RD Sharma Solutions Class 11 Maths Chapter 23 Ex 23.6

Straight Lines Ex 23.6 Q1

(i)

If $(a,0)$ and $(0,b)$ are the intercepts of a line then the intercept form of equation is

$$\frac{x}{a}+\frac{y}{b}=1$$

Here, $a=3, b=2$

$\therefore$ The required equation is

$$\frac{x}{3}+\frac{y}{2}=1$$

$$\Rightarrow 2x+3y=6$$

(ii) If $(a,0)$ and $(0,b)$ are the intercepts of a line then the intercept form of equation is

$$\frac{x}{a}+\frac{y}{b}=1$$

Here, $a=-5, b=6$

$\therefore$ The required equation is

$$\frac{x}{-5}+\frac{y}{6}=1$$

$$\Rightarrow 6x-5y=-30$$

Straight Lines Ex 23.6 Q2

The equation of straight line in the intercept form is

$$\frac{x}{a}+\frac{y}{b}=1 \quad ---(1)$$

If (1) passes through the point $(1,-2)$ and has equal intercepts $(a=b=k)$, we get,

$$\frac{1}{k}+\frac{(-2)}{k}=1$$

$$\frac{1}{k}-\frac{2}{k}=1$$

$$1-2=k$$

$$k=-1$$

$$\Rightarrow a=b=-1$$

Putting in (1)

$$\frac{x}{-1}+\frac{y}{-1}=1$$

$$x+y=-1$$

Straight Lines Ex 23.6 Q3

(i) Intercepts are equal and positive

$\Rightarrow a=b=k$

The equation of straight line is

$$\frac{x}{a}+\frac{y}{b}=1 \quad ---(1)$$

Since this line passes through (5, 6) and a=b=k, we get:

$$\frac{5}{k}+\frac{6}{k}=1$$

$$k=1$$

$$\therefore \frac{x}{11}+\frac{y}{11}=1$$

$\Rightarrow x+y=11$

(ii) Intercepts are equal but opposite in sign

Let, $a=k, b=-k$

Putting in (1), we get,

$$\frac{5}{k}+\frac{6}{-k}=1$$

$$\frac{5}{k}-\frac{6}{k}=1$$

$\Rightarrow \quad k=-1$

thus from (1)

$x-y=-1$

Straight Lines Ex 23.6 Q4

The equation of the given line is,

$ax + by + 8 = 0$

$$\Rightarrow -\frac{x}{\frac{8}{a}} - \frac{y}{\frac{8}{b}} = 1$$

It cuts the axes at $A\left(\frac{-8}{a}, 0\right)$ and $B\left(0, \frac{-8}{b}\right)$.

The equation of the given line is,

$2x - 3y + 6 = 0$

$$\Rightarrow \frac{-x}{3} + \frac{y}{2} = 1$$

It cuts the axes at $C(-3, 0)$ and $D(0, 2)$.

The intercepts of both the lines are opposite in sign

$$\Rightarrow \left(\frac{-8}{a}, 0\right) = -(-3, 0) \quad and \quad \left(0, \frac{-8}{b}\right) = -(0, 2)$$

$$\Rightarrow \frac{-8}{a} = 3 \quad and \quad \frac{-8}{b} = -2$$

$$\Rightarrow a = \frac{-8}{3} \quad and \quad b = 4$$

Straight Lines Ex 23.6 Q5

Let the intercepts on the axes be $(a, 0)$ and $(0, a)$.

Then,

$a \times a = 25$

$a^2 = 25$

$a = 5$

(Ignoring negative sign because it is given that the intercepts are positive)

$\Rightarrow a = b = 5$ (given the intercepts are equal)

$\therefore$ Putting in equation of straight line

$\frac{x}{a} + \frac{y}{b} = 1$

$\frac{x}{5} + \frac{y}{5} = 1$

$x + y = 5$

Straight Lines Ex 23.6 Q6

The equation of the given line is,

$$\frac{x}{a} + \frac{y}{b} = 1$$

It cuts the axes at $A(a,0)$ and $B(0,b)$.

The portion of AB intercepted between the axis is 5:3.

$$\therefore h = \frac{3 \times a + 5 \times 0}{8} \text{ and } k = \frac{3 \times 0 + 5 \times b}{8}$$

$$\Rightarrow p = \left(\frac{3a}{8}, \frac{5b}{8} \right)$$

The line is passing through the point $(-4,3)$

$$\Rightarrow \frac{3a}{8} = -4 \qquad \frac{5b}{8} = 3$$

$$\Rightarrow a = \frac{-32}{3} \qquad b = \frac{24}{5}$$

$\therefore$ The equation of the given line is,

$$\frac{x}{\frac{-32}{3}} + \frac{y}{\frac{24}{5}} = 1$$

$$\frac{-3x}{32} + \frac{5y}{24} = 1$$

$$9x - 20y + 96 = 0$$

Straight Lines Ex 23.6 Q7

The line intercepted by the axes are $(a,0)$ and $(0,b)$, if this line segment is bisected at point (α, β)

then $\frac{a+0}{2} = \alpha, \frac{0+b}{2} = \beta$ (Using mid point formula)

$a = 2\alpha, b = 2\beta$

The equation of straight line in the intercept form is

$\frac{x}{a} + \frac{y}{b} = 1$

$\frac{x}{2\alpha} + \frac{y}{2\beta} = 1$

Straight Lines Ex 23.6 Q8

Suppose $P = (3,4)$ divides the line joining the points $A(a,0)$ and $B(0,b)$ in the ration 2:3.

Then,

$$3 = \frac{2(0) + 3(a)}{2+3} \Rightarrow 3 = \frac{3a}{5} \Rightarrow a = 5$$

$$4 = \frac{2(b) + 3(0)}{2+3} \Rightarrow 4 = \frac{2b}{5} \Rightarrow b = 10$$

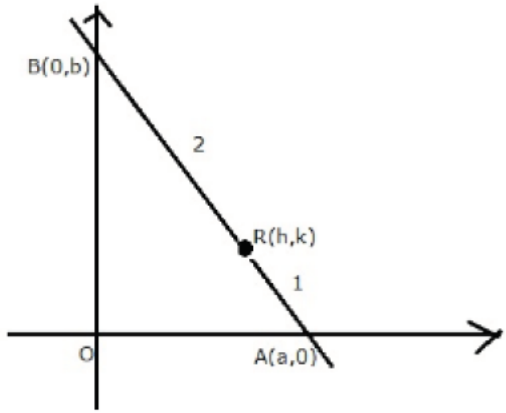
$\therefore A$ is $(5,0), B$ is $(0,10)$

Equation of line AB is

$\frac{x}{5} + \frac{y}{10} = 1$

$2x + y = 10$

Straight Lines Ex 23.6 Q9



Point (h,k) divides the line segment in the ratio 1:2

Thus, using section point formula, we have

$$h = \frac{2 \times a + 1 \times 0}{1+2}$$

and

$$k = \frac{2 \times 0 + 1 \times b}{1+2}$$

Therefore, we have,

$$h = \frac{2a}{3} \text{ and } k = \frac{b}{3}$$

$$\Rightarrow a = \frac{3h}{2} \text{and } b = 3k$$

Thus, the corresponding points of A and B are $\left(\frac{3h}{2}, 0\right)$ *and* $(0, 3k)$

Thus, the equation of the line joining the points A and B is

$$\frac{y-3k}{3k-0} = \frac{x-0}{0-\frac{3h}{2}}$$

$$\Rightarrow -\frac{3h}{2}(y-3k) = x \times 3k$$

$$\Rightarrow -3hy + 9hk = 6kx$$

$$\Rightarrow 2kx + hy = 3kh$$