Syllabus for M 473, Fall 2017
Introduction to Real Analysis

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Course meetings: 10:00-10:50 MTWF, Math 305

Office hours: Monday, Wednesday 2:00 – 3:00, Friday 1:00-2:00, by appointment.

Text: *The Way of Analysis, Revised Edition*, by R. Strichartz, Jones and Bartlett, Boston, 2000.

Course Objectives

Modern analysis has grown out of efforts in the last few centuries to establish a rigorous foundation for calculus and to generalize these notions. Real analysis is thus a branch of mathematics and not simply a course. A very first analysis course like our M 381 usually amounts to a rigorous treatment of calculus of functions of a single real variable. This course focuses on the first set of generalizations of the notions of calculus to the setting of metric spaces. Further courses (such as our M 551) continue the development of these ideas into the twentieth century by considering the even more general setting of measure spaces.

Roughly speaking, a metric space is a set together with a sensible notion of distance. The real number system together with the notion of absolute value is the most familiar example. Euclidean space $\mathbb{R}^n$ with the standard norm is another familiar example. Whenever we have a metric space, it makes sense to talk about limits of sequences in that space and continuous functions from that space into another such space. The discussion of different metrics on spaces of functions leads naturally to a discussion of various notions of convergence (pointwise, uniform, L^2) for sequences of functions.

The official learning goals are:

1. to learn the basics of real analysis (definitions, terminology, concepts, techniques, methods)
2. to understand different notions of convergence.
3. to understand various forms of continuity and how they are related.
4. to learn generalizations of the notion of distance.
5. to be able to write a clear proof involving above items.
6. to learn to think independently and write clearly.

Grading

The grade will be based on three components:

Homework: 35%
Two exams: 40%
Final exam: 25%

Homework

The homework is weighted heavily because it is through routinely solving problems that one develops and refines mathematical thinking and communication skills. On average, problem assignments will be made weekly, and you will be given roughly a week to submit solutions. Each problem assignment will consist of core problems that all students should complete and supplementary problems marked with an asterisk that are only required of graduate students. However, I encourage undergraduates to try supplementary problems as well. I encourage students to work together since this is an excellent way to learn and develop one's ability to communicate mathematical ideas. I ask, however, that students write up solutions individually. If you work with another student or consult with another book, please indicate this on your write-up so I know what resources you are using. It is a violation of professional ethics to submit a solution you found online or obtained from another person as if it is your own work.

Exams

Exams will be given on **Wednesday, October 4** and **Wednesday, November 15**. Because different exam formats give students different ways to use their knowledge, each exam will have an in-class component, a take-home problem, and a problem to be presented to me orally.

Important Dates

Sept. 4 (Monday): No class
Oct. 4 (Wednesday): Exam 1
Nov. 10 (Friday): Veterans' Day - No class
Nov. 15 (Wednesday): Exam 2
Nov. 22 - 24 (Wed. - Fri.): No class (Thanksgiving)
Dec. 15 (Friday): Final exam, 8 - 10 am.