

***NCTM NCATE Mathematics Content for Elementary Mathematics Specialist
Addendum to the NCTM NCATE Standards 2012***

C. Elementary Mathematics Specialist

All elementary mathematics specialists should be prepared with depth and breadth in the following mathematical content domains: Number and Operations, Algebra, Geometry and Measurement, Statistics and Probability. All teachers certified as elementary mathematics specialists should know, understand, teach, and be able to communicate their mathematical knowledge with the breadth of understanding reflecting the following competencies for each of these domains.

C.1. Number and Operations

To be prepared to support the development of student mathematical proficiency, all elementary mathematics specialists should know the following topics related to number and operations with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models:

- C.1.1 Counting and cardinality, comparing and ordering, understanding the structure of the base ten number system with particular attention to place value, order of magnitude, one-to-one correspondence, properties, and relationships in numbers and number systems – whole numbers, integers, rationals, irrationals, and reals
- C.1.2 Arithmetic operations (addition, subtraction, multiplication, and division) including mental mathematics and standard and non-standard algorithms, interpretations, and representations of numbers – whole numbers, fractions, decimals, integers, rationals, irrationals, and reals
- C.1.3 Fundamental ideas of number theory – divisors, factors and factorization, multiples, primes, composite numbers, greatest common factor, and least common multiple
- C.1.4 Quantitative reasoning and relationships that include ratio, rate, proportion, and the use of units in problem situations
- C.1.5 Historical development and perspectives of number, operations, number systems, and quantity including contributions of significant figures and diverse cultures

C.2. Algebra

To be prepared to support the development of student mathematical proficiency, all elementary mathematics specialists should know the following topics related to algebra with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models:

- C.2.1 Algebraic notation, symbols, expressions, equations, inequalities, and proportional relationships, and their use in describing, interpreting, and modeling relationships and operations

- C.2.2 Function classes including constant, linear, quadratic, polynomial, exponential, and absolute value, and how choices of parameters determine particular cases and model real-world situations
- C.2.3 Functional representations (tables, graphs, equations, descriptions, and recursive definitions), characteristics (e.g., zeros, average rates of change, domain and range), and notations as a means to describe, interpret, and analyze relationships and to build new functions
- C.2.4 Patterns of change in linear, quadratic, polynomial, and exponential functions and in proportional and inversely proportional relationships and types of real-world relationships these functions can model
- C.2.5 Historical development and perspectives of algebra including contributions of significant figures and diverse cultures

C.3. Geometry and Measurement

To be prepared to support the development of student mathematical proficiency, all elementary mathematics specialists should know the following topics related to geometry and measurement with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models:

- C.3.1 Core concepts including angle, parallel, and perpendicular, and principles of Euclidean geometry in two and three dimensions
- C.3.2 Transformations including dilations, translations, rotations, reflections, glide reflections; compositions of transformations; and the expression of symmetry and regularity in terms of transformations
- C.3.3 Congruence, similarity and scaling, and their development and expression in terms of transformations
- C.3.4 Basic geometric figures in one, two, and three dimensions (line segments, lines, rays, circles, arcs, polygons, polyhedral solids, cylinders, cones, and spheres) and their elements (vertices, edges, and faces)
- C.3.5 Identification, classification into categories, visualization, two- and three-dimensional representations, and formula rationale and derivation (perimeter, area, and volume) of two- and three-dimensional objects (triangles; classes of quadrilaterals such as rectangles, parallelograms, and trapezoids; regular polygons; rectangular prisms; pyramids; cones; cylinders; and spheres)
- C.3.6 Geometric measurement and units (linear, area, surface area, volume, and angle), unit comparison, and the iteration, additivity, and invariance related to measurements

- C.3.7 Geometric constructions, axiomatic reasoning, and making and proving conjectures about geometric shapes and relations
- C.3.8 Coordinate geometry including the equations of lines and algebraic proofs (e.g., Pythagorean Theorem and its converse)
- C.3.9 Historical development and perspectives of geometry and measurement including contributions of significant figures and diverse cultures

C.4. Statistics and Probability

To be prepared to support the development of student mathematical proficiency, all elementary mathematics specialists should know the following topics related to statistics and probability with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models:

- C.4.1 Statistical variability and its sources and the role of randomness in statistical inference
- C.4.2 Construction and interpretation of graphical displays of univariate and bivariate data distributions (e.g., box plots and histograms), summary measures (mean, median, mode, interquartile range, and mean absolute deviation) and comparison of distributions of univariate data, and exploration of categorical (discrete) and measurement (continuous) data
- C.4.3 Empirical and theoretical probability for both simple and compound events
- C.4.4 Random (chance) phenomena and simulations
- C.4.5 Historical development and perspectives of statistics and probability including contributions of significant figures and diverse cultures