

## Math 54: Linear Algebra & Differential Equations, Section 8

**Instructor:** Alex Kruckman

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**Office Hours:** Mondays, Wednesdays, and Thursdays, 10:10-11:00am, in 1057 Evans Hall.

**Course Website:** <http://math.berkeley.edu/~kruckman/summer2015/>

**Piazza:** <https://piazza.com/berkeley/summer2015/math54/home>. Piazza is a forum which will enable us to participate in group discussion online with the students and instructors from all eight sections of Math 54. In addition to asking questions, I encourage you to comment on and answer other students' questions.

**Time and place:** Monday-Friday 8:10-10:00am in 103 Genetics and Plant Biology Building.

**Textbook:** *Linear Algebra & Differential Equations*, 2nd custom edition for UC Berkeley, by Lay / Nagle, Saff, and Snider. This is a custom merger for UC Berkeley of the textbooks: *Linear Algebra and Its Applications*, Fourth Edition, by Lay, and *Fundamentals of Differential Equations and Boundary Problems*, Eighth Edition, by Nagle, Saff, and Snider.

**Course Format:** For the first hour of class, I will lecture on new material. After a 10 minute break, we will work on challenging problems in groups and discuss examples during the second hour. This is a condensed summer class, so we will have to move *extremely quickly* through the material. Don't let yourself fall behind - at our pace, it will be difficult to catch up. I will not be taking attendance (except on the first day), but I strongly recommend that you come to both hours of class every day!

**Grading:** Letter grade cut-offs will be determined at the end of the course, according to weights:

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

*Homework:* Homework is due at the beginning of class, usually on Tuesdays and Fridays (see schedule on back). Assignments will be posted on the course website. I will select a few problems from each homework for the grader to check for correctness, and the rest will be spot-checked for completeness. When computing your final grade, I will drop your two lowest homework scores.

Collaboration on the homework is encouraged! However, please make sure that all participants are engaged in the discussion. You will not learn nearly as much by watching other students solve your problems or by splitting up the work. After a collaborative discussion in which a problem is solved, I would like you each to write up a solution individually and in your own words.

*Quizzes:* On each day that homework is due (see schedule on back), we will also have a 10 minute quiz, covering selected topics from the homework assignment you have just completed. I will grade the quizzes carefully and provide feedback. When computing your final grade, I will drop your two lowest quiz scores.

*Exams:* There will be two midterms and a final (see schedule on back). All exams will held in class, during *both hours*. I will collect the exams when we change rooms, then hand them back out in the new room so you can continue working. No notes, books, calculators, or other electronic devices may be used during exams. I will provide scratch paper, and you do not need blue books.

Students requiring accommodations for exams and/or quizzes must provide documentation from DSP or the University Extension program and let me know before Thursday July 2nd.

**Schedule:** On the back of this page is a schedule for the course. As far as the topics go, you should view it as a loose guide: which material we cover on which day may need to be adjusted. However, the homework, quiz, and exam days are fixed.

**Week 1: (Linear Algebra - Vectors, matrices, and linear transformations)**

Monday 6/22: Introduction; systems of linear equations and row reduction (Sections 1.1-1.2)

Tuesday 6/23: Vectors and matrices (Sections 1.3-1.5)

Wednesday 6/24: Linear independence; linear transformations (Sections 1.7-1.9)

Thursday 6/25: Matrix operations (Section 2.1)

Friday 6/26: Invertible matrices (Sections 2.2-2.3) **HW 1 Due, Quiz 1**

**Week 2: (Linear Algebra - Vectors, matrices, and linear transformations)**

Monday 6/29: The determinant of a matrix (Sections 3.1-3.2)

Tuesday 6/30: Properties of determinants (Sections 3.2-3.3) **HW 2 Due, Quiz 2**

Wednesday 7/1: Introduction to vector spaces (Section 4.1)

Thursday 7/2: Subspaces; null space and column space (Sections 4.1-4.2) **HW 3 Due, Quiz 3**

Friday 7/3: **No Class**

**Week 3: (Linear Algebra - Vectors, matrices, and linear transformations)**

Monday 7/6: Linear independence and bases (Section 4.3)

Tuesday 7/7: Coordinate systems and change of basis (Sections 4.4, 4.7) **HW 4 due, Quiz 4**

Wednesday 7/8: Dimension (Section 4.5)

Thursday 7/9: The rank theorem (Section 4.6)

Friday 7/10: **Midterm 1**

**Week 4: (Linear Algebra - Eigenvalues and orthogonality)**

Monday 7/13: Eigenvectors and eigenvalues (Section 5.1-5.2)

Tuesday 7/14: Diagonalization (Section 5.2-5.3) **HW 5 due, Quiz 4**

Wednesday 7/15: Eigenvectors and linear transformations (Section 5.4)

Thursday 7/16: Complex eigenvalues (Section 5.5)

Friday 7/17: Geometry: inner product, length, and angle (Section 6.1) **HW 6 due, Quiz 6**

**Week 5: (Linear Algebra - Eigenvalues and orthogonality)**

Monday 7/20: Orthogonality (Section 6.2)

Tuesday 7/21: Orthogonal projections, Gram-Schmidt (Sections 6.3-6.4) **HW 7 due, Quiz 7**

Wednesday 7/22: Inner product spaces (Section 6.7)

Thursday 7/23: Diagonalization of symmetric matrices (Section 7.1)

Friday 7/24: **Midterm 2**

**Week 6: (Differential Equations)**

Monday 7/27: Basic theory of linear differential equations (Section 6.1)

Tuesday 7/28: Homogeneous linear equations I (Sections 6.1, 4.2-4.3) **HW 8 due, Quiz 8**

Wednesday 7/29: Homogeneous linear equations II (Sections 4.3, 6.2)

Thursday 7/30: Nonhomogeneous linear equations I (Sections 4.4-4.5)

Friday 7/31: Nonhomogeneous linear equations II (Section 4.6) **HW 9 due, Quiz 9**

**Week 7: (Differential Equations)**

Monday 8/3: Matrix methods: systems in normal form (Sections 9.1, 9.4)

Tuesday 8/4: Matrix methods: homogeneous systems (Sections 9.5-9.6) **HW 10 due, Quiz 10**

Wednesday 8/5: Nonhomogeneous systems; the matrix exponential (Sections 9.7-9.8)

Thursday 8/6: PDEs; separation of variables (Section 10.2)

Friday 8/7: Fourier series (Section 10.3) **HW 11 due, Quiz 11**

**Week 8: (Differential Equations)**

Monday 8/10: Fourier cosine and sine series (Section 10.4)

Tuesday 8/11: Application: The heat equation (Section 10.5) **HW 12 due, Quiz 12**

Wednesday 8/12: Application: The wave equation (Section 10.6)

Thursday 8/13: Application: Laplace's equation (Section 10.7)

Friday 8/14: **Final Exam**