Chapter 1 - Vectors

- Draw vectors in $\mathbb{R}^2$ and $\mathbb{R}^3$ as well as graphically represent a sum, difference, or scalar multiple of a vector.
- Compute sums, differences, scalar multiples, length, and dot products of vectors algebraically.
- Two definitions of dot product and be able to find the angle between two vectors.
- Properties of the dot product (Thm 1.2) and length (Thm 1.3).
- Definition of orthogonal, both geometrically and in terms of dot product.
- Compute the projection of a vector onto another vector and be able to represent the projection geometrically.
- Equations of lines (vector and parametric) and planes (vector and general).

Chapter 2 - Systems of Linear Equations

- Use Gauss-Jordan elimination (both by hand and with a calculator) to solve a system of linear equations.
- Find the span of a set of vectors.
- Determine if a set of vectors is linearly independent.

Chapter 3 - Matrices

- Find the sum, difference, or product of two matrices. Find the scalar multiple, power or transpose of a matrix.
- Definition of symmetric and skew-symmetric.
- Properties of matrix addition and scalar multiplication (Thm 3.2), matrix multiplication (Thm 3.3), and the transpose (Thm 3.4).
- Definition of the inverse of a matrix.
- Properties of the inverse (Thm 3.9)
- Fundamental Theorem of Invertible Matrices (Thm 3.12, 3.27, 4.17)
- Find the inverse of a 2×2 matrix using special formula or the inverse of an $n \times n$ matrix using the Gauss-Jordan method.
- Definition of subspace of $\mathbb{R}^n$, determine if a set is a subspace of $\mathbb{R}^n$.

- Definition of basis, dimension, rank and nullity. For a set of vectors, find a basis and its dimension. Find the rank and nullity of a matrix.
- The Rank Theorem (Them 3.26).
- Definition of linear transformation (from $\mathbb{R}^n$ to $\mathbb{R}^m$) and matrix transformation.
- Every linear transformation $T : \mathbb{R}^n \to \mathbb{R}^m$ is a matrix transformation and vice versa. (Thm 3.30, 3.31) Find the standard matrix of a linear transformation.
- Find the composition and inverse of a linear transformation using the standard matrix of the transformation.

Chapter 4 - Eigenvalues and Eigenvectors

- Definition of eigenvalue, eigenvector, eigenspace.
- Compute the determinant of and $n \times n$ matrix.
- Properties of the determinant (Thm 4.3,4.7,4.8,4.9,4.10).
- Find eigenvalues, eigenvectors, and eigenspaces of an $n \times n$ matrix.
- Definition of algebraic and geometric multiplicity of an eigenvalue.
- Definition of similarity, properties of similarity (Thm 4.21, 4.22)
- Definition of diagonalizable.
- Determine if a matrix is diagonalizable and if it is, find an invertible matrix P and a diagonal matrix D so that $P^{-1}AP = D$.

Chapter 5 - Orthogonality

- Definition of orthogonal set, orthogonal basis, orthonormal set and orthonormal basis.
- Definition of orthogonal matrix, properties of orthogonal matrices (Thm 5.6,5.7,5.8).
- Definition of orthogonal complement.
- Compute the orthogonal complement of a subspace W of $\mathbb{R}^n$.
- Find the orthogonal decomposition of a vector with respect to a given subspace.

Chapter 6 - Vector Spaces

- Definition of vector space (10 axioms). Determine if a set with two given operations is a vector space.
- Properties of vector spaces (Thm 6.1)
- Definition of subspace. Determine if a set is a subspace of a given vector space.
- Find the span of a set of vectors.
- Determine if a set of vectors is linearly independent.
- Definition of basis and dimension of a vector space.
- Properties of basis/span/L-I of vector space (Thm 6.10).
- Definition of linear transformation on a vector space.
- Properties of linear transformation (Thm 6.14).
- Definition of composition and inverses of linear transformations.
- Definition of kernel and range of a linear transformation.
- Determine if a linear transformation is one-to-one.
- Determine if a linear transformation is onto.