

MATH 2010 LINEAR ALGEBRA

Credit Points 10

Legacy Code 200027

Coordinator Shatha Aziz ([https://directory.westernsydney.edu.au/search/name/Shatha Aziz/](https://directory.westernsydney.edu.au/search/name/Shatha%20Aziz/))

Description The objective of this subject is to present the main fundamentals of linear algebra and includes such topics as solving systems of linear equations, matrix algebra, determinants, eigenvalues and eigenvectors, Euclidean vector spaces, general vector spaces, inner product spaces and linear transformations.

School Computer, Data & Math Sciences

Discipline Mathematics

Student Contribution Band HECS Band 1 10cp

Check your fees via the Fees (https://www.westernsydney.edu.au/currentstudents/current_students/fees/) page.

Level Undergraduate Level 2 subject

Assumed Knowledge

Solving systems of equations with two and three unknowns, basic matrix operations, including multiplication.

Learning Outcomes

On successful completion of this subject, students should be able to:

1. Implement Gaussian elimination to solve systems of linear equations.
2. Use and apply vector operations such as the dot product, and concepts such as orthogonality, span, and linear dependence of vectors.
3. Use matrix operations, including matrix multiplication, matrix inversion and LU factorisation.
4. Use and apply concepts related to vector spaces, subspaces and the connection between dimension, linear independence, spanning sets, and basis.
5. Use and apply concepts related to basic linear transformations of the plane, general linear transformations, and the basic notion of kernel.
6. Evaluate determinants using a range of techniques.
7. Be able to compute the eigenvalues and eigenvectors of a linear transformation.
8. Use the concept of orthogonality and orthogonal matrices, including orthogonal projections and the Gram-Schmidt process.

Subject Content

Linear Equations: Introduction to Linear Systems, Gaussian Elimination, applications.

Matrices: matrix operations and rules of arithmetic, elementary matrices, inverses and their calculation, applications.

Determinants: Determinant function, properties, cofactor expansion, Cramer's rule.

Eigenvalues and Eigenvectors: eigenvalues and eigenvectors, diagonalization, applications.

Euclidean Vector Spaces: Vectors in 2 and 3 space, geometric and algebraic interpretation, norms, dot product, cross product, lines and planes. Generalization to Euclidean n-Space, linear transformations between Euclidean vector spaces.

General Vector Spaces: Real vector spaces, subspaces, and concepts of span, linear independence, basis, and dimension.

Inner Product Spaces: Inner product, Cauchy-Schwarz inequality, angle between vectors, orthogonality, Gram-Schmidt Process, least squares, singular value decomposition.

General Linear Transformations: matrix and linear transformations, kernel and range, matrix of linear transformations.

Assessment

The following table summarises the standard assessment tasks for this subject. Please note this is a guide only. Assessment tasks are regularly updated, where there is a difference your Learning Guide takes precedence.

Type	Length	Percent	Threshold	Individual/ Group Task	Mandatory
Quiz	Weekly, 30 minutes each; 1% each, with the best 10 marks counted	10	N	Individual	Y
Participatio	Weekly Problem Sets, 3 hours in length	10	N	Group/ Individual	Y
Numerical Problem Solving	50-minute closed book test	15	N	Individual	Y
Numerical Problem Solving	50-minute closed book test	15	N	Individual	Y
Final Exam	Three-hour closed book examination	50	N	Individual	Y

Prescribed Texts

- Larson, R., Elementary Linear Algebra, 8th Edition Brooks/ Cole, Cengage Learning, 2017 ISBN-10: 1305658000 ISBN-13: 9781305658004

Teaching Periods

Autumn (2025)

Campbelltown

On-site

Subject Contact Shatha Aziz ([https://directory.westernsydney.edu.au/search/name/Shatha Aziz/](https://directory.westernsydney.edu.au/search/name/Shatha%20Aziz/))

View timetable (https://classregistration.westernsydney.edu.au/odd/timetable/?subject_code=MATH2010_25-AUT_CA_1#subjects)

Penrith (Kingswood)

On-site

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View timetable (https://classregistration.westernsydney.edu.au/odd/timetable/?subject_code=MATH2010_25-AUT_KW_1#subjects)

Parramatta - Victoria Rd

On-site

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