Mathematics Item Specifications

ALGEBRA I

Arizona Department of Education with American Institutes for Research - 2018

Table of Contents

Introduction

The Arizona Statewide Achievement Assessment for English Language Arts and Mathematics (AzMERIT) is Arizona's statewide achievement test. AzMERIT assesses the Arizona English Language Arts Standards and Arizona Mathematics Standards adopted by the Arizona State Board of Education in December 2016. AzMERIT will inform students, teachers, and parents about preparedness for college and careers upon graduating from high school. AzMERIT tests are computer-based, meaning that they can better assess students' critical thinking skills and provide them with opportunities to demonstrate a deeper understanding of the materials. Computer-based testing also allows for the use of a variety of innovative items types.

During the item-development process, all AzMERIT items are written in accordance with the Item Specifications and are reviewed and approved by a committee of Arizona educators to confirm alignment and appropriateness for inclusion in the test. AzMERIT items are generally representative of Arizona's geographic regions and culturally diverse population. Items are reviewed for the following kinds of bias: gender, racial, ethnic, linguistic, religious, geographic, and socioeconomic. Item reviews also include consideration of issues related to individuals with disabilities. Arizona community members also have an opportunity to review items for issues of potential concern to members of the community at large. Reviewers are asked to consider the variety of cultural, regional, philosophical, political, and religious backgrounds throughout Arizona, and then to determine whether the subject matter will be acceptable to Arizona students, families, and other members of Arizona communities.

This *AzMERIT Item Specifications* is a resource document that defines the content and format of the test and test items for item writers and reviewers. Each *Item Specifications* document indicates the alignment of items with the Arizona Mathematics Standards. It also serves to provide all stakeholders with information about the scope and function of assessment items. This document can also serve to assist educators to understand how assessment items are developed in alignment with the standards for English language arts and math. These item specifications for AzMERIT are intended to provide information regarding standards, item formats and response types. The descriptions of blueprints, and depth of knowledge in this document are meant to provide an overview of the test. Item specifications are meant for the purposes of assessment, not instruction. They are not intended to be tools for instruction or the basis for curricula. AzMERIT has a test blueprint that was developed by Arizona and is different from any other state or consortium test blueprint.

For the math portion of AzMERIT, all of the test questions are aligned to the mathematic content standards for these subject areas. Any item specifications that are absent for standards listed in this document may be under development. This document does not endorse the exclusion of the instruction of any grade-level content standards. The test will ask questions that check a student's conceptual understanding of math as well as their procedural skills. These items have been written to be free from bias and sensitivity, and widely vary in their degree of difficulty.

Item Development Process

AzMERIT items go through a rigorous review before they are operational. When an item is "operational" it means it is used to determine a student's score on the assessment. This is a description of the process every item must go through before it is operational on AzMERIT.

Sample tests are available online for the math portion of AzMERIT. For more information view the Guide to the Sample Tests at www.azmeritportal.org.

Test Construction Guidelines

The construction of the AzMERIT assessment is guided by the depth and rigor of the Arizona College and Career Ready Standards. Items are created to address key components of the standards and assess a range of important skills. The AzMERIT Blueprint provides an overview of the distribution of items on the AzMERIT according to the standards. The standards for Math Practices are embedded within all AzMERIT items. Further, the AzMERIT blueprint outlines the Depth of Knowledge distribution of items.

Blueprint

Algebra I AzMERIT Blueprint 2016 Standards		
Reporting Category	**Min.**	**Max.**
Algebra	**33%**	**39%**
Functions	**37%**	**43%**
Statistics &Probability and Number & Quantity	**23%**	**28%**
Statistics	13%	23%
Quantitative Reasoning	6%	15%

Depth of Knowledge (DOK)

DOK refers to the level of rigor or sophistication of the task in a given item, designed to reflect the complexity of the Arizona Mathematics Standards. Items at DOK level 1 focus on the recall of information, such as definitions, terms, and simple procedures. Items at DOK 2 require students to make decisions, solve problems, or recognize patterns; in general, they require a greater degree of engagement and cognitive processing than items at DOK 1. Items at DOK 3 feature higher-order cognitive tasks that assess students' capacities to approach abstract or complex problems.

Percentage of Points by Depth of Knowledge (DOK) Level			
Algebra I	DOK Level 1	DOK Level 2	DOK Level 3
	10% - 20%	60% - 70%	12% - 30%

For more information on DOK go to www.azed.gov/AzMERIT.

Calculators

Arizona Desmos Graphing Calculator is permitted for both the paper-based and computer-based assessment for High School Math.

Item Formats

The AzMERIT Assessments are composed of item formats that include traditional multiple-choice response items and technology-enhanced response items (TEI). TEIs are computer-delivered response items that require students to interact with test content to select, construct, and/or support their responses. TEIs are better able to assess a deeper level of understanding.

Currently, there are nine types of TEIs that may appear on the Math computer-based assessment for AzMERIT:

- Editing Tasks (ET)
- Editing Task Choice (ETC)
- Equation Editor (EQ)
- Graphic Response Item Display (GRID)
- Hot Text (HT)
    - Selectable Hot Text
    - Drag-and-Drop Hot Text
- Matching Item (MI)
- Multi-Select (MS)
- Open Response
- Table Item (TI)

For paper-based assessments (including those for students with an IEP or 504 plan that specifies a paper based accommodation), TEIs will be modified so that they can be scanned and scored electronically or hand-scored.

See the table below for a description of each TEI. In addition, for examples of each response item format described, see the AzMERIT Training Tests at www.azmeritportal.org.

Item Format	Description
Editing Task (ET)	The student clicks on a highlighted word or phrase that may be incorrect, which reveals a text box. The directions in the text box direct the student to replace the highlighted word or phrase with the correct word or phrase. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Editing Task Choice (ETC)	The student clicks a highlighted word or phrase, which reveals a drop-down menu containing options for correcting an error as well as the highlighted word or phrase as it is shown in the sentence to indicate that no correction is needed. The student then selects the correct word or phrase from the drop-down menu. For paper-based assessments, the item is modified so that it can be scanned and scored electronically. The student fills in a circle to indicate the correct word or phrase.

Item Format	Description
Equation Editor (EQ)	The student is presented with a toolbar that includes a variety of mathematical symbols that can be used to create a response. Responses may be in the form of a number, variable, expression, or equation, as appropriate to the test item. For paper-based assessments, this item type may be replaced with a modified version of the item that can be scanned and scored electronically or replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Graphic Response Item Display (GRID)	The student selects numbers, words, phrases, or images and uses the drag-and-drop feature to place them into a graphic. This item type may also require the student to use the point, line, or arrow tools to create a response on a graph. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Hot Text (HT)	**Selectable Hot Text -** Excerpted sentences from the text are presented in this item type. When the student hovers over certain words, phrases, or sentences, the options highlight. This indicates that the text is selectable ("hot"). The student can then click on an option to select it. For paper- based assessments, a "selectable" hot text item is modified so that it can be scanned and scored electronically. In this version, the student fills in a circle to indicate a selection.
	Drag-and-Drop Hot Text - Certain numbers, words, phrases, or sentences may be designated "draggable" in this item type. When the student hovers over these areas, the text highlights. The student can then click on the option, hold down the mouse button, and drag it to a graphic or other format. For paper-based assessments, drag-and-drop hot text items will be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Matching Item (MI)	The student checks a box to indicate if information from a column header matches information from a row. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Multi-Select (MS)	The student is directed to select all of the correct answers from among a number of options. These items are different from multiple-choice items, which allow the student to select only one correct answer. These items appear in the online and paper-based assessments.
Open Response	The student uses the keyboard to enter a response into a text field. These items can usually be answered in a sentence or two. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.

Item Format	Description
Table Item (TI)	The student types numeric values into a given table. The student may complete the entire table or portions of the table depending on what is being asked. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.

Arizona Mathematics Standards Algebra I

Number and Quantity - N		
The Real Number System (N-RN)		
A1.N-RN.B **Use properties of rational and irrational numbers.**	**A1.N-RN.B.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.
Quantities (N-Q)		
A1.N-Q.A **Reason quantitatively and use units to solve problems.**	**A1.N-Q.A.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, include utilizing real-world context.
	A1.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. Include problem-solving opportunities utilizing real-world context.
	A1.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world context.
Algebra - A		
Seeing Structure in Expressions (A-SSE)		
A1.A-SSE.A **Interpret the structure of expressions.**	**A1.A-SSE.A.1**	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret expressions by viewing one or more of their parts as a single entity.
	A1.A-SSE.A.2	Use structure to identify ways to rewrite numerical and polynomial expressions. Focus on polynomial multiplication and factoring patterns.
A1.A-SSE.B **Write expressions in equivalent forms to solve problems.**	**A1.A-SSE.B.3**	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines.

		b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
Arithmetic with Polynomials and Rational Expressions (A-APR)		
A1.A-APR.A **Perform arithmetic operations on polynomials.**	**A1.A-APR.A.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.
A1.A-APR.B **Understand the relationship between zeros and factors of polynomials.**	**A1.A-APR.B.3**	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. Focus on quadratic and cubic polynomials in which linear and quadratic factors are available.
Creating Equations (A-CED)		
A1.A-CED.A **Create equations that describe numbers or relationships.**	**A1.A-CED.A.1**	Create equations and inequalities in one variable and use them to solve problems. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
	A1.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
	A1.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.
	A1.A-CED.A.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.*
Reasoning with Equations and Inequalities (A-REI)		
A1.A-REI.A **Understand solving equations as a process of reasoning and explain the reasoning.**	**A1.A-REI.A.1**	Explain each step in solving linear and quadratic equations 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.
A1.REI.B **Solve equations and inequalities in one variable.**	**A1.A-REI.B.3**	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
	A1.A-REI.B.4	Solve quadratic equations in one variable.

		a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – k)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Focus on solutions for quadratic equations that have real roots. Include cases that recognize when a quadratic equation has no real solutions.
A1.A-REI.C **Solve systems of equations.**	**A1.A-REI.C.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.
	A1.A-REI.C.6	Solve systems of linear equations exactly and approximately, focusing on pairs of linear equations in two variables. Include problem solving opportunities utilizing real-world context.
A1.A-REI.D **Represent and solve equations and inequalities graphically.**	**A1.A-REI.D.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.
	A1.A-REI.D.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). Focus on cases where $f(x)$ and/or $g(x)$ are linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
	A1.A-REI.D.12	Graph the solutions to a linear inequality in two variables as a half-plane, excluding the boundary in the case of a strict inequality, and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
Functions - F		
Interpreting Functions (F-IF)		
A1.F-IF.A **Understand the concept of a function and use function notation.**	**A1.F-IF.A.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 $y = f(x)$.

	A1.F-IF.A.2	Evaluate a function for inputs in the domain, and interpret statements that use function notation in terms of a context.
	A1.F-IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
A1.F-IF.B **Interpret functions that arise in applications in terms of the context**	**A1.F-IF.B.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. Include problem-solving opportunities utilizing real-world context. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
	A1.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
A1.F-IF.B (cont.)	**A1.F-IF.B.6**	Calculate and interpret the average rate of change of a continuous function (presented symbolically or as a table) on a closed interval. Estimate the rate of change from a graph. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
A1.F-IF.C **Analyze functions using different representations.**	**A1.F-IF.C.7**	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
	A1.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square of a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
	A1.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

		Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Building Functions (F-BF)		
A1.F-BF.A **Build a function that models a relationship between two quantities.**	**A1.F-BF.A.1**	Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
A1.F-BF.B **Build new functions from existing functions.**	**A1.F-BF.B.3**	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, 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. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Linear, Quadratic, and Exponential Models (F-LE)		
A1.F-LE.A **Construct and compare linear, quadratic, and exponential models and solve problems.**	**A1.F-LE.A.1**	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. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
A1.F-LE.A (cont.)	**A1.F-LE.A.2**	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input/output pairs.
	A1.F-LE.A.3	Observe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
A1.F-LE.B **Interpret expressions for functions in terms of the situation they model.**	**A1.F-LE.B.5**	Interpret the parameters in a linear or exponential function with integer exponents utilizing real world context.

Statistics and Probability - S		
Summarize, represent, and interpret data on a single count or measurement variable. (S-ID)		
A1.S-ID.A **Summarize, represent, and interpret data on a single count or measurement variable.**	**A1.S-ID.A.1**	Represent real-value data with plots for the purpose of comparing two or more data sets.
	A1.S-ID.A.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.
	A1.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of outliers if present.
A1.S-ID.B **Summarize, represent, and interpret data on two categorical and quantitative variables.**	**A1.S-ID.B.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.
	A1.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the quantities are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Focus on linear models. b. Informally assess the fit of a function by plotting and analyzing residuals.
A1.S-ID.C **Interpret linear models.**	**A1.S-ID.C.7**	Interpret the slope as a rate of change and the constant term of a linear model in the context of the data.
	A1.S-ID.C.8	Compute and interpret the correlation coefficient of a linear relationship.
	A1.S-ID.C.9	Distinguish between correlation and causation.
Conditional Probability and the rules of Probability (S-CP)		
A1.S-CP.A **Understand independence and conditional probability and use them to interpret data.**	**A1.S-CP.A.1**	Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events.
	A1.S-CP.A.2	Use the Multiplication Rule for independent events to understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

Algebra I Math Item Specifications

The Real Number System (N-RN)

A1.N-RN.B.3

Content Standards	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.
Explanations	Since every difference is a sum and every quotient is a product, this includes differences and quotients as well. Explaining why the four operations on rational numbers produce rational numbers can be a review of students understanding of fractions and negative numbers. Explaining why the sum of a rational and an irrational number is irrational, or why the product is irrational, includes reasoning about the inverse relationship between addition and subtraction (or between multiplication and addition).
Content Limits	This standard is aligned to Algebra I only. For products, can include [irrational number] x 0 as rational.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to given sums/products of numbers, identify which are rational and which are irrational.	• Multiple Choice Response • Multi-Select Response
Students will be required to justify why the sums/products of two rational numbers, two irrational numbers, and one irrational and one rational numbers are necessarily rational or irrational.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Recognize that the sum or product of two rational numbers is rational.	Recognize that the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational.
Proficient	**Highly Proficient**
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.	Generalize and develops rules for the sum or product of two rational numbers being rational; the sum of a rational number and an irrational number being irrational; and the product of a nonzero rational number and an irrational number being irrational.

Quantities (N-Q)

A1.N-Q.A.1

Content Standards	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, include utilizing real-world context.
Explanations	Include word problems where quantities are given in different units, which must be converted to make sense of the problem. Graphical representations and data displays include, but are not limited to: line graphs, circle graphs, histograms, multi-line graphs, scatterplots, and multi-bar graphs.
Content Limits	Rational numbers Linear equations and graph Exponential equations and graphs Customary and metric units of measure
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Given a solution, students will determine the correct units based on the context.	• Equation Response • Multiple Choice Response • Multiple Select Response • Editing Task Choice
Students will use dimensional analysis to convert one unit to another in order provide a solution within a real-world situation.	
Students will convert between different units in order to determine the solution for a real-world problem.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify units for the solution of multi-step problems; Identify units consistently in formulas; Identify the scale and the origin in graphs and data displays, include utilizing real-world context.	Choose units for the solution of multi-step problems; choose units consistently in formulas; choose the scale and the origin in graphs and data displays, include utilizing real-world context.
Proficient	**Highly Proficient**
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, include utilizing real-world context.	Use units as a way to understand problems and to justify the solution of multi-step problems; choose and interpret units consistently in formulas; interpret and explain the scale and the origin in graphs and data displays, include utilizing real-world context.

A1.N-Q.A.2

Content Standards	Define appropriate quantities for the purpose of descriptive modeling. Include problem-solving opportunities utilizing real-world context.
Explanations	Reason quantitatively and use units to solve problems.
Content Limits	Linear and exponential models.
Context	Context is required.

Sample Task Demands	Common Item Formats
Students will be required to use quantities appropriate to the context to solve problems.	• Equation Response • Editing Task Choice • Multiple Choice Response

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify appropriate quantities for the purpose of descriptive modeling.	Define appropriate quantities for the purpose of descriptive modeling.
Proficient	**Highly Proficient**
Define appropriate quantities for the purpose of descriptive modeling. Include problem-solving opportunities utilizing real-world context.	Define and use appropriate quantities for the purpose of descriptive modeling. Include problem-solving opportunities utilizing real-world context.

A1.N-Q.A.3

Content Standards	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world context.
Explanations	The margin of error and tolerance limit varies according to the measure, tool used, and context.
Content Limits	
Context	Context is required.

Sample Task Demands	**Common Item Formats**
Students will be required to choose a level of accuracy when reporting quantities in a real-world context.	• Editing Task Choice • Equation Response • Multiple Choice Response • Multi-Select Response

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify a level of accuracy on measurement when reporting quantities utilizing real-world context.	Identify a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world context.
Proficient	**Highly Proficient**
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world context.	Compare the levels of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world context.

Seeing Structure in Expressions (A-SSE)

A1.A-SSE.A.1, A1.A-SSE.A.1a, A1.A-SSE.A.1b

Content Standards	A1.A-SSE.A.1 Interpret expressions that represent a quantity in terms of its context. A1.A-SSE.A.1a Interpret parts of an expression, such as terms, factors, and coefficients. A1.A-SSE.A.1b Interpret expressions by viewing one or more of their parts as a single entity.
Explanations	Students should understand the vocabulary for the parts that make up the whole expression and be able to identify those parts and interpret their meaning in terms of a context.
Content Limits	This standard is aligned to Algebra I only. Focus on factors and coefficients of simpler expressions for A-SSE.A.1a. Focus on termos of complicated expressions for A-SSE.A.1b.
Context	Context is required.

Sample Task Demands	**Common Item Formats**
Students will be required to select the meaning for part of a given expression.	• Multiple Choice Response
Students will be required to identify what part of a given expression has a given meaning.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Interpret expressions that represent a quantity in terms of its context. a. Identify parts of an expression, such as terms, factors, and coefficients. b. Match expressions by viewing one or more of their parts as a single entity.	Interpret expressions that represent a quantity in terms of its context. a. Define parts of an expression, such as terms, factors, and coefficients. b. Use expressions by viewing one or more of their parts as a single entity.
Proficient	**Highly Proficient**
Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret expressions by viewing one or more of their parts as a single entity.	Interpret expressions that represent a quantity in terms of its context. a. Differentiate parts of an expression, such as terms, factors, and coefficients. b. Make observations about expressions by viewing one or more of their parts as a single entity.

A1.A-SSE.A.2

Content Standards	Use structure to identify ways to rewrite numerical and polynomial expressions. Focus on polynomial multiplication and factoring patterns.
Explanations	Students should extract the greatest common factor (whether a constant, a variable, or a combination of each). If the remaining expression is quadratic, students should factor the expression further.
Content Limits	Numerical expressions and polynomial expression in one variable The given expression must be in a form that allows students to use the structure to identify an equivalent expression - not simply using properties of operations.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify an equivalent expression.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to construct a new equivalent expression from a given expression.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify equivalent numerical and polynomial expressions. Focus on polynomial multiplication patterns.	Identify ways to rewrite equivalent numerical and polynomial expressions. Focus on polynomial multiplication and factoring patterns.
Proficient	**Highly Proficient**
Use structure to identify ways to rewrite numerical and polynomial expressions. Focus on polynomial multiplication and factoring patterns.	Assess ways to rewrite numerical and polynomial expressions. Focus on polynomial multiplication and factoring patterns.

A1.A-SSE.B.3, A1.A-SSE.B.3a, A1.A-SSE.B.3b

Content Standards	A1.A-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. A1.A-SSE.B.3a Factor a quadratic expression to reveal the zeros of the function it defines. A1.A-SSE.B.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
Explanations	Students will use the properties of operations to create equivalent expressions.
Content Limits	This standard is aligned to Algebra I only. Quadratic expressions The item must require factoring as the solution method for A-SSE.B.3a. The item must require completing the square as a solution method for A-SSE.B.3b.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify the zeros of a function given in factored form.	• Equation Response • Multiple Choice Response
Students will be required to identify the factored form of a quadratic expression.	
Students will be required to identify the factored form of a quadratic expression and the zeroes of the function it defines.	
Students will be required to identify the maximum or minimum of a quadratic expression in vertex form.	
Students will be required to identify the vertex form of a quadratic expression.	
Students will be required to identify the vertex form of a quadratic expression and the max/min of the function it defines.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Identify a factored quadratic expression that reveals the zeros of the function it defines. b. Identify a quadratic expression that reveals the maximum or minimum value of the function it defines.	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Use a factored quadratic expression that reveals the zeros of the function it defines. b. Use a quadratic expression that reveals the maximum or minimum value of the function it defines.
Proficient	**Highly Proficient**
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Explain conditions for the zeros of a quadratic function. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines and use it to solve problems

Arithmetic with Polynomials & Rational Expressions (A-APR)

A1.A-APR.A.1

Content Standards	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.
Explanations	Perform arithmetic operations on polynomials.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to calculate the sum, difference or product of polynomials.	• Multiple Choice Response

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Add and subtract polynomials.	Add, subtract, and multiply polynomials.
Proficient	**Highly Proficient**
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.	Explain 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.

A1.A-APR.B.3

Content Standards	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. Focus on quadratic and cubic polynomials in which linear and quadratic factors are available.
Explanations	Understand the relationship between zeros and factors of polynomials.
Content Limits	Quadratic and cubic polynomials in which linear and quadratic factors are available
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify the zeroes of a polynomial.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to given a polynomial, determine its graph.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify zeros of polynomials when suitable factorizations are available. Focus on quadratic and cubic polynomials in which linear and quadratic factors are available.	Use the zeros of polynomials to construct a rough graph of the function defined by the polynomial. Focus on quadratic and cubic polynomials in which linear and quadratic factors are available.
Proficient	**Highly Proficient**
Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. Focus on quadratic and cubic polynomials in which linear and quadratic factors are available.	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. Focus cubic polynomials in which quadratic factors are available.

Creating Equations (A-CED)

A1.A-CED.A.1

Content Standards	Create equations and inequalities in one variable and use them to solve problems. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Explanations	Equations can represent real world and mathematical problems. Include equations and inequalities that arise when comparing the values of two different functions, such as one describing linear growth and one describing exponential growth.
Content Limits	Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Context	Context is subject to task demand.

Sample Task Demands	Common Item Formats
Students will be required to identify the solution for a given equation or inequality. Context is not allowed.	• Equation Response • Multiple Choice Response
Students will be required to construct an equation or inequality to model a context. Context is required.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify equations and inequalities in one variable that can be used to solve problems. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	Use equations and inequalities in one variable to solve problems. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Proficient	**Highly Proficient**
Create equations and inequalities in one variable and use them to solve problems. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	Analyze equations and inequalities in one variable and use them to solve problems. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).

A1.A-CED.A.2

Content Standards	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
Explanations	Create equations that describe numbers or relationships.
Content Limits	This standard is aligned to Algebra I only. Students must be required to construct an equation and/or graph given equations.
Context	Context is subject to task demand.

Sample Task Demands	Common Item Formats
Students will be required to identify the solution for an equation. Context is not allowed.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to construct a graphical representation of an equation. Context is not allowed.	
Students will be required to construct an equation to represent a context. Context is required.	
Students will be required to construct an equation and identify a solution. Context is required.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	Use equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
Proficient	**Highly Proficient**
Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	Analyze equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A1.A-CED.A.3

Content Standards	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.
Explanations	Create equations that describe numbers or relationships.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is required.

Sample Task Demands	Common Item Formats
Students will be required to given a constraint or set of constraints, identify possible solutions.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to construct a graphical representation of a constraint or set of constraints.	
Students will be required to create or identify a constraint or set of constraints given a context.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify constraints of equations or inequalities, and of systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.	Apply constraints of equations or inequalities, and of systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.
Proficient	**Highly Proficient**
Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.	Justify constraints of equations or inequalities, and by systems of equations and/or inequalities, and justify solutions as viable or non-viable options in a modeling context.

A1.A-CED.A.4

Content Standards	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.*
Explanations	Create equations that describe numbers or relationships.
Content Limits	This standard is aligned to Algebra I only. The student must be provided an equation. Generally, if the equation to be created is very complex, consider using multiple choice response rather than equation response.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to given an equation, identify or create a form of that equation solved for a specific variable.	• Equation Response • Multiple Choice Response
Students will be required to given an equation, describe how one quantity changes when another changes (ex. Given $V = IR$, how does I change if R is doubled and V remains constant?).	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify formulas that highlight a quantity of interest, using the same reasoning as in solving equations.	Apply formulas that highlight a quantity of interest, using the same reasoning as in solving equations.
Proficient	**Highly Proficient**
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.*	Rearrange and apply formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Reasoning with Equations and Inequalities (A-REI)

A1.A-REI.A.1

Content Standards	Explain each step in solving linear and quadratic equations 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.
Explanations	Properties of operations can be used to change expressions on either side of the equation to equivalent expressions. In addition, adding the same term to both sides of an equation or multiplying both sides by a non-zero constant produces an equation with the same solutions. Other operations, such as squaring both sides, may produce equations that have extraneous solutions.
Content Limits	Linear and quadratic equations
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to justify a next step in a solution process (i.e., "commutative property", etc.).	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to identify a correct next step in a solution process.	
Students will be required to given a series of steps in an attempt to solve an equation identify the error(s) and the correct solution.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify each step in solving linear and quadratic equations as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution.	Carry out each step in solving linear and quadratic equations as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Identify a viable argument to justify a solution method.
Proficient	**Highly Proficient**
Explain each step in solving linear and quadratic equations 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.	Critique each step in solving linear and quadratic equations 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.

A1.A-REI.B.3

Content Standards	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
Explanations	Solve equations and inequalities in one variable.
Content Limits	This standard is aligned to Algebra I only. Equations must be given to the student.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to solve equations or inequalities from context or no context.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to graph the solution of an inequality on a number line.	
Students will be required to analyze and solve equations or inequalities with unknown constant coefficients.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Solve one-step and two-step linear equations and inequalities in one variable, including equations with coefficients represented by letters.	Solve two- step linear equations and inequalities in one variable, including equations with coefficients represented by letters.
Proficient	**Highly Proficient**
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	Compare different methods to solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A1.A-REI.B.4, A1.A-REI.B.4a, A1.A-REI.B.4b

Content Standards	A1.A-REI.B.4 Solve quadratic equations in one variable. A1.A-REI.B.4a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - k)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. A1.A-REI.B.4b Solve quadratic equations by inspection (e.g., $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Focus on solutions for quadratic equations that have real roots. Include cases that recognize when a quadratic equation has no real solutions.
Explanations	Students should solve by factoring, completing the square, and using the quadratic formula. The zero product property is used to explain why the factors are set equal to zero. Students should relate the value of the discriminant to the type of root to expect. A natural extension would be to relate the type of solutions to $ax^2 + bx + c = 0$ to the behavior of the graph of $y = ax^2 + bx + c$.
Content Limits	This standard is aligned to Algebra I only. Quadratics with real solutions.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to create equivalent quadratic equations in the form $(x - p)^2 = q$.	• Equation Response • Multiple Choice Response • Multi-Select
Students will be required to solve quadratic equations.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Solve quadratic equations in one variable. a. Identify the quadratic formula. b. Solve quadratic equations by inspection (e.g., $x^2 = 49$), taking square roots, as appropriate to the initial form of the equation. Focus on solutions for quadratic equations that have real roots. Include cases that recognize when a quadratic equation has no real solutions.	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 $(x - k)^2 = q$ that has the same solutions where $q = 0$. Use the quadratic formula. b. Solve quadratic equations by inspection (e.g., $x^2 = 49$), taking square roots, the quadratic formula and factoring, as appropriate to the initial form of the equation. Focus on solutions for quadratic equations that have real roots. Include cases that recognize when a quadratic equation has no real solutions.
Proficient	**Highly Proficient**
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 $(x - k)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Focus on solutions for quadratic equations that have real roots. Include cases that recognize when a quadratic equation has no real solutions.	Solve quadratic equations in one variable. a. Derive the quadratic formula. b. Determine whether to solve quadratic equations by inspection (e.g., $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Focus on solutions for quadratic equations that have real roots. Include cases that recognize when a quadratic equation has no real solutions.

A1.A-REI.C.5

Content Standards	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.
Explanations	Solve systems of equations.
Content Limits	This standard is aligned to Algebra I only. Linear systems.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to given a system of equations, identify another system that has the same solutions (based on the process described in the standard).	• Multiple Choice Response

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Understand 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.	Explain 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.
Proficient	**Highly Proficient**
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.	Given two systems of two equations in two variables, verify that they have the same solutions by replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A1.A-REI.C.6

Content Standards	Solve systems of linear equations exactly and approximately, focusing on pairs of linear equations in two variables. Include problem solving opportunities utilizing real-world context.
Explanations	The system solution methods can include but are not limited to graphical, elimination/linear combination, substitution, and modeling. Systems can be written algebraically or can be represented in context.
Content Limits	Linear systems with exact solutions and limited calculations. 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)
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to given the graph of a system of equations, identify a possible solution.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to solve a system of equations.	
Students will be required to graph a system of equations and identify an approximate solution.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Solve systems of linear equations approximately, focusing on pairs of linear equations in two variables.	Solve systems of linear equations approximately, focusing on pairs of linear equations in two variables. Include problem solving opportunities utilizing real-world context.
Proficient	**Highly Proficient**
Solve systems of linear equations exactly and approximately, focusing on pairs of linear equations in two variables. Include problem solving opportunities utilizing real-world context.	Analyzes a system of linear equations exactly and approximately, focusing on pairs of linear equations in two variables. Include problem solving opportunities utilizing real-world context.

A1.A-REI.D.10

Content Standards	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.
Explanations	Represent and solve equations and inequalities graphically.
Content Limits	This standard is aligned to Algebra I only. Linear and exponential equations
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify coordinates of points that lie on the graph of a given equation.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to plot points that are solutions to a given equation.	
Students will be required to identify other possible solutions to a given equation, type of equation, and/or the graph of a solution to the equation.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify the graph of an equation in two variables.	Identify a solution given the graph of an equation in two variables.
Proficient	**Highly Proficient**
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.	Explain 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.

A1.A-REI.D.11

Content Standards	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). Focus on cases where $f(x)$ and/or $g(x)$ are linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Explanations	Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that can be represented graphically or numerically.
Content Limits	Focus on cases where *f(x)* and/or *g(x)* are linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step). Note that this standard is not about systems, but about the solution(s) to $f(x) = g(x)$; thus, solutions should be values of *x*.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify the solution(s) to $f(x) = g(x)$, given the graph of the two functions.	• Equation Response • Graphic Response • Multiple Choice Response • Proposition Response
Students will be required to identify the solutions to $f(x) = g(x)$.	
Students will be required to identify a possible $g(x)$, given $f(x)$ and the value(s) of *x* where $f(x) = g(x)$.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect as the solutions of the equation $f(x) = g(x)$. Focus on cases where $f(x)$ and/or $g(x)$ are linear.	Identify the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect as 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). Focus on cases where $f(x)$ and/or $g(x)$ are linear and exponential functions.
Proficient	**Highly Proficient**
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). Focus on cases where $f(x)$ and/or $g(x)$are linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	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 exactly (e.g., using technology to graph the functions, make tables of values, or find successive approximations). Focus on cases where $f(x)$ and/or $g(x)$ are linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).

A1.A-REI.D.12

Content Standards	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.
Explanations	Represent and solve equations and inequalities graphically.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to select the solution region for a system of inequalities.	• Graphic Response • Multiple Choice Response
Students will be required to graph the boundary for a non-strict inequality and drag a symbol to show the solution set.	
Students will be required to graph the boundaries for a system of non-strict inequalities and drag a symbol to show the solution set.	
Students will be required to identify the graph and solution set for a system of non-strict inequalities.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify a solution to a linear inequality in two variables as a half-plane, excluding the boundary in the case of a strict inequality.	Graph the solutions to a linear inequality in two variables as a half-plane, excluding the boundary in the case of a strict inequality.
Proficient	**Highly Proficient**
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.	Create a system of linear inequalities given a graph of the solution set.

Functions- Interpreting Functions (F-IF)

A1.F-IF.A.1

Content Standards	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*).
Explanations	The domain of a function given by an algebraic expression, unless otherwise specified, is the largest possible domain.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to recognize functions.	• Multiple Choice Response • Matching Item Response • Multi-Select Response • Proposition Response • Table Response
Students will be required to create or complete examples of functions and nonfunctions.	
Students will be required to explain why a relation is or is not a function.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Understand that the graph of *f* is the graph of the equation *y* = *f*(*x*).	Understand that 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*).
Proficient	**Highly Proficient**
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*).	Create a function or non-function based on understanding that a function from the domain to the range assigns to each element of the domain exactly one element of the range.

A1.F-IF.A.2

Content Standards	Evaluate a function for inputs in the domain, and interpret statements that use function notation in terms of a context.
Explanations	The domain of a function given by an algebraic expression, unless otherwise specified, is the largest possible domain.
Content Limits	This standard is aligned to Algebra I only. Linear, quadratic, and exponential functions
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to recognize and identify input or output values from the table of a function.	• Equation Response • Graphic Response • HotText Response • Multiple Choice Response • Table Response
Students will be required to recognize correct uses of function notation.	
Students will be required to complete a table of input and output values for a given function.	
Students will be required to interpret statements that use function notation in terms of a context.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Evaluate a function for an input in the domain.	Evaluate a function for inputs in the domain.
Proficient	**Highly Proficient**
Evaluate a function for inputs in the domain, and interpret statements that use function notation in terms of a context.	Evaluate a function for inputs in the domain, and apply statements that use function notation in terms of a context.

A1.F-IF.A.3

Content Standards	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
Explanations	Understand the concept of a function and use function notation.
Content Limits	Linear or exponential Limit sequence representations to rational values
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to construct a function to model a sequence.	• Equation Response

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify sequences or functions defined recursively, whose domain is a subset of the integers.	Use sequences or functions defined recursively, whose domain is a subset of the integers.
Proficient	**Highly Proficient**
Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.	Create a function defined recursively.

A1.F-IF.B.4

Content Standards	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. Include problem-solving opportunities utilizing real-world context. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Explanations	Students may be given graphs to interpret or produce graphs given an expression or table for the function, by hand or using technology.
Content Limits	Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step). Key features may also include domain and range
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify an interval on a graph where the function is increasing or decreasing.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to identify intercepts of a function.	
Students will be required to construct the graph of a linear function with a given verbal description for the intercept and/or slope.	
Students will be required to identify key features, such as relative maximums and minimums, symmetries, and end behavior, of graphs and tables in terms of the quantities.	
Students will be required to create a linear function with the same slope but different y-intercept.	
Students will be required to create an exponential function that grows at a different rate than a given one.	
Students will be required to describe the meaning of key features of a function.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
For a function that models a relationship between two quantities, identify key features of graphs and tables in terms of the quantities. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums. Focus on linear and exponential and functions.	For a function that models a relationship between two quantities, identify key features of graphs and tables in terms of the quantities. Include problem-solving opportunities utilizing real-world context. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums. Focus on linear and exponential and functions.
Proficient	**Highly Proficient**
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. Include problem-solving opportunities utilizing real-world context. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	For a function that models a relationship between two quantities, explain key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Include problem-solving opportunities utilizing real-world context. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).

A1.F-IF.B.5

Content Standards	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
Explanations	Students may explain orally, or in written format, the existing relationships.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to create a graph with a given domain.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to determine the domain of the given graph of a function.	
Students will be required to determine the domain of a given function based on context.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify the domain of a function from its graph.	Identify the domain of a function from its graph and, where applicable, relate it to the quantitative relationship it describes.
Proficient	**Highly Proficient**
Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes in a real-world context.

A1.F-IF.B.6

Content Standards	Calculate and interpret the average rate of change of a continuous function (presented symbolically or as a table) on a closed interval. Estimate the rate of change from a graph. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Explanations	The average rate of change of a function y = f(x) over an interval [a,b] is $\Delta y/\Delta x=(f(b)-f(a))/(b-a)$ In addition to finding average rates of change from functions given symbolically, graphically, or in a table, Students may collect data from experiments or simulations (ex. falling ball, velocity of a car, etc.) and find average rates of change for the function modeling the situation.
Content Limits	Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to estimate the average rate of change of the graph of a given function over a given interval.	• Equation Response • Multiple Choice Response
Students will be required to calculate the average rate of change of a function expressed symbolically or as a table over a given interval.	
Students will be required to interpret the rate of change in context.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Estimate the rate of change from a graph. Focus on linear and exponential functions.	Calculate the average rate of change of a continuous function (presented symbolically or as a table) on a closed interval. Estimate the rate of change from a graph. Include problem-solving opportunities utilizing real-world context. Focus on linear and exponential functions.
Proficient	**Highly Proficient**
Calculate and interpret the average rate of change of a continuous function (presented symbolically or as a table) on a closed interval. Estimate the rate of change from a graph. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	Analyze the average rate of change of a continuous function (presented symbolically or as a table) on a closed interval. Estimate the rate of change from a graph. Include problem-solving opportunities utilizing real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).

A1.F-IF.C.7

Content Standards	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Explanations	Analyze functions using different representations.
Content Limits	Linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step)
Context	Context is not required.

Sample Task Demands	Common Item Formats
Graph a linear function	• Editing Task Choice • Equation Response • Multiple Choice Response • Multi-Select Response
Identify key features of a piecewise function	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify key features of linear and exponential functions shown on a graph.	Identify key features functions shown on a graph. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Proficient	**Highly Proficient**
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	Graph more than one function expressed symbolically, and compare key features of the graphs. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).

A1.F-IF.C.8, A1.F-IF.C.8a

Content Standards	A1.F-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. A1.F-IF.C.8a Use the process of factoring and completing the square of a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
Explanations	Analyze functions using different representations.
Content Limits	Functions in one form must be given to students, who are then expected to write these functions in different forms.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to create an equivalent function in a specific form that reveals characteristics of the function defined by that expression.	• Equation Response • Multiple Choice Response • Proposition Response
Students will be required to interpret parameters of a function in terms of the context.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
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 a quadratic function to show zeros.	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 of a quadratic function to show zeros, extreme values, and symmetry of the graph.
Proficient	**Highly Proficient**
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 of a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Determine an appropriate method to rewrite a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

A1.F-IF.C.9

Content Standards	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Explanations	Analyze functions using different representations.
Content Limits	Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to compare numeric values representing properties of two functions.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to compare two functions qualitatively.	
Students will be required to construct a graph of a function for which a given comparison with another function is true.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify properties of two functions each represented in a different way (graphically or numerically in tables). Focus on linear and exponential functions.	Define properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Focus on linear, quadratic, and exponential functions.
Proficient	**Highly Proficient**
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	Analyze two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).

Functions- Building Functions (F-BF)

A1.F-BF.A.1

Content Standards	Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Explanations	Students will analyze a given problem to determine the function expressed by identifying patterns in the function's rate of change. They will specify intervals of increase, decrease, constancy, and, if possible, relate them to the function's description in words or graphically.
Content Limits	Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to perform arithmetic operations to write one function that models a context for another.	• Equation Response • Multiple Choice Response
Students will be required to create a multi-faceted function to model a context.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify a function that describes a relationship between two quantities. Identify an explicit expression, steps for calculation from real-world context. Focus on linear and exponential functions.	Identify a function that describes a relationship between two quantities. Identify an explicit expression, a recursive process, or steps for calculation from real-world context. Focus on linear, quadratic and exponential functions.
Proficient	**Highly Proficient**
Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from real-world context. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	Write a function that describes a relationship between two quantities. Compare the explicit expression to the recursive process. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).

A1.F-BF.B.3

Content Standards	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\ f(x)$, 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. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Explanations	Students will apply transformations to functions and recognize functions as even and odd.
Content Limits	Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to show the effects of a transformation by translating a graph.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to determine the value of k from two related functions or graphs.	
Students will be required to create a function to model a transformation of a given graph.	
Students will be required to describe the effects of k on a transformation of a function.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify the effect on the graph of replacing f(x) by f(x) + k, and f(x+k) for specific positive values of k. Illustrate the effects on the graph. Focus on linear and exponential functions.	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), and f(x+k) for specific positive values of k; identify the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph. Focus on linear, quadratic, and exponential functions.
Proficient	**Highly Proficient**
Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), 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. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).	Explain the effect on the graph of replacing f(x) by f(x) + k, k f(x), and f(x+k) for specific values of k (both positive and negative rational numbers); determine the value of k given the graphs. Experiment with cases and explain an explanation of the effects on the graph. Focus on linear, quadratic, exponential and piecewise-defined functions (limited to absolute value and step).

Functions- Linear, Quadratic, and Exponential Models (F-LE)

A1.F-LE.A.1, A1.F-LE.A.1a, A1.F-LE.A.1b, A1.F-LE.A.1c

Content Standards	A1.F-LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. A1.F-LE.A.1a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. A1.F-LE.A.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. A1.F-LE.A.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
Explanations	Students can investigate functions and graphs modeling different situations involving simple and compound interest. Students can compare interest rates with different periods of compounding (monthly, daily) and compare them with the corresponding annual percentage rate. Spreadsheets and applets can be used to explore and model different interest rates and loan terms.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to create a value or expression to show how a function grows over equal intervals.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to identify situations that represent linear growth.	
Students will be required to identify situations that represent exponential growth.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Recognize that linear functions grow by equal differences over equal intervals. b. Identify situations in which one quantity changes at a constant rate per unit interval relative to another. c. Identify situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Recognize that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Identify situations in which one quantity changes at a constant rate per unit interval relative to another as a situation that can be modeled with a linear function. c. Identify situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another as a situation that can be modeled with an exponential function.
Proficient	**Highly Proficient**
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. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Explain why linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Create situations in which one quantity changes at a constant rate per unit interval relative to another. c. Create situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

A1.F-LE.A.2

Content Standards	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input/output pairs.
Explanations	Construct and compare linear and exponential models and solve problems.
Content Limits	Constructing linear and exponential functions in simple context (not multi-step)
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to create an equation of a linear function passing through two given points.	• Equation Response
Students will be required to create an equation of a linear function given a graph of that function.	
Students will be required to create an equation of a linear function given a description of that function.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify linear functions, including arithmetic sequences, given a graph, a description of a relationship, or input/output pairs.	Identify linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input/output pairs.
Proficient	**Highly Proficient**
Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input/output pairs.	Explain how linear and exponential functions, can model arithmetic and geometric sequences.

A1.F-LE.A.3

Content Standards	Observe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
Explanations	Construct and compare linear, quadratic, and exponential models and solve problems.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to compare two or more functions for values over various intervals given graphs or other representations of the functions.	• Equation Response • Multi-Select Response
Students will be required to solve problems based on the fact that exponential functions grow/decay faster than linear or quadratic functions.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify graphs and tables that have a quantity increasing linearly, exponentially, or quadratically.	Compare graphs and tables that have quantities increasing linearly, exponentially, and quadratically.
Proficient	**Highly Proficient**
Observe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.	Explain why a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.

A1.F-LE.B.5

Content Standards	Interpret the parameters in a linear or exponential function with integer exponents utilizing real-world context.
Explanations	Interpret expressions for functions in terms of the situation they model.
Content Limits	Exponential functions limited to those with domains in the integers
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to interpret the meaning of a parameter of a function.	• Multi-Select Response
Students will be required to interpret the meaning of a parameter in a function that combines linear and exponential terms.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify the parameters in a linear function with integer exponents utilizing real world context.	Identify the parameters in a linear or exponential function with integer exponents utilizing real world context.
Proficient	**Highly Proficient**
Interpret the parameters in a linear or exponential function with integer exponents utilizing real world context.	Define the parameters while creating a linear or exponential function with integer exponents utilizing real world context.

Statistics and Probability- Summarize, represent, and interpret data on a single count or measurement variable (S-ID)

A1.S-ID.A.1

Content Standards	Represent real-value data with plots for the purpose of comparing two or more data sets.
Explanations	Summarize, represent, and interpret data on a single count or measurement variable.
Content Limits	This standard is aligned to Algebra I only. The amount of data to be plotted should be reasonable.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to construct a data display.	• Graphic Response • Multiple Choice Response

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Match real-value data with dot plots, histograms, and box plots.	Represent real-value data with dot plots, histograms, and box plots.
Proficient	**Highly Proficient**
Represent real-value data with plots for the purpose of comparing two or more data sets.	Represent real-value data with the most appropriate plots and analyze the similarities and differences between two or more data sets.

A1.S-ID.A.2

Content Standards	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.
Explanations	Summarize, represent, and interpret data on a single count or measurement variable.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify data distributions that share commonalities (i.e., same spread, interquartile range, median, and mean) through inspection.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to distinguish between different spreads to compare the mean and medians of the data set.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify the center (median, mean) and spread (interquartile range) of two or more different data sets.	Compare the center (median, mean) or spread (interquartile range, standard deviation) of two or more different data sets.
Proficient	**Highly Proficient**
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.	Use statistics appropriate to the shape of the data distribution to analyze and explain the similarities and differences between the center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

A1.S-ID.A.3

Content Standards	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of outliers if present.
Explanations	Summarize, represent, and interpret data on a single count or measurement variable.
Content Limits	This standard is aligned to Algebra I only.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to construct a graph given information about the shape, center, and spread.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to compare different distributions in order to draw conclusions about the effects of an extreme outlier on different spreads	
Students will be required to make inferences about the spread of distributions to draw conclusions about the given context. (i.e., what does a skewed distribution of test scores tell us about the test questions).	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify differences in shape, center, and spread in the context of the data sets.	Compare informally differences in shape, center, and spread in the context of the data sets, accounting for possible effects of outliers if present.
Proficient	**Highly Proficient**
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of outliers if present.	Interpret and explain differences in shape, center, and spread in the context of the data sets, make observations about the effects different outlier would have.

A1.S-ID.B.5

Content Standards	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.
Explanations	Summarize, represent, and interpret data on two categorical and quantitative variables.
Content Limits	This standard is aligned to Algebra I only. Bivariate data Positive rational numbers
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to construct a contingency table in order to show the relationships between variables.	• Equation Response • Multiple Choice Response • Table Resposne
Students will be required to interpret tables to calculate marginal and joint frequencies within the context.	
Students will be required to identify patterns in a distribution in order to answer questions pertaining to the data set and context.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
For categorical data summarized for two categories in two-way frequency tables, identify relative frequencies in the context of the data.	Complete a partially filled in frequency table to summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data, including joint, and conditional relative frequencies.
Proficient	**Highly Proficient**
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.	Summarize categorical data for two categories in two-way frequency tables. Interpret and explain relative frequencies in the context of the data, including joint, marginal, and conditional relative frequencies. Explain possible associations and trends in the data.

A1.S-ID.B.6, **A1.S-ID.B.6a**, A1.S-ID.B.6b

Content Standards	A1.S-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the quantities are related. A1.S-ID.B.6a Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Focus on linear models. A1.S-ID.B.6b Informally assess the fit of a function by plotting and analyzing residuals.
Explanations	The residual in a regression model is the difference between the observed and the predicted *y* for some *x* (y the dependent variable and *x* the independent variable). So if we have a model $y = ax + b$ and a data point (xi, yi), the residual is for this point is $ri = yi - (axi + b)$. Students may use spreadsheets, graphing calculators, and statistical software to represent data, describe how the variables are related, fit functions to data, perform regressions, and calculate residuals.
Content Limits	Rational numbers; Bivariate data; Linear, quadratic, and exponential models
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to select a function that best represents the data given a set of data. (a)	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to plot and analyze residuals on a number line. (b)	
Students will be required to create a linear function that best represents the data given a scatter plot. (c)	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Represent data on two quantitative variables on a scatter plot, and describe how the quantities are related. a. Identify a linear function that best fits the data represented in a scatter plot. b. Informally assess the fit of a function when given a residual plot.	Represent data on two quantitative variables on a scatter plot, and describe how the quantities are related. a. Identify a linear function that best fits the data represented in a scatter plot; use functions fitted to data to identify the solutions to problems in the context of the data. Focus on linear models. b. Plot the residuals of a function.
Proficient	**Highly Proficient**
Represent data on two quantitative variables on a scatter plot, and describe how the quantities are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Focus on linear models. b. Informally assess the fit of a function by plotting and analyzing residuals.	Represent data on two quantitative variables on a scatter plot, and describe how the quantities are related. a. Compare the fit of different functions to the data, including exponential functions with domains in the integers; use functions fitted to data to solve problems in the context of the data. b. Informally assess the fit of different functions by plotting and analyzing their residuals.

A1.S-ID.C.7

Content Standards	Interpret the slope as a rate of change and the constant term of a linear model in the context of the data.
Explanations	Interpret linear models.
Content Limits	This standard is aligned to Algebra I only. A linear model should be provided The model should not fit exactly a set of data, if given
Context	Context is required.

Sample Task Demands	**Common Item Formats**
Students will be required to interpret the rate of change and/or constant term of a linear model to identify valid conclusions.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to identify the value in a linear model that represents a given interpretation.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Match the slope and the constant term of a linear model with their meaning in the context of the data.	Identify the slope of a linear model as a rate of change in the context of the data, and identify the constant term of a linear model in the context of the data.
Proficient	**Highly Proficient**
Interpret the slope as a rate of change and the constant term of a linear model in the context of the data.	Define the meaning of the slope as a rate of change in the context of the data, and define the constant term of a linear model in the context of the data.

A1.S-ID.C.8

Content Standards	Compute and interpret the correlation coefficient of a linear relationship.
Explanations	Interpret linear models.
Content Limits	This standard is aligned to Algebra I only. Items should focus on interpreting a given correlation coefficient
Context	Context is required.

Sample Task Demands	Common Item Formats
Students will be required to interpret the correlation coefficient of a linear fit.	• Equation Response • Multiple Choice Response
Students will be required to identify another correlation coefficient that satisfies a given condition given a correlation coefficient (i.e., a coefficient that shows a better positive correlation than 0.7).	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Select the correlation coefficient of a linear relationship represented with a scatter plot where the correlation coefficient can be easily estimated.	Identity the correlation coefficient of a linear relationship.
Proficient	**Highly Proficient**
Compute and interpret the correlation coefficient of a linear relationship.	Explain the meaning of different correlation coefficients for linear relationships.

A1.S-ID.C.9

Content Standards	Distinguish between correlation and causation.
Explanations	Some data leads observers to believe that there is a cause and effect relationship when a strong relationship is observed. Students should be careful not to assume that correlation implies causation. The determination that one thing causes another requires a controlled randomized experiment.
Content Limits	This standard is aligned to Algebra I only. Bivariate, linear data Items should focus on the fact that causation cannot be determined from correlation, rather than asking the student to decide which relationships are causal and which are not.
Context	Context is required.

Sample Task Demands	Common Item Formats
Students will be required to distinguish information that a correlation coefficient provides (fit, trend) to information it does not (causation).	• Multiple Choice Response • Multi-Select Response

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Define correlation and causation.	Identify examples of correlation and causation.
Proficient	**Highly Proficient**
Distinguish between correlation and causation.	Supports or refutes claims of causation, distinguishing between correlation and causation.

Statistics and Probability- Conditional Probability and the Rules of Probability(S-CP)

A1.S-CP.A.1

Content Standards	Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events.
Explanations	Intersection: The intersection of two sets *A* and *B* is the set of elements that are common to both set *A* and set *B*. It is denoted by *A* ∩ *B* and is read '*A* intersection *B*.' Union: The union of two sets *A* and *B* is the set of elements, which are in *A* or in *B* or in both. It is denoted by *A* ∪ *B* and is read '*A* union *B*.' Complement: The complement of the set *A* ∪ *B* is the set of elements that are members of the universal set U but are not in *A* ∪ *B*. It is denoted by '(*A* ∪ *B*)'
Content Limits	This standard is aligned to Algebra I only. Positive rational numbers
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify events as outcomes of a trial.	• Multiple Choice Response • Multi-Select Response
Students will be required to identify multiple events as subsets of the sample space, including unions, intersections, and complements.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify an event as a subset of a sample space.	Identify events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events, as shown in a visual model.
Proficient	**Highly Proficient**
Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events.	Using complex representations, explain how specific events are subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events.

A1.S-CP.A.2

Content Standards	Use the Multiplication Rule for independent events to understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
Explanations	Understand independence and conditional probability and use them to interpret data.
Content Limits	Positive rational numbers
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify independent events given their probabilities.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to determine the probability of the other event given that two events are independent and the probability of one event.	
Students will be required to interpret two events in terms of independence given the probabilities of the two events.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use the Multiplication Rule for independent events to calculate the probability of 2 independent events.	Use the Multiplication Rule for independent events to determine if two events *A* and *B* are independent, given the probability of *A*, the probability of *B*, and the probability of *A* and *B* occurring together.
Proficient	**Highly Proficient**
Use the Multiplication Rule for independent events to understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	Use the Multiplication Rule for independent events to understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if several events in a sample space are dependent or independent.