

7th 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.*

Seventh Grade: Overview

1. Develop understanding of proportional relationships.

Students extend their understanding of ratios and rates to develop an understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line. They distinguish proportional relationships as the foundation for the rate of change.

2. Develop understanding of operations with rational numbers and work with expressions, inequalities, and linear equations.

Students develop a unified understanding of number by recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. Students can use variables to represent quantities and construct simple equations and inequalities to solve problems. Students fluently solve one-variable equations of the forms $px + q = r$ and $p(x + q) = r$.

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.

Develop understanding of proportional relationships. Students extend their understanding of ratios and rates to develop an understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line. They distinguish proportional relationships as the foundation for the rate of change.

Clusters Included

7.RP.A Analyze Proportional Relationships and Use Them to Solve Mathematical Problems and Problems in Real-World Context

7.G.A Draw, Construct, and Describe Geometrical Figures, and Describe the Relationships Between Them

7.SP.C Investigate **Cance Processes and Develop, Use and Evaluate Probability Models**

Coding	Standard	Justification
7.RP.A.2	Recognize and represent proportional relationships between quantities.	Highly suggest using SPC.6 context within the 7.RP.A.2 standard
7.RP.A.2.a	Decide whether two quantities are in a proportional relationship (e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin).	Continuation from 6th grade standards, Supports 8th grade slope, graphs, and into high school algebra. Identifying the function families
7.RP.A.2.b	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	Constant proportionality will lead to slope, emphasis on different representation supports 8th and high school RP.A.2 is more than just unit rate as it connects to RP.A.1 but also has an additional limiting factor that it must be a direct variation relationship (it must pass through the origin if graphed).
7.RP.A.2.c	Represent proportional relationships by equations. <i>For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the</i>	Direct connection to 7.EE.B.4

	<i>number of items can be expressed as $t = pn$.</i>	
7.RP.A.2.d	Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.	• Direct connection to 7.EE.B.4
7.RP.A.3	Use proportional relationships to solve multi-step ratio and percent problems (e.g., simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error).	• Connects to RP2, EE standards in 7th grade, • Also connects to 7G.A.1 and 7.SP.C.6, 7.EE.B.4
7.G.A.1	Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	• This standards build the conceptual understanding with 7.RP.A.1, in 5th grade multiplying fractions connects to the understanding of the scale drawings in 7th
Additional standards that support the big ideas of the grade level.		
7.RP.A.1	Compute unit rates associated with ratios involving both simple and complex fractions, including ratios of quantities measured in like or different units.	• Continuation from 6th grade, 7th grade introduces fractions (connection with scale factors)
7.SP.C.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. <i>For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.</i>	• Context application standard for unit rate, for proportional relationships, for scale (in terms of a model) • This is also a great opportunity to refresh former NF standards that are taught in grades 3-5.
7.G.A.2	Draw geometric shapes with given conditions using a variety of methods. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	• Exploration for understanding congruent triangles, we do not visit this standard for a few grade levels
7.G.A.3	Describe the two-dimensional figures that result from slicing three-dimensional figures.	• This is a valuable investigation and exploration, but as an assessment question it can be highly abstract and require significant mental gymnastics in order to respond.

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Develop understanding of operations with rational numbers and work with expressions, inequalities, and linear equations. Students develop a unified understanding of number by recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. Students can use variables to represent quantities and construct simple equations and inequalities to solve problems. Students fluently solve one-variable equations of the forms $px + q = r$ and $p(x + q) = r$.

Clusters Included

7.NS.A Apply and Extend Previous Understanding of Operations with Fractions to Add, Subtract, Multiply, and Divide Rational Numbers Except Division by Zero

7.EE.A Use Properties of Operations to Generate Equivalent Expressions

7.EE.B Solve Mathematical Problems and Problems in Real-World Context Using Numerical and Algebraic Expressions and Equations

7.G.B Solve Mathematical Problems and Problems in Real-World Context Involving Angle Measure, Area, Surface Area, and Volume

7.SP.B Draw Informal Comparative Inferences About Two Populations

7.SP.C Investigate **Cance Processes and Develop, Use, and Evaluate Probability Models**

Coding	Standard	Justification
7.NS.A.1	Add and subtract integers and other rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.	This is the end of a focus on integers as a discrete concept, and it will be leveraged in all subsequent courses/grades embedded within other domains and clusters. This understanding must be developed fully in grade 7. Additionally, this is when we extend our understanding from grade 6 with integers to grade 7 work with all rational numbers and in operating (specifically) with these rational numbers.
7.NS.A.1.a	Describe situations in which opposite quantities combine to make 0.	- Zero pairs, integer chips, algebra tiles! Applying the understanding of zero pairs with specific context and situations - Foundation for algebra 1 thinking and solving

		equations later on in 8th and high school • First introduction to integers is in 7th grade • Develops conceptual understanding!
7.NS.A.1.d	Apply properties of operations as strategies to add and subtract rational numbers.	• This skill is vital in order to manage equations and expressions skills as well as working with functions in grade 8 and in modeling across standards in high school.
7.NS.A.2.c	Apply properties of operations as strategies to multiply and divide rational numbers.	• This skill is vital in order to manage equations and expressions skills as well as working with functions in grade 8 and in modeling across standards in high school.
7.NS.A.3	Solve mathematical problems and problems in real-world context involving the four operations with rational numbers. Computations with rational numbers extend the rules for manipulating fractions to complex fractions where $a/b \div c/d$ when $a, b, c,$ and d are all integers and $b, c,$ and $d \neq 0$.	• This is the application of the understandings developed in NS.A.1 and the substandards of A.1.
7.EE.A.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	• 7.NS.A.1.c and 7.NS.2.C are both leveraged by and are necessary skills and understandings for 7.EE.A.1
7.EE.A.2	Rewrite an expression in different forms, and understand the relationship between the different forms and their meanings in a problem context. For example, $a + 0.05a = 1.05a$ means that "increase by 5%" is the same as "multiply by 1.05."	• Note that this points directly to context, asking students not just to find equivalent forms, but to relate them back to the context of the problem. This standard is a foundation for Algebra 1 and 2 standards. Connects to 7.G.B.4 and 7.G.B.6
7.EE.B.3	Solve multi-step mathematical problems and problems in real-world context posed with positive and negative rational numbers in any form. Convert between forms as appropriate and assess the reasonableness of answers. <i>For example, If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50 per hour.</i>	• This is the performance of many of the NS standards as well as earlier EE standards.
7.EE.B.4.a	Solve word problems leading to equations of the form $px+q = r$ and $p(x+q) = r$, where $p, q,$ and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic	• Foundational for 8th grade and above, direct build from one step in 6th to two step into 7th, then leads into 8th

	solution to an arithmetic solution, identifying the sequence of the operations used in each approach.	- Connects to transformations in terms of graphing in Algebra 1 and beyond - Connects to 7.G.B.5
7.EE.B.4.b	Solve word problems leading to inequalities of the form $px+q > r$ or $px+q < r$, where p , q , and r are rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.	8th grade includes inequalities 8.EE.C.7.b - Foundation for algebra 1 and above
7.G.B.6	Solve mathematical problems and problems in a real-world context involving area of two-dimensional objects composed of triangles, quadrilaterals, and other polygons. Solve mathematical problems and problems in real-world contexts involving volume and surface area of three-dimensional objects composed of cubes and right prisms.	This standard connects with other 6th-grade math standards by reinforcing the use of expressions and equations to apply area and volume formulas
7.SP.A.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.	- Real-world application - Relates to social studies, Econ, ELA, and introduces ethics
7.SP.A.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. <i>For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.</i>	- This assumes an understanding of 7.SP.A.1 and then uses the idea of a representative sample. - Using the data to make the predictions
7.SP.C.7.b	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. <i>For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?</i>	This standard is an introduction to a new topic, probability, in a way that drives at conceptual understanding of an event and how to model it, as well as how to interpret probability in the context of the real situation. This is an outgrowth of 7.SP.5 and 7.SP.7a

Additional standards that support the big ideas of the grade level.

7.NS.A.1.b	Understand $p + q$ as the number located a distance q from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world context.	Disconnected from zero pairs to absolute value, this standard appears in high school
7.NS.A.1.c	Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world context.	- This develops an understanding of the Properties of equality, which is leveraged in algebraic modeling, solving, and representation. - Conceptual understanding that allows students to solve 7.EE.A.1, 7.EE.B.3, 7.EE.B.4,
7.NS.A.2.a	Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world context.	The representation of this and the justification for these “patterns” or “rules” are uncovered through integer chips, algebra tiles, and the area model! This conceptual understanding lays the foundation for its use in 7.NS.A.3 and 7.EE.A.1, 7.EE.B.3 & 4
7.NS.A.2.b	Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world context.	The representation of this and the justification for these “patterns” or “rules” are uncovered through integer chips, algebra tiles, and the area model! This conceptual understanding lays the foundation for its use in 7.NS.A.3 and 7.EE.A.1, 7.EE.B.3 & 4
7.NS.A.2.d	Convert a rational number to decimal form using long division; know that the decimal form of a rational number terminates in 0’s or eventually repeats.	
7.G.B.4	Understand and use the formulas for the area and circumference of a circle to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.	7th grade is the first time they see circumference and a strong focus on circles.
7.G.B.5	Use facts about supplementary, complementary, vertical, and adjacent angles in multi-step problems to write and solve simple equations for an unknown angle in a figure.	This is a great context for solving algebraic relationships, and it is an introduction to geometric figures and relationships.

		The through-line understanding of this is through transformations and mapping which will be developed in Grade 8 and in HS.
7.SP.B.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. <i>For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.</i>	By putting the focus on this sixth grade standard, 6.SP.B.5; sixth grade focuses on what these 7th grade standards would focus on
7.SP.B.4	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. <i>For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.</i>	By putting the focus on this sixth grade standard, 6.SP.B.5; sixth grade focuses on what these 7th grade standards would focus on
7.SP.C.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.	This standard supports the understanding of 7.SP.C.7.b and should be tested as a whole in 7.SP.C.7.b
7.SP.C.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies. If the agreement is not good, explain possible sources of the discrepancy.	This standard supports the understanding of 7.SP.C.7.b and should be tested as a whole in 7.SP.C.7.b
7.SP.C.7.a	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. <i>For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.</i>	This standard supports the understanding of 7.SP.C.7.b and should be tested as a whole in 7.SP.C.7.b

