Southington Public Schools
Curriculum Map

Subject: Calculus **Grade: 12**

UNIT TITLE	Limits & Continuity	Differential Calculus	Test for Extrema
CONTENT	• **Understand the concept of the limit of a function** • **Use limits of a function to solve problems involving continuous and discontinuous function behavior**	• **Understand and determine the derivative of a point using various means** • **Use differentiation to solve real world problems that include a variety of functions**	• **Use differentiation to solve real world problems that include a variety of functions** • **Determine critical values of a function and increasing/decreasing intervals**
STATE STANDARDS	1.1.a. (9-12E) Model real-world situations and make generalizations about mathematical relationships using a variety of patterns and functions. *1) Describe and compare properties and classes of functions, including exponential, polynomial, rational, logarithmic and trigonometric.* *(2) Analyze essential relations in a problem to determine possible functions that could model the situation.* *(7) Apply the concepts of limits to sequences and asymptotic behavior of functions.* 1.2.a. (9-12E) Relate the behavior of functions and relations to specific parameters and determine functions to model real-world situations. *(1) Relate the graphical representation of a function to its function family and find equations, intercepts, maximum or minimum values, asymptotes and line of symmetry for that function.* 1.3.a. (9-12E) Use and extend algebraic concepts to include real and complex numbers, vectors and matrices *(1) Determine equivalent representations of an algebraic equation or inequality to simplify and solve problems*	*Algebraic Reasoning: Patterns and Functions* A wide variety of functions can be used to model real world situations. *11/12-1 Describe and compare properties and classes of functions including exponential, polynomial, rational, logarithmic and trigonometric.* *11/12-3 Analyze essential relations in a problem to determine possible functions that could model the situation.* *11/12-4 Recognize that the slope of the tangent line to a curve represents the rate of change.* *11/12-5 Understand and use optimization strategies including linear programming.* *Geometry and Measurement* Measurements that are not directly determined can be approximated with some degree of precision. *11/12-1 Use successive approximation, upper and lower bounds, and limits to solve measurement problems.* *11/12-2 Use properties of similarity and techniques of trigonometry to make indirect*	Algebraic Reasoning: Patterns and Functions A wide variety of functions can be used to model real world situations. ***11/12-1** Describe and compare properties and classes of functions including exponential, polynomial, rational, logarithmic and trigonometric.* ***11/12-3** Analyze essential relations in a problem to determine possible functions that could model the situation.* Geometry and Measurement Measurements that are not directly determined can be approximated with some degree of precision**.** ***11/12-4** Recognize that the slope of the tangent line to a curve represents the rate of change.* ***11/12-5** Understand and use optimization strategies including linear programming.* A variety of coordinate systems and transformations may be used to solve geometric problems in two- and three-dimensional geometry. ***11/12-1** Use successive approximation, upper and lower bounds, and limits to solve*

	2.1.a. (9-12E) Extend the understanding of number to include the set of complex numbers. *(1) Compare and contrast the properties of numbers and number systems, including rational, real and complex numbers.* *(2) Select and use an appropriate form of number (integer, fraction, decimal, ratio, percent, exponential, scientific notation, irrational, complex) to solve practical problems involving order, magnitude, measures, labels, locations and scales.* *2.2. a. (9-12E) Investigate mathematical properties and operations related to objects that are not numbers* *(2) Perform operations with complex numbers, matrices, determinants and logarithms* 3.3.a. (9-12E) Approximate measurements that cannot be directly determined with some degree of precision using appropriate tools, techniques and strategies. *(1) Use successive approximation, upper and lower bounds, and limits to solve measurement problems.* *(2) Use properties of similarity and techniques of trigonometry to make indirect measurements of lengths and angles to solve a variety of problems.*	*measurements of lengths and angles to solve a variety of problems.* A variety of coordinate systems and transformations may be used to solve geometric problems in two- and three-dimensional geometry. *11/12-3 Visualize three-dimensional objects from different perspectives and analyze cross-sections, surface area, and volume.*	*measurement problems.* ***11/12-2*** *Use properties of similarity and techniques of trigonometry to make indirect measurements of lengths and angles to solve a variety of problems.* ***11/12-3*** *Visualize three-dimensional objects from different perspectives and analyze cross-sections, surface area, and volume.*
ASSESSMENT	**PERFORMANCE TASK** Discontinuity Poster. Students will create a poster which displays a function with a removable discontinuity. Students must prove why it is a discontinuous function. Students must then repair the discontinuity and prove that the new function is continuous.	**PERFORMANCE TASK** **Describe Rectilinear Motion.** You will have to use Calculus to describe the motion of a ladybug along a horizontal path. A graph of the motion will have to be presented. ALL answers will have to be appropriately justified with proper calculus techniques.	**PERFORMANCE TASK** You are to create a box by cutting equal squares from the four corners of a rectangular piece of material. You will use calculus to determine the dimensions that create the largest possible box. Your final product will include the actual box as well as the equation and any work you used to determine the dimensions.

	OTHER EVIDENCE • Homework • Observations of class work • Quiz on evaluating limits • Quiz on proving the continuity of a function • Test; limits, continuity, epsilon-delta definition of a limit.	**OTHER EVIDENCE** • Daily homework assignments • Participation in class • Quiz on the three formal definitions of a limit including piece-wise defined functions. • Quiz on the calculator functions. • Quiz on the power rule, product rule, and quotient rule • Quiz on physical applications of the derivative • Quiz on the derivatives of trig functions and transcendental functions • Quiz on the chain rule. • Quiz on implicit differentiation • Test on differentiation and physical applications • Test on implicit differentiation and related rates • Cooperative group activities that involve actual Advanced Placement questions	**OTHER EVIDENCE** • Homework • Observations of class work • Quiz, given a function, state intervals increasing and decreasing. Create a graph. • Quiz, Given a graph describe the derivative. • Quiz, simple real world problems solved with the derivative. • Test, Advanced placement type questions. • "Be the teacher" Explain a homework problem to the class. • What price should the concert promoter charge to maximize the profit?
SKILLS	• Evaluate a limit intuitively, graphically and analytically. • Explain why certain limits do not exist. • Use limits to investigate end behavior. • Prove a function is either continuous or discontinuous.	• Determine if a function is differentiable at a point. • Differentiate a function using the general definition of the derivative. • Find the derivative at a specific point using each of the three definitions of a derivative.	• Determine a critical value. • Find relative extrema and justify their existence with derivative tests. • Explain how the derivative solves a real problem as it relates to increasing and decreasing. • Predict or confirm functional global

	• Explain the difference between removable and essential discontinuities. • Prove a limit exists using the Epsilon-Delta definition of a limit.	• Use the calculator to find the derivative at a point. • Write the equation of a tangent line at a point by using the derivative. • Write the equation of a normal line at a point by using the derivative. • Differentiate using the power rule for the derivative. • Recognize when to use the product rule and use it appropriately. • Recognize when to use the Quotient rule and use it appropriately. • Recognize when to use the chain rule and use it appropriately. • Recognize the definition of the derivative when confronted with a limit. • Differentiate the trigonometric functions. • Differentiate exponential and logarithmic functions. • Differentiate implicitly defined functions.	behavior through the process of differentiation. • Determine when a tangent line at a point is horizontal.

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UNIT TITLE	Integral Calculus	Applications of the Integral	
CONTENT	• **Understand and apply the properties of Integrals to solve a variety of problems** • **Use Mathematical Theorems to solve problems, including problems involving differential equations**	• **Use integrals to determine the area of regions bounded by two or more functions** • **Use integrals to determine the volume of solids and cross sections**	
STATE STANDARDS	*Algebraic Reasoning: Patterns and Functions* A wide variety of functions can be used to model real world situations. *11/12-1 Describe and compare properties and classes of functions including exponential, polynomial, rational, logarithmic and trigonometric.* *11/12-3 Analyze essential relations in a problem to determine possible functions that could model the situation.* *11/12-4 Recognize that the slope of the tangent line to a curve represents the rate of change.* *11/12-5 Understand and use optimization strategies including linear programming.* *Geometry and Measurement* Measurements that are not directly determined can be approximated with some degree of precision. *11/12-1 Use successive approximation, upper and lower bounds, and limits to solve*	*Algebraic Reasoning: Patterns and Functions* A wide variety of functions can be used to model real world situations. *11/12-1 Describe and compare properties and classes of functions including exponential, polynomial, rational, logarithmic and trigonometric.* *11/12-3 Analyze essential relations in a problem to determine possible functions that could model the situation.* *11/12-4 Recognize that the slope of the tangent line to a curve represents the rate of change.* *11/12-5 Understand and use optimization strategies including linear programming.* *Geometry and Measurement* Measurements that are not directly determined can be approximated with some degree of precision. *11/12-1 Use successive approximation, upper and lower bounds, and limits to solve measurement problems.*	

	measurement problems. *11/12-2 Use properties of similarity and techniques of trigonometry to make indirect measurements of lengths and angles to solve a variety of problems.* A variety of coordinate systems and transformations may be used to solve geometric problems in two- and three-dimensional geometry. *11/12-3 Visualize three-dimensional objects from different perspectives and analyze cross-sections, surface area, and volume.*	*11/12-2 Use properties of similarity and techniques of trigonometry to make indirect measurements of lengths and angles to solve a variety of problems.* A variety of coordinate systems and transformations may be used to solve geometric problems in two- and three-dimensional geometry. *11/12-3 Visualize three-dimensional objects from different perspectives and analyze cross-sections, surface area, and volume.*	
ASSESSMENT	**PERFORMANCE TASK** Land Assessment. Students will estimate the area beneath a curve using the Riemann sum, the RAM program and the definite integral. They will have to be able to compare and discuss the different methods. **OTHER EVIDENCE** • Daily homework assignments • Participation in class • Quiz on basic integration • Quiz on differential equations • Quiz on integral that yield trig functions • Quiz on u-substitution techniques • Quiz on the Riemann Sum definition of the derivative and finding area using the Riemann sum. • Quiz on the properties of the integral,	**PERFORMANCE TASK** _Applications of the Definite Integral Students will have to use the properties of the integral to represent the area between curves. Students will have to use the definite integral to find the volume of the solid formed when an area is revolved around an axis of revolution. Students will have to use the definite integral to find the volume of a solid with a known cross section. Students will have to evaluate all the definite integrals without the use of a calculator. **OTHER EVIDENCE** • Daily homework assignments • Participation in class • Quiz on finding the area between curves. (6.1) • Quiz on disk method (6.2) • Test 6.1-6.3 and cross sections • Cooperative group activities that involve actual Advanced Placement questions	

	the Mean Value Theorem and Average Value. • Quiz on the First and Second Fundamental Theorems. • Test on the Indefinite and Definite Integral including differential equations. • Cooperative group activities that involve actual Advanced Placement questions.		
SKILLS	• Recognize a separable differential equation and solve for a complete solution or a particular solution. • Solve simple integrands using anti-differentiation. • Find the area under a curve using a Riemann sum. • To evaluate a definite integral using a Riemann sum. • Use the Graphing calculator to evaluate a definite integral. • Appropriately use the properties of Integrals. • Recognize when to use the Mean Value theorem for integrals. • How to use the average value for integrals. • Use the First Fundamental Theorem of calculus. • Use the Second Fundamental Theorem of Calculus. • Solve differential equations as they relate to Physics. • Recognize integrands that yield trig functions as their anti-derivatives. • To use U- substitution as a tool when integrating complex integrands. • What is the rectangular approximation method? • What are slope-fields?	• Graph functions in the Cartesian coordinate system. • Graph functions on a graphing calculator. • Find the intersection of two functions algebraically. • Find the intersection of two functions with the use of a graphing calculator. • Set up an integral that represents the area of a region bounded by a function and an axis. • Set up an integral that represents the area bounded by a function and the y-axis. • Set up an integral that represents the area of a region that sits below the x-axis. • Set up an area that represents the area of a region bounded by two functions. • Set up an integral that represents the volume of a solid formed when a region sits against the x-axis or the y-axis. • Set up the integral that represents the volume of a solid formed when a region is revolved about a vertical axis of revolution or a horizontal axis of revolution. • Set up an integral that represents the volume of a known cross section. • To determine the appropriate method to use to find the volume of the solid.	