1. Let $A = \begin{bmatrix} 5 & 3 \\ 3 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -3 & 2 \\ 1 & 4 \end{bmatrix}$, and $C = \begin{bmatrix} 1 & 8 \\ -1 & 4 \end{bmatrix}$.

   (a) Use row reduction to find A^{-1}.

   (b) Use your previous answer to solve the matrix equation $XA + B = C$.

2. Let $A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & -1 & -2 \\ -1 & 2 & 1 \end{bmatrix}$.

(a) Compute the REF of A.

(b) What is the determinant of A?

(c) Find a basis for the column space of A.

(d) Find a basis for the row space of A.

(e) What is the nullity of A?

3. Let $\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3, \mathbf{v}_4$ be vectors in $\mathbb{R}^3$. Answer the following questions, and include a one sentence explanation of your response.

   (a) Can you tell if they are linearly independent?

   (b) Can you tell if they span $\mathbb{R}^3$?

   (c) What can you say about the rank of the matrix $V = \begin{bmatrix} | & | & | & | \\ \mathbf{v}_1 & \mathbf{v}_2 & \mathbf{v}_3 & \mathbf{v}_4 \\ | & | & | & | \end{bmatrix}$?

   (d) What can you say about the nullity of V?

4. Consider the basis $\mathcal{B} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ for $\mathbb{R}^2$.

(a) What is the transition matrix from $\mathcal{B}$ to the standard basis $\mathcal{E}$? Use it to write $\mathbf{v}_{\mathcal{B}} = \begin{pmatrix} -8 \\ 3 \end{pmatrix}$ in standard coordinates.

(b) What is the transition matrix from $\mathcal{E}$ to $\mathcal{B}$? Use it to write $\mathbf{w} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ in $\mathcal{B}$-coordinates.

(c) Write the matrix $A = \begin{bmatrix} 1 & 3 \\ -1 & 4 \end{bmatrix}$ relative to the basis $\mathcal{B}$.