

Math 109 Winter 2007: Mathematical Reasoning  
MWF 2-2:50, WLH 2207  
Professor D. Rogalski

1. CONTACT INFORMATION

**Prof. Rogalski's Office:** 5131 AP&M

**E-mail:** drogalsk@math.ucsd.edu

**Class web site:** [www.math.ucsd.edu/~drogalsk/109.html](http://www.math.ucsd.edu/~drogalsk/109.html). Check frequently for updated homework and lecture information.

**Office hours:** TBA

**Section Leader:** Larissa Horn

**E-mail:** ldhorn@math.ucsd.edu

**Meeting Times:** T 7-7:50 , T 8-8:50 , HSS 2152

**Office hours:** TBA

2. CLASS DESCRIPTION

Math 109 is intended to prepare you for the rigorous upper-division math courses required of math majors. In it, you will learn basic concepts including properties of integers, set theory, functions, and counting. You will also learn techniques and conventions for writing proofs in higher mathematics. Learning to write good proofs does not happen overnight, or even in a single quarter, and you may find it frustrating at first. By the end of the course, the hope is you will achieve a base level of understanding of theorem proving, which you can then build on and improve in subsequent courses.

The *most* important part of the course is the homework. You cannot truly learn how to prove theorems just by watching others, but have to practice doing it yourself. Along with more straightforward problems designed to solidify the basic definitions and concepts, the homeworks will contain some problems which I expect you to find difficult. It is crucial that you begin the homework early, and work on it all week, not in a spurt. You will find that if you get stuck on a problem and come back to it later, you will usually have new ideas and insights. Mathematical writing is just a special kind of writing. You should treat your proofs as you would short essays for an English class. In particular, you should write in full sentences, with good grammar, and what you hand in should not be a first draft. Your TA will write many comments on your assignments. She spends a lot of time giving this advice to you so you can improve, so please read her comments and think about them carefully. To emphasize the main point again: *students that do little or no homework almost always fail the course.*

The lectures are designed to focus on the concepts which I think are the most essential. The textbook by Eccles tends to have more detailed information, and so will learn a lot more by reading it as well. I will tell you when the presentation in the class differs a lot from that in the book. Tuesday section will provide an opportunity for you to ask questions about that week's homework (due Fridays), to ask other general questions about the material, and to see more proofs and

examples in detail. If you would like to meet with me or the TA but cannot make our scheduled office hours, please make an appointment to meet at a different time.

There will be 2 in-class midterm exams on Wednesday 1/31/07 and Wednesday 2/28/07 and a final exam on Monday 3/19/07 from 3:00pm-6:00pm. No makeup exams will be given. The final grades will be determined using the following breakdown: homework 25%, midterms 25%, final exam 50%. The lowest homework score will be dropped.

### 3. TENTATIVE SYLLABUS

The following is a suggested outline of what we will cover when. This is subject to change, and updates to the schedule will be announced in class or posted on the website.

- 1/8/07 Statements and connectives, truth tables. (Chap. 1)
- 1/10 Implications, arithmetic, first proofs. (Chap. 2-3)
- 1/12 Methods of Proof. (Chap. 3-4)
- 1/15 Martin Luther King Day—**NO CLASS**
- 1/17 Proofs by induction I. (Chap. 5)
- 1/19 Proofs by induction II. (Chap. 5)
- 1/22 Set theory I. (Chap. 6)
- 1/24 Set theory II. (Chap. 6)
- 1/26 Quantifiers. (Chap. 7)
- 1/29 The Division theorem (Chap. 15)
- 1/31 **EXAM I.**
- 2/2 The Euclidean algorithm and consequences. (Chap. 16-17)
- 2/5 Linear diophantine equations. (Chap. 18)
- 2/7 Functions I. (Chap. 8)
- 2/9 Functions II. (Chap. 8-9)
- 2/12 Functions III. (Chap. 9)
- 2/14 Congruences. (Chap. 19-20)
- 2/16 Congruence classes. (Chap. 21)
- 2/19 President's Day—**NO CLASS**
- 2/21 Equivalence relations I (Chap. 22)
- 2/23 Equivalence relations II (Chap. 22)
- 2/26 Prime numbers (Chap. 23)
- 2/28 **EXAM II.**
- 3/2 Counting finite sets (Chap. 10-11).
- 3/5 The binomial theorem (Chap. 12)
- 3/7 Number systems and infinite decimals. (Chap. 13)
- 3/9 Counting infinite sets I. (Chap. 14)
- 3/12 Counting infinite sets II. (Chap. 14)
- 3/14 Prime congruences (Chap. 24) or catchup day.
- 3/16 Review Day.
- 3/19 Final exam, 3:00pm-6:00pm.