MATH 425a

Instructor: Christopher Kuo, ckuo0602@usc.edu

Lectures: Section 39647R: MWF 11-12, THH 213

TA Sections: 39648R by Mustafa Sencer Aydin, maydin@usc.edu,
Tu 9-11, LVL13

Office Hours: Christopher Kuo, KAP 438A, M 12-1, F 1-3
Mustafa Sencer Aydin, the Math Center, M 1-2, Tu 12-1, W 2-3.

Course Website: Brightspace.

Course Description: This course serves as an introduction to real analysis, focusing on a rigorous examination of fundamental concepts from Calculus, such as limits, sequences, differentiation, and integration. We will start with (naive) set theory and the construction of real numbers. From there, we will move on to the abstract framework of metric spaces and topological spaces. Finally, we will specialize in the real line, applying these concepts to Calculus.

Prerequisite(s): 1 from (MATH 290 or MATH 430 or MATH 432).

Textbook:

- Required: *Walter Rudin. Principles of Mathematical Analysis*, 3rd Edition.
- Optional: *Charles Chapman Pugh. Real Mathematical Analysis*, 2nd Edition.

We will cover most of the material from Chapters 1 to 6 of Rudin's textbook. If time permits, we may also study parts of Chapter 7. This book is widely regarded as a classic in mathematical literature. The first three chapters are quite abstract, so it may be helpful to read ahead to Chapters 4 to 6, where the theory is applied, to gain a better understanding of the abstract concepts.

Grade Distribution:
Ketter grades will generally be assigned based on the standard 10-point scale (e.g., 90% and above guarantees at least an A-, 80% a B-, and so on). However, depending on the overall class performance, the final grades may be adjusted (curved) upwards. Note that individual exams will not be curved. The following is the distribution of the percentages:

Assignments 30%, Midterm Exams 40%, Final Exam 30%

Assignments: Weekly assignments will be announced on Brightspace and will be due the following Wednesday. Submissions must be made through Gradescope. We will not accept make-ups but will drop two assignments with the lowest scores.

Midterms and Finals: If you need to miss a midterm, please inform the instructor as soon as possible. Make-up midterms will only be provided in cases of personal or medical emergencies and must be taken within a week. If a timely make-up is not feasible, the missed

exam will be dropped, and its weight will be redistributed among the remaining exams. For example, if you miss Midterm 2 and cannot take it within a week, Midterm 1 will then count for 30% of your final grade, and the final exam will count for 40%.

The midterms are scheduled tentatively on 09/30, Monday, and on 11/08, Friday, during the lectures. The final is on 12/11, Wednesday, 11-1, as scheduled by the university. See the link for more details.

Accommodation:
Extra accommodations will only be provided based on an official document from OSAS. Students with such documentation should submit it to the instructor as early as possible to avoid any delays.

Tentative Course Schedule:
The weekly coverage might change as it depends on the progress of the class. However, you must keep up with the reading assignments.

Date	**Materials**	**Reference**
M 08/26/24	Overview, the language of logic	
W 08/28/24	Naive set theory. Sets, functions, injections, surjections, equivalence relations.	Section 2: Finite, Countable, and Uncountable Sets
F 08/30/24	More set theory. Finite sets, unions, intersections, complement, countability.	Section 2: Finite, Countable, and Uncountable Sets
M 09/02/24	Labor Day holiday.	
W 09/04/24	Countability continued, diagonal argument, Russel's paradox, ordered sets.	Section 2: Finite, Countable, and Uncountable Sets
F 09/06/24	Ordered sets, least-upper-bound property, fields.	Section 1: Appendix
M 09/09/24	Construction of reals: Dedekin cut, ordered structure on cuts.	Section 1: Appendix
W 09/11/24	Field structures on cuts.	Section 1: Appendix
F 09/13/24	Finishing the construction of reals, uncountability of reals, metric spaces.	Section 2: Metric Spaces
M 09/16/24	Open sets and closed sets.	Section 2: Metric Spaces
W 09/18/24	More on open sets and closed sets.	Section 2: Metric Spaces
F 09/20/24	More on open sets and closed sets, closure, relative open sets.	Section 2: Metric Spaces

Date	**Materials**	**Reference**
M 09/23/24	Compact sets.	Section 2: Compact Sets
W 09/25/24	More compact sets.	Section 2: Compact Sets
F 09/27/24	Reivew.	
M 09/30/24	Midterm 1	
W 10/02/24	Haine-Borel and the Cantor set	Section 2: Compact Sets. Perfect Sets
F 10/04/24	Connected sets. Beginning of sequences	Section 2: Connected Sets. Section 3.
M 10/07/24	Convergent sequences	Section 3: Convergent Sequences.
W 10/09/24	Convergent sequences. Subsequences	Section 3: Convergent Sequences, Subsequences
F 10/11/24	Fall Recess	
M 10/14/24	Cauchy Sequences	Section 3: Cauchy Sequences
W 10/16/24	Upper and Lower Limits	Section 3: Upper and Lower Limits
F 10/18/24	Special sequences. Series.	Section 3: Special sequences. Series.
M 10/21/24		Section 3:
W 10/23/24		Section 3:
F 10/25/24		Section 3:
M 10/28/24	Continuous functions	Section 4:
W 10/30/24		Section 4:
F 11/01/24		Section 4:
M 11/04/24		Section 4:
W 11/06/24	Review	
F 11/08/24	Midterm 2	

Date	**Materials**	**Reference**
M 11/11/24	Veterans Day holiday	
W 11/13/24		Section 5:
F 11/15/24		Section 5:
M 11/18/24		Section 5:
W 11/20/24		Section 6:
F 11/22/24		Section 6:
M 11/25/24		Section 6:
W 11/27/24	Thanksgiving holiday	
F 11/29/24	Thanksgiving holiday	
M 12/02/24		Section 6:
W 12/04/24		Section 6:
F 12/06/24	Review (Last Day of Class)	
W 12/11/24	Final	