

Math

GRADE 8

STANDARD 1

The student understands and applies the concepts and procedures of *number sense and operations*

To meet this standard, the student will:

Benchmark 8.1.1: Compare, order, and represent decimals, integers, fractions, percents, and square roots

Indicators:

- 8.1.1.1 Compare and order fractions, decimals, and integers
- 8.1.1.2 Represent composite numbers as products of prime factors (e.g., $18 = 2 \times 3 \times 3$)
- 8.1.1.3 Mentally divide numbers by 0.1, 0.01, and 0.001
- 8.1.1.4 Represent whole numbers in expanded form using powers and scientific notation (e.g., $347 = 3 \times 10^2 + 4 \times 10 + 7$, $356 = 3.56 \times 10^2$)
- 8.1.1.5 Convert fractions to lowest terms and between improper and mixed numbers
- 8.1.1.6 Understand that the square roots of non-perfect squares are approximations
- 8.1.1.7 Evaluate perfect squares
- 8.1.1.8 Find the approximate values of square roots of whole numbers with and without a calculator
- 8.1.1.9 Solve problems that involve converting among fractions, decimals, percents, unit rates, and ratios (e.g., that show the conversion of $\frac{1}{3}$ to decimal form)
- 8.1.1.10 Memorize the fraction, decimal, and percent equivalents for denominators 2-10
- 8.1.1.11 Classify numbers into their different categories

Benchmark 8.1.2: Understand and explain operations with integers

Indicator:

- 8.1.2.1 Add, subtract, multiply and divide integers, with and without the use of manipulatives

Benchmark 8.1.3: Demonstrate proficiency in operations with fractions

Indicators:

- 8.1.3.1 Demonstrate an understanding of operations with fractions
- 8.1.3.2 Add, subtract, multiply, and divide simple and compound fractions

Benchmark 8.1.4: Understand and apply the order of operations with brackets and exponents in evaluating expressions

Indicators:

- 8.1.4.1 Apply the order of operations (up to three operations), including brackets and exponents, in evaluating expressions that involve fractions, decimals, and integers
- 8.1.4.2 Perform multi-step calculations involving whole numbers and decimals in real-life situations

Key: 1. Grade 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

SCS Curriculum, Math, Grade 8, approved January, 2007, revised May, 2009

Benchmark 8.1.5: Understand and explain that exponents represent repeated multiplication

Indicators:

- 8.1.5.1 Express repeated multiplication as powers
- 8.1.5.2 Memorize the perfect squares of 0 – 15
- 8.1.5.3 Evaluate expressions with exponents, both positive and negative and zero
- 8.1.5.4 Convert numbers between standard form and scientific notation

Benchmark 8.1.6: Use estimation to justify or assess the reasonableness of calculations

Indicator:

- 8.1.6.1 Justify the choice of method for calculations: estimation, mental computation, concrete materials, pencil and paper, algorithms (rules for calculations), or calculators

Benchmark 8.1.7: Solve and explain multi-step problems involving fractions, decimals, integers, percents, and rational numbers

Indicators:

- 8.1.7.1 Pose problems involving fractions, decimals, integers, percents, and rational numbers; and investigate solutions
- 8.1.7.2 Solve proportions based on rates and ratios
- 8.1.7.3 Apply percents in solving problems involving discounts, sales tax, commission, and simple interest

Benchmark 8.1.8: Explain the process used and the conclusions reached in problem solving using appropriate mathematical language

Indicators:

- 8.1.8.1 Explain numerical information in their own words and respond to numerical information in a variety of media
- 8.1.8.2 Demonstrate an understanding of and apply unit rates in problem-solving situations
- 8.1.8.3 Explain the process used and any conclusions reached in problem solving and investigations
- 8.1.8.4 Reflect on learning experiences and interpret and evaluate mathematical issues using appropriate mathematical language (e.g., in a math journal)
- 8.1.8.5 Use a calculator to solve number questions that are beyond the proficiency expectations for operations using pencil and paper

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STANDARD 2

The student understands and applies and concepts and procedures of *patterns and algebra*.

To meet this standard, the student will:

Benchmark 8.2.1: Identify the relationships between numbers and variables

Indicators:

- 8.2.1.1 Interpret the solution of a given equation as a specific number value that makes the equation true
- 8.2.1.2 Identify and apply the properties of algebra (commutative, associative, identity, zero, distributive)

Benchmark 8.2.2: Identify, create, and discuss patterns in algebraic terms

Indicator:

- 8.2.2.1 Find patterns and describe them using words and algebraic expressions

Benchmark 8.2.3: Evaluate algebraic expressions

Indicators:

- 8.2.3.1 Investigate inequalities and test whether they are true or false by substituting whole number values for the variables
- 8.2.3.2 Evaluate simple algebraic expressions, with up to three terms, by substituting fractions and decimals for the variables
- 8.2.3.3 Solve and verify first-degree equations with one variable, using various techniques involving whole numbers, decimals and fractions
- 8.2.3.4 Create problems giving rise to first-degree equations with one variable and solve them by inspection or by systematic trial (T Method)
- 8.2.3.5 Combine like terms, including with variables or radicals

Benchmark 8.2.4: Identify, create, and solve simple algebraic equations

Indicators:

- 8.2.4.1 Write an algebraic expression for the n th term of a numeric sequence
- 8.2.4.2 Use the concept of variable to write equations and algebraic expressions
- 8.2.4.3 Write statements to interpret simple equations
- 8.2.4.4 Translate complex statements into algebraic expressions or equations
- 8.2.4.5 Solve inequalities of first-degree equations and relate them to number line graphs

Key: 1. Grade 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

SCS Curriculum, Math, Grade 8, approved January, 2007, revised May, 2009

Benchmark 8.2.5: Apply and defend patterning strategies in problem-solving situations

Indicators:

- 8.2.5.1 Describe and justify a rule in a pattern
- 8.2.5.2 Present solutions to patterning problems and explain the thinking behind the solution process

Benchmark 8.2.6: Understand the relationship between an equation and a point or set of points on a graph

Indicators:

- 8.2.6.1 Recognize the relationship between an ordered pair and a solution to an equation
- 8.2.6.2 Graph ordered pairs and identify ordered pairs from a graph in the coordinate plane
- 8.2.6.3 Graph a line from a first-order equation as a set of solutions to the equation

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STANDARD 3

The student understands and applies the concepts and procedures of *geometry*.

To meet this standard, the student will:

Benchmark 8.3.1: Identify, describe, compare, and classify geometric figures

Indicators:

- 8.3.1.1 Identify basic geometric figures in a plane (such as point, line, ray, segment, plane, parallel and perpendicular, etc.)
- 8.3.1.2 Classify basic geometric shapes like angles, triangles, quadrilaterals, and other polygons
- 8.3.1.3 Identify the parts of a circle
- 8.3.1.4 Construct a circle given its center and radius or center and a point on the circle or three points on the circle

Benchmark 8.3.2: Identify and investigate the relationships of angles

Indicators:

- 8.3.2.1 Identify the angle properties of intersecting, parallel, and perpendicular lines by direct measurement: interior, corresponding, opposite, alternate, supplementary, complementary
- 8.3.2.2 Explain why the sum of the angles of a triangle is 180°
- 8.3.2.3 Explore the relationship to each other of the internal angles in a triangle (they add up to 180°) using a variety of methods (e.g., aligning corners of a paper triangle, using a protractor)
- 8.3.2.4 Create and solve angle measurement problems for triangles
- 8.3.2.5 Calculate angle measures in polygons

Benchmark 8.3.3: Construct and solve problems involving lines and angles

Indicators:

- 8.3.3.1 Solve angle measurement problems involving properties of intersecting line segments, parallel lines, and transversals
- 8.3.3.2 Describe the relationship between pairs of angles within parallel lines and transversals
- 8.3.3.3 Use coordinate geometry to solve problems like congruency and identifying shapes

Benchmark 8.3.4: Investigate geometric mathematical theories to solve problems

Indicators:

- 8.3.4.1 Investigate and explain the Pythagorean relationship using area models and diagrams
- 8.3.4.2 Apply the Pythagorean relationship to numerical problems involving area and right triangles

Key: 1. Grade 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

SCS Curriculum, Math, Grade 8, approved January, 2007, revised May, 2009

Benchmark 8.3.5: Explore transformations of geometric figures

Indicators:

- 8.3.5.1 Understand, apply, and analyze key concepts in transformational geometry using concrete materials and drawings
- 8.3.5.2 Recognize the image of a two-dimensional shape under a translation, a reflection, and a rotation in a variety of contexts
- 8.3.5.3 Create and analyze designs that include translated, rotated, and reflected two-dimensional images using concrete materials and drawings, and using appropriate computer applications
- 8.3.5.4 Identify symmetry in figures
- 8.3.5.5 Identify whether a figure will tile a plane
- 8.3.5.6 Construct and analyze tiling patterns with congruent tiles

Benchmark 8.3.6: Identify, draw, and represent three-dimensional geometric figures

Indicators:

- 8.3.6.1 Recognize three-dimensional figures from their top, side, and front views
- 8.3.6.2 Sketch and build representations of three-dimensional figures (e.g., nets, skeletons) from front, top, and side views

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STANDARD 4

The student understands and applies the concepts and procedures of *measurement*.

To meet this standard, the student will:

Benchmark 8.4.1: Demonstrate a verbal and written understanding of and ability to apply accurate measurement and estimation strategies that relate to their environment

Indicators:

- 8.4.1.1 Use listening, reading, and viewing skills to interpret and evaluate the use of measurement formulas
- 8.4.1.2 Make increasingly more informed and accurate measurement estimations based on an understanding of formulas and the results of investigations
- 8.4.1.3 Ask questions to clarify and extend knowledge of linear measurement, area, volume, capacity, and mass, using appropriate measurement vocabulary

Benchmark 8.4.2: Identify relationships between and among measurement concepts (linear, square, cubic, temporal, monetary)

Indicators:

- 8.4.2.1 Explain the relationships between various units of measurement
- 8.4.2.2 Identify the relationship among a base edge, area and volume as related to their units
- 8.4.2.3 Convert among the metric system units and American standard measuring units for capacity, length, and weight

Benchmark 8.4.3: Solve problems related to the calculation of the radius, diameter, and circumference of a circle

Indicators:

- 8.4.3.1 Define radius, diameter, and circumference and explain the relationships among them
- 8.4.3.2 Measure the radius, diameter, and circumference of a circle using concrete materials
- 8.4.3.3 Recognize that there is a constant relationship between the radius, diameter, and circumference of a circle, and approximate its value through investigation
- 8.4.3.4 Develop the formula for finding the circumference and the formula for finding the area of a circle
- 8.4.3.5 Estimate and calculate the radius, diameter, circumference, and area of a circle, using a formula in a problem-solving context

Benchmark 8.4.4: Apply area and volume formulas to problem-solving situations involving polygons and prisms and pyramids

Indicators:

- 8.4.4.1 Apply the formulas for finding the area of a triangle, parallelogram, trapezoid, circles, etc
- 8.4.4.2 Develop the formula for finding the surface area of prisms and pyramids using nets
- 8.4.4.3 Develop the formula for finding the volume of prisms and pyramids
- 8.4.4.4 Understand the relationship between the dimensions and the volume of prisms and pyramids
- 8.4.4.5 Calculate the surface area and the volume of a prism, using a formula in a problem-solving context

Key: 1. Grade 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

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STANDARD 5

The student understands and applies the concepts and procedures of *data analysis and probability*.

To meet this standard, the student will:

Benchmark 8.5.1: Systematically collect, organize, and analyze primary data

Indicators:

- 8.5.1.1 Understand the relationship between a census and a sample
- 8.5.1.2 Construct line graphs, comparative bar graphs, circle graphs, histograms, and box-and-whisker plots, with and without the help of technology, and use the information to solve problems (e.g., extrapolate from a line graph to predict a future trend)
- 8.5.1.3 Use conventional intervals, symbols, titles, and labels when displaying data

Benchmark 8.5.2: Interpret displays of data and present the information using mathematical terms

Indicators:

- 8.5.2.1 Know that a pattern on a graph may indicate a trend (correlation)
- 8.5.2.2 Discuss the quantitative information presented on tally charts, stem-and-leaf plots, frequency tables, and/or graphs
- 8.5.2.3 Read and report information about data presented on line graphs, comparative bar graphs, pictographs, and circle graphs, and use the information to solve problems
- 8.5.2.4 Understand the difference between a bar graph and a histogram
- 8.5.2.5 Determine trends and patterns by making inferences from graphs

Benchmark 8.5.3: Evaluate data and draw conclusions from the analysis of data

Indicators:

- 8.5.3.1 Understand and apply the concept of the best measure of central tendency
- 8.5.3.2 Find measure of variability (range and quartiles)
- 8.5.3.3 Discuss trends in graphs to clarify understanding and draw conclusions about the data
- 8.5.3.4 Assess bias in data-collection methods
- 8.5.3.5 Determine the effect on a measure of central tendency of adding or removing a value (e.g., what happens to the mean when you add or delete a very low or very high data entry)
- 8.5.3.6 Make inferences and convincing arguments that are based on data analysis
- 8.5.3.7 Make inferences and convincing arguments that are based on data analysis

Key: 1. Grade 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

SCS Curriculum, Math, Grade 8, approved January, 2007, revised May, 2009

Benchmark 8.5.4: Identify probability situations and apply knowledge of probability

Indicators:

- 8.5.4.1 Use probability to describe everyday events
- 8.5.4.2 Identify 0 to 1 as a range from "never happens" (impossibility) to "always happens" (certainty) when investigating probability
- 8.5.4.3 List the possible outcomes of simple experiments by using tree diagrams, modeling, and lists
- 8.5.4.4 Identify the favorable outcomes among the total number of possible outcomes and state the associated probability (e.g., of getting chosen in a random draw)
- 8.5.4.5 Use definitions of probability to calculate complex probabilities from tree diagrams and lists (e.g., for tossing a coin and rolling a die at the same time)
- 8.5.4.6 Apply knowledge of probability in sports and games, weather predictions, and political polling

Benchmark 8.5.5: Appreciate the power of using a probability model by comparing experimental results with theoretical results

Indicator:

- 8.5.5.1 Compare predicted and experimental results