Math for Elementary Teachers 2
Reasoning About Algebra, Geometry and Measurement
MTT 302 - Syllabus

Pre-Requisite
Placement Test A with a minimum of 14 points on Part I and 19 points on Part II
Or Permission of Instructor

Required Textbook

Recommended Textbook

Course Description
This is one of two mathematics courses proposed for prospective elementary school teachers. The course provides elements of the mathematical content knowledge and pedagogical content knowledge needed to understand and teach mathematics in elementary school. For each mathematical topic, the course provides multiple representations and multiple tools for understanding, communicating and making connections within the mathematical content and among various ways of learning it. All through, relevant real life situations will be used to anchor the mathematical concepts and skills.

The mathematical content of the course includes addressing Algebra as a symbolic language; as generalized arithmetic; as a study of structures and as a study of relationships among quantities. Graphing of linear and quadratic functions will anchor the study of change with a focus on the relationships among time, distance and rate. The study of Geometry will include 2 and 3 dimensional shapes and their characteristics; 2-dimensional symmetry, similarity and tessellations as well as rigid transformations. The study of Measurement will include basic concepts of measurement with standard and non standard units; measurements of angles, lines, area, surface area and volume will culminate in the development of formulas for the measurement of various 2 and 3 dimensional shapes.

Evaluation
During the semester, there will be two hourly exams and a final three. You will be assigned two take home problem sets, two short papers. These tasks will be graded as follows:

<table>
<thead>
<tr>
<th>Task</th>
<th>Points per task</th>
<th>Total</th>
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<tr>
<td>Hourly Exams</td>
<td>100 points each</td>
<td>200 points</td>
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Proposed Syllabus for MTT 301

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Problem Sets | 50 points | 100 Points
Short papers | 50 points | 100 Points
Final Exam    |            | 150 Points
Attendance, effort & participation | 50 points |  
Total        |            | 600 Points

Letter Grades will be assigned as follows: A for points between 600 - 540; B for points between 539 - 480; C for points between 479 – 420; D for points between 419 – 360; F for points below 360. Ten points on the border of each point range will be assigned a plus or minus the letter grade accordingly. For example a total of 536 points is a B+ while a total of 495 is a B-

**Policies and Expectations**

**Attendance is required.** Attendance will be taken at the beginning of class. Make the effort to arrive on time to hear class announcements and receive course handouts.

**Tardiness is noted.** If you arrive late for class, it is your responsibility to notify the instructor at the end of class on that day so that the attendance record can be changed from absent to tardy. Whether you were absent or late during a class period, you are totally responsible for the content covered during that period.

**There will be no Make-ups for missing exams.** Missing an exam without the permission of the instructor will result in a grade of zero. Medical and other emergency reasons will be considered if and when confirmed by official reports. Failure to appear for and to submit the final exam will result in a grade of F for the course.

**Late Problem sets and short papers** will be accepted if handed in within a week of the deadline. However, they will automatically lose points per each late day.

**Electronic Phones and other Devices should be turned off during class.**

**Academic Dishonesty:** Collaboration and learning from each other will be encouraged and rewarded in class and outside of class. Claiming someone else’s work as your own or cheating on an exam is wrong and will be severely punished. Check the web site [http://www.umb.edu/student_services/student_rights/code_conduct.html](http://www.umb.edu/student_services/student_rights/code_conduct.html)

For more information regarding University Policy on Academic Standards & Cheating; University Statement on Plagiarism and Documentation of Written Work; and Code of Student Conduct.

**Support and Resources**

**Support Groups:** All through the semester each of you will belong to a Support Group of your peers. Initially, the instructor will assign the members of each Support Group. Later on, you will have the opportunity to form your own support group if you so wish. The number in each group will be between four and three students. During class, you will sit in proximity to your support group so you can exchange information, discuss ideas, and engage in collaborative problem solving as instructed by the teacher. Outside class, you will be encouraged to study together, and support each other as you confront difficulties learning or keeping up with course demands.
**Instructor’s assistance:** I am available to assist you learn the content and manage your study effectively. Make good use of my office hours. You may send me email messages anytime. I will make my utmost effort to respond in a timely manner.

**Web Resources:** I will often suggest web resources for you to work with. Some will be readings or videos to supplement your textbooks, some will be tutorials to fill in gaps in your mathematical knowledge base and some will be applets that simulate concrete aids that represent mathematical ideas.

**Accommodations for Disabilities:** If you have a disability, section 504 of the Americans with Disabilities Act of 1990 offers guidelines for curriculum modifications and adaptations for students with documented disabilities. If this applies to you, make sure you visit the Ross Center for Disability Services, Campus Center, Upper Level, Room 211 (617-287-7430, TTY 617-287-7436). The Center will provide you with adaptation recommendations, which you will then present and discuss with your instructor. Make sure you present these recommendations to your instructor within a reasonable period of time, preferably by the end of Drop/Add period.

**About this Course**

This is a mathematics course focusing on the doing and learning of mathematics not the teaching of mathematics. However, learning mathematics in order to learn how to teach it requires special effort on your part to:

- Pay attention to what seems to be simple mathematics in order to deepen and broaden your understanding of each idea.
- Be vigilant about reflecting on your mathematical thinking as you do the mathematics.
- Be attentive to the mathematical thinking of others and incorporate it into your own when appropriate.
- Be observant of the various attitudes and emotions that arise as you work with mathematical ideas. When they are positive and support your learning, remember them and recall them when needed. When they are negative and impede your learning engage them in order to reduce their impact on your learning.
- Develop a sense of community with your classmates and teacher by sharing, communicating, respecting, trusting and learning from each other.

The mathematical content of the course will be listed below under Course content. Throughout the semester, as you address various mathematical topics, there will be an emphasis on the processes of mathematical thinking. These processes will permeate through all the mathematical topics we work with this semester. A summary of these processes is listed below:\(^1\):

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\(^1\) These processes are adapted from the *NCTM Principles and Standards for School Mathematics*: (Reston, VA: NCTM, 2000)
Make Representations
• Use diagrams, tables, graphs, symbols and words to represent a given mathematical situation
• Select and apply appropriate representations to help you solve problems
• Use representations to model and interpret physical, social and mathematical situations

Engage in Problem Solving
• Build new mathematical knowledge through problem solving
• Engage non-routine, multistep problems that occur in mathematics and in other context
• Apply a variety of approaches to problem solving
• Expand your repertoire of problem solving approaches through reflection and observations.

Enhance your Reasoning about Mathematics
• Make and investigate mathematical conjectures
• Develop and evaluate mathematical arguments
• Select and use various types of reasoning as needed

Practice Communicating about Mathematics
• Organize and consolidate mathematical thinking through communication
• Communicate your own mathematical thinking coherently and clearly to classmates, teacher and others
• Analyze and evaluate the mathematical thinking of others
• Use language to express mathematical ideas with precision

Make Connections
• Recognize and use connections among different mathematical ideas
• Understand how mathematical ideas build on each other to produce a coherent whole
• Recognize and apply mathematics in context outside of mathematics

Course Topics
Week 1: Introduction To The Course
Sections 1.1, 1.2
Attitudes and Beliefs about Mathematics
In-class collaborative group problem solving: How Much Will the Patio Cost?
Where is the Algebra in the problem?
Homework Assignment: Read and DO the mathematics on Pages 1-16
Exercises: Pages 26-29 exercises 1-17 odd

Week 2: Working with Patterns – a Precursor to Algebra
Sections 1.3, 1.4
Exploring patterns. Multiple representations of patterns.

Homework Assignment: Read and DO the mathematics on Pages 16-26
Exercises: pages 26-29, exercises 19, 21-24, 29-33,

Week 3: Making Generalizations - a Precursor to Algebra
Sections 1.5 – 1.7
Making generalizations; Reasoning about them; communicating and making connections
Homework Assignment: Read and DO the mathematics on Pages 30 -56
Exercises: Page 28 exercises 25-28; Pages 54 – 57 exercises 3,16, 17, 18, 19, 28, 31, 32.
First Short Paper Due

Week 4: Using Sets to Classify and Represent Relationships
Section 2.1
Classifying Quadrilaterals; Types of sets; Notations; Subsets; Venn Diagrams; Equivalent sets; Operations on sets.
Homework Assignment: Read and DO the mathematics on Pages 61-76
Exercises: pages 76-79 exercises 1-7, 9, 12, 14-17, 23.

Week 5: What is Algebra?
Section 2.2, and Supplementary Material.
Algebra as rules and procedures; As a study of structures; As relationships among quantities – functions.
Homework Assignment: Read and DO the mathematics on Pages 80-90.
Exercises: pages 96-100, exercises 1-6, 8, 10, 12, 13.
For more about the rules and procedures of manipulating symbols, read and do the exercises in the supplementary material provided by the instructor.
First Problem Set Due

Week 6: What is Algebra?
Section 2.2, and Supplementary Material.
More on functions: qualitative and quantitative functions; Developing “graph” sense; Working with linear functions; Slope and proportional reasoning.
Homework Assignment: Read and DO the mathematics on Pages 90 - 96
Exercises: pages 96-100 exercises 16, 19, 20, 25, 27, 28, 36, 37.
For more on linear functions and slope, read and do the exercises in the supplementary material provided by the instructor.

Week 7: Finding Algebraic Reasoning in Elementary School Mathematics
Supplementary Readings provided by the Instructor
First Hour exam

Week 8: Geometry: Shapes all Around us
Section 8.1
Looking and identifying shapes around us; Spatial thinking; Basic terms and ideas.
Homework Assignment: Read and DO the mathematics on pages 498-512
Exercises: Pages 518-521 exercises 2, 3, 4, 6, 7, 8, 18

Second Short Paper Due

Week 9: Angles and Two-Dimensional Figures
Sections 8.1 and 8.2
Angles and their measures; attributes and classification of 2-D figures; polygons.
Homework Assignment: Read and DO the mathematics on pages 512-517 and 521 - 529
Exercises: Pages 519-521, exercises 9, 10, 11, 12, 13, 15, 18. Pages 555-557, exercises 1-4, 6, 9, 10.

Week 10: Triangles, Quadrilaterals and Other Polygons.
Section 8.2
Homework Assignment: Read and DO the mathematics on pages 529-554
Exercises: Pages 555-558 exercises 8, 11-18, 24, 32-35
Second problem Set is Due

Week 11: Three-Dimensional Objects
Section 8.3
Connecting Polygons to Polyhedra; Families of Polyhedra; Relationships among Polyhedra; connecting 2-D representations to 3-D objects; Cylinders and cones
Homework Assignment: Read and DO the mathematics on pages 559-575
Exercises: Pages 575-579 exercises 1-6, 10-12, 14, 18, 19

Week 13: Transformations, Congruence, Symmetry and Similarity
Sections 9.1, 9.2, 9.3
Selected readings and exercises from chapter 9
Second Hour exam
Week 13: Measurement
Section 10.1
Homework Assignment: Read and DO the mathematics on pages 649-660
Exercises: Pages 660-661 exercises 2, 3, 8, 9, 17, 20.

Week 14: Measurement of Area and of Perimeters
Section 10.2
Area and perimeter of polygons and of circles; Pythagorean theorem and its applications to measurement of polygons.
Homework Assignment: Read and DO the mathematics on pages 663-675
Exercises: Pages 675-680 exercises 1-7, 15, 19, 21, 48, 49

Week 15: Measurement of Surface Area and Volume
Section 10.3
Surface area and volume of prisms, cylinders, pyramids and cones
Homework Assignment: Read and DO the mathematics on pages 682-694
Exercises: Pages 695-697 exercises 1, 2, 4, 6, 10, 14, 16.