MATH2270: Midterm 1 Study Guide

The following is an overview of the material that will be covered on the first exam.

§1.1 Systems of Linear Equations

- Solving linear systems of equations by row reducing an augmented matrix.
- Determining the existence and uniqueness of solutions to a linear system.

§1.2 Row Reduction and Echelon Forms

- Row reduction of matrices to echelon or reduced echelon form.
- Identifying pivot positions in a matrix.
- Identifying basic and free variables in a linear system and giving a parametric description of the solution set.

§1.3 Vector Equations

- Be comfortable with performing basic vetor operations of addition and scalar multiplication.
- Writing a linear system of equations as a vector equation and vise versa.
- The definition of the span of a set of vectors in $\mathbb{R}^n$ and a geometric understanding of the span.
- The definition of a linear combination of vectors.

§1.4 The Matrix Equation $A\vec{x} = \vec{b}$

- Solving matrix equations.
- Translating between matrix equations, linear systems of equations, and vector equations.

§1.5 Solution Sets of Linear Systems

- Solutions to homogeneous and nonhomogeneous systems of equations.
- Describing the solution set of a linear system in parametric vector form.

§1.7 Linear Independence

- Definition of linearly independent/dependent sets.
- Determining whether a given set of vectors is linearly independent or not.
- A geometric description of linearly independent sets.

§1.8 Introduction to Linear Transformations

- Definition of a linear transformation.
- Determining whether a given function is a linear transformation.

§1.9 The Matrix of a Linear Transformation

- Finding the matrix of a linear transformation.

- 1-1 and onto linear transformations (and characterizations thereof).

Connecting the Dots: I want to emphasize the connections and relationships between the concepts covered thus far. This will be a recurring theme in this course, and it's *way* too early to get behind on it. You should be able to fluently translate between systems of linear equations, vector equations, matrix equations, augmented matrices. For example, you should be able to translate statements about pivot positions of an augmented matrix into statements about:

- solution sets of (non)homogeneous vector equations
- consistency and uniqueness for the associated linear system
- linear (in)dependence of the columns of the coefficient matrix
- the span of the columns of the matrix
- etc.