

# Grade 8

## Overview

This overview provides only the highlights of the new learning that should take place at the seventh-grade level. The specific skills and subject matter that seventh 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-eight students are

- applying an algorithm to add, subtract, multiply, and divide integers;
- understanding the concept of irrational numbers;
- applying procedures to approximate square and cube roots;
- applying procedures to solve multistep equations;
- classifying relationships between two variables as either linear or nonlinear;
- identifying the coordinates of the  $x$ - and  $y$ -intercepts of a linear equation;
- understanding slope as a constant rate of change;
- applying the Pythagorean theorem;
- using ordered pairs, equations, intercepts, and intersections to locate points and lines in a coordinate plane;
- applying a dilation on a square, rectangle, or right triangle in a coordinate plane and analyzing the effect;
- applying strategies and formulas to determine volume of three-dimensional shapes;
- using multistep unit analysis to convert between and with the U.S. Customary System and the metric system; and
- applying procedures to compute the odds of a given event.

## GRADE 8

### 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 8-1:** 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

- 8-1.1 Generate and solve complex abstract problems that involve modeling physical, social, or mathematical phenomena.
- 8-1.2 Evaluate conjectures and pose follow-up questions to prove or disprove conjectures.
- 8-1.3 Use inductive and deductive reasoning to formulate mathematical arguments.
- 8-1.4 Understand equivalent symbolic expressions as distinct symbolic forms that represent the same relationship.
- 8-1.5 Generalize mathematical statements based on inductive and deductive reasoning.
- 8-1.6 Use correct and clearly written or spoken words, variables, and notations to communicate about significant mathematical tasks.
- 8-1.7 Generalize connections among a variety of representational forms and real-world situations.
- 8-1.8 Use standard and nonstandard representations to convey and support mathematical relationships.

## GRADE 8

### Number and Operations

**Standard 8-2:** The student will demonstrate through the mathematical processes an understanding of operations with integers, the effects of multiplying and dividing with rational numbers, the comparative magnitude of rational and irrational numbers, the approximation of cube and square roots, and the application of proportional reasoning.

#### Indicators

- 8-2.1 Apply an algorithm to add, subtract, multiply, and divide integers.
- 8-2.2 Understand the effect of multiplying and dividing a rational number by another rational number.
- 8-2.3 Represent the approximate location of irrational numbers on a number line.
- 8-2.4 Compare rational and irrational numbers by using the symbols  $\leq$ ,  $\geq$ ,  $<$ ,  $>$ , and  $=$ .
- 8-2.5 Apply the concept of absolute value.
- 8-2.6 Apply strategies and procedures to approximate between two whole numbers the square roots or cube roots of numbers less than 1,000.
- 8-2.7 Apply ratios, rates, and proportions.

## **GRADE 8**

### **Algebra**

**Standard 8-3:** The student will demonstrate through the mathematical processes an understanding of equations, inequalities, and linear functions.

#### **Indicators**

- 8-3.1 Translate among verbal, graphic, tabular, and algebraic representations of linear functions.
- 8-3.2 Represent algebraic relationships with equations and inequalities.
- 8-3.3 Use commutative, associative, and distributive properties to examine the equivalence of a variety of algebraic expressions.
- 8-3.4 Apply procedures to solve multistep equations.
- 8-3.5 Classify relationships between two variables in graphs, tables, and/or equations as either linear or nonlinear.
- 8-3.6 Identify the coordinates of the  $x$ - and  $y$ -intercepts of a linear equation from a graph, equation, and/or table.
- 8-3.7 Identify the slope of a linear equation from a graph, equation, and/or table.

**GRADE 8**  
**Geometry**

**Standard 8-4:** The student will demonstrate through the mathematical processes an understanding of the Pythagorean theorem; the use of ordered pairs, equations, intercepts, and intersections to locate points and lines in a coordinate plane; and the effect of a dilation in a coordinate plane.

**Indicators**

- 8-4.1 Apply the Pythagorean theorem.
- 8-4.2 Use ordered pairs, equations, intercepts, and intersections to locate points and lines in a coordinate plane.
- 8-4.3 Apply a dilation to a square, rectangle, or right triangle in a coordinate plane.
- 8-4.4 Analyze the effect of a dilation on a square, rectangle, or right triangle in a coordinate plane.

## GRADE 8

### Measurement

**Standard 8-5:** The student will demonstrate through the mathematical processes an understanding of the proportionality of similar figures; the necessary levels of accuracy and precision in measurement; the use of formulas to determine circumference, perimeter, area, and volume; and the use of conversions within and between the U.S. Customary System and the metric system..

#### Indicators

- 8-5.1 Use proportional reasoning and the properties of similar shapes to determine the length of a missing side.
- 8-5.2 Explain the effect on the area of two-dimensional shapes and on the volume of three-dimensional shapes when one or more of the dimensions are changed.
- 8-5.3 Apply strategies and formulas to determine the volume of the three-dimensional shapes cone and sphere.
- 8-5.4 Apply formulas to determine the exact (*pi*) circumference and area of a circle.
- 8-5.5 Apply formulas to determine the perimeters and areas of trapezoids.
- 8-5.6 Analyze a variety of measurement situations to determine the necessary level of accuracy and precision.
- 8-5.7 Use multistep unit analysis to convert between and within U.S. Customary System and the metric system.

## **GRADE 8**

### **Data Analysis and Probability**

**Standard 8-6:** The student will demonstrate through the mathematical processes an understanding of the relationships between two variables within one population or sample.

#### **Indicators**

- 8-6.1 Generalize the relationship between two sets of data by using scatterplots and lines of best fit.
- 8-6.2 Organize data in matrices or scatterplots as appropriate.
- 8-6.3 Use theoretical and experimental probability to make inferences and convincing arguments about an event or events.
- 8-6.4 Apply procedures to calculate the probability of two dependent events.
- 8-6.5 Interpret the probability for two dependent events.
- 8-6.6 Apply procedures to compute the odds of a given event.
- 8-6.7 Analyze probability using area models.
- 8-6.8 Interpret graphic and tabular data representations by using range and the measures of central tendency (mean, median, and mode).