SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Trigonometry	**Length of Course:** 30 cycles
Grade Level(s): 10 - 12	**Periods Per Cycle:** 6
Units of Credit: 1	**Length of Period:** 43 minutes
Classification: Elective	**Total Instructional Time:** 129 hours

Course Description

This is a rigorous course in modern trigonometry with emphasis placed on the circular functions, their inverses, and graphs. The course begins with an algebraic examination of functions and continues with a careful and concise study of trigonometric identities, functions, and solutions of triangles. Also included are topics that explore the theory of equations and exponential and logarithmic functions.

Instructional Strategies, Learning Practices, Activities, and Experiences

Anticipatory Sets	Flexible Groups	Projects
Assessments	Graphic Organizers	Teacher Demonstrations
Bell Ringers	Guided Practice	Technology Integration
Class Discussions	High-Level Questioning	Videos/DVD's
Closure	Homework	Wait Time
Critical Thinking	Posted Objectives	

Assessments

Teacher-Prepared Tests, Quizzes	Trigonometry Graphing Project Using Internet	Project Relating Math to Art
Homework Assignments		

Materials/Resources

Student text: *Trigonometry*, Edition 10E, Larson, Copyright 2017	Scientific or Graphing Calculator	Worksheets
	Notes/Power Points	Internet for Instructional Videos

Adopted: 12/07/88
Revised: 09/03/91, 08/18/99, 09/17/03, 08/17/09, 08/01/13; 5/19/14; 5/20/2019

Pre-requisites	
The Standards of Mathematical Practices	
Make sense of problems and persevere in solving them **Construct viable arguments and critique the reasoning of others.** **Use appropriate tools strategically.** **Look for and make use of structure.**	**Reason abstractly and quantitatively.** **Model with mathematics.** **Attend to precision.** **Look for and express regularity in repeated reasoning.**
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Solving Equations • Identify different types of equations • Solve linear equations in one variable and equations that lead to linear equations • Solve quadratic equations by factoring, extracting square roots, completing the square, and using the Quadratic Formula • Solve Polynomial equations of degree three or greater • Solve equations involving radicals • Solve equations with absolute values	**CC.2.2.HS.C.2** - Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.3** - Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.4** - Interpret the effects transformations have on functions and find the inverses of functions. **CC.2.2.HS.C.5** - Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** - Interpret functions in terms of the situations they model. **CC.2.2.HS.D.5** - Use polynomial identities to solve problems. **CC.2.2.HS.D.6** - Extend the knowledge of rational functions to rewrite in equivalent forms. **CC.2.2.HS.D.7** - Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.9** - Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Pre-requisites	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
B. Analyzing Graphs of Functions • Use the Vertical Line Test for functions • Find the zeros of functions • Determine intervals on which functions are increasing or decreasing • Determine relative maximum and relative minimum values of functions • Determine the average rate of change of a function • Identify even and odd functions C. Translations and Combinations • Add, subtract, multiply and divide functions • Find the composition of one function with another function • Use combinations and compositions of functions to model and solve real-life problems	**CC.2.2.HS.C.1** - Use the concept and notation of functions to interpret and apply them in terms of their context. **CC.2.2.HS.C.2** - Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.3** - Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.5** - Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** - Interpret functions in terms of the situations they model. **CC.2.3.HS.A.10** - Translate between the geometric description and the equation for a conic section. **CC.2.4.HS.B.2** - Summarize, represent, and interpret data on two categorical and quantitative variables. **CC.2.2.HS.C.3** - Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.5** - Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** - Interpret functions in terms of the situations they model. **CC.2.2.HS.D.2** - Write expressions in equivalent forms to solve problems. **CC.2.2.HS.D.3** - Extend the knowledge of arithmetic operations and apply to polynomials. **CC.2.2.HS.D.5** - Use polynomial identities to solve problems. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.10** - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Pre-requisites	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
D. Inverse Functions • Find inverse functions informally and verify that two functions are inverse functions of each other • Use graphs of functions to determine whether functions have inverse functions • Use the Horizontal Line Test to determine if functions are one-to-one • Find inverse functions algebraically	**CC.2.2.HS.C.4** - Interpret the effects transformations have on functions and find the inverses of functions. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable.
E. Complex Numbers • Simplify complex expressions	**CC.2.2.HS.D.2** - Write expressions in equivalent forms to solve problems.

Trigonometry	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Radian and Degree Measure • Describe angles • Use radian measure • Use degree measure • Use angles to model and solve real-life problems	**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.
B. The Unit Circle • Identify a unit circle and describe its relationship to real numbers • Evaluate trigonometric functions using the unit circle • Use the domain and period to evaluate sine and cosine functions • Use a calculator to evaluate trigonometric functions	**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.
C. Right Triangle Trigonometry • Apply special right triangles to real-world situations • Evaluate trigonometric functions of acute angles • Use the fundamental trig identities • Use a calculator to evaluate trigonometric functions • Use trigonometric functions to model and solve real-life problems	**CC.2.2.HS.C.9** - Prove the Pythagorean identity and use it to calculate trigonometric ratios. **CC.2.3.HS.A.7** - Apply trigonometric ratios to solve problems involving right triangles.

Trigonometry	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
D. Trigonometric Functions of Any Angle • Evaluate trigonometric functions of any angle • Use reference angles to evaluate trigonometric functions • Evaluate trigonometric functions of real numbers	**CC.2.2.HS.C.9** - Prove the Pythagorean identity and use it to calculate trigonometric ratios. **CC.2.3.HS.A.7** - Apply trigonometric ratios to solve problems involving right triangles.
E. Graphs of Sine and Cosine • Sketch the graphs of basic sine and cosine functions • Use amplitude and period to help sketch the graphs of sine and cosine functions • Use sine and cosine functions to model real-life data	**CC.2.2.HS.C.2** - Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.8** - Choose trigonometric functions to model periodic phenomena and describe the properties of the graphs. **CC.2.2.HS.D.7** - Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.10** - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
F. Graphs of Other Trigonometric Functions • Sketch the graphs of tangent functions • Sketch the graphs of cotangent functions • Sketch the graphs of secant and cosecant functions	**CC.2.2.HS.C.2** - Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.8** - Choose trigonometric functions to model periodic phenomena and describe the properties of the graphs. **CC.2.2.HS.D.7** - Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.10** - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Trigonometry	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
G. Inverse Trigonometric Functions • Evaluate and graph the inverse sine function • Evaluate and graph the other inverse trigonometric functions • Evaluate and graph the compositions of trigonometric functions H. Applications and Models • Solve real-life problems involving right triangles • Solve real-life problems involving directional bearings • Solve real-life problems involving harmonic motion	**CC.2.2.HS.C.2** - Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.3** - Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.4** - Interpret the effects transformations have on functions and find the inverses of functions. **CC.2.2.HS.C.5** - Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** - Interpret functions in terms of the situations they model. **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.5** - Use polynomial identities to solve problems. **CC.2.2.HS.D.6** - Extend the knowledge of rational functions to rewrite in equivalent forms. **CC.2.2.HS.D.7** - Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.9** - Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Analytic Trigonometry	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Using Fundamental Identities • Recognize and write the fundamental trigonometric identities • Use the fundamental trigonometric identities to evaluate trigonometric functions, simplify trigonometric expressions, and rewrite trigonometric expressions B. Verifying Trigonometric Identities • Verify trigonometric identities C. Solving Trigonometric Equations • Use standard algebraic techniques to solve trigonometric equations • Solve trigonometric equations of the quadratic type • Solve trigonometric equations involving multiple angles • Use inverse trigonometric functions to solve trigonometric equations	**CC.2.3.HS.A.2** - Apply rigid transformations to determine and explain congruence. **CC.2.2.HS.C.2** - Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.3** - Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.4** - Interpret the effects transformations have on functions and find the inverses of functions. **CC.2.2.HS.C.5** - Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** - Interpret functions in terms of the situations they model. **CC.2.2.HS.D.5** - Use polynomial identities to solve problems. **CC.2.2.HS.D.6** - Extend the knowledge of rational functions to rewrite in equivalent forms. **CC.2.2.HS.D.7** - Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.9** - Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Analytic Trigonometry	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
D. Sum and Difference Formulas • Use sum and difference formulas to evaluate trigonometric functions, verify trigonometric identities, and solve trigonometric equations E. Multiple Angle Formulas • Use multiple-angle formulas to rewrite and evaluate trigonometric functions • Use multiple-angle formulas to solve trigonometric equations	**CC.2.2.HS.C.2** - Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.3** - Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.6** - Interpret functions in terms of the situations they model. **CC.2.2.HS.D.5** - Use polynomial identities to solve problems. **CC.2.2.HS.D.6** - Extend the knowledge of rational functions to rewrite in equivalent forms. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.9** - Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically**.**

Additional Topics in Trigonometry	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Law of Sines • Use the Law of Sines to solve oblique triangles angle, angle, side (AAS) or angle, side, angle (ASA) • Use the Law of Sines to solve oblique triangles side, side, angle (SSA) • Find the areas of oblique triangles • Use the Law of Sines to model and solve real-life problems B. Law of Cosines • Use the Law of Cosines to solve oblique triangles side, side, side (SSS) or side angle, side (SAS) • Use the Law of Cosines to model and solve real-life problems • Use Heron's Area Formula to find the areas of a triangle	**CC.2.2.HS.C.2** - Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.3** - Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.6** - Interpret functions in terms of the situations they model. **CC.2.2.HS.D.5** - Use polynomial identities to solve problems. **CC.2.2.HS.D.6** - Extend the knowledge of rational functions to rewrite in equivalent forms. **CC.2.2.HS.D.7** - Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.8** - Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.9** - Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Exponential and Logarithmic Functions	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Exponential Functions and their Graphs • Recognize and evaluate exponential functions with base *a* • Graph exponential functions and use the One-to-One Property • Recognize, evaluate, and graph exponential functions with base *e* • Use exponential functions to solve real-life problems B. Logarithmic Functions and their Graphs • Recognize and evaluate logarithmic functions with base a • Graph logarithmic functions • Recognize, evaluate, and graph natural logarithmic functions • Use logarithmic functions to model and solve real-life problems	**CC.2.1.HS.F.3** - Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. **CC.2.1.HS.F.4** - Use units as a way to understand problems and to guide the solution of multi-step problems. **CC.2.2.HS.C.3** - Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.4** - Interpret the effects transformations have on functions and find the inverses of functions. **CC.2.2.HS.C.5** - Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** - Interpret functions in terms of the situations they model. **CC.2.2.HS.D.7** - Create and graph equations or inequalities to describe numbers or relationships. **CC.2.3.HS.A.10** - Translate between the geometric description and the equation for a conic section.

Exponential and Logarithmic Functions	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
C. Properties of Logarithms • Use the change-of-base formula to rewrite and evaluate logarithmic expressions • Use properties of logarithms to evaluate or rewrite logarithmic expressions • Use properties of logarithms to expand or condense logarithmic expressions • Use logarithmic functions to model and solve real-life problems D. Solving Exponential and Logarithmic Equations • Solve simple exponential and logarithmic equations • Solve more complicated exponential equations • Solve more complicated logarithmic equations • Use exponential and logarithmic equations to model and solve real-life problems	**CC.2.1.HS.F.3** Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. **CC.2.1.HS.F.4** Use units as a way to understand problems and to guide the solution of multi-step problems. **CC.2.2.HS.C.3** Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.4** Interpret the effects transformations have on functions and find the inverses of functions. **CC.2.2.HS.C.5** Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** Interpret functions in terms of the situations they model. **CC.2.2.HS.D.7** Create and graph equations or inequalities to describe numbers or relationships. **CC.2.3.HS.A.10** Translate between the geometric description and the equation for a conic section.