Fifth Grade Mathematics

By the end of grade five, students increase their facility with the four basic arithmetic operations applied to whole numbers, fractions, and decimals. They locate integers on a number line and ordered pairs of integers on the coordinate plane. They determine rules for numerical patterns, work with expressions including order of operations, and solve single-operation equations involving a single variable. They classify angles, triangles, and quadrilaterals, and analyze relationships among lines, triangles and quadrilaterals. They recognize and determine surface area and volume of three-dimensional shapes, including right prisms. Students understand the concepts of mean, median, mode, and range of data sets and can calculate them. They use line plots, bar graphs, and line graphs to record and analyze data.

Standard I: Students will expand number sense to include integers and perform operations with whole numbers, simple fractions, and decimals.

Objective 1: Represent whole numbers and decimals from thousandths to one billion, fractions, percents, and integers.

a. Read and write numbers in standard and expanded form.
b. Demonstrate multiple ways to represent whole numbers, decimals, fractions, percents, and integers using models and symbolic representations (e.g., 108 = 2 x 50 + 8; 108 = 10^2 + 8; 90% = 90 out of 100 squares on a hundred chart).
c. Identify, read, and locate fractions, mixed numbers, decimals, and integers on the number line.
d. Represent repeated factors using exponents.
e. Describe situations where integers could be used in the students' environment.

Objective 2: Explain relationships and equivalencies among integers, fractions, decimals, and percents.

a. Compare fractions by finding a common denominator.
b. Order integers, fractions (including mixed numbers), and decimals using a variety of methods, including the number line.
c. Rewrite mixed numbers and improper fractions from one form to the other and represent each using regions, sets of objects, or line segments.
d. Represent commonly used fractions as decimals and percents in a variety of ways (e.g., models, fraction strips, pictures, calculators, algorithms).
e. Model and calculate equivalent forms of a fraction (including simplest form).
f. Rename whole numbers as fractions with different denominators (e.g., 5 = 5/1, 3 = 6/2, 1 = 7/7).

Objective 3: Use number theory concepts to develop and use divisibility tests; classify whole numbers to 50 as prime, composite, or neither; and find common multiples and factors.

a. Identify patterns with skip counting and multiples to develop and use divisibility tests for determining whether a whole number is divisible by 2, 3, 5, 6, 9, and 10.
b. Use strategies for classifying whole numbers to 50 as prime, composite, or neither.
c. Rewrite a composite number between 2 and 50 as a product of only prime numbers.
d. Find common multiples and factors and apply to adding and subtracting fractions.

Objective 4: Model and illustrate meanings of multiplication and division.

a. Represent division-with-remainder using whole numbers, decimals, or fractions.
b. Describe the effect of place value when multiplying and dividing whole numbers and decimals by 10, 100, and 1,000.
c. Model multiplication of fractions and decimals (e.g., tenths multiplied by tenths, a whole number multiplied by tenths, or a whole number with tenths multiplied by tenths) in a variety of ways (e.g., manipulatives, number line and area models, patterns).

Objective 5: Solve problems involving one or two operations.

a. Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, and algorithms.
b. Make reasonable estimations of fraction and decimal sums, differences, and products, including knowing whether results obtained using a calculator are reasonable.
c. Write number sentences that can be used to solve a two-step problem.
d. Interpret division-with-remainder problems as they apply to the environment (e.g., If there are 53 people, how many vans are needed if each van holds 8 people?).

Objective 6: Demonstrate proficiency with multiplication and division of whole numbers and compute problems involving addition, subtraction, and multiplication of decimals and fractions.

a. Multiply multi-digit whole numbers by a two-digit whole number with fluency, using efficient procedures.
b. Divide multi-digit dividends by a one-digit divisor with fluency, using efficient procedures.
c. Add and subtract decimals with fluency, using efficient procedures.
d. Add and subtract fractions with fluency.
e. Multiply fractions.

Mathematical Language and Symbols Students Should Use

prime, composite, exponent, fractions, numerator, denominator, common denominator, common factor, common multiple, decimals, percents, divisible, divisibility, equivalent fractions, integer, dividend, quotient, divisor, factor, order of operations, simplest terms, various symbols for multiplication and division, mixed numeral, improper fraction

Exploratory Concepts and Skills

9 Extend classification of whole numbers from 0-100 as prime, composite, or neither. 9 Apply rules of divisibility.
9 Explore adding and subtracting integers.
9 Divide multi-digit dividends by a two-digit divisor.

Standard II: Students will use patterns and relations to represent and analyze mathematical problems and number relationships using algebraic symbols.

Objective 1: Identify, analyze and determine a rule for predicting and extending numerical patterns involving operations whole numbers, decimals, and fractions.

a. Analyze and make predictions about numeric patterns, including decimals and fractions.
b. Determine a rule for the pattern using organized lists, tables, objects, and variables.

Objective 2: Use algebraic expressions, inequalities, or equations to represent and solve simple real-world problems.

a. Use properties and the order of operations involving addition, subtraction, multiplication, division, and the use of parentheses to compute with whole numbers, decimals, and fractions.
b. Use patterns, models, and relationships as contexts for writing and solving simple equations and inequalities with whole number solutions (e.g., $6x = 54$; $x + 3 = 7$).

Mathematical Language and Symbols Students Should Use

variety of symbols for multiplication and division such as x, [i], and * as symbols for multiplication and ÷, e, and a fraction bar (/ or —) as division symbols; variable, order of operations, parentheses, inequality, expression, equation, associative property, commutative property, distributive property

Exploratory Concepts and Skills 9

Solve multi-step equations.

9 Construct and analyze tables involving equivalent ratios.

Standard III: Students will use spatial reasoning to recognize, describe, and analyze geometric shapes and principles.

Objective 1: Describe relationships between two- and three-dimensional shapes and analyze attributes and properties of geometric shapes.

a. Draw, label, and describe line segments, rays, lines, parallel lines, and perpendicular lines.
b. Draw, label, and define an angle as two rays sharing a common endpoint (vertex).
c. Classify triangles and quadrilaterals and analyze the relationships among the shapes in each classification (e.g., a square is a rectangle).
d. Relate pyramids and right prisms to the two-dimensional shapes (nets) from which they were created.
e. Identify properties and attributes of solids (i.e., right prisms, pyramids, cylinders, cones) and describe them by the number of edges, faces, and vertices as well as the types of faces.

Objective 2: Specify locations in a coordinate plane.

a. Locate points defined by ordered pairs of integers.
b. Write an ordered pair for a point in a coordinate plane with integer coordinates.
c. Specify possible paths between locations on a coordinate plane and compare distances of the various paths.

Mathematical Language and Symbols Students Should Use

perpendicular and parallel lines, rays, angles (acute, obtuse, right, straight), triangles (equilateral, isosceles, scalene, right, acute, obtuse), vertex, vertices, edge, face, corresponding angles, similar, polygon, pyramid, right prism

Exploratory Concepts and Skills

- Compare corresponding angles of two triangles and determine whether the triangles are similar.
- Rotate a shape around a fixed point and identify the location of the new vertices.
- Translate a polygon either horizontally or vertically on a coordinate grid and identify the location of the new vertices.
- Reflect a shape across either the x- or y-axis and identify the location of the new vertices.

Standard IV: Students will determine area of polygons and surface area and volume of three-dimensional shapes.

Objective 1: Determine the area of polygons and apply to real-world problems.

a. Determine the area of a trapezoid by the composition and decomposition of rectangles, triangles, and parallelograms.
b. Determine the area of irregular and regular polygons by the composition and decomposition of rectangles, triangles, and parallelograms.
c. Compare areas of polygons using different units of measure within the same measurement system (e.g., square feet, square yards).

Objective 2: Recognize, describe, and determine surface area and volume of three-dimensional shapes.

a. Quantify volume by finding the total number of same-sized units of volume needed to fill the space without gaps or overlaps.
b. Recognize that a cube having a 1 unit edge is the standard unit for measuring volume expressed as a cubic unit.
c. Derive and use the formula to determine the volume of a right prism with a triangular or rectangular base.
d. Relate the formulas for the areas of triangles, rectangles, or parallelograms to the surface area of a right prism.
e. Derive and use the formula to determine the surface area of a right prism and express surface area in square units.

Mathematical Language and Symbols Students Should Use

area, volume, surface area, volume, right prism

Exploratory Concepts and Skills

9 Investigate pi as the ratio of the circumference to the diameter of a circle. 9
Determine the volume of a right prism with various bases.

Standard V: Students will construct, analyze, and construct reasonable conclusions from data and apply basic concepts of probability.

Objective 1: Formulate and answer questions using statistical methods to compare data, and propose and justify inferences based on data.

a. Construct, analyze, and display data using an appropriate format (e.g., line plots, bar graphs, line graphs).
b. Recognize the differences in representing categorical and numerical data.
c. Identify minimum and maximum values for a set of data.
d. Identify and calculate the mean, median, mode, and range.

Objective 2: Apply basic concepts of probability.

a. Describe the results of experiments involving random outcomes using a variety of notations (e.g., 4 out of 9, 4/9).
b. Recognize that probability is always a value between 0 and 1 (inclusively).
c. Express the likelihood of an outcome in a simple experiment as a value between 0 and 1 (inclusively).

Mathematical Language and Symbols Students Should Use
data, minimum values, maximum values, mean, median, mode, average, range

Exploratory Concepts and Skills
9 Explore the differences in representing categorical and numerical data.