

21-127 CONCEPTS OF MATHEMATICS

Summer I 2018

Instructor:	Shaun Allison	Time:	MTWRF 1:30 – 2:50
Email:	sallison @ cmu . edu	Place:	SH 220

Course Page:

1. <http://math.cmu.edu/~sallison/concepts18/index.html>
2. Canvas (used only for grades)

Office Hours: 3:00pm-4:00pm in WEH 6207

References:

- (Main) **An infinite descent into pure mathematics** by Clive Newstead
<https://infinitedescent.xyz/>
- (Optional) **Mathematical Thinking, Problem Solving and Proofs** by J.P. DAngelo and D.B. West

Course Description: Mathematics is more than just crunching numbers and solving integrals. Mathematics is a language used to communicate abstract and technical ideas concisely and unambiguously. Mathematics is in fact the *only* way to talk about certain ideas, and this holds in more cases than we may realize.

In the first three weeks of the course, we will cover the basic concepts, notation, and proof techniques, as well as functions, sets, and relations, which will serve as a foundation for the second half of the course. In the fourth week, we will apply what we learned to the field of combinatorics, also known as counting. In the fifth week, we will explore the basics of number theory. Finally, in the last week we will briefly cover the real numbers and use some tools to understand the nature of infinite sets.

There are no prerequisites to this course, and only the most basic mathematical background (basic algebra and arithmetic) is assumed.

Objectives: At the end of the course, you should be able to:

- Understand and use mathematical definitions,
- Communicate mathematical concepts and arguments clearly,
- Identify the components of a mathematical proof, and understand when it is or is not logically sound.

Statement on Course Textbook: In this course we will be using **An infinite descent into pure mathematics** by Clive Newstead as our main reference, which can be found for free here: <https://infinitedescent.xyz/>. This textbook is still being written, and has some incomplete parts. At times, we will deviate from the textbook on notation and content. I encourage everyone to follow along in the textbook, and I will give recommended reading for each lecture. However I must emphasize that the official reference for this course will be your notes from lecture, and you will be responsible for exactly what we cover in lecture, regardless of what is in the textbook.

Discussion Session: On May 25, June 1, June 15 and June 22, we will have a discussion session, where the class will split into groups and work on a list of problems. I will walk around the room and check in

on people and will be available for any questions. The discussion session will give you the opportunity to practice problems and communicate your ideas with your peers. It is essential to practice both written and oral communication, so there will be a grade for participation. There will also be a short (10 min) quiz at the end of each session, which will usually be a variant of one of the problems that you discussed. If we fall behind, the discussion sessions may be shortened or replaced with lectures.

Homework: Homework will be due on Wednesday and Friday, except for Fridays when there is an exam. Homework is due in the beginning of lecture the day that it is due. Late homework will not be accepted.

In other iterations of this course, students are often expected to type up at least some of their homework assignments with \LaTeX . I have decided to not make it an official requirement (the less time we have to sit in front of a screen, the better). However, I encourage you to type up your solutions at least once. \LaTeX is very useful for technical writing, and can, for example, be used to produce very professional-looking resumes. The course textbook is a great resource if you decide to take this opportunity to learn \LaTeX . I am also happy to help during office hours.

Whether you decide to type your solutions or hand-write them, you will need to explain your solutions in a legible manner. Homework must also be neatly stapled and submitted according to the guidelines outlined in the homework handout.

When working on homework assignments, you are allowed (even encouraged) to work with your classmates. However, you should try to solve the problems by yourself before you meet. Also, you **must not** take any written material away from your collaborations, and you **must** write up your solutions on your own.

The grading policy for individual homeworks will be written on the homework handout. Your total homework grade will be computed as the average of all of your homework grades. Your lowest homework grade will be dropped.

Exams: There will be two exams: a midterm and a final exam. If you have a very serious, well-documented, and compelling reason to miss an exam, let me know as soon as you can. Otherwise, make-up exams will not be offered.

It is normal for students to struggle the first time they are introduced to proof-based mathematics, and a solid foundation in the material covered in the first half of the course is essential to succeed in the second half of the course. So, a re-test will be offered for the midterm. If you took the midterm and decide to take the re-test, your new midterm grade will be computed using the following formula:

$$\max\{\text{Original Midterm Grade}, \min\{75\%, \text{Midterm Re-test Grade}\}\}.$$

In other words, if you scored less than a 75% on the midterm, you can take the re-test to improve your score to a maximum of 75%. If you scored more than a 75% on the midterm, you are free to take the re-test but your score will not be changed. Also note: you will only be allowed to take the re-test if you took the midterm. We will not be able to offer a re-take for the final exam.

Grading Policy: Participation and quizzes (10%), Homework (30%), Midterm Exam (30%), Final Exam (30%).

The letter grade cutoffs are as follows: 90-100 is an A, 80-89 is a B, 70-79 is a C, 60-69 is a D, and anything less than 60 is an R. The grade cutoffs may be lowered, but will not be raised.

Important Dates:

First Day of Class	Monday, May 21
Memorial Day (no class)	Monday, May 28
Midterm Exam	Friday, June 8 (in lecture)
Midterm Exam Retest	Thursday, June 14 (7:30am - 8:50am)
Drop Deadline	Monday, June 18
Final Exam	Friday, June 29 (in lecture)

It is important to make sure you are free for the retest, even if you don't know yet if you will want to take it.

Class Policy:

- Attendance is required in lecture. I do not plan to take attendance (outside of the discussion sessions), but I reserve the right to start taking attendance at any time and incorporate it into the "Participation and Quizzes" segment of everyone's grade.
- Since we need to cover a lot of material in only six weeks, it is important that everyone arrives on time so lecture can begin without interruption.
- Distracting devices such as laptops and cellphones are not allowed. If you believe that you need to use a device during lecture (for example, to take notes) please talk to me first.
- Calculators will not be helpful in this course, and are prohibited during exams and quizzes, as well as any other electronic devices.
- Visual and audio recordings (including pictures) are not allowed in lecture.
- Note-taking will not be allowed while discussing the homework in office hours.

Academic Integrity: Any acts of academic dishonesty, such as cheating, plagiarism, etc. will be dealt with according to University Policy. Examples of violation include searching the web (or inside a textbook) for solutions, copying part of another student's assignment or showing your assignment to another student. Please see the "Homework" section of this Syllabus to see guidelines on how to complete homework assignments in an academically honest manner. Please speak to me if you have any questions about this.

Accommodations: It is very important to me that my methods of instruction and assessment are fair to everyone enrolled in the course. To this end, please ensure that I'm aware of any accommodations that need to be made ahead of time. To ensure fairness, I will need some kind of supporting documentation from the CMU Office of Disability Resources, in order to grant accommodations on assessments.

Take Care of Yourself:

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website at www.cmu.edu/counseling/. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.