1. Find the complete solution to

\[
\begin{bmatrix}
1 & 3 & 1 & 2 \\
2 & 6 & 4 & 8 \\
0 & 0 & 2 & 4
\end{bmatrix}
\begin{bmatrix}
x \\
y \\
z \\
t
\end{bmatrix}
= 
\begin{bmatrix}
-3 \\
-4 \\
2
\end{bmatrix}.
\]

Write the complete solution as \( x = x_p + x_n \).

2. Give an example of a matrix \( A \) for each of the four possibilities for linear equations depending on the rank \( r \). Show that the matrix has the corresponding number of solutions.

3. Find a basis for the column space and nullspace of \( A \). What is the dimension of the nullspace and columnspace? What is the rank of \( A \)?

\[
A = 
\begin{bmatrix}
1 & 1 & 0 \\
1 & 3 & 1 \\
3 & 1 & -1
\end{bmatrix}.
\]

4. Suppose \( u_1, u_2, u_3 \) are linearly independent.

(a) Let \( v_1 = u_2 - u_3, v_2 = u_1 - u_3, \) and \( v_3 = u_1 - u_2 \). Determine whether \( v_1, v_2, v_3 \) are linearly independent.

(b) Let \( v_1 = u_2 + u_3, v_2 = u_1 + u_3, \) and \( v_3 = u_1 + u_2 \). Determine whether \( v_1, v_2, v_3 \) are linearly independent.