

Mathematical Reasoning: Introduction

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UC San Diego

Department of Mathematics

Math 109

Organization

Instructor: Martin Licht

Website: www.martinwernerlicht.de/math109/math109.html

Email: mlicht@ucsd.edu

Lecture Times: Monday, Wednesday, Friday: 11am - 11:50am

Place: CENTR 212

Final: Monday, March 19th, 11:30am - 2:29pm. **Be there!**

What your instructor usually spends his time with:

- **numerical methods for partial differential equations**
- **computer simulations in C++**
- **electromagnetism and general relativity**

Instructor Office Hours

Office: AP&M 5880E

Hours: Monday, 3:00pm - 4:00pm.

TA: Renee Mirka

Hours: TBA

TA: Pieter Spaas

Hours: 1-3pm in AP&M 5829, 8:30-10:30am in AP&M 7218

TA Sessions

B01 927126: W 4:00p-4:50p, AP&M B412 with Renee Mirka

B02 927127: W 5:00p-5:50p, AP&M B412 with Pieter Spaas

B03 927128: W 6:00p-6:50p, AP&M B412 with Pieter Spaas

- Lost homework? **Write the TAs** and CC me.
- There will be bonus homework if you miss a homework sheet.
- Each of you can receive 5 bonus points on the final exam for presenting a homework problem on the blackboard in the TA sessions.

Course Content and Final Exam

The focus of this course is on you doing proofs.

Emphasis on **Learning by Doing**.

Content of the Final: some formal logic, some set theory, but otherwise only **proofs**.

Grading

The final grade will be based on:

- Homework
- First Midterm
- Second Midterm
- Final Exam

Specifically, it will be

- 20% Homework + 20% First Midterm + 20% Second Midterm + 40% Final Exam
- 20% Homework + 20% First Midterm + 60% Final Exam
- 20% Homework + 20% Second Midterm + 60% Final Exam

depending on which is better.

| Grade | Percentages |
|-------|---------------|
| A+ | 100 - 96.66 |
| A | 96.66 - 93.33 |
| A- | 93.33 - 90.00 |
| B+ | 90.00 - 86.66 |
| B | 86.66 - 83.33 |
| B- | 83.33 - 80.00 |
| C+ | 80.00 - 76.66 |
| ⋮ | ⋮ |

This grading scale is guaranteed. It may be changed in your favor.

Homework

- Homework is collected on Fridays, starting next week.
- Boxes are available in the AP&M basement.
- Please pickup your homework during the TA sessions.

What is Mathematical Reasoning?

Mathematical Reasoning: An Activity

Formal mathematics is to deduce new statements from prior statements via logic.

Example: $a < b, \quad b < c \implies a < c.$

Non-formal mathematical thinking (geometry, physics, ...) can be helpful, but in the end it has to be formalized.

Communicative aspect: explain mathematics to other people and yourself.

Aesthetical aspect: explain it in an aesthetical pleasing manner: *clear, elegantly, concise, ...*

It is easier to communicate beautiful things.

Mathematical Reasoning: Writing

Emphasis in this course is on writing mathematics.

A good mathematical writer is necessarily a good writer.

Mathematics can be written as an ongoing text, and/or with a partition into theorems, lemmas, propositions, and their proofs.

Writing mathematics means to structure your thoughts and what you want to communicate.

Mathematical Reasoning: A Course

Emphasis for this course on soft skills: reasoning, explaining, analyzing in mathematics.

Concrete things are introduced in as much as they can serve as training material: number theory, group theory, linear algebra.

In some sense, similar to a language course:

- The goal is to get proficient in thinking and communicating mathematically.
- The goal is open-ended: you are getting only started.
- The goal is individual: you develop your own style.
- As in a language course, continued permanent practice is mandatory.
- **Emphasis on you doing mathematics!**

Mathematical Reasoning: the soft skill of mathematics

- Solve Problems.
- Assess situation.
- Persistence, patience, grit.
- No BS, know what you are talking about.
- Know what you know and what you don't know.
- Know what you actually want to do and when you are finished.
- Communicate your thoughts clearly to yourself and others.
- Give and receive feedback on your ideas.
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What will be done in this course:

- Proofs, Proofs, and Proofs
- Homework, Midterms and Final Exam: Proofs, Proofs, Proofs.
- Textbook recommended as support for this course:
Daniel Velleman, *How to prove it*.