1. Consider the following three vectors in $\mathbb{R}^3$:

\[
v_1 = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}, \quad v_2 = \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}, \quad v_3 = \begin{pmatrix} -1 \\ 1 \\ 1 \end{pmatrix}
\]

Are the vectors $\{v_1, v_2, v_3\}$ linearly independent or linearly dependent?

2. (a) Find the eigenvalues and corresponding eigenvectors of the following matrix:

\[
A = \begin{pmatrix} 5 & 8 & 16 \\ 4 & 1 & 8 \\ -4 & -4 & -11 \end{pmatrix}
\]

(b) Use your answer from above to find three linearly independent solutions of the system of differential equations given by

\[
x_1' = 5x_1 + 8x_2 + 16x_3 \\
x_2' = 4x_1 + x_2 + 8x_3 \\
x_3' = -4x_1 - 4x_2 - 11x_3
\]