Instructions: This homework is an individual effort. Answer each question. This is due on **Monday, May 18th**. **Show all work to receive full credit.**

1 Chapter 1

1. Find the angle between the pairs of vectors.

   a. $\mathbf{v} = \begin{bmatrix} 1 \\ \sqrt{3} \end{bmatrix}$ and $\mathbf{u} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$

   b. $\mathbf{v} = \begin{bmatrix} 2 \\ 2 \\ -1 \end{bmatrix}$ and $\mathbf{u} = \begin{bmatrix} 2 \\ -1 \\ 2 \end{bmatrix}$

2. Let $\mathbf{v} = (1, 1, ..., 1)$ be in $\mathbb{R}^3$. Find a unit vector in the same direction. Then find a unit vector perpendicular to $\mathbf{v}$.

3. Pick any numbers x, y, z such that $x + y + z = 0$. Let $\mathbf{v}$ be the vector (x, y, z) and $\mathbf{w}$ be the vector (z, x, y). Find the angle between the two vectors. Find $\cos\theta$ for the two vectors. Then take different x, y, z and do the same. Explain the phenomenon.

4. Find a linear combination $x_1\mathbf{w}_1 + x_2\mathbf{w}_2 + x_3\mathbf{w}_3 = 0$ with $x_1 = 1$,

$$\mathbf{w}_1 = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \mathbf{w}_2 = \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix}, \mathbf{w}_3 = \begin{bmatrix} 7 \\ 8 \\ 9 \end{bmatrix}$$

2 Chapter 2

1. Make the following system upper triangular with only 2 row operations:

$$2x + 3y + z = 8 \quad (1)$$

$$4x + 7y + 5z = 20 \quad (2)$$

$$-2y + 2z = 0. \quad (3)$$

2. Use elimination to solve the following system:

$$A\mathbf{x} = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 6 \end{bmatrix}.$$

3. Choose the numbers a, b, c, d such that the augmented matrix has:

   a. No solution

   b. Infinite solutions

   c. one solution

$$[A\ \mathbf{b}] = \begin{bmatrix} 1 & 2 & 3 & a \\ 0 & 4 & 5 & b \\ 0 & 0 & d & c \end{bmatrix}$$

4. Find A^2, A^3, and A^4.

$$A = \begin{bmatrix} 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 2 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

5. Write two 3 x 3 matrices with nonzero entries. Call them A and B. Find A^{-1}, B^{-1}, AB, BA, and $(AB)^{-1}$.