

## What is 21-127 About?

Welcome to Concepts of Mathematics! This course will introduce you to the inner workings of mathematics. You'll learn how to prove mathematical statements with coherent, rigorous arguments.

After completing this course, you should be able to do the following:

1. Write clear and concise mathematical proofs.
2. Apply different proof techniques, including direct proof, proof by contradiction, proof by contraposition, and mathematical induction.
3. Evaluate mathematical arguments for correctness and clarity.
4. Understand mathematical notation for sets, logical statements, and functions.
5. Write and negate statements in propositional logic.
6. Demonstrate when two sets are equal or when one set is contained within another.
7. Reason with properties of functions and relations, such as injectivity, surjectivity, bijectivity, reflexivity, symmetry, and transitivity.
8. Prove statements in elementary number theory involving divisibility and modular arithmetic.
9. Describe the cardinality of sets, including infinite sets.
10. Develop counting arguments for determining the number of elements in a set and verifying equalities.

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This course will likely be very different from math courses you've taken before. You've probably gotten used to learning formulas and algorithms for solving specific types of problems in class, then being asked to apply what you've learned to other problems that look similar. In this course, the goal is for you to learn the mathematical tools and language necessary to understand *why* things work instead of simply applying them. No mathematical knowledge is assumed going into this course beyond fluency in basic algebra, which will allow you to focus on the logic without getting stuck on calculations.

## Staff and Schedule

**Instructor:** As the instructor, I deliver the lectures and oversee the course as a whole. Don't hesitate to email me if you have any questions or if you would like to meet with me one-on-one.

	Instructor	Andrew ID	Office	Lectures
Sec 3	Dylan Quintana	dquintan	WEH 8206	MWF 1:00–1:50pm, DH A302
Sec 4	Dylan Quintana	dquintan	WEH 8206	MWF 2:00–2:50pm, BH A51

**Teaching Assistants:** The teaching assistants run recitations, hold their own office hours, and help grade assignments and exams.

	TA	Andrew ID	Office	Recitations
Sec I	Cat Raanes	craanes	WEH 7110	TR 9:00–9:50am, WEH 5421
Sec J	Joel Newman	jbnnewman	WEH 7211	TR 10:00–10:50am, PH A18B
Sec K	Joel Newman	jbnnewman	WEH 7211	TR 12:00–12:50pm, PH A18A
Sec M	Tom Yuan	ziwenyua	WEH 7125	TR 9:00–9:50am, WEH 4623
Sec N	Albert Zhang	albertzh	WEH 7215	TR 1:00–1:50pm, BH 235B
Sec O	Reed Luttmer	rluttmer	WEH 7215	TR 2:00–2:50pm, WEH 5302
Sec P	Ayush Mediratta	ayushmed	WEH 7215	TR 4:00–4:50pm, BH 235A

**Graders:** The graders grade assignments and may offer additional assistance by holding office hours and answering questions on course content.

Grader	Andrew ID
Anna Deng	yuhanden
Betty Hou	wenyueh
Hanyu Pan	hanyup

## Class Format

### Lectures

The lectures are the main component of the course, generally meeting thrice a week. During the lectures, you'll encounter the main mathematical ideas in the form of definitions, theorems, and proofs. Attendance will not be taken, but it is highly recommended—it's very easy to fall behind in the course if you don't keep pace with the lectures. If you do miss a lecture, you will be responsible for catching up on the missed material by getting notes from another student. Lecture notes and a calendar of lecture topics are posted on [Canvas](#).

### Recitations

You are expected to attend your assigned recitation sessions on Tuesdays and Thursdays. During recitation, you'll deepen your understanding of the material from lecture by working with it yourself. You'll work on problems with other students and have discussions conducted by a TA. Come to recitation prepared to participate and ask questions.

## Coursework

### Problem Sets

Problem sets are designed for you to assess your progress as the semester unfolds. They often feature problems that require using the ideas demonstrated in lecture in new ways. Problem sets will generally be due on Wednesdays at 11:59pm. Late submissions will not earn any credit unless you use one of your 48-hour extensions on them (see [Flexibility](#) below). Problem sets will be submitted by uploading scans to Gradescope. Please be sure to explain all of your reasoning, keep your work legible, and tag each problem with the pages it appears on.

### Quizzes

A brief quiz will be due at the start of each lecture, covering material from the previous lecture. The purpose of the quizzes is to ensure that you've internalized each lecture well enough to be prepared for the next one. Quizzes will be taken online directly through Gradescope. You are permitted to refer to your notes or the textbooks during the quizzes. Late quizzes will not be accepted, although your lowest three quiz scores will be dropped in your final grade calculation.

### Exams

Written exams are the primary means of assessing your learning in the course. There will be five exams in all. Three of them are scheduled during class: Exam 0 on Wednesday, February 12, Exam 1 on Wednesday, March 19, and Exam 2 on Wednesday, April 9. Make-ups will not be given for these exams; a missed exam will count as your lowest score and will be dropped.

The last two exams will take place during the final exam period, to be scheduled by the registrar. The exams will happen back-to-back, with Exam 3 covering material from the last few weeks of class and Exam 4 being cumulative. In case of a conflict, these exams can be made up as long as notice is provided at least two weeks in advance of the regular exam time.

Calculators, notes, or other class materials may not be used during any of the exams.

## Materials

### Textbooks

The main textbook for the course is *An Infinite Descent into Pure Mathematics*, by Clive Newstead. A PDF of the textbook is available on Canvas (it's not yet in print). Readings from the textbook will be posted [alongside each lecture](#) to supplement the material from class; it is recommended to do the reading either shortly before or shortly after each lecture. The textbook is also a great source of extra examples and practice problems.

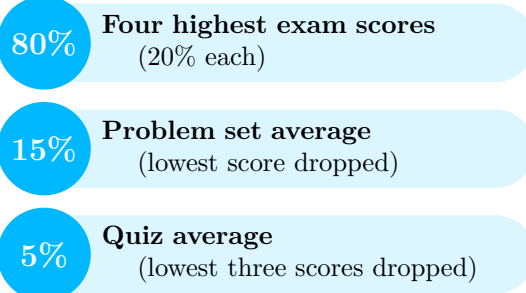
The secondary textbook is *Book of Proof*, by Richard Hammack, available for free online [here](#). We won't be following this textbook as closely, but it is useful for providing another perspective on the main topics of the course.

### Course Websites

- [Canvas](#) is the location for course materials, the schedule for the semester, and additional details about the class.
- [Piazza](#) is a forum where you can post questions and have them answered by other students or the course staff. You should ask general questions about course content or logistics on Piazza so your peers can also benefit from the responses.
- [Gradescope](#) is used for turning in assignments and viewing feedback on your graded work. Be sure to read the comments on your assignments closely when grades are released.

## Grading

Your final course average will be computed as a weighted average of the following components:



Scores on each exam may be adjusted before they are factored into the overall average. Any adjustments will only increase the exam scores, and adjustments will be done in the same way for the entire class. The lowest of the five exam scores (after any adjustments) is not considered at all in the final grade calculation.

Final letter grades will be determined from the averages using the standard 90%/80%/70%/60% cutoffs for letter grades of A/B/C/D. If you are close to a border between letter grades at the end of the semester, please don't notify me of this fact—I will already be aware of your situation, and will take care to deal with the borderline cases uniformly.

## Policies

### Accessibility

If you need accommodation for a documented disability, you must contact the [Office of Disability Resources](#) to obtain an accommodation letter. I encourage you to contact me early in the semester to discuss the details of any accommodations you need.

### Flexibility

Sometimes things come up during the semester that make it more difficult to complete assignments. In recognition of these difficulties, you will be given a total of two extensions that will allow you to submit an problem set up to 48 hours after the deadline. You don't need to contact anyone to use an extension; simply submit the assignment to Gradescope before the late deadline. In addition, your lowest problem set score and your lowest three quiz scores will each be dropped when calculating your final grade (even if nothing was submitted).

If you encounter larger issues that interfere with your ability to focus on the course, contact me as soon as possible so I can make arrangements to support your learning.

### Regrade Requests

Occasionally the course staff will make an error in grading. If you believe an assignment or exam was graded incorrectly, you should submit a regrade request through Gradescope within three days of the grades being released. Appropriate reasons to submit a regrade request are:

- The grader overlooked some of your work.
- The grader misread or misinterpreted your work.
- The grader entered a score incorrectly in Gradescope.

Submitting an excessive number of regrade requests will result in the loss of your regrade request privileges for the remainder of the semester.

### Academic Integrity

All work you submit in this course should be the product of your own effort. CMU's academic integrity policies outlined in [The Word student handbook](#) will be strictly enforced. The following are considered to be academic integrity violations and are not permitted:

- Accessing a solution to a problem that is part of an assignment or exam (including those from previous iterations of this course) from anywhere, including the internet, other students, or work that you completed while taking this course before.
- Distributing course materials to anyone outside of the course.
- Allowing another student to view your work.
- Submitting work created by another person or generative AI.
- Referencing notes, using an electronic device, or communicating with anyone during an exam.

If you are suspected of an academic integrity violation, an investigation will take place to determine whether a violation occurred. If you are found to have committed a violation, it will be reported to the [Office of Community Responsibility](#) and a penalty will be applied. The default penalty for an academic integrity violation is failure in the course, but more lenient or more severe penalties may be applied depending on the nature of the violation and conduct during the investigation.

## Collaboration

While you are not permitted to copy work from other students, you are encouraged to work together on problem sets. Doing math with others is one of the best ways to learn it! You may discuss problems with other students as long as you obey these guidelines:

- Cite the full names of any students you collaborated with at the beginning of your assignment submission.
- You may not directly view any written work from another student.
- You may work through problems collaboratively (for instance, by writing on a whiteboard together), but you may not reference any notes or recordings created as a group while writing up your own solutions independently.

## Resources

### Office Hours

Office hours provide you with opportunities to discuss math with the course staff. You are welcome to drop into any office hours without an appointment, even if the TA running them is not the one in charge of your section. Office hours are useful for clarifying concepts from class, discussing part of a problem set that you're stuck on, or answering questions you have about the course and beyond. The course staff will not tell you how to do homework problems or give you feedback on written solutions during office hours. The schedule of office hours can be found on [Canvas](#).

If you need help outside of scheduled office hours, contact your instructor or TA to schedule a one-on-one meeting. You should also consider asking any questions you have on [Piazza](#).

### Academic Support

The [Student Academic Success Center](#) has several programs and resources available to support your academic needs. They provide specific course support for 21-127:

- [Supplemental Instruction](#) consists of weekly drop-in sessions run by students who have already completed the course. During each session, you'll work through a set of problems designed to strengthen your skills—think of it as an extra recitation.
- [One-in-one and Drop-in Tutoring](#) are opportunities to work alongside a peer tutor who will answer your questions and guide you through practice problems.

Some advice for success in this course:

- You aren't in this alone. Your peers are a valuable resource for collaborating on homework and forming study groups.
- Start working on assignments early! You'll be able to solve some problems on the day problem sets are assigned.
- Keep up with the course by attending every lecture and recitation, and review your notes immediately after to identify areas of confusion.
- Maintain a growth mindset: remember that you can succeed if you put in the effort, and treat mistakes as learning opportunities.
- Don't hesitate to contact the course staff whenever you have a question. We are here to help you!

## Additional Resources

This course is one small part of your experience as a CMU student. Some resources to help you navigate your life outside of this course are listed below.

- [Counseling and Psychological Services \(CaPS\)](#): for mental health and wellness
- [University Health Services](#): for non-emergency medical care
- [Center for Student Diversity and Inclusion](#): for resources targeting historically underrepresented groups and first-generation students
- [Office of International Education](#): for immigration and related issues
- [Office of Title IX Initiatives](#): for issues with discrimination, harassment, and sexual misconduct
- [CMU Pantry](#): for help with food insecurity