

MATH 112: INTRODUCTION TO ANALYSIS COURSE INFORMATION

SPRING 2024

Place & Time:	Eliot 314, MWF 12:00–12:50 P.M.
Instructor:	David Perkinson (davidp@reed.edu)
Office Hours:	See our course Moodle page .
Lecture notes:	See our course homepage .
Supplemental reference:	Introduction to Analysis , by Irena Swanson
Course homepage:	https://people.reed.edu/~davidp/112/

Course description. This course covers the field axioms, the real and complex fields, real and complete sequences and series, an introduction to complex functions, continuity and differentiation; power series and the complex exponential. Prerequisite: Mathematics 111 (Calculus) or equivalent.

Learning outcomes. After taking this course, students will be able to:

- » understand the field axioms and use them to derive properties of the real numbers;
- » understand the basic properties of complex numbers;
- » understand limits of sequences, series, and real and complex functions;
- » better understand the underlying theory of calculus;
- » read and write rigorous mathematical proofs in the context of analysis;
- » work as part of a small group to solve mathematical problems; and
- » communicate mathematical ideas verbally and in writing.

Distribution requirements. This course can be used towards your Group III, “Natural, Mathematical, and Psychological Science,” requirement. It accomplishes the following goals for the group:

- » Use and evaluate quantitative data or modeling, or use logical/mathematical reasoning to evaluate, test, or prove statements.
- » Given a problem or question, formulate a hypothesis or conjecture, and design an experiment, collect data or use mathematical reasoning to test or validate it.

This course **does not** satisfy the “primary data collection and analysis” requirement.

Course design. Nearly all of our meetings will break down into four components:

- » *Reading.* Every class will have an assigned reading which you must complete and engage with before we meet.
- » *Lecture.* A short online lecture and quiz accompanies each reading assignment and must be completed before the start of the corresponding class. Questions that arise during the lecture/quiz will be addressed in class or during office hours.
- » *Active class sessions.* Our 50-minute meetings will focus on group work with your peers. Collaborative problem-solving will allow you to interact with and grow your understanding of the material.
- » *Homework.* Based on each day's work, I will assign two or three harder homework problems for you to complete after class. These will be due via Gradescope on the Friday of the week after the material is covered.

The purpose of this structure is to scaffold your learning so that you will first engage with easy quiz problems based on your reading and the recorded mini-lecture, then bolster skills through collaborative problem-solving, and finally gain mastery over content by engaging with homework problems.

Expectation: Before class starts, you'll complete the reading, lecture, and online quiz related to that day's content.

Texts. The course will use our *Math 112 Lecture Notes* as its primary text. This is a free PDF file available on the course homepage which will be updated as the semester proceeds. (If you find typos or have suggestions for improving the notes, please let me know!) We will use Irena Swanson's *Introduction to Analysis*, also freely available at our course homepage, as a supplement to support the reading in the lecture notes.

Reading assignments and mini-lectures. The required reading and recorded lectures are essential to the course and provide a leaping off point for each of our class meetings. The associated quizzes are intended to ensure that you are following the text and lecture at an appropriate level; they should not be particularly hard, though some of the problems will be nontrivial. The quizzes are embedded into the mini-lecture videos (posted to the course homepage) and are due before class. These quizzes will be assessed on the basis of completion, not on score.

Group work. Most of class time will be spent working in small groups with classmates. The participants in each group will vary from class-to-class. I will rotate among the groups to see how everyone is doing. It is also possible to request my assistance if your group needs immediate help. You should work through the problems for the day *in order*. At times, your group will not be able to make it through every problem—that's expected and is OK, in general. You can work on these problems on your own, if interested, and in any case, solutions will be provided. Class will end with everyone together for a brief discussion of the day's problems.

The ability to work collaboratively and to communicate mathematics verbally is a major goal of the course. Members of each group should work together to make sure everyone is supported, is comfortable, and participates—it's not just about finding a solution to each problem. So please look out for the other members of your group.

Homework. Homework is due via Gradescope¹ before class each Friday. Excellent solutions take many forms, but they all have the following characteristics:

- » they use complete sentences, even when formulas or symbols are involved;

¹Gradescope is an online homework submission and evaluation platform. You will receive a link to register for our class's Gradescope page during the first week of classes.

- » they are written as explanations for other students in the course; in particular, they fully explain all of their reasoning and do not assume that the reader will fill in details;
- » when graphical reasoning is called for, they include large, carefully drawn and labeled diagrams;
- » they are neatly typeset using the \LaTeX document preparation system. A guide to \LaTeX resources is available on the course homepage.

I reserve the right to not accept late homework. If health or family matters might impede the timely completion of your homework, please contact me as early as possible.

Collaboration. You are permitted and encouraged to work with your peers on homework problems. You must cite those with whom you worked, and you must write up solutions independently. **Duplicated solutions will not be accepted and constitute a violation of the Honor Principle.**

Feedback. You will receive timely feedback on your homework via Gradescope, either from me or the course grader (another mathematics undergraduate). Most homework problems will be graded on a five-point scale (5 = perfect; 4 = minor mistake; 3 = major mistake, right idea; 2 = significant idea; 1 = attempted, 0 = none of the above.) The quality of your writing will be taken into account. If your answer is incorrect, this will be reflected in the score, and there will also be a comment indicating where things went wrong with your solution. You are strongly encouraged to engage with this comment, understand your error, and try to come up with a correct solution. You are welcome to talk about problems with me during office hours (see the Help section).

Exams. We will have two midterm exams and a final exam. Calculators, computers, phones, collaboration, books, and the Internet are prohibited during exams. Depending on how the semester goes, we may need to revise the following times:

- » Exam 1: Monday, February 12; due via Gradescope noon, Wednesday, February 14.
- » Exam 2: distributed via email Wednesday, March 20; due via Gradescope noon, Friday, March 22.
- » Final Exam: in-person, as scheduled by the Registrar, May 6–9.

Quizzes. In addition to the online quizzes that accompany the video lectures, we will have short in-class weekly quizzes. Each quiz is designed to summarize important work from the previous week.

Joint expectations. As members of a communal learning environment, we should all expect consideration, fairness, patience, and curiosity from each other. Our aim is to all learn more through cooperation and genuine listening and sharing, not to compete or show off. I expect diligence and academic and intellectual honesty from each of you. I will do my best to focus the course on interesting, pertinent topics, and provide feedback and guidance which will help you excel as a student.

Help. Everyone is welcome and encouraged to attend my **office hours**. They are an opportunity to clarify difficult material and also delve deeper into topics that interest you. The math/stats department also hosts **drop-in tutoring** Tuesday, Wednesday, and Thursday 7–9 P.M. Tutors will be available to clarify concepts and help you with homework problems. Links for office hours and drop-in tutoring are available at our course [Moodle page](#).

Finally, every Reed student is entitled to one hour of free individual tutoring per week. Use the tutoring app in IRIS to arrange to work with a student tutor.

The Internet. You are welcome to use Internet resources to supplement content we cover in this course, with the exception of solutions to homework problems. **Copying solutions from the Internet is an Honor Principle violation and will result in an academic misconduct report.**

Academic accommodations. If you have a documented disability requiring academic accommodation, I will be notified by Disability & Accessibility Resources (DAR). I am happy to communicate with you in person or via email about accommodations. If you believe you have an undocumented disability and that accommodations would ensure equal access to your Reed education, I would be happy to help you contact DAR.

Grades. Your grade will reflect a composite assessment of the work you produce for the class, weighted in the following fashion: 35% homework, 25% final exam, 20% exam 2, 10% exam 1, 5% completion of quizzes, 5% class participation.