

# **MICHIGAN TEST FOR TEACHER CERTIFICATION (MTTC)**

## **TEST OBJECTIVES FIELD 096: PROFESSIONAL READINESS EXAMINATION: MATHEMATICS SUBTEST**

<b>Subarea</b>	<b>Range of Objectives</b>	<b>Approximate Subtest Weighting</b>
VII. Quantitative Literacy and Logic	007–009	20%
VIII. Algebra and Functions	010–012	30%
IX. Geometry and Trigonometry	013–015	30%
X. Statistics and Probability	016–019	20%

**Effective after October 1, 2013**

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## **TEST OBJECTIVES FIELD 096: PROFESSIONAL READINESS EXAMINATION: MATHEMATICS SUBTEST**

### **VII. QUANTITATIVE LITERACY AND LOGIC**

**007 Understand numbers, numbers systems, and the relationships between them.**

Includes:

- demonstrating knowledge of properties of integers, rational numbers, and real numbers (e.g., additive and multiplicative identities and inverses; associative, commutative, and distributive properties)
- using mathematical symbols in context to represent quantitative relationships and situations (e.g., inequalities, absolute values, vectors, logarithms, exponents, complex numbers)

**008 Apply skills in performing calculations, using algorithms, and estimating solutions.**

Includes:

- demonstrating knowledge of sequences and iteration (e.g., terms of arithmetic, geometric, and other simple sequences; sums of finite arithmetic and geometric sequences; the use of iterative processes in computing compound interest)
- applying skills related to measurement units and scales (e.g., units of measurement, conversion of units, calculations involving measurements and units)
- solving problems involving error analysis (e.g., significant digits, error tolerance, percent of error, accumulated error, rounding error, truncating)
- solving problems using number sense
- performing calculations involving real and complex numbers

**009 Understand mathematical reasoning, logic, and proof.**

Includes:

- demonstrating knowledge of inductive and deductive reasoning
- analyzing logical statements and arguments using the rules of logic (e.g., negation, contrapositive, inverse, converse, connectives)
- demonstrating knowledge of mathematical proofs (e.g., use of axioms, postulates, theorems, definitions, counterexamples, contradiction)
- demonstrating knowledge of necessary and sufficient conditions

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**VIII. ALGEBRA AND FUNCTIONS**

**010 Understand expressions, equations, and inequalities.**

Includes:

- constructing and interpreting algebraic expressions (e.g., verbal descriptions of expressions in symbolic form, symbolic representation of verbal descriptions, evaluation of algebraic expressions)
- solving problems involving manipulation of algebraic expressions (e.g., performing operations, simplifying, factoring, transforming exponential and logarithmic expressions)
- demonstrating knowledge of linear, quadratic, polynomial, and rational equations and inequalities

**011 Understand functions, their representations, and their characteristics.**

Includes:

- recognizing definitions and representations of functions including piecewise functions and recursive functions (e.g., recognizing functions and their domains and ranges in contextual, symbolic, tabular, and graphical forms; evaluating functions at a value; representing functions in graphs, tables, diagrams, and words)
- solving problems involving operations on functions (e.g., addition, subtraction, multiplication, division, transformations, inverses)
- recognizing functions as applied to real-world situations (e.g., exponential growth and decay, cost function)

**012 Understand families of functions and their symbolic and graphical representations.**

Includes:

- solving problems involving lines and linear functions
- solving problems involving exponential and logarithmic functions
- solving problems involving quadratic functions
- solving problems involving power functions
- solving problems involving polynomial functions
- solving problems involving rational functions
- solving problems involving trigonometric functions

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**IX. GEOMETRY AND TRIGONOMETRY**

**013 Understand basic geometric figures and their properties.**

Includes:

- demonstrating knowledge of coordinate geometry
- recognizing and using formulas involving perimeter, area, and volume
- solving problems involving geometry of two-dimensional figures (e.g., triangles, circles, quadrilaterals)
- solving problems involving geometry of three-dimensional figures (e.g., cone, pyramid, sphere)
- solving problems involving triangles and trigonometry

**014 Understand the relationships between basic geometric figures.**

Includes:

- recognizing the relationships between area formulas of two-dimensional figures
- recognizing the relationships between volume formulas of three-dimensional figures
- recognizing the relationship between two-dimensional and three-dimensional figures (e.g., recognizing three-dimensional figures from two-dimensional views, cross sections of three-dimensional figures, solids formed by revolving two-dimensional figures around lines)
- demonstrating knowledge of congruence and similarity

**015 Understand transformations of figures in a plane.**

Includes:

- recognizing isometries (i.e., reflections, rotations, translations, and glide reflections)
- recognizing dilations
- recognizing the composition of two or more transformations

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**X. STATISTICS AND PROBABILITY**

**016 Understand univariate data and distributions.**

Includes:

- demonstrating knowledge of statistical significance, margin of error, and confidence level
- solving problems involving measures of center (i.e., mean, mode, median), weighted average, and variation (i.e., percentile, quartile, interquartile, range, variance, standard deviation)
- demonstrating knowledge of the normal distribution (e.g., shape, relationships between measures of center, percent of population at various standard deviations from the mean, z-scores)

**017 Understand bivariate data and relationships.**

Includes:

- demonstrating knowledge of scatterplots and their characteristics
- demonstrating knowledge of Pearson's coefficient of correlation
- differentiating between correlation and causation
- demonstrating knowledge of linear regression

**018 Understand sampling, surveying, experimental design, and graphical representation.**

Includes:

- constructing and interpreting graphic representations of data (e.g., tables, charts, plots, graphs, spreadsheets, histograms, bar graphs)
- demonstrating knowledge of sample statistics and population parameters
- demonstrating knowledge of sources of bias and procedures for reducing and controlling bias
- demonstrating knowledge of observational studies and experimental studies

**019 Understand probability models and probability calculation.**

Includes:

- demonstrating knowledge of sample spaces in simple situations
- calculating the probability of events in various situations (e.g., mutually exclusive events, independent events, dependent events, compound events, complementary events, conditional events)
- demonstrating knowledge of tree diagrams, formulas for combinations and permutations, Venn diagrams, and other counting techniques

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