MATH 21b, FALL 2008:
LINEAR ALGEBRA WITH DIFFERENTIAL EQUATIONS

Topics: An introduction to linear algebra, including linear transformations, determinants, eigenvalues/eigenvectors, inner products, and vector spaces, with applications to linear (and some nonlinear) differential equations.

Course Head: Noam D. Elkies, SC 335, 495-4625, elkies@math.harvard.edu (elkies@math is sufficient from most Harvard computers).

Sections: This course is taught entirely in sections (taught by teaching fellows, TFs), with an additional weekly problem session (conducted by a course assistant, CA).

Grades: Your course grade will be determined according to the following weights:

- homework 20%,
- two midterms 20% each,
- final exam 40%.

(The homework scores may be adjusted for disparities between the sections.)

Midterm examinations:
First midterm Monday, October 20, 7:45–9:15pm, classroom TBA.
Second midterm Monday, November 17, 7:45–9:15pm, classroom TBA.
No calculators will be allowed in the exams.
(If any student feels that they may not be able to take the midterms at these times for religious reasons they should contact the course head immediately.)

Text: For most of the course we will closely follow the textbook *Linear Algebra with applications* by Otto Bretscher. (3rd edition, 2005; Prentice Hall, available at the Coop.) In addition there will be handouts for some of the material on differential equations.
This is a fast-paced course which covers a lot of material. We will cover one section of the text per lecture; your TF will highlight the key concepts introduced in the text, but there will not be enough time to cover all the topics. You will need to study the text to fill in the details.
Reading the text is an integral part of the course. It is preferable to read through each section before it is covered in class and then again after it has been covered. On the tests you will be responsible for all the material discussed in the text, including the handouts for sections 10.1–10.4, unless specifically excluded (some sections of the later chapters may have to be omitted).

Homework: Homework problems are an integral part of this course. It is impossible to understand the material and do well on the exams without working through the homework problems in a thoughtful manner. Don't just crank through computations and write down answers — think about the problems posed, your strategy, the meaning of the computations you perform, and the answers you get. Nothing prevents you from trying a few more problems in a given section if you feel it may do you some good. (We will usually suggest a few extra problems that show a previously introduced idea in a new light, or hint at later developments, but of course you are not limited to these.) More generally the only way to learn any topic in mathematics is to work out examples for yourself.

Many homework problems will look different from problems discussed in class and in the text. This is not an accident: We want you to think about the material and to learn to apply it in unfamiliar settings and interpret it in different ways. Only if you understand the material (as opposed to merely knowing it) will you be able to go beyond the information you are given.

Some students seem to subscribe to the "Ten Minute Rule": if you cannot solve it in ten minutes, you cannot solve it at all. Nothing could be further from the truth: you will learn most from those problems that keep you busy more than ten minutes, whether you ultimately solve them or not.

You are encouraged to discuss the course with other students, your CA and/or your TF, and to use the Question Center in Science Center B10 (8:30–10:30 PM). It is much easier to learn mathematics if you have other people who will help you test your understanding and surmount problems. It is fine to discuss homework problems with other students, but *you should always write your homework solutions out yourself in your own words.*

Your homework is due at the start of class on the due date. Your course assistant will return your corrected homework to you at the end of the following class. He/she will also put homework solutions on reserve at Cabot Library, and/or on the course webpage, within 1 week of the due date. If you hand in your homework late there will be a 25% penalty for the first week of delay (or any part of it), and an additional 25% for any longer delays. Homework will no longer be accepted five days after the beginning of reading period. In calculating the total grade for your homework your 4 worst individual homework grades will be dropped.

You are strongly encouraged to keep up to date with the homework, otherwise you will find that you do not get all you should out of the classes. It will also become increasingly difficult to catch up again.

Technology: In some of the homework problems you will be asked not to use any technology (calculators or software packages). If no restriction is made, you may use the form of technology of your choice (for example, a TI-85 calculator or one of the packages MATLAB or Maple). Make sure to have access to some form of technology; a few calculators are on reserve at Cabot Library. See also the section on "computers and computation" in the Preface of the textbook (pages xi-xii).
No calculators will be allowed in the exams.

Web Page: `www.math.harvard.edu/~elkies/M21b.08`

Homework Assignments: The following are the provisional homework assignments up to the second midterm examination.

Section	Assignment	extras	Due Date
—	—	—	Monday, September 22
1.1	6,10,20,26,30	35,43	Wednesday, September 24
1.2	10,12,30,32,40	29,37	Friday, September 26
1.3	4,14,24,36,50	25,57	Monday, September 29
2.1	6,14,24,34,42	25-30,43,44	Wednesday, October 1
2.2	6,16b,18,26,34	29,32	Friday, October 3
2.3	12,20,30,38,40	45,49	Monday, October 6
2.4	14,28,38,56,76	86,87	Wednesday, October 8
3.1	2,20,32,34,44,54	49,50	Friday, October 11
—	HOLIDAY	—	Monday, October 13
3.2	18,24,32,38,46,50	39,42	Wednesday, October 15
3.3	22,30,32,38,44	53,56	Friday, October 17
3.4	28,30,44,56	64,78	Monday, October 20
—	MIDTERM	—	Monday, October 20, 7:45 – 9:15 PM (Classroom TBA)
5.1	6,26,28,36,38	13,14	Wednesday, October 22
5.2	4,14,32,34		Friday, October 24
5.3	32,34,38,40,66	64,67	Monday, October 27
5.4	10,20,22,30,36	38,39	Wednesday, October 29
6.2	4,16,20,30,40	44,50	Friday, October 31
7.1	8,20,24,36,52	7,54	Monday, November 3
7.2	10,12,16,22,32	28,36	Wednesday, November 5
7.3	12,20,26,36,44	47,48	Friday, November 7
7.4	12,16,30,32,54	38,58	Monday, November 10
7.5	6,24,26,32,38a,b	3,30	Wednesday, November 12
7.6	6,16,20,28,42	37	Friday, November 14
—	[review]	—	Monday, November 17
—	MIDTERM	—	Monday, November 17, 7:45 – 9:15 PM (Classroom TBA)