Iowa Mathematics

Grade 6

Ratios and Proportional Relationships 6.RP

1 **Apply ratio concepts and use ratio reasoning to solve problems.** 6.RP.A

1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. 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.A.1

2 Understand the concept of a unit rate a/b associated with a ratio a:b with $bb \neq 0$, and use rate language in the context of a ratio relationship. 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.” Expectations for unit rates in this grade are limited to non-complex fractions. 6.RP.A.2

3 Use ratio and rate reasoning to solve real-world and mathematical problems, by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. 6.RP.A.3

a Make tables of equivalent ratios relating quantities with wholenumber 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.3.A

b Use unit rates and scaling to solve problems about proportional relationships, including problems involving unit pricing and constant speed. 6.RP.A.3.B

c Find a percentage of a quantity as a rate per 100; solve problems involving finding the whole, given a part and the percentage. For example, 30% of a quantity means 30 100 times the quantity. 6.RP.A.3.C

d Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. 6.RP.A.3.D

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The Number System 6.NS

1. **Apply and extend previous understandings of multiplication and division to divide fractions by fractions.** 6.NS.A
   1. Use and interpret models to compute quotients of fractions. Solve word problems involving division of fractions by fractions. Be able to use visual fraction models and equations to represent the problem. For example, create a story context for $(2\ 3) \div (3\ 4)$ and use a visual fraction - model to show the quotient; use the relationship between multiplication and division to explain that $(2\ 3) \div (3\ 4) = 8\ 9$ because $3\ 4$ of $8\ 9$ is $2\ 3$. (In general, $(aa\ bb) \div (cc\ dd) = aaaa\ bbbb$). If $2\ 3$ of a shoelace is $1\ 2$ meter long, how many meters long is the shoelace? 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-mile? 6.NS.A.1

2. **Compute with multi-digit numbers and find common factors and multiples.** 6.NS.B
   1. Divide multi-digit numbers using the standard algorithm. For at least 4 digits by 1-digit division by hand; more complicated cases using technology. For example, $6{,}389\ 7$. 6.NS.B.2
   2. Add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. For more complex cases, use technology. 6.NS.B.3
   3. 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). 6.NS.B.4

3. **Apply and extend previous understandings of numbers to the system of rational numbers.** 6.NS.C
   1. Describe quantities having opposite directions or values using positive and negative numbers: temperature above/below zero, elevation above/below sea level, credits/debits, and positive/negative electric charge. Use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. 6.NS.C.5
   2. Represent a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from earlier grades to represent points on the line and in the plane with negative number coordinates. 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. For example, $-(-3) = 3$, and that 0 is its own opposite. 6.NS.C.6.A
      b. Describe locations in the coordinate plane using signed numbers in ordered pairs; 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.B
      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.6.C

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3 Compare, order and describe the absolute value of rational numbers. 6.NS.C.7

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. 6.NS.C.7.A

b Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write – 3°CC > – 7°CC to express the fact that −3° CC is warmer than – 7°CC. 6.NS.C.7.B

c Describe 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. 6.NS.C.7.C

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.C.7.D

4 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. 6.NS.C.8

Expressions and Equations 6.EE

1 **Apply and extend previous understandings of arithmetic to algebraic expressions.** 6.EE.A

1 Write and evaluate numerical expressions involving wholenumber exponents. 6.EE.A.1

2 Write, read, and evaluate expressions in which letters stand for numbers. 6.EE.A.2

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 − yy. 6.EE.A.2.A

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. 6.EE.A.2.B

c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. 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). For example, use the formulas VV = ss3 and AA = 6ss2 to find the volume and surface area of a cube with sides of length ss = 1 2 . 6.EE.A.2.C

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3 Apply the properties of operations to generate equivalent expressions. Know that expressions are called equivalent when they name the same number regardless of which value is substituted into them. For example, apply the distributive property to the expression $3(2 + xx)$ to produce the equivalent expression $6 + 3xx$; apply the distributive property to the expression $24xx + 18yy$ to produce the equivalent expression $6(4xx + 3yy)$; apply properties of operations to $yy + yy + yy$ to produce the equivalent expression $3yy$. 6.EE.A.3

4 Describe the properties of operations used to show two expressions are equivalent. For example, show that $3cc + 3cccc$ and $3cc(1 + dd)$ are equivalent. 6.EE.A.4

2 Reason about and solve one-variable equations and inequalities. 6.EE.B

1 Use substitution to determine whether a given number in a specified set makes an equation or inequality true. Solving an equation or inequality is a process of answering a question: Which values from a specified set, if any, make the equation or inequality true? 6.EE.B.5

2 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.B.6

3 Solve real-world and mathematical problems by writing and solving equations of the form $xx + pp = qq$ and $pppp = qq$ for cases in which pp, qq and xx are all nonnegative rational numbers. 6.EE.B.7

4 Write an inequality of the form $xx > cc$ or $xx < cc$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that an inequality of the form $xx > cc$ or $xx < cc$ has infinitely many solutions; use a number line diagram to represent infinitely many solutions of such an inequality. 6.EE.B.8

3 Represent and analyze quantitative relationships between dependent and independent variables. 6.EE.C

1 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 in terms of the other quantity. 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 $dd = 65tt$ to represent the relationship between distance and time. 6.EE.C.9

Geometry 6.G

1 Solve real-world and mathematical problems 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 in the context of solving real-world and mathematical problems. 6.G.A.1

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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. Apply the formulas $VV = llll$ and $VV = BBh$ (where BB stands for the area of the base) to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. 6.G.A.2

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 in the context of solving real-world and mathematical problems. 6.G.A.3

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 in the context of solving realworld and mathematical problems. 6.G.A.4

Statistics and Probability 6.SP

1 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 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.A.1

2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. 6.SP.A.2

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 describes how its values vary with a single number. 6.SP.A.3

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2 Summarize and describe distributions. 6.SP.B

1 Display numerical data in plots on a number line, including dot plots, histograms, and box plots. 6.SP.B.4

2 Summarize numerical data sets in relation to their context, such as by: 6.SP.B.5

a Reporting the number of observations. 6.SP.B.5.A

b Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. 6.SP.B.5.B

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. 6.SP.B.5.C

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.B.5.D