

Math 545 (55559) - Linear Algebra for Applied Mathematics - Spring 2012

MWF 10:10 → 11:00 Eng. Lab 304

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Course Web page: <http://www.math.umass.edu/~markman/> **Please check it often!**

Office hours: (tentative) Wednesday 5:00 → 6:00 pm, Friday 1:40 → 2:40 pm, and by appointment.

Prerequisites: Math 233, Math 235, Math 300.

Text: The main text will be:

Linear Algebra. An introductory approach, by C. W. Curtis, Corrected reprint of the 1984 fourth edition. Undergraduate Texts in Mathematics. Springer-Verlag, New York, 1993.

Description: In spite of its name, this is simply a second course in linear algebra, intended for undergraduates as well as graduate students (in such fields as mathematics, statistics, physics, engineering, etc. . .) who need to use linear algebra. The aim is to get a deeper knowledge of both concepts and techniques. Students in this course will need to write proofs (hence the math 300 prerequisite).

Homework: Will be assigned weekly and will be due each Friday, unless mentioned otherwise. The homework will be graded by a special grader. Due to lack of funds, it will not be possible to grade all the homework problems assigned. A few of the homework problems will be corrected and graded every week. Nevertheless, for your own benefit, you will be asked to hand in *all* the homework problems assigned. Your grade on each homework assignment will be calculated as follows:

70% The grade on the corrected problems.

30% Credit for handing in *most* of the homework problems assigned. Partial credit will be given.

Late homework will not be collected. Instead, your three lowest grades will be dropped.

Grades:

Homework—20%

Two Midterms—50% (each 25%)

Final Exam —30%

First Midterm: Thursday, March 1, from 7:00 to 8:30PM.

Second Midterm: Monday, April 9, from 7:00 to 8:30PM.

Final: During the week beginning Thursday, May 3 and ending on Thursday, May 10. The precise date is yet to be determined.

See back . . .

Homework Assignment 1: Due: Friday, February 3 (a two weeks worth of homework!)
Justify all your answers!!!

1. Read Sections 2, 3, 4, 5, 6, 7, 8, 9, 11 (Review of material from math 235)
2. Section 2 page 15: 2 (a), 4
3. Section 3 page 25: 6, 9, 10
4. Section 4 page 33: 3 (b), (c), (g), (h), (Justify your answer by verifying the conditions in definition 4.1), 4 (f), (g), 7, 9
5. Section 5 page 37: 3, 5
6. Section 6 page 48: 3 (e), 4, 5 (a)
7. Section 7 page 52: 1, 5, and the following problem. Let S and T be both three dimensional subspaces of R_4 . What are all the possible dimensions of $(S \cap T)$?
8. Section 9 page 68: 1, 4 (a), (c)
9. Section 11 page 87: To be announced. Check the web page for updates.

Syllabus:

1. A brief review of basic linear algebra. (Corresponding to the first nine Chapters of Curtis, most of which will be assumed as prerequisite).
2. The theory of a single linear transformation.
 - (a) Eigenvalues, eigenvectors, characteristic polynomial
 - (b) Minimal polynomial
 - (c) Invariant subspaces, direct sums
 - (d) Primary decomposition
 - (e) Diagonalizable operators
 - (f) Triangular form, Cayley-Hamilton Theorem
 - (g) Rational and Jordan canonical form
3. Orthogonal and Unitary transformations
 - (a) The Gram-Schmidt process
 - (b) The structure of orthogonal transformations
 - (c) The Principal Axis Theorem
 - (d) Unitary transformations and the Spectral Theorem
4. Further topics and applications (selection among the following):
 - (a) Systems of first order linear differential equations
 - (b) The QR-algorithm for eigenvalues
 - (c) Least square solution of a linear system
 - (d) Singular value decomposition
 - (e) Other applications, depending of time constraints and class preference.