

# Math 31B (Lecture 2): Linear Algebra and Applications

<https://pabloocal.github.io/Teaching/WMATH33AL22022/>

Winter 2022

## Instructor

**Name:** Pablo S. Ocal

**Office:** MS 5234

**Contact:** <http://www.math.ucla.edu/~socal>

**Lectures:** MWF 12:00-12:50 pm

**Office hours:**

M: 1:00 to 3:00 pm

and by appointment.

**Classroom:** BUNCHE 1209B

## Teaching Assistants

**Name:** Matthew Stone

**Discussion 2A:** T 12:00-12:50 pm

**Discussion 2B:** R 12:00-12:50 pm

**Contact:** stoney31415 at math dot ucla dot edu

**Classroom:** MS 5147

**Classroom:** GEOLOGY 6704

**Name:** Alec Leng

**Discussion 2C:** T 12:00-12:50 pm

**Discussion 2D:** R 12:00-12:50 pm

**Contact:** aleng at math dot ucla dot edu

**Classroom:** MS 5117

**Classroom:** BOELTER 5273

**Name:** Alexander Xue

**Discussion 2E:** T 12:00-12:50 pm

**Discussion 2F:** R 12:00-12:50 pm

**Contact:** alexxue at math dot ucla dot edu

**Classroom:** BOELTER 5440

**Classroom:** BOELTER 5422

## Prerequisites

- You are expected to be familiar with two-by-two and three-by-three determinants.
- You are expected to be familiar with the materials in Math 3B or Math 31B or Math 32A.

## Textbook

*Linear Algebra with Applications (5th edition)* by Otto Bretscher.

## Grading

Your final grade in this class will be computed as the maximum of the following:

Grade 1:	Grade 2:	Grade 3:
Homework 15%	Homework 15%	Homework 15%
Midterm 1 25%	Max. Midterm 35%	Final 85%
Midterm 2 25%	Final 50%	
Final 35%		

## Homework

Homework will be assigned and collected every week. It will be assigned on Tuesdays and it will be due the following week on Wednesday via Gradescope. It will be graded and promptly returned to you via Gradescope. The assignments will be posted on the course website and announced in class. Your score on each homework assignment will be based on completeness, on your work shown, and on a few randomly chosen problems, graded for correctness. The lowest homework score will be dropped. **Late homework will not be accepted.**

## Exams

During the exams, you may not use notes, calculators, cell phones, or anything other than pen and pencil. There will be no make-ups for missed midterms. If you miss one midterm for a legitimate, documented reason, your grade will be computed using the second scheme above. You must take the final exam in order to pass the class. Make-ups for the final exam are permitted only under exceptional circumstances, as outlined in the UCLA student handbook. Please bring a photo ID to every exam. The exams are scheduled for the following dates:

- Midterm 1: Friday, January 28.
- Midterm 2: Friday, February 18.
- Final: Saturday, May 12.

## Schedule

- **Jan 3:** Sections 1.1, 1.2, Introduction to Linear Systems, Matrices, Vectors, and Gauss-Jordan Elimination.
- **Jan 5:** Section 1.3, On the Solutions of Linear Systems; Matrix Algebra.
- **Jan 7:** Section 2.1, Introduction to Linear Transformations and Their Inverses.

- **Jan 10:** Section 2.2, Linear Transformations in Geometry.
- **Jan 12:** Section 2.3, Matrix Products.
- **Jan 14:** Section 2.4, The Inverse of a Linear Transformation.
- **Jan 19:** Section 3.1, Image and Kernel of a Linear Transformation.
- **Jan 21:** Section 3.2, Subspaces of  $\mathbb{R}^n$ ; Bases and Linear Independence.
- **Jan 24:** Section 3.3, The Dimension of a Subspace of  $\mathbb{R}^n$ .
- **Jan 26 :** Section 3.4, Coordinates.
- **Jan 28:** Sections 1.1-1.3, 2.1-2.4, 3.1-3.4, Midterm 1.
- **Jan 31:** Section 5.1, Orthogonal Projections and Orthonormal Bases.
- **Feb 2:** Section 5.1, Orthogonal Projections and Orthonormal Bases (continued).
- **Feb 4:** Section 5.2, Gram-Schmidt Process and QR Factorization.
- **Feb 7:** Section 5.3, Orthogonal Transformations and Orthogonal Matrices.
- **Feb 9:** Section 5.4, Least squares.
- **Feb 11:** Section 6.1, Introduction to Determinants.
- **Feb 14:** Section 6.2, Properties of the Determinant.
- **Feb 16:** Section 6.3, Geometrical Interpretations of the Determinant; Cramer's Rule.
- **Feb 18:** Section 5.1-5.4, 6.1-6.3, Midterm 2.
- **Feb 23:** Section 7.1, Diagonalization.
- **Feb 25:** Section 7.2, Finding the Eigenvalues of a Matrix.
- **Feb 28:** Section 7.3, Finding the Eigenvectors of a Matrix.
- **Mar 2:** Section 7.5, Complex Eigenvalues.
- **Mar 4:** Section 8.1, Symmetric Matrices.
- **Mar 7:** Section 8.2, Quadratic Forms.
- **Mar 9:** Section 8.3, Singular Values.
- **Mar 11:** Sections 1.1-1.3, 2.1-2.4, 3.1-3.4, 5.1-5.4, 6.1-6.3, 7.1-7.3, 7.5, 8.1-8.3, Review.
- **Mar 12:** Sections 1.1-1.3, 2.1-2.4, 3.1-3.4, 5.1-5.4, 6.1-6.3, 7.1-7.3, 7.5, 8.1-8.3, Final Exam.

## Accommodations

If you have a condition that requires accommodation, please contact the Center for Accessible Education (<https://www.cae.ucla.edu>) as soon as possible. They will determine with you what accommodations are appropriate and communicate them to the instructor. This service is confidential. **If you require accommodation, you will take the exams at the CAE's facilities. It is your responsibility to make sure you have contacted the CAE and that they are expecting you. It is your responsibility to make sure CAE contacts me in time to provide the exams.**

## Honor Code

UCLA's Honor Code governs all work in this class. All work submitted for credit must be the student's own and should reflect the student's own understanding of the material.

## COVID-19 Policy

The most updated information is available at <https://covid-19.ucla.edu/>.

- Each of us is responsible, regardless of vaccination status, for wearing an approved mask that fully covers our nose and mouth for the duration of class, office hours, or other course-related activity. Disposable masks are available at the Wooden Center for anyone unable to obtain a mask or who has forgotten to bring one to campus. Appropriate masks include two-ply woven fabric masks, surgical masks, non-woven KN95 masks, and N95 respirators. Scarves, balaclavas and ski masks, single-layer fabric masks and neck gaiters, bandanas, and turtleneck collars are not adequate. For those that have a medical reason not to wear a mask, you can contact the Center for Accessible Education to have this exception approved and sent to me.
- Each of us must be fully vaccinated. Per the COVID-19 Response and Recovery Task Force, unvaccinated students must comply with twice-weekly testing.
- Each of us is required to complete daily symptom checks, regardless of vaccination status.

**Please stay home if sick or potentially exposed.** Be assured that you will not be penalized for doing so. Be advised that refusal to comply with current campus directives related to COVID-19 mitigation will result in dismissal from the classroom and referral to the Office of Student Conduct. If you have any questions or concerns about UCLA's COVID-19 protocol, go to <https://covid-19.ucla.edu/information-for-students/>.