Math 51
Summer 2023

Course Description

Linear Algebra and Multivariable Calculus are two of the most widely used mathematical tools in quantitative work across all fields of study. This course develops conceptual understanding and problem-solving skills in both, highlighting how multivariable calculus is most naturally understood in terms of linear algebra, and the course text addresses a variety of real-world applications.

Our focus is on teaching you skills that underlie a wide array of applications and preparing you for all courses involving advanced quantitative work (across all sciences, engineering, economics, computer science, statistics, and so on).

By the end of this course, you should be able to:

- relate the algebra of systems of linear equations to the geometry of vectors, acquiring the ability to "see" in dimensions far beyond 3 (thinking is seeing!);
- analyze the behavior of multivariable functions via partial derivatives, and combine that information with tools of linear algebra (such as matrices and eigenvalues) to solve optimization problems;
- apply your newly acquired visual skills in high dimensions to gain insight into a variety of real-world applications across data science, natural sciences, and economics.

For a detailed syllabus see the [Syllabus page](#).

First Day Checklist

Welcome to Math 51! This syllabus site details the course's policies, schedules, and expectations, including for assignments and grading calculation.

Per [University policy](#), your decision to take the course implies that you agree to these requirements and to the grading policies spelled out here; so be sure to read everything on these pages.

- **Enrollment in lectures and sections:** Math 51 students attend **lectures on MTuWF, starting on the first Monday of the quarter, and discussion section on Th, starting on the first Thursday of the quarter.** Enroll in lectures and discussion sections on Axess. Please see the [enrollment tab](#) for more information.

- **Required materials:**
  - The **textbook** has been specially created by the Stanford Math department in consultation with colleagues in many other departments; it is free and electronic-only. To get the book using your SUNet ID, visit the textbook page by clicking [here](#) or selecting the Textbook menu item at the top of this page.

    The book contains much more than is covered in the course. It also includes many fully worked examples, helpful for studying. We hope it will be a useful resource for topics that you may encounter in later coursework. On the second page of the introduction, you will find the e-mail address for reporting any corrections, typos, etc. The authors of the text are very eager to hear from you.
  - **Calculators** are neither required nor recommended for any exams in Math 51 (we keep the numbers simple on exams). There are a small number of homework problems for which any basic scientific calculator (even a free online one) is useful to convert some expressions into decimal approximations (and such calculations never arise on exams). There is no programming anywhere in the course.

- **Check for exam conflicts right away and contact us:** Except in case of emergency, you **must inform us of exam conflicts at least two weeks prior to the exam, together with a valid reason for the conflict**. The allowable reasons are course-related or competition-related schedule.

  There will be one 2-hour midterm exam and one 3-hour final exam. For the midterm exam (Friday, July 28, 7:00

p.m. - 9:00 p.m.; see details given on the [Exam page](#) or by clicking the Exam menu item at the top of this page), the allowable reasons are course-related or competition-related schedule.

The final exam is on Saturday, August 19 7:00 p.m. - 10:00 p.m., and all students must take the exam at that time. See all [exam details and policies here](#).

- **Students with documented disabilities:** Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Office of Accessible Education (OAE). See [the Registrar's page on academic accommodations.](#) Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is made. Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations. The ["OAE"](#) is located at 563 Salvatierra Walk (phone: 1-650-723-1066).

  You **must provide an accommodation letter, dated in the current quarter, at least two weeks prior to an exam,** for us to have adequate time to arrange the accommodations. Renewing OAE accommodation is NOT equivalent to alerting the staff of Math 51! Please email [Dr. Kim](#) your accommodation letter.

Class Structure and Assessment

Math 51 has an "active learning" structure; research has shown that pre-class reading, combined with daily participation in class activities targeted to specific learning goals, improves student learning outcomes in math and science courses. Furthermore, active learning [increases student performances](#) and [narrows achievement gaps](#) for historically underserved students. Here's what this means for us:

Both **MTuWF class sessions** and **Th discussion section** are more interactive than traditional math classes:

- Before every lecture (exception on Lecture 1) there will be a modest amount of **reading in the course text** to introduce some of the motivation behind the topic(s) to be discussed in class, along with an associated questionnaire on Gradescope to be completed before class. We strongly urge you to watch the instructional videos on [How to read the course textbook](#) before the first Pre-Class Reading Questionnaire. In addition, there will be one check-in question on material from the previous chapter and lecture to re-enforce your learning; this check-in question will be graded for accuracy, you can think of it as a practice exam question. The responses to the rest of the questionnaire are not graded for correctness, just for a good-faith effort, to inform how the instructor organizes the classroom time around the learning goals for that day.
- The Thursday discussion sections focus on small-group collaboration with worksheets consisting of problems designed around the learning goals and themes in the homework and exam questions. The goal is to engage with the new skills and concepts, and to learn from your peers as well as from the guidance of a graduate student who answers questions. The work in discussion sections is aimed at giving practice with the material recently learned in the course; it is not graded, and **complete solutions** are provided later in the day for each Thursday worksheet.

Canvas questionnaire assignments on the pre-class reading: a typical questionnaire consists of 1 check-in question (always the first question) and 3 to 5 "low-stress" questions. Except for the check-in question, you needn't answer more than one or two sentences per question, and you get full marks for ANY good-faith answer. These assignments are intended to give the instructor feedback on how the reading went and how the course is going; think of them as surveys in which students are voting for which topics need more motivation in class (and which need less or none). Because we will have to review your feedback in a limited time period, the firm deadlines are:

- Mondays at 8 a.m.
- Tuesdays at 8 a.m.
- Wednesdays at 8 a.m.
- Fridays at 8 a.m.

Grading scheme: The course grade is based on the following components:

- 70% for exams, with the breakdown of 28% for the midterm and 42% for the final (see [exams page](#) for dates, policies, and practice exams);
- 20% for weekly written [homework assignments](#) (total points earned divided by 80% of total possible points, not to exceed 100%);

- 10% for pre-class reading questionnaires on Gradescope (total points earned divided by 80% of total possible points, not to exceed 100%).

Honor code policy

By Math Department policy, any student found to be in violation of the Honor Code on any assignment or exam in this course will receive a final course letter grade of NP. You are fully responsible to adhering to the requirements of the Honor Code document. In particular, it is forbidden to

- Collaborating with another student or any other person on an exam.
- Copying from another's homework or exam, or allowing another student to copy your work.
- Communicating with a person other than the teaching staff via email, text messaging, Google, any form of social media, messenger, chat rooms, message boards, etc., about anything related to the exam.
- Plagiarism of material that you did not create, such as copying parts of posted solutions or text wholesale from anywhere, including the internet. The work that you submit must be your own. This also includes representing another's work as your own.
- Sharing the exam questions or anything in your solutions with any other person for any reason. The restrictions on sharing exam content applies until 11:59PM on the exam date.

The university is well-aware of "academic educational sites," such as Chegg, Slader, CourseHero, etc. Their use in connection with the exam is an Honor Code violation that is taken very seriously at Stanford.

More information about the Stanford Honor Code can be found here.

Office hours and other resources for help

You are encouraged to attend the office hours provided by the instructors and teaching assistants. You may attend the office hours of **any** teaching staff member in-person or online. No appointment is ever necessary for Zoom office hours, just drop in on Zoom (links available from Canvas) with your questions! For in-person office hours, instructors and TAs may at their discretion impose office capacity limit and meet with students on a first-come first-served basis; a sign-up sheet will be posted outside the office to facilitate these in-person meetings.

The scheduled in-person and online office hours for any given week can be found on the office hours page. Note that they might change slightly from week to week so it's always a good idea to check both the calendar on the office hours page.

The office hours page also lists some other help resources.

While cell phones are not prohibited in in-person classes, recording or taking pictures in class is strictly prohibited without the consent of your instructor. Please ask before doing.

Affordability of course materials: All students should retain receipts for books and other course-related expenses, as these may be qualified educational expenses for tax purposes. If you are an undergraduate receiving financial aid, you may be eligible for additional financial aid for required books and course materials if these expenses exceed the aid amount in your award letter. For more information, review your award letter or visit the Student Budget website.

COVID adaptations

In accordance with University guidance, everyone must wear mask covering both nose and mouth during in-person classes and office hours. In particular, no eating is permitted during class.

We all need to be prepared to pivot to remote instruction this quarter, possibly at very short notice. Please make sure that your Math 51 Canvas announcement notifications are on so you can receive remote instruction announcement promptly.

Furthermore, the university has set clear [guidelines](#) on classroom and course policies. See in particular policies on [lecture recording](#) and [student absence](#) due to COVID or other illnesses.