Linear algebra - Midterm review topics

Matrix algebra

- Understand how to multiply, add matrices, and how to find / use inverses.

Linear equations

- Be able to solve systems of linear equations $A\mathbf{x} = \mathbf{b}$ using row reduction.
- Once you row reduce $[A|\mathbf{b}] \sim [H|\mathbf{c}]$, understand how to read off from $H, \mathbf{c}$ whether the system $A\mathbf{x} = \mathbf{b}$ is consistent, and if it is, whether it has a unique solution, or infinitely many solutions.
- Understand that the set of solutions of a homogeneous system form a subspace. Be able to find a basis for the space of solutions of the homogeneous system $A\mathbf{x} = \mathbf{0}$ (this is the same as the nullspace of A).

Linear transformations

- Know what a linear transformation is.
- Be able to find the standard matrix representation of a linear transformation $T : \mathbf{R}^n \to \mathbf{R}^m$ given either a geometric description of what T does, or given the values of T on a few vectors in $\mathbf{R}^n$.
- Understand that matrix multiplication corresponds to composition of linear transformations, and inverse matrices correspond to inverse transformations.

Subspaces and bases

- Know the definitions of "subspace", "linear independence", "span", "column space/row space/nullspace of a matrix", "range/kernel of a linear transformation", "basis", "dimension of a subspace", "rank of a matrix or linear transformation".
- Know how to find a basis for a subspace. The subspace could for instance be given as the span of some vectors (e.g. the column space of a matrix), or as the solution space of a homogeneous system.
- In particular know how you can find bases for the column space, nullspace, and the row space of a matrix A, once you row reduce A.