

# 4<sup>th</sup> Grade Math Proficiency Objectives

## Strand One: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-Solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

### Concept 1: Number Sense

**Understand and apply numbers, ways of representing numbers, the relationships among numbers, and different number systems.**

- Express whole numbers, fractions, decimals, and percents using and connecting multiple representations.
- Compose and decompose whole numbers using factors and multiples.
- Express fractions as fair sharing, parts of a whole, parts of a set, and locations on a real number line.
- Compare and order decimals to hundredths.
- Use simple ratios to describe problems in context.

### Concept 2: Numerical Operations

**Understand and apply numerical operations and their relationship to one another.**

- Add and subtract decimals through hundredths including money to \$1000.00 and fractions with like denominators.
- Use multiple strategies to multiply whole numbers
  - two-digit by two-digit and
  - multi-digit by one-digit.
- Demonstrate fluency of multiplication and division facts through 12.
- Use multiple strategies to divide whole numbers.
- Apply associative and distributive properties to solve multiplication and division problems.
- Apply order of operations with whole numbers.

### Concept 3: Estimation

**Use estimation strategies reasonably and fluently while integrating content from each of the other strands.**

- Use benchmarks as meaningful points of comparison for whole numbers, decimals, and fractions.
- Make estimates appropriate to a given situation or computation with whole numbers and fractions.

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## Strand Two: Data Analysis, Probability, and Discrete Math

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-Solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

### Concept 1: Data Analysis (Statistics)

**Identify patterns and apply pattern recognition to reason mathematically. Students begin with simple repetitive patterns of many iterations. This is the beginning of recursive thinking. Later, students can study sequences that can best be defined using recursion.**

- Collect, record, organize, and display data using double bar graphs, single line graphs, or circle graphs.
- Formulate and answer questions by interpreting and analyzing displays of data, including double bar graphs, single line graphs, or circle graphs.
- Use median, mode, and range to describe the distribution of a given data set.
- Compare two sets of related data.

### Concept 2: Probability

**Understand and apply the basic concepts of probability. This is the field of mathematics that deals with the likelihood that an event will occur expressed as the ratio of the number of favorable outcomes in the set of outcomes to the total number of possible outcomes.**

- Describe elements of theoretical probability by listing or drawing all possible outcomes of a given event and predicting the outcome using word and number benchmarks.

### Concept 3: Discrete Math – Systematic Listing and Counting

**Understand and demonstrate the systematic listing and counting of possible outcomes. This field of mathematics is generally referred to as Combinatorics.**

- Construct tree diagrams to solve problems in context by
  - representing all possibilities for a variety of counting problems,
  - explaining how its properties relate to the problem,
  - representing the same counting problem in multiple ways, and
  - drawing conclusions.
- Justify that all possibilities have been enumerated without duplication.

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## Concept 4: Vertex-Edge Graphs

**Understand and apply the concepts of vertex-edge graphs and networks. This field connects graph theory with practical problems.**

- Demonstrate the connection between map coloring and vertex coloring.
- Construct vertex-edge graphs to represent concrete situations and identify paths and circuits.
- Solve conflict problems by constructing and coloring vertex-edge graphs.

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## Strand Three: Patterns, Algebra, and Functions

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### Concept 1: Patterns

**Identify patterns and apply pattern recognition to reason mathematically. Students begin with simple repetitive patterns of many iterations. This is the beginning of recursive thinking. Later, students can study sequences that can best be defined using recursion.**

- Recognize, describe, create, extend, and find missing terms in a numerical sequence involving whole numbers using all four basic operations.
- Explain the rule for a given numerical sequence, verify that the rule works, and use the rule to make predictions.

### Concept 2: Functions and Relationships

**Describe and model functions and their relationships. For example, distribution and communication networks, laws of physics, population models, and statistical results can all be represented in the symbolic language of algebra.**

**No performance objectives at this grade level.**

### Concept 3: Algebraic Representations

**Represent and analyze mathematical situations and structures using algebraic representations. Algebraic representation is about abstract structures and about using the principles of those structures in solving problems expressed with symbols.**

- Use a symbol to represent an unknown quantity in a simple algebraic expression involving all operations.
- Create and solve one-step equations that can be solved using addition, subtraction, multiplication, and division of whole numbers.

### Concept 4: Analysis of Change

**Analyze how changing the values of one quantity corresponds to change in the values of another quantity.**

- Identify the change in a quantity over time and make simple predictions.

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## Strand Four: Geometry and Measurement

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### Concept 1: Geometric Properties

**Analyze the attributes and properties of two- and three-dimensional figures and develop mathematical arguments about their relationships (in conjunction with strand 5, concept 2).**

- Draw and describe the relationships between points, lines, line segments, rays, and angles including parallelism and perpendicularity.
- Justify which objects in a collection match a given geometric description.
- Describe and classify triangles by angles and sides.
- Recognize which attributes (such as shape or area) change and which do not change when 2-dimensional figures are cut up or rearranged.
- Recognize and draw congruent figures, and match them in a given collection.
- Draw right, acute, obtuse, and straight angles and identify these angles in other geometric figures.
- Recognize the relationship between a 3-dimensional figure and its corresponding net(s).

### Concept 2: Transformation of Shapes

**Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.**

**No performance objectives at this grade level.**

### Concept 3: Coordinate Geometry

**Specify and describe spatial relationships using coordinate geometry and other representational systems.**

- Name, locate, and graph points in the first quadrant of the coordinate plane using ordered pairs.
- Plot line segments in the first quadrant of the coordinate plane using a set of ordered pairs in a table.
- Construct geometric figures with vertices at points on the coordinate plane.

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## Concept 4: Measurement

**Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.**

- Compute elapsed time to the minute.
- Apply measurement skills to measure length, mass, and capacity using metric units.
- Solve problems involving conversions within the same measurement system.
- Solve problems involving perimeter of 2-dimensional figures and area of rectangles.
- Describe the change in perimeter or area when one attribute (length or width) of a rectangle changes.

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## Strand Five: Structure and Logic

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-Solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

### **Concept 1: Algorithms and Algorithmic Thinking**

**Use reasoning to solve mathematical problems. Determine step-by-step series of instructions to explain mathematical processes.**

- Analyze common algorithms for computing (adding, subtracting, multiplying, and dividing) with whole numbers using the associative, commutative, and distributive properties.

### **Concept 2: Logic, Reasoning, Problem Solving, and Proof**

**Evaluate situations, select problem solving strategies, draw logical conclusions, develop and describe solutions, and recognize their applications. Develop mathematical arguments based on induction and deduction, and distinguish between valid and invalid arguments.**

- Analyze a problem situation to determine the question(s) to be answered.
- Identify relevant, missing, and extraneous information related to the solution to a problem.
- Select and use one or more strategies to efficiently solve the problem and justify the selection.
- Determine whether a problem to be solved is similar to previously solved problems, and identify possible strategies for solving the problem.
- Represent a problem situation using any combination of words, numbers, pictures, physical objects, or symbols.
- Summarize mathematical information, explain reasoning, and draw conclusions.
- Analyze and evaluate whether a solution is reasonable, is mathematically correct, and answers the question.
- Make and test conjectures based on data (or information) collected from explorations and experiments.