

Math 54: Linear Algebra & Differential Equations

Instructor: Alex Kruckman

Meetings: 12-2pm, M-F in 6 Evans (but this is Berkeley, so class will actually begin at 12:10pm).
Note: Berkeley's course schedule thinks that we meet in 6 Evans from 12-1pm and 2 Evans from 1-2pm. This is incorrect. We will always meet in 6 Evans.

Textbook: *Linear Algebra & Differential Equations* by Lay / Nagle, Saff, and Snider. This is a custom merger for UC Berkeley of the textbooks: Lay's *Linear Algebra and Its Applications*, Third Edition, and Nagle, Saff, and Snider's *Fundamentals of Differential Equations and Boundary Problems*, Fourth Edition.

Course Website: <http://math.berkeley.edu/~kruckman/summer2011/math54>

Email: kruckman@math.berkeley.edu

Office Hours: 1056 Evans Hall, Mondays, Wednesdays, and Thursdays, times TBA.

Course Format: For approximately the first hour of class, I will lecture on new material. This will be followed by a five minute break. The second half will be "section" - I will hand out worksheets of challenging problems to complete in groups, do practice problems on the board, or take questions on the homework.

This is a condensed summer class, which means that it will move *extremely quickly*. We are covering material from 11 chapters of the textbook in only 8 weeks. Attendance is not mandatory, but it is strongly advisable! You will be held responsible on exams for any material we cover on any day, during either hour of class. Some examples from lecture and section will appear on exams.

Grading:

- Homework: 20%
- Midterm 1: 20%
- Midterm 2: 20%
- Final Exam: 40%

There are no predetermined letter grade cutoffs. Your letter grades on the midterms should be a good indication of your performance.

Homework: Homework is due at the end of class each Tuesday and Friday (except on exam weeks). *No late homework will be accepted.* Assignments will be posted on the course webpage. Because of the accelerated nature of this class, there will be some overlap between the current homework and lectures, but I will always finish presenting the necessary material for an assignment at least a day before the homework is due.

Exams: There will be two midterms and a final, held on Thursday 7/7, Friday 7/22, and Friday 8/12. All exams will be 2 hours long, held during class. The final exam will be in a different room, to be announced later.

No notes, books, calculators, or other electronic devices may be used during exams. You will need to bring your own scratch paper, but you do not need blue books.

No makeup exams will be given for any reason. If you miss one midterm, the next exam will count for its portion of your final grade. You cannot "miss" an exam retroactively - if you show up to an exam, you must take it for a grade. If you miss the final or more than one midterm, you may be in trouble.

Students requiring special accommodations for exams must provide documentation from the DSP and contact me by the second week of class at the latest.

On the back of this page is a tentative schedule for the course.

Week 1: (Linear Algebra)

Monday 6/20: Introduction; Systems of linear equations (Sections 1.1-1.2)

Tuesday 6/21: Vectors and matrices (Sections 1.3-1.5)

Wednesday 6/22: Linear independence; Linear transformations (Sections 1.7-1.9)

Thursday 6/23: Matrix algebra (Section 2.1)

Friday 6/24: The inverse of a matrix (Sections 2.2-2.3) **HW 1 Due**

Week 2: (Linear Algebra)

Monday 6/27: The determinant of a matrix (Sections 3.1-3.2)

Tuesday 6/28: Properties of determinants (Sections 3.2-3.3) **HW 2 Due**

Wednesday 6/29: Introduction to vector spaces (Section 4.1)

Thursday 6/30: The null space and column space of a linear transformation (Section 4.2)

Friday 7/1: Linear independence and bases (Sections 4.3-4.4) **HW 3 Due**

Week 3: (Linear Algebra)

Monday 7/4: Dimension (Section 4.5)

Tuesday 7/5: Rank (Section 4.6) **HW 4 due**

Wednesday 7/6: Change of basis (Section 4.7)

Thursday 7/7: **Midterm 1**

Friday 7/8: Eigenvectors and eigenvalues (Section 5.1)

Week 4: (Linear Algebra)

Monday 7/11: The characteristic equation (Section 5.2)

Tuesday 7/12: Diagonalization (Section 5.3) **HW 5 due**

Wednesday 7/13: Eigenvectors and linear transformations (Section 5.4)

Thursday 7/14: The inner product (Section 6.1)

Friday 7/15: Orthogonal sets (Section 6.2) **HW 6 due**

Week 5: (Linear Algebra)

Monday 7/18: Orthogonal projections and Gram-Schmidt (Sections 6.3-6.4)

Tuesday 7/19: Least-squares problems (Section 6.5) **HW 7 due**

Wednesday 7/20: Inner product spaces (Section 6.7)

Thursday 7/21: Symmetric matrices (Section 7.1)

Friday 7/22: **Midterm 2**

Week 6: (Differential Equations)

Monday 7/25: Homogeneous linear equations (Sections 4.2-4.3)

Tuesday 7/26: Nonhomogeneous linear equations I (Sections 4.4-4.5) **HW 8 due**

Wednesday 7/27: Nonhomogeneous linear equations II (Section 4.6)

Thursday 7/28: Higher-order linear equations (Section 6.1)

Friday 7/29: Higher order linear equations: the homogeneous case (Section 6.2) **HW 9 due**

Week 7: (Differential Equations)

Monday 8/1: Matrix methods: systems in normal form (Sections 9.1, 9.4)

Tuesday 8/2: Matrix methods: homogeneous systems (Sections 9.5-9.6) **HW 10 due**

Wednesday 8/3: Nonhomogeneous systems; The matrix exponential (Sections 9.7-9.8)

Thursday 8/4: PDEs; Separation of variables (Section 10.2)

Friday 8/5: Fourier series (Section 10.3) **HW 11 due**

Week 8: (Differential Equations)

Monday 8/8: Fourier series II (Section 10.4)

Tuesday 8/9: Application: The heat equation (Section 10.5) **HW 12 due**

Wednesday 8/10: Application: The wave equation (Section 10.6)

Thursday 8/11: Application: Laplace's equation (Section 10.7)

Friday 8/12: **Final Exam**