Core Content Connectors by Common Core State Standards: Mathematics, Grade 6

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This view is designed to mirror the Common Core document while also including the CCCs linked to each CCSS

Grade 6 Overview

Ratios and Proportional Relationships

- Understand ratio concepts and use ratio reasoning to solve problems.

The Number System

- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- Compute fluently with multi-digit numbers and find common factors and multiples.
- Apply and extend precious understandings of numbers to the system of rational numbers.

Expressions and Equations

- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Reason about and solve one-variable equations and inequalities.
- Represent and analyze quantitative relationships between dependent and independent variables.

Geometry

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

Statistics and Probability

- Develop understanding of statistical variability.
- Summarize and describe distributions.

Ratios and Proportional Relationships—6.RP
Understand ratio concepts and use ratio reasoning to solve problems.

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."

CCCs linked to 6.RP.1
6.NO.1f2 Write or select a ratio to match a given statement and representation.
6.NO.1f31 Select or make a statement to interpret a given ratio.
6.PRF.1c1 Describe the ratio relationship between two quantities for a given situation.
6.PRF.2b3 Complete a statement that describes the ratio relationship between two quantities.
6.NO.1f2 Write or select a ratio to match a given statement and representation.

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. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is ¾ cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."

CCCs linked to 6.RP.2
6.PRF.1c2 Represent proportional relationships on a line graph.
6.PRF.2b4 Determine the unit rate in a variety of contextual situations.
6.NO.1f4 Find a missing value (representations, whole numbers, common fractions, decimals to hundredths place, percent) for a given ratio.

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.
    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 quality 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; manipulate and transform units appropriately when multiplying or dividing quantities.

CCCs linked to 6.RP.3
6.PRF.2b5 Use ratios and reasoning to solve real-world mathematical problems (e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations).
6.NO.1f5 Solve unit rate problems involving unit pricing.
6.ME.2a2 Solve one step real world measurement problems involving unit rates with ratios of whole numbers when given the unit rate (3 inches of snow falls per hour, how much in 6 hours).
7.NO.f6 Solve word problems involving ratios.
6.NO.1f1 Calculate a percent of a quantity as rate per 100.
6.ME.1b4 Complete a conversion table for length, mass, time, and volume.
6.ME.1b5 Analyze table to answer questions.
7.NO.1h1 Identify an equivalent fraction, decimal and percent when given one of the three numbers.

The Number System—6.NS
Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

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 ½ lb of chocolate equally? How many ¾ cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length ¾ mile and square mile?

CCCs linked to 6.NS.1 6.NO.2c3 Solve one-step, addition, subtraction, multiplication , or division problems with fractions or decimals.

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

2. Fluently divide multi-digit numbers using the standard algorithm.

CCCs linked to 6.NS.2 6.NO.2c5 Divide multi-digit whole numbers.

3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

CCCs linked to 6.NS.3 6.NO.2c3 Solve one-step, addition, subtraction, multiplication, or division problems with fractions or decimals.

4. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole number 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).

NO CCCs linked to 6.NS.4

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

5. Understand that positive and negative numbers are used together to 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, explaining the meaning of 0 in each situation.

CCCs linked to 6.NS.5 6.NO.1d4 Select the appropriate meaning of a negative number in a real-world situation.

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.

CCCs linked to 6.NS.6
6.NO.1d5 Find given points between -10 and 10 on both axes of a coordinate plane.
6.NO.1d6 Label points between -10 and 10 on both axes of a coordinate plane.
6.NO.1d1 Identify numbers as positive or negative.
6.NO.1d2 Locate positive and negative numbers on a number line.
6.NO.1d3 Plot positive and negative numbers on a number line.
6.NO.2e1 Determine the difference between two integers using a number line.

7. Understand ordering and absolute value of rational numbers.
    a. Interpret statements of inequality as statements about the relative position of two number on a number line diagram. For example interpret -3 > -7 as a statement that is -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 -3º C > -7º C to express the fact that -3º C is warmer than -7º C.
    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 grater than 30 dollars.

CCCs linked to 6.NS.7
6.NO.2e2 Compare two numbers on a number line (e.g., -2 > -9).
6.NO.1e1 Determine the meaning of absolute value.

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.

CCCs linked to 6.NS.8
7.NO.2f4 Use a rate of change or proportional relationship to determine the points on a coordinate plane.

Expressions and Equations—6.EE
Apply and extend previous understandings of arithmetic to algebraic expressions.

1. Write and evaluate numerical expressions involving whole-number exponents.

CCCs linked to 6.EE.1
6.NO.1i1 Identify what an exponent represents (e.g., $8^3 = 8 \times 8 \times 8$).
6.NO.1i2 Solve numerical expressions involving whole number exponents.

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 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 $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = ½$.

CCCs linked to 6.EE.2
6.SE.1a2 Given a real-world problem, write an equation using 1 set of parentheses.

3. 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 distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.

CCCs linked to 6.EE.3
6.SE.1b2 Use properties to produce equivalent expressions.

4. Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is submitted 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.

CCCs linked to 6.EE.4
6.SE.1b1 Evaluate whether both sides of an equation are equal.

Reason about and solve one-variable equations and inequalities

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 of inequality true? Use substitution to determine whether a given number in a specified set makes and equation or inequality true.

NO CCCs linked to 6.EE.5

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.

CCCs linked to 6.EE.6 6.PRF.2a Use variable to represent numbers and write expressions when solving real world problems.

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.

CCCs linked to 6.EE.7 6.NO.2a6 Solve problems or word problems using up to three-digit numbers and any of the four operations. 6.PRF.1d1 Solve real world, single step linear equations.

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.

CCCs linked to 6.EE.8 6.SE.1a4 Given a real-world problem, write an inequality.

Represent and analyze quantitative relationships between dependent and independent variables.

9. Use variable 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 variable 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.

CCCs linked to 6.EE.9 6.PRF.2a3 Use variables to represent two quantitates in a real-world problem that change in relationship to one another. 6.PRF.2a3 Use variables to represent two quantities in a real-world problem that change in relationship to one another. 6.PRF.2a4 Analyze the relationships between the dependent and independent variables using graphs and tables and relate to the equation.

Geometry—6.G
Solve real-world and mathematical problems involving area, surface area, and volume.

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.

CCCs linked to 6.G.1
6.ME.1a2 Identify the appropriate formula (i.e., perimeter, area, volume) to us when measuring for different purposes in a real-life context.
6.ME.2a3 Apply the formula to find the area of triangles.
6.ME.2b3 Decompose complex shapes (polygon, trapezoid, pentagon) into simple shapes (rectangles, squares, triangles) to measure area.
6.GM.1d1 Find area of quadrilaterals.
6.GM.1d2 Find area of triangles.

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 V = l x w x h and V = b x h to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world mathematical problems.

CCCs linked to 6.G.2
6.ME.1a2 Identify the appropriate formula (i.e., perimeter, area, volume) to use when measuring for different purposes in a real-life context.
6.ME.1c1 Find the area of a 2-dimensional figure and the volume of a 3-dimensional figure.

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.

CCCs linked to 6.G.3
6.GM.1c7 Use coordinate points to draw polygons.
6.GM.1c8 Use coordinate points to find the side lengths of polygons that are horizontal or vertical.

4. Represent three-dimensional figure 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 real-world and mathematical problems.

CCCs linked to 6.G.4
7.GM.1h2 Find the surface area of three-dimensional figures using nets of rectangles of triangles.

Statistic and Probability—6.SP
Develop understanding of statistical variability

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 the students' ages.

CCCs linked to 6.SP.1 6.DPS.1a2 Identify statistical questions and plan for data collection.

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.

CCCs linked to 6.SP.2 6.DPS.1d4 Find the range of a given data set. 6.DPS.1d6 Explain or identify what the mode represents in a set of data.

3. Recognize that a measure of center for a numerical data set summarizes all its values with a single number, while a measure of variation describes how its values vary with a single number.

CCCs linked to 6.SP.3 5.DPS.1d1 Select an appropriate statement about the range of the data for a given graph (bar graph, line plot) (i.e., range of data) up to 10 points. 5.DPS.1e1 Use measure of central tendency to interpret data including overall patterns in the data. 6.DPS.1d2 Solve for mean of a given data set. 6.DPS.1d5 Explain or identify what the mean represents in a set of data.

Summarize and describe distributions.

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

CCCs liked to 6.SP.4 6.DPS.1c2 Collect and graph data; bar graph, line plots, dot plots, histograms. 7.DPS.1g1 Graph continuous data using line graphs, histograms, or dot plots.

5. Summarize numerical data sets in relation to their context, such as by:
    a. Reporting the number of observations.
    b. Describing the nature of the attribute under investigation, including how it was measure and its units of measurement.
    c. Giving quantitative measure 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 measure of center and variability to the shape of the data distribution and the context in which the data were gathered.

CCCs linked to 6.SP.5

6.DPS.1d3 Select statement that matches mean, ode, and spread data for 1 measure of central tendency for a given data set. 7.DPS.1i1 Solve for the median of a given data set. 6.DPS.1d7 Explain or identify what the median represents in a set of data. 6.DPS.1e2 Use measure of central tendency to interpret data including overall patterns in the data. 8.DPS.1i4 Identify outliers, range, mean, median, and mode.

Core Content Connectors by Common Core State Standards: Mathematics, Grade 7

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Grade 7 Overview

Ratios and Proportional Relationships

- Analyze proportional relationships and use them to solve real-world and mathematical problems.

The Number System

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Expressions and Equations

- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Geometry

- Draw, construct, and describe geometrical figures and describe the relationships between them.
- Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

Statistics and Probability

- Use random sampling to draw inferences about a population.
- Draw informal comparative inferences about two populations.
- Investigate chance processes and develop, use, and evaluate probability models.

Ratios and Proportional Relationships—7.RP
Analyze proportional relationships and use them to solve real-world and mathematical problems.

1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks ½ mile in each ¼ hour, compute the unite rate as the complex fraction ½ / ¼ miles per hour, equivalently 2 miles per hour.

CCCs linked to 7.RP.1
7.NO.2f3 Find unit rates given a ratio.
7.PRF.1e1 Determine unit rates associated with ratios of lengths, areas, and other quantities measure in like units.
7.ME.2e2 Solve one-step problems involving unit rates associated with ratios of fractions.

2. Recognize and represent proportional relationships between quantities.
   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 thought the origin.
   b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
   c. Represent proportional relationships by equations. For example, if total cost t is proportional to the number of items can be expressed as t = pn.
   d. Explain what a point (x , y) on the graph of a proportional relationships means in terms of the situation, with special attention to the points (0 , 0) and (1 , r) where r is the unit rate.

CCCs linked to 7.RP.2
7.NO.2f1 Identify the proportional relationship between two quantities.
7.NO.2f2 Determine if two quantities are in a proportional relationship using a table of equivalent ratios or points graphed on a coordinate plane.
7.PRF.1e2 Represent proportional relationships on a line graph.
7.NO.2f4 Use a rate of change or proportional relationship to determine the points on a coordinate plane.

3. Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

CCCs linked to 7.RP.3
7.NO.2h1 Find percents in real world contexts.
7.NO.2h2 Solve one step percentage increase and decrease problems.
7.NO.2f5 Use proportions to solve ratio problems.
7.NO.2f6 Solve word problems involving ratios.
7.PRF.1f1 Use proportional relationships to solve multistep percent problems.
7.NO.2h1 Find percents in real world contexts.
7.NO.2h2 Solve one step percentage increase and decrease problems.

The Number System—7.NS
Apply and extend precious understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
    a. Describe situation in which opposite quantities combine to make 0. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.
    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 additives inverses). Interpret sums of rational numbers by describing real-world contexts.
    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 contexts.
    d. Apply properties of operations as strategies to add and subtract rational numbers.

CCCs linked to 7.NS.1
7.NO.1g1 Identify the additive inverse of a number (e.g., – 3 and + 3).
7.NO.1g2 Identify the difference between two given numbers on a number line using absolute value.
8.NO.2i3 Solve one step addition, subtraction, multiplication, division problems with fractions, decimals, and positive/negative numbers.
8.NO.2i4 Solve two step addition, subtraction, multiplication, and division problems with fractions, decimals, or positive/negative numbers.

1. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
    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 contexts.
    b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (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 contexts.
    c. Apply properties of operations as strategies to multiply and divide rational numbers.
    d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

CCCs linked to 7.NS.2
7.NO.2i1 Solve multiplication problems with positive/negative numbers.
7.NO.2i2 Solve division problems with positive/negative numbers.

3. Solve real world and mathematical problems involving the four operations with rational numbers.

CCCs linked to 7.NS.3 8.NO.2i3 Solve one step addition, subtraction, multiplication, division problems with fractions, decimals, and positive/negative numbers. 8.NO.2i4 Solve two step addition, subtraction, multiplication, and division problems with fractions, decimals, or positive/negative numbers.

Expressions and Equations—7.EE
Use properties of operations to generate equivalent expressions.

1. Apply properties to operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

CCCs linked to 7.EE.1 7.SE.1f3 Add and subtract linear expressions. 7.SE.1f4 Factor and expand linear expressions.

2. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a means that "increase by 5%" is the same as "multiply by 1.05."

NO CCCs linked to 7.EE.2

Solve real life and mathematical problems using numerical and algebraic expressions and equations.

3. Solve multi-step real life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. 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. If you want to place a towel bar 9 ¾ inches long in the center of a door that is 27 ½ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

CCCs linked to 7.EE.3 7.PRF.1g1 Solve real world multi-step problems using whole numbers.

4. Use variables to represent quantities in a real world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities.
    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 solution to an arithmetic solution, identifying the sequences of the operations used to each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?
    b. Solve word problems leading to inequalities of the form $px + q > + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make and describe the solutions.

CCCs linked to 7.EE.4 7.SE.1f2 Solve equations with 1 variable based on real world problems. 7.SE.1f1 Set up equations with 1 variable based on real world problems.

7.PRF.1g2 Use variables to represent quantities in a real world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities.
7.PRF.2d Use a calculator to solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers.

Geometry—7.G

Draw, construct, and describe geometrical figures and describe the relationships between them.

1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

CCCs linked to 7.G.1
7.ME.1d1 Solve problems that use proportional reasoning with ratios of length and area.
7.ME.2e1 Solve one step real world problems related to scaling.

2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. 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.

CCCs linked to 7.G.2
7.GM.1e1 Construct or draw plane figures using properties.

3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

CCCs linked to 7.G.3
7.GM.1h5 Describe the two-dimensional figures that result from a decomposed three-dimensional figure.

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

4. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

CCCs linked to 7.G.4
7.ME.2d1 Apply formula to measure area and circumference of circles.

5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

CCCs linked to 7.G.5
8.GM.1i1 Identify supplementary angles.
8.GM.1i2 Identify complimentary angles.
8.GM.1i3 Identify adjacent angles.
8.GM.1i4 Use angle relationships to find the value of a missing angle.

6. Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

CCCs linked to 7.G.6
7.GM.1h1 Add the area of each face of a prism to find surface area of three-dimensional objects.

7.GM.1h2 Find the surface are of three-dimensional figures using nets of rectangles or triangles.
7.GM.1h3 Find area of plane figures and surface area of solid figures (quadrilaterals).
7.GM.1h4 Find area of an equilateral, isosceles, and scalene triangle.
7.ME.2c1 Solve one step real world measurement problems involving area, volume, or surface of two- and three-dimensional objects.

Statistics and Probability—7.SP
Use random sampling to draw inferences about a population.

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.

CCCs linked to 7.SP.1 7.DPS.1b1 Determine sample size to answer a given question.

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. 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.

CCCs linked to 7.SP.2 7.DPS.1k1 Analyze graphs to determine or select appropriate comparative inferences about two samples or populations.

Draw informal comparative inferences about two populations.

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. For example, the mean height of players on the basketball team is over 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.

CCCs linked to 7.SP.3 7.DPS.1j1 Make or select a statement to compare the distribution of 2 data sets.

4. Use measure of center and measure of variability for numerical data from random samples to draw informal comparative inferences about two populations. 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.

CCCs linked to 7.SP.4 7.DPS.1i2 Identify the range (high/low), median (middle), mean, or mode of a given data set. 7.DPS.1k1 Analyze graphs to determine or select appropriate comparative inferences about two samples or populations. 7.DPS.1j2 Make or select an appropriate statement based upon two unequal data sets using measure of central tendency and shape.

Investigate chance processes to develop, use, and evaluate probability models.

5. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the even occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around ½ indicates an event that is neither unlikely nor likely, and a probably near 1 indicates a likely event.

CCCs linked to 7.SP.5
7.DPS.2d1 Describe the probability of events as being certain or impossible, likely, less likely, or equally likely.
7.DPS.2d2 State the theoretical probability of events occurring in terms of ratios (words, percentages, decimals).

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. 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.

CCCs linked to 7.SP.6
7.DPS.2d4 Make a prediction regarding the probability of an event occurring; conduct simple probability experiments.

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.
    a. Develop a uniform probability model by assigning equal probability to all outcomes and use the model to determine probabilities of events. 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.
    b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. 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.

CCCs linked to 7.SP.7
7.DPS.2d5 Compare actual results of simple experiment with theoretical probabilities.

8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
    a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
    b. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
    c. Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: if 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?

CCCs linked to 7.SP.8
7.DPS.2e1 Determine the theoretical probability of multistage probability experiments (2 coins, 2 dice).

8.DPS.2e4 Determine the theoretical probability of multistage probability experiments (2 coins, 2 dice).
7.DPS.2e2 Collect data from multistage probability experiments (2 coins, 2 dice).
8.DPS.2e5 Collect data from multistage probability experiments (2 coins, 2 dice).
7.DPS.2e3 compare actual results of multistage experiment with theoretical probabilities.
8.DPS.2e6 Compare actual results of multistage experiment with theoretical probabilities.

Core Content Connectors by Common Core State Standards: Mathematics, Grade 8

MSAA Instructional Resource Guide, Revised March 2024 from the NCSC contents developed as part of the National Center and State Collaborative under a grant from the US Department of Education.

This view is designed to mirror the Common Core document whole also including the CCCs linked to each CCSS.

Grade 8 Overview

The Number System

- Know that there are numbers that are not rational and approximate them by rational numbers.

Expressions and Equations

- Work with radicals and integer exponents.
- Understand the connections between proportional relationships, lines, and linear equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

Functions

- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.

Geometry

- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Understand and apply the Pythagorean Theorem.
- Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

Statistics and Probability

- Investigate patterns of association in bivariate data.

The Number System—8.NS

Know that there are numbers that are not rational and approximate them by rational numbers.

1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational number show that the decimal expansion repeats eventually and convert a decimal expansion which repeats eventually into a rational number.

CCCs linked to 8.NS.1
8.NO.1k1 Identify π as an irrational number.
8.NO.1k2 Round irrational numbers to the hundredths place.

2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., 2π). For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

CCCs linked to 8.NS.2
8.NO.1k3 Use approximations of irrational numbers to locate them on a number line.

Expressions and Equations—8.EE
Work with radical and integer exponents.

1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $32 \times 3 - 5 = 3 - 3 = 1/33 = 1/27$.

CCCs linked to 8.EE.1 8.SE.1f5 Use properties of integer exponents to produce equivalent expressions.

2. Use square root and root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

NO CCCs linked to 8.EE.2

3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3×108 and the population of the world as 7×109, and determine that the world population is more than 20 times larger.

CCCs linked to 8.EE.3 8.NO.1i1 Convert a number expressed in scientific notation up to 10,000.

4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that have been generated by technology.

CCCs linked to 8.EE.4 8.NO.1j1 Perform operations with number expressed in scientific notation.

Understand the connections between proportional relationships, lines, and linear equations.

5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

CCCs linked to 8.EE.5 8.PRF.1e2 Represent proportional relationships on a line graph.

6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

NO CCCs linked to 8.EE.6

Analyze and solve linear equations and pairs of simultaneous linear equations.

7. Solve linear equations in one variable.
    a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a =b results (where a and b are different numbers).
    b. Solve linear equations with rational number coefficients including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

CCCs linked to 8.EE.7 8.PRF.1g3 Solve linear equations with 1 variable.

8. Analyze and solve pairs of simultaneous linear equations.
    a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersections of their graphs, because points of intersection satisfy both equations simultaneously.
    b. Solve systems of two linear equations int wo variables algebraically and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x +2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.
    c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

CCCs linked to 8.EE.8 8.PRF.1g4 Solve systems of two linear equations in two variables and graph the results. 8.PRG.1g5 Solve real world and mathematical problems leading to two linear equations in two variables,

Functions—8.F
Define, evaluate, and compare functions.

1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

CCCs linked to 8.F.1 8.PRG.2e1 Distinguish between functions and non-functions, using equations, graphs, or tables.

2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

CCCs linked to 8.F.2 8.PRG.2e5 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1, 1), (2. 4), and (3. 9) which are not on a straight line.

CCCs linked to 8.F.3 8.PRF.2c1 Given two graphs, describe the function as linear and not linear.

Use functions to model relationships between quantities.

4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

CCCs linked to 8.F.4 8.PRF.2e2 Identify the rate of change (slope) and initial value (y-intercept) from graphs.

5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

CCCs linked to 8.F.5
8.PRF.2c1 Given two graphs, describe the function as linear and not linear.
8.PRF.2e3 Given a verbal description of a situation, create or identify a graph to model the situation.
8.PRF.2e4 Given a graph of a situation, generate a description of the situation.
8.PRF.1f2 Describe or select the relationship between the two quantities given a line graph of a situation.

Geometry—8.G

Understand congruence and similarity using physical models, transparencies, or geometry software.

1. Verify experimentally the properties of rotations, reflections, and translations:
   a. Lines are taken to lines, and line segments to line segments of the same length.
   b. Angles are taken to angles of the same measure.
   c. Parallel lines are taken to parallel lines.

CCCs linked to 8.G.1 8.GM.1f1 Recognize a rotation, reflection, or translation of a figure. H.GM.1d1 Use the reflections, rotations, or translations in the coordinate plane to solve problems with right angles.

2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

CCCs linked to 8.G.2 8.GM.1g1 Recognize congruent and similar figures.

3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

CCCs linked to 8.G.3 8.GM.1f2 Identify a rotation, reflection, or translation of a plane figure when given coordinates.

4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

CCCs linked to 8.G.4 8.GM.1g1 Recognize congruent and similar figures. 8.ME.1e1 Describe the changes in surface area, area, and volume when the figure is changed in some way (e.g., scale drawings). 8.ME.1e2 Compare area and volume of similar figures.

5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

CCCs linked to 8.G.5 8.GM.1i4 Use angle relationships to find the value of a missing angle.

Understand and apply the Pythagorean Theorem.

6. Explain a proof of the Pythagorean Theorem and its converse.

NO CCCs linked to 8.G.6

7. Apply the Pythagorean Theorem to determine unknown side length in right triangles in real-world and mathematical problems in two and three dimensions.

CCCs linked to 8.G.7 8.ME.2f1 Apply the Pythagorean Theorem to determine lengths/distances in real-world situations. 8.GM.1j1 Find the hypotenuse of a two-dimensional right triangle (Pythagorean Theorem). 8.GM.1j2 Find the missing side lengths of a two-dimensional right triangle (Pythagorean Theorem). H.GM.1a1 Find the hypotenuse of a two-dimensional right triangle (Pythagorean Theorem). H.GM.1a2 Find the missing side lengths of a two-dimensional right triangle (Pythagorean Theorem).

8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

CCCs linked to 8.G.8 H.GM.1a3 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

CCCs linked to 8.G.9 8.ME.2d2 Apply the formula to find the volume of three-dimensional shapes (i.e., cubes, spheres, and cylinders).

Statistics and Probability—8.SP
Investigate patterns of association in bivariate data.

1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns of such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

CCCs linked to 8.SP.1 8.DPS.1g2 Graph data using line graphs, histograms, or box plots. 8.DPS.1h1 Graph bivariate data using scatter plots and identify possible associations between the variables. 8.DPS.1i3 Using box plots and scatter plots, identify data points that appear to be outliers.

2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fir a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

CCCs linked to 8.SP.2 8.DPS.2g1 Distinguish between a linear and non-linear association when analyzing bivariate data on a scatter plot.

3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr. as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

CCCs linked to 8.SP.3 8.DPS.2g2 Interpret the slope and the y-intercept of a line in the context of a problem.

4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether they have a curfew on school nights and whether they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

CCCs linked to 8.SP.4 8.DPS.1k2 Analyze displays of bivariate data to develop or select appropriate claims about those data. 8.DPS.1f3 Construct a two-way table summarizing data on two categorical variables collected from the same subjects; identify possible association between the two variables.