1. (20 pts.) Find all solutions to the system of linear equations:

\[
\begin{align*}
2x - y - z &= 2 \\
4x + 3y - 2z &= -1 \\
x + 4y + z &= 4
\end{align*}
\]

2. (20 pts.) Find all solutions to the system of homogeneous linear equations:

\[
\begin{align*}
x - y + 2z &= 0 \\
2x - 2y + 4z &= 0 \\
3x - 3y + 6z &= 0
\end{align*}
\]

3. (20 pts.) Find the determinant of the matrix of Problem 1.

4. (20 pts.) Either find the inverse of the matrix of Problem 1 or show that this matrix has no inverse.

5. (20 pts.) Let the matrix \( A \) be given by,

\[
A = \begin{bmatrix} 1 & 2 \\ 2 & -2 \end{bmatrix}.
\]

Find a number \( k \) such that the matrix \( A - kI \) has no inverse.