

MATH 307 Applied Linear Algebra

Course Outline 2021W1

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, differential equations, data fitting, principal component analysis, PageRank, 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
- Create and analyze mathematical models of real-world phenomenon

Instructors

<i>Name</i>	<i>Office</i>	<i>Email</i>
Patrick Walls (he/him)	MATH 229E	pwalls@math.ubc.ca
Chunyi Gai (she/her)	PIMS 4118	cgai@math.ubc.ca
David Stenlund (he/him)	LSK 126E	stenlund@math.ubc.ca

Lectures

<i>Section</i>	<i>Instructor</i>	<i>Time</i>	<i>Location</i>
101	Patrick Walls	MWF 1–2pm	HENN 200
102	Chunyi Gai	MWF 3–4pm	LSK 200
103	David Stenlund	TTh 8–9:30am	MATX 1100

- Section 101 lectures to be recorded and available to view on [Panopto](#)

Canvas and Piazza

Announcements, assignments, grades, lecture recordings 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

<i>Hours</i>	<i>Topics</i>
10	Linear equations. Gaussian elimination, LU decomposition, condition number. Applications: interpolation, finite difference method.
8	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, PageRank.
6	Discrete Fourier transform. Complex vector spaces, discrete Fourier transform, sinusoids, frequency and phase, fast Fourier transform. Applications: digital signal processing.
34	

Assessments

Online Homework	$5 \times 2\%$ each = 10%
Python Assignments	$4 \times 2.5\%$ each = 10%
Midterm Exams	$2 \times 20\%$ each = 40%
Final Exam	40%

- Online homework via Canvas Quizzes including multiple choice and numeric questions
- Midterm exams scheduled during lecture time

Textbooks

MATH 307 Applied Linear Algebra	UBC Math Instructors
Linear Algebra with Applications	Keith Nicolson
Scientific Computing	Michael Heath
Mathematical Python	Patrick Walls

Important Dates

Wednesday September 8	First day of class
Thursday September 30	National Day for Truth and Reconciliation (UBC closed)
Monday October 11	Thanksgiving (UBC closed)
November 10–12	Midterm break (no lectures)
Thursday November 11	Remembrance Day (UBC closed)
Tuesday December 7	Last day of class
December 11–22	Final exam period

- See the [UBC Academic Calendar 2021/2022](#)

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 Schedule](#)

Student Resources

Science Advising	Health and Wellbeing	Centre for Accessibility
Academic Concession	Academic Integrity	Counselling Services

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](#).

Questions?

Will lectures be recorded?

Lectures for Section 101 are recorded and available to view on [Panopto](#). We encourage you to attend and participate in your lecture section but if you feel ill or otherwise not able to attend please view the recordings online. All sections cover the same material and have similar exams.

Where can I ask questions and get help?

The best place to ask questions outside of lectures is on Piazza. TAs are available to answer questions and we encourage students to provide answers as well. Please also visit your instructors office hours.

I won't be on campus at the beginning of the semester. Can I still take MATH 307 online until I arrive in person?

We recognize that some students will arrive in Vancouver after the first day of class. Students may still view lecture videos online, study course notes, do practice problems and participate on Piazza. However all exams are in person therefore all MATH 307 students must be on campus before October 13 to write Midterm Exam 1. If you are not able to be on campus before October 13, then we advise you not to register for MATH 307 2021W1.