Question 1. *(3 marks each)* Determine whether the following statement is true or false. If the statement is false provide a counterexample. If the statement is true provide a proof of the statement.

    a. Consider a system of linear equations with augmented matrix A. If there is a unique solution then A has no row of zeros.

    b. If each equation in a consistent linear system is multiplied through by a constant c, then all solutions to the new system can be obtained by multiplying solutions from the original system by c.

Question 2. *(3 marks)* Find (if possible) conditions on a and b such that the system has no solution, one solution, and infinitely many solutions. Justify.

$$\begin{cases} ax & +y = 1 \\ 2x & +y = b \end{cases}$$

Question 3. *(2 marks)* Consider the following augmented matrix of a consistent linear system.

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 2 & 4 & 6 \end{bmatrix}$$

Find a row which can be added to the augmented matrix to make a new system with four equations which has no solutions. Justify.

Question 4. *(2 marks)* Illustrate **all** relative positions of lines in a inconsistent linear system consisting of three lines.

Question 5. *(3 marks)* Find the solution set of the following equation $4x_1 - x_2 + x_3 + 5x_4 = 1$. Find a particular solution where $x_2 = 1$, $x_4 = -1$.