MATH 241: ANALYSIS IN SEVERAL REAL VARIABLES I

JOHN VOIGHT

Course Info

- **Lectures**: Monday, Wednesday, Friday, 9:35–10:25 a.m. and 10:40–11:30 a.m.
- **Room**: Perkins 200 and Votey 254
- **Instructor**: John Voight
- **Office**: 16 Colchester Ave, Room 207C
- **E-mail**: jvoight@gmail.com
- **Instructor's Office Hours**: Mondays and Wednesdays, 3:00–4:30 p.m.
- **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 50% of the grade, in-class "quick responses" will count for 5% of the grade (see below), and there will be two 50-minute midterm exams which will each count for 10% 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.

Students have the right to practice the religion of their choice. Each semester students should submit in writing by the end of the second full week of classes their documented religious holiday schedule for the semester.

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, you must write the solution up on your own.

Plagiarism, collusion, or other violations of the Code of Academic Integrity

(see http://www.uvm.edu/policies/student/acadintegrity.pdf)

will be referred to the The Center for Student Ethics and Standards.

Quick Response

On occasion throughout the semester, you will be given short (5-minute) in-class quick response quizzes. These will be easy and are simply to encourage you to keep up with the class and reward your attention.

Typos and Comments

If you find typos or have comments about the textbook, please send the instructor an e-mail!

Exams

The two midterm exams and comprehensive final exam will be administered in the usual classroom. You are permitted to bring to each exam one 8×11-inch 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

Although we may deviate from this, the tentative plan for the course is as follows.

- **Chapters 1–3**: The Real Numbers, Sequences and Series, Basic Topology of $\mathbf{R}$
  - **1**, 30 Aug (M): Introduction
  - **2**, 1 Sep (W): §1.1 Discussion: The Irrationality of $\sqrt{2}$
  - **3**, 3 Sep (F): §1.2: Some Preliminaries
    6 Sep (M): *No class, Labor Day*
  - **4**, 8 Sep (W): §1.3: Axiom of Completeness
  - **5**, 10 Sep (F): §1.4: Consequences of Completeness
  - **6**, 13 Sep (M): §1.4
  - **7**, 15 Sep (W): §1.5: Cantor's Theorem
  - **8**, 17 Sep (F): §2.1: Discussion: Rearrangement of Infinite Series, §2.2: The Limit of a Sequence
  - **9**, 20 Sep (M): §2.3: The Algebraic and Order Limit Theorems
  - **10**, 22 Sep (W): §2.4: The Monotone Convergence Theorem...
  - **11**, 24 Sep (F): §2.5: Subsequences and the Bolzano-Weierstrass Theorem
  - **12**, 27 Sep (M): §2.6: The Cauchy Criterion
  - **13**, 29 Sep (W): §2.7: Properties of Infinite Series
  - **14**, 1 Oct (F): §3.1: Dicussion: The Cantor Set
  - **15**, 4 Oct (M): Review
  - **16**, 6 Oct (W): **First Midterm Exam**, covering material in §§1.1–2.7
- **Chapters 4–6**: Functional Limits and Continuity, The Derivative, Sequences and Series of Functions
  - **17**, 8 Oct (F): §3.2: Open and Closed Sets
    11 Oct (M): *No class, Columbus Day*
  - **19**, 13 Oct (W): §3.3: Compact Sets
  - **20**, 15 Oct (F): §3.4: Connected Sets
  - **21**, 18 Oct (M): §4.2: Functional Limits
  - **22**, 20 Oct (W): §4.3: Combinations of Continuous Functions
  - **23**, 22 Oct (F): §4.4: Continuous Functions on Compact Sets
  - **24**, 25 Oct (M): §4.5: The Intermediate Value Theorem
  - **25**, 27 Oct (W): §5.1: Discussion: Are Derivatives Continuous?
  - **26**, 29 Oct (F): §5.2: Derivatives and the Intermediate Value Property
  - **27**, 1 Nov (M): §5.3: The Mean Value Theorem
  - **28**, 3 Nov (W): §5.4: A Continuous Nowhere-Differentiable Function
  - **29**, 5 Nov (F): §6.2: Uniform Convergence of a Sequence of Functions
  - **30**, 8 Nov (M): §6.2
  - **31**, 10 Nov (W): §6.3: Uniform Convergence and Differentiation, §6.4: Series of Functions
  - **32**, 12 Nov (F): §6.5: Power Series
  - **33**, 15 Nov (M): §6.6: Taylor Series
  - **34**, 17 Nov (W): Review
  - **35**, 19 Nov (F): **Second Midterm Exam**, covering material in §§3.1–5.4
    22–26 Nov (M–F): *No class, Thanksgiving Recess*
- **Chapters 7–8**: The Riemann Integral, Metric Spaces
  - **36**, 29 Nov (M): §8.2: Metric Spaces
  - **37**, 1 Dec (W): §8.2
  - **38**, 3 Dec (F): §8.2
  - **39**, 6 Dec (M): Review
  - **40**, 8 Dec (W): Review
- **Comprehensive Final Exam**, covering §§1.1–6.6, §8.2: 17 Dec (F), 7:30 a.m.–10:15 a.m.