1. (6 pts.) \[ \begin{align*}
3x_2 - 7x_4 + x_5 &= 0 \\
-2x_1 - 4x_3 &= 20\pi \\
3x_4 - 11x_5 &= -6
\end{align*} \]

(a) Write the system of linear equations above as an equivalent vector equation.

(b) Write the system of linear equations above in the form \( Ax = b \).

(c) In what sense are the equations in parts (a) and (b) equivalent to the system of linear equations at the top of the page? (Hint: "Row Equivalent" is not the answer.)

2. (4 pts.) Using complete sentences and appropriate notation, define each of the items below.

(a) Linear Combination

(b) \( \text{Span}\{\mathbf{v}_1, \ldots, \mathbf{v}_m\} \)
3. (2 pts.) Suppose \( u, v, w, \) and \( x \) are elements of \( \mathbb{R}^n \), and we have \( 4(x - v) = 3w + 7u \). Write \( x \) as a linear combination of the remaining three vectors.

4. (2 pts.) Suppose \( A \) is a \( 7 \times 4 \) matrix with columns \( a_1, a_2, a_3, \) and \( a_4 \). Can you find a vector \( b \) in \( \mathbb{R}^7 \) so that the vector equation \( x_1a_1 + x_2a_2 + x_3a_3 + x_4a_4 = b \) is inconsistent? Explain your answer.

5. (4 pts.) (a) Compute the matrix-vector product \( Ax \), where

\[
A = \begin{bmatrix}
3 & -6 & 0 & 0 \\
-6 & 12 & -3 & 12 \\
1 & -2 & 1 & -4 \\
\end{bmatrix}
\quad \text{and} \quad
x = \begin{bmatrix}
-2 \\
3 \\
-1 \\
2 \\
\end{bmatrix}.
\]

\[
Ax =
\]

(b) It is known that \( A \sim B \), where the third row of \( B \) is a zero row. Do the columns of \( A \) span \( \mathbb{R}^3 \)? Explain your answer.

6. (2 pts.) Using arbitrary scalars and elements of \( \mathbb{R}^n \), prove that \( c(v + w) = cv + cw \). Cite the properties of real number addition and multiplication that you use. (You may write the vectors as \( n \)-tuples horizontally.)