Math 2130 Linear Algebra for Non-Math Majors
Syllabus

Instructor

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Lectures

Time: MWF 1430-1520
Location: Ketchum Arts & Sciences Building 1B87
See figure 1 for a tentative lecture schedule.

Office hours

Time: MW 1300-1400
Location: Math 307 (my office)
I'll start holding office hours on Wednesday, 3, September 2025. If these times don't work for you and you would like to chat, please reach out to make other arrangements with me, such as a meeting via Zoom.

Textbook

Linear Algebra by Jim Hefferon
Available online at https://hefferon.net/linearalgebra/
A print copy can be obtained from https://hefferon.net/linearalgebra/hardcopy.html

Webpage

The course webpage can be found at https://aten.cool/courses/2025/fall/2130.html. This is where you will find the latest version of the syllabus, lecture slides, homework assignments, and past quizzes.

Prerequisites

Students taking Math 2130 should be familiar with the methods of differential and integral calculus covered in Math 2300, APPM 1360, or an equivalent course.

Drop date

You can drop this course with a 100% refund any time up to and including September 5, 2025. It will also be removed from your academic record. From September 6 onward you will have to take a W on your transcript if you would

like to drop the course, which is referred to as a «withdrawal». See here for more detailed information.

Course learning objectives

This course provides experiences to help strengthen the student's ability to:

- Perform vector and matrix arithmetic.
- Solve systems of linear equations using matrix methods.
- Compute inverse matrices and determinants and determine whether a given matrix is invertible.
- Compute eigenvalues and eigenvectors.
- Understand the concepts of vector spaces, subspaces, linear independence, bases, and dimension.
- Understand properties of morphisms between vector spaces.
- Connect linear algebra to other fields both within and outside of mathematics.
- Develop abstract and critical reasoning by constructing logical proofs to justify the main theoretical aspects behind the fundamental concepts in linear algebra.

Class structure

Lectures occur thrice a week and are 50 minutes long. On certain days the entire lecture period will consist of a quiz instead. A tentative lecture schedule may be found in figure 1.

Slides

I use slides in addition to writing on the board during lectures. I will post the slides I use on the course webpage some time after class. These slides are not a substitute for taking your own notes (or getting them from a friend if you miss class) and are by no means going to contain a complete description of everything I say or compute during class. They can be a helpful supplement to your own, more detailed notes, however.

Course materials

In addition to the textbook, students should bring an ample supply of blank paper and writing utensils. Calculators will not be required and will not be allowed on quizzes.

Week	Date	Sections covered	Skills covered
0	Friday, August 22	1.1.1	P1
1	Monday, August 25	1.1.1	P1
1	Wednesday, August 27	1.1.2, 1.1.3	P1
1	Friday, August 29	1.2.1	S1
2	Wednesday, September 3	1.2.2	S2
2	Friday, September 5	1.3.1	P2
3	Monday, September 8	1.3.1	P2
3	Wednesday, September 10	1.3.1	P2
3	Friday, September 12	Quiz	
4	Monday, September 15	2.1.1	P3
4	Wednesday, September 17	2.1.1	P3
4	Friday, September 19	2.1.2	S3
5	Monday, September 22	2.1.2	S4
5	Wednesday, September 24	2.2.1	S5
5	Friday, September 26	2.2.1	S5
6	Monday, September 29	2.3.1, 2.3.2	P4
6	Wednesday, October 1	2.3.3	P4
6	Friday, October 3	Quiz	
7	Monday, October 6	3.1.1	P5
7	Wednesday, October 8	3.1.1	P5
7	Friday, October 10	3.1.2	P4
8	Monday, October 13	3.4.2	S6
8	Wednesday, October 15	3.4.3	S6
8	Friday, October 17	3.4.3	S6
9	Monday, October 20	3.4.4	S7
9	Wednesday, October 22	3.4.4	S7
9	Friday, October 24	Quiz	
10	Monday, October 27	3.2.1	P5
10	Wednesday, October 29	3.2.1	P5
10	Friday, October 31	3.2.2	P6
11	Monday, November 3	3.2.2	P6
11	Wednesday, November 5	3.2.2	P6
11	Friday, November 7	3.3.1, 3.3.2	S8
12	Monday, November 10	3.3.1, 3.3.2	S8
12	Wednesday, November 12	3.5.1	S8
12	Friday, November 14	Quiz	
13	Monday, November 17	4.1.1	P7
13	Wednesday, November 19	4.1.2	P7
13	Friday, November 21	4.1.3	P7
14	Monday, December 1	5.1.1, 5.1.2, 5.2.1	P8
14	Wednesday, December 3	5.2.2, 5.2.3	P8
14	Friday, December 5	Review	

Figure 1: Tentative lecture schedule

Week	Due date
1	Sunday, August 31
2	Sunday, September 7
3	Sunday, September 14
4	Sunday, September 21
5	Sunday, September 28
6	Sunday, October 5
7	Sunday, October 12
8	Sunday, October 19
9	Sunday, October 26
10	Sunday, November 2
11	Sunday, November 9
12	Sunday, November 16
13	Sunday, November 30
14	Sunday, December 7

Figure 2: Tentative homework schedule

Homework

We will be using Gradescope for biweekly homework assignments. Make an account using your CU email address and use the course entry code «7X7GKV» to join the course on that platform. Each homework assignment is usually due on a Sunday at 2359 on Gradescope. The assignment itself may be found on the course webpage as soon as it is available to work on. See this guide for submitting an assignment on Gradescope and this one for instructions on how to submit your work as a PDF. Consult figure 2 to see when each assignment is due.

Quizzes

Every three weeks we will have a 50-minute quiz during Friday's lecture period, as per the schedule in figure 3. During this quiz you will be able to attempt to suffice or excel at any of the primary or secondary skills we have covered thus far in the course. (See more detail about skills below.)
Each quiz problem will be graded as either «substantially correct» or «not substantially correct». To count towards sufficing or excelling at a skill you need to receive a grade of «substantially correct» on the relevant problem. You do not need to be absolutely perfect to be «substantially correct». For example, small arithmetic errors or mistakes copying down a formula from one line to the next will not prevent you from getting a grade of «substantially correct», **as long as your error doesn't make the problem easier**. Conceptual misunderstandings will always be counted as «not substantially correct».
In order to suffice at a skill you must get a «substantially correct» on one relevant quiz problem. In order to excel at a skill you must get a «substantially

Week	Date
3	Friday, September 12
6	Friday, October 3
9	Friday, October 24
12	Friday, November 14

Figure 3: Tentative quiz schedule

Skill	Suggested problems (Textbook section: Problem numbers)
P1	1.1.1: 1.17-1.20, 1.22, 1.24
P2	1.3.1: 1.8-1.13
P3	2.1.1: 1.17-1.22, 1.28, 1.29
P4	2.3.1: 1.20-1.36; 2.3.2: 2.15-2.21; 3.1.2: 2.10, 2.11, 2.13-2.16
P5	3.1.1: 1.12-1.18; 3.2.1: 1.18, 1.19, 1.21-1.26
P6	3.2.2: 2.21-2.27
P7	4.1.1: 1.1-1.6; 4.1.2: 2.8-2.11
P8	5.2.3: 3.23-3.31
S1	1.2.1: 1.1-1.8
S2	1.2.2: 2.11-2.17
S3	2.1.2: 2.20, 2.21, 2.27, 2.29, 2.30
S4	2.1.2: 2.22-2.26, 2.28
S5	2.2.1: 1.21-1.25
S6	3.4.2: 2.14-2.17; 3.4.3: 3.24-3.29
S7	3.4.4: 4.13-4.20
S8	3.3.1: 1.13-1.22; 3.3.2: 2.12-2.20; 3.5.1: 1.7-1.13

Figure 4: Practice problems

correct» on two relevant quiz problems, not necessarily during the same quiz period. You may attempt two problems for the same primary skill on the same quiz if you have not already excelled at that skill, even if you have sufficed at that skill on a previous quiz.
In figure 4 you can find suggested problems from the text for extra practice. There is a solution key available here.

Final exam

The final exam for this course is merely one final, long quiz period in which to attempt to suffice or excel at any skills you have remaining. The date and location of the final exam will be announced later in the semester.

Grading

This course will be graded on proficiency. This means that, rather than accumulating a total number of points on various exams and homework assignments throughout the semester and having your numerical scores/averages converted into a letter at the end, this course has a collection of 9 primary skills and 8 secondary skills, which are described in figure 5 and figure 6.
Final grades are assigned according to figure 7. If I later choose to deviate from this, it will only be to assign everyone higher letters than originally indicated. I will use my judgment to decide where the + or - grades should fall at the end of the semester.

Honor code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part in adhering to the Honor Code.
All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Accommodation for disabilities, temporary medical conditions, and medical isolation

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or DSinfo@colorado.edu for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.
If you have a temporary illness, injury or required medical isolation for which you require adjustment, you should contact me as soon as reasonably possible in order to make other arrangements. I understand that it may not always be possible to let me know you'll have to turn in an assignment late in advance, but it will be easier for both of us if you can reach out sooner than later.

Skill	Description
P1	**Gauss's method**: Use Gauss's method to determine whether a linear system has zero, one, or infinitely many solutions. Be able to apply Gauss's method when there are some unknown system constants.
P2	**Gauss-Jordan reduction**: Find the (reduced) echelon form of a matrix by using Gauss-Jordan reduction. Understand how to use this to describe the solutions to a linear system.
P3	**Definition of a vector space**: Know the data and axioms which constitute a vector space. Verify whether a given set equipped with an addition and scalar multiplication is a vector space or not.
P4	**Basis and dimension**: Produce a basis for a given vector space and be able to verify whether a given set of vectors is a basis or not.
P5	**Homomorphisms and isomorphisms**: Check whether a given function is a homomorphism/isomorphism.
P6	**Image and kernel**: Find the image and kernel of a linear transformation.
P7	**Determinants**: Compute the determinant of a matrix using cofactor expansion. Use the determinant to find whether a matrix is singular.
P8	**Eigenvectors and eigenvalues**: Find an eigenvector given a corresponding eigenvalue or vice versa. Find all eigenspaces for small matrices.
P9	**Practice material**: The homework assignments are each graded out of a total of 5 points. Thus, the maximum possible score is 70. A total score of 60 is enough to excel at this skill, while a total score of 45 is enough to suffice at this skill.

Figure 5: Primary skills

Skill	Description
S1	**Vector arithmetic**: Perform algebraic operations on vectors. Determine whether a given vector lies in the line/plane determined by a collection of points. Describe the points on a plane containing a given set of points.
S2	**Lengths and angles**: Find the length of a vector or the angle between two vectors in $\mathbb{R}^n$.
S3	**Subspaces**: Determine whether a set of vectors is a subspace of a given vector space.
S4	**Spanning sets**: Find a spanning set for a subspace.
S5	**Linear independence**: Determine whether a set of vector is linearly independent.
S6	**Matrix arithmetic**: Multiply matrices and know how matrix multiplication interacts with the vector operations for matrices.
S7	**Inverses**: Find the inverse of a matrix and know the definition of an inverse matrix.
S8	**Linear maps and matrices**: Be able to represent a linear transformation as a matrix with respect to fixed bases. Know how this representation interacts with composition of linear maps.

Figure 6: Secondary skills

Grade	Primary skills (excel)	Primary skills (suffice)	Secondary skills (suffice)
A	7	9	6
B	4	8	4
C	2	8	3
D	0	7	1

Figure 7: Final grades

Accommodations for religious obligations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, all homework, quizzes, and lectures are scheduled from the beginning of the course, so make sure to look over this document and reach out as soon as you can to resolve any scheduling conflicts. I will notify the class via email should anything in the course schedule change. See the campus policy regarding religious observances for full details.

Preferred student names and pronouns

CU Boulder recognizes that students' legal information does not always align with how they identify. If you wish to have your preferred name (rather than your legal name) and/or your preferred pronouns appear on your instructors' class rosters and in Canvas, visit the Registrar's website for instructions on how to change your personal information in university systems.

Classroom behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, marital status, political affiliation, or political philosophy.
Additional classroom behavior information:

- Student Classroom and Course-Related Behavior Policy
- Student Code of Conduct
- Office of Institutional Equity and Compliance

Sexual misconduct, discrimination, harassment and/or related retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email OIEC@colorado.edu. Information about

university policies, reporting options, and OIEC support resources including confidential services can be found on the OIEC website.
Please know that faculty and graduate instructors must inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure the person impacted receives outreach from OIEC about resolution options and support resources. To learn more about reporting and support a variety of concerns, visit the Don't Ignore It page.

Mental health and wellness

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS), located in C4C, or call (303) 492-2277, 24/7.
Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.