Math for Elementary Teachers 1
Reasoning About Numbers and Quantities
MTT 301 - 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 designed 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 a historical perspective on numeration; The fundamental operations on the set of Whole Numbers; Extending the Number System to Integers, Rationals and Reals; Addressing conventional and alternative ways of computing; Exploring the complexities in understanding Ratios, Proportions and Rates; Some Number Theoretic concepts such as Primes, Composites, Factors, Divisibility and related computations.

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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</thead>
<tbody>
<tr>
<td>Hourly Exams</td>
<td>100 points each</td>
<td>200 points</td>
</tr>
<tr>
<td>Problem Sets</td>
<td>50 points</td>
<td>100 Points</td>
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<tr>
<td>Short papers</td>
<td>50 points</td>
<td>100 Points</td>
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<tr>
<td>Final Exam</td>
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<td>150 Points</td>
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<tr>
<td>Attendance, effort &amp; participation</td>
<td>50 points</td>
<td>600 Points</td>
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</tbody>
</table>

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 a 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

Make Representations
• Use diagrams, tables, graphs, symbols and words to represent a given mathematical situation

1 These processes are adapted from the NCTM Principles and Standards for School Mathematics: (Reston, VA: NCTM, 2000)
• 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 and 1.6
Attitudes and Beliefs about Mathematics
In-class collaborative group problem solving: The Pigs and Chicken problem.
Exploring the different approaches to the same problem
Articulating mathematical processes in writing.
Homework Assignment: Read and DO the mathematics on Pages 1-16, and 44-48.

Week 2: Numeration, A Brief History
Section 2.3
Egyptian, Babylonian and Roman numeration systems
Development of place value and base 10; bases other than 10.
Homework Assignment: Read and DO the mathematics on Pages 101-118.
Exercises: pages 119-122, exercises 15, 16, 17(a, i), 18(a, c) 23, 25, 30, 32, 33, 36
Week 3: *The Four Fundamental Operations Of Arithmetic*  
**Sections 3.1, and 3.2**  
Using Natural numbers and the operations of addition and subtraction, we will look at different contexts and models of representation; standard and alternative algorithms; mental computation; estimation; developing number sense.  
**Homework Assignment:** Read and DO the mathematics on Pages 127-165  
**Exercises:** pages 150-153 exercises 6, 10, 11, 13, 14, 15, 17, 19, and 20.  
Pages 166-167, exercises 1, 5, 7, 13(a, b, c), 15, 18, 19, 23(a, b)  
**First Short Paper Due**

Week 4: *The Four Fundamental Operations Of Arithmetic*  
**Sections 3.3 and 3.4**  
Using Natural numbers and the operations of multiplication and division, we will look at different contexts and models of representation; standard and alternative algorithms; mental computation; estimation; developing number sense.  
**Homework Assignment:** Read and DO the mathematics on Pages 168 - 207  
**Exercises:** pages 186-187 exercises 2, 4, 7, 8, 9, 12, 14, 17, 21, 22(a, b, c), 26.  
Pages 207-208, exercises 2, 4, 9, 10, 11, 13, 15, 17, 41.

Week 5: *Number Theory*  
**Sections 4.1 and 4.2**  
Divisibility, primes and composites, prime factorization, the fundamental theorem of Arithmetic,  
**Homework Assignment:** Read and DO the mathematics on Pages 215 - 239  
**Exercises:** pages 229-231, exercises 3, 6, 7, 8, 9, 11, 14, 15  
Pages 239-241 exercises 1, 2, 3, 4, 6, 8, 11, 12, 15, 16  
**First Problem Set Due**

Week 6: *Number Theory*  
**Section 4.3**  
Greatest Common Factor; Least Common Multiple; Relationship between GCF and LCM  
**Homework Assignment:** Read and DO the mathematics on Pages 241-251  
**Exercises:** pages 252 – 253 exercises 1, 2, 3, 4, 6, 8, 10, 12, 13, 15  
**First Hour exam**

Week 7: *Extending the Number System*  
**Sections 5.1 and 5.2**  
Integers: Models of representation; operations with Integers; Absolute value; Understanding subtraction with Integers; Understanding division with Integers.  
Fractions and Rational Numbers: Models of representation - as measure, as quotient, as operators, as ratio.  
Equivalent fractions: ordering Rational Numbers; the denseness of Rational Numbers  
**Homework Assignment:** Read and DO the mathematics on pages 256-280  
**Exercises:** Pages 265-266 exercises 1, 2, 3, 5, 7, 10, 12, 14, 19, 21  
Pages 281-283 exercises 1, 3, 5, 6, 8, 11, 15, 16, 19, 21, 23, 25
**Week 8: Understanding Operations with Fractions**

**Section 5.3**
Addition and Subtraction; Representation models - Cuisenaire Rods and Pattern Blocks; Connecting concepts to procedures; Mixed Numbers and Improper Fractions; Estimation and mental arithmetic.

**Homework Assignment:** Read and DO the mathematics on pages 284 - 302

**Exercises:** Pages 303-307 exercises 1, 2, 3, 5, 7, 8, 10, 12, 14, 17, 18, 20, 22, 24, 37

**Second Short Paper Due**

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**Week 9: Decimals, Exponents and Real Numbers**

**Section 5.4**
Comparing and Ordering decimals; Role of the Zero – when it is necessary and when it is optional; rounding with decimals; connecting decimals to Fractions; operations with decimals; sense making with decimals.

**Homework Assignment:** Read and DO the mathematics on pages 308 - 320

**Exercises:** Pages 331-332 exercises 1, 2, 3, 4, 5, 6, 7, 9, 10, 13, 23

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**Week 10: Decimals, Exponents and Real Numbers**

Very large and very small numbers; scientific notation; real life contexts and use of language with decimals; repeating and non-repeating decimals; Real Number System and its properties.

**Homework Assignment:** Read and DO the mathematics on pages 321-

**Exercises:** Pages 332-334 exercises 24, 27, 28, 29, 30, 32, 33, 40, 49, 54

**Second problem Set is Due**

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**Week 11: Ratio and Proportion**

**Section 6.1**
Additive versus multiplicative comparisons; Ratio as measure; Comparing ratios; Rates and proportions; When ratios are like fractions and when they are not; real life applications

**Homework Assignment:** Read and DO the mathematics on pages 337 - 344

**Exercises:** Pages 354-355 exercises 1, 3, 5, 7, 9, 11, 13, 15, 19, 22, 29, 30, 33

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**Week 12: Ratio and Proportion**

**Section 6.1**
Rates as functions; more real life applications; dimensional analysis; developing proportional reasoning.

**Homework Assignment:** Read and DO the mathematics on pages 344 - 353

**Exercises:** Pages 356-357 exercises 36, 39, 40,48

**Second Hour exam**
**Week 13: Percents**

*Section 6.2*

Uses of percents – real life applications; different strategies working with percents; Connections between percents and other mathematical topics.

Homework Assignment: Read and DO the mathematics on pages 357-363

Exercises: Pages 373-374 exercises 1, 3, 5, 7, 9, 13, 15, 17, 19, 21

**Week 14: Percents**

*Section 6.2*

Percent change; percent greater than 100 and less than 1; Interest rates; more real-life applications.

Homework Assignment: Read and DO the mathematics on pages 364 - 373

Exercises: Pages 375-376 exercises 24, 29, 31, 33, 35, 38, 40, 47, 51

**Week 15: Review**