



4th GRADE MATH COURSE OF STUDY



Standard 1: 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.

BENCHMARKS **Indicators**

By the end of the 3-4 program:

- A. Use place value structure of the base-ten number system to read, write, represent and compare whole numbers and decimals.
- 1. Use place value structure of the base-ten number system to read, write, represent and compare whole numbers through millions and decimals through thousandths.
- B. Recognize and generate equivalent representations for whole numbers, fractions and decimals.
- 2. Identify and generate equivalent forms of fractions and decimals. For example:
 - a. Connect physical, verbal and symbolic representations of fractions, decimals and whole numbers; e.g., 1/2, 5/10, "five tenths," 0.5, shaded rectangles with half, and five tenths;
 - b. Understand and explain that ten tenths is the same as one whole in both fraction and decimal form.
- C. Represent commonly used fractions and mixed numbers using words and physical models *and symbolic notation*.
- D. Use models, points of reference and equivalent forms of commonly used fractions to judge the size of fractions and to compare, describe and order them.
- 3. Use models and points of reference to compare commonly used fractions.
- E. Recognize and classify numbers as prime or composite and list factors.
- 4. Identify and represent factors and multiples of whole numbers through 100, and classify numbers as prime or composite.
- F. Count money and make change using both coins and paper bills.
- 5. Solve problems involving counting money and making change, using both coins and paper bills.
- G. Model and use commutative and associative *and distributive* properties for addition and multiplication.
- 6. Use associative and distributive properties to simplify and perform computations; e.g., use left to right multiplication and the distributive property to find an exact answer without paper and pencil, such as $5 \times 47 = 5 \times 40 + 5 \times 7 = 200 + 35 = 235$.
- H. Use relationships between operations, such as subtraction as the inverse of addition and division as the inverse of multiplication.
- 7. Demonstrate fluency in adding and subtracting whole numbers and in multiplying and dividing whole numbers by 1- and 2-digit numbers and multiples of ten.
- 8. *Multiply and divide whole numbers by one- and two-digit numbers.*
- 9. Recognize that division may be used to solve different types of problem situations and interpret the meaning of remainders; e.g., situations involving measurement, money
- I. Demonstrate fluency in multiplication facts with factors through 10 and corresponding divisions.
- J. Estimate the results of whole number computations using a variety of strategies, and judge the reasonableness.
- 10. Round whole numbers to a given place value.
- 11. Estimate the results of computations involving whole numbers, fractions and decimals, using a variety of strategies.
- K. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division of whole numbers.
- 12. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division using an organized approach, and verify and interpret results with respect to the original problem.
- L. Use a variety of methods and appropriate tools (mental math, paper and pencil, calculators) for computing with whole numbers.
- 13. Develop and explain strategies for performing computations mentally.
- 14. Use a variety of methods and appropriate tools for computing with whole numbers; e.g., mental math, paper and pencil, and calculator.
- M. Add and subtract commonly used fractions with like denominators and decimals, using models and paper and pencil.
- 15. Use physical models, visual representations, and paper and pencil to add and subtract decimals and commonly used fractions with like denominators.

Standard 2: Measurement Standard
Students estimate and measure to a required degree of accuracy and precision by selecting and using appropriate units, tools and technologies.

BENCHMARKS **Indicators**

- A. Select appropriate units for perimeter, area, weight, volume (capacity), time and temperature, using:
 - objects of uniform size;
 - U.S. customary units; e.g., mile, square inch, cubic inch, second, degree Fahrenheit, and other units as appropriate;
 - metric units; e.g., millimeter, kilometer, square centimeter, kilogram, cubic centimeter, degree, Celsius, and other units as appropriate.
- 1. Demonstrate and use strategies to find perimeter using string or links, area using tiles or a grid, and volume using cubes; e.g., count squares to find area of regular or irregular shapes on a grid, layer cubes in a box to find its volume.
- 2. Make simple unit conversions within a measurement system; e.g., inches to feet, kilograms to grams, quarts to gallons.
- 3. Relate the number of units to the size of the units used to measure an object; e.g., compare the number of cups to fill a pitcher to the number of quarts to fill the same pitcher.

- B. Know that the number of units is inversely related to the size of the unit for any item being measured.
- 4. Estimate and measure length, weight, and volume (capacity) using metric and customary units, accurate to the nearest 1/2, 1/4, or 1/8 unit, as appropriate.
- C. Develop common referents for units of measure for length, weight, volume (capacity) and time to make comparisons and estimates.
- 5. Read thermometers in both Fahrenheit and Celsius. Know common references such as boiling point, freezing point.
- 6. Identify and select appropriate units to measure:
 - a. perimeter - string or links (inches or centimeters);
 - b. area - tiles (square inches or square centimeters);
 - c. volume - cubes (cubic inches or cubic centimeters).
- 7. Write, solve and verify solutions to multi-step problems involving measurement.
- D. Identify appropriate tools and apply counting techniques for measuring side lengths, perimeter and area of squares, rectangles, and simple irregular two-dimensional shapes, volume of rectangular prisms, and time and temperature.
- 8. Demonstrate and describe perimeter as surrounding and area as covering a two-dimensional shape, and volume as filling a three-dimensional object.
- 9. Develop and use strategies to find perimeter using string or links, area using tiles or a grid, and volume using cubes; e.g., count squares to find area of regular or irregular shapes on a grid, layer cubes in a box to find its volume.
- E. Tell time to the nearest minute.
- 10. Accurately determine elapsed time to the nearest minute using a clock.

Standard 3: 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.

BENCHMARKS **Indicators**

- A. Provide rationale for groupings and comparisons of two-dimensional figures and three-dimensional objects.
 - 1. Describe, classify, compare and model two- and three-dimensional objects using their attributes.
 - 2. Identify similarities and differences of quadrilaterals; e.g., squares, rectangles, parallelograms, and trapezoids.
- B. Describe and identify points, lines and planes in the environment.
 - 3. Describe points, lines and planes, and identify models in the environment.
- C. Describe and identify intersecting, parallel and perpendicular lines or segments in the environment.
 - 4. Identify, describe and model intersecting, parallel and perpendicular lines, and line segments; e.g., use straws or other materials to model lines.
- D. Identify and draw right, obtuse, acute and straight angles.
 - 5. Identify and define triangles based on angle measures (equiangular, right, acute and obtuse triangles) and side lengths (isosceles, equilateral and scalene triangles).
- E. Use attributes to describe, classify and sketch plane figures and build solid objects.
 - 6. Describe, classify, compare and model two- and three-dimensional objects using their attributes.
 - 7. Use geometric models to solve problems in other areas of mathematics, such as number (multiplication/division) and measurement (area, perimeter, border).
- F. Develop definitions of classes of shapes.
 - 7. Identify similarities and differences of quadrilaterals; e.g., squares, rectangles, parallelograms and trapezoids.
 - 8. Identify and define triangles based on angle measures (equiangular, right, acute and obtuse triangles) and side lengths (isosceles, equilateral and scalene triangles).
- G. Find and name locations in coordinate systems.
 - 9. Specify locations and plot ordered pairs on a coordinate plane, using first quadrant points.
- H. Identify and describe line and rotational symmetry in two-dimensional shapes and designs.
 - I. Describe, identify and model reflections, rotations and translations, using physical materials.
 - 10. Identify, describe and use reflections (flips), rotations (turns), and translations (slides) in solving geometric problems; e.g., use transformations to determine if 2 shapes are congruent.
- J. Describe a motion or series of transformations that show two shapes are congruent.
 - 11. Identify, describe and use reflections (flips), rotations (turns), and translations (slides) in solving geometric problems; e.g., use transformations to determine if 2 shapes are congruent.

Standard 4: Patterns, Function 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.

BENCHMARKS **Indicators**

- A. Analyze and extend patterns, and describe the rule in words.
 - 1. Use models and words to describe, extend and make generalizations of patterns and relationships occurring in computation, numerical patterns, geometry, graphs and other applications.

- B. Use patterns to make predictions, identify relationships, and solve problems.
 - 2. Represent and analyze patterns and functions, using words, tables, and graphs.
- C. Write and solve open sentences and explain strategies.
 - 3. Represent mathematical relationships with equations or inequalities.
- D. Represent an unknown quantity as a variable using a symbol, including letters.
 - 4. Use rules and variables to describe patterns and other relationships.
- E. Use variables to create and solve equations representing problem situations.
 - 5. Represent mathematical relationships with equations or inequalities.
- F. Construct and use a table of values to solve problems associated with mathematical relationships.
 - 6. Construct a table of values to solve problems associated with a mathematical relationship.
- G. Describe how a change in one variable affects the value of a related variable.
 - 7. Describe how a change in one variable affects the value of a related variable; e.g., as one increases the other increases or as one increases the other decreases.

Standard 5: 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.

BENCHMARKS **Indicators**

- A. Gather and organize data from surveys and classroom experiments, including data collected over a period of time.
 - 1. Create a plan for collecting data for a specific purpose.
- B. Read and interpret tables, charts, graphs (bar, picture, line, line plot), and timelines as sources of information, identify main idea, draw conclusions, and make predictions.
 - 2. Represent and interpret data using tables, bar graphs, line plots and line graphs.
 - 3. Propose and explain interpretations and predictions based on data displayed in tables, charts and graphs.
- C. Construct charts, tables and graphs to represent data, including picture graphs, bar graphs, line graphs, line plots and Venn diagrams.
 - 4. Interpret and construct Venn diagrams to sort and describe data.
- D. Read, interpret and construct graphs in which icons represent more than a single unit or intervals greater than one; e.g., each ♾ = 10 bicycles or the intervals on an axis are multiples of 10.
 - 5. Compare different representations of the same data to evaluate how well each representation shows important aspects of the data, and identify appropriate ways to display the data.
- E. Describe data using mode, median and range.
 - 6. Describe the characteristics of a set of data based on a graphical representation, such as range of the data, clumps of data, and holes in the data.
 - 7. Identify the median of a set of data and describe what it indicates about the data.
 - 8. Use range, median and mode to make comparisons among related sets of data.
- F. Conduct a simple probability experiment and draw conclusions about the likelihood of possible outcomes.
 - 9. Conduct simple probability experiments and draw conclusions from the results; e.g., rolling number cubes or drawing marbles from a bag.
- G. Identify and represent possible outcomes, such as arrangements of a set of up to four members and possible combinations from several sets, each containing 2 or 3 members.
 - 10. Represent the likelihood of possible outcomes for chance situations; e.g., probability of selecting a red marble from a bag containing 3 red and 5 white marbles.
 - 11. List and count all possible combinations using one member from each of several sets, each containing 2 or 3 members; e.g., the number of possible outfits from 3 shirts, 2 shorts and 2 pairs of shoes.
- H. Use the set of possible outcomes to describe and predict events.
 - 12. Represent the likelihood of possible outcomes for chance situations; e.g., probability of selecting a red marble from a bag containing 3 red and 5 white marbles.
 - 13. Relate the concepts of impossible and certain-to-happen events to the numerical values of 0 (impossible) and 1 (certain).
 - 14. Place events in order of likelihood and use a diagram or appropriate language to compare the chance of each event occurring; e.g., impossible, unlikely, equal, likely, certain.

Standard 6: Mathematical Processes Standard
Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

**** All mathematical process benchmarks are met across grade level indicators throughout other standards, and should be taught throughout the school year.**

BENCHMARKS **Indicators**

- A. Apply and justify the use of a variety of problem-solving strategies; e.g., make an organized list, guess and check.
 - 1. Apply various problem-solving strategies (e.g., draw a picture, look for a pattern, act out, graphs, guess and check, tables, Venn diagrams, writing equations, organized list, and make a model).
 - 2. Justify solution in writing.

- B. Use an organized approach and appropriate strategies to solve multi-step problems.
 - 3. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division using an organized approach, and verify and interpret results with respect to the original problem. (Number)
 - 4. Write, solve and verify solutions to multi-step problems involving measurement.
 - 5. Use models and words to describe, extend and make generalizations of patterns and relationships occurring in computation, numerical patterns, geometry, graphs and other applications. (Patterns)
- C. Interpret results in the context of the problem being solved; e.g., the solution must be a whole number of buses when determining the number of buses necessary to transport students.
 - 6. Recognize that division may be used to solve different types of problem situations and interpret the meaning of remainders (e.g., situations involving money measurement).
- D. Use mathematical strategies to solve problems that relate to other curriculum areas and the real world; e.g., use a timeline to sequence events; use symmetry in artwork.
 - 7. Use models and words to describe, extend and make generalizations of patterns and relationships occurring in computation, numerical patterns, geometry, graphs and other applications. (Patterns)
- E. Link concepts to procedures and to symbolic notation; e.g., model 3 x 4 with a geometric array, represent one-third by dividing an object into three equal parts.
 - 8. Use physical models, visual representations, and paper and pencil to add and subtract decimals and commonly used fractions with like denominators. (Number)
 - 9. Determine operation required to solve problem, use correct notation, and solve. (Number)
- F. Recognize relationships among different objects within mathematics; e.g., the length of an object can be represented by a number.
 - 10. Develop and use strategies to find perimeter using string or links, area using tiles or a grid, and volume using cubes; e.g., count squares to find area of regular or irregular shapes on a grid, layer cubes in a box to find volume. (Measurement)
- G. Use reasoning skills to determine and explain the reasonableness of a solution with respect to the problem situation.
 - 11. Explain in words and writing the reasonableness of a solution to a problem.
- H. Recognize basic valid and invalid arguments, and use examples and counter examples, models, number relationships, and logic to support or refute.
 - 12. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division using an organized approach, and verify and interpret results with respect to the original problem. (Number)
 - 13. Write, solve, and verify solutions to a problem.
 - 14. Estimate the results of computations involving whole numbers, fractions and decimals, using a variety of strategies. (Number)
- I. Represent problem situations in a variety of forms (physical model, diagram, in words or symbols), and recognize when some ways of representing a problem may be more helpful than others.
 - 15. Use physical models, visual representations, and paper and pencil to add and subtract decimals and commonly used fractions with like denominators. (Number)
 - 16. Use geometric models to solve problems in other areas of mathematics, such as number (multiplication/division) and measurement (area, perimeter, border). (Geometry)
- J. Read, interpret, discuss and write about mathematical ideas and concepts using both everyday and mathematical language.
 - 17. Develop and explain strategies for performing computations mentally. (Number)
 - 18. Use models and words to describe, extend and make generalizations of patterns and relationships occurring in computation, numerical patterns, geometry, graphs and other applications. (Patterns)
 - 19. Describe how a change in one variable affects the value of a related variable; e.g., as one increases the other increases or as one increases the other decreases. (Patterns)
- K. Use mathematical language to explain and justify mathematical ideas, strategies and solutions.
 - 20. Develop and explain strategies for performing computations.
 - 21. Use models and words to describe, extend, and make generalizations of patterns and relationships occurring in computation, numerical patterns, geometry, graphs and other applications.
 - 22. Write, solve, and verify solutions to a problem.