

TEXAS EDUCATION AGENCY

TExES

TExMaT

TExMaT[™] Master Mathematics Teacher EC-4 (087) Test at a Glance

See the test preparation manual for complete information about the test along with sample questions, study tips and preparation resources.

Test Name	Master Mathematics Teacher EC-4		
Test Code	087		
Time	5 hours		
Number of Questions	90 multiple-choice questions		
Format	Paper-based test (PBT)		
	Domain	Domain Title	Approx. Percentage of Test
	I.	Number Concepts: Content, Instruction and Assessment	23%
	II.	Patterns and Algebra: Content, Instruction and Assessment	18%
	III.	Geometry and Measurement: Content, Instruction and Assessment	23%
	IV.	Probability and Statistics: Content, Instruction and Assessment	18%
	V.	Mathematical Processes, Perspectives, Mentoring and Leadership	18%

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About This Test

The TExMaT Master Mathematics Teacher EC-4 (087) test is designed to assess whether an examinee has the requisite knowledge and skills that an initially certified Texas Master Mathematics Teacher EC-4 must possess. The 90 multiple-choice questions are based on the Master Mathematics Teacher EC-4 test framework. Questions on this test range from grades EC-4. The test may contain questions that do not count toward the score.

The Test Framework

The Master Mathematics Teacher EC-4 test framework is based on the educator standards for this field. The content covered by the test is organized into broad areas of content called **domains**. Each domain covers one or more of the educator standards for this field. Within each domain, the content is further defined by a set of **competencies**. Each competency is composed of two major parts:

- The competency statement, which broadly defines what an entry-level educator in this field in Texas public schools should know and be able to do.
- The **descriptive statements**, which describe in greater detail the knowledge and skills eligible for testing.

The educator standards being assessed within each domain are listed beginning on the next page. These are followed by a complete set of the framework's competencies and descriptive statements. Read each competency with its descriptive statements to get a more specific idea of the knowledge you will be required to demonstrate on the test.

Educator Standards

Master Mathematics Teacher EC-4 Standard I

Number Concepts: The Master Mathematics Teacher understands and applies knowledge of numbers, number systems and their structure, operations and algorithms, quantitative reasoning and the vertical alignment of number concepts to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]).

Master Mathematics Teacher EC-4 Standard II

Patterns and Algebra: The Master Mathematics Teacher understands and applies knowledge of patterns, relations, functions, algebraic reasoning, analysis and the vertical alignment of patterns and algebra to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]).

Master Mathematics Teacher EC-4 Standard III

Geometry and Measurement: The Master Mathematics Teacher understands geometry, spatial reasoning, measurement concepts and principles and the vertical alignment of geometry and measurement to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]).

Master Mathematics Teacher EC-4 Standard IV

Probability and Statistics: The Master Mathematics Teacher understands probability and statistics, their applications and the vertical alignment of probability and statistics to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]).

Master Mathematics Teacher EC-4 Standard V

Mathematical Processes: The Master Mathematics Teacher understands and uses mathematical processes to reason mathematically, to solve mathematical problems, to make mathematical connections within and outside of mathematics and to communicate mathematically.

Master Mathematics Teacher EC-4 Standard VI

Instruction: The Master Mathematics Teacher applies knowledge of mathematical content, uses appropriate theories for learning mathematics, implements effective instructional approaches for teaching mathematics, including teaching students who are at-risk, and demonstrates effective classroom management techniques.

Master Mathematics Teacher EC-4 Standard VII

Creating and Promoting a Positive Learning Environment: The Master Mathematics Teacher demonstrates behavior that reflects high expectations for every student, promotes positive student attitudes towards mathematics and provides equitable opportunities for all students to achieve at a high level.

Master Mathematics Teacher EC-4 Standard VIII

Assessment: The Master Mathematics Teacher selects, constructs and administers appropriate assessments to guide, monitor, evaluate and report student progress to students, administrators and parents, and develops these skills in other teachers.

Master Mathematics Teacher EC-4 Standard IX

Mentoring and Leadership: The Master Mathematics Teacher facilitates appropriate standards-based mathematics instruction by communicating and collaborating with educational stake-holders; mentoring, coaching, exhibiting leadership and consulting with colleagues; providing professional development opportunities for faculty; and making instructional decisions based on data and supported by evidence from research.

Master Mathematics Teacher EC-4 Standard X

Mathematical Perspectives: The Master Mathematics Teacher understands the historical development of mathematical ideas, the interrelationship between society and mathematics, the structure of mathematics and the evolving nature of mathematics and mathematical knowledge.

Domains and Competencies

DOMAIN I — NUMBER CONCEPTS: CONTENT, INSTRUCTION AND ASSESSMENT

Standards Assessed: Master Mathematics Teacher EC-4 I, VI-VIII

Competency 001: The Master Mathematics Teacher EC–4 understands the structure of number systems, the development of a sense of quantity and the relationship between quantity and symbolic representations.

- A. Compares and contrasts numeration systems.
- B. Analyzes the structure of numeration systems and the roles of place value and zero in the base ten system.
- C. Demonstrates a sense of quantity and estimation for the real numbers (i.e., whole numbers, integers, rational and irrational numbers).
- D. Demonstrates an understanding of a variety of models for representing real numbers (e.g., fraction strips, diagrams, base ten blocks, number lines, sets).
- E. Demonstrates an understanding of different representations of equivalent rational numbers.
- F. Selects appropriate representations of real numbers (e.g., expanded notation, fractions, decimals, percents, roots, exponents, scientific notation) for particular situations.
- G. Demonstrates, explains and uses models to show how some situations that have no solution in the whole, integer or rational number systems have solutions in the real number system.

Competency 002: The Master Mathematics Teacher EC–4 understands number operations and computational algorithms.

The Master Mathematics Teacher EC-4:

- A. Recognizes, models and describes different ways to interpret the four basic operations involving real numbers (e.g., whole numbers, integers, fractions, decimals).
- B. Analyzes, describes and connects relationships among number properties, operations and algorithms involving the four basic operations with real numbers (e.g., whole numbers, integers, fractions, decimals).
- C. Recognizes error patterns that often occur when students use algorithms to perform operations.
- D. Recognizes and analyzes appropriate alternative algorithms for the four basic operations with whole numbers, fractions and decimals.
- E. Translates among concrete, pictorial, and symbolic representations of the four basic operations with real numbers, and recognizes these concepts and relationships in real-life situations.

Competency 003: The Master Mathematics Teacher EC–4 understands the basic ideas of number theory and uses numbers to model and solve problems within and outside of mathematics.

- A. Describes, sorts and classifies numbers as prime or composite, and applies the concepts of prime and composite numbers in problem situations.
- B. Recognizes greatest common denominators and least common multiples and uses these concepts to solve problems.
- C. Applies the concept of prime factorization to solve problems.
- D. Applies knowledge of place value and other number properties to develop techniques of mental mathematics and computational estimation.
- E. Recognizes problem situations in which use of particular mathematical operations (e.g., multiplication, division) would be useful or necessary.
- F. Uses integers, fractions, decimals and percents to solve problems in a variety of real-world situations.

Competency 004: The Master Mathematics Teacher EC–4 plans and designs effective instruction and assessment based on knowledge of how all students, including students who are at-risk, learn and develop number concepts, skills and procedures.

- A. Evaluates and applies established research evidence on how all students, including students who are at-risk, learn and use number concepts.
- B. Recognizes and uses the vertical alignment of number concepts across grade levels to plan instruction based on state standards.
- C. Sequences instruction, practice and applications based on students' instructional needs so that all students develop accuracy and fluency of number concepts.
- D. Uses evidence of students' current understanding of number concepts to select strategies to help students move from informal to formal knowledge.
- E. Structures problem-solving activities so students can recognize patterns and relationships within number concepts.
- F. Designs challenging and engaging problem-solving tasks that develop number-concepts content knowledge as well as students' critical and analytical reasoning capacities.
- G. Integrates number concepts within and outside of mathematics.
- H. Selects appropriate materials, instructional strategies and technology to meet the instructional needs of all students.
- I. Uses strategies to help students understand that results obtained using technology may be misleading and/or misinterpreted.
- J. Recognizes common errors and misconceptions and determines appropriate correction procedures.
- K. Develops assessments based on state and national standards to evaluate students' knowledge of number concepts.
- L. Evaluates an assessment for validity with respect to the measured objectives.
- M. Analyzes and uses assessment results from various diagnostic instruments to plan, inform and adjust instruction.
- N. Recognizes how to provide equity for all students in mathematics instruction through reflection on one's own attitudes, expectations, and teaching practices.

Competency 005: The Master Mathematics Teacher EC-4 implements a variety of instruction and assessment techniques to guide, evaluate and improve students' learning of number concepts, skills and procedures.

- A. Creates a positive learning environment that provides all students with opportunities to develop and improve number concepts, skills and procedures.
- B. Knows how to teach number concepts, skills, procedures and problem-solving strategies using instructional approaches supported by established research.
- C. Knows how to maximize student/teacher and student/student interaction and analyzes students' abilities to correctly apply new content.
- D. Uses multiple representations, tools and a variety of tasks to promote students'' understanding of number concepts.
- E. Introduces content by carefully defining new terms using vocabulary that the student already knows.
- F. Uses a variety of questioning strategies to identify, support, monitor and challenge students' mathematical thinking.
- G. Demonstrates classroom management skills, including applying strategies that use instructional time effectively.
- H. Administers a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) consisting of worthwhile tasks that assess mathematical understanding, common misconceptions and error patterns associated with learning number concepts.
- I. Evaluates and modifies instruction to improve learning of number concepts, skills and procedures for all students based on the results of formal and informal assessments.

DOMAIN II — PATTERNS AND ALGEBRA: CONTENT, INSTRUCTION AND ASSESSMENT

Standards Assessed: Master Mathematics Teacher EC-4 II, VI-VIII

Competency 006: The Master Mathematics Teacher EC-4 understands and uses mathematical reasoning to identify, extend and analyze patterns, and understands the relationships among variables, expressions, equations, relations and functions.

The Master Mathematics Teacher EC-4:

- A. Uses inductive reasoning to identify and generalize patterns with numbers, concrete models, geometric figures, tables, graphs and algebraic expressions.
- B. Uses a variety of number patterns (e.g., fact families, number charts, multiplication by powers of 10) to explore number properties.
- C. Formulates rules to describe and construct sequences using concrete models, geometric figures, tables, graphs and algebraic expressions.
- D. Demonstrates an understanding of making, testing, validating and using conjectures about patterns and relationships in data presented in tables, sequences or graphs.
- E. Applies relations and functions to represent mathematical and real-world situations.
- F. Translates problem-solving situations into expressions and equations.

Competency 007: The Master Mathematics Teacher EC-4 understands and uses linear functions to model and solve problems using a variety of methods, including algebra.

- A. Demonstrates an understanding of the concept of linear function using concrete models, tables, graphs and symbolic and verbal representations.
- B. Analyzes the relationship between a linear function or relation and its graph.
- C. Uses linear functions and relations to model problems.
- D. Uses tables, graphs and algebraic techniques to solve linear equations.
- E. Gives appropriate justification for the manipulation of algebraic expressions and equations in one variable.
- F. Models and solves problems, including proportion problems, using concrete, geometric, tabular, graphic and algebraic methods.
- G. Distinguishes between linear and nonlinear functions.

Competency 008: The Master Mathematics Teacher EC–4 plans and designs effective instruction and assessment based on knowledge of how all students, including students who are at-risk, learn and develop patterns and algebra concepts, skills, and procedures.

- A. Evaluates and applies established research evidence on how all students, including students who are at-risk, learn and use patterns and algebra.
- B. Recognizes and uses the vertical alignment of patterns and algebra across grade levels to plan instruction based on state standards.
- C. Sequences instruction, practice and applications based on students' instructional needs so that students develop accuracy and fluency of patterns and algebra.
- D. Uses evidence of students' current understanding of patterns and algebra to select strategies to help students move from informal to formal knowledge.
- E. Structures problem-solving activities so students can recognize patterns and relationships within patterns and algebra.
- F. Designs challenging and engaging problem-solving tasks that develop patterns and algebra content knowledge as well as students' critical and analytical reasoning capacities.
- G. Integrates patterns and algebra concepts within and outside of mathematics.
- H. Selects appropriate materials, instructional strategies and technology to meet the instructional needs of all students.
- I. Uses strategies to help students understand that results obtained using technology may be misleading or misinterpreted.
- J. Recognizes common errors and misconceptions and determines appropriate correction procedures.
- K. Develops assessments based on state and national standards to evaluate students' knowledge of patterns and algebra.
- L. Evaluates an assessment for validity with respect to the measured objectives.
- M. Analyzes and uses assessment results from various diagnostic instruments to plan, inform and adjust instruction.
- N. Recognizes how to provide equity for all students in mathematics instruction through reflection on one's own attitudes, expectations and teaching practices.

Competency 009: The Master Mathematics Teacher EC–4 implements a variety of instruction and assessment techniques to guide, evaluate and improve students' learning of patterns and algebra concepts, skills and procedures.

- A. Creates a positive learning environment that provides all students with opportunities to develop and improve patterns and algebra concepts, skills and procedures.
- B. Knows how to teach patterns and algebra concepts, skills, procedures and problem-solving strategies using instructional approaches supported by established research.
- C. Knows how to maximize student/teacher and student/student interaction and analyzes students' abilities to correctly apply new content.
- D. Uses multiple representations, tools and a variety of tasks to promote students' understanding of patterns and algebra concepts.
- E. Introduces content by carefully defining new terms using vocabulary that the student already knows.
- F. Uses a variety of questioning strategies to identify, support, monitor and challenge students' mathematical thinking.
- G. Demonstrates classroom management skills, including applying strategies that use instructional time effectively.
- H. Administers a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) consisting of worthwhile tasks that assess mathematical understanding, common misconceptions and error patterns associated with learning patterns and algebra concepts.
- Evaluates and modifies instruction to improve learning of patterns and algebra concepts, skills and procedures for all students based on the results of formal and informal assessments.

DOMAIN III — GEOMETRY AND MEASUREMENT: CONTENT, INSTRUCTION AND ASSESSMENT

Standards Assessed: Master Mathematics Teacher EC-4 III, VI-VIII

Competency 010: The Master Mathematics Teacher EC-4 understands measurement as a process.

- A. Identifies attributes to be measured, quantifies the attributes by selecting and using appropriate units (standard and nonstandard) and communicates information about the attributes using the unit measure.
- B. Explains and illustrates the use of numbers and units of measurement for quantities such as length, perimeter, area, volume, temperature, percent, speed and acceleration.
- C. Uses conversions within and between different measurement systems.
- D. Applies measurement concepts and dimensional analysis to derive units and formulas for a variety of situations, including average rates of change of one variable with respect to another.
- E. Uses methods of approximation and estimates the effects of error on measurement.
- F. Applies measurement to solve problems in real-world situations.

Competency 011: The Master Mathematics Teacher EC–4 understands the basic concepts and applications of Euclidean geometry.

- A. Demonstrates an understanding of properties of and relationships among points, lines, planes, angles, polygons and circles.
- B. Demonstrates an understanding of geometric constructions using a compass and straightedge, reflection devices and other appropriate technologies.
- C. Uses logical reasoning to analyze geometric relationships.
- D. Finds length, perimeter, area and volume of geometric objects.
- E. Analyzes and solves problems involving one-, two- and three-dimensional objects (e.g., lines, angles, circles, polygons, cylinders, cones, pyramids, prisms, spheres).
- F. Analyzes the relationship among three-dimensional objects and related twodimensional representations (e.g., perspectives, projections, cross sections, nets) and uses these representations to solve problems.
- G. Demonstrates an understanding of the use of manipulatives and appropriate technology to investigate and illustrate geometric relationships.
- H. Applies geometry to model and solve problems in real-world situations.

Competency 012: The Master Mathematics Teacher EC–4 understands transformational and coordinate geometry and connects geometry with other topics in the mathematics curriculum.

- A. Uses visualization skills, spatial reasoning and geometric modeling to investigate and describe shape in terms of dimension, direction, orientation and perspective.
- B. Uses translations, rotations and reflections to illustrate congruencies and properties of congruent figures.
- C. Demonstrates an understanding of the properties of similar figures.
- D. Uses transformations to explore symmetries of figures.
- E. Analyzes tessellations and shows how they can be used to illustrate geometric concepts, properties and relationships.
- F. Specifies locations and describes spatial relationships using coordinate geometry.
- G. Relates geometry to algebra by using the Cartesian coordinate system and uses this relationship to solve problems.
- H. Makes connections among geometric ideas and number concepts, measurement, probability and statistics, algebra and analysis.

Competency 013: The Master Mathematics Teacher EC–4 plans and designs effective instruction and assessment based on knowledge of how all students, including students who are at-risk, learn and develop geometry and measurement concepts, skills and procedures.

- A. Evaluates and applies established research evidence on how all students, including students who are at-risk, learn and use geometry and measurement.
- B. Recognizes and uses the vertical alignment of geometry and measurement across grade levels to plan instruction based on state standards.
- C. Sequences instruction, practice and applications based on students' instructional needs so that all students develop accuracy and fluency of geometry and measurement.
- D. Uses evidence of students' current understanding of geometry and measurement to select strategies to help students move from informal to formal knowledge.
- E. Structures problem-solving activities so students can recognize patterns and relationships within geometry and measurement.
- F. Designs challenging and engaging problem-solving tasks that develop geometry and measurement content knowledge as well as students' critical and analytical reasoning capacities.
- G. Integrates geometry and measurement within and outside of mathematics.
- H. Selects appropriate materials, instructional strategies and technology to meet the instructional needs of all students.
- I. Uses strategies to help students understand that results obtained using technology may be misleading and/or misinterpreted.
- J. Recognizes common errors and misconceptions and determines appropriate correction procedures.
- K. Develops assessments based on state and national standards to evaluate students' knowledge of geometry and measurement.
- L. Evaluates an assessment for validity with respect to the measured objectives.
- M. Analyzes and uses assessment results from various diagnostic instruments to plan, inform and adjust instruction.
- N. Recognizes how to provide equity for all students in mathematics instruction through reflection on one's own attitudes, expectations and teaching practices.

Competency 014: The Master Mathematics Teacher EC–4 implements a variety of instruction and assessment techniques to guide, evaluate and improve students' learning of geometry and measurement concepts, skills and procedures.

- A. Creates a positive learning environment that provides all students with opportunities to develop and improve geometry and measurement concepts, skills and procedures.
- B. Knows how to teach geometry and measurement concepts, skills, procedures and problem-solving strategies using instructional approaches supported by established research.
- C. Knows how to maximize student/teacher and student/student interaction and analyzes students' abilities to correctly apply new content.
- D. Uses multiple representations, tools and a variety of tasks to promote students' understanding of geometry and measurement.
- E. Introduces content by carefully defining new terms using vocabulary that the student already knows.
- F. Uses a variety of questioning strategies to identify, support, monitor and challenge students' mathematical thinking.
- G. Demonstrates classroom management skills, including applying strategies that use instructional time effectively.
- H. Administers a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) consisting of worthwhile tasks that assess mathematical understanding, common misconceptions and error patterns associated with learning geometry and measurement.
- I. Evaluates and modifies instruction to improve learning of geometry and measurement concepts, skills and procedures for all students based on the results of formal and informal assessments.

DOMAIN IV – PROBABILITY AND STATISTICS: CONTENT, INSTRUCTION AND ASSESSMENT

Standards Assessed: Master Mathematics Teacher EC-4 IV, VI-VIII

Competency 015: The Master Mathematics Teacher EC–4 understands the theory of probability.

The Master Mathematics Teacher EC-4:

- A. Uses data collection, experiments and simulations to explain concepts of probability.
- B. Uses probability to describe the expected outcomes of simple and compound events.
- C. Determines probabilities by constructing a sample space that models a situation.
- D. Solves problems involving counting combinations and permutations.
- E. Generates and uses probability models to represent or simulate a situation.
- F. Uses probability language to make observations and draw conclusions.

Competency 016: The Master Mathematics Teacher EC–4 understands how to collect, describe, display, and draw appropriate inferences from data.

- A. Uses appropriate tabular and graphical displays (e.g., frequency tables, histograms, pie charts) for categorical and numerical data.
- B. Calculates mean, median, mode and range to describe a set of data.
- C. Interprets measures of central tendency and dispersion (i.e., range, percentile, interquartile range, standard deviation) to describe a set of data.
- D. Describes and analyzes relationships between sets of data using techniques such as scatterplots and trend lines.
- E. Applies knowledge of designing, conducting, analyzing and interpreting statistical experiments to investigate real-world problems.
- F. Recognizes the misuse of statistics.
- G. Uses appropriate language to communicate the results of a statistical investigation.

Competency 017: The Master Mathematics Teacher EC–4 plans and designs effective instruction and assessment based on knowledge of how all students, including students who are at-risk, learn and develop probability and statistics concepts, skills, and procedures.

- A. Evaluates and applies established research evidence on how all students, including students who are at-risk, learn and use probability and statistics.
- B. Recognizes and uses the vertical alignment of probability and statistics across grade levels to plan instruction based on state standards.
- C. Sequences instruction, practice and applications based on students' instructional needs so that all students develop accuracy and fluency of probability and statistics.
- D. Uses evidence of students' current understanding of probability and statistics to select strategies to help students move from informal to formal knowledge.
- E. Structures problem-solving activities so students can recognize patterns and relationships within probability and statistics.
- F. Designs challenging and engaging problem-solving tasks that develop probability and statistics content knowledge as well as students' critical and analytical reasoning capacities.
- G. Integrates probability and statistics within and outside of mathematics.
- H. Selects appropriate materials, instructional strategies and technology to meet the instructional needs of all students.
- I. Uses strategies to help students understand that results obtained using technology may be misleading and/or misinterpreted.
- J. Recognizes common errors and misconceptions and determines appropriate correction procedures.
- K. Develops assessments based on state and national standards to evaluate students' knowledge of probability and statistics.
- L. Evaluates an assessment for validity with respect to the measured objectives.
- M. Analyzes and uses assessment results from various diagnostic instruments to plan, inform and adjust instruction.
- N. Recognizes how to provide equity for all students in mathematics instruction through reflection on one's own attitudes, expectations and teaching practices.

Competency 018: The Master Mathematics Teacher EC-4 implements a variety of instruction and assessment techniques to guide, evaluate and improve students' learning of probability and statistics concepts, skills and procedures.

- A. Creates a positive learning environment that provides all students with opportunities to develop and improve probability and statistics concepts, skills and procedures.
- B. Knows how to teach probability and statistics concepts, skills, procedures and problem-solving strategies using instructional approaches supported by established research.
- C. Knows how to maximize student/teacher and student/student interaction and analyzes students' abilities to correctly apply new content.
- D. Uses multiple representations, tools and a variety of tasks to promote students' understanding of probability and statistics.
- E. Introduces content by carefully defining new terms using vocabulary that the student already knows.
- F. Uses a variety of questioning strategies to identify, support, monitor and challenge students' mathematical thinking.
- G. Demonstrates classroom management skills, including applying strategies that use instructional time effectively.
- H. Administers a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) consisting of worthwhile tasks that assess mathematical understanding, common misconceptions and error patterns associated with learning probability and statistics.
- I. Evaluates and modifies instruction to improve learning of probability and statistics concepts, skills and procedures for all students based on the results of formal and informal assessments.

DOMAIN V — MATHEMATICAL PROCESSES, PERSPECTIVES, MENTORING AND LEADERSHIP

Standards Assessed: Master Mathematics Teacher EC-4 V, IX-X

Competency 019: The Master Mathematics Teacher EC–4 understands and uses mathematical processes to reason mathematically and solve problems.

- A. Demonstrates an understanding of the use of logical reasoning to evaluate mathematical conjectures and justifications and to provide convincing arguments or proofs for mathematical theorems.
- B. Applies correct mathematical reasoning to derive valid conclusions from a set of premises, and recognizes examples of fallacious reasoning.
- C. Demonstrates an understanding of the use of inductive reasoning to make conjectures and deductive methods to evaluate the validity of conjectures.
- D. Applies knowledge of the use of formal and informal reasoning to explore, investigate and justify mathematical ideas.
- E. Recognizes that a mathematical problem can be solved in a variety of ways and selects an appropriate strategy for a given problem.
- F. Evaluates the reasonableness of a solution to a given problem.
- G. Demonstrates an understanding of estimation and evaluates its appropriate uses.
- H. Uses physical and numerical models to represent a given problem or mathematical procedure.
- I. Recognizes that assumptions are made when solving problems; then identifies and evaluates those assumptions.
- J. Investigates and explores problems that have multiple solutions.
- K. Applies content knowledge to develop a mathematical model of a realworld situation; then analyzes and evaluates how well the model represents the situation.
- L. Develops and uses simulations as a tool to model and solve problems.

Competency 020: The Master Mathematics Teacher EC–4 understands mathematical connections, the structure of mathematics, the historical development of mathematics and how to communicate mathematical ideas and concepts.

- A. Recognizes and uses multiple representations of a mathematical concept.
- B. Uses mathematics to model and solve problems in other disciplines.
- C. Uses the structure of mathematical systems and their properties (e.g., mappings, inverse operations) to make connections among mathematical concepts.
- D. Recognizes the impacts of technological advances on mathematics (e.g., numerical versus analytical solutions) and of mathematics on technology (binary arithmetic).
- E. Emphasizes the role of mathematics in various careers and professions (e.g., economics, engineering) and how technology (e.g., spreadsheets, statistical software) affects the use of mathematics in various careers.
- F. Knows and uses the history and evolution of mathematical concepts, procedures and ideas (e.g., the development of non-Euclidean geometry).
- G. Recognizes the contributions that different cultures have made to the field of mathematics.
- H. Uses current and professional resources to plan and develop activities that provide cultural, historical and technological instruction for the classroom and that connect society and mathematics.
- I. Expresses mathematical statements using developmentally appropriate language, standard English, mathematical language and symbolic mathematics.
- J. Communicates mathematical ideas using a wide range of technological tools and a variety of representations (e.g., numeric, verbal, graphic, pictorial, symbolic, concrete).
- K. Demonstrates an understanding of the use of visual media such as graphs, tables, diagrams and animations to communicate mathematical information.
- L. Uses the language of mathematics as a precise means of expressing mathematical ideas.

Competency 021: The Master Mathematics Teacher EC-4 knows how to communicate and collaborate with educational stakeholders to facilitate implementation of appropriate, standards-based mathematics instruction.

- A. Knows the dual role of the Master Mathematics Teacher as teacher and mentor in the school community.
- B. Knows leadership, communication and facilitation skills and strategies.
- C. Knows and applies principles, guidelines and professional ethical standards regarding collegial and professional collaborations, including issues related to confidentiality.
- D. Understands the importance of collaborating with administrators, colleagues, parents/guardians and other members of the school community to establish and implement the roles of the Master Mathematics Teacher and ensure effective ongoing communication.
- E. Knows strategies for communicating effectively with stakeholders, including other teachers, about using programs and instructional techniques that are based on established research that supports their effectiveness with a range of students, including students who are at-risk.
- F. Knows strategies for building trust and a spirit of collaboration with other members of the school community to effect positive change in the school mathematics program and mathematics instruction.
- G. Knows how to use leadership skills to ensure the effectiveness and ongoing improvement of the school mathematics program, encourage support for the program and engage others in improving the program.
- H. Knows strategies for collaborating with members of the school community to evaluate, negotiate and establish priorities regarding the mathematics program and to facilitate mentoring, professional development and parent/guardian training.
- I. Knows strategies for conferring with students, colleagues, administrators and parents/guardians to discuss mathematics-related issues.
- Knows strategies for collaborating with teachers, administrators and others to identify professional development needs, generate support for professional development programs and ensure provision of effective professional development opportunities.

Competency 022: The Master Mathematics Teacher EC-4 knows how to provide professional development through mentoring, coaching and consultation with colleagues to facilitate implementation of appropriate, standards-based mathematics instruction, and makes instructional decisions supported by established research.

- A. Knows and applies skills and strategies for mentoring, coaching and consultation in the development, implementation and evaluation of an effective mathematics program.
- B. Knows learning processes and procedures for facilitating adult learning.
- C. Knows strategies for facilitating positive change in instructional practices through professional development, mentoring, coaching and consultation.
- D. Knows models and features of effective professional development programs that promote sustained applications in classroom practice (e.g., modeling, coaching, follow-up).
- E. Knows differences between consultation and supervision.
- F. Knows how to use mentoring, coaching and consultation to facilitate team building for promoting student development in mathematics.
- G. Knows how to select and use strategies for collaborating with colleagues to identify needs related to mathematics instruction.
- H. Knows strategies for collaborating effectively with colleagues with varying levels of skill and experience and/or diverse philosophical approaches to mathematics instruction to develop, implement and monitor mathematics programs.
- I. Knows how to select and use strategies to maximize effectiveness as a Master Mathematics Teacher, such as applying principles of time management and engaging in continuous self-assessment.
- Knows sources for locating information about established research on mathematics learning and understands methods and criteria for reviewing research on mathematics learning.
- K. Knows how to critically examine established research on mathematics learning, analyzes its usefulness for addressing instructional needs and applies appropriate procedures for translating research on mathematics learning into practice.