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M 132.00: Number and Operations for Elementary School Teachers

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(M 132) Numbers and Operations for Elementary School Teachers

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Fall 2018, University of Montana

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1 Overview

This course is for prospective elementary school teachers. The purpose of this course is to prepare students to be competent in teaching the major concepts and practical skills related to the real number system with the four arithmetic operations. Strategies and instructional activities are used and discussed to provide a linkage between what the prospective teachers study and what they will teach. It provides the opportunity to discuss appropriate activities, strategies and programs in teaching areas related to problem solving, and to the use of whole numbers, rational numbers, and real numbers.

Catalog: Offered autumn and spring. The study of number and operations for prospective elementary and middle school teachers, including whole numbers, decimals, fractions, percent, integers, operations, numeration systems, and problem solving.

Credits: 3

Prerequisites: M 095 or M 115, or ALEKS placement ≥ 4.

2 Textbook and materials

2.1 Required textbook

The required text for this course is:

- Beckman, S., et.al., *Mathematics for Elementary Teachers (with activities)* (Pearson).

2.2 Additional readings

Additional readings will be available via Moodle or handouts, or through a selection on hold at the Mansfield Library.

2.3   Materials

- A basic scientific calculator is strongly encouraged. A TI-83 or equivalent may also be used.

- Many students may find graph paper useful as well.

3   Course Requirements

mathematician: someone who studies, teaches, or is an expert in mathematics. (Cambridge Dictionaries Online)

> A mathematician, like a painter or poet, is a maker of patterns. If his patterns are more permanent than theirs, it is because they are made with ideas. (G. H. Hardy, *A Mathematician's Apology*)

By virtue of being in this class, we are mathematicians. Compared to others we know in the field, we may not feel we are experts, but to current and future students, we are viewed as such. As a future elementary mathematics expert, it is expected you will be a student of mathematics: learning the intricacies, patterns, and connections of elementary mathematics. As a future teacher of mathematics, it is not enough to know what your students need to know. You ***need*** to know:

- where this knowledge derives from

- how this knowledge is used in their future.

- how your students build this knowledge internally.

- what mistakes students make, and what thinking or content errors these mistakes represent.

To help meet this need for effective teaching knowledge, students successfully completing this course will begin their personal development of a profound understanding of fundamental mathematics by:

1. Developing as a mathematician and teacher with the ability to explain reasoning (both verbally and in writing) while solving problems, and participating with confidence in mathematical activity.

2. Viewing mathematics as the human activity of structuring the world, by demonstrating knowledge of the historical development of number and number systems including contributions from diverse cultures and its use in describing the world around us.

3. Become a more-central participant in the community of mathematics teachers

4. Develop a meaning of addition, subtraction, multiplication, and division and provide multiple models for whole number operations and their applications.

5. Recognize commutativity, associativity, distributivity, identities, and inverses as properties of operations on a given domain and appreciate that a small set of rules governs all of arithmetic.

6. Recognize the meaning and use of place value in efficiently representing whole numbers and finite decimals, comparing and ordering numbers, and understand the relative magnitude of numbers.

7. Demonstrating proficiency in and understanding of multi-digit computation using standard and alternative/invented algorithms, mental mathematics, and computational estimation. Explain the difference in understanding required for various algorithmic processes.

8. Analyzing integers and rational numbers, their relative size, and how operations with whole numbers extend to integers and rational numbers.

9. Evaluating student work regarding numbers and operations, determine the mathematical reasoning and strategies used, and recognize some common mistakes, including the reasoning that makes these mistakes sensible. Formulate feedback and identify instructional activities to further students' learning.

3.1   Course Grade

There will be one point available in this class, divided accordingly:

Requirement	Points
1. Exams (three planned)	$4/9$
2. Final Exam	$1/6$
3. Class Attendance/Participation/Homework	$7/54$
4. Concept Map	$7/27$

You must earn a C- or better in this course to pass the requirement in the School of Education. You may change to Credit/No Credit up the last day of the class. Credit will be awarded to students earning a D- or better. However, if you choose this option the grade cannot be counted towards the School of Education requirement nor the UM graduation requirement.

Exams

We will have three exams in this course plus a final (scheduled and announced in class one week prior) that will cover integers, fractions, and operations on these numbers. Each exam will be worth $4/27$ of a point towards your grade. Due to the interconnected nature of mathematics, all exams will have a comprehensive nature.

Final exams for this class are held on Wednesday, December 12: Section 01 (9 am) at 8 am; Section 03 (1 pm) at 1:10 pm

Class Attendance/Participation/Homework

Mathematics is a community activity. This class will have multiple in-class individual and group activities, and you are expected to participate fully. Attendance will be kept to monitor presence, level, and quality of activity. You are responsible for all assignments and tasks in class, whether you are in attendance or not. After completing these activities, you will be expected to answer questions and reflect on your experience. If you are not in attendance, your reflection on the experience will not be accepted.

Additional homework may be assigned as an extension or preparation for topics covered in class, as a method to engage students with interesting material that is not covered in class, and as preparation for exams. It may be assessed by collecting and grading, as completion grades, or through in-class quizzes. I will answer questions and provide solutions to homework as requested.

Concept Map The mathematics you're studying are deeply interconnected in ideas and practice. One of the ways to express these relationships is through a concept map.[1] Throughout the course, you are expected to construct your own map of the material in collaboration with your peers. We will take some time to work on these in class at the beginning of the semester, but as our time together continues, you will be expected to work more outside of class time. A copy of your final product is due the last week of class, and must be submitted prior to taking the final. You will go through multiple drafts and iterations of your concept map before the final product, so be prepared to start over, revise and rework as we continue.

Classroom behavior All students in this course are expected to be respectful of other participants, the instructor, and of the learning environment. In the support of free and open academic inquiry, civil behavior is required. This includes but is not limited to:

- restricting comments to current topics in the course

- refraining from disparaging or insulting remarks directed at or about others (present or not)

- silencing cell phones and other extraneous electronic devices

- limiting comments and conversations with classmates to a very quiet minimum

As a general rule, if the behavior will add to the learning environment, it is acceptable. If it disrupts the learning environment, it is not. Students are expected to be well-motivated and constructive in their pursuit of learning in the instructional situation. Expected student conduct is outlined in the Student Code of Conduct.

4 Class Communication

Outside of regular class time, all communication with students as a group or individually will be through your university email account or the Moodle. Be sure and check this account regularly.

5 Notices and Disclaimers

5.1 Passing credit

You must earn a C- or better in this course to pass the requirement in the School of Education. You may change to Credit/No Credit up the last day of the class. Credit will be awarded to students earning a D- or better. However, if you choose this option the grade cannot be counted towards the School of Education requirement nor the UM graduation requirement.

5.2 Access and Accomodation

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors and Disability Services for Students (DSS). If you think that you may have a disability adversely affecting you academic performance, and you have not already registered with DSS, please contact DSS in Lommassen 154. I will work with you and DSS to provide an appropriate accommodation.

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[1] See https://en.wikipedia.org/wiki/Concept_map, or https://www.cmu.edu/teaching/assessment/assesslearning/conceptmaps.html, or https://msu.edu/~luckie/ctools/

5.3   Copyright and Fair-Use

Materials used in connection with this course may be subject to copyright protection under Title 17 of the United States Code. Under certain Fair Use circumstances specified by law, copies may be made for private study, scholarship, or research. Electronic copies should not be shared with unauthorized users. If a user fails to comply with Fair Use restrictions, that user may be liable for copyright infringement.

5.4   Academic Dishonesty

Dishonesty includes plagiarism, cheating and any conscious act by a student that gives him or her undue advantage over fellow students. Plagiarism is copying or using the ideas of another without giving proper credit through the use of quotation marks, footnotes, or other forms of reference. Cheating involves making unauthorized use of answers to examinations, tests, quizzes, in-class work, or homework assignments, as well as copying from fellow students or submitting work that has been done by someone else. Taking photos of tests and/or texting information from the test is also considered cheating.

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://life.umt.edu/vpsa/student_conduct.php

5.5   Safety

Please note the evacuation plan posted in this college classroom in the event of fire, tornado, or other disaster. If you see other hazards, please let us know. Additional information regarding UM's safety policies can be found in the university catalog.

5.6   Disclaimer

Information contained in this syllabus was, to the best knowledge of the instructor, considered correct and complete when distributed for use at the beginning of the class. However, this syllabus should not be considered a contract between University of Montana and the student. The instructor reserves the right, acting within the policies and procedures of UM, to make changes in courses content or instructional technique without notice or obligation. If extenuating circumstances exist in a particular student's situation the instructor reserves the right to make modifications based on the needs of individual students, in accordance with university policy.

6   Schedule

The schedule presented is subject to change as needed to meet the needs of the class and its objectives. It may change upon announcement in class.

Week 1-2 What is number? Numeration systems

Week 3-4 Integers and fractions

Week 4-7 Addition and subtraction: Operations with integers, decimals and fractions

Week 8-10 Multiplication

Week 11-15 Division

6.1   Important dates

- September 17: Last day to drop the course without instructor permission using Cyberbear.

- October 9: Last day to drop with "W" on transcript.

- December 7: Last day to drop the course or change grading option using a late drop form.