High School (9-12)
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Gateway School District
Curriculum Map

Curriculum Map: Mathematics

Course: Honors Advanced Precalculus and Trigonometry
Grade(s): 11-12

Unit 1: Functions and Their Graphs

Brief Summary of Unit
This chapter will develop a more complete, thorough understanding of functions. First, an understanding of what a relation is, and then a determination of whether a relation is a function. Common functions, domain and range of functions, and graphs of functions are discussed. Determining whether a function is increasing or decreasing on an interval and operations on functions and composition of functions are key concepts of this chapter. One-to-one functions and inverse functions as well as model applications with functions using variation are explored in the chapter.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Find and use the slopes of lines to write and graph linear equations in two variables 2. Solve quadratic equations 3. Evaluate functions and find their domains 4. Calculate and interpret the average rate of change of a function over a specified interval 5. Analyze graphs of functions and as well as identify and graph transformations of functions 6. Build new functions from existing functions 7. Find arithmetic combinations and compositions of functions 8. Find inverse functions graphically and algebraically 9. Write algebraic models for direct, inverse and joint variation 10. Fit a linear function for a scatterplot that suggests a linear association	
Understandings: 1. **Equations can be used to model and solve real-life examples.** 2. **Functions can be used as models to represent a wide variety of real-life data sets.**	**Essential Questions:** **1.** How to sketch the graphs of equations? **2.** How to find and the slopes of lines to write and graph linear equations in two variables? **3.** How to evaluate functions and find their domains? **4.** How to analyze graphs of functions? **5.** How to identify and graph transformations of functions?

	6. How to find arithmetic combinations and compositions functions? **7.** How to find inverse functions graphically and algebraically? **8.** How to write algebraic models for direct, inverse, and joint variation?

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)
Stage Three—Learning Plan

Unit 2: Polynomials and Rational Functions

Brief Summary of Unit
The basis of this unit is to show students how to graph more complex functions by using the prior tools of intercepts but also using end behavior and the ability to find multiple zeros of a function through the Rational Root Theorem and synthetic division.
Stage One—Desired Results
Established Goals: (Standards of Learning, Content Standards) 1. Sketch and analyze graphs of polynomial functions key features include: intercepts, intervals of increasing and decreasing, relative maxs and mins, end behavior 2. Use long division and synthetic division to divide polynomials 3. Perform operations with complex numbers 4. Determine the number of rational and real zeros of a polynomial 5. Apply the Remainder Theorem 6. Determine domain and find asymptotes of rational functions then sketch 7. Find partial fraction decomposition of rational expressions

Understandings:	**Essential Questions:**
1. **Equations can be used to model and solve real-life examples.** 2. **Functions can be used as models to represent a wide variety of real-life data sets.** 3. **Complex numbers can be used to model and solve real-life problems in electronics.**	**1.** How to sketch and analyze graphs of polynomial functions? **2.** How to use long division and synthetic division? **3.** How to perform operations with complex numbers? **4.** How to determine and find the number of rational and real zeros of a polynomial? **5.** How to determine the domain of rational functions?

	6. How to find asymptotes of rational functions? 7. How to sketch graphs of rational functions?

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 3: Exponential and Logarithmic Function.

Brief Summary of Unit
Students will explore how to manipulate and solve logarithmic and exponential expressions and equations as well as how to graph them. They will also model real world problem situations with these transcendental functions.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Use the properties of exponents to interpret expressions for exponential functions 2. Evaluate exponential functions with base a and base e 3. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. 4. Graph exponential and log functions showing intercepts and end behaviors 5. Evaluate logarithmic functions with base a and natural logarithmic functions 6. Graph logarithmic functions 7. Use exponential and logarithmic functions to model and solve real-life applications.	
Understandings: 1. **Exponential Functions can be used to model and solve real-life applications.** 2. **Logarithmic Functions can be used to model and solve real-life applications.**	**Essential Questions:** **1.** How to recognize and evaluate exponential and logarithmic functions? **2.** How to graph exponential and logarithmic functions? **3.** How to use change of base formula to rewrite and evaluate logarithmic functions? **4.** How to use properties of logarithms to evaluate, rewrite, expand, or condense? **5.** How to solve exponential and logarithmic equations? **6.** How to use exponential, growth/decay models, logistic growth models to solve real-life problems?

Stage Two—Assessment Evidence

Performance Tasks:
Other Evidence: :(quizzes, tests and so on)
Stage Three—Learning Plan

Unit 4: Trigonometry

Brief Summary of Unit
Students will discover basic trigonometric principles with the Unit Circle followed with right triangle trigonometry to solve for sides and angles in triangles. Students will learn how to graph the basic trigonometric functions as well as their transformations. Students will also learn how to apply inverse trigonometric functions to solve trigonometric equations.
Stage One—Desired Results
Established Goals: (Standards of Learning, Content Standards) 1. Describe an angle and convert between radian and degree measure 2. Identify a Unit Circle and its relationship to real numbers 3. Evaluate trigonometric functions of any angle 4. Use fundamental trigonometric identities 5. Sketch the graph of trig functions and translations of sine and cosine functions

Understandings:	**Essential Questions:**
1. **You can use angles to model and solve real-life applications.** 2. **Trig and inverse trig functions are used to analyze real life situations.** 3. **Sine and cosine functions are used for scientific calculations.**	**1.** How to describe an angle and convert between radian and degree measure? **2.** How to identify a unit circle and its relationship to real numbers? **3.** How to evaluate trig functions of any angle? **4.** How to use the fundamental trig identities? **5.** How to sketch the graph of trig functions and translation of sine and cosine functions? **6.** How to evaluate trig functions?

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)
Stage Three—Learning Plan

Unit 5: Analytic Trigonometry

Brief Summary of Unit
Students will learn basic fundamental identities and use them to verify other trigonometric identities. They will solve trigonometric equations. Some of the formulas taught are the Sum and Difference as well as Multiple-Angle and Product-to-Sum formulas.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Use fundamental trigonometric identities to evaluate trig functions and simplify trig expressions 2. Prove and apply identities 3. Use standard algebraic techniques and inverse tri functions to solve trigonometric equations 4. Use sum/diff formulas, multiple angle formulas, power reducing formulas, half-angle formulas, and product to sum formula to rewrite and evaluate trigonometric functions 5. Evaluate the inverse trigonometric functions	
Understandings: 1. **Fundamental trig identities can be used to simplify trig expressions.** 2. **Trig identities can be rewritten to trig equations that model real-life situations.** 3. **Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trig ratios for acute angles.**	**Essential Questions:** **1.** How to use fundamental trig identities to evaluate trig functions and simplify trig expressions? **2.** How to verify trig identities? **3.** How to use standard algebraic techniques and inverse trig functions to solve trig equations?

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 6: Additional Topics in Trigonometry

Brief Summary of Unit
Students will learn to apply non-right triangle trigonometry to solve for angles and sides by using the Law of Sines and Law of Cosines. Students will use vectors to model and solve real-life problems involving magnitude and direction.

Stage One—Desired Results
Established Goals: (Standards of Learning, Content Standards)

1. Use Law of Sines and Cosines to solve oblique triangles
2. Find the area of an oblique triangle
3. Write the component forms of vectors and perform basic vector operations
4. Find the direction angles of vectors and the angle between two vectors
5. Multiply and divide complex numbers written in trig form
6. Find powers and nth roots of complex numbers

Understandings:	**Essential Questions:**
1. **Law of Sines and Cosines can be used to real life problems involving oblique triangles** 2. **Vectors involving magnitude and direction can be used to model and solve real-life directions**	**1.** How to use law of sines and law of cosines to solve oblique triangles? **2.** How to find the area of an oblique triangles?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 7: Systems of Equations and Inequalities

Brief Summary of Unit

Many problems in science, business, and engineering involve two or more equations in two or more variables. This chapter focuses on solving these system of equations by graphing, substitution, and elimination. Furthermore, the chapter explores systems of inequalities to solve real-life situations.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

1. Solve systems of equations by substitutions, by elimination, by Gaussian elimination, and by graphing
2. Recognize linear systems in row-echelon form and to use back-substitution to solve the system
3. Solve non-square systems of equations
4. Sketch the graphs of inequalities in two variables and to solve systems of inequalities
5. Represent constraints by equations or inequalities or systems, and interpret the solutions as viable or non-viable.
6. Solve linear programming problems

Understandings:	**Essential Questions:**
1. **Systems of equations can be used to model and solve real-life problems** 2. **Systems of inequalities can be used to model and solve real-life problems**	**1.** How can you use linear problems to solve real-life problems? **2.** How can you use systems of equations and inequalities to solve real-life problems?

3. **Linear programming can be used to model and solve real-life problems.**	

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 8: Matrices and Determinants

Brief Summary of Unit
In addition to solving a system of equations by the methods discussed in the previous chapter, matrices can be used to solve systems of linear equations in two or more variables. This chapter explores basic matrix operations, elementary row operations, and more complicated matrix methods to solve the system of equations.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Use matrices, Gaussian elimination, and Gauss- Jordan elimination to solve systems of linear equations 2. Add and subtract matrices, multiply matrices by scalar, and multiply two matrices 3. Find the inverses of matrices and use inverse matrices to solve systems of linear equations 4. Find minors, cofactors, and determinants of square matrices 5. Use Cramer's rule to solve systems of linear equations 6. Use determinants and matrices to model and solve problems	
Understandings: 1. Determinants and matrices to model and solve problems 2. Matrices can be used to decode messages	**Essential Questions:** 1. How can you use determinants and matrices to solve problems? 2. How can you use matrices to decode messages?

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan