1.7.11

EE24BTECH11021 - Eshan Ray

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

Solution: Given,

$$3x - y = -8 \tag{1}$$
$$6x - ry = -16 \tag{2}$$

So, the coefficient matrix $A = \begin{pmatrix} 3 & -1 \\ 6 & -r \end{pmatrix}$
and the constant matrix $B = \begin{pmatrix} -8 \\ -16 \end{pmatrix}$

$$\therefore A\mathbf{x} = B \tag{3}$$
$$\begin{pmatrix} 3 & -1 \\ 6 & -r \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -8 \\ -16 \end{pmatrix} \tag{4}$$
$$so,\ [A \mid B] = \begin{pmatrix} 3 & -1 \mid & -8 \\ 6 & -r \mid & -16 \end{pmatrix} \tag{5}$$

Performing row operations: $R_2 - 2R_1 \longrightarrow R_2$

$$\begin{pmatrix} 3 & -1 \mid & -8 \\ 6-(2)(3) & -r+(2)(1) \mid & -16+(2)(8) \end{pmatrix} = \begin{pmatrix} 3 & -1 \mid & -8 \\ 0 & -r+2 \mid & 0 \end{pmatrix} \tag{6}$$

For two lines to be coincident rank of matrix $[A \mid B]$ must be = 1

$$\therefore -r + 2 = 0 \tag{7}$$
$$\implies r = 2 \tag{8}$$

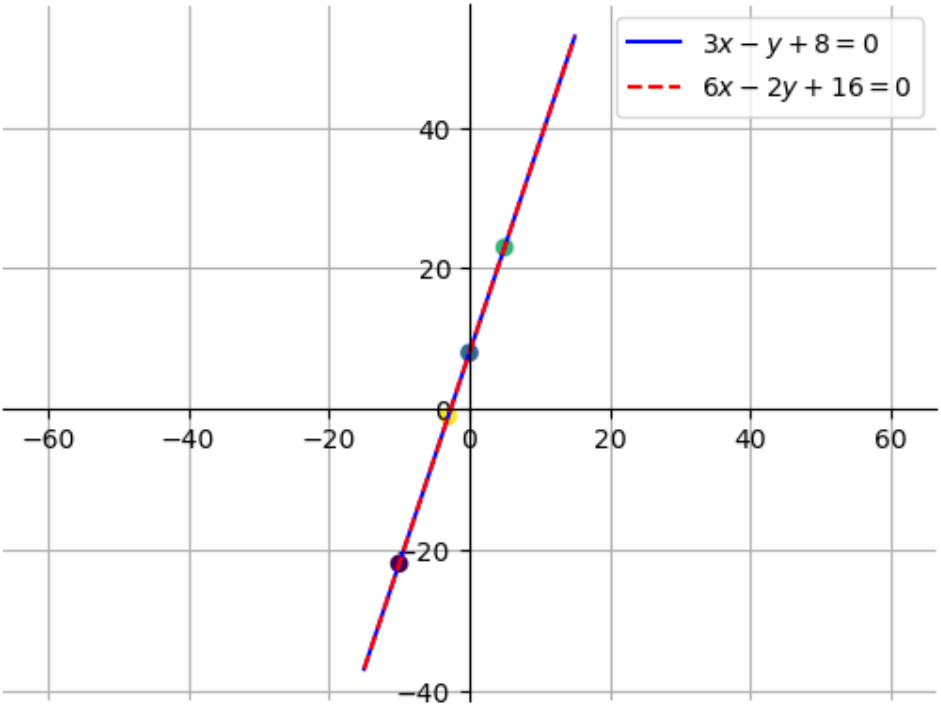

Fig. 0: Coincident Lines