Anthony Wayne Local Schools
Course of Study
Algebra 1

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

8th Grade Honors Algebra 1 Course Description:
This course will cover the remaining topics from Math 8 that are not covered in the Honors 7th Grade Math course. Algebra focuses on developing reasoning, analytical skills, writing, interpreting, translating, (specifically in relation to expressions and equations), functions, linear relationships, function notation, domain and range, exponential functions, quadratic functions, radical expressions, rational expressions, as well as an introductory study of simple statistics. Students taking this course earn high school credit. Grades earned will appear on high school transcripts and count toward high school GPA. *8th grade Honors Algebra 1 varies slightly from high school Algebra 1 due to the fact that some 8th grade skills and concepts are included in 8th grade honors Algebra 1.

Algebra 1 Course Description (High School):
Algebra 1 is a course that focuses on order of operations, number sets, writing, solving, and graphing linear equations and inequalities. Linear and nonlinear functions, including function notation and domain and range are introduced to students in great depth. The course also includes writing and solving systems of equations and inequalities. Work with functions continues in greater depth for exponential functions, and quadratic functions. Students will explore quadratic functions in multiple forms, including factoring and solving quadratic equations. The year will include a unit covering statistics. A scientific calculator is required for this course, preferably the TI-30 XII S.

Honors Algebra 1 Course Description (High School):
Algebra I Honors is a course that focuses on the order of operations, number sets, writing, solving, and graphing linear equations and inequalities. Linear and nonlinear functions, including function notation and domain and range are introduced to students in great depth for exponential

functions and quadratic functions. Students will explore quadratic functions in multiple forms, including factoring and solving quadratic equations. The year will include a unit covering statistics. . A scientific calculator is required for this course, preferably the TI-30XIIS. *This course is designed to support students to be successful in working towards an accelerated pace so that they are better prepared for the honors track at the high school.

8th Grade Honors Algebra 1:

Domain/ Conceptual Category	Standard	Standard Statement
		Chapter 1: Functions
The Number System	8.NS.1	**Know that there are numbers that are not rational, and approximate them by rational numbers.** **8.NS.1** Know that real numbers are either rational or irrational. Understand informally that every number has a decimal expansion which is repeating, terminating, or is non-repeating and non-terminating.
The Number System	8.NS.2	**Know that there are numbers that are not rational, and approximate them by rational numbers.** **8.NS.2** Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions, e.g., π^2. *For example, by truncating the decimal expansion of $\sqrt{2}$, , show that $\sqrt{2}$, is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*
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.

Functions	F.BF.4a	**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.IF.3	**Understand the concept of a function, and use function notation.** **F.IF.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by* $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$.
		Chapter 2: Solving Equations
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.REI.1	**Understand solving equations as a process of reasoning and explain the reasoning.** **A.REI.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
Algebra	A.REI.3	**Solve equations and inequalities in one variable.** **A.REI.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Expressions and Equations	8.EE.7	**Analyze and solve linear equations and pairs of simultaneous linear equations.** **8.EE.7** Solve linear equations in one variable. **a.** Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). **b.** Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
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)
Functions	F.BF.4a	**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.
		Chapter 3: Linear Functions

Expressions and Equations	8.EE.5	**Understand the connections between proportional relationships, lines, and linear equations.** **8.EE.5** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*
Expressions and Equations	8.EE.6	**Understand the connections between proportional relationships, lines, and linear equations.** **8.EE.6** Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.
Algebra	A.REI.10	**Represent and solve equations and inequalities graphically.** **A.REI.10** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
Functions	F.LE.2	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).★
Functions	F.IF.4b	**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)
		Chapter 4: Linear Applications

Algebra	A.CED.1ab	**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.9b	**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.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)
		Chapter 5: Linear Systems
Algebra	A.REI.5	**Solve systems of equations.** **A.REI.5** Verify that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
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.

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)
		Chapter 6: Linear Inequalities
Algebra	A.CED.1ab	**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)
Algebra	A.CED.2ab	**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)
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)
		Chapter 7: Simplifying Expressions

Expressions and Equations	8.EE.1	**Work with radicals and integer exponents.** **8.EE.1** Understand, explain, and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3-5 = 3-3 = 1/3^3 = 1/27$.
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.1a	**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.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.
Expressions and Equations	8.EE.2	**Work with radicals and integer exponents.** **8.EE.2** Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
		Chapter 8: Exponential Functions
Functions	F.LE.5	**Interpret expressions for functions in terms of the situation they model.** **F.LE.5** Interpret the parameters in a linear or exponential function in terms of a context.★

Functions	F.LE.2	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).★
Algebra	A.CED.1ab	**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)
Algebra	A.REI.10	**Represent and solve equations and inequalities graphically.** **A.REI.10** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
Functions	F.IF.4b	**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)
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.IF.7be	**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.
Functions	F.IF.8ab	**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)

Functions	F.IF.9b	**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.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.LE.1abc	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions.★ **a.** Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. **b.** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **c.** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
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)
		Chapter 9: Sequences

Functions	F.BF.1a	**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.2	**Build a function that models a relationship between two quantities.** **F.BF.2** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★
Functions	F.LE.2	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).★
Functions	F.IF.3	**Understand the concept of a function, and use function notation.** **F.IF.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*
		Chapter 10: Factoring
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).*
		Chapter 11: Quadratic Functions

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)
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.*
Functions	F.BF.4a	**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.IF.7be	**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.
Functions	F.IF.8ab	**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)
Functions	F.IF.9b	**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.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.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.BF.3a	**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.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)
		Chapter 12: Applications of Quadratic Functions

Algebra	A.CED.1ab	**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)
Algebra	A.CED.2ab	**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.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)
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.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.
		Chapter 13: Bivariate Data
Statistics and Probability	8.SP.1	**Investigate patterns of association in bivariate data.** **8.SP.1** Construct and interpret scatter plots for bivariateG measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering; outliers; positive, negative, or no association; and linear association and nonlinear association. (GAISE Model, steps 3 and 4)
Statistics and Probability	8.SP.2	**Investigate patterns of association in bivariate data.** **8.SP.2** Understand that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. (GAISE Model, steps 3 and 4)
Statistics and Probability	8.SP.3	**Investigate patterns of association in bivariate data.** **8.SP.3** Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.* (GAISE Model, steps 3 and 4)
Statistics and Probability	S.ID.5	**Summarize, represent, and interpret data on two categorical and quantitative variables.** **S.ID.5** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.★

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.7	**Interpret linear models.** **S.ID.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.★
Statistics and Probability	S.ID.8	**Interpret linear models.** **S.ID.8** Compute (using technology) and interpret the correlation coefficient of a linear fit.★
		Chapter 14: Pythagorean Theorem
Geometry	8.G.6	**Understand and apply the Pythagorean Theorem.** **8.G.6** Analyze and justify an informal proof of the Pythagorean Theorem and its converse.
Geometry	8.G.7	**Understand and apply the Pythagorean Theorem.** **8.G.7** Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
Geometry	8.G.8	**Understand and apply the Pythagorean Theorem.** **8.G.8** Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
		Chapter 15: Transformations
Geometry	8.G.1	**Understand congruence and similarity using physical models, transparencies, or geometry software.** **8.G.1** Verify experimentally the properties of rotations, reflections, and translations (include examples both with and without coordinates). **a.** Lines are taken to lines, and line segments are taken to line segments of the same length. **b.** Angles are taken to angles of the same measure. **c.** Parallel lines are taken to parallel lines.

Geometry	8.G.2	**Understand congruence and similarity using physical models, transparencies, or geometry software.** **8.G.2** Understand that a two-dimensional figure is congruentG to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. (Include examples both with and without coordinates.)
Geometry	8.G.3	**Understand congruence and similarity using physical models, transparencies, or geometry software.** **8.G.3** Describe the effect of dilationsG, translations, rotations, and reflections on two-dimensional figures using coordinates.
Geometry	8.G.4	**Understand congruence and similarity using physical models, transparencies, or geometry software.** **8.G.4** Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. (Include examples both with and without coordinates.)
		Chapter 16: Scientific Notation
Expressions and Equations	8.EE.3	**Work with radicals and integer exponents.** **8.EE.3** Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 × 108; and the population of the world as 7 × 109; and determine that the world population is more than 20 times larger.*
Expressions and Equations	8.EE.4	**Work with radicals and integer exponents.** **8.EE.4** Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities, e.g., use millimeters per year for seafloor spreading. Interpret scientific notation that has been generated by technology.
		Chapter 17: Number and Quantity
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.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★
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 1 (High School):

Domain/ Conceptual Category	Standard	Standard Statement
		Tools of Algebra
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.
		Solving Equations
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.
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.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★
Number and	N.Q.3	**Reason quantitatively and use units to solve problems.**

Quantity		**N.Q.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.★
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)
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.1	**Understand solving equations as a process of reasoning and explain the reasoning.** **A.REI.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
Algebra	A.REI.3	**Solve equations and inequalities in one variable.** **A.REI.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
		Functions

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.
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)
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)
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.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★

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.★
		Linear Equations
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.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★
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.★
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.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 .*

Algebra	A.REI.10	**Represent and solve equations and inequalities graphically.** **A.REI.10** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
Statistics and Probability	S.ID.7	**Interpret linear models.** **S.ID.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.★
Functions	F.LE.5	**Interpret expressions for functions in terms of the situation they model.** **F.LE.5** Interpret the parameters in a linear or exponential function in terms of a context.★
		Systems of Equations
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.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★
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.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)
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)
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)
Algebra	A.REI.3	**Solve equations and inequalities in one variable.** **A.REI.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
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.
Algebra	A.REI.5	**Solve systems of equations.** **A.REI.5** Verify that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
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.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)
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.
		Exponents
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.*
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.
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.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★

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.★
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)
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.BF.2	**Build a function that models a relationship between two quantities.** **F.BF.2** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★
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.LE.1	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions.★ **a.** Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. **b.** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **c.** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
Functions	F.LE.2	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).★
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.LE.5	**Interpret expressions for functions in terms of the situation they model.** **F.LE.5** Interpret the parameters in a linear or exponential function in terms of a context.★
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)
		Polynomials / Factoring

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)
		Quadratics
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.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★

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.★
Functions	F.IF.3	**Understand the concept of a function, and use function notation.** **F.IF.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by* $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$.
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) **e.** Graph simple exponential functions, indicating intercepts and end behavior. (A1, M1)
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)
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.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.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)

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)
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)
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.
		Stats
Statistics and Probability	S.ID.1	**Summarize, represent, and interpret data on a single count or measurement variable.** **S.ID.1** Represent data with plots on the real number line (dot plots, histograms, and box plots) in the context of real-world applications using the GAISE model.★
Statistics and Probability	S.ID.2	**Summarize, represent, and interpret data on a single count or measurement variable.** **S.ID.2** In the context of real-world applications by using the GAISE model, use statistics appropriate to the shape of the data distribution to compare center (median and mean) and spread (mean absolute deviationG, interquartile rangeG, and standard deviation) of two or more different data sets. ★

Statistics and Probability	S.ID.3	**Summarize, represent, and interpret data on a single count or measurement variable.** **S.ID.3** In the context of real-world applications by using the GAISE model, interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★
Statistics and Probability	S.ID.5	**Summarize, represent, and interpret data on two categorical and quantitative variables.** **S.ID.5** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.★
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.7	**Interpret linear models.** **S.ID.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.★
Statistics and Probability	S.ID.8	**Interpret linear models.** **S.ID.8** Compute (using technology) and interpret the correlation coefficient of a linear fit.★

Honors Algebra 1 (High School):

Domain/ Conceptual Category	Standard	Standard Statement
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.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.
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.2	**Reason quantitatively and use units to solve problems.** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.★
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.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.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.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.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.
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.
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.
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)
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)

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)
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.1	**Understand solving equations as a process of reasoning and explain the reasoning.** **A.REI.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
Algebra	A.REI.3	**Solve equations and inequalities in one variable.** **A.REI.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

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.
Algebra	A.REI.5	**Solve systems of equations.** **A.REI.5** Verify that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
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.10	**Represent and solve equations and inequalities graphically.** **A.REI.10** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
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.

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.
Functions	F.IF.3	**Understand the concept of a function, and use function notation.** **F.IF.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by* $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$.
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)

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.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.

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)
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.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.2	**Build a function that models a relationship between two quantities.** **F.BF.2** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★

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.1	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions.★ **a.** Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. **b.** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **c.** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
Functions	F.LE.2	**Construct and compare linear, quadratic, and exponential models, and solve problems.** **F.LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).★
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.LE.5	**Interpret expressions for functions in terms of the situation they model.** **F.LE.5** Interpret the parameters in a linear or exponential function in terms of a context.★
Statistics and Probability	S.ID.1	**Summarize, represent, and interpret data on a single count or measurement variable.** **S.ID.1** Represent data with plots on the real number line (dot plots, histograms, and box plots) in the context of real-world applications using the GAISE model.★
Statistics and Probability	S.ID.2	**Summarize, represent, and interpret data on a single count or measurement variable.** **S.ID.2** In the context of real-world applications by using the GAISE model, use statistics appropriate to the shape of the data distribution to compare center (median and mean) and spread (mean absolute deviationG, interquartile rangeG, and standard deviation) of two or more different data sets. ★
Statistics and Probability	S.ID.3	**Summarize, represent, and interpret data on a single count or measurement variable.** **S.ID.3** In the context of real-world applications by using the GAISE model, interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★
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.5	**Summarize, represent, and interpret data on two categorical and quantitative variables.** **S.ID.5** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.★
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.7	**Interpret linear models.** **S.ID.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.★
Statistics and Probability	S.ID.8	**Interpret linear models.** **S.ID.8** Compute (using technology) and interpret the correlation coefficient of a linear fit.★