Applied Linear Algebra — Outline for Exam 2

Sections 1.8–1.9, 2.1–2.3, 2.8–2.9, 3.1–3.3

Main ideas

A. Working with linear transformations

B. Working with matrices

C. Subspaces of $\mathbb{R}^n$, bases, and dimension

D. Determinants

Skills you should have

1. Be able investigate and work with linear transformations

- Be able to find the standard matrix for a linear transformation
- Be able to determine if a given vector is in the range of linear transformation
- Be able to determine if a linear transformation is one-to-one or onto (or both)

2. Be able to perform matrix operations

- Be able to add, subtract, and multiply matrices (when defined)
- Be able to multiply a matrix by a scalar and find the transpose of a matrix
- Be able to use row reduction to find the inverse of a matrix, if it exists
- Know how to use A^{-1} to solve $A\mathbf{x} = \mathbf{b}$

3. Be able to write down the definition of the following terms: a subspace of $\mathbb{R}^n$, a basis for a subspace, the dimension of a subspace, the null space of a matrix, and the column space of a matrix

4. Be able to determine if a set of vectors is a basis for a subspace

5. Be able to find a basis for subspaces (and their dimension) in the following situations:

- Be able to find a basis for the null space of a matrix
- Be able to find a basis for the column space of a matrix
- Be able to find a basis for the span of a set of vectors (see the in-class handout #06, problem #3)

6. Be able to compute determinants (using cofactor expansion or row-reduction to triangular form)

7. Be able to apply properties of the determinant

- Two key properties are $\det(AB) = (\det A)(\det B)$ and $\det(A^{-1}) = (\det A)^{-1} = \frac{1}{\det A}$ (when $\det A \neq 0$)
- Know that A is invertible if and only if $\det A \neq 0$
- Know how determinants of 2×2 matrices relate to areas of parallelograms

How to study

I. Review core topics

II. Work *lots* of problems all of the way through—focus on WeBWorK problems, Homework problems, and Handout problems.

- WeBWork #6–10 and first two problems in #11, Homework #4–5, Handout #5–6.

III. Practice doing several problems in a short amount of time (by timing yourself)

IV. Come talk with me if you have any questions