Alaska Mathematics Standards
Grade 6

Standards for Mathematical Content Grade 6

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems.

- 6.RP.1. Write and describe the relationship in real life context between two quantities using ratio language. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*

- 6.RP.2. Understand the concept of a unit rate (a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship) and apply it to solve real world problems (e.g., unit pricing, constant speed).
  - *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*

- 6.RP.3. Use ratio and rate reasoning to solve real-world and mathematical problems (e.g., by reasoning about 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, and understand equivalencies.
  b) Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*
  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 problems involving finding the whole, given a part and the percent.
  d) Use ratio reasoning to convert measurement units between given measurement systems (e.g., convert kilometers to miles); manipulate and transform units appropriately when multiplying or dividing quantities.

The Number System

Apply previous understandings of multiplication and division to divide fractions by fractions.

- 6.NS.1. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions (e.g., by 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.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

Compute fluently with multi-digit numbers and find common factors and multiples.

- 6.NS.2. Fluently multiply and divide multi-digit whole numbers using the standard algorithm. Express the remainder as a whole number, decimal, or simplified fraction; explain or justify your choice based on the context of the problem.

- 6.NS.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. Express the remainder as a terminating decimal, or a repeating decimal, or rounded to a designated place value.

- 6.NS.4. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 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).*

Apply and extend previous understandings of numbers to the system of rational numbers.

- 6.NS.5 Understand that positive and negative numbers describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explain the meaning of 0 in each situation.

- 6.NS.6. Understand a rational number 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 [e.g., –(–3) = 3] 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.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 diagram.

For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.

b) Write, interpret, and explain statements of order for rational numbers in real-world contexts.
For example, write –3 ºC > –7 ºC to express the fact that –3 ºC is warmer than –7 ºC.

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 a real-world situation. *For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.*

d) Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.*

- 6.NS.8. Solve real-world and mathematical problems 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.

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions.

- 6.EE.1. Write and evaluate numerical expressions involving whole-number exponents
For example multiply by powers of 10 and products of numbers using exponents.
(7^3 = 7•7•7)

- 6.EE.2. Write, read, and evaluate expressions in which letters stand for numbers.
  a) Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.*
  b) Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.*
  c) Evaluate expressions and formulas. Include formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order with or without parentheses. (Order of Operations)

- 6.EE.3. Apply the properties of operations to generate equivalent expressions. Model (e.g., manipulatives, graph paper) and apply the distributive, commutative, identity, and inverse properties with integers and variables by writing equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x.*

- 6.EE.4. Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.*

Reason about and solve one-variable equations and inequalities.

- 6.EE.5. Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
  For example: does 5 make 3x > 7 true?

- 6.EE.6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

- 6.EE.7. Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

- 6.EE.8. Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

Represent and analyze quantitative relationships between dependent and independent variables.

- 6.EE.9. Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.*

Geometry

Solve real-world and mathematical problems involving area, surface area, and volume.

- 6.G.1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing or decomposing into other polygons (e.g., rectangles and triangles). Apply these techniques in the context of solving real-world and mathematical problems.

- 6.G.2. Apply the standard formulas to find volumes of prisms. Use the attributes and properties (including shapes of bases) of prisms to identify, compare or describe three-dimensional figures including prisms and cylinders.

- 6.G.3. Draw polygons in the coordinate plane given coordinates for the vertices; determine the length of a side joining the coordinates of vertices with the same first or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

Statistics and Probability

Develop understanding of statistical variability.

- 6.SP.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it 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.2 Understand that a set of data has a distribution which can be described by its center (mean, median, or mode), spread (range), and overall shape and can be used to answer a statistical question.

- 6.SP.3 Recognize that a measure of center (mean, median, or mode) for a numerical data set summarizes all of its values with a single number, while a measure of variation (range) describes how its values vary with a single number.

Summarize and describe distributions.

- 6.SP.4. Display numerical data in plots on a number line, including dot or line plots, histograms and box (box and whisker) plots.

- 6.SP.5 Summarize numerical data sets in relation to their context, such as by:
  a) Reporting the number of observations (occurrences).
  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), as well as describing any overall pattern and any outliers 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.

- 6.SP.6 Analyze whether a game is mathematically fair or unfair by explaining the probability of all possible outcomes.

- 6.SP.7. Solve or identify solutions to problems involving possible combinations (e.g., if ice cream sundaes come in 3 flavors with 2 possible toppings, how many different sundaes can be made using only one flavor of ice cream with one topping?)

Standards for Mathematical Practice

Instruction around the Standards of Mathematical Practices is delivered across all grades K-12. These eight standards define experiences that build understanding of mathematics and ways of thinking through which students develop, apply, and assess their knowledge.

1. Make sense of problems and persevere in solving them.

- explain correspondences between a new problem and previous problems
- represent algebraic expressions numerically, graphically, concretely/with manipulatives, verbally/written
- explain connections between the multiple representations
- determine the question that needs to be answered
- analyze a problem and make a plan for solving it
- choose a reasonable strategy
- identify the knowns and unknowns in a problem
- use previous knowledge and skills to simplify and solve problems
- break a problem into manageable parts or simpler problems
- solve a problem in more than one way

2. Reason abstractly and quantitatively.

- represent a situation symbolically and carry out its operations
- create a coherent representation of the problem
- translate an algebraic problem to a real world context
- explain the relationship between the symbolic abstraction and the context of the problem
- compute using different properties
- consider the quantitative values, including units, for the numbers in a problem

3. Construct viable arguments and critique the reasoning of others.

- construct arguments using both concrete and abstract explanations
- justify conclusions, communicate conclusions, and respond to the arguments
- listen to arguments, critique their viability, and ask questions to clarify the argument
- compare effectiveness of two arguments by identifying and explaining both logical and/or flawed reasoning
- recognize general mathematical truths and use statements to justify the conjectures
- identify special cases or counter-examples that don't follow the mathematical rules
- infer meaning from data and make arguments using its context

4. Model with Mathematics.

- apply mathematics to solve problems arising in everyday life and society
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas

- interpret their mathematical results in the context of the situation and reflect on whether the results make sense
- make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- analyze quantitative relationships to draw conclusions
- reflect on whether their results make sense
- improve the model if it has not served its purpose

5. Use appropriate tools strategically.

- select and use tools appropriate to the task: pencil and paper, protractor, visual and physical fraction models, algebra tiles, geometric models, calculator, spreadsheet, and interactive geometry software.
- use estimation and other mathematical knowledge to confirm the accuracy of their problem solving
- identify relevant external and digital mathematical resources and use them to pose or solve problems
- represent and compare possibilities visually with technology when solving a problem
- explore and deepen their understanding of concepts through the use of technological tools

6. Attend to precision.

- use clear definitions in explanations
- understand and use specific symbols accurately and consistently: equality, inequality, ratios, parenthesis for multiplication and division, absolute value, square root
- specify units of measure, and label axes to clarify the correspondence with quantities in a problem
- calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context

7. Look for and make use of structure.

- discern a pattern or structure
- understand complex structures as single objects or as being composed of several objects
- check if the answer is reasonable

8. Look for and express regularity in repeated reasoning.

- identify if calculations or processes are repeated
- use alternative and traditional methods to solve problems
- evaluate the reasonableness of their intermediate results, while attending to the details