



MATHEMATICS (MIDDLE GRADES AND EARLY SECONDARY)

Test Framework

	Content Domain	Range of Competencies	Approximate Percentage of Test Score
I.	Mathematical Processes and Number Sense	0001–0003	24%
II.	Patterns, Algebra, and Functions	0004–0007	28%
III.	Measurement and Geometry	0008–0010	24%
IV.	Statistics, Probability, and Discrete Mathematics	0011–0013	24%

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I. MATHEMATICAL PROCESSES AND NUMBER SENSE

0001 Understand mathematical problem solving.

- ▶ Identify an appropriate problem-solving strategy for a particular problem.
- ▶ Analyze the use of estimation in a variety of situations (e.g., rounding, area, plausibility).
- ▶ Solve mathematical and real-world problems involving integers, fractions, decimals, and percents.
- ▶ Solve mathematical and real-world problems involving ratios, proportions, and average rates of change.

0002 Understand mathematical communication, connections, and reasoning.

- ▶ Translate between representations (e.g., graphic, verbal, symbolic).
- ▶ Recognize connections between mathematical concepts.
- ▶ Analyze inductive and deductive reasoning.
- ▶ Apply principles of logic to solve problems.
- ▶ Demonstrate knowledge of the historical development of major mathematical concepts, including contributions from diverse cultures.

0003 Understand number theory.

- ▶ Analyze the group structure of the real numbers.
- ▶ Use complex numbers and their operations.
- ▶ Analyze the properties of numbers and operations.
- ▶ Apply the principles of basic number theory (e.g., prime factorization, greatest common factor, least common multiple).

II. PATTERNS, ALGEBRA, AND FUNCTIONS

0004 Understand relations and functions.

- ▶ Demonstrate knowledge of relations and functions and their applications.
- ▶ Perform operations with functions, including compositions and inverses.
- ▶ Analyze characteristics of functions.
- ▶ Interpret different representations of functions.

0005 Understand linear, quadratic, and higher-order polynomial functions.

- ▶ Analyze the relationship between a linear, quadratic, or higher-order polynomial function and its graph.
- ▶ Solve linear and quadratic equations and inequalities using a variety of methods.
- ▶ Solve systems of linear equations or inequalities using a variety of methods.
- ▶ Solve higher-order polynomial equations and inequalities in one and two variables.
- ▶ Analyze the characteristics of linear, quadratic, and higher-order polynomial equations.
- ▶ Analyze real-world problems involving linear, quadratic, and higher-order polynomial functions.

0006 Understand exponential and logarithmic functions.

- ▶ Apply the laws of exponents and logarithms.
- ▶ Analyze the relationship between exponential and logarithmic functions.
- ▶ Analyze exponential and logarithmic functions and their graphs.
- ▶ Analyze real-world problems involving exponential and logarithmic functions.

0007 Understand rational, radical, absolute value, and piece-wise defined functions.

- ▶ Manipulate rational, radical, and absolute value expressions, equations, and inequalities.
- ▶ Analyze the relationship between a rational, radical, absolute value, or piece-wise defined function and its graph.
- ▶ Analyze rational, radical, absolute value, and piece-wise defined functions in terms of domain, range, and asymptotes.
- ▶ Analyze real-world problems involving rational, radical, absolute value, and piece-wise defined functions.

III. MEASUREMENT AND GEOMETRY

0008 Understand measurement principles and procedures.

- ▶ Analyze the use of various units and unit conversions within the customary and metric systems.
- ▶ Apply the concepts of similarity, scale factors, and proportional reasoning to solve measurement problems.
- ▶ Analyze precision, error, and rounding in measurements and computed quantities.
- ▶ Apply the concepts of perimeter, circumference, area, surface area, and volume to solve real-world problems.

0009 Understand Euclidean geometry in two and three dimensions.

- ▶ Demonstrate knowledge of axiomatic systems and of the axioms of non-Euclidean geometries.
- ▶ Use the properties of polygons and circles to solve problems.
- ▶ Apply the Pythagorean theorem and its converse.
- ▶ Analyze formal and informal geometric proofs, including the use of similarity and congruence.
- ▶ Use nets and cross sections to analyze three-dimensional figures.

0010 Understand coordinate and transformational geometry.

- ▶ Analyze two- and three-dimensional figures using coordinate systems.
- ▶ Apply concepts of distance, midpoint, and slope to classify figures and solve problems in the coordinate plane.
- ▶ Analyze conic sections.
- ▶ Determine the effects of geometric transformations on the graph of a function or relation.
- ▶ Analyze transformations and symmetries of figures in the coordinate plane.

IV. STATISTICS, PROBABILITY, AND DISCRETE MATHEMATICS

0011 Understand principles and techniques of statistics.

- ▶ Use appropriate formats for organizing and displaying data.
- ▶ Analyze data in a variety of representations.
- ▶ Analyze the use of measures of central tendency and variability.
- ▶ Analyze the effects of bias and sampling techniques.

0012 Understand principles and techniques of probability.

- ▶ Determine probabilities of simple and compound events and conditional probabilities.
- ▶ Use counting principles to calculate probabilities.
- ▶ Use a variety of graphical representations to calculate probabilities.
- ▶ Select simulations that model real-world events.
- ▶ Analyze uniform, binomial, and normal probability distributions.

0013 Understand principles of discrete mathematics.

- ▶ Apply concepts of permutations and combinations to solve problems.
- ▶ Analyze sequences and series including limits and recursive definitions.
- ▶ Perform operations on matrices and vectors.
- ▶ Apply set theory to solve problems.