

## MATH 218D-1: SPRING 2022 SYLLABUS

*Note: the syllabus and course schedule are subject to change. Any changes to the syllabus and/or course schedule after the semester begins will be relayed to the students through Sakai and email.*

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**Office Hours:**                      See the course website  
**Course website:** <https://services.math.duke.edu/~jdr/2122s-218/>

### Description

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This is an introductory course on linear algebra that will focus on concepts, methods and applications. Gaussian elimination is presented as the fundamental process for solving systems of linear equations. Deeper understanding is developed by examination of matrix factorizations, orthogonality, and associated vector subspaces. Least squares problems, eigenvalue problems, the singular value decomposition and principal component analysis will also be studied as fundamental tools for solving data-driven applications. Computational considerations will be a major source of motivation for many of the techniques covered in this course.

This course will be more applied and computational than *Math 221* (for students heading to a math major), which goes into much more depth on theory and develops skills in writing rigorous mathematical proofs. Math 218D-1 is also significantly different from *Math 216*—we will spend less time covering differential equations in favor of more advanced topics from linear algebra.

### Textbook

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The official text for the course is *Introduction to Linear Algebra* (5th Ed) by Gilbert Strang, Wellesley–Cambridge Press/SIAM (2016). However, we will follow Strang only loosely. Another good reference is the online text *Interactive Linear Algebra*, by Dan Margalit and Joe Rabinoff; it can be found here: <https://services.math.duke.edu/~jdr/ila/>.

### Organization

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This course consists primarily of **two 75-minute lectures** and **one 75-minute problem session** each week.

**Lectures** focus on new theory, concepts, and techniques. They are held in large groups of around 50 students. They are conducted in-person. Your **attendance** in the lectures is strongly encouraged; we try to make them as interactive as possible.

**Problem sessions** are devoted to working through problems designed to elucidate the material presented in lecture that week. They are also conducted in-person. Problem sessions are meant to be entirely interactive, with students working in small groups. Hence **attendance** in your problem session is required.

**Homework** will be assigned weekly and posted on the web page above. The homework is where you will directly engage with the concepts, and is absolutely essential for learning the material. As such, expect to spend **several hours** each week on the homework. (Learning math is **hard work**: you will not learn linear algebra just by attending lecture and problem sessions and Googling the answers to your homework questions.)

All homework will be submitted and graded on **Gradescope**. You will need to take photos of your homework or scan it in. Raw photos are very hard to read and are **not accepted**: you will need to use a scanner or an app. I recommend *Scannable* on iOS or *Genius Scan* on Android. You will also need to **tag your submissions** on Gradescope to indicate which problems are found on which page—otherwise the graders waste an enormous amount of time searching for your solutions.

Brief **quizzes** will be given every week during the problem session. These are group quizzes, meaning that you will solve the problems in a groups of 2–3 classmates. They will consist of one or two problems designed to check basic understanding of what happened in the previous two lectures. They are meant to oblige you to review your notes before the problem session.

There will be three **midterm exams**. Each exam will focus on the material covered after the previous exam, but due to the cumulative nature of the material, you will be responsible for knowing all of the material covered up to that point. Midterm exams will take place during the problem session time slots. Calculators may be used for arithmetic purposes only, unless otherwise noted on an exam problem.

The **final exam** will cover all course materials, except those specifically excluded in class. Calculators may be used for arithmetic purposes only, unless otherwise noted on an exam problem.

Most **course materials** will appear on the course website. I will use **Sakai** for the gradebook, announcements, Ed Discussion, and two prerecorded Zoom lectures.

**Grades** for class work will be weighted as follows:

- 20% Homework
- 5% Quizzes
- 15% Midterm 1
- 15% Midterm 2
- 15% Midterm 3
- 30% Final exam

Cutoffs for letter grades will be determined at the end of the semester, subject to the following guarantee: a final score of 90% or above will merit at least an A-; 80% or above is at least a B-, etc.

## Course Schedule

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A calendar outlining the materials covered each day, the relevant sections of Strang, the midterm and final exam dates, and more can be found on the course webpage.

## Policies

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**Late homework** will generally not be accepted, as I will post solutions shortly after the homework is due. Students may be excused from a missed homework assignment on a case-by-case basis.

I will not hold **make-up midterms**. If you must miss a midterm, then you will be excused from that exam and the others will be weighted more heavily. You will need a University-approved excuse for missing a midterm exam.

**Collaboration** on homework assignments is encouraged: please work in groups! However, all students must write up their own work, in their own words. Collaboration of any kind on exams is strictly prohibited; suspected instances will result in a referral to the Office of Student Conduct. Please refer to the [Duke Community Standard](#).

## How to Get Help

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Your first stop for help should be **office hours!** Joe, Alex, and Eylem will be holding plenty, and you should not hesitate to show up with questions and chat with the other students there. If you can't make the scheduled office hours, send us an email and we'll set up a meeting.

If you have questions, post them on **Ed Discussion**, available as a tool on Sakai. It's likely that your classmates will have the same question, or maybe one will know the answer, so it's much better to post the question than to email one of us; plus, you'll likely get a quicker response on Ed Discussion. You can post anonymously if you wish, but I expect that **all of you will get stuck at some point**, so there's no shame in using your name.

The Math Department operates several **Help Rooms** to provide assistance to students in lower-level courses. Students are invited to drop by the Help Rooms whenever they are open. No appointment is necessary. Link:

<https://math.duke.edu/undergraduate/help-tutoring/help-rooms>

The **Academic Resource Center (ARC)** offers free services to all students during their undergraduate careers at Duke. Services include Learning Consultations, Peer Tutoring, Learning Communities, ADHD/LD Coaching, Outreach Workshops, GRE/MCAT Prep, Study Connect, and more. Because learning is a process unique to every individual, we work with each student to discover and develop their own academic strategy for success at Duke. Contact the ARC to schedule an appointment. Undergraduates in any year, studying any discipline can benefit! <https://arc.duke.edu> • [theARC@duke.edu](mailto:theARC@duke.edu) • 919-684-5917 • 211 Academic Advising Center Building, East Campus – behind Marketplace.