Math 204 Elementary Linear Algebra Spring 2025

Instructor	Amites Sarkar
Text	Linear Algebra and its Applications (5^{th} or 6^{th} ed.) Lay, Lay and McDonald
Calculator	TI-85 or higher

Course content

This course is an introduction to linear algebra. We will start by describing an algorithm for reducing a matrix to echelon form. This algorithm will enable us to solve many different types of problem in algebra and geometry, including those on the existence and uniqueness of a system of linear equations. It will also shed light on the more theoretical aspects of the course. We will then move on to the key concepts of linear independence and the span of a set of vectors, before introducing linear transformations.

The middle section of the course concerns *square* matrices, matrices with the same number of rows and columns. We will discuss invertibility and determinants in detail.

Next comes an introduction to abstract vector spaces. Here the material we have previously covered is put into a general context. This is where the intuition you have developed so far really pays dividends. Abstraction is one of the key features of mathematics, no more so than in linear algebra.

We will finish with a section on eigenvalues, eigenvectors and diagonalization.

Exams

Midterm 1	Friday 25 April
Midterm 2	Friday 23 May
Final	Monday 9 June 1–3 pm

Grading

The midterms are each worth 20%, and the final is worth 30%. In addition, there will be six 30 minute quizzes on 11, 18 April and 2, 9, 16, 30 May, which are worth 5% each. If you feel too ill to take an exam, don't take it, but bring a doctor's certificate to me when you feel better and I will make arrangements.

Office hours

My office hours are 9–9:50 on Mondays, Tuesdays and Thursdays, and 11–11:50 Fridays, in 216 Bond Hall. My e-mail is amites.sarkar@wwu.edu.

Course Objectives

The successful student will demonstrate:

1. Ability to translate between systems of linear equations, vector equations, and matrix equations, and perform elementary row operations to reduce the matrix to standard forms.

2. Understanding of linear combination and span.

3. Determination of the existence and uniqueness of a system of linear equations in terms of the columns and rows of its matrix.

4. Ability to represent the solution set of a system of linear equations in parametric vector form and understand the geometry of the solution set.

5. Understanding of linear dependence and independence of sets of vectors.

6. Understanding of linear transformations defined algebraically and geometrically, and ability to find the standard matrix of a linear transformation.

7. Ability to make computations with partitioned matrices.

8. Understanding and computation of the inverse and transpose of a matrix.

9. Understanding and computation of the determinant of a matrix and its connection with invertibility.

10. Understanding of the notions of a vector space and its subspaces and knowledge of their defining properties.

11. Knowledge of the definitions of a basis for and the dimension of a vector space, and ability to compute coordinates in terms of a given basis and to find the change of basis transformation between two given bases.

12. Ability to find bases for the row, column, and null spaces of a matrix, find their dimensions, and knowledge of the Rank Theorem.

13. Ability to find eigenvalues and eigenvectors of a matrix.

14. Knowledge of all aspects of the Invertible Matrix Theorem.

15. Knowledge of the Diagonalization Theorem and ability to diagonalize a matrix.

Relation to Overall Program Goals

Among other things, this course will (i) enhance your problem-solving skills; (ii) help you recognize that a problem can have different useful representations (graphical, numerical, or symbolic); (iii) increase your appreciation of the role of mathematics in the sciences and the real world; (iv) inform you about the historical context of the area of mathematics studied.