Exam 2 Outline

The exam will cover all or parts of sections 3.5, 3.6 and 4.1-4.3. As before, you’ll be given a choice of problems over a mix of calculation and theory. Here are the topics, along the theorems you might be asked to prove:

3.5 Basis, dimension. Using Gaussian elimination to find a bases for subspaces of the form \( \text{span}(v_1, \ldots, v_k) \) and for \( \text{null}(A) \). The nullity of a matrix. Characterizations of rank: \( \text{rank}(A) = \dim(\text{col}(A)) = \dim(\text{row}(A)) \). The rank theorem. The Fundamental Theorem of Invertible Matrices. The rank and invertibility of \( A^T \bar{A} \), where \( A \) is \( m \times n \). Coordinates with respect to a basis. Theorems 3.23-3.26, 3.27 (parts), 3.28 and 3.29.

3.6 Linear transformations. The domain, codomain, image and range of a linear transformation \( T_A : \mathbb{R}^n \rightarrow \mathbb{R}^m \) associated with an \( m \times n \) matrix \( A \). The standard matrix \([T]\) of a linear transformation \( T \). Compositions of linear transformations. Invertible linear transformations. Theorem 3.31.

4.1, 4.3 Eigenvalues, eigenvectors and eigenspaces. The characteristic polynomial. Finding a basis for an eigenspace.