3. Find a basis, if any, for the solution space of the homogeneous system and find its dimension.
\[ x + y + z + w = 0 \]
\[ 2x + y - z + w = 0 \]

5. Find a basis, if any, for the solution space of the homogeneous system and find its dimension.
\[ x + 2y - z + 3w = 0 \]
\[ 2x + 2y - z + 2w = 0 \]
\[ x + 3z + 3w = 0 \]

13(2). Find a basis, if any, for the solution space of
\[ AX = \lambda X \] where \( \lambda = -3 \) and \( A = \begin{bmatrix} -4 & -3 \\ 2 & 3 \end{bmatrix} \).

15. Find a basis, if any, for the solution space of
\[ AX = \lambda X \] where \( \lambda = 1 \) and \( A = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & -3 \\ 0 & 1 & 3 \end{bmatrix} \).

17. Find the two real numbers \( \lambda \) such that \( AX = \lambda X \) has a nontrivial solution.
\[ A = \begin{bmatrix} 2 & 3 \\ 2 & -3 \end{bmatrix} \]

19. Find the three real numbers \( \lambda \) such that \( AX = \lambda X \) has a nontrivial solution.
\[ A = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & -1 \\ 1 & 0 & 0 \end{bmatrix} \]

Answers
3. \{[0, -1, 0, 1]^T, [2, -3, 1, 0]^T\}, dimension = 2
5. \{[1, -8/3, -4/3, 1]^T\}, dimension = 1
13. \{[-1, 1]^T\}
15. \{[1, -2, 1]^T\}
17. \( \lambda = 3, -4 \)
19. \( \lambda = 0, 1 \)