Missouri Educator Gateway Assessments

FIELD 023: MATHEMATICS
TEST FRAMEWORK

January 2014

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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, Probability, and Discrete Mathematics	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 of functions.

3.6   Analyze sequences and series, including limits and recursive definitions.

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   Analyze 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   Analyze and solve real-life and mathematical problems involving exponential and logarithmic functions.

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   Analyze 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 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 polygons and circles to solve problems.

8.3   Apply the Pythagorean theorem and its converse to solve real-life and mathematical problems.

8.4   Analyze formal and informal geometric proofs, including the use of similarity and congruence.

8.5   Use two-dimensional diagrams and representations (e.g., nets, cross sections, vertex-edge graphs) to analyze three-dimensional figures.

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 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.

0012   Understand integral calculus.

For example:

12.1   Analyze the integral as the area under a curve and as the limit of the Riemann sum.

12.2   Calculate the integrals of functions (e.g., polynomial, exponential, logarithmic).

12.3   Apply integration to analyze the graphs of functions.

12.4   Apply integration to solve real-life and mathematical problems, including problems involving solids of revolution.

STATISTICS, PROBABILITY, AND DISCRETE MATHEMATICS

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.