5.3.6 Matgeo

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Question

If the pair of equations 3x - y + 8 = 0 and 6x - ry + 16 = 0 represents coincident lines, then the value of r is

Solution

Let :

$$\mathbf{r_1} = \begin{bmatrix} 3 & -1 \end{bmatrix} \mathbf{x} = -8 \tag{1}$$

$$\mathbf{r_2} = \begin{bmatrix} 6 & -r \end{bmatrix} \mathbf{x} = -16 \tag{2}$$

For coincident lines:

$$Rank(r_1 \quad r_2) = \begin{bmatrix} 3 & -1 \\ 6 & -r \end{bmatrix} = 1 \tag{3}$$

solving using above equation :

$$R_2 = R_2 - 2R_1 \tag{4}$$

$$= \begin{bmatrix} 3 & -1 \\ 0 & -r+2 \end{bmatrix} = 1 \tag{5}$$

Solution

For the rank of above matrix to be one ,we need :

$$-r + 2 = 0 \tag{6}$$

$$r = 2 \tag{7}$$

Graphical Representation