Math 271, Section 01, Spring 2019: Linear Algebra
MWF 9–9:50 AM, SMudd 207; Tu 9–9:50 PM, SMudd 205

Webpage: https://rlbenedetto.people.amherst.edu/math271/
(Also accessible from the Math 271 moodle page.)

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Office Hours: Mon, 2–3:30pm; Thu, 10:30–11:30am; Thu, 2–3:30pm; or by appointment.

Teaching Assistants: Dana Frishman and Denise Noriega
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Denise:     Email: dnoriega19@amherst.edu       Office hours: TBA

Math 271 QFellow: Fernando Liu Lopez ’18, in the Moss Quantitative Center
Office: SCCE D107       Email: fliulopez18@amherst.edu       Office hours: TBA

Text: D. Damiano and J. Little, A Course in Linear Algebra, Dover, 2011.
Available at Amherst Books.

Exams:
• Midterm 1: Friday, March 1, in class
• Midterm 2: Wednesday, April 10, in class
• Final: 3 hours; exact date during finals period is TBA
  [Calculators, cell phones, ipods, etc. are not permitted in exams.]

The only excuses for missing an exam are incapacitating illness, religious conflict, or the like.

Homework:
• Reading from the textbook will be assigned each week.
• Problem sets will be due (usually) twice a week, at the START of class.
  See page 3 of this handout for important homework information.

Grading:
• Effort: 5%
• Problem Sets: 12%
• Midterm Exams: 28% for your better one, 20% for your worse one
• Final Exam: 35%

“Effort” is a combination of class attendance, class participation, and handing in problem sets.
(See pages 2 and 4 for more on attendance and participation.)

If an individual student’s final exam or homework grade is substantially higher or lower than his or her other grades, and if the student’s effort grade is strong, I will tweak the above percentages a little for that student to favor the better grades. Final course grades will be curved.

Any student who fails to hand in at least 50 homework problems on time over the course of the semester AUTOMATICALLY gets an F in the class.

About Cell Phones and Mobile Devices
Cell phones, ipods, tablets, laptops, and other electronic devices have no place in my classroom.
Don’t use them. Not for talking, not for texting, not for anything. So at every class:
  Silence your cell phone, put it away, and pay attention.
Prerequisites

The official prerequisite for this course is second-semester calculus (Math 121 or the equivalent). However, I would strongly recommend that you also have taken one other math course beyond 121, like Math 211 (Multivariable Calculus). The point is not the specific material covered but rather the valuable mathematical experience of having taken both Math 121 and another course beyond it. If you’re not sure whether you belong in this course, please talk to me about it.

Course Content

Naively, linear algebra is about vectors and matrices. Less naively, it’s about more abstract and general notions called “vectors” and “linear transformations.” You’ve probably already seen some basic linear algebra, perhaps without knowing it, when solving several equations with several unknowns, but of course the subject goes a lot deeper than that. Here’s some of what we’ll see.

- Chapter 1: Vector Spaces are the fundamental objects of study in linear algebra. The starting example is $\mathbb{R}^2$ (a.k.a. the familiar $xy$-plane). We’ll learn other examples, plus key concepts such as subspaces, span, linear independence, basis, and dimension. We’ll also discuss general methods for solving systems of linear equations.
- Chapter 2: Linear Transformations are special functions from one vector space to another. We’ll define and discuss them, along with matrices, which are closely related.
- Chapter 3: Determinants are certain special numbers associated with square matrices.
- Chapter 4: Eigenvalues and Eigenvectors are probably the most important concepts in the whole course. They provide a way to massively simplify certain important problems in linear algebra. In the same chapter, we’ll also study inner products and orthogonality.
- Chapter 5: We’ll do a quick survey of Complex Numbers and their use in linear algebra.
- Chapter 6: We’ll largely skip this chapter due to time constraints.
- Chapter 7: Linear algebra, and especially eigenvalues and eigenvectors, provide methods for solving certain types of Differential Equations. We’ll see some of the basics in this chapter.

If time permits, we may talk a little about some related topics, possibly including Adjoints, Least Squares Approximations, or Markov Processes.

Class Participation and Classroom Dynamics

Class participation is part of the Effort portion of your grade. If you are quiet by nature, don’t worry; as long as you attend class devotedly, pay close attention, and do the homework, you will get full Effort credit. That said, even though this is a lecture course, class should be interactive, and participating in classroom discussion helps you learn the material better. So for your own benefit, speak up and ask questions. In addition, when I ask a question to the class, I’m usually expecting an answer. If you have even a half-formed idea of how to answer the question, please share it.

Extra Drop-In Help: Teaching Assistants and Quantitative Fellow

Our two Math 271 Teaching Assistants, Dana Frishman ’21 and Denise Noriega ’19, will hold evening office hours. In addition, our Math QFellow, Fernando Liu Lopez ’18 of the Moss Quantitative Center, will also hold daytime office hours. (I’ll announce times and locations later.) Please make use of any and all three of them; just drop into their scheduled office hours to seek help. No appointments necessary!
Homework

There will usually be two problem sets per week, assigned in class. Your homework consists 
BOTH of reading the relevant sections of the book AND of doing the assigned problems. (Only 
the written work counts directly in your grade, but I expect you to do both.) **Start working on 
each problem set the same day it is assigned; do not put it off until a night or two before it’s 
due.** Please note the following **Important Problem Set Rules:**

1. Problem sets are due **in class** at the **start** of class.
2. Problems must be in the same order as listed in the assignment.
3. **Write legibly,** and leave margins on **all four edges** of your paper.
4. Multiple pages must be **clipped** or (preferably) **stapled** together, not merely folded at the corner.
5. Don’t write on any sheet in the corner where the staple/clip is going to go.
6. Your name must be written on all sheets, in case they get separated.
7. If you worked with other students or got help from a source other than me, Fernando, the TAs, 
or the book, then say so explicitly on the first page of your problem set. (See the discussion below 
on the Statement of Intellectual Responsibility.)
8. The Problem Sets grade for any late problem set will be substantially reduced. The later it is, 
the greater the reduction; see the course webpage under “Problem Set Rules” for details.

I am often willing to grant penalty-free extensions on problem sets; but see “Extensions, Extra Office 
Hours, and Class Attendance” on page 4.

I strongly encourage you to work on problem sets together, in pairs or small groups, provided 
you follow the common-sense guidelines below.

About the Statement of Intellectual Responsibility

**Exams:** Your work must be entirely your own, so no looking at other people’s papers, no talking 
or passing signals, and no outside help. Unless I specifically allow it, no aids like calculators, cell 
phones, books, notes, or cheat sheets are allowed.

**Problem sets:** I urge you to collaborate with each other, under the following ground rules:

1. If you collaborate with, say, Jane and Joe, write a note on the front of your problem set saying, 
   “I worked with Jane and Joe.” (Please make sure your name stands out from Jane’s and Joe’s, 
   so I know that you are the author.) Use similar notation if you get help from a fellow student, a 
tutor, another professor, another book, the web, etc. However, you do **not** need to write about 
help you got from me, Fernando, the Math 271 TAs, or the book.
2. Working together does not mean that Joe does the first half of the problem set and Jane does 
   the second half; everyone should work on every problem.
3. Each student must hand in his or her own problem set; you can’t hand in a single packet as the 
   work of multiple people.
4. Each student must write up each problem **in his or her own words**. Working together means 
   discussing the problems. Copying someone else’s solution (even when the source doesn’t mind) is 
   plagiarism and a violation of intellectual responsibility.

**A common question:** What if Joe asks Jane about a problem she has already solved? If Joe 
simply copies Jane’s solution, both Joe and Jane would be guilty of academic dishonesty, leading 
to an F in the course for both of them and potentially to dismissal from the college. Instead, Jane 
can explain her solution to Joe (even showing him what she wrote), before Joe writes up his own 
solution himself, **in his own words.** Joe would then have to write that he got help from Jane (see 
rule 1 above), but Jane doesn’t need to write anything unless she also got help in return.

If at any time you aren’t sure about what’s OK and what’s not as far as intellectual responsibility 
is concerned for this course, talk to me about it.
Class Attendance, Extensions, and Extra Office Hours

Attendance: You should be at every class meeting, and you should be on time. Of course, if you’re sick, have a religious conflict, or the like, just let me know (in advance, when possible). One or two accidental misses are OK, too; oversleeping can happen. Otherwise, however, I expect you to be in class, and on time, for every class meeting.

I don’t plan to take formal attendance, but I will easily be able to tell who misses class too much; those students’ Effort grades will take a hit. In addition, if attendance becomes a problem, I reserve the right to start taking attendance, and to implement severe grade penalties for students who miss class more than once or twice, or who are late more than once or twice.

Extensions: You may request up to two homework extensions over the course of the semester, each one until the start of the next class meeting at the latest. To claim an extension, you must:

1. Not have taken more than one previous extension,
2. Request the extension (by email, by phone, or in person) no later than 7pm the day BEFORE the due date,
3. Have been attending class and handing in homework on time in the recent past, and
4. Attend class on time on the original due date and the new due date.

Note: you do not need to provide an excuse or reason for your extension request; just ask.

Office Hours: you are always welcome to attend my regularly scheduled office hours. In addition, IF you have been attending class and doing the homework, you are also welcome to make appointments to see me outside of my regularly scheduled office hours.

What to Expect

Abstract Math: For most of you, Linear Algebra will be the most abstract math course you have taken yet. But although it might sound scary at first, abstraction is just a way to cover many similar situations in one stroke. And we will see lots of examples to illustrate abstract concepts.

Proofs: To answer two common questions:

• Yes, you will have to do some basic proofs on a regular basis in Math 271.
• No, I don’t expect you to have ever done proofs before.

Math 271 is a good first course for starting to learn proofs. Proofwriting requires both strategy and meticulous attention to detail, but you’ll have plenty of example proofs in the book and in my lectures to help guide you. And you can also visit my office hours or see Denise or Dana or Fernando.

Homework Solutions: Individual homework problems, whether computational or theoretical, will require more strategizing and scratchwork than you may be used to. Please note:

• Computations: Show every step and all your work, using words along the way.
• Proofs: I’ll model lots of proofs in class. So follow my models!
• All problems: Use complete sentences and well-written paragraphs.

Of course, equations will usually appear, too, and you can certainly use abbreviations and standard mathematical shorthand. But fundamentally, solving any mathematics problem, whether computational or theoretical, is about making an argument using words.

Start on Scratch Paper: Please take pride in handing in neat and organized written work in math courses. In particular, unless a given problem is a totally straightforward computation,

Don’t start working on a problem on the same piece of paper that you will hand in.

Instead, start the problem on scratch paper, to figure things out before you write anything about that problem on the piece of paper that you will hand in.