

## MATH-UA.140.006: LINEAR ALGEBRA - COURSE INFORMATION - FALL 2019

**Instructor:** Daniel L. Stein

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**Office:** Courant Institute (Warren Weaver Hall), Room 819

**Office Hours:** Tuesday, 3:00-4:00pm, Thursday, 2:00-3:00pm, Warren Weaver 819

**Lecture:**

- Warren Weaver 512 - MW 11:00AM - 12:50PM

**Course description:** <sup>1</sup> Linear algebra is an area of mathematics devoted to the study of structure-preserving operators on special sets — specifically, linear operators on vector spaces. Linear algebra is a cornerstone of any mathematics curriculum for two very important (and related) reasons: 1) The theory of linear algebra is well understood, and so a first step in many areas of applied mathematics is to reduce the problem of interest to one in linear algebra; and 2) The spaces and operators studied in linear algebra appear frequently in many different areas of mathematics, science, and engineering.

Over the semester we will study many topics that form a central part of the language of modern science. While taking this course, the successful student will learn to:

- Formulate, solve, apply, and interpret systems of linear equations in several variables;
- Classify, characterize, and compute with matrices;
- Master the fundamental concepts of abstract vector spaces;
- Decompose linear transformations and analyze their spectra (eigenvalues and eigenvectors);
- Utilize the concepts of length and orthogonality in each of the above contexts;
- Apply orthogonal projection to optimization (e.g., least-squares) problems; and
- Explore other topics (as time permits).

The material we take up in this course has applications in physics, chemistry, biology, environmental science, astronomy, economics, statistics, and just about everything else. We want you to leave the course not only with computational ability, but with the ability to use these notions in their natural scientific contexts, and with an appreciation of their mathematical beauty and power.

**Textbook:**

- Strang, Gilbert. *Introduction to Linear Algebra*. 5th Edition.

**Grading:** Your final grade will be computed with the following weights:

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<sup>1</sup>Courtesy C. Jankowski

Homework	10%
Quizzes	20%
Midterm Exams	40%
Final Exam	30%
Total	100%

**A note on grades of W and I:** You may drop the course in the first three weeks without it appearing on your transcript. After that, and through the ninth week, you may withdraw and receive a grade of ‘W’ on your transcript. No withdrawals are granted after the ninth week.

A grade of ‘Incomplete’ (I) is granted only in the rare circumstances that an emergency prevents a student in good standing from finishing the course in its last few weeks. As per the CAS Bulletin:

“Students who are ill or have a serious personal problem should see, call, or write to an advisor in the College Advising Center, College of Arts and Science, New York University, Silver Center, 100 Washington Square East, Room 905, New York, NY 10003-6688; 212-998-8130.”

**NYU Classes:** The chief means of communication for this course will be the NYU Classes site, accessed through [home.nyu.edu](http://home.nyu.edu). Students are expected to check this for up-to-date assignments—including material separate from the text—and announcements.

**Homework:** Weekly problem sets consisting of exercises from the text and occasional supplementary problems will be collected. These include more in-depth problems requiring greater abstraction, understanding and/or synthesis of various concepts. In many ways, these constitute the heart of the course; rigor in their completion often yields the greatest understanding.

All homework assignments appear on the Assignments page of NYU Classes. *You are responsible* for checking this page and making sure that you hand in the appropriate homework before its due date. Homeworks will be submitted electronically through NYU Classes, and completed assignments must generally be submitted by 11:55pm Thursday night. (Each homework will contain instructions regarding its due date and time.)

**Because the homeworks will all be available for weeks before the due date, no excuses will be accepted for late homeworks. This is out of fairness to your fellow students and to the grader. You are strongly urged not to wait until just before the deadline to submit your homeworks — last-minute problems with internet connectivity will not be accepted as an excuse for late homework.**

We will make every effort to return your graded homework within a week of its due date. Solutions to each homework problem will be posted on the Assignments page the day after its due date.

**Quizzes:** There will be four short in-class quizzes given during the semester. *Tentative* dates for the quizzes appear in the Course Schedule.

When calculating the homework and quiz grades for the semester, the lowest grades in each of these areas will be dropped. **N.B.** It is advised that students reserve these “passes” for unexpected absences.

**Exams:** There will be two in-class exams during the semester. See the Course Schedule for likely dates.

**Final Exam:** The final exam date and time is scheduled by the Registrar’s office and as of now has not yet been scheduled. The date and time will be announced as soon as it is available.

**Policy On Out-Of-Sequence Exams and Missed Quizzes:** We are able to accommodate only a limited number of out-of-sequence exams due to limited availability of rooms and proctors. For this reason, we may approve out-of-sequence exams in the following cases:

- A documented medical excuse.
- A University-sponsored event such as an athletic tournament, a play, or a musical performance. Athletic practices and rehearsals do not fall into this category. Please have your coach, conductor, or other faculty advisor contact your instructor.
- A religious holiday.
- Extreme hardship such as a family emergency.

We will *not* be able to accommodate out-of-sequence exams, quizzes, and finals for purposes of more convenient travel, including already purchased tickets. Please note again the date of the final exam and plan your travel accordingly.

Scheduled out-of-sequence exams and quizzes (those not arising from emergencies) must be taken before the actual scheduled exam.

If you require additional accommodation as determined by the Center for Student Disabilities, please let your instructor know as soon as possible.

**N.B.** If you know in advance that you will not be here on an exam date for any reason, such as observance of a religious holiday or an allowed pre-planned trip out of town as discussed above, you *must* notify your instructor in advance, in writing, at least two weeks before the exam date. All other absences will be considered unexcused and will result in a grade of zero for that exam. (So please set a backup alarm or have a reliable friend call you that morning if there’s a chance you might otherwise miss the exam. We will make absolutely no exceptions to this policy.)

**Extra Credit Policy:** The homeworks, quizzes, two in-class examinations, and final examination provide a more than adequate basis for you to demonstrate how well you’ve learned the material and for me to determine an accurate course grade. There will be no exceptions in grade assessment made for anyone; in particular, extra credit

papers or assignments will *not* be allowed under any circumstances. Please understand that this is to ensure fairness and uniformity of grading standards for everyone.

**Technology:** Technology can play an important role in the learning of mathematics, and as such, graphing and scientific calculators are permitted for class and homework, though they will not be required. Calculators will not be permitted on tests and quizzes, and thus it is emphasized that students learn not to rely on them.

**Academic Honesty:** Guidelines regarding cheating and plagiarism are laid out in the [College of Arts and Sciences guidelines](#) and will be adhered to strictly. Collaboration is permitted, in fact encouraged, for homework assignments; however, all submitted assignments must be written up independently and represent your own work and understanding.

Day	Date	Sections	Topics	HW Due Dates	Notes
1	9/4/19	§1.1–2	Introduction, Vectors, Dot Product		
2	9/9/19	§1.3	Matrices		
3	9/11/19	§2.1–2	Linear Systems/Elimination		
4	9/16/19	§2.3–4	Matrix Operations		Last day for Add/Dro
5	9/18/19	§2.5	Inverses	HW 1 due 9/19	
6	9/23/19	§2.6–7	Factorization, Permutations		
7	9/25/19	§3.1	Vector Spaces	HW 2 due 9/26	Q1
8	9/30/19	§3.2	Nullspace and Rank		
9	10/2/19	§3.3	Complete Solutions	HW 3 due 10/3	
10	10/7/19	§3.4	Independence, Dimension		
11	10/9/19	§3.5–§4.1	The Four Subspaces	HW 4 due 10/10	
12	10/15/19	§4.2	Projections		Legislative Day*
13	10/16/19	MIDTERM EXAM 1		HW 5 due 10/17	
14	10/21/19	§4.3	Least Squares		
15	10/23/19	§4.4	Orthonormal Bases, Projections	HW 6 due 10/24	Q2
16	10/28/19	§5.1	The Determinant		
17	10/30/19	§5.2-3	Permutations, Cofactors, Volumes		
18	11/4/19	§6.1	Eigendinge		

\*Classes meet according to a Monday schedule

19	11/6/19	§6.2	Diagonalization	HW 7 due 11/7	Q3
20	11/11/19	§6.4–5	Symmetry and Similarity		
21	11/13/19	MIDTERM EXAM 2			
22	11/18/19	§7.2	Singular Value Decomposition		
23	11/20/19	§8.1	Linear Transformations	HW 8 due 11/21	
24	11/25/19	§8.2	Change of Basis		
			Applications: Systems of Differential Equations, Image Processing, Principal Component Analysis, and other topics if time permits		
25	12/2/19				
26	12/4/19		Applications (continued)	HW 9 due 12/5	Q4
27	12/9/19		Applications (continued)		
28	12/11/19		Applications (continued)	HW 10 due 12/12	

Final Exam (TBD)

