Matrix theory Assignment 1

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Abstract—This documnet contains the solution to a variable k in a set of linear equations

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1 PROBLEM

For which value of k will the following pair of linear equations have no solution

$$(3\ 1)\mathbf{x} = 1$$
$$(2k\text{-}1\ k\text{-}1)\mathbf{x} = 2k\text{+}1$$

2 SOLUTION

Constructing the augmented matrix

$$\begin{pmatrix} 3 & 1 & 1 \\ 2k-1 & k-1 & 2k+1 \end{pmatrix}$$

Transforming the matrix into row-echelon form

$$\begin{pmatrix} 3 & 1 & 1 \\ 2k-1 & k-1 & 2k+1 \end{pmatrix} \xleftarrow{R2 \leftarrow R1 * \frac{2k-1}{3} - R2}$$

$$\begin{pmatrix} 3 & 1 & 1 \\ 0 & \frac{2k-1}{3} - (k-1) & \frac{2k-1}{3} - (2k+1) \end{pmatrix} \quad (2.0.1)$$

For the linear equations to have no solution,
Rank(Coefficient matrix) ≠ Rank(Augmented matrix)

$$\implies \frac{2k-1}{3} - (k-1) = 0 \quad (2.0.2)$$

and

$$\frac{2k-1}{3} - (2k+1) \neq 0 \quad (2.0.3)$$

Solving the above equations,

$$\implies k = 2 \quad \cap \quad k \neq -1 \quad (2.0.4)$$

From equation 2.0.4, it is clear that k = 2
Hence, for k = 2, the given set of linear equations will have no solution.