

OHIO ASSESSMENTS FOR EDUCATORS (OAE)

FIELD 027: MATHEMATICS

ASSESSMENT FRAMEWORK

June 2013

Content Domain	Range of Competencies	Approximate Percentage of Assessment Score
I. Mathematical Processes and Number Sense	0001–0003	19%
II. Patterns, Algebra, and Functions	0004–0007	24%
III. Measurement and Geometry	0008–0010	19%
IV. Trigonometry and Calculus	0011–0013	19%
V. Statistics, Probability, and Discrete Mathematics	0014–0016	19%

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MATHEMATICAL PROCESSES AND NUMBER SENSE

0001 Understand mathematical problem solving.

Includes:

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

0002 Understand mathematical communication, connections, and reasoning.

Includes:

1. Translate between representations (e.g., graphic, verbal, symbolic).
2. Recognize connections between mathematical concepts.
3. Identify viable arguments based on inductive and deductive reasoning.
4. Apply principles of logic to solve problems.
5. Demonstrate knowledge of the historical development of major mathematical concepts, including contributions from diverse cultures.

0003 Understand number theory.

Includes:

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

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PATTERNS, ALGEBRA, AND FUNCTIONS

0004 Understand relations and functions.

Includes:

1. Demonstrate knowledge of relations and functions and their applications.
2. Perform operations with functions, including compositions and inverses.
3. Analyze characteristics of functions.
4. Interpret different representations of functions.

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

Includes:

1. Analyze the relationship between a linear, quadratic, or higher-order polynomial function and its graph.
2. Solve linear and quadratic equations and inequalities using a variety of methods.
3. Solve systems of linear equations or inequalities using a variety of methods.
4. Solve higher-order polynomial equations and inequalities in one and two variables.
5. Analyze the characteristics of linear, quadratic, and higher-order polynomial equations.
6. Solve real-world problems by modeling them with linear, quadratic, and higher-order polynomial functions.

0006 Understand exponential and logarithmic functions.

Includes:

1. Apply the laws of exponents and logarithms.
2. Analyze the relationship between exponential and logarithmic functions.
3. Analyze exponential and logarithmic functions and their graphs.
4. Solve real-world problems by modeling them with exponential and logarithmic functions.

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

Includes:

1. Manipulate rational, radical, and absolute value expressions, equations, and inequalities.
2. Analyze the relationship between a rational, radical, absolute value, or piece-wise defined function and its graph.
3. Analyze rational, radical, absolute value, and piece-wise defined functions in terms of domain, range, and asymptotes.
4. Solve real-world problems by modeling them with rational, radical, absolute value, and piece-wise defined functions.

MEASUREMENT AND GEOMETRY

0008 Understand measurement principles and procedures.

Includes:

1. Analyze the use of various units and unit conversions within the customary and metric systems.
2. Apply the concepts of similarity, scale factors, and proportional reasoning to solve measurement problems.
3. Analyze precision, error, and rounding in measurements and computed quantities.
4. 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.

Includes:

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

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0010 Understand coordinate and transformational geometry.

Includes:

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

TRIGONOMETRY AND CALCULUS

0011 Understand trigonometric functions.

Includes:

1. Apply trigonometric functions to solve problems involving distance and angles.
2. Apply trigonometric functions to solve problems involving the unit circle.
3. Manipulate trigonometric expressions and equations using techniques such as trigonometric identities.
4. Analyze the relationship between a trigonometric function and its graph.
5. Use trigonometric functions to model periodic relationships.

0012 Understand differential calculus.

Includes:

1. Evaluate limits.
2. Demonstrate knowledge of continuity.
3. Analyze the derivative as the slope of a tangent line and as the limit of the difference quotient.
4. Calculate the derivatives of functions (e.g., polynomial, exponential, logarithmic).
5. Apply differentiation to analyze the graphs of functions.
6. Apply differentiation to solve real-world problems involving rates of change and optimization.

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0013 Understand integral calculus.

Includes:

1. Analyze the integral as the area under a curve and as the limit of the Riemann sum.
2. Calculate the integrals of functions (e.g., polynomial, exponential, logarithmic).
3. Apply integration to analyze the graphs of functions.
4. Apply integration to solve real-world problems.

STATISTICS, PROBABILITY, AND DISCRETE MATHEMATICS

0014 Understand principles and techniques of statistics.

Includes:

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

0015 Understand principles and techniques of probability.

Includes:

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

0016 Understand principles of discrete mathematics.

Includes:

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