Instructor: Christy Hazel
Email: chazel@math.ucla.edu

Office Hours: TBA, See "Office Hours" on CCLE

TA: Francis White
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TA Office Hours: TBA

Class meetings: 2:00-2:50PM (Pacific Time) MWF on Zoom. The Zoom link can be found on the main page of the course website. Live lectures will be recorded and posted on the website.

Discussion meetings: 2:00-2:50PM (Pacific Time) TuTh on Zoom. The Zoom link can be found on the main page of the course website. Tuesday discussions will be group work, but Thursday discussions will be recorded and posted.

Course website: https://ccle.ucla.edu/course/view/21S-MATH115A-5

Textbook: S. Friedberg, et al, *Linear Algebra*, 5th Ed.[1], Pearson.

This class participates in a textbook program called Inclusive Access. You should be receiving an email from the UCLA Store with instructions on how to digitally access the textbook. Everyone enrolled in the course will automatically be granted access to the digital course materials. You can opt out if you prefer to get the textbook elsewhere, but make sure you opt out by the end of the 2*nd week or your account will be automatically charged. If you have questions or concerns, please e-mail the UCLA Store at* inclusiveaccess@asucla.ucla.edu.

Prerequisite: Math 33A

Course goals/objectives: This course is an introduction to rigorous mathematics and proof-writing techniques through the study of linear algebra. There are two main goals in the course: (1) learn the basics of abstract linear algebra and (2) learn to write mathematical proofs.

For (1) we will study vector spaces over arbitrary fields, and cover topics such as linear independence, bases, linear transformations, eigenvalues and eigenvectors, diagonalization of transformations, inner product spaces, orthogonality, the Gram-Schmidt process, and adjoints. Note many of these topics were covered in Math 33A over real vector spaces, but this course will consider vector spaces over arbitrary fields with an emphasis on learning to write proofs.

For (2) students will learn to write logically correct mathematical arguments in full sentences in paragraph form. They will learn the main proof writing techniques: direct proof, proving the contrapositive, proof by contradiction, and proof by mathematical induction. Students will also learn to correctly use quantifiers and mathematical notation (set notation, logic symbols, function notation). Note this style of writing is likely to be different from what you are used to, and many people feel uncomfortable and unsure when they first start writing proofs (which is okay and expected!). By the end of the course, a successful student should be comfortable writing proofs.

[1]You can get an earlier edition of the textbook, but note homework problems will be assigned using the numbering/organization from the 4th and 5th editions.

Remote learning/teaching: This term we continue to navigate the strange world of remote teaching and remote learning. I recognize many of you are in different timezones and have unique living/working situations. To allow some flexibility in schedules, lectures will be recorded in case you need to watch lecture asynchronously, and you will have a 24 hour window to complete quizzes and exams. While you will work on worksheets in groups in discussion, attendance is not required, and your group can meet outside of discussion time if that is more convenient for you (I will group people according to timezone). If you are having technical issues or serious personal issues such as illness and are thus unable to complete an assignment/exam, then please let me know so we can try to make alternative arrangements. Lastly, this is a stressful time, so please be kind to yourself and to others.

Communication: A Campuswire is set up for this course (see the tab "Campuswire" on CCLE), and I encourage you to make use of this to ask any mathematical questions. You should also utilize the instructor's and the TA's office hours for math questions. If you have a question about course policy, then you should first see if the answer to your question is in this document or in the FAQ document on CCLE, and if not, then contact your TA or the instructor.

Grading: Course grades will be weighted according to the following scheme:

Worksheets (7)	9% (8% + 1% recorder [see below])
Quizzes (6)	42% (7% each)
Midterm Exams (2)	28% (14% each)
Final Exam	21%

Standard letter grade assignments will be made. Plus and minus grades will be awarded in the upper and lower 3% of a bracket (e.g. anything in the interval $[87, 90)$ is a B+). I reserve the right to apply a course adjustment to grades at the end of the term. If there is any curve, it will happen at end of the term and will only benefit students (so for example, if you earn an 85%, you are guaranteed at least a B, regardless of the curve). Though, you should not expect there to be any curve on this class.

Homework: Homework will be assigned each week on the course website, starting in Week 1. You do not need to turn in your homework, but your weekly quizzes will be heavily based on your homework, so it is strongly recommended you complete the assignment each week.

Worksheets: At the beginning of the course, you will be placed into a group with 3 other students based on timezone. Groups will stay the same all term so you can build a working relationship with your group. During Tuesday discussion, you will work on a worksheet together. Each group will be assigned a Learning Assistant (an undergraduate student who has taken and done well in this course) that will visit your group during discussion to help you complete your worksheet. By Friday morning, your group must submit one completed proof from the worksheet. The problem must be typed in LaTeX (more information about typesetting will be given in Week 1). Note this is an intentionally short assignment so your group can spend time editing to make as clear and coherent argument as possible. A worksheet problem will be due every week except Weeks 1, 4, and 7.

For each worksheet, one person should be the chosen "recorder" for the group. The job of that person is to type up the first draft of the proof during discussion (which can then be edited by everyone) and to submit the final version to Gradescope once everyone is happy with the proof. Each group member must be the recorder at least once. Fulfilling this job is worth 1% of your grade. There are exactly 7 worksheet assignments, and groups will have 4 members.

I will provide feedback on your group's proof and give a grade out of 10 based on the logical correctness and clarity of writing in the proof. All group members will receive the same grade. Your group is allowed to make changes and resubmit the proof the following week for a full regrade.

If your group is in a timezone where discussion attendance is difficult, then you can coordinate a time to meet on your own. One option is your group can come to office hours, and I will place you in a breakout room to work. Then if you have questions while working on the worksheet, I will be able to assist.

If you can't attend discussion one Tuesday, then you should reach out to your group to let them know, and you should still participate in the editing process.

Quizzes: In Weeks 2, 3, 5, 6, 8, 9 and 10, there will be a Friday quiz. You will have 24 hours to complete the quiz, though the quiz should only take about $40 - 60$ minutes if you have done the all of homework. You can use the book and any notes while taking the quiz, but you must work alone and not solicit help from anyone (peers, teaching assistants, instructor, friend, the internet, etc.). The work you submit must be your own work and must not be copied from the internet or any other set of solutions that are not your own work. All students will have to submit an honesty statement on the quizzes.

The problems on the quiz will heavily based on (if not the exact same as) questions from your weekly homework. I recommend that you complete the weekly homework and have your work next to you as you take the quiz. There are 7 quizzes, *but your lowest quiz grade will be dropped.*

Exams: There will be two midterm exams and one cumulative final exam. The midterm exams will take place on **Friday, April 23** (Week 4) and **Friday, May 14** (Week 7). The final exam will be **Tuesday, June 8**. Like the quizzes, you will have 24 hours to complete the exams, though the midterms will be written to be done in 50 minutes, and the final will be written to be done in 3 hours. Note the midterm will not have questions directly pulled from your homework like the quizzes.

As with the quizzes, you can use the book and any notes while taking the exams, but you must work alone and not solicit help from anyone (peers, teaching assistants, instructor, friend, the internet, etc.). The work you submit must be your own work and must not be copied from the internet or any other set of solutions that are not your own work.

University Resources

Student Conduct: All students are expected to adhere to the Student Conduct Code.

Title IX: Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the CARE Advocacy Office for Sexual and Gender-Based Violence, 1st Floor Wooden Center West, CAREadvocate@careprogram.ucla.edu, (310) 206-2465. In addition, Counseling and Psychological Services (CAPS) provides confidential counseling to all students and can be reached 24/7 at (310) 825-0768. You can also report sexual violence or sexual harassment directly to the University's Title IX Coordinator, 2241 Murphy Hall, titleix@conet.ucla.edu, (310) 206-3417. Reports to law enforcement can be made to UCPD at (310) 825-1491.

Accessibility: If there are accommodations that can be made to better facilitate your learning, please feel free to reach out to the instructor or to the Center for Accessible Education.

Tentative Weekly Schedule:

Note this is a tentative schedule and is likely to be adjusted as the course progresses.

Week	Date	Section covered
1	M 03/29	Introductions and overview of the course
	W 03/31	Quantifiers and mathematical statements
	F 04/02	Appendix C: Fields
2	M 04/05	1.2: Vector spaces over a field
	W 04/07	1.3: Subspaces
	F 04/08	1.4: Linear combinations and systems of linear equations
3	M 04/12	1.5: Linear dependence and linear independence
	W 04/14	1.6: Bases and dimensions
	F 04/16	1.6: Bases and dimensions
4	M 04/19	2.1: Linear transformations, null spaces, and ranges
	W 04/21	2.1: Linear transformations, null spaces, and ranges
	F 04/23	**Midterm 1**
5	M 04/26	2.2: The matrix representation of a linear transformation
	W 04/28	2.2: The matrix representation of a linear transformation
	F 04/30	2.3: Composition and matrix multiplication
6	M 05/03	2.4: Invertibility and isomorphisms
	W 05/05	2.5: The change of coordinate matrix
	F 05/07	4.4: Important facts about determinants
7	M 05/10	5.1: Eigenvalues and eigenvectors
	W 05/12	5.1: Eigenvalues and eigenvectors, 5.2: Diagonalizability
	F 05/14	**Midterm 2**
8	M 05/17	5.2: Diagonalizability
	W 05/19	5.2: Diagonalizability
	F 05/21	6.1: Inner products and norms
9	M 05/24	6.2: The Gram-Schmidt orthogonalization process
	W 05/26	6.3: The adjoint of a linear operator
	F 05/28	6.4: Normal and self-adjoint operators
10	M 05/31	*No lecture, Memorial Day*
	W 06/02	6.4: Normal and self-adjoint operators
	F 06/04	Catch-up and review
11	T 06/08	**Final exam**