In all homework problems, it is not sufficient to show only the answers. *You must show your work.* These exercises are based on Chapter Three.I and Three.II from the text.

1. Use these matrices for this exercise.

$$A = \begin{bmatrix} 1 & 3 & -1 \\ 0 & 1 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 2 \\ -1 & 0 \end{bmatrix} \quad C = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 1 \\ 2 & -2 & 3 \end{bmatrix} \quad D = \begin{bmatrix} 0 & 0 \\ 4 & 0 \end{bmatrix}$$

   (a) Find $-3A$, $2A + 3C$ and $2B - 5D$, or state "not defined."

   (b) There are 16 possible ways to multiply two of these matrices together, including multiplying a matrix by itself. Which of the possible matrix products are not defined?

   (c) Compute AB and AC, or state "not defined."

2. Let $A = \begin{bmatrix} 2 & 3 \\ -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 9 \\ -3 & k \end{bmatrix}$. What value of k, if any, will make $AB = BA$?

3. Let $A = \begin{bmatrix} 3 & -6 \\ -1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 1 \\ 3 & 4 \end{bmatrix}$, and $C = \begin{bmatrix} -3 & -5 \\ 2 & 1 \end{bmatrix}$. Verify that $AB = AC$, even though $B \neq C$.

4. Show how to use matrix multiplication to bring this matrix to reduced row echelon form.

$$\begin{bmatrix} 2 & 1 & 4 & -1 \\ 1 & 3 & 10 & 8 \\ -1 & 2 & 3 & 7 \end{bmatrix}$$

5. Find the inverse or show the inverse does not exist for each of the following matrices.

   (a) $A = \begin{bmatrix} 1 & 0 & -2 \\ -3 & 1 & 4 \\ 2 & -3 & 4 \end{bmatrix}$ (b) $B = \begin{bmatrix} 1 & 2 & 1 \\ -4 & -7 & 3 \\ -2 & -6 & 4 \end{bmatrix}$

6. For each space find the matrix changing a vector representation with respect to B to one with respect to D.

   (a) $V = \mathbb{R}^3$, $B = \mathcal{E}_3$, $D = \langle \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ -1 \end{pmatrix} \rangle$

   (b) $V = \mathbb{R}^3$, $B = \langle \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ -1 \end{pmatrix} \rangle$, $D = \mathcal{E}_3$

   (c) $V = \mathcal{P}_2$, $B = \langle x^2, x^2 + x, x^2 + x + 1 \rangle$, $D = \langle 2, -x, x^2 \rangle$