

18.06: Linear algebra

Spring 2016

Lecturer: C. Barwick

Office : 2-476

Office hours : Tue. and Thur., 11 AM – NOON

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Course website : <https://stellar.mit.edu/S/course/18/sp16/18.06/>

Textbook

We will be using:

Strang. *Introduction to linear algebra*. Fourth edition.

This text is required.

Availability

I will be available in my office for an hour each Tuesday and Thursday starting at 11 AM. You may also make an appointment with me through the <http://math.mit.edu/~clarkbar/>.

Evaluation

I must evaluate how successfully you have acquired the skills and knowledge this course is meant to impart, both so that I know I am conveying the material well and so that you know you are mastering what you'll need for your future work in mathematics. To that end, you will be evaluated on the basis of the following three types of work.

Homework (1/2 of your grade)

There will be exercises due each Monday, beginning in week 2. The exercises will be posted on the course website, at least a week before the due date. You are asked to complete each exercise carefully and neatly, and to turn the exercises into the appropriate box in 4-174 by 4 PM on each Monday. They will be returned to you, graded, during recitation.

These exercises form an important component of the course; you will learn most of the material while completing these exercises.

On average, you may expect to be assigned around 30 exercises each week, of the following two types. Around 9/10 of these will be “boilerplate,” meaning that you will not have to have a significantly new idea to perform the exercise; these exercises are intended to demonstrate the utility of the concepts and theorems we have covered, and they will be needed to follow the content of the course. (Note that “boilerplate” does *not* mean “trivial” or “easy.”) The remaining 1/10 will be “starred,” meaning that a significantly novel idea *will* be required to complete the exercise.

The exercises will be sequentially numbered; in all you may expect to be assigned no more than 200 exercises total.

Please turn in your problem sets on time. Late homeworks will not be accepted (except in extreme circumstances), but the lowest two homework scores will be dropped.

Clarity and neatness do count. Your solutions should be final, coherent, and easy to read. Illegible or sloppy work will not be graded, and you will be granted a 5 percent bonus on your work if it is either typed using the \LaTeX document preparation system or written very carefully and legibly.

You are encouraged to work in groups, but there are three guidelines you should follow:

- *Write the solutions yourself.* Papers with multiple authors will not be accepted, as I need to be able to evaluate your proof-writing abilities individually.
- *Give credit where credit is due.* If the key idea for a proof or a computation is someone else’s, indicate this clearly. For instance, you may write, “This argument is due to G. Jetson,” or “This was explained to me by W. Flintstone.” It is common in research to borrow ideas, but it is important that they be correctly attributed; otherwise this practice is indistinguishable from *charlatanism*.
- *Contribute.* Please do not take advantage of your intelligent but meek friends’ tolerance. Be sure that you are making a genuine contribution to the group’s

work. If you are not, please find another group. Sponges cannot learn as much material as those who put forward consistent effort.

Midterm exams (1/10 of your grade each)

There will be four written examinations this semester:

Exam 1 : Wed., 17 February, 11 AM

Exam 2 : Fri., 11 March, 11 AM

Exam 3 : Wed., 6 April, 11 AM

Exam 4 : Fri., 29 April, 11 AM

I'm sorry to say they will all be in Walker Memorial. You will be not be permitted the aid of any books, class notes, completed homework solutions, computer power, or communication tools.

Final exam (1/10 of your grade)

There will be a final written exam at the end of the semester, during which you will be permitted to use books, class notes, and your homework solutions. The date and location will be announced later. If your score on the final exam is higher than your lowest midterm score, the final exam score will supplant the lowest midterm score in the final grade calculation.

Policies

My operating assumption will be that I am working with motivated, intelligent adults who will treat one another with respect and courtesy. This plays out in a variety of ways:

- The difficulty of the material, combined with the differences in skills of your colleagues, can engender frustration. To some extent, this is to be expected. Do not permit that frustration to get in the way of your education, or the education of your colleagues.
- It is impossible to impart the entirety of the knowledge you are expected to acquire in this course during lectures. You should expect the bulk of your learning to result from the reading and from the exercises you will perform.

- Please do not hesitate to provide me with appropriate, timely feedback. My lectures are interactive, and my pace is determined in part by the responses I get from students. If the course is moving at a pace or in a direction with which you are uncomfortable, please do not wait until your head explodes (either from confusion or from boredom) before speaking with me.

Lecture plan for the semester

Below is an approximate schedule for the semester. There may be cause for me to move more quickly or more slowly through the material than what is here. I estimate the margin of error here at about two lectures.

Date	Lecture	Reading
3 February	Dimension	
5 February	Linear combinations of vectors	§1.1
8 February	Length and angle	§1.2
10 February	Matrices	§1.3
12 February	Systems of linear equations as matrices	§2.1
16 February	Solving and elimination	§§2.2–3
17 February	Exam 1	
19 February	Matrix operations	§2.4
22 February	Inverting matrices	§2.5
24 February	More on matrices	§§2.6–7
26 February	Spaces of vectors	§3.1
29 February	Nullspace	§3.2
2 March	Rank	§3.3
4 March	Dimension, redux	§3.4–5
7 March	Rank-nullity theorem 1	§3.6
9 March	Rank-nullity theorem 2	
11 March	Exam 2	
14 March	Orthogonal and orthonormal vectors	§4.1
16 March	Projections	§4.2
18 March	Orthogonal bases and Gram–Schmidt	§4.4
28 March	Key properties of determinants	§5.1
30 March	Permutations	§5.2
1 April	Cramer’s rule	§5.3
4 April	Inverting matrices, redux	
6 April	Exam 3	
8 April	Eigenvalues	§6.1
11 April	Diagonalizable matrices	§6.2
13 April	Symmetric matrices	§6.4
15 April	Positive definiteness	§6.5
20 April	Similarity	§6.6
22 April	Linear transformations	§7.1
25 April	Linear transformations and matrices	§7.2
27 April	Diagonalization of matrices	§7.3
29 April	Exam 4	
2 May	Complex numbers	§10.1
4 May	Complex linear algebra	§10.2
6–11 May	Leftovers and review	