

Missouri Educator Gateway Assessments

FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST TEST FRAMEWORK

May 2015

Content Domain	Range of Competencies	Approximate Percentage of Test Score
I. Number Concepts and Operations	0001–0002	25%
II. Algebra and Functions	0003–0004	15%
III. Geometry and Measurement	0005–0006	13%
IV. Data Analysis and Probability	0007–0008	13%
V. Pedagogical Knowledge and Instructional Leadership	0009–0010	34%

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TEST FRAMEWORK
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*A scientific calculator will be available to examinees taking the
Elementary Mathematics Specialist test.*

NUMBER CONCEPTS AND OPERATIONS

0001 Analyze the structure of number systems and the properties of the real number system.

For example:

- 1.1 Analyze prenumber concepts (e.g., one-to-one correspondence, cardinality, ordering operations).
- 1.2 Analyze the roles of place value and zero within the base-10 system.
- 1.3 Represent, compare, and order numbers using a variety of models (e.g., number lines, base-10 blocks, diagrams).
- 1.4 Identify different representations of equivalent rational numbers (e.g., fractions, decimals, percents) and convert between them in mathematical and real-world situations.
- 1.5 Analyze the characteristics of numbers (e.g., absolute value, odd and even) and the sets of whole numbers, integers, rational numbers, and real numbers.
- 1.6 Recognize common student misconceptions and errors related to the structure of number systems and the properties of the real number system and identify appropriate interventions to develop student understanding.
- 1.7 Promote teachers' abilities to use results of various types of assessments to identify and differentiate instruction on the basis of students' needs (e.g., remediation, enrichment, extension) and to plan strategies that enhance student mathematical understanding in relation to the structure of number systems and the properties of the real number system.

**FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST
TEST FRAMEWORK**

0002 Analyze number operations and computational algorithms.

For example:

- 2.1 Apply basic concepts of number theory (e.g., factors, prime numbers, least common multiple).
- 2.2 Analyze customary algorithms involving basic operations and their inverses with real numbers and use number properties and the order of operations to justify procedures and solve problems.
- 2.3 Analyze alternative algorithms and multiple representations (e.g., rectangular arrays, partitioning, decomposing) of basic operations with whole numbers, fractions, and decimals.
- 2.4 Apply a variety of algorithms appropriately and demonstrate knowledge of their advantages, limitations, and relationships.
- 2.5 Apply estimation techniques and mental math strategies to real-world problems involving integers, fractions, decimals, and percents.
- 2.6 Solve a variety of mathematical and real-world problems using whole numbers, integers, fractions, and decimals.
- 2.7 Represent and solve mathematical and real-world problems involving ratios and proportions (e.g., percents, rates, scale factors).
- 2.8 Recognize common student misconceptions and errors related to number operations and computational algorithms and identify appropriate interventions to develop student understanding.
- 2.9 Promote teachers' abilities to use results of various types of assessments to identify and differentiate instruction on the basis of students' needs (e.g., remediation, enrichment, extension) and to plan strategies that enhance student mathematical understanding in relation to number operations and computational algorithms.

**FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST
TEST FRAMEWORK**

ALGEBRA AND FUNCTIONS

0003 Analyze patterns and algebraic expressions.

For example:

- 3.1 Identify and extend a variety of patterns (e.g., numbers, figures, expressions) and use a variety of number patterns to explore number properties.
- 3.2 Justify the manipulation of algebraic expressions, equations, and inequalities and solve equations and inequalities in both mathematical and real-world problems.
- 3.3 Analyze mathematical and real-world problems and translate them into algebraic expressions and equations.
- 3.4 Recognize common student misconceptions and errors related to patterns and algebraic expressions, and identify appropriate interventions to develop student understanding.
- 3.5 Promote teachers' abilities to use results of various types of assessments to identify and differentiate instruction on the basis of students' needs (e.g., remediation, enrichment, extension) and to plan strategies that enhance student mathematical understanding in relation to patterns and algebraic expressions.

0004 Apply linear functions to model and solve problems.

For example:

- 4.1 Identify the relationships between linear functions, proportions, and direct variation.
- 4.2 Analyze the relationships between a linear function, its average rate of change, and its graph.
- 4.3 Analyze linear functions, using a variety of representations (e.g., tabular, graphic, verbal).
- 4.4 Model and solve mathematical and real-world problems involving linear functions, using a variety of representations (e.g., tabular, graphic, algebraic).
- 4.5 Recognize common student misconceptions and errors related to modeling and problem solving with linear functions and identify appropriate interventions to develop student understanding.
- 4.6 Promote teachers' abilities to use results of various types of assessments to identify and differentiate instruction on the basis of students' needs (e.g., remediation, enrichment, extension) and to plan strategies that enhance student mathematical understanding in relation to modeling and problem solving with linear functions.

**FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST
TEST FRAMEWORK**

GEOMETRY AND MEASUREMENT

0005 Apply concepts of measurement.

For example:

- 5.1 Use the customary and metric systems appropriately and convert within them.
- 5.2 Use standard and nonstandard units to represent and solve problems in a variety of situations.
- 5.3 Analyze and solve a variety of measurement problems involving length, perimeter, circumference, angles, area and surface area, volume, temperature, time, percentage, speed, and acceleration.
- 5.4 Analyze and solve measurement problems involving composite geometric figures.
- 5.5 Recognize common student misconceptions and errors related to concepts of measurement and identify appropriate interventions to develop student understanding.
- 5.6 Promote teachers' abilities to use results of various types of assessments to identify and differentiate instruction on the basis of students' needs (e.g., remediation, enrichment, extension) and to plan strategies that enhance student mathematical understanding in relation to concepts of measurement.

**FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST
TEST FRAMEWORK**

0006 Apply concepts of Euclidean, transformational, and coordinate geometry.

For example:

- 6.1 Use logical reasoning to prove geometric relationships.
- 6.2 Use concepts of geometry (e.g., congruence and similarity, parallel and perpendicular lines) to solve mathematical and real-world problems involving one-, two-, and three-dimensional figures and shapes.
- 6.3 Apply the Pythagorean theorem to solve problems.
- 6.4 Analyze three-dimensional figures using two-dimensional representations (e.g., cross sections, perspective drawings).
- 6.5 Analyze representations of polygons in the coordinate plane.
- 6.6 Analyze tessellations and transformations (i.e., translations, reflections, glide reflections, rotations, and dilations) of figures in terms of congruence and symmetry.
- 6.7 Recognize common student misconceptions and errors related to concepts of Euclidean, transformational, and coordinate geometry and identify appropriate interventions to develop student understanding.
- 6.8 Promote teachers' abilities to use results of various types of assessments to identify and differentiate instruction on the basis of students' needs (e.g., remediation, enrichment, extension) and to plan strategies that enhance student mathematical understanding in relation to concepts of Euclidean, transformational, and coordinate geometry.

**FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST
TEST FRAMEWORK**

DATA ANALYSIS AND PROBABILITY

0007 Analyze and interpret data.

For example:

- 7.1 Select appropriate formats for presenting different types of data.
- 7.2 Compare and analyze data presented in a variety of formats (e.g., frequency distribution, box plot, circle graph).
- 7.3 Apply concepts of central tendency (e.g., mean, median, mode) and spread (e.g., range, interquartile range) to data sets and data distributions.
- 7.4 Analyze experimental designs, interpret results, and draw inferences from observations and experiments that investigate real-world problems.
- 7.5 Analyze sampling techniques, select the appropriate approach in real-world situations, and analyze the relationship between sample size and the level of confidence in conclusions.
- 7.6 Recognize common student misconceptions and errors related to the analysis and interpretation of data and identify appropriate interventions to develop student understanding.
- 7.7 Promote teachers' abilities to use results of various types of assessments to identify and differentiate instruction on the basis of students' needs (e.g., remediation, enrichment, extension) and to plan strategies that enhance student mathematical understanding in relation to the analysis and interpretation of data.

**FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST
TEST FRAMEWORK**

0008 Apply concepts of probability.

For example:

- 8.1 Identify the appropriate sample space in problems involving probability (e.g., using counting techniques).
- 8.2 Apply concepts of probability to solve problems involving simple and compound events.
- 8.3 Use concepts of probability to identify simulations that model real-world and experimental situations.
- 8.4 Represent and solve problems using multiple representations (e.g., tree diagrams, Venn diagrams) of real-world situations.
- 8.5 Recognize common student misconceptions and errors related to concepts of probability and identify appropriate interventions to develop student understanding.
- 8.6 Promote teachers' abilities to use results of various types of assessments to identify and differentiate instruction on the basis of students' needs (e.g., remediation, enrichment, extension) and to plan strategies that enhance student mathematical understanding in relation to concepts of probability.

**FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST
TEST FRAMEWORK**

PEDAGOGICAL KNOWLEDGE AND INSTRUCTIONAL LEADERSHIP

0009 Demonstrate knowledge of mathematics instruction and assessment.

For example:

- 9.1 Identify appropriate questions to assess students' mathematical understanding and advance their mathematical learning.
- 9.2 Identify ways to support student learning and use of academic language and vocabulary.
- 9.3 Identify sequences of instruction that develop students' content knowledge, reasoning skills, conceptual understanding, and computational fluency and precision.
- 9.4 Identify problem-solving tasks that develop students' content knowledge, reasoning skills, conceptual understanding, and computational fluency and precision.
- 9.5 Demonstrate knowledge of how tools (e.g., manipulatives, technology) can be used to enhance student understanding.
- 9.6 Analyze and use assessment results from various types of instruments (e.g., diagnostic, formative, summative) to plan, inform, and adjust instruction.
- 9.7 Recognize and use the vertical alignment of mathematical topics and concepts across grade levels to plan instruction based on state standards.
- 9.8 Demonstrate knowledge of ways to promote equity for all students in mathematical instruction and to establish research-based evidence on how students learn and use mathematics.

**FIELD 065: ELEMENTARY MATHEMATICS SPECIALIST
TEST FRAMEWORK**

0010 Demonstrate knowledge of instructional leadership in mathematics.

For example:

- 10.1 Recognize ways to establish a culture of collaboration in regard to the use of data to plan, evaluate, and improve mathematics instruction and to promote positive changes in the school mathematics program.
- 10.2 Identify ways to promote and support a rigorous district instructional program based on research-supported best practices regarding curriculum, instruction, technology, and assessment.
- 10.3 Demonstrate knowledge of ways to use professional resources (e.g., organizations, journals, discussion groups) to stay current regarding critical issues related to mathematics teaching and learning.
- 10.4 Select appropriate and effective methods for communicating professionally with educational stakeholders about students, curriculum, instruction, use of technology, and assessment.
- 10.5 Demonstrate knowledge of educational structures and policies that affect students' equitable access to quality mathematics instruction and promote the use of practices with proven effectiveness in promoting academic success for students with diverse characteristics and needs.
- 10.6 Demonstrate knowledge of ways to use professional development (e.g., mentoring, coaching, peer-teaching, workshops) to facilitate appropriate research-supported, standards-based mathematics instruction and to promote the use of instructional methods supported by research.