Course: Advanced Placement Calculus AB **Grade:** 11-12 **Unit Name:** Limits and Continuity

Essential Questions/ Focus Questions:

- How do you calculate average and instantaneous speeds?
- How will you define and calculate limits for function values and apply the properties of limits?
- How do you use the Sandwich Theorem to find certain limits indirectly?
- How will you find and verify end behavior models for various functions?
- How do you calculate limits as x goes to infinity and negative infinity and horizontal and vertical asymptotes?
- How will you identify continuous intervals and understand the meaning of a continuous function?
- How do you remove a removable discontinuity by extending or modify it?
- How will you find the slope, tangent line, and the normal line at a given point?
- How do you find the average rate of change?
- How will you apply the definition of the slope of a curve in order to calculate slope?

Suggested Time Frame: Approximately fourteen 60-minute class periods.

The College Board Course Description – Calculus AB Content Expectations:

- 1.B1 An intuitive understanding of the limiting process
- 1.B2 Calculating limits using algebra
- 1.B3 Estimating limits from graphs or tables of data
- 1.C1 Understanding asymptotes in terms of graphical behavior
- 1.C2 Describing asymptotic behavior in terms of limits involving infinity
- 1.C3 Comparing relative magnitudes of functions and their rates of change
- 1.D1 An intuitive understanding of continuity
- 1.D2 Understanding continuity in terms of limits
- 1.D3 Geometric understanding of graphs of continuous functions
- 2.A1 Derivative presented graphically, numerically, and analytically
- 2.A2 Derivative interpreted as an instantaneous rate of change
- 2.A3 Derivative defined as the limit of the difference quotient
- 2.B1 Slope of a curve at a point
- 2.B2 Tangent line to a curve at a point and local linear approximation
- 2.B3 Instantaneous rate of change as the limit of average rate of change

Materials Used: (textbooks, websites, videos, etc...)

- Finney Demana Waits Kennedy Calculus - Graphical, Numerical, Algebraic, TI Calculators(TI 83, TI 84)

Major Themes/ Concepts:

- Rates of Change and Limits
- Limits involving infinity
- Continuity
- Rates of Change and Tangent Lines

Assessments:

- Unit Test

C. M. Novak

Course: Advanced Placement Calculus AB **Grade:** 11-12 **Unit Name:** Derivatives

Essential Questions/ Focus Questions:

- How will you calculate slopes and derivatives using the definition of the derivative?
- How do you graph f from the graph of f' and f' from f?
- How will you be able to find where a function is not differentiable?
- How do you approximate derivatives numerically and graphically?
- How will you use the rules of differentiation to calculate derivatives, including second and higher order derivatives.
- How do you use the derivative of calculate the instantaneous rate of change?
- How will you use derivatives to solve straight line motion and rates of change?
- How do you differentiate composite functions using the Chain Rule?
- How do you find derivatives using implicit differentiation?
- How will you use the rules for differentiating the six basic trigonometric functions?
- How do you calculate derivatives of functions involving the inverse trigonometric functions?
- How will you calculate derivatives of exponential and logarithmic functions?

Suggested Time Frame: Approximately forty-five 60-minute class periods.

The College Board Course Description – Calculus AB Content Expectations:

- 2.A1 Derivative presented graphically, numerically, and analytically
- 2.A3 Derivative defined as the limit of the difference quotient
- 2.A4 Relationship between differentiability and continuity
- 2.B3 Instantaneous rate of change as the limit of average rate of change
- 2.B4 Approximate rate of change from graphs and tables of values
- 2.C1 Corresponding characteristics of graphs of f and f'
- 2.C4 Equations involving derivatives. Verbal descriptions are translated
- 2.E5 Use of implicit differentiation to find the derivative of an inverse function
- 2.E6 Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
- 2.F1 Knowledge of derivatives of basic functions, including power, exponential , logarithmic, trigonometric, and inverse trigonometric functions
- 2.F2 Basic rules for derivative of sums, products, and quotients of functions
- 2.F3 Chain rule and implicit differentiation

Materials Used: (textbooks, websites, videos, etc...)

- Finney Demana Waits Kennedy Calculus - Graphical, Numerical, Algebraic, TI Calculators(TI 83, TI 84)

Major Themes/ Concepts:

- Derivative of a Function
- Differentiability
- Rules for Differentiation
- Velocity and other rates of change
- Derivatives of Trigonometric Functions
- Chain Rule
- Implicit Differentiation
- Derivatives of Inverse Trigonometric Functions
- Derivatives of Exponential and Logarithmic Functions

Assessments:

- Quiz
- First Half Unit Test
- Second Half Unit Test

Course: Advanced Placement Calculus AB **Grade:** 11-12 **Unit Name:** Derivatives

Essential Questions/ Focus Questions:

- How will you calculate slopes and derivatives using the definition of the derivative?
- How do you graph f from the graph of f' and f' from f?
- How will you be able to find where a function is not differentiable?
- How do you approximate derivatives numerically and graphically?
- How will you use the rules of differentiation to calculate derivatives, including second and higher order derivatives.
- How do you use the derivative of calculate the instantaneous rate of change?
- How will you use derivatives to solve straight line motion and rates of change?
- How do you differentiate composite functions using the Chain Rule?
- How do you find derivatives using implicit differentiation?
- How will you use the rules for differentiating the six basic trigonometric functions?
- How do you calculate derivatives of functions involving the inverse trigonometric functions?
- How will you calculate derivatives of exponential and logarithmic functions?

Suggested Time Frame: Approximately forty-five 60-minute class periods.

The College Board Course Description – Calculus AB Content Expectations:

- 2.A1 Derivative presented graphically, numerically, and analytically
- 2.A3 Derivative defined as the limit of the difference quotient
- 2.A4 Relationship between differentiability and continuity
- 2.B3 Instantaneous rate of change as the limit of average rate of change
- 2.B4 Approximate rate of change from graphs and tables of values
- 2.C1 Corresponding characteristics of graphs of f and f'
- 2.C4 Equations involving derivatives. Verbal descriptions are translated
- 2.E5 Use of implicit differentiation to find the derivative of an inverse function
- 2.E6 Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
- 2.F1 Knowledge of derivatives of basic functions, including power, exponential , logarithmic, trigonometric, and inverse trigonometric functions
- 2.F2 Basic rules for derivative of sums, products, and quotients of functions
- 2.F3 Chain rule and implicit differentiation

Materials Used: (textbooks, websites, videos, etc...)

- Finney Demana Waits Kennedy Calculus - Graphical, Numerical, Algebraic, TI Calculators(TI 83, TI 84)

Major Themes/ Concepts:

- Derivative of a Function
- Differentiability
- Rules for Differentiation
- Velocity and other rates of change
- Derivatives of Trigonometric Functions
- Chain Rule
- Implicit Differentiation
- Derivatives of Inverse Trigonometric Functions
- Derivatives of Exponential and Logarithmic Functions

Assessments:

- Quiz
- First Half Unit Test
- Second Half Unit Test

Course: Advanced Placement Calculus AB **Grade:** 11-12 **Unit Name:** Applications of Derivatives

Essential Questions/ Focus Questions:

- How will the student determine the local or absolute maximums and minimums of a function?
- How will the student apply the Mean Value Theorem and find the intervals on which a function is increasing or decreasing.
- How will the student use the first and second derivative tests to determine the local extreme values of a function?
- How will the student determine the concavity of a function and locate the points of inflection by analyzing the second derivative?
- How will the student graph f using the information about f'?
- How will the student solve application problems involving finding minimum or maximum values of functions?
- How will the student estimate the change in a function using differentials?
- How will the student find linearization and use Newton's method to approximate the zeros of a function?
- How will the student solve related rate problems?

Suggested Time Frame: Approximately twenty-one 60-minute class periods.

The College Board Course Description – Calculus AB Content Expectations:

- 1.D3 Geometric understanding of graphs of continuous functions
- 2.B2 Tangent line to a curve at a point and local linear approximation
- 2.B3 Instantaneous rate of change as the limit of average rate of change
- 2.B4 Approximate rate of change from graphs and tables of values
- 2.C1 Corresponding characteristics of graphs of f and f'
- 2.C2 Relationship between the increasing and decreasing behavior of f and the sign of f'
- 2.C3 The Mean Value Theorem and its geometric consequences
- 2.C4 Equations involving derivatives. Verbal descriptions are translated
- 2.D1 Corresponding characteristics of graphs of f, f', and f''
- 2.D2 Relationship between the concavity of f and the sign of f''
- 2.D3 Points of inflection as places where concavity changes
- 2.E1 Analysis of curves, including the notion of concavity
- 2.E3 Otimization of both absolute and relative extrema
- 2.E4 Modeling of rates of change, including related rates problems
- 2.E5 Use of implicit differentiation to find the derivative of an inverse function
- 2.E6 Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
- 2.F1 Knowledge of derivatives of basic functions, including power, exponential , logarithmic, trigonometric, and inverse trigonometric functions
- 2.F2 Basic rules for derivative of sums, products, and quotients of functions
- 3.D1 Antiderivatives following directly from derivatives of basic functions

Materials Used: (textbooks, websites, videos, etc...)

- Finney Demana Waits Kennedy Calculus - Graphical, Numerical, Algebraic, TI Calculators(TI 83, TI 84)

Major Themes/ Concepts:

- Extreme Values of Functions
- Mean Value Theorem
- Connecting f' and f'' with the Graph of f
- Modeling and Optimiation
- Linearization and Newton's Method
- Relate Rates

Assessments:

- Quiz
- Unit Test