

Matrix theory Assignment 1

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

Download all python codes from

<https://github.com/saipranavkr/EE5609/codes>

and latex-tikz codes from

<https://github.com/saipranavkr/EE5609>

1 PROBLEM

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

$$\begin{aligned}(3 \ 1)\mathbf{x} &= 1 \\ (2k-1 \ k-1)\mathbf{x} &= 2k+1\end{aligned}$$

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

$$\begin{pmatrix} 3 & 1 & 1 \\ 2k-1 & k-1 & 2k+1 \end{pmatrix} \xrightarrow{R2 \leftarrow R1 * \frac{2k-1}{3} - R2} \begin{pmatrix} 3 & 1 & 1 \\ 0 & \frac{2k-1}{3} - (k-1) & \frac{2k-1}{3} - (2k+1) \end{pmatrix} \quad (2.0.1)$$

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

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

and

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

Solving the above equations,

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

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.