

Know the following definitions and/or techniques:

1. length and dot product of vectors in R^n ,
2. addition and multiplication of matrices, as well as scalar multiplication of matrices,
3. Gaussian elimination, free variables, bound variables,
4. transpose, inverse and determinant of a matrix, augmented matrix,
5. column, row, and null space of a matrix, rank of a matrix,
6. vector space, linear independent set of vectors, span of a set of vectors, basis, coordinates of a vector with respect to a given basis, change of basis matrix,
7. if A is an $m \times n$ matrix know the relationships between the four subspaces,

$$\text{NS}(A), \text{NS}(A^T), \text{RS}(A), \text{CS}(A),$$

8. Gram-Schmidt procedure for constructing an orthonormal basis,
9. least squares solution and its relation to the 'normal' equations,
10. eigenvalues and eigenvectors of a matrix, characteristic polynomial and characteristic equation for a matrix,
11. diagonalization of a matrix, theorems that guarantee a matrix is similar to a diagonal matrix,
12. an $n \times n$ real symmetric matrix has an orthonormal set of eigenvectors, which form a basis of R^n ,
13. quadratic forms,
14. linear transformations and their matrix representations,
15. kernel and range of a linear transformation, and their relation to the null space and column space, respectively, of a matrix representation of the transformation.
16. definition of an inner product

You need to be able to do the following:

1. be able to solve a system of equations,
2. determine whether something is or is not a subspace, or whether something is or is not a linear transformation,
3. solve least squares problems,
4. compute eigenvalues and eigenvectors, diagonalize a matrix,
5. compute the following $\lim_{n \rightarrow \infty} A^n \vec{x}$ and $\lim_{n \rightarrow \infty} A^n$,
6. find change of basis matrices, find matrix representations of linear transformations,
7. compute the orthogonal projection of a vector onto a subspace,
8. construct linear transformations that reflect \mathbb{R}^3 through a plane or rotate it about an axis.