

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

Number, Number Sense and Operations Standard

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

By the end of the 5 – 7 program, students will . . .

- A. Represent and compare numbers less than 0 through familiar applications and extending the number line.
- B. Compare, order and convert among fractions, decimals and percents.
- C. Develop meaning for percents, including percents greater than 100 and less than 1.
- D. Use models and pictures to relate concepts of ratio, proportion and percent.
- E. Use order of operations, including use of parenthesis and exponents to solve multi-step problems, and verify and interpret the results.
- F. Apply number system properties when performing computations.
- G. Apply and explain the use of prime factorizations, common factors, and common multiples in problem situations.
- H. Use and analyze the steps in standard and non-standard algorithms for computing with fractions, decimals and integers.
- I. Use a variety of strategies, including proportional reasoning, to estimate, compute, solve and explain solutions to problems involving integers, fractions, decimals and percents.

- 1. Demonstrate an understanding of place value using powers of 10 and write large numbers in scientific notation.
- 2. Explain the meaning of exponents that are negative or 0.
- 3. Describe differences between rational and irrational numbers; e.g., use technology to show that some numbers (rational) can be expressed as terminating or repeating decimals and others (irrational) as non-terminating and non-repeating decimals.
- 4. Use order of operations and properties to simplify numerical expressions involving integers, fractions and decimals.
- 5. Explain the meaning and effect of adding, subtracting, multiplying and dividing integers; e.g., how adding two integers can result in a lesser value.
- 6. Simplify numerical expressions involving integers and use integers to solve real-life problems.
- 7. Solve problems using the appropriate form of a rational number (fraction, decimal or percent).
- 8. Develop and analyze algorithms for computing with percents and integers, and demonstrate fluency in their use.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

By the end of the 5 – 7 program,
students will . . .

9. Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents and square roots (for perfect squares).

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

By the end of the 5 – 7 program, students will . . .

Measurement Standard

Students estimate and measure to a required degree of accuracy and precision by selecting and using appropriate units, tools and technologies.

A. Select appropriate units to measure angles, circumference, surface area, mass and volume, using:

a. U.S. customary units; e.g., degrees, square feet, pounds, and other units as appropriate;

b. metric units; e.g., square meters, kilograms and other units as appropriate.

A. Convert units of length, area, volume, mass and time within the same measurement system.

C. Identify appropriate tools and apply appropriate techniques for measuring angles, perimeter or circumference and area of triangles, quadrilaterals, circles and composite shapes, and surface area and volume of prisms and cylinders.

D. Select a tool and measure accurately to a specified level of precision.

E. Use problem solving techniques and technology as needed to solve problems involving length, weight, perimeter, area, volume, time and temperature.

F. Analyze and explain what happens to area and perimeter or surface area and volume when the dimensions of an object are changed.

1. Select appropriate units for measuring derived measurements; e.g., miles per hour, revolutions per minute.

2. Convert units of area and volume within the same measurement system using proportional reasoning and a reference table when appropriate; e.g., square feet to square yards, cubic meters to cubic centimeters.

3. Estimate a measurement to a greater degree of precision than the tool provides.

4. Solve problems involving proportional relationships and scale factors; e.g., scale models that require unit conversions within the same measurement system.

5. Analyze problem situations involving measurement concepts, select appropriate strategies, and use an organized approach to solve narrative and increasingly complex problems.

6. Use strategies to develop formulas for finding area of trapezoids and volume of cylinders and prisms.

7. Develop strategies to find the area of composite shapes using the areas of triangles, parallelograms, circles and sectors.

MATHEMATICS STANDARD
Grade – Seventh
Standard

Benchmark

Indicators

By the end of the 5 – 7 program,
students will . . .

G. Understand and demonstrate the independence of perimeter and area for two-dimensional shapes and of surface area and volume for three-dimensional shapes.

8. Understand the difference between surface area and volume and demonstrate that two objects may have the same surface area, but different volumes or may have the same volume, but different surface areas.
9. Describe what happens to the surface area and volume of a three-dimensional object when the measurements of the object are changed; e.g., length of sides are doubled.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

**Geometry and Spatial Sense
Standard**

Students identify, classify, compare and analyze characteristics, properties and relationships of one-, two- and three-dimensional geometric figures and objects. Students use spatial reasoning, properties of geometric objects, and transformations to analyze mathematical situations and solve problems.

By the end of the 5 – 7 program, students will . . .

- A. Identify and label angle parts and the regions defined within the plane where the angle resides.
- B. Draw circles, and identify and determine the relationships among the radius, diameter, center and circumference.
- C. Specify locations and plot ordered pairs on a coordinate plane.
- D. Identify, describe and classify types of line pairs, angles, two-dimensional figures and three-dimensional objects using their properties and use proportions to express relationships among corresponding parts of similar figures.
- E. Describe and use the concepts of congruence, similarity and symmetry to solve problems.
- F. Describe and use properties of triangles to solve problems involving angle measures and side lengths of right triangles.
- G. Predict and describe results (size, position, orientation) of transformations of two-dimensional figures.

- 1. Use proportional reasoning to describe and express relationships between parts and attributes of similar and congruent figures.
- 2. Determine sufficient (not necessarily minimal) properties that define a specific two-dimensional figure or three-dimensional object. For example:
 - a. Determine when one set of figures is a subset of another; e.g., all squares are rectangles.
 - b. Develop a set of properties that eliminates all but the desired figure; e.g., only squares are quadrilaterals with all sides congruent and all angles congruent.
- 3. Use and demonstrate understanding of the properties of triangles. For example:
 - a. Use Pythagorean Theorem to solve problems involving right triangles.
 - b. Use triangle angle sum relationships to solve problems.
- 4. Determine necessary conditions for congruence of triangles.
- 5. Apply properties of congruent or similar triangles to solve problems involving missing lengths and angle measures.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

By the end of the 5 – 7 program, students will . . .

H. Identify and draw three-dimensional objects from different views (top, side, front and perspective).

I. Apply properties of equality and proportionality to solve problems involving congruent or similar figures; e.g., create a scale drawing.

6. Determine and use scale factors for similar figures to solve problems using proportional reasoning.

7. Identify the line and rotation symmetries of two-dimensional figures to solve problems.

8. Perform translations, reflections, rotations and dilations of two-dimensional figures using a variety of methods (paper folding, tracing, graph paper).

9. Draw representations of three-dimensional geometric objects from different views.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

Patterns, Functions and Algebra Standard

Students use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities. Students analyze, model and solve problems using various representations such as tables, graphs and equations.

By the end of the 5 – 7 program, students will . . .

- A. Describe, extend and determine the rule for patterns and relationships occurring in numeric patterns, computation, geometry, graphs and other applications.
- B. Represent, analyze and generalize a variety of patterns and functions with tables, graphs, words and symbolic rules.
- C. Use variables to create and solve equations and inequalities representing problem situations.
- D. Use symbolic algebra to represent and explain mathematical relationships.
- E. Use rules and variables to describe patterns, functions and other relationships.
Use representations, such as tables, graphs and equations, to model situations and to solve problems, especially those that involve linear relationships.
Write, simplify and evaluate algebraic expressions.
Solve linear equations and inequalities symbolically, graphically and numerically.
- I. Explain how inverse operations are used to solve linear equations.

- 1. Represent and analyze patterns, rules and functions with words, tables, graphs and simple variable expressions.
- 2. Generalize patterns by describing in words how to find the next term.
- 3. Recognize and explain when numerical patterns are linear or nonlinear progressions; e.g., 1, 3, 5, 7... is linear and 1, 3, 4, 8, 16... is nonlinear.
- 4. Create visual representations of equation-solving processes that model the use of inverse operations.
- 5. Represent linear equations by plotting points in the coordinate plane.
- 6. Represent inequalities on a number line or a coordinate plane.
- 7. Justify that two forms of an algebraic expression are equivalent, and recognize when an expression is simplified;
e.g., $4m = m + m + m + m$ or $a \cdot 5 + 4 = 5a + 4$.
- 8. Use formulas in problem-solving situations.
- 9. Recognize a variety of uses for variables; e.g., placeholder for an unknown quantity in an equation, generalization for a pattern, formula.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

By the end of the 5 – 7 program,
students will . . .

J. Use formulas in problem-solving
situations.

K. Graph linear equations and
inequalities.

L. Analyze functional relationships,
and explain how a change in one
quantity results in a change in the other.

M. Approximate and interpret rates of
change from graphical and numerical
data.

10. Analyze linear and simple
nonlinear relationships to explain how
a change in one variable results in the
change of another.

11. Use graphing calculators or
computers to analyze change; e.g.,
distance-time relationships.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

Data Analysis and Probability Standard

Students pose questions and collect, organize, represent, interpret and analyze data to answer those questions. Students develop and evaluate inferences, predictions and arguments that are based on data.

By the end of the 5 – 7 program, students will . . .

- A. Read, create and use line graphs, histograms, circle graphs, box-and-whisker plots, stem-and-leaf plots, and other representations when appropriate.
- B. Interpret data by looking for patterns and relationships, draw and justify conclusions, and answer related questions.
- C. Evaluate interpretations and conclusions as additional data are collected, modify conclusions and predictions, and justify new findings.
- D. Compare increasingly complex displays of data, such as multiple sets of data on the same graph.
- E. Collect, organize, display and interpret data for a specific purpose or need.
- F. Determine and use the range, mean, median and mode to analyze and compare data, and explain what each indicates about the data.
- G. Evaluate conjectures and predictions based upon data presented in tables and graphs, and identify misuses of statistical data and displays.
- H. Find all possible outcomes of simple experiments or problem situations, using methods such as lists, arrays and tree diagrams.

1. Read, create and interpret box-and-whisker plots, stem-and-leaf plots, and other types of graphs, when appropriate.
2. Analyze how decisions about graphing affect the graphical representation; e.g., scale, size of classes in a histogram, number of categories in a circle graph.
3. Analyze a set of data by using and comparing combinations of measures of center (mean, mode, median) and measures of spread (range, quartile, interquartile range), and describe how the inclusion or exclusion of outliers affects those measures.
4. Construct opposing arguments based on analysis of the same data, using different graphical representations.
5. Compare data from two or more samples to determine how sample selection can influence results.
6. Identify misuses of statistical data in articles, advertisements, and other media.
7. Compute probabilities of compound events; e.g., multiple coin tosses or multiple rolls of number cubes, using such methods as organized lists, tree diagrams and area models.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

By the end of the 5 – 7 program,
students will . . .

I. Describe the probability of an event using ratios, including fractional notation.

J. Compare experimental and theoretical results for a variety of simple experiments.

K. Make and justify predictions based on experimental and theoretical probabilities.

8. Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results to predicted results, and explain differences.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

By the end of the 5 – 7 program,
students will . . .

Mathematical Processes Standard

Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

- A. Clarify problem-solving situation and identify potential solution processes; e.g., consider different strategies and approaches to a problem, restate problem from various perspectives.
- B. Apply and adapt problem-solving strategies to solve a variety of problems, including unfamiliar and non-routine problem situations.
- C. Use more than one strategy to solve a problem, and recognize there are advantages associated with various methods.
- D. Recognize whether an estimate or an exact solution is appropriate for a given problem situation.
- E. Use deductive thinking to construct informal arguments to support reasoning and to justify solutions to problems.
- F. Use inductive thinking to generalize a pattern of observations for particular cases, make conjectures, and provide supporting arguments for conjectures.
- G. Relate mathematical ideas to one another and to other content areas; e.g., use area models for adding fractions, interpret graphs in reading, science and social studies.

MATHEMATICS STANDARD

Grade – Seventh

Standard

Benchmark

Indicators

By the end of the 5 – 7 program,
students will . . .

- H. Use representations to organize and communicate mathematical thinking and problem solutions.
- I. Select, apply, and translate among mathematical representations to solve problems; e.g., representing a number as a fraction, decimal or percent as appropriate for a problem.
- J. Communicate mathematical thinking to others and analyze the mathematical thinking and strategies of others.
- K. Recognize and use mathematical language and symbols when reading, writing and conversing with others.