Mathematics Item Specifications

GRADE 6

Arizona Department of Education with Pearson - 2021

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Introduction

Arizona's Academic Standards Assessment (AASA) of English Language Arts and Mathematics is Arizona's statewide achievement test. AASA assesses the Arizona English Language Arts Standards and Arizona Mathematics Standards adopted by the Arizona State Board of Education in December 2016. AASA will inform students, teachers, and parents about preparedness for college and careers upon graduating from high school. AASA 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.

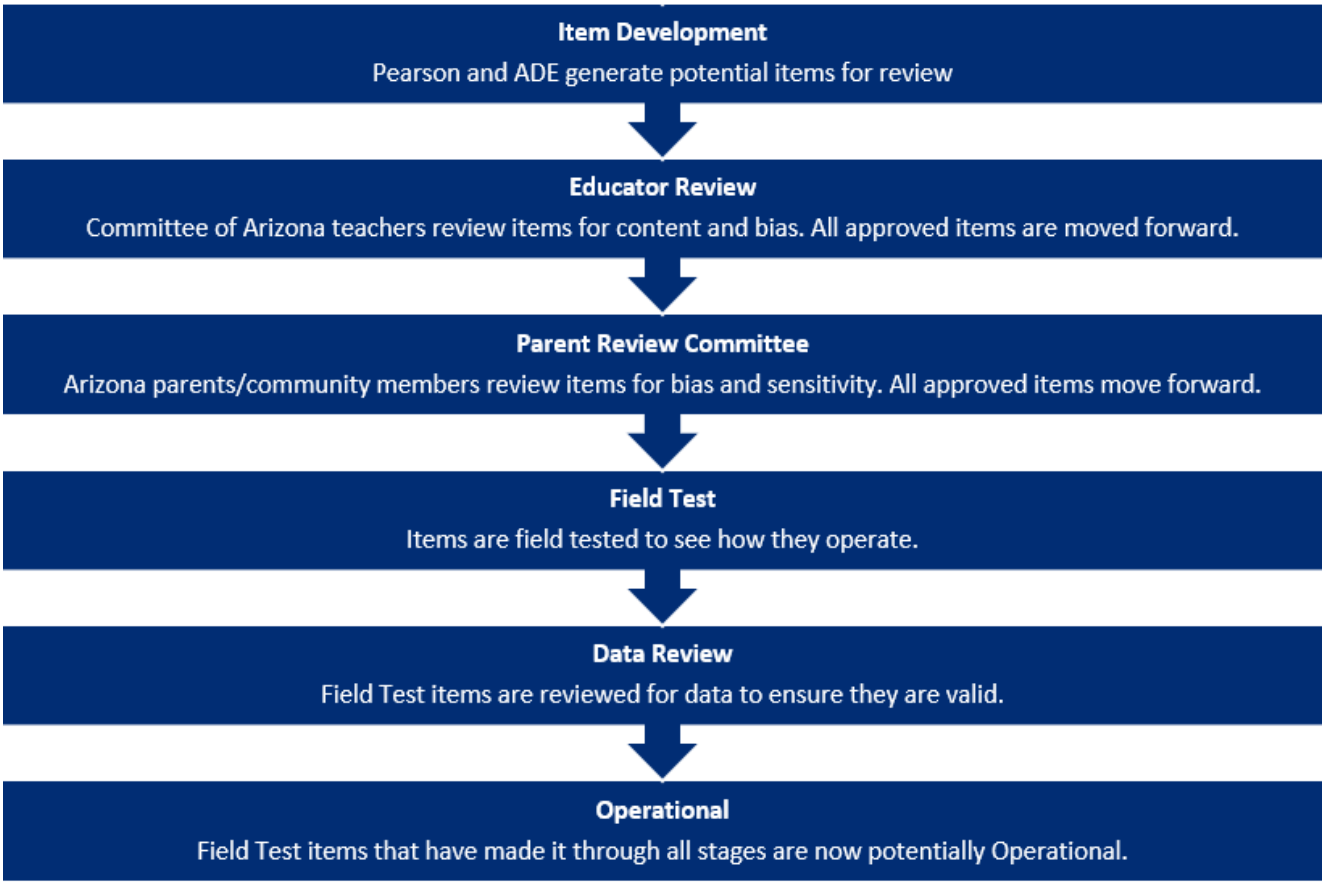
During the item-development process, all AASA items are written in accordance with the Item Specifications and are reviewed and approved by a committee of Arizona educators to confirm alignment and appropriateness for inclusion in the test. AASA items are generally representative of Arizona's geographic 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 *AASA 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 AASA are intended to provide information regarding standards, item formats and response types. The descriptions of math 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. AASA 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 AASA, 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

AASA 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 AASA.



Sample tests are available online for the math portion of AASA. To access the AASA Sample Tests, go to: https://home.testnav.com/, click on "Arizona", then click on "Mic Check and Sample Tests".

Test Construction Guidelines

The construction of the AASA 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 AASA Blueprint provides an overview of the distribution of items on the AASA according to the standards. The standards for Math Practices are embedded within all AASA items. Further, the AASA blueprint outlines the Depth of Knowledge distribution of items.

Blueprint

Grade 6 AASA Blueprint 2016 Standards		
Reporting Category	**Min.**	**Max.**
Ratio and Proportional Relationships	19%	23%
Expressions and Equations	29%	33%
Geometry, Statistics & Probability	15%	19%
Geometry	6%	15%
Statistics and Probability	6%	11%
The Number System	28%	32%

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			
Grade 6	DOK Level 1	DOK Level 2	DOK Level 3
	10% - 20%	60% - 70%	12% - 30%

For more information on DOK go to https://www.azed.gov/assessment/aasa.

Calculators

Arizona Desmos Graphing Calculator is not permitted for the paper-based and computer-based assessment for Grade 6 Math.

Item Formats

The AASA 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.

These are the different types of items, including TEIs, that may appear on the Math computer-based assessment for AASA:

- Bar Graph
- Choice
- Equation Editor
- Fraction Model
- Gap Match
- Hot Spot
- Inline Choice
- Match Table Grid
- Point Graph
- Shape Transformation

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 human-scored.

See the table below for a description of each item type. In addition, for examples of each response item format described, see the AASA Sample Tests. To access the AASA Sample Tests, go to: https://home.testnav.com/, click on “Arizona”, then click on “Mic Check and Sample Tests”.

Item Format	Description
Bar Graph	Bar Graph Interaction allows the student to drag bars vertically or horizontally along numerical values. Individual bars, histograms, and clusters are supported.

Item Format	Description
Choice	Choice (also called Multiple Choice or Choice Interaction) allows the student to choose the correct answer(s) from pre-set responses.
Equation Editor	Equation Editor allows the student to use a palette of buttons to enter a numerical response or to create mathematical expressions.
Fraction Model	Fraction Model allows the student to divide a shape (circle or rectangle) into varying numbers of segments by clicking a 'Fewer' or 'More' button and select those segments, which shades those segments with a solid color.
Gap Match	Gap Match allows the student to drag text or images (also called choices) to a gap (a location on a background image).
Hot Spot	Hot Spot allows the student to select one or more areas called hot spots on an image.
Inline Choice	An Inline Choice item is like a fill-in-the-blank item where the student selects a single text option from a drop-down menu within a table or inline text. The item may contain multiple blanks.

Item Format	Description
Match Table Grid	The Match Table Grid interaction allows students to select radio buttons or check checkboxes in cells to indicate a match between the column and row labels.
Point Graph	Point Graph allows the test-taker to plot points, line segments, continuous lines, and/or polygons. Point Graph items can use one or multiple graph interactions (composite graphs).
Shape Transformation	Shape Transformation allows the test-taker to choose one of four variants of a single shape, drag it onto a four-quadrant grid, and position it on the grid.

Arizona Math Standards Grade 6

Ratio and Proportion (RP)		
6.RP.A **Understand ratio concepts and use ratio reasoning to solve problems.**	**6.RP.A.1**	Understand the concept of a ratio as comparing two quantities multiplicatively or joining/composing the two quantities in a way that preserves a multiplicative relationship. Use ratio language to describe a ratio relationship between two quantities. *For example, "There were 2/3 as many men as women at the concert."*
	6.RP.A.2	Understand the concept of a unit rate a/b associated with a ratio $a : b$ with $b \neq 0$, and use rate language (e.g., for every, for each, for each 1, per) in the context of a ratio relationship. (Complex fraction notation is not an expectation for unit rates in this grade level.)
	6.RP.A.3	Use ratio and rate reasoning to solve mathematical problems and problems in real-world context (e.g., by reasoning about data collected from measurements, tables of equivalent ratios, tape diagrams, double number line diagrams, or equations). a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems including those involving unit pricing and constant speed. c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity). Solve percent problems with the unknown in all positions of the equation. d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
The Number System (NS)		
6.NS.A **Apply and extend previous understanding of multiplication and division to divide fractions by fractions.**	**6.NS.A.1**	Interpret and compute quotients of fractions to solve mathematical problems and problems in real-world context involving division of fractions by fractions using visual fraction models and equations to represent the problem. *For example, create a story context for 2/3 ÷ 3/4 and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that 2/3 ÷ 3/4 = 8/9 because 3/4 of 8/9 is 2/3. In general, a/b ÷ c/d = ad/bc.*
6.NS.B **Compute fluently with multi-digit numbers and find common factors and multiples.**	**6.NS.B.2**	Fluently divide multi-digit numbers using a standard algorithm.
	6.NS.B.3	Fluently add, subtract, multiply, and divide multi-digit decimals using a standard algorithm for each operation.
	6.NS.B.4	Use previous understanding of factors to find the greatest common factor and the least common multiple. a. Find the greatest common factor of two whole numbers less than or equal to 100. b. Find the least common multiple of two whole numbers less than or equal to 12. c. Use the distributive property to express a sum of two whole numbers 1 to 100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4(9+2).*

6.NS.C **Apply and extend previous understanding of numbers to the system of rational numbers.** *Note: Limit negative rational numbers to integers and fractions with denominators of 2, 3, 4, 5, 10.*	**6.NS.C.5**	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Use positive and negative numbers to represent quantities in real-world context, explaining the meaning of 0 in each situation.
	6.NS.C.6	Understand a rational number can be represented as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself and that 0 is its own opposite. b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.
	6.NS.C.7	Understand ordering and absolute value of rational numbers. a. Interpret statements of inequality as statements about the relative position of two numbers on a number line. b. Write, interpret, and explain statements of order for rational numbers in real-world context. c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in real-world context. d. Distinguish comparisons of absolute value from statements about order in mathematical problems and problems in real-world context.
	6.NS.C.8	Solve mathematical problems and problems in real-world context by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Geometry (G)		
6.G.A **Solve mathematical problems and problems in real-world context involving area, surface area, and volume.**	**6.G.A.1**	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques to solve mathematical problems and problems in real-world context.
	6.G.A.2	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Understand and use the formula $V = B \cdot h$, where in this case, B is the area of the base ($B = l \times w$) to find volumes of right rectangular prisms with fractional edge lengths in mathematical problems and problems in real-world context.
	6.G.A.3	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques to solve mathematical problems and problems in a real-world context.
	6.G.A.4	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques to solve mathematical problems and problems in real-world context.
Statistics and Probability (SP)		
6.SP.A **Develop understanding of statistical variability.**	**6.SP.A.1**	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for variability in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*
	6.SP.A.2	Understand that a set of data collected to answer a statistical question has a distribution whose general characteristics can be described by its center, spread, and overall shape.
	6.SP.A.3	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation uses a single number to describe the spread of the data set.
6.SP.B **Summarize and describe distributions.**	**6.SP.B.4**	Display and interpret numerical data by creating plots on a number line including histograms, dot plots, and box plots.
	6.SP.B.5	Summarize numerical data sets in relation to their context by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Grade 6 Item Specifications

Expressions and Equations

6.EE.A.1

Content Standards	Write and evaluate numerical expressions involving whole-number exponents.
Explanations	Apply and extend previous understanding of arithmetic to algebraic expression.
Content Limits	Positive rational number bases Whole number exponents Expressions can contain operations that are not exponentiation, but should contain at least one exponentiation
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to evaluate numeric expressions involving whole number exponents.	• Equation Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to create expressions using whole number exponents	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Write and evaluate numerical expressions involving a single number with a whole-number exponent.	Write and evaluate numerical expressions involving a single term and whole-number exponents.
Proficient	**Highly Proficient**
Write and evaluate numerical expressions involving whole-number exponents.	Write and evaluate numerical expressions involving multiple terms and whole-number exponents.

6.EE.A.2, 6.EE.A.2a, 6.EE.A.2b, 6.EE.A.2c

Content Standards	**6.EE.A.2** Write, read, and evaluate algebraic expressions. **6.EE.A.2a** Write expressions that record operations with numbers and variables. **6.EE.A.2b** Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, and coefficient); view one or more parts of an expression as a single entity. **6.EE.A.2c** Evaluate expressions given specific values of their variables. Include expressions that arise from formulas used to solve mathematical problems and problems in real-world context. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
Explanations	It is important for students to read algebraic expressions in a manner that reinforces that the variable represents a number. Students should identify the parts of an algebraic expression including variables, coefficients, constants, and the names of operations (sum, difference, product, and quotient). Development of this common language helps students to understand the structure of expressions and explain their process for simplifying expressions. Terms are the parts of a sum. When the term is an explicit number, it is called a constant. When the term is a product of a number and a variable, the number is called the coefficient of the variable. Variables are letters that represent numbers. There are various possibilities for the numbers they can represent; students can substitute these possible numbers for the letters in the expression for various different purposes.
Content Limits	Rational numbers For items asking the student to evaluate, the student should be given the expression, or, in rare cases, be asked to create an expression from a context and then evaluate. The student should not be required to know real-world formulas for this standard. For standard 2b, in addition to the mathematical terms listed, “difference” may also be used
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify parts of an expression using mathematical terms.	• Equation Response • Matching Item Response • Multi-Select Response
Students will be required to evaluate given expressions, including real-world formulas, with variables by substituting numeric values.	
Students will be required to create, and also possibly evaluate, expressions with variables by analyzing the context.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Write, read, and evaluate algebraic expressions. a. Write expressions that record a single operation with numbers and variables. b. Match part of an expression to its mathematical term (sum, term, and product); view one part of an expression as a single entity. c. Identify the value of an expression with one variable given the specific value of the variable. Include expressions that arise from formulas used to solve mathematical problems and problems in real-world context. Perform arithmetic operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).	Write, read, and evaluate algebraic expressions. a. Write expressions that record two operations with numbers and variables. b. Identify parts of an expression using mathematical terms (sum, term, and product); view one or more parts of an expression as a single entity. c. Identify the value of an expression with two variables given specific values of their variables. Include expressions that arise from formulas used to solve mathematical problems and problems in real-world context. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
Proficient	**Highly Proficient**
Write, read, and evaluate algebraic expressions. a. Write expressions that record operations with numbers and variables. b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, and coefficient); view one or more parts of an expression as a single entity. c. Evaluate expressions given specific values of their variables. Include expressions that arise from formulas used to solve mathematical problems and problems in real-world context. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).	Write, read, and evaluate algebraic expressions. a. Write expressions that record operations, including exponents, with numbers and variables. b. Create expressions given mathematical terms (sum, term, product, factor, quotient, and coefficient); explain how one part of an expression relates to other parts of the expression. c. Evaluate expressions with multiple variables and multiple operations given specific values of their variables. Include expressions that arise from formulas used to solve mathematical problems and problems in real-world context. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

6.EE.A.3

Content Standards	Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x.*
Explanations	Apply and extend previous understanding of arithmetic to algebraic expression.
Content Limits	Positive rational numbers, values may include exponents Variables must be included in the expression Collecting like terms limited to coefficients of 1
Context	Context is allowed.

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

Performance Level Descriptions

Minimally Proficient	**Partially Proficient**
Apply the Associative and Commutative properties of operations to generate equivalent expressions involving whole-numbers.	Apply the properties of operations to generate equivalent expressions involving whole-numbers.
Proficient	**Highly Proficient**
Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x.	Apply the properties of operations to generate equivalent expressions involving rational numbers and whole-number exponents in real-world contexts.

6.EE.A.4

Content Standards	Identify when two expressions are equivalent. *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.*
Explanations	Students connect their experiences with finding and identifying equivalent forms of whole numbers and can write expressions in various forms. Students generate equivalent expressions using the associative, commutative, and distributive properties. They can prove that the expressions are equivalent by simplifying each expression into the same form.
Content Limits	Positive rational numbers Variables must be included in the expression To distinguish from 6.EE.3, equivalent expressions do not necessarily need to be direct applications of the associative, commutative, and distributive properties - the focus should be on the student recognizing that equivalent expressions have the same va Collecting like terms limited to coefficients of 1
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify which expressions are equivalent.	• Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to determine that two expressions are equivalent by substitution.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify when two expressions are equivalent in cases of repeated addition.	Identify when two expressions are equivalent in cases where the resulting expression only has one term.
Proficient	**Highly Proficient**
Identify when two expressions are equivalent. For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.	Create equivalent expressions.

6.EE.B.5

Content Standards	Understand solving an equation or inequality as a process of reasoning to find the value(s) of the variables that make that equation or inequality true. Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
Explanations	Beginning experiences in solving equations should require students to understand the meaning of the equation as well as the question being asked. Solving equations using reasoning and prior knowledge should be required of students to allow them to develop effective strategies such as using reasoning, fact families, and inverse operations. Students may use balance models in representing and solving equations and inequalities.
Content Limits	Nonnegative rational numbers One-variable linear equations and inequalities An equation or inequality should be given if a context is included
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to choose which value(s) satisfy an equation or inequality.	• Equation Response • Multiple Choice • Matching Item Response • Multi-Select Response
Students will be required to choose a set of numbers which contains only solutions to an inequality.	
Students will be required to determine the value of an expression that makes the equation true.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Understand solving an equation or inequality as a process of reasoning to find the value(s) of the variables that make that equation or inequality true. Use substitution to identify a whole number in a specified set that makes an equation or inequality true.	Understand solving an equation or inequality as a process of reasoning to find the value(s) of the variables that make that equation or inequality true. Use substitution to identify a number in a specified set that makes an equation or inequality true.
Proficient	**Highly Proficient**
Understand solving an equation or inequality as a process of reasoning to find the value(s) of the variables that make that equation or inequality true. Use substitution to determine whether a given number in a specified set makes an equation or inequality true.	Explain how solving an equation or inequality is the process of reasoning to find the value(s) of the variables that make that equation or inequality true.

6.EE.B.6

Content Standards	Use variables to represent numbers and write expressions when solving mathematical problems and problems in real-world context; understand that a variable can represent an unknown number or any number in a specified set.
Explanations	Connecting writing expressions with story problems and/or drawing pictures will give students a context for this work. It is important for students to read algebraic expressions in a manner that reinforces that the variable represents a number.
Content Limits	Nonnegative rational numbers Expression must contain variables
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to construct an expression that represents a situation.	• Equation Response • Multiple Choice Response
Students will be required to explain or choose what a variable in an expression represents in a real world context.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify what the variables represent when solving mathematical problems and problems in real-world context; understand that a variable can represent an unknown number.	Identify what the expressions represent when solving mathematical problems and problems in real-world context; understand that a variable can represent an unknown number or any number in a specified set.
Proficient	**Highly Proficient**
Use variables to represent numbers and write expressions when solving mathematical problems and problems in real-world context; understand that a variable can represent an unknown number or any number in a specified set.	Solve problems by writing an expression with a variable that represents several possible rational numbers within a mathematical or real-world context; understand that a variable can represent an unknown number or any number in a specified set.

6.EE.B.7

Content Standards	Solve mathematical problems and problems in real-world context by writing and solving equations of the form $x + p = q$, $x - p = q$, $px = q$, and $x/p = q$ for cases in which p, q and x are all non-negative rational numbers.
Explanations	Students create and solve equations that are based on real world situations. It may be beneficial for students to draw pictures that illustrate the equation in problem situations. Solving equations using reasoning and prior knowledge should be required of students to allow them to develop effective strategies.
Content Limits	Nonnegative rational numbers One-step linear equations of one variable
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to solve one step linear equations for purely mathematical problems.	• Equation Response
Students will be required to given a simple context, write and/or solve one step linear equations.	
Students will be required to write and/or solve one step linear equations where the given information can be simplified to a form given in the standard.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Solve mathematical equations of the form $x + p = q$, $x - p = q$, and $px = q$, for cases in which p, q and x are all non-negative whole numbers.	Solve mathematical problems and problems in real-world context by solving equations of the form $x + p = q$, $x - p = q$, $px = q$, and $x/p = q$ for cases which p, q and x are all non-negative whole numbers.
Proficient	**Highly Proficient**
Solve mathematical problems and problems in real-world context by writing and solving equations of the form $x + p = q$, $x - p = q$, $px = q$, and $x/p = q$ for cases in which p, q and x are all non-negative rational numbers.	Create mathematical problems and problems in real-world context that can be solved using equations of the form $x + p = q$, $x - p = q$, $px = q$, and $x/p = q$ for cases in which p, q and x are all non-negative rational numbers.

6.EE.B.8

Content Standards	Write an inequality of the form $x > c$, $x < c$, $x \geq c$, or $x \leq c$ to represent a constraint or condition to solve mathematical problems and problems in real-world context. Recognize that inequalities have infinitely many solutions; represent solutions of such inequalities on number lines.
Explanations	None
Content Limits	Nonnegative rational numbers Both strict and non-strict inequalities are acceptable When creating rubrics for items with real-world contexts, be wary that some students may create compound inequalities if a natural bound exists (e.g., when describing the weight of something, a student may create the inequality $x < 50$, or $0 < x < 50$)
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to write an inequality that represents a constraint or condition in a mathematical problem.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to relate a graph to an inequality or a description.	
Students will be required to represent a constraint or condition in a real-world or mathematical problem on a number line.	
Students will be required to write an inequality that represents a constraint or condition in a real-world problem.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Recognize that inequalities of the form $x > c$, $x < c$, $x \geq c$, or $x \leq c$ have infinitely many solutions; identify solutions of such inequalities on number lines.	Recognize that inequalities of the form $x > c$, $x < c$, $x \geq c$, or $x \leq c$ have infinitely many solutions; identify solutions of compound inequalities on number lines.
Proficient	**Highly Proficient**
Write an inequality of the form $x > c$, $x < c$, $x \geq c$, or $x \leq c$ to represent a constraint or condition to solve mathematical problems and problems in real-world context. Recognize that inequalities have infinitely many solutions; represent solutions of such inequalities on number lines.	Given an inequality of the form $x > c$, $x < c$, $x \geq c$, or $x \leq c$ create mathematical problems and problems in real-world context that could be represented by the inequality.

6.EE.C.9

Content Standards	Use variables to represent two quantities that change in relationship to one another to solve mathematical problems and problems in real-world context. Write an equation to express one quantity (the dependent variable) in terms of the other quantity (the independent variable). Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
Explanations	Students can use many forms to represent relationships between quantities. Multiple representations include describing the relationship using language, a table, an equation, or a graph. Translating between multiple representations helps students understand that each form represents the same relationship and provides a different perspective on the function.
Content Limits	Equation of the form y=px or y=x+p Positive rational numbers (zero can be used in graph and table)
Context	Context is required.

Sample Task Demands	**Common Item Formats**
Students will be required to identify or model the relationship between an independent and a dependent variable by constructing or referring to a graph or a table, or by reviewing an equation.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response • Table Response
Students will be required to construct an equation that represents the relationship between the independent and dependent variables in a context or from a graph or table	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Given a graph or table representing two quantities that change in relationship to one another, identify an equation that expresses one quantity in terms of the other quantity.	Given a graph or table representing two quantities that change in relationship to one another, identify the dependent and independent variables, and write an equation that expresses one quantity in terms of the other quantity.
Proficient	**Highly Proficient**
Use variables to represent two quantities that change in relationship to one another to solve mathematical problems and problems in real-world context. Write an equation to express one quantity (the dependent variable) in terms of the other quantity (the independent variable). Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.	Given an equation where variables represent two quantities that change in relationship to one another, create a problem in real-world context that could be represented by the equation. Explain the relationship between the dependent and independent variables and relate these to the equation.

Geometry & Statistics and Probability

6.G.A.1

Content Standards	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques to solve mathematical problems and problems in real-world context.
Explanations	Special quadrilaterals include rectangles, squares, parallelograms, trapezoids, rhombi, and kites.
Content Limits	Positive rational numbers For drawing items, do not use scales - this concept is not mastered until 7th grade. Limit shapes to those that can be decomposed or composed into rectangles and/or right triangles.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to find the area of a shape (by composing/decomposing).	• Equation Response • Graphic Response
Students will be required to create an expression with an unknown to model the area of a shape as a composition/decomposition of rectangles and/or right triangles.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Find the area of right triangles and polygons decomposed into right triangles and rectangles, given all the measurements.	Find the area of triangles and polygons decomposed into right triangles and rectangles, given some of the measurements.
Proficient	**Highly Proficient**
Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques to solve mathematical problems and problems in real-world context.	Find the area of triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques to solve mathematical problems and problems in real-world context, including decimal and fractional measurements.

6.G.A.2

Content Standards	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Understand and use the formula $V = B \cdot h$, where in this case, B is the area of the base ($B = l \times w$) to find volumes of right rectangular prisms with fractional edge lengths in mathematical problems and problems in real-world context.
Explanations	Students need multiple opportunities to measure volume by filling rectangular prisms with blocks and looking at the relationship between the total volume and the area of the base. Through these experiences, students derive the volume formula (volume equals the area of the base times the height). In addition to filling boxes, students can draw diagrams to represent fractional side lengths, connecting with multiplication of fractions. This process is similar to composing and decomposing two dimensional shapes.
Content Limits	Right rectangular prisms Unit fractional edge lengths (numerator is 1).
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to find the volume of a right rectangular prism given its fractional dimensions.	• Equation Response • Graphic Response • Table Response
Students will be required to find the volume of a right rectangular prism when the number of unit cubes packed in it and their unit fraction edge length is given.	
Students will be required to find the edge lengths (and volume) of a rectangular prism given the number of unit cubes packed in the prism and their fractional edge length.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use the formula $V = B \cdot h$, where in this case, B is the area of the base ($B = l$ x w) to find volumes of right rectangular prisms with whole number edge lengths in mathematical problems and problems in real-world context.	Use the formula $V = B \cdot h$, where in this case, B is the area of the base ($B = l$ x w) to find volumes of right rectangular prisms with one fractional edge length in mathematical problems and problems in real-world context.
Proficient	**Highly Proficient**
Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Understand and use the formula $V = B \cdot h$, where in this case, B is the area of the base ($B = l$ x w) to find volumes of right rectangular prisms with fractional edge lengths in mathematical problems and problems in real-world context.	Explain that the volume of a right rectangular prism with fractional edge lengths found by multiplying the edge lengths of the prism. Understand the formula $V = B \cdot h$, where in this case, B is the area of the base ($B = l$ x w). Given the volume, use the formula to find edge lengths of right rectangular prisms with fractional edge lengths in mathematical problems and problems in real-world context.

6.G.A.3

Content Standards	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques to solve mathematical problems and problems in a real-world context.
Explanations	Solve real-world and mathematical problems involving area, surface area, and volume.
Content Limits	Can use rational numbers Can use all four quadrants When finding side length, limit polygons to traditional orientation (side lengths perpendicular to axes).
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to draw a polygon on the coordinate plane given the coordinates that represent each of its vertices.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to find the side length or perimeter of a polygon whose sides are parallel to the axes and its vertices are given as ordered pairs.	
Students will be required to identify the visual shape that is created if a set of given points would be plotted on a coordinate plane.	
Students will be required to compose a polygon when given some of its vertices and the name of the polygon.	
Students will be required to compose a polygon when given some of its vertices and other constraints which require strategic planning (such as perimeter, side lengths, area).	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Draw polygons in the coordinate plane given coordinates for the vertices.	Use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate.
Proficient	**Highly Proficient**
Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques to solve mathematical problems and problems in a real-world context.	Use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques to solve mathematical problems and problems in a real-world context. Finds a missing vertex of a polygon given other vertices.

6.G.A.4

Content Standards	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques to solve mathematical problems and problems in real-world context.
Explanations	Students construct models and nets of three dimensional figures, describing them by the number of edges, vertices, and faces. Solids include rectangular and triangular prisms. Students are expected to use the net to calculate the surface area. Students also describe the types of faces needed to create a three-dimensional figure. Students make and test conjectures by determining what is needed to create a specific three-dimensional figure.
Content Limits	Positive rational numbers 3-dimensional figures are limited to rectangular prisms, triangular prisms, rectangular pyramids, and triangular pyramids.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to match net(s) to 3-D figure(s).	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response
Students will be required to identify the set of shapes that can be arranged to form a net of a given 3-D figure.	
Students will be required to find the surface area of a 3-D figure given its net.	
Students will be required to draw a net of a given 3-D figure.	
Students will be required to create an expression with one unknown to model the surface area of a solid.	
Students will be required to given the surface area, net, and all but one dimension of a 3-D figure, determine the unknown dimension.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Represent three-dimensional figures using nets made up of rectangles and triangles.	Use the nets representing three-dimensional figures to find the surface area of these figures.
Proficient	**Highly Proficient**
Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques to solve mathematical problems and problems in real-world context.	Represent three-dimensional figures with fractional edges using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques to solve mathematical problems and problems in real-world context.

6.SP.A.1

Content Standards	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for variability in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*
Explanations	Statistics are numerical data relating to an aggregate of individuals; statistics is also the name for the science of collecting, analyzing and interpreting such data. A statistical question anticipates an answer that varies from one individual to the next and is written to account for the variability in the data. Data are the numbers produced in response to a statistical question. Data are frequently collected from surveys or other sources (e.g., documents).
Content Limits	Data and contexts should be familiar to students at this grade.
Context	Context is required.

Sample Task Demands	**Common Item Formats**
Students will be required to recognize whether questions are statistical in nature.	• Multiple Choice Response • Multi-Select Response

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify a statistical question.	Change a non-statistical question into a statistical question.
Proficient	**Highly Proficient**
Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for variability in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*	Create a statistical question given a context.

6.SP.A.2

Content Standards	Understand that a set of data collected to answer a statistical question has a distribution whose general characteristics can be described by its center, spread, and overall shape.
Explanations	Develop understanding of statistical variability.
Content Limits	Rational numbers Dot plot, histogram, box plot Mode should not be referred to in any item
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify features, such as symmetry, clusters, peaks, and gaps, or common shapes and patterns of a set of data or data display.	• Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to interpret features, such as symmetry, clusters, peaks, and gaps, or common shapes and patterns of a set of data or data display.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify a set of data by its center, spread, and overall shape.	Describe a set of data by its center, spread, and overall shape.
Proficient	**Highly Proficient**
Understand that a set of data collected to answer a statistical question has a distribution whose general characteristics can be described by its center, spread, and overall shape.	Create a set of data with a distribution whose general characteristics can be described by a given center, spread, and overall shape.

6.SP.A.3

Content Standards	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation uses a single number to describe the spread of the data set.
Explanations	When using measures of center (mean, median, and mode) and range, students are describing a data set in a single number. The range provides a single number that describes how the values vary across the data set. The range can also be expressed by stating the minimum and maximum values.
Content Limits	Rational numbers, only numerical data sets Mode should not be referred to in any item
Context	Context is subject to task demand.

Sample Task Demands	**Common Item Formats**
Students will be required to distinguish between situations where data is summarized by its measure of center (mean or median) or its variation (range, interquartile range, mean absolute deviation.) Context is allowed.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to apply understanding of the qualitative properties of measures of center and/or variation. Context is required.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Recognize mean, median, and mode as measures of center and range as a measure of variation.	Calculate mean, median, and mode as measures of center and range as a measure of variation.
Proficient	**Highly Proficient**
Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation uses a single number to describe the spread of the data set.	Recognize how a measure of center or a measure of variation would be impacted by outliers in a numerical data set.

6.SP.B.4

Content Standards	Display and interpret numerical data by creating plots on a number line including histograms, dot plots, and box plots.
Explanations	In order to display numerical data in dot plots, histograms or box plots, students need to make decisions and perform calculations. Students are expected to display data graphically in a format appropriate for that data set as well as reading data from graphs generated by others students or contained in reference materials. Dot plots are simple plots on a number line where each dot represents a piece of data in the data set. Dot plots are suitable for small to moderate size data sets and are useful for highlighting the distribution of the data including clusters, gaps, and outliers. In most real data sets, there is a large amount of data and many numbers will be unique. A graph (such as a dot plot) that shows how many ones, how many twos, etc. would not be meaningful; however, a histogram can be used. Students organize the data into convenient ranges and use these intervals to generate a frequency table and histogram. Note that changing the size of the range changes the appearance of the graph and the conclusions you may draw from it. Box plots are another useful way to display data and are plotted horizontally or vertically on a number line. Box plots are generated from the five number summaries of a data set consisting of the minimum, maximum, median, and two quartile values. Students can readily compare two sets of data if they are displayed with side-by-side box plots on the same scale. Box plots display the degree of spread of the data and the skewness of the data.
Content Limits	Rational numbers Focus should be on dot plots, box plots, and histograms, but other data displays, such as bar graphs, can be used as distractors
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify the graph(s) for a given set of data.	• Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to determine the best and/or appropriate type(s) of graph(s) to display data sets.	
Students will be required to create number lines, dot plots, histograms, and/or box plots to display given data.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify an appropriate display for numerical data including histograms, dot plots, and box plots.	Construct an appropriate display for numerical data including histograms, dot plots, and box plots.
Proficient	**Highly Proficient**
Display and interpret numerical data by creating plots on a number line including histograms, dot plots, and box plots.	Display and interpret numerical data by creating plots on a number line including histograms, dot plots, and box plots, and explaining what the display indicates about the data.

6.SP.B.5, 6.SP.B.5a, 6.SP.B.5b, 6.SP.B.5c, 6.SP.B.5d

Content Standard	**6.SP.B.5** Summarize numerical data sets in relation to their context by: **6.SP.B.5a** Reporting the number of observations. **6.SP.B.5b** Describing the nature of the attribute under investigation including how it was measured and its units of measurement. **6.SP.B.5c** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. **6.SP.B.5d** Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.
Explanations	Students summarize numerical data by providing background information about the attribute being measured, methods and unit of measurement, the context of data collection activities, the number of observations, and summary statistics. Summary statistics include quantitative measures of center, spread, and variability including extreme values (minimum and maximum), mean, median, mode, range, quartiles, interquartile ranges, and mean absolute deviation. The measure of center that a student chooses to describe a data set will depend upon the shape of the data distribution and context of data collection. The mode is the value in the data set that occurs most frequently. The mode is the least frequently used as a measure of center because data sets may not have a mode, may have more than one mode, or the mode may not be descriptive of the data set. The mean is a very common measure of center computed by adding all the numbers in the set and dividing by the number of values. The mean can be affected greatly by a few data points that are very low or very high. In this case, the median or middle value of the data set might be more descriptive. In data sets that are symmetrically distributed, the mean and median will be very close to the same. In data sets that are skewed, the mean and median will be different, with the median frequently providing a better overall description of the data set. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students develop understanding of what the mean represents by redistributing data sets to be level or fair. The leveling process can be connected to and used to develop understanding of the computation of the mean. The use of mean absolute deviation in 6th grade is mainly exploratory. The intent is to build a deeper understanding of variability. Students would understand the mean distance between the pieces of data and the mean of the data set expresses the spread of the data set. Students can see that the

	larger the mean distance, the greater the variability. Comparisons can be made between different data sets. Students can also summarize and describe the center and variability in data sets using the median and a five number summary consisting of the minimum, quartiles, and maximum as seen in the box plot example in 6.SP.4. The median is the middle number of the data set with half the number below the median and half the numbers above the median. The quartiles partition the data set into four parts by dividing each of the halves of the data set into half again. Quartile 1 (Q1 or the lower quartile) is the middle value of the lower half of the data set and quartile 3 (Q3 or the upper quartile) is the middle value of the upper half of the data set. The median can also be referred to as quartile 2 (Q2). The range of the data is the difference between the minimum and maximum values. The interquartile range of the data is the difference between the lower and upper quartiles (Q3 – Q1). The interquartile range is a measure of the dispersion or spread of the data set: a small value indicates values that are clustered near the median whereas a larger value indicates values that are more distributed.
Content Limits	Histograms, dot plots, or box plots may be used when appropriate Rational numbers Mode should not be referred to in any item

Sample Task Demands	Common Item Formats
Students will be required to identify measures of center and variability from a given graph.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response • Table Response
Students will be required to identify the center and/or spread of data set.	
Students will be required to identify the number of observations from a data set.	
Students will be required to solve problems involving measures of center and spread.	
Students will be required to describe overall pattern of a data set including clusters, peaks, and gaps in distributions, within a context.	
Students will be required to create or complete data sets given certain attributes and information about spread of data and/or measure of center.	
Students will be required to draw conclusions about a data set and select the most appropriate measure to answer a question.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Summarize numerical data sets in relation to their context by: a. Reporting the number of observations in a dot plot. b. For the attribute under investigation, identify its units of measurement. c. Distinguish between measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation). d. Identify mean and mean absolute deviation as the best choice of measures of center and variability for a symmetric data distribution.	Summarize numerical data sets in relation to their context by: a. Reporting the number of observations in a histogram. b. For the attribute under investigation, identify how it was measured. c. Calculate measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation. d. Identify median and interquartile range as the best choice of measures of center and variability for a skewed data distribution.
Proficient	**Highly Proficient**
Summarize numerical data sets in relation to their context by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.	Summarize numerical data sets in relation to their context by: a. Reporting the number of observations given calculations for a measure of center or variability. b. Describing the nature of the attribute under investigation including explaining why it was measured a particular way and why certain units of measurement were used. c. Comparing data sets using measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Choose the appropriate measure of center and variability for data set and explains the reasoning for the choice.

The Number System

6.NS.A.1

Content Standards	Interpret and compute quotients of fractions to solve mathematical problems and problems in real-world context involving division of fractions by fractions using visual fraction models and equations to represent the problem. *For example, create a story context for 2/3 ÷ 3/4 and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that 2/3 ÷ 3/4 = 8/9 because 3/4 of 8/9 is 2/3. In general, a/b ÷ c/d = ad/bc.*
Explanations	Contexts and visual models can help students to understand quotients of fractions and begin to develop the relationship between multiplication and division. Model development can be facilitated by building from familiar scenarios with whole or friendly number dividends or divisors. Computing quotients of fractions build upon and extends student understandings developed in Grade 5. Students make drawings, model situations with manipulatives, or manipulate computer generated models.
Content Limits	Dividing a unit fraction by a whole number or vice versa (e.g., [1/*a*] ÷ *q* or *q* ÷ [1/*a*]) is below grade level.
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to calculate the quotient of two fractions or a non-unit fraction and whole number.	• Equation Response • Multiple Choice Response
Students will be required to use context cues from a story to represent or calculate the quotient of two fractions or a non-unit fraction and whole number.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Compute quotients of fractions to solve mathematical problems using visual fraction models to represent the problem.	Compute quotients of fractions to solve mathematical problems using visual fraction models and equations to represent the problem.
Proficient	**Highly Proficient**
Interpret and compute quotients of fractions to solve mathematical problems and problems in real-world context involving division of fractions by fractions using visual fraction models and equations to represent the problem. *For example, create a story context for 2/3 ÷ 3/4 and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that 2/3 ÷ 3/4 = 8/9 because 3/4 of 8/9 is 2/3. In general, a/b ÷ c/d = ad/bc.*	Compute quotients of fractions to solve mathematical problems and problems in real-world context involving mixed numbers using visual fraction models and equations to represent the problem. Interpret the solution in the context of the problem.

6.NS.B.2

Content Standards	Fluently divide multi-digit numbers using a standard algorithm.
Explanations	Students are expected to fluently and accurately divide multi-digit whole numbers. Divisors can be any number of digits at this grade level. As students divide they should continue to use their understanding of place value to describe what they are doing. When using the standard algorithm, students' language should reference place value.
Content Limits	5-digit dividend by 2-digit divisor and 4-digit dividend by 2- or 3-digit divisor
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to calculate the quotient of 2 numbers.	• Equation Response • Multiple Choice Response

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Fluently divide three-digit numbers by two-digit numbers using a standard algorithm.	Fluently divide four-digit numbers by two-digit numbers using a standard algorithm.
Proficient	**Highly Proficient**
Fluently divide multi-digit numbers using a standard algorithm.	Fluently divide multi-digit numbers to solve real-world problems, not including multi-digit decimals, using a standard algorithm and assess the reasonableness of the result.

6.NS.B.3

Content Standards	Fluently add, subtract, multiply, and divide multi-digit decimals using a standard algorithm for each operation.
Explanations	The use of estimation strategies supports student understanding of operating on decimals. Students use the understanding they developed in Grade 5 related to the patterns involved when multiplying and dividing by powers of ten to develop fluency with operations with multi-digit decimals.
Content Limits	Positive rational numbers only Limit to one type of operation per problem
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to perform calculations involving all 4 operations.	• Equation Response

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Fluently add, subtract, and multiply multi-digit decimals, where decimals are limited to the hundredths, using a standard algorithm for each operation.	Fluently add, subtract, multiply, and divide multi-digit decimals, where the divisor is a whole number, using a standard algorithm for each operation.
Proficient	**Highly Proficient**
Fluently add, subtract, multiply, and divide multi-digit decimals using a standard algorithm for each operation.	Fluently add, subtract, multiply, and divide multi-digit decimals to solve real world problems, using a standard algorithm for each operation, and assess the reasonableness of the result.

6.NS.B.4, 6.NS.B.4a, 6.NS.B.4b, 6.NS.B.4c

Content Standards	**6.NS.B.4** Use previous understanding of factors to find the greatest common factor and the least common multiple. **6.NS.B.4a** Find the greatest common factor of two whole numbers less than or equal to 100. **6.NS.B.4b** Find the least common multiple of two whole numbers less than or equal to 12. **6.NS.B.4c** Use the distributive property to express a sum of two whole numbers 1 to 100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4(9 + 2).*
Explanations	Compute fluently with multi-digit numbers and find common factors and multiples.
Content Limits	Whole numbers less than or equal to 100 Least common multiple of two whole numbers less than or equal to 12
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify the greatest common factor (GCF) of two numbers given.	• Equation Response • Multiple Choice Response • Table Response
Students will be required to identify the least common multiple (LCM) of two given numbers.	
Students will be required to recongize equivalent expressions that express the same sum.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use previous understanding of factors to find the greatest common factor and the least common multiple. a. Select the greatest common factor of two whole numbers less than or equal to 100 using visual models. b. Select the least common multiple of two whole numbers less than or equal to 12 using visual models. c. Identify the distributive property to express a sum of two whole numbers 1 to 100 with a common factor as a multiple of a sum of two whole numbers. For example, express 16 + 8 as 2(8 + 4).using visual models.	Use previous understanding of factors to find the greatest common factor and the least common multiple. a. Identify the greatest common factor of two whole numbers less than or equal to 100. b. Identify the least common multiple of two whole numbers less than or equal to 12. c. Identify the distributive property to express a sum of two whole numbers 1 to 100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 16 + 8 as 8(2 + 1).
Proficient	**Highly Proficient**
Use previous understanding of factors to find the greatest common factor and the least common multiple. a. Find the greatest common factor of two whole numbers less than or equal to 100. b. Find the least common multiple of two whole numbers less than or equal to 12. c. Use the distributive property to express a sum of two whole numbers 1 to 100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4(9 + 2).	Use previous understanding of factors to find the greatest common factor and the least common multiple. a. Find two whole numbers when given their greatest common factor. b. Find two whole numbers when given their least common multiple. c. Use the greatest common factor and the distributive property to express a sum of two whole numbers greater than 100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 336 + 270 as 6(56 + 45).

6.NS.C.5

Content Standards	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Use positive and negative numbers to represent quantities in real-world context, explaining the meaning of 0 in each situation.
Explanations	Apply and extend previous understandings of numbers to the system of rational number.
Content Limits	Rational numbers Items should not require the student to perform an operation
Context	Context is required.

Sample Task Demands	**Common Item Formats**
Students will be required to identify a rational number which represents a given situation.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to interpret a rational number in terms of a context.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Identify positive and negative numbers that represent quantities in real-world context, identifying the meaning of 0 in each situation.	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Identify real-world context that can be represented with positive and negative numbers, defining the meaning of 0 in each situation.
Proficient	**Highly Proficient**
Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Use positive and negative numbers to represent quantities in real-world context, explaining the meaning of 0 in each situation.	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Use positive and negative numbers to represent quantities in real-world context, explaining the meaning of 0 in each situation. Interpret and represent changes in positive and negative numbers representing quantities in real-world situations in terms of the context.

6.NS.C.6, 6.NS.C.6a, 6.NS.C.6b, 6.NS.C.6c

Content Standards	**6.NS.C.6** Understand a rational number can be represented as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. **6.NS.C.6a** Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself and that 0 is its own opposite. **6.NS.C.6b** Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. **6.NS.C.6c** Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.
Explanations	Number lines can be used to show numbers and their opposites. Both 3 and -3 are 3 units from zero on the number line. Graphing points and reflecting across zero on a number line extends to graphing and reflecting points across axes on a coordinate grid. The use of both horizontal and vertical number line models facilitates the movement from number lines to coordinate grids.
Content Limits	Rational numbers Plotting of points in the coordinate plane should include some negative values (not just first quadrant)
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to locate rational numbers on the number line.	• Equation Response • Graphic Response
Students will be required to plot points on the coordinate plane.	
Students will be required to identify the opposite of a number, including the opposite of a negative number.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Understand a rational number can be represented as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Identify the opposite of a number. b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize a negative coordinate indicates left or down while a positive coordinate indicates up or right. c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram.	Understand a rational number can be represented as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line and that 0 is its own opposite. b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; indicate the quadrant a point lies in based on the sign of the coordinates. c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and on a coordinate plane.
Proficient	**Highly Proficient**
Understand a rational number can be represented as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself and that 0 is its own opposite. b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.	Understand a rational number can be represented as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself and that 0 is its own opposite. Indicate whether a number will be to the left or right of 0 on the number line, given the number of negative symbols it has. b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; explain why it is that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. c. Create real world problems that are solved by given rational numbers on a number line diagram; create real world problems that are solved by given pairs of integers and other rational numbers on a coordinate plane.

6.NS.C.7, 6.NS.C.7a, 6.NS.C.7b, 6.NS.C.7c, 6.NS.C.7d

Content Standards	**6.NS.C.7** Understand ordering and absolute value of rational numbers. **6.NS.C.7a** Interpret statements of inequality as statements about the relative position of two numbers on a number line. **6.NS.C.7b** Write, interpret, and explain statements of order for rational numbers in real-world context. **6.NS.C.7c** Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in real-world context. **6.NS.C.7d** Distinguish comparisons of absolute value from statements about order in mathematical problems and problems in real-world context.
Explanations	Common models to represent and compare integers include number line models, temperature models and the profit-loss model. On a number line model, the number is represented by an arrow drawn from zero to the location of the number on the number line; the absolute value is the length of this arrow. The number line can also be viewed as a thermometer where each point of on the number line is a specific temperature. In the profit-loss model, a positive number corresponds to profit and the negative number corresponds to a loss. Each of these models is useful for examining values but can also be used in later grades when students begin to perform operations on integers. In working with number line models, students internalize the order of the numbers; larger numbers on the right or top of the number line and smaller numbers to the left or bottom of the number line. They use the order to correctly locate integers and other rational numbers on the number line. By placing two numbers on the same number line, they are able to write inequalities and make statements about the relationships between the numbers. Comparative statements generate informal experience with operations and lay the foundation for formal work with operations on integers in Grade 7. Students recognize the distance from zero as the absolute value or magnitude of a rational number. Students need multiple experiences to understand the relationships between numbers, absolute value, and statements about order.
Content Limits	Positive and negative rational numbers
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to compare integers in terms of relative locations on the number line.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to compare values of rational numbers in a context.	
Students will be required to order rational numbers.	
Students will be required to compare integers and absolute value of integers in terms of relative locations on the number line.	
Students will be required to distinguish between order and magnitude of rational numbers.	
Students will be required to compare integers and/or absolute values of integers for abstract values represented by variables.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Understand ordering and absolute value of rational numbers. a. Identify a statement of inequality given the position of the two numbers on a number line. b. Identify correct statements of order for rational numbers in real-world context. c. Understand the absolute value of a rational number is always positive. d. Compare the absolute value of two positive numbers in mathematical problems and problems in real-world context.	Understand ordering and absolute value of rational numbers. a. Create a statement of inequality given the position of the two numbers on a number line. b. Write statements of order for rational numbers in real-world context. c. Understand the absolute value of a rational number as its distance from 0 on the number line. d. Compare the absolute value of two numbers in mathematical problems and problems in real-world context.
Proficient	**Highly Proficient**
Understand ordering and absolute value of rational numbers. a. Interpret statements of inequality as statements about the relative position of two numbers on a number line. b. Write, interpret, and explain statements of order for rational numbers in real-world context. c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in real-world context. d. Distinguish comparisons of absolute value from statements about order in mathematical problems and problems in real-world context.	Understand ordering and absolute value of rational numbers. a. Justify the relative position of multiple numbers on a number line given statements of inequality about their relative positions. b. Create scenarios in real-world context that fit statements of order for rational numbers. c. Solve problems involving understanding the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in real-world context. d. Explain comparisons of absolute value from statements about order in mathematical problems and problems in real-world context.

6.NS.C.8

Content Standards	Solve mathematical problems and problems in real-world context by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
Explanations	Apply and extend previous understandings of numbers to the system of rational number.
Content Limits	Positive and negative whole numbers Do not use polygons/vertices for this standard Do not exceed 10x10 coordinate grid, though scales can vary
Context	Context is required.

Sample Task Demands	**Common Item Formats**
Students will be required to identify the location of a point that is a specified distance from another point.	• Equation Response • Graphic Response
Students will be required to calculate the distance between two points.	
Students will be required to solve problems related to location and distance in the coordinate plane.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Solve mathematical problems by graphing points in all one quadrant of the coordinate plane. Count spaces between coordinates to find whole number distances between points with the same first coordinate or the same second coordinate.	Solve mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates to find whole number distances between points with the same first coordinate or the same second coordinate.
Proficient	**Highly Proficient**
Solve mathematical problems and problems in real-world context by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.	Justify solutions to mathematical problems and problems in real-world context solved by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Ratio and Proportional Relationships

6.RP.A.1

Content Standards	Understand the concept of a ratio as comparing two quantities multiplicatively or joining/composing the two quantities in a way that preserves a multiplicative relationship. Use ratio language to describe a ratio relationship between two quantities. *For example, "There were 2/3 as many men as women at the concert."*
Explanations	A ratio is a comparison of two quantities which can be written as *a* to *b*, *a*/*b*, or *a*:*b*. A rate is a ratio where two measurements are related to each other. When discussing measurement of different units, the word rate is used rather than ratio. Understanding rate, however, is complicated and there is no universally accepted definition. When using the term rate, contextual understanding is critical. Students need many opportunities to use models to demonstrate the relationships between quantities before they are expected to work with rates numerically. Students should be able to identify all these ratios and describe them using "For every…, there are …"
Content Limits	Whole numbers Ratios can be expressed with a colon (1:5) or with words such as per, to, each, for each, for every, etc (1 to 5); be sure to vary these representations across items at this standard Quantities/Units can be discrete or continuous and can be the same or different across the two quantities. Be precise in describing relationships such as "the ratio of the number of *x* to the number of *y*" or "the ratio of the length of *x* to the length of *y*", or explicitly reference types of quantities. Limit use of percents to 6.RP.3c
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to recognize correct ratio notation (1:2, 1 to 2, ½) for a given ratio relationship - items should focus on notation, meaning that all options should contain the same numbers.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response • Table Response
Students will be required to represent a ratio relationship described in situational contexts or shown in tape diagrams, double number line diagrams, or graphics, etc. using ratio notation or descriptions.	
Students will be required to distinguish between part-to-part and part-to-whole ratio relationships described in situational contexts or shown in tape diagrams, double number line diagrams, or graphics, etc. using ratio notation or descriptions.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Understand the concept of a ratio as comparing two quantities. Use ratio language to identify a ratio relationship between two quantities.	Understand the concept of a ratio as comparing two quantities multiplicatively. Use ratio language to describe a ratio relationship between two quantities using a limited variety of representations.
Proficient	**Highly Proficient**
Understand the concept of a ratio as comparing two quantities multiplicatively or joining/composing the two quantities in a way that preserves a multiplicative relationship. Use ratio language to describe a ratio relationship between two quantities. *For example, "There were 2/3 as many men as women at the concert."*	Explain the concept of a ratio as comparing two quantities multiplicatively or joining/composing the two quantities in a way that preserves a multiplicative relationship. Use ratio language to describe a ratio relationship between two quantities.

6.RP.A.2

Content Standards	Understand the concept of a unit rate *a/b* associated with a ratio *a* : *b* with *b* ≠ 0, and use rate language (e.g., for every, for each, for each 1, per) in the context of a ratio relationship. (Complex fraction notation is not an expectation for unit rates in this grade level.)
Explanations	A unit rate compares a quantity in terms of one unit of another quantity. Students will often use unit rates to solve missing value problems. Cost per item or distance per time unit are common unit rates, however, students should be able to flexibly use unit rates to name the amount of either quantity in terms of the other quantity. Students will begin to notice that related unit rates are reciprocals as in the first example. It is not intended that this be taught as an algorithm or rule because at this level, students should primarily use reasoning to find these unit rates. In Grade 6, students are not expected to work with unit rates expressed as complex fractions. Both the numerator and denominator of the original ratio will be whole numbers.
Content Limits	Whole numbers except when identifying a unit rate. Rates can be expressed as fractions, with ":" or with words. Units can be the same or different across the two quantities. Context itself does not determine the order Name the amount of either quantity in terms of the other as long as one of the values is one unit Expectations for unit rates in this grade are limited to non-complex fractions, as stated in the standards.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify unit rates.	• Equation Response • Multiple Choice Response • Multi-Select Response • Table Response
Students will be required to find the unit rate given a ratio or ratio relationship expressed as a tape diagram or double number line diagram.	
Students will be required to solve word problems where the solution is in terms of a unit rate.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify a unit rate associated with a ratio and use basic unit rate language to describe it.	Determine a unit rate associated with a ratio and use unit rate language to describe it.
Proficient	**Highly Proficient**
Understand the concept of a unit rate a/b associated with a ratio a : b with b ≠ 0, and use rate language (e.g., for every, for each, for each 1, per) in the context of a ratio relationship. (Complex fraction notation is not an expectation for unit rates in this grade level.)	Explain the concept of a unit rate a/b associated with a ratio a : b with b ≠ 0, and use rate language in the context of a ratio relationship.

6.RP.A.3, 6.RP.A.3a, 6.RP.A.3b, 6.RP.A.3c, 6.RP.A.3d

Content Standards	**6.RP.A.3** Use ratio and rate reasoning to solve mathematical problems and problems in real-world context (e.g., by reasoning about data collected from measurements, tables of equivalent ratios, tape diagrams, double number line diagrams, or equations). **6.RP.A.3a** Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. **6.RP.A.3b** Solve unit rate problems including those involving unit pricing and constant speed. **6.RP.A.3c** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity). Solve percent problems with the unknown in all positions of the equation. **6.RP.A.3d** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
Explanations	Understand ratio and concepts and use ratio reasoning to solve problems.
Content Limits	Whole numbers except when identifying a unit rate. Rates can be expressed as fractions, with ":" or with words. Units can be the same or different across the two quantities. Percent found as a rate per 100.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to generate tables of equivalent ratios. (a,b)	• Equation Response • Graphic Response • Multiple Choice Response • Table Response
Students will be required to plot ordered pairs of equivalent ratios. (a)	
Students will be required to solve a unit rate problem by finding a missing quantity based on that unit rate. (b)	
Students will be required to given a unit rate, add to a set to create an equivalent ratio.	
Students will be required to find a specified percent of a given quantity. (c)	
Students will be required to find a total quantity from a given quantity that is a percent of the whole. (c)	
Students will be required to apply a unit rate as a conversion factor to transform units when multiplying or dividing quantities. (d)	
Students will be required to given two criteria based on unit rates (part-to-part and/or part-to-whole), create a set of objects that satisfies both criteria.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use ratio and rate reasoning to solve mathematical problems and problems in real-world context (e.g., by reasoning about data collected from measurements, tables of equivalent ratios, tape diagrams, double number line diagrams, or equations). a. Use tables of equivalent ratios relating quantities with whole-number measurements, identify missing values in the tables, and identify the pairs of values plotted on the coordinate plane. Use tables to compare ratios. b. Identify the unit rate for unit rate problems including those involving unit pricing and constant speed. c. Identify a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity). Identify solutions to percent problems when the percent is the unknown. d. Use ratio reasoning to match measurement units; transform units appropriately when multiplying quantities.	Use ratio and rate reasoning to solve mathematical problems and problems in real-world context (e.g., by reasoning about data collected from measurements, tables of equivalent ratios, tape diagrams, double number line diagrams, or equations). a. Use tables of equivalent ratios relating quantities with whole-number measurements, determine missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Define unit rate for unit rate problems including those involving unit pricing and constant speed. c. Identify a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity). Identify solutions to percent problems when the percent or the part is the unknown. d. Use ratio reasoning to identify measurement units; transform units appropriately when multiplying or dividing quantities.
Proficient	**Highly Proficient**
Use ratio and rate reasoning to solve mathematical problems and problems in real-world context (e.g., by reasoning about data collected from measurements, tables of equivalent ratios, tape diagrams, double number line diagrams, or equations). a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems including those involving unit pricing and constant speed. c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity). Solve percent problems with the unknown in all positions of the equation. d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.	Use ratio and rate reasoning to solve mathematical problems and problems in real-world context (e.g., by reasoning about data collected from measurements, tables of equivalent ratios, tape diagrams, double number line diagrams, or equations). a. Explain the pattern in tables of equivalent ratios relating quantities with whole-number measurements, explain how to find missing values in the tables, and how to plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems involving more than one unit rate. c. Explain why a percent of a quantity is a rate per 100. Create and solve percent problems with the unknown in all positions of the equation. d. Use ratio reasoning to convert measurement units when more than one conversion is required; manipulate and transform units appropriately when multiplying or dividing quantities.