

Linear Algebra - Check your knowledge

- Are you comfortable with the following matrix manipulations?
 - Addition, subtraction, and multiplication of matrices, including multiplication of a matrix by a vector;
 - Multiplication of a matrix by a scalar;
 - Transposition of matrices.
- Do you know the definition of linear independence of a set of vectors?
- Do you know what a vector space is? Do you know how to decide whether a subset of a given vector space is a subspace (i.e. is itself a vector space)?
- Do you know what the span of a set of vectors is?
- Do you know what a basis is? Given a set of vectors, do you know how to decide whether the vectors in the set form a basis of a given vector space?
- Do you know how to find the dimension of a vector space? In particular, do you know how to find the dimensions of the column space, of the row space, and of the null space of a matrix?
- How is the rank of a matrix defined?
- Do you know what the rank theorem says?
- What is a linear system of equations?
- Do you know how to decide whether a linear system of equations is consistent?
- If a system is consistent, how do you know whether it has just one or an infinite number of solutions?
- What does it mean for a linear system of equations to be homogeneous? What is the form of the general solution to a non-homogeneous linear system of equations?
- Do you know how to find the inverse of a square matrix?
- Do you know how to expand a determinant with respect to one of its columns or one of its rows?
- Do you know what happens to a determinant if you multiply one row by a constant? What if you multiply 2 rows by the same constant? What if instead of rows, you multiply some of the columns by a constant?

- What are the typical manipulations needed to calculate a determinant?
- Is the inverse of a product of matrices equal to the product of their inverses?
- How does one calculate the inverse of a 2 by 2 matrix?
- What does it mean for a matrix to be singular?
- What is the general method for finding the eigenvalues of a matrix? Is there a “shortcut” if the matrix is 2 by 2? If so, what is it?
- How does one find an eigenvector of a matrix A ?
- What are the algebraic and geometric multiplicities of an eigenvalue? Are they always the same?
- What is an eigenspace? How does one find its dimension?
- What is a generalized eigenvector?
- Sometimes it is possible to find an eigenvector just by looking at a matrix. When does this occur? Why?
- Under what conditions on a matrix A are the eigenvalues of A equal to the diagonal entries of A ?