1. Let 
\[
A = \begin{bmatrix}
1 & -2 & 2 & 1 & 4 & -1 & 3 \\
-1 & 2 & -1 & 2 & -2 & 5 & -2 \\
2 & -4 & 7 & 11 & 14 & 11 & 8 \\
-1 & 2 & 0 & 5 & 0 & 10 & -2 \\
2 & -4 & 5 & 5 & 10 & 5 & 4
\end{bmatrix}
\]

a) What are the rank and nullity of \( A \)?
b) Find a basis for \( \text{Row}(A) \).
c) Find a basis for \( \text{N}(A) \).
d) Find a basis for \( \text{Col}(A) \) consisting of columns of \( A \).
e) Write each of the columns not in the basis you gave for \( \text{Col}(A) \) as a linear combination of the basis elements.
f) Write \( y = \begin{bmatrix} -2 \\ 3 \\ -1 \\ 4 \\ -3 \end{bmatrix} \) as a linear combination of the basis elements of \( \text{Col}(A) \). (Hint: set the non-pivot variables equal to 0.)
g) Give the general solution to \( Ax = y \), with \( y \) from part f).
h) Write \( \text{Col}(A) \) as the nullspace of another matrix.

2. Let \( p_1 = 2 + x + 2x^2 \), \( p_2 = 3 + 2x + x^2 \), and \( p_3 = 1 + x \).
a) Show that \( p_1, p_2, p_3 \) form a basis for \( P_2 \).
b) Find the coordinates of \( p = 1 - x + 2x^2 \) relative to \( S = \{ p_1, p_2, p_3 \} \).