The Math 5-9 Endorsement program requires special attention be paid to items in the i) Portfolio Plan, ii) Course Requirements and iii) in the TPA. Please carefully read these sections and talk to the math specialization coordinator to ensure your teacher certification process and graduation from Shepherd University is successful.

I. Mathematics 5-9 Portfolio Plan

1. Pre-service teacher candidates develop the constructs of a unit plan which supports the use of technology to create effective learning environments that provide opportunities for students to interact with content in meaningful ways. For Juncture 1, Mathematics 5-9 candidates must include a lesson plan (not necessarily graded or used in an actual classroom) in the *Skills* section of the portfolio that incorporates the use of technology and demonstrates the candidates' ability to use math equation editors. The lesson plan could represent the equivalent of a single day lesson in a traditional 50-60 minute 5-9 mathematics classroom. The focus should be on the delivery of the content that includes technology. Juncture 2 candidates must include a lesson plan that incorporates the use of technology that was formally evaluated during one of their EDUC courses.

2. Students must include at least two graded work samples demonstrating their ability to complete mathematical proofs and mathematical arguments in the *Knowledge* section of the portfolio. Suggested courses to consider for Juncture 1 portfolios would include math 155 and 254. Suggested courses to consider for Juncture 2 portfolios would include Math 154, 254, 200 and 205.

3. Students must include the History Assignment in the *Knowledge* Section of the portfolio.

The purpose of the History assignment is for you to demonstrate your knowledge and understanding of the historical development of mathematical domains including contributions from diverse cultures. At a minimum, you must thoroughly discuss the prompts given. As you respond consider why these topics are important, which cultures contributed, and how those contributions moved the field forward.

Domain I: Number and Operator. Discuss the differences and similarities between the numeration systems of ancient Egypt, Babylon, China and India. In what ways were the Indian and the Babylonian systems superior? Compare the approaches of the algorists and the abacists to mathematical operations during the middle ages. Discuss some procedures used by them.

Domain II: Algebra. In what ways were the algebraic problems tackled by the ancient Babylonians more advanced than those of ancient Egypt? Discuss the main features of the geometric algebra used by the ancient Greeks. In what ways did the Arab and Islamic mathematics develop algebra?

Domain III: Calculus. What part of Calculus did the ancient Greeks develop? Who were the precursors to the work of Newton and Leibniz?

Domain IV: Discrete Mathematics. Discuss the earliest appearances of what we now know as Pascal's triangle in Chinese and Arabic Mathematics. What were the contributions of the ancient Greeks to discrete Mathematics? Where does the earliest known discrete mathematical result originate?

Domain V: Data Analysis, Statistics, and Probability. List the first appearances of statistical methods in history. Who were the first proponents of probability theory? What are the connections with probability theory to other fields?

Your work will be scored according to this rubric. You must obtain a Meets Standard level in each domain or resubmit the response.

Domain	**Exceeds Standard Level**	**Meets Standard Level**	**Approaching Standard Level**
I. Number and Operator NCTM 9.10	Candidate work is insightful. Candidate understands the importance of contributions to the domain by Egypt, Babylon, China and India. Candidate provides insightful remarks regarding Indian and Babylonian systems. Candidate discusses procedures emphasizing the differences in approaches to mathematical operations.	Candidate demonstrates an understanding of the important contributions to the domain by Egypt, Babylon, China and India. Candidate provides sufficient discussion of Indian and Babylonian systems. Candidate discusses procedure emphasizing the differences in approaches to mathematical operations.	Candidate work is superficial or not beyond an elementary dictation of names and locations. Candidate provides insufficient information regarding Indian and Babylonian systems. Candidate does not show evidence of understanding the differences in approaches to mathematical operations.
II. Algebra NCTM 10.6	Candidate work is insightful. Candidate demonstrates a deep understanding of geometric algebra. Candidate demonstrates a deep understanding of the importance of Arab and Islamic developments.	Candidate work sufficiently demonstrates an understanding of the importance of the Babylonians. Candidate demonstrates a sufficient understanding of geometric algebra. Candidate demonstrates an understanding of the importance of Arab and Islamic developments.	Candidate work is superficial or not beyond an elementary dictation of names and locations. Candidate does not demonstrate an understanding of geometric algebra. Candidate does demonstrate an understanding of the important historical Arab and Islamic developments in algebra.
III. Calculus NCTM 11.8	Candidate work is insightful. Candidate demonstrates a deep understanding of ancient Greeks contribution to the development of Calculus. Candidate recognizes important precursors to Leibniz and Newton. Candidate includes a	Candidate demonstrates knowledge of ancient Greeks contribution to the development of Calculus. Candidate recognizes the important contributions of precursors to Leibniz and Newton and includes a discussion of the	Candidate work is superficial or not beyond an elementary dictation of names and locations. Candidate knowledge of contributions to calculus is primarily limited to Newton and/or Leibniz.

	of the mathematical contributions to the domain.	contributions to the domain.	
IV. Discrete Mathematics NCTM 13.4	Candidate provides insightful discussion of early Chinese, Greek and Arabic contributions to the field. Candidate recognizes the mathematicians and work that developed into the field of study we know today.	Candidate demonstrates knowledge of the contributions by early Chinese, Greek and Arabic peoples. Candidate recognizes the mathematicians and work that developed into the field of study we know today.	Candidate work is superficial or not beyond an elementary dictation of names and locations. Candidate does not demonstrate an understanding of the importance of historical developments.
V. Data Analysis, Statistics and Probability NCTM 14.8	Candidate demonstrates an insightful understanding of the development of statistical methods. Candidate recognizes the first proponents of probability theory and the importance of their work. Candidate demonstrates an understanding of the important connections of probability theory to other fields.	Candidate demonstrates an understanding of the development of statistical methods. Candidate recognizes the first proponents of probability theory. Candidate identifies important connections of probability theory to other fields.	Candidate work is superficial or not beyond an elementary dictation of names and locations. Candidate does not demonstrate an understanding of the importance of historical developments of statistical methods. Candidate does not demonstrate an understanding of the important connection of probability theory to other field.

II. Mathematics 5-9 Course Requirements.

Core curriculum coursework ensures that prospective elementary teachers have background in the liberal arts and sciences and have developed theoretical and practical knowledge. Core Curriculum courses include courses and/or experiences in the arts, communications, history, literature, mathematics, philosophy, science, and the social sciences. Additionally, the core curriculum builds a disposition and knowledge of multicultural and global perspectives.

Core Curriculum Courses

These courses are determined by whether the student is enrolled in Elementary or Secondary Education. Please refer to the catalog.

Specific Core Curriculum Requirements

Specialty studies courses ensure that prospective teachers attain academic competence in the content that they will be teaching in 5-9 classrooms. These courses help to develop an understanding of the structure, skills, core concepts, ideas, values, facts, methods of inquiry

and uses of technology for the content areas they will be teaching. The purposes of elementary education multi-subjects specialization are:

1. To promote teachers who are reflective problem solvers in the daily workplace of elementary schools;
2. To promote teachers who plan and implement a learning environment responsive to the social and psychological conditions which characterize their school;
3. To promote a strong background in child development and related pedagogical practices;
4. To provide teachers with a wide range of teaching methodologies and strategies across many content areas;
5. To promote a broadly based understanding of elementary school and its place and function in society; and
6. To promote a desire for continued investigation of the teaching/learning dialectic beyond the undergraduate preparation.

MATH 102 - Math for Elementary Teachers (3 cr) [Required for Elementary Ed degree]
MATH 105 – College Algebra (3 cr) [Required for Elementary Ed degree]
MATH 108 – Precalculus (4 cr)
MATH 155 – Discrete Structures (3 cr)
MATH 200 - Geometry and Measurement (3 cr) [Required for Elementary Ed degree]
MATH 205 – Applied Calculus (4 cr)
MATH 254 – Discrete Mathematics (3 cr)
MATH 314 – Statistics (3 cr)

Professional Core Requirements

Professional Studies courses ensure that the prospective teacher acquires and learns to apply the professional and pedagogical knowledge and skills to become competent to teach elementary children.

EDUC 150 - Seminar in Education **(1 cr)**
EDUC 200 - Foundations of American Education **(3 cr)**
EDUC 320 - The Social and Psychological Conditions of Learning **(4 cr)**
EDUC 341 - (previously MATH 300) Math Methods for Elementary Teachers (3 cr)

EDUC 351 - Integrated Reading and Language Arts I **(5 cr)**
EDUC 352 - Integrated Math, Science, and Social Studies I **(4 cr)**
EDUC 353 - Integrated Reading and Language Arts II **(4 cr)**
EDUC 354 - Integrated Math, Science, and Social Studies II **(5 cr)**
EDUC 380 - Technology in 21st-Century Teaching and Learning **(3 cr)**
EDUC 400 - Inclusion in the Regular Classroom **(3 cr)**
EDUC 450 - Student Teaching, Elementary School Grades K-6 **(9 cr)**

Note. See professional education course listings under Education: Professional Studies Core for Endorsement in Middle School Education (40-48 hours required). Special Methods of Teaching Mathematics is EDUC 420.

Prerequisites for EDUC 320 and for Juncture 1. You must have grades of C or better in ENGL 101, ENGL 102, and COMM 202. Minimum GPA of 2.5 required for admittance into EDUC 320. Juncture 1 GPA of 2.75 required. (Elementary Education students only, you must have completed at least one math course.)

Suggested Math Course Progression.
Department scheduling may vary. This is not a guaranteed course rotation.

Mathematics Teaching Field Endorsement Grades 5-9 General Math through Algebra I							
FALL		**FIRST YEAR**		**SPRING**		**FIRST YEAR**	
Sub./Course No.	**Tier**	**Title**	**Credit**	**Sub./Course No.**	**Tier**	**Title**	**Credit**
MATH 105		College Algebra	3	MATH 155		Discrete Structures	3
MATH 102		Math for Elem Teachers	3	MATH 108		Precalculus	4
FALL		**SECOND YEAR**		**SPRING**		**SECOND YEAR**	
Sub./Course No.	**Tier**	**Title**	**Credit**	**Sub./Course No.**	**Tier**	**Title**	**Credit**
MATH 200		Geometry and Measurement	3	MATH 254		Discrete Mathematics	3
MATH 205		Calculus with Applications	4	MATH 314		Statistics	3

STRONGLY SUGGEST COMPLETION of or co-enrollment in ENGL 101 (or ENGL 100A or ENGL 100B with a grade of C or better before taking EDUC 150;
COMPLETION of EDUC 150 and ENGL 102 with grades of C or better before taking EDUC 200;
COMPLETION of EDUC 200 and COMM 202 with grades of C or better before taking EDUC 320 (minimum overall GPA of 2.5 to qualify for EDUC 320)

III. The TPA

During student teaching, all teacher candidates complete a Teacher Performance Assessment (TPA). The TPA entails creating a unit of instruction for the student teaching classroom, developing assessment instruments, administering the assessments and then analyzing the assessment data to determine whether their students have learned. The assignment requires candidates to demonstrate their ability to plan a standards-based unit of instruction that is developmentally appropriate and builds upon the prior knowledge that students bring with them to the classroom. It also requires that candidates use assessment data to drive their instruction.

Math 5-9 Endorsement candidates must satisfy the requirements of both the TPA for the Elementary Education program and the TPA for Math 5-9 Endorsement. Elementary Education candidates complete their Elementary Education TPA during the first of two student teaching placements.

Carefully review the elements shown below that must be demonstrated sufficiently in your TPA to satisfy the Math 5-9 Endorsement. It is possible to have elements from your Elementary Education TPA contribute significantly to the requirements for the Math 5-9 Endorsement TPA; thus avoiding the need to complete two entire TPA's. Note that element 5c specifically mentions middle grade students. If your Elementary Education TPA is completed in an elementary grade, you will need to complete an addendum activity during your second placement to satisfy this element.

It is strongly recommended that you meet with the specialization coordinator in math before beginning your TPA process.

Alignment with Standards.

Element
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.
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.
3b Analyze and consider research in planning for and leading students in rich mathematical learning experiences.
3c Plan lessons and units that incorporate a variety of strategies, differentiated instruction for diverse populations, and mathematics-specific and instructional technologies in building all students' conceptual understanding and procedural proficiency.
3d Provide students with opportunities to communicate about mathematics and make connections among mathematics, other content areas, everyday life, and the workplace.
3e Implement techniques related to student engagement and communication including selecting high quality tasks, guiding mathematical discussions, identifying key mathematical ideas, identifying and addressing student misconceptions, and employing a range of questioning strategies.
3f Plan, select, implement, interpret, and use formative and summative assessments to inform instruction by reflecting on mathematical proficiencies essential for all students.

3g Monitor students' progress, make instructional decisions, and measure students' mathematical understanding and ability using formative and summative assessments.
4b Plan and create developmentally appropriate, sequential, and challenging learning opportunities grounded in mathematics education research in which students are actively engaged in building new knowledge from prior knowledge and experiences.
4c Incorporate knowledge of individual differences and the cultural and language diversity that exists within classrooms and include culturally relevant perspectives as a means to motivate and engage students.
5a **Verify that middle grades students demonstrate conceptual understanding; procedural fluency; the ability to formulate, represent, and solve problems; logical reasoning and continuous reflection on that reasoning; productive disposition toward mathematics; and the application of mathematics in a variety of contexts within major mathematical domains.**
5b Engage students in developmentally appropriate mathematical activities and investigations that require active engagement and include mathematics-specific technology in building new knowledge.
5c Collect, organize, analyze, and reflect on diagnostic, formative, and summative assessment evidence and determine the extent to which students' mathematical proficiencies have increased as a result of their instruction.