KUTZTOWN AREA SCHOOL DISTRICT
Maximize potential, embrace change, create the future

Kutztown Area School District Curriculum (Unit Map)

Honors Algebra III/Trigonometry
Written by Sallie Sandler

Course Description: This advanced offering includes a study of functions and graphs, polynomial functions, exponential, logarithmic functions and rational functions, as well as advanced algebraic processes. The course will also provide a solid foundation in the concepts, process, and applications of basic and analytic trigonometry. Technology, especially scientific and/or graphing calculators, will be used throughout the course.

Table of Contents

Unit #	***Title***
1	*Algebra Bootcamp*
2	*Functions and Graphs*
3	*Polynomial, Power and Rational Functions*
4	*Exponential, Logistic, and Logarithmic Functions*
5	*Trigonometric Functions*
6	*Analytic Trigonometry*
7	*Conic Sections, Polar Equations, and DeMoivre's Theorem*
8	*Systems and Matrices (if time permits)*

Unit #/Title	1/Algebra Bootcamp	Time Frame	4-5 Weeks

Standards

Standards of Mathematical Practices

- Make sense of problems and persevere in solving them.
- Look for and make use of structure.

CC.2.1.HS.F.1 Apply and extend the properties of exponents to solve problems with rational exponents.
CC.2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical problems.
CC.2.1.HS.F.3 Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays.
CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
CC.2.2.HS.D.4 Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.
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.10 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
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.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically.
CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.
CC.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.

Big Ideas

- Algebra is a language of representation in which problems are represented by models which allow us to reduce the solution to algebraic manipulation.
- Linear functions and their multiple representations can model average rates of change.

Essential Questions

- How real-life data be modeled verbally, graphically, numerically, and algebraically?
- How are equations, functions and their graphs related?

Content

- Real Number System
- Interval Notation
- Scientific Notation
- Cartesian Coordinate Plane
- Absolute Value Equations and Inequalities
- Distance Formula
- Midpoint Formula
- Circle Equation
- General form, Standard form, Intercept form, and Point-Slope form of a linear equation
- Vertical and horizontal lines
- Parallel and perpendicular lines
- Applications of linear functions
- Scatterplot
- Correlation
- Best-fit Lines
- Radicals and Rational Exponents
- Radical Equations and Inequalities
- Factoring Patterns

Skills

- Classify numbers
- Write numbers in equivalent forms
- Use interval notation to represent inequalities
- Apply properties of exponents to simplify expressions
- Apply algebraic properties to simplify expressions
- Calculate distance between two points
- Calculate the midpoint of two points
- Write the equation of a circle given its center and radius
- Identify the center of a circle and its radius from an equation
- Apply algebraic properties to solve linear equations and inequalities
- Calculate slope
- Write linear equations in point-slope form
- Write linear equations in general form
- Write linear equations in standard form
- Write linear equations in intercept form
- Write linear equations in point-slope form

• Rational Expressions	• Write equations of vertical, horizontal, parallel, and perpendicular lines • Use linear equations to solve applications • Create scatter plots from data • Identify correlation • Identify and calculate line of best fit for linear data • Use technology to find best-fit line via linear regression • Apply factoring patterns to factor expressions completely • Simplify rational expressions • Recognize when a plot is reasonable (hidden behavior) • Solve equations and inequalities graphically, numerically, and algebraically using factoring, extracting square roots, completing the square, and the Quadratic Formula • Solve Absolute Value and Radical Equations and Inequalities • Identify extraneous roots (solutions) • Write solutions to inequalities in interval notation

Unit #/Title	2/Functions and Graphs	Time Frame	5-6 Weeks

Standards

Standards of Mathematical Practices

- Make sense of problems and persevere in solving them.
- Model with mathematics.
- Use appropriate tools strategically.

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.D.1 Interpret the structure of expressions to represent a quantity in terms of its context.
CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
CC.2.2.HS.D.4 Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their 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.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.
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.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.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

Big Ideas

- Numeric, graphic, and algebraic models allow us to represent problems with multiple representations.
- Mathematical manipulation of functions allows us to learn more about the function and its properties.

Essential Questions

- How are equations, functions, and their graphs related?
- How can functions be used to represent physical situations in the world around us?

Content

- Functions
- Function notation
- Zero Factor Property
- Domain
- Range
- Vertical Line Test
- Continuity
- Local and Absolute Extrema
- Increasing
- Decreasing
- Constant
- Asymptotes
- End Behavior

Skills

- Evaluate functions
- Function evaluation using technology
- Identify domain algebraically and graphically
- Identify range graphically
- Interpret graphs of functions using the vertical line test
- Identify extrema
- Determine where a graph is increasing, decreasing, and/or constant

• Piecewise functions • Even and odd functions • Function Combination • Function Composition • Function Decomposition • Relations • Implicitly Defined Functions • Relations defined Parametrically • Inverse Relations and Functions • Horizontal Line Test • One-to-One Functions • Graphical Transformations • Modeling with Functions • Hidden Graph Behavior	• Identify extrema using technology • Interpret a piecewise-defined function • Graph piecewise-defined functions • Evaluate piecewise-defined functions • Write equations of piecewise-defined functions • Determine whether a function is even, odd, or neither numerically, algebraically, and graphically • Recognize when a plot is reasonable (hidden behavior) • Perform operations on functions • Compose functions • Determine the domain of a function resulting from operations and/or function composition • Decompose a function • Solve application problems involving function composition algebraically and graphically • Identify translations algebraically and graphically • Identify reflections algebraically and graphically • Identify vertical/horizontal stretch and shrink algebraically and graphically • Determine function-specific appropriate application of transformations • Graph functions based on transformation knowledge • Graph a relation and its inverse • Graph a function and its inverse • Confirm inverses both algebraically and graphically • Determine if a function is one-to-one both algebraically and graphically • Find the inverse of a function or relations • Identify the domain and range of a function and its inverse

Unit #/Title	3/Polynomial, Power, & Rational Functions	Time Frame	6-7 Weeks

Standards

Standards of Mathematical Practices

- Look for and make use of structure.
- Attend to precision.
- Look for and express regularity in repeated reasoning.

CC.2.1.HS.F.1 Apply and extend the properties of exponents to solve problems with rational exponents.
CC.2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical 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.2.1.HS.F.6 Extend the knowledge of arithmetic operations and apply to complex numbers.
CC.2.1.HS.F.7 Apply concepts of complex numbers in polynomial identities and quadratic equations to solve problems.
CC.2.2.HS.D.1 Interpret the structure of expressions to represent a quantity in terms of its context.
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.4 Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.
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.
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.6 Interpret functions in terms of the situations they model.
CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 Analyze linear models to make interpretations based on the data.

Big Ideas	Essential Questions
• Algebraic methods can be used to determine polynomial function behavior. • Algebraic methods can be used to determine power function behavior. • Algebraic methods can be used to determine rational function behavior.	• How can polynomial functions be graphed without technology? • How can transformations be used to understand quadratic functions and their properties? • What role do complex numbers play in polynomials and their graphs? • How can rational functions be graphed? • What is an asymptote and how is it related to a limit? • What algebraic methods can be used to find all solutions of polynomial and rational functions?
Content	**Skills**

• Polynomial functions • Average Rate of Change • Correlation • Regression Analysis • Quadratics and parabolas • Applications of quadratics • Line of symmetry • Vertex • Quadratic regression • Power Functions • Variation • Higher degree polynomial functions • End behavior • Limit notation • Roots of polynomial functions • Intermediate Value Theorem • Applications of polynomial functions • Polynomial long division • Factor theorem • Remainder theorem • Synthetic division • Linear factorization • Polynomial regression • Descartes' Rule of Signs • Upper bounds • Rational root theorem • Applications of polynomial functions • Complex numbers • Standard form of complex numbers • Complex number operations • Complex conjugates • Complex roots • Plotting complex Numbers • Modulus • Fundamental theorem of algebra • Linear factorization theorem • Multiplicity and graph behavior • Complex conjugate roots • Applications of polynomial functions • Polynomial inequalities • Rational Functions • Transformations of Rational Functions • Horizontal, Vertical and Slant Asymptotes • Rational Equations and Inequalities • Extraneous Solutions • Applications of Rational Functions • Radical Inequalities • Partial Fraction Decomposition	• Identify the degree and leading coefficient of a polynomial function • Calculate the average rate of change of a function • Create scatter plots from data • Identify correlation • Identify and calculate line of best fit for linear data • Use technology to find best-fit line via linear regression • Use transformations to graph quadratic functions • Use transformations to identify the vertex of a quadratic function • Model quadratic data using quadratic regression • Identify a power function and its constant(s) of proportionality • Graph power functions • Write power function formulas • Solve direct, inverse, and compound variation problems • Identify end behavior of polynomial functions • Identify local extrema of polynomial functions • Find zeros of polynomial functions with a graphing calculator • Write and draw polynomial functions with given zeros • Solve application problems involving polynomial functions • Divide polynomials using long division • Use synthetic division to identify roots of polynomial functions • Use synthetic division to identify remainders of polynomial functions • Use the Intermediate Value Theorem to identify roots of polynomial functions • Use the Factor Theorem and Remainder Theorem to identify linear factors of polynomial functions • Use the Rational Root Theorem to identify potential factors of polynomials • Use Descartes Rule of Signs to identify potential combinations of roots of polynomials • Use the Upper Bound test to identify potential factors of polynomials • Write a Linear factorization of a polynomial • Solve application problems involving polynomial functions • Perform operations on complex numbers • Use the complex conjugate to rationalize complex numbers • Find complex roots of polynomial functions • Use the powers of i to simplify complex expressions • Use the Fundamental Theorem of Algebra to identify all linear factors of polynomial functions • Use the Linear Factorization Theorem to write polynomial functions • Write a polynomial function given the roots of the function • Use complex conjugates to write Linear Factorizations • Identify Rational Functions • Use transformations to describe the properties of a rational function • Identify horizontal, vertical, and slant asymptotes of Rational Functions • Graph Rational Functions

	• Solve application problems involving rational functions • Solve Rational Equations and Inequalities • Solve Polynomial and Radical Equations and Inequalities • Decompose Rational Functions into partial fractions

Unit #/Title	4/Exponential, Logistic, & Logarithmic Functions	Time Frame	4-5 Weeks

Standards

Standards of Mathematical Practices

- Construct viable arguments and critique the reasoning of others.
- Use appropriate tools strategically.
- Model with mathematics.

CC.2.1.HS.F.1 Apply and extend the properties of exponents to solve problems with rational exponents.
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.2.1.HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
CC.2.2.HS.D.1 Interpret the structure of expressions to represent a quantity in terms of its context.
CC.2.2.HS.D.2 Write expressions in equivalent forms 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.
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.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.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

Big Ideas	Essential Questions
• We can use exponential functions to model percentage change. • Logarithms enable us to work with a wide range of numbers using a similar scale.	• What is an exponential function, how does it compare to a power function, how do I graph one and what properties does an exponential function have? • In which situations are exponential functions applicable? • What is a logarithmic function, how does it compare to an exponential function, how do I graph one and what properties does a logarithmic function have? • How can exponential and logarithmic equations be solved using algebraic methods?
Content	**Skills**
• Exponential functions vs. power functions • Graphs of exponential functions • Comparing exponential functions • End behavior of exponential functions • Exponential growth/decay applications • Exponential regression • Logistic growth function • Logarithmic functions	• Compare graphs of exponential functions • Recognize exponential growth/decay numerically, algebraically, and graphically • Graph exponential functions • Use transformations to graph exponential functions • Identify the end behavior of exponential functions • Solve application problems involving exponential growth and decay using graphing calculator technology

• Logarithms of various bases • Natural logarithm, common logarithm • The number e • Graphs of logarithmic functions • Transformations of exponential & logarithmic functions • Applications of logarithmic functions • Logarithmic regression • Change of base formula • Properties of Logarithms • Orders of Magnitude • Solving exponential & logarithmic equations • Applications of exponential & logarithmic functions • Compounding interest • Continuous compounding • Annual Percentage Yield • Annuities: present value, future value • Applications supported by technology • Asymptotes: horizontal and vertical • Logarithmic Re-Expression	• Identify the difference between the end behavior of exponential functions and power functions • Identify the domain and range of exponential functions • Write equations and identify properties of logistic functions • Use logarithmic functions to represent inverse exponential functions • Solve equations involving logarithmic and exponential functions (natural logarithm and common logarithm) • Solve equations requiring the Properties of Logarithms • Use transformations to graph logarithmic functions • Identify the domain and range of logarithmic functions • Use properties of logarithms to solve equations • Use properties of logarithms and exponential functions to solve application problems • Use the change of base formula for logarithms to evaluate using technology • Use the logistic growth model to solve application problems • Use exponential functions to derive formulas for compounding interest • Use exponential functions to derive formulas for compounding continuous interest • Calculate and compare Annual Percentage Yield • Calculate present value, future value, or time of an ordinary annuity • Solve financial application problems using technology and/or TVM solver • Identify an appropriate model for a scatter plot using logarithmic re-expression

Unit #/Title	5/Trigonometric Functions	Time Frame	5-6 Weeks

Standards

Standards of Mathematical Practices

- Look for and make use of structure.
- Model with mathematics.
- Attend to precision.

CC.2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical 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.D.1 Interpret the structure of expressions to represent a quantity in terms of its context.
CC.2.2.HS.D.2 Write expressions in equivalent forms 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.
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.4 Interpret the effects transformations have on functions and find the inverses of functions.
CC.2.2.HS.C.6 Interpret functions in terms of the situations they model.
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.
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.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

Big Ideas	Essential Questions
• Angles can be represented as rotations positively or negatively. • The six trigonometric functions can be used in triangle measurement and can be represented graphically, in particular, harmonic motion can be represented using sinusoidal functions.	• How are rotational angles represented and measured? • What is radian measure and how is it used? • What are trigonometric functions, how are they graphed, and how are they used? • What is the Unit Circle and how can it be used? • What are inverse operations for trigonometric functions?
Content	**Skills**
• Rotational angles • Standard position • Coterminal angles • Fluency in radian measure • Angles measured in degrees, minutes, seconds • Angles measured in radians • Degree-radian conversion • Angular velocity	• Draw and calculate rotational angles • Draw and calculate positive and negative coterminal angles • Calculate complements and supplements of angles • Convert between degrees, minutes, seconds and decimal degrees • Convert between degree and radian measure • Calculate arc length, angular velocity, and linear velocity

• Linear velocity • Arc length • Trigonometric functions and right triangles • Solving right triangles • Pythagorean and Quotient Identities • Applications of right triangle trigonometry • Extending trigonometric functions beyond QuadrantI • Reference angles • Quadrantal angles • Unit circle • Periodicity and amplitude of trigonometric functions • Graphs of sinusoidal functions • Domain and range of sinusoidal functions • Unwrapping the unit circle • Solving equations involving sinusoidal functions • Transformations of sinusoidal functions • Harmonic wave applications • Graph rational and reciprocal trigonometric functions • Vertical asymptotes • Properties of rational and reciprocal trigonometric functions • Graphs of Composite trigonometric functions • Damped oscillation • Inverse trigonometric functions • Domain and range of inverse trigonometric functions • Graphs of inverse trigonometric functions • Composition of trigonometric functions and their inverses • Applications of trigonometric functions • Angle of elevation/depression • Simple harmonic motion	• Solve applications involving angular velocity, linear velocity, and arc length • Calculate the six trigonometric ratios for a given right triangle • Use the rules of 45-45-90 and 30-60-90 triangles to calculate the six trigonometric ratios • Evaluate trigonometric functions on a calculator • Derive the quotient and Pythagorean Identities for Trigonometry • Solve right triangles using trigonometry • Solve application problems involving right triangles • Use angles of elevation and depression to solve right triangle trigonometry applications • Extend trigonometric function into quadrants 2, 3, & 4 • Evaluate trigonometric ratios of any rotational angle • Identify the sign of each trigonometric function in each quadrant • Use reference angles to evaluate trigonometric ratios • Graph sinusoidal functions • Use the periodicity of sinusoidal functions to evaluate trigonometric ratios • Identify the domain and range of sinusoidal functions • Identify the properties of sinusoidal functions • Describe the behavior of sinusoidal functions • Graph transformations of sinusoidal functions • Use sinusoidal functions to solve application problems • Graph rational and reciprocal trigonometric functions • Graph transformations of rational trigonometric functions and reciprocal trigonometric functions • Identify the properties of rational and reciprocal trigonometric functions • Use graphing calculator technology to solve trigonometric equations • Identify composite trigonometric functions that are and are not sinusoids • Identify the domain and range of composite trigonometric functions • Identify the domain and range of inverse trigonometric functions • Evaluate inverse trigonometric functions • Graph inverse trigonometric functions • Evaluate composition of trigonometric functions and their inverses

Unit #/Title	6/Analytic Trigonometry	Time Frame	4-5 Weeks

Standards

Standards of Mathematical Practices

- Make viable arguments and critique the reasoning of others.
- Look for and make use of structure.
- Reason abstractly and quantitatively.

CC.2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical 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.5 Choose a level of accuracy appropriate to limitations on measurements when reporting quantities.
CC.2.1.HS.D.1 Interpret the structure of expressions to represent a quantity in terms of its context.
CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
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.
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.4 Interpret the effects transformations have on functions and find the inverses of functions.
CC.2.2.HS.C.6 Interpret functions in terms of the situations they model.
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
CC.2.2.HS.C.9 Prove the Pythagorean identity and use it to calculate trigonometric ratios.
CC.2.2.HS.A.7 Apply trigonometric ratios to solve problems involving right triangles.
CC.2.2.HS.A.14 Apply geometric concepts to model and solve real world problems.

Big Ideas	Essential Questions
• Algebraic methods can be applied to solve equations of trigonometric functions. • Trigonometric identities can be used to write equations in terms of trigonometric function factors. • Trigonometry can also be used to solve and calculate areas of oblique triangles.	• How can trigonometry be used to solve oblique triangles? • How do you know when a triangle cannot exist? • How can trigonometry be used to calculate area of triangles? • Why prove a trigonometric identity? • What methods can be used prove trigonometric identities? • How can trigonometric equations be solved? • How can algebraic methods be used to solve trigonometric equations?
Content	**Skills**
• Fundamental trigonometric identities • Confirm trigonometric identities • Factoring trigonometric expressions	• Use Fundamental Identities, Sum and Difference Identities, and Multiple-Angle Identities to confirm/prove identities

• Sum and Difference Identities • Multiple-Angle Identities • Solving trigonometric equations • Applications involving trigonometric equations • Solve trigonometric equations for specific and general solutions • Law of Sines • Applications involving Law of Sines • Law of Cosines • Applications involving Law of Cosines • Heron's Formula • Triangle Area Formula	• Recognize that identities can be confirmed/proven in multiple ways • Solve trigonometric equations using algebraic methods • Solve trigonometric equations involving multiple angles • Solve trigonometric equations by graphing • Solve applications involving trigonometry by graphing • Solve applications involving trigonometry by algebraic methods • Apply algebraic techniques to solve equations involving trigonometric functions • Solve trigonometric equations using Sum and Difference Identities • Solve trigonometric equations using Multiple-Angle Identities • Solve triangles using Law of Sines • Recognize when a triangle cannot exist based on given information • Solve applications using Law of Sines • Solve triangles using Law of Cosines • Recognize when a triangle cannot exist based on given information • Solve applications using Law of Cosines • Calculate area of a triangle using sine function • Calculate semiperimeter of a triangle • Calculate area of a triangle using Heron's Formula and the Triangle Area formula

Unit #/Title	7/Conic Sections, Polar Equations, & DeMoivre's Theorem	Time Frame	4-5 Weeks

Standards

Standards of Mathematical Practices

- Make sense of problems and persevere in solving them.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

CC.2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical problems.
CC.2.1.HS.F.6 Extend the knowledge of arithmetic operations and apply to complex numbers.
CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
CC.2.3.HS.A.10 Translate between the geometric description and the equation for a conic section.

Big Ideas

- Analytic Geometry allows us to solve geometry problems algebraically, and algebra problems geometrically.
- The Conic Sections are represented by second-degree equations in two variables.
- Rectangular coordinates can be converted to Polar coordinates, used to model rotational motion.

Essential Questions

- What is a double-napped cone, and how are the Conic Sections derived from it?
- How are analytic geometry and algebra connected?
- What is the Polar Coordinate System and how can graphs be drawn using it?

Content

- Double-napped cone
- Conic section
- Degenerate conic section
- Parabola
- Focus
- Focal Length
- Focal Width
- Directrix
- Ellipse
- Major Axis
- Minor Axis
- Semimajor Axis
- Semiminor Axis
- Eccentricity
- Hyperbola
- Transverse Axis
- Conjugate Axis
- Semitransverse Axis
- Semiconjugate Axis
- Physical Properties of Conic Sections
- Transformations of Conic Sections
- Cross-product term
- Translation of Axes
- Rotation of Axes
- Discriminant Test
- Pole
- Polar Axis
- Polar Coordinates

Skills

- Recognize conic sections as intersections of a plane with a double-napped cone
- Identify the focus and directrix of a parabola
- Write the standard form equation of a parabola
- Calculate the focal length and width of a parabola
- Draw graphs of parabolas
- Identify the vertices and foci of an ellipse
- Write the standard form equation of an ellipse
- Identify the length of the major axis, minor axis, semimajor axis, and semiminor axis of an ellipse
- Apply translations to the equation of an ellipse
- Calculate eccentricity of an ellipse
- Draw graphs of ellipses
- Identify the vertices and foci of a hyperbola.
- Write the standard form equation of a hyperbola
- Draw graphs of hyperbolas
- Apply translations to the equation of a hyperbola
- Calculate the eccentricity of a hyperbola
- Graph conic sections that have been rotated
- Apply the Discriminant Test to determine if an second-degree equation represents a hyperbola, a parabola, or an ellipse
- Convert points and equations from polar to rectangular form and vice versa
- Apply polar symmetry tests
- Graph roses, limacon, lemniscate, and spiral curves in polar form

• Directed Distance • Directed Angle • Distance with Polar Coordinates • Polar Symmetry Tests • Rose curves • Limacon • Lemniscate • Spiral curves • Trigonometric Form of Complex Numbers • DeMoivre's Theorem • Polar Equations of Conic Sections	• Represent complex numbers in trigonometric form and perform operations on them • Apply DeMoivre's Theorem to calculate nth roots of complex numbers • Apply the focus-directrix definition of a conic section to an equation in polar form • Write equations of conic sections in polar form

Unit #/Title	8/Systems and Matrices (if time permits)	Time Frame	4-5 Weeks

Standards

Standards of Mathematical Practices

- Reason abstractly and quantitatively.
- Look for and make use of structure.
- Look for and make sense of regularity in repeated reasoning.

CC.2.2.HS.D.1 Interpret the structure of expressions to represent a quantity in terms of its context.
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.

Big Ideas	Essential Questions
• Matrices can be used to simplify the process of finding a solution to systems of equations or inequalities in two or more variables. • Linear programming can be used as a decision-making tool.	• What are matrices and how do they simplify our efforts to solve systems of equations in two or more variables? • How can the graphs of equations and inequalities be used as a decision-making tool?
Content	**Skills**
• System of equations • Solution of a system • Substitution • Elimination • Matrix • Matrix addition, subtraction, multiplication • Identity matrix • Inverse matrix • Determinant • Matrix Properties • Triangular form • Gaussian elimination • Row Echelon form • System of Inequalities • Linear Programming	• Solve systems of equations graphically and algebraically • Recognize when a system has one solution, no solution, or infinitely many solutions. • Perform mathematical operations on matrices • Determine the inverse of a matrix • Determine if two matrices are inverses of one another • Evaluate determinants • Solve systems of linear equations using Gaussian elimination, reduced row echelon form, or an inverse matrix • Solve application problems using matrices • Solve systems of inequalities graphically • Solve linear programming problems