MATH 200 - Linear Algebra
Fall Term 2023
Course Description

Instructor: John Schmitt
Office: Warner 205
E-mail: jschmitt@middlebury.edu
Office Hours: Tuesday 1pm–2:15pm, Thursday 10am–11am, Friday 2:15pm–3:45pm

Meeting Times:
Section D – MWF 1:10pm-2pm Warner Science Hall 104

Textbook: David Lay's *Linear Algebra and its Applications, 4th edition*, Pearson Education, Inc., Boston, 2012. **Not the 5th or 6th 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.*

Students who violate the Honor Code by copying solutions found via the internet, a solutions manual or some other source will *at minimum* forfeit the entire portion of the homework grade. The set of homework problems is considered as one assignment, with due dates spread over the course of the semester. There have been occasions in the past when a student has violated the Honor Code and failed the course; please, let's not repeat this!

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.

Tutor: There is a tutor for the course this semester. Her name is Jasmine Wang. She will be available to meet with students in a one-on-one situation or in small groups.

Additional Resources:

- There are two copies of the 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.
- Course website available at: http://community.middlebury.edu/∼jschmitt/ and a Canvas page.
- Professor Swenton's interactive linear algebra website: http//community.middlebury.edu/∼mathanimations/
- **Computational software:** The College has purchased a site-license for MATLAB, which you can install on your computer. Second, the software package Maple is available on many computers throughout campus and should facilitate computations and drawing when appropriate. Third, Wolfram Alpha has a powerful on-line computational tool at `https://www.wolframalpha.com/`.

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. If you are color-blind, please let me know as I like to use colored ink/chalk.

Students who have Letters of Accommodation in this class are encouraged to contact me as early in the semester as possible to ensure that such accommodations are implemented in a timely fashion. For those without Letters of Accommodation, assistance is available to eligible students through the Disability Resource Center. Please contact Jodi Litchfield (litchfie@middlebury.edu or 802-443-5936) or Peter Ploegman (pploegman@middlebury.edu or 802-443-2382), the ADA Coordinators. All discussions will remain confidential.

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 scores will be determined at the conclusion of the semester.

Midterm Exams:
Midterm on Chapters 1 and 2: Thursday evening (7:30pm-9:00pm) October 12
Midterm on Chapters 3 and 4: Thursday evening (7:30pm-9:00pm) November 9.
Midterms may include a "pledged problem" due on or around the exam date.

Final Exam: Thursday, December 14, 7-10pm
The final exam will be given only at the scheduled time so please plan accordingly.

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. Using AI tools (e.g., ChatGPT, Bard) is forbidden in this class. You may not use them to assist in any part of your homework or other assignments. Any use of generative AI tools will be treated as a violation of Middlebury's Honor Code. **All exams will be proctored.**

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/ and the course Canvas site.

Basic Etiquette: Please turn off all cell phones and other noise-making electronic devices. If you abuse of this policy, you will be asked to leave. I anticipate you remaining seated in the room for the entire time period, though not without exception. Please use the restroom before coming to class.

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
7. Google's Page Rank Algorithm

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			EXAM through 2.3	Fall recess (no class)
October 16	2.5 Matrix Factorizations		3.1 Into. to determinants		3.2 Properties of determinants
October 23	4.1 Vector spaces and subspaces		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		4.9 Markov Chains	EXAM	5.1 Eigenvectors and eigenvalues
November 13	5.2 The characteristic equation		5.3 Diagonalization		5.4 Eigenvectors and linear transformations
November 20	Thanksgiving recess		Thanksgiving recess		Thanksgiving 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		Google's Page Rank Algorithm
December 11	Google's Page Rank Algorithm			Final Exam 7pm–10pm	