MATH 325.001 − Analysis

Fall 2022 Syllabus (*Last updated 9/5*)

Instructor	Norman Cao	**Email**	norman.cao@cims.nyu.edu
Lecture	Mon/Wed 2:00-3:15pm	**Classroom**	CIWW 109
Office Hours	(refer to NYU Brightspace course page)	**Office**	CIWW 704

Textbook

The course will use "Basic Analysis I", by Jiří Lebl. The book is available for free online in PDF format at https://www.jirka.org/ra/. Paper copies can also be purchased online. I strongly recommend you read chapters both *before and after lecture.*

If this is your first exposure to proof-based math, I recommend going through Unit 1 (Proofs) of this MIT 6.042J (Math for Computer Science) OCW course. It provides a much gentler introduction to proofs!

Objectives

Math 325 Analysis is an upper level course which serves as an introduction to real analysis. Unlike lower level math courses which focus more on computation aspects of mathematics, this is a theoretical course that focuses on the foundations of calculus and the real numbers.

In this course, students will learn how to read, write, and understand mathematical proofs. All homework and exam problems will require students to write rigorous proofs. In addition, students will gain an understanding of the techniques and ideas used to rigorously understand ("analyze") calculus and the real numbers. The course content is roughly organized into three parts:

1. Foundations of analysis. Real numbers, sequences, and continuous functions

2. Rigorous treatment of calculus. Differentiation and integration.

3. Topics in modern analysis. Sequences of functions and metric spaces.

The material covered in this course forms a core pillar of modern mathematics. The ideas of analysis also appear in and have applications to other scientific disciplines.

Calendar

Tentative schedule following the textbook:

- Sets (Chapter 0) and Real Numbers (Chapter 1): Sep 7, 12, 14, 19

- Sequences and series (Chapter 2): Sep 21, 26, 28, Oct 3, 5

- **Midterm 1: Tuesday, October 11**

- Continuity (Chapter 3): Oct 12, 17, 19, 24

- Differentiation (Chapter 4): Oct 26, 31, Nov 2

- Integration (Chapter 5): Nov 7, 9, 14, 16

- **Midterm 2: Monday, November 21**

- Sequences of functions (Chapter 6): Nov 28, 30, Dec 5

- Metric Spaces (Chapter 7): Dec 7, 12, 14

Communication and Software

The syllabus, homework solutions, other course material, and any updates/announcements for this course will be posted on NYU Brightspace. Lecture notes will be uploaded after every lecture. Homework will be submitted and graded electronically via Gradescope.

Course Components and Grading

Homework (30%):

Homework will be assigned weekly via Gradescope, except during exam weeks. Solutions should be submitted online via Gradescope. Late homework will only be accepted either due to emergency circumstances, or if *prior notice at least 24 hours in advance* is given for non-emergency circumstances (refer to the sick and late policy below).

When collaborating on homeworks, each student is responsible for writing up their own solutions individually. Direct copying of another student's homework, even if both students contributed, is considered a violation of academic integrity.

Homework should be written clearly, and proper justification is required. For an idea of what constitutes a rigorous and complete proof, students should consult the course textbook, the homework solutions, recitation sections, or office hours. Even if you are unable to fully solve a problem, please submit your best attempt as partial credit will be awarded.

In order to allow the grader to give more detailed feedback on homeworks, not all exercises may be graded (you will not know which). The lowest homework score will be dropped from the final grade.

Collaboration (5%):

"The best way to learn something is to teach it to someone else."

This course has a mandatory collaboration component. To fulfill this requirement and receive a full grade, students must collaborate with at least one other person on every submitted homework. **Write the names of any collaborator(s) on the first page of your homework**.

Both giving and receiving help count towards collaboration! Discussing the course material for a few minutes or checking homework answers together is sufficient to qualify as collaboration. Anyone other than the course instructor and TA can count as a collaborator, including people who are not currently taking the course.

While live attendance at recitations is not mandatory, it is **highly recommended**, as recitations will focus on problem solving and concrete usage of the ideas introduced in lecture. A chat with a classmate after recitation would be sufficient to complete the collaboration component.

Exams (65%):

There will be two midterm exams and a cumulative final exam. The two midterms will be held **synchronously during lecture time** (see Calendar section), while the final exam will be held during finals week (time and date TBA)

The 65% exam component will be determined from your three exam grades (two midterms + one final) by the following formula:

$$25\% \text{ (highest of three exam grades)} + 20\% \text{ (2nd highest of three exam grades)} +$$
$$10\% \text{ (lowest of three exam grades)} + 10\% \text{ (final)}$$

Sick and Late Policy

Extensions on homework will be granted in qualifying cases, such as religious holiday, family emergency, sickness that extends over several days, qualified academically related activity, or unavoidable circumstance which prevents you from working on the homework. I will generally try to be flexible and understanding with late homework, however, **non-emergency extensions will only be granted if requested at least 24 hours prior to the homework due date**. If you miss a homework or exam due to emergency circumstances, please contact me ASAP via email.

Other Course Policies

I expect students to contribute to our positive learning environment: **try to attend live classes**, **pay attention** for the duration of the class, **participate** meaningfully during class by asking questions or answering them. Students who disrupt our learning environment will be asked to leave.

If you have questions related to the course, please feel free to send me an email or drop by office hours. I will normally reply within 24 hours. If I do not, please send me a reminder.

This course will abide by NYU CAS academic policies and honor code.

Resources

I am available during **office hours and by appointment** to review course material or address any course related concerns. Peer tutoring is available at University Learning Center and Undergraduate Mathematics Tutoring Center. Students seeking accommodations must consult the Moses Center for Student Accessibility.