

Missouri Educator Gateway Assessments

FIELD 023: MATHEMATICS TEST FRAMEWORK

June 2014

Content Domain	Range of Competencies	Approximate Percentage of Test Score
I. Numbers and Quantity	0001–0002	14%
II. Patterns, Algebra, and Functions	0003–0006	30%
III. Measurement and Geometry	0007–0009	21%
IV. Trigonometry and Calculus	0010–0012	21%
V. Statistics and Probability	0013–0014	14%

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TEST FRAMEWORK
FIELD 023: MATHEMATICS

A scientific calculator will be available to examinees taking the Mathematics test.

NUMBERS AND QUANTITY

0001 Understand real numbers and mathematical problem solving.

For example:

- 1.1 Analyze the structure of the real numbers.
- 1.2 Analyze the properties of numbers and operations.
- 1.3 Apply the principles of basic number theory (e.g., prime factorization, greatest common factor, least common multiple) to solve real-life and mathematical problems.
- 1.4 Solve real-life and mathematical problems involving integers, fractions, decimals, and percents.
- 1.5 Solve real-life and mathematical problems involving ratios, proportions, and average rates of change.
- 1.6 Solve real-life and mathematical problems involving irrational numbers and exponents.

0002 Understand complex numbers, vectors, and matrices.

For example:

- 2.1 Apply complex numbers and their operations to solve problems.
- 2.2 Translate between representations of vector quantities (e.g., graphic, verbal, symbolic).
- 2.3 Perform vector operations and solve problems that can be modeled using vectors.
- 2.4 Demonstrate knowledge of matrix operations.
- 2.5 Apply properties of matrices to model and solve problems.

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PATTERNS, ALGEBRA, AND FUNCTIONS

0003 Understand relations and functions.

For example:

- 3.1 Demonstrate knowledge of relations and functions and their applications.
- 3.2 Translate between different representations of functions.
- 3.3 Perform operations with functions, including compositions and inverses.
- 3.4 Analyze characteristics of functions.
- 3.5 Interpret different representations (e.g., equations, graphs, tables) of functions.
- 3.6 Analyze sequences and series, including limits and recursive definitions, and use them to solve problems.

0004 Understand linear, quadratic, and higher-order polynomial functions.

For example:

- 4.1 Analyze the relationship between a linear, quadratic, or higher-order polynomial function and its graph.
- 4.2 Solve linear and quadratic equations and inequalities using a variety of methods.
- 4.3 Solve systems of linear equations or inequalities using a variety of methods.
- 4.4 Solve higher-order polynomial equations and inequalities in one and two variables.
- 4.5 Analyze the characteristics of linear, quadratic, and higher-order polynomial equations.
- 4.6 Model and solve real-life problems involving linear, quadratic, and higher-order polynomial functions.

0005 Understand exponential and logarithmic functions.

For example:

- 5.1 Apply the laws of exponents and logarithms.
- 5.2 Analyze the relationship between exponential and logarithmic functions.
- 5.3 Analyze exponential and logarithmic functions and their graphs.
- 5.4 Model and solve real-life and mathematical problems involving exponential and logarithmic functions.

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0006 Understand rational, radical, absolute value, and piecewise defined functions.

For example:

- 6.1 Manipulate rational, radical, and absolute value expressions, equations, and inequalities.
- 6.2 Analyze the relationship between a rational, radical, absolute value, or piecewise defined function and its graph.
- 6.3 Analyze rational, radical, absolute value, and piecewise defined functions in terms of domain, range, and asymptotes.
- 6.4 Model and solve real-life and mathematical problems involving rational, radical, absolute value, and piecewise defined functions.

MEASUREMENT AND GEOMETRY

0007 Understand measurement principles and procedures.

For example:

- 7.1 Reason quantitatively and use units and unit conversions to solve problems.
- 7.2 Apply the concepts of similarity, scale factors, and proportional reasoning to model and solve measurement problems.
- 7.3 Analyze precision, error, and rounding in measurements and computed quantities.
- 7.4 Apply the concepts of perimeter, circumference, area, surface area, and volume to solve real-life and mathematical problems.

0008 Understand Euclidean geometry in two and three dimensions.

For example:

- 8.1 Demonstrate knowledge of inductive and deductive reasoning and of axiomatic systems.
- 8.2 Use the properties of triangles (e.g., centroid, orthocenter) and of right triangles (e.g., basic trigonometric ratios) to model and solve problems.
- 8.3 Use the properties of polygons and circles to model and solve problems.
- 8.4 Apply the Pythagorean theorem and its converse to model and solve real-life and mathematical problems.
- 8.5 Analyze formal and informal proofs, using geometric concepts (e.g., similarity, properties of angles, parallel lines).
- 8.6 Use two-dimensional diagrams and representations (e.g., nets, cross sections, vertex-edge graphs) to analyze three-dimensional figures.

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0009 Understand coordinate and transformational geometry.

For example:

- 9.1 Analyze two- and three-dimensional figures using coordinate systems.
- 9.2 Apply concepts of distance, midpoint, and slope to classify figures and model and solve problems in the coordinate plane.
- 9.3 Analyze conic sections, their equations, and the relationship between the equation of a conic section and its graph.
- 9.4 Determine the effects of transformations on the graph of a function or relation.
- 9.5 Analyze transformations and symmetries of figures and of the graphs of functions in the coordinate plane.

TRIGONOMETRY AND CALCULUS

0010 Understand trigonometric functions.

For example:

- 10.1 Apply trigonometric functions to solve problems involving distance and angles.
- 10.2 Apply trigonometric functions to solve problems involving the unit circle.
- 10.3 Manipulate trigonometric expressions and solve equations using techniques such as trigonometric identities.
- 10.4 Analyze the relationship between a trigonometric function and its graph.
- 10.5 Use trigonometric functions to model periodic relationships.

0011 Understand differential calculus.

For example:

- 11.1 Evaluate limits.
- 11.2 Demonstrate knowledge of continuity.
- 11.3 Analyze the derivative as the slope of a tangent line and as the limit of the difference quotient.
- 11.4 Calculate the derivatives of functions (e.g., polynomial, exponential, logarithmic).
- 11.5 Apply differentiation to analyze the graphs of functions.
- 11.6 Apply differentiation to solve real-life and mathematical problems involving rates of change and optimization.

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0012 Understand integral calculus.

For example:

- 12.1 Apply the fundamental theorem of calculus to model and solve problems.
- 12.2 Analyze the integral as the area under a curve and as the limit of the Riemann sum.
- 12.3 Calculate the integrals of functions (e.g., polynomial, exponential, logarithmic).
- 12.4 Apply integration to analyze the graphs of functions.
- 12.5 Apply integration to solve real-life and mathematical problems, including problems involving solids of revolution.

STATISTICS AND PROBABILITY

0013 Understand principles and techniques of statistics.

For example:

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

0014 Understand principles and techniques of probability.

For example:

- 14.1 Apply the rules of probability to compute probabilities of simple and compound events and conditional probabilities.
- 14.2 Use counting principles (e.g., permutations, combinations) and set theory to calculate probabilities and solve problems.
- 14.3 Use a variety of graphical representations to calculate probabilities.
- 14.4 Select simulations that model real-life events.
- 14.5 Analyze uniform, binomial, and normal probability distributions.