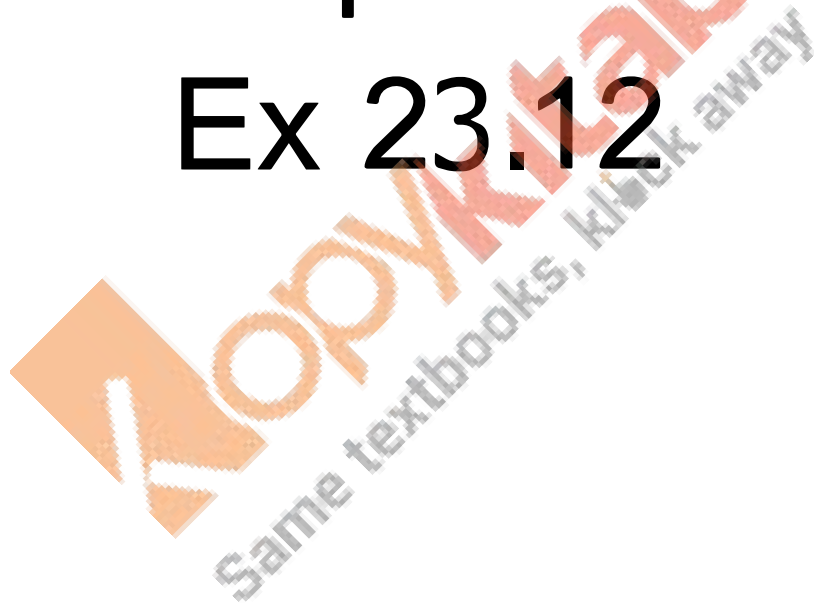


RD Sharma
Solutions
Class 11 Maths
Chapter 23
Ex 23.12



Straight lines Ex 23.12 Q1

Equation of line through $(2, 3)$ is

$$y - y_1 = m(x - x_1) \quad \text{--- (1)}$$

$$(2, 3) \text{ is } (x_1, y_1)$$

Since the line is parallel to $3x - 4y + 5 = 0$

\Rightarrow The slope will be equal

$$\text{Slope of } 3x - 4y + 5 = 0$$

$$4y = 3x + 5$$

$$y = \frac{3}{4}x + \frac{5}{4}$$

$$\Rightarrow m = \frac{3}{4}$$

Substituting m and (x_1, y_1) is (1)

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

$$4y - 12 = 3x - 6$$

$$3x - 4y = -12 + 6 = -6$$

$$3x - 4y + 6 = 0$$

Straight lines Ex 23.12 Q2

Any equation passing through $(3, -2)$ and perpendicular to given line is

$$y - y_1 = -\frac{1}{m}(x - x_1) \quad \text{--- (1)}$$

Where (x_1, y_1) is $(3, -2)$ and m is slope of line.

$\frac{-1}{m}$ is taken as lines are perpendicular

Finding slope of line $x - 3y + 5 = 0$

$$3y = x + 5$$

$$y = \frac{x}{3} + \frac{5}{3}$$

$$\Rightarrow m = \frac{1}{3}$$

Substituting the value of m and $(x_1 - y_1)$ in (1)

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

$$y + 2 = -3(x - 3) = -3x + 9$$

$$3x + y = 7$$

Straight lines Ex 23.12 Q3

Any line which is perpendicular bisector means line is perpendicular to the given line and one end point is the mid-point of that line.

The line joining $(1, 3)$ and $(3, 1)$.
 (x_1, y_1) (x_2, y_2)

Has the mid-point

$$x = \frac{x_1 + x_2}{2}, y = \frac{y_1 + y_2}{2}$$

$$\Rightarrow (x_1, y_1) = \left(\frac{1+3}{2}, \frac{3+1}{2} \right) = (2, 2)$$

Also slope of line is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 3}{3 - 1} = \frac{-2}{2} = -1$$

So, the slope of required line is 1 (negative reciprocal of slope)

Thus, the equation of perpendicular bisector is

$$y - y_1 = \frac{-1}{m}(x - x_1)$$

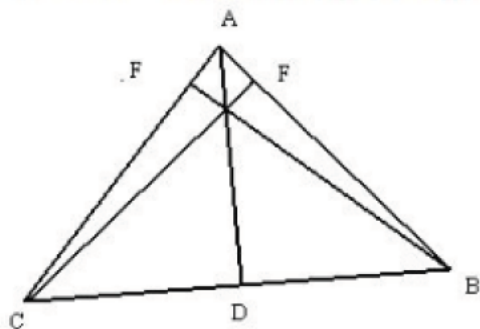
$$y - 2 = 1(x - 2)$$

$$y - 2 = x - 2$$

$$y = x$$

Straight lines Ex 23.12 Q4

Let the perpendiculars of the triangle on the side AB, BC and AC be CF, AD and FB respectively.



$$\text{Slope of the side AB} = \frac{4-2}{1+3} = \frac{2}{4} = \frac{1}{2}$$

$$\text{Corresponding slope of CF} = -\frac{1}{1/2} = -2$$

[since $m_1 \times m_2 = -1$]

Equation of CF, $y - y_1 = m(x - x_1)$

$$y + 3 = -2(x + 5)$$

of C in place of x_1 and y_1]

$$y + 3 = -2x - 10$$

$$y = -2x - 13$$

$$\text{Slope of the side BC} = \frac{2+3}{-3+5} = \frac{5}{2}$$

$$\text{Corresponding slope of AD} = -\frac{1}{5/2} = -\frac{2}{5}$$

Equation of AD,

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

$$y - 4 = -\frac{2}{5}(x - 1)$$

$$5y - 20 = -2x + 2$$

$$5y = -2x - 22$$

$$\text{Slope of the side AC} = \frac{4+3}{1+5} = \frac{7}{6}$$

$$\text{Corresponding slope of FB} = -\frac{1}{7/6} = -\frac{6}{7}$$

Equation of FB,

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

$$y - 2 = -\frac{6}{7}(x + 3)$$

$$7y - 14 = -6x - 18$$

$$7y = -6x - 4$$

Equation of AD, $2x + 5y + 22 = 0$

Equation of CF, $2x + y + 13 = 0$

Equation of FB, $6x + 7y + 4 = 0$

Straight lines Ex 23.12 Q5

Required equation of line is

$$y - y_1 = m'(x - x_1) \quad \text{--- (1)}$$

Point is $(x_1, y_1) = (0, -4)$

It is perpendicular to line $\sqrt{3}x - y + 5 = 0$

\Rightarrow Slope is $y = mx + c$

$$y = -\sqrt{3}x + 5$$

$$m = \sqrt{3}$$

$$m' = \frac{-1}{m} = \frac{-1}{\sqrt{3}}$$

Putting m' and (x_1, y_1) in (1)

$$y - (-4) = \frac{-1}{\sqrt{3}}(x - 0)$$

$$y + 4 = \frac{-x}{\sqrt{3}}$$

$$x + \sqrt{3}y + 4\sqrt{3} = 0$$

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Straight lines Ex 23.12 Q6

Here,

Let l be line mirror and B is image of A

Let m be slope of line l

So,

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

$$m\left(\frac{2-1}{5-2}\right) = -1$$

$$m\left(\frac{1}{3}\right) = -1$$

$$m = -3$$

M is mid point of AB

$$M = \left(\frac{2+5}{2}, \frac{2+1}{2}\right)$$

$$M = \left(\frac{7}{2}, \frac{3}{2}\right)$$

Equation line l is,

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

$$y - \frac{3}{2} = (-3)\left(x - \frac{7}{2}\right)$$

$$\frac{2y - 3}{2} = -3x + \frac{21}{2}$$

$$2y - 3 = -6x + 21$$

$$6x + 2y = 24$$

$$3x + y = 12$$

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Straight lines Ex 23.12 Q7

Any line is given by equation

$$y - y_1 = m(x - x_1) \quad \dots (1)$$

Where (x_1, y_1) is (α, β)

And m is negative reciprocal of slope of line $lx + my + n = 0$.

i.e; $y = \frac{-lx}{m} - \frac{n}{m}$

$$\Rightarrow \text{Slope of line} = \frac{-l}{m}$$

Putting the data in (i), we get

$$y - \beta = \frac{m}{l}(x - \alpha)$$

$$ly + mx = m\alpha + l\beta$$

$$m(x - \alpha) = l(y - \beta)$$

Straight lines Ex 23.12 Q8

Let the equation of the required line be $y - y_1 = m(x - x_1)$, where 'm' denotes the slope of the line and (x_1, y_1) be the point through which the line passes.

Since the x-intercept of the line is 1 on the positive direction of the x-axis therefore the line passes through $(1, 0)$

Also, $2x - 3y = 5$

$$3y = 2x - 5$$

$$y = \frac{2x}{3} - \frac{5}{3}$$

Therefore, the slope of the given line is $2/3$.

$$\text{Slope of the required line} = \frac{-1}{2/3} = -\frac{3}{2}$$

Therefore the equation of the required line is

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

$$y-0 = \frac{2}{3}(x-1)$$

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

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

The equation of the required line is $3x + 2y - 3 = 0$

Straight lines Ex 23.12 Q9

Slope of line through the points $(a, 2a)$, $(-2, 3)$
 (x_1, y_1) (x_2, y_2)

$$\Rightarrow m_1 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 2a}{-2 - a}$$

Also, slope of line $x - ay = 1$ in the form $y = mx + c$

$$4x + 3y + 5 = 0$$

$$y = -\frac{4}{3}x - \frac{5}{3}$$

$$\Rightarrow m_2 = \frac{-4}{3}$$

If two lines are perpendicular then, $m_1 m_2 = -1$

$$\left(\frac{3-2a}{-2-a}\right)\left(\frac{-4}{3}\right) = -1$$

$$-12 + 8a = 6 + 3a$$

$$5a = 18$$

$$a = \frac{18}{5}$$

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