



# Math 194

## Methods of Linear Algebra

Fall 2013  
Tuesdays & Thursdays  
11:00a - 12:15p  
Stevenson Center 1307

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### INTRODUCTION

A great many phenomena can be described by systems of linear equations, that is, equations of the form  $y = a_0 + a_1x_1 + a_2x_2 + \dots + a_nx_n$ . These are simple equations, in that no variables appear with any power higher than 1. And yet these equations can be used to model very complex processes, including traffic networks, population migration, economic systems, and even the algorithm Google uses to rank pages in its search results. In this class, we'll explore these and other applications of linear algebra along with the mathematical structures and properties that allow us to model and analyze these complex systems.

### COURSE GOALS

- To model and analyze discrete dynamical systems using concepts and techniques from linear algebra
- To interpret questions about existence and uniqueness of solutions to systems of linear equations as questions about vectors, matrices, subspaces, and linear transformations
- To communicate solutions to mathematical problems effectively using words and images

### OFFICE HOURS

Mondays 10:30-11:30 (CFT)  
Tuesdays 3:30-4:30 (CFT)  
Wednesdays 4:00-5:00 (FGH)

### TEXTBOOK

*Linear Algebra with Applications*, 8<sup>th</sup> ed., Steven J. Leon

### WEBSITE

[derekbruff.org/blogs/math194](http://derekbruff.org/blogs/math194)

## CLICKERS

During most class sessions, we'll work through a few multiple-choice questions relevant to the day's topic via the TurningPoint classroom response system. I use these questions to help you engage with and make sense of the course content, to provide me information on your learning that I use to make the most of class time, and to provide you with ongoing feedback about how well you understand the course material. Clicker questions are an integral part of your learning experience in this course.

You'll need to obtain a TurningPoint clicker. They come in several models (RF, RF-A, RF LCD, NXT, and XR), any of which will do for this course. (The very old infrared models won't work, so stay away from those.) You can purchase a clicker from the Vanderbilt bookstore or directly from the vendor: <http://www.turningtechnologies.com/student>, school code JS8Y. You're also welcome to purchase a used clicker from another student—or borrow one from a friend, as long as you use the same clicker all semester.

Once you have your clicker, you'll need to register it on OAK. Pull up our course on OAK and click on Tools from the menu panel on the left. Then click on "Turning Technologies Registration Tool" and follow the directions. I'll then be able to download information from OAK and associate you with your clicker. If you have any questions about this process, let me know. All students should have their clickers and register them online by Thursday, August 29<sup>th</sup>. (If you're having one shipped and need more time, let me know.)

You'll be given a clicker score for each class period in which I ask clicker questions. This grade is based on effort, not accuracy, so you get the same score whether you answer questions correctly or not. (I'll be asking some questions designed to be difficult, so it's not fair of me to grade you on accuracy.) If I ask four clicker questions on a particular day and you answer three of them (right or wrong), you'll receive a 75 for your clicker score that day. I'll average your clicker scores over the semester to find your overall clicker average. I'll add 10 points to this, capping your clicker grade at 100. This way you can miss a few classes if you need to, and your grade won't suffer.

Please note that you are responsible for (a) registering your clicker via OAK, (b) keeping it in good working condition, and (c) bringing it to class every day. If you forget your clicker or it isn't working on a particular day, you'll receive a 0 for that day's clicker score. Think of your clicker like your notebook, cell phone, or shoes—don't leave the dorm room without it on class days.

## PIAZZA

Outside of class, we'll be using an online discussion tool called Piazza. On Piazza, you'll be able to post questions about the course material (anonymously, if you wish) and answer other student's questions, wiki-style. That is, students will be able to collaboratively write and edit a "best" answer to each question. There's also a space for threaded discussion on each question. Piazza handles mathematical notation well, via an equation editor and LaTeX integration, and you can upload images, too. Sometimes, you might find it useful to snap a photo of your handwritten work with your phone, and post that along with your question.

I'll be monitoring your questions and providing some answers here and there, but I want to encourage you to answer each other's questions. It's the nice thing to do, and you'll firm up your own understanding of the course material when you try to put it in terms your classmates can understand. I'll endorse student answers that I feel are on the mark, so look for these "good answers" on the forum. Also, if you have a question about the course material, look to see if it's already been asked—and answered—on Piazza.

To enroll in our course on Piazza, visit <http://piazza.com/vanderbilt/fall2013/math194> and follow the instructions. You'll see folders for each of the units in this course, as well as "logistics" and "other" folders. You're welcome to start asking and answering questions right away.

## PROBLEM SETS

You will be given weekly problem sets. Each problem set counts equally, and your lowest problem set grade will be dropped. Late problem sets will not be accepted, except in extraordinary circumstances.

It is essential not only that you get the right answers on your homework but also that you understand how those answers were obtained. Some problems will require you to apply the concepts and techniques you are studying in creative ways. Take advantage of the resources listed below under "Getting Help" when you encounter difficult homework problems. You are encouraged to work on your homework with other students, although copying another student's work is not permitted. If you do work with others on a homework assignment, list your collaborators' names on your assignment. That way you can give appropriate credit to your collaborators.

As you've no doubt found in your other courses, problem sets are a great way to make sure you understand the concepts and techniques included in a course. My grades and comments on your work will provide you with useful feedback on how well you understand the course material. Keep in mind that when you take your exams in this course, you'll be working on your own, so if you collaborate with others to work on homework, make sure you understand what you're doing.

## MIDTERM EXAMS

We will have two in-class midterms this semester. Midterm 1 will be given on Thursday, October 3<sup>rd</sup>, and Midterm 2 will be given on Thursday, November 14<sup>th</sup>.

Plan your schedule around the midterms, as missed midterms may not be made up. If you are absent from a midterm, you will receive a 0 for that test. Exceptions will only be made in extraordinary circumstances and only with prior notification.

The midterms (and the final exam, see below) are the best tools I have to assess your understanding of concepts and techniques included in this course. As you prepare for these exams, you'll likely increase your understanding, so please take these exams

seriously. My grades and comments on the midterms also provide you with feedback on your learning in this course.

## APPLICATION PROJECT

The linear algebra ideas and techniques you are studying this semester have applications in a variety of fields. Learning about the ways in which mathematical ideas are applied to problems from other disciplines is one of the goals of this course. To that end, you will be required to complete an application project during the semester. The project will take the form of a proposal (due Tuesday, November 5<sup>th</sup>), a properly formatted and referenced paper about five pages long (due on Reading Day, Friday, December 6<sup>th</sup>), and a short presentation (delivered during one of the last two class sessions, December 3<sup>rd</sup> and 5<sup>th</sup>).

The application project should demonstrate your understanding of a particular problem from the engineering sciences or other discipline, the mathematical concepts and techniques that can be used to solve the problem, and the ways in which mathematical modes of thought are brought to bear on the problem. The project should be an extension of mathematical ideas or applications seen in this course.

Please note that you must work with a partner on each part of your project. You are responsible for sharing the workload with your partner fairly. I have three reasons for this policy: (1) the quality of your work will likely be greater than it be if you worked alone, (2) developing collaboration skills is a valuable learning goal for this project, and (3) having half as many projects to grade and on which to provide feedback makes it more feasible for me to implement this very important assignment in this course.

Further details about the application project will be distributed later in the semester, but keep your eyes open for applications of course content through the semester.

## FINAL EXAM

The final exam for this course will be cumulative. We will have an out-of-class review session prior to the final exam. You can take the final exam either of the following times:

- Tuesday, December 10<sup>th</sup>, 3:00 – 5:00pm
- Friday, December 13<sup>th</sup>, 12:00-2:00pm

## ACADEMIC INTEGRITY

Please (re)familiarize yourself with Vanderbilt's Honor System (<http://is.gd/ogTf6o>). I'm encouraging you to collaborate frequently during class and outside of class, but you must turn in your own work on all assignments. You may work with others on problem sets, but each student is expected to turn in his or her own work—and acknowledge his or her collaborators on that work. On your application projects, please be careful not to plagiarize. The Library has a very helpful guide to understanding plagiarism (<http://is.gd/VCoZcq>), and I'm glad to answer any questions you have about citing sources. And, of course, on the exams, you'll be all on your own, so make sure you're learning the material well as you study with others.

If your life is falling apart and you are tempted to plagiarize to save time or get a good grade, please see me instead. I would rather grant you an extension than send you before the Honor Council.

## GETTING HELP

As mentioned above, please take advantage of Piazza to ask questions you have about the course material. You might also find it useful to see what questions have been asked by other students. Of course, you're also welcome to come by my office and ask me for help. My regular office hours are listed above. You do not need an appointment to see me if you stop by during my office hours. If you cannot make my office hours in a given week, you are free to contact me to schedule an individual appointment.

You are also welcome to email me any questions you have. Please allow for up to 24 hours for a response, however, since (a) I'm not on email 24 hours a day and (b) I get a ton of emails. You might get a quicker response if you contact me through Twitter, where my handle is @derekbruff. If you can ask your question in under 140 characters and I can answer it in under 140 characters, chances are, I can respond quickly!

## GRADING

Your assignments in this course will be weighted according to the following chart to yield a numerical score.

Clicker Questions	10%
Problem Sets	10%
Midterm 1	20%
Midterm 2	20%
Application Project	15%
Final Exam	25%

Your numerical score will be converted to a letter grade according to the following scale.

Score	Grade	Score	Grade
93-100	A	73-76	C
90-92	A-	70-72	C-
87-89	B+	67-69	D+
83-86	B	63-66	D
80-82	B-	60-62	D-
77-79	C+	0-59	F