1. Let \( A = \begin{bmatrix} 5 & -6 & 1 \\ 2 & -4 & 7 \\ 1 & 0 & 2 \\ -2 & 3 & 4 \end{bmatrix} \) and \( B = \begin{bmatrix} 10 & -20 & 30 & -10 \\ 5 & 10 & 20 & 30 \\ 15 & -10 & 10 & 10 \end{bmatrix} \). Find each of the following. If a particular item doesn’t exist, explain why not!

1A) The number of entries of \( BA \).

1B) The number of entries of \( A + A + A \).

1C) The entry in the second row, third column of \( AB \).

1D) The entry in the second row, third column of \( A^T + B \).

2. What is the inverse of \( \begin{bmatrix} w & x \\ y & z \end{bmatrix} \), and what condition(s) must \( w, x, y \) and \( z \) satisfy in order for the inverse to exist?

3. Suppose \( A \) and \( B \) are both \( n \times n \) matrices. Find a formula for the inverse of \( (AB)^T \) in terms of \( A^{-1} \) and \( B^{-1} \). Show all your steps.

4. Suppose the inverse of \( A \) is \( \begin{bmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \\ 10 & 0 & 20 \end{bmatrix} \).

4A) Find all solutions of \( Ax = \begin{bmatrix} 1 \\ 0 \\ 4 \end{bmatrix} \).

4B) Do the columns of \( A \) span \( \mathbb{R}^3 \)? Explain.