RD Sharma Solutions Class 11 Maths Chapter 23 Ex 23.4

Straight Lines Ex 23.4 Q1

Let the required equation of the line be

$$y - y_1 = m(x - x_1)$$

Now,
m = slope = -3
$(x_1 y_1) = (6, 2)$

$\therefore\ y - y_1 = m(x - x_1)$
$\Rightarrow y - 2 = -3(x - 6)$
$\Rightarrow y - 2 = -3x + 18$
$\Rightarrow 3x + y = +20$
$\Rightarrow 3x + y - 20 = 0$

$\therefore$ The equation of the given line is $3x + y - 20 = 0$.

Straight Lines Ex 23.4 Q2

Let the required equation of the line be

$y - y_1 = m(x - x_1)$

Now,

The line is inclined at an angle of 45^0 with x-axis

$\therefore m = \tan 45^0 = 1$

$(x_1 y_1) = (-2, 3)$

$\therefore \quad y - y_1 = m(x - x_1)$

$\Rightarrow y - 3 = 1(x - (-2))$

$\Rightarrow y - 3 = x + 2$

$\Rightarrow x - y = -5$

$\therefore$ Equation of required line is $x - y + 5 = 0$

Straight Lines Ex 23.4 Q3

The required equation of the line is

$y - y_1 = m(x - x_1)$

$(x_1, y_1) = (0, 0)$ and slope is m

Therefore, $y - y_1 = m(x - x_1)$

$$y - 0 = m(x - 0)$$

$$y = mx$$

Straight Lines Ex 23.4 Q4

The required equation of the line is

$y - y_1 = m(x - x_1)$

Since the line makes an angle 75° with $x-axis$

$m = \tan 75^\circ = 3.73$

$(x_1, y_1) = \left(2, 2\sqrt{3}\right)$

Therefore, $y - y_1 = m(x - x_1)$

$$y - 2\sqrt{3} = \left(2 + \sqrt{3}\right)(x - 2)$$

$$y - 2\sqrt{3} = \left(2 + \sqrt{3}\right)x - 7.46$$

$$\left(2 + \sqrt{3}\right)x - y - 4 = 0$$

Straight Lines Ex 23.4 Q5

Let $\sin\theta = \frac{3}{4}$

Then,

$\Rightarrow m = \text{slope} = \tan\theta = \frac{3}{4}$

The equation of straight line with slope m and passing through (1, 2) is

$y - y_1 = m(x - x_1)$

$y - 2 = \frac{3}{4}(x - 1)$

$4y - 8 = 3x - 3$

$3x - 4y = -5$

$3x - 4y + 5 = 0$

Straight Lines Ex 23.4 Q6

The required equation of the line is

$y - y_1 = m(x - x_1)$

Since the line makes an angle 60^0 with the positive direction of y axis, it makes 30^0 with the positive direction of x axis.

$\therefore m = \tan 30^0 = \frac{1}{\sqrt{3}}$ (angle with y-axis)

A point on the line is $(x_1 y_1) = (3, -2)$

Therefore, the equation of the line is:

$y - y_1 = m(x - x_1)$

$y - (-2) = \frac{1}{\sqrt{3}}(x - 3)$

$x - \sqrt{3}y - 3 - 2\sqrt{3} = 0$

Straight Lines Ex 23.4 Q7

Equation of the line passing through (x_1, y_1)
and making angle θ with the x-axis is,
$(y - y_1) = \tan\theta(x - x_1)$

For the first line: $(x_1, y_1) = (0,2), \theta = \frac{\pi}{3}$

$(y - y_1) = \tan\theta(x - x_1)$

$(y - 2) = \left(\tan\frac{\pi}{3}\right)(x - 0)$

$y - 2 = \sqrt{3}x$

$\sqrt{3}x - y + 2 = 0$

For the second line: $(x_1, y_1) = (0,2), \theta = \frac{2\pi}{3}$

$(y - y_1) = \tan\theta(x - x_1)$

$(y - 2) = \left(\tan\frac{2\pi}{3}\right)(x - 0)$

$y - 2 = -\sqrt{3}x$

$\sqrt{3}x + y - 2 = 0$

The line parallel to $\sqrt{3}x - y + 2 = 0$
and cutting y-axis at a distance of 2 units below the origin.

$y = \sqrt{3}x - 2$

$\sqrt{3}x + y - 2 = 0$

The line parallel to $\sqrt{3}x + y - 2 = 0$
and cutting y-axis at a distance of 2 units below the origin.

$y = -\sqrt{3}x - 2$

$\sqrt{3}x + y + 2 = 0$

Straight Lines Ex 23.4 Q8

If a line is equally inclined to axis, then

$\theta = 45^0$ or $\theta = 135^0 \Rightarrow m = \tan\theta = \pm 1$

Since, y intercept, $c = 5$

$\therefore$ We get the solution of the line as:

$y = mx + c$

$y = \pm 1x + 5$

$y - x = 5$ or $y + x = 5$

Straight Lines Ex 23.4 Q9

The line passes through the point $(2,0)$.

Also its inclination to $y-axis$ is $135°$.

That is, the inclination of the given line with the $x-axis$ is $180°-135°$.

That is, the slope of the given line is $45°$

The equation of the line having slope 'm' and passing through the point (x_1,y_1) is $y-y_1=m(x-x_1)$

Therefore, the required equation is

$y-0=\tan 45°(x-2)$

$\Rightarrow y=1\times(x-2)$

$\Rightarrow y=x-2$

$\Rightarrow x-y-2=0$

Straight Lines Ex 23.4 Q10

The coordinates of the point which divides the join of the points $(2,3)$ and $(-5,8)$ in the ratio 3:4 is given by (x, y) where,

$$x=\frac{lx_2+mx_1}{l+m}=\frac{3(-5)+4(2)}{3+4}=\frac{-15+6}{7}=\frac{-9}{7}$$

$$y=\frac{ly_2+my_1}{l+m}=\frac{3(8)+4(3)}{3+4}=\frac{24+12}{7}=\frac{36}{7}$$

Slope of the line joining the points $(2,3)$ and $(-5,8)$ $=\frac{8-3}{-5-2}=\frac{5}{-7}=\frac{-5}{7}$

$\therefore$ Slope of line perpendicular to line=m $=\frac{7}{5}$

The required equation is:

$$y-y_1=m(x-x_1)$$

$$y-\frac{36}{7}=\frac{7}{5}\left(x-\left(\frac{-9}{7}\right)\right)$$

$$49x-35y+229=0$$

Straight Lines Ex 23.4 Q11

Let the perpendicular drawn from $P(4,1)$ on line joining $A(2,-1)$ and $B(6,5)$ divide in the ratio k:1 at the point R.

Using section formula, coordinates of R are:

$$x = \frac{6k+2}{k+1} \text{ and } y = \frac{5k-1}{k+1} \quad ---(1)$$

PR is perpendicular to AB

$\therefore$ (slope of PR) $\times$ (slope of AB) $= -1$

$$\Rightarrow \left(\frac{y-1}{x-4}\right) \times \left(\frac{5-(-1)}{6-2}\right) = -1$$

$$\Rightarrow \frac{\frac{5k-1}{k+1} - 1}{\frac{6k+2}{k+1} - 4} \times \frac{6}{4} = -1$$

$$\Rightarrow \frac{5k-1-k-1}{6k+2-4k-4} = \frac{-4}{6}$$

$$\Rightarrow \frac{4k-2}{2k-2} = \frac{-2}{3}$$

$$\Rightarrow 3(2k-1) = -2(k-1)$$

$$\Rightarrow 6k-3 = -2k+2$$

$$\Rightarrow 8k = 5$$

$$\Rightarrow k = \frac{5}{8}$$

ratio is 5 : 8

$\therefore$ R divides AB in the ratio 5 : 8

Straight Lines Ex 23.4 Q12

AD, BE and CF are the three altitudes of the triangle

We know,

Slope of AD $\times$ Slope of BC = -1; AD passes through A(2,-2)

Slope of BE $\times$ Slope of AC = -1; AD passes through B(1,1)

Slope of CF $\times$ Slope of AB = -1; AD passes through C(-1,0)

$$\text{Slope of BC} = \frac{0-1}{-1-1} = \frac{-1}{-2} = \frac{1}{2} \Rightarrow \text{Slope of AD} = -2$$

$$\text{Slope of AC} = \frac{0-(-2)}{-1-2} = \frac{2}{-3} = \frac{-2}{3} \Rightarrow \text{Slope of BE} = \frac{3}{2}$$

$$\text{Slope of AB} = \frac{1+2}{1-2} = \frac{3}{-1} = -3 \Rightarrow \text{Slope of CF} = \frac{1}{3}$$

So, for AD, we have

$y - y_1 = m(x - x_1)$

$\Rightarrow y - (-2) = -2(x - 2)$

$\Rightarrow y + 2 = -2x + 4$

$\Rightarrow 2x + y - 2 = 0$

And, for BE, we have

$y - y_1 = m(x - x_1)$

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

$\Rightarrow 2y - 3x + 1 = 0$

And, for CF, we have

$y - y_1 = m(x - x_1)$

$\Rightarrow y - 0 = \frac{1}{3}(x + 1)$

$\Rightarrow x - 3y + 1 = 0$

Straight Lines Ex 23.4 Q13

The right bisector PQ of AB bisects AB at C and is perpendicular to AB.

$$\text{The co-ordinates of } C \text{ are} = \left(\frac{3-1}{2}, \frac{4+2}{2}\right) = (1,3)$$

$$\text{And slope of } PQ = \frac{-1}{\text{slope of } AB} = \frac{-1}{2-4}(-1-3) = \frac{4}{-2} = -2$$

The equation of PQ is

$(y - 3) = -2(x - 1)$

$y - 3 = -2x + 2$

$y + 2x = 5$

Straight Lines Ex 23.4 Q14

The line passes through the point $(-3,5)$

So $(x_1,y_1)=(-3,5)$

The line is perpendicular to the line joining $(2,5)$ and $(-3,6)$.

$$\Rightarrow m = \frac{-1}{\text{slope of line joining } (2,5) \text{ and } (-3,6)} == \frac{-1}{\frac{y_2-y_1}{x_2-x_1}} = \frac{-1}{\frac{6-5}{-3-2}} = \frac{-1}{\frac{-1}{5}}$$

$\therefore m = 5$

Hence, equation of straight line is

$y - y_1 = m(x - x_1)$

$y - 5 = 5(x(-3))$

$y - 5 = 5x + 15$

$5x - y + 20 = 0$

Straight Lines Ex 23.4 Q15

The right bisector PQ of AB bisects AB at C and is also perpendicular to AB.

Slope of $AB = \frac{3-0}{2-1} = 3$

Now,

$(\text{slope of } AB) \times (\text{slope of } PQ) = -1$

$\therefore$ slope of $PQ = \frac{-1}{3}$

Co-ordinates of c are $= \left(\frac{1+2}{2}, \frac{3+0}{2}\right) = \left(\frac{3}{2}, \frac{3}{2}\right)$

$\therefore$ Equation of right bisector PQ is

$\left(y - \frac{3}{2}\right) = \frac{-1}{3}\left(x - \frac{3}{2}\right)$

$6y - 9 = -2x + 3$

$x + 3y = 6$

Straight Lines Ex 23.4 Q16

Equation of the line passing through (x_1, y_1) and making angle θ with the x-axis is,

$(y - y_1) = \tan\theta(x - x_1)$

Here $(x_1, y_1) = (1, 2)$, angle with y-axis is 30°

$\therefore$ angle with x-axis is $\theta = 90^\circ - 30^\circ = 60^\circ$

$(y - y_1) = \tan\theta(x - x_1)$

$(y - 2) = (\tan 60^\circ)(x - 1)$

$y - 2 = \sqrt{3}x - \sqrt{3}$

$\sqrt{3}x - y + 2 - \sqrt{3} = 0$