The beginning (pre-service) mathematics teacher will demonstrate knowledge of and/or competency in the following areas of study:

For the teacher of:	Grades 1-6
1. Mathematical Processes and Tools: The beginning teacher of mathematics understands mathematical process and tools, and makes these aspects of subject matter meaningful for students. **1997 SSC: 1; CR 1-4, a-h**	1. use problem solving to investigate and understand mathematical content. (G 1.2, 3.5-6; ACEI 2c; NCTM P1.1.1, M1.1.1, S1.1.1; MAA I.2)
	2. communicate mathematical ideas in writing and orally, using mathematical language and symbols. (G 2.1, 4.1; ACEI 2c; NCTM P1.2.1, M1.2.1, S1.2.1; MAA I.2, I.3)
	3. develop and evaluate mathematical conjectures and arguments to explain and validate mathematical reasoning. (ACEI 2c; NCTM P1.3, M1.3, S1.3; MAA I.1, IV.2, IV.7)
	4. use mathematical modeling to simulate events and occurrences. (G 1.8, 3.2; ACEI 2c; NCTM M1.5, S1.5.4, S1.5.11; MAA I.4)
	5. analyze and articulate connections within mathematics (G 1.6; ACEI 2c; NCTM P1.4.2, M1.4.2, S1.4.2; MAA I.2)
	6. analyze and articulate connections of mathematics to other disciplines through applications (G 2.4; ACEI 2c; NCTM P1.4.2, M1.4.2, S1.4.2; MAA I.2)
	7 . understand historical development of mathematics, including the contributions of under-represented groups and diverse cultures. (G 2.3, 2.4; ACEI 2c; NCTM P1.7, M1.8, S1.7; MAA I.6, II.2, IV.1, IV.2)
	8. use manipulatives to model and explain mathematical concepts. (G 1.4, 4.1; ACEI 2c; NCTM P1.7, M1.8, S1.7; MAA I.6, III.2, IV.1, IV.2)
	9. articulate the dynamic nature of mathematics and its significant role in social, cultural, and economic development. (G 1.6, 1.10, 4.1; ACEI 2c; NCTM S1.4.1; MAA I.3, I.6)
	10. use calculators and computers as tools to generate multiple representations of mathematical concepts. (ACEI 2c; MAA I.5)
	11. demonstrate facility with technological tools to support geometric construction/investigation, graphing, pattern exploration, and data investigation. (G 2.7; ACEI 2c; NCTM P2.3, M2.2, S2.2; MAA I.5)
	12. understand and articulate the role of technology in supporting the development of mathematical understanding. (G 1.4; ACEI 2c; NCTM P1.6.1, P1.6.2, M1.7.2, S1.6.1, S1.6.2)

2: Number Operation: The beginning teacher of mathematics understands numbers and their operations and makes these aspects of subject matter meaningful for students. **1997 SSC: 2; CR 1 2, b, c**	1. understand properties of real numbers, including equivalent representations. (M.1; ACEI 2c; NCTM P1.6.1, M1.7.1, M1.7.2, S1.6.1, S1.6.2; MAA II.1, III.1)
	2. analyze effects of and relationships among operations on real numbers, including place value (e.g., how place value permits efficient representation of whole numbers and finite decimals; that the value of each place is ten times larger than the value of the next place to the right; implications of place value for ordering numbers, estimation, and approximation; the relative magnitude of numbers) and concepts of integers and rationales (e.g., definitions of integer and rational number; a sense of their relative size; how operations on whole numbers extend to integers and rational numbers; and the behavior of units under the operations) (M1; ACEI 2c; NCTM P1.5.1, P1.5.4; MAA II.1)
	3. use estimation in working with quantities, measurement, computation, and problem solving. (M.1; ACEI 2c; NCTM P1.5.10; MAA II.1)
	4. develop, use, model, and explain computational algorithms, including multi-digit calculations involving standard algorithms, Amental math,@ and non-standard methods commonly created by students, the reasoning behind the procedures, how the base-10 structure of a number is used in these calculations. (M.1; ACEI 2c; NCTM P1.5.10; MAA II.1)
	5. understand and apply numerical computation techniques (mental, paper/pencil, calculator) and extend them to algebraic expressions. (M 2; ACEI 2c; NCTM P1.5.3, M1.6.2, S1.5.3)
	6. understand a large repertoire of interpretations of addition, subtraction, multiplication, and division and of ways they can be applied.
3: Geometry and Measurement: The beginning teacher of mathematics understands the central concepts, tools of inquiry, and structures of geometry and measurement and makes these aspects of subject matter meaningful for students. **1997 SSC:3; CR 3**	1. understand and apply various systems and tools of measurement and the process of measurement (e.g., understanding the idea of a unit and the need to select a unit appropriate to the attribute being measured, knowing the standard [English and metric] systems of units, understanding that measurements are approximate and that different units affect precision, comparing units and converting measurements from one unit to another. (M 2; ACEI 2c; NCTM P1.5.5, M1.6.3, S1.5.3)
	2. understand and apply Euclidean geometric concepts, properties, and relationships to describe and model mathematical ideas in real-world constructs, including technical vocabulary and the role of mathematical definition. (M 2; ACEI 2c; NCTM P1.5.6, M1.6.4, S1.5.4; MAA III.2)
	3. identify, describe, measure, compare, classify, and represent two- and three-dimensional figures. (M 2; ACEI 2c; MAA II.2)

	n/a
	5. understand and apply concepts of motion in two-dimensional space through transformations, including familiarity with projections, cross-sections, and decompositions of common two-dimensional shapes (M 2; ACEI 2c; MAA III.2)
4: Data Analysis, Probability, and Statistics: The beginning teacher of mathematics understands the central concepts, tools of inquiry, and structures of data analysis, probability, and statistics and makes these aspects of subject matter meaningful for students. **1997 SSC:4; CR e**	1. collect, organize, and display data in meaningful form(s) by describing data (e.g., understanding shape, spread, and center; using different forms of representation; comparing two sets of data) (M 3, 1.8, 2.1; ACEI 2c; NCTM P1.5.7, M1.6.5, S1.5.5; MAA II.4, III.4, IV.4)
	2. use experimental and theoretical probabilities as appropriate to formulate and solve problems involving uncertainty. (M 3, 1.8, 2.1; ACEI 2c; NCTM P1.5.8, M1.6.5, S1.5.6; MAA II.4, III.4, IV.4
	3. use descriptive statistics (e.g., measures of central tendency and dispersion) to analyze data and to make predictions and decisions; choose among representations and summary statistics to communicate conclusions; understand variability; understand some of the difficulties arising in sampling and inference. (M 3; ACEI 2c; NCTM P1.5.8; MAA II.4)
	4. understand the kinds of questions that can be addressed by data, create data sets, and move back and forth between the question (i.e., the purpose of the study) and its design.
5: Patterns, Functions, & Relationships: The beginning teacher of mathematics understands patterns, functions, and relationships and makes these aspects of subject matter meaningful for students. **1997 SSC:5; CR 1-4, a-h**	1. identify and describe patterns and relationships. (M 4, 1.6; ACEI 2c; NCTM P1.3; MAA II.3)
	2. represent and justify patterns and functions in multiple ways, including reading and creating graphs of functions; reading and creating formulas (in closed and recursive forms) and tables; and understanding the characteristics of particular classes of functions on integers. (M 4, 1.6, 2.2, 3.4; ACEI 2c; NCTM P1.5.9, M1.6.6, S1.5.7; MAA I.3, II.3, IV.3, III.3)
	3. discover and analyze functional relations which arise from diverse problem situations. (ACEI 2c; NCTM E1.4.1)
	4. represent and justify general arithmetic claims, using a variety of representations including algebraic notation; understand different forms of argument; and devise deductive arguments.
	5. use algebraic notation to represent calculation, to express identities, and to solve problems. (M 4; ACEI 2c; MAA II.3)

6: Mathematical Systems: The beginning teacher of mathematics understands the central concepts, tools of inquiry, and structures of mathematical systems and makes these aspects of subject matter meaningful for students. **1997 SSC:6; CR 2, 3, h**	n/a
7: Discrete Mathematics: The beginning teacher of mathematics understands the central concepts, tools of inquiry, and structures of discrete mathematics and makes these aspects of subject matter meaningful for students. **1997 SSC:7; CR 1-4, b, d-f**	1. use a variety of counting techniques and principles (e.g., permutations and combinations). (M 6; ACEI 2c; NCTM S1.5.10; MAA IV.6) 2. identify, model, and analyze situations represented by discrete and continuous data. (M 6; ACEI 2c; NCTM P, M, S1.5.10)
8: Concepts of Calculus: The beginning teacher of mathematics understands the central concepts, tools of inquiry, and structures of the calculus and makes these aspects of subject matter meaningful for students. **1997 SSC:8; CR 1, d**	n/a