

MATH 241: ANALYSIS IN SEVERAL REAL VARIABLES I

JOHN VOIGHT

COURSE INFO

- **Lectures:** Monday, Wednesday, Friday, 11:45 a.m.–12:35 p.m.
- **Room:** 220 Votey Hall
- **Instructor:** John Voight
- **Office:** 16 Colchester Ave, Room 207C
- **E-mail:** jvoight@gmail.com
- **Instructor's Office Hours:** Mondays 10:00–11:30 a.m. and 2:00–3:30 p.m.; or please make an appointment!
- **Course Web Page:** <http://www.cems.uvm.edu/~voight/241/>
- **Instructor's Web Page:** <http://www.cems.uvm.edu/~voight/>

- **Prerequisites:** Math 52, 121, 124 or permission.
- **Required Text:** Stephen Abbott, *Understanding Analysis*, Springer, 2002.
- **Grading:** Weekly homework will count for 45% of the grade. There will be two 50-minute midterm exams which will each count for 15% of the grade and a comprehensive final exam which will count for 25%.

I am happy to provide appropriate and fair accommodations for students with documented special needs; early in the semester, please contact the ACCESS office (<http://www.uvm.edu/~access/>) directly.

HOMEWORK

Homework is due on Wednesdays. Be sure to show your work and explain how you got your answer. Correct but incomplete answers will only receive partial credit. Part of the beauty of mathematics is in the elegance of its proofs, and one goal of this course is for you to learn to write mathematics excellently.

Cooperation on homework is permitted (and encouraged), but if you work together, do not take any paper away with you—in other words, you can share your thoughts (say on a blackboard), but you have to walk away with only your understanding. In particular, write the solution up on your own.

EXAMS

The three exams will take place on the following dates:

- **First Midterm Exam:** Wednesday, October 7 (in class)
- **Second Midterm Exam:** Friday, November 20 (in class)
- **Comprehensive Final Exam:** Tuesday, 15 December 2009, 3:30 p.m.–6:30 p.m.

Each of these exams will be administered in the usual classroom, 220 Votey Hall.

You are permitted to bring to each exam one 8×11 -sheet of paper upon which you may write anything that you like on one side. Outside of exceptional circumstances, make-up exams will not be given.

SYLLABUS

According to the “official” catalog description, we will cover:

Properties of the real numbers, metric spaces, infinite sequences and series, continuity.

Although we may deviate from this by adding or skipping topics, the tentative plan for the course is as follows.

- **Chapters 1–2:** The Real Numbers, Sequences and Series
 - 1, 31 Aug (M): Introduction, §1.1 Discussion: The Irrationality of $\sqrt{2}$
 - 2, 2 Sep (W): §1.2: Some Preliminaries
 - 3, 4 Sep (F): §1.3: Axiom of Completeness
7 Sep (M): *No class, Labor Day*
 - 4, 9 Sep (W): §1.4: Consequences of Completeness
 - 5, 11 Sep (F): §1.4
 - 6, 14 Sep (M): §1.5: Cantor’s Theorem
 - 7, 16 Sep (W): §2.1: Discussion: Rearrangement of Infinite Series
 - 8, 18 Sep (F): §2.2: The Limit of a Sequence
 - 9, 21 Sep (M): §2.3: The Algebraic and Order Limit Theorems
 - 10, 23 Sep (W): §2.4: The Monotone Convergence Theorem...
 - 11, 25 Sep (F): §2.5: Subsequences and the Bolzano-Weierstrass Theorem
 - 12, 28 Sep (M): §2.6: The Cauchy Criterion
 - 13, 30 Sep (W): §2.7: Properties of Infinite Series
 - 14, 2 Oct (F): §2.7
 - 15, 5 Oct (M): Review
 - 16, 7 Oct (W): **First Midterm Exam**, covering material in §§1.1–2.7
9 Oct (F): *No class, Fall Recess*
- **Chapters 3–5:** Basic Topology of \mathbf{R} , Functional Limits and Continuity, The Derivative
 - 17, 12 Oct (M): §3.1: Discussion: The Cantor Set
 - 18, 14 Oct (W): §3.2: Open and Closed Sets
 - 19, 16 Oct (F): §3.3: Compact Sets
 - 20, 19 Oct (M): §3.3
 - 21, 21 Oct (W): §3.4: Perfect Sets and Connected Sets
 - 22, 23 Oct (F): §4.1: Discussion: Examples of Dirichlet and Thomae
 - 23, 26 Oct (M): §4.2: Functional Limits
 - 24, 28 Oct (W): §4.2
 - 25, 30 Oct (F): §4.3: Combinations of Continuous Functions
 - 26, 2 Nov (M): §4.4: Continuous Functions on Compact Sets
 - 27, 4 Nov (W): §4.4
 - 28, 6 Nov (F): §4.5: The Intermediate Value Theorem
 - 29, 9 Nov (M): §5.1: Discussion: Are Derivatives Continuous?
 - 30, 11 Nov (W): §5.2: Derivatives and the Intermediate Value Property
 - 31, 13 Nov (F): §5.2
 - 32, 16 Nov (M): §5.3: The Mean Value Theorem
 - 33, 18 Nov (W): Review
 - 34, 20 Nov (F): **Second Midterm Exam**, covering material in §§3.1–5.3
 - 35, 23 Nov (M): §5.4: A Continuous Nowhere-Differentiable Function
25–27 Nov (W–F): *No class, Thanksgiving Recess*
- **Chapter 6:** Sequences and Series of Functions
 - 36, 30 Nov (M): §6.1: Discussion: Branching Processes
 - 37, 2 Dec (W): §6.2: Uniform Convergence of a Sequence of Functions
 - 38, 4 Dec (F): §6.2
 - 39, 7 Dec (M): §6.3: Uniform Convergence and Differentiation
 - 40, 9 Dec (W): Review
 - **Comprehensive Final Exam:** 15 Dec (T), 3:30 p.m.–6:30 p.m.