

MATHEMATICS STANDARD

Grade – Fifth

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. Use models and visual representation to develop the concept of ratio as part-to-part and part-to-whole, and the concept of percent as part-to-whole.
- 2. Use various forms of “one” to demonstrate the equivalence of fractions; e.g., $\frac{18}{24} = \frac{9}{12} \times \frac{2}{2} = \frac{3}{4} \times \frac{6}{6}$.
- 3. Identify and generate equivalent forms of fractions, decimals and percents.
- 4. Round decimals to a given place value and round fractions (including mixed numbers) to the nearest half.
- 5. Recognize and identify perfect squares and their roots.
- 6. Represent and compare numbers less than 0 by extending the number line and using familiar applications; e.g., temperature, owing money.
- 7. Use commutative, associative, distributive, identity and inverse properties to simplify and perform computations.
- 8. Identify and use relationships between operations to solve problems.
- 9. Use order of operations, including use of parentheses, to simplify numerical expressions.

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

10. Justify why fractions need common denominators to be added or subtracted.

11. Explain how place value is related to addition and subtraction of decimals; e.g., $0.2 + 0.14$; the two tenths is added to the one tenth because they are both tenths.

12. Use physical models, points of reference, and equivalent forms to add and subtract commonly used fractions with like and unlike denominators and decimals.

13. Estimate the results of computations involving whole numbers, fractions and decimals, using a variety of strategies.

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Measurement Standard

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

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

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

- U.S. customary units; e.g., degrees, square feet, pounds, and other units as appropriate;
- metric units; e.g., square meters, kilograms and other units as appropriate.
- Convert units of length, area, volume, mass and time within the same measurement system.

B. 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.

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

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

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

1. Identify and select appropriate units to measure angles; i.e., degrees.
2. Identify paths between points on a grid or coordinate plane and compare the lengths of the paths; e.g., shortest path, paths of equal length.
3. Demonstrate and describe the differences between covering the faces (surface area) and filling the interior (volume) of three-dimensional objects.
4. Demonstrate understanding of the differences among linear units, square units and cubic units.
5. Make conversions within the same measurement system while performing computations.
6. Use strategies to develop formulas for determining perimeter and area of triangles, rectangles and parallelograms, and volume of rectangular prisms.
7. Use benchmark angles (e.g.; 45°, 90°, 120°) to estimate the measure of angles, and use a tool to measure and draw angles.

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students will . . .

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

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

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.

- 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.
- E. Use proportions to express relationships among corresponding parts of similar figures.
- F. Describe and use the concepts of congruence, similarity and symmetry to solve problems.
- G. Describe and use properties of triangles to solve problems involving angle measures and side lengths of right triangles.
- H. Predict and describe results (size, position, orientation) of transformations of two-dimensional figures.

- 1. Draw circles, and identify and determine relationships among the radius, diameter, center and circumference; e.g., radius is half the diameter, the ratio of the circumference of a circle to its diameter is an approximation of π .
- 2. Use standard language to describe line, segment, ray, angle, skew, parallel and perpendicular.
- 3. Label vertex, rays, interior and exterior for an angle.
- 4. Describe and use properties of congruent figures to solve problems.
- 5. Use physical models to determine the sum of the interior angles of triangles and quadrilaterals.
- 6. Extend understanding of coordinate system to include points whose x or y values may be negative numbers.
- 7. Understand that the measure of an angle is determined by the degree of rotation of an angle side rather than the length of either side.
- 8. Predict what three-dimensional object will result from folding a two-dimensional net, then confirm the prediction by folding the net.

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

- I. Identify and draw three-dimensional objects from different views (top, side, front and perspective).
- J. Apply properties of equality and proportionality to solve problems involving congruent or similar figures; e.g., create a scale drawing.

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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.
- F. Use representations, such as tables, graphs and equations, to model situations and to solve problems, especially those that involve linear relationships.
- G. Write, simplify and evaluate algebraic expressions.
- H. Solve linear equations and inequalities symbolically, graphically and numerically.
- I. Explain how inverse operations are used to solve linear equations.

- 1. Justify a general rule for a pattern or a function by using physical materials, visual representations, words, tables or graphs.
- 2. Use calculators or computers to develop patterns, and generalize them using tables and graphs.
- 3. Use variables as unknown quantities in general rules when describing patterns and other relationships.
- 4. Create and interpret the meaning of equations and inequalities representing problem situations.
- 5. Model problems with physical materials and visual representations, and use models, graphs and tables to draw conclusions and make predictions.
- 6. Describe how the quantitative change in a variable affects the value of a related variable; e.g., describe how the rate of growth varies over time, based upon data in a table or graph.

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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.

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

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.

- 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, construct and interpret frequency tables, circle graphs and line graphs.
- 2. Select and use a graph that is appropriate for the type of data to be displayed; e.g., numerical vs. categorical data, discrete vs. continuous data.
- 3. Read and interpret increasingly complex displays of data, such as double bar graphs.
- 4. Determine appropriate data to be collected to answer questions posed by students or teacher, collect and display data, and clearly communicate findings.
- 5. Modify initial conclusions, propose and justify new interpretations and predictions as additional data are collected.
- 6. Determine and use the range, mean, median and mode, and explain what each does and does not indicate about the set of data.
- 7. List and explain all possible outcomes in a given situation.
- 8. Identify the probability of events within a simple experiment, such as three chances out of eight.

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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.

9. Use 0, 1 and ratios between 0 and 1 to represent the probability of outcomes for an event, and associate the ratio with the likelihood of the outcome.

10. Compare what should happen (theoretical/expected results) with what did happen (experimental/actual results) in a simple experiment.

11. Make predictions based on experimental and theoretical probabilities.

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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.

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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.