



Calculus Yearly Overview

Quarter 1	Properties and Characteristics of Functions	Limits	
Quarter 2	Derivatives Part 1	Derivatives - Part 2	
Quarter 3	Applications of Derivatives - Part 1	Applications of Derivatives - Part 2	Area Under the Curve
Quarter 4	Integration - Part 1	Integration - Part 2	

VDOE Process Goals

- To build new mathematical knowledge through problem solving and to develop a repertoire of skills and strategies for solving a variety of problem types (**Problem Solving**)
- To communicate mathematical ideas coherently and clearly and to analyze and evaluate the mathematical thinking of others (**Communication**)
- To use logical reasoning in solving mathematical problems and to explain and justify mathematical ideas (**Reasoning**)
- To understand how mathematical ideas interconnect and build on one another and to use those connections to solve problems (**Connections**)
- To create and use a variety of representations in learning, doing, and communicating mathematics (**Representations**)



Scope and Sequence

Quarter 1: 49 Days/24 Blocks

Blocks	Unit	Standards	Topics
7	Properties and Characteristics of Functions <i>Note: The recommendation is that the introduction unit piece of this gets addressed at the beginning of the year. The rest of the topics can be covered at the beginning OR spiraled in throughout the year as necessary.</i>	CALC.1 CALC.2 CALC.3 CALC.4	<ul style="list-style-type: none"> ● Functions: domain, range, and inverses ● Parent Functions and transformations and End Behavior (linear, quadratic, cubic, step, square root, cube root, absolute value, rational, radical, trig, exponential, logarithmic, e, \ln) ● Even and Odd Functions ● Solve and graph absolute value equations and inequalities ● Piecewise functions ● Binomial Expansion ● Rational Exponents <p><u>Pre-requisite skills to be spiraled in throughout the year:</u></p> <ul style="list-style-type: none"> ● e and \ln ● Factoring ● Long division and synthetic division ● Simplifying Complex Fractions ● Rationalizing with conjugates ● Recognize the equation of a circle and a semicircle ● Summation Notation
3	Unit Circle Trigonometry and Trigonometric Identities	CALC.5	<ul style="list-style-type: none"> ● Unit Circle ● Double Angle Formula (sine only) ● Inverse Trig Functions ● Pythagorean Identities ● Angle of Elevation
12	Limits <i>Pre-requisite skills needed: review factoring, complex fractions, rationalizing (denominator and numerator), piecewise functions, basic unit circle trig, graphical behavior of e</i>	CALC.6 CALC.7 CALC. 8	<ul style="list-style-type: none"> ● Basic concept of limit ● Evaluating Limits Numerically, Algebraically (rationalizing, factoring, direct substitution), and Graphically ● Intermediate Value Theorem ● Limits at Infinity ● One sided limits ● Vertical and Horizontal Asymptotes as limit definitions ● Indeterminate Form ● Continuity



	and ln.		<i>Optional: L'Hopital's Rule, special trig limits</i>
2	Quarter Review		

Quarter 2: 41 Days/20 Blocks

Blocks	Unit / Pre-Requisite Skills	Standard	Topic
7	Unit 3: Derivatives - Part 1 <i>Pre-requisite skills needed: Review rules of exponents, factor by grouping, rational expressions, binomial expansion (Pascal's triangle)</i>	<p>CALC.9 The student will investigate derivatives presented in graphic, numerical, and analytic contexts and the relationship between continuity and differentiability. The derivative will be defined as the limit of the difference quotient and interpreted as an instantaneous rate of change.</p> <p>CALC.10 The student will investigate the derivative at a point on a curve. This will include</p> <p>a) finding the slope of a curve at a point, including points at which the tangent is vertical and points at which there are no tangents;</p> <p>b) using local linear approximation to find the slope of a tangent line to a curve at the point;</p> <p>c) defining instantaneous rate of change as the limit of average rate of change; and</p> <p>d) approximating rate of change from graphs and tables of values.</p>	<ul style="list-style-type: none"> ● Slope of a Tangent Line ● Writing the equation of a tangent line ● Writing the equation of the normal line ● Limit Definition of the Derivative ● Derivative as instantaneous rate of change <p><i>Include 6 basic trig functions, ln, e</i> <i>Optional: inverse trig derivatives</i></p>
11	Unit 4: Derivatives - Part 2 <i>Pre-requisite skills needed: Trigonometric pythagorean identities and double-angle</i>		<ul style="list-style-type: none"> ● Power Rule ● Product Rule ● Quotient Rule ● Linear Approximation ● Chain Rule



	formulas (sine only).		<ul style="list-style-type: none"> ● Tabular Differentiation
2	Quarter Review		

Quarter 3: 47 Days/23 Blocks

Blocks	Unit / Pre-Requisite Skills	Standard	Topic
10	Unit 5: Applications of Derivatives - Part 1 Pre-requisite skills needed: Angle of elevation		<ul style="list-style-type: none"> ● Implicit Differentiation ● Rectilinear Motion ● Mean Value Theorem ● Related Rates ● Optimization <p><i>Make sure to use chain rule with 6 basic trig functions.</i> <i>Optional: inverse trig derivatives, logarithmic differentiation, Rolle's Theorem.</i> <i>Keep Related Rates and Optimization Problems basic for assessment yet show the AP level type of problems as part of instruction (see resources for sample Calculus / AP comparison problems).</i></p>
8	Unit 6: Applications of Derivatives - Part 2		<ul style="list-style-type: none"> ● Critical values ● Points of inflection ● Extrema and Concavity ● First Derivative Test ● Second Derivative Test ● Graph Interpretation / Curve Sketching
3	Unit 7: Area Under the Curve Pre-requisite skills needed: Recognize the formula for a circle and semi-circle,		<ul style="list-style-type: none"> ● Geometric representation ● Signed area ● Left, right, and midpoint approximations ● Trapezoid Rule <p><i>Optional: discussion of over and under approximations, tabular</i></p>



	summation notation.		
2	Quarter Review		



Quarter 4: 43 Days/22 Blocks

Blocks	Unit / Pre-Requisite Skills	Standard	Topic
10	Unit 8: Integration - Part 1		<ul style="list-style-type: none">● Power Rule● Definite Integrals● Fundamental Theorem of Calculus● U-substitution <i>Optional: Discussion of limit-sum as the definition of the integral, Second Fundamental Theorem of Calculus</i>
10	Unit 9: Integration - Part 2		<ul style="list-style-type: none">● Integrating \ln and e● Displacement● Total distance traveled● Rectilinear motion <i>Optional: inverse trig integration</i>
2	Quarter Review		