

Calculus Curriculum

Course Description: In Calculus, the student brings together all the skills learned in Algebra through Precalculus and applies them to the study of limits. Students will find themselves in a course traditionally taken by first and second semester college students. During the first semester, the student will engage in a complete analysis of limits of ratios (derivatives). During the second semester the student will perform the same analysis on limits of sums (integrals).

**This course is available for dual credit through University of Missouri St. Louis.*

Grades: 11-12th

Course Resources & Materials

Calc Medic, Desmos, Infinite Calculus Series, AP Classroom (College Board), TI Graphing Calculator

Course Essential Questions:

- How do you use the definition and the properties of limits to evaluate finite, infinite, and one-sided limits?
- How do you use the definition of a continuous function to recognize and graph continuous and discontinuous functions?
- How do you find derivatives of algebraic and trigonometric functions by using differentiation rules, the product and quotient rules, the chain rule, and implicit differentiation?
- How do you apply the first and second derivative tests to curve sketching and use real data to develop and solve models of real world applications involving related rates, optimization and differentials, making estimates, predictions, and making informed estimates?
- How do you find antiderivatives, compute definite integrals, and apply several integration techniques including integration by substitution?
- How do you use the definite integral to calculate areas and volumes?

College Board Calculus Standards:

- CHA-1.A: Interpret the rate of change at an instant in terms of average rates of change over intervals containing that instant
- LIM-1.A: Represent limits analytically using correct notation
- LIM-1.B: Interpret limits expressed in analytic notation
- LIM-1.D: Determine the limits of functions using limit theorems
- LIM-1.E: Determine the limits of functions using equivalent expressions for the function
- LIM-2.A: Justify conclusions about continuity at a point using the definition
- LIM-2.B: Determine intervals over which a function is continuous
- LIM-2.C: Determine the values of x or solve for parameters that make discontinuous functions continuous, if possible
- LIM-2.D: Interpret the behavior of functions using limits involving infinity
- FUN-1.A: Explain the behavior of a function on an interval using the Intermediate Value Theorem
- CHA-2.A: Determine average rates of change using difference quotients
- CHA-2.B: Represent the derivative of a function as the limit of a difference quotient

- CHA-2.C: Determine the equation of a line tangent to a curve at a given point
- FUN-2.A: Explain the relationship between differentiability and continuity
- FUN-3.A: Calculate derivatives of familiar functions
- FUN-3.B: Calculate derivatives of products and quotients of differentiable functions
- FUN-3.C: Calculate derivatives of compositions of differentiable functions
- FUN-3.D: Calculate derivatives of implicitly defined functions
- FUN-3.E: Calculate derivatives of inverse functions and inverse trigonometric functions
- FUN-3.F: Determine higher order derivatives of a function
- CHA-3.A: Interpret the meaning of a derivative in context
- CHA-3.B: Calculate rates of change in applied contexts
- CHA-3.C: Interpret rates of change in applied contexts
- CHA-3.D: Calculate rate of change in applied contexts
- CHA-3.E: Interpret related rates in applied contexts
- CHA-3.F: Approximate a value on a curve using the equation of a tangent line
- LIM-4.A: Determine limits of functions that result in indeterminate form
- FUN-1.B: Justify conclusions about functions by applying the Mean Value Theorem over an interval
- FUN-1.C: Justify conclusions about functions by applying the Extreme Value Theorem
- FUN-4.A: Justify conclusions about the behavior of a function based on the behavior of its derivatives
- FUN-4.B: Calculate minimum and maximum values in applied contexts or analysis of functions
- FUN-4.C: Interpret minimum and maximum values calculated in applied contexts
- FUN-4.D: Determine critical points of implicit relations
- FUN-4.E: Justify conclusions about the behavior of an implicitly defined function based on evidence from its derivatives
- CHA-4.A: Interpret the meaning of areas associated with the graph of a rate of change in context
- LIM-5.A: Approximate a definite integral using geometric and numerical methods
- LIM-5.B: Interpret the limiting case of the Riemann sum as a definite integral
- LIM-5.C: Represent the limiting case of the Riemann sum as a definite integral
- FUN-5.A: Represent accumulation functions using definite integrals
- FUN-6.A: Calculate a definite integral using areas and properties of definite integrals
- FUN-6.B: Evaluate definite integrals analytically using the Fundamental Theorem of Calculus
- FUN-6.C: Determine antiderivatives of functions and indefinite integrals, using knowledge of derivatives
- FUN-6.D: For integrands requiring substitution or rearrangements in equivalent forms: (a) Determine indefinite integrals, (b) Evaluate definite integrals
- FUN-7.B: Verify solutions to differential equations
- FUN-7.C: Estimate solutions to differential equations
- FUN-7.D: Determine general solutions to differential equations
- FUN-7.E: Determine particular solutions to differential equations

- CHA-4.B: Determine the average value of a function using definite integrals
- CHA-4.C: Determine values for positions and rates of change using definite integrals in problems involving rectilinear motion
- CHA-4.D: Interpret the meaning of a definite integral in accumulation problems
- CHA-4.E: Determine net change using definite integrals in applied contexts
- CHA-5.A: Calculate areas in the plane using the definite integral
- CHA-5.B: Calculate volumes of solids with known cross sections using definite integrals
- CHA-5.C: Calculate volumes of solids of revolution using definite integrals

Course Enduring Understandings:

- Mathematicians use derivatives to describe rates of change of one variable to another.
- Mathematicians use definite integrals to describe the net change in one variable over an interval of another allows students to understand change in a variety of contexts.
- The Fundamental Theorem of Calculus expresses a relationship between integration and differentiation.
- Beginning with a discrete model and then considering the consequences of a limiting case allows us to model real-world behavior and to discover and understand important ideas, definitions, formulas, and theorems in calculus such as continuity, differentiation, and integration.
- Calculus allows us to analyze the behaviors of functions by relating limits to differentiation and integration and relate each of these concepts to the others.

Course Essential Vocabulary:

- Limit, Left-hand Limit, Right-hand Limit, Continuity, Discontinuity, Essential, Removable, Intermediate Value Theorem or IVT, Derivative, Constant, Power, Product, Quotient, Chain, Differentiability, Higher Order, Inverse, Trigonometric, Exponential, Logarithmic, Tangent Line, Product Rule, Quotient Rule, Chain Rule, Critical Numbers, Increasing, Decreasing, Intervals, Extrema, Relative, Local, Absolute, Extreme Value Theorem (EVT), Concavity, Concave Up, Concave Down, Points of Inflection, Rectilinear Motion, Optimization, Position, Velocity, Acceleration, L'Hopital's, Indeterminate, Differentiation, Implicit, Linearize, Linearization, Approximation, Mean Value Theorem, MVT, Average, Related Rates, Antiderivative, Integral, Antidifferentiation, Integration, Integrate, Substitution, Differential, Differential Equation, General Solution, Slope Field, Antiderivative, Definite Integral, Indefinite Integral, Riemann Sum, Approximate Area, Exact Area, Limit of a Riemann Sum, Sigma Notation, First and Second Fundamental Theorems of Calculus, Area, Volume, Cross Section, Slicing, Rotation, Revolution, Disk, Washer, Average Value, Net Change, Displacement, Total Distance, Accumulator

Unit 1	Limits and Continuity (4 Weeks) In this unit, students evaluate limits, define continuity, and apply the Intermediate Value Theorem.
Unit 1 Enduring Understandings	• Limits introduce the subtle distinction between evaluating a function at a point and considering what value the function is approaching, if any, as x approaches a point. • Limits are the basis for important definitions and for theorems that are used to solve realistic problems involving change and to justify conclusions. • Reasoning with definitions, theorems, and properties can be used to justify claims about continuity. • Reasoning with definitions, theorems, and properties can be used to justify claims about limits. • Calculus allows us to generalize knowledge about motion to diverse problems involving change.
Unit 1 Essential Questions	• How does knowing the value of a limit, or that a limit does not exist, help you to make sense of interesting features of functions and their graphs? • How do we close loopholes so that a conclusion about a function is always true? • How do we evaluate limits? • How do we define and apply continuity? • In what context is the Intermediate Value Theorem required? • Can change occur at an instant?
Unit 1 Student Learning Goals	• Students will evaluate a limit using a graph. • Students will evaluate a limit using a table. • Students will evaluate a limit by factoring, rationalizing, or other algebraic processes. • Students will evaluate a limit of a piecewise function. • Students will justify a limit does not exist using a left hand limit and right hand limit . • Students will use the definition of continuity to justify a function is continuous/discontinuous at a value of x. • Students will justify reasoning by applying the Intermediate Value of Theorem (IVT). • Students will calculate average and instantaneous rates of change. • Students will calculate limits as x approaches positive or negative infinity. • Students will identify intervals on which a function is continuous. • Students will find the equation of a tangent and a normal line to a curve.
Unit 1 Vocabulary	Limit, Left hand Limit, Right Hand Limit, Continuity, Discontinuity, Essential, Removable, Intermediate Value Theorem or IVT
Unit 1 College Board Learning Standards	• <u>CHA-1.A</u>: Interpret the rate of change at an instant in terms of average rates of change over intervals containing that instant • <u>LIM-1.A</u>: Represent limits analytically using correct notation • <u>LIM-1.B</u>: Interpret limits expressed in analytic notation • <u>LIM-1.D</u>: Determine the limits of functions using limit theorems

	• <u>LIM-1.E</u>: Determine the limits of functions using equivalent expressions for the function • <u>LIM-2.A</u>: Justify conclusions about continuity at a point using the definition • <u>LIM-2.B</u>: Determine intervals over which a function is continuous • <u>LIM-2.C</u>: Determine the values of x or solve for parameters that make discontinuous functions continuous, if possible • <u>LIM-2.D</u>: Interpret the behavior of functions using limits involving infinity • <u>FUN-1.A</u>: Explain the behavior of a function on an interval using the Intermediate Value Theorem • <u>LIM-4.A</u>: Determine limits of functions that result in indeterminate form
Unit 1 Assessments	Common Assessments (PLC created and revised annually)
Unit 1 Curricular Resources	TI Graphing Devices, Desmos, AP Classroom, Calc Medic, DeltaMath, Kuta Software (Infinite Calculus) and teacher created materials

Unit 2	Derivatives (4-5 Weeks) In this unit, students learn methods to find derivatives, equations of tangent lines, and test for differentiability.
Unit 2 Enduring Understandings	• Derivatives allow us to determine instantaneous rates of change at an instant by applying limits to knowledge about rates of change over intervals. • Recognizing that a function's derivative may also be a function allows us to develop knowledge about the related behaviors of both. • Recognizing opportunities to apply derivative rules can simplify differentiation.
Unit 2 Essential Questions	• Why do mathematical properties and rules for simplifying and evaluation limits apply to differentiation? • What are the applications for derivatives? • How do we find a derivative? • What does a derivative represent as an application? • How do we find the equation of a tangent line? • How do we determine if a function is differentiable at a given value of x?
Unit 2 Student Learning Goals	• Students will find the derivative of a function by applying the Definition of the Derivative. • Students will find the derivative of a function by applying a Power Rule. • Students will find the derivative of a function by applying the Product Rule. • Students will find the derivative of a function by applying the Quotient Rule. • Students will find the derivative of a function by applying the Chain Rule. • Students will justify the differentiability of a function at a value of x. • Students will find the slope of a tangent line using the derivative of a function. • Students will connect application of a derivative to find instantaneous velocity at a specific time.

	• Students will find the equation of a tangent line. • Students will find the higher order derivative of a function. • Students will calculate the slope of a function using the definition of a derivative. • Students will tell where a function is not differentiable. • Students will use the rules of differentiation to calculate a derivative. • Students will use derivatives to analyze straight line motion.
Unit 2 Vocabulary	Derivative, Constant, Power, Product, Quotient, Chain, Differentiability, Tangent Line, Higher Order (First Derivative, Second Derivative, etc.)
Unit 2 College Board Learning Standards	• <u>CHA-2.A</u>: Determine average rates of change using difference quotients • <u>CHA-2.B</u>: Represent the derivative of a function as the limit of a difference quotient • <u>CHA-2.C</u>: Determine the equation of a line tangent to a curve at a given point • <u>FUN-2.A</u>: Explain the relationship between differentiability and continuity • <u>FUN-3.A</u>: Calculate derivatives of familiar functions • <u>FUN-3.B</u>: Calculate derivatives of products and quotients of differentiable functions • <u>FUN-3.C</u>: Calculate derivatives of compositions of differentiable functions • <u>FUN-3.F</u>: Determine higher order derivatives of a function
Unit 2 Assessments	To be developed in Implementation - Year 1. PLC created and revised annually.
Curricular Resources Utilized in Unit 2	TI Graphing Devices, Desmos, AP Classroom, Calc Medic, DeltaMath, Kuta Software (Infinite Calculus) and teacher created materials

Unit 3	Derivatives of Functions (3-4 Weeks) In this unit, students learn techniques for finding derivatives of specific types of functions.
Unit 3 Enduring Understandings	• Recognizing opportunities to apply derivative rules can simplify differentiation.
Unit 3 Essential Questions	• How do the derivative rules relate to each other? • How do the rates of change relate to real life situations?
Unit 3 Student Learning Goals	• Students will find the derivative of a Inverse Function. • Students will find the derivative of Trigonometric functions. • Students will find the derivative of a Inverse Trigonometric Function.

	• Students will find the derivative of a Exponential Function. • Students will find the derivative of a Logarithmic Function. • Students will find the derivative of any type of function by applying Product or Quotient Rules. • Students will find the derivative of any type of function by applying the Chain Rule. • Students will find the equation of a tangent line to any type of function. • Students will use the rules of differentiation to calculate derivatives for the six basic trigonometric functions. • Students will differentiate a composite function. • Students will find the derivative of an implicitly defined function. • Students will calculate the derivative of an inverse trigonometric function. • Students will calculate the derivative of an exponential and a logarithmic function.
Unit 3 Vocabulary	Derivative, Inverse, Trigonometric, Exponential, Logarithmic, Tangent Line, Product Rule, Quotient Rule, Chain Rule
Unit 3 College Board Learning Standards	<u>FUN-3.E</u> : Calculate derivatives of inverse functions and inverse trigonometric functions
	<u>FUN-3.A</u> : Calculate derivatives of familiar functions
Unit 3 Assessments	To be developed in Implementation - Year 1. PLC created and revised annually.
Unit 3 Curricular Resources	TI Graphing Devices, Desmos, AP Classroom, Calc Medic, DeltaMath, Kuta Software (Infinite Calculus) and teacher created materials

Unit 4	Applications of Derivatives to Graphing (4-5 Weeks) In this unit, students apply derivative techniques to analyze graphs of functions and select applications.
Unit 4 Enduring Understandings	• Derivatives allow us to solve real-world problems involving rates of change.

Unit 4 Essential Questions	• Since certain indeterminate forms seem to actually approach a limit, how can we determine that limit, provided it exists? • How do we apply derivatives to analyze the graph of a function? • How do we apply derivatives to analyze rectilinear motion? • How do we apply derivatives to analyze optimization? • How do we connect derivatives to determine absolute extrema as part of the Extreme Value Theorem? • 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?
Unit 4 Student Learning Goals	• Students will use derivatives to find critical numbers. • Students will use derivatives to determine increasing/decreasing intervals. • Students will use derivatives to determine relative and absolute extrema. • Students will apply the Extreme Value Theorem (EVT). • Students will use derivatives to determine concavity. • Students will use derivatives to determine points of inflection. • Students will use derivatives as an applicable process to analyze rectilinear motion. • Students will use derivatives as an applicable process to optimize. • Students will determine the local and absolute extrema of a function. • Students will find the open intervals in which a function is increasing and decreasing. -Use the first derivative test to find local extrema of a function. • Students will 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.
Unit 4 Vocabulary	Critical Numbers, Increasing, Decreasing, Intervals, Extrema, Relative, Local, Absolute, Extreme Value Theorem (EVT), Concavity, Concave Up, Concave Down, Points of Inflection, Rectilinear Motion, Optimization, Position, Velocity, Acceleration
Unit 4 College Board Learning Standards	<u>FUN-1.C</u> : Justify conclusions about functions by applying the Extreme Value Theorem
	<u>FUN-4.A</u> : Justify conclusions about the behavior of a function based on the behavior of its derivatives
	<u>FUN-4.B</u> : Calculate minimum and maximum values in applied contexts or analysis of functions
	<u>FUN-4.C</u> : Interpret minimum and maximum values calculated in applied contexts
	<u>FUN-4.D</u> : Determine critical points of implicit relations

Unit 4 Assessments	To be developed in Implementation - Year 1. PLC created and revised annually.
Unit 4 Curricular Resources	TI Graphing Devices, Desmos, AP Classroom, Calc Medic, DeltaMath, Kuta Software (Infinite Calculus) and teacher created materials

Unit 5	Further Applications of Derivatives (4-5 Weeks) In this unit, students apply derivative techniques to select applications. They deepen their understanding of how derivatives can be used further in other problem solving processes.
Unit 5 Enduring Understandings	- Existence theorems allow us to draw conclusions about a function's behavior on an interval without precisely locating that behavior. - A function's derivative can be used to understand some behaviors of the function.
Unit 5 Essential Questions	- What additional information is included in a sound mathematical argument about optimization that a simple description of an equivalent answer lacks? - How do we apply L'Hopital's Rule to evaluate limits? - How are equations of tangent lines related to linearization problems? - How do we know when a linear approximation is an overestimate or underestimate? - How (and when) do we implicitly differentiate? - In what context is the Mean Value Theorem required? - How do we differentiate with respect to time as an application (Related Rates)?
Unit 5 Student Learning Goals	- Students will use derivatives through L'Hopital's Rule to evaluate limits. - Students will use derivatives and equations of tangent lines to linearly approximate values of functions. - Students will use derivatives to determine if linear approximations are an overestimate or underestimate. - Students will apply the Mean Value Theorem (MVT). - Students will use derivatives to differentiate implicitly. - Students will use derivatives to evaluate Related Rates problems. - Students will solve a real world problem that involves multiple rates of change.
Unit 5 Vocabulary	L'Hopital's, Indeterminate, Limit, Derivative, Differentiation, Implicit, Linearize, Linearization, Tangent Line, Approximation, Mean Value Theorem, MVT, Average, Related Rates
Unit 5 College Board Learning Standards	<u>FUN-3.D</u> : Calculate derivatives of implicitly defined functions
	<u>CHA-3.A</u> : Interpret the meaning of a derivative in context

	<u>CHA-3.B</u> : Calculate rates of change in applied contexts
	<u>CHA-3.C</u> : Interpret rates of change in applied contexts
	<u>CHA-3.D</u> : Calculate rate of change in applied contexts
	<u>CHA-3.E</u> : Interpret related rates in applied contexts
	<u>CHA-3.F</u> : Approximate a value on a curve using the equation of a tangent line
Unit 5 Assessments	To be developed in Implementation - Year 1. PLC created and revised annually.
Unit 5 Curricular Resources	TI Graphing Devices, Desmos, AP Classroom, Calc Medic, DeltaMath, Kuta Software (Infinite Calculus) and teacher created materials

Unit 6	Antiderivatives (3 Weeks) In this unit, students apply antiderivative techniques, solve differential equations, and develop and interpret slope fields.
Unit 6 Enduring Understandings	Recognizing opportunities to apply knowledge of geometry and mathematical rules can simplify integration.
Unit 6 Essential Questions	- How do we take an antiderivative? - How can we simplify a function to take an antiderivative? - How do we take an antiderivative using substitution? - How do we solve a differential equation? - How do we connect a differential equation to a slope field? - How do we connect the solution of a differential equation to a slope field? - How can antiderivatives be used to solve equations with derivatives in them? - What techniques can be used to solve initial value problems?
Unit 6 Student Learning Goals	- Students will take an antiderivative. - Students will simplify functions to take an antiderivative. - Students will solve an initial value problem using antiderivatives. - Students will use separation of variables to solve a differential equation. - Students will take an antiderivative using substitution as a technique. - Students will find a general solution of a differential equation. - Students will create a slope field given a differential equation.

	Students will match a slope field to a differential equation.
Unit 6 Vocabulary	Antiderivative, Integral, Antidifferentiation, Integration, Integrate, Substitution, Differential, Differential Equation, General Solution, Slope Field
Unit 6 College Board Learning Standards	<u>FUN-4.E</u> : Justify conclusions about the behavior of an implicitly defined function based on evidence from its derivatives
	<u>FUN-6.C</u> : Determine antiderivatives of functions and indefinite integrals, using knowledge of derivatives
	<u>FUN-6.D</u> : For integrands requiring substitution or rearrangements in equivalent forms: (a) Determine indefinite integrals, (b) Evaluate definite integrals
	<u>FUN-7.B</u> : Verify solutions to differential equations
	<u>FUN-7.C</u> : Estimate solutions to differential equations
	<u>FUN-7.D</u> : Determine general solutions to differential equations
	<u>FUN-7.E</u> : Determine particular solutions to differential equations
Unit 6 Assessments	To be developed in Implementation - Year 1. PLC created and revised annually.
Unit 6 Curricular Resources	TI Graphing Devices, Desmos, AP Classroom, Calc Medic, DeltaMath, Kuta Software (Infinite Calculus) and teacher created materials

Unit 7	The Definite Integral (5 Weeks) In this unit, students approximate area beneath a curve, evaluate exact area beneath a curve, apply definite integration as an application to determine area, and apply the Fundamental Theorem of Calculus (FTC) to evaluate or differentiate a definite integral.
Unit 7 Enduring Understandings	- Definite integrals allow us to solve problems involving the accumulation of change over an interval. - Definite integrals can be approximated using geometric and numerical methods. - The Fundamental Theorem of Calculus connects differentiation and integration. - Recognizing opportunities to apply knowledge of geometry and mathematical rules can simplify integration.
Unit 7 Essential	How can we approximate the area under a curve?

Questions	• How can we find the exact area under a curve? • How does the definite integral apply to area under a curve? • What is the Fundamental Theorem of Calculus? • How does the FTC apply to evaluate a definite integral? • How does the FTC apply to take a derivative of a definite integral? • What is a definite integral and how do I calculate it? • How is the definite integral set up in different contexts? • What are Riemann Rectangles and how are they used? • How do I evaluate an integral when the equation for the integrand is known?
Unit 7 Student Learning Goals	• Students will evaluate using Sigma Notation. • Students will approximate area under a curve using Riemann Sums (Left, Right, Midpoint and Trapezoid). • Students will find exact area under a curve using the Limit of a Riemann Sum. • Students will use a definite integral to represent the area under a curve. • Students will evaluate a definite integral using the First Fundamental Theorem of Calculus. • Students will differentiate a definite integral using the Second Fundamental Theorem of Calculus. • Students will distinguish between differentiation and integration.
Unit 7 Vocabulary	Antiderivative, Integral, Integration, Definite Integral, Indefinite Integral, Riemann Sum, Approximate Area, Exact Area, Limit of a Riemann Sum, Sigma Notation, First and Second Fundamental Theorems of Calculus, FTC Pt 1 & 2
Unit 7 College Board Learning Standards	<u>CHA-4.A</u> : Interpret the meaning of areas associated with the graph of a rate of change in context
	<u>LIM-5.A</u> : Approximate a definite integral using geometric and numerical methods
	<u>LIM-5.B</u> : Interpret the limiting case of the Riemann sum as a definite integral
	<u>LIM-5.C</u> : Represent the limiting case of the Riemann sum as a definite integral
	<u>FUN-5.A</u> : Represent accumulation functions using definite integrals
	<u>FUN-6.A</u> : Calculate a definite integral using areas and properties of definite integrals
	<u>FUN-6.B</u> : Evaluate definite integrals analytically using the Fundamental Theorem of Calculus
	<u>FUN-6.D</u> : For integrands requiring substitution or rearrangements in equivalent forms: (a) Determine indefinite integrals, (b) Evaluate definite integrals
Unit 7 Assessments	To be developed in Implementation - Year 1. PLC created and revised annually.

Unit 7 Curricular Resources	TI Graphing Devices, Desmos, AP Classroom, Calc Medic, DeltaMath, Kuta Software (Infinite Calculus) and teacher created materials
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Unit 8	Area, Volume, and Net Change (4-5 Weeks) In this unit, students apply definite integrals to determine area between curves, volume, average value of a function and accumulating amounts.
Unit 8 Enduring Understandings	Definite integrals allow us to solve problems involving the accumulation of change in area of volume over an interval.
Unit 8 Essential Questions	- How can we determine area contained by 2 or more functions? - How can we determine volume using slicing as a method? - How can we determine the volume of revolution using a washer method? - How can we determine the volume of revolution using a disk method? - How can we find an average value for a function? - How can we determine displacement or net change? - How can we determine total distance traveled? - What does it mean for an integral to be “an accumulator?” - How do I tell the difference between the theorems (Average Value, Mean Value, Intermediate Value, etc) that all sound alike?
Unit 8 Student Learning Goals	- Students will determine the area contained by 2 or more functions. - Students will determine the volume given the region contained by 2 or more functions and the shape of a cross section (slicing). - Students will determine the volume given the region contained by 2 or more functions and the revolution of that region about a given line (disk/washer). - Students will determine the average value of a function. - Students will determine/interpret net change (displacement). - Students will determine the total distance traveled by an object.
Unit 8 Vocabulary	Area, Volume, Cross Section, Slicing, Rotation, Revolution, Disk, Washer, Average Value, Net Change, Displacement, Total Distance, Accumulator, Definite Integral, Integration, Antiderivative, Antidifferentiation, Limits (or Bounds)
Unit 8 College Board Learning Standards	<u>CHA-4.B</u> : Determine the average value of a function using definite integrals
	<u>CHA-4.C</u> : Determine values for positions and rates of change using definite integrals in problems involving rectilinear motion

	<u>CHA-4.D</u> : Interpret the meaning of a definite integral in accumulation problems
	<u>CHA-4.E</u> : Determine net change using definite integrals in applied contexts
	<u>CHA-5.A</u> : Calculate areas in the plane using the definite integral
	<u>CHA-5.B</u> : Calculate volumes of solids with known cross sections using definite integrals
	<u>CHA-5.C</u> : Calculate volumes of solids of revolution using definite integrals
Unit 8 Assessments	To be developed in Implementation - Year 1. PLC created and revised annually.
Unit 8 Curricular Resources	TI Graphing Devices, Desmos, AP Classroom, Calc Medic, DeltaMath, Kuta Software (Infinite Calculus) and teacher created materials