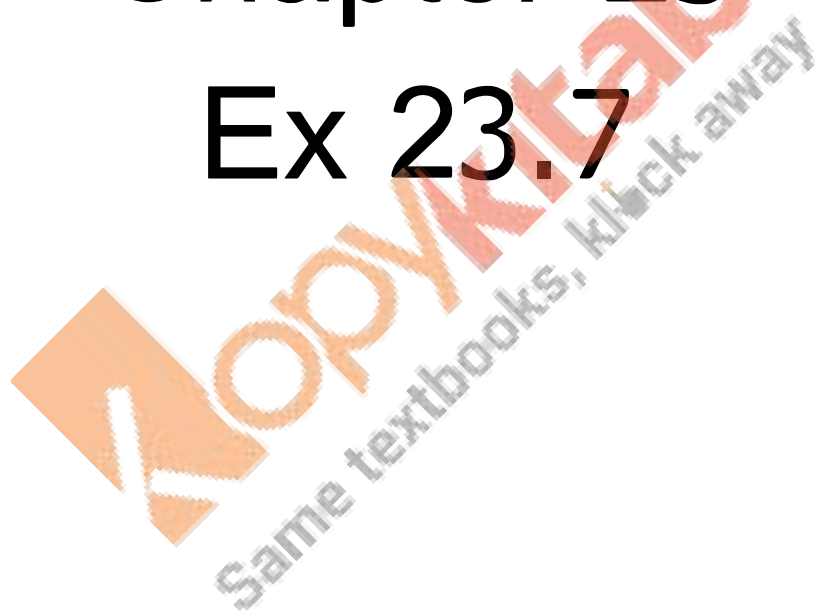


RD Sharma
Solutions
Class 11 Maths
Chapter 23
Ex 23.7



Straight lines Ex 23.7 Q1(i)

$$p = 5, \alpha = 60^\circ$$

$$x \cos \alpha + y \sin \alpha = p$$

$$\Rightarrow x \cos 60^\circ + y \sin 60^\circ = 5$$

$$\Rightarrow x \times \frac{1}{2} + y \times \frac{\sqrt{3}}{2} = 5$$

$$\Rightarrow x + \sqrt{3}y = 10$$

Straight lines Ex 23.7 Q1(ii)

$$p = 4, \alpha = 150^\circ$$

$$x \cos \alpha + y \sin \alpha = p$$

$$\Rightarrow x \cos 150^\circ + y \sin 150^\circ = 4$$

$$\Rightarrow -x \times \frac{\sqrt{3}}{2} + y \times \frac{1}{2} = 4$$

$$\Rightarrow -\sqrt{3}x + y = 8$$

Straight lines Ex 23.7 Q1(iii)

$$p = 8, \alpha = 225^\circ$$

$$x \cos \alpha + y \sin \alpha = p$$

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$$\Rightarrow x \cos 225^\circ + y \sin 225^\circ = 8$$

$$\Rightarrow -x \times \frac{1}{\sqrt{2}} - y \times \frac{1}{\sqrt{2}} = 8$$

$$\Rightarrow x + y + 8\sqrt{2} = 0$$

Straight lines Ex 23.7 Q1(iv)

$$P = 8, \alpha = 300^\circ$$

$$x \cos \alpha + y \sin \alpha = P$$

$$\Rightarrow x \cos 300^\circ + y \sin 300^\circ = 8$$

$$\Rightarrow x \times \frac{1}{2} - y \times \frac{\sqrt{3}}{2} = 8$$

$$\Rightarrow x - \sqrt{3}y = 16$$

Straight lines Ex 23.7 Q2

Given, Inclination of perpendicular line (L) passing through origin is 30°

$$\Rightarrow \text{Slope} = \tan 30^\circ = \frac{1}{\sqrt{3}}$$

Slope of perpendicular line (M) which is perpendicular to line L is $-\sqrt{3}$

So equation of line M is $y = -\sqrt{3}x + c$

Given perpendicular distance from origin to line M is 4

$$4 = \frac{c}{2} \Rightarrow c = 8$$

So equation of line M is $y = -\sqrt{3}x + 8$

Straight lines Ex 23.7 Q3

Here,

$$p = 4 \text{ and } \alpha = 15^\circ$$

The equation of line is

$$x \cos \alpha + y \sin \alpha = p \quad \text{--- (1)}$$

$$x \cos 15^\circ + y \sin 15^\circ = 4$$

$$\cos 15^\circ = \cos (45 - 30) = \cos 45 \cos 30 + \sin 45 \sin 30$$

$$(\because \cos(\theta - \phi) = \cos \theta \cos \phi + \sin \theta \sin \phi)$$

$$= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \times \frac{1}{2}$$

$$= \frac{1}{2\sqrt{2}} (\sqrt{3} + 1)$$

$$\sin 15^\circ = \sin (45 - 30) = \sin 45 \cos 30 - \cos 45 \sin 30$$

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

Putting in (1)

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

$$x (\sqrt{3} + 1) + y (\sqrt{3} - 1) = 8\sqrt{2}$$

Straight lines Ex 23.7 Q4

Here $p = 3$

$$\text{and } \alpha = \tan^{-1}\left(\frac{5}{12}\right)$$

$$\Rightarrow \cos \alpha = \frac{12}{13}, \sin \alpha = \frac{5}{13}$$

Equation of straight line is:

$$x \cos \alpha + y \sin \alpha = p$$

$$x \left(\frac{12}{13}\right) + y \left(\frac{5}{13}\right) = 3$$

$$12x + 5y = 39$$

Straight lines Ex 23.7 Q5

Here $p = 2$, $\sin \alpha = \frac{1}{3}$

$$\Rightarrow \cos \alpha = \frac{2\sqrt{2}}{3}$$

The equation of straight line is

$$x \cos \alpha + y \sin \alpha = p$$

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

$$2\sqrt{2}x + y = 6$$

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Straight lines Ex 23.7 Q6

Given:

$$p = \pm 2$$

$$\tan \alpha = \frac{5}{12}$$

The equation of line is

$$x \cos \alpha + y \sin \alpha = \pm p$$

$$x \frac{12}{13} + y \frac{5}{13} = \pm 2$$

$$12x + 5y \pm 26 = 0$$

Straight lines Ex 23.7 Q7

Here,

p = perpendicular distance from origin = 7

Angle made with y-axis is 150° ,

\therefore Angle made with x-axis is 30°

$$\cos \alpha = \cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\sin \alpha = \sin 30^\circ = \frac{1}{2}$$

The equation of line is

$$x \cos \alpha + y \sin \alpha = p$$

$$x \left(\frac{\sqrt{3}}{2} \right) + y \left(\frac{1}{2} \right) = 7$$

$$\sqrt{3}x + y = 14$$

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Straight lines Ex 23.7 Q8

We have,

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

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

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

This same as $x \cos \theta + y \sin \theta = p$

$$\text{Therefore, } \cos \theta = \frac{-\sqrt{3}}{2}, \sin \theta = -\frac{1}{2} \text{ and } p = 1$$

$$\theta = 210^\circ \text{ and } p = 1$$

$$\theta = \frac{7\pi}{6} \text{ and } p = 1$$

Straight lines Ex 23.7 Q9

Perpendicular from origin makes an angle of 30° with y-axis, thus making 60° with x-axis

Area of triangle is $= 96\sqrt{3}$

$$\frac{1}{2} \times 2p \times \frac{2p}{\sqrt{3}} = 96\sqrt{3}$$

$$p^2 = \frac{96\sqrt{3} \times \sqrt{3}}{2} = 48 \times 3 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$$

$$p = 12$$

$$x \cos \alpha + y \sin \alpha = p$$

$$x \cos 60^\circ + y \sin 60^\circ = 12$$

$$x \times \frac{1}{2} + y \frac{\sqrt{3}}{2} = 12$$

$$x + \sqrt{3}y = 24$$