



Indiana Content Standards for Educators

MATHEMATICS

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.

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Standard 1: Number and Quantity

Mathematics teachers have a broad and comprehensive understanding of number systems, number representations, number operations, and number theory.

Standard 2: Algebra

Mathematics teachers have a broad and comprehensive understanding of the structure of mathematical expressions, the application of algebraic techniques, and the use of equations and inequalities to model and solve problems.

Standard 3: Functions

Mathematics teachers have a broad and comprehensive understanding of the characteristics of functions and relations and of the properties, behaviors, and applications of linear and nonlinear functions and their multiple representations (graphs, equations, tables, and concrete models).

Standard 4: Measurement and Geometry

Mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, Euclidean plane geometry and its applications, Euclidean coordinate geometry and its applications, and the role of reasoning and proof in geometry.

Standard 5: Statistics and Probability

Mathematics teachers have a broad and comprehensive understanding of the collection, presentation, interpretation and misinterpretations of data, and the fundamental principles of probability.

Standard 6: Calculus

Mathematics teachers have a broad and comprehensive understanding of the principles, techniques, and applications of differential and integral calculus.

Standard 7: Discrete Mathematics

Mathematics teachers have a broad and comprehensive understanding of the principles, techniques, and applications of discrete mathematics.

Standard 8: Mathematics Instruction and Assessment

Mathematics teachers have a broad and comprehensive understanding of content-specific instruction and assessment in mathematics education.

The Indiana Educator Standards for Mathematics describe the knowledge and skills that teachers need to help students achieve the learning outcomes defined by the Indiana Academic Standards for Mathematics. The Indiana Academic Standards can be found [here](#).

Standard 1: Number and Quantity

Mathematics teachers have a broad and comprehensive understanding of number systems, number representations, number operations, and number theory, including the following:

- 1.1 properties of the real and complex numbers and their subsets
- 1.2 ordering and equivalence of different representations of numbers
- 1.3 attending to accuracy and precision with different representations of numbers
- 1.4 number sense and place value, including bases other than base 10
- 1.5 application and use of factors
- 1.6 properties of vector spaces and matrices and their applications
- 1.7 traditional and alternative computational algorithms
- 1.8 problem solving with different representations of numbers (fractions, decimals, percents, scientific notation)

Standard 2: Algebra

Mathematics teachers have a broad and comprehensive understanding of the structure of mathematical expressions, the application of algebraic techniques, and the use of equations and inequalities to model and solve problems, including the following:

- 2.1 algebraic notation, language, and expressions
- 2.2 simplification and manipulation of polynomials and rational expressions
- 2.3 creating and solving equations and inequalities
- 2.4 modeling and solving systems of equations and inequalities, including the use of matrix techniques
- 2.5 algebraic reasoning and the proof and justification of algebraic techniques
- 2.6 graphical representations of equations and inequalities
- 2.7 concepts of linear and abstract algebra, including vector spaces and matrices involving both real and complex numbers

Standard 3: Functions

Mathematics teachers have a broad and comprehensive understanding of the characteristics of functions and relations and of the properties, behaviors, and applications of linear and nonlinear functions and their multiple representations (graphs, equations, tables, and concrete models), including the following:

- 3.1 properties of patterns, ratios, proportions, relations, and functions
- 3.2 properties of linear functions, inequalities, systems, and their representations
- 3.3 modeling problems with linear functions, inequalities, systems, and their representations
- 3.4 behaviors of nonlinear functions and relationships between their various representations
- 3.5 manipulation of functions, including transformation, translation, composition, and other manipulations
- 3.6 modeling problems with nonlinear functions and their representations
- 3.7 trigonometric functions and the unit circle
- 3.8 properties of the trigonometric functions
- 3.9 modeling periodic phenomena with trigonometric functions
- 3.10 polar coordinates and parametric equations

Standard 4: Measurement and Geometry

Mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, Euclidean plane geometry and its applications, Euclidean coordinate geometry and its applications, and the role of reasoning and proof in geometry, including the following:

- 4.1 principles, procedures, and applications of measurement and geometry
- 4.2 derivation and application of length, perimeter, area, and volume formulas of basic geometric figures
- 4.3 techniques of indirect measurement, including estimation and proportional reasoning
- 4.4 properties and construction of figures and shapes in two and three dimensions
- 4.5 the use of translations, rotations, reflections, dilations, and contractions in relation to similarity, congruence, and symmetries
- 4.6 coordinate and transformational geometry
- 4.7 conic sections and their applications
- 4.8 modeling and solving problems using geometric concepts
- 4.9 axiomatic structures of Euclidean and non-Euclidean geometries
- 4.10 logical reasoning, justification, and proof in relation to the axiomatic structure of geometry

Standard 5: Statistics and Probability

Mathematics teachers have a broad and comprehensive understanding of the collection, presentation, interpretation and misinterpretations of data, and the fundamental principles of probability, including the following:

- 5.1 summarizing, representing, and interpreting data for one or two variables
- 5.2 making inferences and evaluating claims based on data
- 5.3 variability and randomization in data
- 5.4 lines of best fit
- 5.5 sampling, bias, and misrepresentations in data
- 5.6 probabilities of simple and compound events
- 5.7 calculation and application of expected values
- 5.8 estimation of probabilities by observation and use of simulations
- 5.9 representations of probabilities
- 5.10 modeling and solving problems with normal, uniform, and binomial probability distributions

Standard 6: Calculus

Mathematics teachers have a broad and comprehensive understanding of the principles, techniques, and applications of differential and integral calculus, including the following:

- 6.1 limits, continuity, and the graphs of functions
- 6.2 concept and definition of the derivative and the second derivative
- 6.3 techniques and applications of differentiation
- 6.4 interpretation and properties of the definite integral
- 6.5 fundamental theorem of calculus
- 6.6 techniques and applications of antidifferentiation
- 6.7 numerical approximations of definite integrals
- 6.8 infinite sequences and series
- 6.9 properties of vector functions

Standard 7: Discrete Mathematics

Mathematics teachers have a broad and comprehensive understanding of the principles, techniques, and applications of discrete mathematics, including the following:

- 7.1 counting techniques and combinatorics
- 7.2 symbolic logic
- 7.3 sequences and series
- 7.4 induction and recursion
- 7.5 graphs, trees, arrays, and their representations
- 7.6 social choice (including apportionment and voting methods) and its applications
- 7.7 linear programming and its applications
- 7.8 game theory and its applications

Standard 8: Mathematics Instruction and Assessment

Mathematics teachers have a broad and comprehensive understanding of content-specific curriculum, instruction, and assessment in mathematics education, including the following:

- 8.1 the Indiana Academic Standards and Core Standards for Mathematics
- 8.2 the Common Core State Standards for Mathematics, the NCATE/NCTM Standards for Mathematics, and the ISTE National Educational Technology Standards
- 8.3 instructional strategies and resources for promoting student understanding of concepts and skills related to mathematics, including the use of multiple representations
- 8.4 evaluation and development of curriculum and curricular materials (including textbooks and digital content) that support standards-based instruction and assessment
- 8.5 strategies and skills for planning and differentiating mathematics instruction, based on the Indiana Response to Instruction (RTI) model, to meet the needs of all learners
- 8.6 instructional strategies to promote student learning and to connect the *Standards for Mathematical Content* to the *Standards for Mathematical Practice* of the Common Core State Standards
- 8.7 communication methods that promote student learning and foster active inquiry, interaction, and collaboration in the mathematics classroom
- 8.8 strategies and skills for selecting, adapting, and using technology to enhance the teaching and learning of mathematics
- 8.9 strategies and skills for effectively assessing student understanding and mastery of essential mathematics concepts and skills
- 8.10 implementation of the Indiana Response to Instruction (RTI) model for all students, including differentiation in Tiers 1 and 2 and intensive intervention and extension in Tier 3

Selected Bibliography of Standards and Sources Related to Mathematics

State and National Standards and Curriculum Frameworks

1. Indiana Department of Education. (2010). *Indiana academic standards for mathematics*.
2. Indiana Department of Education. (2008). *Indiana's core standards for mathematics: core academic concepts across the K–12 continuum. A companion to Indiana's academic standards*. <http://dc.doe.in.gov/Standards/AcademicStandards/PrintLibrary/docs-core/2008-06-09-corestandards-math.pdf>
3. Council of Chief State School Officers (CCSSO)/National Governors Association (NGA). (2010). *Common core state standards for mathematics*. <http://www.corestandards.org/the-standards/mathematics>
4. National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*.
5. National Council for Accreditation of Teacher Education (NCATE)/National Council of Teachers of Mathematics (NCTM). (2003). *Standards for middle level mathematics teachers*. http://www.nctm.org/uploadedFiles/Math_Standards/NCTMMIDDLEStandards%281%29.pdf
6. National Council for Accreditation of Teacher Education (NCATE)/National Council of Teachers of Mathematics (NCTM). (2003). *Standards for secondary mathematics teachers*. http://www.nctm.org/uploadedFiles/Math_Standards/NCTMSECONStandards.pdf
7. International Society for Technology in Education (ISTE). (2008). *The ISTE NETS and performance indicators for teachers (NETS-T)*. http://www.iste.org/Libraries/PDFs/NETS_for_Teachers_2008_EN.sflb.ashx

Sources on Mathematics Content

8. Cuoco, A., Goldenberg, E. P., & Mark, J. (2010). Organizing a curriculum around mathematical habits of mind. *Mathematics Teacher*, 103(9), 682–688.
9. Jankvist, U. T. (2009). A categorization of the "whys" and "hows" of using history in mathematics education. *Educational Studies in Mathematics*, 71(3), 235–261.
10. Steen, L. A. (2006). Facing facts: Achieving balance in high school mathematics. *Mathematics Teacher*, 100, 86.
11. Schmidt, W., Houang, R., & Cogan, L. (2004). A coherent curriculum: The case of mathematics. *Journal of Direct Instruction*, 4(1), 13–28.

Sources on Student Learning and Pedagogical Methodology

12. Ma, L. (1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States*. New York: Routledge.
13. Silverman, J., & Clay, E. L. (2010). Online asynchronous collaboration in mathematics teacher education and the development of mathematical knowledge for teaching. *Teacher Educator*, 45(1), 54–73.
14. Reed, H. C., Drijvers, P., & Kirschner, P. A. (2010). Effects of attitudes and behaviours on learning mathematics with computer tools. *Computers & Education*, 55(1), 1–15.
15. Morris, A. K., Hiebert, J., & Spitzer, S. M. (2009). Mathematical knowledge for teaching in planning and evaluating instruction: What can preservice teachers learn? *Journal for Research in Mathematics Education*, 40(5), 491–529.
16. Simon, M. A. (2009). Amidst multiple theories of learning in mathematics education. *Journal for Research in Mathematics Education*, 40(5), 477–490.
17. Hoffman, B. L., Breyfogle, L. M., & Dressler, J. A. (2009). The power of incorrect answers. *Mathematics*

Selected Bibliography of Standards and Sources Related to Mathematics

Teaching in the Middle School, 15(4), 232–238.

Alignment of Educator Standards with State and National Standards

Indiana Educator Standards for Mathematics	Indiana Academic Standards for Mathematics	Indiana Core Standards for Mathematics	Common Core State Standards for Mathematics	NCATE/NCTM Standards for Mathematics	ISTE National Educational Technology Standards
<u>Standard 1: Number and Quantity</u> Mathematics teachers have a broad and comprehensive understanding of number systems, number representations, number operations, and number theory.	5.1, 5.2, 5.7, 6.1, 6.2, 6.7, 7.1, 7.2, 7.7, 8.1, 8.2, 8.7, A1.1, IM1.1	CS5-1, CS6-1, CS7-1, CS8-1, CSAII-2	5.OA, 5.NBT, 5.NF, 6.RP, 6.NS, 7.RP, 7.NS, 8.NS, N-RN, N-CN, N-YM	1, 5, 9, 10	
<u>Standard 2: Algebra</u> Mathematics teachers have a broad and comprehensive understanding of the structure of mathematical expressions, the application of algebraic techniques, and the use of equations and inequalities to model and solve problems.	A1.2, A1.9, A2.10, DM.2, IM1.2.1–1.2.25, IM1.7, IM2.7, IM3.7,	CS5-3, CS6-3, CS7-3, CS8-3, CSAI-1-6, CSAII-1, CSAII-3, CSAII-4	6.EE, 7.EE, 8.EE, 8.F, N-Q, A-SSE, A-APR, A-CED, A-REI, F-IF, F-BF, F-LE	2, 3, 5, 6, 10	
<u>Standard 3: Functions</u> Mathematics teachers have a broad and comprehensive understanding of the characteristics of functions and relations, and of the properties, behaviors, and applications of linear and nonlinear functions and their multiple representations (graphs, equations, tables, and concrete models).	5.3, 6.3, 7.3, 8.3, A1.3–1.8, A2.1–2.7, IM1.2.26–1.2.31, IM2.1, IM2.6, IM3.1, IM3.6, PC.1–.6	CSAI-7, CSAII-5-8, CSPC-1-6	F-TF, G-SRT	1, 3–5	

Alignment of Educator Standards with State and National Standards

Indiana Educator Standards for Mathematics	Indiana Academic Standards for Mathematics	Indiana Core Standards for Mathematics	Common Core State Standards for Mathematics	NCATE/NCTM Standards for Mathematics	ISTE National Educational Technology Standards
<u>Standard 4: Measurement and Geometry</u> Mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, Euclidean plane geometry and its applications, Euclidean coordinate geometry and its applications, and the role of reasoning and proof in geometry.	5.4, 5.5, 6.4, 6.5, 7.4, 7.5, 8.4, 8.5, G.1–.8, IM1.3, IM2.2, IM3.2, PC.9	CS5-2, CS6-2, CS7-2, CS8-2, CSG-1-9	5.MD, 5.G, 6. G, 7.G, 8.G, G-CO, G-C, G-GPE, G-GMD, G-MG	1–5, 11, 15	
<u>Standard 5: Statistics and Probability</u> Mathematics teachers have a broad and comprehensive understanding of the collection, presentation, interpretation and misinterpretations of data, and of the fundamental principles of probability.	5.6, 6.6, 7.6, 8.6, IM1.4, IM1.5, IM2.3, IM2.4, PC.8, PS.1–.3	CS7-4, CS-8-4, CSAII-10	6.SP, 7.SP, 8.SP, S-ID, S-IC, S-CP, S-MD	1–6, 14	
<u>Standard 6: Calculus</u> Mathematics teachers have a broad and comprehensive understanding of the principles, techniques, and applications of differential and integral calculus.	A2.8, C.1–.5, PC.7	CSAII-9, CSPC-7		3–6, 12	

Alignment of Educator Standards with State and National Standards

Indiana Educator Standards for Mathematics	Indiana Academic Standards for Mathematics	Indiana Core Standards for Mathematics	Common Core State Standards for Mathematics	NCATE/NCTM Standards for Mathematics	ISTE National Educational Technology Standards
<u>Standard 7: Discrete Mathematics</u> Mathematics teachers have a broad and comprehensive understanding of the principles, techniques, and applications of discrete mathematics.	A1.9, A2.9, A2.10, DM.1, DM.3–.7, IM1.6, IM1.7, IM2.5, IM2.7, IM3.5			1–6, 13	
<u>Standard 8: Mathematics Instruction and Assessment</u> Mathematics teachers have a broad and comprehensive understanding of content-specific instruction and assessment in mathematics education.				7, 8, 16	1a, 1b, 1c, 1d 2a, 2b, 2c, 2d 3a, 3b, 3c, 3d 4b, 5a, 5c