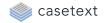
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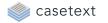
Section 6.64.4.9 - COMPETENCIES FOR ENTRY-LEVEL MATHEMATICS TEACHERS

- **A.** Teachers will understand and use mathematics in problem-solving.
 - (1) Teachers for grades K-8 will be able to:
 - (a) use problem-solving approaches to investigate and understand mathematical content;
 - **(b)** formulate and solve problems from both mathematical and everyday situations;
 - **(c)** identify, select and use appropriate problem-solving strategies; as well as develop and apply their own strategies;
 - (d) verify and interpret solutions to problems;
 - (e) use mathematical language and symbolism to model problem situations.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) use a problem solving approach to investigate and understand mathematical concepts;
 - **(b)** formulate and solve problems from both mathematical and everyday experiences;
 - (c) develop their own processes and techniques for solving problems.
- **B.** Teachers will understand and use mathematics in communication.
 - (1) Teachers for grades K-8 will be able to:
 - (a) identify and define mathematical concepts in a variety of situations;
 - **(b)** communicate mathematical ideas both verbally and in writing;
 - (c) use drawings, discussion, reading, and listening to learn and communicate mathematical ideas;
 - (d) use a variety of electronic media and manipulatives to explore and communicate mathematical concepts and problem solutions.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) develop skills in both written and oral communication of mathematical concepts;
 - **(b)** learn to communicate effectively at various levels of formality and with people who have differing levels of mathematical understanding.
- C. Teachers will understand and use mathematics in reasoning.
 - (1) Teachers for grades K-8 will be able to:

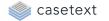


- (a) describe logical conclusions;
- (b) use information sources, models and known facts to explain mathematical thinking;
- (c) make and evaluate mathematical conjectures and validate their own mathematical thinking;
- (d) recognize and construct logical arguments for mathematical statements, concepts, and principles;
- (e) apply a variety of reasoning processes to include deductive and inductive reasoning.
- (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
- (3) Teachers for grades 7-12 will be able to:
 - (a) recognize patterns, make and refine conjectures and definitions, and construct both formal and heuristic proofs;
 - **(b)** judge the validity of mathematical arguments;
 - (c) formulate counterexamples.
- **D.** Teachers will understand and use mathematical connections.
 - (1) Teachers for grades K-8 will be able to:
 - (a) show an understanding of the interrelationships within mathematics;
 - (b) connect mathematics to other disciplines and everyday situations.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) develop an understanding of the interrelationships within mathematics and an appreciation of its unity;
 - **(b)** understand and appreciate the power of mathematical language and symbolism in the development of mathematical concepts;
 - (c) explore the connections between mathematics and other disciplines;
 - (d) apply mathematics learned in one context to other contexts.
- E. Teachers will understand and use numbers, and their relationships, systems and theory.
 - (1) Teachers for grades K-8 will be able to:
 - (a) construct number meanings through everyday experiences and the use of physical materials;
 - (b) understand prenumeration concepts.
 - (c) describe and compare ancient and modern numeration systems by relating counting, grouping, and place value concepts;

- (d) develop number sense;
- (e) identify different sets of numbers in the real number system;
- **(f)** understand representations of numbers, including mixed numbers, fractions, decimals, and scientific notation;
- (g) demonstrate ability to use models to explore and explain relationships among fractions, decimals, percents, ratios, and proportions;
- (h) use the relations of equality and inequality.
- (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
- (3) Teachers for grades 7-12 will be able to: Explore and discuss the properties, relations, and extensions of the real and complex numbers.
- **F.** Teachers will understand and use computation and estimation.
 - (1) Teachers for grades K-8 will be able to:
 - (a) model, explain, and develop proficiency with the basic number facts and algorithms, including addition, subtraction, multiplication and division;
 - **(b)** recognize alternative algorithms for the four basic operations;
 - **(c)** select and use computation techniques appropriate to specific problems and determine the reasonableness of solutions;
 - (d) use estimation strategies;
 - (e) recognize when estimates are appropriate.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) understand and apply numerical computational and estimation techniques and extend them to symbolic expressions;
 - **(b)** use estimation to assess the reasonableness of solutions.
- **G.** Teachers will have a foundation in geometric concepts.
 - (1) Teachers for grades K-8 will be able to:
 - (a) describe, model, draw and classify geometric figures;
 - **(b)** investigate, predict, and describe the results of combining, subdividing and changing shapes;
 - (c) develop spatial sense and relationships;
 - (d) relate geometric and measurement ideas;

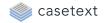


- (e) use geometric concepts and relationships to describe and model mathematical ideas and relationships to the world;
- **(f)** solve simple problems in two- and three-dimensional geometry involving parallelism, perpendicularity, congruence, similarity, translation, reflection, rotation, symmetry, and incidence.
- (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
- (3) Teachers for grades 7-12 will be able to:
 - (a) understand the role of axiomatic systems in geometry;
 - **(b)** develop both synthetic and algebraic geometric concepts using coordinates and vectors;
 - (c) use geometry as a source of mathematical models for a variety of applications;
 - (d) employ geometric reasoning as a problem solving strategy;
 - (e) model features of the real world using different geometries.
- **H.** Teachers will understand and use measurement.
 - (1) Teachers for grades K-8 will be able to:
 - (a) determine what needs to be measured, select an appropriate unit of measurement, and then select an appropriate tool with which to measure;
 - **(b)** use standard and nonstandard units for measurement to an appropriate degree of accuracy;
 - **(c)** use estimation, informal procedures, and formulas to solve problems involving linear measures, area, volume, mass, and temperature by using both traditional and metric systems.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) identify and use the appropriate units, tools of measurement, and degree of accuracy required in particular problems, making calculations of relative error as necessary;
 - **(b)** apply measurement as a tool in other disciplines.
- I. Teachers will understand and use statistics and probability.
 - (1) Teachers for grades K-8 will be able to:
 - (a) collect data from real world experiences or surveys, organize and display data using various charts/graphs manually and by using appropriate technology, analyze and interpret the data, and write convincing arguments based on the data;
 - **(b)** solve elementary statistical problems relating to measures of central tendency, measures of dispersion, regression equations, and non-linear regression;



- (c) critically examine and analyze data for reliability and validity;
- (d) demonstrate an understanding of randomness by conducting sampling experiments;
- **(e)** find experimental and theoretical discrete probabilities using sample spaces, tree diagrams, and other representations;
- (f) plan and conduct simulations to determine experimental probabilities;
- (g) compute the mathematical expectation of simple games and lotteries;
- **(h)** solve simple problems involving probability, inference, and the testing of hypotheses;
- (i) use simple combinations and permutations to solve counting problems.
- (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
- (3) Teachers for grades 7-12 will be able to:
 - (a) understand measures of central tendency, variability, and correlation;
 - (b) collect, display, analyze, and interpret sample data in a variety of situations;
 - (c) investigate the role of estimation and probability in statistical analysis;
 - (d) use experimental and theoretical probabilities to formulate and solve problems;
 - (e) develop strategies for reasoning and making decisions based on uncertainty;
 - **(f)** explore the probabilistic nature of statistical analyses including hypothesis testing, correlation, analysis of variance, and nonparametric methods.
- J. Teachers will understand and use patterns and functions.
 - (1) Teachers for grades K-8 will be able to:
 - (a) recognize, describe, extend, and create a wide variety of patterns;
 - **(b)** represent relationships with manipulatives, tables, graphs, verbal and written statements, and formulas;
 - **(c)** describe what a function means both intuitively and using formal mathematical language;
 - (d) demonstrate a basic understanding of classes of functions and their properties; e.g. linear, exponential, polynomial, and periodic.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) use multiple representations of functions, including symbolic expressions, verbal descriptions, tables, and graphs, and relate one representation to another;

- **(b)** use the language of functions to describe and model change;
- (c) use the concept of function in the study of mathematics and other disciplines.
- **K.** Teachers will understand and apply algebraic concepts.
 - (1) Teachers for grades K-8 will be able to:
 - (a) explore and use variables and open sentences to express mathematical relationships;
 - **(b)** solve real world problems involving linear and quadratic equations and inequalities by using traditional techniques and graphing methods that use technology.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) understand and apply the major concepts of linear and abstract algebra;
 - **(b)** use theoretical results to understand tangible situations.
- L. Teachers will understand and apply concepts of calculus.
 - (1) Not required of teachers for grades K-8.
 - (2) Teachers for grade 5-9 will be able to:
 - (a) recognize particular types of change such as linear, quadratic and exponential;
 - **(b)** use graphs, diagrams, charts, physical models, and graphing technology to explore the notions of limit, differentiation, and integration, and interpret the relationships among them;
 - **(c)** construct infinite sequences and series, relating them to non-terminating decimals and the approximation of functions;
 - (d) solve real world problems involving average and instantaneous rates of change, area, volume, and curve length, and relate those to differentiation and integration.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) investigate the phenomenon of change as a limiting process;
 - **(b)** explore intuitively and in depth the concepts of limit, continuity, differentiation, and integration;
 - (c) demonstrate an understanding of the underlying theory of analysis;
 - (d) use properties and techniques of calculus to model phenomena in diverse settings.
- **M.** Teachers will understand and apply discrete processes.
 - (1) not required of teachers for grades K-8;
 - (2) not required of teachers for grades 5-9;



- (3) teachers for grades 7-12 will be able to: understand concepts and applications of discrete mathematics, such as graph theory, recurrence relations, linear programming, difference equations, and combinatorics.
- N. Teachers will understand the use of technology.
 - (1) Teachers for grades K-8 will be able to:
 - (a) use calculators and computers to represent mathematical ideas and construct different representations of mathematical concepts;
 - **(b)** use calculators and computers to develop and use alternate strategies for solving problems;
 - (c) use networking and information technologies to solve problems and broaden the scope of inquiry.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) engender a broad array of mathematical modes of thinking through the use of powerful computing tools (including function graphers, curve fitters, symbolic manipulators, dynamic geometric software, and programming languages);
 - **(b)** use calculators, spreadsheets, and statistical packages to solve problems;
 - (c) use technology to explore probabilities through simulations;
 - (d) use graphing calculators and computer algebra systems in the study and application of the calculus.
- **O.** Teachers will develop perspectives on mathematics as a human endeavor.
 - (1) Teachers for grades K-8 will be able to:
 - (a) understand the dynamic nature of mathematics and its increasingly significant role in social, cultural, and economic development;
 - **(b)** develop an appreciation for the contributions made by various cultures to the growth and development of mathematical ideas;
 - (c) investigate the contributions made by individuals, both female and male, and from a variety of cultures, in the development of ancient, modern, and current mathematical topics;
 - (d) gain an understanding of the historical development of major school mathematics concepts.
 - (2) Teachers for grades 5-9 will be able to meet the standards set for K-8 teachers.
 - (3) Teachers for grades 7-12 will be able to:
 - (a) explore the dynamic nature of mathematics and its increasingly significant role in social, cultural, and economic development;

- **(b)** gain an understanding of the historical development of major school mathematics concepts;
- **(c)** understand the historical development of non-Euclidean geometries and the questions relating to the parallel postulate involved in this development;
- (d) develop an appreciation of the contributions made by the various cultures to the growth and development of mathematical ideas;
- **(e)** investigate the contributions made by individuals, both female and male, and from a variety of cultures, in the development of ancient, modern, and current mathematical topics.

N.M. Code R. § 6.64.4.9

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