

## Course Description

Linear algebra is a remarkable subject, being both mathematically beautiful and pervasive in practical applications. The central goal is to study systems of linear equations; these generalize the familiar scalar equation  $y = mx + b$  to higher dimensions. Major topics include vectors, linear functions, norms and distance, orthogonality, linear independence, the Gram-Schmidt algorithm, matrix multiplication and inverses, QR factorization, and least squares fitting.

The course is intended to emphasize the practical side of linear algebra. As such we will use computers to solve problems over the semester; students will have a choice of Julia or MATLAB.

The applied focus of the course is an experiment; expect adjustments to the syllabus if needed.

## Essential Information

Professor	David Maxwell
Office	Chapman 308C
Email	damaxwell@alaska.edu
Phone	474-1196
Web	damaxwell.github.io
Required Text	<b>Introduction to Applied Linear Algebra</b> , <i>Boyd and Vandenberghe</i> , Cambridge University Press

## Prerequisites:

The course prerequisite is a C or better in Math 252 (Calculus II).

## Student Learning Outcomes

Students will:

- become fluent in linear combinations, bases, and matrix algebra
- apply linear algebra tools to dynamical systems, clustering, and least squares fitting
- understand how QR factorization is used to solve matrix equations, including non-square systems
- use software to solve practical problems using skills from linear algebra

## Class Time

There will be three hours of class lecture each week.

Lecture Times

MWF 9:15–10:15 Chapman 106

## Office Hours

I will schedule 3 hours a week of formal office hours. Some of these will be held in the Engineering building, but I will be available by Zoom.

## **Discord**

A Discord server has been set up for this class. We will use it as the primary means of group communication.

Communication in Discord will be on-topic, polite and collegial as is suitable for a workplace setting.

## **Homework**

There will be a homework assignment due roughly every week, usually on Wednesdays. Each week's assignment and due date will be announced in class and will be posted on my web page.

Answers to homework problems will be posted in advance, and homework will be graded solely on completion.

Regarding late homework, I will accept from each student a single late homework with no questions asked. Simply hand in a note indicating you are using your free late homework in place of your actual assignment. You must notify me no later than the time the homework is due that you intend to take advantage of this opportunity, and you must hand in the homework no later than one week after it was due. Subsequent late homeworks will be accepted only under extenuating circumstances to be determined at my discretion.

The late homework freebie cannot be used for the first two homework sets, nor can it be used for the final assignment.

## **Quizzes**

There will be a weekly 15 minute quiz on Fridays based on the homework handed in on the previous Wednesday.

Quizzes cannot be made up unless there are extenuating circumstances (e.g. a school sponsored absence, a death in the family, a hospitalization). Your lowest quiz score will be dropped.

## **Labs**

In addition to the more routine homework, there will be about four labs (i.e short projects) covering more in-depth material. More details on the labs will be announced along with your first lab.

## **Julia**

Real-world problems in linear algebra are solved using computer software. We will use the software program Julia (a kind of modern Matlab) on assignments and for the labs. I do not expect that you have any programming experience, and I will provide materials to help you get up to speed.

## **Chapman Math Lab**

The Math Lab in Chapman 305 has tutors available at scheduled times throughout the week. The tutors are most experienced at answering calculus questions, but you might find that some of the tutors (especially the graduate students) would welcome the opportunity to discuss something other than calculus. The hours for the Math Lab are posted on its door and on a link from the department's home page at <http://www.dms.uaf.edu>.

**Midterms**

There will be two in-class midterm exams.

**Final Exam**

There will be a comprehensive final exam 8am-10am on Friday, May 3.

**Evaluation**

Course grades will be determined as follows:

Homework	10%
Quizzes	14%
Labs	14%
Midterm 1	18%
Midterm 2	18%
Final	26%

Letter grades will be assigned according to the following scale. This scale is a guarantee; I also reserve the right to lower the thresholds.

A+	97–100%	C+	77–79%	F	$\leq 59$
A	93–96%	C	73–76%		
A-	90–92%	C-	70–72%		
B+	87–89%	D+	67–69%		
B	83–86%	D	63–66%		
B-	80–82%	D-	60–62%		

**Covid 19**

The pandemic is largely behind us. In the event that circumstances change, official university information can be found at:

<https://sites.google.com/alaska.edu/coronavirus/>

**Tentative Schedule**

The following is a tentative list of the topics to be covered in this class. As we proceed in the course, the course web page will list specific sections to be read for each week.

Week	Topics and Events
1/15 – 1/19	Chapter 1 Monday: Alaska Civil Rights Day
1/22 – 1/26	Chapter 2
1/29 – 2/2	Chapter 3
2/5 – 2/9	Chapter 4
2/12 – 2/16	Chapter 5
2/19 – 2/23	Chapter 6 First Midterm
2/26 – 3/1	Spring Break
3/4 – 3/8	Chapter 7
3/11 – 3/15	Chapter 8
3/18 – 3/22	Chapter 10
3/25 – 3/29	Chapter 11 Friday: Last day to withdraw with a 'W'
4/1 – 4/5	Eigenvalues Second Midterm
4/8 – 4/12	Chapter 9
4/15 – 4/19	Least Squares
4/22 – 4/26	Least Squares Data Fitting

## Rules and Policies

### Collaboration

You are encouraged to work together in solving homework problems. But each student must write up his or her own solutions independently. If you receive significant help solving a problem, it is customary to make a note in your homework to give the person who helped you credit.

### Makeup Exams

You can make up an exam if certain extenuating circumstances prevent you from taking it and if you inform me in advance. Contact me as soon as possible if you are going to miss an exam.

### Attendance

Attendance is not included directly as part of your grade.

### Cell Phones

Turn off your cell phone before you come to class.

### Disabilities Services

I will work with the Office of Disabilities Services (203 Whitaker, 474-7043) to provide reasonable accommodation to students with disabilities.

### Incomplete Grade

Incomplete (I) will only be given in Computer Science, Mathematics or Statistics courses in cases where the student has completed the majority (normally all but the last three weeks) of a course with a grade of C or better, but for personal reasons beyond his/her control has been unable to complete the course during the regular term. Negligence or indifference are not acceptable reasons for the granting of an incomplete grade. (Note: this is essentially the old University policy.)

### **Late Withdrawals**

A withdrawal after the university deadline from a Department of Mathematical Sciences course will normally be granted only in cases where the student is performing satisfactorily (i.e., C or better) in a course, but has exceptional reasons, beyond his/her control, for being unable to complete the course. These exceptional reasons should be detailed in writing to the instructor, department head and dean.

### **Academic Dishonesty**

Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.

### **Artificial Intelligence (AI)**

In this class you are learning fundamental mathematical skills. Because you need to acquire and master these skills for yourself, unless otherwise stated explicitly, there are no acceptable uses of AI in this class. Unless specifically authorized, you may not use any form of AI to assist with solving a homework assignment (programming or otherwise) or a lab.

## **Official UAF Syllabus Addendum**

**Student protections statement:** UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: <https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/>.

**Disability services statement:** I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities.

### **Student Academic Support:**

- Speaking Center (907-474-5470, [uaf-speakingcenter@alaska.edu](mailto:uaf-speakingcenter@alaska.edu), Gruening 507)
- Writing Center (907-474-5314, [uaf-writing-center@alaska.edu](mailto:uaf-writing-center@alaska.edu), Gruening 8th floor)
- UAF Math Services, [uafmathstatlab@gmail.com](mailto:uafmathstatlab@gmail.com), Chapman Building (for math fee paying students only)
- Developmental Math Lab, Gruening 406

- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, <https://www.ctc.uaf.edu/student-services/student-success-center/>)
- For more information and resources, please see the Academic Advising Resource List ([https://www.uaf.edu/advising/lr/SKM\\_364e19011717281.pdf](https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf))

**Student Resources:**

- Disability Services (907-474-5655, [uaf-disability-services@alaska.edu](mailto:uaf-disability-services@alaska.edu), Whitaker 208)
- Student Health & Counseling [6 free counseling sessions] (907-474-7043, <https://www.uaf.edu/chc/appointments.php>, Whitaker 203)
- Center for Student Rights and Responsibilities (907-474-7317, [uaf-studentrights@alaska.edu](mailto:uaf-studentrights@alaska.edu), Eielson 110)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, [asuaf.office@alaska.edu](mailto:asuaf.office@alaska.edu), Wood Center 119)

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UAF Department of Equity and Compliance  
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907-474-7300  
[uaf-deo@alaska.edu](mailto:uaf-deo@alaska.edu)