Problem 1 (4 points): Are the vectors $(2, -1, -3), (3, 0, -2), (1, 1, -4)$ linearly independent?

Problem 2 (4 points): Is the set $\{x \in \mathbb{R}^4 : (x_1 - x_2)^2 + x_3^4 = 0\}$ a subspace? Justify

Problem 3 (4 points): Solve the system
\[
\begin{align*}
2x_1 + x_2 + 3x_3 + x_4 &= 1 \\
x_2 + 4x_3 + x_4 &= 1 \\
3x_1 + 2x_4 &= 1.
\end{align*}
\]

Problem 4 (5 points): Find an orthonormal basis of the subspace
\[
S = \{x \in \mathbb{R}^4 : x_1 + x_2 + x_3 + x_4 = x_1 - x_2 - 2x_3 + x_4 = x_2 + 3x_3 = 0\}. \text{ What is the dimension on } S?
\]

Problem 5 (4 points): Let
\[
A = \begin{bmatrix}
0 & 2 & -1 \\
1 & 2 & 3 \\
2 & 2 & -1
\end{bmatrix}
\]
Compute $A^{-1}$.

Problem 6 (4 points): Find the eigenvalues and eigenvectors of
\[
A = \begin{bmatrix}
-1 & 1 \\
1 & -2
\end{bmatrix}
\]

Problem 7 (5 points): Find the eigenvalues and eigenvectors of
\[
A = \begin{bmatrix}
-2 & 1 \\
-4 & -2
\end{bmatrix}
\]