MATH 131/223: Honours Linear Algebra

Fall 2026

Instructor:	Kasia Jankiewicz (she/her)	**Time:**	MWF 10:00 - 10:50
Email:	through Canvas	**Place:**	BUCH A102
Office:	Math 216	**Canvas:**	link
Office hours:	M 3-4 & W 11-12		

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1 Acknowledgement

UBC's Point Grey Campus is located on the ancestral and unceded territory of the xʷməθkʷəyəm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site. Learn more about Musqueam here.

2 Course description

This linear algebra course is faster and more abstract than MATH 152 and MATH 221. We will focus on mathematical thinking with an emphasis on definitions and writing rigorous proofs. We will cover topics such as vector spaces, linear transformations, matrices, determinants, eigenvalues, eigenvectors, diagonalization, inner product spaces, orthogonality, the Gram-Schmidt process, the spectral theorem.

3 References and resources

- Linear Algebra Done Right by Axler - proof based and accessible, covers most of what we will discuss, but with a few exceptions.

- Linear Algebra by Friedberg, Insel, and Spence (no need for the newest edition, older editions can be found online) - covers a lot in depth, more than we will discuss.
- Interactive Linear Algebra (UBC Edition) by Margalit, Rabinoff, and Williams - used in Math 221, less focus on rigorous proofs, but great for building intuition and for computational practice
- Math Learning Centre - a space for undergraduate students to study math together, with friendly support from tutors. Located in Math 102.

4 Learning tools

Canvas

All the course information and assignment will be posted on Canvas. Please check it for announcements.

Piazza

All questions about the mathematical content of the course or the course logistics should be posted on Piazza for everyone's benefit. You are welcome to answer questions of your peers. Active participation on Piazza might result in a grade bump at the end of the term.

iClicker

We will use iClicker in class for anonymous polling. The answers are not graded. The iClicker code for this class is RIGD.

5 Homework

Homework problem sets will be assigned on Wednesdays and due the following Tuesday at 11:59pm. The homework submission is through Canvas. Typesetting your solutions in LaTeX is strongly encouraged. A list of LaTeX resources is available on Canvas.
You are encouraged to work together on problem sets. However, your solutions must be written up independently. The use of generative AI is permitted, but needs to be acknowledged in your written solution of each problem where you use it.
Late homework is accepted with a 10% penalty per each 24 hour period that it is late, for up to 5 days. To accommodate unforeseeable circumstances, two lowest homework scores are automatically dropped.

6 Quizzes

Short quizzes will be posted on Canvas after some classes. They will be short answer or multiple choice questions, and will be due before the next class. Unlimited attempts are allowed. The quizzes help you gauge your understanding of the course material and whether you should seek extra assistance.

7 Exams

There will be three equal weight exams:

- Wednesday, October 14
- Monday, November 16
- during the finals week - date TBA

Each exam will be of similar length and cover part of the material. Exams are worth 70% total. If your lower midterm score falls below your final exam score, it is dropped and the remaining midterm and final are worth 35% each; otherwise all three count equally. There will be no make-up exams. All exams will be closed-book.

8 Grade breakdown

Homework: 25%
Quizzes: 5%
Exams: 70%

The letter grades will be assigned at the end of the term using the standard UBC grading scale. The grades might be curved up, if the instructor decides it is appropriate. They will not be curved down.

9 Course topic schedule

Subject to change. The topics covered in class will be posted on Canvas each week.

Week 1: Introduction, Vector spaces
Week 2: Subspaces and span, Linear independence
Week 3: Gaussian elimination, Bases, Dimension
Week 4: Linear transformations, Matrix representation of $F^k \to F^n$, Kernel and image
Week 5: The rank nullity theorem, Isomorphisms, Inverses
Week 6: Matrix representation of $V \to W$, Change of basis
Week 7: Determinants
Week 8: Eigenvalues, Eigenvectors, Eigenspaces, Characteristic polynomial
Week 9: Diagonalizable operators, Inner products, Norms
Week 10: Orthogonal and orthonormal sets
Week 11: Gram-Schmidt procedure, Orthogonal complements
Week 12: Functionals on inner product spaces, Adjoint operators
Week 13: The spectral theorem
Week 14: Singular Value Decomposition

10 Learning goals

- Solve problems that require new ideas.

- Write simple proofs.
- Work with real and complex numbers, abstract vector spaces.
- Compute bases and understand the dimension of a vector space.
- Add, multiply, invert matrices and compute their determinants.
- Relate linear transformations to matrices.
- Recognize eigenvalue problems and compute the eigenvalues and corresponding eigenvectors.
- Compute in inner product spaces, find orthogonal complements and orthogonal projections.
- Describe and compute the characteristic polynomial.

11 Accessibility

Students requiring support due to physical or learning disabilities may apply for accommodations through the Centre for Accessibility (CfA). Students must register with the CfA before requesting accommodation.

12 UBC resources to support student success

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 here.

13 UBC statement on respectful environment

The University expects courses to be respectful environments. This expectation extends to discussion forums associated with the course, where posts must be respectful and civil. The University's Statement on Respectful Environment highlights two central principles, *freedom of expression* and *promotion of free inquiry*, and an underlying requirement of *a vigorous commitment to recognition of and respect for the freedoms of others, and concern for the well-being of every member of the university community.*