

# Math 251: Foundations of Advanced Mathematics

## Spring 2009

### Course Procedures

**Professor:** Josh Laison

Collins 305, x6689, [jlaison@willamette.edu](mailto:jlaison@willamette.edu)

#### Office Hours:

Monday 3:00-4:30

Wednesday 3:00-4:30

Tuesday 10:00-11:30 AM, at the Bistro

or anytime by appointment or by catching me in my office. You can see my schedule and available times at <http://www.willamette.edu/~jlaison>

**Class Meetings:** Collins 306

Section 2: 9:10-10:10 Monday, Wednesday, Friday

Section 3: 1:50-2:50 Monday, Wednesday, Friday

**Textbook:** Proofs and Fundamentals: A First Course in Abstract Mathematics, Ethan Bloch

**Course Web Page:** <http://www.willamette.edu/~jlaison/foundations.html>

#### Grading:

Written problems (around 6)	25%
Individual problems (around 6)	25%
Reading problems (around 25)	20%
Oral problems (around 10)	20%
Class participation	5%
Math colloquium talks (2)	5%
<b>Total</b>	<b>100%</b>

#### Course Goals:

- Learn to write mathematical proofs.
- Learn mathematical writing and typesetting.
- Learn to communicate mathematics verbally, in conversations and in formal presentations.
- Learn a core set of mathematical tools that appear in most pure mathematics.
- Get an introduction to some of the most important fields of pure mathematics.
- Have fun.

#### Topics Covered:

We will spend the first few weeks of class on logic and proof techniques (Chapters 1 and 2), and then use these techniques to prove theorems in set theory (Chapter 3), number theory (5.2, 9.2, 9.3), real analysis (Chapter 4), abstract algebra (7.1, 7.2), combinatorics (7.6, 7.7), and possibly other fields of mathematics.

## Ways in Which This Course Is Different From Calculus:

1. In calculus, you could solve a problem set of 10 problems in a couple hours. In foundations, 10 problems might take closer to 20 hours to solve, and you will have 2 weeks or more to work on them.
2. In calculus, most of the problems are very similar to others that have already been solved for you. In other words, the textbook and the professor produced the new ideas, and you absorbed them. In foundations, you produce new ideas yourself. It is somewhat less important to memorize facts, and much more important to learn to think creatively in math.
3. During a calculus class, you were mostly a passive learner. During a foundations class, you are mostly an active participant!
4. Foundations is much more fun than calculus.

## Homework:

There will be four types of homework in this course:

**Reading and Reading Problems:** Since you will be spending a lot of class time working with classmates, it is important that you read and start thinking about the relevant sections of the textbook before class. This will also help you become a better reader of mathematics, a skill that takes a long time to learn. I will assign a problem or two to help you think about the reading each day, and we will discuss these problems in class.

**Written Problems:** The written problems will be due approximately every two weeks. You may work together on these problems; in fact, you may have the opportunity to work on them in class. However, please write your solutions to these problems in your own words. In addition, all of your solutions to these problems should be written in the L<sup>A</sup>T<sub>E</sub>X word-processing application. We will talk more about this in class.

Part of the goal of this course is for you to learn to speak and write mathematics well. Therefore it is not enough to submit a written solution which includes the key ideas, or the final “answer.” The clarity and form of your solution are just as important, and will count for half of your grade.

To further this goal, you will have a chance to rewrite and resubmit your written problems, within the two weeks after you get them back, for an improved grade. Editing is part of the process of learning to be a better mathematical writer, and I strongly suggest you take advantage of this opportunity. I may grade these problems more harshly for the first few assignments to help this process along.

**Oral Problems:** I will frequently ask members of the class to prepare solutions to problems to present in class. Sometimes the whole class will be asked to work on the same set of problems; sometimes they will be divided up by groups or by individual. You will probably find that, although giving an oral presentation on a problem seems easier than

writing up the solution, you will have to think just as carefully about these problems as you do about the written ones. In fact, it would probably help to write out your argument beforehand, so you have things straight in your mind.

**Individual Problems:** These are problems that I will ask you to complete by yourself, without help from other students. You may not consult any person about these problems other than me. You may not consult any source about these problems other than your textbook, your notes, and class handouts. No special word processing is necessary for these problems (you may write the solutions by hand if you wish) although writing style and clarity of presentation is still important. These problems take the place of exams in this course. Please treat them accordingly.

### **Attendance and Class Participation:**

The class will cease to function if many people are absent or disengaged. Please support your classmates by coming to class every day prepared, thinking about other students' oral problems so that you can follow their presentations, and designing your own oral presentations so as to benefit your classmates.

During a classmates' presentation, you are not off the hook. Your classmate is relying on you to help them if they have difficulty. You should ask questions if you are confused, make helpful suggestions, and learn from their presentation. Above all, treat the presenter with respect. Listen to what they have to say, and do not make disparaging comments. "I don't quite understand what you did in that step," is appropriate, "You didn't explain that well," or "You're wrong" are not.

### **Attendance at the Math Department Colloquium:**

According to math department policy, since you are enrolled in a 200-level mathematics course, you are required to attend at least 2 mathematics department colloquium talks. The goal of this requirement is to expose you to a wider range of mathematics, and to make you want to go to more than 2 talks! I hope you will decide by the end of the semester, as I have, that math talks are a lot of fun.

### **Disabilities:**

If you have a documented disability for which accommodations may be required in this class, please contact me to discuss your needs. Additionally, you will need to register with Disability and Learning Services in the Bishop Wellness Center within the first two weeks of class. All such discussions will be confidential.

### **Academic Honesty:**

**on the reading, written, and oral problems:** You may, and are encouraged to, discuss the homework with anyone, get help from your textbook, notes, computer algebra systems, etc. However, your submitted written work should be your own.

**on the individual problems:** You may consult your text and notes. You may not discuss the individual problems with anyone other than me.