High School – Algebra 1

Kentucky Academic Standards with Targets

Grade Level/ Course: Algebra 1 Unit 1	
Standard:	**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.**
Domain:	**Quantities* (*Modeling Domain)**
Cluster:	**Reason quantitatively and use units to solve problems.**
Type: _____Knowledge _X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Calculate unit conversions. Recognize units given or needed to solve problem.	Use given units and the context of a problem as a way to determine if the solution to a multi-step problem is reasonable (e.g. length problems dictate different units than problems dealing with a measure such as slope) Choose appropriate units to represent a problem when using formulas or graphing. Interpret units or scales used in formulas or represented in graphs. Use units as a way to understand problems and to guide the solution of multi-step problems.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 1	
Standard with code:	**N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.**
Domain:	**Quantities* (*Modeling Domain)**
Cluster:	**Reason quantitatively and use units to solve problems.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define descriptive modeling.	Determine appropriate quantities for the purpose of descriptive modeling.		

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Grade Level/ Course: Algebra 1 Unit 1	
Standard:	**N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.**
Domain:	**Quantities* (*Modeling Domain)**
Cluster:	**Reason quantitatively and use units to solve problems.**
Type: _____Knowledge __X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify appropriate units of measurement to report quantities. Determine the limitations of different measurement tools.	Choose and justify a level of accuracy and/or precision appropriate to limitations on measurement when reporting quantities. Identify important quantities in a problem or real-world context.		

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Grade Level/ Course (HS): Algebra 1 Unit 1	
Standard with code:	**A.SSE.1a Interpret expressions that represent a quantity in terms of its context.*(*Modeling standard)** **a. Interpret parts of an expression, such as terms, factors, and coefficients.**
Domain:	**Seeing Structure in Expressions**
Cluster:	**Interpret the structure of expressions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. Notes from Appendix A: limit to linear expressions and to exponential expressions with integer exponents.	For expressions that represent a contextual quantity, interpret parts of an expression, such as terms, factors, and coefficients in terms of the context. Notes from Appendix A: limit to linear expressions and to exponential expressions with integer exponents.		

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Grade Level/ Course (HS): Algebra 1 Unit 1	
Standard with code:	**A.SSE.1b Interpret expressions that represent a quantity in terms of its context.* (Modeling standard)** **b. Interpret complicated expressions by viewing one or more of their parts as a single entity.** ***For example, interpret*** $P(1+r)^n$ ***as the product of P and a factor not depending on P.***
Domain:	**Seeing Structure in Expressions**
Cluster:	**Interpret the structure of expressions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
The underpinning knowledge for this standard is addressed in **A.SSE.1a:** For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. Notes from Appendix A: Limit to linear expressions with integer exponents	For expressions that represent a contextual quantity, interpret complicated expressions, in terms of the context, by viewing one or more of their parts as a single entity. Notes from Appendix A: Limit to linear expressions with integer exponents		

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Grade Level/ Course: Algebra 1 Unit 1	
Standard with code:	**A.CED.1 Create equations and inequalities in one variable and use them to solve problems.** ***Include equations arising from linear and quadratic functions, and simple rational and exponential functions.***
Domain:	**Creating Equations* (*Modeling Domain)**
Cluster:	**Create equations that describe numbers or relationships**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Solve linear and exponential equations in one variable. Solve inequalities in one variable. Describe the relationships between the quantities in the problem (for example, how the quantities are changing or growing with respect to each other); express these relationships using mathematical operations to create an appropriate equation or inequality to solve. Note from Appendix A: Limit to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.	Create equations (linear and exponential) and inequalities in one variable and use them to solve problems. Create equations and inequalities in one variable to model real-world situations. Compare and contrast problems that can be solved by different types of equations (linear & exponential). Note from Appendix A: In the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.		

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Grade Level/ Course: Algebra 1 Unit 1	
Standard:	**A.CED.2 Create equations in two or more variables to represent relationships between quantities, graph equations on a coordinate axes with labels and scales.**
Domain:	**Create Equations* (*Modeling Domain)**
Cluster:	**Create equations that describe numbers or relationships**
Type: _____Knowledge ____X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify the quantities in a mathematical problem or real-world situation that should be represented by distinct variables and describe what quantities the variables represent. Graph one or more created equation on a coordinate axes with appropriate labels and scales. Notes from Appendix A: The targets are limited to linear and exponential equations, and, in the case of exponential equations, limited to situations requiring evaluation of exponential functions at integer inputs	Create at least two equations in two or more variables to represent relationships between quantities Justify which quantities in a mathematical problem or real-world situation are dependent and independent of one another and which operations represent those relationships. Determine appropriate units for the labels and scale of a graph depicting the relationship between equations created in two or more variables. Notes from Appendix A: The targets are limited to linear and exponential equations, and, in the case of exponential equations, limited to situations requiring evaluation of exponential functions at integer inputs		

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Grade Level/ Course (HS): Algebra 1 Unit 1	
Standard with code:	**A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.** ***For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.***
Domain:	**Creating Equations***
Cluster:	**Create equations that describe numbers or relationships**
Type: ___ __Knowledge ___X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize when a modeling context involves constraints. From Appendix A: Limit targets to linear equations and inequalities.	Interpret solutions as viable or nonviable options in a modeling context. Determine when a problem should be represented by equations, inequalities, systems of equations and/ or inequalities. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities. From Appendix A: Limit targets to linear equations and inequalities.		

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Grade Level/ Course: Algebra 1 Unit 1	
Standard:	**A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.** ***For example, rearrange Ohm's law V = IR to highlight resistance R.***
Domain:	**Creating Equations* (*Modeling Domain)**
Cluster:	**Create equations that describe numbers and relationships**
Type: _____Knowledge ___X__ Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define a "quantity of interest" to mean any numerical or algebraic quantity. (e.g. $2\left(\frac{a}{b}\right) = d$, in which 2 is the quantity of interest showing that d must be even; $\frac{\pi r^2 h}{3} = V_{cone}$ and $\pi r^2 h = V_{cylinder}$ showing that $V_{cylinder} = 3 * V_{cone}$) From Appendix A: Limit A.CED.4 to formulas which are linear in the variable of interest.	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (e.g. $\pi * r^2$ can be re-written as $(\pi * r) * r$ which makes the form of this expression resemble b*h.) From Appendix A: Unit 1 is limited to formulas which are linear in the variable of interest.		

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Grade Level/ Course: Algebra 1 Unit 1	
Standard with code:	**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.**
Domain:	**Reasoning with equations and inequalities**
Cluster:	**Understand solving equations as a process of reasoning and explain the reasoning.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Know that solving an equation means that the equation remains balanced during each step. Recall the properties of equality. Explain why, when solving equations, it is assumed that the original equation is equal. From Appendix A: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses.	Determine if an equation has a solution. Choose an appropriate method for solving the equation. Justify solution(s) to equations by explaining each step in solving a simple equation using the properties of equality, beginning with the assumption that the original equation is equal. Construct a mathematically viable argument justifying a given, or self-generated, solution method.		

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Grade Level/ Course: Algebra 1 Unit 1	
Standard:	**A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Solve equations and inequalities in one variable**
Type: _____Knowledge ___ X __Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recall properties of equality Solve multi-step equations in one variable Solve multi-step inequalities in one variable	Determine the effect that rational coefficients have on the inequality symbol and use this to find the solution set. Solve equations and inequalities with coefficients represented by letters.		

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**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 $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.***
Domain:	**The Real Number System**
Cluster:	**Extend the properties of exponents to rational exponents**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define radical notation as a convention used to represent rational exponents.	Explain the properties of operations of rational exponents as an extension of the properties of integer exponents. Explain how radical notation, rational exponents, and properties of integer exponents relate to one another. Note from Appendix A: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.		

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.**
Domain:	**The Real Number System**
Cluster:	**Extend the properties of exponents to rational exponents**
Type: __X__Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Using the properties of exponents, rewrite a radical expression as an expression with a rational exponent. Using the properties of exponents, rewrite an expression with a rational exponent as a radical expression. Notes from Appendix A: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.			

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**A.REI.5 Prove 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.**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Solve system of equations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize and use properties of equality to maintain equivalent systems of equations.	Justify that replacing one equation in a two-equation system with the sum of that equation and a multiple of the other will yield the same solutions as the original system.		

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Grade Level/ Course: Algebra 1 Unit 2	
Standard with code:	**A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Solve systems of equations**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Solve systems of linear equations by any method.	Justify the method used to solve systems of linear equations exactly and approximately focusing on pairs of linear equations in two variables. Notes from Appendix A: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines.		

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**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).**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Represent and solve equations and inequalities graphically**
Type: ___X ___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize that the graphical representation of an equation in two variables is a curve, which may be a straight line. Explain why each point on a curve is a solution to its equation. Notes from Appendix A: For A.REI.10, focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.			

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard:	**A.REI.11 Explain why the *x*-coordinates of the points where the graphs of the equations *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, make tables of values, or find successive approximations. Include cases where *f*(*x*) and/or *g*(*x*) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* (Modeling standard)**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	Represent and solve equations and inequalities graphically
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize and use function notation to represent linear and exponential equations Recognize that if (x_1, y_1) and (x_2, y_2) share the same location in the coordinate plane that $x_1 = x_2$ and $y_1 = y_2$. Recognize that f(x) = g(x) means that there may be particular inputs of f and g for which the outputs of f and g are equal. Notes from Appendix A: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential.	Explain why the x-coordinates of the points where the graph of the equations y=f(x) and y=g(x) intersect are the solutions of the equations f(x) = g(x) . (Include cases where f(x) and/or g(x) are linear and exponential equations) Approximate/find the solution(s) using an appropriate method for example, using technology to graph the functions, make tables of values or find successive approximations (Include cases where f(x) and/or g(x) are linear and exponential equations).		

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Grade Level/ Course (HS): Algebra 1Unit 2	
Standard with code:	**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.**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Represent and Solve Equations and Inequalities Graphically**
Type: _____Knowledge _____Reasoning _____Performance Skill __X____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify characteristics of a linear inequality and system of linear inequalities, such as: boundary line (where appropriate), shading, and determining appropriate test points to perform tests to find a solution set.	Explain the meaning of the intersection of the shaded regions in a system of linear inequalities.		Graph a line, or boundary line, and shade the appropriate region for a two variable linear inequality. Graph a system of linear inequalities and shade the appropriate overlapping region for a system of linear inequalities.

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Grade Level/ Course: Algebra I Unit 2	
Standard with code:	**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*).**
Domain:	**Interpreting Functions**
Cluster:	**Understand the concept of a function and use function notation.**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify the domain and range of a function. Determine if a relation is a function. Determine the value of the function with proper notation (i.e. f(x)=y, the y value is the value of the function at a particular value of x) Evaluate functions for given values of x. Note from Appendix A: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses.			

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Grade Level/ Course: Algebra I Unit 2	
Standard with code:	**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.**
Domain:	**Interpreting Functions**
Cluster:	**Understand the concept of a function and use function notation.**
Type: _____Knowledge __X ____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify mathematical relationships and express them using function notation. Define a reasonable domain, which depends on the context and/or mathematical situation, for a function focusing on linear and exponential functions. Evaluate functions at a given input in the domain, focusing on linear and exponential functions.	Interpret statements that use functions in terms of real world situations, focusing on linear and exponential functions. Note from Appendix A: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses.		

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Grade Level/ Course: Algebra I Unit 2	
Standard with code:	**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.***
Domain:	**Interpreting Functions**
Cluster:	**Understand the concept of a function and use function notation.**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
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.* Notes from Appendix A: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions. In F.IF.3, draw connection to F.BF.2, which requires students to write arithmetic and geometric sequences. Emphasize arithmetic and geometric sequences as examples of linear and exponential functions.			

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Grade Level/Course (high School): Algebra I Unit 2	
Standard with Code:	**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.**(*Modeling standard)**
Domain:	**Interpreting Functions**
Cluster:	**Interpret functions that arise in applications in terms of the context.**

Type: _____Knowledge __X __Reasoning ___ __Performance Skill __ ___Product

Knowledge Targets	Reasoning Targets	Performance Skill Targets	Product Targets
Define and recognize the key features in tables and graphs of linear and exponential functions: intercepts; intervals where the function is increasing, decreasing, positive, or negative, and end behavior. Identify whether the function is linear or exponential, given its table or graph. Notes from Appendix A: Focus on linear and exponential.	Interpret key features of graphs and tables of functions in the terms of the contextual quantities the function represents. Sketch graphs showing key features of a function that models a relationship between two quantities from a given verbal description of the relationship. Notes from Appendix A: Focus on linear and exponential.		

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Grade Level/ Course: Algebra I Unit 2	
Standard with code:	**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.*(*Modeling standard)**
Domain:	**Interpreting Functions**
Cluster:	**Interpret functions that arise in applications in terms of a context**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Given the graph or a verbal/written description of a function, identify and describe the domain of the function. Identify an appropriate domain based on the unit, quantity, and type of function it describes. Notes from Appendix A: For F.IF.4 and 5, focus on linear and exponential functions in Algebra 1 unit 2.	Relate the domain of the function to its graph and, where applicable, to the quantitative relationship it describes. Explain why a domain is appropriate for a given situation.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/Course (high School): Algebra I Unit 2	
Standard with Code:	**F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*(Modeling standard)**
Domain:	**Interpreting Functions**
Cluster:	**Interpret functions that arise in applications in terms of a context**

Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product

Knowledge Targets	Reasoning Targets	Performance Skill Targets	Product Targets
Recognize slope as an average rate of change. Calculate the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a linear or exponential graph. Notes from Appendix A: Focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 of the Traditional Algebra 1 Pathway and the Traditional Algebra II Pathway address other types of functions.	Interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 2	
Standard with code:	**F.IF.7a Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard)** **a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Graph linear functions by hand in simple cases or using technology for more complicated cases and show/label intercepts of the graph. Note from Appendix A: Focus linear functions. Include comparisons of two functions presented algebraically. For example, compare two linear functions.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 2	
Standard with code:	**F.IF.7e Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard)** **e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X ___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Graph exponential functions, by hand in simple cases or using technology for more complicated cases, and show intercepts and end behavior. Note from Appendix A: Focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$.	Determine the differences between simple and complicated linear and exponential functions and know when the use of technology is appropriate.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 2	
Standard with code:	**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.***
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, growth rates, average rates of change, and end behaviors) Differentiate between exponential and linear functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) Note from Appendix A: Focus on linear and exponential functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$.	Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**F.BF.1a Write a function that describes a relationship between two quantities.*(Modeling standard)** **a. Determine an explicit expression, a recursive process, or steps for calculation from a context.**
Domain:	**Building Functions**
Cluster:	**Build a function that models a relationship between two quantities**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define "explicit function" and "recursive process". Note from Appendix A: Limit to F.BF.1a to linear and exponential functions	Write a function that describes a relationship between two quantities by determining an explicit expression, a recursive process, or steps for calculation from a context. Note from Appendix A: Limit to F.BF.1a to linear and exponential functions		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**F.BF.1b Write a function that describes a relationship between two quantities.*(Modeling standard)** **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.***
Domain:	**Building Functions**
Cluster:	**Build a function that models a relationship between two quantities**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Combine two functions using the operations of addition, subtraction, multiplication, and division Evaluate the domain of the combined function. Note from Appendix A: Limit to linear and exponential functions.	Given a real-world situation or mathematical problem: • build standard functions to represent relevant relationships/ quantities, • determine which arithmetic operation should be performed to build the appropriate combined function, and • relate the combined function to the context of the problem Note from Appendix A: Limit to linear and exponential functions.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**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.*(*Modeling standard)**
Domain:	**Building Functions**
Cluster:	**Build a function that models a relationship between two quantities**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify arithmetic and geometric patterns in given sequences. Generate arithmetic and geometric sequences from recursive and explicit formulas. Given an arithmetic or geometric sequence in recursive form, translate into the explicit formula. Given an arithmetic or geometric sequence as an explicit formula, translate into the recursive form. Notes from Appendix A: Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.	Use given and constructed arithmetic and geometric sequences, expressed both recursively and with explicit formulas, to model real-life situations. Determine the recursive rule given arithmetic and geometric sequences. Determine the explicit formula given arithmetic and geometric sequences. Justify the translation between the recursive form & explicit formula for arithmetic and geometric sequences. Notes from Appendix A: Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**F.BF.3 Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k f*(*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.***
Domain:	**Building Functions**
Cluster:	**Build new functions from existing functions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Given a single transformation on a function (symbolic or graphic) identify the effect on the graph. Using technology, identify effects of single transformations on graphs of functions. Graph a given function by replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative).	Describe the differences and similarities between a parent function and the transformed function. Find the value of k, given the graphs of a parent function, f(x), and the transformed function: f(x) + k, k f(x), f(kx), or f(x + k). Recognize even and odd functions from their graphs and from their equations. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Notes from Appendix A: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**F.LE.1a Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals; and that exponential functions grow by equal factors over equal intervals.**
Domain:	**Linear, Quadratic, and Exponential Models *(*Modeling Domain)**
Cluster:	**Construct and compare linear and exponential models and solve problems**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize that linear functions grow by equal differences over equal intervals. Recognize that exponential functions grow by equal factors over equal intervals.	Distinguish between situations that can be modeled with linear functions and with exponential functions to solve mathematical and real-world problems. Prove that linear functions grow by equal differences over equal intervals. Prove that exponential functions grow by equal factors over equal intervals.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**F.LE.1b Distinguish between situations that can be modeled with linear functions and with exponential functions.** **b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.**
Domain:	**Linear, Quadratic, and Exponential Models *(*Modeling Domain)**
Cluster:	**Construct and compare linear, quadratic, and exponential models and solve problems**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize situations in which one quantity changes at a constant rate per unit (equal differences) interval relative to another to solve mathematical and real-world problems.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**F.LE.1c Distinguish between situations that can be modeled with linear functions and with exponential functions.** **c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.**
Domain:	**Linear, Quadratic, and Exponential Models *(*Modeling Domain)**
Cluster:	**Construct and compare linear, quadratic, and exponential models and solve problems**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize situations in which a quantity grows or decays by a constant percent rate per unit (equal factors) interval relative to another to solve mathematical and real-world problems.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**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).**
Domain:	**Linear, Quadratic, and Exponential Models *(Modeling Domain)**
Cluster:	**Construct and compare linear, quadratic, and exponential models and solve problems**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize arithmetic sequences can be expressed as linear functions. Recognize geometric sequences can be expressed as exponential functions. Construct linear functions, including arithmetic sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). Construct exponential functions, including geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	Determine when a graph, a description of a relationship, or two input-output pairs (include reading these from a table) represents a linear or exponential function in order to solve problems.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.**
Domain:	**Linear, Quadratic, and Exponential Models *(Modeling Domain)**
Cluster:	**Construct and compare linear, quadratic, and exponential models and solve problems**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Informally define the concept of “end behavior”.	Compare tables and graphs of linear and exponential functions to observe that a quantity increasing exponentially exceeds all others to solve mathematical and real-world problems. Note from Appendix A: Limit to comparisons between linear and exponential models.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 2	
Standard with code:	**F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.**
Domain:	**Linear, Quadratic, and Exponential Models *(Modeling Domain)**
Cluster:	**Interpret expressions for functions in terms of the situation they model**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize the parameters in a linear or exponential function including: vertical and horizontal shifts, vertical and horizontal dilations. Recognize rates of change and intercepts as "parameters" in linear or exponential functions.	Interpret the parameters in a linear or exponential function in terms of a context.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). (Statistics and Probability is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Summarize, represent, and interpret data on a single count or measurement variable**
Type: _X_ Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Represent data with plots on the real number line using various display types by creating dot plots, histograms and box plots.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**S.ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (Statistics and Probability is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Summarize, represent, and interpret data on a single count or measurement variable**
Type: _____Knowledge ___X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
From Appendix A: In grades 6-8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution such as the shape of the distribution or the existence of extreme data points.	Choose the appropriate measure for center (mean, median) and spread (interquartile range, standard deviation) based on the shape of a data distribution. Use appropriate statistics for center and spread to compare two or more data sets.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**S.ID.3 Interpret differences in shape, center and spread in the context of data sets, accounting for possible effects of extreme data points (outliers).** **(Statistics and Probability is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Summarize, represent, and interpret data on a single count or measurement variable**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define "the context of data sets" as meaning the specific nature of the attributes under investigation.	Interpret differences in shape, center and spread in the context of data sets. Describe the possible effects the presence of outliers in a set of data can have on shape, center, and spread in the context of the data sets.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**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 is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Summarize, represent, and interpret data on two categorical and quantitative variables**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Recognize the differences between joint, marginal and conditional relative frequencies. Calculate relative frequencies including joint, marginal and conditional relative frequencies. Summarize categorical data for two categories in two-way frequency tables.	Interpret relative frequencies in the context of the data. Recognize possible associations and trends in the data.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**S.ID.6a 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 and exponential models.* (Statistics and Probability is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Summarize, represent, and interpret data on two categorical and quantitative variables.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Represent data on a scatter plot (2 quantitative variables). Fit a given function class (e.g. linear, exponential) to data.	Using given scatter plot data represented on the coordinate plane, informally describe how the two quantitative variables are related. Determine which function best models scatter plot data represented on the coordinate plane, and describe how the two quantitative variables are related. Use functions fitted to data to solve problems in the context of the data. From Appendix A: Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**S.ID.6b Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. b. Informally assess the fit of a function by plotting and analyzing residuals. (Statistics and Probability is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Summarize, represent, and interpret data on two categorical and quantitative variables.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Represent the residuals from a function and the data set it models numerically and graphically.	Informally assess the fit of a function by analyzing residuals from the residual plot. From Appendix A: Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. Focus on linear models, however, this standard could also preview quadratic functions in Unit 5 of Algebra I.		

Make sense of problems and persevere in so lving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**S.ID.6c Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.** **c. Fit a linear function for a scatter plot that suggests a linear association.** **(Statistics and Probability is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Summarize, represent, and interpret data on two categorical and quantitative variables.**
Type: ___ ___Knowledge _X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
From Appendix A: By the end of Middle School, students were creating scatter plots and recognizing linear trends in data. This unit builds upon that prior experience, providing students with more formal means of assessing how a model fits data.	Fit a linear function for a scatter plot that suggests a linear association.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**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 is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Interpret linear models.**
Type: _____Knowledge _X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
From Appendix A: Build on students' work with linear relationships in eighth grade.	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 3	
Standard with code:	**S.ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. (Statistics and Probability is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Interpret linear models.**
Type: _____Knowledge _X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Compute (using technology) the correlation coefficient of a linear fit. Define the correlation coefficient.	Interpret the correlation coefficient of a linear fit as a measure of how well the data fit the relationship. From Appendix A: Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra I Unit 3	
Standard with code:	**S.ID.9 Distinguish between correlation and causation.** **(Statistics and Probability is a Modeling Conceptual Category.)**
Domain:	**Interpreting Categorical and Quantitative Data**
Cluster:	**Interpret Linear Models**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define positive, negative, and no correlation and explain why correlation does not imply causation. Define causation.	Distinguish between correlation and causation. From Appendix A: Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 4	
Standard with code:	**A.SSE.1a Interpret expressions that represent a quantity in terms of its context.* (*Modeling standard)** **a. Interpret parts of an expression, such as terms, factors, and coefficients.**
Domain:	**Seeing Structure in Expressions**
Cluster:	**Interpret the structure of expressions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. Note from Appendix A: Extend to quadratic and exponential expressions	For expressions that represent a contextual quantity, interpret parts of an expression, such as terms, factors, and coefficients in terms of the context. Note from Appendix A: Extend to quadratic and exponential expressions		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 4	
Standard with code:	**A.SSE.1b Interpret expressions that represent a quantity in terms of its context.* (Modeling standard)** **b. Interpret complicated expressions by viewing one or more of their parts as a single entity.** ***For example, interpret*** $P(1+r)^n$ ***as the product of P and a factor not depending on P.***
Domain:	**Seeing Structure in Expressions**
Cluster:	**Interpret the structure of expressions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
The underpinning knowledge for this standard is addressed in **A.SSE.1a:** For expressions that represent a contextual quantity, define and recognize parts of an expression, such as terms, factors, and coefficients. Notes from Appendix A: Extend to exponential and quadratic expressions, extend exponents to rational exponents focusing on those that represent square or cube roots.	For expressions that represent a contextual quantity, interpret complicated expressions, in terms of the context, by viewing one or more of their parts as a single entity. Notes from Appendix A: Extend to exponential and quadratic expressions, extend exponents to rational exponents focusing on those that represent square or cube roots.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 4	
Standard with code:	**A.SSE.2 Use the structure of an expression to identify ways to rewrite it.** ***For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.***
Domain:	**Seeing Structure in Expressions**
Cluster:	**Interpret the structure of expressions.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify ways to rewrite expressions, such as difference of squares, factoring out a common monomial, regrouping, etc. Identify various structures of expressions (e.g. an exponential monomial multiplied by a scalar of the same base, difference of squares in terms other than just x) Notes from Appendix A: Focus on quadratics and exponential expressions	Use the structure of an expression to identify ways to rewrite it. Classify expressions by structure and develop strategies to assist in classification. Notes from Appendix A: Focus on quadratics and exponential expressions		

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Grade Level/ Course: Algebra 1 Unit 4	
Standard with code:	**A.SSE.3a Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*(Modeling standard)** **a. Factor a quadratic expression to reveal the zeros of the function it defines.**
Domain:	**Seeing Structure in Expressions**
Cluster:	**Write expressions in equivalent forms to solve problems.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Factor a quadratic expression to produce an equivalent form of the original expression Explain the connection between the factored form of a quadratic expression and the zeros of the function it defines. Explain the properties of the quantity represented by the quadratic expression.	Choose and produce an equivalent form of a quadratic expression to reveal and explain properties of the quantity represented by the original expression. Notes from Appendix A: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 4	
Standard with code:	**A.SSE.3b Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.* (Modeling standard)** **b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.**
Domain:	**Seeing Structure in Expressions**
Cluster:	**Write expressions in equivalent forms to solve problems.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Complete the square on a quadratic expression to produce an equivalent form of an expression. Explain the connection between the completed square form of a quadratic expression and the maximum or minimum value of the function it defines. Explain the properties of the quantity represented by the expression.	Choose and produce an equivalent form of a quadratic expression to reveal and explain properties of the quantity represented by the original expression. Notes from Appendix A: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 4	
Standard with code:	**A.SSE.3c Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.* (*Modeling standard)** **c. Use the properties of exponents to transform expressions for exponential functions.** ***For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.01212^t$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.***
Domain:	**Seeing Structure in Expressions**
Cluster:	**Write expressions in equivalent forms to solve problems.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Use the properties of exponents to transform simple expressions for exponential functions. Use the properties of exponents to transform expressions for exponential functions.	Choose and produce an equivalent form of an exponential expression to reveal and explain properties of the quantity represented by the original expression. Explain the properties of the quantity or quantities represented by the transformed exponential expression.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 4	
Standard with code:	**A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.**
Domain:	**Arithmetic with Polynomial and Rational Expressions**
Cluster:	**Perform arithmetic operations on polynomials**
Type: ___X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify that the sum, difference, or product of two polynomials will always be a polynomial, which means that polynomials are closed under the operations of addition, subtraction, and multiplication. Define “closure”. Apply arithmetic operations of addition, subtraction, and multiplication to polynomials. Note from Appendix A: Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 1	
Standard with code:	**A.CED.1 Create equations and inequalities in one variable and use them to solve problems.** ***Include equations arising from linear and quadratic functions, and simple rational and exponential functions.***
Domain:	**Creating Equations* (*Modeling Domain)**
Cluster:	**Create equations that describe numbers or relationships**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Solve linear and exponential equations in one variable. Solve inequalities in one variable. Describe the relationships between the quantities in the problem (for example, how the quantities are changing or growing with respect to each other); express these relationships using mathematical operations to create an appropriate equation or inequality to solve. Note from Appendix A: Limit to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.	Create equations (linear and exponential) and inequalities in one variable and use them to solve problems. Create equations and inequalities in one variable to model real-world situations. Compare and contrast problems that can be solved by different types of equations (linear & exponential).		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 4	
Standard:	**A.CED.2 Create equations in two or more variables to represent relationships between quantities, graph equations on a coordinate axes with labels and scales.**
Domain:	**Create Equations and describe***
Cluster:	**Create equations that describe numbers or relationships**
Type: _____Knowledge ____X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify the quantities in a mathematical problem or real-world situation that should be represented by distinct variables and describe what quantities the variables represent. Graph one or more created equation on a coordinate axes with appropriate labels and scales. Appendix A: the targets extend work on linear and exponential equation in Unit 1 to quadratic equations.	Create at least two equations in two or more variables to represent relationships between quantities Justify which quantities in a mathematical problem or real-world situation are dependent and independent of one another and which operations represent those relationships. Determine appropriate units for the labels and scale of a graph depicting the relationship between equations created in two or more variables.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 4	
Standard:	**A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.** ***For example, rearrange Ohm's law V = IR to highlight resistance R.***
Domain:	**Creating Equations* (*Modeling Domain)**
Cluster:	**Create equations that describe numbers and relationships**
Type: _____Knowledge ___X__ Reasoning _____Performance Skill _____Product	

Knowledge Targets	**Reasoning Targets**	**Performance Skills Targets**	**Product Targets**
Define a "quantity of interest" to mean any numerical or algebraic quantity (e.g. $2\left(\frac{a}{b}\right) = d$, in which 2 is the quantity of interest showing that d must be even; $\frac{\pi r^2 h}{3} = V_{cone}$ and $\pi r^2 h = V_{cylinder}$ showing that $V_{cylinder} = 3 * V_{cone}$) From Appendix A: Extend A.CED.4 to formulas involving squared variables.	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (e.g. $\pi * r^2$ can be re-written as (π *r)*r which makes the form of this expression resemble b*h.)		

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Grade Level/ Course: Algebra 1 Unit 4	
Standard with code:	**A.REI.4a 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. Derive the quadratic formula from this form.**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Solve equations and inequalities in one variable.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
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. Solve quadratic equations in one variable. Notes from Appendix A: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II.	Derive the quadratic formula by completing the square on a quadratic equation in x.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 4	
Standard with code:	**A.REI.4b Solve quadratic equations in one variable.** **b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.**
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Solve equations and inequalities in one variable.**
Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring Express complex solutions as a ± bi for real numbers solutions as a and b.	Determine appropriate strategies (see first knowledge target listed) to solve problems involving quadratic equations, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions. Note from Appendix A: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II.		

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Grade Level/ Course: Algebra 1 Unit 4	
Standard with code:	**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 $x^2 + y^2 = 3$.***
Domain:	**Reasoning with Equations and Inequalities**
Cluster:	**Solve systems of equations**
Type: ___X___Knowledge ____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Transform a simple system consisting of a linear equation and a quadratic equation in 2 variables so that a solution can be found algebraically and graphically. Notes from Appendix A: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2 + y^2 = 1$ and y = $\frac{x+1}{2}$ leads to the point ($\frac{3}{5}$, $\frac{4}{5}$) on the unit circle, corresponding to the Pythagorean triple of $3^2 + 4^2 = 5^2$.	Explain the correspondence between the algebraic & graphical solutions to a simple system consisting of a linear equation and a quadratic equation in 2 variables.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/Course (HS): Algebra 1 Unit 5	
Standard with Code:	**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.**
Domain:	**The Real Number System**
Cluster:	**Use properties of rational and irrational numbers.**

Type: _____Knowledge __X__Reasoning ___ __Performance Skill _____Product

Knowledge Targets	Reasoning Targets	Performance Skill Targets	Product Targets
Find the sums and products of rational and irrational numbers. Recognize that the sum of a rational number and an irrational number is irrational. Recognize that the product of a nonzero rational number and an irrational number is irrational.	Explain why rational numbers are closed under addition or multiplication. Note from Appendix A: Connect N.RN.3 to physical situations, e.g., finding the perimeter of a square of area 2.		

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Grade Level/Course (high School): Algebra I Unit 5	
Standard with Code:	**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.**(Modeling standard)**
Domain:	**Interpreting Functions**
Cluster:	**Interpret functions that arise in applications in terms of the context.**

Type: _____Knowledge __X __Reasoning _____Performance Skill _____Product

Knowledge Targets	Reasoning Targets	Performance Skill Targets	Product Targets
Define and recognize the key features in tables and graphs of linear, exponential, and quadratic functions: intercepts; intervals where the function is increasing, decreasing, positive, or negative, relative maximums and minimums, symmetries, and end behavior. Identify whether the function is linear, exponential, or quadratic, given its table or graph.	Interpret key features of graphs and tables of functions in the terms of the contextual quantities the function represents. Sketch graphs showing key features of a function that models a relationship between two quantities from a given verbal description of the relationship. Notes from Appendix A: Focus on quadratic functions; compare with linear and exponential functions studied in unit 2.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 5	
Standard with code:	**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.*****(Modeling standard)**
Domain:	**Interpreting Functions**
Cluster:	**Interpret functions that arise in applications in terms of a context**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Given the graph or a verbal/written description of a function, identify and describe the domain of the function. Identify an appropriate domain based on the unit, quantity, and type of function it describes. Note from Appendix A: Focus on quadratic functions; compare with linear and exponential functions studied in Unit 2.	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Explain why a domain is appropriate for a given real-world situation.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/Course (high School): Algebra 1 Unit 5	
Standard with Code:	**F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*(Modeling standard)**
Domain:	**Interpreting Functions**
Cluster:	**Interpret functions that arise in applications in terms of a context**

Type: _____Knowledge __X__Reasoning _____Performance Skill _____Product

Knowledge Targets	Reasoning Targets	Performance Skill Targets	Product Targets
Recognize slope as an average rate of change. Calculate the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a linear, exponential, or quadratic graph.	Interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Note from Appendix A: Focus on quadratic functions; compare with linear and exponential functions studied in Unit 2 of the Traditional Algebra 1 Pathway.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 5	
Standard with code:	**F.IF.7a Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard)** **a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Graph linear and quadratic functions, by hand in simple cases or using technology for more complicated cases, and show/label intercepts, maxima, and minima of the graph.	Determine the differences between simple and complicated linear, exponential and quadratic functions and know when the use of technology is appropriate.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course: Algebra 1 Unit 5	
Standard with code:	**F.IF.7b Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(Modeling standard)** **b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions, by hand in simple cases or using technology for more complicated cases, and show/label key features of the graph. Notes from Appendix A: Compare and contrast absolute value, step and piece-wise defined functions with linear, quadratic, and exponential functions. Highlight issues of domain, range, and usefulness when examining piece-wise defined functions.	Determine the difference between simple and complicated linear, quadratic, square root, cube root, and piecewise-defined functions, including step functions and absolute value functions and know when the use of technology is appropriate. Compare and contrast the domain and range of absolute value, step and piece-wise defined functions with linear, quadratic, and exponential.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/Course (high School): Algebra 1 Unit 5	
Standard with Code:	**F.IF.8a 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.**
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations.**
Type: _____Knowledge __X_Reasoning _____Performance Skill ____Product	

Knowledge Targets	Reasoning Targets	Performance Skill Targets	Product Targets
Identify different forms of a quadratic expression. Write functions in equivalent forms using the process of factoring Identify zeros, extreme values, and symmetry of the graph of a quadratic function	Interpret different but equivalent forms of a function defined by an expression in terms of a context 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. Note from Appendix A: Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): HS Algebra 1 Unit 5	
Standard with code:	**F.IF.8b Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function:** **b. Use the properties of exponents to interpret expressions for exponential functions.** ***For example: identify percent rate of change in functions such as*** $y= (1.02)^t$, $y=(.97)^t$, $y=(1.01)^{12t}$, $y=(1.2)^{t/10}$***, and classify them as representing exponential growth or decay.***
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X ___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Classify the exponential function as exponential growth or decay by examining the base.	Use the properties of exponents to interpret expressions for exponential functions in a real-world context. Note from Appendix A: Note this unit extends the work begun in Unit 2 on exponential functions with integer exponents.		

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Grade Level/ Course: Algebra 1 Unit 5	
Standard with code:	**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.***
Domain:	**Interpreting Functions**
Cluster:	**Analyze functions using different representations**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Identify types of functions based on verbal , numerical, algebraic, and graphical descriptions and state key properties (e.g. intercepts, maxima, minima, growth rates, average rates of change, and end behaviors) Differentiate between exponential, linear, and quadratic functions using a variety of descriptors (graphically, verbally, numerically, and algebraically) Note from Appendix A: Focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored.	Use a variety of function representations (algebraically, graphically, numerically in tables, or by verbal descriptions) to compare and contrast properties of two functions		

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Grade Level/ Course (HS): Algebra 1 Unit 5	
Standard with code:	**F.BF.1a Write a function that describes a relationship between two quantities.*(Modeling standard)** **a. Determine an explicit expression, a recursive process, or steps for calculation from a context.**
Domain:	**Building Functions**
Cluster:	**Build a function that models a relationship between two quantities**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define "explicit function" and "recursive process". Note from Appendix A: Focus on situations that exhibit a quadratic relationship. This standard builds from Algebra 1 Unit 2.	Write a function that describes a relationship between two quantities by determining an explicit expression, a recursive process, or steps for calculation from a context.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 5	
Standard with code:	**F.BF.1b Write a function that describes a relationship between two quantities.*(Modeling standard)** **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.***
Domain:	**Building Functions**
Cluster:	**Build a function that models a relationship between two quantities**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Combine two functions using the operations of addition, subtraction, multiplication, and division Evaluate the domain of the combined function. Note from Appendix: Focus on situations that exhibit a quadratic relationship.	Given a real-world situation or mathematical problem: • build standard functions to represent relevant relationships/ quantities • determine which arithmetic operation should be performed to build the appropriate combined function • relate the combined function to the context of the problem		

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Grade Level/ Course (HS): Algebra 1 Unit 5	
Standard with code:	**F.BF.3 Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k f*(*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.***
Domain:	**Building Functions**
Cluster:	**Build new functions from existing functions**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Given a single transformation on a function (symbolic or graphic) identify the effect on the graph. Using technology, identify effects of single transformations on graphs of functions. Graph a given function by replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative).	Describe the differences and similarities between a parent function and the transformed function. Find the value of k, given the graphs of a parent function, f(x), and the transformed function: f(x) + k, k f(x), f(kx), or f(x + k). Recognize even and odd functions from their graphs and from their equations. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Note from Appendix A: focus on quadratic functions, and consider including absolute value functions.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 5	
Standard with code:	**F.BF.4a Find the inverse functions.** **a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse.** ***For example:*** $f(x) = 2x^3$ ***or*** $f(x) = (x+1)/(x-1)$ ***for x ≠ 1.***
Domain:	**Building Functions**
Cluster:	**Building New Functions from Existing Functions**
Type: __X___Knowledge _____Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Define inverse function. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. Notes from Appendix A: Focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as f(x) = x^2, x>0.			

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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Grade Level/ Course (HS): Algebra 1 Unit 5	
Standard with code:	**F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.**
Domain:	**Linear, Quadratic, and Exponential Models *(Modeling Domain)**
Cluster:	**Construct and compare linear, quadratic, and exponential models and solve problems**
Type: _____Knowledge ___X___Reasoning _____Performance Skill _____Product	

Knowledge Targets	Reasoning Targets	Performance Skills Targets	Product Targets
Fluently compute growth rates for linear, exponential and quadratic functions.	Compare tables and graphs of exponential and other polynomial functions to observe that a quantity increasing exponentially exceeds all others to solve mathematical and real-world problems. Notes from Appendix A: Compare linear and exponential growth to quadratic growth.		

Make sense of problems and persevere in solving them.	Reason abstractly and quantitatively.	Construct viable arguments and critique the reasoning of others.	Model with mathematics.	Use appropriate tools strategically.	Attend to precision.	Look for and make use of structure.	Look for and express regularity in repeated reasoning.

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