



*Working Together for Student Success*

# Indiana Content Standards for Educators

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## MIDDLE SCHOOL MATHEMATICS

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These standards can be used by educator preparation programs to design licensure programs for middle school mathematics teachers. An educator preparation program can use these standards to develop middle school mathematics content preparation for elementary candidates to meet the REPA 3 requirement for a content area and for middle school mathematics licensure. Any candidate recommended for licensure for middle school mathematics needs to have mastery of all standards indicated in this document.

Middle school mathematics teachers are expected to have a broad and comprehensive understanding of the knowledge and skills needed for this educator license, and to use that knowledge to help students prepare for the challenges and opportunities of the twenty-first century. This requires the ability to identify, comprehend, analyze, synthesize, and evaluate the basic principles, fundamental concepts, and essential content defined in these standards, and to apply that knowledge to the tasks of planning and delivering effective instruction and assessment.

September 2019

## Middle School Mathematics Educator Standards

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### **Standard 1: Number Sense and Computation**

Middle school mathematics teachers have a broad and comprehensive understanding of number operations and algebraic thinking, ratios and proportional relationships, and the number system.

### **Standard 2: Algebra and Functions**

Middle school mathematics teachers have a broad and comprehensive understanding of the extension of arithmetic to one- and two-variable expressions, equations, and inequalities; the relationship between dependent and independent variables; the characteristics, evaluation, and comparison of functions; and the modeling and solving of problems with algebraic expressions, equations, inequalities, and linear and nonlinear functions.

### **Standard 3: Measurement and Geometry**

Middle school mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, the properties of two- and three-dimensional figures, and applications of coordinate and transformational geometry.

### **Standard 4: Statistics and Probability**

Middle school mathematics teachers have a broad and comprehensive understanding of the collection and presentation of data, the summary and descriptions of statistical variability, and the fundamental principles of probability.

### **Standard 5: Calculus**

Middle school mathematics teachers have a broad and comprehensive understanding of the fundamental principles and conceptual foundations of differential and integral calculus.

### **Standard 6: Middle School Mathematics Instruction and Assessment**

Middle school mathematics teachers have a broad and comprehensive understanding of content-specific curricula, instruction, and assessment in mathematics education.

## Middle School Mathematics Educator Standards

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### Standard 1: Number Sense and Computation

**Middle school mathematics teachers have a broad and comprehensive understanding of number operations and algebraic thinking, ratios and proportional relationships, and the number system, including:**

- 1.1** structure and properties of real and complex numbers and their subsets
- 1.2** order, absolute value, and equivalence of different representations of numbers
- 1.3** number sense, estimation, and place value
- 1.4** numerical expressions and order of operations
- 1.5** fundamental concepts of number theory, including divisibility, greatest common factors, least common multiples, and prime and composite numbers
- 1.6** computational fluency with rational numbers and standard and non-standard algorithms
- 1.7** conceptual understanding and quantitative reasoning with ratio, rate, proportion, percent, and units
- 1.8** problem solving using models and different representations of numbers
- 1.9** applications of and methods of modeling with vector and matrix operations
- 1.10** historical development of numbers and number systems

### Standard 2: Algebra and Functions

**Middle school mathematics teachers have a broad and comprehensive understanding of the extension of arithmetic to one- and two-variable expressions, equations, and inequalities; the relationship between dependent and independent variables; the characteristics, evaluation, and comparison of functions; and the modeling and solving of problems with algebraic expressions, equations, inequalities, and linear and nonlinear functions, including:**

- 2.1** algebraic notation, language, and expressions
- 2.2** application of arithmetic properties to algebraic linear and nonlinear expressions, equations, and inequalities
- 2.3** application of order of operations to algebraic expressions
- 2.4** methods of solving one- and two-variable linear and nonlinear equations and inequalities
- 2.5** connections between proportional relationships, lines, and linear equations
- 2.6** identification, extension, and algebraic representation of a variety of patterns
- 2.7** characteristics of relations, functions, and domains
- 2.8** functional relationships between quantities, graphs, and linear equations and inequalities
- 2.9** methods of modeling and solving mathematical and real-life problems using numeric and algebraic expressions, linear equations, systems, and inequalities and their representations
- 2.10** methods of modeling linear, absolute value, quadratic, polynomial, exponential, logarithmic, rational, and trigonometric functions
- 2.11** behaviors of nonlinear functions and relationships between their various representations
- 2.12** manipulation of functions, including transformations, translations, and compositions
- 2.13** individuals and cultures that contributed to the historical development of algebra

## Middle School Mathematics Educator Standards

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### Standard 3: Measurement and Geometry

**Middle school mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, the properties of two- and three-dimensional figures, and applications of coordinate and transformational geometry, including:**

- 3.1** unit conversion and comparison
- 3.2** points, lines, planes, and angle measures in Euclidean geometry
- 3.3** applications and derivations of length, perimeter, circumference, area, surface area, and volume formulas of geometric figures
- 3.4** indirect measurement, including proportional reasoning, the Pythagorean theorem, and trigonometric ratios in right triangles
- 3.5** derivation of the area formulas for triangles and parallelograms
- 3.6** application of periodic phenomena and trigonometric identities
- 3.7** properties of figures in two and three dimensions
- 3.8** concepts and applications of similarity and congruence
- 3.9** representation and analysis of geometric figures in the coordinate plane
- 3.10** concepts and applications of dilations, translations, rotations, reflections, and symmetry
- 3.11** methods of modeling and solving problems using geometric concepts, including the application of axiomatic reasoning to Euclidean geometry

### Standard 4: Statistics and Probability

**Middle school mathematics teachers have a broad and comprehensive understanding of the collection and presentation of data, the summary and descriptions of statistical variability, and the fundamental principles of probability, including:**

- 4.1** representation, summarization, and interpretation of data, including the description of center, spread, shape, and outliers, for one or two variables
- 4.2** inference, evaluation of claims based on data, and the data collection process
- 4.3** statistical variability, sampling techniques, bias, and randomization
- 4.4** simple, compound, and conditional probabilities
- 4.5** simulations of real-world situations that use concepts from probability
- 4.6** methods of modeling and solving problems involving simple discrete and continuous probability distributions
- 4.7** application of combinations and permutations for describing outcomes of probability events

## Middle School Mathematics Educator Standards

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### Standard 5: Calculus

**Middle school mathematics teachers have a broad and comprehensive understanding of the fundamental principles and conceptual foundations of differential and integral calculus.**

- 5.1** infinitesimal quantities, limits, and continuity
- 5.2** concepts, techniques, and applications of the derivative
- 5.3** fundamental theorem of calculus
- 5.4** concepts and applications of the integral
- 5.5** applications of function, geometry, and trigonometry concepts to solve problems involving calculus

### Standard 6: Middle School Mathematics Instruction and Assessment

**Middle school mathematics teachers have a broad and comprehensive understanding of content-specific curricula, instruction, and assessment in mathematics education, including:**

- 6.1** state and national content standards for middle school mathematics
- 6.2** process standards for mathematics
- 6.3** instructional strategies and resources for promoting student understanding of concepts and skills related to mathematics, including the use of multiple representations
- 6.4** instructional strategies and resources for developing and supporting students' literacy skills in the context of mathematics
- 6.5** evaluation and development of curricula and curricular materials, including textbooks and digital content, that support standards-based mathematics instruction and assessment
- 6.6** strategies and skills for planning and differentiating mathematics instruction to meet the needs of all learners
- 6.7** methods of communication that promote student learning and foster active inquiry, interaction, and collaboration in the mathematics classroom
- 6.8** strategies and skills for selecting, adapting, and using technology to enhance the teaching and learning of mathematics
- 6.9** strategies and skills for effectively assessing student understanding and mastery of essential mathematics concepts and skills