

Math 200D - Linear Algebra
Fall Term 2017
Course Description

September 6, 2017

Instructor: John Schmitt

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Office Hours: Monday 1:30pm-2:30pm, Wednesday 1:30pm-2:30pm, Thursday 10:30am-12pm, Friday 10am-11am, when my office door is open and by arrangement

Meeting Times:

Section D – MWF, 11:15am-12:05pm Warner 207

Textbook: David Lay's *Linear Algebra and its Applications*, 4th edition, Pearson Education, Inc., Boston, 2012. **Not the 5th edition!** (Note that there is little change in content between the various editions. I'd like for us to use the 4th edition in order to save you money!)

Homework: Homework will be assigned on a daily basis. The content of this course is best learned by *practicing problems*. I **encourage you to work together**. However, the write-up of homework solutions *should be done on your own*. Homework will be collected three times a week, on Monday, Wednesday and Friday. Please see my *Thoughts on Homework*.

Quizzes: I reserve the right to give quizzes. If given, they will be short in length and cover recent homework problems. They will generally be announced beforehand.

Additional Resources

- I hope to have several copies of course text available at the circulation desk in the Davis Family Library for short-term checkout.
- Text available in library: Howard Anton, Chris Rorres, *Elementary linear algebra: applications version*, 8th edition, Wiley, New York, 2000.
- Text available in library: Peter D. Lax, *Linear algebra*, Wiley, New York, 1997.

- Text available in library: Serge Lang, *Linear Algebra, 3rd edition*, Springer-Verlag, New York, 1987.
- Textbook website (which includes study guides, review materials, etc.): <http://www.laylinalgebra.com>
- Course website available at: <http://community.middlebury.edu/~jschmitt/>
- Professor Swenton's interactive linear algebra website: <http://community.middlebury.edu/~mathanimations/>
- The software package Maple 2016 is available on many computers throughout campus and should facilitate computations and drawing when appropriate. Other software packages may also be useful, including Mathematica and MATLAB.

Special Needs: If you require special arrangements for class or during tests/exams please talk to me as soon as possible to make such arrangements.

Grading Percentages:

| | |
|------------------|--------------|
| Homework/Quizzes | 10 |
| Midterms | 60 (30 each) |
| Final | 30 |

The lowest two homework scores will be dropped from consideration.

Assignment of Grades:

The assignment of grades will follow the scheme below *at minimum*.

| | |
|--------------|---|
| 90 and above | A |
| 80 - 89 | B |
| 70 - 79 | C |
| 60 -69 | D |
| below 60 | F |

Plus and minus will be assigned at my discretion.

Midterm Exams: Midterm on Chapters 1 and 2: Thursday, October 12 at 7:30pm
 Midterm on Chapters 3 and 4: Thursday, November 9 at 7:30pm. Midterms may include a “pledged problem” due on or around the exam date.

Final Exam: Wednesday, December 13, 7-10pm. The exam will only be given at the assigned time.

Absences: Please see me as far in advance as possible for absences that will occur on the day of an exam. Any such absences, or unforeseen ones, must be documented in writing by the appropriate person.

Honor Code: The Honor Code will be observed throughout this class and for all examinations. The most common ways the Honor Code has been violated in this class are: copying solutions for homework problems from another student or from an internet source, and copying/sharing answers on a mid-term or final exam. When these have been identified, the matter has been referred to the College's Judicial Affairs Officer. If you have a question about how the Honor Code applies to this class please ask.

Course Webpage: Problem sets and syllabi and other relevant material will be posted on a course website, available by linking from my homepage:
<http://community.middlebury.edu/~jschmitt/>.

Basic Etiquette: Please turn off all cell phones and other noise-making electronic devices. I anticipate you remaining seated in the room for the entire time period, though not without exception.

Goals of the course:

- gain an understanding of basic linear algebra techniques,
- gain the skills to perform computations involving vectors, matrices and systems of linear equations,
- gain an appreciation for applications of linear algebra to biology, economics, engineering, physics, computer science and more,
- gain a desire for further study within mathematics,
- improve one's ability to write a logical and coherent mathematical proof.

Linear Algebra - Course Content

1. Linear Equations in Linear Algebra
 - Systems of linear equations
 - Row reduction and echelon forms
 - Vectors and vector equations
 - The matrix equation $A\mathbf{x} = \mathbf{b}$
 - Linear independence
2. Matrix algebra
 - Matrix operations
 - Characterizations of invertible matrices
3. Determinants
 - Basic introduction and properties
4. Vector spaces
 - Vector spaces and subspaces
 - Null spaces, column spaces and linear transformations
 - Bases, dimension, rank, change of basis
5. Eigenvalues and eigenvectors
 - Eigenvalues and eigenvectors
 - The characteristic equation
 - Diagonalization
 - Eigenvectors and linear transformations
6. Orthogonality and Least Squares
 - Inner product, length and orthogonality
 - Orthogonal sets and projections
 - The Gram-Schmidt process
 - Least Squares
 - Applications to Linear Models

Table 1: Below is a “fairly” accurate schedule for the topics we will cover, and exam dates. These may change, if need be.

| Week beg. Mon. | Monday | Tuesday | Wednesday | Thursday | Friday |
|----------------|--|---------|--|--------------------|--|
| September 11 | 1.1 Systems of Linear Equations | | 1.2 Row reduction and echelon forms | | 1.3 Vector equations |
| September 18 | 1.4 The matrix equation $A\mathbf{x} = \mathbf{b}$ | | 1.5 Solutions sets of linear systems | | 1.6 Network flow |
| September 25 | 1.7 Linear independence | | 1.8 Linear transformations | | 1.9 Matrix of linear transformation |
| October 2 | 2.1 Matrix operations (and adjacency matrices) | | 2.2 Inverse of a matrix | | 2.3 Characterizations of invertible matrices |
| October 9 | 2.4 Partitioned matrices | | Questions | EXAM (7:30-9:30pm) | 2.5 Matrix factorizations |
| October 16 | 3.1 Intro. to determinants | | 3.2 Properties of determinants | | 4.1 Vector spaces and subspaces |
| October 23 | Fall | Recess | 4.2 Null spaces, column spaces, linear transformations | | 4.3 Linearly independent sets; bases |
| October 30 | 4.4 Coordinate systems | | 4.5 Dimension of a vector space | | 4.6 Rank |
| November 6 | 4.7 Change of basis | | Questions | EXAM (7:30-9:30pm) | 4.9 Markov Chains |
| November 13 | 5.1 Eigenvectors and eigenvalues | | 5.2 The characteristic equation | | 5.3 Diagonalization |
| November 20 | 5.4 Eigenvectors and linear transformations | | Thanks- | giving | recess |
| November 27 | 6.1 Inner product, length, orthogonality | | 6.2 Orthogonal sets | | 6.3 Orthogonal projections |
| December 4 | 6.4 Gram-Schmidt process | | 6.5 Least Squares | | 6.6 Applications to Linear Models |
| December 11 | | | FINAL EXAM (7-10pm) | | |