AB Calculus Syllabus

Course Description: (For a course outline, see back)

AP Calculus AB is a demanding course that requires students to investigate ideas and use a variety of skills and concepts to solve problems. Analytic, graphic and numeric techniques are explored and students learn to recognize which method or methods are viable and should be used to find the solution. Explaining results and methods of solution is vital to demonstrating understanding and an answer could require a diagram, an algebraic type proof, or a written explanation. Recognizing answers in a variety of forms is also essential to success in AP calculus. Graphing calculators will provide a powerful tool with which we will explore relationships.

Contact Information:

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Grading System:

10% HW / 20% Quizzes / 70% Tests. HW's will be graded for completion/effort (legitimately trying to work each problem). All work must be shown to receive full or partial credit for any problem on homework, quizzes, and tests. Students can turn in no more than **2** late homework assignments each grading period for a grade of 90, but they must be complete or they will remain a one in the grade book. Late assignments must also be turned in on or before their accompanying test date. At the end of each grading period, I will also drop the two lowest homework grades and one lowest quiz grade if the student has no more than 3 tardies, all absences have been cleared, all homework has been turned in.

Makeup Policy:

We will follow the standard school makeup policy – one day for each excused day absent

Tutorials:

I will have a varying schedule. I am available before 8 am before school for the first semester and after school by appointment. Please email me ahead of time.

AP Calculus AB Course Outline

First Semester

Chapter P: Preparation for Calculus (2 days)

- Pre-Calculus review

Chapter 1: Limits and Their Properties (11 days—2 test)

- An introduction to limits, including an intuitive understanding of the limit process and the formal definition for limits of functions
- Using graphs and tables of data to determine limits of functions and sequences
- Properties of limits
- Algebraic techniques for evaluating limits of functions
- Comparing relative magnitudes of functions and their rates of change (comparing exponential growth, polynomial growth and logarithmic growth)
- Continuity and one-sided limits
- Geometric understanding of the graphs of continuous functions
- Intermediate Value Theorem
- Infinite limits
- Understanding asymptotes in terms of graphical behavior
- Using limits to find the asymptotes of a function, vertical and horizontal

Chapter 2: Differentiation (21 days—2 tests)

- Tangent line to a curve and local linearity approximation
- Understanding of the derivative: graphically, numerically and analytically
- Approximating rates of change from graph and table of data
- The derivative as: the limit of the difference quotient, the slope of a curve at a point and interpreted as an instantaneous rate of change
- The meaning of the derivative—translating verbal descriptions into equations and vice versa
- The relationship between differentiability and continuity
- Functions that have a vertical tangent at a point and points at which there are no tangents
- Instantaneous rate of change as the limit of average rate of change
- Approximate rate of change from graphs and table of values
- Differentiation rules for basic functions, including power functions and trigonometric functions
- Rules of differentiation for sums, differences, products and quotients
- The Chain rule
- Implicit differentiation
- Related rates, modeling rates of change

Chapter 3: Applications of Differentiation (16 days—2 tests)

- Extrema on an interval and the Extreme Value Theorem
- Rolle's Theorem and the Mean Value Theorem and their geometric consequences
- Increasing and decreasing functions and the First Derivative Test
- Concavity and points of inflections and the relationship with the 2nd derivative
- Points of inflection as places where concavity changes
- Second Derivative Test
- Limits at infinity
- Summary of graphing techniques, analysis of curves, including the notions of monotonicity and concavity
- Relating the graphs of f, f', and f''
- Optimization including both relative and absolute extrema
- Differentials, tangent line to a curve, linear approximations and Newton's Method of approximating zeros
- Application problems including position, velocity, acceleration, and rectilinear motion

Chapter 4: Integration (28 days—3 tests)

- Antiderivatives and indefinite integration, including antiderivatives following directly from derivatives of basic functions
- Basic properties of the definite integral
- Area under a curve
- Meaning of the definite integral
- Definite integral as a limit of Riemann sums
- Riemann sums, including left, right and midpoint sums
- Use of the First Fundamental Theorem of Calculus to evaluate definite integrals
- Use of the Fundamental Theorem of Calculus to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined
- The Second Fundamental Theorem of Calculus and functions defined by integrals
- Use of substitution of variables to evaluate definite integrals
- Integration by substitution
- The Mean Value Theorem for Integrals and the average value of a function
- Trapezoidal sums
- Use of Riemann sums and trapezoidal sums to approximate definite integrals of functions that are represented analytically, graphically and by tables of data

First Semester Exam (3 review days)

Second Semester

Chapter 5: Logarithmic, Exponential, and Other Transcendental Functions (25 days—3 tests)

- Define the natural logarithmic function as a definite integral
- The natural logarithmic function: differentiation and integration
- Inverse functions and the use of implicit differentiation to find the derivative of an inverse function
- Exponential functions: differentiation and integration
- Bases other than e and applications
- Solving separable differential equations
- Applications of differential equations in modeling, including exponential growth
- Use of slope fields to interpret a differential equation geometrically
- Drawing slope fields and solution curves for differential equations
- Inverse trig functions and differentiation
- Integrals yielding inverse trig functions

Chapter 6: Applications of Integration (15 days—2 tests)

- The integral as an accumulator of rates of change
- Area between 2 curves
- Volume of solids of revolution by disc, washer and shell method
- Volume of solids of know cross sections
- Problems from past AP tests involving setting up an approximating Riemann sum and representing its limit as a definite integral
- Average value of a function
- Applications of integration in problems involving a particle moving along a line, including the use of the definite integral with an initial condition and using the definite integral to find the distance traveled by a particle along a line

Chapter 7: Integration Techniques, L'Hopital's Rule, and Improper Integrals (10 days—1 tests)

- Review of basic integration rules
- Integration by parts
- L'Hopital's Rule and its use in determining limits
- Indeterminate forms : $\frac{\infty}{\infty}$, $\frac{0}{0}$, $0\cdot\infty$, $\infty-\infty$, 1^{∞}, 0^{0}, ∞^{0} (I do not assign problems for the last 3)
- Relative rates of growth

Review and Practice for AP Tests until Test date (20 days—2 test)

During the 2 weeks of AP testing, the students work in groups on projects on Calculus topics not covered (e.g. solving non-separable differential equations, hyperbolic functions, etc.) or an extension or application of a topic already covered. After AP testing is complete, the students present their projects to the class. They are required to use technology in their presentations and they may work collaboratively with other students. (14 days—1 project presentation)

Second Semester Exam (2 review days)