

Mathematics 23b, Spring 2006

Theoretical Linear Algebra and Multivariable Calculus II

Catalog Number: 8571
Exam Group: 4

COURSE INFORMATION

- **Instructor:** Alberto De Sole
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- **Course Assistants:**
Gerardo Con Diaz , condiaz@fas.harvard.edu
Samuel Cross , cross@fas.harvard.edu
Robert Furrow , rfurrow@fas.harvard.edu
Andrew Laitman , laitman@fas.harvard.edu
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- **Textbooks:**
C. H. Edwards Jr., *Advances calculus of several variables*,
Other suggested readings:
W. Rudin, *Principles of mathematical analysis*, 3rd edition,
T. Apostol, *Calculus*,,
A. N. Kolmogorov and S. V. Fomin, *Elements of the theory of functions
and functional analysis*.
- **Meeting times:**
Lectures: M., W., F., 11–12 am, in Science Center E
Instructor’s office hours: M., 12–1 & W. 6–7.
Problem sessions: *TBA*
- **Course Web Page:**
<http://www.courses.fas.harvard.edu/~math23a/>
Course announcements, homework assignments, and homework solution
sets will all be posted here.
- **Grading policy:** Problem sets: 30%, mid–term exams: 30%, final exam:
40%

SYLLABUS

Metric and topological spaces. Limits and continuity.

1. Wednesday, February 1
 - Subject: *Course overview*

2. Friday, February 3
 - Subject: *Completeness axiom of \mathbb{R}*
 - Reading: Rudin, 1.4

3. Monday, February 6
 - Subject: *Countable and uncountable sets*
 - Reading: Rudin, 2.1

4. Wednesday, February 8
 - Subject: *Metric spaces*
 - Reading: Rudin 2.2

5. Friday, February 10
 - Subject: *Topology of metric spaces*
 - Reading: Rudin, 2.2
 - **Problem Set #1 due**

6. Monday, February 13
 - Subject: *Sequences and limits*
 - Reading: Rudin, 3.1, 3.2

7. Wednesday, February 15
 - Subject: *Definition of limit and continuity*
 - Reading: Rudin, 4.2, 4.2 & Edwards 1.7

- Friday, February 17
 - *Class cancelled*
 - **Problem Set #2 due**

- Monday, February 20

President's day: no class

- 8. Wednesday, February 22
 - Subject: *Continuous functions*
 - Reading: Rudin, 4.2, 4.2 & Edwards 1.7

- 9. Wednesday, February 22 (afternoon, make up class)
 - Subject: *Examples and properties of continuous functions*
 - Reading: Rudin, 4.2, 4.2 & Edwards 1.7

- 10. Friday, February 24
 - Subject: *Compact sets.*
 - Reading: Rudin, 2.3 & Edwards 1.8
 - **Problem Set #3 due**

- 11. Monday, February 27
 - Subject: *Bolzano-Weierstrass Theorem and Heine-Borel Theorem for compact sets in \mathbb{R}^n*
 - Reading: Edwards 1.8 & Appendix

Multivariable differential calculus.

- 12. Wednesday, March 1
 - Subject: *Curves in \mathbb{R}^n*
 - Reading: Edwards, 2.1

- 13. Friday, March 3
 - Subject: *Directional derivatives and the differential*
 - Reading: Edwards, 2.2

- **Problem Set #4 due**

– Monday, March 6

Midterm Exam # 1

14. Wednesday, March 8

- Subject: *Directional derivatives and tangent planes*
- Reading: Edwards, 2.2

15. Friday, March 10

- Subject: *Continuously differentiable functions*
- Reading: Edwards, 2.2
- **Problem Set #5 due**

16. Monday, March 13

- Subject: *Chain rule*
- Reading: Edwards, 2.3

17. Wednesday, March 15

- Subject: *Mixed second order partial derivatives*
- Reading: Edwards, 2.3

18. Friday, March 17

- Subject: *Taylor's formula in one variable*
- Reading: Edwards, 2.6
- **Problem Set #6 due**

19. Monday, March 20

- Subject: *Taylor's formula in several variables*
- Reading: Edwards, 2.7

20. Wednesday, March 22

- Subject: *Maximum-minimum problems*
- Reading: Edwards, 2.4, 2.5, 2.8

21. Friday, March 24
- Subject: *Second derivative test*
 - Reading: Edwards, 2.4, 2.5, 2.8
 - **Problem Set #7 due**
- Monday, March 27 – Friday, March 31
- Spring Break: no class*
22. Monday, April 3
- Subject: *Lagrange multipliers*
 - Reading: Edwards, 2.4, 2.5, 2.8

Multivariable integral calculus.

23. Wednesday, April 5
- Subject: *Area and the 1-dimensional integral*
 - Reading: Edwards, 4.1
24. Friday, April 7
- Subject: *Volume and the n-dimensional integral*
 - Reading: Edwards, 4.2
 - **Problem Set #8 due**
25. Monday, April 10
- Subject: *Step functions and Riemann Sums*
 - Reading: Edwards, 4.3
26. Wednesday, April 12
- Subject: *Iterated integrals and Fubini's Theorem*
 - Reading: Edwards, 4.4
27. Friday, April 14
- Subject: *Change of variables*
 - Reading: Edwards, 4.5

- **Problem Set #9 due**
- Monday, April 17
- Midterm Exam # 2**
28. Wednesday, April 19
- Subject: *Improper integrals*
 - Reading: Edwards, 4.6
29. Friday, April 21
- Subject: *Path length. Line integrals*
 - Reading: Edwards, 5.1
 - **Problem Set #10 due**
30. Monday, April 24
- Subject: *Green's Theorem*
 - Reading: Edwards, 5.2
31. Wednesday, April 26
- Subject: *Multilinear functions. Area of a parallelepiped*
 - Reading: Edwards, 5.3
32. Friday, April 28
- Subject: *Surface area*
 - Reading: Edwards, 5.4
 - **Problem Set #11 due**
33. Monday, May 1
- Subject: *Differential forms*
 - Reading: Edwards, 5.5
34. Wednesday, May 3
- Subject: *Stokes' Theorem*
 - Reading: Edwards, 5.6

35. Friday, May 5

- Subject: *The classical theorems of vector analysis*
- Reading: Edwards, 5.7
- **Problem Set #12 due**

Reading Period: May 6 – May 17

Final Examination Period: May 18 – May 26

The final exam is scheduled on: **Saturday, May 20.**