
Grade 7

Mathematics Objectives

Number System

1. Orders any mixed group of rational numbers from millionths through hundred trillions (e.g., a mixed group of integers, mixed decimals, and positive and negative fractions)
2. Finds the greatest common factor (GCF) and least common multiple (LCM) of any two or more whole numbers
3. Gives the prime factorization of any whole number
4. Recognizes that any number to the zero power is equal to 1 (e.g., $5^0 = 1$), but that 0^0 is undefined
5. Recognizes that between any two decimals or fractions there exists another decimal or fraction (the property of betweenness) (SMP 8)
6. Defines *additive inverse* and shows that any number and its opposite have a sum of 0 (7.NS.1a) (SMP 6)
7. Describes situations in which opposite quantities combine to make 0 (e.g., a hydrogen atom has a 0 charge because it has a single positively charged proton and a single negatively charged electron) (7.NS.1a)
8. Defines *multiplicative inverse*, or *reciprocal*, and gives the multiplicative inverse/reciprocal of any number (SMP 6)
9. Converts a rational number to a decimal, using long division, and recognizes that the decimal form of a rational number terminates in zeros or eventually repeats (7.NS.2d)
10. Converts a repeating decimal (when the whole decimal portion repeats) to a fraction (e.g., with a denominator of 9, 99, 999, etc.)
11. Converts between proper fractions and decimals (7.NS.2e)
12. Converts between decimals (through thousandths) and percents (through 100%) (7.NS.2e)
13. Converts between proper fractions and percents (through 100%) (7.NS.2e)
14. Converts among simple fractions, decimals, and percents in his or her head (e.g., $\frac{4}{5} = 0.8 = 80\%$)
15. Calculates or estimates frequently used percentages of numbers though 1,000 in his or her head (e.g., 10%, 15%, 20%, 25%, 50%) (SMP 4)
16. Raises any positive rational number to a positive whole number exponent (or *power*)
17. Uses numbers through 100 in Iñupiaq orally in everyday tasks (ILF B.I.cb.1.1) (ACS A.5) (ACS D.5)

Computation

1. Represents addition and subtraction of positive and negative rational numbers on a horizontal or vertical number line (7.NS.1) (SMP 4)

2. Explains the addition of positive and negative rational numbers as $p + q$ yields the number located a distance of $|q|$ from p , in the positive or negative direction, depending on whether q is positive or negative (7.NS.1b) (SMP 2) (SMP 6)
3. Interprets the sums of positive and negative rational numbers in real-world contexts (7.NS.1b) (SMP 4)
4. Explains the subtraction of positive and negative rational numbers as adding the additive inverse: $p - q = p + (-q)$ (7.NS.1c) (SMP 2) (SMP 6)
5. Shows that the distance between two rational numbers on the number line is the absolute value of their difference and applies this principle to real-world contexts (7.NS.1c) (SMP 4)
6. Applies and names properties of operations as strategies when adding and subtracting rational numbers (7.NS.1d) (SMP 1) (SMP 2)
7. Explains that the multiplication of positive and negative rational numbers requires the satisfaction of the properties of operations, particularly the distributive property, leading to the rules for multiplying signed numbers (7.NS.2a) (SMP 2)
8. Interprets products of positive and negative rational numbers in real-world contexts (7.NS.2a) (SMP 4)
9. Explains that integers can be divided, provided that the divisor is not zero, and that every quotient will be a rational number: $-(p/q) = (-p)/q = (p/-q)$ (7.NS.2b) (SMP 6)
10. Interprets quotients of positive and negative rational numbers in real-world contexts (7.NS.2b) (SMP 4)
11. Applies and names properties of operations as strategies when multiplying and dividing rational numbers (7.NS.2c) (SMP 1) (SMP 2)
12. Adds any combination of two or more rational numbers (7.NS.3) (SMP 6)
13. Adds with numbers 0 through 20, using Kaktovik numerals (ILF B.I.cb.1.1) (ACS A.5) (ACS D.5)
14. Subtracts any combination of two rational numbers (7.NS.3) (SMP 6)
15. Subtracts with numbers 0 through 20, using Kaktovik numerals (ILF B.I.cb.1.1) (ACS A.5) (ACS D.5)
16. Multiplies any combination of two or more rational numbers (7.NS.3) (SMP 6)
17. Divides any combination of two rational numbers (7.NS.3) (SMP 6)
18. Solves real-world problems involving simple interest, using the memorized formula $I = prt$ (including figuring the amount of the loan to be paid back and the total amount of savings on deposit) (SMP 2) (SMP 4)
19. Solves multi-step mathematical problems involving positive and negative rational numbers in any form and assesses the reasonableness of the answers, using mental computation and estimation strategies (7.EE.3) (SMP 1) (SMP 6) (SMP 7) (SMP 8)
20. Performs arithmetic operations in the conventional order, including problems involving whole number exponents and parentheses (order of operations) (SMP 2) (SMP 6)
21. Uses a calculator to solve problems and to check the accuracy of his or her computations, as appropriate (SMP 5)

Problem Solving, Reasoning, and Communication

1. Solves real-world problems involving the addition of any combination of two or more rational numbers (7.NS.3) (SMP 4)

2. Solves real-world problems involving the subtraction of any combination of two rational numbers (7.NS.3) (SMP 4)
3. Solves real-world problems involving the multiplication of any combination of two or more rational numbers (7.NS.3) (SMP 4)
4. Solves real-world problems involving the division of any combination of two rational numbers (7.NS.3) (SMP 4)
5. Solves multi-step real-world problems involving positive and negative rational numbers in any form and assesses the reasonableness of the answers, using mental computation and estimation strategies (7.EE.3) (SMP 1) (SMP 2) (SMP 4) (SMP 5) (SMP 7) (SMP 8)
6. Determines relevant, irrelevant, and/or missing information in a given word problem (SMP 1)
7. Chooses the most appropriate method for solving a problem from a variety of problem-solving strategies and justifies that choice (SMP 1)
8. Identifies, extends, and creates a variety of complex patterns involving rational numbers (including their squares, cubes, reciprocals, and multiples), units of measure, and geometric shapes, and uses symbolic notation to represent the patterns (SMP 2) (SMP 7)
9. Uses both alternative and traditional methods to solve problems (SMP 8)
10. Explains a variety of mathematical concepts and his or her reasoning in solving particular problems, orally and in writing (SMP 6)
11. Works cooperatively with others to use mathematics to solve complex problems in other school subjects
12. Challenges both teachers' and students' mathematical arguments and conclusions, when appropriate, and seeks to improve them (SMP 3)
13. Describes college majors and postsecondary technical school fields that require students to have a strong mathematical background
14. Believes that mathematical knowledge and skills (e.g., algebra, statistics) are important to postsecondary study

Measurement

1. Converts within customary units of length (inches, feet, yards, and miles), weight (ounces, pounds, and tons), and volume (fluid ounces, cups, pints, quarts, and gallons) and uses these conversions in solving multi-step real-world problems (SMP 2) (SMP 4) (SMP 6) (SMP 8)
2. Estimates and measures in customary units of length (inches, feet, yards, and miles), weight (ounces, pounds, and tons), and volume (fluid ounces, cups, pints, quarts, and gallons), using appropriate tools (SMP 4) (SMP 5) (SMP 6)
3. Uses commonly used metric units of length (mm, cm, m, and km), weight (g, kg, and metric tons), and volume (ml and L) in solving multi-step real-world problems, converting when necessary (SMP 2) (SMP 4) (SMP 6) (SMP 8)
4. Estimates and measures in commonly used metric units of length (mm, cm, m, and km), weight (g, kg, and metric tons), and volume (ml and L), using appropriate tools (SMP 4) (SMP 5) (SMP 6)
5. Knows by heart and uses, when appropriate, these customary to metric conversions: 1 inch = 2.54 centimeters, 1 liter = a little more than 1 quart, 1 kilogram = about 2.2 pounds, 1 meter = a little more than 1 yard or approximately 39.37 inches, and 1 kilometer = 0.6 miles (SMP 2) (SMP 4)

6. Defines and explains the uses of a variety of less common customary and metric units of measurement (e.g., peck, bushel, rod, nanosecond, micrometer, megaton)
7. Compares body measurements used today in a variety of cultures, including measuring braided sinew for boats in the Iñupiaq culture and measuring ropes on lobster boats in the Northeast U.S. (two outstretched arms from fingertips to fingertips, as a measure of about one fathom) (ILF N.E.s.3.1) (ACS B.1) (ACS D.5) (SMP 4)

Geometry

1. Computes actual side lengths, perimeters, and areas from scale drawings of geometric figures (7.G.1)
2. Draws to scale and reproduces a scale drawing of a geometric figure, using a different scale (7.G.1)
3. Draws (freehand, with a ruler and protractor, and with technology) geometric shapes, including polygons and circles with given conditions (7.G.2) (SMP 5)
4. Identifies when the measures of sides and angles determine a unique triangle, more than one triangle, or no triangle (7.G.2) (SMP 5)
5. Draws front, top, side, bottom, and corner views of any three-dimensional geometric solid (SMP 5)
6. Describes the two-dimensional *cross sections* that result from slicing three-dimensional shapes, as in plane sections of right rectangular prisms and right rectangular pyramids (7.G.3)
7. Constructs a circle, using a compass (SMP 5)
8. Gives an informal derivation of the relationship between the circumference and the area of a circle (7.G.4)
9. Finds the circumference of a circle in customary or metric units, using the memorized formulas $C = 2\pi r$ and $C = \pi d$ (7.G.4) (SMP 2)
10. Finds the area of a circle in customary or metric units, using the memorized formula $A = \pi r^2$ (7.G.4) (SMP 2)
11. Identifies, defines, and calculates the measurement of *complementary angles* and *supplementary angles* (7.G.5) (SMP 6)
12. Identifies and defines *adjacent angles* and *vertical angles* (7.G.5) (SMP 6)
13. Uses facts about complementary angles, supplementary angles, adjacent angles, and vertical angles to write equations for and solve multi-step problems involving the measure of an unknown angle in a figure (7.G.5) (SMP 2) (SMP 8)
14. Solves mathematical and real-world problems involving the perimeter of any regular or irregular polygon, given the measures of a sufficient number of sides (SMP 4)
15. Solves mathematical and real-world problems involving the area of a trapezoid, using the memorized formula $A = 1/2h (b_1 + b_2)$ (SMP 2) (SMP 4)
16. Solves mathematical and real-world problems involving the area of two-dimensional figures composed of triangles, quadrilaterals, and other polygons (7.G.6) (SMP 1) (SMP 4)
17. Solves mathematical and real-world problems involving the volume of three-dimensional figures composed of cubes, right rectangular prisms, and triangular prisms (7.G.6) (SMP 1) (SMP 64) (SMP 7)
18. Defines *surface area*, describes it as measured in square units, and uses a two-dimensional model (e.g., a net) to illustrate it (SMP 6)

19. Solves mathematical and real-world problems involving the surface area of cubes and right rectangular prisms, using the memorized formulas $A = 6s^2$ for a cube and $A = 2(wl + hl + hw)$ for a right rectangular prism (7.G.6) (SMP 2) (SMP 4)
20. Determines the surface area of a triangular prism by calculating and adding together the areas of its faces and bases (SMP 1)
21. Determines the surface area of a rectangular pyramid and triangular pyramid by calculating and adding together the areas of its faces and base (SMP 1)
22. Describes relationships among the lengths, areas, and volumes of similar geometric figures (e.g., doubling linear dimensions does not double area)
23. Identifies and defines *dilations* (*enlargements* and *reductions*, magnifying and shrinking) of two-dimensional shapes (SMP 6)
24. Performs and explains multiple transformations on any two-dimensional shape: rotations/turns, reflections/flips, translations/slides, and/or dilations/enlargements/reductions (SMP 6)
25. Explains the impact of any transformation on the perimeter and area of a two-dimensional shape
26. Identifies and defines *midpoint*, *diagonal*, and *plane* (SMP 6)
27. Identifies and describes parallel, perpendicular, and intersecting planes in geometric shapes
28. Distinguishes among geometric figures that have line symmetry, *point symmetry*, and *plane symmetry* (SMP 6)

Probability and Statistics

1. Designs and makes complex picture graphs, circle graphs (including when given percentages of data to be represented), line graphs, multiple-line line graphs, bar graphs, and double-bar bar graphs from real-world data, choosing an appropriate size for intervals and using correct titles and labels, both by hand and using a computer (SMP 4) (SMP 6)
2. Solves real-world problems using information in complex picture graphs, circle graphs, line graphs, multiple-line line graphs, bar graphs, and double-bar bar graphs (SMP 4)
3. *Extrapolates* lines on line graphs or multiple-line line graphs (SMP 7)
4. Chooses which type of graph presents a given set of data most effectively: complex picture graph, circle graph, bar graph, double-bar bar graph, line graph, or multiple-line line graph (SMP 1)
5. Judges a change in the scale used in a graph as improving or damaging the usefulness and appearance of the graph
6. Makes analyses of real-world data displayed in frequency tables and charts and draws reasonable conclusions (SMP 1) (SMP 4) (SMP 7)
7. Explains how statistics can be used to gain information about a population by examining a reasonably sized sample of the population and explains why generalizations about a population from a sample are valid only if the sample is *representative* (7.SP.1) (SMP 6)
8. Explains why *random sampling* tends to produce representative samples and to support valid inferences (7.SP.1) (SMP 6)
9. Uses data from a random sample to draw inferences about a population (7.SP.2) (SMP 3)

10. Generates multiple random samples (or simulated random samples) of the same size to gauge the variation in estimates or predictions that those samples would produce and how far off those estimates or predictions might be (7.SP.2)
11. Explains how to determine whether to use a census or a sample of the population when collecting data
12. Recognizes that the measure of certainty or uncertainty varies with the amount of data collected
13. Calculates the *mean absolute deviation* for the distribution of a set of numerical data (7.SP.3)
14. Assesses informally the degree of visual overlap (e.g., on a dot plot, line plot) of two numerical data distributions with similar variabilities, measuring the difference between the centers (e.g., mean, median) by expressing it as a multiple of a measure of variability (e.g., mean absolute deviation) (e.g., 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 mean absolute deviation on either team; on a dot plot the separation between the two distributions of heights is noticeable) (7.SP.3) (SMP 5)
15. Uses measures of center (mean or median) and measures of variability (mean absolute deviation) for numerical data from random samples to draw informal comparative inferences about two populations (7.SP.4) (SMP 3)
16. Explains the effects of outliers on the mean, median, mode, and range of a set of data generally and specifically in a given set of data
17. Explains the advantages and disadvantages of using the mean, median, mode, or range to describe a given set of data
18. Chooses to use the mean, median, mode, or range to describe a given set of data and justifies his or her choice (SMP 1)
19. Works cooperatively in a group to design a data-based study: what questions to ask, what data to collect, what data collection methods to use, what sampling techniques and sample size to use, and what graphs and tables to use to report the results (SMP 1) (SMP 4) (SMP 6)
20. Conducts and reports on a group-designed data-based study, using graphs and tables and reporting on the mean, median, mode, and range of data, as appropriate (SMP 3) (SMP 4) (SMP 6)
21. Discusses ways that statistics can be manipulated and can, therefore, be misleading
22. Identifies misleading statistics in actual newspaper, magazine, radio, or television advertisements and news stories
23. Believes it is important to be ethical when using statistics to inform or persuade people
24. Recognizes that the probability of a chance event is a number between 0 and 1, which expresses the likelihood of the event's occurring, with larger numbers indicating greater likelihood (i.e., a probability near 0 indicates an unlikely event, a probability near $\frac{1}{2}$ indicates an event's being neither unlikely nor likely, a probability near 1 indicates a likely event) (7.SP.5)
25. Approximates the probability of a chance event (by collecting data on the chance process that produces it and observing its long-run relative frequency) and predicts the approximate relative frequency, given the probability (e.g., 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) (7.SP.6)

26. Designs a uniform probability model, when all outcomes are equally likely, and uses the model to predict probabilities of events (e.g., *If a student is selected at random from a class, what is the probability that Jane will be selected?*) (7.SP.7a)
27. Designs a probability model, when all outcomes may or may not be equally likely, and observes frequencies in actual data generated from a chance process (e.g., a spinning coin, a tossed cup landing with the open end down) (7.SP.7b)
28. Compares probabilities from a model to observed frequencies and explains possible sources of any major discrepancies (7.SP.7)
29. Recognizes that, just as with simple events, the probability of a compound event's occurring is the fraction of possible outcomes in the sample space when the compound event occurs (7.SP.8a)
30. Represents sample spaces for compound events composed of two independent events (using methods such as organized lists, tables, and tree diagrams) by identifying the possible outcomes for an event described in everyday language (e.g., rolling double sixes), and finds the probability of a given compound event (7.SP.8b) (SMP 1) (SMP 4)
31. Designs and uses a simulation to generate frequencies for predicting the probability of the occurrence of compound events composed of two independent events, and finds the probability of such a given compound event (7.SP.8c)
32. Identifies the uses of probability concepts in the real world
33. Solves real-world or mathematical problems involving combinations and permutations (SMP 4) (SMP 7)

Algebra

1. Orders algebraic expressions and explains their relative magnitudes (e.g., $x + 3$, $x + 4$, $x + 5$, $10x$, $15x$, $20x$) (SMP 1)
2. Simplifies algebraic expressions (e.g., $x(x-4) + x = x^2 - 3x$) (SMP 1)
3. Applies properties of operations (e.g., the distributive, commutative, identity, and inverse properties) as strategies for adding, subtracting, factoring, expanding, and simplifying linear expressions with rational coefficients (7.EE.1) (SMP 1) (SMP 2)
4. Evaluates complex expressions, given a value for the variable (e.g., *If $x = 5$, what is $x^2 - 3x + 7$?*) (SMP 1)
5. Recognizes 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 (e.g., $a + 0.05a = 1.05a$ means that “increase by 5%” is the same as “multiply by 1.05”) (7.EE.2) (SMP 1)
6. Differentiates between expressions and equations
7. Writes and uses equations to solve mathematical problems involving percents, including finding the percent, finding the part, finding the whole, percent increase, and percent decrease (SMP 2)
8. Solves a multi-variable equation for any of the variables (e.g., *If $E = mc^2$, then what does m equal?*) (SMP 2)
9. Uses variables to represent quantities in real-world or mathematical problems and constructs multi-step equations and inequalities to solve those problems (7.EE.4) (SMP 1) (SMP 2) (SMP 4)
10. Solves real-world and mathematical problems leading to equations in the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers (e.g., *The*

perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?) (7.EE.4a) (SMP 2) (SMP 4)

11. Solves real-world and mathematical problems leading to inequalities in the form $px + q > r$ or $px + q < r$, where p , q , and r are specific rational numbers (e.g., *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 solution.*) (7.EE.4b) (SMP 2) (SMP 4)
12. Computes unit rates involving ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units (e.g., if a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, computes the unit rate as the complex fraction $(\frac{1}{2})/(\frac{1}{4})$ or, equivalently, 2 miles per hour) (7.RP.1)
13. Applies a given scale factor to find missing dimensions of similar geometric figures (7.RP.1)
14. Defines a *proportion* as a comparison between two ratios and interprets proportion statements in words (7.RP.2) (SMP 6)
15. Decides 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) (7.RP.2a)
16. Sets up a proportion to solve a problem and solves for the variable (the missing term) in the proportion (SMP 4)
17. Identifies the *constant of proportionality* (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships in real-world situations (7.RP.2b) (SMP 6)
18. Represents proportional relationships by equations and multiple representations such as tables, graphs, diagrams, sequences, and contextual situations (e.g., 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 number of items can be expressed as $t = pn$) (7.RP.2c) (SMP 1) (SMP 4)
19. Demonstrates the concept of unit rate on a coordinate plane by explaining 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 (7.RP.2d)
20. Uses proportional relationships to solve real-world multi-step ratio and percent problems, including simple interest, tax, markups and markdowns, gratuities, commissions, fees, percent increase and percent decrease, and percent error (7.RP.3) (SMP 4) (SMP 8)
21. Creates a function table (T-table) and plots ordered pairs in any quadrant on a coordinate plane (SMP 4) (SMP 7)
22. Determines whether a given point is on a line, given the graph of the line
23. Lists five coordinate pairs from the graph of a line and then identifies the pattern (SMP 7)
24. Graphs lines on a coordinate plane (e.g., $x = -3$)
25. Represents solution sets for linear equations in two variables on the coordinate plane