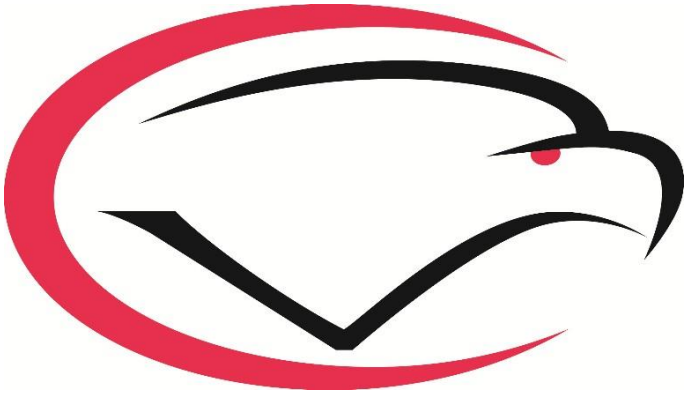
Secondary Curriculum Maps



Cumberland Valley School District

Soaring to Greatness, Committed to Excellence

Calculus

CVSD *Calculus L2* Curriculum Map

CV Priority Standard/PA Academic Standard
CC.2.2.HS.C.1 Use the concept and notation of functions to interpret and apply them in terms of their content
Taught in Unit(s)
Derivatives, Integration
Explanation/Example of Standard
● Determine the derivative of a function using appropriate derivative rules. ● Evaluate the derivative of a point to interpret an instantaneous rate of change. ● Determine the antiderivative of a function.
Common Misconceptions
● Students will confuse the derivative function with a derivative's value at a specific point. ● Students will fail to recognize the need for the product or quotient rule. ● Students will confuse the power rules for derivatives and integrals.

Big Idea(s)	Essential Question(s)
● Mathematical relationships among numbers can be represented, compared, and communicated. ● Mathematical relationships can be represented as expressions and equations in mathematical situations. ● Patterns exhibit relationships that can be extended, described, and generalized. ● Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.	• How is mathematics used to quantify, compare, represent, and model numbers? • How can mathematics support effective communication? • How can expressions and equations be used to quantify, solve, model, and/or analyze mathematical situations? • How are relationships represented mathematically? • How can recognizing repetition or regularity assist in solving problems more efficiently? • How can patterns be used to describe relationships in mathematical situations?

Assessments	
See file for specific unit common assessments.	
Concepts (what students need to know)	**Skills** (what students must be able to do)
● Average Rate of Change ● Instantaneous Rate of Change ● Limit Definition of Derivative ● Slope of a Tangent Line ● Equation of a Tangent Line ● Derivative Rules (Constant Rule, Constant Multiple Rule, Chain Rule, Product Rule, Quotient Rule) ● Implicit Differentiation ● Derivatives of Exponentials ● Derivatives of Logarithms	● Determine the difference between average rate of change and instantaneous rate of change ● Use the limit definition of derivative to determine a derivative function ● Identify the slope of a tangent line ● Write the equation of a tangent line ● Determine the derivative of a function using an appropriate rule ● Determine the integral of a function using an appropriate rule

• Trigonometric Derivatives • Logarithmic Differentiation • Anti-derivative • Integral Rules • Particular Solutions	• Find the particular solution to an anti-derivative given an initial condition

CVSD *Calculus L2* Curriculum Map

CV Priority Standard/PA Academic Standard
CC.2.2.HS.C.2 Graph and analyze functions and their properties to make connections between the different representations
Taught in Unit(s)
Derivative Applications
Explanation/Example of Standard
● Identify intercepts, asymptotes, relative extrema, inflection points. ● Describe increasing/decreasing behavior and concavity. ● Sketch a graph using its properties.
Common Misconceptions
● Students will reverse coordinates of x and y intercepts. ● Students will fail to test for extrema and inflection points. ● Students will attempt to sketch conflicting information.

Big Idea(s)	Essential Question(s)
● Mathematical relationships can be represented as expressions and equations in mathematical situations. ● Patterns exhibit relationships that can be extended, described, and generalized. ● Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.	● How can mathematics support effective communication? ● How can expressions and equations be used to quantify, solve, model, and/or analyze mathematical situations? ● How are relationships represented mathematically? ● How can recognizing repetition or regularity assist in solving problems more efficiently? ● How can patterns be used to describe relationships in mathematical situations?

Assessments	
See file for specific unit common assessments.	
Concepts (what students need to know)	**Skills** (what students must be able to do)
● Intercepts ● Vertical and Horizontal Asymptotes ● Increasing/Decreasing Behavior ● Relative Extrema ● Concavity ● Points of Inflection ● Critical Numbers ● First Derivative Test	● Determine intercepts algebraically ● Apply rules for finding horizontal asymptotes ● Factor rational expressions to determine vertical asymptotes ● Find first derivative of a function to identify critical numbers ● Perform first derivative test to find increasing/decreasing intervals and relative extrema ● Use second derivative of function and a sign test to determine concavity and points of inflection

CVSD *Calculus L2* Curriculum Map

CV Priority Standard/PA Academic Standard
CC.2.2.HS.C.6 Interpret functions in terms of the situations they model
Taught in Unit(s)
Derivatives, Derivative Applications, Integration
Explanation/Example of Standard
● Apply rates of change to business and physics applications. ● Analyze how two related quantities change with respect to each other. ● Determine an optimal solution that satisfies given conditions. ● Use the summation properties of an integral to determine function models given their derivative formula.
Common Misconceptions
Students will confuse the marginals with the function values. Students will fail to take the derivative with respect to time with related rates. Students will interchange the conditions with the target function. Students will fail to test solutions to verify the optimal situation.

Big Idea(s)	Essential Question(s)
● Mathematical relationships among numbers can be represented, compared, and communicated. ● Mathematical relationships can be represented as expressions and equations in mathematical situations. ● Patterns exhibit relationships that can be extended, described, and generalized. ● Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.	• How is mathematics used to quantify, compare, represent, and model numbers? • How can mathematics support effective communication? • How can expressions and equations be used to quantify, solve, model, and/or analyze mathematical situations? • How are relationships represented mathematically? • How can recognizing repetition or regularity assist in solving problems more efficiently? • How can patterns be used to describe relationships in mathematical situations?

Assessments	
See file for specific unit common assessments.	
Concepts (what students need to know)	**Skills** (what students must be able to do)
● Marginal Revenue ● Marginal Cost ● Marginal Profit ● Projectile Motion ● Related Rates ● Optimization	● Use derivatives to find marginal revenue, marginal cost, or marginal profit formulas and specific values. ● Describe the motion of a projectile using acceleration, velocity, and position. ● Determine a rule to illustrate the relationships between changing quantities. ● Determine and verify an optimal solution that satisfies given conditions. ● Given a derivative formula, use the summation properties of integration to

	determine a function model. ● Apply the models found through integration or derivation to make predictions or describe real-world situations.

CVSD *Calculus L2* Curriculum Map

CV Priority Standard/PA Academic Standard
CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems
Taught in Unit(s)
Limits
Explanation/Example of Standard
● Determine the limit of a function analytically using Replacement Theorem ● Use trigonometric identities to rewrite trigonometric expressions to evaluate limits
Common Misconceptions
● When students simplify a rational expression, they will cancel individual terms instead of entire factors. ● When adding and subtracting rational expressions, students will simplify without finding a common denominator. ● Students inappropriately apply trigonometric identities.

Big Idea(s)	**Essential Question(s)**
● Mathematical relationships among numbers can be represented, compared, and communicated. ● Mathematical relationships can be represented as expressions and equations in mathematical situations. ● Patterns exhibit relationships that can be extended, described, and generalized. ● Mathematical relationships can be represented and analyzed using words, tables, graphs, and equations.	• How is mathematics used to quantify, compare, represent, and model numbers? • How are relationships represented mathematically? • How can patterns be used to describe relationships in mathematical situations?

Assessments
See file for specific unit common assessments.

Concepts (what students need to know)	**Skills** (what students must be able to do)
● Definition of a limit ● Direct substitution ● Basic limit properties ● Replacement Theorem ● Factor polynomial expressions ● Rationalize radical expressions ● One-sided limits ● Limits at infinity ● Infinite limits (Unbounded functions) ● Definition of continuity ● L'Hopital's Rule ● Squeeze Theorem ● Special Trigonometric Limits	● Identify the conditions for a limit to exist ● Evaluate a limit using direct substitution ● Simplify rational expressions by factoring, rationalizing, or using trigonometric identities ● Evaluate a limit using the Replacement Theorem ● Identify the conditions for continuity at a point ● Evaluate a limit using L'Hopital's Rule after finding derivative of both the numerator and denominator of a rational expression

CVSD *Calculus L2* Curriculum Map

CV Priority Standard/PA Academic Standard
CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems
Taught in Unit(s)
Applications of Integration
Explanation/Example of Standard
● Estimate area under a curve using Riemann Sums. ● Determine areas bounded by curves. ● Determine volumes of solids of revolution.
Common Misconceptions
● Students will confuse left-endpoint rectangles and right-endpoint rectangles. ● Students will use incorrect function values when calculating Riemann Sums. ● Students will confuse disk and shell methods when calculating volume.

Big Idea(s)	**Essential Question(s)**
● Patterns exhibit relationships that can be extended, described, and generalized. ● Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.	• How can patterns be used to describe relationships in mathematical situations? • How can recognizing repetition or regularity assist in solving problems more efficiently? • How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving?
Assessments	
See file for specific unit common assessments.	
Concepts (what students need to know)	**Skills** (what students must be able to do)
● Riemann Sums ● Trapezoidal Rule ● Definite Integral ● Fundamental Theorem of Calculus ● Areas Bounded by Curves vs. Evaluating an Integral ● Disk Method ● Shell Method	● Evaluate a function at a point ● Calculate area approximations using rectangles and trapezoids ● Use the Fundamental Theorem of Calculus to evaluate definite integrals ● Calculate areas bounded by curves using properties of definite integrals ● Calculate volumes of solids of revolutions using disk and shell methods (extensions of basic volume formulas of static solids)

Grade:			SUBJECT
Unit	**Timeline**	**Topics**	**Priority Standards**
Limits	20 days	Limits	CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems
		Continuity	
Derivatives	58 days	Derivative Rules	CC.2.2.HS.C.1 Use the concept and notation of functions to interpret and apply them in terms of their content
		Exponentials and Logs	CC.2.2.HS.C.6 Interpret functions in terms of the situations they model
		Trigonometric Derivatives	
Derivative Applications	48 days	Related Rates	CC.2.2.HS.C.2 Graph and analyze funtions and their properties to make connections between the different representations
		Curve Sketching	CC.2.2.HS.C.6 Interpret functions in terms of the situations they model
		Optimization	
Integration	23 days	Integration Rules	CC.2.2.HS.C.1 Use the concept and notation of functions to interpret and apply them in terms of their content
		Advanced Integration	CC.2.2.HS.C.6 Interpret functions in terms of the situations they model
Applications of Integration	16 days	Riemann Sums	CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems
		Area	
		Volume	
Supplemental Unit	15 days	Student Project	
		Enrichment Topics	