

MATH 221 – Fall 2024 – Section 1 & 2

Linear Algebra

General Information

Please note:

1. The information in this syllabus is subject to change at any point in the semester, as deemed necessary by the instructor. ¹ Any changes will be communicated to the students both in class and via email in a timely fashion. For the latest version of this document, please check the course page on Canvas or on class webpage.
 2. This course provides an introduction to linear algebra, covering topics such as systems of linear equations, matrices, determinants, linear transformations, eigenvalues and eigenvectors, least-squares.
 3. Prerequisite is MATH 111 or MATH_OX 111 or MATH 112 or MATH_OX 112 or MATH 112Z or equivalent transfer credit or equivalent transfer credit.
- **Instructor:** Tianshi Xu <txu41@emory.edu>.
 - **TA:** Nat Milnes <nathaniel.milnes@emory.edu>.
 - **Class Schedule:** MW 10:00 - 11:15 pm — Math & Science Center - W201.
 - **Lab Schedule:**
 - Section 1: F 8:30 - 9:20 am — Math & Science Center - N302.
 - Section 2: F 10:00 - 10:50 am — Math & Science Center - N302.
 - **Instruction Method:** In person, unless there are special circumstances.
 - **Office Hours:**
 - Instructor: MW 1:30 - 2:30 pm — Math & Science Center - N436
 - TA 1: T 12:00 - 1:00 pm — Math & Science Center - N412
 - TA 2: F 8:00 AM - 8:30 AM, 9:30 AM - 10:00 AM — Math & Science Center - N302
 - Other times: You are always welcome to email the instructor or the TA directly to make extra appointments.

All instructor's office hours will be held in a hybrid format, allowing you to attend in person or join via Zoom.

¹Last Updated: April 3, 2025

Materials and Tools

- **Canvas Page:** <https://canvas.emory.edu/courses/134876> It is your responsibility to visit the website periodically.
- **Textbook:** Linear Algebra With Applications, W. Keith Nicholson. The textbook can be found at <https://lyryx.com/linear-algebra-applications/>
- **Lecture Notes:** Lecture notes will be posted to the Canvas page after class.
- **Tech Requirements:** It is recommended that you have access to the following equipment:
 - A computer with reliable internet access. You should be able to access the Canvas site.
 - A scanner or smartphone for taking photos to upload online.

No calculators or calculating devices are allowed during the midterms and the final.

Grading Information

- **Grade Distribution:**

Homework	15 %
Lab Assignments	10 %
Quizzes	15 %
Midterms	30 %
Final	30 %
Total	100 %

- **Grading Scale:** Your final grade will be decided based on the following scale:

	B+: [87,90)	C+: [77,80)	D+: [67,70)		
A: [93,100]	B: [83,87)	C: [73,77)	D: [60,67)	F: [0,60]	
A-: [90,93)	B-: [80,83)	C-: [70,73)			

The class may be curved in the end at the discretion of the instructor. However, your final course grade will be no worse than your actual grade. That is, we will never “curve down”. Besides, each exam may be “curved up”. As a result, the course grade will not be rounded up. For example, a course grade of 92.99% is strictly 92.99% (and hence an A-).

- **Honor Code:** Students are required to follow the Emory University Honor Code throughout the semester. Details can be found at [Emory Honor Code](#).

- **Attendance:** Attendance is not required but strongly recommended. Please maintain a respectful and professional demeanor if you come to class.
- **Homework:** There will be ten homework assignments (please see the tentative schedule section for the schedule). Regarding homework, while most assignments will primarily be graded on completion, one problem—specified in advance by the instructor—will be assessed for accuracy. To accommodate late submissions, we have a policy that allows for late assignments with a deduction of 15% per day, for up to two days. Assignments submitted later than two days will receive no credit. The two lowest homework scores will be dropped, and some problems will be graded solely based on completion.
- **Lab Assignments:** There will be twelve lab assignments during each lab except the midterms (please see the tentative schedule section for the schedule). Those assignments are short. The two lowest lab assignment scores will be dropped.
- **Quizzes:** There will be three short in-class quizzes (please see the tentative schedule section for the schedule). Those quizzes are short. The lowest quiz score will be dropped.
- **Exams:** There will be two midterms and one final exam (cumulative). Please see the tentative schedule section for the schedule of the exams. All exams will be held in person. Makeup exams will be given only with adequate excuses. The exam may be curved at the discretion of the instructor. However, your grades will be no worse than your actual grades. That is, we will never “curve down”.
- **Important Dates:**
 - **10/04/24:** Midterm 1. Regular lab time. Location — Math & Science Center - N302.
 - **11/15/24:** Midterm 2. Regular lab time. Location — Math & Science Center - N302.
 - **12/16/24:** Final exam. 8:00 AM – 10:30 AM. Location — White Hall 207

Student Success Resources

- **Tech Support:** For technical assistance, refer to [Emory IT Services](#).
- **Undergraduate Education Resources:** The Office of Undergraduate Education offers various student support services including academic advice, peer tutoring, and guidelines for missed exams. More information is available at [OUE Emory](#).
- **Accessibility Services:** Students with documented disabilities or who suspect they may have a disability should reach out to the Office of Accessibility Services for accommodation support and resources. Confidentiality regarding any disability-related information is assured. Further details can be found at [Office of Accessibility Services Emory](#).

- **Academic and Religious Observance Calendar:** Please familiarize yourself with the [Academic Calendar](#) for crucial academic dates.
- **Health and Wellness Resources for Students:** Achieving academic success is closely linked to maintaining a healthy lifestyle, both mentally and physically. Emory University offers several no-cost resources to support student well-being:
 - Emory HelpLine: For non-critical mental health needs, students can reach out to the Emory HelpLine at 404-727-4357. This confidential, peer-run phone counseling service operates every evening from 8:30 pm to 1:00 am.
 - For immediate mental health concerns, the Student Counseling Center is available at 404-727-7450.
 - This program supports students dealing with sexual assault, relationship violence, or stalking. Confidential consultations, crisis intervention, and referrals are provided. Contact them at 404-727-1514.
 - Offering a broad range of services including primary care, physical exams, dietary and substance abuse counseling, Emory Student Health is committed to supporting students' physical health.
- **Policy on Harassment:** As per [Emory Equal Opportunity and Discriminatory Harassment Policy](#), Emory University strictly prohibits any form of discriminatory harassment. This includes sexual harassment and harassment based on race, color, religion, ethnic or national origin, gender, genetic information, age, disability, sexual orientation, gender identity, gender expression, veteran status, or any other category protected under applicable law. This policy applies to faculty, staff, administration, students, vendors, contractors, guests, and patrons on campus.

Tentative Topics

Section	Topic
Chapter 1	
Section 1.1	Solutions and Elementary Operations Lecture 1
Section 1.2	Gaussian Elimination Lecture 2
Section 1.3	Homogeneous Equations Lecture 3
Chapter 2	
Section 2.1	Matrix Addition, Scalar Multiplication, and Transposition Lecture 4

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Section	Topic
Section 2.2	Matrix-Vector Multiplication Lecture 5
Section 2.3	Matrix Multiplication Lecture 6
Section 2.4	Matrix Inverses Lecture 6 & 7
Section 2.5	Elementary Matrices Lecture 7
Section 2.6	Linear Transformations Lecture 8
Section 2.7	LU-Factorization Lecture 9
Chapter 3	
Section 3.1	The Cofactor Expansion Lecture 10
Section 3.2	Determinants and Matrix Inverses Lecture 11
Section 3.3	Eigenvalues and Eigenvectors Lecture 12
Chapter 4	
Section 4.1	Vectors and Lines Lecture 13
Section 4.2	Projections and Planes Lecture 14
Section 5.1	Subspaces and Spanning Lecture 15
Section 5.2	Independence and Dimension Lecture 16
Section 5.3	Orthogonality Lecture 17

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Section	Topic
Section 5.4	Rank of a Matrix Lecture 18
Section 5.5	Similarity and Diagonalization Lecture 18 & 19
Section 5.6	Best Approximation and Least Squares Lecture 19
Chapter 6	
Section 6.1	Examples and Basic Properties Lecture 20
Section 6.2	Subspaces and Spanning Sets Lecture 20 & 21
Section 6.3	Linear Independence and Dimension Lecture 21
Chapter 7	
Section 7.1	Examples and Elementary Properties Lecture 22
Section 7.2	Kernel and Image of a Linear Transformation Lecture 23
Section 7.3	Isomorphisms and Composition Lecture 24
Chapter 8	
Section 8.1	Orthogonal Complements and Projections Lecture 25
Section 8.2	Orthogonal Diagonalization Lecture 25 & 26
Section 8.3	Positive Definite Matrices Lecture 26

Tentative Schedule

Red: No Lecture (exam or holiday)

Blue: In-class quiz or lab assignment

Orange: Homework out

Purple: Homework due

Week	Monday	Wednesday	Friday
Week 1	No Class: 08/26/24 No Class	Lecture 1: 08/28/24 Section 1.1	Lab 1: 08/30/24 Lab Assignment 1
Week 2	No Class: 09/02/24 Labor Day University Holiday No Class	Lecture 2: 09/04/24 Section 1.2 Homework 1 out	Lab 2: 09/06/24 Lab Assignment 2
Week 3	Lecture 3: 09/09/24 Section 1.3	Lecture 4: 09/11/24 Section 2.1 Homework 2 out	Lab 3: 09/13/24 Lab Assignment 3 Homework 1 due
Week 4	Lecture 5: 09/16/24 Section 2.2 Quiz 1	Lecture 6: 09/18/24 Section 2.3 & 2.4 Homework 3 out	Lab 4: 09/20/24 Lab Assignment 4 Homework 2 due
Week 5	Lecture 7: 09/23/24 Section 2.4 & 2.5	Lecture 8: 09/25/24 Section 2.6 Homework 4 out	Lab 5: 09/27/24 Lab Assignment 5 Homework 3 due
Week 6	Lecture 9: 09/30/24 Section 2.7	Lecture 10: 10/02/24 Section 3.1	Midterm 1: 10/04/24 Section 1.1 – 2.7
Week 7	Lecture 11: 10/07/24 Section 3.2	Lecture 12: 10/09/24 Section 3.3 Homework 5 out	Lab 6: 10/11/24 Lab Assignment 6 Lab Skipped Homework 4 due
Week 8	No Class: 10/14/24 Fall Break No Class	Lecture 13: 10/16/24 Section 4.1 Homework 6 out	Lab 7: 10/18/24 Lab Assignment 7 Homework 5 due

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Week	Monday	Wednesday	Friday
Week 9	Lecture 14: 10/21/24 Section 4.2	Lecture 15: 10/23/24 Section 5.1 Homework 7 out	Lab 8: 10/25/24 Lab Assignment 8 Homework 6 due
Week 10	Lecture 16: 10/28/24 Section 5.2 Quiz 2	Lecture 17: 10/30/24 Section 5.2 & 5.3 Homework 8 out	Lab 9: 11/01/24 Lab Assignment 9 Homework 7 due
Week 11	Lecture 18: 11/04/24 Section 5.4	Lecture 19: 11/06/24 Section 5.5 Homework 9 out	Lab 10: 11/08/24 Lab Assignment 10 Now Midterm Review Homework 8 due
Week 12	Lecture 20: 11/11/24 Section 6.1	Lecture 21: 11/13/24 Section 6.2	Midterm 2: 11/15/24 Section 3.1 – 5.5
Week 13	Lecture 22: 11/18/24 Section 6.3	Lecture 23: 11/20/24 Section 7.1 Homework 10 out	Lab 11: 11/22/24 Lab Assignment 11 Homework 9 due
Week 14	Lecture 24: 11/25/24 Section 7.2 Quiz 3	No Class: 11/27/24 Thanksgiving University Holiday No Class	No Class: 11/29/24 Thanksgiving University Holiday No Class
Week 15	Lecture 25: 12/02/24 Section 7.3	Lecture 26: 12/04/24 Section 8.1 & 8.2	Lab 12: 12/06/24 Lab Assignment 12 Now Final Review Homework 10 due
Week 16	Review: 12/09/24 Section 8.3 & 8.4	No Class: 12/11/24 No Class	No Class: 12/13/24 No Class
Week 17	Final: 12/16/24 Final Exam 8:00 AM – 10:30 AM Location TBD		