

George Mason University
College of Education and Human Development
Mathematics Education Leadership

MATH 611.6M1 – Geometry and Measurement for K-8 Teachers
3 Credits, Summer 2017
June 5 – July 29 Mondays & Wednesdays (4:30 – 7:10) Online

Faculty

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Prerequisites/Corequisites

None.

University Catalog Course Description

The course explores the foundations of informal measurement and geometry 'in one, two, and three dimensions. The van Hiele model for geometric learning is used as a framework for how children build their understanding of length, area, volume, angles, and geometric relationships. Visualization, spatial reasoning, and geometric modeling are stressed. As appropriate, transformational geometry, congruence, similarity, and geometric constructions will be discussed.

Course Overview

This course is for future K-8 mathematics teacher specialists will cover the Virginia SOL strands in geometry and measurement, especially those in grades 5-8. Special attention will be given to interpreting and assessing students' work and learning.

Course Delivery Method

This course will be delivered online (76% or more) using a synchronous format via Blackboard Learning Management system (LMS) housed in the MyMason portal. You will log in to the Blackboard (Bb) course site using your Mason email name (everything before @masonlive.gmu.edu) and email password. The course site will be available on May 9, 2017.

Under no circumstances, may candidates/students participate in online class sessions (either by phone or Internet) while operating motor vehicles. Further, as expected in a face-to-face class meeting, such online participation requires undivided attention to course content and communication.

Technical Requirements

To participate in this course, students will need to satisfy the following technical requirements:

- High-speed Internet access with a standard up-to-date browser, either Internet Explorer or Mozilla Firefox is required (note: Opera and Safari are not compatible with Blackboard).
- Students must maintain consistent and reliable access to their GMU email and Blackboard, as these are the official methods of communication for this course.
- Students will need a headset microphone for use with the Blackboard Collaborate web conferencing tool.
- Students may be asked to create logins and passwords on supplemental websites and/or to download trial software to their computer or tablet as part of course requirements.
- The following software plug-ins for PCs and Macs, respectively, are available for free download:
 - Adobe Acrobat Reader: <https://get.adobe.com/reader/>
 - Windows Media Player:
<https://windows.microsoft.com/en-us/windows/downloads/windows-media-player/>
 - Apple Quick Time Player: www.apple.com/quicktime/download/

Expectations

- Course Week: Our course week will begin on the day that our synchronous meetings take place as indicated on the Schedule of Classes.
- Log-in Frequency:
Students must actively check the course Blackboard site and their GMU email for communications from the instructor, class discussions, and/or access to course materials at least 2 times per week. In addition, students must log-in for all scheduled online synchronous meetings.
- Participation:
Students are expected to actively engage in all course activities throughout the semester, which includes viewing all course materials, completing course activities and assignments, and participating in course discussions and group interactions.
- Technical Competence:
Students are expected to demonstrate competence in the use of all course technology. Students who are struggling with technical components of the course are expected to seek assistance from the instructor and/or College or University technical services.
- Technical Issues:
Students should anticipate some technical difficulties during the semester and should, therefore, budget their time accordingly. Late work will not be accepted based on individual technical issues.

- Workload:
Please be aware that this course is **not** self-paced. Students are expected to meet *specific deadlines* and *due dates* listed in the **Class Schedule** section of this syllabus. It is the student's responsibility to keep track of the weekly course schedule of topics, readings, activities and assignments due.
- Instructor Support:
Students may schedule a one-on-one meeting to discuss course requirements, content or other course-related issues. Those unable to come to a Mason campus can meet with the instructor via telephone or web conference. Students should email the instructor to schedule a one-on-one session, including their preferred meeting method and suggested dates/times.
- Netiquette:
The course environment is a collaborative space. Experience shows that even an innocent remark typed in the online environment can be misconstrued. Students must always re-read their responses carefully before posting them, so as others do not consider them as personal offenses. *Be positive in your approach with others and diplomatic in selecting your words.* Remember that you are not competing with classmates, but sharing information and learning from others. All faculty are similarly expected to be respectful in all communications.
- Accommodations:
Online learners who require effective accommodations to insure accessibility must be registered with George Mason University Disability Services.

Learner Outcomes or Objectives

This course is designed to enable students to do the following:

1. Candidates will develop a comprehensive understanding of an axiomatic system of reasoning, representation and creation of shapes using old and new ways to draw and construct the concepts of measurement and symmetry of structure.
2. Candidates will examine in depth geometry content appropriate for K-8 mathematics teachers, including the use of technology to study geometry and historical connections to geometry.
3. Candidates will explore fundamentals of geometry, congruence and similarity, two- and three- dimensional figures, transformations and isometries, and basic measurement properties of perimeter, area, and volume.
4. Candidates will examine two frameworks, Van Hiele's model for geometric learning and geometric Habits of Mind, in order to assess their own progress throughout the course and to discover these models' pedagogical implications on classroom instruction.

Professional Standards (National Council of Teachers of Mathematics)

Upon completion of this course, students will have met the following professional standards:

Geometry and Measurement (NCTM NCATE Mathematics Content for Elementary Mathematics Specialist *Addendum to the NCTM NCATE Standards 2012*)

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

C.3.1 Core concepts including angle, parallel, and perpendicular, and principles of Euclidean geometry in two and three dimensions

C.3.2 Transformations including dilations, translations, rotations, reflections, glide reflections; compositions of transformations; and the expression of symmetry and regularity in terms of transformations

C.3.3 Congruence, similarity and scaling, and their development and expression in terms of transformations

C.3.4 Basic geometric figures in one, two, and three dimensions (line segments, lines, rays, circles, arcs, polygons, polyhedral solids, cylinders, cones, and spheres) and their elements (vertices, edges, and faces)

C.3.5 Identification, classification into categories, visualization, two- and three-dimensional representations, and formula rationale and derivation (perimeter, area, and volume) of two- and three-dimensional objects (triangles; classes of quadrilaterals such as rectangles, parallelograms, and trapezoids; regular polygons; rectangular prisms; pyramids; cones; cylinders; and spheres)

C.3.6 Geometric measurement and units (linear, area, surface area, volume, and angle), unit comparison, and the iteration, additivity, and invariance related to measurements

C.3.7 Geometric constructions, axiomatic reasoning, and making and proving conjectures about geometric shapes and relations

C.3.8 Coordinate geometry including the equations of lines and algebraic proofs (e.g., Pythagorean Theorem and its converse)

C.3.9 Historical development and perspectives of geometry and measurement including contributions of significant figures

Standard 2: Mathematical Practices (NCTM NCATE Mathematics Content for Elementary Mathematics Specialist *Addendum to the NCTM NCATE Standards 2012*)

In their role as teacher, lead teacher, and/or coach/mentor, elementary mathematics specialist candidates:

3a) Apply knowledge of curriculum standards for elementary mathematics and their relationship to student learning within and across mathematical domains in teaching elementary students and coaching/mentoring elementary classroom teachers.

3c) Plan and assist others in planning lessons and units that incorporate a variety of strategies, differentiated instruction for diverse populations, and mathematics-specific instructional technologies in building all students' conceptual understanding and procedural proficiency.

3e) Implement and promote 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.

5b) Engage students and coach/mentor teachers in using developmentally appropriate mathematical activities and investigations that require active engagement and include mathematics-specific technology in building new knowledge.

Required Texts

Schifter, D., Bastable, V., & Jo Russell, S. (2001 or 2015). Examining Features of Shape (Developing Mathematical Ideas).

Schifter, D., Bastable, V., & Jo Russell, S. (2001 or 2015). Measuring Space in One, Two, and Three Dimensions (Developing Mathematical Ideas).

Course Performance Evaluation

Students are expected to submit all assignments on time in the manner outlined by the instructor (e.g., Blackboard, Tk20, hard copy).

- **Assignments and/or Examinations**

- A. Professional Development Session (20%)**

- NCATE/NCTM 5b

- Purpose: As a math leader, you will be responsible for supporting teachers, administrators and the school community in math understanding. In this class, you will prepare a professional development session that incorporates the following:

- An interactive activity – not a lecture presentation
 - Includes math specific technology tool
 - References the reading

- B. Reflection Log (20%) – Performance Based Assessment**

- NCATE/NCTM Indicator 1a (C.3.1 - C. 3.9), 2a, 2b, 2c, 2f

- Each class sessions will consist of working on a rich problem and utilizing the following: practices for promoting productive mathematics discussions, differentiation, the NCTM Process Standards and the multiple representations utilized. Students are expected to analyze and reflect solution strategies and come to class prepared to participate in the discussion.

You will submit 9 reflection logs. Eight of the reflection logs should be approximately 1 page in length, include a picture or screenshot of student work, and answer the following questions:

- 1) Reflect on the process of mathematical problem solving used in this rich task.
- 2) What generalizations and conjectures did you make, and how did you use reasoning to construct viable arguments and proofs?
- 3) How are different representations and models similar and how are they different?
- 4) How did you demonstrate flexibility in mathematical modeling when confronted with different models, representations, or solutions?
- 5) How could you see this problem in the real world?

- C. Rich Task Project (20%) – Performance Based Assessment**

- NCATE/NCTM 3a, 3c, 3e, 5b

- Develop a lesson that includes a rich task involving GEOMETRY. Plan should follow the template given and cover ideas and topics outlined in the rubric. Task must include some type of manipulative or technology usage. **See Rubric for additional details.**

- D. Two Content Exams (40%)**

NCATE/NCTM All Standards listed.

Students will take two content exams each worth 20% of the grade covering the content studied in the course. The focus of the exams will be on the mathematical content of the course. Students are expected to demonstrate their own understanding and reasoning of the content as well as the knowledge and understanding needed by K-8 students in order to make sense of this content.

- **Other Requirements**

It is your responsibility to attend all class sessions. Please report your reasons for any absences to the instructor in writing.

Tardiness: It is your responsibility to be on time for each class session. Please report your reasons for any tardiness to the instructor in writing.

Class materials will be posted for each class session on Blackboard. Students are responsible for reviewing these materials and submitting required artifacts (where appropriate) to online class discussion boards.

- **Grading**

100: A+	89 – 87: B+	79 – 77: C+	69 & below: F
99 – 93: A	86 – 83: B	76 – 73: C	
92 – 90: A-	82 – 80: B-	72 – 70: C-	

Professional Dispositions

Students are expected to exhibit professional behaviors and dispositions at all times.

This course will meet online. A professional disposition can be seen as positive, problem solving, and supportive. Students should ask questions to further understand another person's viewpoint before making assumptions.

Class Schedule

JUNE & JULY 2017						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5 How Full?	6	7 Scones <u>Assignments Due</u> Log 1	8	9	10
11	12 Pasta Party <u>Assignments Due</u> Log 2	13	14 Pizza Shade <u>Assignments Due</u> Log 3	15	16	17

18	19 Escher <u>Assignments Due</u> Log 4 PD 1	20	21 Polygon Company <u>Assignments Due</u> Log 5 PD 2 PBA: Task	22	23	24
25	26 Pythagoras <u>Assignments Due</u> Log 6 PD 3	27	28 <u>asynchronous</u> MIDTERM	29	30	1
2	3 <u>No class</u>	4	5 <u>asynchronous</u> <u>Assignments Due</u> PBA: Curric	6	7	8
9	10 Pasta Party 2 <u>Assignments Due</u> Log 7 PD 4 PBA: Strat& Misconcep	11	12 How big is it? <u>Assignments Due</u> Log 8 PD 5 PBA: Questions	13	14	15
16	17 Hockey Rink <u>Assignments Due</u> PD 6 PBA: Handout & Technology	18	19 Ice Cream & Oragnes <u>Assignments Due</u> PD 7 PBA: Differentiation Reflections	20	21	22
23	24 YOUR exploration <u>Assignments Due</u> Log 9 Final PBA	25	26 <u>asynchronous</u> FINAL EXAM	27	28	29

Note: Faculty reserves the right to alter the schedule as necessary, with notification to students.

Core Values Commitment

The College of Education and Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles: <http://cehd.gmu.edu/values/>.

GMU Policies and Resources for Students

Policies

- Students must adhere to the guidelines of the Mason Honor Code (see <http://oai.gmu.edu/the-mason-honor-code/>).

- Students must follow the university policy for Responsible Use of Computing (see <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/>).
- Students are responsible for the content of university communications sent to their Mason email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students **solely** through their Mason email account.
- Students with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services. Approved accommodations will begin at the time the written letter from Disability Services is received by the instructor (see <http://ods.gmu.edu/>).
- Students must follow the university policy stating that all sound emitting devices shall be silenced during class unless otherwise authorized by the instructor.

Campus Resources

- Support for submission of assignments to Tk20 should be directed to tk20help@gmu.edu or <https://cehd.gmu.edu/aero/tk20>. Questions or concerns regarding use of Blackboard should be directed to <http://coursessupport.gmu.edu/>.
- The Writing Center provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing (see <http://writingcenter.gmu.edu/>).
- The Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance (see <http://caps.gmu.edu/>).
- The Student Support & Advocacy Center staff helps students develop and maintain healthy lifestyles through confidential one-on-one support as well as through interactive programs and resources. Some of the topics they address are healthy relationships, stress management, nutrition, sexual assault, drug and alcohol use, and sexual health (see <http://ssac.gmu.edu/>). Students in need of these services may contact the office by phone at 703-993-3686. Concerned students, faculty and staff may also make a referral to express concern for the safety or well-being of a Mason student or the community by going to <http://ssac.gmu.edu/make-a-referral/>.

For additional information on the College of Education and Human Development, please visit our website <https://cehd.gmu.edu/>.

Rich Task Project Rubric– Performance Based Assessment

Levels/Criteria	4	3	2	1
	Exceeds Expectations	Meets Expectations	Developing	Does Not Meet Expectations
<p>a) CURRICULUM STANDARDS NCTM Indicator 3A.1 Apply knowledge of mathematics curriculum standards for elementary within and across mathematical domains.</p>	<p>Includes the grade level, major concept, objective/goals, VA SOL's, NCTM process standards, mathematical practice CCSS, and prerequisite knowledge.</p> <p>Cites research on the rationale for choosing a rich task and why your choice in task meets the requirements of a rich task.</p>	<p>Includes the grade level, major concept, objective/goals, VA SOL's, NCTM process standards, mathematical practice CCSS, and prerequisite knowledge.</p> <p>Lesson is based on research and it cited correctly.</p>	<p>Includes the grade level, major concept, objective/goals, VA SOL's, NCTM process standards, mathematical practice CCSS, and prerequisite knowledge.</p>	<p>Lesson plan is not based on research. Many aspects of the plan are missing.</p>
<p>3A.2 Relate mathematics curriculum standards to student learning.</p>	<p>Cites research on what elements make a "rich" question or a "high level" question.</p> <p>Cites research on what is a major mathematical concept or "big mathematical idea".</p>			
<p>b) COMPLETED LESSON PLAN 3C.5 Assist others in planning lessons and units that incorporate multiple strategies, differentiated instruction for diverse populations, and mathematics-specific and instructional technologies to build all students' conceptual understanding and procedural proficiency.</p>	<p>Lesson plan provides enough information and clarity for a teacher to implement the lesson and task as intended.</p> <p>Assisted peers in developing multiple strategies to build all students' conceptual understanding and procedural proficiency. Assisted peers in identifying diverse populations and modifying the task to build all students' conceptual</p>	<p>Lesson plan provides enough information and clarity for a teacher to implement the lesson and task as intended with some questions.</p> <p>Assisted peers in developing multiple strategies and identifying diverse populations and modifying the task or aligning mathematics-specific and instructional technologies to build all students' conceptual</p>	<p>Lesson plan provides information for a teacher to implement the lesson and task as intended with many questions.</p> <p>Assisted peers in developing multiple strategies or identifying diverse populations and modifying the</p>	<p>Lesson plan is vague – teacher would be unable to implement the task as intended.</p> <p>Does not collaborate with peers on lesson plan.</p>

	<p>understanding and procedural proficiency. Assisted peers in aligning mathematics-specific and instructional technologies to build all students' conceptual understanding and procedural proficiency.</p>	<p>understanding and procedural proficiency.</p>	<p>task or aligning mathematics-specific and instructional technologies to build all students' conceptual understanding and procedural proficiency.</p>	
<p>c) QUESTIONS NCTM Indicator 3E.2 Provide instruction that incorporates high quality tasks and a range of questioning strategies.</p>	<p>Plan contains key questions and student expectations to aid teacher when implementing the task to maintain rigor. Plan contains questions and expected student expectations to address misconceptions. Plan contains questioning strategies to guide productive mathematical discussions in classrooms centered on key mathematical ideas. Questions engage students and teachers in communicating about mathematics. Plan describes how student misconceptions will be used as opportunities for learning.</p>	<p>Plan contains key questions and student expectations to aid teacher when implementing the task to maintain rigor but lacks some clarity. Plan contains questions and expected student expectations to address misconceptions. Questions engage students and teachers in communicating about mathematics.</p>	<p>Plan contains questions low in cognitive demand. Student expectations are also low in rigor.</p>	<p>Plan does not contain key questions. Student expectations are missing.</p>
<p>3E.3 Guide productive mathematical discussions in classrooms centered on key mathematical ideas.</p>				
<p>3E.4 Select and apply instructional techniques that assist in identifying and addressing student misconceptions.</p>				
<p>3E.5 Engage students and teachers in communicating about mathematics.</p>				
<p>3E.6 Use students' misconceptions as opportunities for learning.</p>				

<p>d) STRATEGIES & MISCONCEPTIONS NCTM Indicator 3C.1 Plan lessons and units that incorporate a variety of strategies.</p>	<p>Plan contains at least five different strategies that show multiple opportunities and solution avenues for students to demonstrate conceptual understanding and procedural proficiency. Plan contains at least two different misconceptions. Plan describes the connections between the different strategies/misconceptions using descriptions such as similarities, differences, efficiency, visual clarity, mathematical accuracy and/or precision to support students' conceptual understanding and procedural proficiency.</p>	<p>Plan contains four different strategies that show multiple opportunities and solution avenues for students to demonstrate conceptual understanding and procedural proficiency. Plan contains one misconception. Plan describes the connections between the different strategies/misconceptions to support students' conceptual understanding and procedural proficiency.</p>	<p>Plan contains three different strategies that show multiple opportunities and solution avenues for students to demonstrate conceptual understanding and procedural proficiency. Description of conceptual understanding and procedural proficiency is incomplete.</p>	<p>Student strategies and misconceptions lack a complete listing and in-depth understanding.</p>
<p>3C.4 Build all students' conceptual understanding and procedural proficiency in planned lessons and units.</p>				
<p>3C.6 Include in planned lessons and units multiple opportunities and solution avenues for students to demonstrate conceptual understanding and procedural proficiency.</p>				
<p>e1) TECHNOLOGY NCTM Indicator 3C.1 Include mathematics-specific and instructional technologies in planned lessons and units.</p>	<p>Your choice of technology is explained regarding how it is math-specific and supports the task. The tool is specific to the task (ie: the geoboard on NLVM, and not simply "iPads"). Links to the web or appstore are provided and screen captures of the tool are included.</p>	<p>Your choice of technology is explained regarding how it is math-specific and supports the task. The tool is specific to the task (ie: the geoboard on NLVM, and not simply "iPads").</p>	<p>Your choice of technology is not explained regarding how it is math-specific and supports the task or the tool is not specific.</p>	<p>Your choice of technology is not explained regarding how it is math-specific and supports the task and the tool is not specific.</p>
<p>e2) Developmental TECHNOLOGY NCTM Indicator 5B.3 Engage students in developmentally appropriate mathematical activities and investigations that include mathematics-specific technology in</p>	<p>Your choice of technology is explained regarding how it will enhance learning. Tool engages students in developmentally appropriate mathematical activities and investigations that include mathematics-</p>	<p>Your choice of technology is explained regarding how it will enhance learning. Tool engages students in developmentally appropriate mathematical activities and investigations that include mathematics-</p>	<p>Your choice of technology is not explained regarding how it will enhance learning or the tool does not engage students in developmentall</p>	<p>Your choice of technology is not explained regarding how it will enhance learning and the tool does not engage students in developmentally</p>

building new knowledge.	specific technology in building new knowledge. Plan contains a detailed explanation of how the students will interact with the tool.	specific technology in building new knowledge.	y appropriate mathematical activities and investigations that include mathematics-specific technology in building new knowledge.	appropriate mathematical activities and investigations that include mathematics-specific technology in building new knowledge.
f1) DIFFERENTIATION NCTM Indicator 3A.3 Demonstrate how mathematics curriculum standards and learning progressions impact the teaching of elementary students at different developmental levels and coaching/mentoring elementary classroom teachers.	Plan identifies the grade level standard (VA SOL & CCSS) and at least two other grade levels and describes the progression and vertical alignment. Modifications to the lesson are given for different developmental levels to meet all student needs. Collaborated with peers to coach and give feedback on the differentiation of others' geometry task.	Plan includes how to modify the lesson to gear down and gear up to meet all student needs but is lacking clarity or completeness. Modifications are given that are appropriate for the given level but may lack clarity or completeness. Collaborated with peers to coach and give feedback on the differentiation of others' geometry task.	Plan includes how to modify the lesson to gear down and gear up to meet all student needs but is lacking clarity and completeness. Grade modifications are given that are appropriate for the given level but may lack clarity and completeness.	Plan differentiation and modifications are very minimal.
f2) DIVERSE POPULATIONS 3C.2 Plan lessons and units addressing student differences and diverse populations and how these differences influence student learning of mathematics.	Modifications to the lesson are given for diverse populations to meet all student needs. Explanation of how student differences may influence their learning of mathematics.	Modifications are given for diverse populations but may lack clarity or completeness.	Modifications are given for diverse populations but may lack clarity and completeness.	Plan modifications are very minimal.
g) HANDOUT & KEY <u>Geometry Task</u> : handout is clear and applicable for the grade level. Answer key is provided.	Geometry Task handout is clear and applicable for the grade level. Answer key is provided.	Geometry Task handout is applicable for the grade level but lacks clarity. Answer key is provided.	Geometry Task handout is applicable for the grade level but lacks clarity. Answer key is not provided.	Geometry Task handout is not applicable for the grade level. Answer key is not provided.
h) TASK NCTM Indicator 3E.1 Implement and promote techniques for actively engaging students in learning and doing mathematics.	Geometry task implements and promotes techniques for actively engaging students in learning and doing mathematics.	Geometry Task_has a cognitive demand of "Procedures with Connections"	Geometry Task has a cognitive demand of "Procedures without Connections"	Geometry Task has a cognitive demand of "Memorization"

<p>i) LESSON REFLECTION - JUSTIFICATION NCTM Indicator 5B.1 Engage students in developmentally appropriate mathematical activities and investigations that require active engagement in building new knowledge.</p>	<p>Reflection shows evidence that students were engaged in developmentally appropriate mathematical activities and investigations that require active engagement in building new knowledge.</p>	<p>Reflection shows evidence that students were engaged in investigations that require active engagement in building new knowledge.</p>	<p>Reflection shows evidence that students were engaged in investigations that require active engagement.</p>	<p>Reflection of lesson implementation is missing.</p>
<p>j) LESSON REFLECTION - PROBLEM SOLVING 5B.4 Facilitate students' ability to develop future inquiries based on current analyses.</p>	<p>Reflection shows evidence that you facilitated students' ability to develop future inquiries based on current analyses.</p>	<p>Reflection shows evidence that you facilitated students' ability to develop inquiries about the task.</p>	<p>Reflection shows evidence that you facilitated students' ability solve the task.</p>	<p>There is no expectation of students communicating their problem solving strategies.</p>
<p>k) COACHING/ASSISTING NCTM INDICATOR 5B.2 Coach/mentor teachers in using developmentally appropriate mathematical activities and investigations that require active student engagement in building new knowledge.</p>	<p>Assist peers in designing a task that uses developmentally appropriate mathematical activities and investigations that require active student engagement in building new knowledge.</p>	<p>Assist peers in designing a task that is developmentally appropriate and uses investigations.</p>	<p>Assist peers in thinking about their task.</p>	<p>Does not collaborate with peers during task creation.</p>

Reflection Log Rubric – Performance Based Assessment

Rubric for Logs 1-8

Log 1: C.3.1 Core concepts including angle, parallel, and perpendicular, and principles of Euclidean geometry in two and three dimensions

Log 2: C.3.2 Transformations including dilations, translations, rotations, reflections, glide reflections; compositions of transformations; and the expression of symmetry and regularity in terms of transformations

Log 3: C.3.3 Congruence, similarity and scaling, and their development and expression in terms of transformations

Log 4: C.3.4 Basic geometric figures in one, two, and three dimensions (line segments, lines, rays, circles, arcs, polygons, polyhedral solids, cylinders, cones, and spheres) and their elements (vertices, edges, and faces)

Log 5: C.3.5 Identification, classification into categories, visualization, two- and three-dimensional representations, and formula rationale and derivation (perimeter, area, and volume) of two- and three-dimensional objects (triangles; classes of quadrilaterals such as rectangles, parallelograms, and trapezoids; regular polygons; rectangular prisms; pyramids; cones; cylinders; and spheres)

Log 6: C.3.6 Geometric measurement and units (linear, area, surface area, volume, and angle), unit comparison, and the iteration, additivity, and invariance related to measurements

Log 7: C.3.7 Geometric constructions, axiomatic reasoning, and making and proving conjectures about geometric shapes and relations

Log 8: C.3.8 Coordinate geometry including the equations of lines and algebraic proofs (e.g., Pythagorean Theorem and its converse)

Criteria	Does not meet standard 1	Approaches standard 2	Meets standard 3	Exceeds standard 4
Section 1 – Rich Task Work Time				
NCTM CAEP Element 1A.1: Demonstrate knowledge of major concepts, algorithms, and procedures within and among mathematical domains.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 1A.2: Apply knowledge of major concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 1A.4: Apply conceptual and procedural knowledge of major concepts, algorithms, and	The candidate did not show evidence of the standard.	The candidate shows minimal	The candidate shows evidence of	The candidate shows evidence of

applications in building new knowledge from prior knowledge and experiences.		evidence of the standard.	mastery of the standard.	exceeding mastery of the standard.
NCTM CAEP Element 2B.2: Represent and model generalizations using mathematics.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2B.3: Recognize structure and express regularity in patterns of mathematical reasoning.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2B.4: Use multiple representations to model and describe mathematics.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2B.5: Use appropriate mathematical vocabulary and symbols to communicate mathematical ideas to others.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
Section 2 – Rich Task Debate and Discussion				
NCTM CAEP Element 1A.3: Explain how concepts, algorithms, procedures, and applications have developed.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2A.2: Make sense of a wide variety of problems and persevere in solving them.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2A.3: Apply and adapt a variety of strategies in solving problems confronted within the field of mathematics and other contexts.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2A.4: Formulate and test conjectures in order to frame generalizations.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2B.1: Reason abstractly, reflectively, and quantitatively with attention to units, constructing viable arguments and proofs, and critiquing the reasoning of others.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.

NCTM CAEP Element 2B.6: Demonstrate an appreciation for mathematical rigor and inquiry.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2F.1: 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.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
Section 3 – Reflection Paper				
NCTM CAEP Element 2A.5: Monitor and reflect on the process of mathematical problem solving.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2A.1: Use problem solving to develop conceptual understanding and to formulate and test generalizations.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2F.2: Reflect on how the mathematical practices of problem solving, reasoning, communicating, connecting, and representing impact mathematical understanding.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2C.2: Demonstrate flexibility in mathematical modeling when confronted with different purposes or contexts.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.
NCTM CAEP Element 2C.1: Formulate, represent, analyze, interpret, and validate mathematical models derived from real-world contexts or mathematical problems.	The candidate did not show evidence of the standard.	The candidate shows minimal evidence of the standard.	The candidate shows evidence of mastery of the standard.	The candidate shows evidence of exceeding mastery of the standard.

Reflection Log 9

The final reflection log will involve researching a major mathematical historical development and the contributions of a historically significant figure. We will discuss many of these developments and figures during the math talk all throughout the semester. However, this discussion will be brief. Once you find a topic that interests you, you should research it further. The following reflection should be about 2 pages in length and will be evaluated using the following criteria.

Levels/Criteria	4	3	2	1
	Exceeds Expectations	Meets Expectations	Developing	Does Not Meet Expectations
NCTM Indicator C.1.5 Historical development of number, operations, number systems, and quantity.	Essay describes the historical development of number, operations, number systems, and quantity in depth and provides specific examples.	Essay describes the historical development of number, operations, number systems, and quantity and provides specific examples.	Essay describes the historical development of number, operations, number systems, and quantity and provides an example.	Essay includes incomplete description of historical development of number, operations, number systems, and quantity.
NCTM Indicator C.1.5 Historical perspectives of number, operations, number systems, and quantity.	Essay describes the historical perspectives of number, operations, number systems, and quantity in depth and provides specific examples.	Essay describes the historical perspectives of number, operations, number systems, and quantity and provides specific examples.	Essay describes the historical perspectives of number, operations, number systems, and quantity and provides an example.	Essay includes incomplete description of historical perspectives of number, operations, number systems, and quantity.
NCTM Indicator C.1.5 Contributions of historically significant figures and diverse cultures.	Essay describes contributions of historically significant figures and diverse cultures in depth and provides specific examples.	Essay describes contributions of historically significant figures and diverse cultures and provides specific examples.	Essay describes contributions of historically significant figures and diverse cultures and provides an example.	Essay includes incomplete description of historically significant figures and diverse cultures.