Mathematics 54 (Section 2)
Linear Algebra and Differential Equations, Spring 2015

(revised March 17, 2015)

Professor Mariusz Wodzicki
995 Evans Hall

Office Hours: 5-6pm MWF

Text: David Lay, *Linear Algebra*, 4th ed., and Nagle, Saff & Snider, *Fundamentals of differential equations and boundary value problems* (combined paperback edition for UC Berkeley).

Class meetings: The lectures are Mondays, Wednesdays and Fridays, 4:10 am-5, in Room 2050 of Valley Life Sciences Building.

In addition, there are 15 discussion sections:

Section	Teaching Assistant	Time (TuTh)	Location
201	Tao	8-9:30 am	6 Evans
202	Lee	8-9:30 am	4 Evans
203	Tao	9:30-11 am	75 Evans
204	Lee	9:30-11 am	4 Evans
205	Brereton	9:30-11 am	6 Evans
206	Brereton	11-12:30 pm	4 Evans
207	Scott	11-12:30 pm	6 Evans
208	Scott	12:30-2 pm	5 Evans
209	Farid	12:30-2 pm	6 Evans
210	Farid	8-9:30 am	9 Evans
211	Ishii	2-3:30 pm	122 Latimer
212	Ishii	8-9:30 am	385 Leconte
213	Ryder	3:30-5 pm	121 Latimer
214	Park	3:30-5 pm	237 Cory
215	Park	5-6:30 pm	5 Evans
216	Ryder	5-6:30 pm	75 Evans

	Date	Topic	Homework
1	Jan 21	Linear systems, matrix notation	**1.1:**1-15(odd);20,23,24,28
2	Jan 23	Reduced echelon form and parametric solution	**1.2:**1-15(odd);21,23-26 **1.5:**1,5,29,30,31
3	Jan 26	Vector and matrix equations	**1.3:**1,3,5,11,12,24 **1.4:**1,5,7,9,17,18,31,34
4	Jan 28	Span, linear independence, subspaces of $\mathbf{R}^n$	**1.5:**9,14,24,32 **1.7:**1-17(odd) **2.6:**1,3,5,9
5	Jan 30	Basis, coordinates, dimension	**2.6:**11,16 **2.7:**1,3,9,11,13,15 **4.2:**1,3,5,7,23
6	Feb 2	Linear transformations	**1.8:**1,3,9,11,17 **1.9:**1-17(odd)
7	Feb 4	General vector spaces	**4.1:**9,11,17,24,27,32 **4.2:**7,9,30,31 **4.3:**1,3,9,11,15,21
8	Feb 6	Matrix algebra	**2.1:**1-13(odd),17 **2.2:**1,3,11,19
9	Feb 9	Invertible matrices	**2.3:**1-7(odd),11,13,15,21,24
10	Feb 11	Determinants	**3.1:**1,5,9,13,19-22,41 **3.2:**1,3,5,7,11,19,21,27,31,33-35
11	Feb 13	Cramer's Rule	**3.3:**1-11(odd);21,24,32
12	Feb 18	Coordinates, dimension and rank	**4.4:**1,3,9,11,17,27 **4.5:**1-17(odd),26,27 **4.6:**1-15(odd),33
13	Feb 20	Change of basis	**4.7:**1-9(odd),13,16
14	Feb 23	Review and Change of basis continued	
15	Feb 25	Eigenvalues, eigenvectors	**5.1:**1,3,9,11,17 **5.2:**1,3,5,7 **5.3:**1,2,3,7
16	Feb 27	Diagonalization	**5.2:**9,11,13,15,17 **5.3:**9,11,13 **5.4:**1,3,9,11,17
17	Mar 2	Complex eigenvalues and rotations	**5.5:**1-17(odd)
18	Mar 4	Inner product, length, angles, orthogonality	**6.1:**1,5,7,9,13,17,21,22,24 **6.2:**3,9,17,19,21
19	Mar 6	Projections, Least Squares	**6.3:**1,3,5,7,11,17,21 **6.4:**1-11(odd),22 **6.5:**1,3,7,13
20	Mar 9	Inner product spaces	**6.6:**1,3,7,15 **6.7:**1-15(odd),19,22,24 **6.8:**1,2,3,4
21	Mar 11	Review	
22	Mar 13	MIDTERM #1	covers Lectures 1-19
23	Mar 16	Symmetric matrices, Spectral theorem	**7.1:**7,11,13,17,22,24,26
24	Mar 18	Quadratic forms	**7.2:**5,9,19

	Date	Topic	Homework
25	Mar 20	Homogeneous linear ODE's and the auxiliary equation	**4.2:**1,5,7,13,15,26 **4.3:**1,3,9,17,33,34
26	Mar 30	Inhomogeneous equations I	**4.4:**1,3,5,9,11 **4.5:**1-13(odd),25,29
27	Apr 1	Inhomogeneous equations II	**4.6:**1,3,9,15
28	Apr 3	Free and forced oscillations	**4.1:**3,5,8,9 **4.8:**7,14 **4.9:**3,5,10
29	Apr 6	Time-continous dynamical systems	**9.4:**1,3,9,11 **9.5:**13
30	Apr 8	Matrix functions	**9.5:**19,21 **9.6:**5,7,21 **9.8:**7,25
31	Apr 10	Generalized eigenvectors. Inhomogeneous eqs.	**9.7:**3,5,11,13,34 **9.8:**1,3,5
32	Apr 13	Fourier series	**10.3:**1-11(odd),17,19,37
33	Apr 15	Fourier series and orthogonal expansions	**10.3:**26,27,31 **10.4:**1-13(odd)
34	Apr 17	Separation of variables	**10.2:**1,3,5,9,11,27,31
35	Apr 20	Heat equation	**10.5:**1-9(odd),12
36	Apr 22	Review	
37	Apr 24	MIDTERM #2	covers Lectures 18-33
38	Apr 27	Wave equation	**10.6:**1,3,5,6,12,13,15
39	Apr 29	Laplace equation	**10.7:**1,3,5
40	May 1	Review	
	May 15	FINAL EXAM (8-11 pm)	covers all lectures

Overview of the course

Topic	Number of lectures
Linear Equations in Linear Algebra	$3\frac{1}{2}$
Matrix Algebra	2
Determinants	2
vector Spaces	6
Eigenvalues and Eigenvectors	$3\frac{1}{2}$
Orthogonality and Least Squares	5
Symmetry Matrices and Quadratic Forms	1
Linear Second-Order Equations	3
Higher Order Linear Equations	2
Matrix Methods for Linear Systems	3
Partial Differential Equations	6
Total classes	40

Homework and Quizzes

A weekly quiz will be given each Tuesday in the discussion sections. **No** make-up quizzes will be given, but we will drop the two lowest quiz scores in computing your grade.

Homework from a Monday lecture is due on Thursday in the discussion sections; homework from a Wednesday and Friday lectures is due on Tuesday. The homework will be graded "pass/fail".

Tests

Exam	Date	Material covered
Midterm #1	Mar 13	Lectures 1-19
Midterm #2	Apr 24	Lectures 20-34
Final Exam	May 15	All lectures

Grades

Work	Percentage of final grade
Homework and Quizzes	20%
Midterm #1	20%
Midterm #2	20%
Final Exam	40%

The student is expected to take both Midterms and the Final. Missing one Midterm (but not both) is allowed under special circumstances (you will have to bring a valid note from a doctor saying you were physically unable to take the Midterm). If you do not take one Midterm, the other Midterm will count for 30% of your grade and the Final Exam will count for 50% of your grade. You will not pass the course if you take neither Midterm #1 nor Midterm #2. No exceptions.

Your grade will be computed as follows. You will earn a letter grade (with a plus or minus, as appropriate) for each item of work above, and we will later combine these grades as indicated to obtain the final grade for the course. The TAs will lastly identify borderline cases, for which we will carefully look at the numerical grades on the various tests to determine the grade.

Please save your homeworks, midterms and quizzes, in case questions come up about the grading.

Grading policy. We put considerable emphasis on *getting the correct answer* in the grading of computational problems on the midterms and on the final exam. Approximately half the points will be given for setting up a problem properly and about half for computing the numerical answer correctly. You will loose many or even all points for setting up the calculation incorrectly, even if the subsequent computations or the answer are correct.

The grading policy thus emphasizes the importance in Mathematics tests of actually getting the correct answer. We feel very strongly that you must obtain the right answer to earn substantial credit, at least for the easier problems. (For more difficult problems, we may give partial credit for partial solutions.)

There is also a practical reason for this grading policy: in a large class it is extraordinarily difficult to assign partial credit to a student's calculations, *after* the student has made a mistake (even a simple error). There are an infinite number of erroneous pathways a calculation can take once there has been a mistake, and as a practical matter the graders do not have time to sort through all the subsequent computations and possible further errors.