Algebra 1 Mathematics Item Specifications

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Introduction

In 2014 Missouri legislators passed House Bill 1490, mandating the development of the Missouri Learning Expectations. In April of 2016, these Missouri Learning Expectations were adopted by the State Board of Education. Groups of Missouri educators from across the state collaborated to create the documents necessary to support the implementation of these expectations.

One of the documents developed is the item specification document, which includes all Missouri grade level/course expectations arranged by domains/strands. It defines what could be measured on a variety of assessments. The document serves as the foundation of the assessment development process.

Although teachers may use this document to provide clarity to the expectations, these specifications are intended for summative, benchmark, and large-scale assessment purposes.

Components of the item specifications include:

Expectation Unwrapped breaks down a list of clearly delineated content and skills the students are expected to know and be able to do upon mastery of the Expectation.

Depth of Knowledge (DOK) Ceiling indicates the highest level of cognitive complexity that would typically be assessed on a large scale assessment. The DOK ceiling is not intended to limit the complexity one might reach in classroom instruction.

Item Format indicates the types of items used in large scale assessment. For each expectation, the item format specifies the type best suited for that particular expectation.

Text Types suggests a broad list of text types for both literary and informational expectations. This list is not intended to be all inclusive: other text types may be used in the classroom setting. The expectations were written in grade level bands; for this reason, the progression of the expectations relies upon increasing levels of quantitative and qualitative text complexities.

Content Limits/Assessment Boundaries are parameters that item writers should consider when developing a large scale assessment. For example, some expectations should not be assessed on a large scale assessment but are better suited for local assessment.

Sample stems are examples that address the specific elements of each expectation and address varying DOK levels. The sample stems provided in this document are in no way intended to limit the depth and breadth of possible item stems. The expectation should be assessed in a variety of ways.

Mathematics		A1.NQ.A.1
NQ A 1	**Number and Quantity** **Extend and use properties of rational exponents.** Explain how the meaning of rational exponents extends from the properties of integer exponents.	

Expectation Unwrapped

The student will explain the properties of exponents, including rational exponents.

The student will articulate in words the properties of exponents using rational exponents.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

$x^{\frac{1}{2}} \cdot x^{\frac{1}{5}} = x^{\frac{7}{10}}$

$\frac{x^{\frac{1}{2}}}{x^{\frac{1}{4}}} = x^{\frac{1}{4}}$

$\left(x^{\frac{1}{5}}\right)^{5} = x$

Content Limits/Assessment Boundaries
Limit rational exponent numerators to one and rational exponent denominators to natural numbers less than or equal to ten in the prompt; however the response may have numerators greater than one.
Items may have algebraic or numeric expressions.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.NQ.A.2
NQ A 2	**Number and Quantity** **Extend and use properties of rational exponents.** Rewrite expressions involving radicals and rational exponents using the properties of exponents. Limit to rational exponents with a numerator of 1.	

Expectation Unwrapped

The student will rewrite expressions with rational exponents as equivalent radical expressions.

The student will rewrite radical expressions as equivalent expressions with rational exponents.

DOK Ceiling

1

Item Format

Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Which of the following are equivalent to $\sqrt[4]{81}$. (multi-select)

$\sqrt[2]{9}$
$\sqrt[3]{27}$
9
3
$(9)^{1/2}$
$(81)^{1/2}$

Content Limits/Assessment Boundaries

Limit rational exponent numerators to one and rational exponent denominators to natural numbers less than or equal to ten; however the response may have numerators greater than one.

Calculator Designation

YES – a calculator will be available for items

Mathematics		A1.NQ.B.3.a
NQ	**Number and Quantity**	
B	**Use units to solve problems.**	
3	Use units of measure as a way to understand and solve problems involving quantities.	
a	Identify, label and use appropriate units of measure within a problem.	

Expectation Unwrapped

The student will identify, label and use appropriate units of measure within the context of problems involving quantities such as rates, time, length, area and capacity.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Do not provide conversions when converting within systems of measurement.
Provide conversions when converting between systems of measurement.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.NQ.B.3.b
NQ	**Number and Quantity**	
B	**Use units to solve problems.**	
3	Use units of measure as a way to understand and solve problems involving quantities.	
b	Convert units and rates.	

Expectation Unwrapped

The student will convert units.

The student will convert rates.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Do not provide conversions when converting within systems of measurement.
Provide embedded conversions when converting between systems of measurement.
Prompt may require converting units of area or volume, or it may require converting between rates.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.NQ.B.3.c
NQ	**Number and Quantity**	
B	**Use units to solve problems.**	
3	Use units of measure as a way to understand and solve problems involving quantities.	
c	Use units within problems.	

Expectation Unwrapped

The student will use unit conversions to perform calculations within a multi-step problem.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems
An L-shaped concrete slab is composed of a rectangular piece 30 feet 6 inches by 20 feet 4 inches and a second piece 10 feet 8 inches by 8 feet 3 inches. If the slab is 4 inches thick, how many cubic yards (to the nearest greater ¼ cubic yard) need to be ordered?)

The density of a material is 0.02 kg/cm^3. How much would a cubic inch of this material weigh? (use 1 in ≈2.54 cm)

Content Limits/Assessment Boundaries
Do not provide conversions when converting within systems of measurement.
Provide embedded conversions when converting between systems of measurement.
Prompt may require converting units of area or volume, or it may require converting between rates.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.NQ.B.3.d
NQ	**Number and Quantity**	
B	**Use units to solve problems.**	
3	Use units of measure as a way to understand and solve problems involving quantities.	
d	Choose and interpret the scale and the origin in graphs and data displays.	

Expectation Unwrapped

The student will choose appropriate scales for the horizontal and vertical axes for graphs and data displays.

The student will interpret the scale for horizontal and vertical axes and the origin in graphs and data displays.

The student will identify situations where information is displayed in a misleading way.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.NQ.B.4
NQ **B** **4**	**Number and Quantity** **Use units to solve problems.** Define and use appropriate quantities for representing a given context or problem.	
Expectation Unwrapped The student will define appropriate units to label a solution based on a given context or problem. The student will use appropriate units to label a solution based on a given context or problem.		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
Content Limits/Assessment Boundaries		**Calculator Designation** **YES** – a calculator will be available for items

Mathematics		A1.NQ.B.5
NQ B 5	**Number and Quantity** **Use units to solve problems.** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	

Expectation Unwrapped

The student will choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

The student will choose a level of accuracy appropriate to limitations on measurement with any given tool.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems
What is 1.6 million divided by 7? How should this answer be divided? How many significant digits should be used? Describe a real-world situation where this might happen.

John says that he measured the angle with his protractor and it was 30.123 degrees. How could Jane critique John's answer with respect to significant digits?

Content Limits/Assessment Boundaries
Very large or very small values may be given in scientific notation.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.SSE.A.1
SSE A 1	**Seeing Structure in Expressions** **Interpret and use structure.** Interpret the contextual meaning of individual terms or factors from a given problem that utilizes formulas or expressions.	

Expectation Unwrapped

The student will interpret each individual term or factor of an expression in terms of the mathematics structures.

The student will interpret the meaning of individual terms or factors from a given problem that utilizes formulas or expressions in terms of the context of the situation.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems
Compare how doubling the beginning principal affects the final amount as opposed to doubling the time or the rate. $A = P(1+r)^t$

Content Limits/Assessment Boundaries
If the prompt has a polynomial, limit its degree to three or lower.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.SSE.A.2
SSE A 2	**Seeing Structure in Expressions** **Interpret and use structure.** Analyze the structure of polynomials to create equivalent expressions or equations.	

Expectation Unwrapped

The student will factor a polynomial expression.

The student will analyze the structure of polynomials to determine an appropriate method for decomposing and composing to create equivalent expressions.

The student will analyze the structure of polynomials to determine an appropriate method for decomposing and composing to create equivalent equations.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to polynomials with integer coefficients.
Limited to polynomials of nth degree with a GCF that, when factored, results in a factorable quadratic expression.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.SSE.A.3.a
SSE	**Seeing Structure in Expressions**	
A	**Interpret and use structure.**	
3	Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties.	
a	Find the zeros of a quadratic function by rewriting it in factored form.	

Expectation Unwrapped

The student will find the zeros of a quadratic function by rewriting it in factored form.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to integer coefficients and given $f(x) = ax^2 + bx + c$, and $|a \cdot c| \leq 100$.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.SSE.A.3.b
SSE	**Seeing Structure in Expressions**	
A	**Interpret and use structure.**	
3	Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties.	
b	Find the maximum or minimum value of a quadratic function by completing the square.	

Expectation Unwrapped

The student will find the maximum value of a quadratic (the y coordinate of the vertex) function by completing the square.

The student will find the minimum value of a quadratic (the y coordinate of the vertex) function by completing the square.

The student will understand that the vertex of an equation in the form $y = a(x - h)^2 + k$ is (h, k).

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Given $ax^2 + bx + c$, Limited to a = 1 and limit b to even integers.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.CED.A.1
CED A 1	**Creating Equations** **Create equations that describe linear, quadratic and exponential relationships.** Create equations and inequalities in one variable and use them to model and/or solve problems.	

Expectation Unwrapped

The student will create linear equations in one variable and use them to model and/or solve problems

The student will create quadratic equations in one variable and use them to model and/or solve problems.

The student will create exponential equations in one variable and use them to model and/or solve problems.

The student will create linear inequalities in one variable and use them to model and/or solve problems.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
In exponential relationships when solving for the exponent, limit bases to 2, 3, 5, and 10, and limit exponents to 1, 2, 3, and 4.
Limited to linear inequalities.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.CED.A.2
CED A 2	**Creating Equations** **Create equations that describe linear, quadratic and exponential relationships.** Create and graph linear, quadratic and exponential equations in two variables.	

Expectation Unwrapped

The student will create and/or graph linear equations in two variables on the Cartesian coordinate plane with labels and scales.

The student will create and/or graph exponential equations in two variables on the Cartesian coordinate plane with labels and scales.

The student will create and/or graph quadratic equations in two variables on the Cartesian coordinate plane with labels and scales.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Limited to simple quadratics ($y = ax^2$, $y = ax^2 + b$) for creating equations.
Limit exponentials to the form $y = ab^x$, where b is rational and greater than zero, for creating and graphing equations.

Calculator Designation

YES – a calculator will be available for items

Mathematics		A1.CED.A.3
CED A 3	**Creating Equations** **Create equations that describe linear, quadratic and exponential relationships.** Represent constraints by equations or inequalities and by systems of equations or inequalities, and interpret the data points as a solution or non-solution in a modeling context.	

Expectation Unwrapped

The student will represent constraints with an equation within a modeling context.

The student will represent constraints with an inequality within a modeling context.

The student will represent constraints with a system of equation and/or inequalities within a modeling context.

The student will interpret data points to determine if they are a solution or non-solution within a modeling context.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Equations and inequalities should be limited to linear (in terms of representing constraints).

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.CED.A.4
CED A 4	**Creating Equations** **Create equations that describe linear, quadratic and exponential relationships.** Solve literal equations and formulas for a specified variable that highlights a quantity of interest.	

Expectation Unwrapped

The student will solve literal equations for a specified variable that highlights a quantity of interest.

The student will solve formulas for a specified variable that highlights a quantity of interest.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to formulas and equations with degree three or less and no more than four variables.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.REI.A.1
REI A 1	**Reasoning with Equations and Inequalities** **Understand solving equations as a process, and solve equations and inequalities in one variable.** Explain how each step taken when solving an equation or inequality in one variable creates an equivalent equation or inequality that has the same solution(s) as the original.	

Expectation Unwrapped

The student will explain how each step taken when solving an equation in one variable creates an equivalent equation that has the same solution(s) as the original.

The student will explain how each step taken when solving an inequality in one variable creates an equivalent inequality that has the same solution(s) as the original.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems
Explain why $2x + 6 = 8$ and $2x = 2$ are equivalent and have the same solution.

Content Limits/Assessment Boundaries
Emphasis is not on two-column proofs or formal articulation of properties to explain equivalent equations or inequalities.
Limited to linear equations and inequalities.

Calculator Designation
YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.REI.A.2.a
REI	**Reasoning with Equations and Inequalities**	
A	**Understand solving equations as a process, and solve equations and inequalities in one variable.**	
2	Solve problems involving quadratic equations.	
a	Use the method of completing the square to create an equivalent quadratic equation.	

Expectation Unwrapped

The student will use the method of completing the square to create an equivalent quadratic equation in the form $(x - p)^2 = q$, for the purpose of solving the quadratic equation for a certain value(s).

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Given $ax^2 + bx + c$, Limited to a = 1 and limit b to even integers.

Calculator Designation
YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.REI.A.2.b
REI	**Reasoning with Equations and Inequalities**	
A	**Understand solving equations as a process, and solve equations and inequalities in one variable.**	
2	Solve problems involving quadratic equations.	
b	Derive the quadratic formula.	

Expectation Unwrapped

The student will understand the relationship between the quadratic formula and the quadratic equation $ax^2 + bx + c = 0$.

The student will derive the quadratic formula from $ax^2 + bx + c = 0$, where a, b, and c are real numbers.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.REI.A.2.c
REI	**Reasoning with Equations and Inequalities**	
A	**Understand solving equations as a process, and solve equations and inequalities in one variable.**	
2	Solve problems involving quadratic equations.	
c	Analyze different methods of solving quadratic equations.	

Expectation Unwrapped

The student will solve quadratic equations using different methods. *(e.g., inspection, the square root property, completing the square, using the quadratic formula, factoring)*

The student will analyze quadratic equations to determine the best method for solving.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
If a quadratic equation has a complex solution, the result should be stated as "no real solution."

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.REI.B.3
REI B 3	**Reasoning with Equations and Inequalities** **Solve systems of equations.** Solve a system of linear equations algebraically and/or graphically.	

Expectation Unwrapped

The student will solve a system of linear equations graphically.

The student will solve a system of linear equations algebraically *(e.g., substitution, linear combination).*

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to two equations per system.
Limit solutions to intersecting grid lines when solving systems by graphing.
The scale of the graphs does not have to be in integer increments.

Calculator Designation
YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.REI.B.4
REI **B** **4**	**Reasoning with Equations and Inequalities** **Solve systems of equations.** Solve a system consisting of a linear equation and a quadratic equation algebraically and/or graphically.	

Expectation Unwrapped

The student will solve a system consisting of a linear equation and a quadratic equation graphically.

The student will solve a system consisting of a linear equation and a quadratic equation algebraically.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Limited to integer solutions.
Limited to quadratic equations in the form $y = ax^2$ or $y = ax^2 + b$ where a and b are integers.
Both equations should be solved for y.
Limit solutions to intersecting grid lines when solving systems by graphing.

Calculator Designation

YES – a calculator will be available for items

Mathematics		A1.REI.B.5
REI **B** **5**	**Reasoning with Equations and Inequalities** **Solve systems of equations.** Justify that the technique of linear combination produces an equivalent system of equations.	

Expectation Unwrapped

The student will justify that the technique of linear combination produces an equivalent system of equations.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to integer coefficients.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.REI.C.6
REI C 6	**Reasoning with Equations and Inequalities** **Represent and solve linear and exponential equations and inequalities graphically** Explain that the graph of an equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane.	

Expectation Unwrapped

The student will explain that the graph of a linear equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane.

The student will explain that the graph of an exponential equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane.

The student will explain that a point not on the graph of a linear equation or exponential equation in the Cartesian coordinate plane is not a solution.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limit exponentials to the form $y = ab^x$, where b is rational and greater than zero.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.REI.C.7
REI C 7	**Reasoning with Equations and Inequalities** **Represent and solve linear and exponential equations and inequalities graphically.** Graph the solution to a linear inequality in two variables.	
Expectation Unwrapped The student will graph the solution to a linear inequality in two variables.		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
Content Limits/Assessment Boundaries Limited to integer x- and y-intercepts.		**Calculator Designation** **YES** – a calculator will be available for items

Mathematics		A1.REI.C.8
REI **C** **8**	**Reasoning with Equations and Inequalities** **Represent and solve linear and exponential equations and inequalities graphically.** Solve problems involving a system of linear inequalities.	

Expectation Unwrapped

The student will solve problems involving a system of linear inequalities by graphing.

The student will interpret the solution to a system of linear inequalities in the context provided when appropriate.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
System of inequalities should be given rather than the student having to write them.
Limited to integer x- and y-intercepts.
Limited to systems of two inequalities.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.APR.A.1
APR A 1	**Arithmetic with Polynomials and Rational Expressions** **Perform operations on polynomials.** Add, subtract and multiply polynomials, and understand that polynomials follow the same general rules of arithmetic and are closed under these operations.	

Expectation Unwrapped

The student will add polynomials and understand that polynomials follow the same general rules of arithmetic and are closed under addition.

The student will subtract polynomials and understand that polynomials follow the same general rules of arithmetic and are closed under subraction.

The student will multiply polynomials and understand that polynomials follow the same general rules of arithmetic and are closed under multiplication.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems
$(x^3 + 2x^2 - x) - (3x^3 + 4x^2 - x + 2)$

Content Limits/Assessment Boundaries
Multiplying polynomials should be limited to the product of a binomial and a trinomial (or fewer terms in either factor). Limited to integer coefficients for all polynomial operations.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.APR.A.2
APR A 2	**Arithmetic with Polynomials and Rational Expressions** **Perform operations on polynomials.** Divide polynomials by monomials.	

Expectation Unwrapped

The student will divide polynomials by monomials.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to integer coefficients in the problem and answer.
The monomial should be a factor of the polynomial.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.IF.A.1.a
IF	**Interpreting Functions**	
A	**Understand the concept of a function and use function notation.**	
1	Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.	
a	Represent a function using function notation.	

Expectation Unwrapped

The student will represent a function using function notation $f(x)$.

The student will understand that $f(x)$ denotes the elements of the range of a function f that correspond to the elements of the domain.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
If the function is given in equation form it is limited to linear, quadratic and exponential relationships.

Calculator Designation
YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.IF.A.1.b
IF	**Interpreting Functions**	
A	**Understand the concept of a function and use function notation.**	
1	Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.	
b	Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation y=f(x).	

Expectation Unwrapped

The student will understand that the input and output values of a function correspond to (x, y) values on the Cartesian coordinate plane.

The student will understand that all of the ordered pairs on the graph of a function labeled f are solutions to $f(x)$ such that, $y = f(x)$.

The student will graph an equation that is presented using functional notation.

DOK Ceiling

2

Item Format

Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Graph the following.
$f(x)$ = 7x + 2

If f and g are two linear functions such that $f(2) = g(2) = 6$ describe something you know about these two functions.

Content Limits/Assessment Boundaries

The equation is limited to linear, exponential and quadratic functions.

Calculator Designation

YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.IF.A.2
IF A 2	**Interpreting Functions** **Understand the concept of a function and use function notation.** Use function notation to evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	

Expectation Unwrapped

The student will use function notation to evaluate functions for inputs in their domains.

The student will interpret statements involving the inputs and outputs of a function in terms of a context.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems
If $P(x)$ is profit where x is the revenue, what is $P(2000)$ and what does it mean in terms of the function?

Explain what $P(40) = 2$ means in the context of the situation.

Content Limits/Assessment Boundaries
Functions are limited to linear, exponential and quadratic functions.
Functions can be named with letters other than f *(e.g., $g(x)$, $h(x)$, etc.).*

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.IF.B.3
IF **B** **3**	**Interpreting Functions** **Interpret linear, quadratic and exponential functions in terms of the context.** Using tables, graphs and verbal descriptions, interpret key characteristics of a function that models the relationship between two quantities.	

Expectation Unwrapped

The student will interpret key characteristics of a function that models the relationship between two quantities using tables.

The student will interpret key characteristics of a function that models the relationship between two quantities using graphs.

The student will interpret key characteristics of a function that models the relationship between two quantities using verbal descriptions.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Functions are limited to linear, quadratic and exponential functions.

Intercepts should be written as ordered pairs.

Calculator Designation

YES – a calculator will be available for items

Mathematics		A1.IF.B.4
IF **B** **4**	**Interpreting Functions** **Interpret linear, quadratic and exponential functions in terms of the context.** Relate the domain and range of a function to its graph, and where applicable, to the quantitative relationship it describes.	

Expectation Unwrapped

The student will relate the domain and range of a function to its graph.

The student will describe how the domain and range within the context of a situation affect the characteristics of the graph of the function.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Notation for domain and range should be limited to inequality notation *(e.g., $x > 0$, etc.)* or verbal descriptions *(e.g., all real numbers, positive real numbers, etc.)*.
Limited to linear, quadratic and exponential functions.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.IF.B.5
IF **B** **5**	**Interpreting Functions** **Interpret linear, quadratic and exponential functions in terms of the context.** Determine the average rate of change of a function over a specified interval and interpret the meaning.	

Expectation Unwrapped

The student will determine the average rate of change of a function over a specified interval.

The student will interpret the meaning of the average rate of change over a specified interval in a given context.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
The focus should be on intervals across quadratics and exponentials.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.IF.B.6
IF **B** **6**	**Interpreting Functions** **Interpret linear, quadratic and exponential functions in terms of the context.** Interpret the parameters of a linear or exponential function in terms of the context.	

Expectation Unwrapped

The student will interpret the parameters of a linear function in terms of the context.

The student will interpret the parameters of an exponential function in terms of the context.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems
Explain what happens as the values of t increase in the function $A = 300(.96)^t$.

Content Limits/Assessment Boundaries
Items should focus on interpreting parameters ***in context***.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.IF.C.7
IF **C** **7**	**Interpreting Functions** **Analyze linear, quadratic and exponential functions using different representations.** Graph functions expressed symbolically, and identify and interpret key features of the graph.	

Expectation Unwrapped

The student will graph linear functions expressed symbolically and identify and interpret key features of the graph by hand and by using technology.

The student will graph quadratic functions expressed symbolically, and identify and interpret key features of the graph by hand and by using technology.

The student will graph exponential functions expressed symbolically, and identify and interpret key features of the graph by hand and/or technology.

The student will graph simple piecewise functions (linear, simple quadratic and simple exponential) expressed symbolically, and identify and interpret key features of the graph by hand and by using technology.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Do not assess piecewise functions.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.IF.C.8
IF C 8	**Interpreting Functions** **Analyze linear, quadratic and exponential functions using different representations.** Translate between different but equivalent forms of a function to reveal and explain properties of the function and interpret these in terms of a context.	

Expectation Unwrapped

The student will translate between different but equivalent forms of a function to reveal and explain properties of the function.

The student will interpret different but equivalent forms of a function in terms of a context.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limit quadratics to forms that are factorable and limited to cases where the a value is one and the b value is even when completing the square.
Limit exponentials to the form, $y = ab^x$, where b is rational and greater than zero.

Calculator Designation
YES – a calculator will be available for item

Mathematics		A1.IF.C.9
IF C 9	**Interpreting Functions** **Analyze linear, quadratic and exponential functions using different representations.** Compare the properties of two functions given different representations.	

Expectation Unwrapped

The student will compare the properties of two functions (both linear, both exponential, or both quadratic) given different representations.

The student will compare the properties of two different types of functions (linear, quadratic, and/or exponential) given different representations.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limit exponentials to the form, $y = ab^x$, where b is rational and greater than zero.

Calculator Designation
YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.BF.A.1
BF **A** **1**	**Building Functions** **Build new functions from existing functions (limited to linear, quadratic and exponential).** Analyze the effect of translations and scale changes on functions.	

Expectation Unwrapped

The student will analyze the effect of the scale change on the graph of $f(x)$ by $kf(x)$ for specific values of k (any real number).

The student will analyze the effect of the translation on the graph of $f(x)$ by $f(x)+k$ for specific values of k (any real number).

The student will analyze the effect of the translation on the graph of $f(x)$ by $f(x+k)$ for specific values of k (any real number).

The student will find the specific value of k given the graphs of $f(x)$ and the graph after translations and scale changes has been performed.

DOK Ceiling

2

Item Format

Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Limit quadratics to vertex form.

Calculator Designation

YES – a calculator will be available for items

Mathematics		A1.LQE.A.1.a
LQE	**Linear, Quadratic and Exponential Models**	
A	**Construct and compare linear, quadratic and exponential models and sole problems.**	
1	Distinguish between situations that can be modeled with linear or exponential functions.	
a	Determine that linear functions change by equal differences over equal intervals.	

Expectation Unwrapped

The student will determine that linear functions change by equal differences over equal intervals, by showing that linear functions change by equal difference over equal intervals.

The student will recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.LQE.A.1.b
LQE	**Linear, Quadratic and Exponential Models**	
A	**Construct and compare linear, quadratic and exponential models and solve problems.**	
1	Distinguish between situations that can be modeled with linear or exponential functions.	
b	Recognize exponential situations in which a quantity grows or decays by a constant percent rate per unit interval.	

Expectation Unwrapped

The student will recognize exponential situations in which a quantity grows by a constant percent rate per unit interval.

The student will recognize exponential situations in which a quantity decays by a constant percent rate per unit interval.

The student will show that exponential functions change by equal factors over equal intervals.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to exponentials, where $y = ab^x$, and b is rational and greater than zero.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.LQE.A.2
LQE A 2	**Linear, Quadratic and Exponential Models** **Construct and compare linear, quadratic and exponential models and sole problems.** Describe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.	

Expectation Unwrapped

The student will describe using graphs that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.

The student will describe using tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to exponentials where $b > 1$, in $y = ab^x$.
Limited to linear where $m > 0$, in $y = mx + b$.
Limited to quadratics where $a > 0$, in $= ax^2 + bx + c$.

Calculator Designation
YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.LQE.A.3
LQE A 3	**Linear, Quadratic and Exponential Models** **Construct and compare linear, quadratic and exponential models and sole problems.** Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.	

Expectation Unwrapped

The student will construct linear equations given graphs.

The student will construct linear equations given verbal descriptions.

The student will construct linear equations given tables.

The student will construct quadratic equations given graphs.

The student will construct quadratic equations given verbal descriptions.

The student will construct quadratic equations given tables.

The student will construct exponential equations given graphs.

The student will construct exponential equations given verbal descriptions.

The student will construct exponential equations given tables.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Limited to exponentials, where $y = ab^x$ and b is rational and greater than zero.
When given the graph of a quadratic function, the zeros, the a value and the vertex are integers.

Calculator Designation
YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.LQE.B.4
LQE B 4	**Linear, Quadratic and Exponential Models** **Use arithmetic and geometric sequences.** Write arithmetic and geometric sequences in recursive and explicit forms, and use them to model situations and translate between the two forms.	

Expectation Unwrapped

The student will write arithmetic sequences in recursive and explicit forms given graphs, verbal descriptions or tables.

The student will connect arithmetic sequences to linear functions.

The student will tranlsate between explicit and recursive forms of arithmetic sequences.

The student will model situations with arithmetic sequences.

The student will write geometric sequences in recursive and explicit forms given graphs, verbal descriptions or tables.

The student will connect geometric sequences to exponential functions.

The student will tranlsate between explicit and recursive forms of geometric sequences.

The student will model situations with geometric sequences.

DOK Ceiling

2

Item Format

Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Recursive form should be limited to subscript notation.
Remove Next/Now language from assessment items.

Calculator Designation

YES – a calculator will be available for items

Mathematics		A1.LQE.B.5
LQE B 5	**Linear, Quadratic and Exponential Models** **Use arithmetic and geometric sequences.** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of integers.	
Expectation Unwrapped The student will recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of the integers.		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
Content Limits/Assessment Boundaries Recursive form should be limited to subscript notation. Remove Next/Now language from assessment items.		**Calculator Designation** **YES** – a calculator will be available for items

Mathematics		A1.LQE.B.6
LQE B 6	**Linear, Quadratic and Exponential Models** **Use arithmetic and geometric sequences.** Find the terms of sequences given an explicit or recursive formula.	

Expectation Unwrapped

The student will find the terms of sequences given an explicit formula.

The student will find the terms of sequences given a recursive formula.

DOK Ceiling
1

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Recursive form should be limited to subscript notation.
Remove Next/Now language from assessment items.
When finding terms of a sequence given a recursive formula, limit finding terms within ten.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.DS.A.1
DS A 1	**Data and Statistical Analysis** **Summarize, represent and interpret data.** Analyze and interpret graphical displays of data.	
Expectation Unwrapped The student will analyze and interpret data plots displayed in a dot plot. The student will analyze and interpret data plots displayed in a histogram. The student will analyze and interpret data plots displayed in a box plot.		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
Content Limits/Assessment Boundaries		**Calculator Designation** **YES** – a calculator will be available for items

Mathematics		A1.DS.A.2
DS A 2	**Data and Statistical Analysis** **Summarize, represent and interpret data.** Use statistics appropriate to the shape of the data distribution to compare center and spread of two or more different data sets.	

Expectation Unwrapped

The student will use statistics appropriate to the shape of the data distribution to compare center (median, mean, mode) of two or more different data sets.

The student will use statistics appropriate to the shape of the data distribution to compare spread (interquartile range) of two or more different data sets.

The student will calculate and use statistics appropriate to the shape of the data distribution to compare spread (standard deviation) of two or more different data sets.

DOK Ceiling
3

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Standard deviation should be limited to a small data set (less than or equal to ten data points) with an integral mean.

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.DS.A.3
DS A 3	**Data and Statistical Analysis** **Summarize, represent and interpret data.** Interpret differences in shape, center and spreads in the context of the data sets, accounting for possible effects of outliers.	
Expectation Unwrapped The student will interpret differences in shape, center and spread in the context of the data sets, accounting for possible effects of outliers.		**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
Content Limits/Assessment Boundaries Limited to comparing three data sets.		**Calculator Designation** **YES** – a calculator will be available for items

Mathematics		A1.DS.A.4.a
DS	**Data and Statistical Analysis**	
A	**Summarize, represent and interpret data.**	
4	Summarize data in two-way frequency tables.	
a	Interpret relative frequencies in the context of the data.	

Expectation Unwrapped

The student will interpret relative frequencies in the context of the data.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.DS.A.4.b
DS	**Data and Statistical Analysis**	
A	**Summarize, represent and interpret data.**	
4	Summarize data in two-way frequency tables.	
b	Recognize possible associations and trends in the data.	

Expectation Unwrapped

The student will recognize possible associations in the data.

The student will recognize possible trends in the data.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.DS.A.5.a
DS	**Data and Statistical Analysis**	
A	**Summarize, represent and interpret data.**	
5	Construct a scatter plot of bivariate quantitative data describing how the variables are related; determine and use a function that models the relationship.	
a	Construct a linear function to model bivariate data represented on a scatter plot that minimizes residuals.	

Expectation Unwrapped

The student will construct a scatter plot of bivariate quantitative data and determine the type of function that models the relationship.

The student will construct a linear function to model the bivariate data on a scatter plot that minimizes residuals (distance from the mean) using calculation and/or technology.

DOK Ceiling
3

Item Format
Selected Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries
Outliers in the data should be obvious.
On a multiple choice question, there should not be more than one answer choice that is closely related to the distance from the mean.

Calculator Designation
YES – a calculator will be available for items

High School Algebra 1

Mathematics		A1.DS.A.5.b
DS	**Data and Statistical Analysis**	
A	**Summarize, represent and interpret data.**	
5	Construct a scatter plot of bivariate quantitative data describing how the variables are related; determine and use a function that models the relationship.	
b	Construct an exponential function to model bivariate data represented on a scatter plot that minimizes residuals.	

Expectation Unwrapped

The student will construct a scatter plot of bivariate quantitative data and determine the type of function that models the relationship.

The student will construct an exponential function to model the bivariate data on a scatter plot that minimizes residuals using calculation and/or technology.

DOK Ceiling
3

Item Format
Selected Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Outliers in the data should be obvious.
On a multiple choice question, there should not be more than one answer choice that is closely related to the distance from the mean.
Do not assess creating an exponential model (calculator bias).

Calculator Designation

YES – a calculator will be available for items

Mathematics		A1.DS.A.6
DS A 6	**Data and Statistical Analysis** **Summarize, represent and interpret data.** Interpret the slope (rate of change) and the y-intercept (constant term) of a linear model in the context of the data.	

Expectation Unwrapped

The student will interpret the slope (rate of change) of a linear model in the context of the data.

The student will interpret the y-intercept (constant term) of a linear model in the context of the data.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems

Content Limits/Assessment Boundaries

Calculator Designation
YES – a calculator will be available for items

Mathematics		A1.DS.A.7
DS A 7	**Data and Statistical Analysis** **Summarize, represent and interpret data.** Determine and interpret the correlation coefficient for a linear association.	
Expectation Unwrapped The student will determine the correlation coefficient for a linear association. The student will interpret the correlation coefficient for a linear association.		**DOK Ceiling** 2 **Item Format** Selected Response Constructed Response Technology Enhanced **Sample Stems**
Content Limits/Assessment Boundaries Limit assessment items to interpreting the correlation coefficients given.		**Calculator Designation** **YES** – a calculator will be available for items

Mathematics		A1.DS.A.8
DS A 8	**Data and Statistical Analysis** **Summarize, represent and interpret data.** Distinguish between correlation and causation.	

Expectation Unwrapped

The student will distinguish between correlation and causation.

The student will understand and explain that a strong correlation does not imply causation.

DOK Ceiling
2

Item Format
Selected Response
Constructed Response
Technology Enhanced

Sample Stems
Tall individuals tend to also have large feet. *(correlation)*

When you exercise more minutes, the number of calories burned will increase. *(causation)*

Content Limits/Assessment Boundaries
Limit assessment items to interpreting the correlation coefficients given.

Calculator Designation
YES – a calculator will be available for items