

6th Grade Essential Standards Justification

Essential Standards are individual standards selected to receive a greater proportion of questions on the AASA exams. The AASA exams, administered in grades three through eight, are developed based on a standards blueprint approved by the State Board of Education that includes individual standards grouped into clusters and identifies an allocation of questions for each cluster. The identified Essential Standards will receive the maximum number of questions allowed by the standards blueprint. Note that ALL standards will continue to be included in the test design of the annual state exams. ALL STANDARDS WILL BE ASSESSED. The identified Essential Standards are targeted for emphasis, indicating that these standards will have a higher proportion of the AASA when possible. The state assessment will retain the same length and duration. ALL STANDARDS remain valid and subject to inclusion in each year's AASA. *All justifications listed on this document were developed by a working group of Arizona math educators and leaders*

Sixth Grade: Overview

1. [Develop competency of division of whole numbers and fractions, and extend the notion of number to the system of rational numbers.](#)

Students develop fluency with division of whole numbers and extend their understanding to division of fractions. Students extend their previous understandings of number and the ordering of numbers to the system of rational numbers, which includes integers and negative fractions with denominators of 2, 3, 4, 5, 10. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.

2. [Develop understanding of ratio and rate and use multiplicative reasoning to solve ratio and rate problems.](#)

Students use multiplicative reasoning to solve ratio and rate problems. This extends their knowledge of multiplication, division, and fractions as the foundation for proportional reasoning that begins in 7th grade. Students utilize multiple types of representations to demonstrate their understanding of the relationship between two quantities represented in a ratio or rate.

3. [Develop understanding of expressions, equations, and inequalities.](#)

Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as $3x = y$) to describe relationships between quantities.

The Standards for Mathematical Practice complement the content standards so that students increasingly engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years.

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Clusters Included

6.NS.A Apply and Extend Previous Understanding of Multiplication and Division to Divide Fractions by Fractions

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.G.A Solve Mathematical Problems and Problems in Real-World Contexts Involving Area, Surface Area, and Volume

6.NS.B Compute Fluently With Multi-Digit Numbers and Find Common Factors and Multiples

Coding	Standard	Justification
6.NS.A.1	Interpret and compute quotients of fractions to solve mathematical problems and problems in real-world contexts involving division of fractions by fractions using visual fraction models and equations to represent the problem. <i>For example, create a story context for $\frac{2}{3} \div \frac{3}{4}$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $\frac{2}{3} \div \frac{3}{4} = \frac{8}{9}$ because $\frac{3}{4}$ of $\frac{8}{9}$ is $\frac{2}{3}$. In general, $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$.</i>	- The focus is on using models of dividing fractions - Understanding complex problems in high school is based on the foundation of this standard
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 contexts, explaining the meaning of 0 in each situation.	This is a foundation standard for 7th, 8th, and Algebra 1
6.NS.C.6	Understand that 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	Extends number sense by introducing negative numbers and their placement on the number line, helping students understand opposites and symmetry.

	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.	
6.NS.C.6.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.	Understanding rational numbers and the coordinate plane in Grade 6 builds the foundation for algebraic thinking in Grades 7 and 8.
6.NS.C.8	Solve mathematical problems and problems in real-world contexts by graphing points in all four quadrants of the coordinate plane. Include the use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.	- This standard is important for vertical articulation in 8th grade - This standard uses context and can be taught together with 6.G.A.3
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.	- Need this standard for 8th grade for transformations 6.NS.C.8 + 6.G.A.3 can be combined and taught together
Additional standards that support the big ideas of the grade level.		
6.NS.B.2	Fluently divide multi-digit numbers using a standard algorithm.	- First grade level that uses the standard algorithm all year - This supports unit rate problems in 6th and 7th
6.NS.B.3	Fluently add, subtract, multiply, and divide multi-digit decimals using a standard algorithm for each operation.	- First grade level to use all decimal operations, which is important for RP Standards such as Unit Rate in 6th and 7th - In 8th grade, high school, and college, students begin to use calculators to solve these types of problems
6.NS.B.4.a	Find the greatest common factor of two whole numbers less than or equal to 100.	Factor and product vocabulary are introduced in 4th grade, 6th grade uses the GCF and LCM, but this supports adding and subtracting unlike denominators of fractions

6.NS.B.4.b	Find the least common multiple of two whole numbers less than or equal to 12.	Factor and product vocabulary are introduced in 4th grade, 6th grade use the GCF and LCM, but this supports adding and subtracting unlike denominators of fractions
6.NS.B.4.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. <i>For example, express $36 + 8$ as $4(9+2)$.</i>	- Supports 7th, 8th, and Algebra with solving equations 6.NS.B.4 embedded within 6.EE.A.3 when students are applying the distributive property with equivalent expressions. They will be tested within the EE standard
6.NS.C.6.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.	- This is important to understand for 7th grade with positive and negative integers 6th grade is one of the only grades that use the word opposite - NS.C.6.a & NS.C.6.b can be connected when teaching
6.NS.C.6.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.	This standard is introduced in 6th grade and is not seen again until 8th grade. This standard supports the plotting and reflections that the 8th-grade geometry standard has
6.NS.C.7.a	Interpret statements of inequality as statements about the relative position of two numbers on a number line.	- This supports the 7th-grade standard of using word problems. In 8th grade, students are solving linear and inequalities. In 9th grade, solve linear inequalities and graph systems of linear inequalities 6.NS.C.7 standards are all foundational for the 6.EE standards
6.NS.C.7.b	Write, interpret, and explain statements of order for rational numbers in real-world context.	Working with numbers from a real-world context, students can place them on a number line and define the relationship between the numbers.
6.NS.C.7.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.	

6.NS.C.7.d	Distinguish comparisons of absolute value from statements about order in mathematical problems and problems in real-world context.	
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.	• This standard is rich in visual understanding and reasoning, especially in terms of space, fit, and decomposition.
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.	• Connects with 7th grade 7.G.B.6 which solves area, volume and surface area

Develop understanding of ratio and rate and use multiplicative reasoning to solve ratio and rate problems. Students use multiplicative reasoning to solve ratio and rate problems. This extends their knowledge of multiplication, division, and fractions as the foundation for proportional reasoning that begins in 7th grade. Students utilize multiple types of representations to demonstrate their understanding of the relationship between two quantities represented in a ratio or rate.

Clusters Included

6.RP.A Understand Ratio Concepts and Use Ratio Reasoning to Solve Problems

Coding	Standard	Justification
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. <i>For example, "There were 2/3 as many men as women at the concert."</i>	First time for this content to be taught to students, RP in 6th is the foundation for 7th grade as it goes into a deeper depth
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.)	First time for this content to be taught to students, RP in 6th is the foundation for 7th grade as it goes into a deeper depth
6.RP.A.3.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.	First time for this content to be taught to students, RP in 6th is the foundation for 7th grade as it goes into a deeper depth
6.RP.A.3.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.	This standard supports the 7th grade RPA3 for markup, simple interest, and markdown
6.RP.A.3.d	Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.	This is a life skill; supports science standards
Additional standards that support the big ideas of the grade level.		
6.RP.A.3.b	Solve unit rate problems, including those involving unit pricing and constant speed.	First time for this content to be taught to students, RP in 6th is the foundation for 7th

		grade as it goes into a deeper depth
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Clusters Included

6.EE.A Apply and Extend Previous Understanding of Arithmetic to Algebraic Expressions

6.EE.B Apply and Extend Previous Understanding of Arithmetic to Algebraic Expressions

6.G.A Solve Mathematical Problems and Problems in Real-World Contexts Involving Area, Surface Area, and Volume

6.EE.C Represent and Analyze Quantitative Relationships Between Dependent and Independent Variables

6.SP.A Develop Understanding of Statistical Variability

6.SP.B Summarize and Describe Distributions

Coding	Standard	Justification
6.EE.A.2.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 contexts. 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).	Evaluating expressions and applying order of operations in Grade 6 builds essential skills for using formulas and solving real-world problems, which is key to future algebra success.
6.EE.A.3	Apply the properties of operations to generate equivalent expressions. <i>For example, apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$.</i>	6.NS.B.4 is assessed within this standard
6.EE.A.4	Identify when two expressions are equivalent. <i>For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the</i>	- Brand new learning - Identifying equivalent expressions helps

	<i>same number regardless of which number y stands for.</i>	students understand mathematical structure, a key skill for simplifying and solving equations in algebra.
6.EE.B.5	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.	Solving equations and inequalities through reasoning and substitution
6.EE.B.6	Use variables to represent numbers and write expressions when solving mathematical problems and problems in real-world contexts; understand that a variable can represent an unknown number or any number in a specified set.	Understanding that a variable can represent an unknown or any number builds a strong foundation for algebra
6.EE.B.7	Solve mathematical problems and problems in real-world contexts 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.	6.G.A.2 can be taught within 6.EE.B.7 - This standard is foundational for 7th, 8th, and Algebra, with solving equations and going into two-step equations 6.G.A.2 can be one context within this standard, but not the only context
6.EE.B.8	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.	Vertically aligned in 7th, 8th, algebra
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 contexts.	- Volume is a major focus in 5th, and then in 6th, we do fractions and are given the volume and find the missing side 6.G.A.2 can be taught using the EE. B.7 standards and be tested under those standards
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.	
Additional standards that support the big ideas of the grade level.		
6.EE.C.9	Use variables to represent two quantities that change in relationship to one another to solve mathematical problems and problems in real-world contexts. 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.	• Sets foundation for 7th, 8th • Introduction to relationships, tables, and equations connects to 7th grade and 8th grade
6.EE.A.1	Write and evaluate numerical expressions involving whole-number exponents.	• This standard can be applied to the context of volume • Exponent appears in 7th grade in Geometry • Exponents appear in 8th grade with exponent rules
6.EE.A.2.a	Write expressions that record operations with numbers and variables.	
6.EE.A.2.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.	
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. <i>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.</i>	

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.4	Display and interpret numerical data by creating plots on a number line, including histograms, dot plots, and box plots.	