

# 7<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.**

- Recognize and convert between expressions for positive and negative rational numbers, including fractions, decimals, percents, and ratios.
- Find or use factors, multiples, or prime factorization within a set of numbers.
- Compare and order rational numbers using various models and representations.
- Model and solve simple problems involving absolute value.

### Concept 2: Numerical Operations

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

- Add, subtract, multiply, and divide integers.
- Solve problems with rational numbers and appropriate operations using exact answers or estimates.
- Solve problems involving percentages, ratio and proportion, including tax, discount, tips, and part/whole relationships.
- Represent and interpret numbers using scientific notation (positive exponents only).
- Simplify numerical expressions using the order of operations and appropriate mathematical properties.

### Concept 3: Estimation

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

- Estimate and apply benchmarks for rational numbers and common irrational numbers.
- Make estimates appropriate to a given situation.
- Estimate square roots of numbers less than 1000 by locating them between two consecutive whole numbers.
- Estimate the measure of an object in one system of units given the measure of that object in another system and the approximate conversion factor.

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

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### 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.**

- Solve problems by selecting, constructing, and interpreting displays of data including multi-line graphs and scatterplots.
- Interpret trends in a data set, estimate values for missing data, and predict values for points beyond the range of the data set.
- Identify outliers and determine their effect on mean, median, mode, and range.
- Distinguish between a simple random and non-random sample.

### 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.**

- Determine conditional probabilities (experimental) in compound probability experiments.
- Experiment with two different events to determine whether the two events are dependent or independent of each other.
- Compare the results of multiple repetitions of the same probability experiment to the theoretical probability.
- Compare probabilities to determine fairness in experimental situations.

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## 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.

- Analyze relationships among the tree diagrams where items repeat and do not repeat; make numerical connections to the multiplication principle of counting.
- Solve counting problems using Venn diagrams and represent the answer algebraically.

## Concept 4: Vertex-Edge Graphs

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

- Use vertex-edge graphs and algorithmic thinking to represent and find solutions to practical problems related to Euler/Hamilton paths and circuits.

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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, and analyze numerical and geometric sequences using tables or graphs; make conjectures about these sequences.

### 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.**

- Use a table of values to graph an equation or proportional relationship; describe the graph's characteristics.

### 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.**

- Write a single variable algebraic expression or one-step equation given a contextual situation.
- Evaluate an expression containing one or two variables by substituting numbers for the variables.
- Solve multi-step equations using inverse properties with rational numbers.
- Translate between graphs and tables that represent a linear equation.
- Create and solve two-step equations that can be solved using inverse operations with rational numbers.
- Create and solve one-step inequalities with whole numbers.

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## Concept 4: Analysis of Change

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

- Use graphs and tables to model and analyze change.

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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).**

- Recognize the relationship between central angles and intercepted arcs; identify arcs and chords of a circle.
- Analyze and determine relationships between angles created by parallel lines cut by a transversal.
- Draw and classify 3-dimensional figures with appropriate labels showing specified attributes of parallelism, congruence, perpendicularity, and symmetry.
- Describe the relationship between the number of sides in a regular polygon and the sum of its interior angles.
- Identify corresponding parts of congruent figures.

### Concept 2: Transformation of Shapes

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

- Model the result of a double transformation (translations or reflections) of a 2-dimensional figure on a coordinate plane using all four quadrants.

### Concept 3: Coordinate Geometry

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

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

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## Concept 4: Measurement

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

- Solve problems involving the circumference and area of a circle by calculating and estimating.
- Identify polygons having the same perimeter or area.
- Calculate the area and perimeter of composite 2-dimensional figures.
- Determine actual lengths based on scale drawings or maps.
- Create a net to calculate the surface area of a given solid.
- Identify the appropriate unit of measure to compute the volume of an object and justify reasoning.
- Measure to the appropriate degree of accuracy and justify reasoning.

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## Strand Five: Structure and Logic

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### Concept 1: Algorithms and Algorithmic Thinking

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

- Create an algorithm to determine the area of a given composite figure.

### 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.
- Analyze and compare mathematical strategies for efficient problem solving; select and use one or more strategies to solve a problem.
- Identify relevant, missing, and extraneous information related to the solution to a problem.
- Represent a problem situation using multiple representations, describe the process used to solve the problem, and verify the reasonableness of the solution.
- Apply a previously used problem-solving strategy in a new context.\*
- Communicate the answer(s) to the question(s) in a problem using appropriate representations, including symbols and informal and formal mathematical language.
- Isolate and organize mathematical information taken from symbols, diagrams, and graphs to make inferences, draw conclusions, and justify reasoning.
- Make and test conjectures based on information collected from explorations and experiments.
- Solve logic problems using multiple variables and multiple conditional statements using words, pictures, and charts.
- Demonstrate and explain that the process of solving equations is a deductive proof.
- Use manipulatives and other modeling techniques to defend  $\pi$  (pi) as a ratio of circumference to diameter.

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