Firstly, we solve the equation (i) and (ii)

$x + y = 6$ …(i)

$x – 3y = 2$ …(ii)

Subtracting eq. (ii) from (i), we get

$x + y – x + 3y = 6 – 2$

$\Rightarrow 4y = 4$

$\Rightarrow y = 1$

Putting the value of $y = 1$ in eq. (i), we get

$x + 1 = 6$

$\Rightarrow x = 5$

Thus, AB and BC intersect at (5, 1)

Now, we solve eq. (ii) and (iii)

$x – 3y = 2$ …(ii)

$5x – 3y = -2$ …(iii)

Subtracting eq. (ii) from (iii), we get

$5x – 3y – x + 3y = – 2 – 2$

$\Rightarrow 4x = - 4$

$\Rightarrow x = -1$

Putting the value of $x = -1$ in eq. (ii), we get

$– 1 – 3y = 2$

$\Rightarrow -3y = 2 + 1$

$\Rightarrow -3y = 3$

$\Rightarrow y = -1$

Thus, BC and AC intersect at (-1, -1)

Now, we solve eq. (iii) and (i)

$5x - 3y = -2$ …(iii)

$x + y = 6$ …(i)

From eq. (i), we get

$x = 6 - y$

Putting the value of x in eq. (iii), we get

$5(6 - y) - 3y = -2$

$\Rightarrow 30 - 5y - 3y = -2$

$\Rightarrow 30 - 8y = -2$

$\Rightarrow -8y = -32$

$\Rightarrow y = 4$

Putting the value of y = 4 in eq. (i), we get

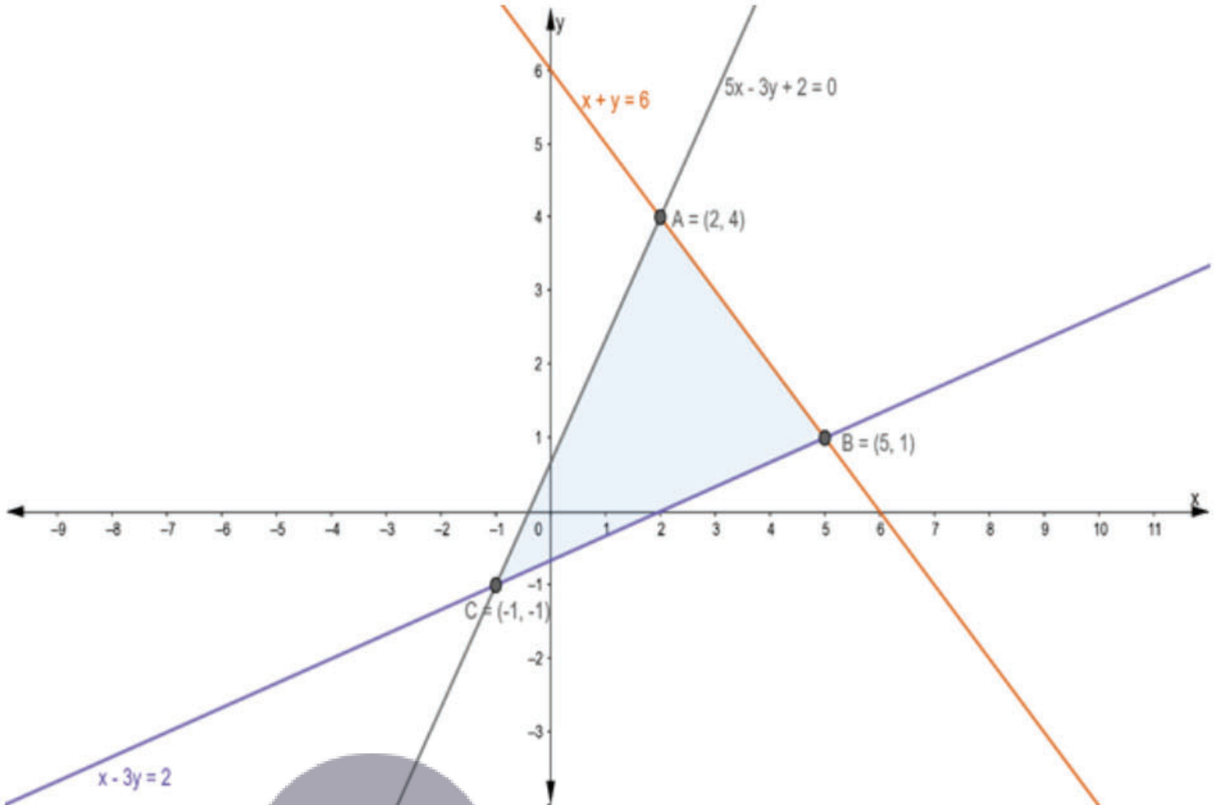
$x + 4 = 6$

$\Rightarrow x = 6 - 4$

$\Rightarrow x = 2$

Thus, AC and AB intersect at (2, 4)

So, vertices of triangle ABC are: (5, 1), (-1, -1) and (2, 4)



$$\therefore \text{Area of } \Delta ABC = \frac{1}{2}\begin{vmatrix} 2 & 4 & 1 \\ 5 & 1 & 1 \\ -1 & -1 & 1 \end{vmatrix}$$

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

$$= \frac{1}{2}\left[2\{1+1\}-4\{5+1\}+1\{-5+1\}\right]$$

$$= \frac{1}{2}[4-24-4]$$

$$= \frac{1}{2}[|-24|]$$

= 12 sq. units [∵, area can't be negative]

Q. 7. Find the area of the triangle formed by the lines x = 0, y = 1 and 2x + y = 2.

Answer : The given equations are

x = 0 …(i)

y = 1 …(ii)

and 2x + y = 2 …(iii)

Let eq. (i), (ii) and (iii) represents the sides AB, BC and AC respectively of ΔABC

From eq. (i) and (ii), we get x = 0 and y = 1

Thus, AB and BC intersect at (0, 1)

Solving eq. (ii) and (iii), we get

y = 1 …(ii)

and 2x + y = 2 …(iii)

Putting the value of y = 1 in eq. (iii), we get

2x + 1 = 2

⇒ 2x = 1

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

Thus, BC and AC intersect at $\left(\frac{1}{2}, 1\right)$

Now, Solving eq. (iii) and (i), we get

2x + y = 2 …(iii)

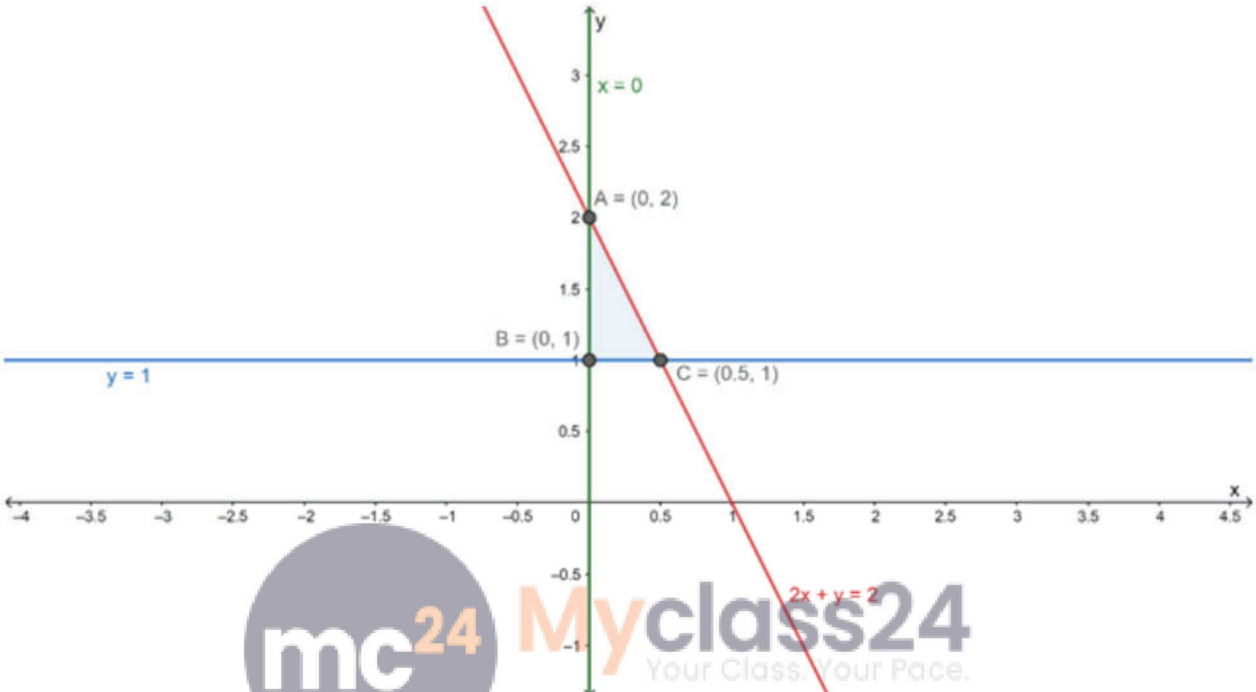
and x = 0 …(i)

Putting the value of x = 0 in eq. (iii), we get

y = 2

Thus, AC and AB intersect at (0, 2)

So, vertices of triangle ABC are : $(0, 1), \left(\frac{1}{2}, 1\right)$ and $(0, 2)$



$\therefore$ Area of $\Delta ABC = \frac{1}{2} \times \text{base} \times \text{height}$

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

$= \frac{1}{4}$ sq. units

Q. 8. Find the area of the triangle, the equations of whose sides are y = x, y = 2x and y – 3x = 4.

Answer : The given equations are

y = x …(i)

y = 2x …(ii)

and $y – 3x = 4$ …(iii)

Let eq. (i), (ii) and (iii) represents the sides AB, BC and AC respectively of ΔABC

From eq. (i) and (ii), we get $x = 0$ and $y = 0$

Thus, AB and BC intersect at (0, 0)

Solving eq. (ii) and (iii), we get

$y = 2x$ …(ii)

and $y – 3x = 4$ …(iii)

Putting the value of $y = 2x$ in eq. (iii), we get

$2x – 3x = 4$

$\Rightarrow -x = 4$

$\Rightarrow x = -4$

Putting the value of $x = -4$ in eq. (ii), we get

$y = 2(-4)$

$\Rightarrow y = -8$

Thus, BC and AC intersect at (-4, -8)

Now, Solving eq. (iii) and (i), we get

$y – 3x = 4$ …(iii)

and $y = x$ …(i)

Putting the value of $y = x$ in eq. (iii), we get

$x – 3x = 4$

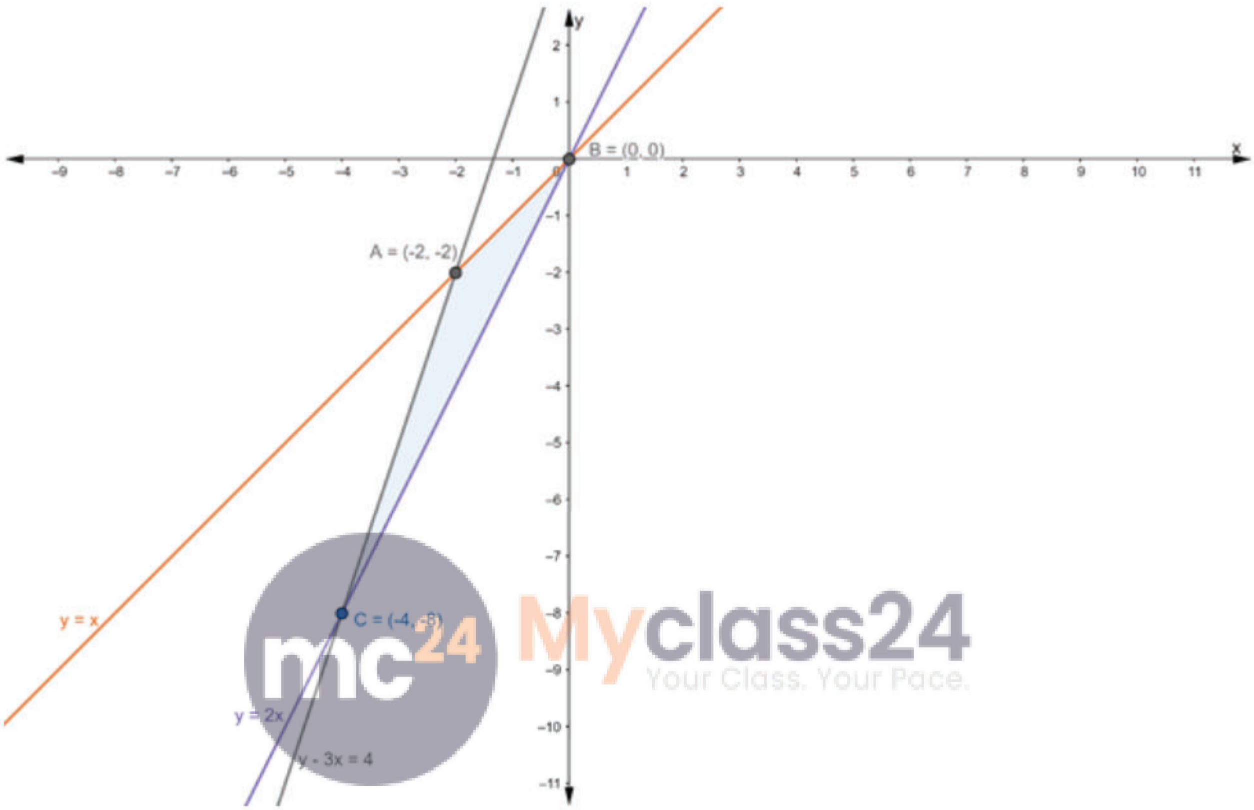
$\Rightarrow -2x = 4$

$\Rightarrow x = -2$

Putting the value of $x = -2$ in eq. (i), we get y = -2

Thus, AC and AB intersect at (-2, -2)

So, vertices of triangle ABC are: (0, 0), (-4, -8) and (-2, -2)



$$\therefore \text{Area of } \Delta ABC = \frac{1}{2}\begin{vmatrix} 0 & 0 & 1 \\ -2 & -2 & 1 \\ -4 & -8 & 1 \end{vmatrix}$$

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

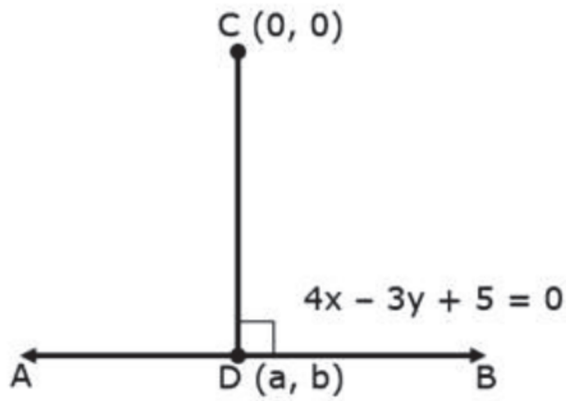
$$= \frac{1}{2}\left[1\{16 - 8\}\right]$$

$$= \frac{1}{2}[8]$$

= 4 sq. units

Q. 9. Find the equation of the perpendicular drawn from the origin to the line 4x – 3y + 5 = 0. Also, find the coordinates of the foot of the perpendicular.

Answer :



Let the equation of line AB be 4x – 3y + 5 = 0

and point C be (0, 0)

CD is perpendicular to the line AB, and we need to find:

1) Equation of Perpendicular drawn from point C

2) Coordinates of D

Let the coordinates of point D be (a, b)

Also, point D(a, b) lies on the line AB, i.e. point (a, b) satisfy the equation of line AB

Putting x = a and y = b, in equation, we get

4a – 3b + 5 = 0 …(i)

Also, the CD is perpendicular to the line AB

and we know that, if two lines are perpendicular then the product of their slope is equal to -1

∴ Slope of AB × Slope of CD = -1

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

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

$$\text{Slope of CD} = -\frac{3}{4}$$

Now, Equation of line CD formed by joining the points C(0, 0) and D(a, b) and having the slope $-\frac{3}{4}$ is

$y_2 - y_1 = m(x_2 - x_1)$

$$\Rightarrow b - 0 = -\frac{3}{4}(a - 0)$$

$$\Rightarrow b = -\frac{3}{4}a$$

⇒ 4b = -3a

⇒ 3a + 4b = 0 …(ii)

Now, our equations are

4a – 3b + 5 = 0 …(i)

and 3a + 4b = 0 …(ii)

Multiply the eq. (i) by 4 and (ii) by 3, we get

16a – 12b + 20 = 0 …(iii)

9a + 12b = 0 …(iv)

Adding eq. (iii) and (iv), we get

16a – 12b + 20 + 9a + 12b = 0

$\Rightarrow$ 25a + 20 = 0

$\Rightarrow$ 25a = -20

$$\Rightarrow a = -\frac{20}{25} = -\frac{4}{5}$$

Putting the value of a in eq. (ii), we get

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

$$\Rightarrow -\frac{12}{5} + 4b = 0$$

$\Rightarrow$ -12 + 20b = 0

$\Rightarrow$ 20b = 12

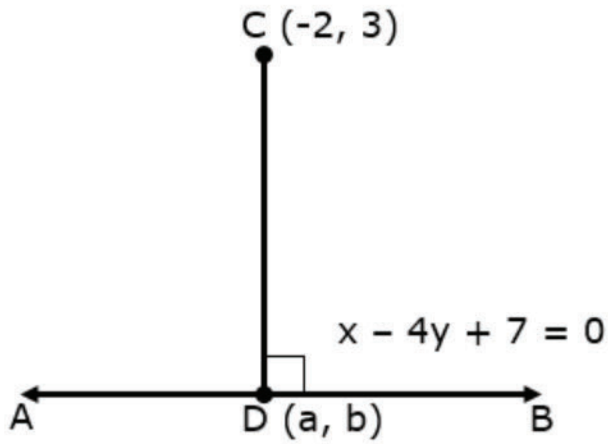
$$\Rightarrow b = \frac{12}{20}$$

$$\Rightarrow b = \frac{3}{5}$$

Hence, the coordinates of $D(a, b)$ is $\left(-\frac{4}{5}, \frac{3}{5}\right)$

Q. 10. Find the equation of the perpendicular drawn from the point P(-2, 3) to the line x– 4y + 7 = 0. Also, find the coordinates of the foot of the perpendicular.

Answer :



Let the equation of line AB be x – 4y + 7 = 0

and point C be (-2, 3)

CD is perpendicular to the line AB, and we need to find:

1) Equation of Perpendicular drawn from point C

2) Coordinates of D

Let the coordinates of point D be (a, b)

Also, point D(a, b) lies on the line AB, i.e. point (a, b) satisfy the equation of line AB

Putting x = a and y = b, in equation, we get

a – 4b + 7 = 0 …(i)

Also, the CD is perpendicular to the line AB

and we know that, if two lines are perpendicular then the product of their slope is equal to -1

∴ Slope of AB × Slope of CD = -1

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

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

Slope of CD = - 4

Now, Equation of line CD formed by joining the points C(-2, 3) and D(a, b) and having the slope – 4 is

$y_2 - y_1 = m(x_2 - x_1)$

⇒ b – 3 = (-4)[a – (-2)]

⇒ b – 3 = -4(a + 2)

⇒ b – 3 = -4a – 8

⇒ 4a + b + 5 = 0 …(ii)

Now, our equations are

a – 4b + 7 = 0 …(i)

and 4a + b + 5 = 0 …(ii)

Multiply the eq. (ii) by 4, we get

16a + 4b + 20 = 0 …(iii)

Adding eq. (i) and (iii), we get

a – 4b + 7 + 16a + 4b + 20 = 0

⇒ 17a + 27 = 0

⇒ 17a = -27

$$\Rightarrow a = -\frac{27}{17}$$

Putting the value of a in eq. (i), we get

$$-\frac{27}{17}-4b+7=0$$

$$\Rightarrow \frac{-27-68b+119}{17}=0$$

⇒ 92 – 68b = 0

⇒ -68b = -92

$$\Rightarrow b=\frac{92}{68}$$

$$\Rightarrow b=\frac{23}{17}$$

Hence, the coordinates of $D(a,\ b)$ is $\left(-\frac{27}{17},\frac{23}{17}\right)$

Q. 11. Find the equations of the medians of a triangle whose sides are given by the equations 3x + 2y + 6 = 0, 2x – 5y + 4 = 0 and x -3y – 6 = 0.

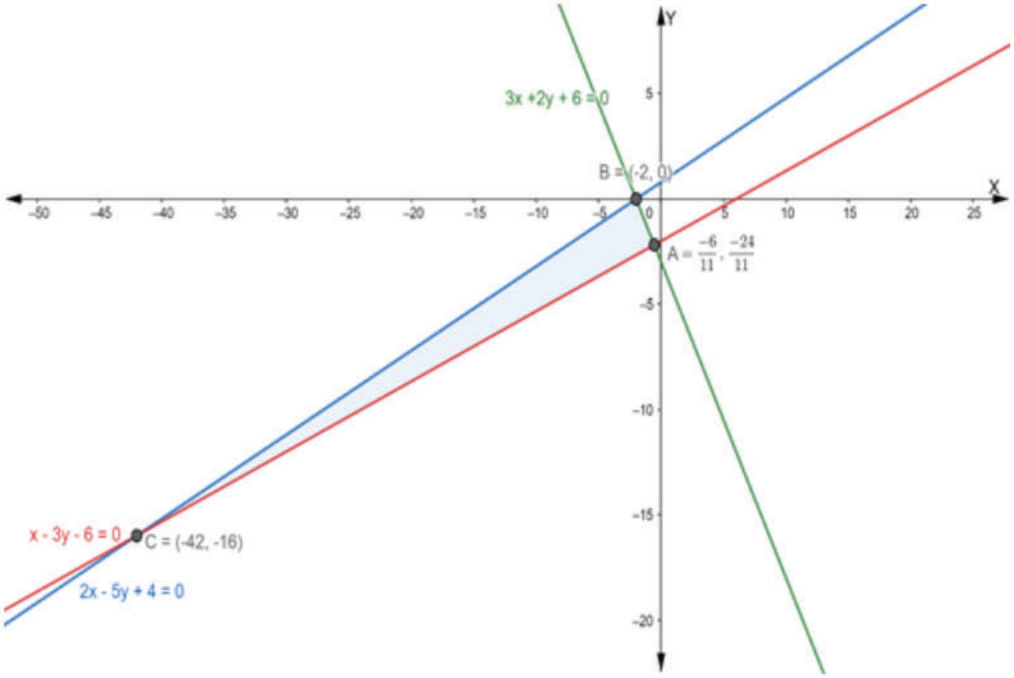
Answer : The given equations are

3x + 2y + 6 = 0 …(i)

2x – 5y + 4 = 0 …(ii)

and x – 3y – 6 = 0 …(iii)

Let eq. (i), (ii) and (iii) represents the sides AB, BC and AC respectively of ΔABC



Firstly, we solve the equation (i) and (ii)

3x + 2y + 6 = 0 …(i)

2x – 5y + 4 = 0 …(ii)

Multiplying the eq. (i) by 2 and (ii) by 3, we get

6x + 4y + 12 = 0 …A

6x – 15y + 12 = 0 …B

Subtracting eq. (B) from (A), we get

6x + 4y + 12 – 6x + 15y – 12 = 0

⇒ 19y = 0

⇒ y = 0

Putting the value of y = 0 in eq. (i), we get

3x + 2(0) + 6 = 0

⇒ 3x + 6 = 0

⇒ 3x = -6

⇒ x = -2

Thus, AB and BC intersect at (-2, 0)

Now, we solve eq. (ii) and (iii)

2x – 5y + 4 = 0 …(ii)

and x – 3y – 6 = 0 …(iii)

Multiplying the eq. (iii) by 2, we get

2x – 6y – 12 = 0 …(iv)

Subtracting eq. (iv) from (ii), we get

2x – 5y + 4 – 2x + 6y + 12 = 0

⇒ y + 16 = 0

⇒ y = -16

Putting the value of y = -16 in eq. (ii), we get

2x – 5(-16) + 4 = 0

⇒ 2x + 80 + 4 = 0

⇒ 2x + 84 = 0

⇒ 2x = -84

⇒ x = -42

Thus, BC and AC intersect at (-42, -16)

Now, we solve eq. (iii) and (i)

x – 3y – 6 = 0 …(iii)

3x + 2y + 6 = 0 …(i)

Multiplying the eq. (iii) by 3, we get

3x – 9y – 18 = 0 …(v)

Subtracting eq. (v) from (i), we get

3x + 2y + 6 – 3x + 9y + 18 = 0

$\Rightarrow$ 11y + 24 = 0

$\Rightarrow$ 11y = -24

$$\Rightarrow y = -\frac{24}{11}$$

Putting the value of y in eq. (iii), we get

$$x - 3\left(-\frac{24}{11}\right) - 6 = 0$$

$$\Rightarrow x + \frac{72}{11} - 6 = 0$$

$$\Rightarrow x = 6 - \frac{72}{11}$$

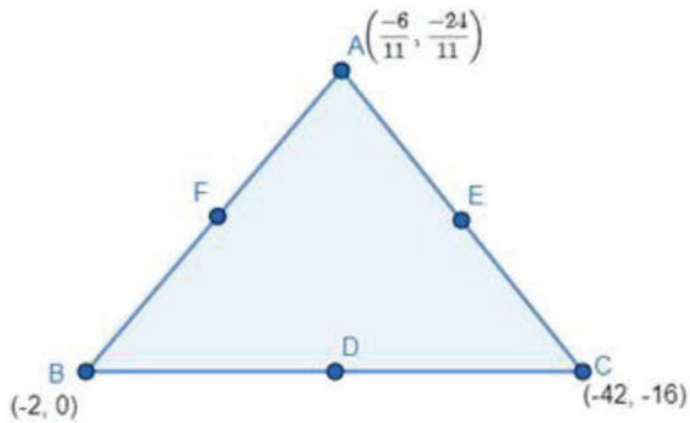
$$\Rightarrow x = \frac{66 - 72}{11}$$

$$\Rightarrow x = -\frac{6}{11}$$

Thus, AC and AB intersect at $\left(-\frac{6}{11}, -\frac{24}{11}\right)$

So, vertices of triangle ABC are: $A\left(-\frac{6}{11}, -\frac{24}{11}\right)$, $B(-2, 0)$ & $C(-42, -16)$

Let D, E and F be the midpoints of sides BC, CA and AB respectively.



Then the coordinates of D, E and F are

$$\text{Coordinates of D} = \left(\frac{-42+(-2)}{2}, \frac{-16+0}{2}\right)$$

$$= \left(\frac{-42-2}{2}, -\frac{16}{2}\right)$$

$$= \left(-\frac{44}{2}, -8\right)$$

= (-22, -8)

$$\text{Coordinates of E} = \left(\frac{-42+\left(-\frac{6}{11}\right)}{2}, \frac{-16+\left(-\frac{24}{11}\right)}{2}\right)$$

$$= \left(\frac{-42-\frac{6}{11}}{2}, \frac{-16-\frac{24}{11}}{2}\right)$$

$$=\left(\frac{-462-6}{22},\frac{-176-24}{22}\right)$$

$$=\left(-\frac{468}{22},-\frac{200}{22}\right)$$

$$=\left(-\frac{234}{11},-\frac{100}{11}\right)$$

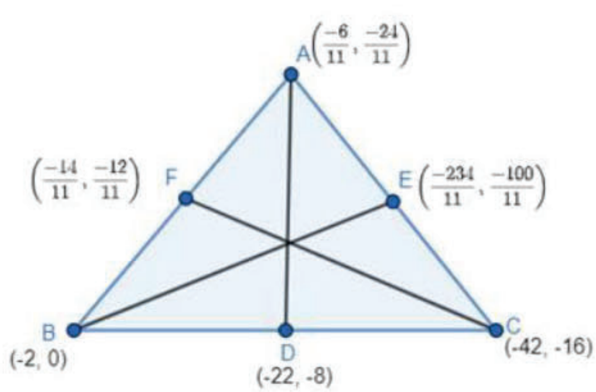
$$\text{Coordinates of F}=\left(\frac{-\frac{6}{11}+(-2)}{2},\frac{-\frac{24}{11}+0}{2}\right)$$

$$=\left(\frac{-6-22}{22},-\frac{24}{22}\right)$$

$$=\left(-\frac{28}{22},-\frac{12}{11}\right)$$

$$=\left(-\frac{14}{11},-\frac{12}{11}\right)$$

Now, we have to find the equations of Medians AD, BE and CF



The equation of median AD is

$$y-\left(-\frac{24}{11}\right)=\frac{-8-\left(-\frac{24}{11}\right)}{-22-\left(-\frac{6}{11}\right)}\left[x-\left(-\frac{6}{11}\right)\right]$$

$$\Rightarrow y+\frac{24}{11}=\frac{\frac{-88+24}{11}}{\frac{-222+6}{11}}\left(x+\frac{6}{11}\right)$$

$$\Rightarrow y+\frac{24}{11}=\frac{-64}{-216}\left(x+\frac{6}{11}\right)$$

$$\Rightarrow y+\frac{24}{11}=\frac{16}{59}\left(x+\frac{6}{11}\right)$$

$$\Rightarrow y+\frac{24}{11}=\frac{16}{59}x+\frac{96}{59\times 11}$$

$$\Rightarrow \frac{16}{59}x-y=\frac{24}{11}-\frac{96}{59\times 11}$$

$$\Rightarrow \frac{16x-59y}{59}=\frac{1416-96}{59\times 11}$$

$$\Rightarrow 16x-59y=\frac{1320}{11}$$

$\Rightarrow 16x - 59y = 120$

The equation of the median BE is

$$y-(0)=\frac{-\frac{100}{11}-0}{-\frac{234}{11}-(-2)}\left[x-(-2)\right]$$

$$\Rightarrow y=\frac{-\frac{100}{11}}{\frac{-234+2}{11}}(x+2)$$

$$\Rightarrow y=\frac{-100}{-232}(x+2)$$

$$\Rightarrow y=\frac{25}{58}(x+2)$$

⇒ 58y = 25x + 50

⇒ 25x – 58y + 50 = 0

The equation of median AD is

$$y-(-16)=\frac{-16-\left(-\frac{12}{11}\right)}{-42-\left(-\frac{14}{11}\right)}\left[x-(-42)\right]$$

$$\Rightarrow y+16=\frac{\frac{-176+12}{11}}{\frac{-462+14}{11}}(x+42)$$

$$\Rightarrow y+16=\frac{-164}{-448}(x+42)$$

$$\Rightarrow y + 16 = \frac{41}{112}(x + 42)$$

$\Rightarrow$ 112y + 1792 = 41x + 1722

$\Rightarrow$ 41x – 112y + 1722 – 1792 = 0

$\Rightarrow$ 41x – 112y – 70 = 0

Exercise 20J

Q. 1. If the origin is shifted to the point (1, 2) by a translation of the axes, find the new coordinates of the point (3, -4).

Answer : Let the new origin be (h, k) = (1, 2) and (x, y) = (3, -4) be the given point.

Let the new coordinates be (X, Y)

We use the transformation formula:

x = X + h and y = Y + k

$\Rightarrow$ 3 = X + 1 and -4 = Y + 2

$\Rightarrow$ X = 2 and Y = -6

Thus, the new coordinates are (2, -6)

Q. 2. If the origin is shifted to the point (-3, -2) by a translation of the axes, find the new coordinates of the point (3, -5).

Answer : Let the new origin be (h, k) = (-3, -2) and (x, y) = (3, -5) be the given point.

Let the new coordinates be (X, Y)

We use the transformation formula:

x = X + h and y = Y + k

$\Rightarrow$ 3 = X – 3 and -5 = Y – 2

$\Rightarrow$ X = 6 and Y = -3

Thus, the new coordinates are (6, -3)

Q. 3. If the origin is shifted to the point (0, -2) by a translation of the axes, the coordinates of a point become (3, 2). Find the original coordinates of the point.

Answer : Let the new origin be (h, k) = (0, -2) and (x, y) = (3, 2) be the given point.

Let the new coordinates be (X, Y)

We use the transformation formula:

x = X + h and y = Y + k

⇒ 3 = X + 0 and 2 = Y + (-2)

⇒ X = 3 and Y = 4

Thus, the new coordinates are (3, 4)

Q. 4. If the origin is shifted to the point (2, -1) by a translation of the axes, the coordinates of a point become (-3, 5). Find the origin coordinates of the point.

Answer : Let the new origin be (h, k) = (2, -1) and (x, y) = (-3, 5) be the given point.

Let the new coordinates be (X, Y)

We use the transformation formula:

x = X + h and y = Y + k

⇒ -3 = X + 2 and 5 = Y + (-1)

⇒ X = -5 and Y = 6

Thus, the new coordinates are (-5, 6)

Q. 5. At what point must the origin be shifted, if the coordinates of a point (-4,2) become (3, -2)?

Answer : Let (h, k) be the point to which the origin is shifted. Then,

x = -4, y = 2, X = 3 and Y = -2

∴ x = X + h and y = Y + k

⇒ -4 = 3 + h and 2 = -2 + k

⇒ h = -7 and k = 4

Hence, the origin must be shifted to (-7, 4)

Q. 6. Find what the given equation becomes when the origin is shifted to the point (1, 1).

$x^2 + xy - 3x - y + 2 = 0$

Answer : Let the new origin be (h, k) = (1, 1)

Then, the transformation formula become:

$x = X + 1$ and $y = Y + 1$

Substituting the value of x and y in the given equation, we get

$x^2 + xy - 3x - y + 2 = 0$

Thus,

$(X + 1)^2 + (X + 1)(Y + 1) - 3(X + 1) - (Y + 1) + 2 = 0$

$\Rightarrow (X^2 + 1 + 2X) + XY + X + Y + 1 - 3X - 3 - Y - 1 + 2 = 0$

$\Rightarrow X^2 + 1 + 2X + XY - 2X - 1 = 0$

$\Rightarrow X^2 + XY = 0$

Hence, the transformed equation is $X^2 + XY = 0$

Q. 7. Find what the given equation becomes when the origin is shifted to the point (1, 1).

$xy - y^2 - x + y = 0$

Answer : Let the new origin be (h, k) = (1, 1)

Then, the transformation formula become:

$x = X + 1$ and $y = Y + 1$

Substituting the value of x and y in the given equation, we get

$xy - y^2 - x + y = 0$

Thus,

$(X + 1)(Y + 1) - (Y + 1)^2 - (X + 1) + (Y + 1) = 0$

$\Rightarrow XY + X + Y + 1 – (Y^2 + 1 + 2Y) – X – 1 + Y + 1 = 0$

$\Rightarrow XY + X + Y + 1 – Y^2 – 1 – 2Y – X + Y = 0$

$\Rightarrow XY – Y^2 = 0$

Hence, the transformed equation is $XY – Y^2 = 0$

Q. 8. Find what the given equation becomes when the origin is shifted to the point (1, 1).

$x^2 – y^2 – 2x + 2y = 0$

Answer : Let the new origin be (h, k) = (1, 1)

Then, the transformation formula become:

x = X + 1 and y = Y + 1

Substituting the value of x and y in the given equation, we get

$x^2 – y^2 – 2x + 2y = 0$

Thus,

$(X + 1)^2 – (Y + 1)^2 – 2(X + 1) + 2(Y + 1) = 0$

$\Rightarrow (X^2 + 1 + 2X) – (Y^2 + 1 + 2Y) – 2X – 2 + 2Y + 2 = 0$

$\Rightarrow X^2 + 1 + 2X – Y^2 – 1 – 2Y – 2X + 2Y = 0$

$\Rightarrow X^2 – Y^2 = 0$

Hence, the transformed equation is $X^2 – Y^2 = 0$

Q. 9. Find what the given equation becomes when the origin is shifted to the point (1, 1).

$xy – x – y + 1 = 0$

Answer :

Let the new origin be (h, k) = (1, 1)

Then, the transformation formula become:

$x = X + 1$ and $y = Y + 1$

Substituting the value of x and y in the given equation, we get

$xy - x - y + 1 = 0$

Thus,

$(X + 1)(Y + 1) - (X + 1) - (Y + 1) + 1 = 0$

$\Rightarrow XY + X + Y + 1 - X - 1 - Y - 1 + 1 = 0$

$\Rightarrow XY = 0$

Hence, the transformed equation is $XY = 0$

Q. 10. Transform the equation $2x^2 + y^2 - 4x + 4y = 0$ to parallel axes when the origin is shifted to the point (1, -2).

Answer :

Let the new origin be (h, k) = (1, -2)

Then, the transformation formula become:

$x = X + 1$ and $y = Y + (-2) = Y - 2$

Substituting the value of x and y in the given equation, we get

$2x^2 + y^2 - 4x + 4y = 0$

Thus,

$2(X + 1)^2 + (Y - 2)^2 - 4(X + 1) + 4(Y - 2) = 0$

$\Rightarrow 2(X^2 + 1 + 2X) + (Y^2 + 4 - 4Y) - 4X - 4 + 4Y - 8 = 0$

$\Rightarrow 2X^2 + 2 + 4X + Y^2 + 4 - 4Y - 4X + 4Y - 12 = 0$

$\Rightarrow 2X^2 + Y^2 - 6 = 0$

$\Rightarrow 2X^2 + Y^2 = 6$

Hence, the transformed equation is $2X^2 + Y^2 = 6$

Exercise 20K

Q. 1. Find the equation of the line drawn through the point of intersection of the lines $x - 2y + 3 = 0$ and $2x - 3y + 4 = 0$ and passing through the point (4, -5).

Answer : Suppose the given two lines intersect at a point $P(x_1, y_1)$. Then, (x_1, y_1) satisfies each of the given equations.

$x - 2y + 3 = 0$ …(i)

$2x - 3y + 4 = 0$ …(ii)

Now, we find the point of intersection of eq. (i) and (ii)

Multiply the eq. (i) by 2, we get

$2x - 4y + 6 = 0$ …(iii)

On subtracting eq. (iii) from (ii), we get

$2x - 3y + 4 - 2x + 4y - 6 = 0$

$\Rightarrow y - 2 = 0$

$\Rightarrow y = 2$

Putting the value of y in eq. (i), we get

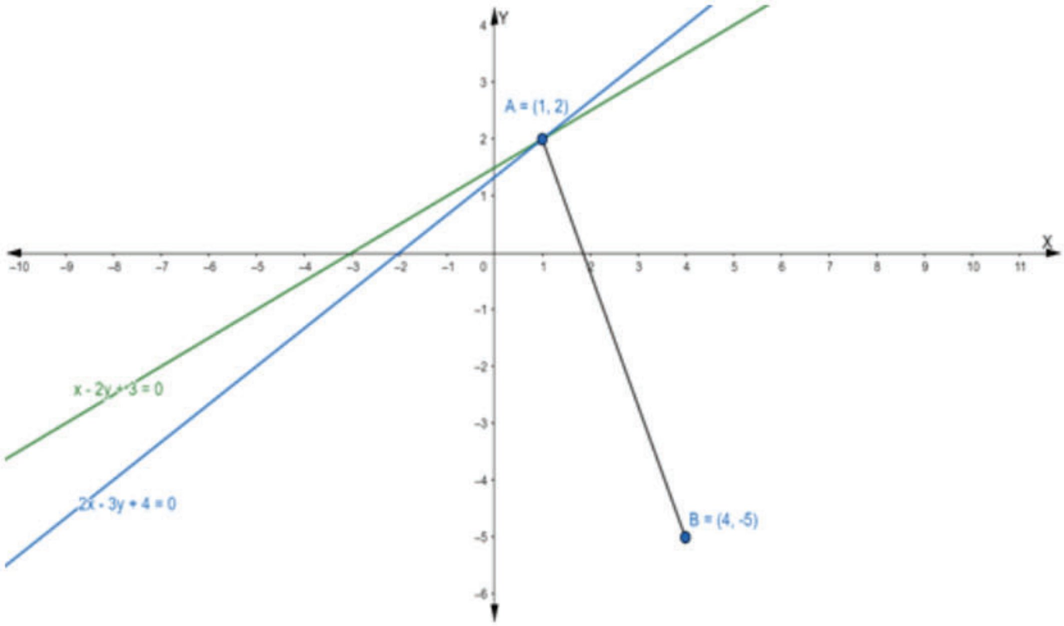
$x - 2(2) + 3 = 0$

$\Rightarrow x - 4 + 3 = 0$

$\Rightarrow x - 1 = 0$

$\Rightarrow x = 1$

Hence, the point of intersection $P(x_1, y_1)$ is (1, 2)



Let AB is the line drawn from the point of intersection (1, 2) and passing through the point (4, -5)

Firstly, we find the slope of the line joining the points (1, 2) and (4, -5)

$$\text{Slope of line joining two points} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\therefore m_{AB} = \frac{-5-2}{4-1} = \frac{-7}{3}$$

Now, we have to find the equation of line passing through point (4, -5)

Equation of line: $y - y_1 = m(x - x_1)$

$$\Rightarrow y - (-5) = -\frac{7}{3}(x-4)$$

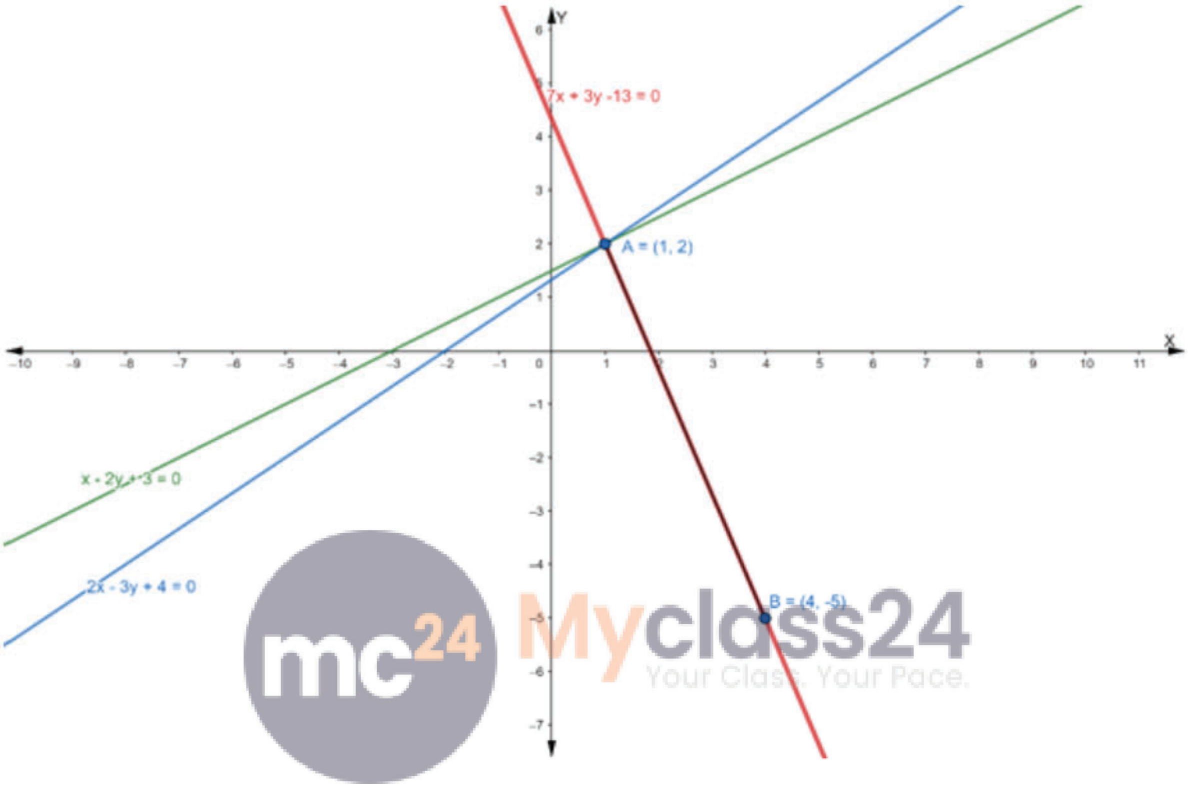
$$\Rightarrow y + 5 = -\frac{7}{3}(x-4)$$

⇒ 3y + 15 = -7x + 28

⇒ 7x + 3y + 15 – 28 = 0

⇒ 7x + 3y – 13 = 0

Hence, the equation of line passing through the point (4, -5) is 7x + 3y – 13 = 0



Q. 2. Find the equation of the line drawn through the point of intersection of the lines x – y = 7 and 2x + y = 2 and passing through the origin.

Answer : Suppose the given two lines intersect at a point P(x_1, y_1). Then, (x_1, y_1) satisfies each of the given equations.

x – y = 7 …(i)

2x + y = 2 …(ii)

Now, we find the point of intersection of eq. (i) and (ii)

Multiply the eq. (i) by 2, we get

2x – 2y = 14 …(iii)

On subtracting eq. (iii) from (ii), we get

2x – 2y – 2x – y = 14 – 2

$\Rightarrow -3y = 12$

$\Rightarrow y = -4$

Putting the value of y in eq. (i), we get

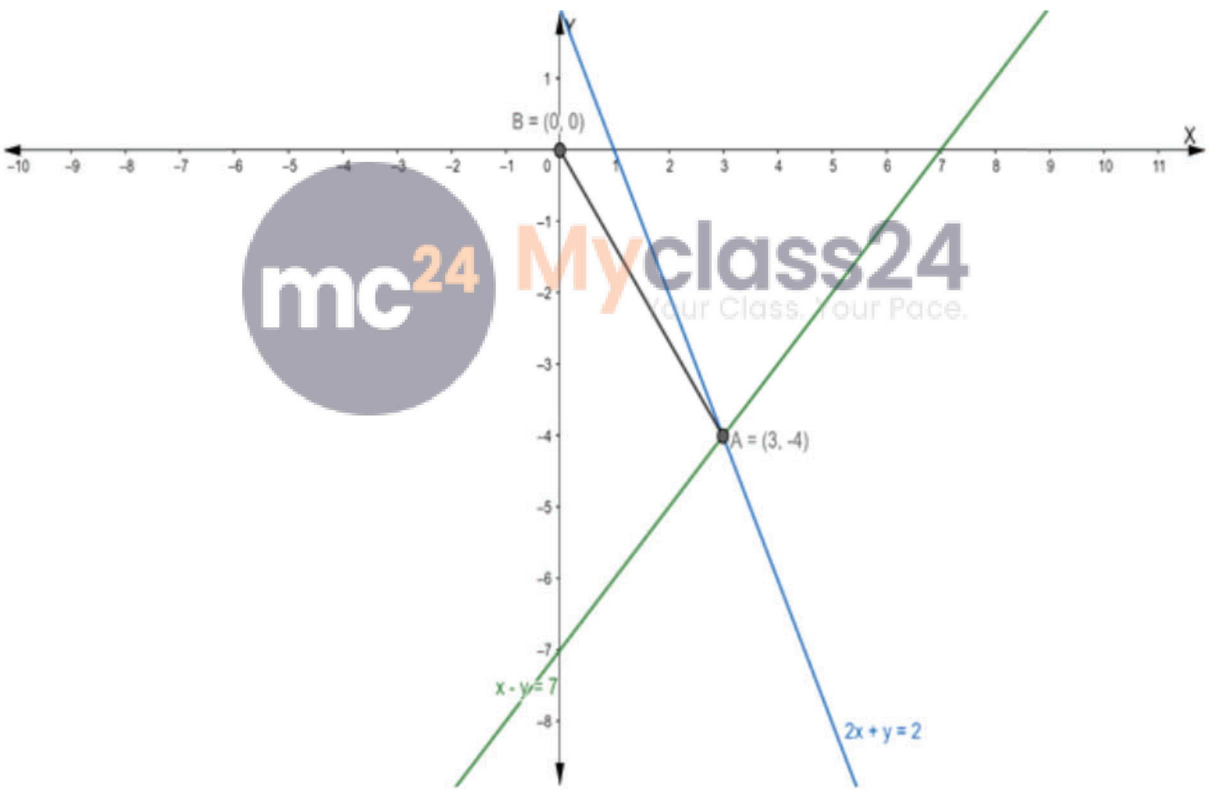
$x - (-4) = 7$

$\Rightarrow x + 4 = 7$

$\Rightarrow x = 7 - 4$

$\Rightarrow x = 3$

Hence, the point of intersection $P(x_1, y_1)$ is (3, -4)



Let AB is the line drawn from the point of intersection (3, -4) and passing through the origin.

Firstly, we find the slope of the line joining the points (3, -4) and (0, 0)

$$\text{Slope of line joining two points} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\therefore m_{AB} = \frac{0-(-4)}{0-3} = \frac{4}{-3}$$

Now, we have to find the equation of the line passing through the origin

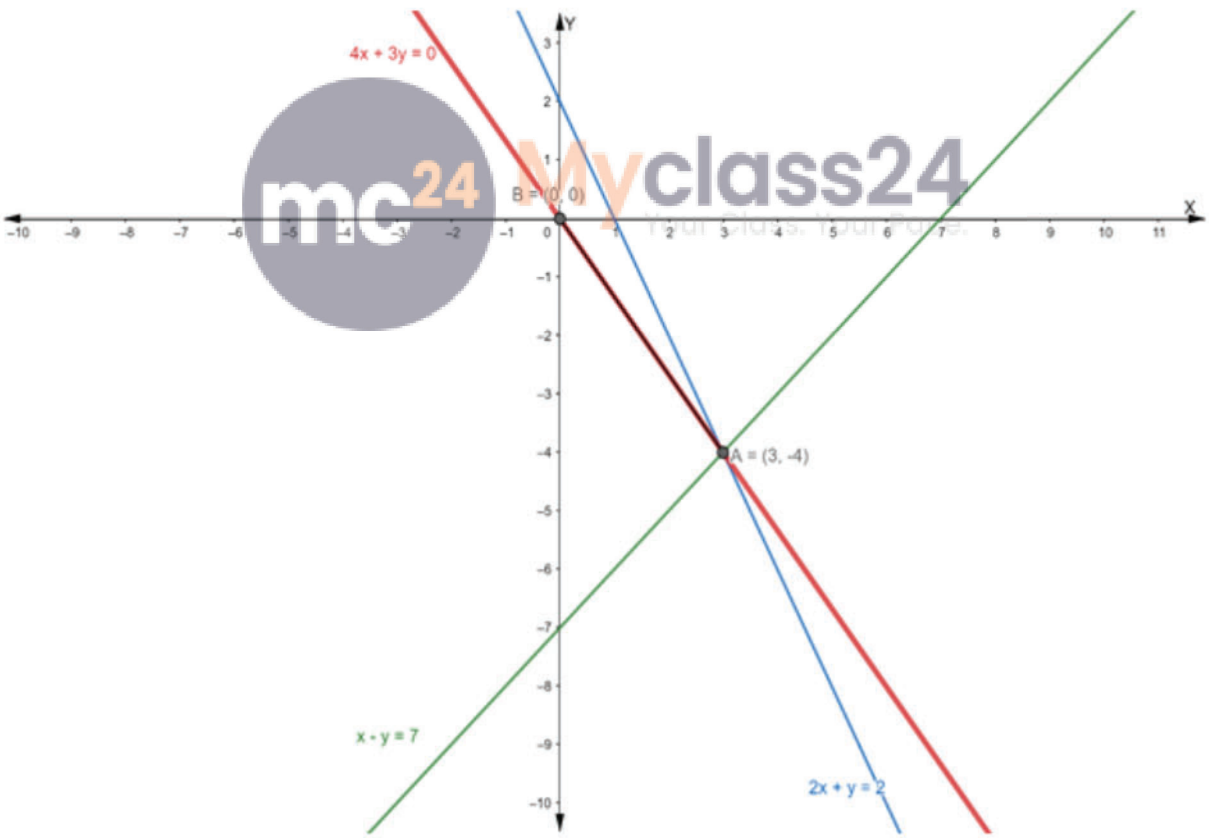
Equation of line: $y - y_1 = m(x - x_1)$

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

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

$\Rightarrow 4x + 3y = 0$

Hence, the equation of the line passing through the origin is $4x + 3y = 0$



Q. 3. Find the equation of the line drawn through the point of intersection of the lines $x + y = 9$ and $2x - 3y + 7 = 0$ and whose slope is $\frac{-2}{3}$.