

Mathematics 431 and 731 , Spring 2024

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Text: Fundamental Ideas of Analysis, M. Reed, Wiley

Welcome to Math 431 and Math 731. The course is the same for undergraduates (Math 431) and graduate students (Math 731), except that graduate students will complete one extra assignment (see below). There is one other section of the course taught by Zachary Bezemek zachary.bezemek@duke.edu. All sections of the course cover the same material.

Lectures and the flipped classroom. We will use the flipped classroom format. This means that the lectures are prerecorded and posted under Resources on Sakai. The lectures correspond to the sections of the book as indicated on the syllabus. Each lecture will be divided into two 25-minute parts, and there will usually be 6 of these 25 minutes lectures each week labeled by the week, the lecture, and the part. So, for example, the six 25 minute lectures for week 1 will be labeled w1-lec1-1, w1-lec1-2, w1-lec1-3, and so forth. The lectures for a week in the course will be posted early in the previous weekend under “Resources” on Sakai. There may be small adjustments to the syllabus as the course goes on.

Intellectual goals. The goals of the course are to introduce you to mathematical analysis and to teach you how to create and write logical, clear proofs.

Class time. In class, further examples of proofs will be given and students can ask questions and ask for help with proofs. Usually we will work on proofs together, or in small groups in the class.

The Problems. This course is centered on the problems that are listed for most days and weeks on the syllabus. Most problems ask you to prove something. We encourage you to work with other students to construct proofs for the problems. A large percentage of the questions on quizzes will simply ask you to prove problems exactly like or very similar to problems on the previous week’s homework. However, quizzes will sometimes also ask you to state definitions or theorems, or ask you to give a proof from the book, or to challenge you to construct a proof in a new situation. There are a total of 12 quizzes (including one makeup quiz). The lowest two grades will be dropped and the remaining 10 quizzes counted.

Writing. This is a writing course. Most questions on evaluations will ask you to prove something. All proofs must consist of complete sentences with good grammar and appropriate punctuation. Special mathematical symbols such as $\Rightarrow$ for “implies” and $\exists$ for “there exists” may **not** be used, except for $\geq, \leq$ and ϵ for “contained in.”

Evaluation. There will be 10 quizzes, 2 midterms and a final exam that will be weighted as follows:

Quizzes (100 points) + 1st midterm (100 points) + 2nd midterm (100 points) + final exam (200 points) = 500 points.

Homework Assignments. There will be weekly homework assignments during the semester. Homework will be collected via Gradescope and feedback will be given by the grader and your instructor. Handing in Homework is not mandatory and homework will not count as part of your grade. Collaboration is highly encouraged.

Graduate students. The extra assignment will count 8% of the course, or 40 points. Thus, if $P = \text{sum of quizzes} + \text{midterms} + \text{final}$, the final score of a graduate student will be $(.92)P + \text{score on the graduate student assignment}$. The graduate student assignment will be given before Spring Break and will be due before 5pm on April 23. Late assignments will lose 5 points/day.

Missed evaluations. If you miss a midterm examination (and have a University-approved excuse), you must take a make-up midterm during the following week at the Testing Center. It is student's responsibility to reserve a room at Testing Center.

There are 5 legitimate reasons for missing an evaluation:

1. Significant illness (you must send me the form before the evaluation).
2. Religious observance (inform both me and your Dean before the evaluation).
3. Varsity athletic participation (give me the form before the evaluation).
4. Personal or family emergency (your Dean must send me an email requesting a makeup).
5. Required legal appearance (your Dean must send me an email requesting a makeup).

Otherwise, you may not makeup the work.

There is no make up quizzes for this class. Except that there are one makeup quizzes in the last week of class (making a total of 12 quizzes) and the lowest two quiz grades will be dropped.

Academic assistance. The Mathematics Department maintains a list of tutors whom you can hire. Contact Laurie Triggiano in the Mathematics Department Office. In addition, the Academic Resource Center (ARC) offers free services to all students during their undergraduate careers at Duke. Contact the ARC to schedule an appointment. 211 Academic Advising Center Building, East Campus – behind Marketplace. email: theARC@duke.edu, 919-684-5917.

Testing Center. This class will use the Testing Center to provide testing accommodations and temporary test-taking supports to undergraduates registered with and approved by the Student Disability Access Office (SDAO) and/or Academic Resource Center (ARC). The Testing Center operates by appointment only and appointments must be made at least 7 consecutive days in advance, but please schedule your appointments as far in advance as possible. You will not be able to make an appointment until you have submitted a Semester Request with the SDAO or completed screening at the ARC and your accommodations or supports have been approved. If you have not already done so, promptly submit a Semester Request to the SDAO or schedule your screening with the ARC in order to make your appointment in time. For instructions on how to register with SDAO, visit

their website at <https://access.duke.edu/requests>. For instructions on how to schedule a screening with the ARC, visit their website at <https://arc.duke.edu/ld-adhd/overview>. For instructions on how to make an appointment at the Testing Center, visit their website at <https://testingcenter.duke.edu>

Mental Health/Wellness

Duke offers several resources for students to nurture daily habits that support overall well-being, some of which are listed below:

- DuWell. (919) 681-8421, provides Moments of Mindfulness (stress management and resilience building) and meditation programming (Koru workshop) to assist students in developing a daily emotional well-being practice. To see schedules for programs please see <https://studentaffairs.duke.edu/duwell>. All are welcome and no experience necessary. If your mental health concerns and/or stressful events negatively affect your daily emotional state, academic performance, or ability to participate in your daily activities, many resources are available to help you through difficult times. Duke encourages all students to access these resources.
- DukeReach. Provides comprehensive outreach services to identify and support students in managing all aspects of well-being. If you have concerns about a student's behavior or health visit the website for resources and assistance: <https://students.duke.edu/wellness/dukereach/>
- Counseling and Psychological Services (CAPS). CAPS services include individual and group counseling services, psychiatric services, and workshops. To initiate services, walk-in/call-in 9-4 M,W,Th,F and 9-6 Tuesdays. CAPS also provides referral to off-campus resources for specialized care. (919) 660-1000 or <https://students.duke.edu/wellness/caps/>
- TimelyCare (formerly known as Blue Devils Care). An online platform that is a convenient, confidential, and free way for Duke students to receive 24/7 mental health support through TalkNow and scheduled counseling. bluedevilscore.duke.edu

Community Standard. All students must uphold the Duke Community Standard:

- I will not lie, cheat, or steal in my academic endeavors.
- I will conduct myself honorably in all my endeavors; and
- I will act if the standard is compromised.

How to do well. First, you must keep up with the course because each week uses the theorems proven in the previous weeks. Secondly, all students can learn to write logical, clear proofs, and this is a major intellectual achievement. As in all other intellectual achievements, hard work is required.