

**CERTIFICATION EXAMINATIONS
FOR OKLAHOMA EDUCATORS™ (CEOETM)**

OKLAHOMA SUBJECT AREA TESTS™ (OSAT™)

**FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS
TEST FRAMEWORK**

October 2005

Subarea	Range of Competencies
I. Mathematical Processes and Number Sense	01–04
II. Relations, Functions, and Algebra	05–09
III. Measurement and Geometry	10–13
IV. Probability, Statistics, and Discrete Mathematics	14–16

Copyright © 2005 by National Evaluation Systems, Inc. (NES®)

"Certification Examinations for Oklahoma Educators," "CEOE," "Oklahoma General Education Test," "OGET," "Oklahoma Professional Teaching Examination," "OPTE," "Oklahoma Subject Area Tests," "OSAT," and the "CEOE" logo are trademarks of the Oklahoma Commission for Teacher Preparation and National Evaluation Systems, Inc. (NES®).

"NES®" and its logo are registered trademarks of National Evaluation Systems, Inc.™

OKLAHOMA SUBJECT AREA TESTS™ (OSAT™)

FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS TEST FRAMEWORK

Mathematical Processes and Number Sense
Relations, Functions, and Algebra
Measurement and Geometry
Probability, Statistics, and Discrete Mathematics

SUBAREA I—MATHEMATICAL PROCESSES AND NUMBER SENSE

Competency 0001

Understand mathematical problem solving and the connections between and among the fields of mathematics and other disciplines.

The following topics are examples of content that may be covered under this competency.

- Analyze and apply a variety of problem-solving strategies to contexts within and outside mathematics.
- Select and use appropriate manipulatives and technological tools (e.g., spreadsheets, graphing utilities) to solve problems.
- Recognize and apply connections among mathematical concepts in different fields (e.g., algebra, geometry, probability) and be able to apply mathematics in a real-world setting.
- Demonstrate knowledge of the historical development of mathematics, including contributions from diverse cultures.

Competency 0002

Understand the principles and processes of mathematical reasoning.

The following topics are examples of content that may be covered under this competency.

- Construct and evaluate mathematical conjectures, arguments, and informal proofs.
- Apply inductive and deductive reasoning to solve problems.
- Use counterexamples to evaluate arguments and disprove suppositions.
- Apply proportional and spatial reasoning (e.g., using ratios or geometric concepts) to solve problems.

OKLAHOMA SUBJECT AREA TESTS (OSAT™)
FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS
TEST FRAMEWORK

Competency 0003

Understand and communicate mathematical concepts, symbols, and terminology.

The following topics are examples of content that may be covered under this competency.

- Convert everyday language into mathematical language, notation, and symbols, and vice versa.
- Analyze, use, and perform conversions among algebraic, graphic, pictorial, and other modes of presenting and modeling mathematical concepts and relationships.
- Deduce the assumptions inherent in a given mathematical statement, expression, or definition.
- Evaluate the mathematical thinking and strategies of others.

Competency 0004

Understand number theory and the principles and properties of the complex number system (i.e., real and imaginary numbers).

The following topics are examples of content that may be covered under this competency.

- Apply the operations of complex numbers (e.g., integers, fractions, decimals, percents, rational exponents) in problem-solving situations.
- Analyze and apply the properties of complex numbers (e.g., associative, distributive, commutative).
- Represent and interpret numbers in exponential and scientific notation.
- Understand the fundamentals of number theory (e.g., prime numbers, divisibility, order of operations).
- Understand the hierarchy of the complex number system and its reclassification into various subsets.

OKLAHOMA SUBJECT AREA TESTS (OSAT™)
FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS
TEST FRAMEWORK

SUBAREA II—RELATIONS, FUNCTIONS, AND ALGEBRA

Competency 0005

Understand mathematical patterns and use them to solve problems.

The following topics are examples of content that may be covered under this competency.

- Identify and extend a variety of numerical and geometric patterns.
- Analyze and generalize sequences and series (e.g., arithmetic, geometric) and use them to model and solve problems.
- Analyze and develop algebraic generalizations of different types of patterns (e.g., recursive, exponential).
- Use patterns and functions to represent and solve problems.

Competency 0006

Understand the principles and properties of algebraic relations and functions, including inverses and compositions.

The following topics are examples of content that may be covered under this competency.

- Analyze relationships among different representations (e.g., tabular, algebraic, graphic) of relations and functions.
- Analyze relations and functions and their graphs in terms of domain, range, symmetry, intercepts, maxima, and minima.
- Distinguish between relations and functions.
- Determine the effects of transformations such as $f(x + k)$, $f(x) + k$, and $kf(x)$ on the graph of the relation or function $f(x)$.

OKLAHOMA SUBJECT AREA TESTS (OSAT™)
FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS
TEST FRAMEWORK

Competency 0007

Understand the properties of linear functions and relations.

The following topics are examples of content that may be covered under this competency.

- Determine the equation of a line and interpret the slope and intercept in mathematical and everyday contexts.
- Develop the equation of a line on the basis of different types of information (e.g., two points on the line, the slope and one point on the line).
- Model and solve problems involving linear equations and inequalities using algebraic and graphic techniques.
- Solve systems of linear equations and inequalities in mathematical and everyday contexts using a variety of techniques (e.g., substitution, graphing, linear combination, matrices).

Competency 0008

Understand the properties of quadratic and higher-order polynomial functions and relations.

The following topics are examples of content that may be covered under this competency.

- Analyze relationships among different representations of quadratic and higher-order polynomial functions (e.g., tabular, algebraic, graphic).
- Model and solve problems involving quadratic and higher-order polynomial equations and inequalities using a variety of techniques (e.g., completing the square, factoring, graphing, quadratic formula).
- Analyze the roots of quadratic and higher-order polynomial equations.
- Analyze and use the equations and graphs of conic sections.

OKLAHOMA SUBJECT AREA TESTS (OSAT™)
FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS
TEST FRAMEWORK

Competency 0009

Understand the principles and properties of rational, absolute value, exponential, and logarithmic functions.

The following topics are examples of content that may be covered under this competency.

- Manipulate and simplify rational, absolute value, exponential, and logarithmic expressions.
- Describe and analyze characteristics of rational, absolute value, exponential, and logarithmic functions and their graphs (e.g., asymptotes).
- Convert algebraic representations of rational, absolute value, exponential, and logarithmic functions into graphic representations, and vice versa.
- Model and solve problems involving rational, absolute value, exponential, and logarithmic equations in mathematical and everyday contexts.

SUBAREA III—MEASUREMENT AND GEOMETRY

Competency 0010

Understand principles and procedures related to measurement.

The following topics are examples of content that may be covered under this competency.

- Apply appropriate techniques, tools, and units to determine measurements.
- Apply formulas to find measures (e.g., angles, length, perimeter, area, volume) of a variety of two- and three-dimensional figures.
- Solve problems involving derived units (e.g., density, pressure, rates of change).
- Compare and convert measurements within customary and metric measurement systems.

OKLAHOMA SUBJECT AREA TESTS (OSAT™)
FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS
TEST FRAMEWORK

Competency 0011

Understand the principles and properties of Euclidean geometry in two and three dimensions.

The following topics are examples of content that may be covered under this competency.

- Use the properties of lines (e.g., parallel, perpendicular) and angles (e.g., supplementary, vertical) to characterize geometric relationships and solve problems.
- Apply the principles of similarity and congruence to solve problems involving two- and three-dimensional figures.
- Apply the properties of circles (e.g., intersecting chords and secants) and polygons (e.g., numbers and lengths of sides, measures of angles) to analyze and solve problems.
- Use principles and theorems of geometry to construct and evaluate informal proofs.

Competency 0012

Understand the principles and properties of coordinate and transformational geometries.

The following topics are examples of content that may be covered under this competency.

- Apply geometric concepts (e.g., distance, midpoint, slope) to model and solve problems.
- Apply the geometric concepts of parallel and perpendicular lines to model and solve problems.
- Use two- and three-dimensional coordinate systems to represent and analyze geometric figures.
- Analyze and apply geometric transformations (e.g., translations, reflections, dilations, rotations).

OKLAHOMA SUBJECT AREA TESTS (OSAT™)
FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS
TEST FRAMEWORK

Competency 0013

Understand right triangle trigonometry and the conceptual foundations of calculus.

The following topics are examples of content that may be covered under this competency.

- Use the sine, cosine, and tangent ratios in right triangles to solve problems.
- Apply the concept of limits to algebraic functions and their graphs.
- Relate the concept of the derivative to instantaneous rate of change and the concept of the slope of the line tangent to a curve.
- Relate the concept of the integral to the area under a curve.

SUBAREA IV—PROBABILITY, STATISTICS, AND DISCRETE MATHEMATICS

Competency 0014

Understand the principles, properties, and techniques of probability.

The following topics are examples of content that may be covered under this competency.

- Demonstrate knowledge of probabilistic events and their characteristics (e.g., conditional, independent, mutually exclusive).
- Solve problems using the techniques of probability (e.g., addition and multiplication rules).
- Use and interpret graphic representations of probabilities (e.g., tables, Venn diagrams, tree diagrams, frequency graphs, the normal curve).
- Analyze and apply the properties of normal probability distributions to model and solve problems.

OKLAHOMA SUBJECT AREA TESTS (OSAT™)
FIELD 25: MIDDLE LEVEL/INTERMEDIATE MATHEMATICS
TEST FRAMEWORK

Competency 0015

Understand the principles, properties, and techniques of statistics.

The following topics are examples of content that may be covered under this competency.

- Determine random sampling techniques to collect representative data.
- Identify and use data in a variety of graphic formats (e.g., charts, bar graphs, circle graphs, stem-and-leaf plots, histograms, scatter plots, line of best fit).
- Determine, analyze, and interpret measures of central tendency (e.g., mean, median) and dispersion (e.g., standard deviation).
- Evaluate statistical claims, inferences, and predictions based on a set of data (e.g., analyzing sampling techniques, interpreting statistical measures).

Competency 0016

Understand the principles of discrete mathematics.

The following topics are examples of content that may be covered under this competency.

- Apply various counting strategies (e.g., permutations, combinations, factorials) to problem-solving situations.
- Analyze recurrence relations (e.g., Fibonacci sequence, triangular numbers) and use them to model and solve problems in mathematics and other disciplines.
- Apply the basic elements of discrete mathematics (e.g., finite graphs, trees) to model everyday problems.
- Identify potential applications of discrete mathematics (e.g., set theory, graph theory) across the curriculum.
- Demonstrate a knowledge of matrices and their operations.