Math 54: Linear Algebra and Differential Equations. Spring 2021.

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, on Zoom (link on bCourses).

Section: MWF, see list for times

Office Hours:T 1-2pm or F 4-5pm on Zoom

Course Control Number: 25957

Piazza signup

Gradescope: If you have not already been added, the entry code for this course's Gradescope is D5K2Y6 at gradescope.com. For instructions on how to scan and upload your hw on Gradescope, see this video and handout.

List of GSI's and Office Hours: see bCourses or Piazza for office hours and zoom links. Any student can attend any GSI's office hours.

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 the Mathematics undergraduate advisor Jennifer Sixt, 964 Evans, *jensixt@math.obvious.edu*

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 two HW and Quiz grades will be dropped, and the lower midterm score will be replaced by the final, if it helps. All quizzes and exams are open book and based on an honor code. Scores will not be curved so you do not have to worry about competing with others, and can focus on learning the material and showing me and the GSIs that you understand it. 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 take-home 36 hour midterm exams on Gradescope, on **Thursday, 2/18**, and **Tuesday, 4/6**. There will be no makeup exams, except for documented medical emergencies.

Take-home 24 hour **Quizzes** will be held on Gradescope every **Wednesday**. They will cover material up to the preceding Thursday. The quizzes will be of roughly the same difficulty as the exams, and are the best way to check your understanding of the material.

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. 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 **Wednesday 1/20**. Watch out for an announcement from your GSI. The first Quiz will be next week on **Wednesday 1/27**, released on Gradescope.
- (2/12) Practice MT1 #1 and solutions.
- (2/12) Practice MT1 #2 [`rank(A)' means `dimension of Col(A)'] and solutions.
- (2/12) Practice MT1 #3 [ignore Q1(j)] and solutions. [correction: the answer to Q5 should be -(1/2)v_3-(1/2)v_4]
- (2/12) Study sheet for Midterm 1.

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 1/19	intro, linear equations, existence and uniqueness	Lay 1.1	Lay 1.1: 1,3,5,7,11,15,20,23,24,28.	
2	Th 1/21	row echelon form, row reduction	1.2, 1.3	1.2: 1,5,7,11,15,23,26,30.	
3	T 1/26	vectors, linear combinations, span, column 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 1/28	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 2/2	linear transformations, the matrix of a linear transformation	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.	
6	Th 2/4	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: 10, 16, 20, 24, 30, 32.~~ ~~2.3: 2 , 5, 12, 15, 21, 28, 36.~~	
7	T 2/9	inverse, determinant	2.2, 2.3, 3.1,3.2	2.2: 10, 16, 20, 24, 30, 32. 2.3: 2 , 5, 12, 15, 21, 28, 36. 3.1:5,11,22,31,33. 3.2:3,7,17,21,27,28,29,32,33,34	
8	Th	subspaces, basis,	2.8, 2.9	2.8: 2,4,5,12,13,22,23,27,31,34.	

		2/11	dimension,		2.9: ~~2,6,7~~,9,17bcde,27,28.	
9	T 2/17	review and applications				[xkcd] word2vec paper word2vec demo
10	Th 2/18	Midterm 1	Ch. 1-3			
11	T 2/23	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 2/25	bases, coordinates	4.3, 4.4	4.3: 26,31,32,33. 4.4: 15,22,23,24,25,31,32.	
13	T 3/2	dimension, the matrix of a linear trans	4.5, 5.4 first 2 sec	4.5: 9,11,19,21,23,25,26,27,29,31,32. 5.4:1,3,5,9.	
14	Th 3/4	change of basis	4.7	4.7:1,3,5,7,11,13,15,20a.	
21	T 4/6	Midterm 2 (online, no lecture)	Ch. 1-7		