Assessment 6: Content Assessment

a. Description of the Assessment:
Prior to admission to internship, candidates are required to successfully complete a content portfolio providing evidence that they are prepared with depth and breadth in the following mathematical domains: Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus and Discrete Mathematics. Candidates must successfully complete this portfolio in order to pass MTH4893 Special Methods – Mathematics.

The Mathematics Content Portfolio is designed to demonstrate knowledge of major concepts, algorithms, and procedures within and among mathematical domains (Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics) as outlined in the NCTM CAEP (NCATE) Mathematics Content for Secondary.

The portfolio is a collection of artifacts providing evidence of the candidate's ability to

- Apply knowledge of major concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains.
- Explain how concepts, algorithms, procedures, and applications have developed.
- Apply conceptual and procedural knowledge of major concepts, algorithms, and applications in building new knowledge from prior knowledge and experiences.

Artifacts are ***graded*** coursework that might include but not limited to exams, homework, project, lesson plan, paper, journals etc. Grades must support proficiency as described in the assessment tool.

Candidates must demonstrate proficiency in ***each*** component of the competency to earn an acceptable rating for that competency. Candidates must earn an acceptable rating for ***each*** competency within ***each*** domain. After the initial review, candidates have an opportunity to revise the portfolio. For each domain with an unacceptable rating, a faculty mentor will help the candidate identify content resources and materials that would sufficiently align to any components with unacceptable ratings. The candidate is required to complete additional assigned work in cases where grades do not support proficiency. Such work, graded by the faculty mentor would then be resubmitted as artifacts in the Mathematics Content Portfolio and the portfolio will be re-graded by a departmental committee. Candidates must successfully complete this portfolio in order to pass MTH4893 Special Methods – Mathematics.

b. Alignment of Assessment to the NCTM Standards and Elements:

Please see the Scoring Guide in Part f for a more detailed alignment.

Standard 1: NCTM CAEP Content Standard Domains	**Competencies Addressed**
A.1 Number and Quantity	A.1.1, A.1.2, A.1.3, A.1.4
A.2 Algebra	A.2.1, A.2.2, A.2.3, A.2.4, A.2.5, A.2.6
A.3 Geometry and Trigonometry	A.3.1, A.3.2, A.3.3, A.3.4, A.3.5, A.3.6, A.3.7, A.3.8, A.3.9
A.4 Statistics and Probability	A.4.1, A.4.2, A.4.3, A.4.4, A.4.5
A.5 Calculus	A.5.1, A.5.2, A.5.3, A.5.4, A.5.5
A.6 Discrete Mathematics	A.6.1, A.6.2, A.6.3, A.6.4

c. Analysis of the data findings:

This assessment was created in the spring of 2014. The data for this assessment is collected during MTH 4893 Special Methods – Mathematics. One candidate was enrolled in MTH 4893 in the spring of 2014, and two candidates were enrolled in the fall of 2014. So the two administrations of this assessment are limited to the performance of three (3) candidates.

Data table A summarizes the candidates' performance in each rubric criteria and provides evidence supporting proficiency in all but four of the NCTM CAEP standard one competencies represented. Specifically, the spring 2014 and the fall 2014 candidates collectively were able to demonstrate proficiency for each of the domain competencies assessed with the exception of the A.1.1, A.1.3, A.2.6, and A.4.2 competencies.

The spring of 2014 candidate met minimum expectations for all rubric criteria. One of the fall 2014 candidates failed to meet minimum expectations for criteria A.1.1. One of the fall 2014 candidates failed to meet minimum expectations for criteria A.1.3. Both of the fall 2014 candidates failed to meet minimum expectations for criteria A.2.6 and A.4.2.

See Data Table A for the complete data set.

d. Interpretation of how that data provides evidence for meeting standards:

This assessment was created in the spring of 2014 to collect additional content knowledge data. In future administrations, this portfolio will be assigned as candidates declare secondary mathematics licensure as a major allowing them to build a portfolio during their program of study. The portfolio must be completed at the end of their program of study during MTH 4893 Special Methods – Mathematics. Candidates must successfully complete this portfolio in order to pass MTH4893 Special Methods – Mathematics.

For the first two administrations of this assessment, the portfolio assignment was made during MTH 4893 Special Methods – Mathematics, at the end of their program of study. This was particularly problematic for the candidates due to the portfolio being so extensive and the limited amount of time to address any areas that were unacceptable. The spring 2014 candidate was allowed additional time during the summer to complete the portfolio. This candidate was able to successfully complete the project.

The fall 2014 candidates were notified of the assignment during the spring of 2014, but both candidates chose to wait until the fall semester to begin working on the portfolio. One of the candidates had not kept any previous course materials. The MTH 4893 instructor worked with the other mathematics faculty to collect and duplicate final exams for use in the candidates' portfolios. After the initial assessment of the portfolios and unacceptable competencies were identified, the candidates chose faculty mentors for each domain with unacceptable ratings. In both cases, the candidates did not work with their faculty mentor at all for one or more of the domains with unacceptable ratings. The portfolios were rated four times through out the semester.

It became clear early in the semester that there were serious concerns regarding the [redacted] fall 2014 candidates. The MTH 4893 instructor, the candidates' advisors, the department chair, and the Teachers College Intervention Team each counseled with the two candidates throughout the semester to no avail. Both candidates were unable to demonstrate proficiency in all the assessment 6 competencies. Unable to pass MTH 4893, the candidates chose to withdraw from the course. Each of the candidates later chose to change their major.

The unique circumstances associated to the fall 2014 candidates do serve to support the fact that standards are held in the highest regard and not compromised. The standards

and expectations are clearly communicated to candidates. There are structures in place to intervene and support candidates that are not successful. But candidates not meeting those standards are not "passed" through the system.

Just for clarification, it bears repeating that the spring 2014 and the fall 2014 candidates collectively were able to demonstrate proficiency for each of the domain competencies assessed with the exception of four competencies A.1.1, A.1.3, A.2.6, and A.4.2.

e. Assessment Tool:

Candidates must demonstrate proficiency in ***each*** component of the competency to earn an acceptable rating for that competency. Candidates must earn an acceptable rating for ***each*** competency within ***each*** domain. After the initial review, candidates have an opportunity to revise the portfolio. For each domain with an unacceptable rating, a faculty mentor will help the candidate identify content resources and materials that would sufficiently align to any components with unacceptable ratings. The candidate may be required to complete additional assigned work in cases where course materials were not kept. Such work, graded by the faculty mentor would then be resubmitted as artifacts in the Mathematics Content Portfolio and the portfolio will be re-graded by a departmental committee. Candidates must successfully complete this portfolio in order to pass MTH4893 Special Methods – Mathematics.

Each competency will be rated using the below rubric.		
Target	Acceptable	Unacceptable

• Artifacts align to each component of the competency.
• Each artifact shows full grasp of the aligned competency component.
  ○ Numerical score of each artifact is equivalent to 80% or better.
OR
  ○ Rubric score of each artifact equivalent to acceptable or better with at least 50% being met at the target level.
• Artifacts include evidence that content understanding is supported by appropriate mathematical practices, technology, varied representational tools, including concrete models.
	• Artifacts align to each component of the competency.
	• Collectively the artifacts show essential grasp of the central ideas of each competency component.
	  ○ Numerical score of each artifact is equivalent to 70% or better.
	OR
	  ○ Rubric score of each artifact equivalent to acceptable or better.
	• Artifacts include evidence that content knowledge is supported by appropriate mathematical practices, technology, varied representational tools, including concrete models.
		• Artifacts do not align to each component of the competency.
		OR
		• Artifacts do not meet the minimum expectation of mastery.
		OR
		• Artifacts do not include evidence of appropriate mathematical practices, technology, varied representational tools, or concrete models support content understanding.

f. The Scoring Guide:

Appendix

Secondary Mathematics Content Portfolio Rubric

g. Data:

Data Table A
Secondary Mathematics Content Portfolio
Undergraduate Program Candidates

*Each indicator is rated as: target (3), acceptable (2), or unacceptable (1).

Rubric Criteria (NCTM CAEP Standard 1 Competency Alignment)	Spring 2014			Fall 2014		
	Mean Criteria Score*	Number of Completers	% of Completers Meeting Minimum Expectation (Acceptable better)	Mean Criteria Score* and (Range)	Number of Completers	% of Completers Meeting Minimum Expectation (Acceptable better)
A.1.1	2	[redacted]	100%	1.5 (1-2)	[redacted]	50%
A.1.2	2	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.1.3	2	[redacted]	100%	1.5 (1-2)	[redacted]	50%
A.1.4	2	[redacted]	100%	2.5 (2-3)	[redacted]	100%
A.2.1	2	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.2.2	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.2.3	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.2.4	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.2.5	2	[redacted]	100%	2.5 (2-3)	[redacted]	100%
A.2.6	2	[redacted]	100%	1.0 (1-1)	[redacted]	0%

Data Table A (continued) *Each indicator is rated as: target (3), acceptable (2), or unacceptable (1).						
Rubric Criteria (NCTM CAEP Standard 1 Competency Alignment)	Spring 2014			Fall 2014		
	Mean Criteria Score*	Number of Completers	% of Completers Meeting Minimum Expectation (Acceptable better)	Mean Criteria Score* and (Range)	Number of Completers	% of Completers Meeting Minimum Expectation (Acceptable better)
A.3.1	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.3.2	2	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.3.3	2	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.3.4	2	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.3.5	2	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.3.6	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.3.7	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.3.8	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.3.9	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.4.1	3	[redacted]	100%	2.5 (2-3)	[redacted]	100%
A.4.2	3	[redacted]	100%	1.0 (1-1)	[redacted]	0%
A.4.3	3	[redacted]	100%	3.0 (3-3)	[redacted]	100%
A.4.4	2	[redacted]	100%	3.0 (3-3)	[redacted]	100%
A.4.5	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%

Data Table A (continued) *Each indicator is rated as: target (3), acceptable (2), or unacceptable (1).						
Rubric Criteria (NCTM CAEP Standard 1 Competency Alignment)	Spring 2014			Fall 2014		
	Mean Criteria Score*	Number of Completers	% of Completers Meeting Minimum Expectation (Acceptable better)	Mean Criteria Score* and (Range)	Number of Completers	% of Completers Meeting Minimum Expectation (Acceptable better)
A.5.1	3	[redacted]	100%	2.5 (2-3)	[redacted]	100%
A.5.2	2	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.5.3	3	[redacted]	100%	2.5 (2-3)	[redacted]	100%
A.5.4	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.5.5	2	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.6.1	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.6.2	3	[redacted]	100%	2.0 (2-2)	[redacted]	100%
A.6.3	3	[redacted]	100%	3.0 (3-3)	[redacted]	100%
A.6.4	3	[redacted]	100%	2.5 (2-3)	[redacted]	100%

Secondary Mathematics Content Portfolio

All secondary mathematics internship candidates should be prepared with depth and breadth in the following mathematical domains: Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus and Discrete Mathematics. All candidates qualified to intern in secondary mathematics should know, understand, and teach with the breadth of understanding reflecting the following competencies for each of these domains.

The Mathematics Content Portfolio should demonstrate knowledge of major concepts, algorithms, and procedures within and among mathematical domains (Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics) as outlined in the NCTM CAEP (NCATE) Mathematics Content for Secondary.

Artifacts should provide evidence of the candidate's ability to

- Apply knowledge of major concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains.
- Explain how concepts, algorithms, procedures, and applications have developed.
- Apply conceptual and procedural knowledge of major concepts, algorithms, and applications in building new knowledge from prior knowledge and experiences.

Portfolios should be organized in a 3-ring binder with 6 tabs, one for each domain. Each domain should include a typed competency alignment followed by a typed table of contents. Each competency must be clearly labeled within its designated artifacts. Artifacts may be used more than once. Do not cross reference a domain outside of its designated tab. If an artifact is to be used for more than one domain, place a copy of the artifact within the tab for each domain as needed.

Artifacts should be ***graded*** coursework. Possible artifacts might include but are not limited to exams, homework, project, lesson plan, paper, journals etc. If the grade does not support proficiency with the aligned competency, then the candidate may attach corrections and or a reflection. Such attachments much be clearly identified.

Scoring

Candidates must demonstrate proficiency in ***each*** component of the competency to earn an acceptable rating for that competency. Candidates must earn an acceptable rating for ***each*** competency within ***each*** domain. After the initial review, candidates have an opportunity to revise the portfolio. For each domain with an unacceptable rating, a faculty mentor will help the candidate identify content resources and materials that would sufficiently align to any components with unacceptable ratings. The candidate may be required to complete additional assigned work in cases where course materials were not kept. Such work, graded by the faculty mentor would then be resubmitted as artifacts in the Mathematics Content Portfolio and the portfolio will be re-graded by a departmental committee. Candidates must successfully complete this portfolio in order to pass MTH4893 Special Methods – Mathematics.

Secondary Mathematics Content Portfolio

Each competency will be rated using the below rubric.		
Target	**Acceptable**	**Unacceptable**

• Artifacts align to each component of the competency.
• Each artifact shows full grasp of the aligned competency component.
  ○ Numerical score of each artifact is equivalent to 80% or better.
  OR
  ○ Rubric score of each artifact equivalent to acceptable or better with at least 50% being met at the target level.
• Artifacts include evidence that content understanding is supported by appropriate mathematical practices, technology, varied representational tools, including concrete models.
	• Artifacts align to each component of the competency.
	• Collectively the artifacts show essential grasp of the central ideas of each competency component.
	  ○ Numerical score of each artifact is equivalent to 70% or better.
	  OR
	  ○ Rubric score of each artifact equivalent to acceptable or better.
	• Artifacts include evidence that content knowledge is supported by appropriate mathematical practices, technology, varied representational tools, including concrete models.
		• Artifacts do not align to each component of the competency.
		  OR
		• Artifacts do not meet the minimum expectation of mastery.
		  OR
		• Artifacts do not include evidence of appropriate mathematical practices, technology, varied representational tools, or concrete models support content understanding.

Secondary Mathematics Content Portfolio

Domain A.1 Number and Quantity Alignment

To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to number and quantity with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models:

Competency	Rating
A.1.1 Structure, properties, relationships, operations, and representations including standard and non-standard algorithms, of numbers and number systems including integer, rational, irrational, real, and complex numbers	
A.1.2 Fundamental ideas of number theory (divisors, factors and factorization, primes, composite numbers, greatest common factor, least common multiple, and modular arithmetic)	
A.1.3 Quantitative reasoning and relationships that include ratio, rate, and proportion and the use of units in problem situations	
A.1.4 Vector and matrix operations, modeling and applications	

Secondary Mathematics Content Portfolio

Domain A.2 Algebra Alignment

To be prepared to develop student mathematical proficiency, all secondary mathematics teachers 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:

Competency	Rating
A.2.1 Algebraic notation, symbols, expressions, equations, inequalities, and proportional relationships, and their use in describing, interpreting, modeling, generalizing, and justifying relationships and operations	
A.2.2 Function classes including polynomial, exponential and logarithmic, absolute value, rational, and trigonometric, including those with discrete domains (e.g., sequences), and how the choices of parameters determine particular cases and model specific situations	
A.2.3 Functional representations (tables, graphs, equations, descriptions, recursive definitions, and finite differences), characteristics of functions (e.g., zeros, intervals of increase or decrease, extrema, average rates of change, domain and range, and end behavior), and notations as a means to describe, reason, interpret, and analyze relationships and to build new functions	
A.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	
A.2.5 Linear algebra including vectors, matrices, and transformations	
A.2.6 Abstract algebra, including groups, rings, and fields, and the relationship between these structures and formal structures for number systems and numerical and symbolic calculations	

Secondary Mathematics Content Portfolio

Domain A.3 Geometry and Trigonometry Alignment

To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to geometry and trigonometry with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models:

Competency	Rating
A.3.1 Core concepts and principles of Euclidean geometry in two and three dimensions and two-dimensional non-Euclidean geometries	
A.3.2 Transformations including dilations, translations, rotations, reflections, glide reflections; compositions of transformations; and the expression of symmetry in terms of transformations	
A.3.3 Congruence, similarity and scaling, and their development and expression in terms of transformations	
A.3.4 Right triangles and trigonometry	
A.3.5 Application of periodic phenomena and trigonometric identities	
A.3.6 Identification, classification into categories, visualization, and representation of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, prisms, pyramids, cones, cylinders, and spheres)	
A.3.7 Formula rationale and derivation (perimeter, area, surface area, and volume) of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, rectangular prisms, pyramids, cones, cylinders, and spheres), with attention to units, unit comparison, and the iteration, additivity, and invariance related to measurements	
A.3.8 Geometric constructions, axiomatic reasoning, and proof	
A.3.9 Analytic and coordinate geometry including algebraic proofs (e.g., the Pythagorean Theorem and its converse) and equations of lines and planes, and expressing geometric properties of conic sections with equations	

Secondary Mathematics Content Portfolio

Domain A.4 Statistics and Probability Alignment

To be prepared to develop student mathematical proficiency, all secondary mathematics teachers 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:

Competency	Rating
A.4.1 Statistical variability and its sources and the role of randomness in statistical inference	
A.4.2 Creation and implementation of surveys and investigations using sampling methods and statistical designs, statistical inference (estimation of population parameters and hypotheses testing), justification of conclusions, and generalization of results	
A.4.3 Univariate and bivariate data distributions for categorical data and for discrete and continuous random variables, including representations, construction and interpretation of graphical displays (e.g., box plots, histograms, cumulative frequency plots, scatter plots), summary measures, and comparisons of distributions	
A.4.4 Empirical and theoretical probability (discrete, continuous, and conditional) for both simple and compound events	
A.4.5 Random (chance) phenomena, simulations, and probability distributions and their application as models of real phenomena and to decision making	

Domain A.5 Calculus Alignment

To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to calculus with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models:

Competency	Rating
A.5.1 Limits, continuity, rates of change, the Fundamental Theorem of Calculus, and the meanings and techniques of differentiation and integration	
A.5.2 Parametric, polar, and vector functions	
A.5.3 Sequences and series	
A.5.4 Multivariate functions	
A.5.5 Applications of function, geometry, and trigonometry concepts to solve problems involving calculus	

Secondary Mathematics Content Portfolio

Domain A.6 Discrete Mathematics Alignment

To be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to discrete mathematics with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models:

Competency	Rating
A.6.1 Discrete structures including sets, relations, functions, graphs, trees, and networks	
A.6.2 Enumeration including permutations, combinations, iteration, recursion, and finite differences	
A.6.3 Propositional and predicate logic	
A.6.4 Applications of discrete structures such as modeling and solving linear programming problems and designing data structures	