AP Calculus AB
Course Description

COURSE OUTLINE: The following topics define the AP Calculus AB course as it is taught over three trimesters, each consisting of twelve week grading periods.

Limits and their Properties

* The Tangent Line Problem
* The Area Problem
* An Introduction to Limits
* Limits That Fail to Exist
* Properties of Limits
* Strategies for Finding Limits
  - Analytically
  - Graphically
  - Using tables to approximate limits
* Continuity at a point and one sided limits
* One-Sided Limits and Continuity on a Closed Interval
* The Squeeze Theorem for limits
* Properties of Continuity
* The Intermediate Value Theorem
* Definition of and determination of Infinite Limits and Vertical Asymptotes
  - Limits of Infinity
  - Limits at Infinity

Differentiation

* Use graphing calculators: zoom-in exercise and local linearity
* The tangent line problem
* Definition of the Derivative of a function
* Sketching a Derivative Based on the Graph of f(x)
* Relationship between differentiability and continuity
  - Zoom-in activity for ;
  - Sharp turn discussion
  - Vertical tangent discussion
* Differentiation Rules
  - Power Rule
  - Constant Multiple Rule
  - Sum and Difference Rule
* Derivatives of Sine and Cosine Functions
* Graphing only : f , f' , f''
* Approximating rates of change from graphs and tables
* The product rule and quotient rule
* Derivatives of trigonometric functions
* Higher-Order Derivatives
* Position, Velocity, Acceleration Functions

* The Chain Rule
* The General Power Rule
* Trigonometric Functions and the Chain Rule
* Implicit Differentiation
* Related Rates

Applications of Differentiations

* Extrema of a function
* Relative extrema and critical numbers
* Extrema on a closed interval
* Rolle's Theorem and the Mean Value Theorem
* Increasing and decreasing functions
* The First Derivative Test
  Relative and absolute extrema
* The Second Derivative Test
  Concavity
  Points of inflection
* Horizontal asymptotes
* Curve-sketching techniques
  Graphing given the functional equation
  Relating f , f' , f''
  Symmetry of graphs
* Applied Minimum and Maximum Problems (Optimization)
* Calculating differentials
* Linear approximations
* Tangent line approximations
* Application problems involving position, velocity, and acceleration, and rectilinear motion
* Graphical analysis of position versus time, velocity versus time, and acceleration versus time

Integration

* Antiderivatives and indefinite integration
* Notation for anti-derivatives
* Basic Integration Rules
* Initial Conditions and Particular Solutions
* Area: Sigma Notation
* The Area of a Plane Region
* Definite integral as a limit of a Riemann Sum
  Upper, Lower, Midpoint sums
  Use Riemann sums and trapezoidal sums to approximate definite integrals
  presented analytically, graphically, or as tables of data.
* Trapezoidal Rule
* Definite Integrals and their properties
* Use of the First Fundamental Theorem of Calculus in evaluating integrals
* The Mean Value Theorem for Integrals
* Average Value of a Function
* The Second Fundamental Theorem of Calculus
* Integration by substitution; change of variables in the integration process
* The General Power Rule for integration

* Change of Variables for Definite Integrals
* Integration of even and odd Functions
* Functions defined by integrals
* Error Analysis

Logarithmic, Exponential, and other Transcendental Functions

* The natural logarithmic function
* The number e as a limit
* The derivative of the natural log function
* Log rule for integration
* Integrals of trigonometric functions
* Inverse Functions
* Existence of an inverse function
* Derivative of an inverse function
* The natural exponential functions
* Derivatives of exponential functions
* Integrals of exponential functions
* Bases other than e
* Applications of exponential functions
* Differential equations and separation of variables
* Growth and decay models
* Newton's Law of Cooling
* Slope Fields
  Geometric interpretation of slope fields and differential equations
  Drawing slope fields
* Inverse trigonometric functions: Domains, ranges, and graphs
* Derivatives of inverse trigonometric functions
* Integration of inverse trigonometric functions

Applications of Integration

* The integral defined as the accumulation of rates of change
* Area of a region between two curves
* Volume of solids of revolution
  the disk and washer methods
  the shell method
* Volume of solids with known cross sections
* Arc length in f(x) form
* Integration involved with motion applications of position, velocity, and acceleration.
  Using initial conditions and the definite integral to calculate distance traveled.