

Math 114: Real Analysis II

Instructor. Kevin Yang (kevinyang@math.harvard.edu), Science Center 333i

Course details. Tuesday, Thursday: 9-10:15am. (Location: Science Center E)

Course assistants.

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Office Hours.

- Kevin Yang: Tuesday, 11am-12pm, SC 333i, Wednesday 11am-12pm, SC333i. (*If you are unable to make these times, please email me to arrange another time to meet. If this is not a good time for a critical mass, I may change them.*)

Prerequisites. Math 22b, 25b, 55b, or 112 (i.e., real analysis and Riemann integrals). Math 131 (i.e. point set topology on abstract topological spaces) helpful but not necessary.

Course website. We will use Canvas (<https://canvas.harvard.edu/courses/138638>). All assignments, announcements, and files will be posted there. Please check this course site regularly.

References.

- (SS) R. Shakarchi, E. Stein, *Real Analysis: Measure Theory, Integration, and Hilbert Spaces*
- (SS2) R. Shakarchi, E. Stein, *Fourier Analysis: an Introduction*
- (LL) E. Lieb, M. Loss, *Analysis*
- (T) Notes of Terence Tao (see <https://terrytao.wordpress.com/2009/04/30/245c-notes-4-sobolev-spaces/>)

Topics.

- Basic elements of measure theory and Lebesgue integration: Chapters 1 and 2 in [SS]
- L^p -spaces: Chapters 2 and 4 in [LL]
- Fourier transform: Chapters 5 and 6 in [LL]
- Fourier series: Chapter 2 in [SS2]
- Hilbert spaces: Chapter 4 in [SS]
- Radon-Nikodym theorem: Chapter 6 in [SS]
- Hölder spaces: (T)

There are topics (e.g. Banach spaces and Lebesgue differentiation) that are also important. Time permitting, we will cover those near the end of the semester.

Homework. There will be weekly HW. The first half will be posted after lecture on Tuesday, and the second half will be posted after lecture on Thursday. It will be due the following Tuesday. *Late homework will not be accepted without permission.* Students will be offered two free late HW assignments (up to two days, to be submitted by Thursday of the same week). Homework will be posted and are to be uploaded on Canvas.

Exams. There will be one in-class midterm exam and a final take-home exam. The midterm will take place on **Tuesday, October 15, 2024**. Its goal is to check in on students' understanding. The final take-home will happen during reading period. Its goal will be to further explore some of the topics related to this class with guided walkthroughs (it is meant to be more fun than stressful).

Grading. Homework (60%), one in-class midterm (10%), and a final take-home exam (30%).

Special rule about the use of AI (such as ChatGPT). You are not allowed to use AI to solve questions (homework, exam, midterm), nor ask it to suggest resources to solve these questions. Doing so is a violation of Harvard Honor Code.