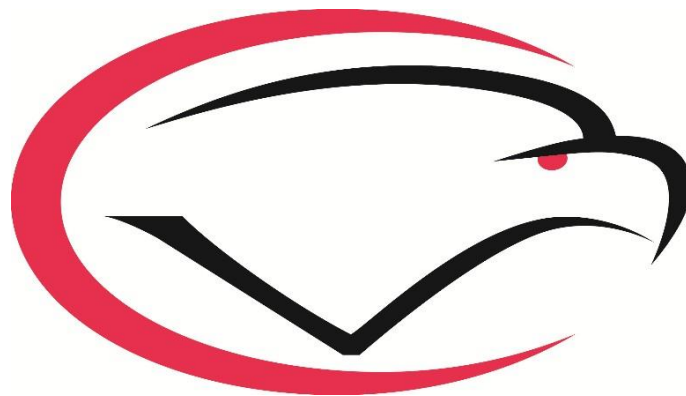# Secondary Curriculum Maps

Cumberland Valley School District
Soaring to Greatness, Committed to Excellence

Pre-Calculus

CVSD *PreCalculus* Curriculum Map ~ *9 to 12*

CV Priority Standard/PA Academic Standard
CC.2.1.HS.F2 - Apply properties of rational and irrational numbers to solve real world or mathematical problems.
Taught in Unit(s)
Applications of Algebra Topics in Precalculus
Explanation/Example of Standard
Interpret a real word problem using variables; apply math operations to solve and present solution
Common Misconceptions
Students fail to create a valid equation from the problem information Students use the incorrect operation Students fail to present answer in appropriate form and identification

Big Idea(s)	Essential Question(s)
Inter Interpret the results of solving equations, inequalities, systems of equations, and inequalities in the context of the situations that motivated the model. Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.	How are LOGs used to approximate solutions to equations? How can LOGS and Exponential Functions be utilized to solve real-world application problems? How are real world Piecewise functions written to express data? How is the velocity of a rocket charted over time and how does Area under a curve relate velocity versus time? How are sequences and series used to calculate recurring iterations such as the sum of heights of a bouncing ball, rows of items, etc.

Assessments	
See unit map for specific unit common assessments.	
Concepts (what students need to know)	**Skills** (what students must be able to do)
Properties of rational and irrational numbers Rules for solving equations	Create models from real world descriptions Solve equations Interpret results with appropriate accuracy and labeling

CVSD *PreCalculus* Curriculum Map ~ *9 to 12*

CV Priority Standard/PA Academic Standard
CC.2.2.HS.C.4 -Interpret the effects transformations have on functions and find the inverses of functions.
Taught in Unit(s)
Applications of Algebra Trigonometry
Explanation/Example of Standard
Find the inverse for a relation and understand its properties Analyze graphs and their translations on the coordinate plane. Identify domain, range, concavity, left/right behavior of relations and their graphs.
Common Misconceptions
Students switch the domain and range of the function. When solving for an inverse function, students will improperly apply the order of operations. When shifting graphs, students will move the opposite direction. Misunderstanding of interval notation.

Big Idea(s)	Essential Question(s)
Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range), and the relationship is recognizable across representations. Families of functions exhibit properties and behaviors that can be recognized across representations. Functions can be transformed, combined, and composed to create new functions in mathematical and real world situations.	What are the benefits of using multiple methods to represent algebraic and trigonometric functions (tables, graphs, equations, and contextual situations)? How are relationships represented mathematically? Determine the inverse of a function. What are the properties (domain, range, intercepts, asymptotes, dilation, vertical shift, horizontal shift, compositions) of Algebraic and Trigonometric functions?

Assessments	
See unit map for specific unit common assessments.	
Concepts (what students need to know)	**Skills** (what students must be able to do)
Function vs. Relations Function notation Domain and Range Transformations of functions Inverses Relative maximum and minimum Compositions of functions Symmetry of Functions	Identify relations that are functions. Identify domain and range of functions. Identify increasing and decreasing intervals. Determine relative maximums and minimums. Graph piecewise functions. Apply rigid and nonrigid transformations to graphs. Determine and evaluate composition of functions. Determine the inverse of a function.

CVSD *PreCalculus* Curriculum Map ~ *9 to 12*

CV Priority Standard/PA Academic Standard
CC.2.2HS.C.7- Apply radian measure of an angle and the unit circle to analyze the trigonometric functions.

Taught in Unit(s)
Trigonometry
Applications of Trigonometry

Explanation/Example of Standard
Understand the parts of the unit circle - coordinates, trigonometric relationships, angles
Be able to manipulate, estimate, convert and use equivalent measurements for angles on the unit circle

Common Misconceptions
Students will confuse the co-functions.
Students make fundamental algebra mistakes.
Students will not pay attention to the quadrant in which the angle lies.

Big Idea(s)	Essential Question(s)
Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms. Some geometric relationships can be described and explored as functional relationships. Patterns exhibit relationships that can be extended, described, and generalized.	How are coordinates and algebraic techniques used to represent, interpret, and verify trigonometric relationships? How are the trigonometric values of quadrantal and special angles used? How are the cartesian and polar coordinate system related? How are application problems solved involving triangles, angular displacement and velocity?

Assessments
See unit map for specific unit common assessments.

Concepts (what students need to know)	Skills (what students must be able to do)
Angle measures in the unit circle Coordinates on the unit circle Relationships between angles	State trigonometric values for angles Convert between radians and degrees. Identify reference angles and coterminal angles

CVSD *PreCalculus* Curriculum Map ~ *9 to 12*

CV Priority Standard/PA Academic Standard
CC.2.2.HS.C.8 - Choose trigonometric functions to model periodic phenomena and describe the properties of the graphs.

Taught in Unit(s)
Trigonometry Applications of Trigonometry

Explanation/Example of Standard
Recognize, interpret and graph basic trigonometric functions. Identify the parameters of the graphs.

Common Misconceptions
Students misunderstand the graphs of sine and cosine and where they begin. Students confuse the period with the angular frequency. When determining the translations from a trigonometric equation, students switch the direction of the translations. When dealing with inverse sine and cosine, students confuse the domain restriction that allow for an inverse function.

Big Idea(s)	Essential Question(s)
Patterns exhibit relationships that can be extended, described, and generalized. Relations and functions are mathematical relationships that can be represented and analyzed using words, tables, graphs, and equations. Graphs can be transformed in an infinite number of ways. Transformations can be described and analyzed mathematically.	How do each of the parameters in the general equations of trigonometric functions affect the graph? How can trigonometric properties be used to model and analyze real situations? How is sinusoidal data analyzed and interpreted into transformed trigonometric models?

Assessments	
See unit map for specific unit common assessments.	

Concepts (what students need to know)	Skills (what students must be able to do)
Basic graphs and the transformations Inverse Sine Inverse Cosine	Identify amplitude, period, phase shift and vertical shift of a trigonometric equation and graph. Sketch translations of sine and cosine graphs. Model real - life data using sine and cosine functions. Solve trigonometric equations using inverse sine and cosine.

CVSD *PreCalculus* Curriculum Map ~ *9 to 12*

CV Priority Standard/PA Academic Standard
CC.2.2.HS.C.9 - Prove the Pythagorean Identity and use it to calculate trigonometric ratios.

Taught in Unit(s)
Trigonometry Applications of Trigonometry

Explanation/Example of Standard
Using the pythagorean identity to find trigonometric values. Verify trigonometric identities. Use the pythagorean identity to solve trigonometric equations.

Common Misconceptions
When verifying identities, the students use inverse operations Students use incorrect Unit Circle coordinate associations Students make fundamental algebra mistakes Students confuse cosecant and secant and which one is the reciprocal function for sine and cosine.

Big Idea(s)	Essential Question(s)
Mathematical relationships among numbers can be represented, compared, and communicated. Mathematical statements can be justified through deductive and inductive reasoning and proof.	What is the Pythagorean Trig Identity and how can it be used? What strategies can be used to estimate, model and calculate Trigonometric values? How can trigonometric properties and theorems be used to estimate, describe, model, and analyze situations?

Assessments
See unit map for specific unit common assessments.

Concepts (what students need to know)	Skills (what students must be able to do)
Six basic trig functions Pythagorean Identities Quotient Identities Sum and Difference Angle Identities Calculating trigonometric ratios outside of "special" angles	Evaluate trigonometric functions using trigonometric identities. Verify trigonometric identities. Simplify trigonometric expressions. Be able to write expressions in multiple equivalent forms.

CVSD *PreCalculus* Curriculum Map ~ *9 to 12*

CV Priority Standard/PA Academic Standard
CC.2.2.HS.D.2 - Write expressions in equivalent forms to solve problems.

Taught in Unit(s)
Applications of Algebra Trigonometry Application of Trigonometry

Explanation/Example of Standard
Using substitution to manipulate expressions

Common Misconceptions
When substituting, part of the original expression is "left behind" **Unequal substitutions**

Big Idea(s)	Essential Question(s)
Evaluate and simplify algebraic expressions and solve and graph linear, quadratic, exponential, and logarithmic equations and inequalities, and solve and graph systems of equations and inequalities. Interpret the results of solving equations, inequalities, systems of equations, and inequalities in the context of the situations that motivated the model.	What is the process for converting Quadratic Equations and conic sections into both traditional and vertex standard forms? What are the procedures for factoring Algebraic Expressions and Equations? What LOG properties can be utilized to expand LOG expressions and compress LOG expressions? How are arithmetic and geometric sequences written explicitly and recursively? How do we convert between radian and degrees? What strategies can be used to estimate, model and solve Trigonometric equations? How are trigonometric identities used to manipulate expressions?

Assessments
See unit map for specific unit common assessments.

Concepts (what students need to know)	Skills (what students must be able to do)
Factoring Exponential and Logarithmic properties Sequence and series formulas All trigonometric identities	Use substitution Use all factoring methods Write sequences in explicit and recursive forms Converting angles between radian and degree Trigonometric identities

CVSD *PreCalculus* Curriculum Map ~ *9 to 12*

CV Priority Standard/PA Academic Standard
CC.2.2.HS.D.2 - Write expressions in equivalent forms to solve problems.

Taught in Unit(s)
Applications of Algebra Trigonometry Application of Trigonometry

Explanation/Example of Standard
Using substitution to manipulate expressions

Common Misconceptions
When substituting, part of the original expression is "left behind" **Unequal substitutions**

Big Idea(s)	Essential Question(s)
Evaluate and simplify algebraic expressions and solve and graph linear, quadratic, exponential, and logarithmic equations and inequalities, and solve and graph systems of equations and inequalities. Interpret the results of solving equations, inequalities, systems of equations, and inequalities in the context of the situations that motivated the model.	What is the process for converting Quadratic Equations and conic sections into both traditional and vertex standard forms? What are the procedures for factoring Algebraic Expressions and Equations? What LOG properties can be utilized to expand LOG expressions and compress LOG expressions? How are arithmetic and geometric sequences written explicitly and recursively? How do we convert between radian and degrees? What strategies can be used to estimate, model and solve Trigonometric equations? How are trigonometric identities used to manipulate expressions?

Assessments
See unit map for specific unit common assessments.

Concepts (what students need to know)	Skills (what students must be able to do)
Factoring Exponential and Logarithmic properties Sequence and series formulas All trigonometric identities	Use substitution Use all factoring methods Write sequences in explicit and recursive forms Converting angles between radian and degree Trigonometric identities

CVSD *PreCalculus* Curriculum Map ~ *9 to 12*

CV Priority Standard/PA Academic Standard
CC.2.2.HS.D.8 - Apply inverse operations to solve equations or formulas for a given variable

Taught in Unit(s)
Applications of Algebra Trigonometry Applications of Trigonometry

Explanation/Example of Standard
Use Inverses to Isolate a Variable

Common Misconceptions
Students use the incorrect inverse operation **Students use improper order of operations** **Students apply an inverse to only one side of an equation**

Big Idea(s)	Essential Question(s)
Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range), and the relationship is recognizable across representations. Families of functions exhibit properties and behaviors that can be recognized across representations. Functions can be transformed, combined, and composed to create new functions in mathematical and real world situations. Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.	How are linear, polynomial, rational, logarithmic, exponential and trigonometric equations evaluated using inverse operations? How are inverse operations used to manipulate formulas and trigonometric identities?

Assessments
See unit map for specific unit common assessments.

Concepts (what students need to know)	Skills (what students must be able to do)
How to manipulate formulas How to solve problems	Solve linear, polynomial, rational, logarithmic, exponential and trigonometric equations Manipulate formulas and trigonometric identities

Grade:			SUBJECT
Overall Topic	**Timeline**	**Specific Unit**	**Priority Standards**
Applications of Algebra	51 days	Algebra Skills Review (13 days)	CC.2.1.HS.F.2 - Apply properties of rational and irrational numbers to solve real world or mathematical problems.
		Analytic Geometry (11 days)	CC.2.2.HS.C.4 -Interpret the effects transformations have on functions and find the inverses of functions.
		Rational Functions (12 days)	CC.2.2.HS.D.2 - Write expressions in equivalent forms to solve problems.
		Exponents & Logarithms (15 days)	CC.2.2.HS.D.8 - Apply inverse operations to solve equations or formulas for a given variable
Trigonometry	54 days		CC.2.2.HS.C 4 -Interpret the effects transformations have on functions and find the inverses of functions.
		Unit Circle & Graphing (30 days)	CC.2.2.HS.C.7- Apply radian measure of an angle and the unit circle to analyze the trigonometric functions
		Identities (24 days)	CC.2.2.HS.C.8 - Choose trigonometric functions to model periodic phenomena and describe the properties of the graphs
			CC.2.2.HS.C.9 - Prove the Pythagorean Identity and use it to calculate trigonometric ratios.
			CC.2.2.HS.D.2 - Write expressions in equivalent forms to solve problems
			CC.2.2.HS.D.8 - Apply inverse operations to solve equations or formulas for a given variable
Applications of Trigonometry	20 days	Law of Sines & Cosines (9 days)	CC.2.2.HS.C.7- Apply radian measure of an angle and the unit circle to analyze the trigonometric functions..
			CC.2.2.HS.C.8 - Choose trigonometric functions to model periodic phenomena and describe the properties of the graphs
		Polar coordinates & equations (11 days)	CC.2.2.HS.C.9 - Prove the Pythagorean Identity and use it to calculate trigonometric ratios.
			CC.2.2.HS.D.2 - Write expressions in equivalent forms to solve problems.
			CC.2.2.HS.D.8 - Apply inverse operations to solve equations or formulas for a given variable
Topics in PreCalculus	24 days	Sequences and Series (10 days)	CC.2.1.HS.F2 - Apply properties of rational and irrational numbers to solve real world or mathematical problems.
		Area and Velocity (14 days)	CC.2.2.HS.C3 - Write sequences that model relationships between two quantities