

**Land Acknowledgement**

We respectfully acknowledge the Syilx Okanagan Nation and their peoples, in whose traditional, ancestral, unceded territory UBC Okanagan is situated.

MATH 221: MATRIX ALGEBRA

Faculty: Irving K. Barber Faculty of Science

Department: Computer Science, Mathematics, Physics, and Statistics

Instructor(s): Donovan Hare

Instructor(s) Email: donovan.hare@ubc.ca

Duration: Term 2 Winter 2022

Delivery Modality: In-Person

Course Location: LIB 305

Course Days: Tue/Thu

Class Hours: 2:00 PM - 3:20 PM

Office hours: Tuesdays and Thursdays from 1:00 PM to 1:50 PM.

Other Instructional Staff

1	L2A:	Name of TA:	Neha Bansal	Wednesday	9:00am – 9:50am	SCI 234
2	L2B:	Name of TA:	Neha Bansal	Monday	9:00am – 9:50am	ASC 165
3	L2C:	Name of TA:	Yiwen Chen	Friday	12:00pm – 12:50pm	SCI 234
4	L2D:	Name of TA:	Yiwen Chen	Wednesday	1:00pm – 1:50pm	SCI 234
5	L2E:	Name of TA:	Yiwen Chen	Wednesday	8:00am – 8:50am	SCI 234
6	L2F:	Name of TA:	Yiwen Chen	Monday	8:00am – 8:50am	ASC 165

Course Description

Systems of linear equations, operations on matrices, determinants, eigenvalues and eigenvectors, diagonalization of symmetric matrices. [3-1-0]

Prerequisite: One of MATH 100, MATH 116.

Corequisite: One of MATH 101, MATH 103, MATH 142.

Course Format

Each lecture will in-person/on campus. The slides of each lecture will be provided on Canvas in a PDF file. Each student is required to be enrolled in a tutorial. The tutorials are for extra support. All evaluation will be through the use of online assignments and in-person, on campus exams.

Learning Outcomes

Upon successful completion of this course, students will be able to...

demonstrate problem-solving and logic skills for problems from matrix algebra.

Assessments of Learning

Assignments	10%
Midterm 1	20%
Midterm 2	20%
Final Exam	50%

Final grades will be based on the evaluations listed above and the final grade will be assigned according to the standardized grading system outlined in the UBC Okanagan Calendar.

All evaluation is from scores obtained from in-person examinations and online assignments whose dates are given below. The two midterms will each be 50 minutes long, and the cumulative final exam will be 2.5 hours long. Students will use the WeBWork system for the online assignments (access through Canvas). There will be an assignment of problems each week, due on Friday at 5 pm of the following week. The first assignment will be due Jan. 20. No late assignments are accepted. The total number of marks from assignments awarded will be divided by the total possible in order to determine the percentage from the assignments. All exams are in person/on campus. The midterm exams will start at 2:00 pm in LIB 305.

<u>Item</u>	<u>Weighting</u>	<u>Description</u>
Assignments	10%	Fridays at 5 pm on: Jan. 20, 27, Feb. 3, 10, 17, Mar. 3, 10, 17, 24, 31 Apr. 7, 14
Midterm 1	20%	Tuesday, Feb. 14
Midterm 2	20%	Tuesday, Mar. 21
Final Exam	50%	date to be determined

Course schedule

Week	Topics	Sections
1	Systems of Linear Equations Row Reduction and Echelon Forms	Ch. 1, Sections 1 – 2
2	Vector Equations The Matrix Equation $A\mathbf{x} = \mathbf{b}$ Solution Sets of Linear Systems	Ch. 1, Sections 3 – 5
3	Applications of Linear Systems Linear Independence Introduction to Linear Transformations	Ch. 1, Sections 6 – 8
4	The Matrix of a Linear Transformation Matrix Operations	Ch. 1, Section 9 Ch. 2, Section 1
5	The Inverse of a Matrix Characterizations of Invertible Matrices	Ch. 2, Sections 2 – 3
6	Subspaces of \mathbb{R}^n	Ch. 2, Section 8

8	Dimension and Rank Introduction to Determinants Properties of Determinants	Ch. 2, Section 9 Ch. 3, Sections 1 – 2
9	Eigenvalues and Eigenvectors The Characteristic Equation Diagonalization	Ch. 5, Sections 1 – 3
10-11	Discrete Dynamical Systems Inner Product, Length and Orthogonality Orthogonal Sets	Ch. 5, Section 6 Ch. 6, Sections 1 – 2
12	Orthogonal Projections The Gram-Schmidt Process	Ch. 6, Sections 3 – 4
13	Least-Squares Problems Machine Learning and Linear Models	Ch. 6, Sections 5 – 6

Learning Materials

TEXTBOOK:

Linear Algebra and Its Applications 6th Edition by David Lay, Judi McDonald and Steven Lay

Course Website:

Other course materials are available at <https://canvas.ubc.ca>.

Other Course Policies**Academic Integrity**

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. **For example, incidences of plagiarism or cheating usually result in a failing grade or mark of zero on the assignment or in the course.** Careful records are kept to monitor and prevent recidivism.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar at:

<http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,54,111,0>

Final Examinations

You can find the [Senate-approved term and examination dates here](#). Except in the case of examination clashes and hardships (three or more formal examinations scheduled within a 27-hour period) or unforeseen events, students will be permitted to apply for out-of-time final examinations only if they are representing the University, the province, or the country in a competition or performance; serving in the Canadian military; observing a religious rite; working to support themselves or their family; or caring for a family member. Unforeseen events include (but may not be limited to) the following: ill health or other personal challenges that arise during a term and changes in the requirements of an ongoing job.

Further information on Academic Concession can be found under Policies and Regulation in the Okanagan Academic Calendar <http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,48,0,0>

Grading Practices

Faculties, departments, and schools reserve the right to scale grades in order to maintain equity among sections and conformity to University, faculty, department, or school norms. Students should therefore note that an unofficial grade given by an instructor might be changed by the faculty, department, or school. Grades are not official until they appear on a student's academic record.

<http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,41,90,1014>

Resources to Support Student Success:

UBC Okanagan Disability Resource Centre

The DRC facilitates disability-related accommodations and programming initiatives to remove barriers for students with disabilities and ongoing medical conditions. If you require academic accommodations to achieve the objectives of a course please contact the DRC at:

UNC 215 250.807.8053

Email: drc.questions@ubc.ca

Web: www.students.ok.ubc.ca/drc

UBC Okanagan Equity and Inclusion Office

Through leadership, vision, and collaborative action, the Equity & Inclusion Office (EIO) develops action strategies in support of efforts to embed equity and inclusion in the daily operations across the campus. The EIO provides education and training from cultivating respectful, inclusive spaces and communities to understanding unconscious/implicit bias and its operation within in campus environments. UBC Policy 3

prohibits discrimination and harassment on the basis of BC's Human Rights Code. If you require assistance related to an issue of equity, educational programs, discrimination or harassment please contact the EIO.

UNC 325H 250.807.9291

Email: equity.ubco@ubc.ca

Web: www.equity.ok.ubc.ca

Student Wellness

At UBC Okanagan health services to students are provided by Student Wellness. Nurses, physicians and counsellors provide health care and counselling related to physical health, emotional/mental health and sexual/reproductive health concerns. As well, health promotion, education and research activities are provided to the campus community. If you require assistance with your health, please contact Student Wellness for more information or to book an appointment.

UNC 337 250.807.9270

Email: healthwellness.okanagan@ubc.ca

Web: www.students.ok.ubc.ca/health-wellness

Office of the Ombudperson

The Office of the Ombudsperson for Students is an independent, confidential and impartial resource to ensure students are treated fairly. The Ombuds Office helps students navigate campus-related fairness concerns. They work with UBC community members individually and at the systemic level to ensure students are treated fairly and can learn, work and live in a fair, equitable and respectful environment. Ombuds helps students gain clarity on UBC policies and procedures, explore options, identify next steps, recommend resources, plan strategies and receive objective feedback to promote constructive problem solving. If you require assistance, please feel free to reach out for more information or to arrange an appointment.

UNC 328 250.807.9818

Email: ombuds.office.ok@ubc.ca

Web: www.ombudsoffice.ubc.ca

Student Learning Hub

The Student Learning Hub is your go-to resource for free math, science, writing, and language learning support. The Hub welcomes undergraduate students from all disciplines and year levels to access a range of supports that include **tutoring in math, sciences, languages, and writing, as well as help with study skills and learning strategies**. Students are encouraged to visit often and early to build the skills, strategies and behaviors that are essential to being a confident and independent learner. For more information, please visit the Hub's website.

LIB 237 250.807.8491

Email: learning.hub@ubc.ca

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Web: www.students.ok.ubc.ca/slh

The Global Engagement Office

The Global Engagement Office provides advising and resources to assist International students in navigating immigration, health insurance, and settlement matters, as well as opportunities for intercultural learning, and resources for Go Global experiences available to all UBC Okanagan students, and more.

Come and see us – we are here to help! You may also contact geo.ubco@ubc.ca

Safewalk

*Don't want to walk alone at night? Not too sure how to get somewhere on campus? Call Safewalk at **250-807-8076**.*

For more information, see: www.security.ok.ubc.ca