**Course Information** Math 385: Mathematics for Elementary School Teachers

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| **Instructor** | Nicholas Vlamis (vlamis@umich.edu)<br>5856 East Hall<br>Office Hours: M 4-5PM, F 12-1:30PM, Su 4-5PM*<br>(Or by appointment) |
| **GSI** | Francesca Gandini (fragandi@umich.edu)<br>4080 East Hall<br>Office Hours: M 5-6PM, F 1:30-3PM, Su 4-5PM*<br>(Or by appointment) |
| **Course Assistant** | Alison Shoemaker (alishoe@umich.edu)<br>Office Hours: Tu 4-5PM (Brandon Center)<br>Su 3-4PM (Starbucks South University) |
| **Class** | 001: MW 1:10–2:30pm, 1033 DENT<br>002: MW 2:40–4:00pm, 1033 DENT |
| **Website** | Access through Canvas. |

*Francesca and Nick will alternate Sunday office hours

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## Course Description

**Overview.** What does it mean to justify mathematical claims? Why do the standard algorithms you know for addition, subtraction, multiplication, and division give the correct answer? Can one intuitively make sense of the equation $5-(-4)=5+4$? Can different visual representations illuminate different mathematical concepts? Why does dividing by a fraction give the same result as multiplying by its reciprocal? These are examples of the kind of questions we will consider in this class.

Our focus will be on understanding the mathematical structures, representations, and reasoning underlying numbers (whole numbers, integers, fractions) and their operatoions ($+,-,\times,\div$: strategies, models, and algorithms). The goal is to create the specific mathematical knowledge needed for teaching: the knowledge necessary to create instructive tasks for elementary school students and to understand and effectively utilize student thinking in the classroom. While this is a *content* class, and not a *methods* class, we will make the greatest effort to explicitly connect what we do in our classroom to your own future classroom practice.

**Format.** This is an Inquiry-Based Learning (IBL) course. In order to support development of problem-solving skills, communication, and mathematical habits of mind, we will spend the majority of class time working in groups and presenting ideas and solutions to problems. We may give mini–lectures to set the context for the class activities, but my main role will be to support and facilitate your engagement with and exploration of the material. This means that we are jointly responsible for how class time is spent as well as the successful development of the course!

## Course Objectives

We will be revisiting the mathematics of the elementary school curriculum as future teachers. In this capacity, we will work to develop mathematical practices that will be relevant in the classroom. More specifically, the objectives of this course are that you will be able to:

- Communicate mathematical ideas effectively in both written and oral formats.
- Find and evaluate mathematical content in elementary school work.
- Persist in solving challenging problems and devise strategies to help in this process.
- Justify mathematical solutions while considering both rigor and developmental context.
- Use representations, models, and diagrams to help you solve problems and communicate solutions.
- Recognize mistakes as an important part of doing and learning mathematics.
- Explain your reasoning for using certain procedures in solving a problem.
- Understand the ways in which math content knowledge supports the activity of teaching.
- Evaluate your own mathematics as well as the work of your peers critically and supportively.
- Learn from and mathematically evaluate material found in common teacher resources.

## Assessment Plan

Your course grade will be determined from the following categories and weights:

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| Participation | 12% |
| Homework | 38% |
| Exams (3) | 40% |
| Final Project | 10% |

You are guaranteed an A (possibly ±) for a score of 90% or higher, a B(±) for a score of 80% or higher, and so on. These thresholds may be lowered (but not raised) at the end of the term, so as to follow the historical grade distribution for this course.

**Participation.** Participation takes a variety of forms: listening, contributing from your seat, presenting at the board, asking questions, working in small teams, coming to class prepared, etc. In order to have success in this course, it is very important for you to participate in class *actively*. The participation component of your grade will be determined by the following categories:

- *Attendance.* You are allowed one unexcused absence any time during the semester. Additional absences either must be excused by the instructor (with appropriate documentation and in advance, if possible), or will lower your overall grade by 2% per absence.
- *Group Work and Class Discussions.* We will spend a lot of time working on math problems in small groups. Being a productive and contributing group member can take a number of forms: facilitating discussion, suggesting ideas, asking questions, listening closely, considering others' ideas, clarifying concepts, etc. Your participation is integral to both your own and your group members' success in this course, and is assessed by instructor observation every couple

weeks on a scale of ($\checkmark-$, $\checkmark$, $\checkmark+$) where $\checkmark-$ indicates you are not participating enough, $\checkmark$ indicates sufficient participation, and $\checkmark+$ indicates exemplary participation.

- *Problem Presentations.* A major component of this class involves you and your classmates presenting your mathematical work to each other. The goals of this activity include: improving your oral mathematical communication, thinking critically about others' mathematical arguments, and providing the opportunity for the class to consider multiple solutions to the same problem, including possibly incorrect solutions. For this reason it is important to note that you are **not graded on mathematical correctness of the work you choose to present.** As we'll see, solutions that are not entirely correct can often be incredibly valuable for us to consider and discuss. **Students are expected to present 3 times during the semester**.
- *Reading Responses.* From time to time you will be asked to read articles pertaining to math education. As we may not always have the desired amount of time for discussion of these readings, you will be asked to write short responses to what you read. This falls under participation as it is part of being a participant in the larger math education community.
- *Weekly Workout Gauge and Drafts.* On a standard Monday, we will hear student presentations of *workout problems* from the homework assigned the previous week (see Homework section below). Write-ups of workout problems will be due on Wednesdays to allow you to reflect on the presentations given in class. In order to be a participant in the discussion you will need to give serious thought to the problems beforehand. To this end, you will bring a working draft of solutions to the workouts to class on Monday. In addition, every Sunday you will submit a *workout gauge* online indicating the workout problem you would be willing to present and your enthusiasm level for doing so.

Breakdown of the 12% of your course grade allotted to participation will be: approximately 5% to group work and presentations, 5% to workout gauges and workout drafts, and 2% to reading responses.

**Homework.** Homework will be assigned weekly. There will be three main components to homework: Warm-ups, Exercises, and Workouts. *Warm-ups* are short problems intended to help you review and use some basic skills in connection with the material. **These will not be graded** and solutions will be provided. *Exercises* are based on applications of ideas discussed in class, while *Workouts* usually involve investigation, problem solving, and more involved writing. Exercises will generally be due each Monday[1]. Workouts will be checked for completion at the beginning of class on Monday[2], and we will talk about your solutions in class. Based on the presentations of your peers and the discussion in class, you will be able to revise your work and submit a final draft at the beginning of class on Wednesday[3]. Unless otherwise stated, you are welcome to work with classmates on the homework, but **you must write up your solutions individually** (this means you can work with classmates on solving problems, but you should write your solutions by yourself; this is an issue of academic integrity).

[1]This is the normal schedule, but there will be slight changes around Fall Break.
[2]This is the normal schedule, but there will be slight changes around Fall Break.
[3]This is the normal schedule, but there will be slight changes around Fall Break.

To give you time to get used to the expectations for Workout problems, you'll have ample chances to revise your solutions during the first third of the semester. In particular, for each homework before the first exam, you will be allowed to turn in a *Revision* of the graded workouts, which will be regraded out of the original number of points. Revisions will require a short statement of how and why you revised your solution, and will be due one week after the homework is first turned back to you. The purpose of revisions is to give you opportunities to learn the characteristics of a good mathematical explanation; for that reason, you are not allowed to submit a revision for a problem you did not already seriously attempt. After the first exam, you will be permitted only **2 more revisions** for the rest of the semester to be used as you see fit.

**Exams.** There will be three written exams during the semester. Each exam will be scheduled in the evening over a three–hour time block in order to provide ample time to finish (the exams are written with a standard 80 minute class period in mind). The dates and times of the exams are as follows:

- Exam 1: Monday, October 9, 6–9pm
- Exam 2: Monday, November 13, 6–9pm
- Exam 3: Thursday, December 14, 4–7pm

Any conflicts with these exams dates must be brought to the instructor's attention immediately; there are no make-up exams. Exam 3 is cumulative.

**Final Project.** You will be assigned a final project, to be completed in groups, that will ask you to synthesize the material between the second exam and the end of the semester. More information on this project will be provided during the third unit.

## Course Resources

**Canvas.** You will need to use the course Canvas site regularly for viewing the homework, accessing readings, submitting some homework, and receiving important communications from the instructor.

**Course Textbooks.** There is no required text for the course. The optional textbook for this course is a helpful and well-written reference, but it is in no way required for you to complete or do well in this course. This book does a good job of providing explanations of the ideas we will discuss in class, and we will indicate which sections of Beckmann's book correspond to our in-class materials.

optional Beckmann, S. (2011). *Mathematics for elementary teachers with activity manual.* Pearson Addison Wesley.

**Readings.** Other relevant readings will be uploaded to Canvas as the semester progresses.

**Office Hours.** We encourage you to attend office hours! After an initial availability poll, we will update the top of this document with instructors' office hours. Office hours are a great place to spend extra time on the course material and help you build your understanding and skill.

**Accommodation.** If you have a documented disability requiring special accommodations, please inform an instructor as early as possible. Special arrangements for graded work require appropriate documentation.

## Schedule

The following schedule is subject to revision as needed:

I. Practices and Structures

0. Problem Solving
   *...or, the art of doing mathematics.*
1. Evens and Odds
   *...or, the importance of good definitions.*
2. Place Value
   *...or, how we write numbers and the ways it affects our thinking.*

II. The Four Operations of Arithmetic

3. Addition and Subtraction Strategies
   *...or, a great wealth of patterns in our number system.*
4. Integers
   *...or, why we need more numbers and how to think about them.*
5. Addition and Subtraction Algorithms
   *...or, the close relationship between standard procedures and place value.*
6. Models of Multiplication and Division
   *...or, thinking about what our arithmetic means.*
7. Primes and Factoring
   *...or, the multiplicative structure of the integers.*
8. Algorithms for Multiplication and Division
   *...or, linking procedures and conceptual understanding.*

III. Fractions and Decimals

9. Fractions, Models, and Equivalence
   *...or, why we need even more numbers and how to think about them.*
10. Decimals and Their Fractions
    *...or, relating fractions with the place value system.*
11. Addition and Subtraction of Fractions
    *...or, how arithmetic plays with fractions (part 1).*
12. Multiplication of Fractions
    *...or, how arithmetic plays with fractions (part 2).*
13. Division of Fractions
    *...or, how arithmetic plays with fractions (part 3).*