MATH 307 Applied Linear Algebra

Course Outline 2026W1

Linear systems of equations, LU decomposition, condition number, orthogonal projection, QR decomposition, least squares approximation, orthogonal diagonalization, singular value decomposition, discrete Fourier transform. Applications: interpolation, data fitting, principal component analysis, digital signal processing. Matrix computations with mathematical software Python, SciPy and Jupyter.

Learning Goals

- Summarize properties and constructions of matrix decompositions LU, QR and SVD
- Perform matrix computations using mathematical software Python, SciPy and Jupyter
- Compute solutions of systems of linear equations using matrix decompositions
- Compute least squares approximations of linear systems using matrix decompositions
- Approximate eigenvalues and eigenvectors using numerical methods
- Analyze digital signals using the discrete Fourier transform

Instructors

Name	*Office*	*Email*
Patrick Walls	MATH 229E	pwalls@math.ubc.ca
Ahmet Alacaoglu	MATX 1114	alacaoglu@math.ubc.ca
Ido Levin	LSK 233	idolevin@math.ubc.ca

Lectures

Section	*Instructor*	*Time*	*Location*
101	Ido Levin	MWF 1-2pm	SWNG 121
102	Patrick Walls	MWF 3-4pm	BUCH A104
103	Ahmet Alacaoglu	TTh 3:30-5pm	IRC 4

Course Notes and Problem Book

See MATH 307 Course Notes and MATH 307 Problem Book (posted on Canvas)

Canvas and Piazza

Announcements, assignments, grades, lecture notes and all other course information will be posted on Canvas. Please check it often! Use Piazza to ask and answer questions about lecture notes, textbook exercises, etc. Find the Piazza link on the Canvas course page.

Schedule

Hours	*Topics*
9	**Linear equations.** Gaussian elimination, LU decomposition, condition number. Applications: polynomial interpolation, cubic spline interpolation.
10	**Orthogonality.** Orthogonal subspaces, fundamental subspaces of a matrix, orthogonal projection, Gram-Schmidt orthogonalization, QR decomposition, least squares approximation. Applications: fitting models to data.
10	**Eigenvalues.** Diagonalization, spectral theorem, SVD, pseudoinverse, SVD expansion, power method. Applications: principal component analysis, image deblurring.
7	**Discrete Fourier transform.** Complex vector spaces, discrete Fourier transform, sinusoids, frequency and phase. Applications: digital signal processing.
36	

Assessments

Python Assignments	$4 \times 2.5\% = 10\%$
Midterm Exams	$2 \times 20\% = 40\%$
Final Exam	50%

- Assignments do not require any prior Python experience
- Midterm exams scheduled during lecture time
- Contact your instructor if you miss an assessment

Important Dates

Tuesday September 8	UBC Imagine Day (No lectures)
Wednesday September 9	Lectures begin
Wednesday September 30	National Day for Truth and Reconciliation (UBC closed)
Monday October 12	Thanksgiving Day (UBC closed)
November 9–11	Midterm Break (No lectures)
Wednesday November 11	Remembrance Day (UBC closed)
Monday December 7	Last day of lectures
December 11–22	Final exam period

- See the UBC Academic Calendar 2026/2027

Prerequisites

Linear Algebra	One of MATH 152, MATH 221, MATH 223
Multivariable Calculus	One of MATH 200, MATH 217, MATH 226, MATH 253, MATH 254

- See the UBC Course Descriptions

Student Resources

Science Advising	Health and Wellbeing	Centre for Accessibility
Academic Concession	Academic Integrity	Counselling Services
Math Learning Center	Registration Issues	Standing Deferred Exams

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the UBC Senate website.