Problem 1: Solve the system of linear equations or else show that there is no solution
\[
\begin{align*}
2x_1 + x_2 + x_3 &= 0 \\
3x_1 + x_2 + x_3 &= 1 \\
-x_1 + x_2 + 2x_3 &= 2
\end{align*}
\]

Problem 2: Determine whether the vectors are linearly independent. If they are linearly dependent, find a relation among them.
(a) \(x^{(1)} = (1,2,-2)^T, x^{(2)} = (3,1,0)^T, x^{(3)} = (2,-1,1)^T, x^{(4)} = (4,3,-2)^T\)
(b) \(x^{(1)} = (1,2,-1,0)^T, x^{(2)} = (2,3,1,-1)^T, x^{(3)} = (-1,0,2,2)^T, x^{(4)} = (3,-1,1,3)^T\)

Problem 3: Find eigenvalues and eigenvectors of the given matrix
(a) \[
\begin{pmatrix}
1 & i \\
-i & 1
\end{pmatrix}
\]
(b) 
\[
\begin{pmatrix}
3 & 2 & 4 \\
2 & 0 & 2 \\
4 & 2 & 3
\end{pmatrix}
\]

Problem 4: Find the general solution of the differential equation and describe the behavior of the solutions as \(t \to \infty\)
(a) \(x' = \begin{pmatrix} 1 & 1 \\ 4 & -2 \end{pmatrix} x\)
(b) \(x' = \begin{pmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & 1 & 1 \end{pmatrix} x\)

Problem 5: Solve the initial value problem
(a) \(x' = \begin{pmatrix} 5 & -1 \\ 3 & 1 \end{pmatrix} x, \quad x(0) = \begin{pmatrix} 2 \\ -1 \end{pmatrix}\)
(b) \(x' = \begin{pmatrix} 1 & 1 & 2 \\ 0 & 2 & 2 \\ -1 & 1 & 3 \end{pmatrix} x, \quad x(0) = \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}\)