

Math 54: Linear Algebra and Differential Equations. Spring 2020.

Course description: Basic linear algebra; matrix arithmetic and determinants. Vector spaces; inner product spaces. Eigenvalues and eigenvectors; linear transformations; symmetric matrices and SVD. Homogeneous ordinary differential equations; Fourier series and partial differential equations.

Instructor: [Nikhil Srivastava](#), email: *firstname at math.obvious.edu*

Please come to office hours or consult with your GSI **before** sending me email about logistical concerns. As far as possible, please use Piazza for mathematical questions.

Lectures: TTh 5:00-6:30pm, Wheeler 150.

Section: MWF, see [list](#) for times

Office Hours: W 5-6:30pm, Th 12:30-2pm (1035 Evans)

Course Control Number: [20365](#)

Piazza [signup](#)

List of GSI's and Office Hours: [txt](#)

Enrollment Issues: Unfortunately, I have no control over enrollment issues. If you have any concerns about the waitlist, switching sections, and so on, please contact the registrar or one of the Mathematics undergraduate advisors:

- Thomas Brown, 965 Evans, brown@math.obvious.edu
- Jennifer Sixt, 964 Evans, jensixt@math.obvious.edu

[Online Guidelines](#), describing how the course will be delivered online

Textbook: Linear Algebra and Differential Equations, ~~Second~~ **Third** Custom Edition for UC Berkeley, by Lay, Nagle, Saff and Snider (includes **5e** of Lay and **9e** of NSS). [picture of the cover](#)

Grading: 5% HW, 15% quizzes, 20% x 2 midterms, 40% final. The bottom three HW and Quiz grades will be dropped, and the lower midterm score will be replaced by the final, if it helps. All exams will be curved. The median grade will be **at least** a B-. This is not an upperbound; if everyone does extremely well, I will be happy to give everyone an A+.

Exams: There will be two in-class midterm exams on **Thursday, 2/20**, and **Tuesday, 4/7**. There will be no makeup exams, except for documented medical emergencies.

Quizzes will be held in section every **Wednesday**. They will cover material up to the preceding Thursday. The quizzes will be substantially easier than the exams, are and designed to regularly check basic understanding of the material, so that you know in case you are falling behind.

Homework will be assigned daily (problems from the textbook+occasional extra problems) on this webpage, and each week's homework (i.e., both Tuesday's and Thursday's problems, from the webpage) will be collected the following **Tuesday on Gradescope** by 11:59pm on Tuesday, in a **single gradescope assignment**. If you have not already been added, the entry code for this course's Gradescope is 9BRB4G at gradescope.com. For instructions on how to scan and upload your hw on

Gradescope, see this [video](#) and [handout](#). Homework will be corrected on a 0/1/2 scale for completeness. Homework **solutions** will be posted on Wednesdays in bCourses under 'files'.

Announcements

- (1/21). Welcome to the class! The first section is on **Friday 1/24**
- (1/23). Quizzes will be held on **Wednesday** in section. So the next quiz is on 1/29.
- (2/3). Section 214 and 215 (2-3 and 3-4pm) will take place starting today in 85 and 87 Evans respectively, with GSI Yash Somaiya.
- (2/6) Since I didn't get to explain the algorithm for computing the inverse of a matrix today, I have moved three problems (2.2: 10,30,32) to the next homework.
- (2/10) HW solutions will now be posted on bCourses, not on this webpage.
- (2/13) [Practice MT1 #1](#) and [solutions](#).
- (2/13) [Practice MT1 #2](#) and [solutions](#).
- (2/13) [Practice MT1 #3](#) and [solutions](#). correction: the answer to Q5 should be $-(1/2)v_3 - (1/2)v_4$
- (2/13) [Study sheet](#) for Midterm 1.
- (2/13) For a short introduction to set theoretic notation, see Appendix A of these [notes](#) by Prof. Hutchings.
- (2/17) There will be **no quiz** on Wednesday, 2/19, the day before the midterm.
- (2/18) My office hours this week are moved to 11-1230 and 630-8pm TODAY.
- (3/12) My second office hours this week are moved to F 630-8pm on Zoom.
- (3/16) HW7 will now be due on Gradescope on **friday** instead of tuesday.

Class Schedule

This course covers a lot of material very quickly, and in order to digest it you will have to read the assigned sections **before** lecture.

#	Date	Topics	Readings	Homework problems	Remarks
1	T 1/21	intro, linear equations	1.1	1.1: 1,3,5,7,11,15,20,23,24,28.	
2	Th 1/23	row echelon form, row reduction	1.2, 1.3	1.2: 1,5,7,11,15,23,26,30.	
3	T 1/28	linear combinations, span, column picture, matrix picture	1.3, 1.4	1.3: 1,5,9,11,14,23,24,29,32 1.4: 1, 4, 11, 13, 15, 24, 25, 29, 30, 31, 34.	
4	Th 1/30	linear independence, solution sets	1.5, 1.7	1.5: 1,5,9,23,24,25,38,39. 1.7: 1, 7, 9, 11,21, 22, 31, 32, 33, 34, 37, 38.	
5	T 2/4	linear transformations, the matrix of a	1.8, 1.9	1.8: 1,4,8,12,14,16,17,22,24,31,32. 1.9: 4,6,9,23abcd,33,36.	

		linear transformation			
6	Th 2/6	1-1 and onto transformations, matrix algebra, inversion	1.9, 2.1-2.3	1.9: 29, 30. 2.1: 1, 10, 12, 15, 18, 22, 23, 31, 32. 2.2: 40 , 16, 20, 24, 30, 32 . 2.3: 2, 5, 12, 15, 21, 28, 36.	
7	T 2/11	subspaces, basis, dimension,	2.8, 2.9	2.2: 10, 30, 32. 2.8: 2, 4, 5, 12, 13, 22, 23, 27, 31, 34. 2.9: 2, 6, 7, 9, 17, 27, 28.	
8	Th 2/13	determinants	3.1, 3.2	3.1: 5, 11, 22, 31, 33. 3.2: 3, 7, 17, 21, 27, 28, 29, 32, 33, 34	
9	T 2/18	review and applications			
10	Th 2/20	Midterm 1 (in class)	Ch. 1-3		
11	T 2/25	vector spaces, linear transformations	4.1, 4.2	4.1: 1, 2, 5, 6, 8, 11, 20, 21, 22, 23, 31, 32 4.2: 30, 31, 33, 35.	
12	Th 2/27	bases, coordinates	4.3, 4.4	4.3: 26, 31, 32, 33. 4.4: 15, 22, 23, 24, 25, 31, 32.	
13	T 3/3	dimension, the matrix of a linear trans, change of basis	4.5, 5.4 first 2 sec	4.5: 9, 11, 19, 21, 23, 25, 26, 27, 29, 31, 32. 4.7: 1, 3, 5, 7, 11, 13, 15, 20a. 5.4: 1, 3, 5, 9.	
14	Th 3/5	change of basis	4.7	4.7: 1, 3, 5, 7, 11, 13, 15, 20a. 5.1: 5, 7, 13, 20, 21, 22, 23, 24, 25, 26, 29, 31. 5.2: 7, 9, 19, 21.	
15	T 3/10	eigenvalues, eigenvectors	5.1-5.3	5.1: 5, 7, 13, 20, 21, 22, 23, 24, 25, 26, 29, 31. 5.2: 7, 9, 19, 21. +watch this video	
16	Th 3/12	similarity, diagonalization	5.3-5.5	5.3: 5, 8, 13, 14, 21, 22, 23, 27, 31, 32 5.4: 11, 13, 17, 23, 19, 20, 21, 22, 24	
17	T 3/17	complex eigenvalues, applications, begin orthogonality	5.5, 6.1	5.5: 3, 9, 13, 17, 22, 23, 24, 25. read this article on universality 6.1: 11, 13, 15, 19, 21, 24, 27, 28, 30, 31.	
18	Th	geometry of	6.1, 6.2, 6.3		

	3/19	\mathbb{R}^n		6.2:3,11,13,23,25,26. 6.3:3,7,13,16,20,21,24.	
19	T 3/31	gram-schmidt, least squares	6.4,6.5	6.4:3,9,17ab,18ab. 6.5:3,5,7,17,19,20,21,22. 6.6:1,7.	
20	Th 4/2	symmetric matrices, svd	7.1,7.4	7.1:9,10,17,19,23,25,26,28,29,30,31,35. 7.4:5,13,17,18,19. + read this article on image compression	
21	T 4/7	Midterm 2 (in class)			