V63.0140-3 : Linear Algebra

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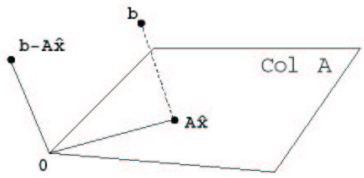
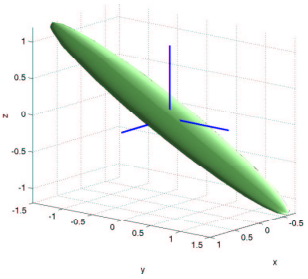
Fall 2003

$$A = \begin{bmatrix} -1 & 2 & 3 & 6 \\ 2 & -5 & -6 & -12 \\ 1 & -3 & -3 & -6 \end{bmatrix}$$





Linear algebra is an essential tool for every scientist, engineer, economist, statistician, and mathematician. It is also useful for computer scientists and countless other numerical sciences. Linear problems are often the simplest models of the natural world that can be made, and arise in literally thousands of applications. Complexity can arise because large numbers of variables can be involved. With the rise in electronic computing power, huge linear algebra problems can be solved, and these can be used to model very complicated situations in the real world. In fact, the desire to solve such problems has driven computing technology. In this course you will learn the language, concepts, and techniques, from the ground up. You will also learn how to visualize geometrically (*e.g.* middle and right pictures above), and manipulate abstract ideas which may not be visualizable.

Lectures: Waverly 435, Tuesday and Thursday, 8:55am – 10:45am. 2 × 50 mins, with 5–10 min break to get up and stretch! Attendance of lecture is important: there will often be activities such as worksheets which you will do in pairs or small groups. These will allow you to grapple with concepts and explain them to each other. For students lying on grade boundaries I will take lecture participation into account.

Required book: *Linear Algebra and its Applications, 3rd Edition* by David C. Lay, available at NYU Bookstore, Amazon, etc. (about $108). You may find the paperback Study Guide useful too. If the bookstore is sold out, or if you

want to see what the Study Guide is like, you can get the first chapter for free at `http://www.laylinalgebra.com`. This website also has review notes.

Web-site: I will post homeworks, useful material, applets that I find, etc, at `http://www.cims.nyu.edu/~barnett/linalg/`

Homework: 11 problem sets, almost all from the book, to be handed in at start of Thursday lectures. Permission to hand in late must be obtained from me the previous week, and otherwise, unless you have a doctor's note or there are exceptional circumstances, late homework will not be counted in your grade. However you should still do HW even if late, since it forms an essential part of the learning process. Your lowest *two* HW scores will be dropped, so this allows you leeway.

Collaboration: I encourage you to study in groups. Get to know others in class. If you have no-one to study with, I can help you find someone. However you must write up homework in your own words, and understand what you write. Plagiarism (in homework or in exams) is a serious offense (see NYU CAS Academic Policies).

Exams and Grades: There will be 1 midterm and 1 final (dates given on below). There will also be about 4 quizzes, whose dates I will announce a week in advance, and which will happen during the last 30 minutes of lecture. Your lowest quiz grade will be dropped. Your overall grade will be determined using:

- homework 30%, quizzes 20%, midterm 20%, final 30%.

The grades will not be curved. After the midterm I will settle on and announce a fixed grade boundary scheme.

Office Hours: Tuesday 4-5pm, and Wednesday 2-3pm (rm 1122 WWH).

Tutoring: Free math help has historically been available 4 days a week on a drop-in basis at rm 704, WWH. Hours were 1pm–8pm Mon+Wed, 11am–8pm Tues+Thurs. Tutors may vary in their knowledge of linear algebra. However I don't know if the room has changed or if this is offered this year. Details to follow...

Timeline: (approximate)

wk		date	due	book	content
1	Tu	Sep 2		1.1-1.3	solving systems of linear equations
	Th	4			vectors
2	Tu	9		1.4-1.6	matrices, applications
	Th	11	HW1		linear independence
3	Tu	16		1.7-1.9	linear transformations
	Th	18	HW2		applications
4	Tu	23		2.1-2.4	matrices, inverse
	Th	25	HW3		partitioned matrix
5	Tu	30		2.5-2.7	factorizations, Leontief I/O model
	Th	Oct 2	HW4		computer graphics applications
6	Tu	7		3.1-3.3	determinants
	Th	9	HW5		Cramer's rule
7	Tu	14			review
	Th	16	Midterm1		
8	Tu	21		4.1-4.4	vector spaces, subspaces
	Th	23	HW6		bases, coordinate systems
9	Tu	28		4.5-4.8	dimension, rank
	Th	30	HW7		applications
10	Tu	Nov 4		4.9-5.3	Markov chains, eigenvectors
	Th	6	HW8		eigenvalues
11	Tu	11		5.4-5.6	linear transformations
	Th	13	HW9		eigenvalue applications
12	Tu	18		6.1-6.3	inner product
	Th	20	HW10		orthogonal projection
13	Tu	25		6.4-6.8	Gram-Schmidt, least squares
	Nov 27-29 : Thanksgiving Recess				
	Tu	Dec 2			applications
14	Th	4	HW11		quadratic forms
	Tu	Dec 9			review
	Tues Dec 9 : last day of classes (Thurs schedule)				
	Dec 12-19 : Finals				
	Tentative final exam date: Thurs Dec 18 10-11:50am				