

Computational Linear Algebra
Spring 2024
MATH 225 - 001 CRN 44435



Meeting: Mon, Wed, Fri, 9-9:50am in Wubben 118

Dr. Eric Miles

Office: WS 134A

Phone: (970) 248-1955

E-mail: emiles@coloradomesa.edu *preferred communication method

Website: ericwmiles.weebly.com

Office hours: MTWRF 10-10:50am (no appointment necessary)

Linear Algebra is a beautiful exploration of the interplay between equations, vectors, matrices, and things like lines and planes. I'm excited to have you on our team of explorers! -Dr. Miles

Prerequisites: Calculus I (Std, Engr, or Appl)

Time commitment: 6 hours of work outside class per week

In class: Lecture/practice/group work

MyLab homework: Online homework for each section

Octave homework: Computational/programming explorations

Exams: 2 Midterms, 1 cumulative Final

Prerequisite: A grade of C or better in Math 151 (Calculus I), 135 (Engineering Calculus I), or 131 (Applied Calculus). If you do not meet this prerequisite, come see me!

Required Material:

- **Text + MyLab:** *Linear Algebra and its Applications, 6th ed* by Lay, Lay, & McDonald, together with MyLab Math.
 - Our course is “direct digital,” meaning that **you already have full access** to our textbook (ebook) and MyLab homework **through D2L**.
 - No need to purchase the textbook/MyLab on your own, that’s already been taken care of - the \$79 cost will be reflected in your student fees.
- **Octave Online:** <http://octave-online.net>
 - Free, online matrix program that is essentially MATLAB
 - Also available to download: <https://octave.org/>
- **Calculator:** A scientific calculator is required for this course and a calculator that can perform matrix operations (such as the TI-83 or TI-84) is strongly recommended. I will typically use a TI-84 for in-class demonstrations.

Course Description: Computational approach to systems of equations, vector spaces, matrices, matrix transformations, subspaces of \mathbb{R}^n , eigenvalues, as well as their applications. Software for linear algebra computations is introduced and utilized.

Student Learning Outcomes:

Upon satisfactory completion of MATH 225: Computational Linear Algebra, students should be able to:

- Represent a linear system as both a vector equation and matrix equation and vice versa.
- Interpret vector operations and the span of vectors geometrically.
- Apply definitions and theorems to draw conclusions about key linear algebra topics such as subspaces, linear independence, and spanning sets.
- Use the Invertible Matrix Theorem to draw conclusions about a matrix and associated linear systems.
- Compute determinants and eigenvalues and associated eigenvectors for a square matrix.
- Use computational software to solve problems in linear algebra.
- Communicate mathematical ideas and solutions to problems using correct mathematical notation and terminology.
- Communicate mathematical analysis symbolically, graphically, and in written language that clarifies/justifies/summarizes reasoning.

Anyone who has never made a mistake has never tried anything new.
-Albert Einstein

Class Periods: Classes will involve a mixture of lecture, practice, and working in groups. I will often ask the class questions and you should always feel free to ask questions throughout the class period. *To get the most out of class, you should read and try to understand the main point(s) of the section to be covered before class.* Throughout the semester, we will devote certain class periods to group work. The group work is designed to reinforce and synthesize previously introduced concepts (or to introduce new concepts), and allows you to interact, learn from, and help each other.

Participation: Each student in this class has chosen to be part of this community of learners, and continuing in this class carries an obligation to contribute to and respect our community (both in-person and online). This looks like coming to class a few minutes early, being prepared for class, asking questions, participating in discussions and activities, and seeking help outside of class when appropriate. Distracting or negative behavior (e.g. using your cell phone during class, consistently coming late, unprofessional communication) disrupts our learning environment and may hurt your grade. (Students who persist in inappropriate behavior may be administratively dropped from the class.) If you come to class and participate in a positive, constructive, focused way, you'll be all set here.

MyLab Homework: To give us a chance to regularly practice with class concepts and computations, we use MyLab online homework through D2L. You will receive instant feedback on whether or not your answers are correct, and *you can retry problems as many times as you like (in general) with no loss of credit*. Homework assignments will be due at 11:59pm on Wednesdays and Sundays. For these assignments to help your understanding as much as possible, *you should work on a homework assignment each day*. It is possible to work problems after the due date, but late problems will have a 30% point reduction.

Octave Homework: Throughout the semester, we will complete several assignments using the online matrix program Octave. These are designed to give us practice working with a widely used computational programming language (MATLAB) while exploring various applications and extensions of class material. The Octave assignments will be graded not just on correctness, but also presentation and explanation. Even in computer code, **math is as much about communicating your process as it is about getting the correct answer**, therefore answers without supporting work will generally earn no credit, and partial credit will be given at the instructor's discretion. You **may work in groups of 2** for Octave assignments, and feel free to **come to office hours for help, hints, or feedback on your write-up**. If you will be unable to turn in a homework the day it is due, it is your responsibility to complete it early. Due dates will be announced with each assignment and your lowest score will be dropped.

Midterm Tests: We will have 2 midterm tests, occurring in-class approximately every six weeks. As with the weekly homework, answers without supporting work will generally earn no credit, and partial credit will be given at the instructor's discretion. *No notecards or notes will be allowed on any quiz or exam.*

- Tentative Midterm 1 date: Friday, March 1
- Tentative Midterm 2 date: Friday, April 19

Final Exam: The final exam is on *Wed., May 15, 8-9:50 am. This will be a cumulative exam.* Do not make plans to leave campus before this date; you *have* to take the final at this date and time.

Picture your brain forming new connections as you meet the challenge and learn. Keep on going.
-Carol Dweck

Grade Computation:	Octave Homework	15%
	MyLab Homework	20%
	Participation	10%
	Midterms	30%
	Final Exam	25%

The following percentages of the maximum semester score determine your grade: 90% earns an A, 80% earns a B, 70% earns a C, and 60% earns a D.

Attendance: I value your attendance and contribution very much. It is incredibly important for the atmosphere of collaborative learning we look to create, and is essential for your understanding of the class material - *so come to class every day!* Attendance also directly affects your Participation score: you have 2 “free” absences, then after 2 more, your maximum Participation score is 90%, and each additional *unexcused* absence lowers your maximum Participation grade by 10% (e.g. after 5 absences, max = 80%). Any student having with 8 *unexcused* absences may be dropped by the instructor without notice to the student. Please do not come to class if you are ill. Accommodations will be made for students absent for COVID-related reasons – in this situation, please email me as soon as possible.

Alternate Exams: Alternate times for midterms will only be given for a documented medical reason or participation in an inter-collegiate activity. Work, travel, vacation, or any other non-college sanctioned activity is not an acceptable excuse for missing an exam. Exceptions to this rule are rare and given only in extreme circumstances as judged by me.

If you are going to miss a test (for one of the two reasons stated above), *it is your responsibility to notify me at least one week in advance.* After this deadline, I cannot guarantee an alternate time. Note that no makeup exams will be given after they have been returned to students.

Credit Hours Policy: An undergraduate student should expect to spend on this course a *minimum of two hours outside of the classroom for every hour in the classroom.* The outside hours may vary depending on the number of credit hours or type of course. More details are available from the faculty member or the department office and in CMU’s Curriculum Policies and Procedures Manual.

Great works are performed, not by strength, but by perseverance.
-Samuel Johnson

Tutoring: CMU offers ***FREE*** *walk-in tutoring* at the Tutorial Learning Center, located in Houston 113. Do you have a quick question? Do you need homework clarification or feedback on a paper? Are you reviewing for a test? Help is available at the TLC! See their website for schedules and locations: www.coloradomesa.edu/tutoring or call at 248-1392 with any questions.

Academic Honesty: Cheating is unacceptable on this campus. Students caught cheating may be removed from the class and given an F for the course. Again, from the university’s code of integrity: By submitting work which is not your own, you may forfeit the opportunity to continue as a student.

EAS: In coordination with Educational Access Services, reasonable accommodations will be provided for qualified students with disabilities. Students should contact Educational Access Services at 970-248-1856 or Houston Hall, Suite 108 as soon as possible.

Citizenship: To keep the classroom environment as amenable to learning as possible, students agree to behave as mature, respectful adults. Be considerate of others and help the class focus. In particular...

- Using your cell phone distracts you and those around you, *so keep phones stored away during class.*
 - A few friendly reminders may be granted early in the semester, but for persistent violators each observed unapproved instance of a cell phone or technology violation will result in a 1 point deduction from their final exam score.
- Come to class on time. If you need to come late or leave early, that's fine – but don't make it a habit.
- Any guests must be authorized beforehand by the instructor.
- Do let me know if you have a question, if you didn't see what happened at a certain step, or didn't catch why we did something, or if you have no idea what just happened.
- Do offer any insights you have as to alternative ways of solving problems, connections with other lines of thought, etc.
- Do speak **LOUDY** and positively during group work (*no whispering!*) and collaborate with your group members, working together and asking and answering questions.
- Do let me know if my writing is illegible, if I need speak up, or if you don't want me to erase something from the board yet.

Please read the student code of conduct in your student handbook or online:

<http://www.coloradomesa.edu/student-services/maverick-guide.html>

The only way to learn mathematics is to do mathematics.
- Paul Halmos

Plan of Content

Over the semester we will cover portions of the following chapters/sections from the text:

1.1 – Systems of Linear Equations	2.1 – Matrix Operations	5.1 – Eigenvectors and Eigenvalues
1.2 – Row Reduction and Echelon Forms	2.2 – The Inverse of a Matrix	5.2 – The Characteristic Equation
1.3 – Vector Equations	2.3 – Characterizations of Inv. Mat	5.8 – Iterative Estimates for Eigenvalues
1.4 – The Matrix Equation $Ax = b$	2.5 – Matrix Factorizations	
1.5 – Solution Sets of Linear Systems	2.8 – Subspaces of \mathbb{R}^n	7.4 – The Singular Value Decomposition
1.7 – Linear Independence	2.9 – Dimension and Rank	
1.8 – Introduction to Linear Transformations		Additional topics and applications may be discussed depending on time and student interest.
1.9 – The Matrix of a Linear Transformation	3.1 – Introduction to Determinants	
	3.2 – Properties of Determinants	
	3.3 – Volume and Linear Trans.	

Math 225 Questionnaire Assignment – Fill out and turn in the 2nd day of class

A. Syllabus Confirmation

I have read and understood the syllabus for this course.

Signature

Date

B. Background Information

Name (Print Clearly)	
How Your Name is Pronounced	
Year in College	

Fill in the following table with all previous and current math/stat/related college-level courses.

	Course Name	When (Semester/Year)
1		
2		
3		
4		
5		
6		

What is your intended major?

Why are you taking this course?

What (if any) previous programming experience have you had?

What is your hometown?

What's something interesting about you?

Other (Please comment below on any other information that you would like me to be aware of.)