Math 220, Section 01, Fall 2026: Mathematical Reasoning

MWF 9:00 – 9:50am, SMUD 205

Webpage: `https://rlbenedetto.people.amherst.edu/math220/`
(Also linked from the Math 220-01 moodle page.)

Instructor: Rob Benedetto **Office**: SMUD 406 **Email**: `rlbenedetto@amherst.edu`
Office Hours: Mon, 1:45–3:15pm; Tue, 1:45–3:15pm; Fri, 1:00-2:00pm; or by appointment.

Our Math 220 Fellows (or "TAs"): Sohyun Ahn, Oscar Hernandez, and John Lim
Evening Office Hours: Times and locations TBA

Text: B. Richmond and T. Richmond, *A Discrete Transition to Advanced Mathematics*, 2nd ed., American Mathematical Society, 2023.
For Amherst students: available through the Amherst College Textbook program.

Exams:

- **Midterm 1**: **Friday, October 9**, in class.
- **Midterm 2**: **Friday, November 13**, in class.
- **Final**: **TBA; it will be three hours, during finals period**

The only excuses for missing an exam are incapacitating illness, religious conflict, or the like.

Using cell phones, etc. during an in-class exam is CHEATING.
Using outside sources on homework or exams — AI tools, other websites, outside textbooks, etc. — without advance permission is CHEATING.
All cheating will be prosecuted, potentially leading to an F in the course.

Homework: Most weeks, assignments will include:

- Reading from the textbook, sometimes with a short video to watch, too.
- Usually two problem sets, each due **on Gradescope by 11:59pm ET**
  See Homework 0, and see page 3 of this syllabus, for important homework information.

Grading:

- **Effort**: 5%
- **Problem Sets**: 20%
- **Midterm Exams**: Better one: 25%. Worse one: 15%. (Total 40%.)
- **Final Exam**: 35%

"Effort" is a combination of attendance (including being on time), class participation, and handing in problem sets. It is not computed proportionally; a student deficient in any one of those areas will get a very low Effort grade. (See pages 2 and 4 of this handout for more on attendance and participation.)

"Problem Sets" means actual grades on the problem sets. Late problem sets will be marked down substantially in the Problem Sets portion of your grade (see the webpage for details); but all problem sets handed in by the last day of classes count towards Effort.

If one component of an individual student's course grade is substantially higher or lower than their other grades, and if the student's Effort grade is strong, I will tweak the above percentages a little for that student to favor the better grades. Overall course grades will be curved.

About Cell Phones and Mobile Devices

Cell phones and similar devices have no place in my classroom. Don't use them. Not for talking, not for texting, not for anything. So at every class:

Silence your cell phone, put it away, and pay attention.

Necessary Background and Target Audience

Fundamentally, Math 220 is about learning to write proofs, which are essential for later math courses. The prerequisite is Math 121 (or placement out of Math 121). However, we will not actually use any of the *content* from that course; instead, that requirement is there to ensure you have an appropriate level of depth in your prior mathematical training and experience. Even more important is an enthusiasm for mathematics, and a desire to dig deeper even when it starts to get tough.

So if this is your first math course in college, Math 220 is a perfectly fine place to start, provided you're ready to approach math in a (probably) new way, and willing to work hard at it. And if you've already had some calculus in college and are looking to level up a bit, Math 220 is designed for making that transition. Feel free to talk to me about it if you're not sure if this course is appropriate for you right now, but in any event: Welcome.

Course Content

Most of your experience of mathematics to date has probably been computational: solve this equation, compute that derivative, etc. But mathematics is really about making deductions via logical arguments and being able to justify them with bulletproof, rigorous reasoning. Thus, the main point of Math 220 is to give you a basic foundation in the art and science of mathematical reasoning and proofwriting. Here's a sketch of what we'll see.

- Chapter 1: **Sets and Logic** form the essential foundation of all mathematical thinking. We'll see the basics in this chapter. We'll also start learning to write mathematical proofs.
- Chapter 2: More on **Proofs**. Among other things, we'll learn a few different proof structures.
- Chapter 3: We'll only touch on a few sections of this chapter on **Number Theory** (i.e., the in-depth study of the arithmetic of integers).
- Chapter 6: We'll learn about **Functions** in their most general context, another absolutely essential idea in mathematics.
- Chapter 8: We'll learn about convergence of **Sequences**, yet another important foundational idea in mathematics.

If time permits, we will cover some of the topics in Chapter 5 (**Relations**), and the second half of Chapter 6 (**Cardinality**).

Class Participation and Classroom Dynamics

Class participation is part of the Effort portion of your grade. If you are quiet by nature, don't worry; as long as you attend class devotedly, pay close attention, and do the homework, you will get full Effort credit. That said, finding your voice in class helps you learn better. So for your own benefit, **speak up, ask questions, and even try to answer questions I may ask in class**.

On the flip side,

respect your fellow students

both in and out of the classroom. Treat every person's ideas the same way you would if it had been me or the college president sharing them.

Homework

Your homework consists of **ALL THREE** of reading the book, watching any required videos, **AND** doing problem sets. Skim textbook sections **before** the corresponding lecture, and then go back and read more carefully to solidify your understanding and to help with the problem sets.

Please note the following **Important Problem Set Rules:**

1. Problem sets are due **on Gradescope**, each by its specified deadline.
2. You must **assign pages** in Gradescope, matching problems to pages of your submission.
3. **Write legibly**, and organize your work clearly. **Make it a pleasure to read!**
4. If you worked with other students in the class, then say so explicitly on the first page of your problem set. (See the discussion below on the Statement of Intellectual Responsibility.)
5. You **may** also get help from me, the Fellows (Sohyun, Oscar, and John), the QCenter (Ris Paulino), the book, and all of the handouts and videos from the course and the course websites.
6. If you want to use any **other** resources or aides, including outside websites, people, or textbooks, **you must first get advance permission from me for each such outside source**.
7. The Problem Sets grade for any late assignment will be substantially reduced. The later it is, the greater the reduction; see the course webpage under "Problem Set Rules" for details.

See Homework 0 and the handout on Gradescope Instructions for more information on Gradescope.

I am often willing to grant penalty-free extensions on problem sets; but see "Class Attendance, Extensions, and Extra Office Hours" on page 4.

I strongly encourage you to work on problem sets together, in pairs or small groups, provided you follow the common-sense guidelines below.

About the Statement of Intellectual Responsibilty

Exams: Your work must be entirely your own, so no looking at other people's papers, no communication of any kind, and no outside help. Cell phones, smart watches, and other devices must be silenced and put away. Unless I specifically allow it, no other aids or reference materials are permitted.

Problem sets: I urge you to collaborate with each other, under the following ground rules:

1. If you collaborate with, say, Jane and Joe, write a note on the front of your problem set saying, "I worked with Jane and Joe." Use similar notation if you got help from a peer tutor, classmate, another professor, or an outside source that I approved. However, you do **not** need to write about help you got from me, the QCenter, the Math 220 Fellows, the textbook, or course materials.
2. Working together does not mean that Joe does the first half of the problem set and Jane does the second half; everyone should work on every problem.
3. Each student must hand in their own problem set; you can't hand in a single packet as the work of multiple people.
4. Each student must write up each problem **in their own words**. Working together means discussing the problems. Using outside sources without approval, copying someone else's solution, or knowingly allowing someone else to copy your solution, is a violation of intellectual responsibility.

A common question: What if Joe asks Jane about a homework problem she has already solved? If Joe copies Jane's solution, both Joe and Jane would be guilty of academic dishonesty, potentially leading to an F in the course for both of them, among other bad consequences. Instead, Jane can explain her solution to Joe (even showing him what she wrote), before Joe writes up his own solution himself, **in his own words**. Joe would then have to write that he got help from Jane (see rule 1 above), but Jane doesn't need to write anything unless she also got help in return.

If at any time you aren't sure about what's OK and what's not as far as intellectual responsibility is concerned for this course, please talk to me about it.

Class Attendance, Extensions, and Extra Office Hours

Attendance: You should be at every class meeting, and you should be **on time**. Of course, if you're sick, have a religious conflict, or the like, just let me know (in advance, when possible). One or two accidental misses are OK, too; oversleeping can happen, but it should be **rare**. Otherwise, however,

I expect you to be in class, and on time, for every class meeting.

I don't plan to take formal attendance, but I can easily tell who misses class too much; those students' Effort grades will take a hit. (And after more than just a couple unexcused absences, or showing up late too much, your Effort grade will truly plummet, since I do not compute it proportionally.)

Extensions: You may request **up to two** homework extensions over the course of the semester, each for up to 48 hours. To claim an extension, you must:

1. Request the extension (by email, or in person) **no later than 8pm ET on the due date**,
2. Not have used both your extensions yet, and
3. Have been attending class devotedly and meeting homework deadlines.

Note: you do **not** need to provide an excuse or reason for your extension request.

Office Hours: You are always welcome to attend my regularly scheduled office hours. In addition, **IF you have been attending class and doing the homework**, you are also welcome to make appointments to see me **outside** of my regularly scheduled office hours.

Getting Help

If you're ever stuck or confused, seek help immediately:

Office Hours:	Stop by (unannounced) to see me during my scheduled office hours, or make an appointment to see me another time.
Math Fellows:	Visit our Fellows' office hours, too. See the course website for details.
The QCenter:	**Ris Paulino** of the the Moss Quantitative Center offers Math 220 help, both for appointments and for unscheduled drop-ins. See the course website for details.
Tutoring:	If you feel you need regular one-on-one help from a peer tutor, we can probably set that up. To do so, talk to me first.

Advice, and What to Expect

If you've had no math in college other than calculus, this course will probably be very different from any math class you've had in the past. For example:

- Our focus will be less on methods and techniques (like algebraic calculations, or how to differentiate a polynomial) and more on understanding *why* the underlying structures behave the way they do. The biggest goal is to learn to prove mathematical statements rigorously.
- Problem sets will consist of some computational problems — for which you will usually need to explain your reasoning fully, not just write the answer — and some proof problems.
- For **all** homework problems, you will need to use **complete sentences** and **well-written paragraphs**. Of course, you can and should use equations, abbreviations, and standard mathematical shorthand. But fundamentally, any mathematics problem, even a computation, is about making a coherent argument using **words**.
- Get in the habit of working things out on scratch paper in advance, figuring out what needs to be said, what **doesn't** need to be said, and what **order** everything should come in. You don't need to explain the intuition; you need to **solve the problem** or **write the proof**.

And if you're ever feeling lost, there's always office hours: mine, the Fellows', or Ris's.