Anthony Wayne Local Schools
Course of Study
Algebra 2

Anthony Wayne Local Schools Mathematics Belief Statements

All Generals will experience an innovative and engaging curriculum with instruction that is personalized, promotes creativity and application, and provides real-world experiences that facilitate deeper learning.

AWLS believes Mathematics instruction should:

- identify skill gaps for individual students and work to close them
- include engaging learning activities where all learners can grow through productive struggle.
- develop strong number sense with the ability to manipulate numbers and perform mental math with an emphasis on subitizing
- provide scenarios where real world problems help to provide a path towards being future ready students.
- develop strong mathematical modeling and reasoning skills that continually build on prior knowledge.
- encourage students to be risk takers, demonstrate resilience and grit, while solving complex mathematical problems.
- encourage flexibility, creativity, and communication while working collaboratively with peers.
- include consistent and cohesive academic vocabulary through all grade-levels that is utilized by both teachers and students

Algebra 2 Course Description:

Algebra II is a course designed to incorporate the Common Core State Standards, providing students with a rigorous study of intermediate algebra techniques and an introduction to advanced techniques. This course begins with the study of linear relationships and a renewal of basic techniques mastered in Algebra I. First semester study is devoted to the progression from linear to quadratic to polynomial algebra. Students learn to work extensively with radical expressions and complex numbers are introduced, as are matrices. Second semester students extend the work of first semester through work with rational expressions and conic sections, and techniques for working with exponential, logarithmic, and trigonometric functions are introduced. A graphing calculator is required for this course, preferably the TI-83 Plus or TI-84.

Honors Algebra 2 Course Description:

Honors Algebra II is a course designed to incorporate the Common Core State Standards. It is designed for the student with high math abilities. The course begins with a basic review of Algebra I concepts, explores the solutions of higher order equations and covers extensively the use of matrices in solving linear systems. The course also includes topics of powers and roots, exponential functions, logarithmic functions, and trigonometric functions, rational equations, analytic geometry, and sequences and series. A graphing calculator is required for this course, preferably the TI 83 Plus or the TI 84.

Domain/ Conceptual Category	Standard	
Number and Quantity	N.RN.3	**Use properties of rational and irrational numbers.** **N.RN.3** Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
Algebra	A.CED.4	**Create equations that describe numbers or relationships.** **A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.★ **a.** Focus on formulas in which the variable of interest is linear or square. *For example, rearrange Ohm's law V=IR to highlight resistance R, or rearrange the formula for the area of a circle A=(π)r2to highlight radius r.* (A1) **b.** Focus on formulas in which the variable of interest is linear. *For example, rearrange Ohm's law V=IR to highlight resistance R.* (M1) **c.** Focus on formulas in which the variable of interest is linear or square. *For example, rearrange the formula for the area of a circle A=(π)r2 to highlight radius r.* (M2) **d.** While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations. (A2, M3)
Algebra	A.REI.6	**Solve systems of equations.** **A.REI.6** Solve systems of linear equations algebraically and graphically. **a.** Limit to pairs of linear equations in two variables. (A1, M1) **b.** Extend to include solving systems of linear equations in three variables, but only algebraically. (A2, M3)
Algebra	A.REI.11	**Represent and solve equations and inequalities graphically.** **A.REI.11** Explain why the *x*-coordinates of the points where the graphs of the equation *y=f(x)* and *y=g(x)* intersect are the solutions of the equation *f(x)=g(x)*; find the solutions approximately, e.g., using technology to graph the functions, making tables of values, or finding successive approximations.

Functions	F.IF.6	**Interpret functions that arise in applications in terms of the context.** **F.IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★ (A2, M3)
Number and Quantity	N.VM.8	**Perform operations on matrices, and use matrices in applications.** **N.VM.8** (+) Add, subtract, and multiply matrices of appropriate dimensions.
Algebra	A.REI.6	**Solve systems of equations.** **A.REI.6** Solve systems of linear equations algebraically and graphically. **a.** Limit to pairs of linear equations in two variables. (A1, M1) **b.** Extend to include solving systems of linear equations in three variables, but only algebraically. (A2, M3)
Algebra	A.REI.7	**Solve systems of equations.** **A.REI.7** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.*
Algebra	A.REI.12	**Represent and solve equations and inequalities graphically.** **A.REI.12** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
Functions	F.IF.1	**Understand the concept of a function, and use function notation.** **F.IF.1** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y = f(x)*.
Functions	F.IF.2	**Understand the concept of a function, and use function notation.** **F.IF.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Algebra	A.CED.2	**Create equations that describe numbers or relationships.** **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.★ **a.** Focus on applying linear and simple exponential expressions. (A1, M1) **b.** Focus on applying simple quadratic expressions. (A1, M2) **c.** Extend to include more complicated function situations with the option to graph with technology. (A2, M3)
Number and Quantity	N.Q.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★
Functions	F.IF.9	**Analyze functions using different representations.** **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* (A2, M3) **a.** Focus on linear and exponential functions. (M1) **b.** Focus on linear, quadratic, and exponential functions. (A1, M2)
Functions	F.IF.4	**Interpret functions that arise in applications in terms of the context.** **F.IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★(A2, M3) **a.** Focus on linear and exponential functions. (M1) **b.** Focus on linear, quadratic, and exponential functions. (A1, M2)
Algebra	A.CED.1	**Create equations that describe numbers or relationships.** **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations and inequalities arising from linear, quadratic, simple rational, and exponential functions.*★ **a.** Focus on applying linear and simple exponential expressions. (A1, M1) **b.** Focus on applying simple quadratic expressions. (A1, M2) **c.** Extend to include more complicated function situations with the option to solve with technology. (A2,

		M3)
Functions	F.IF.7	**Analyze functions using different representations.** **F.IF.7** Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.★ **a.** Graph linear functions and indicate intercepts. (A1, M1) **b.** Graph quadratic functions and indicate intercepts, maxima, and minima. (A1, M2) **c.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. (A2, M3) **d.** Graph polynomial functions, identifying zeros, when factoring is reasonable, and indicating end behavior. (A2, M3) **e.** Graph simple exponential functions, indicating intercepts and end behavior. (A1, M1) **f.** Graph exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (A2, M3) **g.** (+) Graph rational functions, identifying zeros and asymptotes, when factoring is reasonable, and indicating end behavior. (A2, M3) **h.** (+) Graph logarithmic functions, indicating intercepts and end behavior.
Number and Quantity	N.CN.1	**Perform arithmetic operations with complex numbers.** **N.CN.1** Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.
Number and Quantity	N.CN.2	**Perform arithmetic operations with complex numbers.** **N.CN.2** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
Number and Quantity	N.CN.7	**Use complex numbers in polynomial identities and equations.** **N.CN.7** Solve quadratic equations with real coefficients that have complex solutions.
Number and Quantity	N.CN.9	**Use complex numbers in polynomial identities and equations.** **N.CN.9** (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
Algebra	A.SSE.1	**Interpret the structure of expressions.** **A.SSE.1.** Interpret expressions that represent a quantity in terms of its context.★ **a.** Interpret parts of an expression, such as terms, factors, and coefficients. **b.** Interpret complicated expressions by viewing one or more of their parts as a single entity.

Algebra	A.SSE.2	**Interpret the structure of expressions.** **A.SSE.2** Use the structure of an expression to identify ways to rewrite it. *For example, to factor 3x(x – 5) + 2(x – 5), students should recognize that the "x – 5" is common to both expressions being added, so it simplifies to (3x+2)(x – 5); or see x4– y4 as (x2)2– (y2)2, thus recognizing it as a difference of squares that can be factored as (x2– y2)(x2+y2).*
Algebra	A.SSE.3	**Write expressions in equivalent forms to solve problems.** **A.SSE.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★ **a.** Factor a quadratic expression to reveal the zeros of the function it defines. **b.** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. **c.** Use the properties of exponents to transform expressions for exponential functions. *For example, 8t can be written as 23t.*
Algebra	A.APR.1	**Perform arithmetic operations on polynomials.** **A.APR.1** Understand that polynomials form a system analogous to the integers, namely, that they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. **a.** Focus on polynomial expressions that simplify to forms that are linear or quadratic. (A1, M2) **b.** Extend to polynomial expressions beyond those expressions that simplify to forms that are linear or quadratic. (A2, M3)
Algebra	A.APR.2	**Understand the relationship between zeros and factors of polynomials**. **A.APR.2** Understand and apply the Remainder Theorem: For a polynomial *p(x)* and a number *a*, the remainder on division by *x – a* is *p(a).* In particular, *p(a) = 0* if and only if *(x – a)* is a factor of *p(x).*
Algebra	A.APR.3	**Understand the relationship between zeros and factors of polynomials.** **A.APR.3** Identify zeros of polynomials, when factoring is reasonable, and use the zeros to construct a rough graph of the function defined by the polynomial.
Algebra	A.APR.5	**Use polynomial identities to solve problems.** **A.APR.5** (+) Know and apply the Binomial Theorem for the expansion of (*x* + *y*)*n* in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers. *For example by using coefficients determined for by Pascal's Triangle.* The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

Functions	F.IF.8	**Analyze functions using different representations.** **F.IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. **a.** Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. (A2, M3) **i.** Focus on completing the square to quadratic functions with the leading coefficient of 1. (A1, M2) **b.** Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of changeG in functions such as y = (1.02)t, and y = (0.97)t and classify them as representing exponential growth or decay.* (A2, M3) **i.** Focus on exponential functions evaluated at integer inputs. (A1, M2)
Number and Quantity	N.CN.3	**Perform arithmetic operations with complex numbers.** **N.CN.3** (+) Find the conjugate of a complex number; use conjugates to find magnitudes and quotients of complex numbers.
Algebra	A.REI.4	**Solve equations and inequalities in one variable.** **A.REI.4** Solve quadratic equations in one variable. **a.** Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. **b.** Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for $x^2 = 49$; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring. (+) **c.** Derive the quadratic formula using the method of completing the square.
Functions	F.IF.9	**Analyze functions using different representations.** **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* (A2, M3) **a.** Focus on linear and exponential functions. (M1) **b.** Focus on linear, quadratic, and exponential functions. (A1, M2)

Algebra	A.CED.2	**Create equations that describe numbers or relationships.** **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.★ **a.** Focus on applying linear and simple exponential expressions. (A1, M1) **b.** Focus on applying simple quadratic expressions. (A1, M2) **c.** Extend to include more complicated function situations with the option to graph with technology. (A2, M3)
Functions	F.IF.4	**Interpret functions that arise in applications in terms of the context.** **F.IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★(A2, M3) **a.** Focus on linear and exponential functions. (M1) **b.** Focus on linear, quadratic, and exponential functions. (A1, M2)
Algebra	A.CED.1	**Create equations that describe numbers or relationships.** **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations and inequalities arising from linear, quadratic, simple rational, and exponential functions.*★ **a.** Focus on applying linear and simple exponential expressions. (A1, M1) **b.** Focus on applying simple quadratic expressions. (A1, M2) **c.** Extend to include more complicated function situations with the option to solve with technology. (A2, M3)

Functions	F.IF.7	**Analyze functions using different representations.** **F.IF.7** Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.★ **a.** Graph linear functions and indicate intercepts. (A1, M1) **b.** Graph quadratic functions and indicate intercepts, maxima, and minima. (A1, M2) **c.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. (A2, M3) **d.** Graph polynomial functions, identifying zeros, when factoring is reasonable, and indicating end behavior. (A2, M3) **e.** Graph simple exponential functions, indicating intercepts and end behavior. (A1, M1) **f.** Graph exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (A2, M3) **g.** (+) Graph rational functions, identifying zeros and asymptotes, when factoring is reasonable, and indicating end behavior. (A2, M3) **h.** (+) Graph logarithmic functions, indicating intercepts and end behavior.
Number and Quantity	N.Q.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★
Algebra	A.REI.2	**Understand solving equations as a process of reasoning and explain the reasoning.** **A.REI.2** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
Number and Quantity	N.RN.1	**Extend the properties of exponents to rational exponents.** **N.RN.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define 51/3 to be the cube root of 5 because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5.*
Number and Quantity	N.RN.2	**Extend the properties of exponents to rational exponents.** **N.RN.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.
Number and Quantity	N.Q.1	**Reason quantitatively and use units to solve problems.** **N.Q.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.★

Number and Quantity	N.Q.3	**Reason quantitatively and use units to solve problems.** **N.Q.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.★
Algebra	A.CED.3	**Create equations that describe numbers or relationships.** **A.CED.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*★ (A1, M1) **a.** While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations. (A2, M3)
Functions	F.IF.5	**Interpret functions that arise in applications in terms of the context.** **F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★ **a.** Focus on linear and exponential functions. (M1) **b.** Focus on linear, quadratic, and exponential functions. (A1, M2) **c.** Emphasize the selection of a type of function for a model based on behavior of data and context. (A2, M3)
Functions	F.BF.1	**Build a function that models a relationship between two quantities.** **F.BF.1** Write a function that describes a relationship between two quantities.★ **a.** Determine an explicit expression, a recursive process, or steps for calculation from a context. **i.** Focus on linear and exponential functions. (A1, M1) **ii.** Focus on situations that exhibit quadratic or exponential relationships. (A1, M2) **b.** Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* (A2, M3) **c.** (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time .*

Functions	F.BF.3	**Build new functions from existing functions.** **F.BF.3** Identify the effect on the graph of replacing *f(x)* by *f(x)+k*, *kf(x)*, *f(kx),* and *f(x+k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.* (A2, M3) **a.** Focus on transformations of graphs of quadratic functions, except for *f*(*kx*). (A1, M2)
Functions	F.BF.4	**Build new functions from existing functions.** **F.BF.4** Find inverse functions. **a.** Informally determine the input of a function when the output is known. (A1, M1) **b.** (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. (A2, M3) **c.** (+) Verify by composition that one function is the inverse of another. (A2, M3) **d.** (+) Find the inverse of a function algebraically, given that the function has an inverse. (A2, M3) **e.** (+) Produce an invertible function from a non-invertible function by restricting the domain.
Functions	F.LE.4	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.4** For exponential models, express as a logarithm the solution to *abct = d* where *a*, *c*, and *d* are numbers and the base *b* is *2*, *10*, or *e*; evaluate the logarithm using technology.★
Functions	F.BF.5	**Build new functions from existing functions.** **F.BF.5** (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
Functions	F.LE.3	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically. ★(A1, M2)
Functions	F.IF.9	**Analyze functions using different representations.** **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* (A2, M3) **a.** Focus on linear and exponential functions. (M1) **b.** Focus on linear, quadratic, and exponential functions. (A1, M2)

Functions	F.IF.4	**Interpret functions that arise in applications in terms of the context.** **F.IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★(A2, M3) **a.** Focus on linear and exponential functions. (M1) **b.** Focus on linear, quadratic, and exponential functions. (A1, M2)
Number and Quantity	N.Q.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★
Algebra	A.CED.1	**Create equations that describe numbers or relationships.** **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations and inequalities arising from linear, quadratic, simple rational, and exponential functions.*★ **a.** Focus on applying linear and simple exponential expressions. (A1, M1) **b.** Focus on applying simple quadratic expressions. (A1, M2) **c.** Extend to include more complicated function situations with the option to solve with technology. (A2, M3)
Functions	F.IF.7	**Analyze functions using different representations.** **F.IF.7** Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.★ **a.** Graph linear functions and indicate intercepts. (A1, M1) **b.** Graph quadratic functions and indicate intercepts, maxima, and minima. (A1, M2) **c.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. (A2, M3) **d.** Graph polynomial functions, identifying zeros, when factoring is reasonable, and indicating end behavior. (A2, M3) **e.** Graph simple exponential functions, indicating intercepts and end behavior. (A1, M1) **f.** Graph exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (A2, M3) **g.** (+) Graph rational functions, identifying zeros and asymptotes, when factoring is reasonable, and indicating end

		behavior. (A2, M3) **h.** (+) Graph logarithmic functions, indicating intercepts and end behavior.
Algebra	A.SSE.4	**Write expressions in equivalent forms to solve problems.** **A.SSE.4** (+) Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★
Algebra	A.APR.6	**Rewrite rational expressions.** **A.APR.6** Rewrite simple rational expressionsG in different forms; write *a(x)*/*b(x)* in the form *q(x)* + *r(x)*/*b(x)*, where *a(x)*, *b(x)*, *q(x)*, and *r(x)* are polynomials with the degree of *r(x)* less than the degree of *b(x)*, using inspection, long division, or, for the more complicated examples, a computer algebra system.
Algebra	A.APR.7	**Rewrite rational expressions.** **A.APR.7** (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
Functions	F.TF.1	**Extend the domain of trigonometric functions using the unit circle.** **F.TF.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
Functions	F.TF.2	**Extend the domain of trigonometric functions using the unit circle.** **F.TF.2** Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
Functions	F.TF.5	**Model periodic phenomena with trigonometric functions.** **F.TF.5** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★
Functions	F.TF.8	**Prove and apply trigonometric identities.** **F.TF.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.
Geometry	G.SRT.8	**Define trigonometric ratios and solve problems involving right triangles.** **G.SRT.8** Solve problems involving right triangles.★ **a.** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems if one of the two acute angles and a side length is given. (G, M2) **b.** (+) Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied

		problems.★ (A2, M3)
Geometry	G.C.6	**Find arc lengths and areas of sectors of circles.** **G.C.6** Derive formulas that relate degrees and radians, and convert between the two. (A2, M3)
Algebra	A.CED.1	**Create equations that describe numbers or relationships.** **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations and inequalities arising from linear, quadratic, simple rational, and exponential functions.*★ **a.** Focus on applying linear and simple exponential expressions. (A1, M1) **b.** Focus on applying simple quadratic expressions. (A1, M2) **c.** Extend to include more complicated function situations with the option to solve with technology. (A2, M3)
Functions	F.IF.7	**Analyze functions using different representations.** **F.IF.7** Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.★ **a.** Graph linear functions and indicate intercepts. (A1, M1) **b.** Graph quadratic functions and indicate intercepts, maxima, and minima. (A1, M2) **c.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. (A2, M3) **d.** Graph polynomial functions, identifying zeros, when factoring is reasonable, and indicating end behavior. (A2, M3) **e.** Graph simple exponential functions, indicating intercepts and end behavior. (A1, M1) **f.** Graph exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (A2, M3) **g.** (+) Graph rational functions, identifying zeros and asymptotes, when factoring is reasonable, and indicating end behavior. (A2, M3) **h.** (+) Graph logarithmic functions, indicating intercepts and end behavior.
Algebra	A.APR.4	**Use polynomial identities to solve problems.** **A.APR.4** Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*
Geometry	G.SRT.9	**Apply trigonometry to general triangles.** **G.SRT.9** (+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

Geometry	G.SRT.10	**Apply trigonometry to general triangles.** **G.SRT.10** (+) Explain proofs of the Laws of Sines and Cosines and use the Laws to solve problems.
Geometry	G.SRT.11	**Apply trigonometry to general triangles.** **G.SRT.11** (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles, e.g., surveying problems, resultant forces.
Statistics and Probability	S.ID.4	**Summarize, represent, and interpret data on a single count or measurement variable.** **S.ID.4** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.★
Statistics and Probability	S.ID.6	**Summarize, represent, and interpret data on two categories and quantitative variables** **S.ID.6** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.★ **a.** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions, or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.* (A2, M3) **b.** Informally assess the fit of a function by discussing residuals. (A2, M3) **c.** Fit a linear function for a scatterplot that suggests a linear association. (A1, M1)
Statistics and Probability	S.ID.9	**Interpret linear models.** **S.ID.9** Distinguish between correlation and causation.★
Statistics and Probability	S.IC.1	**Understand and evaluate random processes underlying statistical experiments.** **S.IC.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population.★
Statistics and Probability	S.IC.2	**Understand and evaluate random processes underlying statistical experiments.** **S.IC.2** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*★
Statistics and Probability	S.IC.3	**Make inferences and justify conclusions from sample surveys, experiments, and observational studies.** **S.IC.3** Recognize the purposes of and differences among sample surveys, experiments, and

		observational studies; explain how randomization relates to each.★
Statistics and Probability	S.IC.4	**Make inferences and justify conclusions from sample surveys, experiments, and observational studies.** **S.IC.4** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.★
Statistics and Probability	S.IC.5	**Make inferences and justify conclusions from sample surveys, experiments, and observational studies.** **S.IC.5** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between sample statistics are statistically significant.★