

Math 828: Real Analysis I

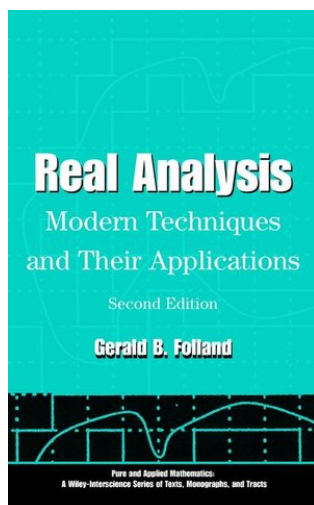
Lecture: Mondays, Wednesdays, and Fridays 10:20 - 11:10 am in C304 Wells Hall.

Instructor: Brent Nelson (brent@math.msu.edu). Office hours in D215 Wells Hall on Mondays 2:30 - 3:30 pm, Tuesdays 3:30 - 4:30 pm, and by appointment.

Teaching Assistant: Yoonkyeong Lee (leeyoo16@msu.edu). Recitations in C517 Wells Hall on Mondays 8:30 - 9:50 am.

Course Webpage: <https://www.math.msu.edu/~banelson/828.html>

Textbook: Though **not** required, we will follow the material in the book: Gerald B. Folland, *Real Analysis: Modern Techniques and Their Applications*, Wiley, 2nd Edition. Lecture notes will be posted regularly that can substitute for the book.



Course Description: The focus of this course is on abstract measure theory and integration, which offer generalizations of Riemann integration that one learns about in calculus. A *measure* μ on a set X gives a way to associate a weight or mass to a subset of X (subject to some natural constraints), and in turn this allows one to define an *integral* $\int_X f d\mu$ for so-called *measurable* functions $f: X \rightarrow \mathbb{C}$. While the notion of a measure may seem simple at first, the resulting theory is full of interesting (and at times pathological) examples and has applications to many fields of mathematics: probability theory, functional analysis, topological group theory etc.

We will begin by formally defining measures and exploring examples, including the Lebesgue measure. Next, we will define measurable functions and their integrals, which will allow us to compare different measures on the same space. We will also see what kinds of convergence of functions $f_n \rightarrow f$ implies convergence of their integrals, and explore differentiability in the context of the Lebesgue measure. Finally, we will use functional analysis to study classes of measurable functions called L^p -spaces. This material corresponds to Chapter 1 - 3 and 6.

In-Class Tone: My aim is to foster an open and inclusive atmosphere in class. Therefore questions, participation, collaboration, and curiosity are strongly encouraged. Math can be hard, especially when we aren't honest with ourselves about whether or not we understand something. Confusion is not a sign of weakness, nor is asking for help. If you need help beyond class time and office hours, please do not hesitate to contact me so that we can work out additional times to meet.

Grading: Your course grade will be determined according to the following scheme:

Homework	60%
Exams	40%

Details for the above components are provided below. A gradebook will be maintained in **D2L**, but you are also welcome to ask me for your current grade at any time. If you believe there is an error with the grading of any course material, **you must notify the instructor within 14 calendar days** of when it was completed, otherwise it will not be given further consideration.

Homework: There will be a total of 10 homework assignments. The lowest two homework scores will be automatically dropped, and the remaining eight will count equally toward your overall homework score. These will be posted on the course webpage, and will be collected at the beginning of lecture on Wednesdays. No late homework will be accepted, but extensions may be granted on an individual basis. Collaboration is encouraged so long as your written work is clearly your own.

Exams: The course will have two in-class midterm exams and a timed take-home final exam. The lowest exam score will be automatically dropped, and the remaining two will count equally toward your overall exam score. Additionally, exam corrections will be offered for each midterm exam (but not the final exam):

- Choose one question from the exam and prepare a solution for it or any of its parts.
- Schedule a time to meet with the instructor and present the solution (no notes allowed).
- You can earn up to full credit for the question back.
- The deadline for the presentations will be two weeks from the date graded exams were returned.

Please check early in the semester for time conflicts with these exams as make-up midterm exams will be offered:

Midterm 1	Wednesday, October 4th	10:20 - 11:10 am	C304 Wells Hall
Midterm 2	Wednesday, November 15th	10:20 - 11:10 am	C304 Wells Hall

Department policy requires that the final exam will be offered during the last week of class (December 4-8) so that students have sufficient time to prepare for the qualifying exam. Therefore the final exam will be a timed take-home exam. You will individually select any 3-hour window between Monday, December 4th 9:00 am and Friday, December 15th 12:00 pm (noon). During this window, you will be able to download the exam and upload your solutions through D2L. Additional details will be provided towards the end of the semester.

Academic Integrity: Cheating will not be tolerated. Students who cheat may receive a 0.0 on the assignment or fail the course. This includes plagiarism and copying another's work. MSU policies on academic misconduct can be found [here](#).

Student Accommodations: If the Resource Center for Persons with Disabilities (RCPD) has determined that you eligible for testing or classroom accommodations, then you should submit a [Verified Individualized Services and Accommodations document](#) (VISA) to the instructor no later than Friday, September 22nd.

Course Calender: The following is a tentative schedule for the course.

Week 1	8/28 - 9/1	Class begins on 8/28
Week 2	9/4 - 9/8	No class on 9/4 (Labor Day) Homework 1 due on 9/6
Week 3	9/11 - 9/15	Homework 2 due on 9/13
Week 4	9/18 - 9/22	Homework 3 due 9/20
Week 5	9/25 - 9/29	Homework 4 due 9/27
Week 6	10/2 - 10/6	Midterm 1 on 10/4
Week 7	10/9 - 10/13	Homework 5 due 10/11
Week 8	10/16 - 10/20	Homework 6 due 10/18
Week 9	10/23 - 10/27	No class 10/23 (Fall Break)
Week 10	10/30 - 11/3	Homework 7 due 11/1
Week 11	11/6 - 11/10	Homework 8 due 11/8
Week 12	11/13 - 11/17	Midterm 2 on 11/15
Week 13	11/20 - 11/24	No Class on 11/24 (Thanksgiving Break) Homework 9 due 11/22
Week 14	11/27 - 12/1	
Week 15	12/4 - 12/8	Final Exam availability begins 12/4 at 9:00 am Homework 10 due 11/29
Finals Week	12/11 - 12/15	Final Exam availability ends 12/15 at 12:00 pm

Other important dates:

- Friday 9/1 – Online open add period for Fall full-term classes ends at 11:59 pm.
- Thursday 9/21 – End of tuition refund period for full-term Fall semester courses.
- Sunday 12/10 – Classes end for Fall semester 2023.