SOLUTIONS WORKSHEET No: 3 (class No: 4)

STRAIGHT LINES

Ans: 1 given lines:

$$4x + 7y - 3 = 0$$
$$2x - 3y + 1 = 0 \quad \times 2$$
$$4x - 6y + 2 = 0$$
$$13y = 5$$

$\boxed{y = 5/13}$ put in eq (2)

$$2x - \frac{15}{13} + 1 = 0 \Rightarrow 2x - \frac{2}{13} = 0$$
$$\Rightarrow 2x = \frac{2}{13} \Rightarrow \boxed{x = 1/13}$$

$\therefore$ point on required line is $\left(\frac{1}{13}, \frac{5}{13}\right)$

let equation of required line is

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

given ~~equati~~ equal Intercepts $a = b$

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

$$\Rightarrow x + y = a$$

this line passes through the point $\left(\frac{1}{13}, \frac{5}{13}\right)$

$$\Rightarrow \frac{1}{13} + \frac{5}{13} = a$$

$$\Rightarrow a = \frac{6}{13}$$

$\therefore$ equation becomes

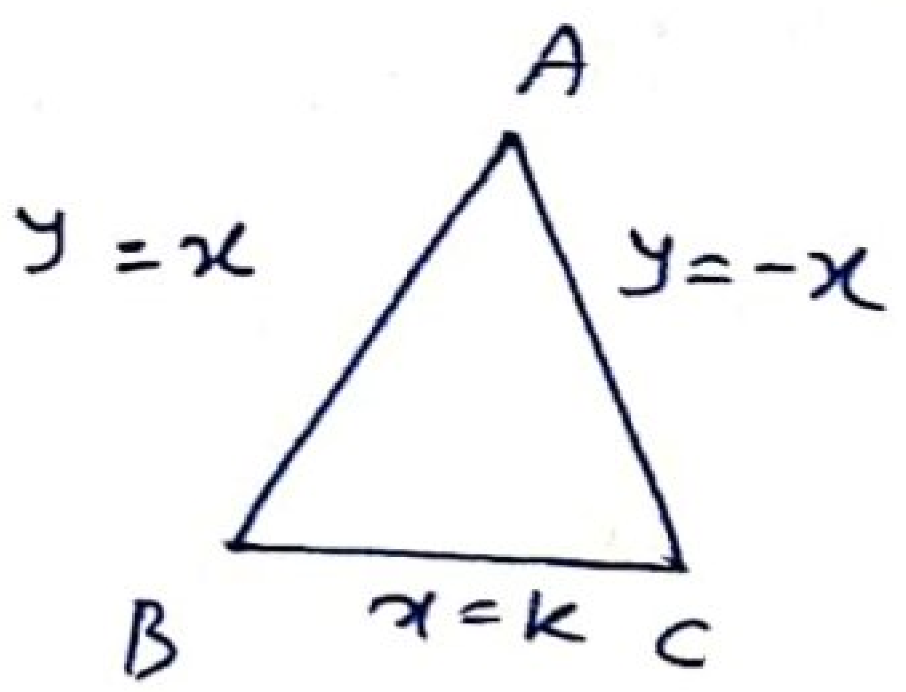
$$x + y = \frac{6}{13} \Rightarrow \boxed{13x + 13y = 6} \text{ Ans}$$

Ans: 2 → given equation

(i) AB: $y = x$

(ii) AC: $y = -x$

(iii) BC = $x = k$



Solving these equations we get

vertices $B(k, k)$ $C(k, -k)$ $A(0, 0)$

Now Area of triangle

$$\Delta = \frac{1}{2}\left| x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2) \right|$$

$$\Delta = \frac{1}{2}\left| 0 + k(-k+0) + k(0-k) \right|$$

$$= \frac{1}{2}\left| -k^2 - k^2 \right|$$

$$= \frac{1}{2}\left| -2k^2 \right|$$

$$= \frac{1}{\cancel{2}}(\cancel{2}k^2) = k^2$$

$\therefore$ Area of triangle ABC = k^2 square units **Ans**

Ans: 3 → given lines $x - 7y = -5$

$3x + y = 0$

Solving these two equations, we get

$x = -\frac{5}{22}$; $y = \frac{15}{22}$

$\therefore$ point on the required line is $\left(-\frac{5}{22}, \frac{15}{22}\right)$

Slope of Y-axis = $\frac{1}{0}$ (Infinity)

Since Required line is parallel to Y-axis

$\therefore$ Slope of Required line = $\frac{1}{0}$

Now equation of Required line (Point-Slope form)

$$y - \frac{15}{22} = \frac{1}{0}\left(x + \frac{5}{22}\right)$$

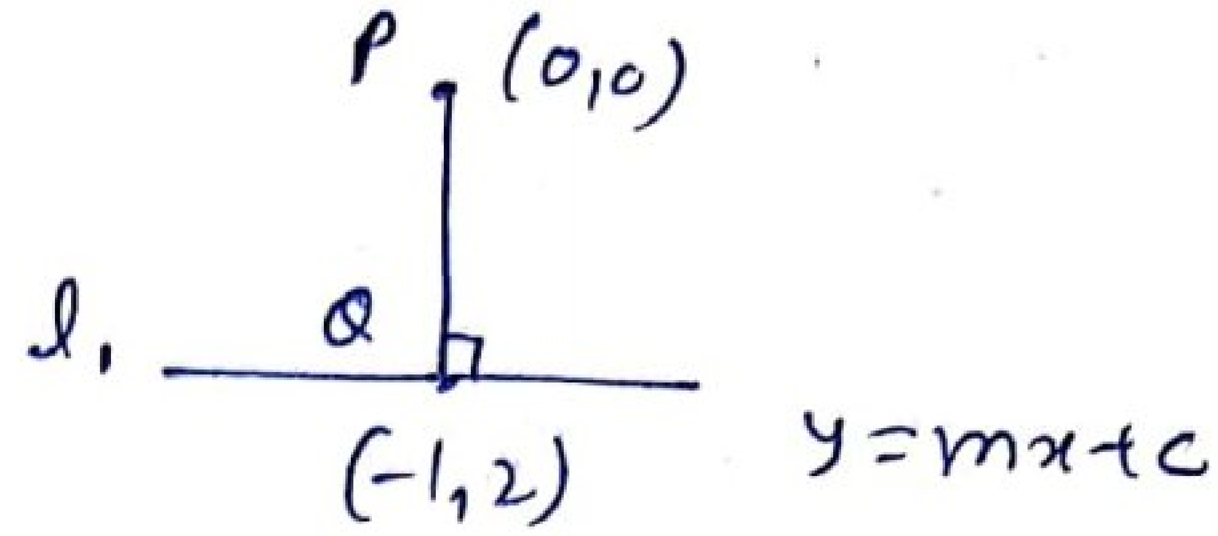
$$\Rightarrow 0 = x + \frac{5}{22}$$

$$\Rightarrow \boxed{22x + 5 = 0}$$ **Ans**

QN: 4 →

equation of given line

$y = mx + c$



Slope of PQ $= \dfrac{2-0}{-1-0} = -2$

Since line (l_1) is $\perp^r$ to PQ

$\therefore$ Slope of line (l_1) $= \frac{1}{2}$ (−ve Reciprocal)

equation of line (l_1) (point slope form)

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

$\Rightarrow 2y - 4 = x + 1$

$\Rightarrow x - 2y = -5$

$\Rightarrow 2y = x + 5$

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

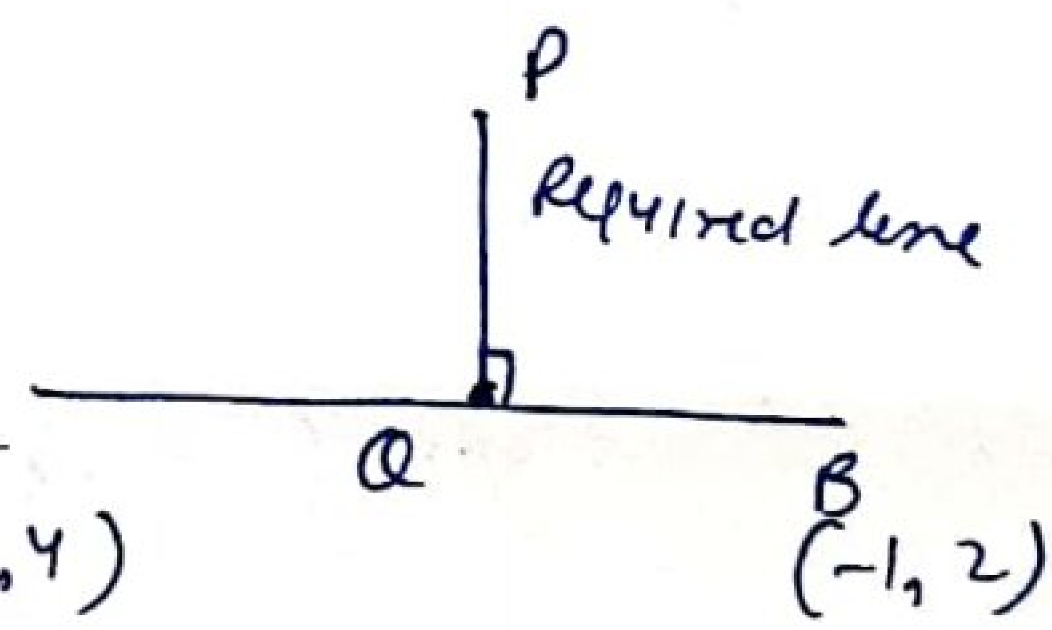
Comparing with $y = mx + c$

we get $\boxed{m = 1/2 \;\; \& \;\; c = 5/2}$ Ans

QN: 5 →

(·) Slope of AB $= \dfrac{2-4}{-1-3} = \dfrac{-2}{-4}$

$= 1/2$



(·) Slope of PQ $= -2$ (−ve Reciprocal)

(·) Mid point of AB : $Q\left(\frac{3-1}{2}, \frac{4+2}{2}\right) = Q(1, 3)$

(·) equation of PQ ($\perp^r$ bisector) point slope form

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

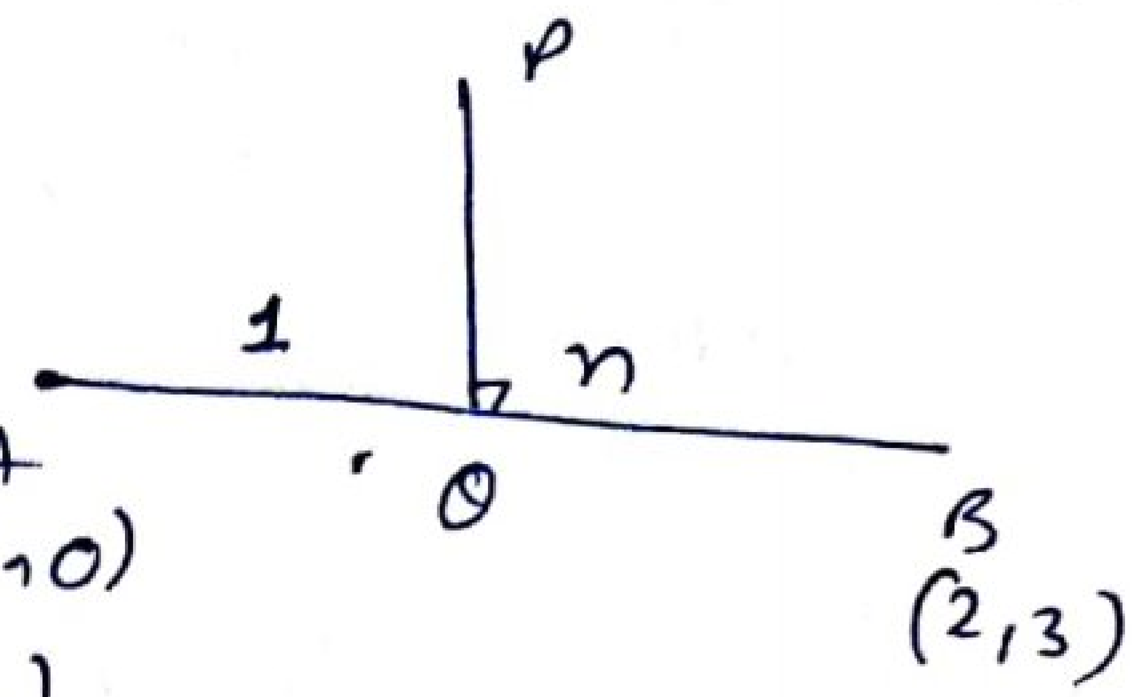
$y - 3 = -2x + 2$

$\Rightarrow \boxed{2x + y = 5}$ Ans.

Ans 7 →

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

(·) PQ ⊥ AB



(·) Slope of PQ = $-\frac{1}{3}$ (-ve reciprocal)

(·) Coordinate of Q (Section formula)

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

$$\therefore Q\left(\frac{n+2}{n+1}, \frac{3}{n+1}\right)$$

(·) equation of PQ (Required line) ; point slope form

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

$$\Rightarrow 3(n+1)y - 9 = -(n+1)x + (n+2)$$

$$\Rightarrow \boxed{(n+1)x + 3(n+1)y = n+11}$$ Ans

Ans: 8 →

1st part (·) point on required line is (0,2)

(·) angle made by line with the X-axis = $2\pi/3$

$\therefore$ Slope of line = $\tan(2\pi/3) = \tan(\pi - \pi/3) = -\tan(\pi/3)$
$= -\sqrt{3}$

(·) equation of Required line (point-slope form)

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

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

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

2nd part (·) here required line is parallel to the above (1st part) line.

(∵) Slope must be same

(∴) slope of required line $= -\sqrt{3}$

(∵) New line cuts Y-axis 2 units below the origin

∴ line passes through the point $(0,-2)$

(∵) Now equation of required line (point - slope form)

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

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

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

QN: 9 → given points $A(3,0)$ $B(-2,-2)$ & $C(8,2)$

equation of AB

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

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

$$\Rightarrow 5y = 2x-6$$

$$\Rightarrow 2x-5y = 6$$

~~If~~ let us check 3rd point $C(8,2)$ satisfy this equation or not?

$$2\times8 - 5\times2$$

$$= 16-10$$

$$= 6 = \text{RHS}$$

∴ the three given points are collinear Ans

Ans 10 → given lines

$\sqrt{3}x + y = 1$

& $\sqrt{3}y + x = 1$

Slope of 1st line = $m_1 = -\frac{\sqrt{3}}{1} = -\sqrt{3}$

Slope of 2nd line : $m_2 = -\frac{1}{\sqrt{3}}$

let θ be the angle b/w them

$$\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|$$

$$\Rightarrow \tan\theta = \left|\frac{-\sqrt{3} + \frac{1}{\sqrt{3}}}{1+1}\right|$$

$$= \left|\frac{-3+1}{2\sqrt{3}}\right|$$

$$= \left|-\frac{1}{\sqrt{3}}\right|$$

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

$\Rightarrow \boxed{\theta = 30^\circ}$ also $\theta = 180 - 30^\circ$

$\boxed{\theta = 150^\circ}$ Ans

—x—