

Grade 6

Overview

This overview provides only the highlights of the new learning that should take place at the sixth-grade level. The specific skills and subject matter that sixth graders should be taught in each of the five mathematical strands are set forth in the formal standards and indicators for these strands. To alert educators as to when the progression in learning should occur for students in this grade, specific language is used with certain indicators:

- An indicator beginning with the phrase “**Generate strategies**” addresses a concept that is being formally introduced for the first time, and students must therefore be given experiences that foster conceptual understanding.
- An indicator beginning with the phrase “**Apply an algorithm,**” “**Apply a procedure,**” “**Apply procedures,**” or “**Apply formulas**” addresses a concept that has been introduced in a previous grade: students should already have the conceptual understanding, and the goal must now be fluency.
- An indicator beginning with the phrase “**Apply strategies and formulas**” or “**Apply strategies and procedures**” addresses a concept that is being formally introduced for the first time, yet the goal must nonetheless be that students progress to fluency.

Highlights of the new learning for grade-six students are

- understanding the concepts of percentages and integers,
- comparing rational numbers and percentages,
- applying an algorithm to add and subtract fractions,
- generating strategies to multiply and divide fractions and decimals,
- understanding the concepts of exponents and powers of ten,
- applying order of operations,
- using inverse operations to solve one-step equations,
- representing location of points in all four quadrants,
- constructing two-dimensional shapes with rotational symmetry,
- classifying shapes as similar,
- identifying pairs of angles that are complementary or supplementary,
- applying strategies and formulas to approximate circumference and area of a circle,
- applying strategies and procedures to estimate and determine perimeters and areas of irregular shapes,
- using proportions to determine unit rates,
- using a scale to determine distance, and
- applying procedures to calculate the probability of complementary events.

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Mathematical Processes

The mathematical processes provide the framework for teaching, learning, and assessing in mathematics at all grade levels. Instructional programs should be built around these processes.

Standard 6-1: The student will understand and utilize the mathematical processes of problem solving, reasoning and proof, communication, connections, and representation.

The indicators for this standard, which are appropriate for grades six through eight, are adapted from *Principles and Standards for School Mathematics* (NCTM 2000). Classroom application should be based on the standard and its indicators; the mathematical goals for the class; and the skills, needs, and understandings of the particular students.

Indicators

- 6-1.1 Generate and solve complex abstract problems that involve modeling physical, social, and/or mathematical phenomena.
- 6-1.2 Evaluate conjectures and pose follow-up questions to prove or disprove conjectures.
- 6-1.3 Use inductive and deductive reasoning to formulate mathematical arguments.
- 6-1.4 Understand equivalent symbolic expressions as distinct symbolic forms that represent the same relationship.
- 6-1.5 Generalize mathematical statements based on inductive and deductive reasoning.
- 6-1.6 Use correct and clearly written or spoken words, variables, and notations to communicate about significant mathematical tasks.
- 6-1.7 Generalize connections among a variety of representational forms and real-world situations.
- 6-1.8 Use standard and nonstandard representations to convey and support mathematical relationships.

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Number and Operations

Standard 6-2: The student will demonstrate through the mathematical processes an understanding of the concepts of whole-number percentages, integers, and ratio and rate; the addition and subtraction of fractions; accurate, efficient, and generalizable methods of multiplying and dividing fractions and decimals; and the use of exponential notation to represent whole numbers.

Indicators

- 6-2.1 Understand whole-number percentages through 100.
- 6-2.2 Understand integers.
- 6-2.3 Compare rational numbers and whole-number percentages through 100 by using the symbols \leq , \geq , $<$, $>$, and $=$.
- 6-2.4 Apply an algorithm to add and subtract fractions.
- 6-2.5 Generate strategies to multiply and divide fractions and decimals.
- 6-2.6 Understand the relationship between ratio/rate and multiplication/division.
- 6-2.7 Apply strategies and procedures to determine values of powers of 10, up to 10^6 .
- 6-2.8 Represent the prime factorization of numbers by using exponents.
- 6-2.9 Represent whole numbers in exponential form.

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Algebra

Standard 6-3: The student will demonstrate through the mathematical processes an understanding of writing, interpreting, and using mathematical expressions, equations, and inequalities.

Indicators

- 6-3.1 Analyze numeric and algebraic patterns and pattern relationships.
- 6-3.2 Apply order of operations to simplify whole-number expressions.
- 6-3.3 Represent algebraic relationships with variables in expressions, simple equations, and simple inequalities.
- 6-3.4 Use the commutative, associative, and distributive properties to show that two expressions are equivalent.
- 6-3.5 Use inverse operations to solve one-step equations that have whole-number solutions and variables with whole-number coefficients.

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Geometry

Standard 6-4: The student will demonstrate through the mathematical processes an understanding of shape, location, and movement within a coordinate system; similarity, complementary, and supplementary angles; and the relationship between line and rotational symmetry.

Indicators

- 6-4.1 Represent with ordered pairs of integers the location of points in a coordinate grid.
- 6-4.2 Apply strategies and procedures to find the coordinates of the missing vertex of a square, rectangle, or right triangle when given the coordinates of the polygon's other vertices.
- 6-4.3 Generalize the relationship between line symmetry and rotational symmetry for two-dimensional shapes.
- 6-4.4 Construct two-dimensional shapes with line or rotational symmetry.
- 6-4.5 Identify the transformation(s) used to move a polygon from one location to another in the coordinate plane.
- 6-4.6 Explain how transformations affect the location of the original polygon in the coordinate plane.
- 6-4.7 Compare the angles, side lengths, and perimeters of similar shapes.
- 6-4.8 Classify shapes as similar.
- 6-4.9 Classify pairs of angles as either complementary or supplementary.

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Measurement

Standard 6-5: The student will demonstrate through the mathematical processes an understanding of surface area; the perimeter and area of irregular shapes; the relationships among the circumference, diameter, and radius of a circle; the use of proportions to determine unit rates; and the use of scale to determine distance.

Indicators

- 6-5.1 Explain the relationships among the circumference, diameter, and radius of a circle.
- 6-5.2 Apply strategies and formulas with an approximation of π (3.14, or $\frac{22}{7}$) to find the circumference and area of a circle.
- 6-5.3 Generate strategies to determine the surface area of a rectangular prism and a cylinder.
- 6-5.4 Apply strategies and procedures to estimate the perimeters and areas of irregular shapes.
- 6-5.5 Apply strategies and procedures of combining and subdividing to find the perimeters and areas of irregular shapes.
- 6-5.6 Use proportions to determine unit rates.
- 6-5.7 Use a scale to determine distance.

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Data Analysis and Probability

Standard 6-6: The student will demonstrate through the mathematical processes an understanding of the relationships within one population or sample.

Indicators

- 6-6.1 Predict the characteristics of one population based on the analysis of sample data.
- 6-6.2 Organize data in frequency tables, histograms, or stem-and-leaf plots as appropriate.
- 6-6.3 Analyze which measure of central tendency (mean, median, or mode) is the most appropriate for a given purpose.
- 6-6.4 Use theoretical probability to determine the sample space and probability for one- and two-stage events such as tree diagrams, models, lists, charts, and pictures.
- 6-6.5 Apply procedures to calculate the probability of complementary events.