Course Name:	A.P. Calculus AB		
Credits:	1		
Prerequisites:	Pre-Calculus & Trigonometry (Recommended grade of B or better or by teacher approval)		
Description:	Equivalent to a first semester college calculus course. The basis of study includes limits and continuity, derivatives, integrals, and the applications. A TI-83 or TI-84 calculator is required. A TI-89 is not allowed.		
Academic Standards:	College Board Mathematical Practices for AP Calculus AB		
Units:	Unit Length:	Unit Standards:	Unit Outcomes:
Limits and Continuity	16 days	CHA 1-2B, Lim 1-2B, Lim 1-1E, Lim 1-1C, Lim 1-3C, Lim 1-2C, Lim 2-3D, Lim 2-2D, Lim 2-3B, Lim 2-3C, Lim 2-1E, Fun 1-3E, Cha 2-2B	Students will learn the concept of the limit in this unit. They will learn how to evaluate, notate and apply limits to real world applications. This unit will also explore rates of change and how to connect the limit to the following concept of the derivative.
Derivatives	35 days	Cha 2-1D, Cha 2-4C, Cha 2-1E, Fun 2-3E, Fun 3-1E, Cha 3-1E, Fun 3-1D, Fun 3-1C, Cha 3-2A	Students will learn how to take the derivative of various functions in this unit. They will also learn notation and begin investigating some uses of the derivative in real world applications.
Applications of Derivatives	24 days	Fun 1-3E, Fun 4-1E, Fun 4-2E, Fun 4-3D, Fun 4-2D, Fun 4-2A, Fun 4-3F, Cha 3-1F, Fun 4-1E, Fun 4-3E, Cha 3-1E, Cha 3-3F	Students will apply their knowledge of derivatives in this unit to solve real worlds problems. They will learn how derivatives relate to the graphs of functions and how tests can be used to picture important features of graphs.
The Definite Integral	19 days	Cha 4-4B, Lim 5-1F, Lim 5-2C, Fun 5-2D, Fun 5-1D, Fun 5-3D, Fun 5-3D, Fun 6-4C, Fun 6-1C	Students wil explore and learn about the definite integral. They will learn notation and properties of integrals and how the fundamental theorem of calculus makes a connection between derivative calculus and integral calculus.
Differential Equations and Mathematical Modeling	10 days	Fun 7-2C, Fun 7-3G, Fun 7-4D, Fun 6-1E, Fun 7-1E, Fun 7-3G	Students will get an introduction to differential equations in this unit. They will learn how antiderivatives can be used with various strategies to solve differential equations problems.
Applications of Definite Integrals	20 days	Cha 4-4B, Cha 4-3D, Cha 5-4C, Cha 5-1E, Cha 5-2B, Cha 5-3D, Cha 5-2D, Cha 5-4E, Cha 6-3D	Students will explore various applications of the definite integral in this unit. They will solve real world problems with rates of change and learn how the integral can be used to calculate geometric values such as area and volume.

Unit Name: Limits and Continuity	**Length:** 16 days
Standards: CHA 1-2B, Lim 1-2B, Lim 1-1E, Lim 1-1C, Lim 1-3C, Lim 1-2C, Lim 2-3D, Lim 2-2D, Lim 2-3B, Lim 2-3C, Lim 2-1E, Fun 1-3E, Cha 2-2B	**Outcomes:** Students will learn the concept of the limit in this unit. They will learn how to evaluate, notate and apply limits to real world applications. This unit will also explore rates of change and how to connect the limit to the following concept of the derivative.
Essential Questions: How do limits describe the behavior of a function? What are the strategies used to determine the limit of a function? What determines continuity and how can you find and describe discontinuities?	**Learning Targets:** Students will be able to: -Calculate average and intantaneous rates of change. -Calculate limits as x approaches positive or negative infinity. -Identify intervals on which a function is continuous. -Find the equation of a tangent and a normal line to a curve.
Topic 1: Rates of Change and Limits	Length: 4 days
Standard(s): CHA 1-2B, Lim 1-2B, Lim 1-1E, Lim 1-1C, Lim 1-3C, Lim 1-2C	Academic Vocabulary: Average Speed, Instantaneous Speed, Limit, One-Sided Limit, Two-Sided Limit, Sandwich Theorem
Lesson Frame:	We will explore the definition of a limit and how it can be used to find rates of change.
	I will calculate average and intantaneous rates of change.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 2: Limits Involving Infinity	Length: 3 days
Standard(s): Lim 1-2B, Lim 1-1E, Lim 2-3D, Lim 2-2D	Academic Vocabulary: Infinite Limits, End Behavior Model
Lesson Frame:	We will investigate what happens at the end of a function.
	I will calculate limits as x approaches positive or negative infinity.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 3: Continuity	Length: 3 days
Standard(s): Lim 2-3B, Lim 2-3C, Lim 2-1E, Fun 1-3E	Academic Vocabulary: Continuity, Continuous Function, Intermediate Value Theorem
Lesson Frame:	We will define continuity and the properties of continuous functions.
	I will identify intervals on which a function is continuous.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 4: Rates of Change and Tangent Lines	Length: 4 days
Standard(s): Cha 2-2B	Academic Vocabulary: Average Rate of Change, Tangent, Normal Line
Lesson Frame:	We will define a tangent line and discuss its relation to slope.
	I will find the equation of a tangent and a normal line to a curve.

Unit Name: Limits and Continuity	**Length:** 16 days
Standards: CHA 1-2B, Lim 1-2B, Lim 1-1E, Lim 1-1C, Lim 1-3C, Lim 1-2C, Lim 2-3D, Lim 2-2D, Lim 2-3B, Lim 2-3C, Lim 2-1E, Fun 1-3E, Cha 2-2B	**Outcomes:** Students will learn the concept of the limit in this unit. They will learn how to evaluate, notate and apply limits to real world applications. This unit will also explore rates of change and how to connect the limit to the following concept of the derivative.
Essential Questions: How do limits describe the behavior of a function? What are the strategies used to determine the limit of a function? What determines continuity and how can you find and describe discontinuities?	**Learning Targets:** Students will be able to: -Calculate average and intantaneous rates of change. -Calculate limits as x approaches positive or negative infinity. -Identify intervals on which a function is continuous. -Find the equation of a tangent and a normal line to a curve.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:

Unit Name: Derivatives	**Length:** 35 days
Standards: Cha 2-1D, Cha 2-4C, Cha 2-1E, Fun 2-3E, Fun 3-1E, Cha 3-1E, Fun 3-1D, Fun 3-1C, Cha 3-2A	**Outcomes:** Students will learn how to take the derivative of various functions in this unit. They will also learn notation and begin investigating some uses of the derivative in real world applications.
Essential Questions: How do you find the slope of a curve at an instantaneous point? How can you find the derivative of a function using the limit process? What rules allow you to find the derivative of a function without using the entire limit process?	**Learning Targets:** Students will be able to: - Calculate the slope of a function using the definition of a derivative. - Tell where a function is not differentiable. - Use the rules of differentiation to calculate a derivative. - Use derivatives to analyze straight line motion. - Use the rules of differentiation to calculate derivatives for the six basic trigonometric functions. - Differentiate a composite function. - Find the derivative of an implicitly defined function. - Calculate the derivative of an inverse trigonometric function. - Calculate the derivative of an exponential and a logarithmic function.
Topic 1: Derviative of a Function	Length: 3 days
Standard(s): Cha 2-1D, Cha 2-4C, Cha 2-1E, Fun 4-2D	Academic Vocabulary: Derivative, Derivative Notation
Lesson Frame:	We will define a derivative and practice writing notations for derivatives.
	I will calculate the slope of a function using the definition of a derivative.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 2: Differentiability	Length: 2 days
Standard(s): Fun 2-3E	Academic Vocabulary: Differentiable, Intermediate Value Theorem for Derivatives
Lesson Frame:	We will explore where functions fail to have derivatives.
	I will tell where a function is not differentiable.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 3: Rules for Differentiation	Length: 4 days
Standard(s): Fun 3-1E	Academic Vocabulary: Power Rule, Product Rule, Quotient Rule, Second Derivative
Lesson Frame:	We will define the basic shortcut rules for taking derivatives.
	I will use the rules of differentiation to calculate a derivative.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 4: Velocity and Other Rates of Change	Length: 4 days
Standard(s): Cha 3-1E, Cha 3-2A	Academic Vocabulary: Instantaneous Rate of Change, Velocity, Speed, Acceleration
Lesson Frame:	We will explore how derivatives tie into real worl applications of velocity and acceleration.
	I will use derivatives to analyze straight line motion.

Unit Name: Derivatives	**Length:** 35 days
Standards: Cha 2-1D, Cha 2-4C, Cha 2-1E, Fun 2-3E, Fun 3-1E, Cha 3-1E, Fun 3-1D, Fun 3-1C, Cha 3-2A	**Outcomes:** Students will learn how to take the derivative of various functions in this unit. They will also learn notation and begin investigating some uses of the derivative in real world applications.
Essential Questions: How do you find the slope of a curve at an instantaneous point? How can you find the derivative of a function using the limit process? What rules allow you to find the derivative of a function without using the entire limit process?	**Learning Targets:** Students will be able to: - Calculate the slope of a function using the definition of a derivative. - Tell where a function is not differentiable. - Use the rules of differentiation to calculate a derivative. - Use derivatives to analyze straight line motion. - Use the rules of differentiation to calculate derivatives for the six basic trigonometric functions. - Differentiate a composite function. - Find the derivative of an implicitly defined function. - Calculate the derivative of an inverse trigonometric function. - Calculate the derivative of an exponential and a logarithmic function.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 5: Derivatives of Trigonometric Functions	Length: 3 days
Standard(s): Fun 3-1D	Academic Vocabulary: Harmonic Motion, Jerk
Lesson Frame:	We will define the rules for taking the derivative of basic trigonometric functions.
	I will use the rules of differentiation to calculate derivatives for the six basic trigonometric functions.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 6: Chain Rule	Length: 3 days
Standard(s): Fun 3-1C	Academic Vocabulary: Chain Rule, Power Chain Rule
Lesson Frame:	We will investigate composite functions and how to use the chain rule to take the derivative.
	I will differentiate a composite function.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 7: Implicit Differentiation	Length: 3 days
Standard(s): Fun 3-1E	Academic Vocabulary: Implicit Differentiation,
Lesson Frame:	We will investigate implicitly defined functions and learn to take derivatives of them.
	I will find the derivative of an implicitly defined function.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 8: Derivatives of Inverse Trigonometric Functions	Length: 3 days
Standard(s): Fun 3-1E	Academic Vocabulary: Inverse Trigonometric Function

Unit Name: Derivatives	**Length:** 35 days
Standards: Cha 2-1D, Cha 2-4C, Cha 2-1E, Fun 2-3E, Fun 3-1E, Cha 3-1E, Fun 3-1D, Fun 3-1C, Cha 3-2A	**Outcomes:** Students will learn how to take the derivative of various functions in this unit. They will also learn notation and begin investigating some uses of the derivative in real world applications.
Essential Questions: How do you find the slope of a curve at an instantaneous point? How can you find the derivative of a function using the limit process? What rules allow you to find the derivative of a function without using the entire limit process?	**Learning Targets:** Students will be able to: - Calculate the slope of a function using the definition of a derivative. - Tell where a function is not differentiable. - Use the rules of differentiation to calculate a derivative. - Use derivatives to analyze straight line motion. - Use the rules of differentiation to calculate derivatives for the six basic trigonometric functions. - Differentiate a composite function. - Find the derivative of an implicitly defined function. - Calculate the derivative of an inverse trigonometric function. - Calculate the derivative of an exponential and a logarithmic function.
Lesson Frame:	We will derive a formula for taking the derivative of inverse trigonometric functions.
	I will calculate the derivative of an inverse trigonometric function.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 9: Derivatives of Exponential and Logarithmic Functions	Length: 4 days
Standard(s): Fun 3-1E	Academic Vocabulary: Exponential Function, Logarithmic Function
Lesson Frame:	We will explore how derivatives can be used on logarithmic and exponential functions.
	I will calculate the derivative of an exponential and a logarithmic function.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:

Unit Name: Applications of Derivatives	**Length:** 24 days
Standards: Fun 1-3E, Fun 4-1E, Fun 4-2E, Fun 4-3D, Fun 4-2D, Fun 4-2A, Fun 4-3F, Cha 3-1F, Fun 4-1E, Fun 4-3E, Cha 3-1E, Cha 3-3F	**Outcomes:** Students will apply their knowledge of derivatives in this unit to solve real worlds problems. They will learn how derivatives relate to the graphs of functions and how tests can be used to picture important features of graphs.
Essential Questions: How can the derivative be used to find key information on a graph of a function? How do you use the derivative to optimize a function? How do you use linearization and differentials to estimate values of a function?	**Learning Targets:** Students will be able to: -Determine the local and absolute extrema of a function. -Find the open intervals in which a function is increasing and decreasing. -Use the first derivative test to find local extrema of a function. -Solve an application problem that asks to find a minimum or maximum value. -Use a linearization to approximate the value of a square root value. -Solve a real world problem that involves multiple rates of change.
Topic 1: Extreme Values of Functions	Length: 4 days
Standard(s): Fun 1-3E, Fun 4-1E	Academic Vocabulary: Extreme Value, Extreme Value Theorem, Absolute Extreme, Local Extreme
Lesson Frame:	We will define basic vocabulary for finding the highest and lowest points of a function.
	I will determine the local and absolute extrema of a function.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 2: Mean Value Theorem	Length: 3 days
Standard(s): Fun 1-3E, Fun 4-2E	Academic Vocabulary: Mean Value Theorem, Increasing Functions, Decreasing Functions
Lesson Frame:	We will explore how derivatives can be used to find where functions are increasing or decreasing.
	I will find the open intervals in which a function is increasing and decreasing.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 3: Connecting f' and f'' with the Graph of f	Length: 4 days
Standard(s): Fun 4-3D, Fun 4-2E, Fun 4-2D	Academic Vocabulary: First Derivative Test, Concavity, Points of Inflection, Second Derivative
Lesson Frame:	We will learn how to use tests to make finding maximums and minimums easier.
	I will use the first derivative test to find local extrema of a function.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 4: Optimization	Length: 4 days
Standard(s): Fun 4-2A, Fun 4-3F	Academic Vocabulary: Optimization, Constraint, Objective Equation
Lesson Frame:	We will learn the optimization process and how it can be used to find minimums and maximums.
	I will solve an application problem that asks to find a minimum or maximum value.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 5: Linearizations and Differentials	Length: 3 days
Standard(s): Cha 3-1F	Academic Vocabulary: Linear Approximation, Differential, Absolute Change, Relative Change, Percentage Change
Lesson Frame:	We will explore how tangent lines and derivatives can be used in conjunction with estimation.
	I will use a linearization to approximate the value of a square root value.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 6: Related Rates	Length: 4 days
Standard(s): Fun 4-1E, Fun 4-3E, Cha 3-1E, Cha 3-3F	Academic Vocabulary: Related Rate Equation
Lesson Frame:	We will explore problems that relate multiple rates of change and how derivatives can be used to solve them.
	I will solve a real world problem that involves multiple rates of change.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:

Unit Name: The Definite Integral	**Length:** 19 days
Standards: Cha 4-4B, Lim 5-1F, Lim 5-2C, Fun 5-2D, Fun 5-1D, Fun 5-3D, Fun 5-3D, Fun 6-4C, Fun 6-1C	**Outcomes:** Students wil explore and learn about the definite integral. They will learn notation and properties of integrals and how the fundamental theorem of calculus makes a connection between derivative calculus and integral calculus.
Essential Questions: How does the definite integral connect to the concept of derivatives? How can you find the area under the curve of a function?	**Learning Targets:** Students will be able to: -Approximate the area under a curve using rectangles. -Use definite integral notation to expess the area under the curve. -Apply rules for definite integrals to find the average value of a function. -Apply the fundamental theorem of calculus to evaluate a definite integral. -Use trapezoids to estimate the area under the curve.
Topic 1: Estimiting With Finite Sums	Length: 3 days
Standard(s): Cha 4-4B, Lim 5-1F, Lim 5-2C	Academic Vocabulary: Distance, Rectangular Approximation Method
Lesson Frame:	We will connect rates of change back to function values with area under the curve.
	I will approximate the area under a curve using rectangles.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 2: Definite Integrals	Length: 3 days
Standard(s): Fun 5-2D	Academic Vocabulary: Riemann Sums, Definite Integral
Lesson Frame:	We will define a definite integral and learn the notation used to write them.
	I will use definite integral notation to expess the area under the curve.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 3: Definite Integrals and Antiderivatives	Length: 4 days
Standard(s): Fun 5-1D, Fun 5-3D	Academic Vocabulary: Average Value, Mean Value Theorem for Definite Integrals
Lesson Frame:	We will learn the basic properties of definite integrals and how to apply them together.
	I will apply rules for definite integrals to find the average value of a function.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 4: Fundamental Theorem of Calculus	Length: 4 days
Standard(s): Fun 5-3D, Fun 6-4C, Fun 6-1C	Academic Vocabulary: Fundamental Theorem Part 1, Fundamental Theorem Part 2
Lesson Frame:	We will connect derivatives to the antiderivative and learn how the processes can work together.
	I will apply the fundamental theorem of calculus to evaluate a definite integral.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 5: Trapezoidal Rule	Length: 3 days
Standard(s): Lim 5-1F	Academic Vocabulary: Trapezoidal Approximations
Lesson Frame:	We will learn how to improve rectangular approximation methods using trapezoids.
	I will use trapezoids to estimate the area under the curve.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:

Unit Name: Differential Equations and Mathematical Modeling	**Length:** 10 days
Standards: Fun 7-2C, Fun 7-3G, Fun 7-4D, Fun 6-1E, Fun 7-1E, Fun 7-3G	**Outcomes:** Students will get an introduction to differential equations in this unit. They will learn how antiderivatives can be used with various strategies to solve differential equations problems.
Essential Questions: How can antiderivatives be used to solve equations with derivatives in them? What techniques can be uesd to solve initial value problems?	**Learning Targets:** Students will be able to: -Solve an initial value problem using antiderivatives. -Compute an indefinite integral using u-substitution methods. -Use separation of variables to solve a differential equation.
Topic 1: Slope Fields and Differential Equations	Length: 3 days
Standard(s): Fun 7-2C, Fun 7-3G, Fun 7-4D	Academic Vocabulary: Differential Equations, Slope Fields
Lesson Frame:	We will define a differential equation and explore strategies to solve them.
	I will solve an initial value problem using antiderivatives.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 2: Antidifferentiation by Substititution	Length: 3 days
Standard(s): Fun 6-1E	Academic Vocabulary: Indefinite Integrals, U-Substitution
Lesson Frame:	We will create a method for finding the antiderivative of a function that needs to use substitution.
	I will compute an indefinite integral using u-substitution methods.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 3: Separable Differential Equations	Length: 2 days
Standard(s): Fun 7-1E, Fun 7-3G	Academic Vocabulary: Separable Differential Equation, Law of Exponential Change
Lesson Frame:	We will explore differential equations with both x and y on the same size and formalize a way to solve them.
	I will use separation of variables to solve a differential equation.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:

Unit Name: Applications of Definite Integrals	**Length:** 20 days
Standards: Cha 4-4B, Cha 4-3D, Cha 5-4C, Cha 5-1E, Cha 5-2B, Cha 5-3D, Cha 5-2D, Cha 5-4E, Cha 6-3D	**Outcomes:** Students will explore various applications of the definite integral in this unit. They will solve real world problems with rates of change and learn how the integral can be used to calculate geometric values such as area and volume.
Essential Questions: How can you use integrals to solve real world problems involving rates of change? How can you find the area between two curves in the plane? How can integrals be used to find volumes of solid objects?	**Learning Targets:** Students will be able to: -Integrate a rate of change function to find net change. -Use integration to find the area between two curves. -Use integration to calculate volumes of solids. -Use integration to calculate the length of a curve.
Topic 1: Integral as Net Change	Length: 3 days
Standard(s): Cha 4-4B, Cha 4-3D	Academic Vocabulary: Net Change, Consumption, Work
Lesson Frame:	We will investigate the connection of integrals and rates of change in real world problems.
	I will integrate a rate of change function to find net change.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 2: Areas in the Plane	Length: 4 days
Standard(s): Cha 5-4C, Cha 5-1E, Cha 5-2B	Academic Vocabulary: Area Between Curves
Lesson Frame:	We will formalize techniques for finding the areas of shapes in the x-y plane.
	I will use integration to find the area between two curves.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 3: Volumes of Solids	Length: 4 days
Standard(s): Cha 5-3D, Cha 5-2D, Cha 5-4E	Academic Vocabulary: Cross Section, Volume of Revolution, Disk Method, Shell Method
Lesson Frame:	We will explore how integrals can be used to find the volume of 3 dimensional objects.
	I will use integration to calculate volumes of solids.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:
Topic 4: Lengths of Curves	Length: 3 days
Standard(s): Cha 6-3D	Academic Vocabulary: Sine Wave, Arc Length
Lesson Frame:	We will explore how integrals can be used to find the length of curves.
	I will use integration to calculate the length of a curve.
Performance Tasks: Warmup Problems, Exit Tickets, Challenge Problems, Application Examples	Notes:

September	October	November	December	January	February	March	April	May	June