

## Chapter 13. Equation of A Straight Line

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### Ex 13.1

#### Answer 2.

The line  $3y = 5x - 7$  passes through  $(p,6)$

$\therefore (p,6)$  will satisfy the equation of line

$$3(6) = 5(p) - 7$$

$$\Rightarrow 25 = 5p$$

$$\Rightarrow p = 5$$

#### Answer 3.

The line  $3y = 5x - 7$  passes through  $(p,6)$

$\therefore (p,6)$  will satisfy the equation of line

$$3(6) = 5(p) - 7$$

$$\Rightarrow 25 = 5p$$

$$\Rightarrow p = 5$$

#### Answer 4.

The line  $4x = 11 - 3y$  passes through the point  $(a,5)$ ,

$\therefore (a,5)$  will satisfy the equation of line

$$4(a) = 11 - 3(5)$$

$$\Rightarrow 4a = -4$$

$$\Rightarrow a = -1$$

### Answer 5.

The line  $y = 6 - \frac{3x}{2}$  passes through the point  $(r, 3)$

$\therefore (r, 3)$  will satisfy the equation of line

$$3 = 6 - \frac{3r}{2}$$

$$\Rightarrow -3 = -\frac{3r}{2}$$

$$\Rightarrow r = 2$$

### Answer 6.

The line  $\frac{3+5y}{2} = \frac{4x-7}{2}$  passes through the point  $(1, k)$ ,

$\therefore (1, k)$  will satisfy the equation of line

$$\frac{3+5k}{2} = \frac{4(1)-7}{2}$$

$$\Rightarrow 9 + 15k = 6$$

$$\Rightarrow 15k = -15$$

$$\Rightarrow k = -1$$

### Answer 7.

Let the point of intersection of AB and line  $4x+4y=11$  be the point  $P(a, b)$ ,

Also given  $4x+3y = 11$  bisects line segment AB

$\therefore AP : PB = 1 : 1$

Coordinates of P are,

$$P(a, b) = P\left(\frac{6+4}{2}, \frac{m-9}{2}\right) = P\left(5, \frac{m-9}{2}\right)$$

Since  $P(a, b)$  lies on the line  $4x+3y=11$ ,  $\therefore P$  will satisfy the equation of line

$$4(5) + 3\left(\frac{m-9}{2}\right) = 11$$

$$\frac{3m-27}{2} = 11 - 20$$

$$\Rightarrow 3m - 27 = -18$$

$$\Rightarrow 3m = 9$$

$$\Rightarrow m = 3$$

### Answer 8.

Let the point of intersection of AB and the line  $2x-5y+31=0$  be the point  $R(a,b)$

Also, given the line  $2x - 5y+31=0$  bisects the line segment AB

$$\therefore AR : RB = 1 : 1$$

Coordinates of R are,

$$R(a,b) = R\left(\frac{-4+p}{2}, \frac{5+9}{2}\right) = R\left(\frac{-4+p}{2}, 7\right)$$

$\therefore R(a,b)$  lies on the line  $2x-5y+31=0$ ,

$\therefore R$  will satisfy the equation of the line

$$2\left(\frac{-4+p}{2}\right) - 5(7) + 31 = 0$$

$$\Rightarrow (-4+p) - 4 = 0$$

$$\Rightarrow p = 8$$

### Answer 9.

Let the point of intersection of AB and the line  $3x + 4y = 18$  be the point  $P(a,b)$

Also, given the line  $3x+4y=18$  bisects the line segment AB

$$\therefore AP : PB = 1 : 1$$

Coordinates of P are,

$$P(a,b) = P\left(\frac{3-7}{2}, \frac{7+z}{2}\right) = P\left(-2, \frac{7+z}{2}\right)$$

$\therefore P(a,b)$  lies on the line  $3x + 4y = 18$ ,

$\therefore P$  will satisfy the equation of the line

$$3(-2) + 4\left(\frac{7+z}{2}\right) = 18$$

$$\Rightarrow 14 + 2z = 24$$

$$\Rightarrow 2z = 10$$

$$\Rightarrow z = 5$$

### Answer 10.

Let the point of intersection of PQ and  $5x - 3y + 1 = 0$  be the point  $R(a,b)$ .

Also given the line  $5x - 3y + 1 = 0$  divides the line segment PQ in the ratio 2 : 3,

i.e.  $PR : RQ = 2 : 3$

Coordinates of R are,

$$R(a,b) = R\left(\frac{14+6}{5}, \frac{18+3m}{5}\right) = R\left(4, \frac{18+3m}{5}\right)$$

$\therefore R(a,b)$  lies on the line  $5x - 3y + 1 = 0$ ,

$\therefore R$  will satisfy the equation of the line

$$5(4) - 3\left(\frac{18+3m}{5}\right) + 1 = 0$$

$$\Rightarrow -3\left(\frac{18+3m}{5}\right) = -21$$

$$\Rightarrow 18 + 3m = 35$$

$$\Rightarrow 3m = 17$$

$$\Rightarrow m = \frac{17}{3}$$

### Answer 11.

Let the point of intersection of AB and the line  $7x - 8y = 4$ , be the point  $P(a,b)$ .

Also, given the line  $7x - 8y = 4$  divides the line segment AB in the ratio 2 : 5.

i.e.  $AP : PB = 2 : 5$

Coordinates of P are,

$$P(a,b) = P\left(\frac{12-40}{7}, \frac{2k-20}{7}\right) = P\left(-4, \frac{2k-20}{7}\right)$$

$\therefore P(a,b)$  lies on the line  $7x - 8y = 4$ ,

$\therefore P$  will satisfy the equation of the line

$$7(-4) - 8\left(\frac{2k-20}{7}\right) = 4$$

$$-8\left(\frac{2k-20}{7}\right) = 32$$

$$2k - 20 = -28$$

$$2k = -8$$

$$k = -4$$

### Answer 12.

Let the point of intersection of PQ and the line  $5x+3y=25$ , be the point  $R(x,y)$

Also, given the line  $5x+3y = 25$  divides the line segment PQ in the ratio 1 : 3.

i.e.  $PR : RQ = 1 : 3$

Coordinates of R are,

$$R(x, y) = R\left(\frac{5+3b}{4}, \frac{8+12}{4}\right) = R\left(\frac{5+3b}{4}, 5\right)$$

$\because R(x, y)$  lies on the line  $5x+3y=25$

$\therefore R$  will satisfy the equation of the line

$$5\left(\frac{5+3b}{4}\right) + 3(5) = 25$$

$$\Rightarrow 5\left(\frac{5+3b}{4}\right) = 10$$

$$\Rightarrow 5+3b = 8$$

$$\Rightarrow 3b = 3$$

$$\Rightarrow b = 1$$

### Answer 13.

Let the point P on the line segment AB be  $P(a,b)$

Also, given that  $P(a,b)$  divides the line segment AB in the ratio 2 : 3

i.e.  $AP : PB = 2 : 3$

Coordinates of P are,

$$P(a,b) = P\left(\frac{16-6}{5}, \frac{16+9}{5}\right) = P(2,5)$$

If  $P(a,b)$  lies on the line  $7x-2y=4$ , then will satisfy the equation of the line

LHS  $7(2) - 2(5) = 14 - 10 = 4 =$  RHS

Yes, the point  $P(2,5)$  lies on the line  $7x - 2y = 4$

### Answer 14.

Let  $L(a,b)$  be the point on line segment  $PQ$  dividing it in the ratio  $1 : 3$

i.e.  $PL : LQ = 1 : 3$

Coordinates of  $L$  are,

$$\begin{aligned}L(a,b) &= L\left(\frac{11+9}{4}, \frac{-5+21}{4}\right) \\ &= L(5, 4)\end{aligned}$$

If  $L(a,b)$  lies on the line  $2x+5y=20$ , then it will satisfy the equation of the line

$$\text{LHS} = 2(5) + 5(4) = 10 + 20 = 30 \neq \text{RHS}$$

No,  $L(a,b)$  does not lie on the line  $2x+5y = 20$

### Answer 15.

Let the point on x-axis be  $P(x,y)$  which divides the line segment  $AB$  in the ratio  $1 : 2$ ,

i.e.  $AP : PB = 1 : 2$

Coordinates of  $P$  are,

$$P(x,y) = P\left(\frac{5+4}{3}, \frac{6+6}{3}\right)$$

$$x = 3, y = 4$$

If  $P(x,y)$  lies on the line  $3x - 4y + 5 = 0$ , then it will satisfy the equation of the line.

$$\text{LHS} = 3(3) - 4(4) + 5 = 9 - 9 + 5 = 0 = \text{RHS}$$

Yes, the point  $P$  lies on the line  $3x-4y+5 = 0$ .

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**Ex 13.2****Answer 1.**

(a) Slope of line =  $m = \tan \theta$

$$\begin{aligned} &= \tan 60^\circ \\ &= \sqrt{3} \\ &= 1.73 \end{aligned}$$

(b) Slope of line =  $m = \tan \theta$

$$\begin{aligned} &= \tan 50^\circ \\ &= 1.19 \end{aligned}$$

(c) Slope of line =  $m = \tan \theta$

$$= \tan 45^\circ = 1$$

(d) Slope of line =  $m = \tan \theta$

$$= \tan 75^\circ$$

$$\tan(75^\circ) = \tan(45^\circ + 30^\circ) = \frac{\tan 45^\circ + \tan 30^\circ}{1 - \tan 45^\circ \tan 30^\circ}$$

$$\begin{aligned} &= \frac{1 + \frac{1}{\sqrt{3}}}{1 - \frac{1}{\sqrt{3}}} = \frac{\sqrt{3} + 1}{\sqrt{3} - 1} \\ &= \frac{2.73}{0.73} = \frac{273}{73} = 3.73 \end{aligned}$$

(e) Slope of line =  $m = \tan \theta$

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

**Answer 2.**

(a)  $\tan \theta = 0.4663$

$\therefore \theta = 25^\circ$

(b)  $\tan \theta = 1.4281$

$\therefore \theta = 55^\circ$

(c)  $\tan \theta = 3.0777$

$\therefore \theta = 72^\circ$

(d)  $\tan \theta = 5.6713$

$\therefore \theta = 80^\circ$

(e)  $\tan \theta = 0.5317$

$\therefore \theta = 28^\circ$

**Answer 3.**

(a) Slope of line =  $\frac{y_2 - y_1}{x_2 - x_1}$   
 $= \frac{8 - 5}{-1 - 2}$

$= -1$

(b) Slope of line =  $\frac{y_2 - y_1}{x_2 - x_1}$   
 $= \frac{13 - 7}{5 - 3}$

$= 3$

(c) Slope of line =  $\frac{y_2 - y_1}{x_2 - x_1}$   
 $= \frac{-7 + 1}{-9 - 5} = \frac{3}{2}$

$= 1.5$

(d) Slope of line =  $\frac{y_2 - y_1}{x_2 - x_1}$

(e) Slope of line =  $\frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{0 - 5}{5 - 0}$

$= -1$



**Answer 4.**

$$(a) A(x_1, y_1) = A(a^2m^2, 2am)$$

$$B(x_2, y_2) = B(p^2m^2, 2pm)$$

$$\begin{aligned}\text{Slope of line AB} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{2pm - 2am}{p^2m^2 - a^2m^2} \\ &= \frac{2m(p - a)}{m^2(p^2 - a^2)} \\ &= \frac{2}{m} \times \frac{(p - a)}{(p + a)(p - a)} \\ &= \frac{2}{m(p + a)} \\ &= \frac{2}{pm + am}\end{aligned}$$

$$(b) A(x_1, y_1) = A(5pq, p^2q)$$

$$B(x_2, y_2) = B(5qr, qr^2)$$

$$\begin{aligned}\text{Slope of line AB} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{qr^2 - p^2q}{5qr - 5pq} \\ &= \frac{q(r^2 - p^2)}{5q(r - p)} \\ &= \frac{1}{5} \frac{(r - p)(r + p)}{(r - p)} \\ &= \frac{r + p}{5}\end{aligned}$$

**Answer 5.**

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

$$3x - 5 = 2y$$

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

$$y = mx + c$$

$$\text{Slope} = \frac{3}{2}$$

(b)  $x + 3y = 7$

$$3y = -x + 7$$

$$y = -\frac{1}{3}x + \frac{7}{3}$$

$$\text{Slope} = -\frac{1}{3}$$

(c)  $5x - y = 10$

$$5x - 10 = y$$

$$\text{Slope} = 5$$

(d)  $4x - 2y = 3$

$$-2y = -4x + 3$$

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

$$\text{Slope} = 2$$

(e)  $5x + 2y = 11$

$$2y = -5x + 11$$

$$y = -\frac{5}{2}x + \frac{11}{2}$$

$$\text{Slope} = -\frac{5}{2}$$

**Answer 6.**

When the lines are perpendicular to the product of their slopes is  $-1$ .

i.e.  $m_1 \times m_2 = -1$

(a)  $2x - 3y = 4$

$$3y = 2x - 4$$

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

$$\text{Slope } m_1 = \frac{2}{3}$$

Required slope of line ( $m_2$ )

$$m_1 \cdot m_2 = -1$$

$$\Rightarrow m_2 = \frac{-1}{m_1}$$

$$\Rightarrow m_2 = \frac{-1}{2/3} = \frac{-3}{2}$$

(b)  $5x + 2y - 9 = 0$

$$2y = -5x + 9$$

$$y = -\frac{5}{2}x + \frac{9}{2}$$

$$m_1 = -\frac{5}{2}$$

$$\text{Required slope } m_2 = \frac{-1}{m} = \frac{-1}{-5/2} = \frac{2}{5}$$

(c)  $3x + 4y = 13$

$$4y = -3x + 13$$

$$y = \frac{-3}{4}x + \frac{13}{4}$$

$$m_1 = \frac{-3}{4}$$

$$\text{Required slope} = \frac{-1}{m_1} = \frac{4}{3}$$

(d)  $x - 4y = 8$

$$4y = x - 8$$

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

$$m_1 = \frac{1}{4}$$

$$\text{Required slope} = \frac{-1}{m_1} = -4$$

(e)  $9x - 3y = 5$

$$3y = 9x - 5$$

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

$$m_1 = 3$$

$$\text{Required slope} = \frac{-1}{m_1} = \frac{-1}{3}$$

**Answer 7.**

$$\begin{aligned}\text{Slope of line AB} &= \frac{Y_2 - Y_1}{X_2 - X_1} \\ &= \frac{5 + 1}{-7 - 3} = -\frac{3}{5}\end{aligned}$$

$$\begin{aligned}\text{Slope of line parallel to AB} \\ &= \text{Slope of AB} \\ &= -\frac{3}{5}\end{aligned}$$

**Answer 8.**

$$\begin{aligned}\text{Slope of line MN} &= \frac{Y_2 - Y_1}{X_2 - X_1} \\ &= \frac{3 - 9}{-2 - 4} = \frac{-6}{-6} \\ &= -1\end{aligned}$$

$$\text{Slope of line parallel to MN} = \text{Slope of MN} = 1$$

**Answer 9.**

$$\begin{aligned}\text{Slope of line PQ} &= \frac{Y_2 - Y_1}{X_2 - X_1} \\ &= \frac{13 + 3}{7 - 11} = \frac{16}{-4} \\ &= -4\end{aligned}$$

$$\begin{aligned}\text{Slope of line parallel to PQ} \\ &= \text{Slope of PQ} \\ &= -4\end{aligned}$$

**Answer 10.**

Slope of line AB

$$\Rightarrow \frac{-1}{3} = \frac{6-9}{12-x}$$

$$\Rightarrow x - 12 = -9$$

$$\Rightarrow x = 3$$

**Answer 11.**

$$\text{Slope of line PQ} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\Rightarrow \frac{1}{3} = \frac{m-5}{2+7}$$

$$\Rightarrow 3 = m - 5$$

$$\Rightarrow m = 8$$

**Answer 12.**

$$\text{Slope of line AB} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\Rightarrow 1 = \frac{2p+1-5}{p+2}$$

$$\Rightarrow p + 2 = 2p - 4$$

$$\Rightarrow 6 = p$$

**Answer 13.**

$$\text{Slope of line PQ} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{5 - 1}{6 - 8}$$

$$= \frac{4}{-2}$$

$$\text{Slope} = -2$$

$$\text{Also, Slope of line PQ} = \tan \theta$$

$$\therefore \tan \theta = -2$$

$$\theta = \tan^{-1}(-2)$$

$$\text{Inclination} = \tan^{-1}(-2)$$

**Answer 14.**

$$\text{Slope of line PQ} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-5 - 7}{7 + 5} = -1$$

$$\text{Also, Slope of line AB} = \tan \theta$$

$$\therefore \tan \theta = -1$$

$$\tan \theta = \tan (90^\circ + 45^\circ)$$

$$\theta = 135^\circ$$

$$\text{Inclination} = 135^\circ$$

**Answer 15.**

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

$$y = 2x + 10$$

$$m_1 = 2$$

$$\text{Slope of required line}(m_2) = m_1 = 2$$

$$(b) x = \frac{3y}{2} + 2$$

$$3y = 2x - 4$$

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

$$m_1 = \frac{2}{3}$$

Slope of required line ( $m_2$ ) =  $m_1 = \frac{3}{5}$

$$(c) \frac{3x}{4} + \frac{5y}{2} = 7$$

$$10y = -3x + 28$$

$$y = \frac{-3}{10}x + \frac{14}{5}$$

$$m_1 = \frac{-3}{10}$$

Slope of required line ( $m_2$ ) =  $m_1 = \frac{-3}{10}$

$$(d) \frac{x}{4} + \frac{y}{3} = 1$$

$$3x + 4y = 12$$

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

$$m_1 = \frac{-3}{4}$$

Slope of required line ( $m_2$ ) =  $m_1 = \frac{-3}{4}$

$$(e) \frac{2x}{5} + \frac{y}{3} = 2$$

$$6x + 5y = 30$$

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

$$m_1 = \frac{-6}{5}$$

Slope of required line ( $m_2$ ) =  $m_1 = -\frac{6}{5}$

### Answer 16.

When two lines are perpendicular to each other the product of their slope is -1.

i.e.  $m_1 \times m_2 = -1$

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

$$3x + 2y = 8$$

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

$$m_1 = \frac{-3}{2}$$

$$\text{Slope of required line } (m_2) = \frac{-1}{m_1} = \frac{-1}{3}$$

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

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

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

$$m_1 = \frac{2}{3}$$

$$\text{Slope of required line } (m_2) = \frac{-1}{m_1} = \frac{-3}{2}$$

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

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

$$m_1 = \frac{3}{4}$$

$$\text{Slope of required line } (m_2) = \frac{-1}{m_1} = \frac{-4}{3}$$

$$(d) 3x - 5y = 9$$

$$y = \frac{3}{5}x - \frac{9}{5}$$

$$m_1 = \frac{3}{5}$$

$$\text{Slope of required line } (m_2) = \frac{-1}{m_1} = \frac{-5}{3}$$

$$(e) 4x + y = 7$$

$$y = -4x + 7$$

$$m_1 = -4$$

$$\text{Slope of required line } (m_2) = \frac{-1}{m_1} = \frac{1}{4}$$



**Answer 17.**

$$\text{Slope of AB } (m_1) = \frac{6-8}{-2-12} = \frac{-2}{-14} = \frac{1}{7}$$

$$\text{Slope of BC } (m_2) = \frac{0-6}{6+2} = \frac{-3}{4}$$

$$\text{Slope of AC } (m_3) = \frac{0-8}{6-12} = \frac{-8}{-6} = \frac{4}{3}$$

$$\begin{aligned}\text{Slope of BC} \times \text{Slope of AC} &= m_2 \times m_3 \\ &= \frac{-3}{4} \times \frac{4}{3} \\ &= -1\end{aligned}$$

∴ AC and BC are perpendicular to each other and ABC form a right angled triangle.

**Answer 18.**

$$\text{Slope of PQ} = \frac{-5-1}{-1-2} = 2$$

$$\text{Slope of RS} = \frac{5+1}{1+2} = 2$$

∴ Slope of PQ = Slope of RS

∴ PQ || RS

$$\text{Also, Slope of QR} = \frac{5+5}{1+1} = 5$$

$$\text{Slope of SP} = \frac{-1-19}{-2-2} = 5$$

Slope of QR = Slope of SP

∴ QR || SP

**Answer 19.**

We have to prove that ABCD is a rhombus

$$\text{Slope of AC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 8}{0 - 5} = \frac{-3}{-5} = \frac{3}{5}$$

$$\text{Slope of BD} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9 - 4}{1 - 4} = \frac{5}{-3}$$

Thus, slope of AC  $\times$  slope of BD = -1

So, the diagonals AC and BC are perpendicular to each other.

Hence, ABCD is a rhombus.

**Answer 20.**

$$\text{Slope of OM} = \frac{7 - 5}{1 - 5} = \frac{2}{-4} = \frac{-1}{2}$$

$$\text{Slope of PN} = \frac{8 - 4}{4 - 2} = \frac{4}{2} = 2$$

$$\text{Slope of OM} \times \text{Slope of PM} = \frac{1}{2} \times 2 = -1$$

$\therefore$  OM and PN bisect each other at  $90^\circ$ . Hence, MNOP is a square.

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**Ex 13.3****Answer 3.**

$$m = \tan 30^\circ,$$

$$= \frac{1}{\sqrt{3}}$$

Equation of line is given by,

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

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

$$\Rightarrow x - 2 = \sqrt{3}y - 5\sqrt{3}$$

$$\Rightarrow x - \sqrt{3}y - 2 + 5\sqrt{3} = 0$$

$$\Rightarrow \sqrt{3}y = x - 2 + 5\sqrt{3}$$

**Answer 4.**

$$m = \tan (180^\circ - 60^\circ)$$

$$= -\tan 60^\circ$$

$$= -\sqrt{3}$$

Equation of line is given by

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

$$= \frac{y - 7}{x - 3} = -\sqrt{3}$$

$$\sqrt{3}x + y - 7 - 3\sqrt{3} = 0$$

**Answer 5.**

$$m = \tan 45^\circ = 1$$

$$\text{Equation of line, } \frac{y - y_1}{x - x_1} = m$$

$$\frac{y - 3}{x - 8} = 1$$

$$\Rightarrow x - 8 = y - 3$$

$$\Rightarrow x - y = 5$$

**Answer 6.**

$$3x + 4y = 11$$

$$4y = -3x + 11$$

$$y = \frac{-3}{4}x + \frac{11}{4}$$

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

$$\text{Equation of line, } \frac{y - y_1}{x - x_1} = m$$

$$\frac{y - 9}{x - 2} = \frac{-3}{4}$$

$$4y - 36 = -3x + 6$$

$$3x + 4y = 42$$

**Answer 7.**

$$3x + y = 9$$

$$y = -3x + 9$$

$$m = -3$$

$$\text{Slope of required line} = \frac{1}{3}$$

$$\text{Equation of line is, } \frac{y - y_1}{x - x_1} = m$$

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

$$\Rightarrow x + 5 = 3y + 3$$

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

**Answer 8.**

Let  $l$  be the perpendicular bisector of  $AB$

$$\text{Slope of } AB = \frac{-6 - 6}{4 + 2} = \frac{-12}{6} = -2$$

$$\text{Slope of } l \text{ i.e slope of line perpendicular to } AB = \frac{1}{2}$$

Let  $l$  intersects  $AB$  at  $P$ ,

$$\therefore AP : PB = 1 : 1$$

Coordinates of  $P$  are,

$$P(x_1, y_1) = P\left(\frac{-2 + 4}{2}, \frac{6 - 6}{2}\right) = P(1, 0)$$

$$\text{Equation of } l \text{ is } \frac{y - y_1}{x - x_1} = \text{slope}$$

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

$$x - 1 = 2y$$

$$x - 2y - 1 = 0$$

**Answer 9.**

Let  $MN$  be perpendicular bisector of  $AB$

$$\therefore AP : PB = 1 : 1$$

Coordinates of  $P$  are,

$$P(a, b) = P\left(\frac{3 - 1}{2}, \frac{5 + 7}{2}\right) = P(1, 6)$$

$$\text{Slope of } AB = \frac{7 - 5}{-1 - 3} = \frac{2}{-4} = \frac{-1}{2}$$

$$\text{Slope of } MN = 2$$

$$\text{Equation of Line } MN \text{ is } \frac{y - y_1}{x - x_1} = \text{slope}$$

$$\frac{y - 6}{x - 1} = 2$$

$$\Rightarrow 2x - 2 = y - 6$$

$$\Rightarrow 2x - y + 4 = 0$$

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

**Answer 10.**

$$x + 3y = 6 \dots (1)$$

$$2x - 3y = 12 \dots (2)$$

Adding (1) and (2), we get

$$3x = 18$$

$$\Rightarrow x = 6$$

$$\text{And } y = 0$$

Point of intersection of given line is (6,0)

$$\text{Slope of } 5x + 2y = 10 \text{ is } \frac{-5}{2}$$

$$\text{Slope of required line is } \frac{-5}{2}$$

$$\text{Equation of required line is } \frac{y - y_1}{x - x_1} = \text{slope}$$

$$\frac{y - 0}{x - 6} = \frac{-5}{2}$$

$$\Rightarrow -5x + 30 = 2y$$

$$\Rightarrow 5x + 2y - 30 = 0$$

**Answer 11.**

$$x + 2y + 1 = 0 \quad \text{----(1)}$$

$$2x - 3y = 12 \quad \text{----(2)}$$

$$(1) \text{ can be rewritten as } 2x + 4y = -2 \dots (3)$$

$$(2) \text{ can be rewritten as } 2x - 3y = 12 \dots (4)$$

Subtracting (4) from (3) we get

$$y = -2$$

$$x = 3$$

$$\text{i.e. } (3, -2)$$

Point of intersection of (1) and (2) is (3, -2).

$$\text{Slope of } 2x + 3y = 9 \text{ is } \frac{-2}{3}$$

$$\text{Slope of required line is } \frac{3}{2}$$

$$\text{Equation of required line is } \frac{y - y_1}{x - x_1} = m$$

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

$$\Rightarrow 3x - 9 = 2y + 4$$

$$\Rightarrow 3x - 2y = 13$$

**Answer 12.**

$$\frac{x}{10} + \frac{y}{5} = 14 \Rightarrow x + 2y = 140 \text{ --- (1)}$$

$$\frac{x}{8} + \frac{y}{6} = 15 \Rightarrow 3x + 4y = 360 \text{ --- (2)}$$

(1) can be rewritten as  $2x + 4y = 280$ ....(3)

(2) can be rewritten as  $3x + 4y = 360$ ....(4)

Subtracting (3) from (4), we get

$$x = 80$$

$$y = 30$$

Point of intersection of (1) and (2) is (80,30)

Slope of  $x - 2y = 5$  is  $\frac{1}{2}$

Equation of required line is  $\frac{y - y_1}{x - x_1} = m$

$$\frac{y - 30}{x - 80} = -2$$

$$\Rightarrow -2x + 160 = y - 30$$

$$\Rightarrow 2x + y = 190$$

**Answer 13.**

Slope of  $px + 5y + 7 = 0$  is  $\frac{-p}{5}$

Slope of  $2y = 5x - 6$  is  $\frac{5}{2}$

Since the lines are given perpendicular to each other, the product of their slopes must be equal to -1.

$$\frac{-p}{5} \times \frac{5}{2} = -1$$

$$\therefore p = 2$$

**Answer 14.**

Slope of  $3x - 2y + 4 = 0$  is  $\frac{3}{2}$

Slope of  $3x + my + 6 = 0$  is  $\frac{-3}{m}$

Since the lines are given parallel their slopes must be equal

$$\therefore \frac{3}{2} = \frac{-3}{m} \Rightarrow m = -2$$

**Answer 15.**

Slope of line  $py = 2x + 5$  is  $\frac{2}{p}$

Slope of line  $qx + 3y = 2$  is  $\frac{-q}{3}$

Since the lines are given parallel their slopes must be equal

$$\therefore \frac{2}{p} = \frac{-q}{3}$$

$$\therefore pq = -6$$

**Answer 16.**

Slope of line  $ay = 2x + 4$  is  $\frac{2}{a}$

Slope of line  $4y + bx = 2$  is  $\frac{-b}{4}$

Since the lines are given perpendicular to each other, the product of the slopes must be equal to -1.

$$\therefore \frac{2}{a} \times \frac{-b}{4} = -1$$

$$\therefore b = 2a$$



**Answer 17.**

Let PS be the median of the  $\Delta PQR$  from P

$$\therefore RS : SQ = 1 : 1$$

Coordinates of S are,

$$S\left(\frac{8+4}{2}, \frac{3+7}{2}\right) = S(2, 5)$$

$$\text{Equation of PS is } \frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

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

$$\Rightarrow 2x - 10 = -3y + 9$$

$$\Rightarrow 2x + 3y = 19$$

**Answer 18.**

Let CE be the median of  $\Delta ABC$  from C

$$\therefore AE : EB = 1 : 1$$

By using mid-point formula

Coordinates of E are,

$$E\left(\frac{8+2}{2}, \frac{5+1}{2}\right) = E(3, 3)$$

$$\text{Equation of CE is } \frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

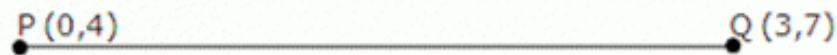
$$\frac{y - 3}{x - 3} = \frac{4 - 3}{5 - 3}$$

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

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

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

**Answer 22.**



$$\text{Slope of PQ} = \frac{7-4}{3-0} = 1$$

(i)  $\tan \theta = 1$

$\therefore$  Gradient = 1

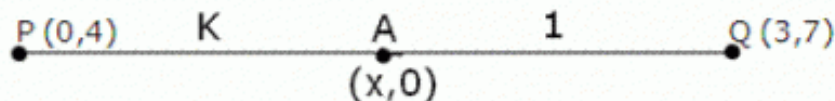
(ii) Equation of PQ  $\rightarrow \frac{y - y_1}{x - x_1} = \text{slope}$

$$\frac{y - 7}{x - 3} = 1$$

$$\Rightarrow x - 3 = y - 7$$

$$\Rightarrow y = x + 4$$

(iii)



Let A(x, 0) divides PQ in the ratio k:1

Using section formula,

$$\text{Coordinates of A(x, 0)} = \left( \frac{3k}{k+1}, \frac{7k+4}{k+1} \right)$$

Equating we get

$$\frac{7k+4}{k+1} = 0$$

$$7k + 4 = 0$$

**Answer 25.**

The altitude through X is perpendicular to YZ.

$$\text{Slope of } YZ = \frac{-4-4}{7+5} = \frac{-2}{3}$$

$$\Rightarrow m = \text{Slope of } YZ = \frac{-2}{3}$$

Slope line perpendicular to YZ will be

$$\frac{-1}{m} = \frac{3}{2}$$

This line passes through X(4,9)

Using the point slope formula,

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

$$y - 9 = \frac{3}{2}(x - 4)$$

$$\Rightarrow 2y - 18 = 3x - 12$$

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