Course Syllabus

Course title: Matrix Algebra for Engineers
Class section: MATH **-** 251 **-** X03
Term: 2026W
Course credits: 3
Total hours: 75
Delivery method: In-Person

Territorial acknowledgment

Camosun College respectfully acknowledges that our campuses are situated on the territories of the Lək̓ʷəŋən (Songhees and Kosapsum) and W̱SÁNEĆ peoples. We honour their knowledge and welcome to all students who seek education here.

Instructor details

Name: George Ballinger
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Office hours: Mon 12:30-1:20pm and Wed-Fri 10:30-11:20am in E260

Course description

Course Description:
This course in matrix algebra includes solving linear systems, performing matrix operations, performing computations with complex numbers, finding determinants, performing vector operations in

2-space and 3-space, vector spaces, linear dependence and independence, orthogonality, eigenvalues and eigenvectors, and linear transformations. Applications to engineering are provided throughout the course.

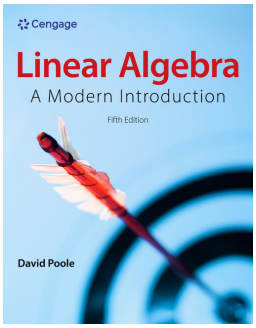
Prerequisites:
Co-requisites:
Pre or Co-requisites:
Equivalencies:

Learning outcomes

Upon successful completion of this course, the learner will be able to

1. Perform vector operations and use vectors to write parametric equations for lines and planes
2. Use the dot product to find projections and to find angles between vectors
3. Solve linear systems using row reduction
4. Perform matrix operations and give examples of matrices with specific properties
5. Determine if a transformation is a linear transformation and find the standard matrix for a linear transformation
6. Find the inverse of an invertible matrix and use it to solve matrix equations
7. Construct and use elementary matrices to perform row operations
8. Find LU decompositions
9. Determine whether a set of vectors is a basis and be able to prove simple facts about linear independence and spans. Find the components of a vector with respect to a given basis
10. Determine whether a set of vectors in n-dimensional Euclidean space forms a subspace
11. Use the Gram-Schmidt process to construct an orthonormal basis
12. Find the matrix of a linear transformation in a different basis
13. Find matrices for general linear transformations. Determine the kernels and ranges of general linear transformations
14. Find determinants by cofactor expansion and use Cramer's rule to solve linear systems of equations
15. Use the cross product to find areas, volumes, and perpendicular vectors
16. Find eigenvalues and eigenvectors of matrices and linear transformations and construct diagonal matrices for the transformations
17. Perform operations with complex numbers including finding the n'th roots of complex numbers

Course reading materials



Title: Linear Algebra: A Modern Introduction
Authors: David Poole
Publisher: Cengage Learning
Publication Date: 2026
Edition: 5th
Required/Optional: Required

Course materials

Sharp EL-531 (or EL-510R) scientific calculator.

Course schedule

Tests

Three term tests are tentatively scheduled for the following dates:

Test 1 on Friday, February 6 on Sec 1.1-1.3, Expl. Cross Product and 2.1-2.4

Test 2 on Friday, March 6 on Sec 3.1-3.6

Test 3 on Thursday, April 2 on Sec App. C, 4.1-4.4, Expl. Determinants and 5.1-5.2

A comprehensive, 3-hour final exam will take place during the final exam period of April 13-21.

Chapters and Sections

1. Vectors

1.1 The Geometry and Algebra of Vectors

1.2 Length and Angle: The Dot Product

1.3 Lines and Planes

Exploration: The Cross Product

2. Systems of Linear Equations

2.1 Introduction to Systems of Linear Equations

2.2 Direct Methods for Solving Linear Systems

2.3 Spanning Sets and Linear Independence

2.4 Applications

3. Matrices

3.1 Matrix Operations

3.2 Matrix Algebra

3.3 The Inverse of a Matrix

3.4 The LU Factorization

3.5 Subspaces, Basis, Dimension, and Rank

3.6 Introduction to Linear Transformations

Appendix C – Complex Numbers

4. Eigenvalues and Eigenvectors

4.1 Introduction to Eigenvalues and Eigenvectors

4.2 Determinants

Exploration: Geometric Applications of Determinants

4.3 Eigenvalues and Eigenvectors of n×n Matrices

4.4 Similarity and Diagonalization

5. Orthogonality

5.1 Orthogonality in Rn

5.2 Orthogonal Complements and Orthogonal Projections

5.3 The Gram-Schmidt Process and the QR Factorization

5.4 Orthogonal Diagonalization of Symmetric Matrices

7. Distance and Approximation

7.3 Least Squares Approximation

Assessment and evaluation

Type	Description	Weight
Assignment	Assignments (best 6 of 7)	15
Assignment	MATLAB Assignment	3
Exams (Midterms and finals)	Test 1	14
Exams (Midterms and finals)	Test 2	14
Exams (Midterms and finals)	Test 3	14
Exams (Midterms and finals)	Final Exam	40

Course guidelines and expectations

Homework: There will be periodic assignments (7 all together) to be completed and handed in for marking. They must be completed on the worksheets provided (not on blank paper), copies of which will be handed out in class. While collaboration with your classmates is permitted, you must submit your *own* work and ensure you don't let collaboration turn into plagiarism. You may not post assignment questions to, or copy solutions from, "cheat" websites such as Chegg and ChatGPT.

Due dates for assignments will be posted on the course webpage, and assignments are due by the end of class on the due dates. If you are unable to hand in a hard copy of your assignment solutions, you may scan and email me a single PDF file (not JPG images) of your assignment so long as it prints legibly and arrives by the deadline. Solutions will be posted soon after assignments are collected. As such, *late assignments will not be accepted under any circumstances.* To further accommodate

situations where a student is unable to submit his or her assignment on time (e.g. due to illness), the lowest assignment mark will be dropped when computing the assignment average.

MATLAB: MATLAB is a software program that is very useful for performing linear algebra calculations involving vectors and matrices. GNU Octave, octave.org, is an open-source alternative (clone) of MATLAB that can interpret and execute MATLAB commands. Octave Online, octave-online.net, is a free web UI for GNU Octave. In addition to the 7 homework assignments, you will complete one MATLAB assignment using Octave Online covering various topics in the course. The due date will be posted on the course webpage.

Test Absences: If you miss a test for a legitimate reason such as illness, accident or family affliction, you should notify me (by email, phone/voicemail, or in person) *as soon as possible* and *before* the test, and be prepared to provide supporting documentation upon your return. There will be no "make-up" tests, but instead, in the event of an excused absence, the mark from your final exam, or relevant subset thereof, will replace your test mark.

School or departmental information

Math Lab (Ewing 224): This drop-in centre is freely available for your use to work on math homework and to seek help from the instructional assistant. Hours are posted on the door or online at camosun.ca/services/academic-supports/help-centres/math-help.

Academic Integrity: The Department of Mathematics and Statistics has prepared a handout called *Student Guidelines for Academic Integrity* to help you interpret college policies involving student conduct, academic dishonesty, plagiarism, etc. It is your responsibility to become familiar with the contents of the document and the college policies it references.

Calculator Policy: As per department policy, the only calculator permitted for use on tests and the final exam is the Sharp EL-531 (or EL-510R) scientific calculator. No other calculator or any other electronic device including cell phones, smartwatches, etc. is allowed.

Academic integrity acknowledgement

When you registered you acknowledged the following:

> As a Camosun student, I understand that I am responsible for upholding the standards outlined in the Academic Integrity Policy, and commit to completing my coursework honestly, without cheating, plagiarizing, or getting unauthorized assistance.
> I will also follow my instructors' guidelines regarding the use of artificial intelligence (AI) tools in my academic work.
> I acknowledge that the Academic Integrity Policy explains the consequences of academic misconduct. These may include loss of marks, failing grades, or, in serious or repeated cases, suspension. If I violate the policy, my instructor may require me to complete a short online course on academic integrity.
> Camosun College offers resources to help me understand and uphold academic integrity. The Academic Integrity Online Guide provides real-life examples, tips for avoiding misconduct, and strategies for completing work with integrity.
> If I'm ever unsure about what constitutes plagiarism, cheating, or other forms of academic misconduct, I will ask my instructor for clarification.

It is your responsibility to uphold these academic integrity standards.

College policies and student responsibilities

The college expects students to be responsible, respectful members of the college community. Responsible students meet expectations about attendance, assignments, deadlines, and appointments. They become familiar with academic policies and regulations, and their rights and responsibilities.

College polices are available online at the Policies and Directives page. Academic regulations are detailed on the Academic Policies and Procedures for Students page.

Policies all students should be familiar with include the Academic Integrity Policy. This policy expects students to be honest and ethical in all aspects of their studies. It defines plagiarism, cheating, and other forms of academic dishonesty. Infractions of this policy can result in loss of marks or a failing grade. To learn more about plagiarism and cheating, including the use of artificial intelligence, review the Academic Integrity Guide.

The Academic Accommodations for Students with Disabilities Policy defines how Camosun provides appropriate and reasonable academic accommodations. The Centre for Accessible Learning (CAL) coordinates academic accommodations. Students requiring academic accommodations should request and arrange accommodations through CAL. Contact CAL at least one month before classes start to ensure accommodations can be put in place in time. Accommodations for quizzes, tests, and exams must follow CAL's booking procedures and deadlines. More information is available on the CAL website.

Students must meet the grading and promotion standards to progress academically. More information is available in the Grading Policy.

The college uses two grading systems. A course will either use the standard letter grade system (A+ to F) or a competency-based approach with grades of complete, completed with distinction or not completed. Visit the Grades/GPA page for more information.

Students must meet the college's academic progress standards to continue their studies. A student is not meeting the standards of progress when a GPA falls below 2.0. The college offers academic supports for students at risk of not progressing. The Academic Progress Policy provides more details.

If you have a concern about a grade, contact your instructor as soon as possible. The process to request a review of grades is outlined in the Grade Review and Appeals Policy.

The Course Withdrawals Policy outlines the college's requirements for withdrawing from a course. Consult the current schedule of deadlines for fees, course drop dates, and tuition refunds.

If students experience a serious health or personal issue, they may be eligible for a medical or compassionate withdrawal. The Medical/Compassionate Withdrawal Request Form outlines what is required.

The Acceptable Technology Use policy ensures the use of the college network and computers contribute to a safe learning environment. This policy also applies to the use of personal devices with the college network.

Students experiencing sexual violence can get support from the Office of Student Support. This Office of Student support is a safe and private place to discuss supports and options. More information is available on the sexual violence support and education site. Students can email oss@camosun.ca or phone 250-370-3046 or 250-370-3841.

The Student Misconduct Policy outlines the college's expectations of conduct. Students should behave to contribute to a positive, supportive, and safe learning environment.

The Ombudsperson provides an impartial, independent service to help students understand college policies.

Services for students

Successful students seek help and access college services. These services are recommended to make the most of your time at college.

Services for Academic Success

- Career Lab: Connects students with work-integrated learning experiences, including co-op placements and career fairs.
- English, Math, and Science Help Centres: Get one-on-one help with homework.
- Library: Get help with research, borrow materials, and access e-journals and e-books. Libraries at both campuses provide computers, individual and group study spaces.
- Makerspace: A place to innovate, collaborate, and learn new skills and technology in a fun, dynamic, inclusive environment.
- Writing Centre & Learning Skills: Get assistance with academic writing or meet with a learning skills specialist for help with time management, preparing for exams, and study skills.

Enrolment, Registration, and Records

- Academic Advising: Talk to an academic advisor for help with program planning.
- Financial Aid and Awards: Learn about student loans, bursaries, awards, and scholarships.
- Registration: Get information about Camosun systems, including myCamosun, and college policies and procedures.
- Student Records: Get verification of enrolment to access funding, request a transcript, or credential.

Wellness and Cultural Supports

- Counselling: It's normal to feel overwhelmed or unsure of how to deal with life's challenges. The college's team of professional counsellors are available to support you to stay healthy. Counselling is free and available on both campuses. If you need urgent support after-hours, contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.
- Centre for Indigenous Education and Community Connections: Provides cultural and academic supports for Indigenous students.
- Camosun International: Provides cultural and academic supports for international students.
- Fitness and Recreation: Free fitness centres are located at both campuses.

For a complete list of college services, see the Student Services page.

Changes to this syllabus

Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change the course content or schedule. When changes are necessary the instructor will give clear and timely notice.