

# MATH 312H    Honors Concepts of Real Analysis    Spring 2025    Schedule

Lec.	Date	Section	Topic
1	1/13	2, 3	Introduction. Rational numbers. Ordered fields. Absolute value. ( <i>Notes</i> )
2	1/15	4	Upper and lower bounds. The Completeness Axiom.
3	1/17	4, 5, 6	Archimedean Property. Symbols $\infty$ and $-\infty$ . A construction of $\mathbb{R}$ .
-	1/20	-	<i>Martin Luther King Day - no classes.</i>
4	1/22	<i>Notes</i>	<b>Quiz 1.</b> Metric spaces.
5	1/24	7, 8	Sequences. The limit of a sequence: definition and examples.
6	1/27	<i>Notes</i>	<b>Quiz 2.</b> Sequences in metric spaces. Uniqueness of the limit. Bounded sequences.
7	1/29	9	Limit theorems for sequences of real numbers.
8	1/31		<b>Team Worksheet 1.</b>
9	2/3	9	<b>Quiz 3.</b> Basic examples. Sequences diverging to $\infty$ and $-\infty$ .
10	2/5	10	Monotone sequences. A recursively defined sequence.
11	2/7	10	Lim inf and lim sup.
12	2/10	10	<b>Quiz 4.</b> Cauchy sequences. ( <i>Notes</i> )
13	2/12		<b>Team Worksheet 2.</b>
14	2/14		Review.
15	2/17		<b>Exam 1.</b>
16	2/19	<i>Notes</i>	Complete metric spaces. Subsequences. (Sec.11)
17	2/21	<i>Notes</i>	Bolzano-Weierstrass theorem. Limits of subsequences. (Sec. 11)
18	2/24	14	<b>Quiz 5.</b> Series: definitions and examples, Cauchy Criterion for series.
19	2/26	14	Absolute convergence. Comparison Test, Root Test, and Ratio Test.
20	2/28	15, 23	Alternating Series Theorem. Power series.
21	3/3	<i>Notes</i>	<b>Quiz 6.</b> Decimal expansions of real numbers. (Sec 16.)
22	3/5		<b>Team Worksheet 3.</b>
23	3/7	<i>Notes</i>	Countable and uncountable sets. Open and closed sets.
-	3/9-15	-	<i>Spring Break - no classes</i>
24	3/17	17	<b>Quiz 7.</b> Continuous functions. Two definitions of continuity.
25	3/19	17	Examples of continuous and discontinuous functions.
26	3/21	17	Continuity of $kf$ , $ f $ , $f + g$ , $fg$ , $f/g$ , and $g \circ f$ .
27	3/24	18	<b>Quiz 8.</b> Properties of continuous functions.
28	3/26		<b>Team Worksheet 4:</b> Continuity in metric spaces.
29	3/28		Review.
30	3/31		<b>Exam 2.</b>
31	4/2	19	Uniform continuity. (Sec. 19) Compactness in terms of sequences. ( <i>Notes.</i> )
32	4/4	<i>Notes</i>	Limits of functions.
33	4/7	<i>Notes</i>	<b>Quiz 9.</b> More on limits and continuity. The derivative (Sec. 28).
34	4/9	28	Examples, continuity and differentiability, differentiation rules.
35	4/11	29	Zeros of the derivatives. The Mean Value Theorem.
36	4/14	18, 29	<b>Quiz 10.</b> The inverse function and its derivative. ( <i>Notes.</i> )
37	4/16		<b>Team Worksheet 5.</b>
38	4/18	<i>Notes</i>	Linear approximation and Taylor polynomials.
39	4/21	32	<b>Quiz 11.</b> Riemann integral: Darboux construction. A criterion for integrability.
40	4/23	32, 33	Integrable functions. Riemann sums. Properties of the integral.
41	4/25	34	The Fundamental Theorem of Calculus.
42	4/28	34	<b>Quiz 12.</b> Integration and differentiation.
43	4/30		<b>Team Worksheet 6.</b>
44	5/2		Review.

**Final Exam:** Monday, May 5.