Secondary Mathematics Map

Standard 1: Knowledge of Mathematical Problem Solving

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates know, understand, and apply the process of mathematical problem solving.	Candidates can: • Apply and adapt a variety of appropriate strategies to solve problems. • Solve problems that arise in mathematics and those involving mathematics in other • contexts. • Build new mathematical knowledge through problem solving. • Monitor and reflect on the process of mathematical problem solving.		

Standard 2: Knowledge of Reasoning and Proof

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates reason, construct, and evaluate mathematical arguments and develop an	Candidates can: • Recognize reasoning and proof as fundamental aspects of mathematics.		

appreciation for mathematical rigor and inquiry.	• Make and investigate mathematical conjectures. • Develop and evaluate mathematical arguments and proofs. • Select and use various types of reasoning and methods of proof.		

Standard 3: Knowledge of Mathematical Communication

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates communicate their mathematical thinking orally and in writing to peers, faculty, and others.	Candidates can: • Communicate their mathematical thinking coherently and clearly to peers, faculty, and others. • Use the language of mathematics to express ideas precisely. • Organize mathematical thinking through communication. • Analyze and evaluate the mathematical thinking and strategies of others.		

Standard 4: Knowledge of Mathematical Connections

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates recognize,	Candidates can:		

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding.	• Recognize and use connections among mathematical ideas. • Recognize and apply mathematics in contexts outside of mathematics. • Demonstrate how mathematical ideas interconnect and build on one another to produce a coherent whole.		

Standard 5: Knowledge of Mathematical Representation

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates use varied representations of mathematical ideas to support and deepen students' mathematical understanding.	Candidates can: • Use representations to model and interpret physical, social, and mathematical phenomena. • Create and use representations to organize, record, and communicate mathematical ideas. • Select, apply, and translate among mathematical representations to solve problems.		

Standard 6: Knowledge of Technology

Description	Indicator	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies

| Candidates embrace technology as an essential tool for teaching and learning mathematics. | Candidates can:

• Use knowledge of mathematics to select and use appropriate technological tools, such as but not limited to, spreadsheets, dynamic graphing tools, computer algebra systems, dynamic statistical packages, graphing calculators, data-collection devices, and presentation software. | | |

Standard 7: Dispositions

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates support a positive disposition toward mathematical processes and mathematical learning.	Candidates can: • Attention to equity • Use of stimulating curricula • Effective teaching • Commitment to learning with understanding • Use of various assessments • Use of various teaching tools including technology		

Standard 8: Knowledge of Mathematics Pedagogy

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies

Candidates possess a deep understanding of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning.	Candidates can: • Selects, uses, and determines suitability of the wide variety of available mathematics curricula and teaching materials for all students including those with special needs such as the gifted, challenged and speakers of other languages. • Selects and uses appropriate concrete materials for learning mathematics. • Uses multiple strategies, including listening to and understanding the ways students think about mathematics, to assess students' mathematical knowledge. • Plans lessons, units and courses that address appropriate learning goals, including those that address local, state, and national mathematics standards and legislative mandates. • Participates in professional mathematics organizations and uses their print and on-line resources. • Demonstrates knowledge of research results in the teaching and learning of mathematics. • Uses knowledge of different types of instructional strategies in planning mathematics lessons. • Demonstrates the ability to lead classes in mathematical problem solving and in developing in-depth		

| | conceptual understanding, and to help students develop and test generalizations.
• Develop lessons that use technology's potential for building understanding of mathematical concepts and developing important mathematical ideas. | | |

Standard 9: Knowledge of Number and Operation

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates demonstrate computational proficiency, including a conceptual understanding of numbers, ways of representing number, relationships among number and number systems, and meanings of operations.	Candidates can: • Analyze and explain the mathematics that underlies the procedures used for operations involving integers, rational, real, and complex numbers. • Use properties involving number and operations, mental computation, and computational estimation. • Provide equivalent representations of fractions, decimals, and percents. • Create, solve, and apply proportions. • Apply the fundamental ideas of number theory. • Make sense of large and small numbers and use scientific notation. • Compare and contrast properties of numbers and number systems. • Represent, use, and apply complex		

	numbers.		
	• Recognize matrices and vectors as systems that have some of the properties of the real number system.		
	• Demonstrate knowledge of the historical development of number and number systems including contributions from diverse cultures.		

Standard 10: Knowledge of Different Perspectives on Algebra

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates emphasize relationships among quantities including functions, ways of representing mathematical relationships, and the analysis of change.	Candidates can: • Analyze patterns, relations, and functions of one and two variables. • Apply fundamental ideas of linear algebra. • Apply the major concepts of abstract algebra to justify algebraic operations and formally analyze algebraic structures. • Use mathematical models to represent and understand quantitative relationships. • Use technological tools to explore algebraic ideas and representations of information and in solving problems. • Demonstrate knowledge of the historical development of algebra		

	including contributions from diverse cultures.		

Standard 11: Knowledge of Geometries			
Description	**Indicators**	**Map to Field Experience / Map to Curriculum and Course Experiences**	**Assessment Strategies**
Candidates use spatial visualization and geometric modeling to explore and analyze geometric shapes, structures, and their properties.	Candidates can: • Demonstrate knowledge of core concepts and principles of Euclidean and non-Euclidean geometries in two and three dimensions from both formal and informal perspectives. • Exhibit knowledge of the role of axiomatic systems and proofs in geometry. • Analyze characteristics and relationships of geometric shapes and structures. • Build and manipulate representations of two- and three- dimensional objects and visualize objects from different perspectives. • Specify locations and describe spatial relationships using coordinate geometry, vectors, and other representational systems. • Apply transformations and use symmetry, similarity, and congruence to analyze mathematical situations. • Use concrete models, drawings, and		

	dynamic geometric software to explore geometric ideas and their applications in real-world contexts.		
	• Demonstrate knowledge of the historical development of Euclidean and non-Euclidean geometries including contributions from diverse cultures.		

Standard 12: Knowledge of Calculus

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates demonstrate a conceptual understanding of limit, continuity, differentiation, and integration and a thorough background in the techniques and application of the calculus.	Candidates can: • Demonstrate a conceptual understanding of and procedural facility with basic calculus concepts. • Apply concepts of function, geometry, and trigonometry in solving problems involving calculus. • Use the concepts of calculus and mathematical modeling to represent and solve problems taken from real-world contexts. • Use technological tools to explore and represent fundamental concepts of calculus. • Demonstrate knowledge of the historical development of calculus including contributions from diverse cultures.		

Standard 13: Knowledge of Discrete Mathematics

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates apply the fundamental ideas of discrete mathematics in the formulation and solution of problems.	Candidates can: • Demonstrate knowledge of basic elements of discrete mathematics such as graph theory, recurrence relations, finite difference approaches, linear programming, and combinatorics. • Apply the fundamental ideas of discrete mathematics in the formulation and solution of problems arising from real-world situations. • Use technological tools to solve problems involving the use of discrete structures and the application of algorithms. • Demonstrate knowledge of the historical development of discrete mathematics including contributions from diverse cultures.		

Standard 14: Knowledge of Data Analysis, Statistics, and Probability

Description	Indicators	Map to Field Experience / Map to Curriculum and Course Experiences	Assessment Strategies
Candidates demonstrate	• Design investigations, collect data,		

an understanding of concepts and practices related to data analysis, statistics, and probability.	and use a variety of ways to display data and interpret data representations that may include bivariate data, conditional probability and geometric probability. • Use appropriate methods such as random sampling or random assignment of treatments to estimate population characteristics, test conjectured relationships among variables, and analyze data. • Use appropriate statistical methods and technological tools to describe shape and analyze spread and center. • Use statistical inference to draw conclusions from data. • Identify misuses of statistics and invalid conclusions from probability. • Draw conclusions involving uncertainty by using hands-on and computer-based simulation for estimating probabilities and gathering data to make inferences and conclusions. • Determine and interpret confidence intervals. • Demonstrate knowledge of the historical development of statistics and probability including contributions from diverse cultures.		

Standard 15: Knowledge of Measurement			
Description	**Indicators**	**Map to Field Experience / Map to Curriculum and Course Experiences**	**Assessment Strategies**
Candidates apply and use measurement concepts and tools.	Candidates can: • Recognize the common representations and uses of measurement and choose tools and units for measuring. • Apply appropriate techniques, tools, and formulas to determine measurements and their application in a variety of contexts. • Completes error analysis through determining the reliability of the numbers obtained from measures. • Demonstrate knowledge of the historical development of measurement and measurement systems including contributions from diverse cultures.		

Standard 16: Field-Based Experiences			
Description	**Indicators**	**Map to Field Experience / Map to Curriculum and Course Experiences**	**Assessment Strategies**
Candidates complete field-based experiences in mathematics	Candidates can: • Engage in a sequence of planned opportunities prior to student teaching		

classrooms.	that includes observing and participating in both middle and secondary mathematics classrooms under the supervision of experienced and highly qualified teachers. • Experience full-time student teaching in secondary mathematics that is supervised by a highly qualified teacher and a university or college supervisor with secondary mathematics teaching experience. • Demonstrate the ability to increase students' knowledge of mathematics.		