Chapter 12

Equation of Straight line

<u>Exercise 12.1</u>

1.Find the slope of a line whose inclination is

(i) 45°

(ii) 30°

Solution:

The slope of a line having inclination :

(i) 45°

Slope = $tan45^{\circ} = 1$

(ii) 30°

Slope = $tan30^{\circ} = \frac{1}{\sqrt{3}}$

2. Find the inclination of a line whose gradient is

(i) 1

(ii) $\sqrt{3}$

(iii) $\frac{1}{\sqrt{3}}$

Solution:

Given,

(i) tan $\theta = 1$

$\Rightarrow \theta = 45^{\circ}$

(ii) tan $\theta = \sqrt{3}$

$\Rightarrow \theta = 60^{\circ}$

(iii) $tan\theta = \frac{1}{\sqrt{3}}$

$\Rightarrow \theta = 30^{\circ}$

3. Find the equation of a straight line parallel to x-axis which is at a distance.

(i) 2 units above it

(ii) 3 units below it.

Solution:

(i) A line which is parallel to x-axis is y = a

$\Rightarrow y = 2$

Hence, the equation of line parallel to x-axis which is at a distance of 2 units above it is y – 2 =0.

(ii) A line which is parallel to x –axis is y = a

⇒ y = - 3

Hence, the equation of line parallel to x – axis which is at a distance of 3 units below it is y + 3 = 0.

4. Find the equation of a striaght line parallel to y-axis which is at a distance of :

(i) 3 units to the right

(ii) 2 units to the left.

Solution:

A line which is parallel to y – axis is x = a.

(i) Here, x = 3

Hence, the equation of line parallel to y-axis is at a distance of units to the right is $x - 3 = 0$.

(ii) Here, $x = -2$

Hence, the equation of line parallel to y-axis at a distance of 2 units to the left is $x + 2 = 0$.

5. Find the equation of a straight line parallel to y-axis and passing through the point (-3.5).

Solution:

The equation of the line parallel to y-axis passing through (-3, 5) to x = -3.

$\Rightarrow x + 3 = 0$

6. Find the equation of a line whose

(i) slope = 3, y-intercept = -5

(ii) slope = $\frac{-2}{7}$, y-intercept = 3

(iii) gradient = $\sqrt{3}$, y-intercept = $\frac{-4}{3}$

(iv) inclination = 30°, y-intercept = 2

Solution:

Equation of a line whose slope and y-intercept is given by ;

$y = mx + c,$ where m is the slope and c is the y-intercept.

(i) Given : slope = 3, y-intercept = -5

$\Rightarrow y = 3x + (-5)$

Hence, the equation of line is y = $3x - 5$.

(ii) Given : Slope = $\frac{-2}{7}$, y-intercept = 3

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

$\Rightarrow \frac{(-2x+21)}{7}$

$7y = -2x + 21$

Hence, the eqution of line is $2x + 7y - 21 = 0.$

(iii) Given : gradient = $\sqrt{3}$, y –intercept = $\frac{-4}{3}$

$\Rightarrow y = \sqrt{3}\text{x} + \left(\frac{-4}{3}\right)$

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

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

Hence, the equation of line of $3\sqrt{3}$x -3y -4 = 0.

(iv) Given : inclination = $30^\circ, y - intercept = 2$

Slope = $tan30^\circ = \frac{1}{\sqrt{3}}$

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

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

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

Hence, the equation of line is $x - \sqrt{3}$y +2$\sqrt{3}$ =0.

7. Find the slope and y-intercept of the following lines :

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

(ii) $4x - 5y - 9 = 0$

(iii) $3x + 5y + 7 = 0$

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

(v) $y - 3 = 0$

(vi) $x - 3 = 0$

Solution:

We know that, equation of line whose slope and y-intercept is given by :

$y = mx + c$, where m is the slope and c is the y-intecept

Using the above and converting to this, we find

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

$2y = x - 1$

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

Hence, slope $= \frac{1}{2}$ and y-intercept $= \frac{-1}{2}$

(ii) $4x - 5y - 9 = 0$

$5y = 4x - 9$

$\Rightarrow y = \left(\frac{4}{5}\right)x + \left(\frac{-9}{5}\right)$

Hence, slope $= \frac{4}{5}$ and y-intercept $= \frac{-9}{5}$

(iii) $3x + 5y + 7 = 0$

$5y = -3x - 7$

$\Rightarrow \left(\frac{-3}{5}\right)x + \left(\frac{-7}{5}\right)$

Hence, slope = $\frac{-3}{5}$ and y-intercept = $\frac{-7}{5}$

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

$\frac{(4x+3y)}{12} = 1$

$4x + 3y = 12$

$3y = -4x + 12$

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

Hence, slope $= \frac{-4}{3}$ and y-intercept = 4

(v) $y - 3 = 0$

$y = 3$

$\Rightarrow y = (0)x + 3$

Hence, slope = 0 and y-intercept = 3

(vi) $x - 3 = 0$

Here, the slope cannot be defined as the line does not meet y-axis.

8. The equation of the line PQ is 3y- 3x+7 = 0

(i) Write down the slope of the line PQ.

(ii) Calculate the angle that the line PQ makes with the positive direction of x-axis.

Solution:

Given, equation of line PQ is $3y - 3x + 7 = 0$

Re – writing in form of y = mx + c, we have

$3y = 3x - 7$

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

Here,

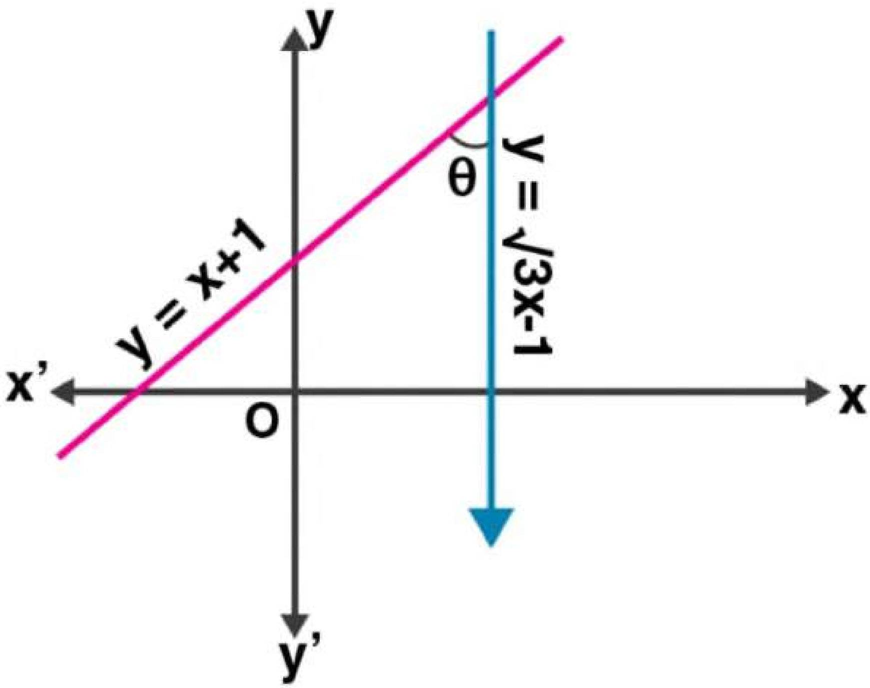
(i) Slope = 1

(ii) as tan $\theta = 1$

$\theta = 45^{\circ}$

Hence, the angle which PQ makes with the x-axis is Q.

9. The given figure represents the line y = x + 1 and y = $\sqrt{3x}$ – 1. write down the angles which the lines make with the positive direction of the x-axis. Hence determine $\boldsymbol{\theta}$.



Solution:

Given line equations, y =$x + 1$ and $y = \sqrt{3x} - 1$

On comparing with y = $mx + c,$

The slope of the line : $y = x + 1$ is 1 as m = 1

So, $tan\theta = 1 \Rightarrow \theta = 45^{\circ}$

And,

The slope of the line : $y = \sqrt{3}$x -1 is $\sqrt{3}$ as m = $\sqrt{3}$

So, tan $\theta = \sqrt{3} \Rightarrow \theta = 60^{\circ}$

Now, in triangle formed by the given two lines and x-axis

Ext. angle = sum of interior opposite angle

$60^{\circ} = \theta + 45^{\circ}$

$\theta = 60^{\circ} - 45^{\circ}$

Thus, $\theta = 15^{\circ}$

10. Find the value of p, given that the line $\frac{y}{2} = x - p$ passes through the point (-4, 4)

Solution :

Given, equation of line : $\frac{y}{2} = x - p$

And, it passes through the point (-4,4)

Hence, it satisfies the line equation

So,

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

$2 = -4 - p$

$p = -4 - 2$

Thus, p = -6

11. Given that $(a, 2a)$ lies on the line $\frac{y}{2} = 3x - 6$. Find the value of a.

Solution:

Given, equation of line : $\frac{y}{2} = 3x - 6$

and, it passes through the point (a,2a)

Hence, it satisfies the line equation

So,

$\frac{2a}{2} = 3(a) - 6$

$a = 3a - 6$

$2a = 6$

Thus, a = 3

12. The graph of the equation y = $mx + c$ passes through the points (1,4) and (-2, -5). Determine the values of m and c.

Solution:

Given, equation of the line is y = $mx + c$

And, it passes through the points (1, 4)

So, the point will satisfy the line equation

$\Rightarrow 4 = m \times 1 + c$

$4 = m + c$

$m + c = 4$ …… (i)

Also, the line passes through another point (-2, -5)

So,

$5 = m(-2) + c$

$5 = -2m + c$

$\Rightarrow 2m - c = 5 \,..(ii)$

Now, on adding (i) and (ii) we get

$3m = 9$

$\Rightarrow m = 3$

Substituting the value of m in (i), we get

$3 + c = 4$

$\Rightarrow c = 4 - 3 = 1$

Therefore, m = 3, c = 1.

13. Find the equation of the line passing through the point (2, -5) and making an intercept of -3 on the y-axis.

Solution:

Given, a line equation passes through point (2,-5) and makes a y-intercept of -3.

We know that,

The eqution of line is $y = mx + c,$ where m is the slope and c is the y-intercept

So, we have

$y = mx - 3$

Now, this line equation will satisfy the point (2, -5)

$-5 = m(2) - 3$

$-5 = 2m - 3$

$2m = 3 - 5 = -2$

$\Rightarrow m = -1.$

Hence, the equation of the line is y = $-x + (-3) \Longrightarrow x + y + 3 = 0$

14. Find the equation of a straight line passing through (-1, 2) and whose slope is $\frac{2}{5}$.

Solution:

Given, the equation of straight lien passes through (-1, 2) and having slope as $\frac{2}{5}$

So, the equation of the line will be

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

Here, $(x_1, y_1\ )$ is (-1, 2)

$\Rightarrow y - 2 = \left(\frac{2}{5}\right)[x - (-1)]$

$5(y - 2) = 2(x + 1)$

$5y - 10 = 2x + 2$

Thus, the line equation is $2x - 5y + 12 = 0$.

15. Find the equation of a straight line whose inclination is 60° and which passes through the point (0, -3).

Solution:

Given,

Inclination of a straight line is 60°

So, the slope = tan 60° = $\sqrt{3}$ = m

And, the equation of line passes through the point (0, -3) =(x_1, y_1)

Hence, the equation of line is given by

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

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

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

$\sqrt{3}x$ – y – 3 = 0

Thus, the line equation is $\sqrt{3}x$ – y – 3 = 0

16. Find the gradient of a line passing through the following pairs of points.

(i) (0, -2), (3, 4)

(ii) (3, -7), (-1, 8)

Solution :

Gradient of a line (m) = $\frac{y_2 - y_1}{x_2 - x_1}$

(i) (0, -2), (3, 4)

$m = \frac{(4+2)}{(3-0)} = \frac{6}{3} = 2$

Hence, gradient = 2

(ii) (3, -7), (-1,8)

$m = \frac{8+7}{-1-3} = \frac{15}{-4}$

Hence, gradient = $\frac{-15}{4}$.

17. The coordinates of two points E and F are (0,4) and (3,7) respectively. Find :

(i) The gradient of EF
(ii) The equation of EF
(iii) The coordinates of the point where the line EF intersects the x-axis.

Solution:

Given, co-ordinates of points E and F are (0,4) and (3,7) respectively

(i) The gradient of EF

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(7-4)}{(3-0)} = \frac{3}{3}$$

$$\Rightarrow m = 1$$

(ii) Equation of line EF is given by,

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

$$y - 7 = 1(x - 3)$$

$$y - 7 = x - 3$$

$$x - y + 7 - 3 = 0$$

Hence, the equation of line EF is $x - y + 4 = 0$.

(iii) It's seen that the co-ordinates of point of intersection of EF and the x-axis will be y = 0

So, substituting the value y = 0 in the above equation

$$x - y + 4 = 0$$

$$x - 0 + 4 = 0$$

$$x = -4$$

Hence, the co-ordinates are (-4,0).

18. Find the intercepts made by the line $\mathbf{2x - 3y + 12 = 0}$ on the co-ordinate axis.

Solution:

Given line equation is $2x - 3y + 12 = 0$

On putting y = 0, we will get the intercept made on x-axis.

$2x - 3y + 12 = 0$

$2x - 3 \times 0 + 12 = 0.$

$2x - \ 0 + 2 = 0$

$2x = \ -12$

$\Rightarrow x = -6$

Now, on putting $x = 0$, we get the intercepts made on y-axis

$2x - 3y + 12 = 0$

$2 \ \times 0 - 3y + 12 = 0$

-3y = -12

$\Rightarrow y = 4$

Hence, the x – intercept and y-intercept of the given line is -6 and 4 respectively.

19. Find the equation of the line passing through the points P(5,1) and Q (1, -1). Hence, show that the points P, Q and R (11, 4) are collinear.

Solution:

Give, two points P(5,1) and G(1,-1)

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

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

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

$= \frac{1}{2}$

So, the equation of the line is

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

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

$2y - 2 = x - 5$

$x - 2y - 3 = 0$

Now, if point R (11,4) is collinear to points P and Q then, R (11, 4) should satisfy the line equation

On substituting, we have

11- 2 (4) – 3 = 11 - 8 – 3 = 0

As point R satisfy the line equation.

Hence, P, Q and R are collinear.

20. Find the value of 'a' for which the following points A (a, 3), B (2,1) and C (5,a) are collinear. Hence find the equation of the line.

Solution:

Given,

Points A (a,3), B (2,1) and C (5,a) are collinear.

So, slope of AB = slope of BC

$\frac{1-3}{2-a} = \frac{a-1}{5-2}$

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

⇒ -6 = $(a-1)(2-a)$ [On cross multiplying]

-6 = $2a - 2 - a^2 + a$

$-6 = 3a - a^2 - 2$

= $a^2 - 3a - 4 = 0$

= $a^2 - 4a + a - 4 = 0$

$a(a-4) + (a-4) = 0$

$(a+1)(a-4) = 0$

$a = -1$ or 4

As a = -1 doesn't satisfy the equation

$\Rightarrow a = 4$

Now,

Slopw of BC = $\frac{(a-1)}{(5-2)} = \frac{(4-1)}{3} = \frac{3}{3}$ = 1 = m

So, the equation of BC is

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

$x - y = -1 + 2$

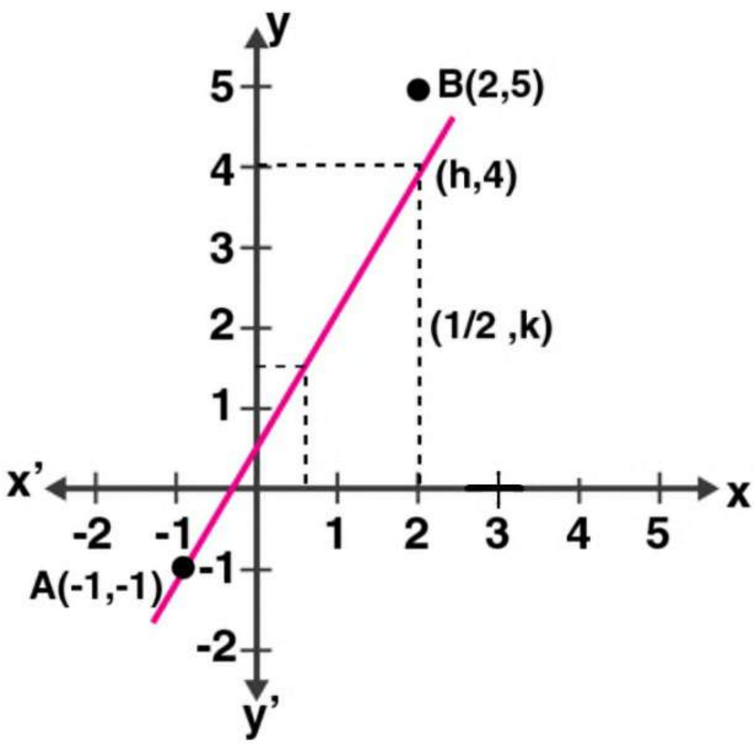
Thus, the equation of BC is $x - y = 1$.

21. Use a graph paper for this equation. The graph of a linear equation in x and y, passees through A (-1, -1) and B (2,5). From your graph, find the values of h and k, if the line passes through (h, 4) and $\left(\frac{1}{2}, k\right)$.

Solution:

Given,

Points (h,4) and $\left(\frac{1}{2}, k\right)$ lie on the line passing through A(-1, -1) and B (2,5)



From the graph, its clearly seen that

$h = \frac{3}{2}$ and

k = 2

22. ABCD is a parallelogram where A(x,y), B(5,8), C(4,7) and D(2, -4). Find

(i) The coordinates of A

(ii) The equation of the diagonal BD.

Solution:

(i) Given,

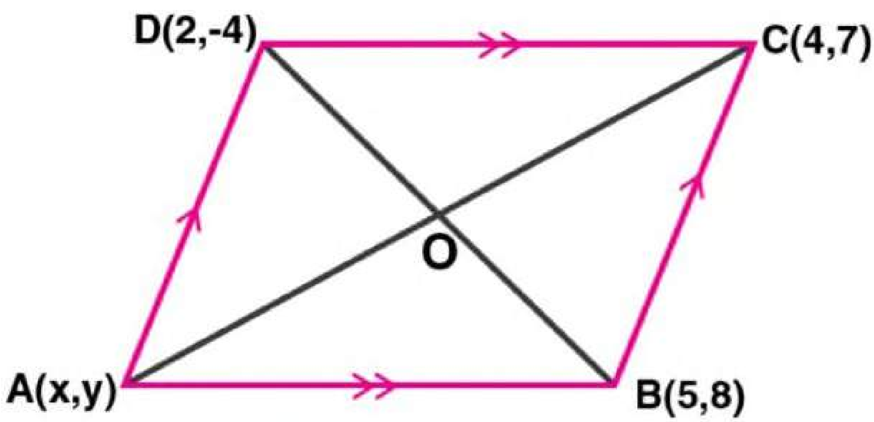
ABCD is a parallelogram where A(x,y), B(5,8), C(4,7) and D(2, -4)

O in the point of intersection of the diagonals of the parallelogram

So, the co-ordinates of O = $\left(\frac{[5+2]}{2}, \frac{[8-4]}{2}\right) = (3.5, 2)$

Now, for the line AC we have

3.5 = $\frac{(x+4)}{2}$ and 2 = $\frac{(y+7)}{2}$



$7 = x + 4$ and $4 = y + 7$

$x = 7 - 4$ and $y = 4 - 7$

$x = 3$ and $y = -3$

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

(ii) Equation of diagonal BD is given by

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

$y-8=\left(\frac{-12}{-3}\right)\times(x-5)$

$y-8=4(x-5)$

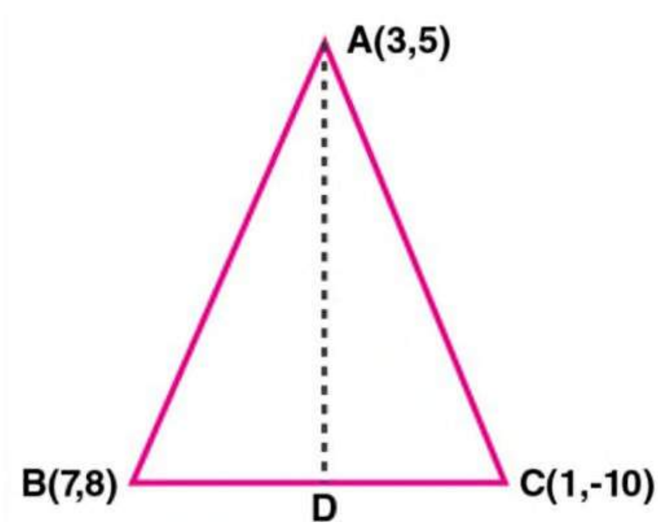
$y-8=4x-20$

$4x-y-20+8=0$

Hence, the equation of the diagonal is $4x-y-12=0$.

23. In $\Delta ABC, A(3,5),\ B(7,8)\ and\ C(1,-10)$. Find the equation of the median through A.

Solution:



Given,

ΔABC and their vertices A(3,5), B(7,8) and C(1, -10).

And, AD is median

So, D is mid-point of BC

Hence, the co-ordinates of D is $\left(\frac{[7+1]}{2}, \frac{[8-10]}{2}\right) = (4, -1)$

Now,

Slope of AD, m = $\frac{y_2 - y_1}{x_2 - x_1}$

$m = \frac{(5+1)}{(3-4)}$

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

= -6

Thus, the equation of AD is given by

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

$y + 1 = -6(x - 4)$

$y + 1 = -6x + 24$

$\Rightarrow 6x + y - 23 = 0$

24. Find the equation of a line passing through the point (-2, 3) and having x – intercept 4 units.

Solution:

Given, point (-2, 3) and the x-intercept of the line passing through that point is 4 units.

So, the co-ordinates of the point where the line meets the x-axis is (4,0)

Now, slope of the line passing through the points (-2,3) and (4,0)

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

m = $\frac{(0-3)}{(4+2)} = \frac{-3}{6} = \frac{-1}{2}$

Hence, the equation of the line will be

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

$y - 0 = \frac{-1}{2}(x - 4)$

$2y = -x + 4$

$\Rightarrow x + 2y = 4$

25. Find the equation of the line whose x-intercept is 6 and y-intercept is -4.

Solution:

Given, x-intercept of a line is 6

So,

The line will pass through the point (6,0)

Also given, the y-intercept of the line is -4 ⇒ $c = -4$

So, the line will pass through the point (0, -4)

Now,

Slope, m = m = $\frac{y_2-y_1}{x_2-x_1}$

m = $\frac{(-4-0)}{(0-6)} = \frac{-4}{-6} = \frac{2}{3}$

Thus, the equation of the line is given by

$y = mx + c$

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

$3y = 2x - 12$

$\Rightarrow 2x - 3y - 12 = 0$

26. Write down the equation of the line whose gradient is $\frac{3}{2}$ and which passes through P where P divides the line segment joining A (-2, 6) and B(3, -4) in the ratio 2 :3.

Solution:

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

So, the co-ordinates of P will be

$x = \frac{(m_1x_2+m_2x_1)}{(m_1+m_2)}$

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

$= \frac{(6-6)}{5}$

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

$y = \frac{(m_1y_2+m_2y_1)}{(m_1+m_2)}$

$= \frac{(2\times(-4)+3 \times (6))}{(2+3)}$

$= \frac{(-8+18)}{5}$

$= \frac{10}{5}$

$= 2$

Hence, the co-ordinates of P are (0,2)

Now, the slope (m) of the line passing through (0,2) is $\frac{3}{2}$

Thus, the equation will be

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

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

$2y - 4 = 3x$

$\Rightarrow 3x - 2y + 4 = 0$

27. Find the equation of the line passing through the point (1,4) and intersecting the line $\mathbf{x - 2y - 11 = 0}$ on the y-axis.

Solution:

Given, line $x - 2y - 11 = 0$ passes through y- axis and point (1,4)

So, putting $x = 0$ in the line equation we get the y-intercept

$0 - 2y - 11 = 0$

$y = \frac{-11}{2}$

The co-ordinates are $\left(0, \frac{-11}{2}\right)$

Now, the slope of the line joining the points $(1,4)$ and $\left(0, \frac{-11}{2}\right)$ is given by

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

$= \frac{\left(\frac{-11}{2} - 4\right)}{(0-1)}$

$= \frac{19}{2}$

Thus, the line equation will be

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

$y + \frac{11}{2} = \frac{19}{2}(x - 0)$

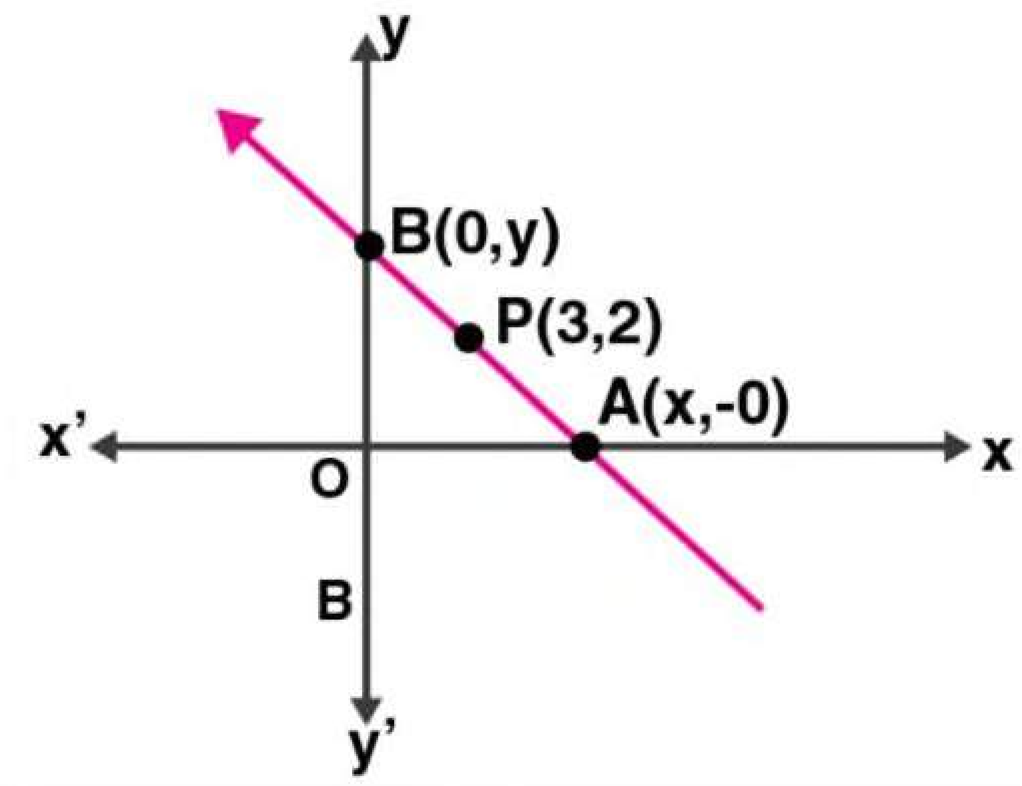
$2y + 11 = 19x$

$\Rightarrow 19x - 2y - 11 = 0$

28. Find the equation of the straight line containing the point (3,2) and making positive equal intercepts on axes.

Solution:

Let the line containing the point P (3,2) pass through x-axis at A(x,0) and y-axis at B (0,y)



Given OA = OB

Thus, $x = y$

Now, the slope of the line (m) $= \frac{y_2 - y_1}{x_2 - x_1}$

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

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

= -1

Hence, the equation of the line will be

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

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

$y - 2 = -x + 3$

$\Rightarrow x + y - 5 = 0$

29. Three vertices of a parallelogram ABCD taken in ordee are A$(3, 6)$, B$(5 - 10)$ and $C(3, 2)$ find :

(i) The coordinates of the fourth vertex D.

(ii) length of diagonal BD.

(iii) equation of side AB of the parallelogram ABCD.

Solution:

Given, the three vertices of a parallelogram ABCD taken in order are A(3, 6), B(5,10) and C (3,2)

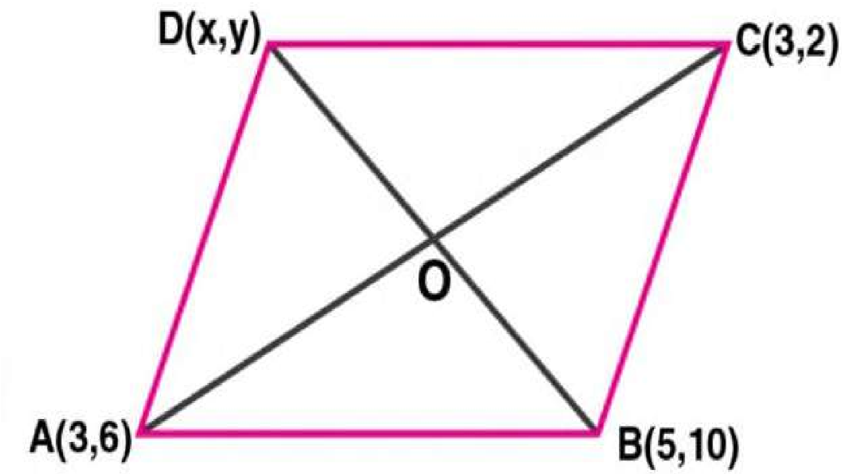
(i) We know that the diagonals of a parallelogram bisect each other.

Let (x,y) be the co-ordinates of D

Hence, we have

Mid-point of diagonal AC = $\left(\frac{(3+3)}{2}, \frac{(6+2)}{2}\right) = (3,4)$

Mid-point of diagonal BD = $\left(\frac{(5+x)}{2}, \frac{(10+y)}{2}\right)$



And, these two should be the same

On equating we get,

$\frac{(5+x)}{2} = 3$ and $\frac{(10+y)}{2} = 4$

$5 + x = 6$ and $10 + y = 8$

$x = 1$ and $y = -2$

Thus, the co-ordinates of D = (1, -2)

(ii) Length of diagonal BD

$= \sqrt{(1-5)^2 + (-2-10)^2} = \sqrt{(4)^2 + (-12)^2}$

$= \sqrt{16+144}$

$= \sqrt{160}$ units

(iii) Equation of the side joining A (3,6) and D(1, -2) is given by

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

$\Rightarrow \frac{x-3}{2} = \frac{y-6}{8}$

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

$4x - 12 = y - 6$

$4x - y = 6$

Thus, the equation of the side joining A(3,6) and D(1, -2) is $4x - y = 6$.

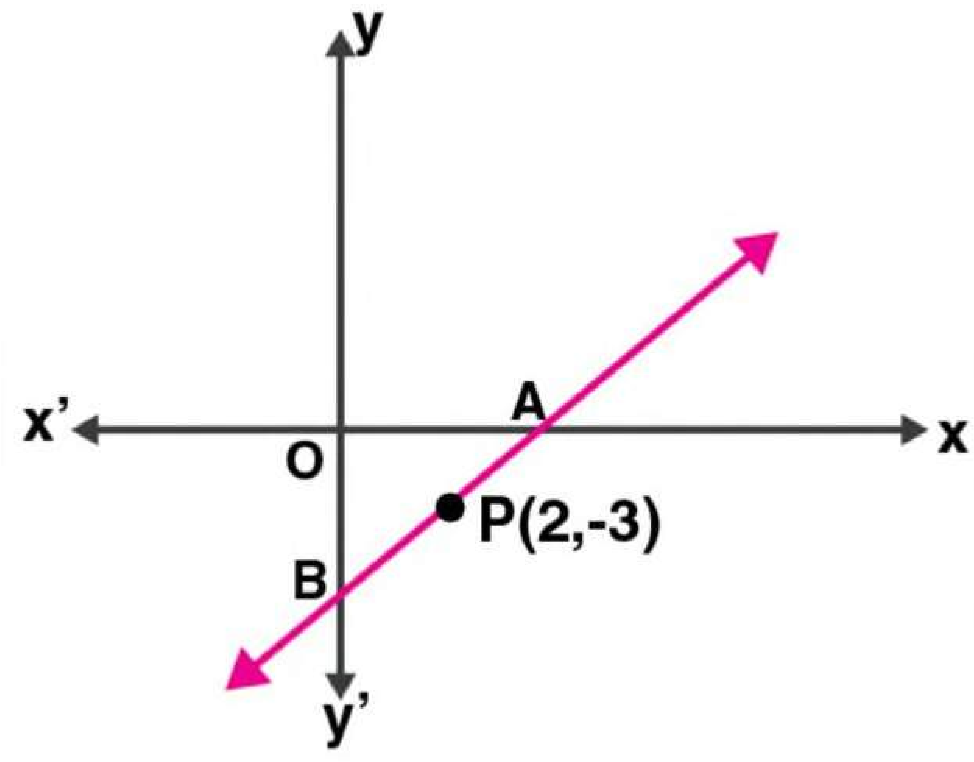
30. A and B are two points on the x-axis and y-axis respectively. P (2, -3) is the mid point of AB. Find the

(i) the co-ordinates of A and B.

(ii) the slope of the line AB.

(iii) the equation of the line AB.

Solution:



Given, points A and B are on x-axis and y-axis respectively

Let co-ordinates of A be (x,0) and of B be (0,y) and P (2, -3) is the midpoint of AB

So, we have

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

$x = 4$ and y = -6

(i) Hence, the co-ordinates of A are (4,0) and of B are (0, -6).

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

$= \frac{(-6-0)}{(0-4)}$

$= \frac{-6}{-4}$

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

(iii) Equation of AB will be

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

$y - (-3) = \frac{3}{2}(x - 2)$ [As P lies on it]

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

$2y + 6 = 3x - 6$

$3x - 2y - 12 = 0$

31. Find the equations of the diagonals of a rectangle whose sides are $x = -1$ $x = 2, y = -2$ and $y = 6$.

Solution:

Given,

The equations of sides of a rectangle are

$x_1 = -1$ $x_2 = 2,$ $y_1 = -2$ and $y_2 = 6.$

The equations of sides of a rectangle are

$x_1 = -1$, $x_2 = 2$, $y_1 = -2$, $y_2 = 6$.

These lines form a rectangle when they intersect at A, B, C, D respectively

Now,

The co-ordinates of A, B, C and D will be (-1, -2), (2, -2), (2,6) and (-1, 6) respectively.

And, AC and BD are its diagonals.

Slope of the diagonal AC

$= \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{(6+2)}{(2+1)}$

$= \frac{8}{3} = m$

So, the equation of AC will be

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

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

$3y + 6 = 8x + 8$

$\Rightarrow 8x - 3y + 2 = 0$

32. Find the equation of a straight line passing through the origin and through the point of intersection of the line $5x + 1y - 3$ and $2x - 3y = 7$

Solution:

Given line equations,

$5x + 7y = 3 \ldots \ldots ..(i)$

$2x - 3y = 7 \ldots \ldots (ii)$

Now, performing multiplcation of (i) by 3 and (ii) by 7, we get

$15x + 21y = 9$

$14x - 21y = 49$

On adding we get,

$29x = 58$

$x = \frac{58}{29}$ = 2

Substituting the value of x in (i), we get

5(2) + 7y= 3

$10 + 7y = 3$

$7y = 3 - 10$

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

Hence, the point of intersection of lines is (2, -1)

Now, the slope of the line joining the points (2, -1) and (0, 0) will be

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

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

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

Equation of the line is given by :

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

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

$2y = -x$

Thus the required line equation is $x + 2y = 0.$

33. Point A (3,-2) on reflection in the x-axis is mapped as 'A' and point B on reflection in the y-axis is mapped onto B' (-4, 3).

(i) Write down the co-ordinates of A' and B.

(ii) Find the slope of the line A'B, hence find its inclination.

Solution:

Given,

‘A’ is the image of A(3, -2) on reflection in the x-axis.

(i) The co-ordinates of A’ will be (3,2).

Again B; (-4, 3) in the image of A’, when reflected in the y-axis

Hence, the co-ordinates of B will be (4, 3)

(ii) Slope of the line joining, the points A’ (3,2) and B (4,3) will be

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

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

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

= 1

So, tan$\theta = 45^{\circ}$

Thus, the angle of inclination is 45°.

Exercise 12.2

1. State which one of the following is true : The straight line y = $3x-5$ and $2y=4x+7$ are

(i) Parallel

(ii) perpendicular

(iii) neither parallel nor perpendicular

Solution:

Given straight lines : $y=3x-5$ and $2y=4x+7 \Rightarrow y=2x+\frac{7}{2}$

And, their slops are 3 and 2

The product of slopes is $3 \times 2 = 6$.

Hence, as the slopes of both lines are neither equal nor their product is -1 the given pair of straight lines are neither parallelo nor perpendicular.

2. If $6x+5y-7=0$ and $2px+5y+1=0$ are parallel lines, findd the value of p.

Solution:

For two lines to be parallel, their slopes must be same.

Given line equations,

$6x+5y-7=0$ and $2px+5y+1=0$

$6x+5y-7=0$

$2px+5y+1=0$

In equation $6x + 5y - 7 = 0$,

$5y = -6x + 7$

$y = \left(\frac{-6}{5}\right)x + \frac{7}{5}$

So, the slope of the line $(m_1) = \frac{-6}{5}$

Again, in equation $2px + 5y + 1 = 0$

5y = $-2px - 1$

$y = \left(\frac{-2p}{5}\right)x - \frac{1}{5}$

So, the slope of the line $(m_2) = \left(\frac{-2p}{5}\right)$

For these two lines to be parallel

$m_1 = m_2$

$\frac{-6}{5} = \frac{-2p}{5}$

$p = \left(\frac{-6}{5}\right) \times \left(\frac{-5}{2}\right)$

Thus, p = 3

3. Line $2x - by + 5 = 0$ and $ax + 3y = 2$ are parallel. Find the relation connecting a aand b.

Solution:

Given lines are : $2x - by + 5 = 0$

and $ax + 3y = 2$

If two lines to be parallel then their slopes must be equal.

In equation $2x - by + 5 = 0$

$by = 2x + 5$

$y = \left(\frac{2}{b}\right)x + \frac{5}{b}$

So, the slope of the line $(m_1) = \frac{2}{b}$

And in equation $ax + 3y = 2$.

$3y = -ax + 2$

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

So, the slope of the line $(m_2) = \left(\frac{-a}{3}\right)$

As the lines are parallel

$m_1 = m_2$

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

6 = -ab

Hence, the relation connecting a and b is ab + c = 0

4. Given that the line $\frac{y}{2} = x - p$ and the line $ax + 5 = 3y$ are parallel, find the value of a.

Solution:

Given,

Line equation : $\frac{y}{2} = x - p$

$\Rightarrow y = 2x - 2p$

Here, the slope of the line is 2.

And, another line equation : $ax + 5 = 3y$

$\Rightarrow 3y = ax + 5$

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

Hence, the slope of the line is $\frac{a}{3}$

As the line are parallel, their slopes must be equal

$\Rightarrow 2 = \frac{a}{3}$

$a = 6$

Thus, the value of a is 6.

5. If the lines y = 3x + 7 and $2y + px = 3$ perpendicular to each other, find the value of p.

Solution:

If two lines are perpendicular, then the product of their slopes is -1

Now, slope of the line $y = 3x + 7$ is $m_1 = 3$

And,

The slope of the line : $2y + px = 3$

2y = $-px + 3$

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

$m_2 = \frac{-p}{2}$

As the line as perpendicular,

$\Rightarrow m_1 \times m_2 = -1$

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

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

Thus, the value of p is $\frac{2}{3}$.

6. If the straight lines $kx - 5y + 4 = 0$ and $4x - 2y + 5 = 0$ are perpendicular to each other. Find the value of k.

Solution:

Given,

In equation, $kx - 5y + 4 = 0$

$\Rightarrow 5y = kx + 5$

$y = \left(\frac{k}{5}\right)x + \frac{4}{5}$

So, the slope $(m_1) = \frac{k}{5}$

And, in equation $4x - 2y + 5 = 0$

$\Rightarrow 2y = 4x + 5$

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

So, the slope $(m_2) = 2$

As the line are perpendicular to each other

$\Rightarrow m_1 \times m_2 = -1$

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

$= k = \frac{(-1\times5)}{2}$

Hence, the value of k = $\frac{-5}{2}$.

7. If the lines $3x + by + 5 = 0$ and $ax - 5y + 7 = 0$ are perpendicular to each other, find the relation connection a and b.

Solution:

Given that the lines $3x + by + 5 = 0$ and $ax - 5y + 7 = 0$ are perpendicular to each other

Then the product of their slopes must be -1.

Slope of line $3x + by + 5 = 0$ is,

by = $-3x - 5$

$y = \left(\frac{-3}{b}\right) - \frac{5}{b}$

So, slope $(m_1) = \frac{-3}{b}$

And,

The slope of line $ax - 5y + 7 = 0$ is

$5y = ax + 7$

$y = \left(\frac{a}{5}\right)x + \frac{7}{5}$

So, slope $(m_2) = \frac{a}{5}$

As the lines are perpendicular, we have

$m_1 \times m_2 = -1$

$\frac{-3}{b} \times \frac{a}{5} = -1$

$\frac{-3a}{5b} = -1$

$-3a = -5b$

$3a = 5b$

Hence, the relation connecting a and b is 3a = 5b.

8. Is the line through (-2, 3) and (4,1) perpendicular to the line $3x = y + 1$?

Does the line $3x = y + 1$ bisect the join of $(-2, 3)$ and $(4, 1)$

Solution:

Slope of the line passing through the points (-2, 3) and (4, 1) is given by

$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$

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

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

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

And, the slope of the line : $3x = y + 1$

$y = 3x - 1$

Slope $(m_2) = 3$

Now,

$m_1 \times m_2 = \frac{-1}{3} \times 3 = -1$

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

Now,

Co-ordinates of the mid-point of the line joining the points (-2, 3) and (4, 1) is

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

Now, if the line $3x = y + 1$ passes through the mid-point then it will satisfy the equation

$3(1) = (2) + 1$

3 = 3

Hence, the line $3x = y + 1$ bisects the line joining the points (-2, 3) and (4, 1).

9. The line through A(-2, 3) and B(4,b) is perpendicular to the line $2x - 4y = 5$. Find the value of b.

Solution:

The slope of the line passing through A(-2, 3) and B(4,b) will be $m_1 = \frac{(b-3)}{(4+2)} = \frac{(b-3)}{6}$

Now, the gradient of the given line $2x - 4y = 5$ is

$4y = 2x + 5$

$y = \left(\frac{2}{4}\right)x + \frac{5}{4}$

$y = \frac{1}{2}x + \frac{5}{4}$

So, $m_2 = \frac{1}{2}$

As the line are perpendicular to each other, we have

$m_1 \times m_2 = -1$

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

$\frac{(b-3)}{12} = -1$

$(b - 3) = -12$

$b = -12 + 3 = -9$

Hence, the value of b is -9.

10. If the lines $3x + y = 4, x - ay + 7 = 0$ and $bx + 2y + 5 = 0$ form three consecutive sides of a rectangle, find the value of a and b.

Solution:

Given lines are;

$3x + y = 4 \ldots (i)$

$x - ay + 7 = 0$ ……(ii)

$bx + 2y + 5 = 0$ ….(iii)

It's said that these lines form three consecutive sides of a rectangle.

So,

Lines (i) and (ii) must be perpendicular

Also, lines (ii) and (iii) must be perpendicular

We know that, for two perpendicular lines the product of their slopes will be -1.

Now,

Slope of line (i) is

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

Hence, slope (m_1) = 3

And, slope of line (ii) is

$x - ay + 7 = 0 \quad \Rightarrow ay = x + 7$

$y = \left(\frac{1}{a}\right) x + \frac{7}{a}$

Hence, slope $(m_2) = \frac{1}{a}$

Finally, the slope of line (iii) is

$bx + 2y + 5 = 0 \Rightarrow 2y = -bx - 5$

$y = \left(\frac{-b}{2}\right)x - \frac{5}{2}$

Hence, slope $(m_3) = \frac{-b}{2}$

As lines (i), (ii) and (iii) are consecutive sides of rectangle, we have

$= m_1 \times m_2 = -1$ and $m_2 \times m_3 = -1$

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

$= -3 = -a$ and $\frac{-b}{2a} = -1$

$= a = 3$ and $b = 2a$

$\Rightarrow b = 2(3) = 6$

Thus, the value of a is 3 and the value of b is 6.

11. Find the equation of a line, which has the y-intercept 4, and is parallel to the line $2x - 3y - 7 = 0$. Find the coordinates of the point where it cuts the x-axis.

Solution:

Given line = $2x - 3y - 7 = 0$

Its slope is,

$3y = 2x - 7$

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

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

So, the equation of the line parallel to the given line will be $\frac{2}{3}$.

Also given, the y-intercept is 4 = c

Hence, the equation of the line is given by

$y = mx + c$

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

$3y = 2x + 12$

$2x - 3y + 12 = 0$

Now, when this line intersects the x-axis the y co-ordinate becomes zero.

So, putting y = 0 in the line equation, we get

$2x - 3(0) + 12 = 0$

$2x + 12 = 0$

$x = \frac{-12}{2}$ = 6

Hence the co-ordinates of the point where it cuts the x-axis is (-6, 0).

12. Find the equation of a straight line perpendicular to the line $2x + 5y + 7 = 0$ and with y-intercept -3 units.

Solution:

Given line : $2x + 5y + 7 = 0$

So, its slope is given by

$5y = -2x - 7$

$y = \left(\frac{-2}{5}\right) - \frac{7}{5}$

$\Rightarrow m = \frac{-2}{5}$

Now, let the slope of the line perpendicular to this line be m'

Then,

$m \times m' = -1$

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

$\Rightarrow m' = \frac{5}{2}$

Also given, the y-intercept (c) = -3

Hence, the equation of the line is given by

$y = m'x + c$

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

$2y = 5x - 6$

$5x - 2y - 6 = 0$

13. Find the equation of a st. line perpendicular to the line $3x - 4y + 12 = 0$ and having same y-intercept as $2x - y + 5 = 0$.

Solution:

Given line : $3x - 4y + 12 = 0$

The slope of the line is given by

$3x - 4y + 12 = 0 \Rightarrow 4y = 3x + 12$

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

Thus, slope $(m_1) = \frac{3}{4}$

Now, let the slope of the line perpendicular to the given line be taken as m_2

So,

$m_1 \times m_2 = -1$

$\left(\frac{3}{4}\right) \times m_2 = -1$

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

And, given, the y-intercept of the line is same as $2x - y + 5 = 0$

$\Rightarrow y = 2x + 5$

So, the y- intercept is 5 = c.

Hence, the equation of line is given by

$y = m_2x + c$

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

$3y = -4x + 15$

$4x + 3y = 15$

14. Find the equation of the line which is parallel to which is parallel to 3x -2y = -4 and passes through the point (0, 3).

Solution:

Given line : $3x - 2y = -4$

Slope (m_1) *is given by*

$2y = 3x + 4$

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

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

Now, the slope of the line parallelo to the given line will have the same slope as $\frac{3}{2}$ = m

And the line passes through point (0, 3)

Thus, the equation of the required line is given by

$y = mx + c$

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

$2y = 3x + 6$

$3x - 2y + 6 = 0$

15. Find the equation of the line passing through (0, 4) and parallel to the line $3x + 5y + 15 = 0$.

Solution:

Given line : $3x + 5y + 15 = 0$

$5y = -3x - 15$

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

So, slope (m) = $\left(\frac{-3}{5}\right)$

The slope of the line parallel to the given line will the same $\frac{-3}{5}$

And, the line passes through the point (0, 4)

Hence, equation of the line will be

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

$y - 4 = \left(\frac{-3}{5}\right)(x - 0)$

5y - 20 = -3x

$3x + 5y - 20 = 0$

16. The equation of line is $\boldsymbol{y = 3x - 5}$, Write down the **slope of this line and the intercept made by it on the y-axis. Hence or otherwise, write down the equation of a line which is parallel to the line and which passes through the point (0, 5).**

Solution:

Given line : y = 3x – 5

Here slope (m_1) = 3

Substituting $x = 0$, we get y = -5

Hence, the y-intercept = -5

Now, the slope of the line parallel to the given line will be 3 and it passes through the point (0, 5).

Thus, equation of the line will be

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

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

$y = 3x + 5$

17. Write down the equation of the line perpendicular to $3x + 8y = 12$ and passing through the point (-1, -2).

Solution:

Given line ; $3x + 8y = 12$

$8y = -3x + 12$

$y = \left(\frac{-3}{8}\right)x + 12$

So, the slope $(m_1) = \frac{-3}{8}$

Let's consider the slope of the line perpendicular to the given line as m_2

Then, $m_1 \times m_2 = -1$

$\frac{-3}{8} \times m_2 = -1$

$m_2 = \frac{8}{3}$

Now,

The equation of the line perpendicular to the given line and passing through the point (-1, -2) wil be

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

$y - (-2) = \left(\frac{8}{3}\right)(x - (-1))$

$y + 2 = \left(\frac{8}{3}\right)(x + 1)$

$3y + 6 = 8x + 8$

$3y = 8x + 2$

Thus, the equation of the required line is $3y = 8x + 2$.

18. (i) The line $4x - 3y + 12 = 0$ meets the x-axis at A. Write down the co-ordinates of A.

(ii) Determine the equation of the line passing through A and perpendicular to $4x - 3y + 12 = 0$.
Solution:

Given line : $4x - 3y + 12 = 0$

(i) When this line meets the $x - axis, its\ y$ co-ordinate becomes 0.

So, putting y =0 in the given equation, we get

$4x - 3(0) + 12 = 0$

$4x + 12 = 0$

$x = \frac{-12}{4}$

$x = -3$

Hence, the line meets the x-axis at A (-3, 0).

(ii) Now, the slope of the line is given by

$4x - 3y + 12 = 0$

$3y = 4x + 12$

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

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

Let's assume the slope of the line perpendicular to the given line be m_2

Then, $m_1 \times m_2 = -1$

$\frac{4}{3} \times m_2 = -1$

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

Thus, the equation of the line perpendicular to the given line passing through A will be

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

$4y = -3\ (x + 3)$

$3x + 4y + 9 = 0$

19. Find the equation of the line that is parallel to $2x + 5y - 7 = 0$ and passses throught the mid-point of the line segment joining the points (2, 7) and (-4,1).

Solution:

Given line : $2x + 5y - 7 = 0$

$5y = -2x + 7$

y = $\left(\frac{-2}{5}\right)x + \frac{7}{5}$

So, the slope is $\frac{-2}{5}$

Hence, the slope of the line that is parallel to the given line will be the same, m = $\frac{-2}{5}$

Now, the mid-point of the line segment joining points (2, 7) and (-4, 1) is

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

Thus, the equation of the line will be

y – $y_1 = m(x - x_1)$

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

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

$$2x + 5y = 18$$

20. Find the equation of the line that is perpendicular to $3x + 2y - 8 = 0$ and passes through the mid-point of the line segment joining the points (5, -2) and (2, 2).

Solution:

Given line : $3x + 2y - 8 = 0$

$2y = -3x + 8$

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

Here, slope $(m_1) = \frac{-3}{2}$

Now, the co-ordinates of the mid-point of the line segment joining the points $(5, -2)$ and $(2, 2)$ will be

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

Let's consider the slope of the line perpendicular to the given line be m_2

Then,

$m_1 \times m_2 = -1$

$\left(\frac{-3}{2}\right) \times m_2 = -1$

$m_2 = \frac{2}{3}$

So, the equation of the line with slope m_2 and passing through $\left(\frac{7}{2}, 0\right)$ will be

$y - 0 = \left(\frac{2}{3}\right)\left(x - \frac{7}{2}\right)$

$3y = 2x - 7$

$2x - 3y - 7 = 0$

Thus, the required line equation is $2x - 3y - 7 = 0$.

21. Find the equation of a straight line passing through the intersection of $2x + 5y - 4 = 0$ with $x - axis$ and parallel to the line $3x - 7y + 8 = 0$.

Solution:

Let's assume the point of

Let's assume the point of intersection of the line 2x + 5y – 4 = 0 and x-axis be (x, 0)

Now, substituting the value y = 0 in the line equation, we have

2x + 5(0) – 4 = 0

2x – 4 = 0

x = 4/2 = 2

Hence, the co-ordinates of the point of intersection is (2, 0)

Also given, line equation: 3x – 7y + 8 = 0

7y = 3x + 8

$y = \left(\frac{3}{7}\right)x + \frac{8}{7}$

So, the slope (m) = $\frac{3}{7}$

We know that the slope of any line parallel to the given line will be the same.

So, the equation of the line having slope $\frac{3}{7}$ and passing through the point (2, 0) will be

$y - 0 = \left(\frac{3}{7}\right)(x - 2)$

$7y = 3x - 6$

$3x - 7y - 6 = 0$

Thus, the required line equation is 3x – 7y =0.

22. The equation of a line is $3x + 4y - 7 = 0$. Find (i) the line. (ii) the equation of a line perpencdicular to the given line and passing through the intersection of the lines $x - y + 2 = 0$ and $3x + y - 10 = 0$.

Solution:

Given line equation : $3x + 4y - 7 = 0$

(i) Slope of the line is given by,

$4y = -3x + 7$

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

Hence, slope $(m_1) = \frac{-3}{4}$

(ii) Let the slope of the perpendicular to the given line be m_2

Then, $m_1 \times m_2 - 1$

$\left(\frac{-3}{4}\right) \times m_2 = -1$

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

Now, to find the point of intersection of

$x - y + 2 = 0$ ……….(i)

$3x + y - 10 = 0$ ……(ii)

On adding (i) and (ii), we get

$4x - 8 = 0$

$4x = 8$

$x = \frac{8}{4} = 2$

Putting $x = 2$ in (i), we get

$2 - y + 2 = 0$

$y = 4$

Hence, the point of intersection of the lines is (2, 4).

The equation of the line having slope m_2 and passing through (2,4) will be

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

$3y - 12 = 4x - 8$

$4x - 3y + 4 = 0$

Thus, the required line equation is $4x - 3y + 4 = 0$.

23. Find the equation of the line perpendicular from the point (1, -2) on the line $4x - 3y - 5 = 0$. Also find the co-ordinates of the foot of perpendicular.

Solution:

Given line equation ; $4x - 3y - 5 = 0$

$3y = 4x - 5$

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

Slope of the line $(m_1) = \frac{4}{3}$

Let the slope of the line perpendicular to the given line be m_2

Then, $m_1 \times m_2 = -1$

$\left(\frac{4}{3}\right) \times m_2 = -1$

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

Now, the equation of the line having slope m_2 and passing through the point (1, -2) will be

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

$4y + 8 = -3x + 3$

$3x + 4y + 5 = 0$

Next, for finding the co-ordinates of the foot of the perpendicular which is the point of intersection of the lines

$4x - 3y - 5 = 0$ …..(1) and

$3x + 4y + 5 = 0$ ….(2)

On multiplying (1) by 4 and (2) by 3, we get

$16x - 12y - 20 = 0$

$9x + 12y + 15 = 0$

Adding we get,

$25x - 5 = 0$

$x = \frac{5}{25}$

$x = \frac{1}{5}$

Putting the value of x in (1), we have

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

$\frac{4}{5} - 3y - 5 = 0$

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

$= \frac{(4-25)}{5}$

$= 3y = \frac{-21}{5}$

$y = \frac{-7}{5}$

Thus, the co-ordinates are $\left(\frac{1}{5}, \frac{-7}{5}\right)$.

24. Prove that the line through (0,0) and (2, 3) is parallel to the line through (2, -2) and (6, 4).

Solution:

Let the slope of the line through (0, 0) and (2, 3) be m_1

So, $m_1 = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

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

$= \frac{3}{2}$

And, let the slope of the line through (2, -2) and (6, 4) be m_2

So, $m_2 = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

$= \frac{(4+2)}{(6-2)}$

$= \frac{6}{4}$

$= \frac{3}{2}$

It's clearly seen that the slopes $m_1 = m_2$

Thus, the lines are parallel to each other.

25. Prove that the line through (-2, 6) and (4,8) is perpendicular to the line through (8,12) and (4, 24).

Solution:

Let the slope of the line through points (-2, 6) and (4, 8) be m_1

So, $m_1 = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

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

$= \frac{2}{6}$

$= \frac{1}{3}$

And, let the slope of the line through (8, 12) and (4, 24) be m_2

So, $m_2 = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

$= \frac{(24-12)}{(4-8)}$

$= \frac{12}{-4}$

= -3

Now, product of slopes is

$m_1 \times m_2 = \frac{1}{3} \times (-3) = -1$

Thus, the lines are perpendicular to each other.

26. Show that the triangle formed by the points A (1,3), B(3,-1) and C (-5, -5) is a right-angles triangle by using slopes.

Solution:

Given, points A(1, 3), B (3, -1) and C(-5, -5) form a triangle

Now,

Slope of the line AB = $m_1 = \frac{(-1-3)}{(3-1)} = \frac{-4}{2} = -2$

And,

Slope of the line BC = $m_2 = \frac{(-5+1)}{(-5-3)}$

$= \frac{-4}{-8}$

$= \frac{1}{2}$

Hence,

$m_1 \times m_2 = (-2) \times \left(\frac{1}{2}\right) = -1$

So, the lines AB and BC are perpendicular to each other.

Therefore, ΔABC is a right-angled triangle.

26. Show that the triangle formed by the points A(1,3), B (3, -1) and C(-5, -5) is a right angled triangle by using slopes.

Solution:

Given, points A(1,3), B(3, -1) and C(-5, -5) form a triangle

Now,

Slope of the line AB = $m_1 = \frac{(-1-3)}{(3-1)} = \frac{-4}{2}$ = -2

Hence,

$m_1 \times m_2 = (-2) \times \left(\frac{1}{2}\right)$ = -1

So, the lines AB and BC are perpendicular to each other.

Therefore, ΔABC is a right-angled triangle.

27. Find the equation of the line through the point (-1, 3) and parallel to the line joining the points (0, -2) and (4, 5).

Solution:

Slope of the line joining the points (0, -2) and (4, 5) is

$m = \frac{(5+2)}{(4-0)}$

$= \frac{7}{4}$

Now, the slope of the line parallel to it and passing through (-1, 3) will be also be $\frac{7}{4}$

Hence, the equation of the line is

Hence, the equation of the line is

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

$\Rightarrow y - y_1 = m(x - x_1) \Rightarrow y - 3 = \frac{7}{4}(x + 1)$

$\Rightarrow 4y - 12 = 7x + 7$

$\Rightarrow 7x - 4y + 19 = 0$

28. Are the vertices of a triangle.

(i) Find the coordinates of the centroid G of the triangle.

(ii) Find the equation of the line through G and parallel to AC.

Solution:

Given, A (-1, 3), B (4, 2), C (3, -2)

(i) Co- ordinates of centroid G is

G (x,y) = $\left(\frac{(x_1+x_2+x_3)}{2}, \frac{(y_1+y_2+y_3)}{2}\right)$

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

= $\left(\frac{6}{3}, \frac{3}{3}\right)$

= (2,1)

Hence, the co-ordinates of the centroid G of the triangle is (2,1)

(ii) Slope of AC = $\frac{(y_2-y_1)}{(x_2-x_1)}$

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

= $\frac{-5}{4}$

So, the slope of the line parallel to AC is also $\frac{-5}{4}$

Now, the equation of line through G is

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

$4y-4=\ -5x+10$

$5x+4y\ =14$

Thus, the required line equation is $5x+4y=14.$

29. The line through P(5, 3) intersects y-axis at Q. (i) Write the slope of the line. (ii) Write the equation of the line. (iii) Find the coordinates of Q.

Solution:

(i) Here, $\theta\ =45^{\circ}$

So, the slope of the line = tanθ

So, the slope of the line = tan θ = tan 45° = 1

(ii) Equation of the line through P and Q is

$y - 3 = 1\ (x - 5)$

$x - y - 2 = 0$

(iii) Let the co-ordinates of Q be (0, y)

Then, m = $\frac{(y_2 - y_1)}{(x_2 - x_1)}$

1 = $\frac{(3 - y)}{(5 - 0)}$

5 = 3 – y

y = 3 – 5 = -2

Thus, co-ordinates of Q are (0, -2).

30. In the adjoining diagram, write down (i) the co-ordinates of the points A, B and C. (ii) the equation of the line through A parallel to BC.

Solution :

From the given figure, its clearly seen that

Co- ordinates of A are (2, 3) and of B are (-1, 2) and of C are (3, 0).

Now,

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

Now,

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

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

So, the slope of the line parallel to BC is also $\frac{-1}{2}$

And, the line passes through A(2, 3)

Hence, the equation will be

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

$2y - 6 = -x + 2$

$x + 2y = 8$

31. Find the equation of the line through (0, -3) and perpendicular to the line joining the points (-3, 2) and (9, 1).

Solution:

The slope of the line joining the points (-3, 2) and (9, 1) is

$m_1 = \frac{(1-2)}{(9+3)} = \frac{-1}{12}$

Now, let the slope of the line perpendicular to the above line be m_2

Then, $m_1 \times m_2 = -1$

$= \left(\frac{-1}{12}\right) \times m_2 = -1$

$= m_2 = 12$

So, the equation of the line passing through (0, -3) and having slope of m_2 will be

$y - (-3) = 12(x - 0)$

y + 3 = 12 x

$12x - y = 3$

Thus, the required line equation is $12x - y = 3$.

32. The vertices of a triangle are A (10, 4), B (4, -9) and C(-2, -1). Find the equation of the altitude through A. The opposite side is called altitue.

Solution:

Given, vertices of a triangle are A(10, 4), B(4, -9) and C(-2, -1)

Now,

Slope of line BC (m_1) = $\frac{(-1+9)}{(-2-4)} = \frac{8}{-6} = \frac{-4}{3}$

Let the slope of the altitude from A (10,4) to BC be m_2

Then, $m_1 \times m_2 = -1$

$= \left(\frac{-4}{3}\right) \times m_2 = -1$

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

So, the equation of the line will be

$y - 4 = \frac{3}{4}(x - 10)$

$4y - 16 = 3x - 30$

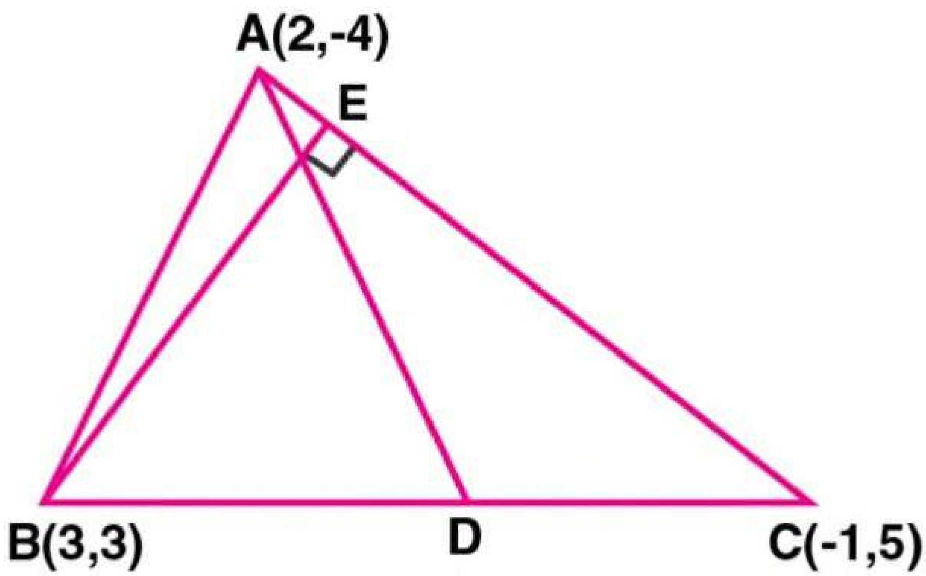
$3x - 4y - 14 = 0$

33. A(2, -4), B (3,3) and C(-1, 5) are the vertices of triangle ABC. Find the equation of :

(i) the median of the triangle through A

(ii) the altitude of the triangle through B.

Solution:



Given A(2, -4), B(3, 3) and C(-1, 5) are the vertices of triangle ABC

(i) D is the mid-point of BC

So, the co-ordinates of D will be

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

Now,

The slope of AC $(m_1) = \frac{(5+4)}{(-1-2)} = \frac{9}{-3} = -3$

Let the slope of BE be m_2

Then, $m_1 \times m_2 = -1$

= $-3 \times m_2 = -1$

= $m_2 = \frac{1}{3}$

So, the equation of BE will be

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

$3y - 9 = x - 3$

$x - 3y + 6 = 0$

Thus, the required line equation is $x - 3y + 6 = 0$.

34. Find the equation of the right bisector of the line segment joining the points (1, 2) and (5, -6).

Solution:

The slope of the line joining the points (1, 2) and (5, -6) is

$m_1 = \frac{(-6-2)}{(5-1)} = \frac{-8}{4} = -2$

Now, if m_2 is the slope of the right bisector of the above line

Then,

$m_1 \times m_2 = -1$

$-2 \times m_2$ = -1

$m_2 = \frac{1}{2}$

The mid-point of the line segment joining (1,2) and (5, -6) will be

$\left(\frac{(1+5)}{2}, \frac{(2-6)}{2}\right) = \left(\frac{6}{2}, \frac{-4}{2}\right)$ = (3, -2)

So, equation of the line is

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

$2y + 4 = x - 3$

$x - 2y - 7 = 0$

Thus, the equation of the required right bisector is $x - 2y - 7 = 0$.

35. Points A and B have coordinates (7, -3) and (1, 9) respectively. Find

(i) the slope of AB.

(ii) The equation of the perpendicular bisector of the line segment AB.

Solution:

Given, co-ordinates of points A are (7,-3) and of B are (1,9)

(i) The slope of AB(m) = $\frac{(9+3)}{(1-7)} = \frac{12}{-6}$ = -2

(ii) Let PQ be the perpendicular bisector of AB intersecting it at M

Now, the co-ordinates of M will be the mid-point of AB

Co-ordinates of M will be

$= \frac{(7+1)}{2}, \frac{(-3+9)}{2} = \frac{8}{2}, \frac{6}{2}$

$= (4, 3)$

The slope of line PQ will be $= \frac{-1}{m} = \frac{-1}{(-2)} = \frac{1}{2}$

Thus, the equation of PQ is

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

$2y - 6 = x - 4$

$x - 2y + 2 = 0$

(iii) As point (-2, p) lies on the above line

The point will satisfy the line equation

-2 - 2p + 2 =0

- 2p = 0

$p = 0$

Thus, the value of p is 0.

36. The points B(1, 3) and D(6,8) are two opposite vertices of a square ABCD. Find the equation of the diagonal AC.

Solution:

Given, points B(1, 3) and D (6,8) are two opposite vertices of a square ABCD

Slope of BD is given by

$$m_1 = \frac{(8-3)}{(6-1)} = \frac{5}{5} = 1$$

We know that, the diagonal AC is a perpendicular bisector of diagonal BD

So, the slope of AC (m_2) will be

$$m_1 \times m_2 = -1$$

$$1 \times m_2 = -1$$

$$m_2 = -1$$

And, the co-ordinates of mid-point of BD and AC will be

$$\left(\frac{(1+6)}{2}, \frac{(3+8)}{2}\right) = \left(\frac{7}{2}, \frac{11}{2}\right)$$

So, the equation of AC is

$$y - \frac{11}{2} = -1\left(x - \frac{7}{2}\right)$$

$$2y - 11 = -2x - 7$$

$$2x + 2y - 7 - 11 = 0$$

$$\Rightarrow 2x + 2y - 18 = 0$$

Thus, the equation of diagonal AC is $x + y - 9 = 0$.

37. ABCD is a rhombus. The co-ordinates of A and C are (3,6) and (-1, 2) respectively. Write down the equation of BD.

Solution :

Given, ABCD is a rhombus and co-ordinates of A are (3, 6) and of C are (-1, 2)

Slope of AC $(m_1) = \frac{(2-6)}{(-1-3)} = \frac{-4}{-4} = 1$

We know that, the diagonals of a rhombus bisect each other at right angles.

So, the diagonal BD is perpendicular to diagonal AC

Let the slope of BD be m_2

Then, $m_1 \times m_2 = -1$

$m_2 = \frac{-1}{(m_1)}$

$= \frac{-1}{(1)}$

= -1

Now, the co-ordinates of the mid-point of AC is given by

$\left(\frac{(3-1)}{2}, \frac{(6+2)}{2}\right) = \left(\frac{2}{2}, \frac{8}{2}\right) = (1, 4)$

So, the equation of BD will be

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

$y - 4 = -x + 1$

$x + y = 5$

Thus, the equation of BD is $x + y = 5$.

38. Find the equation of the line passing through the intersection of the lines $4x + 3y = 1$ and $5x + 4y = 2$ and

(i) parallel to the line $x + 2y - 5 = 0$

(ii) perpendicular to the x-axis.

Solution:

Given, line equations:

$4x + 3y = 1$ ….(1)

$5x + 4y = 2$ …..(2)

On solving the above equation to find the point of intersection, we have

Multiplying (1) by 4 and (2) by 3

$16x + 12y = 4$

$15x + 12y = 6$

On subtracting, we get

$x = -2$

Putting the value of x in (1), we have

$4(-2) + 3y = 1$

$-8 + 3y = 1$

$3y = 1 + 8 = 9$

$y = \frac{9}{3} = 3$

Hence, the point of intersection is $(-2, 3)$.

(i) Given line, $x + 2y - 5 = 0$

$2y = -x + 5$

$y = \left(\frac{-1}{2}\right)x + \frac{5}{2}$

Slope (m) = $\frac{-1}{2}$

A line parallel to this line will have the same slope m = $\frac{-1}{2}$

So, the equation of line having slope m and passing through (-2, 3) will be

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

$2y - 6 = -x - 2$

$x + 2y = 4$

(ii) As any line perpendicular to x-axis will be parallel to y-axis.

So, the equation of line will be

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

39. (i) Write down the co-ordinates of the point P that divides the line joining A(-4, 1) and B(17, 10) in the ratio 1 : 2.

(ii) Calculate the distance OP where 0 is the origin

(iii) In what ratio does the y-axis divide the line AB ?

Solution:

(i) Given, co-ordinates of the line joining A (-4,1) and B(17, 10) and point P divides the line segment in the ratio 1 : 2.

Let the co-ordiates of P be (x, y)

Then,

$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2} = \frac{1 \times 17 + 2 \times -4}{1 + 2}$$

$$= \frac{17 - 8}{3} = \frac{9}{3} = 3$$

$$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2} = \frac{1\times10 + 2\times1}{1+2}$$

$$= \frac{10+2}{3}$$

$$= \frac{12}{3} = 4$$

Thus, Co-ordinates of P will be (3, 4)

(ii) O is the origin

So, Distance between O and P

$$= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$= \sqrt{(0-3)^2 + (0-4)^2}$

$= \sqrt{(-3)^2 + (-4)^2}$

$= \sqrt{9+16} = \sqrt{25}$

= 5 units.

(iii) Let y-axis divides AB in the ratio of $m_1 : m_2$

Then,

$x = \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}$

$\Rightarrow 0 = \frac{m_1 \times 17 + m_2 \times (-4)}{m_1 + m_2}$

$\Rightarrow 17\ m_1 - 4\ m_2 = 0$

$\Rightarrow 17\ m_1 = 4\ m_2$

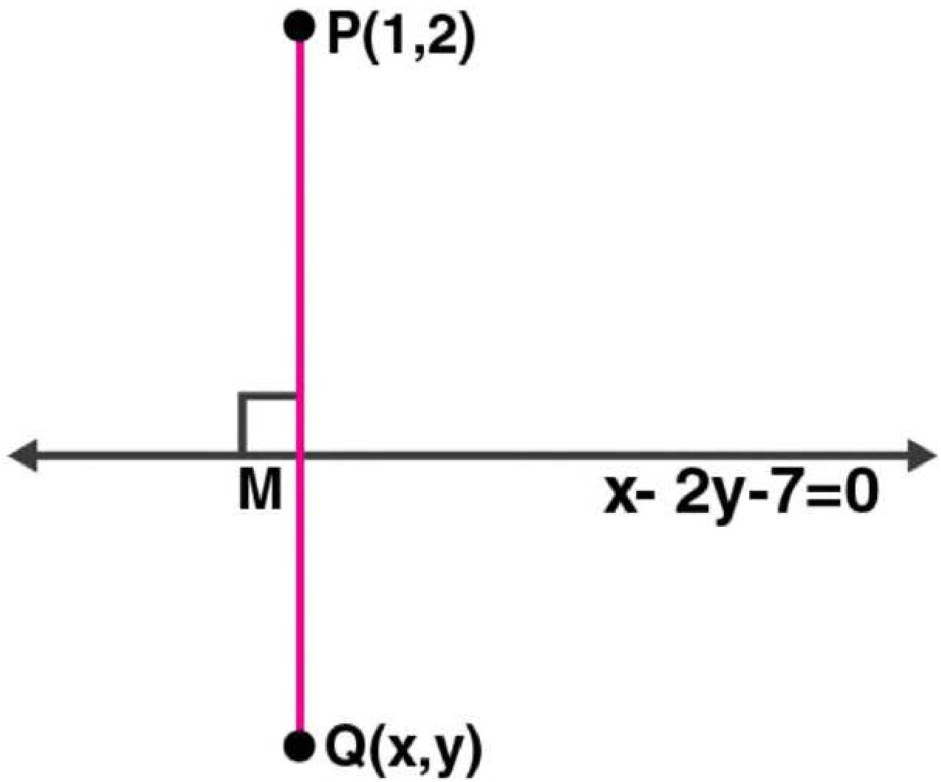
$\frac{m_1}{m_2} = \frac{4}{17}$

$\Rightarrow m_1 : m_2 = 4 : 17$

40. Find the image of the point (1, 2) in the line $\boldsymbol{x - 2y - 7 = 0}$.

Solution:

Given line equation : $x - 2y - 7 = 0$ ……(i)



Draw a perpendicular from point P (1, 2) on the line

Let P' be the image of P and let its co-ordinates be (x, y)

The slope of the given line is given as,

$2y = x - 7$

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

Slope $(m_1) = \frac{1}{2}$

Let the slope of line segment PP' be m_2

As PP' is perpendicular to the given line, product of slopes : $m_1 \times m_2 =$ -1.

So, $\frac{1}{2} \times m_2 = -1$

$m_2 = -2$

So, the equation of the line perpendicular to the given line and passing through P(1,2) is

y – 2 = (-2) (x-1)

$y - 2 = -2x + 2$

$2x + y - 4 = 0$ ….(ii)

Let the intersection point of lines (i) and (ii) be taken as M.

Solving both the line equations, we have

Multiplying (ii) by 2 and adding with (i)

$x - 2y - 7 = 0$

$4x + 2y - 8 = 0$

$5x - 15 = 0$

$x = \frac{15}{5} = 3$

Putting value of x in (i), we get

$3 - 2y - 7 = 0$

$2y = -4$

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

So, the co-ordinates of M are (3, -2)

Hence, its seen that M should be the mid-point of the line segment PP'

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

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

$x + 1 = 6$

$x = 6 - 1 = 5$

And,

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

$y + 2 = -4$

$y = -4 - 2 = -6$

Therefore, the co-ordinates of P' are (5, -6).

41. If the line $x - 4y - 6 = 0$ is the perpendicular bisector of the line segment PQ and the co-ordinates of P are (1,3), find the co-ordinates of Q.

Solution:

Given, line equation : $x - 4y - 6 = 0$ ... (i)

Given, line equation: x – 4y – 6 = 0 … (i)

Co-ordinates of P are (1, 3)

Let the co-ordinates of Q be (x , y)

Now, the slope of the given line is

$4y = x - 6$

$y = \left(\frac{1}{4}\right)x - \frac{6}{4}$

Slope (m) = $\frac{1}{4}$

So, the slope of PQ will be $\left(\frac{-1}{m}\right)$

[As the product of slopes of perpendicular lines is -1]

Slope of PQ = $\frac{-1}{\left(\frac{1}{4}\right)}$ = -4

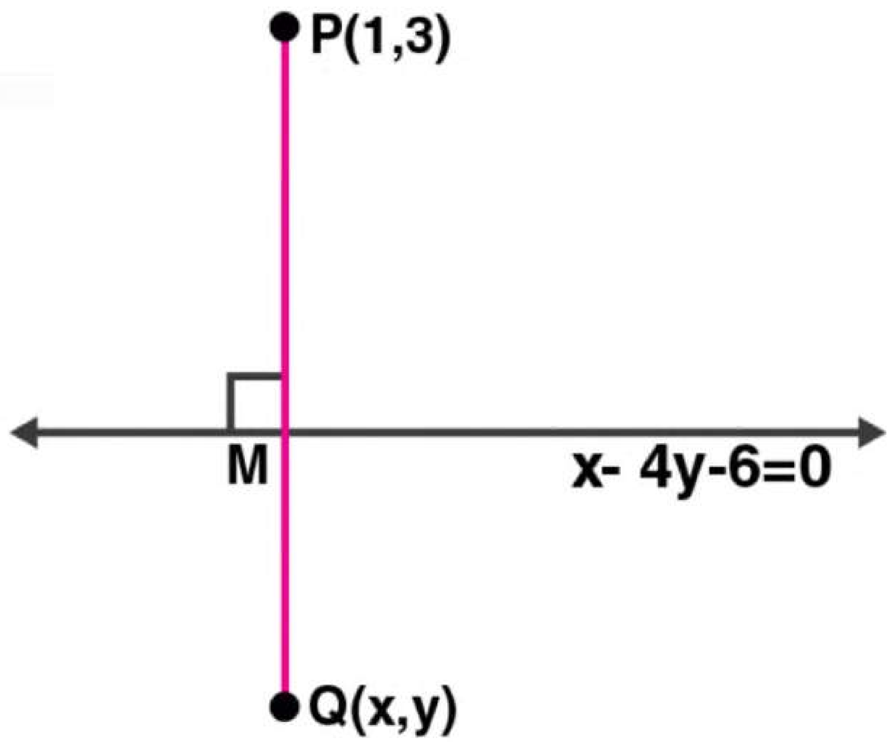
Now, the equation of line PQ will be

$y - 3 = (-4)(x - 1)$

$y - 3 = -4x + 4$

$4x + y = 7$ .....(ii)

On solving equation (i) and (ii), we get the coordinates of M



Multiplying (ii) by 4 and adding with (i), we get

$x - 4y - 6 = 0$

$16x + 4y = 28$

Multiplying (ii) by 4 and adding with (i), we get

$x - 4y - 6 = 0$

$16x + 4y = 28$

$17x = 34$

$x = \frac{34}{17} = 2$

Putting the value of x in (i)

$2 - 4y - 6 = 0$

$-4 - 4y = 0$

$4y = -4$

$y = -1$

So, the co-ordinates of M are (2, -1)

But, M is the mid-point of line segment PQ

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

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

$x + 1 = 4$

$x = 3$

And,

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

$(y + 3) = -2$

$y = -5$

Thus, the co-ordinates of Q are (3, -5).

42. OABC is a square, O is the origin and the points A and B are $(3, 0)$ and (p, q). If OABC lies in the first quadrant, find the value of p and q. Also write down the equation of AB and BC.

Solution:

Given, OABC is a square

Co- ordinates of A and B are (3, 0) and (p, q) respectively.

By distance formula, we have

OA = $\sqrt{(3-0)^2 + (0-0)^2}$

= $\sqrt{(3)^2 + (0)^2}$

= $\sqrt{9+0} = \sqrt{9} = 3$

AB = $\sqrt{(3-p)^2 + (0-q)^2}$

= $\sqrt{(3-p)^2 + q^2}$

As OA = AB (sides of a square)

$\Rightarrow \sqrt{(3-p)^2 + q^2} = 3$

$(3-p)^2 + q^2 = 9$ (squaring both sides)

$9 + p^2 - 6p + q^2 = 9$

$p^2 + q^2 - 6p = 0 \qquad \ldots\ldots \text{(i)}$

Now, $OB = \sqrt{(p-0)^2 + (q-0)^2} = \sqrt{p^2 + q^2}$

But $OB^2 = OA^2 + AB^2$

$\Rightarrow \left(\sqrt{p^2 + q^2}\right)^2 = 3^2 + \left(\sqrt{(3-p)^2 + q^2}\right)^2$

$p^2 + q^2 = 9 + (3-p)^2 + q^2$

$p^2 + q^2 = 9 + 9 + p^2 - 6p + q^2$

$(p^2 + q^2) = 18 + (p^2 - 6p + q^2)$ [Using (i)]

$6p = 18 \Rightarrow p = \frac{18}{6} = 3$

Substituting the value of p in (i)

$(3)^2 + q^2 - 6(3) = 0 \Rightarrow 9 + q^2 - 18 = 0$

$q^2 - 9 = 0 \Rightarrow q^2 = 9 \Rightarrow q = 3$

$\therefore p = 3, q = 3$

As, AB parallel to y-axis

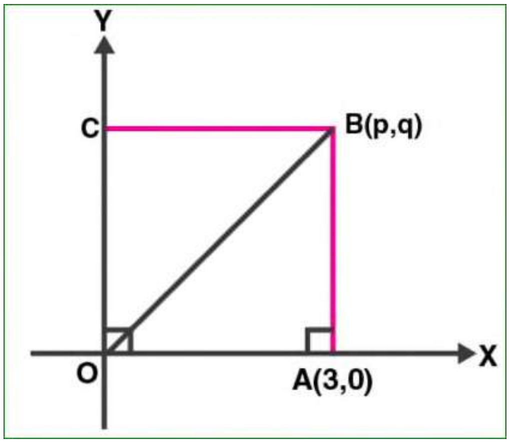
$\therefore$ Equation AB will be $x = 3$

$\Rightarrow x - 3 = 0$

and equation of BC will be $y = 3$

$(\because BC \parallel x\text{-axis})$

$\Rightarrow y - 3 = 0$



OA = $\sqrt{(3-0)^2+(0-0)^2}$

$=\sqrt{(3)^2+(0)^2}$

$=\sqrt{9+0} = \sqrt{9} = 3$

AB = $\sqrt{(3-\text{p})^2+(0-\text{q})^2}$

$= \sqrt{(3-\text{p})^2+\text{q}^2}$

As OA = AB (sides of a square)

$\Rightarrow \sqrt{(3-\text{p})^2+\text{q}^2} = 3$

$(3-p)^2+q^2 = 9$ (Squaring both sides)

$9+p^2-6p+q^2 = 9$

$p^2+q^2-6p = 0$ …. (i)

Now, $OB = \sqrt{(p-0)^2+(q-0)^2} = \sqrt{p^2+q^2}$

But $OB^2 = OA^2 + AB^2$

$\Rightarrow \left(\sqrt{p^2+q^2}\right)^2 = 3^2 + \left(\sqrt{(3-p)^2+q^2}\right)^2$

$p^2 + q^2 = 9 + (3-p)^2 + q^2$

$p^2 + q^2 = 9 + 9 + p^2 - 6p + q^2$

$(p^2 + q^2) = 18 + (p^2 - 6p + q^2)$ **[Using (i)]**

$6\,p = 18 \Rightarrow p = \frac{18}{6} = 3$

Substituting the value of *p* in (i)

$(3)^2 + q^2 - 6\,(3) = 0 \Rightarrow 9 + q^2 - 18 = 0$

$q^2 - 9 = 0 \Rightarrow q^2 = 9 \Rightarrow q = 3$

∴ p = 3, q = 3

As, AB parallel to y-axis

∴ Equation AB will be $x = 3$

$\Rightarrow \quad x - 3 = 0$

and equation of BC will be $y = 3$

(∵ BC ∥ x − axis)

$\Rightarrow y - 3 = 0.$

Chapter Test

1. Find the equation of a line whose inclination is 60° and y-intercept is -4.

Solution:

Given, inclination $=60^{\circ}$ and y-intercept (c) = -4

So, slope (m) = $tan60^{\circ} = \sqrt{3}$

Hence, the equation of the line is given by

$y = mx + c$

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

2. Write down the gradient and the intercept on the y – axis of the line $3y + 2x = 12$.

Solution:

Given line equation : $3y + 2x = 12.$

$3y = -2x + 12$

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

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

Hence, gradient = $\frac{-2}{3}$ and the intercept on the y-axis is 4.

3. If the equation of a line is y - $\sqrt{3x}$ + 1, find its inclination.

Solution:

Given line equation : $y - \sqrt{3}$x + 1

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

Here, slope = $\sqrt{3}$

$\Rightarrow$ tan $\theta = \sqrt{3}$

$\theta = 60^{\circ}$

Hence, the inclination of the line is 60° .