

## Arizona Educator Proficiency Assessments (AEPA™)

### FIELD 10: MATHEMATICS TEST OBJECTIVES

<b>Subarea</b>	<b>Range of Objectives</b>	<b>Approximate Test Proportions</b>
I. Number Sense	1–4	14%
II. Data Analysis and Probability	5–8	14%
III. Patterns, Algebra, and Functions	9–13	18%
IV. Geometry and Measurement	14–18	18%
V. Trigonometry and the Conceptual Foundations of Calculus	19–23	18%
VI. Mathematical Structure and Logic	24–28	18%

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# Arizona Educator Proficiency Assessments (AEPA™) Subject Knowledge Test

## Test Objectives Field 10: Mathematics

### Subareas:

Number Sense  
Data Analysis and Probability  
Patterns, Algebra, and Functions  
Geometry and Measurement  
Trigonometry and the Conceptual Foundations of Calculus  
Mathematical Structure and Logic

### NUMBER SENSE

**0001 Understand principles and concepts related to integers, fractions, decimals, percents, ratios, and proportions and their application to problem solving.**

For example: using a variety of models and methods (e.g., manipulatives, estimation, technology) to explore concepts (e.g., absolute value) and patterns and solve problems involving integers, fractions, decimals, percents, ratios, and proportions.

**0002 Understand the properties of the real and complex number systems, and solve problems related to their structure.**

For example: analyzing and applying properties (e.g., distributive, associative) of the real and complex numbers and their subsystems (e.g., rational numbers, irrational numbers); applying procedures related to order of operations; finding sums, products, powers, and roots of complex numbers; representing complex numbers as vectors; and recognizing the trigonometric form of a complex number.

**0003 Understand the principles of number theory.**

For example: analyzing properties of divisibility and prime numbers; applying the Euclidean algorithm; and analyzing properties of congruence classes and modular arithmetic.

**TEST OBJECTIVES**  
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**0004 Understand the principles and properties of discrete mathematics and the application of discrete mathematics to problem solving.**

For example: analyzing and applying the properties of finite sets; solving enumeration and finite probability problems; patterns; algorithms and algorithmic thinking; combinatorics; recursive relationships; sequences and series; and modeling and solving problems using the techniques of graph theory.

**DATA ANALYSIS AND PROBABILITY**

**0005 Understand principles and concepts of descriptive statistics and their application to the problem-solving process.**

For example: constructing and interpreting tables, charts, and graphs (e.g., line plots, stem-and-leaf plots, box plots, scatter plots) related to descriptive statistics; determining and interpreting measures of central tendency and dispersion; interpreting, calculating, and solving problems related to correlations, frequency distributions, and percentile scores; and recognizing the effects of data transformations on measures of central tendency and variability.

**0006 Understand the fundamental principles of probability and probability distributions.**

For example: applying fundamental axioms of probability; computing theoretical probability; using simulations to explore real-world situations; applying knowledge of connections between geometry and probability (e.g., probability as a ratio of two areas); and using probability models to describe real-world phenomena.

**0007 Use techniques related to probability and probability distributions to analyze real-world situations.**

For example: modeling and solving problems involving dependent, independent, and mutually exclusive events and conditional probabilities; applying the concept of random variables; and analyzing and applying properties of the binomial, uniform, and normal distributions.

**0008 Understand methods used in collecting, reporting, and analyzing data.**

For example: evaluating real-world situations to determine appropriate sampling techniques and methods for reporting data; applying procedures for designing a statistical experiment; making appropriate inferences, interpolations, and extrapolations; and solving problems involving linear regression models.

**TEST OBJECTIVES**  
**FIELD 10: MATHEMATICS**

**PATTERNS, ALGEBRA, AND FUNCTIONS**

**0009 Understand algebraic functions, relations, and expressions.**

For example: manipulating algebraic expressions; describing and analyzing characteristics of algebraic patterns, functions (e.g., domain, range, continuity), and relations; using qualitative and quantitative graphing; analyzing relationships among tabular, graphic, and algebraic representations of functions; interpreting the graphic representation of a function and its inverse; analyzing how changing parameters affects the graph of a function; and operating with composite functions.

**0010 Understand the principles and properties of linear and matrix algebra.**

For example: analyzing properties of matrices and determinants; using matrices to solve systems of equations; representing vectors geometrically and algebraically; and finding the matrix of a linear transformation.

**0011 Understand the properties of linear and quadratic equations, inequalities, and functions and their application to the problem-solving process.**

For example: using linear and quadratic functions to model and solve problems; evaluating the accuracy and applicability of a linear or quadratic model for real-world problems; and solving linear and quadratic systems using geometric and algebraic methods.

**0012 Understand radical, exponential, and logarithmic functions and their application to the problem-solving process.**

For example: applying radical, exponential, and logarithmic functions to model real-world problems; understanding the use of graphing calculators or computers to find numerical solutions to such problems; evaluating the accuracy and applicability of such models; and recognizing and generating algebraic and geometric representations of functions.

**0013 Understand and interpret polynomial, rational, and absolute value functions and relations.**

For example: analyzing properties and graphs of polynomial, rational, and absolute value functions; modeling problems involving these functions; and understanding the use of graphing calculators or computers to find numerical solutions to such problems.

**TEST OBJECTIVES**  
**FIELD 10: MATHEMATICS**

**GEOMETRY AND MEASUREMENT**

**0014 Understand principles, concepts, and procedures related to measurement.**

For example: applying knowledge of attributes of length, area, volume, mass, capacity, time, temperature, speed, angles, and rotational speed, and the units (metric and customary) and tools used to measure them; applying knowledge of conversions within systems; and using dimensional analysis (unit analysis) to solve problems.

**0015 Understand properties of geometric figures and their application to the problem-solving process.**

For example: using synthetic geometric concepts (e.g., similar and congruent figures, parallel lines) to solve problems in context; classifying geometric figures (e.g., parallelograms); deducing properties of polygons and circles; and justifying geometric constructions.

**0016 Understand and interpret drawings of three-dimensional objects.**

For example: identifying and analyzing three-dimensional figures; representing figures in three-dimensional coordinate systems; analyzing perspective drawings, cross sections (including conic sections), and nets (e.g., folding connected squares into a cube); and generating three-dimensional figures from two-dimensional shapes.

**0017 Understand the principles and properties of coordinate geometry and the connections between geometry and algebra.**

For example: applying geometric concepts (e.g., distance, midpoint, slope, parallel and perpendicular lines) to model and solve problems; analyzing coordinate representations (e.g., rectangular, polar) of geometric figures; analyzing properties of conic sections; and translating between synthetic and coordinate representations.

**0018 Understand the principles of vectors and transformational geometry and the application of transformational geometry to the problem-solving process.**

For example: applying transformational techniques (e.g., translations, rotations, reflections, dilations, tessellations) to determine graphic and numeric solutions to problems; interpreting figures in terms of transformations (e.g., determining center of rotation, line of reflection, scale of dilation); deducing geometric properties using transformations; and analyzing the algebraic structure of the composition of transformations.

**TEST OBJECTIVES**  
**FIELD 10: MATHEMATICS**

**TRIGONOMETRY AND THE CONCEPTUAL FOUNDATIONS OF CALCULUS**

**0019 Understand techniques used to model and solve problems related to triangles.**

For example: applying trigonometric ratios and relationships (e.g., law of sines, law of cosines) to model and solve problems; and deducing properties of polygons and circles (e.g., perimeter and area) using trigonometric ratios and relationships.

**0020 Understand the properties of trigonometric functions and identities.**

For example: solving problems involving radian measure and trigonometric equations; analyzing the relationship between circular and trigonometric functions; analyzing the graphs of a trigonometric function in terms of amplitude, period, and phase shift; using trigonometric functions to model real-world periodic phenomena; and recognizing relationships among trigonometric functions.

**0021 Understand characteristics and applications of the concepts of limit, continuity, and rate of change.**

For example: demonstrating an understanding of characteristics and concepts related to limits of algebraic functions; limits of infinite sequences and series; the continuity/discontinuity of functions; applying and interpreting the equation of a secant line; and solving problems involving average rates of change (e.g., average velocity, average acceleration).

**0022 Understand the derivative of a function and its applications to the problem-solving process.**

For example: recognizing and interpreting the slope of a line tangent to a function as the limit of the secant line; determining maxima, minima, points of inflection, and concavity and applying this information to describe a function; applying the slope of the tangent line to analyze functions; and modeling and solving problems involving the derivative of a function.

**0023 Understand the integral of a function and its applications to the problem-solving process.**

For example: applying algebraic and geometric techniques to approximate the area under a curve; recognizing the definite integral as the area under a curve; analyzing the relationship between differentiation and integration; evaluating algorithms for integrating a function; and modeling and solving problems involving the integral of a function.

**TEST OBJECTIVES**  
**FIELD 10: MATHEMATICS**

**MATHEMATICAL STRUCTURE AND LOGIC**

- 0024 Understand principles of problem solving, and apply varied and efficient problem-solving techniques and strategies and technological tools to explore and solve problems in context.**

For example: applying appropriate techniques and multiple strategies (e.g., estimating, guess and check, using a diagram, making a list) to solve problems, including multistep, nonroutine, and open-ended problems; recognizing strengths and limitations of these techniques and strategies; and understanding the process of mathematical modeling and the use of technological tools (e.g., manipulatives, graphing calculators, computers) for modeling and solving problems.

- 0025 Understand mathematical communication and the use of mathematical terminology, symbols, and representations to communicate information.**

For example: communicating mathematical ideas, concepts, and reasoning processes to a variety of audiences; interpreting mathematical symbols and representations; using graphic, numeric, symbolic, and verbal representations to communicate and model mathematical concepts and relationships; and making connections among graphic, numeric, symbolic, and verbal representations.

- 0026 Understand mathematical reasoning, and apply techniques of mathematical reasoning in varied contexts.**

For example: using inductive and deductive reasoning to solve problems; understanding the properties and use of the converse, contrapositive, and inverse of a statement; understanding modes of inquiry and research in mathematics; applying knowledge of the components of a formal argument; using counterexamples to formulate or evaluate arguments; applying techniques for constructing and evaluating an indirect proof; and formulating, evaluating, and justifying conjectures and arguments.

- 0027 Understand the connections among the domains of mathematics and the relationships between mathematics and other disciplines and real-world situations.**

For example: analyzing conceptual connections among the various mathematical domains; recognizing how methods from one or more domains can be used to solve problems in another domain (e.g., using geometric methods to help solve algebraic problems); and recognizing how mathematical concepts and strategies can be used to solve problems in other disciplines and in real-world situations (e.g., analyzing census data, determining the capacity of a container).

**TEST OBJECTIVES**  
**FIELD 10: MATHEMATICS**

**0028 Understand the nature and structure of axiomatic systems.**

For example: analyzing the relationships among undefined terms, axioms, and theorems; and analyzing the foundations, assumptions, and properties of various geometries (e.g., Euclidean, non-Euclidean) and algebras, and the connections between their mathematical structure.