TEST SUMMARY AND FRAMEWORK

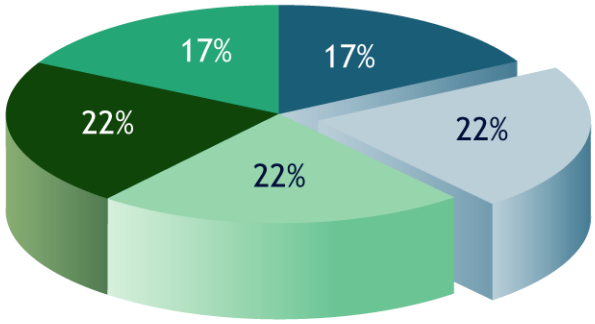
TEST SUMMARY

MIDDLE LEVEL MATHEMATICS

The Washington Educator Skills Tests—Endorsements™ (WEST-E™) are designed to measure a candidate's knowledge of the subject-area content contained in the test framework for each field. All WEST-E tests are fully aligned with the state's teacher endorsement competencies and, as applicable, the Essential Academic Learning Requirements.

This test summary describes general testing information as well as the approximate percentage of the total test score derived from each content domain. The test framework, organized by content domain, contains the objectives that define the content for the test.

Test Format	Multiple-choice questions
Number of Questions	Approximately 110
Test Session	Up to 5 hours (examinees may take more than one test per session)
Passing Score	240 (scores are calculated in a range from 100 to 300)
Test Code	012



Key	Approximate Percentage of Test	Content Domain	Range of Objectives
	17%	Mathematical Processes	0001-0003
	22%	Numbers and Operations	0004-0007
	22%	Algebra and Calculus	0008-0011
	22%	Measurement and Geometry	0012-0015
	17%	Discrete Mathematics, Probability, and Statistics	0016-0018

TEST FRAMEWORK

MIDDLE LEVEL MATHEMATICS

MATHEMATICAL PROCESSES

0001 Understand the problem-solving process.

For example:

- determining necessary and extraneous information, and determining what information is still needed to solve a problem
- selecting appropriate problem-solving strategies (e.g., estimation, working backward, drawing a diagram) for solving a particular problem
- applying estimation strategies and determining the reasonableness of solutions
- solving problems that arise in mathematics and applying mathematics to solve problems in other disciplines
- recognizing features of technological tools (e.g., graphing calculators, spreadsheets, dynamic geometry software) and their applications in problem solving

0002 Understand mathematical reasoning and proof.

For example:

- recognizing reasoning and proof as fundamental aspects of mathematics
- using and distinguishing among various types of reasoning (e.g., inductive, deductive, proportional, spatial)
- making and investigating mathematical conjectures
- developing and evaluating mathematical arguments and proofs

0003 Understand mathematical communication, mathematical representations, and connections among mathematical ideas.

For example:

- using appropriate mathematical terminology and notation with precision and accuracy
- using varied representations (e.g., pictorial, verbal, numerical, graphic, symbolic) of mathematical ideas
- applying mathematical ideas to other subject areas and to real-world situations
- recognizing connections among different concepts and areas of mathematics (e.g., algebra, geometry)
- demonstrating knowledge of the historical development of number systems, algebra, geometry (including non-Euclidean geometry), calculus, and probability and statistics

NUMBERS AND OPERATIONS

0004 Analyze the structure of the base-ten number system and fundamental principles of number theory.

For example:

- recognizing the use of place value in representing whole numbers and finite decimals
- analyzing characteristics of whole numbers (e.g., prime/composite, divisibility)
- analyzing and applying computational procedures involving whole numbers (e.g., multidigit multiplication, long division)
- demonstrating knowledge of the fundamental principles of number theory (e.g., prime factorization, divisibility, greatest common factor)

0005 Analyze properties of rational numbers.

For example:

- converting among decimals, fractions, and percents
- comparing and ordering rational numbers
- using a variety of representations of rational numbers (e.g., textual, graphic, numerical)
- analyzing and applying computational procedures involving rational numbers (e.g., division of fractions, multiplication of decimals)
- applying properties of rational numbers to solve problems
- using proportional reasoning to solve problems

0006 Understand the real and complex number systems.

For example:

- demonstrating knowledge of the properties of the complex number system and its subsets
- selecting and using different representations of real numbers (e.g., radicals, exponents, scientific notation) to solve problems
- selecting and using different representations of complex numbers (e.g., vector, graphic) to solve problems
- recognizing matrices and vectors as systems that have some of the properties of the real number system

0007 Analyze operations on real numbers.

For example:

- applying number properties and number operations to simplify numerical expressions
- using properties of number operations to justify computational procedures (e.g., standard algorithms, mental computations, estimation)
- using properties of the real numbers to justify algebraic manipulations
- performing a variety of operations on various representations (e.g., radical form, exponents) of real numbers

ALGEBRA AND CALCULUS

0008 Understand patterns, functions, relations, and algebraic techniques.

For example:

- analyzing and demonstrating the use of variables in different situations (e.g., solving a word problem, stating a general rule, representing a function)
- using number properties and operations to simplify, manipulate, or solve an expression, equation, or inequality
- analyzing patterns and sequences (e.g., numerical, pictorial, recursive) using rules and algebraic expressions
- using function notation and performing operations on functions (e.g., evaluation of functions, composition of functions)
- identifying the domain and range of various functions
- analyzing characteristics of functions presented in a variety of forms (e.g., tabular, graphic, algebraic)
- analyzing the effects of transformations (e.g., translations, reflections) on functions

0009 Analyze linear functions and their applications.

For example:

- analyzing the relationship between a linear function and its graph
- translating among various representations (e.g., verbal, tabular, graphic, algebraic) of linear functions
- interpreting the meaning of the slope and the *y*-intercept of a line in a given context
- selecting a linear equation that best fits a set of data
- solving problems involving systems of linear equations and inequalities algebraically, graphically, and numerically

0010 Analyze nonlinear expressions and functions.

For example:

- evaluating and performing operations (e.g., factoring, combining) on polynomial, rational, and other algebraic expressions and equations
- translating among tabular, symbolic, and graphic representations of quadratic and exponential functions and inverse variation
- solving quadratic equations using a variety of methods (e.g., factoring, completing the square)
- solving problems involving exponential growth and decay
- solving problems involving inverse variation

0011 Understand the conceptual and procedural principles of single-variable calculus.

For example:

- demonstrating knowledge of limits and continuity
- describing the relationship between the slope of the secant line and the slope of the tangent line
- recognizing the relationship between the rate of change of a function and its derivative
- recognizing relationships between the graph of a function and the derivative of the function
- describing the relationship between the area under the graph of a function and the definite integral of the function

MEASUREMENT AND GEOMETRY

0012 Apply measurement units and tools.

For example:

- selecting appropriate units of measurement (e.g., length, area, angle, weight, time, density) for a given purpose
- converting measurements within the U.S. and metric systems
- analyzing precision, accuracy, and error in measurement situations
- solving problems involving unit analysis and rates of change

0013 Apply measurement concepts and techniques.

For example:

- finding and applying formulas for the perimeter, area, surface area, and volume of two- and three-dimensional shapes and figures
- using nets and cross sections to analyze three-dimensional figures
- applying the concepts of similarity, scale factors, and proportional reasoning to solve measurement problems
- demonstrating knowledge of strategies for estimating measurements
- applying the Pythagorean theorem and right-triangle trigonometry to solve problems

0014 Apply the principles of Euclidean geometry.

For example:

- applying properties of points, lines, planes, and angles
- identifying and justifying basic compass-and-straightedge constructions
- applying the properties of similarity and congruence to solve problems and prove theorems
- applying the properties of triangles, quadrilaterals, other polygons, and three-dimensional shapes and figures to solve problems

0015 Apply coordinate and transformational geometry.

For example:

- representing basic geometric figures in the coordinate plane
- applying the concepts and properties of slope, midpoint, parallelism, perpendicularity, and distance to solve problems in the coordinate plane
- applying the concepts of symmetry and transformations (e.g., translations, rotations, reflections) to figures in the coordinate plane
- using dilations and proportionality to analyze figures in the coordinate plane

DISCRETE MATHEMATICS, PROBABILITY, AND STATISTICS

0016 Understand discrete mathematics.

For example:

- applying and demonstrating an understanding of counting principles (e.g., combinations, permutations)
- demonstrating knowledge of the principles of logic (e.g., truth tables, Boolean expressions)
- using recurrence relations to model and solve problems
- applying methods of finite differences to analyze sequences
- demonstrating knowledge of the fundamentals of graph theory (e.g., simple circuits, graphs, trees)
- demonstrating knowledge of the techniques of linear programming
- applying discrete structures to generate and analyze algorithms

0017 Apply the theory of probability.

For example:

- determining probabilities of simple and compound events
- determining and demonstrating understanding of conditional probabilities and independent events
- using different graphic representations (e.g., Venn diagrams, tree diagrams) to calculate and interpret probabilities
- demonstrating knowledge of methods (e.g., rolling dice, using random numbers) for predicting probabilities
- applying geometric principles to estimate or calculate probabilities
- identifying invalid conclusions from probability

0018 Understand data analysis and statistics.

For example:

- selecting an appropriate format for organizing and displaying data
- analyzing data presented in a variety of formats (e.g., histograms, scatter plots, stem-and-leaf plots)
- determining and interpreting measures of central tendency (e.g., mean, median) and dispersion (e.g., standard deviation, interquartile range)
- demonstrating knowledge of sampling including methods for collecting data through surveys and experiments
- demonstrating knowledge of confidence limits, the importance of sample size, and ways to reduce bias in sampling
- identifying misuses of statistics