Description of Assessment 2 Grade Point Averages in math courses required of all candidates

1. Narrative

1a. Description of assessment.

Candidates' grade point averages of courses required of all candidates in the MAT program are being used for assessment 2. All of the candidates in our MAT program seek certification in Adolescence Education: Mathematics (grades 7 – 12).

It is important to note that until the Spring semester of 2013, when the new Program Coordinator assembled a 3-member MAT admissions committee (two members of the mathematics department and the Coordinator, herself), that an official protocol for admitting candidates to the MAT Program was established. This protocol includes establishing what undergraduate mathematics courses potential candidates have to take before being admitted to our program. The required prerequisite undergraduate courses are as follows: courses equivalent to our Calculus and Analytical Geometry 1, 2, and 3 (MA2310, MA2320, MA3330, respectively), Discrete Mathematics (MA3030), Linear Algebra (MA3160), and Introduction to Probability & Statistics (MA3210).

Twelve courses are *required* of all candidates in the MAT program: 6 graduate courses and the 6 prerequisite undergraduate courses identified by the MAT admissions committee. Since the 11 program completers reported here were admitted to the program before Spring of 2013, we do not have their individual grades for the 6 prerequisite undergraduate courses.

As stated in the School of Education Graduate Catalog (http://www.oldwestbury.edu/sites/default/files/documents/Graduate-Education-Catalog-2010-13.pdf), the SOE uses a 14 letter-grade system consisting of A, A-, B+, B, B-, C+, C, C-, F, CR (credit), NC (no credit), I (incomplete), W (withdrawal), and NR (not reported). All grades with the exception of CR, NC, I, W, and NR are calculated in candidates' respective GPAs. Grade points awarded for each grade can be found in section 2f. When a candidate repeats a course, if the new grade is higher, it replaces the old grade in the GPA computation. All grades, however, remain on the student's transcript. Grades for courses that were taken at another institution are accepted as transfer grades if and only if the college has found those courses to be equivalent to Old Westbury courses. Transfer grades are included in the GPA computation for this report.

Mathematics department policy dictates that grades of C- or lower earned in required courses do not satisfy degree requirements. For this reason, all program completers have earned at least a C in their required courses. For the candidates whose data is being used for this report, this means graduate courses only. In future reports this policy will include both the 6 graduate mathematics courses and the 6 prerequisite undergraduate mathematics courses.

1b. Alignment between the Assessment 2 and the NCTM CAEP 2012 Content Standards.

A course-by-course alignment between course alignment and the content standards was identified by a committee consisting of four faculty members: the mathematics department chair, two full-time mathematics professors, and the coordinator for the Adolescence Education: Mathematics Program, who is both a member of the School of Education and the mathematics department. A table identifying the alignment can be found in Appendix A at the end of this document.

1c. Analysis of data findings.

Grades were obtained from an examination of each candidate's transcript. GPAs were computed separately using only those courses required of all candidates per SPA requirement.

Our first cohort of program completers graduated in Spring 2012.

1d. Interpretation of data.

Course GPA and corresponding grade distribution are summarized in the tables found in section 2g. Numerically speaking, the ranges of course GPAs show an increase from the 2011 – 2012 program completers (Group 1; 2.7 to 3.85) to the 2012 – 2013 program completers (Group 2; 3.42 to 4.0) and then a decrease for the 2013 – 2014 program completers (Group 3: 2.57 – 3.67). With the exception of MA6100 (Probability and Statistics) for which the course GPA dropped (3.5 to 3.42 to 3.07), all required courses reflect the same increase then decrease pattern for the three groups of program completers. The averages GPA of candidates in the three years of data being reported are all above 3.0.

The small numbers of program completers (i.e., 2, 6, and 3 respectively) make interpretation of the data difficult.

2. Assessment Documentation

2e. Assessment tool.

Grade point averages of mathematics courses required to earn an MAT degree. Grades are obtained from an examination of each candidate's transcript(s).

Courses taken by candidates as part of the MAT program:

- MA6100 – Probability & Statistics
- MA6150 – Geometry
- MA6200 – Algebra
- MA6250 – Analysis
- MA6400 – Topics in Adv. Mathematics and Technology
- MA7500 – Topics in Mathematics and Mathematics Education

Courses equivalent to the following undergraduate mathematics courses taken before being admitted to the MAT program:

- MA2310 – Calculus & Analytic Geometry 1
- MA2320 – Calculus & Analytic Geometry 2
- MA3030 – Discrete Mathematics
- MA3160 – Linear Algebra
- MA3210 – Introduction to Probability & Statistics
- MA3330 – Calculus & Analytic Geometry 3

f. Scoring guide.

Each semester grade is determined by the corresponding professor as described by the course syllabus. Grade point awards are determined by the college and are as follows:

	B+ = 3.5	C+ = 2.5	
A = 4.0	B = 3.0	C = 2	F = 0
A- = 3.7	B- = 2.7	C- = 1.7	

2g. Candidate data derived from Assessment 2.

Table 1. Mean scores by course over 3 years

Grades * in Required in Mathematics and/or Mathematics Education Courses
Adolescence Education: Mathematics 7-12
MAT Program Completers

*A = 4.0, A- = 3.7, B+ = 3.5, B = 3.0, B- = 2.7, C+ = 2.5, C = 2.0, C- = 1.7, F = 0

Course Number and Name	**2011-2012**			**2012-2013**			**2013-2014**		
	Mean Course Grade* and (Range)	**Number of Completers**	**% of Completers Meeting Minimum Expectation**	**Mean Course Grade* and (Range)**	**Number of Completers**	**% of Completers Meeting Minimum Expectation**	**Mean Course Grade* and (Range)**	**Number of Completers**	**% of Completers Meeting Minimum Expectation**
MA6100 Probability & Statistics	3.5 (3.5 – 3.5)	[redacted]	100	3.42 (3.0 – 4.0)	[redacted]	100	3.07 (2.7 – 3.5)	[redacted]	100
MA6150 Geometry	3.85 (3.7 – 4.0)	[redacted]	100	3.95 (3.7 – 4.0)	[redacted]	100	3.67 (3.0 – 4.0)	[redacted]	100
MA6200 Algebra	2.7 (2.7 – 2.7)	[redacted]	100	3.73 (3.0 – 4.0)	[redacted]	100	2.57 (2.0 – 3.0)	[redacted]	100
MA6250 Analysis	2.85 (2.7 – 3.0)	[redacted]	100	3.61 (3.0 – 4.0)	[redacted]	100	3.57 (3.0 – 4.0)	[redacted]	100
MA6400 Topics in Adv. Math and Technology	3.0 (3.0 – 3.0)	[redacted]	100	3.75 (3.0 – 4.0)	[redacted]	100	3.5 (3.0 – 4.0)	[redacted]	100
MA7500 Topics in Mathematics and Mathematics Education	2.75 (2.5 – 3.0)	[redacted]	100	4.0 (4.0 – 4.0)	[redacted]	100	3.23 (2.0 – 4.0)	[redacted]	100

Table 2. Mean GPA by academic year

Mean GPA * in Required in Mathematics and/or Mathematics Education Courses Adolescence Education: Mathematics 7-12 MAT Program Completers *A = 4.0, A- = 3.7, B+ = 3.3, B = 3.0, B- = 2.7, C+ = 2.3, C = 2.0, C- = 1.7, F = 0			
Academic Year	**Mean GPA* and (Range)**	**Number of Completers**	**% of Completers Meeting Minimum Expectation**
2011 - 2012	3.11 (3.02 – 3.20)	[redacted]	100
2012 – 2013	3.80 (3.5 – 4.0)	[redacted]	100
2013 – 2014	3.27 (3.02 – 3.7)	[redacted]	100

Appendix A

Course Alignments

NCTM Standard Elements Addressed by Course(s)	Course Number and Name	Course Components Addressing Cited Standard Elements
1a) Demonstrate and apply knowledge of major mathematics concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains (Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics) as outlined in the *NCTM NCATE Mathematics Content for Secondary*.	MA2310 – Calculus and Analytical Geometry1 MA2320 – Calculus and Analytical Geometry 2 MA3160 – Linear Algebra MA3030 – Discrete Math MA3330 – Calculus and Analytical Geometry 3 MA3210 – Introduction to Probability & Statistics MA6100 – Probability & Statistics MA6150 – Geometry MA6200 – Algebra MA6250 – Analysis MA6400 – Topics in Adv. Mathematics and Technology MA7500 – Topics in Mathematics and Mathematics Education	**Refer to NCTM CAEP Mathematics Content for Secondary Alignment Table attached to the program report.**

2a) Use problem solving to develop conceptual understanding, make sense of a wide variety of problems and persevere in solving them, apply and adapt a variety of strategies in solving problems confronted within the field of mathematics and other contexts, and formulate and test conjectures in order to frame generalizations.	MA3030 – Discrete Math	Candidates are introduced to proof techniques (e.g., direct proof, proof by induction, proof by contrapositive, and proof by contradiction). Candidates are asked to apply these proof methods in the context of a number of contexts (e.g., number theory, sets) and as part of proposing and proving generalizations. Candidates are asked to solve problems related to real-world phenomena such as the use of graphs and trees in the study of scheduling problems and in transportation.
	MA3160 – Linear Algebra	Candidates are given multiple opportunities to solve problems and develop new problem solving strategies as they study two- and three-dimensional spaces in new contexts (e.g., matrices, systems of equation, determinants, vectors, and linear transformations). In this study they learn new learn representations (e.g., vectors as ordered pairs and vectors as matrices), and new procedures to solve problems.
	MA 6100 – Probability and Statistics	Candidates are asked to solve problems that are set in real-world and other contexts that require them to determine, for example, which distribution is required, and justify their choice of distribution.
	MA 6150 – Geometry	Use of software such as GeoGebra to may sometimes help a student test conjectures and formulate a proof Candidates solve a wide variety of problems (i.e., homework exercises) in Euclidean geometry and this helps in understanding the concepts and techniques and theorems
	MA 6200 – Algebra	As part of this course, candidates "discover" properties of the number systems. They model these properties in numbers by creating abstract structures (rings and groups) that generalize properties. Candidates go on to prove that given abstract structures satisfy (or fail to satisfy) the list of properties (thus verifying that it is a group or ring).

	MA 6250 – Analysis	In Calculus and Analytical Geometry 1 & 2 candidates learned a non-rigorous version of limits. In this course they learn what limits are rigorously and what the Real Numbers are rigorously. Candidates study the axioms that define the number systems.
	MA 6400 – Topics in Advanced Mathematics and Technology	Candidates solve problems (abstract and real world) for which the use of technological tools (e.g., Mathematica, Maple) play an important role in helping candidates to develop understandings of complex ideas. Using the tools candidates formulate and test conjectures on their way to solving problems.
2b) Reason abstractly, reflectively, and quantitatively with attention to units, constructing viable arguments and proofs, and critiquing the reasoning of others; represent and model generalizations using mathematics; recognize structure and express regularity in patterns of mathematical reasoning; use multiple representations to model and describe mathematics; and utilize appropriate mathematical vocabulary and symbols to communicate mathematical ideas to others.	MA3160 – Linear Algebra	Candidates study two- and three-dimensional spaces in new contexts (e.g., matrices, systems of equation, determinants, vectors, and linear transformations) and new mathematical objects. They learn the axiomatic definition of vector spaces, and thereby abstract certain properties of R^n; candidates develop their mathematical vocabulary to include terms such as subspace, basis, linearly independent; and candidates develop their understanding of these concepts when they determine whether a specified set of vectors forms a subspace, or basis, or is linearly independent, etc. Using the new mathematical objects (e.g., matrices, vectors), candidates are given many opportunities to reason abstractly and quantitatively about 2- and 3-space.
	MA 6100 – Probability and Statistics	As part of their study of mathematical laws of random phenomena, expectation and variance, probability distributions, candidates examine fundamental properties of Probability and asked to prove them.
	MA 6150 – Geometry	Candidates learn multiple approaches to geometry - e.g. through an axiomatic way, or through a transformation-based way (Erlangen program). Candidates construct proofs of geometrical propositions and in doing so learn to reason abstractly, represent and model generalizations using mathematics.

		Candidates are asked to share their proofs in class and provide feedback to their classmates.
	MA 6200 – Algebra	Candidates continue their study of abstract algebraic structures (e.g., groups, rings, Integral domains, and fields) at a more in-depth level. Working in these algebraic structures, candidates demonstrate their ability to reason abstractly and reflectively in a rigorous and formalized format by constructing rigorous proofs. Communication of their arguments/proofs is required to be written in correct logic and presented clearly and precisely. Candidates are often asked to share and provide feedback to their fellow classmates as proofs are shared and discussed in class.
	MA 6250 – Analysis	Candidates are introduced to rigorous real analysis in this course. Candidates are required to reason about abstract ideas and formulate proofs of properties/theorems and communicate their proofs precisely and clearly in writing. Candidates are encouraged to share and discuss their proofs in class.
2c) Formulate, represent, analyze, and interpret mathematical models derived from real-world contexts or mathematical problems.	MA2310 – Calculus and Analytical Geometry1	Candidates are asked to use model real-world situations using functions (e.g., polynomial, trigonometric, exponential, and logarithmic) and use to the derivative to optimize the given situation. Candidates are also given functions and use the derivative to locate maximum/minimum points, zeroes, determine intervals of increase/decrease and intervals of positive/negative concavity.
	MA2320 – Calculus and Analytical Geometry 2	Candidates are asked to use integrals to model real-world situations using functions (e.g., polynomial, trigonometric, exponential, and logarithmic) and to compute areas of regions and volumes of solids. Candidates use integration techniques to solve problems set in real-world contexts (e.g., finance, resource consumption, density).
	MA3330 – Calculus and Analytical Geometry 3	As candidates in MA3330 learn the techniques of multivariable calculus, ideas are applied to physical phenomena such as trajectories through space and basic problems

		in physics. Candidates apply later techniques in vector fields to model problems in fluid flow and force fields.
	MA 6100 – Probability and Statistics	Applying probability models to real world situations is an emphasis of the course. Some models include, wait times (Poisson Distribution), life expectancy (Exponential Distribution), survey results (Binomial Distribution and Normal Distribution).
	MA 6150 – Geometry	Candidates study projective geometry, which is a mathematical model derived from the study of perspective in art, and Euclidean geometry, which is also derived from real word context. As part of this study they asked to solve problems in these geometries as part of proving propositions/properties.
	MA 6400 – Topics in Advanced Mathematics and Technology	The topics vary from semester to semester where there are two elements. One is a technological tool such as Maple or SAS. Candidates are asked to solve real-world/realistic problems who complexities require the use of technological tools to assist them in analysis, interpreting and/or representation.
2d) Organize mathematical thinking and use the language of mathematics to express ideas precisely, both orally and in writing to multiple audiences.	MA 6100 - Probability and Statistics	Candidates are required to solve problems and to formulate and write proofs of properties/theorems in the fields of probability and statistics. Candidates are required to express their ideas using the language of mathematics in their proofs and in class discussions of mathematical ideas being examined in the each lesson.
	MA 6150 – Geometry	Candidates are required to solve problems and to formulate and write proofs of properties/theorems in the different geometries they study in this course (e.g., projective, hyperbolic, Euclidean). Candidates are required to express their ideas using the language of mathematics in their proofs and in class discussions of mathematical ideas being examined in the each lesson.
	MA 6200 – Algebra	Candidates are required to solve problems and to formulate and write proofs of properties/theorems in the algebra. Candidates are required to express their ideas

		using the language of mathematics in their proofs and in class discussions of mathematical ideas being examined in the each lesson.
	MA 6250 – Analysis	Candidates are required to solve problems and to formulate and write proofs of properties/theorems in real analysis. Candidates are required to express their ideas using the language of mathematics in their proofs and in class discussions of mathematical ideas being examined in the each lesson.
	MA 6400 – Topics in Advanced Mathematics and Technology	Candidates are each required to do a project in this course in which he or she demonstrates a mathematical solution to a real-world problem using technology. Candidates' solutions to their problem are submitted in writing and shared with the class in a presentation.
	MA 7500 – Topics in Mathematics and Mathematics Education	Candidates are each required to do a project in this course on a topic taken from secondary mathematics. Candidates' write a paper on this topic and share their project with the class..
2e) Demonstrate the interconnectedness of mathematical ideas and how they build on one another and recognize and apply mathematical connections among mathematical ideas and across various content areas and real-world contexts.	MA3030 – Discrete Math	Candidates are asked to draw upon their knowledge of school mathematics in conjunctions with understandings of ideas learned in their college courses (e.g., number theory, set theory, and calculus) to learn methods of proof and proving.
	MA3330 – Calculus and Analytical Geometry 3	Candidates combine their existing knowledge in 2- and 3-diemsnional geometry and trigonometry with the notions of single-variable calculus to develop dot- and cross-products, as well as techniques in multiple integration and differentiation, cumulating with the combined analytic and geometric approach to vector fields and the fundamental theorems of multivariable calculus (Green's theorem and the divergence theorem).
	MA 6100 - Probability and Statistics	Candidates are given multiple opportunities to make connections between ideas of Probability and Statistics and other areas of mathematics in their proofs of properties they encounter in this course. They use their understandings of series from Analysis, for

		example, in their proofs of properties of the Poisson Distribution or properties of the geometric distribution. The binomial formula, which candidates typically see as an algebraic topic is examined from the standpoint of probability.
	MA 6150 – Geometry	Candidates are given multiple opportunities to make connections among the geometries they study in this course. For example, they examine inversive geometry is connected to complex numbers, and how that can be used to model hyperbolic geometry Starting from basic axioms of geometry, candidates see how mathematical ideas build on one another. Candidates demonstrate the interconnectedness as they prove propositions that are new (to them).
	MA 6200 – Algebra	Candidates are given multiple opportunities to make connections between ideas of Algebra and other areas of mathematics in their proofs of properties they encounter in this course. For example, they examine the space of functions or polynomials, a topic from Analysis, and show the space to be a group or a ring.
	MA 6250 – Analysis	Candidates are given multiple opportunities to make connections between ideas of Analysis and other areas of mathematics in their proofs of properties they encounter in this course. The real numbers, for example, are defined and proven to be a field, a mathematical idea they study in Algebra.
	MA 6400 – Topics in Advanced Mathematics and Technology	Candidates are each required to do a project in this course in which he or she demonstrates a mathematical solution to a real-world problem using technology. As part of solving their selected problems, candidates have to make decisions about what field of mathematics and corresponding ideas/methods to use in their solution.
	MA 7500 – Topics in Mathematics and Mathematics Education)	As part of this course, candidates study historical development of mathematics. Using history as a lens, candidates examine interconnectedness of the many fields.
	MA 6200 – Algebra	Candidates are required to write proofs in this course. Candidates use the mathematical

		practices of problem solving and reasoning as they formulate their proofs, and the connecting and representing in their writing as they communicate their arguments.
	MA 6250 – Analysis	Candidates are required to write proofs in this course. Candidates use the mathematical practices of problem solving and reasoning as they formulate their proofs, and the connecting and representing in their writing as they communicate their arguments.
	MA 6400 – Topics in Advanced Mathematics and Technology	Candidates are each required to do a project for which the use of technological tools plays a major role in helping them solve a real-world problem. Candidates use the mathematical practices of problem solving and reasoning as they formulate use tools to formulate their respective solutions, and the practices of connecting and representing in their writing as they communicate their solutions.
2f) Model how the development of mathematical understanding within and among mathematical domains intersects with the mathematical practices of problem solving, reasoning, communicating, connecting, and representing.	MA3030 – Discrete Math	Candidates are asked to draw upon their knowledge of school mathematics in conjunctions with understandings of ideas learned in their college courses (e.g., number theory, set theory, and calculus) to learn methods of proof and proving.
	MA 6400 – Topics in Advanced Mathematics and Technology	Candidates are each required to do a project in this course in which he or she demonstrates a mathematical solution to a real-world problem using technology. As part of solving their selected problems, candidates have to make decisions about what field of mathematics and corresponding ideas/methods to use in their solution. Solving the problem candidates choose require mathematical reasoning, making connections to mathematics. Candidates present their project to the class. In preparing for the presentation candidates make decisions about how to communicate and represent their thinking and their solution process(es).
	MA 7500 – Topics in Mathematics and Mathematics Education	Candidates are each required to do a project in this course on a topic taken from secondary mathematics. Candidates' write a paper on this topic and share their project

		with the class. In preparing for the presentation candidates make decisions about how to communicate and represent their thinking and their solution process(es).

NCTM CAEP Standards (2012) Content Alignment Table – Secondary
(Supporting *Documenting Course Grades as an Assessment of Candidate Content Knowledge*)

Instructions:
Completion of this mathematics content alignment table is one of the required components of the documentation requirements for programs using course grades as an assessment. This document is designed as a form and must be used for entering required information into each “Click here to enter text” box, which will expand as needed. Do not retype the form. Since this form is a template, it will open as a document to be renamed and saved upon completion. Separate forms by program level (e.g., undergraduate or graduate) and program type (e.g., MAT or M. Ed.) are required. Specific directions for completing the form based on the location of mathematics/mathematics education coursework completion follow:

Undergraduate Programs and Graduate Programs where Mathematics/Mathematics Education Coursework Taken at Submitting Institution

- Column 2: Specify selected course number(s) and name(s) of **required** coursework that addresses each competency listed in the first column. If no required coursework addresses a specific competency, enter “Not addressed.”

- Column 3: Describe all technology and representational tools, including concrete models, used in **required** courses that address each competency listed in the first column. If required coursework does not include the use of technology and representational tools, enter “Not included.”

- Column 4: Include course description(s) for all **required** courses listed in the second column. It is sufficient to include course descriptions by mathematical domain (e.g., algebra, statistics and probability) rather than by individual competency.

Graduate Program where Mathematics/Mathematics Education Coursework Taken at Another (Non-Submitting) Institution

- Column 2: Specify selected course number(s) and name(s) of **required** undergraduate coursework that addresses each competency listed in the first column. Describe the advising decision that ensures program completers have studied the required mathematics content. If no required coursework addresses a specific competency, enter “Not addressed.”

- Column 3: Describe all technology and representational tools, including concrete models, used in **required** courses that address each competency listed in the first column. If not known, do not leave the cell blank; rather, enter “Not verifiable”.

- Column 4: Include course description(s) for all **required** courses listed in the second column. It is sufficient to include course descriptions by mathematical domain (e.g., algebra, statistics and probability) rather than by individual competency.

- Include the transcript analysis form that is used by the program to determine sufficiency of undergraduate courses taken by a program candidate at another institution and to specify coursework required to remediate deficiencies in the mathematics acquirement of program candidates or completers. The transcript analysis process must adhere to the *Guidelines for Documenting a Transcript Analysis*.

Institution Name	SUNY Old Westbury
Program Name	Adolescence Education: Mathematics
Program Type (e.g., Baccalaureate or M.Ed.)	M.A.T

A. Secondary Mathematics Teachers

All secondary mathematics teachers should be prepared with depth and breadth in the following mathematical domains: Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics. All teachers certified in secondary mathematics 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.

A.1. Number and Quantity 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:	**Required Course Number(s) and Name(s)**	**Technology and Representational Tools Including Concrete Models by Competency**	**Course Description(s)**
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	MA6200 – Algebra; MA6250 - Analysis	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	MA2310 – Topics include functions and their graphs, limits and continuity, derivatives of polynomials, rational functions, algebraic functions, exponential & logarithmic functions, and trigonometric functions, and applications of the derivative (e.g., velocity and acceleration problems; graphing functions). Additional topics include solving related rates problems for which students use quantitative reasoning
A.1.2 Fundamental ideas of number theory (divisors, factors and factorization, primes, composite numbers, greatest common factor, least common multiple, and modular arithmetic)	MA3030 – Discrete Math; MA6200 - Algebra	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
A.1.3 Quantitative reasoning and relationships that include ratio, rate, and proportion and the use of units in problem situations	MA2310 – Calculus & Analytical Geometry 1; MA6100 – Probability &	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing	

	Statistics	calculators (e.g., https://www.desmos.com/calculator)	and relationships (e.g., ratio and proportions). MA3030 - An introduction to discrete mathematical structures. Topics include propositional and predicate logic, set theory, relations and functions, induction and recursion, algorithms and number theory, and graphs and trees. Candidates learn about the concept of proof and techniques of proving in mathematical contexts which include fundamental ideas of number theory (e.g., divisors, factors & factorization, prime/composite numbers modular arithmetic, greatest common factors, least common multiples and modular arithmetic). MA3160 - An introduction to linear algebra beginning with two and three dimensional spaces, and including such topics as matrices, systems of equations, determinants, vector spaces, linear transformations, eigenvalues, and applications. MA3330 – Three main areas will be studied. The first is the Vector algebra and geometry
A.1.4 Vector and matrix operations, modeling, and applications	MA3160 – Linear Algebra; MA3330 – Calculus & Analytical Geometry 3	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator)	
A.1.5 Historical development and perspectives of number, number systems, and quantity including contributions of significant figures and diverse cultures	MA7500 - Topics in Mathematics and Mathematics Education	Click here to enter text.	

			of three-dimensional space including: lines, planes, and curves in space; polar, cylindrical, and spherical coordinate systems. Using this geometry, limits, partial differentiation, directional derivatives, max-min theory, and Lagrange Multipliers are studied. The final area of study is integration, including double, triple integrals, line integrals, and the divergence, Green's and Stokes Theorems. MA6100 - This course presents the mathematical laws of random phenomena, including discrete and continuous random variables, expectation and variance, and common probability distributions such as the binomial, Poisson, and normal distributions. Topics also include basic ideas and techniques of statistical analysis such as descriptive statistics, frequency distributions and graphs, measures of central tendency, measures of dispersion, correlation, inferential statistics and hypothesis testing and error. Structures and problems relevant

			to the secondary mathematics curriculum will be addressed. Use of quantitative reasoning is a critical aspect of this course. MA6200 - This course is a rigorous course in Abstract Algebra. Structure, properties, relationships, operations, and representations including standard and non-standard algorithms of numbers an number systems including integer, rational, irrational, real, and complex numbers are addressed through the study of the theory of groups, rings, and fields. Basic number theory (e.g., divisors, factors and factorization, primes greatest common divisor, least common multiple, and modular arithmetic), matrix algebra, and more abstract concepts are addressed as well. MA6250 – This course provides an introduction to rigorous real analysis. Topics include the real number system, sequence and series of real numbers, topology of the real line, limits and continuity, sequence and series of

			functions, differentiability and integrability of functions. Within this course the number systems are studied (e.g., counting numbers, integers, rationals, real numbers, and complex numbers). MA7500 – Historical development and perspectives of numbers, number systems, and quantities including contributions of significant figures are addressed as part of this course. Candidates will read historical and contemporary research literature. As part of the history of mathematics component, topics include mathematics from the Greeks (e.g., Pythagoreans, Euclid) and follow the development of mathematics, including Indian and Chinese mathematics, up to more modern times (including Algebra & Calculus). Connections are made from the historical development to the modern way we teach (e.g., "propositions" are the same geometric axioms in MA6150 and in high school

			geometry).

A.2. Algebra 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:	**Required Course Number(s) and Name(s)**	**Technology and Representational Tools Including Concrete Models by Competency**	**Course Description(s)**
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	MA3160 – Linear Algebra; MA6200 – Algebra	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	MA2310 – Topics include functions and their graphs, limits and continuity, derivatives of polynomials, rational functions, algebraic functions, exponential & logarithmic functions, and trigonometric functions, and applications of the derivative. As part of the application of the derivative, candidates solve both abstract and real-world problems which require examinations of patterns of change in functions (e.g., polynomials and exponential), proportional and inversely proportional relationships between quantities and between functions (e.g., f(x) and f'(x) and f'(x) and f''(x)) and how the choices of parameters determine particular
A.2.2 Function classes including polynomial, exponential and logarithmic, absolute value, rational, trigonometric, including those with discrete domains (e.g., sequences), and how the choices of parameters determine particular cases and model specific situations	MA2310 – Calculus & Analytical Geometry 1; MA2320 – Calculus & Analytical Geometry 2; MA6250 - Analysis	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
A.2.3 Functional representations (tables, graphs, equations, descriptions, recursive definitions, and finite differences), characteristics (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	MA2310 – Calculus & Analytical Geometry 1; MA2320 – Calculus & Analytical Geometry 2; MA6250 - Analysis	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
A.2.4 Patterns of change in linear, quadratic, polynomial,	MA2310 – Calculus &	Graphing calculators (e.g.,	

and exponential functions and in proportional and inversely proportional relationships and types of real-world relationships these functions can model	Analytical Geometry 1; MA2320 – Calculus & Analytical Geometry 2; MA6250 - Analysis	TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	cases and model specific situations. Given different representations of functions, candidates interpret and analyze the given data to identify characteristics (e.g domain, range, zeroes, local min/max points, intervals of increase/decrease, end behaviors). Candidates communicate and support their findings analytically (e.g., using limits, the derivative, domain and range restrictions). They use the derivative to determine the velocity and acceleration of functions for a given position function. MA2320 - Topics include indefinite and definite integral, applications of definite integral, integration techniques, infinite sequences and series, and analytic geometry. Candidates use integration techniques to determine position and/or velocity functions from a given function that describes acceleration. As part of the application of integration techniques and the concept of area under a curve, candidates solve both abstract and real-world
A.2.5 Linear algebra including vectors, matrices, and transformations	MA3160 – Linear Algebra; MA6200 - Algebra	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
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	MA6200 - Algebra	Click here to enter text.	
A.2.7 Historical development and perspectives of algebra including contributions of significant figures and diverse cultures	MA7500 - Topics in Mathematics and Mathematics Education	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	

			problems. MA3160 - An introduction to linear algebra beginning with two and three dimensional spaces, and including such topics as matrices, systems of equations, determinants, vector spaces, linear transformations, eigenvalues, and applications. MA6200 - This course is a rigorous course in Abstract Algebra. Algebraic notation, symbols, and expressions are used to justify relationships and operations through the study of theory of groups, rings, and fields. Basic number theory (e.g., divisors, factors and factorization, primes greatest common divisor, least common multiple, and modular arithmetic), matrix algebra and more abstract concepts are studied as well. MA6250 – This course provides an introduction to rigorous real analysis. Topics include the real number system, sequence and series of real numbers, topology of the real line, limits and continuity, sequence and series of

			functions, differentiability and integrability of functions. Sequences and series are studied in detail and rigor including convergence of sequences with an nth formula and recursively defined sequences, divergence with proof and Taylor series. MA7500 – Historical development and perspectives of algebra including contributions of significant figures and diverse cultures are studied as part of this course. Candidates will read historical and contemporary research literature. As part of the history of mathematics component, topics include mathematics from the Greeks (e.g., Pythagoreans, Euclid) and follow the development of mathematics, including Indian and Chinese mathematics, up to more modern times (including Algebra & Calculus). Connections are made from the historical development to the modern way we teach (e.g., "propositions" are the same geometric axioms in MA6150 and in high school

			geometry).

A.3. Geometry and Trigonometry 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:	**Required Course Number(s) and Name(s)**	**Technology and Representational Tools Including Concrete Models by Competency**	**Course Description(s)**
A.3.1 Core concepts and principles of Euclidean in two and three dimensions and two-dimensional non-Euclidean geometries	MA3330 – Calculus & Analytical Geometry 3; MA6150 - Geometry	Geogebra downloaded from http://www.geogebra.org/cms/en/	MA2310 – Topics include functions and their graphs, limits and continuity, derivatives of polynomials, rational functions, algebraic functions, exponential & logarithmic functions, and trigonometric functions, and applications of the derivative. As part of their study of applications of the derivative students solve related-rates problems including periodic phenomena which provide students with opportunities to apply their knowledge of right triangles which includes the Pythagorean Theorem and trigonometric ratios. MA2320 - Topics include indefinite and definite integral, applications of definite
A.3.2 Transformations including dilations, translations, rotations, reflections, glide reflections; compositions of transformations; and the expression of symmetry in terms of transformations	MA3160 – Linear Algebra; MA6150 - Geometry	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator). Geogebra downloaded from http://www.geogebra.org/cms/en/	
A.3.3 Congruence, similarity and scaling, and their development and expression in terms of transformations	MA6150 - Geometry	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator). Geogebra downloaded from http://www.geogebra.org/cms/en/	
A.3.4 Right triangles and trigonometry	MA2310 – Calculus & Analytical Geometry 1; MA2320 – Calculus & Analytical	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing	

	Geometry 2; MA6150 - Geometry	calculators (e.g., https://www.desmos.com/calculator). Geogebra downloaded from http://www.geogebra.org/cms/en/	integral, integration of functions (e.g., polynomials, rational, algebraic, exponential & logarithmic, and trigonometric), infinite series, and analytic geometry. In order to integrate when trigonometric functions are involved, trigonometric identities are used. In addition, the method of trigonometric substitution requires candidates to use right triangles and trigonometry. MA3160 - An introduction to linear algebra beginning with two and three dimensional spaces, and including such topics as matrices, systems of equations, determinants, vector spaces, linear transformations, eigenvalues, and applications. Applications of linear transformations include dilations, translations, rotations, reflections, glide reflections, compositions of reflections, and the expression of symmetry using matrices. MA3330 – Core concepts and principles of Euclidean
A.3.5 Application of periodic phenomena and trigonometric identities	MA2310 – Calculus & Analytical Geometry 1; MA2320 – Calculus & Analytical Geometry 2	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
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)	MA3330 – Calculus and Analytic Geometry 3; MA6150 - Geometry	Geogebra downloaded from http://www.geogebra.org/cms/en/	
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	MA3330 – Calculus and Analytic Geometry 3; MA6150 - Geometry	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator). Geogebra downloaded from http://www.geogebra.org/cms/en/	
A.3.8 Geometric constructions, axiomatic reasoning, and proof	MA6150 - Geometry	Geogebra downloaded from http://www.geogebra.org/cms/en/	
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	MA2310 – Calculus & Analytical Geometry 1; MA2320 – Calculus & Analytical Geometry 2; MA3330 – Calculus & Analytic Geometry 3	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator). Geogebra downloaded from	

		http://www.geogebra.org/cms/en/	Geometry are studied in two dimensions (e.g. polar coordinates, finding areas of 2-dimensional shapes using double integration) and three dimensions (e.g. algebra and geometry of three-dimensional space including: lines, planes, and curves in space; cylindrical, and spherical coordinate systems, finding volumes of 3-dimesional objects (e.g., cones, spheres cylinders) using double and triple integration).
A.3.10 Historical development and perspectives of geometry and trigonometry including contributions of significant figures and diverse cultures	MA6150 – Geometry; MA7500 - Topics in Mathematics and Mathematics Education	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	MA6150 – This course is aimed at mathematics teachers who are interested in enhancing their understanding of basic and advanced topics in geometry. It aims to give teachers a foundation in the fundamental working and structure of the field, both from a historical perspective and through the examination of both Euclid's work and modern geometry, including non-Euclidean systems. Candidates will learn how to use Dynamical Geometry Software. Topics include use of dynamical geometry

			software as a means to examine transformations (e.g., dilations, shears), classical geometry with constructions, axiomatics and proof, Euclidean geometry, coordinate geometry and vectors, transformations, non-Euclidean geometry, historical background of Euclidean and non-Euclidean geometries, and three-dimensional geometry and spatial reasoning. MA7500 – Historical development and perspectives of geometry and trigonometry including contributions of significant figures and diverse cultures are studied as part of this course. Candidates will read historical and contemporary research literature. As part of the history of mathematics component, topics include mathematics from the Greeks (e.g., Pythagoreans, Euclid) and follow the development of mathematics, including Indian and Chinese mathematics, up to more modern times (including Algebra & Calculus). Connections are made

			from the historical development to the modern way we teach (e.g., “propositions” are the same geometric axioms in MA6150 and in high school geometry).

A.4. Statistics and Probability 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:	**Required Course Number(s) and Name(s)**	**Technology and Representational Tools Including Concrete Models by Competency**	**Course Description(s)**
A.4.1 Statistical variability and its sources and the role of randomness in statistical inference	MA3210 – Introduction to Statistics and Probability; MA6100 – Statistics and Probability	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator) Statistical software (e.g., Base SAS, Mathematica, Maple).	MA3210 - A one-semester course containing foundation material in probability and statistical inference. Topics include discrete and continuous distributions, unirvariate and bivariate distributions, random events, estimation and hypothesis testing. Candidates are given multiple opportunities to examine empirical and theoretical probability of simple and compound events. Probability studied include discrete, continuous, and conditional. The are many opportunities to
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	MA3210 – Introduction to Statistics and Probability; MA6100 – Statistics and Probability; MA6400 – Topics in Advanced Mathematics and Technology	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator). Computer software (e.g., Mathematica, Maple, Statistical Analysis System [SAS], Base SAS).	

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	MA3210 – Introduction to Statistics and Probability; MA6100 – Statistics and Probability	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	examine random phenomena, simulations and probability distributions in the context of modeling real-world phenomena and using statistics and probability in decision making. MA6100 – This course presents the mathematical laws of random phenomena, including discrete and continuous random variables, expectation and variance, and common probability distributions such as the binomial, Poisson, and normal distributions. Topics also include basic ideas and techniques of statistical analysis such as descriptive statistics, frequency distributions and graphs, measures of central tendency, measures of dispersion, correlation, inferential statistics and hypothesis testing and error. Structures and problems relevant to the secondary mathematics curriculum will be addressed. MA6400 - Candidates will be introduced to various branches of contemporary mathematics, recent
A.4.4 Empirical and theoretical probability (discrete, continuous, and conditional) for both simple and compound events	MA3210 – Introduction to Statistics and Probability; MA6100 – Statistics and Probability	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
A.4.5 Random (chance) phenomena, simulations, and probability distributions and their application as models of real phenomena and to decision making	MA3210 – Introduction to Statistics and Probability; MA6100 – Statistics and Probability; MA6400 – Topics in Advanced Mathematics and Technology	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator). Computer software (e.g., Mathematica, Maple, Statistical Analysis System [SAS], Base SAS).	
A.4.6 Historical development and perspectives of statistics and probability including contributions of significant figures and diverse cultures	Click here to enter text.	Click here to enter text.	

			developments in mathematics, and the use of technology in problem solving and in teaching. A connection among different branches of mathematics will be emphasized. Students will be given real-world and abstracts problems to solve using technologies. For abstract problems candidates use technologies such as Mathematica or Maple. For real-world problems candidates will use Statistical Analysis System (SAS) software or Base SAS software to examine the data resulting from their surveys and investigations.

A.5. Calculus 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:	**Required Course Number(s) and Name(s)**	**Technology and Representational Tools Including Concrete Models by Competency**	**Course Description(s)**
A.5.1 Limits, continuity, rates of change, the Fundamental Theorem of Calculus, and the meanings and techniques of differentiation and integration	MA2310 - Calculus & Analytical Geometry 1; MA2320 - Calculus & Analytical Geometry 2; MA3330 - Calculus	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desm	MA2310 – Topics include functions and their graphs, limits and continuity, derivatives of polynomials, rational functions,

	& Analytical Geometry 3; MA6250 - Analysis	os.com/calculator).	algebraic functions, exponential & logarithmic functions, and trigonometric functions, and applications of the derivative. As part of solving problems which require candidates to use the derivative, students also make use of geometry and trigonometric concepts (e.g., Pythagorean Theorm, trig ratios). MA2320 - Topics include indefinite and definite integral (Fundamental Theorem of Calculus), applications of definite integral, integration techniques, infinite sequences and series, and analytic geometry. Candidates solve problems that require the students to make use of their understandings of the concepts of function, geometry, and trigonometry in addition to their newly acquired understandings of the definite integral and integration techniques. MA3330 – Three main areas will be studied. The first is the Vector algebra and geometry of three-dimensional space including: lines, planes, and curves in
A.5.2 Parametric, polar, and vector functions	MA3330 - Calculus & Analytical Geometry 3;	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
A.5.3 Sequences and series	MA2320 - Calculus & Analytical Geometry 2; MA6250 - Analysis	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
A.5.4 Multivariate functions	MA3330 - Calculus & Analytical Geometry 3	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
A.5.5 Applications of function, geometry, and trigonometry concepts to solve problems involving calculus	MA2310 - Calculus & Analytical Geometry 1; MA2320 - Calculus & Analytical Geometry 2; MA3330 - Calculus & Analytical Geometry 3;	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	
A.5.6 Historical development and perspectives of calculus including contributions of significant figures and diverse cultures	MA7500 - Topics in Mathematics and Mathematics Education	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator)	

			space; poloar, cylindrical, and spherical coordinate systems. Using this geometry, limits, partial differentiation, directional derivatives, max-min theory, and Lagrange Multipliers are studied. The final area of study is integration, including double, triple integrals, line integrals, and the divergence, Green's and Stokes Theorems. MA6250 – This course provides an introduction to rigorous real analysis. Topics include the real number system, sequence and series of real numbers, topology of the real line, limits and continuity, sequence and series of functions, differentiability and integrability of functions. MA7500 – Historical development and perspectives of calculus including contributions of significant figures and diverse cultures are studied as part of this course. Candidates will read historical and contemporary research literature. As part of the history of mathematics component, topics

			include mathematics from the Greeks (e.g., Pythagoreans, Euclid) and follow the development of mathematics, including Indian and Chinese mathematics, up to more modern times (including Algebra & Calculus). Connections are made from the historical development to the modern way we teach (e.g., "propositions" are the same geometric axioms in MA6150 and in high school geometry).

A.6. Discrete Mathematics 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:	**Required Course Number(s) and Name(s)**	**Technology and Representational Tools Including Concrete Models by Competency**	**Course Description(s)**
A.6.1 Discrete structures including sets, relations, functions, graphs, trees, and networks	MA3030 – Discrete Mathematics	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	MA3030 – An introduction to discrete mathematical structures. Topics include propositional and predicate logic, set theory, relations and functions, induction and recursion, algorithms and number theory, and graphs and trees. Candidates learn about the concept of
A.6.2 Enumeration including permutations, combinations, iteration, recursion, and finite differences	MA3030 – Discrete Mathematics ; MA3210 – Introduction to Probability and Statistics;	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g.,	

	MA6100 - Probability and Statistics	https://www.desmos.com/calculator).	proof and techniques of proving in mathematical contexts which include permutations, combinations, iteration and recursion. Applications of discrete structures such as modeling and solving linear programming problems and designing data structures are included. MA3210 - A one-semester course containing foundation material in probability and statistical inference. Topics include discrete and continuous distributions, random events, estimation and hypothesis testing, enumeration including permutations and combinations is used to find probability of events. MA6100 – This course presents the mathematical laws of random phenomena, including discrete and continuous random variables, expectation and variance, and common probability distributions such as the binomial, Poisson, and normal distributions. Topics also include basic ideas and techniques of statistical analysis such
A.6.3 Propositional and predicate logic	MA3030 – Discrete Mathematics	Click here to enter text.	
A.6.4 Applications of discrete structures such as modeling and solving linear programming problems and designing data structures	MA3030 – Discrete Mathematics; MA6400 - Topics in Advanced Mathematics and Technology	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator) Computer software (e.g., Maple, Mathematica)	
A.6.5 Historical development and perspectives of discrete mathematics including contributions of significant figures and diverse cultures	Click here to enter text.	Graphing calculators (e.g., TI-83 TI-84, Casio 9850) or online graphing calculators (e.g., https://www.desmos.com/calculator).	

			as descriptive statistics, frequency distributions and graphs, measures of central tendency, measures of dispersion, correlation, inferential statistics and hypothesis testing and error. Structures and problems relevant to the secondary mathematics curriculum will be addressed. MA6400 - Students will be introduced to various branches of contemporary mathematics, recent developments in mathematics, and the use of technology in problem solving and in teaching. A connection among different branches of mathematics will be emphasized. Students will be given opportunities to solve real-world problems using, for example, modelling and for which technology (e.g., Mathematica, Maple, SAS) plays a critical role in finding solutions. MA7500 – As part of this course, students will read historical and contemporary research literature. As part of the history of mathematics component topics

			include mathematics from the Greeks (e.g., Pythagoreans, Euclid) and follow the development of mathematics, including Indian and Chinese mathematics,up to more modern times (including Algebra & Calculus). Connections are made from the historical development to the modern way we teach (e.g., “propositions” are the same geometric axioms in MA6150 and in high school geometry).

Appendix B: Documentation Requirements for a Transcript Analysis (All Graduate Programs):

1. Describe the transcript analysis process including when it occurs, who does the analysis, etc.

Transcript analysis for prospective graduate students occurs when the Program Coordinator is informed by the Admissions Office that the prospective candidate's application to the college is complete. The transcript(s) is/are examined to identify what mathematics classes the prospective mathematics candidate has taken along with the corresponding grades. Prior to January 2013, when the current Program Coordinator took over full responsibilities of her position, the process used to analyze transcripts was not documented. The current Program Coordinator was told that the previous Program Coordinator, who no longer works for the college, had sole responsibility for making admissions decisions. In the spring semester of 2013, the current Program Coordinator and two professors from the Mathematics Department established a protocol for admissions into the MAT program. This program is for certification in Adolescence Education: Mathematics (grades 7 – 12). We do not offer a Middle School Education Program. The protocol is a follows:

1. After the Program Coordinator is notified by the Admissions office that a prospective candidate's application is complete, copies of the prospective candidate's transcripts are examined by a math education admissions committee composed of the Program Coordinator who is a member of the School of Education and the Math Department, the Math Department chair, and another full-time math professor. The latter two members of this committee teach many of the mathematics classes taken by our MAT candidates.

2. Based upon the examination of the transcripts, one of three decisions are made:
   a. The candidate is accepted into the program.
   b. The candidate is not accepted into the program, but is encouraged to reapply after taking mathematics classes to meet prerequisite requirements. The candidate is given a list of courses which can be taken at a community college or at Old Westbury as a non-degree student.
   c. The candidate is not accepted into the program.

2. Describe policies used by the program in evaluating the transcript

Prior to the Spring semester of 2013, no policy for transcript evaluation existed. In the Spring semester of 2013, the math education admissions committee was formed to establish guidelines for admitting candidates to our graduate program and to improve communications between the School of Education and the Mathematics Department. The guidelines are as follows:

a. Admissions decisions are made by the math education admissions committee. If all three members are not available, then the decision can be made by the Program Coordinator AND one other member of the committee. No one member of the committee will decide whether or not a prospective candidate is to be admitted.

b. The college admission requirements include the following requirements: "at least 30 credits of mathematics" with an overall GPA of 3.0. At most institutions, 30 credits are equivalent to 10 classes. Given that undergraduate mathematics courses as Old Westbury are 4-credit classes, the committee chose to define "at least 30 credits" to mean at least eight mathematics courses. The committee decided that candidates have to have courses equivalent to six specific courses and provided general descriptions for two additional courses. The courses are as follows:

- MA2310 (Calculus and Analytic Geometry 1)
- MA2310 (Calculus and Analytic Geometry 2)
- MA3330 (Calculus and Analytic Geometry 3)
- MA3160 (Linear Algebra)
- MA3030 (Discrete Math)
- MA3210 (Probability and Statistics)
- An upper division proof class
- An elective non-remedial math class (beyond the level of Pre-Calculus)

Assumed in the "at least 30 credits of mathematics" requirement is that the credits are semester credits. For potential candidates who earned an undergraduate degree from a college/university that operates on a quarter system, the committee decided to use the following formula: 1 quarter unit equals 2/3 semester unit.

c. **Currency of Preparation**. Sometimes a candidate may be asked to repeat a course that he/she has already taken. Such situations include a course that was taken a long time ago. The definition of "a long time ago" is determined by the committee at the time the candidate's transcripts are examined. In the last situation this policy was applied, the candidate had taken Calculus 1 (and no mathematics since) more than 10 years ago. The goal is to try and help the candidate be successful in the mathematics classes that he/she will be taking as part of the MAT course of study.

d. **Other related degrees (i.e., how are degrees in related fields addressed).** For candidates who do not meet the "at least 30 credits of mathematics" requirement, the committee provides each candidate with a list of courses to take and earn an overall mathematics GPA of 3.0 or higher. The list of courses is the 8 courses (cf. bulleted list in section 2b above) minus courses the candidate has taken.

e. **Minimum grade requirements**. For candidates who meet the "at least 30 credits of mathematics" requirement, but do not have a mathematics GPA of at least 3.0—a requirement of all candidates in our programs, the committee provides each candidate with a list of courses to retake/take and earn grades of B or higher. Courses in which candidates earn a grade of "satisfactory" are not accepted as meeting our course requirements. Courses in which candidates earn a "pass" (i.e., P) are interpreted as a letter grade of "C."

f. **Alignment clarification**. For courses whose titles are not clearly aligned with NCTM standard elements, the committee uses the college's course equivalencies webpage which identifies courses offered at other institutions that have been found to be equivalent to courses at Old Westbury (https://owsis.oldwestbury.edu/pls/prod/ywsktrar.P_Disp_States) to determine alignments. If the course equivalencies webpage does not contain the needed data, the committee visits websites for the institutions attended by the candidate to find online course catalogs. If online catalogs are not found, the candidate is asked to provide course information such as a syllabus or to contact those institutions for course information to help us determine course alignment.

3. Describe the process used to ensure that candidates who do not meet the coursework requirements are required to remediate mathematics content deficiencies.

To avoid challenges of ensuring candidates meet coursework deficiencies, we do not admit prospective candidates until after the content and mathematics GPA prerequisite requirements are met.

4. Provide the form used to complete the transcript analysis that is used to determine sufficiency of courses taken at another institution and to specify coursework required to remediate deficiencies in the mathematics content acquirement of admitted candidates.

Graduate Applicant: Adolescent Education: Mathematics Program: MAT MS

Course Semester & Institution Grade

Old Westbury Course #	Course			
MA2310	Calculus and Analytic Geometry I	required		
MA2320	Calculus and Analytic Geometry II	required		
MA3030	Discrete Mathematics	required		
MA3160	Linear Algebra	required		
MA3210	Introduction to Probability & Statistics	required		
MA3330	Calculus and Analytic Geometry III	required		
	Upper division proof class	required		
	Elective non-remedial math class (beyond the level of Pre-Calculus)	required		

Examples of proof classes offered at Old Westbury

MA3520	Transition to Advanced Mathematics (introductory proof course)		
MA4510	Geometry (upper division proof course)		
MA5120	Abstract Algebra I (upper division proof course)		
MA5320	Advanced Calculus I (upper division proof course)		

Notes:

____ Accepted

____ Not accepted, but encouraged to reapply

____ Not accepted