Topics for Exam 2

1. **Matrices**

    1.1 The set, $\mathbb{M}(m, n)$, of $m \times n$ matrices as a linear space

    1.2 Matrix Algebra

    1.3 Null space, column space and row space of a matrix

    1.4 Elementary matrices and invertibility

    1.5 Singular and nonsingular matrices

2. **Linear Transformations**

    2.1 Definition of linearity

    2.2 Matrix representation

    2.3 Null space and image

    2.4 Compositions

    2.5 Invertible linear transformation

    2.6 Orthogonal transformations

        2.6.1 Orthogonal matrices

        2.6.2 Determinant, cross–product and triple–scalar product

        2.6.3 Areas and volumes

        2.6.4 Area and volume preserving transformations

        2.6.5 Orientation

        2.6.6 Orientation preserving transformations

        2.6.7 Orthogonal, orientation preserving transformations in $\mathbf{R}^2$ and $\mathbf{R}^3$.

3. **The Eigenvalue Problem**

    3.1 Eigenvalues, eigenvectors and eigenspaces

    3.2 The eigenvalue problem

    3.3 Invariant subspaces

    3.4 Orthogonal transformations in $\mathbf{R}^2$ and $\mathbf{R}^3$.

Relevant sections in text: 2.1 and 2.2.

Relevant chapters in the online class notes: Chapters 3, 4 and 5

Important Concepts: linear transformation, null space, image, elementary matrices, invertibility, eigenvalue, eigenvector and eigenspace

Important Skills: know how to tell whether a given matrix is invertible or not; know how to compute inverses of invertible matrices; know how to determine whether a given function is linear or not; know how to obtain matrix representations of linear transformations; know how to compute determinants of 2×2 and 3×3 matrices; know how to find eigenvalues, eigenvectors and eigenspaces of linear transformations.