MATH 2250, Linear Algebra, Summer 2025

Instructor: Michael Raney
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Office: 310 St. Mary's Hall
Textbook: Lay, Lay and McDonald, *Linear Algebra and its Applications*, 6th edition, Pearson

Course overview: This course presents the basic theory and methods of finite dimensional vector spaces and linear transformations on them. Topics include: matrices and systems of linear equations; vector spaces, bases, and dimension; linear transformations, kernel, image, matrix representation, basis change, and rank; scalar products and orthogonality; determinants, inverse matrices; eigenvalues, eigenvectors, diagonalization of symmetric matrices, positive definite matrices, spectral theorem for Hermitian matrices; linear discrete dynamical systems via matrix iteration.

Tentative course schedule (sections covered):

- Mon, 6/2: 1.1 (systems of linear equations), 1.2 (row reduction and echelon forms), 1.3 (vector equations)
- Tue, 6/3: 1.4 (matrix equation $A\mathbf{x} = \mathbf{b}$), 1.5 (solution sets of linear systems), 1.7 (linear transformations)
- Wed, 6/4: 1.8 (introduction to linear transformations), 1.9 (matrix of a linear transformation)
- Thu, 6/5: 2.1 (matrix operations), 2.2 (matrix inverses), 2.3 (characterizations of invertible matrices)
- Mon, 6/9: 2.5 (LU-factorization), 2.8 (subspaces of $\mathbb{R}^n$)
- Tue, 6/10: 2.9 (dimension and rank), 3.1 (introduction to determinants)
- Wed, 6/11: 3.2 (properties of determinants), 3.3 (volume and linear transformations)
- Thu, 6/12: 4.1 (vector spaces and subspaces), 4.2 (null spaces, column spaces, row spaces, and linear transformations)
- Mon, 6/16: 4.3 (linear independence and bases in vector spaces), 4.4 (coordinate systems), 4.5 (dimension of a vector space)
- Tue, 6/17: Review for Midterm Exam
- Wed, 6/18: Midterm Exam
- Thu, 6/19: Juneteenth (no class)
- Mon, 6/23: 5.1 (eigenvalues and eigenvectors), 5.2 (characteristic equation)
- Tue, 6/24: 5.3 (diagonalization), 5.4 (eigenvectors and linear transformations)
- Wed, 6/25: 5.6 (discrete dynamical systems), 5.9 (Markov chains)
- Thu, 6/26: 6.1 (inner products and orthogonality), 6.2 (orthogonal sets), 6.3 (orthogonal projections)
- Mon, 6/30: 6.4 (Gram-Schmidt process), 6.7 (inner product spaces)
- Tue, 7/1: 7.1 (diagonalization of symmetric matrices), 7.2 (quadratic forms)
- Wed, 7/2: Review for Final Exam
- Thu, 7/3: Final Exam

Homework: A homework assignment will be given over each section after it is covered in lecture. The assignments will be collected and graded. You are allowed and even encouraged to discuss the assignments with each other, but the work that you hand in must be your own.

Exams: We will have a midterm exam on Wednesday, June 18 and a final exam on Thursday, July 3. Each exam will last 2.5 hours. The midterm covers Chapters 1 through 4 of our textbook, and the final exam covers Chapters 5 through 7. On each exam you are allowed to bring a one-sided $8.5'' \times 11''$ sheet of notes.

Grading scheme: Your homework average constitutes 30% of your overall course average. The midterm exam is worth 35%, and the final exam is worth 35%.