# MIDDLE GRADES MATHEMATICS

## Test Framework

<table>
<thead>
<tr>
<th>Content Domain</th>
<th>Range of Competencies</th>
<th>Approximate Percentage of Test Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Number Sense and Operations</td>
<td>0001–0002</td>
<td>17%</td>
</tr>
<tr>
<td>II. Algebra and Functions</td>
<td>0003–0006</td>
<td>33%</td>
</tr>
<tr>
<td>III. Measurement and Geometry</td>
<td>0007–0009</td>
<td>25%</td>
</tr>
<tr>
<td>IV. Statistics, Probability, and Discrete Mathematics</td>
<td>0010–0012</td>
<td>25%</td>
</tr>
</tbody>
</table>
I. NUMBER SENSE AND OPERATIONS

0001 Understand numbers.

► Analyze the relationships between the subsets of the real numbers.
► Analyze the role of place value in any number system.
► Analyze the use of estimation in a variety of situations.
► Translate between different representations of numbers.
► Apply number-theory concepts (e.g., divisibility rules, prime factorization, greatest common factors) in problem-solving situations.

0002 Understand operations.

► Analyze relational and operational properties.
► Analyze a variety of conventional and alternative algorithms.
► Solve a variety of problems involving integers, fractions, and decimals.
► Solve a variety of problems involving ratios, proportions, and percents.
II. ALGEBRA AND FUNCTIONS

0003 Understand patterns, relations, and functions.
► Analyze a variety of patterns.
► Analyze the properties of relations and functions in multiple representations (e.g., tables, graphs, equations, words).
► Analyze direct and inverse proportional relationships.
► Determine the effects of transformations on the graph of a function or relation.

0004 Understand algebraic techniques and applications.
► Manipulate algebraic expressions, equations, and inequalities (e.g., simplify, transform, factor).
► Solve linear and nonlinear equations and inequalities.
► Connect appropriate algebraic notation to phrases and sentences.

0005 Understand linear relations and applications.
► Analyze the relationship between a linear equation or inequality and its representations.
► Solve systems of linear inequalities or equations with a variety of methods.
► Interpret the meaning of the slope and the $y$-intercept in various contexts.
► Analyze a variety of real-world problems involving linear equations, systems, and inequalities.

0006 Understand nonlinear relations and concepts of calculus.
► Analyze relationships between multiple representations of a nonlinear equation or inequality.
► Solve a variety of real-world problems involving nonlinear equations and inequalities.
► Analyze function behavior in terms of limits, continuity, and rates of change.
► Apply concepts of calculus to solve problems in real-world situations.
III. Measurement and Geometry

0007 Understand measurement principles, procedures, and applications.
► Analyze the use of various units and unit conversions within the customary and metric systems.
► Calculate or estimate measures of lengths, areas, and volumes.
► Apply the concepts of similarity, scale factors, and proportional reasoning to solve indirect measurement problems.
► Analyze precision, accuracy, and rounding in measurements and computed quantities.

0008 Understand Euclidean geometry in two and three dimensions.
► Analyze properties of points, lines, planes, and angles.
► Use the properties of triangles, quadrilaterals, and other polygons and circles to solve problems.
► Apply principles of similarity and congruence.
► Apply the Pythagorean theorem and its converse.
► Use nets, cross sections, and projections to analyze three-dimensional figures.
► Analyze geometric arguments using deductive reasoning.

0009 Understand coordinate and transformational geometry.
► Analyze two- and three-dimensional figures using coordinate systems.
► Connect algebra and geometry by applying concepts of distance, midpoint, and slope to classify figures and solve problems in the coordinate plane.
► Analyze transformations of figures in the coordinate plane.
► Analyze figures in terms of symmetry, and tessellations of the plane.
IV. STATISTICS, PROBABILITY, AND DISCRETE MATHEMATICS

0010 Understand principles and techniques of statistics.
► Analyze the effects of bias and sampling techniques.
► Use appropriate formats for organizing and displaying data.
► Analyze univariate and bivariate data in a variety of representations.
► Make predictions from data presented in a variety of representations.
► Analyze the use of measures of central tendency and spread.

0011 Understand principles of probability and techniques for determining probability.
► Determine probabilities of simple and compound events.
► Use counting principles to calculate probabilities.
► Use a variety of visual representations to calculate probabilities.
► Demonstrate knowledge of methods for simulating probabilities.

0012 Understand principles of discrete mathematics.
► Apply concepts of permutations and combinations to solve problems.
► Analyze sequences and series, including limits and recursive definitions.
► Use finite graphs and trees to represent problem situations.
► Apply set theory to solve problems.
► Apply principles of logic to solve problems (e.g., conditional and biconditional statements, conjunctions, negations).