*Book Name: Selina Concise*

**EXERCISE**

## Solution 1:

The given line is $x - 2y + 5 = 0$.

(i) Substituting $x = 1$ and $y = 3$ in the given equation, we have:
L.H.S. $= 1 - 2 \times 3 + 5$
$= 1 - 6 + 5$
$= 6 - 6$
$= 0$
$=$ R.H.S.
Thus, the point (1, 3) lies on the given line.

(ii) Substituting $x = 0$ and $y = 5$ in the given equation, we have:
L.H.S. $= 0 - 2 \times 5 + 5$
$= -10 + 5$
$= -5 \neq$ R.H.S.
Thus, the point (0, 5) does not lie on the given line.

(iii) Substituting $x = -5$ and $y = 0$ in the given equation, we have:
L.H.S. $= -5 - 2 \times 0 + 5$
$= -5 - 0 + 5$
$= 5 - 5$
$= 0 =$ R.H.S.
Thus, the point (−5, 0) lie on the given line.

(iv) Substituting $x = 5$ and $y = 5$ in the given equation, we have:
L.H.S. $= 5 - 2 \times 5 + 5$
$= 5 - 10 + 5$
$= 10 - 10$
$= 0 =$ R.H.S.
Thus, the point (5, 5) lies on the given line.

(v) Substituting $x = 2$ and $y = -1.5$ in the given equation, we have:
L.H.S. $= 2 - 2 \times (-1.5) + 5$
$= 2 + 3 + 5$
$= 10 \neq$ R.H.S.
Thus, the point (2, −1.5) does not lie on the given line.

(vi) Substituting $x = -2$ and $y = -1.5$ in the given equation, we have:
L.H.S. $= -2 - 2 \times (-1.5) + 5$
$= -2 + 3 + 5$
$= 6 \neq$ R.H.S.
Thus, the point (-2, -1.5) does not lie on the given line.

## Solution 2:

(i) The given line is $\frac{x}{2}+\frac{y}{3}=0$

Substituting x = 2 and y = 3 in the given equation,

L.H.S = $\frac{x}{2}+\frac{y}{3}=1+1=2 \neq$ R.H.S

Thus, the given statement is false.

(ii) The given line is $\frac{x}{2}+\frac{y}{3}=0$

Substituting x = 4 and y = -6 in the given equation,

L.H.S. = $\frac{4}{2}+\frac{-6}{3}=2-2=0=$ R.H.S

Thus, the given statement is true.

(iii)L.H.S = y − 7 = 7 − 7 = 0 = R.H.S.

Thus, the point (8, 7) lies on the line y - 7 = 0.

The given statement is true.

(iv)L.H.S. = x + 3 = −3 + 3 = 0 = R.H.S

Thus, the point (−3, 0) lies on the line x + 3 = 0.

The given statement is true.

(v) The point (2, a) lies on the line 2x − y = 3.

∴ 2(2) − a = 3

4 - a = 3

a = 4 − 3 = 1

Thus, the given statement is false.

## Solution 3:

Given, the line given by the equation $2x-\frac{y}{3}=7$ passes through the point (k, 6).

Substituting x = k and y = 6 in the given equation, we have:

$$2x-\frac{6}{3}=7$$

$$2k-2=7$$

$$2k=9$$

$$k=\frac{9}{2}=4.5$$

## Solution 4:

The given equation of the line is $9x + 4y = 3$.
Put $x = 3$ and $y = -k$, we have:
$9(3) + 4(-k) = 3$
$27 - 4k = 3$
$4k = 27 - 3 = 24$
$k = 6$

## Solution 5:

The equation of the given line is $\frac{3x}{5} - \frac{2y}{3} + 1 = 0$

Putting $x = m$, $y = 2m - 1$, we have:

$$\frac{3m}{5} - \frac{2(2m-1)}{3} + 1 = 0$$

$$\frac{3m}{5} - \frac{4m-2}{3} = -1$$

$$\frac{9m - 20m + 10}{15} = -1$$

$$9m - 20m + 10 = -15$$

$$-11m = -25$$

$$m = \frac{25}{11} = 2\frac{3}{11}$$

## Solution 6:

The given line will bisect the join of A $(5, -2)$ and B $(-1, 2)$, if the co-ordinates of the mid-point of AB satisfy the equation of the line.
The co-ordinates of the mid-point of AB are

$$\left(\frac{5-1}{2}, \frac{-2+2}{2}\right) = (2, 0)$$

Substituting $x = 2$ and $y = 0$ in the given equation, we have:
L.H.S. $= 3x - 5y$
$= 3(2) - 5(0)$
$= 6 - 0$
$= 6 =$ R.H.S.
Hence, the line $3x - 5y = 6$ bisect the join of $(5, -2)$ and $(-1, 2)$.

## Solution 7:

(i) The given line bisects the join of A (a, 3) and B (2, −5), so the co-ordinates of the mid-point of AB will satisfy the equation of the line.
The co-ordinates of the mid-point of AB are

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

Substituting $x = \frac{a+2}{2}$ and $y = -1$ in the given equation, we have:

$$y = 3x - 2$$
$$-1 = 3 \times \frac{a+2}{2} - 2$$
$$3 \times \frac{a+2}{2} = 1$$
$$a + 2 = \frac{2}{3}$$
$$a = \frac{2}{3} - 2 = \frac{2-6}{3} = \frac{-4}{3}$$

(ii) The given line bisects the join of A (8, −1) and B (0, k), so the co-ordinates of the mid-point of AB will satisfy the equation of the line.
The co-ordinates of the mid-point of AB are

$$\left(\frac{8+0}{2}, \frac{-1+k}{2}\right) = \left(4 \frac{-1+k}{2}\right)$$

Substituting $x = 4$ and $y = \frac{-1+k}{2}$ in the given equation, we have:

$$x - 6y + 11 = 0$$
$$4 - 6\left(\frac{-1+k}{2}\right) + 11 = 0$$
$$6\left(\frac{-1+k}{2}\right) = 15$$
$$\frac{-1+k}{2} = \frac{15}{6}$$
$$\frac{-1+k}{2} = \frac{5}{2}$$
$$-1 + k = 5$$
$$k = 6$$

## Solution 8:

(i) Given, the point (−3, 2) lies on the line ax + 3y + 6 = 0.
Substituting x = −3 and y = 2 in the given equation, we have:

$a(-3) + 3(2) + 6 = 0$
$-3a + 12 = 0$
$3a = 12$
$a = 4$

(ii) Given, the line $y = mx + 8$ contains the point $(-4, 4)$.
Substituting $x = -4$ and $y = 4$ in the given equation, we have:
$4 = -4m + 8$
$4m = 4 = m = 1$

## Solution 9:

Given, the point P divides the join of (2, 1) and (−3, 6) in the ratio 2 : 3.
Co-ordinates of the point P are

$$\left(\frac{2x(-3)+3\times 2}{2+3}, \frac{2\times 6+3\times 1}{2+3}\right)$$
$$=\left(\frac{-6+6}{5}, \frac{12+3}{5}\right)$$
$$=(0,3)$$

Substituting x = 0 and y = 3 in the given equation, we have:
L.H.S. = 0 − 5(3) + 15
= −15 + 15
= 0 = R.H.S.
Hence, the point P lies on the line $x - 5y + 15 = 0$.

## Solution 10:

Given, the line segment joining the points (5, −4) and (2, 2) is divided by the point Q in the ratio 1: 2.
Co-ordinates of the point Q are

$$\left(\frac{1\times 2+2\times 5}{1+2}, \frac{1\times 2+2\times(-4)}{1+2}\right)$$
$$=\left(\frac{2+10}{3}, \frac{2-8}{3}\right)$$
$$=(4,-2)$$

Substituting x = 4 and y = -2 in the given equation, we have:
L.H.S. = $x - 2y$
$= 4 - 2(-2)$
$= 4 + 4$
$= 8 \neq$ R.H.S.
Hence, the given line does not contain point Q.

## Solution 11:

Consider the given equations:
$4x + 3y = 1$ ....(1)
$3x - y + 9 = 0$ ....(2)
Multiplying (2) with 3, we have:
$9x - 3y = -27$ ....(3)
Adding (1) and (3), we get,
$13x = -26$
$x = -2$
From (2), $y = 3x + 9 = -6 + 9 = 3$
Thus, the point of intersection of the given lines (1) and (2) is $(-2, 3)$.
The point $(-2, 3)$ lies on the line $(2k - 1)x - 2y = 4$.
$(2k - 1)(-2) - 2(3) = 4$
$-4k + 2 - 6 = 4$
$-4k = 8$
$k = -2$

## Solution 12:

We know that two or more lines are said to be concurrent if they intersect at a single point.
We first find the point of intersection of the first two lines.
$2x + 5y = 1$ ....(1)
$x - 3y = 6$ ....(2)
Multiplying (2) by 2, we get,
$2x - 6y = 12$ ....(3)
Subtracting (3) from (1), we get,
$11y = -11$
$y = -1$
From (2), $x = 6 + 3y = 6 - 3 = 3$
So, the point of intersection of the first two lines is $(3, -1)$.
If this point lie on the third line, i.e., $x + 5y + 2 = 0$, then the given lines will be concurrent.
Substituting $x = 3$ and $y = -1$, we have:
L.H.S. $= x + 5y + 2$
$= 3 + 5(-1) + 2$
$= 5 - 5$
$= 0 =$ R.H.S.
Thus, $(3, -1)$ also lie on the third line.
Hence, the given lines are concurrent.

**EXERCISE. 14 (B)**

## Solution 1:

(i) Slope $= \tan 0^\circ = 0$

(ii) Slope = tan 30° = $\frac{1}{\sqrt{3}}$

(iii) Slope = tan 72° 30' = 3.1716

(iv) Slope = tan 46° = 1.0355

## Solution 2:

(i) Slope = tan θ = 0

$\Rightarrow \theta = 0^\circ$

(ii) Slope = tan θ = $\sqrt{3}$

$\Rightarrow \theta = 60^\circ$

(iii) Slope = tan θ = 0.7646

$\Rightarrow \theta = 37^\circ\ 24'$

(iv) Slope = tan θ = 1.0875

$\Rightarrow \theta = 47^\circ\ 24'$

## Solution 3:

We know:

Slope = $\frac{y_2 - y_1}{x_2 - x_2}$

(i) Slope = $\frac{2+3}{1+2} = \frac{5}{3}$

(ii) Slope = $\frac{0-0}{0+4} = \frac{0}{4} = 0$

(iii) Slope = $\frac{-a+b}{b-a} = 1$

## Solution 4:

(i) Slope of AB = $\frac{6-4}{0+2} = \frac{2}{2} = 1$

Slope of the line parallel to AB = Slope of AB = 1

(ii) Slope of AB = $\frac{5+3}{-2-0} = \frac{8}{-2} = -4$

Slope of the line parallel to AB = Slope of AB = -4

## Solution 5:

(i) Slope of AB = $\frac{4=5}{-2-0}=\frac{-9}{2}$

Slope of the line perpendicular to AB = $\frac{-1}{\text{Slope of AB}}=\frac{-1}{\frac{-9}{2}}=\frac{2}{9}$

(ii) Slope of AB = $\frac{2+2}{-1-3}=\frac{4}{-4}=-1$

Slope of the line perpendicular to AB = $\frac{-1}{\text{Slope of AB}}=1$

## Solution 6:

Slope of the line passing through (0, 2) and (−3, −1) = $\frac{-1-2}{-3-0}=\frac{-3}{-3}=1$

Slope of the line passing through (−1, 5) and (4, a) = $\frac{a-5}{4+1}=\frac{a-5}{5}$

Since, the lines are parallel.

$\therefore\ 1=\frac{a-5}{5}$

$a-5=5$

$a=10$

## Solution 7:

Slope of the line passing through (−4, −2) and (2, −3) = $\frac{-3+2}{2+4}=\frac{-1}{6}$

Slope of the line passing through (a, 5) and (2, −1) = $\frac{-1-5}{2-a}=\frac{-6}{2-a}$

Since, the lines are perpendicular.

$\therefore\ \frac{-1}{6}=\frac{-1}{\frac{-6}{2-a}}$

$\frac{-1}{6}=\frac{2-a}{6}$

$2 - a = -1$

$a = 3$

## Solution 8:

The given points are A (4, −2), B (−4, 4) and C (10, 6).

Slope of AB = $\frac{4+2}{-4-4} = \frac{6}{-8} = \frac{-3}{4}$

Slope of BC = $\frac{6-4}{10+4} = \frac{2}{14} = \frac{1}{7}$

Slope of AC = $\frac{6+2}{10-4} = \frac{8}{6} = \frac{4}{3}$

It can be seen that:

Slope of AB = $\frac{-1}{\text{Slope of AC}}$

Hence, AB ⊥ AC

Thus, the given points are the vertices of a right – angled triangle.

## Solution 9:

The given points are A (4, 5), B (1, 2), C (4, 3) and D (7, 6).

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

Slope of CD = $\frac{6-3}{7-4} = \frac{3}{3} = 1$

Since, slope of AB = slope of CD

Therefore, AB ∥ CD

Slope of BC = $\frac{3-2}{4-1} = \frac{1}{3}$

Slope of DA = $\frac{5-6}{4-7} = \frac{-1}{-3} = \frac{1}{3}$

Since, slope of BC = slope of DA

Therefore, BC ∥ DA

Hence, ABCD is a parallelogram

## Solution 10:

Let the given points be A (−2, 4), B (4, 8), C (10, 7) and D (11, −5).
Let P, Q, R and S be the mid-points of AB, BC, CD and DA respectively.

Co-ordinates of P are $\left(\frac{-2+4}{2}, \frac{4+8}{2}\right) = (1, 6)$

Co-ordinates of Q are $\left(\frac{4+10}{2}, \frac{8+7}{2}\right) = \left(7, \frac{15}{2}\right)$

Co-ordinates of R are $\left(\frac{10+11}{2}, \frac{7-5}{2}\right) = \left(\frac{21}{2}, 1\right)$

Co-ordinates of S are $\left(\frac{11-2}{22}, \frac{-5+4}{2}\right) = \left(\frac{9}{2}, \frac{-1}{2}\right)$

Slope of PQ = $\frac{\frac{15}{2}-6}{7-1} = \frac{\frac{15-12}{2}}{6} = \frac{3}{12} = \frac{1}{4}$

Slope of RS = $\frac{\frac{-1}{2}-1}{\frac{9}{2}-\frac{21}{2}} = \frac{\frac{-1-2}{2}}{\frac{9-21}{2}} = \frac{-3}{-12} = \frac{1}{4}$

Since, slope of PQ = Slope of RS, PQ ∥ RS.

Slope of QR = $\frac{1-\frac{15}{2}}{\frac{21}{2}-7} = \frac{\frac{2-15}{2}}{\frac{21-14}{2}} = \frac{-13}{7}$

Slope of SP = $\frac{6+\frac{1}{2}}{1-\frac{9}{2}} = \frac{\frac{12+1}{2}}{\frac{2-9}{2}} = \frac{13}{-7} = \frac{-13}{7}$

Since, slope of QR = Slope of SP, QR ∥ SP.
Hence, PQRS is a parallelogram.

## Solution 11:

The points P, Q, R will be collinear if slope of PQ and QR is the same.

Slope of PQ = $\frac{c+a-b-c}{b-c} = \frac{a-b}{b-a} = -1$

Slope of QR = $\frac{a+b-c-a}{c-b} = \frac{b-c}{c-b} = -1$

Hence, the points P, Q, and R are collinear.

## Solution 12:

Let A = (x, 2) and B = (8, -11)

Slope of AB = $\frac{-11-2}{8-x}$

$\frac{-11-2}{8-x} = \frac{-3}{4}$ (Given)

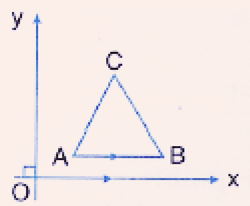
$\frac{13}{8-x} = \frac{3}{4}$

$52 = 24 - 3x$

$3x = 24 - 52 = -28$

$x = \frac{-28}{3}$

## Solution 13:



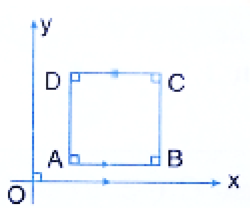

We know that the slope of any line parallel to x-axis is 0.
Therefore, slope of AB = 0

Since, ABC is an equilateral triangle, $\angle A = 60^\circ$

Slope of AC = tan 60° = $\sqrt{3}$

Slope of BC = -tan 60° = $-\sqrt{3}$

## Solution 14:




We know that the slope of any line parallel to x-axis is 0.

Therefore, slope of AB = 0

As CD || BC, slope of CD = Slope of AB = 0

As BC ⊥ AB, slope of BC = $-\dfrac{1}{\text{slope of AB}} = \dfrac{-1}{0} = \text{not defined}$

As AD ⊥ AB, slope of AD = $-\dfrac{1}{\text{slope of AB}} = \dfrac{-1}{0} = \text{not defined}$

(i) The diagonal AC makes an angle of 45° with the positive direction of x axis.
∴ Slope of AC = tan 45° = 1

(ii) The diagonal BC makes an angle of -45° with the positive direction of x axis.
∴ Slope of BC = tan (−45°) = −1

## Solution 15:

Given, A (5, 4), B (−3, −2) and C (1, −8) are the vertices of a triangle ABC.

(i) Slope of AB = $\dfrac{-2-4}{-3-5} = \dfrac{-6}{-8} = \dfrac{3}{4}$

Slope of the altitude of AB = $\dfrac{-1}{\text{slope of AB}} = \dfrac{-1}{\frac{3}{4}} = \dfrac{-4}{3}$

(ii) Since, D is the mid-point of BC.

Co-ordinates of point D are $\left(\dfrac{-3+1}{2}, \dfrac{-2-8}{2}\right) = (-1, -5)$

Slope of AD = $\dfrac{-5-4}{-1-5} = \dfrac{-9}{-6} = \dfrac{3}{2}$

(iii) Slope of AC = $\dfrac{-8-4}{1-5} = \dfrac{-12}{-4} = 3$

Slope of line parallel to AC = Slope of AC = 3

## Solution 16:

(i) Since, BC is perpendicular to AB,

Slope of AB = $\dfrac{-1}{\text{slope of BC}} = \dfrac{-1}{\frac{2}{3}} = \dfrac{-3}{2}$

(ii) Since, AD is parallel to BC,

Slope of AD = Slope of BC = $\frac{2}{3}$

## Solution 17:

(i) A = (-3, -2) and B = (1, 2)

Slope of AB = $\frac{2+2}{1+3} = \frac{4}{4} = 1 = \tan\theta$

Inclination of line AB = θ = 45°

(ii) A = (0, $\sqrt{3}$ ) and B = (3, 0)

Slope of AB = $\frac{0+\sqrt{3}}{3-0} = \frac{\sqrt{3}}{3} = \frac{1}{\sqrt{3}} = \tan\theta$

Inclination of line AB = θ = 30°

(iii) A = (−1, 2 $\sqrt{3}$ ) and B = (−2, $\sqrt{3}$ )

Slope of AB = $\frac{\sqrt{3}-2\sqrt{3}}{-2+1} = \frac{-\sqrt{3}}{-1} = \sqrt{3} = \tan\theta$

Inclination of line AB = θ = 60°

## Solution 18:

Given, points A (−3, 2), B (2, −1) and C (a, 4) are collinear.

∴ Slope of AB = Slope of BC

$$\frac{-1-2}{2+3} = \frac{4+1}{a-2}$$

$$\frac{-3}{5} = \frac{5}{a-2}$$

$$-3a+6=25$$

$$-3a = 25-6 = 19$$

$$a = \frac{-19}{3} = -6\frac{1}{3}$$

## Solution 19:

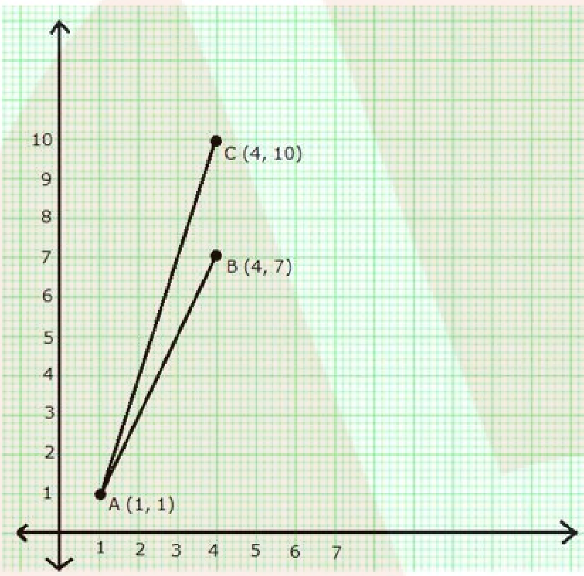
Given, points A (K, 3), B (2, −4) and C (−K + 1, −2) are collinear.

∴ Slope of AB = Slope of BC

$$\frac{-4-3}{2-k} = \frac{-2+4}{-k+1-2}$$

$$\frac{-7}{2-k}=\frac{2}{-k-1}$$
$$7k+7=4-2k$$
$$9k=-3$$
$$k=\frac{-1}{3}$$

## Solution 20:




From the graph, clearly, AC has steeper slope.

Slope of AB = $\frac{7-1}{4-1}=\frac{6}{3}=2$

Slope of AC = $\frac{10-1}{4-1}=\frac{9}{3}=3$

The line with greater slope is steeper. Hence, AC has steeper slope.

## Solution 21:

Since, PQ || RS,
Slope of PQ = Slope of RS

(i) Slope of PQ = $\frac{6-4}{3-2}=2$

Slope of RS = $\frac{k-1}{10-8}=\frac{k-1}{2}$

$$\therefore\ 2 = \frac{k-1}{2}$$

$$k-1=4$$

$$k=5$$

(ii) Slope of PQ = $\frac{11+1}{7-3} = \frac{12}{4} = 3$

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

$$\therefore\ 3 = \frac{k+1}{2}$$

$$k+1=6$$

$$k=5$$

(iii) Slope of PQ $= \frac{11+1}{6-5} = \frac{12}{1} = 12$

Slope of RS = $= \frac{k^2+4k}{7-6} = k^2+4k$

$$\therefore\ 12 = k^2+4k$$

$$k^2+4k-12=0$$

$$(k+6)(k-2)=0$$

$$k=-6 \text{ and } 2$$

**EXERCISE. 14 (C)**

## Solution 1:

Given, y-intercept = c = 2 and slope = m = 3.
Substituting the values of c and m in the equation y = mx + c, we get,
y = 3x + 2, which is the required equation.

## Solution 2:

Given, y-intercept = c = −1 and inclination = 45°.
Slope = m = tan 45° = 1
Substituting the values of c and m in the equation y = mx + c, we get,
y = x - 1, which is the required equation.

## Solution 3:

Given, slope = $\frac{-4}{3}$

The equation passes through (−3, 4) = $(x_1, y_1)$

Substituting the values in $y - y_1 = m(x - x_1)$, we get,

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

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

$4x + 3y = 0$, which is the required equation.

## Solution 4:

Slope of the line = $\tan 60^o = \sqrt{3}$

The line passes through the point (5, 4) = $(x_1, y_1)$

Substituting the values in $y - y_1 = m(x - x_1)$, we get,

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

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

$y = \sqrt{3}x + 4 - 5\sqrt{3}$, which is the required equation.

## Solution 5:

(i) Let (0, 1) = $(x_1, y_1)$ and (1, 2) = $(x_2, y_2)$

$\therefore$ slope of the line = $\frac{2-1}{1-0} = 1$

The required equation of the line is given by:

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

$y - 1 = 1(x - 0)$

$y - 1 = x$

$y = x + 1$

(ii) Let (−1, −4) = $(x_1, y_1)$ and (3, 0) = $(x_2, y_2)$

$\therefore$ slope of the line = $\frac{0+4}{3+1} = \frac{4}{4} = 1$

The required equation of the line is given by:

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

$y + 4 = 1(x + 1)$

$y + 4 = x + 1$

$y = x - 3$

## Solution 6:

Given, co-ordinates of two points P and Q are (2, 6) and (-3, 5) respectively.

(i) Gradient of PQ = $\frac{5-6}{-3-2} = \frac{-1}{-5} = \frac{1}{5}$

(ii) The equation of the line PQ is given by:

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

$y - 6 = \frac{1}{5}(x - 2)$

$5y - 30 = x - 2$

$5y = x + 28$

(iii) Let the line PQ intersects the x-axis at point A (x, 0).

Putting y = 0 in the equation of the line PQ, we get,

$0 = x + 28$

$x = -28$

Thus, the co-ordinates of the point where PQ intersects the x-axis are A (−28, 0).

## Solution 7:

(i) Given, co-ordinates of two points A and B are (-3, 4) and (2, -1).

Slope = $\frac{-1-4}{2+3} = \frac{-5}{5} = -1$

The equation of the line AB is given by:

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

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

$y + 1 = -x + 2$

$x + y = 1$

(ii) Let the line AB intersects the y-axis at point (0, y).

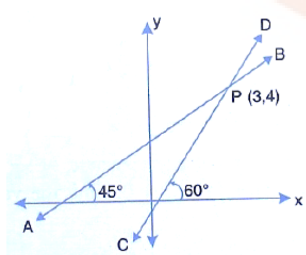
Putting x = 0 in the equation of the line, we get,

$0 + y = 1$

$y = 1$

Thus, the co-ordinates of the point where the line AB intersects the y-axis are (0, 1).

## Solution 8:



Slope of line AB = tan 45° = 1
The line AB passes through P (3, 4). So, the equation of the line AB is given by:
$y - y_1 = m(x - x_1)$
$y - 4 = 1(x - 3)$
$y - 4 = x - 3$
$y = x + 1$
Slope of line CD = tan 60° = $\sqrt{3}$
The line CD passes through P (3, 4). So, the equation of the line CD is given by:
$y - y_1 = m(x - x_1)$
$y - 4 = \sqrt{3}(x - 3)$
$y - 4 = \sqrt{3}x - 3\sqrt{3}$
$y = \sqrt{3}x + 4 - 3\sqrt{3}$

## Solution 9:

The vertices of the triangle are given as vertices are A (3, −5), B (1, 2) and C (-7, 4).

Slope of AB = $\frac{2+3}{1-3} = \frac{7}{-2} = \frac{-7}{2}$

The equation of the line AB is given by:
$y - y_1 = m(x - x_1)$
$y + 5 = \frac{-7}{2}(x - 3)$
$2y + 10 = -7x + 21$
$7x + 2y = 11$

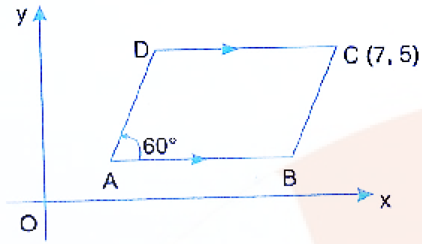
Slope of BC = $\frac{4-2}{-7-1} = \frac{2}{-8} = \frac{-1}{4}$

The equation of the line BC is given by:
$y - y_1 = m(x - x_1)$
$y - 2 = \frac{-1}{4}(x - 1)$
$4y - 8 = -x + 1$
$x + 4y = 9$

Slope of AC = $\frac{4+5}{-7-3} = \frac{9}{-10} = \frac{-9}{10}$

The equation of the line AC is given by:
$y - y_1 = m(x - x_1)$
$y - 4 = \frac{-9}{10}(x + 7)$
$10y - 40 = -9x - 63$
$9x + 10y + 23 = 0$

## Solution 10:




Since, ABCD is a parallelogram,
$\angle A + \angle B = 180^\circ$
$\angle B = 180^\circ - 60^\circ = 120^\circ$
Slope of BC = tan 120° = tan (90° + 30°) = cot30° = $\sqrt{3}$
Equation of the line BC is given by:
$y - y_1 = m(x - x_1)$
$y - 5 = \sqrt{3}(x - 7)$
$y - 5 = \sqrt{3}x - 7\sqrt{3}$
$y = \sqrt{3}x + 5 - 7\sqrt{3}$
Since, CD || AB and AB || x-axis, slope of CD = Slope of AB = 0
Equation of the line CD is given by:
$y - y_1 = m(x - x_1)$
$y - 5 = 0(x - 7)$
$y = 5$

## Solution 11:

The given equations are:
$x + 2y = 7$ ....(1)
$x - y = 4$ ....(2)
Subtracting (2) from (1), we get,
$3y = 3$
$y = 1$
From (2), $x = 4 + y = 4 + 1 = 5$
The required line passes through (0, 0) and (5, 1).
Slope of the line = $\dfrac{1-0}{5-0} = \dfrac{1}{5}$
Required equation of the line is given by:
$y - y_1 = m(x - x_1)$
$\Rightarrow y - 0 = \frac{1}{5}(x - 0)$
$\Rightarrow 5y = x$
$\Rightarrow x - 5y = 0$

## Solution 12:

Given, the co-ordinates of vertices A, B and C of a triangle ABC are (4, 7), (-2, 3) and (0, 1) respectively.
Let AD be the median through vertex A.
Co-ordinates of the point D are

$$\left(\frac{-2+0}{2},\frac{3+1}{2}\right)$$

$$(-1,2)$$

$\therefore$ Slope of AD = $\frac{2-7}{-1-4}=\frac{-5}{-5}=1$

The equation of the median AD is given by:
$y - y_1 = m(x - x_1)$
$y - 2 = 1(x + 1)$
$y - 2 = x + 1$
$y = x + 3$

The slope of the line which is parallel to line AC will be equal to the slope of AC.

Slope of AC = $\frac{1-7}{0-4}=\frac{-6}{-4}=\frac{3}{2}$

The equation of the line which is parallel to AC and passes through B is given by:

$y - 3 = \frac{3}{2}(x + 2)$
$2y - 6 = 3x + 6$
$2y = 3x + 12$

## Solution 13:

Slope of BC = $\frac{0-4}{8-4}=\frac{-4}{4}=-1$

Slope of line perpendicular to BC = $\frac{-1}{\text{slope of BC}}=1$

The equation of the line through A and perpendicular to BC is given by:
$y-y_1=m(x-x_1)$
$y - 3 = 1(x - 0)$
$y - 3 = x$
$y = x + 3$

## Solution 14:

Let A = (1, 4), B = (2, 3), and C = (−1, 2).

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

Slope of equation perpendicular to AB = $\frac{-1}{\text{slope of AB}} = 1$

The equation of the perpendicular drawn through C onto AB is given by:

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

y − 2 = 1(x + 1)

y − 2 = x + 1

y = x + 3

## Solution 15:

(i) When x-intercept = 5, corresponding point on x-axis is (5, 0)

When y-intercept = 3, corresponding point on y-axis is (0, 3).

Let $(x_1, y_1) = (5, 0)$ and $(x_2, y_2) = (0, 3)$

Slope = $\frac{3-0}{0-5} = \frac{-3}{5}$

The required equation is:

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

y − 0 = $\frac{-3}{5}$ (x − 5)

5y = −3x + 15

3x + 5y = 15

(ii) When x-intercept = -4, corresponding point on x-axis is (−4, 0)

When y-intercept = 6, corresponding point on y-axis is (0, 6).

Let $(x_1, y_1) = (-4, 0)$ and $(x_2, y_2) = (0, 6)$

Slope = $\frac{6-0}{0+4} = \frac{6}{4} = \frac{3}{2}$

The required equation is:

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

y − 0 = $\frac{3}{2}$ (x + 4)

2y = 3x + 12

(iii) When x-intercept = −8, corresponding point on x-axis is (−8, 0)

When y-intercept = −4, corresponding point on y-axis is (0, −4).

Let $(x_1, y_1) = (-8, 0)$ and $(x_2, y_2) = (0, -4)$

Slope = $\dfrac{-4-0}{0+8} = \dfrac{-4}{8} = \dfrac{-1}{2}$

The required equation is:

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

$y - 0 = \dfrac{-1}{2}(x + 8)$

$2y = -x - 8$

$x + 2y + 8 = 0$

## Solution 16:

Since, x-intercept is 6, so the corresponding point on x-axis is (6, 0).

Slope = m = $\dfrac{-5}{6}$

Required equation of the line is given by:

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

$y - 0 = \dfrac{-5}{6}(x - 6)$

$6y = -5x + 30$

$5x + 6y = 30$

## Solution 17:

Since, x-intercept is 5, so the corresponding point on x-axis is (5, 0).

The line also passes through (-3, 2).

$\therefore$ Slope of the line = $\dfrac{2-0}{-3-5} = \dfrac{2}{-8} = \dfrac{-1}{4}$

Required equation of the line is given by:

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

$y - 0 = \dfrac{-1}{4}(x - 5)$

$4y = -x + 5$

$x + 4y = 5$

## Solution 18:

Since, y-intercept = 5, so the corresponding point on y-axis is (0, 5).

The line passes through (1, 3).

$\therefore$ Slope of the line $= \dfrac{3-5}{1-0} = \dfrac{-2}{1} = -2$

Required equation of the line is given by:

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

$y - 5 = -2(x - 0)$

$y - 5 = -2x$

$2x + y = 5$

## Solution 19:

Let AB and CD be two equally inclined lines.

**For line AB:**

Slope = m = tan 45° = 1

$(x_1, y_1) = (-2, 0)$

Equation of the line AB is:

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

$y - 0 = 1(x + 2)$

$y = x + 2$

**For line CD:**

Slope = m = tan (−45°) = −1

$(x_1, y_1) = (-2, 0)$

Equation of the line CD is:

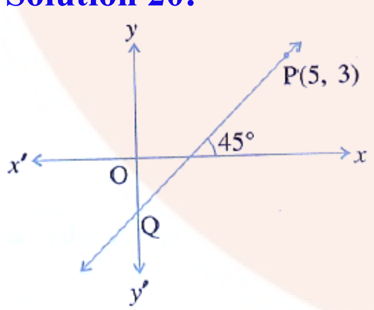
$y - y_1 = m(x - x_1)$

$y - 0 = -1(x + 2)$

$y = -x - 2$

$x + y + 2 = 0$

## Solution 20:




(i) The equation of the y-axis is x = 0

Given that the required line through P (5, 3)
Intersects the y-axis at Q and the angle
of inclination is 45°
Therefore slope of the line PQ = tan 45° = 1

(ii) The equation of a line passing through the point

A($x_1$, $y_1$) with slope 'm' is
$y - y_1 = m (x - x_1)$
Therefore, the equation of the line passing through the point P (5, 3) with slope 1 is
$y - 3 = 1 \times (x - 5)$
$\Rightarrow y - 3 = x - 5$
$\Rightarrow x - y = 2$

(iii) From subpart (ii), the equation of the line PQ
Is $x - y = 2$
Given that the line intersects with the y – axis, x = 0
Thus, substituting x = 0 in the equation x – y = 2
We have, $0 - y = 2$
$\Rightarrow y = -2$
Thus, the coordinates point of intersection Q
Are q(0, −2)

## Solution 21:

Given, P divides the line segment joining A (4, -8) and B (12, 0) in the ratio 3: 1.
Co-ordinates of point P are

$$\left(\frac{3\times12+1\times4}{3+1},\frac{3\times0+1\times(-8)}{3+1}\right)$$

$$=\left(\frac{36+4}{4},\frac{-8}{4}\right)$$

$$=(10,-2)$$

Slope = m = $\frac{-2}{5}$ (Given)

Thus, the required equation of the line is
$y - y_1 = m (x - x_1)$

$y + 2 = \frac{-2}{5}(x - 10)$

$5y + 10 = -2x + 20$
$2x + 5y = 10$

## Solution 22:

(i) Co-ordinates of the centroid of triangle ABC are

$$\left(\frac{1+3+7}{3},\frac{4+2+5}{3}\right)$$

$$= \left(\frac{11}{3}, \frac{11}{3}\right)$$

(ii) Slope of AB = $\frac{2-4}{3-1} = \frac{-2}{2} = -1$

Slope of the line parallel to AB = Slope of AB = −1

Thus, the required equation of the line is

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

$$y - \frac{11}{3} = -1\left(x - \frac{11}{3}\right)$$

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

$$3x + 3y = 22$$

## Solution 23:

Given, AP: CP = 2: 3

∴ Co-ordinates of P are

$$\left(\frac{2\times(-3)+3\times 7}{2+3}, \frac{2\times 4+3(-1)}{2+3}\right)$$

$$= \left(\frac{-6+21}{5}, \frac{8-3}{5}\right)$$

$$= \left(\frac{15}{5}, \frac{15}{5}\right)$$

$$= (3,1)$$

Slope of BP = $\frac{1-1}{3-4} = 0$

Required equation of the line passing through points B and P is

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

y - 1 = 0(x - 3)

y = 1

**EXERCISE. 14 (D)**

## Solution 1:

(i) 3x + 2y + 4 = 0

2y = −3x − 4

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

This is of the form y = mx + c.

(ii) Slope = m = $\frac{-3}{2}$

y-intercept = c = -2

## Solution 2:

(i) y = 4

Comparing this equation with y = mx + c, we have:

Slope = m = 0

y-intercept = c = 4

(ii) ax − by = 0

$\Rightarrow by = ax \Rightarrow y = \frac{a}{b}x$

Comparing this equation with y = mx + c, we have:

Slope = m = $\frac{a}{b}$

y-intercept = c = 0

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

Comparing this equation with y = mx + c, we have:

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

y-intercept = c = $-\frac{5}{4}$

## Solution 3:

Given equation of a line is x - y = 4

$\Rightarrow$ y = x - 4

Comparing this equation with y = mx + c. We have:

Slope = m = 1

y-intercept = c = −4

Let the inclination be θ.

Slope = 1 = tan θ = tan 45°

∴ θ = 45°

## Solution 4:

(i) $3x + 4y + 7 = 0$

$$\Rightarrow 4y = -3x - 7$$

$$\Rightarrow y = -\frac{3}{4} \times - \frac{7}{4}$$

Slope of this line $= \frac{-3}{4}$

$28x - 21y + 50 = 0$

$$\Rightarrow 21y = 28x + 50$$

$$\Rightarrow y = \frac{28}{21}x + \frac{50}{21}$$

$$\Rightarrow y = \frac{4}{3}x + \frac{50}{21}$$

Slope of this line $= \frac{4}{3}$

Since, product of slopes of the two lines = -1, the lines are perpendicular to each other.

(ii) $x - 3y = 4$

$3y = x - 4$

$$y = \frac{1}{3} \times - \frac{4}{3}$$

Slope of this line $= \frac{1}{3}$

$3x - y = 7$

$y = 3x - 7$

Slope of this line = 3

Product of slopes of the two lines = $1 \neq -1$

So, the lines are not perpendicular to each other.

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

$2y = -3x + 5$

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

Slope of this line $= \frac{-3}{2}$

$x + 2y = 1$

$2y = -x + 1$

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

Slope of this line $= \frac{-1}{2}$

Product of slopes of the two lines = $3 \neq -1$

So, the lines are not perpendicular to each other.

(iv) Given, the slope of the line through (1, 4) and (x, 2) is 2.

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

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

$$\frac{-1}{x-1}=1$$

$$-1=x-1$$

$$x=0$$

## Solution 5:

(i) $x + 2y + 3 = 0$

$2y = -x - 3$

$$y=\frac{-1}{2}\times-\frac{3}{2}$$

Slope of this line $=\frac{-1}{2}$

Slope of the line which is parallel to the given line = Slope of the given line = $=\frac{-1}{2}$

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

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

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

Slope of this line $=\frac{3}{2}$

Slope of the line which is parallel to the given line = Slope of the given line $=\frac{3}{2}$

## Solution 6:

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

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

$y = 2x + 6$

Slope of this line = 2

Slope of the line which is perpendicular to the given line

$= \frac{-1}{\text{Slope of the given line}} = \frac{-1}{2}$

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

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

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

Slope of this line = $\frac{1}{6}$

Slope of the line which is perpendicular to the given line = $\frac{-1}{\text{Slope of this line}} = \frac{-1}{\frac{1}{6}} = -6$

## Solution 7:

(i) 2x - by + 3 = 0

by = 2x + 3

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

Slope of this line = $\frac{2}{b}$

ax + 3y = 2

3y = − ax + 2

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

Slope of this line = $\frac{-a}{3}$

Since, the lines are parallel, so the slopes of the two lines are equal.

$\therefore \frac{2}{b} = \frac{-a}{3}$

$ab = -6$

(ii) $mx + 3y + 7 = 0$
$3y = - mx - 7$
$y = \frac{-mx}{3} - \frac{7}{3}$
Slope of this line $= \frac{-m}{3}$
$5x - ny - 3 = 0$
$ny = 5x - 3$
$y = \frac{5x}{n} - \frac{3}{n}$
Slope of this line $= \frac{5}{n}$
Since, the lines are perpendicular; the product of their slopes is -1.
$\therefore \left(\frac{-m}{3}\right)\left(\frac{5}{n}\right) = -1$
$5m = 3n$

## Solution 8:

$2x - y + 5 = 0$
$y = 2x + 5$
Slope of this line = 2
$px + 3y = 4$
$3y = - px + 4$
$y = \frac{-px}{3} + \frac{4}{3}$
Slope of this line $= \frac{-p}{3}$
Since, the lines are perpendicular to each other, the product of the slopes is −1.
$\therefore (2)\left(\frac{-p}{3}\right) = -1$
$\frac{2p}{3} = 1$
$p = \frac{3}{2}$

## Solution 9:

(i) $2x - 2y + 3 = 0$

$2y = 2x + 3$

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

Slope of the line AB = 1

(ii) Required angle = $\theta$

Slope = $\tan\theta = 1 = \tan 45^{o}$

$\theta = 45^{o}$

## Solution 10:

$4x + 3y = 9$

$3y = -4x + 9$

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

Slope of this line $= \frac{-4}{3}$

$px - 6y + 3 = 0$

$6y = px + 3$

$y = \frac{px}{6} + \frac{1}{2}$

Slope of this line $= \frac{p}{6}$

Since, the lines are parallel, their slopes will be equal.

$\therefore \frac{-4}{3} = \frac{p}{6}$

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

$p = -8$

## Solution 11:

$y = 3x + 7$

Slope of this line = 3

$2y + px = 3$

$2y = -px + 3$

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

Slope of this line $= -\frac{p}{2}$

Since, the lines are perpendicular to each other, the product of their slopes is -1.

$$\therefore\ (3)\left(-\frac{p}{2}\right) = -1$$

$$\frac{3p}{2} = 1$$

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

## Solution 12:

The slope of the line passing through two given points A($x_1$, $y_1$) and B ($x_2$, $y_2$) is

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

The slope of the line passing through two
Given points A(−2, 3) and B (4, b) is

Slope of AB = $\frac{b-3}{4-(-2)} = \frac{b-3}{4+2} = \frac{b-3}{6}$

Equation of the given line is 2x – 4y = 5

⇒ Equation is 4y = 2x – 5

⇒ Equation is y = $\frac{1}{4}(2x-5)$

⇒ Equation is y = $\frac{x}{2} - \frac{5}{4}$

Comparing this equation with the general equation,
Y = mx + c, we have m = $\frac{1}{2}$

Since the given line and AB are perpendicular
to each other, the product of their slopes is -1

$$\therefore \left(\frac{b-3}{6}\right) \times \frac{1}{2} = -1$$

$$\Rightarrow b - 3 = -12$$

$$\Rightarrow b = 3 - 12$$

$$\Rightarrow b = -9$$

## Solution 13:

(i) The slope of the line parallel to x-axis is 0.

$(x_1, y_1) = (-5, 7)$
Required equation of the line is
$y - y_1 = m(x - x_1)$
$y - 7 = 0(x + 5)$
$y = 7$

(ii) The slope of the line parallel to y-axis is not defined.
That is slope of the line is tan 90° and hence the given line is parallel to y-axis.
$(x_1, y_1) = (-5, 7)$
Required equation of the line is
$x - x_1 = 0$
$\Rightarrow x + 5 = 0$

## Solution 14:

(i) $x - 3y = 4$

$\Rightarrow 3y = x - 4$

$\Rightarrow y = \frac{1}{3}\times - \frac{4}{3}$

Slope of this line $= \frac{1}{3}$

Slope of a line parallel to this line $= \frac{1}{3}$

Required equation of the line passing through (5, −3) is
$y - y_1 = m(x - x_1)$

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

$3y + 9 = x - 5$
$x - 3y - 14 = 0$

(ii) $2y = -3x + 8$

Or $y = -\frac{3}{2}\times + \frac{8}{2}$

Slope of given line $= -\frac{3}{2}$

Since the required line is parallel to given straight line.

$\therefore$ Slope of required line (m) $= -\frac{3}{2}$

Now the equation of the required line is given by:
$y - y_1 = m(x - x_1)$

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

## Solution 15:

$4x + 5y = 6$
$5y = - 4x + 6$
$y = \frac{-4x}{5} + \frac{6}{5}$

Slope of this line $= \frac{-4}{5}$

The required line is perpendicular to the line $4x + 5y = 6$.

$\therefore$ Slope of the required line $= \frac{-1}{\text{slope of the given line}} = \frac{-1}{\frac{-4}{5}} = \frac{5}{4}$

The required equation of the line is given by
$y - y_1 = m (x - x_1)$
$y - 1 = \frac{5}{4} (x + 2)$
$4y - 4 = 5x + 10$
$5x - 4y + 14 = 0$

## Solution 16:

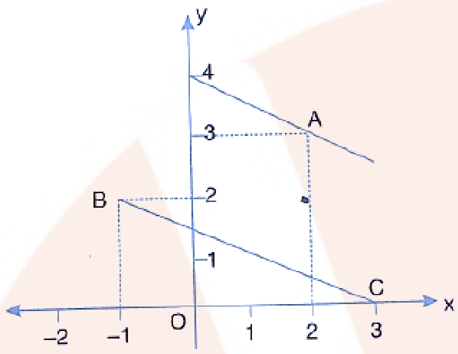
Let $A = (6, -3)$ and $B = (0, 3)$.
We know the perpendicular bisector of a line is perpendicular to the line and it bisects the line, that it, it passes through the mid-point of the line.
Co-ordinates of the mid-point of AB are
$\left(\frac{6+0}{2}, \frac{-3+3}{2}\right) = (3,0)$
Thus, the required line passes through (3, 0).
Slope of AB $= \frac{3+3}{0-6} = \frac{6}{-6} = -1$

$\therefore$ Slope of the required line $= \frac{-1}{\text{slope of AB}} = 1$

Thus, the equation of the required line is given by:
$y - y_1 = m (x - x_1)$
$y - 0 = 1(x - 3)$

$y = x - 3$

## Solution 17:




(i) The co-ordinates of points A, B and C are (2, 3), (−1, 2) and (3, 0) respectively.

(ii) Slope of BC = $\frac{0-2}{3+1} = \frac{-2}{4} = \frac{-1}{2}$

Slope of a line parallel to BC = Slope of BC = $\frac{-1}{2}$

Required equation of a line passing through A and parallel to BC is given by

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

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

$2y - 6 = -x + 2$

$x + 2y = 8$

## Solution 18:

We know that in a rhombus, diagonals bisect each other at right angle.

Let O be the point of intersection of the diagonals AC and BD.

Co-ordinates of O are

$\left(\frac{-5+1}{2}, \frac{6+4}{2}\right) = (-2, 5)$

Slope of BD = $\frac{4-6}{1+5} = \frac{-2}{6} = \frac{-1}{3}$

For line BD:

Slope = m = $\frac{-1}{3}$ , $(x_1, y_1) = (-5, 6)$

Equation of the line BD is

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

$y - 6 = \frac{-1}{3}(x + 5)$

$3y - 18 = -x - 5$

$x + 3y = 13$

For line AC:

Slope = m = $\frac{-1}{\text{slope of BD}} = 3$ , $(x_1, y_1) = (-2, 5)$

Equation of the line AC is

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

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

$y - 5 = 3x + 6$

$y = 3x + 11$

## Solution 19:

We know that in a square, diagonals bisect each other at right angle.
Let O be the point of intersection of the diagonals AC and BD.
Co-ordinates of O are

$\left(\frac{7-1}{2}, \frac{-2-6}{2}\right) = (3, -4)$

Slope of AC = $\frac{-6+2}{-1-7} = \frac{-4}{-8} = \frac{1}{2}$

For line AC:

Slope = m = $\frac{1}{2}$ , $(x_1, y_1) = (7, -2)$

Equation of the line AC is

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

$y + 2 = \frac{1}{2}(x - 7)$

$2y + 4 = x - 7$

$2y = x - 11$

For line BD:

Slope = m = $\frac{-1}{\text{slope of AC}} = \frac{-1}{\frac{1}{2}} = -2$,

$(x_1, y_1) = (3, -4)$

Equation of the line BD is

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

$y + 4 = -2(x - 3)$
$y + 4 = -2x + 6$
$2x + y = 2$

## Solution 20:

(i) We know the median through A will pass through the mid-point of BC. Let AD be the median through A.
Co-ordinates of the mid-point of BC, i.e., D are

$$\left(\frac{2-2}{2}, \frac{2+4}{2}\right) = (0,3)$$

Slope of AD = $\frac{3+5}{0-1} = -8$

Equation of the median AD is
$y - 3 = -8(x - 0)$
$8x + y = 3$

(ii) Let BE be the altitude of the triangle through B.

Slope of AC = $\frac{4+5}{-2-1} = \frac{9}{-3} = -3$

$\therefore$ Slope of BE = $\frac{-1}{\text{slope of AC}} = \frac{1}{3}$

Equation of altitude BE is

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

$3y - 6 = x - 2$
$3y = x + 4$

(iii) Slope of AB = $\frac{2+5}{2-1} = 7$

Slope of the line parallel to AB = Slope of AB = 7
So, the equation of the line passing through C and parallel to AB is
$y - 4 = 7(x + 2)$
$y - 4 = 7x + 14$
$y = 7x + 18$

## Solution 21:

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

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

Slope of this line $= \frac{3}{2}$

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

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

The required equation of the line AB is

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

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

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

$2x + 3y = 12$

(ii) For the point A (the point on x-axis), the value of $y = 0$.

$2x + 3y = 12 \Longrightarrow 2x = 12 \Longrightarrow x = 6$

Co-ordinates of point A are (6, 0).

For the point B (the point on y-axis), the value of $x = 0$.

$\therefore 2x + 3y = 12$

$\Longrightarrow 3y = 12$

$\Longrightarrow y = 4$

Co-ordinates of point B are (0, 4).

Area of $\Delta$ OAB $= \frac{1}{2} \times OA \times OB$

$= \frac{1}{2} \times 6 \times 4$

= 12 sq units

## Solution 22:

For the point A (the point on x-axis), the value of $y = 0$.

$4x - 3y + 12 = 0$

$\Longrightarrow 4x = -12$

$\Longrightarrow x = -3$

Co-ordinates of point A are (-3, 0).

Here, $(x_1, y_1) = (-3, 0)$

The given line is $4x - 3y + 12 = 0$

$3y = 4x + 12$

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

Slope of this line $= \frac{4}{3}$

$\therefore$ Slope of a line perpendicular to the given line $= \dfrac{-1}{\frac{4}{3}} = \dfrac{-3}{4}$

Required equation of the line passing through A is

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

$y - 0 = \dfrac{-3}{4}(x + 3)$

$4y = -3x - 9$

$3x + 4y + 9 = 0$

## Solution 23:

(i) The given equation is

$2x - 3y + 18 = 0$

$3y = 2x + 18$

$y = \dfrac{2}{3}x + 6$

Slope of this line $= \dfrac{2}{3}$

Slope of a line perpendicular to this line $= \dfrac{-1}{\frac{2}{3}} = \dfrac{-3}{2}$

$(x_1, y_1) = (-5, 7)$

The required equation of the line AP is given by

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

$y - 7 = \dfrac{-3}{2}(x + 5)$

$2y - 14 = -3x - 15$

$3x + 2y + 1 = 0$

(ii) P is the foot of perpendicular from point A.

So P is the point of intersection of the lines $2x - 3y + 18 = 0$ and $3x + 2y + 1 = 0$.

$2x - 3y + 18 = 0$

$\Rightarrow 4x - 6y + 36 = 0$

$3x + 2y + 1 = 0$

$\Rightarrow 9x + 6y + 3 = 0$

Adding the two equations, we get,

$13x + 39 = 0$

$x = -3$

$\therefore 3y = 2x + 18 = -6 + 18 = 12$

$y = 4$

Thus, the co-ordinates of the point P are (−3, 4).

## Solution 24:

For the line AB:

$$\text{Slope of AB} = m = \frac{2-0}{2-4} = \frac{2}{-2} = -1$$

$(x_1, y_1) = (4, 0)$

Equation of the line AB is

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

$y - 0 = -1(x - 4)$

$y = -x + 4$

$x + y = 4$ ....(1)

For the line BC:

$$\text{Slope of BC} = m = \frac{6-2}{0-2} = \frac{4}{-2} = -2$$

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

Equation of the line BC is

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

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

$y - 2 = -2x + 4$

$2x + y = 6$ ....(2)

Given that AB cuts the y-axis at P. So, the abscissa of point P is 0.

Putting x = 0 in (1), we get,

$y = 4$

Thus, the co-ordinates of point P are (0, 4).

Given that BC cuts the x-axis at Q. So, the ordinate of point Q is 0.

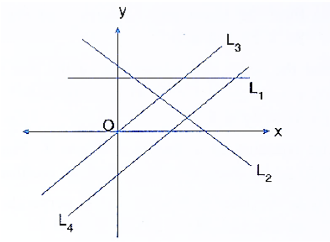
Putting y = 0 in (2), we get,

$2x = 6$

$\Rightarrow x = 3$

Thus, the co-ordinates of point Q are (3, 0).

## Solution 25:



Putting x = 0 and y = 0 in the equation y = 2x, we have:
LHS = 0 and RHS = 0
Thus, the line y = 2x passes through the origin.
Hence, A = $L_3$
Putting x = 0 in y − 2x + 2 = 0, we get, y = −2
Putting y = 0 in y − 2x + 2 = 0, we get, x = 1
So, x-intercept = 1 and y-intercept = -2
So, x-intercept is positive and y-intercept is negative.
Hence, B = $L_4$
Putting x = 0 in 3x + 2y = 6, we get, y = 3
Putting y = 0 in 3x + 2y = 6, we get, x = 2
So, both x-intercept and y-intercept are positive.
Hence, C = $L_2$
The slope of the line y = 2 is 0.
So, the line y = 2 is parallel to x-axis.
Hence, D = $L_1$

**EXERCISE. 14 (E)**

## Solution 1:

Using section formula, the co-ordinates of the point P are

$$\left(\frac{3\times16+5\times8}{3+5},\frac{3\times(-8)+5\times0}{3+5}\right)$$

$$=(11,-3)=(x_1,y_1)$$

3x + 5y = 7

$$\Rightarrow y=\frac{-3}{5}\times+\frac{7}{5}$$

Slope of this line = $\frac{-3}{5}$

As the required line is parallel to the line 3x + 5y = 7,

Slope of the required line = Slope of the given line = $\frac{-3}{5}$

Thus, the equation of the required line is

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

$y + 3 = \frac{-3}{5}(x - 11)$

5y + 15 = -3x + 33

3x + 5y = 18

## Solution 2:

Using section formula, the co-ordinates of the point P are

$$\left(\frac{1\times(-2)+3\times3}{1+3},\frac{1\times1+3\times(-4)}{1+3}\right)$$

$$=\left(\frac{7}{4},\frac{-11}{4}\right)=(x_1,y_1)$$

The equation of the given line is

$5x - 3y + 4 = 0$

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

Slope of this line $=\frac{5}{3}$

Since, the required line is perpendicular to the given line,

Slope of the required line = $\frac{-1}{\frac{5}{3}}=\frac{-3}{5}$

Thus, the equation of the required line is

$y - y1 = m(x - x1)$

$$y+\frac{11}{4}=\frac{-3}{5}\left(x-\frac{7}{4}\right)$$

$$\frac{4y+11}{4}=\frac{-3}{5}\left(\frac{4x-7}{4}\right)$$

$$20y+55=-12x+21$$

$$12x+20y+34=0$$

$$6x+10y+17=0$$

## Solution 3:

Point P lies on y-axis, so putting x = 0 in the equation 5x + 3y + 15 = 0, we get, y = -5

Thus, the co-ordinates of the point P are (0, -5).

$$x - 3y + 4 = 0 \Rightarrow y=\frac{1}{3}x+\frac{4}{3}$$

Slope of this line = $\frac{1}{3}$

The required equation is perpendicular to given equation x - 3y + 4 = 0.

$\therefore$ Slope of the required line = $\dfrac{-1}{\frac{1}{3}} = -3$

$(x_1, y_1) = (0, -5)$

Thus, the required equation of the line is

$y - y1 = m(x - x_1)$

$y + 5 = -3(x - 0)$

$3x + y + 5 = 0$

## Solution 4:

$kx - 5y + 4 = 0$

$\Rightarrow 5y = kx + 4$

$\Rightarrow y = \dfrac{k}{5}x + \dfrac{4}{5}$

Slope of this line = $m_1 = \dfrac{k}{5}$

$5x - 2y + 5 = 0$

$\Rightarrow 2y = 5x + 5$

$\Rightarrow y = \dfrac{5}{2}x + \dfrac{5}{2}$

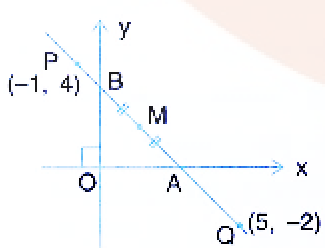
Slope of this line = $m_2 = \dfrac{5}{2}$

Since, the lines are perpendicular, $m_1 \times m_2 = -1$

$\Rightarrow \dfrac{k}{5} \times \dfrac{5}{2} = -1$

$\Rightarrow k = -2$

## Solution 5:



(i) Slope of PQ = $\frac{-2-4}{5+1}=\frac{-6}{6}=-1$

Equation of the line PQ is given by

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

$y - 4 = -1(x + 1)$

$y - 4 = -x - 1$

$x + y = 3$

(ii) For point A (on x-axis), y = 0.

Putting y = 0 in the equation of PQ, we get,

x = 3

Thus, the co-ordinates of point A are (3, 0).

For point B (on y-axis), x = 0.

Putting x = 0 in the equation of PQ, we get,

y = 3

Thus, the co-ordinates of point B are (0, 3).

(iii) M is the mid-point of AB.

So, the co-ordinates of point M are

$$\left(\frac{3+0}{2},\frac{0+3}{2}\right)=\left(\frac{3}{2},\frac{3}{2}\right)$$

## Solution 6:

A = (1, 5) and C = (-3, -1)

We know that in a rhombus, diagonals bisect each other at right angle.

Let O be the point of intersection of the diagonals AC and BD.

Co-ordinates of O are

$$\left(\frac{1-3}{2},\frac{5-1}{2}\right)=\left(-1,2\right)$$

Slope of AC = $\frac{-1-5}{-3-1}=\frac{-6}{-4}=\frac{3}{2}$

For line AC:

Slope = m = $\frac{3}{2}$, $(x_1, y_1) = (1, 5)$

Equation of the line AC is

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

$y - 5 = \frac{3}{2}(x - 1)$

$2y - 10 = 3x - 3$

$3x - 2y + 7 = 0$

For line BD:

$\text{Slope} = m = \dfrac{-1}{\text{slope of AC}} = \dfrac{-2}{3}$,

$(x_1, y_1) = (-1, 2)$

Equation of the line BD is
$y - y_1 = m(x - x_1)$
$y - 2 = \dfrac{-2}{3}(x + 1)$
$3y - 6 = -2x - 2$
$2x + 3y = 4$

## Solution 7:

Using distance formula, we have:
$AB = \sqrt{(6-3)^2 + (-2-2)^2} = \sqrt{9+16} = 5$
$BC = \sqrt{(2-6)^2 + (-5+2)^2} = \sqrt{16+9} = 5$
Thus, AC = BC
Also, Slope of AB $= \dfrac{-2-2}{6-3} = \dfrac{-4}{3}$
Slope of BC $= \dfrac{-5+2}{2-6} = \dfrac{-3}{-4} = \dfrac{3}{4}$
Slope of AB × Slope of BC = - 1
Thus, AB ⊥ BC
Hence, A, B, C can be the vertices of a square…..

(i) Slope of AB $= \dfrac{-2-2}{6-3}$ Slope of CD

Equation of the line CD is
$y - y_1 = m(x - x_1)$
$\Rightarrow y + 5 = \dfrac{-4}{3}(x - 2)$
$\Rightarrow 3y + 15 = -4x + 8$
$\Rightarrow 4x + 3y = -7$.........(1)

Slope of BC $= \left(\dfrac{-5+2}{2-6}\right) = \dfrac{-3}{-4} = \dfrac{3}{4}$ Slope of AD

Equation of the line AD is
$y - y_1 = m(x - x_1)$

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

$$\Rightarrow 4y-8=3x-9$$

$$\Rightarrow 3x-4y=1........(2)$$

Now, D is the point of intersection of CD and AD.

$$(1)\Rightarrow 16x+12y=-28$$

$$(2)\Rightarrow 9x-12y=3$$

Adding the above two equations we get,

$$25x=-25$$

$$\Rightarrow x=-1$$

so, $4y=3x-1=-3-1=-4$

$$\Rightarrow y=-1$$

Thus, the co-ordinates of point D are$(-1,-1)$.

(ii) The equation of line AD is found in part (i)

It is $3x - 4y = 1$ Or $4y = 3x - 1$

Slope of BD = $\frac{-1+2}{-1-6}=\frac{1}{-7}=\frac{-1}{7}$

The equation of diagonal BD is

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

$$\Rightarrow y+1=\frac{-1}{7}(x+1)$$

$$\Rightarrow 7y+7=-x-1$$

$$\Rightarrow x+7y+8=0$$

## Solution 8:

The given line is

$x = 3y + 2$ ...(1)

$3y = x - 2$

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

Slope of this line is $\frac{1}{3}$

The required line intersects the given line at right angle.

$\therefore$ Slope of the required line = $\frac{-1}{\frac{1}{3}}=-3$

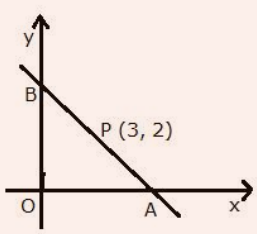
The required line passes through (0, 0) = ($x_1$, $y_1$)
The equation of the required line is
$y - y_1 = m(x - x_1)$
$y - 0 = -3(x - 0)$
$3x + y = 0$ ...(2)
Point X is the intersection of the lines (1) and (2).
Using (1) in (2), we get,
$9y + 6 + y = 0$

$$y = \frac{-6}{10} = \frac{-3}{5}$$

$$\therefore\ x = 3y + 2 = \frac{-9}{5} + 2 = \frac{1}{5}$$

Thus, the co-ordinates of the point X are $\left(\frac{1}{5}, \frac{-3}{5}\right)$

## Solution 9:




Let the line intersect the x-axis at point A (x, 0) and y-axis at point B (0, y).

Since, P is the mid-point of AB, we have:

$$\left(\frac{x+0}{2}, \frac{0+y}{2}\right) = (3,2)$$

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

$x = 6,\ y = 4$
Thus, A = (6, 0) and B = (0, 4)

Slope of line AB = $\frac{4-0}{0-6} = \frac{4}{-6} = \frac{-2}{3}$

Let ($x_1$, $y_1$) = (6, 0)
The required equation of the line AB is given by
$y - y_1 = m(x - x_1)$

$$y - 0 = \frac{-2}{3}(x - 6)$$

$3y = -2x + 12$

$2x + 3y = 12$

## Solution 10:

$7x + 6y = 71 \Longrightarrow 28x + 24 = 284$ ...(1)
$5x - 8y = -23 \Longrightarrow 15x - 24y = -69$ ...(2)
Adding (1) and (2), we get,
$43x = 215$
$x = 5$
From (2), $8y = 5x + 23 = 25 + 23 = 48 \Longrightarrow y = 6$
Thus, the required line passes through the point (5, 6).
$4x - 2y = 1$
$2y = 4x - 1$
$y = 2x - \frac{1}{2}$
Slope of this line = 2
Slope of the required line = $\frac{-1}{2}$
The required equation of the line is
$y - y_1 = m\left(x_1, x_2\right)$
$y - 6 = \frac{-1}{2}(x - 5)$
$2y - 12 = -x + 5$
$x + 2y = 17$

## Solution 11:

The given line is
$\frac{x}{a} - \frac{y}{b} = 1$
$\Rightarrow \frac{y}{b} = \frac{x}{a} - 1$
$\Rightarrow y = \frac{b}{a}x - b$
Slope of this line = $\frac{b}{a}$
Slope of the required line = $\frac{-1}{\frac{b}{a}} = \frac{-a}{b}$

Let the required line passes through the point P (0, y).

Putting x = 0 in the equation $\frac{x}{a}-\frac{y}{b}=1$, we get,

$$0-\frac{y}{b}=1$$
$$\Rightarrow y=-b$$

Thus, P = (0, −b) = ($x_1$, $y_1$)

The equation of the required line is

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

$y + b = \frac{-a}{b}(x - 0)$

$by + b^2 = -ax$

$ax + by + b^2 = 0$

## Solution 12:

(i) Let the median through O meets AB at D. So, D is the mid-point of AB.

Co-ordinates of point D are

$$\left(\frac{3-5}{2},\frac{5-3}{2}\right)=\left(-1,1\right)$$

Slope of OD = $\frac{1-0}{-1-0}=-1$

($x_1$, $y_1$) = (0, 0)

The equation of the median OD is

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

$y - 0 = -1(x - 0)$

$x + y = 0$

(ii) The altitude through vertex B is perpendicular to OA.

Slope of OA = $\frac{5-0}{3-0}=\frac{5}{3}$

Slope of the required altitude $=\frac{-1}{\frac{5}{3}}=\frac{-3}{5}$

The equation of the required altitude through B is

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

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

$5y + 15 = -3x - 15$

$3x + 5y + 30 = 0$

## Solution 13:

Let A = (−2, 3) and B = (4, 1)

Slope of AB = m1 = $\frac{1-3}{4+2}=\frac{-2}{6}=\frac{-1}{3}$

Equation of line AB is

$y - y_1 = m_1(x - x_1)$

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

$3y - 9 = - x - 2$

$x + 3y = 7$ ...(1)

Slope of the given line 3x = y + 1 is 3 = $m_2$.

$\therefore m_1 \times m_2 = -1$

Hence, the line through points A and B is perpendicular to the given line.

Given line is 3x = y +1 ...(2)

Solving (1) and (2), we get,

x = 1 and y = 2

So, the two lines intersect at point P = (1, 2).

The co-ordinates of the mid-point of AB are

$$\left(\frac{-2+4}{2},\frac{3+1}{2}\right)=(1,2)=P$$

Hence, the line 3x = y + 1 bisects the line segment joining the points A and B.

## Solution 14:

x cos 30° + y sin 30° = 2

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

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

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

Slope of this line = $-\sqrt{3}$

Slope of a line which is parallel to this given line = $-\sqrt{3}$

Let (4, 3) =$(x_1, y_1)$

Thus, the equation of the required line is given by:

$y - y_1 = m_1(x_1, x_1)$

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

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

## Solution 15:

$(k - 2)x + (k + 3)y - 5 = 0$ ....(1)

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

$y = \left(\frac{2-k}{k+3}\right)x + \frac{5}{k+3}$

Slope of this line = $m_1 = \frac{2-k}{k+3}$

(i) $2x - y + 7 = 0$

$y = 2x + 7 = 0$

Slope of this line = $m_2 = 2$

Line (1) is perpendicular to $2x - y + 7 = 0$

$\therefore\ m_1 m_2 = -1$

$\Rightarrow \left(\frac{2-k}{k+3}\right)(2) = -1$

$\Rightarrow 4 - 2k = -k - 3$

$\Rightarrow k = 7$

(ii) Line (1) is parallel to $2x - y + 7 = 0$

$\therefore\ m_1 = m_2$

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

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

$\Rightarrow 3k = -4$

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

## Solution 16:

Slope of BC = $\frac{7+2}{11+1} = \frac{9}{12} = \frac{3}{4}$

Equation of the line BC is given by

$y - y_1 = m_1(x - x_1)$

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

$4y + 8 = 3x + 3$
$3x - 4y = 5....(1)$

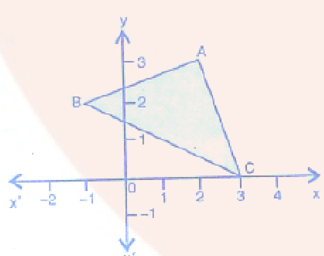
(i) Slope of line perpendicular to BC = $\frac{-1}{\frac{3}{4}} = \frac{-4}{3}$

Required equation of the line through A (0, 5) and perpendicular to BC is
$y - y_1 = m_1 (x - x_1)$
$y - 5 = \frac{-4}{3}(x - 0)$
$3y - 15 = -4x$
$4x + 3y = 15 ....(2)$

(ii) The required point will be the point of intersection of lines (1) and (2).
(1) $\Longrightarrow 9x - 12y = 15$
(2) $\Longrightarrow 16x + 12y = 60$

Adding the above two equations, we get,
$25x = 75$
$x = 3$
So, $4y = 3x - 5 = 9 - 5 = 4$
$y = 1$
Thus, the co-ordinates of the required point is (3, 1).

## Solution 17:




(i) A = (2, 3), B = (−1, 2), C = (3, 0)

(ii) Slope of BC = $\frac{0-2}{3+1} = -\frac{2}{4} = -\frac{1}{2}$

Slope of required line which is parallel to BC = Slope of BC = $-\frac{1}{2}$

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

The required equation of the line through A and parallel to BC is given by:

$y - y_1 = m1(x - x_1)$

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

$2y - 6 = -x + 2$

$x + 2y = 8$

## Solution 18:

The median (say RX) through R will bisect the line PQ.

The co-ordinates of point X are

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

Slope of RX = $\frac{1+1}{5+2} = \frac{2}{7} = m$

$(x_1, y_1) = (-2, -1)$

The required equation of the median RX is given by:

$y - y_1 = m_1(x - x_1)$

$y + 1 = \frac{2}{7}(x + 2)$

$7y + 7 = 2x + 4$

$7y = 2x - 3$

## Solution 19:

P is the mid-point of AB. So, the co-ordinate of point P are

$\left(\frac{8-4}{2}, \frac{-6+2}{2}\right) = (2, -2)$

Q is the mid-point of AC. So, the co-ordinate of point Q are

$\left(\frac{8+0}{2}, \frac{-6-10}{2}\right) = (4, -8)$

Slope of PQ = $\frac{-8+2}{4-2} = \frac{-6}{2} = -3$

Slope of BC = $\frac{-10-2}{0+4} = \frac{-12}{4} = -3$

Since, slope of PQ = Slope of BC,

$\therefore$ PQ || BC

Also, we have:

Slope of PB = $\frac{-2-2}{2+4}=\frac{-2}{3}$

Slope of QC = $\frac{-8+10}{4-10}=\frac{1}{2}$

Thus, PB is not parallel to QC.
Hence, PBCQ is a trapezium.

## Solution 20:

(i) Let the co-ordinates of point A (lying on x-axis) be (x, 0) and the co-ordinates of point B (lying y-axis) be (0, y).
Given, P = (−4, −2) and AP : PB = 1 : 2
Using section formula, we have:

$$(-4,-2)=\left(\frac{1\times 0+2\times x}{1+2},\frac{1\times y+2\times 0}{1+2}\right)$$

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

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

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

Thus, the co-ordinates of A and B are (−6, 0) and (0, -6).

(ii) Slope of AB = $\frac{-6-0}{0+6}=\frac{-6}{6}=-1$

Slope of the required line perpendicular to AB = $\frac{-1}{-1}=1$

$(x_1, y_1)$ = (−4, −2)

Required equation of the line passing through P and perpendicular to AB is given by

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

y + 2 = 1(x + 4)
y + 2 = x + 4
y = x + 2

## Solution 21:

The required line intersects x-axis at point A (−2, 0).
Also, y-intercept = 3
So, the line also passes through B (0, 3).

Slope of line AB = $\dfrac{3-0}{0+2} = \dfrac{3}{2}$ m

$(x_1, y_1) = (-2, 0)$

Required equation of the line AB is given by

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

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

$2y = 3x + 6$

## Solution 22:

The required line passes through A (2, 3).

Also, x-intercept = 4

So, the required line passes through B (4, 0).

Slope of AB = $\dfrac{0-3}{4-2} = \dfrac{-3}{2} = m$

$(x_1, y_1) = (4, 0)$

Required equation of the line AB is given by

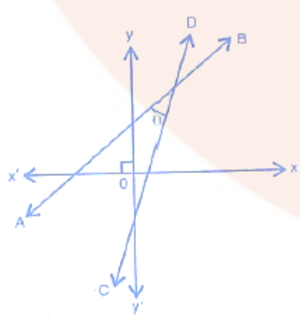
$y - y_1 = m(x - x_1)$

$y - 0 = \dfrac{-3}{2}(x - 4)$

$2y = -3x + 12$

$3x + 2y = 12$

## Solution 23:




Equation of the line AB is y = x + 1

Slope of AB = 1

Inclination of line AB = 45° (Since, $\tan 45^0 = 1$)

$\Rightarrow \angle RPQ = 45^\circ$

Equation of line CD is $y = \sqrt{3}\ x - 1$

Slope of CD = $\sqrt{3}$

Inclination of line CD = 60 (Since, $\tan\ 60^0 = \sqrt{3}$)

$\Rightarrow \angle DQX = 60^\circ$

$\therefore \angle DQP = 180 - 60 = 120$

Using angle sum property in Δ PQR,

$\theta = 180^\circ - 45^\circ - 120^\circ = 15^\circ$

## Solution 24:

Given, P divides the line segment joining A (−2, 6) and B (3, −4) in the ratio 2: 3.

Co-ordinates of point P are

$$\left(\frac{2\times 3+3\times(-2)}{2+3}, \frac{2\times(-4)+3\times 6}{2+3}\right)$$

$$=\left(\frac{6-6}{5}, \frac{-8+18}{5}\right)$$

$$=(0,2)=(x_1, y_1)$$

Slope of the required line = m = $\frac{3}{2}$

The required equation of the line is given by

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

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

$2y - 4 = 3x$

$2y = 3x + 4$

## Solution 25:

Let A = (6, 4) and B = (7, −5)

Slope of the line AB = $\frac{-5-4}{7-6} = -9$

$(x_1, y_1) = (6, 4)$

The equation of the line AB is given by

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

$y - 4 = -9\ (x - 6)$

$y - 4 = -9x + 54$

$9x + y = 58$ ...(1)
Now, given that the ordinate of the required point is -23.
Putting $y = -23$ in (1), we get,
$9x - 23 = 58$
$9x = 81$
$x = 9$
Thus, the co-ordinates of the required point is $(9, -23)$.

## Solution 26:

Given points are A $(7, -3)$ and B$(1, 9)$.

(i) Slope of AB = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{9+3}{1-7} = \frac{12}{-6} = -2$

(ii) Slope of perpendicular bisector = $\frac{-1}{-2} = \frac{1}{2}$

Mid-point of AB = $\left(\frac{7+1}{2}, \frac{-3+9}{2}\right)$ = (4, 3)

Equation of perpendicular bisector is:

$y - 3 = \frac{1}{2}(x - 4)$
$2y - 6 = x - 4$
$x - 2y + 2 = 0$
(iii) Point $(-2, p)$ lies on $x - 2y + 2 = 0$.
$\therefore\ -2 - 2p + 2 = 0$
$\Rightarrow 2p = 0$
$\Rightarrow p = 0$

## Solution 27:

(i) Let the co-ordinates be A $(x, 0)$ and B $(0, y)$.

Mid-point of A and B is given by $\left(\frac{x+0}{2}, \frac{y+0}{2}\right) = \left(\frac{x}{2}, \frac{y}{2}\right)$

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

$\Rightarrow \frac{x}{2} = 2 \text{ and } \frac{y}{2} = -3$

$\Rightarrow x = 4 \text{ and } y = -6$

$\therefore\ A = (4, 0) \text{ and } B = (0, -6)$

(ii) Slope of line AB, m = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{-6-0}{0-4} = \frac{3}{2} = 1\frac{1}{2}$

(iii) Equation of line AB, using A (4, 0)

$y - 0 = \frac{3}{2}(x-4)$

2y = 3x – 12

## Solution 28:

3x + 4y − 7 = 0 ...(1)

4y = −3x + 7

$y = \frac{-3}{4}x + \frac{7}{4}$

(i) Slope of the line = m = $\frac{-3}{4}$

(ii) Slope of the line perpendicular to the given line = $\frac{-1}{\frac{-3}{4}} = \frac{4}{3}$

Solving the equations x - y + 2 = 0 and 3x + y - 10 = 0, we get x = 2 and y = 4.
So, the point of intersection of the two given lines is (2, 4).

Given that a line with slope $\frac{4}{3}$ passes through point (2, 4).

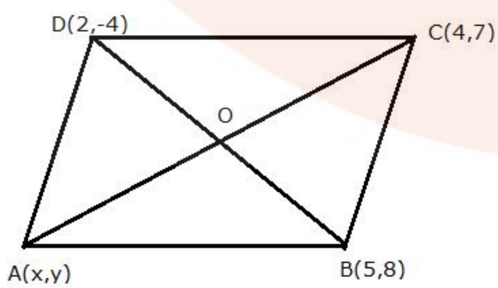
Thus, the required equation of the line is

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

3y − 12 = 4x − 8

4x − 3y + 4 = 0

## Solution 29:




In parallelogram ABCD, A (x, y), B(5, 8), C(4, 7) and D(2, -4).

The diagonals of the parallelogram bisect each other.
O is the point of intersection of AC and BD
Since O is the midpoint of BD, its coordinates will be

$$\left(\frac{2+5}{2},\frac{-4+8}{2}\right)\text{or}\left(\frac{7}{2},\frac{4}{2}\right)\text{or}\left(\frac{7}{2},2\right)$$

(i) Since O is the midpoint of AC also,

$$\frac{x+4}{2}=\frac{7}{2}$$

$$\Rightarrow x+4=7$$

$$\Rightarrow x=7-4=3$$

$$\frac{y+7}{2}=2$$

$$\Rightarrow y+7=14$$

and $\Rightarrow y=14-7=7$

Thus, Coordinates of A are (3,7)

(ii) $\dfrac{y-y_1}{y_2-y_1}=\dfrac{x-x_1}{x_2-x_1}$

$$\Rightarrow y-y_1=\frac{(y_2-y_1)}{(x_2-x_1)}\times(x-x_1)$$

$$\Rightarrow y+4=\frac{8+4}{5-2}\times(x-2)$$

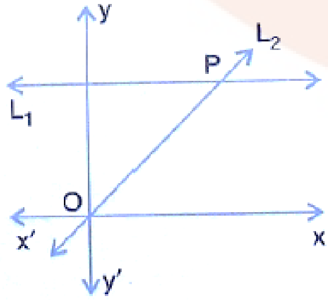
$$\Rightarrow y+4=\frac{12}{3}\times(x-2)$$

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

$$\Rightarrow y+4=4x-8$$

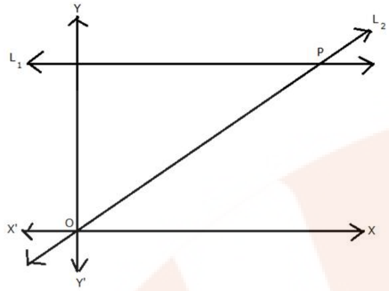
$$\Rightarrow 4x-y=12$$

## Solution 30:



(i) Equation of line $L_1$ is $y = 4$

$\because$ $L_2$ is the bisector of $\angle O$




$\therefore \angle POX = 45^\circ$

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

Let coordinates of P be (x, y)

$\because$ P lies on $L_1$

(ii)

$\therefore$ Slope of $L_2 = \dfrac{y_2 - y_1}{x_2 - x_1}$

$1 = \dfrac{4-0}{x-0} \Rightarrow 1 = \dfrac{4}{x}$

$\Rightarrow x = 4$

$\therefore$ Coordinates of P are (4, 4)

(iii) Equation of $L_2$ is

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

$\Rightarrow y - 4 = 1(x - 4)$

$\Rightarrow y - 4 = x - 4$

$\Rightarrow x = y$