each semester.

Final grade is 50% for each semester grade.

Missed assignments, quizzes, or tests should be made up within three school days.

Arrangements need to be made with the teacher about when this can be done.

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### Reference and Supplemental Materials:

- Supplemental resources from AP Central and AP materials from workshops and Summer Institutes are used at various times in the school year, i.e. slopefields.
- Finley, Demana, Waits, Kennedy, Calculus-Graphical, Numerical, Algebraic (Third edition). Pearson Prentice Hall, 2007.
- Lederman, David. Multiple-Choice and Free-Response Questions In Preparation for the AP Calculus (AR/) Examinations (Eighth Edition) D&S Marketing Systems, Inc. (2004)
- Other Calculus Textbooks.

Course Outline based on approximately 160 days prior to AP Calculus Exam

Unit	Time	Objectives	Assignments/Activities
Limits	12 days + 1 test day	<ul style="list-style-type: none"> <li>• Limits using tables (numerical approach)</li> <li>• Limits using graphs</li> <li>• Limit properties &amp; using algebraic manipulation (substitution, factoring, simplifying complex fractions, rationalizing)</li> <li>• Trig Limits and Squeeze Theorem</li> <li>• One-sided limits (right and left sided)</li> <li>• Non-existent limits</li> <li>• Limits involving infinity</li> <li>• Continuity (graphically)</li> <li>• Types of discontinuities</li> <li>• Continuity (algebraically)</li> <li>• Continuity properties</li> <li>• Intermediate Value Theorem</li> </ul>	Chapter 1  Investigative Lab on Limits and Continuity Using calculator
Derivatives	20 days + 2 test days	<ul style="list-style-type: none"> <li>• Introduce derivatives intuitively as rate of change (slopes, velocity)</li> <li>• Approximate derivatives as limiting the secant slope (graphically and numerically)</li> <li>• Definition as limit of difference quotient</li> </ul>	Chapter 2.1 to 2.4  Local Linearity Activity using calculator

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		<ul style="list-style-type: none"> <li>• Differentiability and continuity</li> <li>• Slope of a curve at a point.</li> <li>• Writing equation of tangent line at a point on a function</li> <li>• Local Linearity</li> <li>• Derivatives algebraically</li> <li>• Relationship of average rate of change to instantaneous rate of change</li> <li>• Derivative rules (power, sums, chain, product, quotient)</li> <li>• Derivatives graphically</li> <li>• Derivatives numerically</li> </ul>	
Implicit Differentiation and Related Rates	11 days + 1 test day	<ul style="list-style-type: none"> <li>• Implicit differentiation</li> <li>• Applying derivatives to verbal descriptions of real-world situations</li> <li>• Modeling rates of change</li> <li>• Related Rates</li> <li>• Position, velocity, acceleration relationship</li> </ul>	Chapter 2.5 & 2.6, selected AP problems
Transcendental Functions	9 days + 1 test day	<ul style="list-style-type: none"> <li>• Definition and derivatives of logarithmic functions</li> <li>• Derivatives of exponential functions</li> <li>• Derivatives of inverse functions including using implicit differentiation</li> </ul>	Chapter 5.1, 5.3 to 5.5
Inverse Trig	6 days + 1 test day	<ul style="list-style-type: none"> <li>• Derivatives involving inverse trig</li> </ul>	Chapter 5.7
Applications of Differentiation	13 days + 1 test day	<ul style="list-style-type: none"> <li>• Extrema on open and closed intervals (relative and absolute)</li> <li>• Extreme Value Theorem</li> <li>• Mean Value Theorem/Rolle's Theorem</li> <li>• First Derivative Test (Increasing / Decreasing)</li> <li>• Critical numbers</li> <li>• Concavity and points of inflection</li> <li>• Second Derivative Test</li> <li>• Monotonicity</li> </ul>	Chapter 3.1 to 3.6 and Chapter 1.5, 7.7  <i>f, f', f''</i> Card Matching Activity

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		<ul style="list-style-type: none"><li>• Asymptotic Behavior (Vertical and Horizontal Asymptotes)</li><li>• Comparing <math>f, f', f''</math></li><li>• Analysis of curves</li><li>• L'Hopital's Rule</li></ul>	
Optimization	6 days + 1 test day	<ul style="list-style-type: none"><li>• Optimization</li></ul>	Chapter 3.7
First Semester Exam	2 days + 1 test day	<ul style="list-style-type: none"><li>• Review first semester topics</li></ul>	

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Antiderivatives	14 days + 1 test day	<ul style="list-style-type: none"> <li>• Basic integration rules for antiderivatives</li> <li>• Solving for a particular solution of an antiderivative</li> <li>• Integration by u-substitution</li> <li>• Integrals of logarithmic functions</li> <li>• Integrals of exponential functions</li> <li>• Integrals of trig functions</li> <li>• Integrals involving inverse trig</li> </ul>	Chapter 4.1, 5.2, 5.4, 5.5
Approximation of Definite Integrals and Definite Integrals	16 days + 1 test day	<ul style="list-style-type: none"> <li>• Riemann sums (left, right, midpoint), Trapezoidal and other geometric methods for approximation of accumulation using algebra, graphs and tables</li> <li>• Limit of Riemann sums over equal subintervals as a definite integral</li> <li>• (First) Fundamental Theorem of Calculus to evaluate definite integrals</li> <li>• Average Value Theorem for definite integrals</li> <li>• Properties of definite integrals (additivity and linearity)</li> <li>• (Second) Fundamental Theorem of Calculus to evaluate definite integrals</li> <li>• Definite integral of a rate of change of the quantity over an interval</li> <li>• Functions defined by integrals, analytical and graphical analysis</li> <li>• Integration by u-substitution</li> <li>• Include definite integrations of transcendental functions</li> <li>• Include definite integrations of trig functions</li> </ul>	Chapter 4.2 – 4.6 and sections of Chapter 5
Differential Equations and Slopefields	8 days + 1 test	<ul style="list-style-type: none"> <li>• Solving separable differentiable equations</li> <li>• Exponential growth and decay models</li> <li>• Slopefields</li> </ul>	Chapter 5.6 and Slopefields supplements  Slopefields Activity

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Areas and Volumes	15 days + 1 test day	<ul style="list-style-type: none"> <li>• Area between two curves</li> <li>• Volume by cross sections</li> <li>• Volume by disk and washer methods</li> </ul>	Chapter 6.1 to 6.2  Build Volume by Cross Section Activity
AP Review	15-20 days	Practice released AP Multiple Choice and Free Response Exams	
AP Exam	1 day	Date specified by The College Board	
After AP Exam topics	10 days	Optional topics to select from: <ul style="list-style-type: none"> <li>○ Shell Method</li> <li>○ Integration by parts</li> <li>○ Euler's method</li> </ul>	
Second Semester Exam	2 days + 1 test day	Review second semester topics.	Second Semester Exam

### Teaching Strategies:

- Student's desks are arranged in various size groups in the classroom depending on the activity or lesson.
- Students are encouraged to form study groups for daily work and reviewing for exams.
- Exams and other various assessments model the AP format with multiple choice and free response questions throughout the course work.
- The "Rule of 4" {graphical, numerical, analytical, and verbal} will be emphasized to reach all learners when teaching.
- During the first few weeks, extra time is spent familiarizing students with their graphing calculators. Ideas can be investigated analytically, graphically, and numerically. Students are expected to relate the various representations to each other.
- Communication is stressed as a goal of the course.
- The graphing calculator is used to help students develop an intuitive feel for concepts before they are approached through typical algebraic techniques.