

Vector

11th Maths - Chapter 10

The following problem is question 09 from exercise 10.4:

1. Find the value of \mathbf{p} so that the three lines $3x + y - 2 = 0$, $px + 2y - 3 = 0$ and $2x - y - 3 = 0$ may intersect at one point.

Solution:

Given equations can be written in the form of $\mathbf{a}^T \mathbf{x} = c$

Therefore,

$$\begin{pmatrix} 3 & 1 \end{pmatrix} \mathbf{x} = 2 \quad (1)$$

$$\begin{pmatrix} p & 2 \end{pmatrix} \mathbf{x} = 3 \quad (2)$$

$$\begin{pmatrix} 2 & -1 \end{pmatrix} \mathbf{x} = 3 \quad (3)$$

Now, Solving equations (1) and (3)
augumented matrix is

$$\begin{pmatrix} 3 & 1 & 2 \\ 2 & -1 & 3 \end{pmatrix} \quad (4)$$

$$R_1 \rightarrow R_1 + R_2$$

$$\begin{pmatrix} 5 & 0 & 5 \\ -2 & 1 & -3 \end{pmatrix} \quad (5)$$

$$R_1 \rightarrow \frac{R_1}{5}$$

$$\begin{pmatrix} 1 & 0 & 1 \\ -2 & 1 & -3 \end{pmatrix} \tag{6}$$

$$R_2 \rightarrow 2R_1 + R_2$$

$$\begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & -1 \end{pmatrix} \tag{7}$$

Therefore, $\mathbf{x} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$ If the three lines may intersect, this point lies on equation(2), then

$$(p \ 2) \begin{pmatrix} 1 \\ -1 \end{pmatrix} = 3$$

$$p - 2 = 3$$

$$p = 5$$

Therefore, the equation is $(5 \ 2) \mathbf{x} = 3$

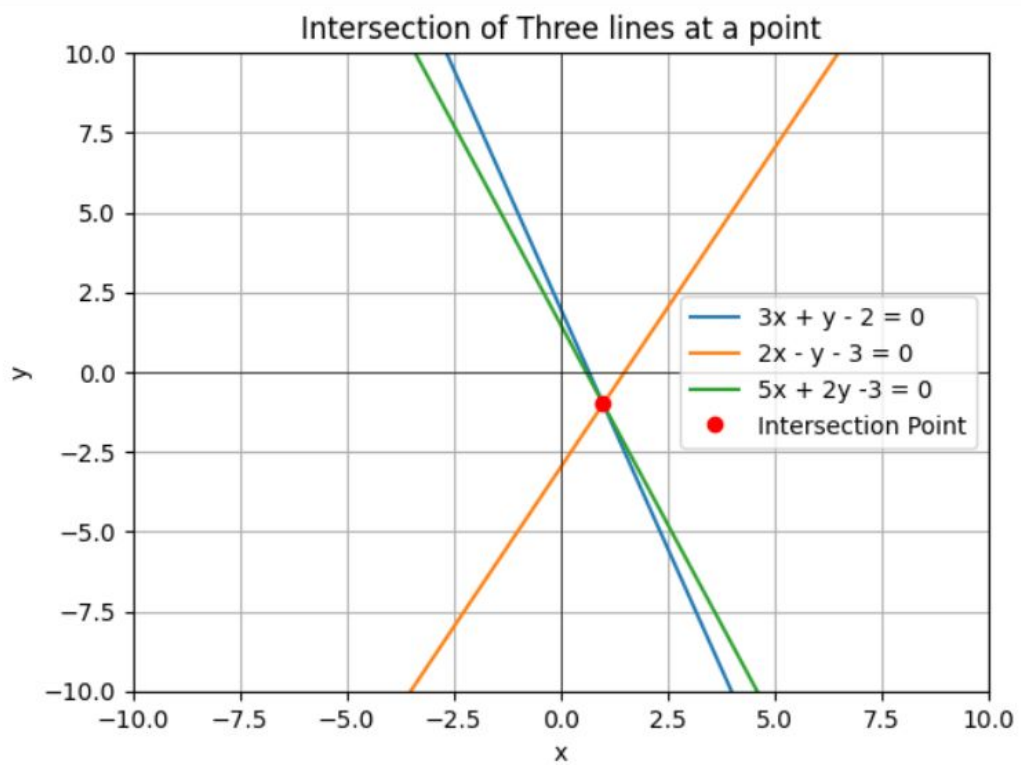


Figure 1: Straight-lines