

MATH 109: INTRODUCTION TO MATHEMATICAL REASONING

1. WHO, WHEN AND WHERE!?

- **Class information:** MWF 1:00-1:50 pm; HSS 1330.
- **Instructor:** Alireza Salehi Golsefidy. You can call me Alireza or Ali.
- **Office:** APM 7230.
- **Office Hour:** MW 2:00-3:00 pm.
- **e-mail:** golsefidy@ucsd.edu.
- **Teaching Assistance:**
 - (1) Jacob Hughes: Tu 1:00-1:50 pm, U413 1; e-mail: jthughes@math.ucsd.edu; Office hour: Thu 1:00-3:00 pm in APM 6436.
 - (2) Jacob Hughes: Tu 2:00-2:50 pm, U413 1; e-mail: jthughes@math.ucsd.edu
 - (3) James Pascoe: Tu 2:00-2:50 pm, APM 5402; e-mail: jpascoe@math.ucsd.edu; Office hour: Tu 9:00-10:00 am and Th 2:00-3:00 pm.
- Math 109 homepage: www.math.ucsd.edu/~asalehigolsefidy/math109-11-f
- Homework assignments will be available online.

2. WHAT IS MATH 109?

The major goals of this course are to teach you the fundamentals of how

- (1) to read and understand a mathematical text, e.g. new concepts, theorems and proofs;
- (2) to reproduce a mathematical proof that is presented to you;
- (3) to communicate your thoughts rigorously: both in an oral fashion and in a written form.

In some sense, this course will provide a playground for you to practice your communication skills. It gives you lots of opportunities to exercise whenever you are facing a new problem in life it is crucial to know what are your abilities (the assumptions) and what are your goals.

Since you will be building new kind of “muscles”, it is extremely important to practice, practice and practice:

For the first goal, you should, at least, read your textbook before and after lectures. Sometimes I will assign hard problems, and tell you where you can find their solution. You are supposed to read their proof and *rewrite it in your own wording*.

For the second goal, I would suggest that you reprove a result after you read its prove. Sometimes I will assign hard problems and you can learn their solutions either during my office hour or in the discussion session. Then you are supposed to *rewrite their solution in your own wording*.

The whole course helps you for the last task!

Date: 9/21/2011.

1991 *Mathematics Subject Classification.* 00-01, 03-01.

3. THE MAIN TEXTBOOK AND ADDITIONAL SUGGESTED BOOKS.

The textbook for the course is *An Introduction to Mathematical Reasoning: numbers, sets and functions*, by Peter J. Eccles. You will find the following books useful:

- (1) R. B. Maddox, *Mathematical Thinking and Writing: A Transition to Abstract Mathematics*.
- (2) D. Smith, M. Eggen and R. St. Andre, *A Transition to Advanced Mathematics*.
- (3) D. Solow, *How to Read and Do Proofs*.

4. GRADING

The course grade is divided as: 50% homework, 20% midterm and 30% final.

5. HOMEWORK

Each week, I will assign a set of homework exercises, which will be due at 5:00 pm on Fridays. You are supposed to drop them by that time in the assigned boxes on the sixth floor of APM.

The best way to learn the material is *completing the homework exercises*.

You are encouraged to collaborate on your problem sets. However you have to write up your solutions individually. When collaborating with someone, or using a book as a reference, you should mention her/his name, or the name of the book, respectively, in your assignment. Otherwise, it is considered a breach of your honor code.

What usually works best is to spend some time working on the problems on your own, then meeting with your study group to share ideas, compare progress, and brainstorm about the more difficult problems.

Handwritten assignments are acceptable. However, you are encouraged to learn \LaTeX . It is a special version of \TeX program, designed by D. Knuth to produce high-quality typesetting for mathematics. The program is free, and there are also free editors. I use \TeX Shop on my mac and \TeX nicCenter or \TeX works on my PC. It is pretty easy to work with \LaTeX , especially if you use the header part of a written article. You also may find L. Lamport's *A Document preparation system \LaTeX* a useful source.

Please staple your homework and write your name on each of the pages.

6. EXAMS

You are not allowed to collaborate, or use books for your midterm or final exams.

There will be one take home midterm exam on Oct 28.

7. SCHEDULE

- (1) **Sep 23:** Language of mathematics: e.g. mathematical statement; Logical connectives; Table of truth; Implication;
Reading: Chapter 1 and Section 2.1
- (2) **Sep 26-Sep 30:** More on implications; Mathematical truth; Proof;
Reading: Chapters 2, 3 and Section 4.1 and 4.2
- (3) **Oct 3-Oct 7:** More on Proof (specially proof by induction); Language of Set theory;
Reading: Chapters 4, 5 and 6
- (4) **Oct 10-Oct 14:** Quantifiers; Functions and special classes of functions;
Reading: Chapters 7, 8 and 9

- (5) **Oct 17-Oct 21:** Division algorithm; Euclidean algorithm and its applications;
Reading: Chapters 15, 16 and 17
- (6) **Oct 24-Oct 28:** Linear Diophantine Equations; Congruences;
Reading: Chapters 18, 19, 20
- (7) **Oct 31-Nov 4:** More on Congruences; Chinese Remainder Theorem; (Maybe Euler's theorem)
Partitions and equivalence relations.
Reading: Chapters 21, 22; more reading will be provided.
- (8) **Nov 7-Nov 9:** More on Partitions; Counting!
Reading: Chapters: 22, 10
- (9) **Nov 14-Nov 18:** More on Counting; Finite sets;
Reading: Chapters 10, 11, 12
- (10) **Nov 21-Nov 23:** Different infinities!
Reading: Chapter 14
- (11) **Nov 28-Nov 30:** It depends on how our class goes! Either we learn a new topic, catch up or review.