

CLASS-11
CHAPTER-10
STRAIGHT LINES

Exercise 10.4

Q6. Find the equation of the line parallel to y-axis and drawn through the point of intersection of the lines $x - 7y + 5 = 0$ and $3x + y = 0$.

Solution

The given line equations represented in vector form:

$$(1 \quad -7) \mathbf{x} = -5 \quad (1)$$

$$(3 \quad 1) \mathbf{x} = 0 \quad (2)$$

$$(3)$$

The intersection of two lines is given by:

$$\begin{pmatrix} 1 & -7 & 5 \\ 3 & 1 & 0 \end{pmatrix} \mathbf{x} = 0 \quad (4)$$

$$\begin{pmatrix} 1 & -7 & 5 \\ 3 & 1 & 0 \end{pmatrix} \xleftrightarrow{R_2=R_2-3R_1} \begin{pmatrix} 1 & -7 & 5 \\ 0 & 22 & -15 \end{pmatrix} \mathbf{x} = 0 \quad (5)$$

$$\xleftrightarrow{R_2=\frac{R_2}{22}} \begin{pmatrix} 1 & -7 & 5 \\ 0 & 1 & -\frac{15}{22} \end{pmatrix} \mathbf{x} = 0 \quad (6)$$

$$\xleftrightarrow{R_1=R_1+7R_2} \begin{pmatrix} 1 & 0 & \frac{5}{22} \\ 0 & 1 & -\frac{15}{22} \end{pmatrix} \mathbf{x} = 0 \quad (7)$$

$$\mathbf{x} = \begin{pmatrix} -\frac{5}{22} \\ \frac{15}{22} \end{pmatrix} \quad (8)$$

$$(9)$$

To find the equation of the line parallel to the y-axis and the line passing through the \mathbf{P} is given as

$$\mathbf{n}^\top (\mathbf{x} - \mathbf{P}) = 0 \quad (10)$$

Since a line is parallel to the y-axis, normal vector is in the direction of the x-axis is

$$\mathbf{n} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (11)$$

Let $\mathbf{P} = \begin{pmatrix} -\frac{5}{22} \\ \frac{15}{22} \end{pmatrix}$ and by using (10) and (11)

$$(1 \ 0) \left(\mathbf{x} - \begin{pmatrix} -\frac{5}{22} \\ \frac{15}{22} \end{pmatrix} \right) = 0 \quad (12)$$

$$(1 \ 0) \mathbf{x} = -\frac{5}{22} \quad (13)$$

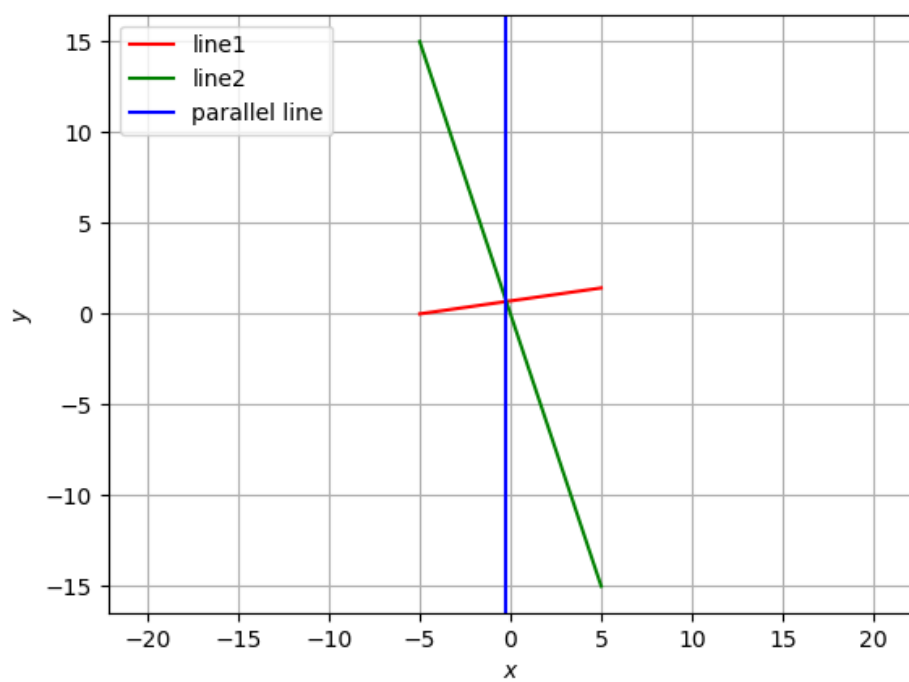


Figure 1: