1. Solve the system of equations represented by the augmented matrix

\[
\begin{bmatrix}
1 & -4 & 0 & -1 & 2 & 1 & 2 \\
0 & 0 & 1 & 0 & -2 & -3 & -1 & -3 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{bmatrix}
\]

You do NOT need to show your work. You can write some things if you like, but you should be able to do this problem mostly in your head with very little writing.

2. Use Gaussian elimination to find the reduced row echelon form of the following matrix, and then solve the system of equations represented by the augmented matrix

\[
\begin{bmatrix}
-4 & -2 & -10 & 2 \\
-3 & -4 & -5 & 1 \\
-3 & -2 & -7 & 1 \\
\end{bmatrix}
\]

3. Use Gaussian elimination to solve the following system of equations:

\[
\begin{align*}
4x_1 - 2x_2 - 6x_3 - 7x_4 + x_5 &= 4 \\
-x_1 + x_2 + 7x_3 + x_4 - 4x_5 &= 1 \\
3x_1 + x_3 + 5x_4 + x_5 &= -3 \\
-3x_1 - x_2 - x_3 - 4x_4 - x_5 &= 3.
\end{align*}
\]

4. Suppose you are working in the vector space \( P_2 \), which is the space of polynomials in the variable \( y \) with degree at most 2 (with its usual operations). Let

\[
\begin{align*}
p_1(y) &= -4 - 2y \\
p_2(y) &= 3 + 3y^2 \\
p_3(y) &= 2y - 3y^2 \\
p_4(y) &= 13 + 8y - 3y^2 \\
w(y) &= -2y + y^2
\end{align*}
\]

Use Gaussian elimination to solve the following system of equations for \( x_1, x_2, x_3, \) and \( x_4 \):

\[
x_1p_1(y) + x_2p_2(y) + x_3p_3(y) + x_4p_4(y) = w(y).
\]

**Hint:** First choose a basis for this vector space to move the problem out of this vector space and into \( \mathbb{R}^m \) for some \( m \). Also, you don’t need to prove that the basis for \( P_2 \) that you choose actually is a basis for \( P_2 \).