CHAPTER 4 Linear Equations in Two Variables

EXERCISE 4A

1. (i) Ordinate (y) = thrice abscissa (x)

$\Rightarrow$ $\mathbf{y = 3x}$

(ii) Sum of the ordinate (y) and abscissa (x) of a point = 6 [given]

$\Rightarrow$ $\mathbf{x + y = 6}$

(iii) Twice the ordinate (y) of a point + 3 times the abscissa (x) = 16 [given]

$\Rightarrow$ $2y + 3x = 16$

$\Rightarrow$ $\mathbf{3x + 2y = 16}$

(iv) Let the cost of 1 orange be ₹ x.

$\therefore$ the cost of 2 oranges = ₹ $2x$.

Let the cost of 1 apple be ₹ y.

$\therefore$ the cost of 3 apples = ₹ $3y$.

Cost of 2 oranges and 3 apples = ₹ 45. [given]

$\Rightarrow$ $\mathbf{2x + 3y = 45}$

(v) Let the cost of a table be ₹ x and that of a chair be ₹ y.

Cost of a table = 6 times cost of a chair [given]

$\Rightarrow$ $\mathbf{x = 6y}$

(vi) Let Tanay's age be x years and Vihaan's age be y years

Tanay's age – Vihaan's age = 3.

$\Rightarrow$ $\mathbf{x - y = 3}$

(vii) Let the man's present age be x years.

Let the son's present age be y years.

Man's present age = 4 times son's present age [given]

$\Rightarrow$ $\mathbf{x = 4y}$

(viii) Let the two required numbers be x and y.

Three times one number = 5 times the other number [given]

$\Rightarrow$ $\mathbf{3x = 5y}$

(ix) Let the cost of one egg be ₹ x

and the cost of one bread be ₹ y.

Cost of half dozen eggs = Cost of one bread [given]

$\Rightarrow$ $\mathbf{6x = y}$

(x) Let the cost of one ball point pen = ₹ x

and the cost of one ink pen = ₹ y.

Cost of 1 ball point pen and 1 ink pen = ₹ 200.

$\Rightarrow$ $\mathbf{x + y = 200}$

2. (i) $2x - 3y = 5.4$

Here, $\mathbf{a = 2, b = -3, c = -5.4.}$ $\Rightarrow$ $2x - 3y - 5.4 = 0$

(ii) $\sqrt{3}\,y = 2x \Rightarrow 2x - \sqrt{3}\,y = 0 \Rightarrow \mathbf{2x - \sqrt{3}\,y + 0 = 0.}$

$\Rightarrow$ $\mathbf{a = 2, b = -\sqrt{3}, c = 0.}$

(iii) $\frac{3}{5}x - \frac{y}{3} = 1 \Rightarrow \frac{3}{5}x - \frac{y}{3} - 1 = 0 \Rightarrow \mathbf{9x - 5y - 15 = 0}$

Here, $\mathbf{a = 9, b = -5, c = -15.}$

(iv) $4x = 3y \Rightarrow 4x - 3y = 0 \Rightarrow \mathbf{4x - 3y + 0 = 0}$

Here, $\mathbf{a = 4, b = -3, c = 0}$

(v) $y + 3 = 9 \Rightarrow y + 3 - 9 = 0$

$\Rightarrow y - 6 = 0$

$\Rightarrow \mathbf{0 \cdot x + 1 \cdot y - 6 = 0}$

Here, $\mathbf{a = 0, b = 1, c = -6.}$

(vi) $-37 = 5x \Rightarrow 5x + 37 = 0 \Rightarrow \mathbf{5x + 0 \cdot y + 37 = 0}$

Here, $\mathbf{a = 5, b = 0, c = 37.}$

3. (i) $3x = -4 \Rightarrow 3x + 4 = 0 \Rightarrow \mathbf{3x + 0 \cdot y + 4 = 0}$

(ii) $2y = 3 \Rightarrow 2y - 3 = 0 \Rightarrow \mathbf{0 \cdot x + 2y - 3 = 0}$

(iii) $3x = 5 \Rightarrow 3x - 5 = 0 \Rightarrow \mathbf{3x + 0 \cdot y - 5 = 0}$

(iv) $7y = 2 \Rightarrow 7y - 2 = 0 \Rightarrow \mathbf{0.x + 7y - 2 = 0}$

(v) $\frac{2}{3}x = 7 \Rightarrow \frac{2}{3}x - 7 = 0 \Rightarrow \frac{2}{3}x + 0 \cdot y - 7 = 0$

$\Rightarrow \mathbf{2x + 0 \cdot y - 21 = 0}$

(vi) $\frac{3}{5}y = 2 \Rightarrow \frac{3}{5}y - 2 = 0 \Rightarrow 0.x + \frac{3}{5}y - 2 = 0$

$\Rightarrow \mathbf{0 \cdot x + 3y - 10 = 0}$

EXERCISE 4B

Sample answer has been given for Q.1 to Q.4. You may give different values to x and obtain the corresponding values of y.

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

$\therefore$ $x = 0 \Rightarrow y = 4 - 2\,(0) = 4$

$x = 2 \Rightarrow y = 4 - 2\,(2) = 0$

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

$x = -1 \Rightarrow y = 4 - 2\,(-1) = 6$

Hence, four solutions are

$\mathbf{x = 0, y = 4;\quad x = 2, y = 0;\quad x = 1, y = 2;}$

$\mathbf{x = -1, y = 6.}$

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

$\therefore$ $x = 0 \Rightarrow y = \frac{0-4}{2} = -2.$

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

$x = 3 \Rightarrow y = \frac{3-4}{2} = -0.5$

$x = 4 \Rightarrow y = \frac{4-4}{2} = 0.$

Hence, four solutions are

$x = 0, y = -2$; $x = 2, y = -1$; $x = 3, y = -0.5$, $x = 4, y = 0$.

3. $\pi x + 3y = 5 \Rightarrow 3y = 5 - \pi x \Rightarrow y = \dfrac{5-\pi x}{3}$

$\therefore \quad x = \dfrac{2}{\pi} \quad \Rightarrow y = \dfrac{5-\pi\cdot\dfrac{2}{\pi}}{3} = \dfrac{5-2}{3} = \dfrac{3}{3} = 1.$

$\therefore \quad x = \dfrac{5}{\pi} \quad \Rightarrow y = \dfrac{5-\pi\cdot\dfrac{5}{\pi}}{3} = \dfrac{5-5}{3} = \dfrac{0}{3} = 0.$

$\therefore \quad x = -\dfrac{1}{\pi} \quad \Rightarrow y = \dfrac{5-\pi\cdot\left(-\dfrac{1}{\pi}\right)}{3} = \dfrac{5+1}{3} = \dfrac{6}{3} = 2.$

$\therefore \quad x = -\dfrac{4}{\pi} \quad \Rightarrow y = \dfrac{5-\pi\cdot\left(-\dfrac{4}{\pi}\right)}{3} = \dfrac{5+4}{3} = \dfrac{9}{3} = 3$

$\boldsymbol{x = \dfrac{2}{\pi}, y = 1; \quad x = \dfrac{5}{\pi}, y = 0; \quad x = -\dfrac{1}{\pi}, y = 2,}$

$\boldsymbol{x = -\dfrac{4}{\pi}, y = 3.}$

4. $\dfrac{3}{2}x + y = 6 \Rightarrow y = 6 - \dfrac{3}{2}x$

$\therefore \quad x = 0 \Rightarrow y = 6 - \dfrac{3}{2}(0) = 6$

$x = 2 \Rightarrow y = 6 - \dfrac{3}{2}(2) = 3$

$x = 4 \Rightarrow y = 6 - \dfrac{3}{2}(4) = 0$

$x = 6 \Rightarrow y = 6 - \dfrac{3}{2}(6) = -3$

$x = 0, y = 6$; $x = 2, y = 3$; $x = 4, y = 0$, $x = 6, y = -3$.

5. $y - 15x = 500 \Rightarrow y = 500 + 15x$

$\therefore \quad x = -1 \Rightarrow y = 500 + 15(-1) = 485$

$x = 0 \Rightarrow y = 500 + 15(0) = 500$

$x = 2 \Rightarrow y = 500 + 15(2) = 530$

$x = 3 \Rightarrow y = 500 + 15(3) = 545$

$x = -1, y = 485$; $x = 0, y = 500$, $x = 2, y = 530$; $x = 3, y = 545$.

6. $3x + y + 5 = 0.$

Putting $x = -2, y = 1$ in the given equation, we get

L.H.S. $= 3(-2) + 1 + 5$

$= -6 + 6 = 0 =$ R.H.S.

Hence, **$x = -2, y = 1$ is a solution of $3x + y + 5 = 0$.**

7. $3y - x - 5 = 0.$

Putting $x = -2, y = 1$ in the given equation, we get

L.H.S. $= 3(1) - (-2) - 5 = 3 + 2 - 5$

$= 5 - 5 = 0 =$ R.H.S.

Hence, **$x = -2, y = 1$ is a solution of $3y - x - 5 = 0$.**

8. $2x + 5y - 1 = 0.$

Putting $x = -2, y = 1$ in the given equation, we get

L.H.S. $= 2(-2) + 5(1) - 1 = -4 + 5 - 1$

$= -5 + 5 = 0 =$ R.H.S.

Hence, **$x = -2, y = 1$ is a solution of $2x + 5y - 1 = 0$.**

9. $2x - y = 6.$

(i) Putting $x = 4, y = -2$ in the given equation, we get

L.H.S. $= 2(4) - (-2) = 8 + 2 = 10 \neq$ R.H.S.

Hence, $x = 4, y = -2$ **is not a solution** of $2x - y = 6$.

(ii) Putting $x = 0, y = 6$ in the given equation, we get

L.H.S. $= 2(0) - 6 = -6 \neq$ R.H.S.

Hence, $x = 0, y = 6$ **is not a solution** of $2x - y = 6$.

(iii) Putting $x = 4, y = 2$ in the given equation, we get

L.H.S. $= 2(4) - 2 = 8 - 2 = 6 =$ R.H.S.

Hence, $x = 4, y = 2$ **is a solution** of $2x - y = 6$.

(iv) Putting $x = 3, y = 0$ in the given equation, we get

L.H.S. $= 2(3) - 0 = 6 - 0 = 6 =$ R.H.S.

Hence, $x = 3, y = 0$ **is a solution** of $2x - y = 6$.

(v) Putting $x = 5, y = 4$ in the given equation, we get

L.H.S. $= 2(5) - 4 = 10 - 4 = 6 =$ R.H.S.

Hence, $x = 5, y = 4$ **is a solution** of $2x - y = 6$.

10. Since $x = -2$ and $y = 2$ is a solution of the equation $x + 3y = \dfrac{k}{2}$, therefore the given values of x and y will satisfy the equation.

$\therefore \quad (-2) + 3(2) = \dfrac{k}{2} \quad \Rightarrow \quad -2 + 6 = \dfrac{k}{2}$

$\Rightarrow \quad 4 = \dfrac{k}{2}$

$\Rightarrow \quad \boldsymbol{k = 8.}$

11. Since, $x = 0$ and $y = k$ is a solution of the equation $5x - 3y = 0$, therefore the given values of x and y will satisfy the equation.

$\therefore \quad 5(0) - 3(k) = 0 \Rightarrow -3k = 0 \Rightarrow \boldsymbol{k = 0.}$

12. Since $x = -p$ and $y = 3$ is a solution of the equation $2x + 9y - 13 = 0$, therefore the given values of x and y will satisfy the equation.

$\therefore \quad 2(-p) + 9(3) - 13 = 0 \Rightarrow -2p + 27 - 13 = 0.$

$\Rightarrow -2p + 14 = 0.$

$\Rightarrow 2p = 14$

$\Rightarrow \boldsymbol{p = 7.}$

13. Since $x = 2k - 1$ and $y = k$ is a solution of the equation $3x - 5y = 7$, therefore the given values of x and y will satisfy the equation.

$3(2k - 1) - 5(k) = 7$

$\Rightarrow \quad 6k - 3 - 5k = 7$

$\Rightarrow \quad k - 3 = 7$

$\boldsymbol{k = 10.}$

14. $ax - by = 2ab$

$by = ax - 2ab$

$\Rightarrow \qquad by = a(x - 2b)$

$\Rightarrow \qquad y = \dfrac{a(x-2b)}{b}.$

Sample solutions

$\therefore \qquad x = b \quad \Rightarrow \quad y = \dfrac{a(b-2b)}{b} = \dfrac{a(-b)}{b} = -a.$

$x = \dfrac{b}{2} \quad \Rightarrow \quad y = \dfrac{a\left(\dfrac{b}{2}-2b\right)}{b} = \dfrac{ab\left(\dfrac{1}{2}-2\right)}{b}$

$= a\left(\dfrac{-3}{2}\right) = \dfrac{-3a}{2}.$

Hence, $\boldsymbol{x = b, y = -a}$ **and** $\boldsymbol{x = \dfrac{b}{2}, y = \dfrac{-3a}{2}}$.

15. $3x - 8y = 27. \quad \Rightarrow \quad 8y = 3x - 27 \quad \Rightarrow \quad y = \dfrac{3x-27}{8}$

$\therefore \qquad x = 9 \quad \Rightarrow \quad y = \dfrac{3(9)-27}{8} = \dfrac{27-27}{8} = \dfrac{0}{8} = 0$

$x = 1 \quad \Rightarrow \quad y = \dfrac{3(1)-27}{8} = \dfrac{-24}{8} = -3$

$x = -7 \quad \Rightarrow \quad y = \dfrac{3(-7)-27}{8} = \dfrac{-21-27}{8}$

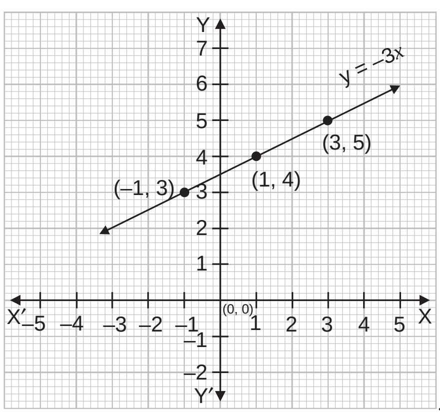
$= \dfrac{-48}{8} = -6$

Some solutions are

$\boldsymbol{x = 9, y = 0; \quad x = 1, y = -3, \quad x = -7, y = -6.}$

EXERCISE 4C

1.



From the graph, we find that the line passes through the point (1, 4).

2. (i) Graph of $y = -3x$

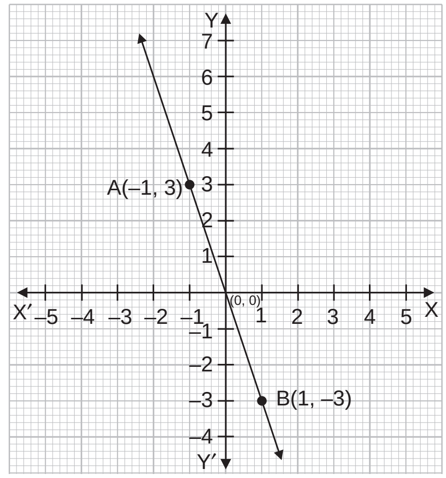
$\therefore \qquad x = -1 \quad \Rightarrow \quad y = -3(-1) = 3$

$x = 1 \quad \Rightarrow \quad y = -3(1) = -3$

Thus, we have the following table for

$y = -3x$

x	–1	1
y	3	–3



Plot point A (0, 0) and B (1, –3) on a graph paper. Draw a line passing through the points A and B. Then, the line AB represents the equation $y = -3x$.

(ii) $x + y = 8 \quad \Rightarrow \quad y = 8 - x$

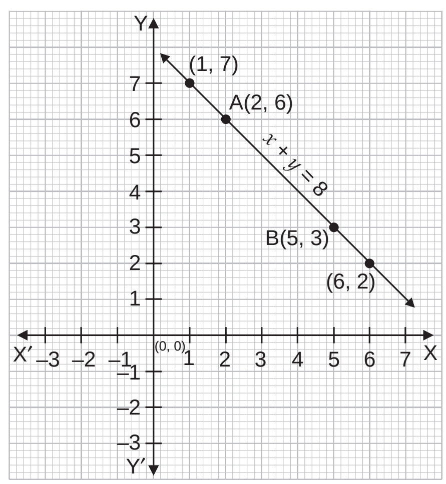
$\therefore \quad x = 2 \quad \Rightarrow \quad y = 8 - 2 = 6$

$x = 5 \quad \Rightarrow \quad y = 8 - 5 = 3$

Thus, we have the following table for

$x + y = 8$

x	2	5
y	6	3



Plot points A (2, 6) and B (5, 3) on a graph paper. Draw a line passing through the points A and B. Then, the line AB represents the equation $x + y = 8$.

(iii) $x = 2y - 3 \quad \Rightarrow \quad 2y = x + 3 \quad \Rightarrow \quad y = \dfrac{x+3}{2}$

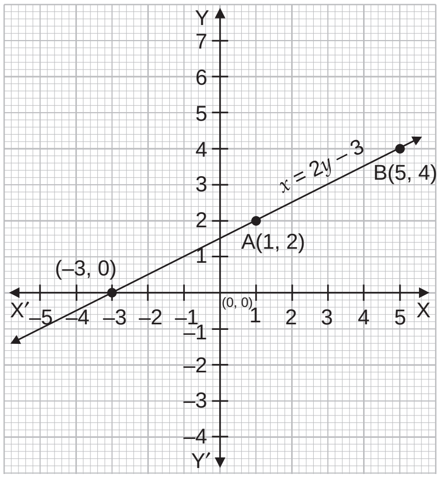
$\therefore \qquad x = 1 \quad \Rightarrow \quad y = \dfrac{1+3}{2} = \dfrac{4}{2} = 2$

$x = 5 \quad \Rightarrow \quad y = \dfrac{5+3}{2} = \dfrac{8}{2} = 4$

Thus, we have the following table for

$x = 2y - 3$

x	1	5
y	2	4



Plot points A (1, 2) and B (5, 4) on a graph paper. Draw a line passing through the points A and B. Then, the line AB represents the equation $x = 2y - 3$.

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

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

$\Rightarrow 3y = 6 - 2x$

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

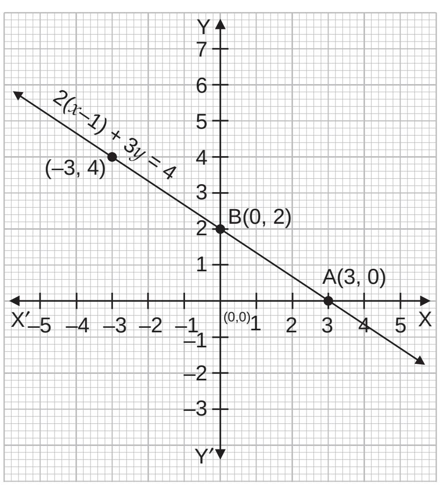
$\therefore \quad x = 3 \Rightarrow y = \dfrac{6 - 2(3)}{3} = \dfrac{6 - 6}{3} = 0$

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

Thus, we have the following table for

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

x	3	0
y	0	2



Plot points A (3, 0) and B (0, 2) on a graph paper. Draw a line passing through the points A and B. Then, the line AB represents the equation

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

(v) $y = -\dfrac{1}{3}x + 4$

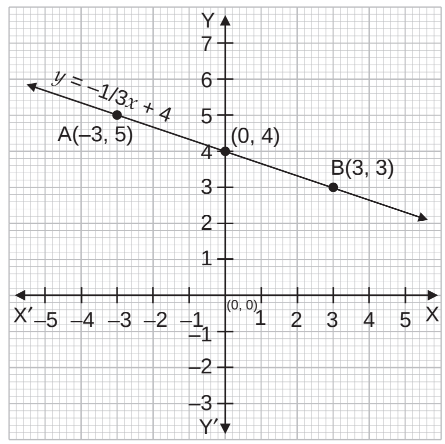
$\therefore \quad x = -3 \Rightarrow y = \dfrac{-(-3)}{3} + 4 = 5$

$\therefore \quad x = 3 \Rightarrow y = \dfrac{-(3)}{3} + 4 = 3$

Thus, we have the following table for

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

x	–3	3
y	5	3



Plot points A (–3, 5) and B (3, 3) on a graph paper. Draw a line passing through A and B. Then, the line AB represents the equation

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

(vi) $\dfrac{x - 5}{2} = y - 1 \Rightarrow x - 5 = 2y - 2 \Rightarrow 2y = x - 3$

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

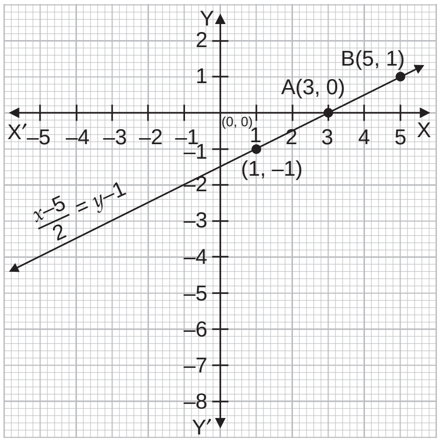
$\therefore \quad x = 3 \Rightarrow y = \dfrac{3 - 3}{2} = \dfrac{0}{2} = 0$

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

Thus, we have the following table for

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

x	3	5
y	0	1



Plot points A (3, 0) and B (5, 1) on a graph paper.
Draw a line passing through A and B.
Then, the line AB represents the equation

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

3. $y = 4x$

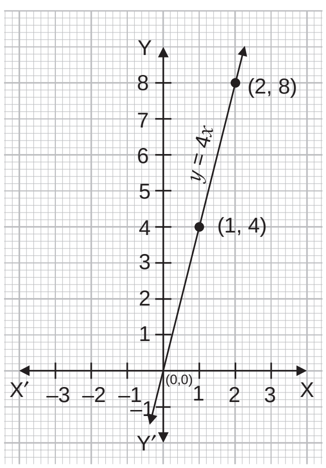
$\therefore \quad x = 0 \Rightarrow y = 4 \times 0 = 0$

$\quad x = 1 \Rightarrow y = 4 \times 1 = 4$

$\quad x = 2 \Rightarrow y = 4 \times 2 = 8$

Hence, the completed table is

x	0	1	2
y	0	4	8



4. $y = 3x + 1$

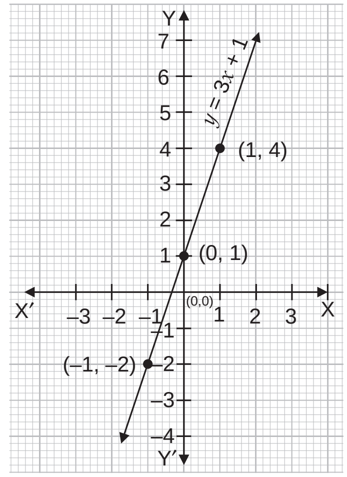
$\therefore \quad x = -1 \Rightarrow y = 3(-1) + 1 = -3 + 1 = -2$

$\therefore \quad x = 0 \Rightarrow y = 3(0) + 1 = 1$

$\quad x = 1 \Rightarrow y = 3(1) + 1 = 4$

Hence, the completed table is

x	–1	0	1
y	–2	1	4



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

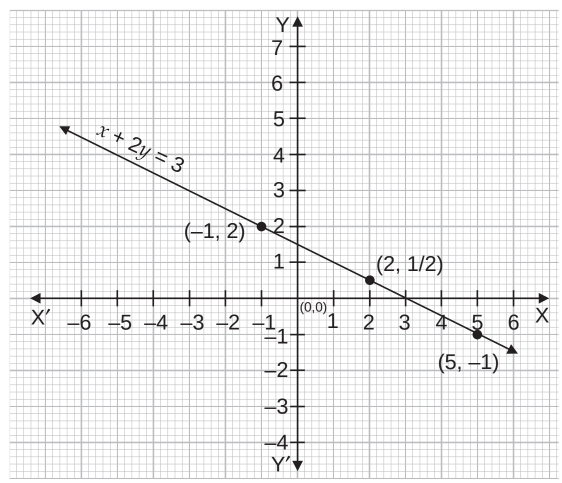
$\therefore \quad x = -1 \Rightarrow y = \dfrac{3-(-1)}{2} = \dfrac{3+1}{2} = 2$

$\quad x = 2 \Rightarrow y = \dfrac{3-2}{2} = \dfrac{1}{2}$

$\quad x = 5 \Rightarrow y = \dfrac{3-5}{2} = \dfrac{-2}{2} = -1$

Hence, the completed table is

x	–1	2	5
y	2	1/2	–1



6. **(i)** $x = 2y \Rightarrow y = \dfrac{x}{2}$

When $x = -1 \Rightarrow y = -\dfrac{1}{2}$ (rejected)

(ii) $2x - y = 0 \Rightarrow y = 2x$

When $x = -1, \Rightarrow y = 2 \times (-1) = -2$ (rejected)

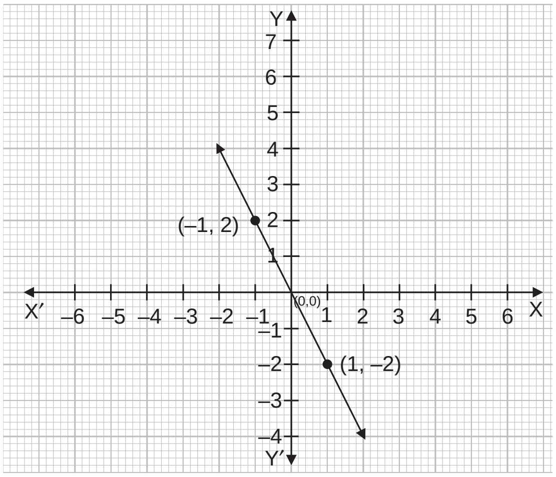
(iii) $y = 2x + 1$

When $x = -1 \Rightarrow y = 2(-1) + 1 = -1$ (rejected)

(iv) $2x + y = 0 \Rightarrow y = -2x$

When $x = -1, \Rightarrow y = -2 \times (-1) = 2$

which is true for the given graph line.



Hence, the equation for the given graph line is

$$2x + y = 0.$$

7. When $x = 1$, $y = 2$ is satisfied by

$$x + 2y = 5; \qquad 7x - 2y = 3; \qquad \ldots$$

Infinite solutions are possible.

8. $2x + 3y = 5 \Rightarrow 3y = 5 - 2x \Rightarrow y = \dfrac{5-2x}{3}$

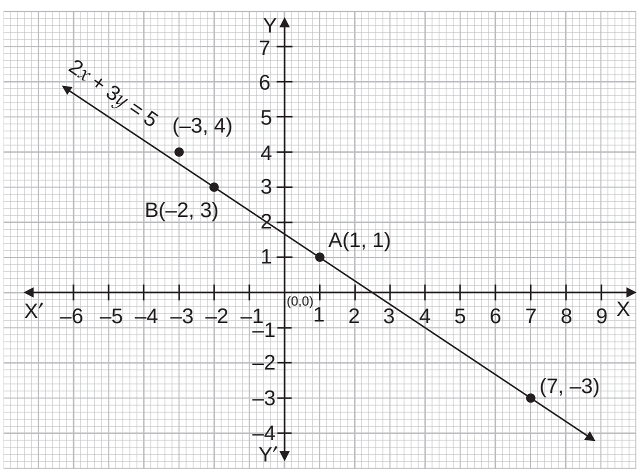
$\therefore \quad x = 1 \Rightarrow y = \dfrac{5-2(1)}{3} = \dfrac{3}{3} = 1$

$x = -2 \Rightarrow y = \dfrac{5-(2)(-2)}{3} = \dfrac{5+4}{3} = \dfrac{9}{3} = 3.$

Thus, we have the following table for

$2x + 3y = 5$

x	1	–2
y	1	3



Plot the points A (1, 1) and B (–2, 3).

Draw a line passing through A and B.

Then, the line AB represents the equation $2x + 3y = 5$.

$x = -3$, $y = 4$, i.e., (–3, 4) does not lie on the graph line. So, it is **not a solution but $x = 7$, $y = -3$, i.e., (7, –3)** lies on the graph line. So, it **is a solution** of the given equation.

9. $2x - 3y - 5 = 0$

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

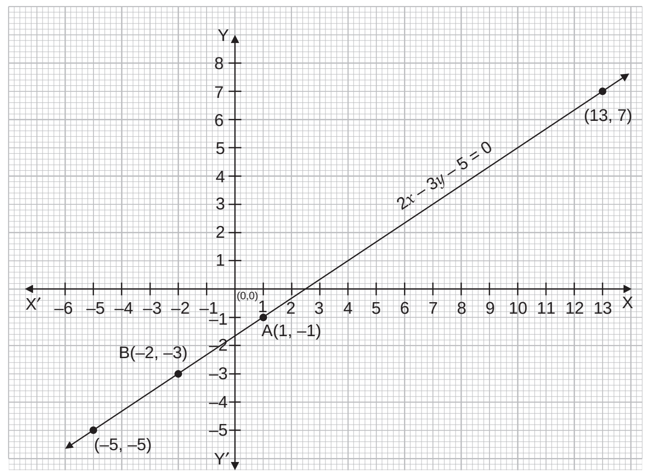
$\therefore \quad x = 1 \Rightarrow y = \dfrac{2(1)-5}{3} = \dfrac{-3}{3} = -1$

$x = -2 \Rightarrow y = \dfrac{2(-2)-5}{3} = \dfrac{-4-5}{3} = \dfrac{-9}{3} = -3$

Thus, we have the following table for

$2x - 3y - 5 = 0.$

x	1	–2
y	–1	–3



Plot the points A (1, –1) and B (–2, –3).

Draw a line passing through A and B.

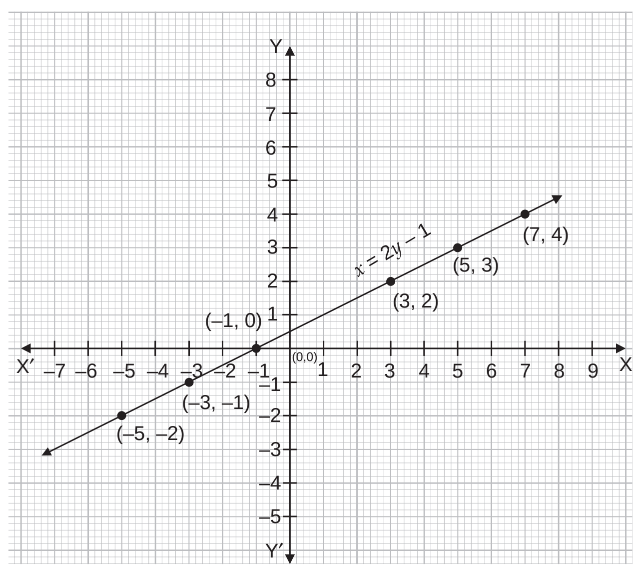
Then, the line AB represents the equation $2x - 3y - 5 = 0$.

From the graph, we observe that

(i) When $x = 13$, $y = 7$, shown by the point **(13, 7)** on the graph line.

(ii) When $x = -5$, $y = -5$ shown by the point **(–5, –5)** on the graph line.

10.



x	a	3	–5	5	c	–1
y	–1	2	b	3	4	0

From the graph, we get

(i) The abscissa corresponding to ordinate –1 is –3.

$\therefore$ $\quad$ $\boldsymbol{a = -3}$

The ordinate corresponding to abscissa –5 is –2.

$\therefore$ $\quad$ $\boldsymbol{b = -2}$

The abscissa corresponding to ordinate 4 is 7.

$\therefore$

The relationship between the variables x and y is given by the equation

$$\boldsymbol{x = 2y - 1.}$$

11. Since (2, –2) lies on the graph of linear equation

$$5x + ay = 4,$$

$\therefore$ $x = 2$ and $y = -2$ is a solution of $5x + ay = 4$.

$\Rightarrow$ $\quad 5(2) + a(-2) = 4$

$\Rightarrow$ $\quad 10 - 2a = 4$

$\Rightarrow$ $\quad 2a = 6$

$\Rightarrow$ $\quad \boldsymbol{a = 3.}$

12. Since the points (3, 5) and (1, 4) line on the graph

$$ax + by + 7 = 0$$

$\therefore$ $x = 3, y = 5$ and $x = 1, y = 4$ are solutions of

$$ax + by + 7 = 0.$$

Putting $x = 3, y = 5$ in $ax + by + 7 = 0$, we get

$$a(3) + b(5) + 7 = 0$$

$$3a + 5b + 7 = 0 \qquad \ldots(1)$$

Putting $x = 1, y = 4$ in $ax + by + 7 = 0$, we get

$$a(1) + b(4) + 7 = 0$$

$$a + 4b + 7 = 0 \qquad \ldots(2)$$

Multiplying equation (2) by 3, we lie get

$$3a + 12b + 21 = 0 \qquad \ldots(3)$$

Subtracting equation (1) from equation (3), we get

$$7b + 14 = 0$$

$\Rightarrow$ $\quad 7b = -14$

$\Rightarrow$ $\quad b = -2.$

Substituting $b = -2$ in equation (2), we get

$$a + 4(-2) + 7 = 0$$

$\Rightarrow$ $\quad a - 1 = 0$

$\Rightarrow$ $\quad a = 1$

Hence, $\boldsymbol{a = 1, b = -2.}$

13. The graph line passes through (–1, 4) and (2, 1) and these points are solutions of equation $x + y = 3$

The graph line also passes through $(p, 3)$ and $(1, q)$.

$\therefore$ $(p, 3)$ and $(1, q)$ are also solutions of $x + y = 3$.

Putting $x = p$ and $y = 3$ in $x + y = 3$, we get

$$p + 3 = 3$$

$\Rightarrow$ $\quad p = 0$

Putting $x = 1$ and $y = q$ in $x + y = 0$, we get

$$1 + q = 3$$

$\Rightarrow$ $\quad q = 2$

Hence, $\boldsymbol{p = 0, q = 2.}$

14. $\dfrac{x}{2} + \dfrac{y}{3} = 1$

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

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

$\therefore$ $\quad x = 2 \Rightarrow y = \dfrac{6 - 3(2)}{2} = \dfrac{0}{2} = 0$

$\quad x = -2 \Rightarrow y = \dfrac{6 - 3(-2)}{2} = \dfrac{12}{2} = 6$

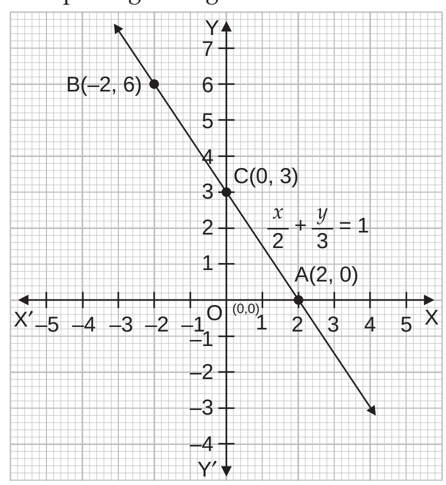
Thus, we have the following table for

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

x	2	–2
y	0	6

Plot points A (2, 0) and B (–2, 6) on a graph paper.

Draw a line passing through A and B.



Then, the line AB represents the equation $\dfrac{x}{2} + \dfrac{y}{3} = 1$.

Area of the triangle formed by the line drawn and the coordinate axis

$$= ar(\Delta COA) = \frac{1}{2} \times OA \times OC$$

$$= \frac{1}{2} \times 2 \times 3 \text{ sq. units } = \textbf{3 sq.units.}$$

15. $\quad x + y = 6$

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

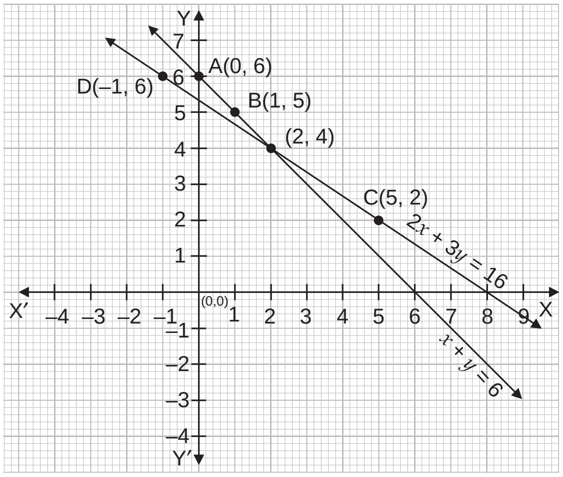
$\therefore$ $\quad x = 0 \Rightarrow y = 6 - 0 = 6$

$\quad x = 1 \Rightarrow y = 6 - 1 = 5$

Thus, we have the following table for $x + y = 6$.

x	0	1
y	6	5

Plot points A (0, 6) and B (1, 5) on a graph paper.



Draw a line passing through A and B.

Then, the line AB represents $x + y = 6$.

$$2x + 3y = 16$$

$$\Rightarrow \quad 3y = 16 - 2x \quad \Rightarrow \quad y = \frac{16 - 2x}{3}$$

$$\therefore \quad x = 5 \quad \Rightarrow \quad y = \frac{16 - 2(5)}{3} = \frac{6}{3} = 2$$

$$x = -1 \quad \Rightarrow \quad y = \frac{6 - 2(-1)}{3} = \frac{18}{3} = 6.$$

Thus, we have the following table for $2x + 3y = 16$.

x	5	–1
y	2	6

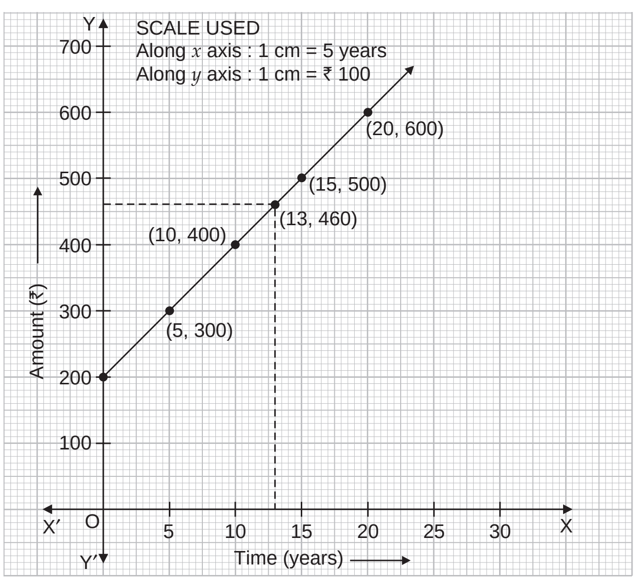
Plot points C (5, 2) and D (–1, 6) on a graph paper.

Draw a line passing through C and D.

Then, the line CD represents the equation $2x + 3y = 16$.

From the graph, we observe that the two graph lines intersect at **(2, 4).**

16.



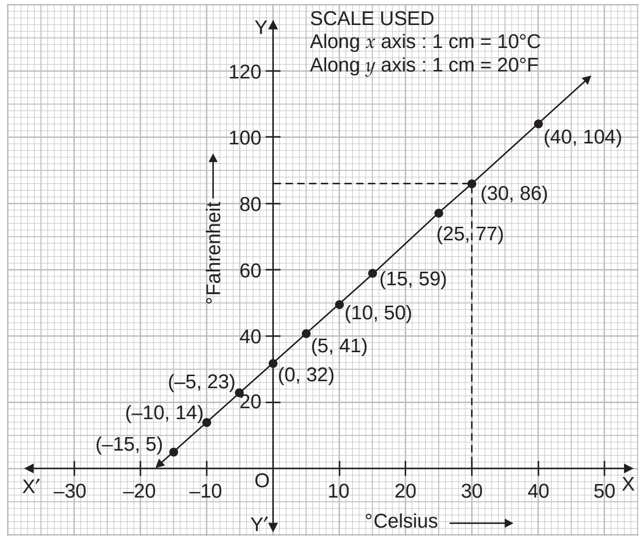
(i) The ordinate corresponding to abscissa 0 is 200.

∴ **The sum of money invested is ₹ 200.**

(ii) The ordinate corresponding to abscissa 13 is 460.

∴ **The amount at the end of 13 years is ₹ 460.**

17.



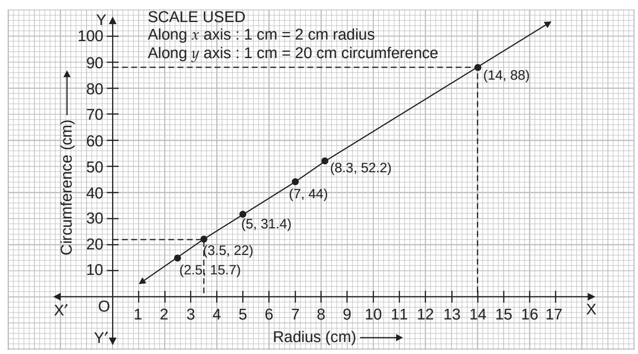
The ordinate corresponding to abscissa –15 is 5.

∴ **The temperature corresponding to –15°C is 5°F.**

Also, the ordinate corresponding to abscissa 30 is 86.

∴ **The temperature corresponding to 30°C is 86°F.**

18.



The abscissa corresponding to the ordinate 22 is 3.5.

∴ **The radius corresponding to the circumference 22 cm is 3.5 cm.**

Also, the ordinate corresponding to the abscissa 14 is 88.

∴ **The circumference of a circle whose radius is 14 cm is 88 cm.**

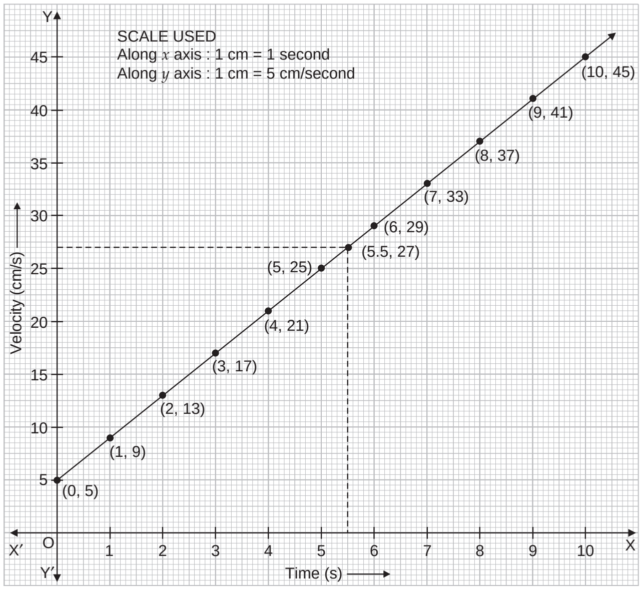
19.

The ordinate corresponding to abscissa 0 is 5.

∴ **The initial velocity is 5 cm/s.**

The abscissa corresponding to ordinate 27 is 5.5.

∴ **5.5 seconds have elapsed when the velocity is 27 cm/s.**



20. $v = 9.8t$

$\therefore \quad t = 1 \Rightarrow v = 9.8 \times 1 = 9.8$

$t = 2 \Rightarrow v = 9.8 \times 2 = 19.6$

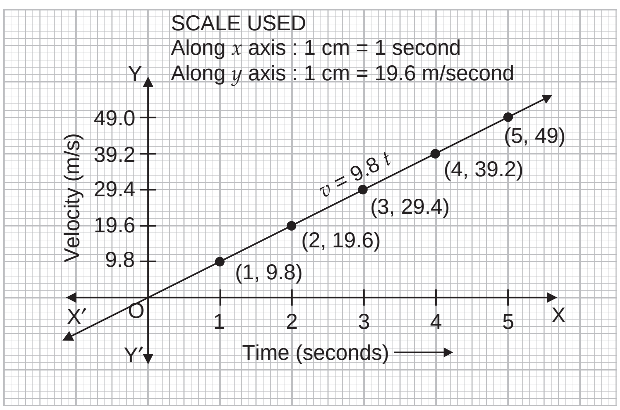
$t = 3 \Rightarrow v = 9.8 \times 3 = 29.4$

$t = 4 \Rightarrow v = 9.8 \times 4 = 39.2$

$t = 5 \Rightarrow v = 9.8 \times 5 = 49$

Then, we have the following table for $v = 9.8t$.

t	1	2	3	4	5
v	9.8	19.6	29.4	39.2	49



Plot the points (1, 9.8), (2, 19.6), (3, 29.4), (4, 39.2), (5, 49). on a graph paper and draw a line passing through them to obtain the required graph.

The ordinate corresponding to abscissa 4 is 39.2.

Hence, the velocity of the stone after 4 seconds is **39.2 m/s.**

21. $y = 2x - 1$

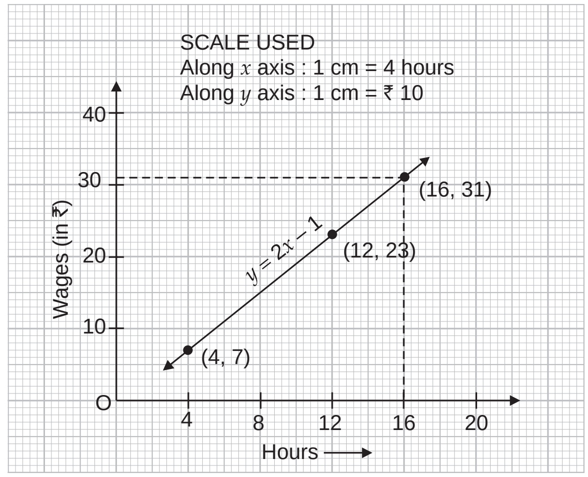
$\therefore \quad x = 4 \Rightarrow y = 2 \times 4 - 1 = 7$

$x = 12 \Rightarrow y = 2 \times 12 - 1 = 23$

Thus, we have the following table for $y = 2x - 1$.

x	4	12
y	7	23

Plot the points (4, 7) and (12, 23) on a graph paper and draw a line passing through them to obtain the graph of the given work wage equation.



The ordinate corresponding to abscissa 16 is 31.

Hence, his wages for 16 hours is ₹ **31.**

22. x represents the number of litres of petrol
y represents the total cost of petrol (in ₹)

Cost of petrol is ₹ 50 per litre.

$\Rightarrow$ Cost of 1 litre of petrol is ₹ 50.

$\therefore$ Cost of x litres of petrol is ₹ $50x$.

Total cost = ₹ $50x$

$\Rightarrow \quad y$ (in ₹) = ₹ $50x$

$\Rightarrow \quad \mathbf{y = 50x.}$

23. Let the total number of students of a class be x and let the number of boys in the class be y.

The ratio of girls and boys is 1 : 3.

The ratio of boys to total number of students is

3 : (3 + 1) or 3 : 4.

$\Rightarrow \quad y : x = 3 : 4.$

$$\Rightarrow \quad \frac{y}{x} = \frac{3}{4}$$

$$\Rightarrow \quad y = \frac{3}{4}x$$

Hence, the required equation is $y = \frac{3}{4}x$, where y is the number of boys and x is the total number of students.

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

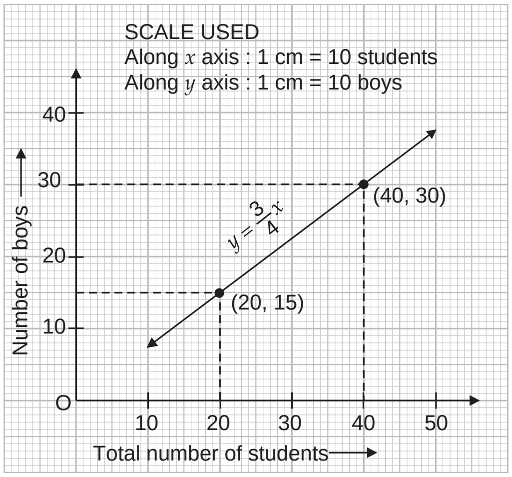
$$\therefore \quad x = 20 \Rightarrow y = \frac{3}{4} \times 20 = 15$$

$$x = 40 \Rightarrow y = \frac{3}{4} \times 40 = 30$$

Thus, we have the following table for $y = \frac{3}{4}x$

x	20	40
y	15	30

Plot the points (20, 15) and (40, 30) and draw a line passing through these points to obtain to obtain the required graph.



The ordinate corresponding to abscissa 40 is 30.

Thus, out of 40 students, the number of boys is 30.

24. Let the cost of x kg of onions be ₹ y. …(1)

It is given that the cost of $\frac{1}{2}$ kg of onions is ₹ 4.50 $= ₹\ \frac{9}{2}$.

$\therefore$ the cost of x kg wt of onions

$$= ₹\ \frac{9}{2} \times 2 \times x \ = ₹\ 9x \qquad \text{…(2)}$$

From (1) and (2), we get

$$y = 9x$$

$\therefore$ $x = \frac{1}{2} \Rightarrow y = 9 \times \frac{1}{2} = \frac{9}{2} = 4.5$

$x = 2 \Rightarrow y = 9 \times 2 = 18$

$x = 3 \Rightarrow y = 9 \times 3 = 27$

$x = 4 \Rightarrow y = 9 \times 4 = 36$

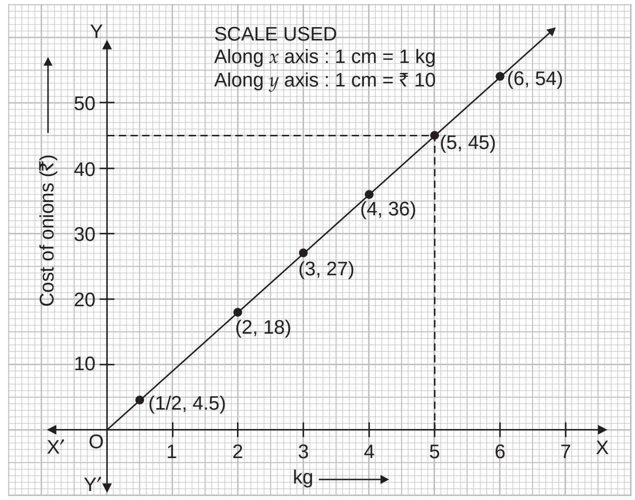
$x = 5 \Rightarrow y = 9 \times 5 = 45$

$x = 6 \Rightarrow y = 9 \times 6 = 54$

Thus, we have the following table for $y = 9x$

x	$\frac{1}{2}$	2	3	4	5	6
y	4.5	18	27	36	45	54

Plot the points ($\frac{1}{2}$, 4.5), (2, 18), (3, 27), (4, 36), (5, 45), (6, 54) and draw a line passing through these points to obtain the required graph which gives the price of any number of kilograms of onions.



The ordinate corresponding to abscissa 5 is 45.

$\therefore$ Cost of 5 kg of onions is **₹ 45.**

25. Let the cost of x eggs be ₹ y. …(1)

It is given that 6 eggs cost ₹ 18.

$\therefore$ Cost of x eggs $= ₹\ \frac{18}{6} \times x \ = ₹\ 3x$ …(2)

From (1) and (2), we get

$y = 3x$ where y is the cost of x eggs.

$\therefore$ $x = 1 \Rightarrow y = 3 \times 1 = 3$

$x = 4 \Rightarrow y = 3 \times 4 = 12$

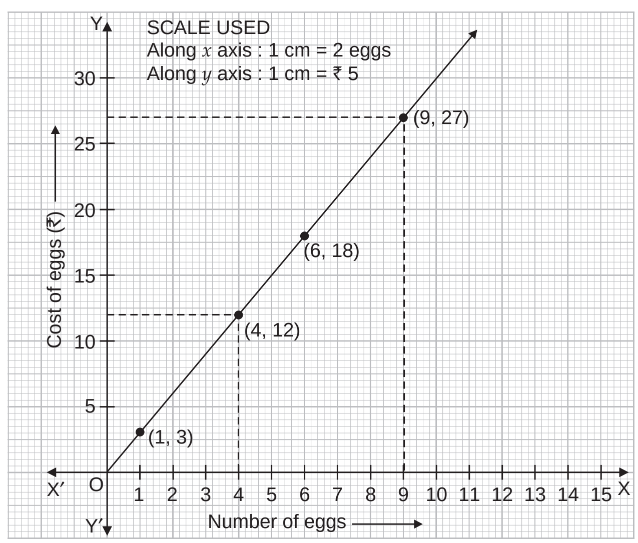
$x = 6 \Rightarrow y = 3 \times 6 = 18$

$x = 9 \Rightarrow y = 3 \times 9 = 27.$

Thus, we have the following table for $y = 3x$

x	1	4	6	9
y	3	12	18	27

Plot the points (1, 3), (4, 12), (6, 18) and (9, 27) and draw a line passing through these points to obtain the required graph which gives the price of any number of eggs.



The abscissa corresponding to ordinate 27 is 9.

$\therefore$ **9 eggs** can be bought for ₹ 27.

Also, the ordinate corresponding to abscissa 4 is 12.

$\therefore$ Cost of 4 eggs is **₹ 12.**

26. Suppose x cups of flour is used to make a cake and the corresponding number of eggs needed is y. ...(1)

It is given that 6 eggs and 2 cups of flour were used to make a cake.

i.e., if 2 cups of flour is used to make a cake, then the number of eggs needed = 6.

$\therefore$ If x cups of flour is used to make a cake then the number of eggs needed

$$= \frac{6}{2} \times x = 3x \qquad ...(2)$$

From (1) and (2), we get

$y = 3x$ where x is the number of cups of flour used and y is the corresponding number of eggs needed.

$\therefore$ $x = 1 \Rightarrow y = 3 \times 1 = 3.$

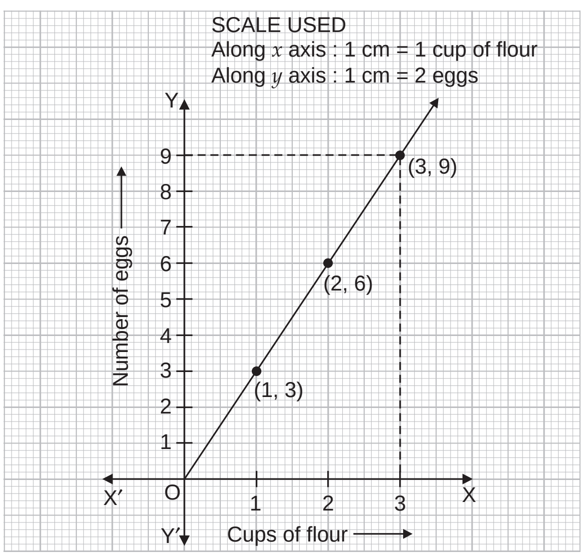
$x = 2 \Rightarrow y = 3 \times 2 = 6.$

$x = 3 \Rightarrow y = 3 \times 3 = 9.$

Thus, we have the following table for $y = 3x$

x	1	2	3
y	3	6	9

Plot the points (1, 3), (2, 6) and (3, 9) and draw a line passing through these points to obtain the required graph which gives the relationship between the cups of flour used and the corresponding number of eggs needed to make a cake.



The ordinate corresponding to abscissa 3 is 9.

$\therefore$ **9 eggs** are needed to bake the cake, when 3 cups of flour are used.

27. Let x be the total population and y be the female population.

$\therefore$ Ratio of female and total population is $y : x$ ...(1)

Ratio of female and male population is 5 : 7

$\Rightarrow$ Ratio of female and total population is 5 : (5 + 7)

i.e., 5 : 12 ...(2)

From (1) and (2), we get

$y : x = 5 : 12$

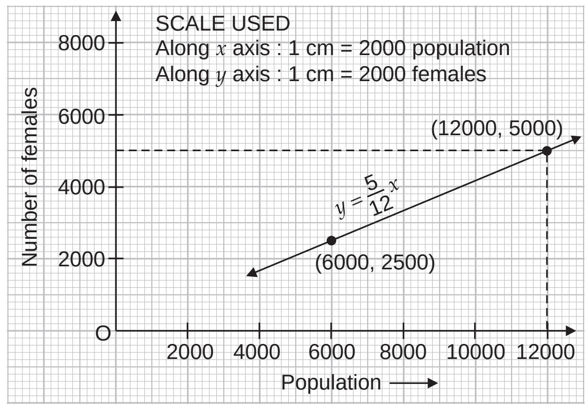
$\Rightarrow \quad \frac{y}{x} = \frac{5}{12}$

$\Rightarrow \quad y = \frac{5}{12}x$, where x is the population and y is the number of females.

$\therefore \quad x = 6000 \Rightarrow y = \frac{5}{12} \times 6000 = 2500$

$x = 12000 \Rightarrow y = \frac{5}{12} \times 12000 = 5000$

Plot the points (6000, 2500) and (1200, 5000) to obtain the required graph which gives a relationship between the population and the number of females.



The ordinate corresponding to abscissa 12000 is 5000.

$\therefore$ No. of female = **5000.**

28. Let x be the volume of mixture is litres and y be the volume of milk in it.

$\therefore$ Ratio of volume of milk and mixture is $y : x$. ...(1)

Ratio of milk and water is 5 : 2.

$\therefore$ Ratio of milk and mixture is 5 : (5 + 2)

= 5 : 7 ...(2)

From (1) and (2), we get

$y : x = 5 : 7$

$\Rightarrow \quad \frac{y}{x} = \frac{5}{7}$

$\Rightarrow \quad y = \frac{5}{7}x$ where x is the volume of mixtures in litres and y is the volume of milk in litres in the mixture.

$\therefore \quad x = 7 \Rightarrow y = \frac{5}{7} \times 7 = 5$

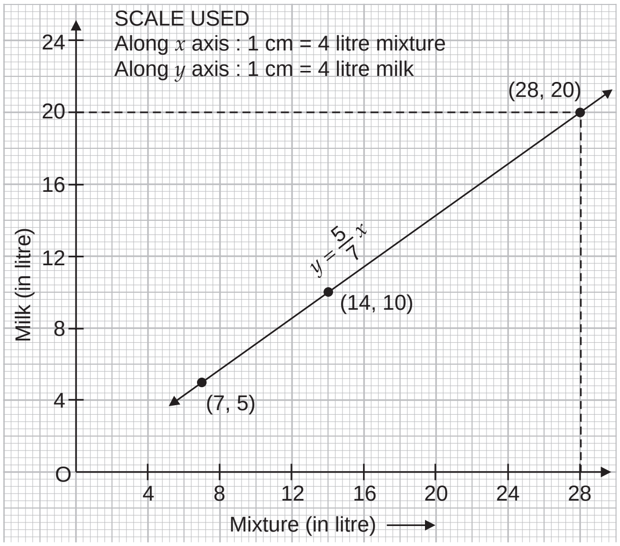
$x = 14 \Rightarrow y = \frac{5}{7} \times 14 = 10$

$x = 28 \Rightarrow y = \frac{5}{7} \times 28 = 20$

Thus, we have the following table for $y = \frac{5}{7}x$.

x	7	14	28
y	5	10	20

Plot the points (7, 5), (14, 10), (28, 20) on a graph paper and draw a line passing through these points to obtain the required graph which gives a relation between the volume of mixture and the volume of milk in it.



The ordinate corresponding to abscissa 28 is 20.

$\therefore$ Volume of milk in the mixture = **20 litres.**

29. Let the number of male employees be x and the number of female employees be y. ...(1)

It is given that 35% of employee are females.

If the number of female employees is 35, then the number of male employees 65.

If the number female employees is y, then the number of male employees

$$= \frac{65}{35}y = \frac{13}{7}y \qquad ...(2)$$

From (1) and (2), we get

$$\frac{13}{7}y = x$$

$\Rightarrow \quad y = \frac{7}{13}x$ where x is the number of males and y is the number of females.

$$\therefore \quad x = 13 \quad \Rightarrow \quad y = \frac{7}{13} \times 13 = 7$$

$$x = 26 \quad \Rightarrow \quad y = \frac{7}{13} \times 26 = 14$$

$$x = 39 \quad \Rightarrow \quad y = \frac{7}{13} \times 39 = 21$$

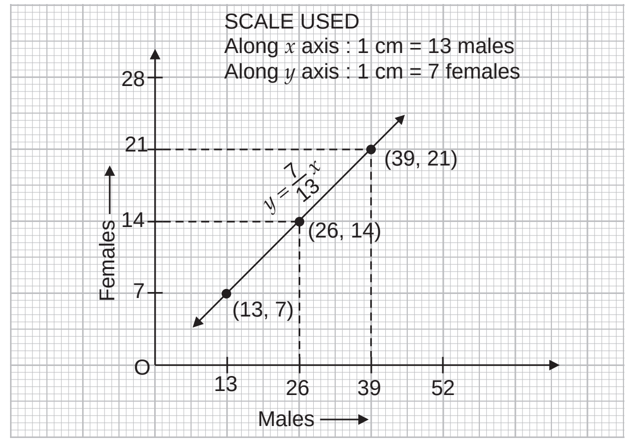
Plot points (13, 7), (28, 14), and (39, 21) on a graph paper and draw a line through these points to obtain the required graph which gives a relation between the number of male employees and the number of female employees.

(i) The ordinate corresponding to abscissa 26 is 14.

Hence, **the number of females are 14 when the number of males is 26.**

(ii) The abscissa corresponding to ordinate 21 is 39.

Hence, **there are 39 males when the number of females is 21.**



30. Let x be the total number of voters and y be the number of voters who cast their votes. ...(1)

It is given that 60% of voters cast their votes in an election.

If the total number of votes is 100, the number of voters who cast their votes = 60.

$\therefore$ If the total number of voters is x, the number of voters who cast their votes $\frac{60}{100} \times x = \frac{3}{5}x$ ...(2)

From (1) and (2), we get

$y = \frac{3}{5}x$, where x is the total number of voters and y is the number of voters who cast their votes.

$$\therefore \quad x = 3500 \quad \Rightarrow \quad y = \frac{3}{5} \times 3500 = 2100$$

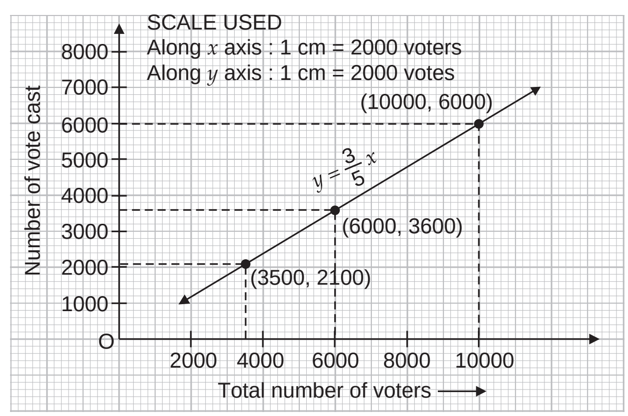
$$x = 6000 \quad \Rightarrow \quad y = \frac{3}{5} \times 6000 = 3600$$

and $$x = 10000 \quad \Rightarrow \quad y = \frac{3}{5} \times 10000 = 6000.$$

Thus, we have the following table for $y = \frac{3}{5}x$.

x	3500	6000	10000
y	2100	3600	6000

Plot the points (3500, 2100), (6000, 3600), (10000, 6000) and draw a line passing through these points to obtain the required graph which gives a relation between the total number of voters and the votes cast.



(i) The abscissa corresponding to ordinate 2100 is 3500.

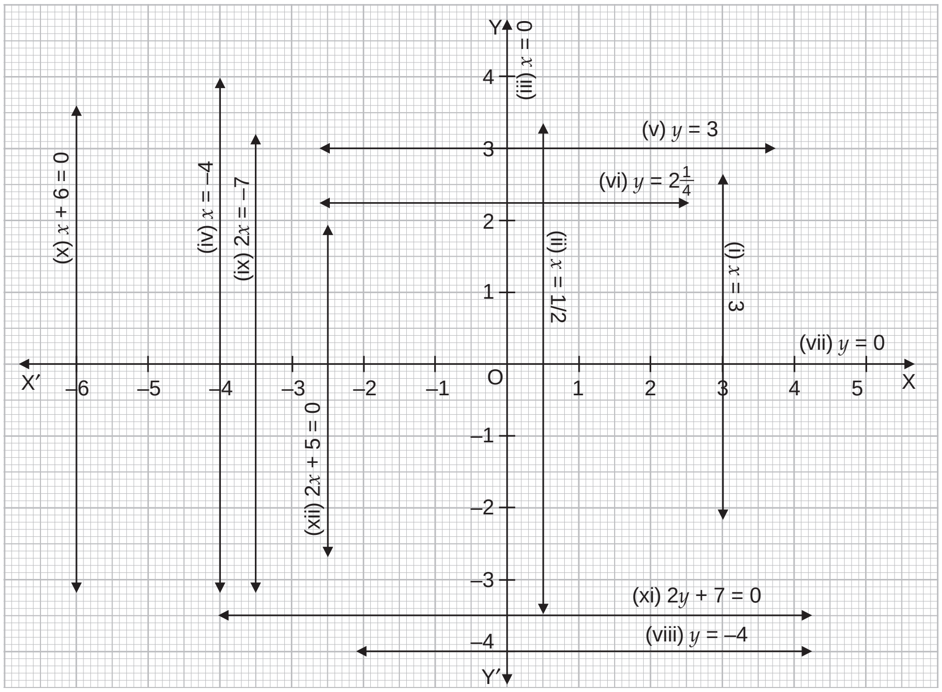
Hence, **the total number of voters are 3500 if 2100 voters cast their votes.**

(ii) The ordinate corresponding to 10000 is 6000.

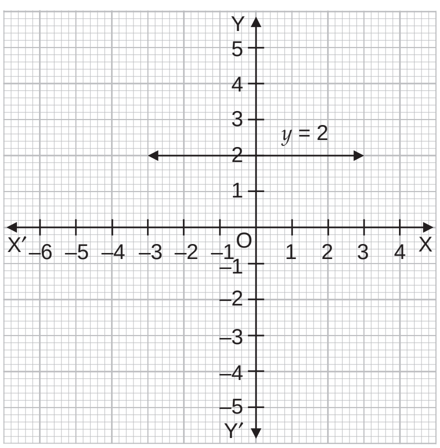
Hence, **the number of votes cast is 6000 when the total number of voters are 10000.**

EXERCISE 4D

1.



2. Line parallel to x-axis is at a constant distance from it lying either above or below the x-axis.



So, its y-intercept remains constant for all values of x.

(i) Here, the y-intercept remains constant at 2, i.e. for all values of x-coordinate the y-coordinate is always 2.

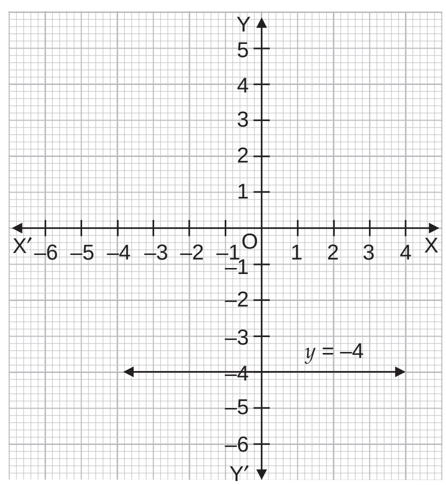
Since, the y intercept is positive 2.

$\therefore$ the line parallel to the x-axis lies at a distance of 2 units above it and required equation is

$$\boldsymbol{y = 2 \text{ or } y - 2 = 0}$$

(ii) Here, the y-intercept remains constant at -4, i.e. for all values of x-coordinates the y-coordinate is always -4.

Since, the y intercept is negative 4.

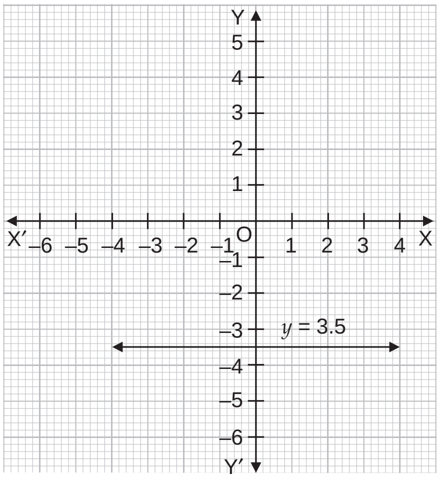


$\therefore$ the line parallel to the x-axis lies at a distance of 4 units below it and the required equation is

$$\boldsymbol{y = -4 \text{ or } y + 4 = 0}$$

(iii) Here, the y-intercept remains constant at -3.5, i.e. for all values of x-coordinate, the y-coordinate is always -3.5.

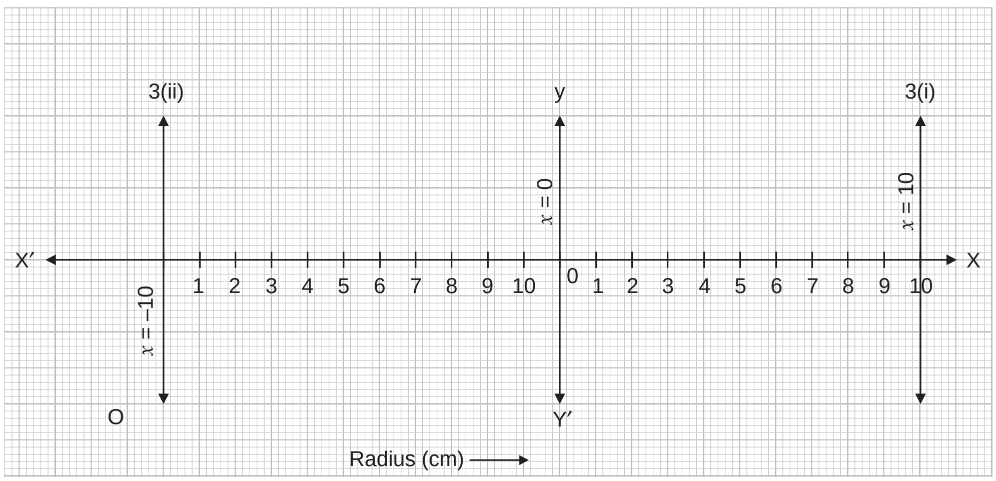
Since, the y-intercept is negative 3.5.



∴ the line parallel to the x-axis lies at a distance of 3.5 units below it ant the required equation is

$$y = -3.5 \text{ or } y + 3.5 = 0$$

3.



Line parallel to y-axis is at a constant distance from it, lying either to the left or to the right of the y-axis.

So, its x-intercept remains constant for all values of y.

(i) Here, the x-intercept remains constant at 10, i.e. for all values of y-coordinates, the x-coordinate is always 10.

Since the x-coordinate is positive 10,

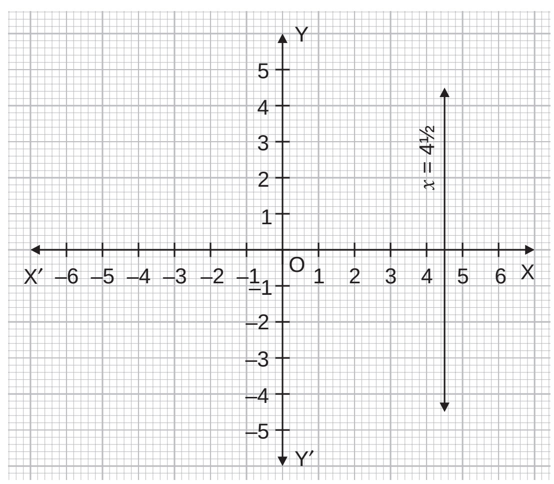
∴ the line parallel to the y-axis lies at a distance of 10 units to the right of it and the required equation is $\boldsymbol{x = 10}$ **or** $\boldsymbol{x - 10 = 0}$**.**

(ii) Here, the x-intercept remains constant at –10, i.e. for all values of y-coordinates, the x-coordinate is always –10.

Since the x-coordinate is negative 10,

∴ the line parallel to the y-axis lies at a distance of 10 units to the left of it and the required equation is $\boldsymbol{x = -10}$ **or** $\boldsymbol{x + 10 = 0}$**.**

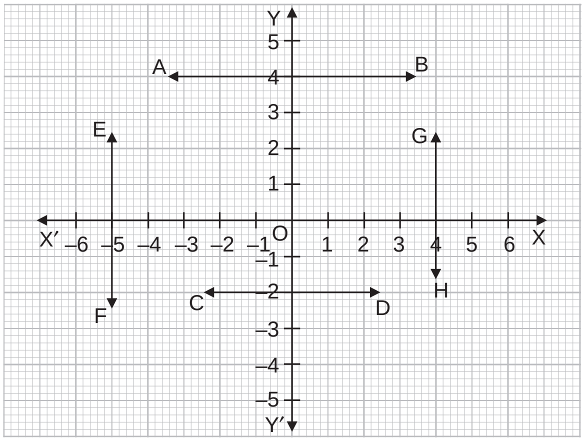
(iii) Here, the x-intercept remains constant at $4\frac{1}{2}$, i.e. for all values y-coordinates, the x-coordinate is always $4\frac{1}{2}$.



Since the x-coordinate is positive $4\frac{1}{2}$,

∴ the line parallel to the y-axis lies at a distance of $4\frac{1}{2}$ units to the right of it and the required equation is $\boldsymbol{x = \frac{9}{2}}$ **or** $\boldsymbol{2x - 9 = 0}$**.**

4. AB intersects the y-axis at (0, 4). So, the y-intercept of line AB is 4.



Since AB is parallel to the x-axis, therefore its y-intercept remains constant i.e., for all values of x-coordinate, the y-coordinate is always 4.

Hence, the required equation of the line AB is $\boldsymbol{y = 4}$.

CD intersects the y-axis at (0, –2), so the y-intercept of line CD is –2.

Since CD is parallel to the x-axis, therefore its y-intercept remains constant i.e., for all values of x-coordinate, the y-coordinate is always –2.

Hence, the required equation of line CD is $\boldsymbol{y = -2}$.

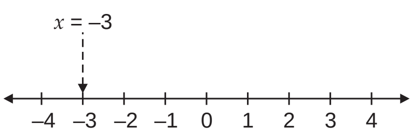
EF intersects the x-axis at (–5, 0), so the x-intercept of line EF is –5. Since EF is parallel to the y axis, therefore, its x-intercept remains constant i.e., for all values of y-coordinates the x-coordinate is always –5.

Hence, the required equation of the line EF is $\boldsymbol{x = -5}$.

GH intersects the x-axis at (4, 0), so the x-intercept of line GH is 4. Since GH is parallel to the y-axis, therefore, its x-intercept remains constant i.e., for all values of y-coordinate, the x-coordinate is always 4. Hence, the required equation of the line GH is $\boldsymbol{x = 4}$.

5. (i) Geometric representation of $x = -3$ as an equation in one variable.

The representation of the solution on the number line is shown in the figure given below, where $x = -3$ is treated as equation in one variable.



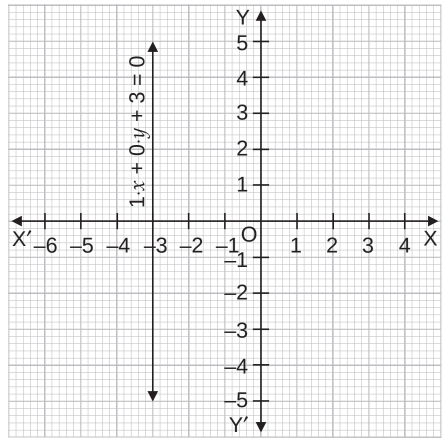
(ii) Geometric representation of $x = -3$ as an equation in two variables.

$$x = -3$$

$\Rightarrow \quad x + 3 = 0$

$\Rightarrow \quad 1{\cdot}x + 0{\cdot}y + 3 = 0,$ which is a linear equation in two variables.

We see that for all values of y, $x = -3$.



Thus, the graph line of the equation $1{\cdot}x + 0{\cdot}y + 3 = 0$ is a line parallel to the y-axis at a distance of 3 units to the left of it, (as shown in the graph).

6. (i) Geometric representation of $x + 5 = 5x - 7$ as an equation in one variable

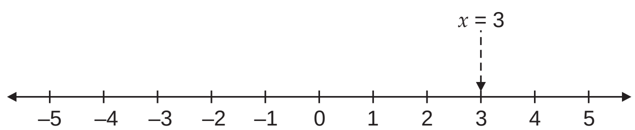
$$x + 5 = 5x - 7$$

$\Rightarrow \quad 5x - x = 5 + 7$

$\Rightarrow \quad 4x = 12$

$\Rightarrow \quad x = 3$

The representation of the solution on the number line is shown in the figure given below, where $x = 3$ is treated as equation in one variable.



(ii) Geometric representation of $x + 5 = 5x - 7$ as an equation in two variables.

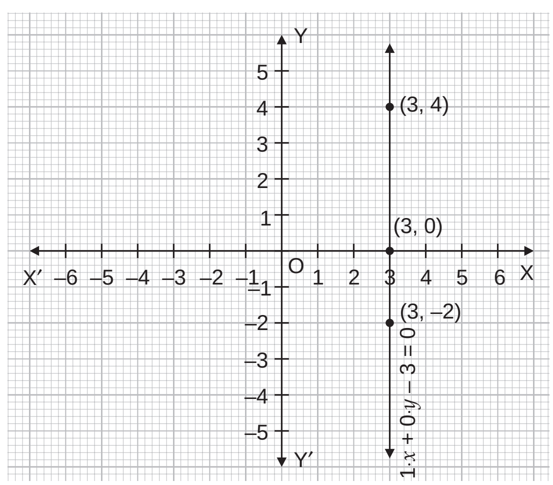
$$x + 5 = 5x - 7$$

$\Rightarrow \quad 5x - x = 5 + 7$

$\Rightarrow \quad 4x = 12$

$\Rightarrow \quad x = 3$

$\Rightarrow \quad x - 3 = 0,\ 1{\cdot}x + 0{\cdot}y - 3 = 0,$ which is a linear equation in two variables.



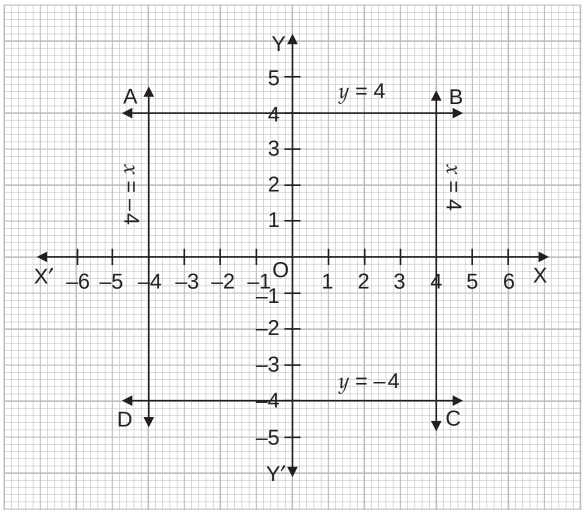
We see that for all values of y, $x = 3$.

Thus, the graph line of the equation $1 \cdot x + 0 \cdot y - 3 = 0$ is a line parallel to the y-axis at a distance of 3 units to the right of it (as shown in the graph).

7. $x = 4$ is a line parallel to the y-axis at a constant distance of 4 units to its right $x = -4$ is a line parallel to the axis y-axis at a constant distance 4 units to its left.

$y = 4$ is a line parallel to the x-axis at a constant distance of 4 units above it.

$y = -4$ is a line parallel to the x-axis at a constant distance of 4 units below it.



ABCD is the required square.

CHECK YOUR UNDERSTANDING

MULTIPLE-CHOICE QUESTIONS

1. (b) $\mathbf{2y - 3x = 6.}$

If x represents the abscissa and y represents the ordinate, then twice the ordinate is $2y$ and three times the abscissa is $3x$.

Given, twice the ordinate –6 = Three times the abscissa

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

$\Rightarrow \quad \mathbf{2y - 3x = 6}$

2. (d) $\mathbf{a \neq 0, b \neq 0.}$

Coefficient of the two variables x and y, i.e., coefficient of x and coefficient of y cannot be zero in a linear equation in two variables.

3. (a) **Infinitely many solutions.**

$y = mx, m \neq 0.$

By putting different values of x in the equation $y = mx$, the corresponding values of y can be found.

Since infinite number of values can be given to x and the corresponding values of y can be found out. So, the given linear equation $y = mx$ has infinitely many solutions.

4. (a) $\mathbf{x - \sqrt{3}y - 4 = 0}$

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

$\Rightarrow \quad x - 4 - \sqrt{3}y = 0$

$\Rightarrow \quad \mathbf{x - \sqrt{3}y - 4 = 0.}$

5. (c) $\mathbf{0 \cdot x + 1 \cdot y - 5 = 0}$

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

$\Rightarrow \quad y = 5$

$\Rightarrow \quad y - 5 = 0$

$\Rightarrow \quad \mathbf{0 \cdot x + 1 \cdot y - 5 = 0}$

6. (d) **5, –1**

$5x - y = 10$

$\Rightarrow \quad 5 \cdot x - y - 10 = 0$

$\Rightarrow \quad (5)(x) + (-1)(y) - 10 = 0$

Coefficient of x is 5 and coefficient of y is (–1).

Hence, coefficients of x and y respectively in $5x - y = 10$ are **5, –1.**

7. (b) $\mathbf{1 \cdot x + 0 \cdot y = 9.}$

$y = 9$

$\Rightarrow \quad y - 9 = 0$

$\Rightarrow \quad 0 \cdot x + 1 \cdot y - 9 = 0$

$\Rightarrow \quad \mathbf{0 \cdot x + 1 \cdot y = 9.}$

8. (a) **4**

Since (4, 19) is a solution of the equation $y = px + 3$,

$\therefore \quad x = 4, y = 19$, satisfy the given.

Putting $x = 4$ and $y = 19$ in $y = px + 3$, we get

$19 = p(4) + 3$

$\Rightarrow \quad p = \mathbf{4}$

9. (b) **Passes through the origin**

$6x - y = 0$

$\Rightarrow \quad 6x = y$

$\therefore \quad x = 0 \Rightarrow 6 \times 0 = y \Rightarrow y = 0.$

Hence, the graph of the equation $6x - y = 0$ passes through (0, 0) i.e., it **passes through the origin.**

10. (b) **4**

Since (2, 0) is a solution of the linear equation

$2x + 3y - k = 0$

$\therefore \quad x = 2, y = 0$, satisfy the given equation.

Putting $x = 2, y = 0$ in $2x + 3y - k = 0$, we get

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

$\Rightarrow \quad 4 - k = 0$

$\Rightarrow \quad k = \mathbf{4.}$

11. (a) $\mathbf{(a, a)}$

Given equation is $y = x$.

Putting $x = a$ in the given equation, we get

$y = a$

So, when $x = a, y = a$.

Thus, any point on the line $y = x$ is of the form (a, a).

12. (b) $\left(\frac{-7}{3}, m\right)$

$$3 \cdot x + 0 \cdot y + 7 = 0$$
$$\Rightarrow \quad 3x + 7 = 0$$
$$\Rightarrow \quad x = \frac{-7}{3}$$

So, any solution of the linear equation

$3x + 0 \cdot y + 7 = 0$ in two variables is of the form $\left(\frac{-7}{3}, m\right)$ where m is a real number.

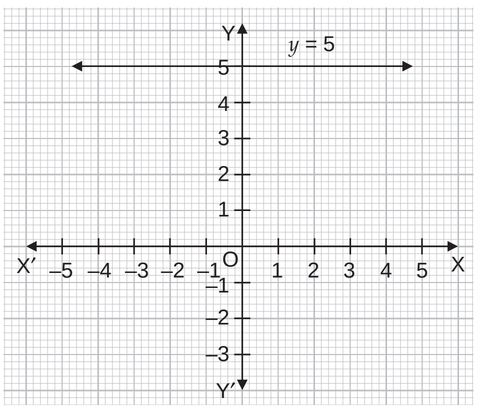
13. (c) **$y = 0$.**

On the x-axis the ordinate of all the points is always zero i.e., for all values of x-coordinates the corresponding y-coordinate is zero. Hence, the equation of two x-axis is $\mathbf{y = 0}$.

14. (b) **It is parallel to x-axis.**

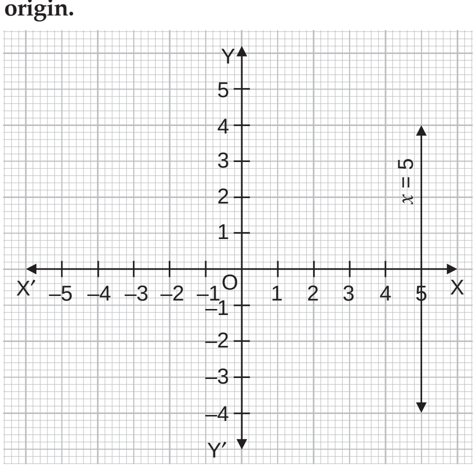
$$y = 5$$

The y-intercept is always equal to 5. i.e., for all values of x-coordinate the corresponding value of y-coordinate is 5.



So, the graph of $y = 5$ is a line **parallel to x-axis** at a distance of 5 units above it.

15. (b) **Parallel to y-axis at a distance of 5 units from the origin.**



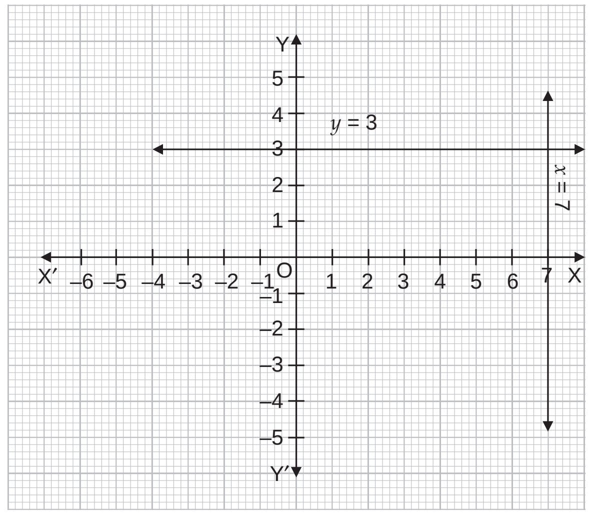
$$x = 5$$

The x-intercept is always equal to 5, i.e., for all values of y-coordinates, the corresponding value of x-coordinate is 5.

So, the graph of $x = 5$ is a line **parallel to y axis at a distance of 5 units from the origin.**

16. (c) **90°**

$y = 3$ is a line parallel to the x-axis lying at a distance of 3 units above it and $x = 7$ is a line parallel to the y-axis lying at a distance of 7 units to its right.



Since, the x-axis and y-axis are mutually perpendicular,

$\therefore$ angle between graph lines of the equations

$x = 7$, $y = 3$ is **90°**.

17. (b) **$x + y = 0$**

$$0 + 0 = 0$$
$$(-3) + 3 = 0$$
$$3 + (-3) = 0.$$

Hence, the linear equation having solutions (0, 0), (–3, 3), (3, –3) is $\mathbf{x + y = 0}$.

18. (c) **3rd quadrant.**

In the 3rd quadrant $x < 0$ and $y < 0$.

Hence, negative solutions of $ax + by + c = 0$ always lie in the **3rd quadrant.**

19. (c) **Line $y = x$.**

Point (a, a) has its y-coordinate = x-coordinate

$\therefore$ it will lie on the line $\mathbf{y = x}$.

20. (d) **$x = 3$, $y = 2$.**

$$x + 2y = 7.$$

Putting $x = 3$ in the given equation, we get

$$3 + 2y = 7$$
$$\Rightarrow \quad 2y = 4$$
$$\Rightarrow \quad y = 2$$

Hence, $\mathbf{x = 3, y = 2}$ is a solution of the given equation.

21. (b) **Remains the same**

Multiplying or dividing both sides of a linear equation with a non-zero number does not affect its solution as the impact of the arithmetic operation performed on both sides is the same and cancels out eventually.

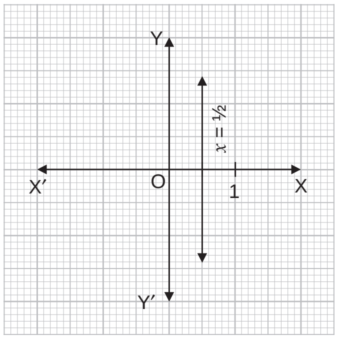
22. (d) **Infinitely many**

Some of the linear equations which can be satisfied by $x = 3$ and $y = 1$ are $x + y = 4$, $2x - y = 5$, $x + 3y = 6$.

Infinitely many equation can be formed which can be satisfied by $x = 3$ and $y = 1$.

23. (d) ***y*-axis at a distance of $\frac{1}{2}$ unit.**

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



For all values of the y-coordinates, the x-coordinate is always $\frac{1}{2}$. So, the graph of the equation $2x = 1$ is a line parallel to the y-axis at a distance of $\frac{1}{2}$ unit (to its right).

24. (b) **(0, –2)**

Since the x-coordinate of all the points on the y-axis is always 0, so the y-coordinate of the point where the graph of the linear equation $3x - y = 2$ cuts the y-axis is obtained by putting $x = 0$ in the equation $3x - y = z$.

Putting $x = 0$ in $3x - y = 2$, we get

$$3 \times 0 - y = 2.$$

$$\Rightarrow \quad y = -2$$

So, the point where the graph of linear equation $3x - y = 2$ cuts the y-axis is **(0, –2)**.

25. (a) **(3, 0)**

Since the y-coordinate of all the points on the x-axis is always 0, so the x-coordinate of the point where the graph of $x - 2y = 3$ meets the x-axis is obtained by putting $y = 0$ in the equation $x - 2y = 3$.

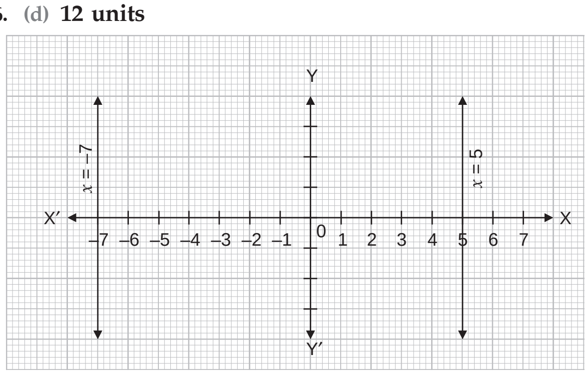
Putting $y = 0$ in $x - 2y = 3$, we get

$$x - 2 \times 0 = 3$$

$$\Rightarrow \quad x = 3$$

So, the point where the graph of the linear equation $x - 2y = 3$ meets the y-axis is **(3, 0)**.

26. (d) **12 units**



Graph line of the equation $x = 5$ is a line parallel to the y-axis, at a distance of 5 units to the right of it.

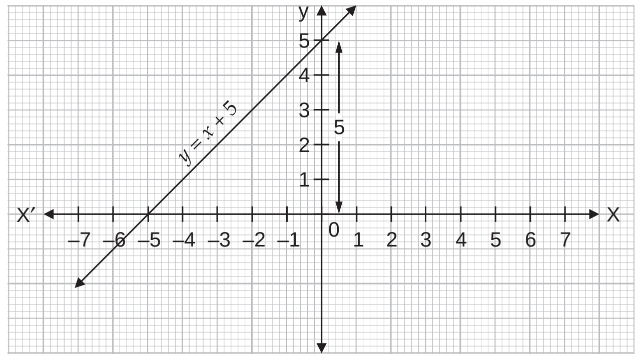
Graph line of the equation $x = -7$ is a line parallel to the y-axis, at a distance of 7 units to the left of it.

So, total distance between the two given graph lines is $(5 + 7) =$ **12 units**.

27. (b) **5**

The y-intercept of a line is the y-coordinate of the point at which the line intersects the y-axis.

The x-coordinates of all the points on the y-axis is O.



$\therefore$ Putting $x = 0$ in $y = x + 5$, we get

$$y = 0 + 5 = 5.$$

So, the coordinates of the point at which the graph line of $y = x + 5$ intersects the y-axis are (0, 5).

Clearly, the y-intercept is **5**.

28. (b) $\frac{\mathbf{8 - 2x}}{\mathbf{x}}$, $x \neq 0$

The given equation $2x + cy = 8$ will have equal values of x and y, where $y = x$.

Putting $y = x$ in $2x + cy = 8$, we get

$$2x + cx = 8.$$

$$\Rightarrow \quad cx = 8 - 2x$$

$$\Rightarrow \quad c = \frac{\mathbf{8 - 2x}}{\mathbf{x}}, \mathbf{x \neq 0}$$ as division by 0 is not possible.

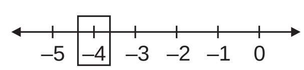
29. (d) **One, infinitely many solutions.**

$$2x + 1 = x - 3$$

$$\Rightarrow \quad 2x - x = -3 - 1$$

$$\Rightarrow \quad x = -4 \quad \text{(linear equation in one variable)}$$

$x = -4$ will have **one** solution on the number line.



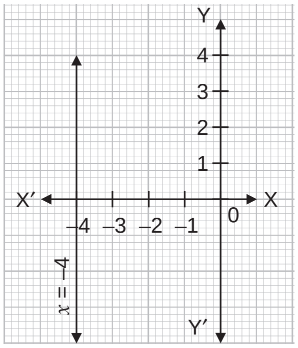
Again, $2x + 1 = x - 3$

$$\Rightarrow 2x - x + 1 + 3 = 0$$

$$\Rightarrow \quad x + 4 = 0$$

$$\Rightarrow \quad 1 \cdot x + 0 \cdot y + 4 = 0 \quad \text{(linear equation in two variables)}$$

Graph line of $1 \cdot x + 0 \cdot y + 4 = 0$ is a straight line parallel to the y-axis at a distance of –4 units, i.e. 4 units to the left of the origin and all the points on this line are solutions of the given equation. So, on the Cartesian plane, the given equation will have **infinitely many solutions**.



30. (b) $y = 2x$

$$\text{Ordinate} = 2 \text{ abscissa}$$
$$\Rightarrow \quad y\text{-coordinate} = 2\ x\text{-coordinate}$$
$$\Rightarrow \quad \boldsymbol{y = 2x}$$

31. (b) **(2, 3)**

Given equation is $2x + 5y = 19$.

A point on the graph of the given equation has its ordinate = $1\frac{1}{2}$ its abscissa.

So, putting $y = \frac{3}{2}x$ in the given equation, we get

$$2x + 5\left(\frac{3}{2}x\right) = 19$$
$$\Rightarrow \quad 4x + 15x = 19 \times 2$$
$$\Rightarrow \quad 19x = 19 \times 2$$
$$\Rightarrow \quad x = 2$$

Now, $\quad y = \frac{3}{2}x = \frac{3}{2} \times 2 = 3.$

$\therefore$ Coordinates of the point on the graph of the equation $2x + 5y = 19$ where ordinates its $1\frac{1}{2}$ times its abscissa are **(2, 3)**.

32. (c) **3 : 2**

To obtain the x-intercept, we put

$y = 0$ in $2x + 3y = 9$ ($\because$ $y = 0$ on the x-axis)

x-intercept is given by

$$2x + 3 \times 0 = 9$$
$$\Rightarrow \quad 2x = 9$$
$$\Rightarrow \quad x = \frac{9}{2}$$

To obtain the y-intercept, we get

$x = 0$ in $2x + 3y = 9$ ($\because$ $x = 0$ on the y-axis)

$\therefore$ y-intercept is given by $2 \times 0 + 3y = 9$

$$\Rightarrow \quad 3y = 9$$
$$\Rightarrow \quad y = 3$$

Ratio of x-intercept to y-intercept is

$$\frac{9}{2} : 3 \text{ or } 9 : 6 \text{ or } \mathbf{3 : 2}.$$

33. (a) $\boldsymbol{x = 2y, x + 2y = 4}$

Points lying on CA are (0, 2), (2, 1) and (4, 0).

Points lying on BO are (4, 2), (2, 1) and (0, 0).

Point M (2, 1) lies on both CA and BO.

x-coordinate of M is twice its y-coordinate

$$\Rightarrow \quad x = 2y$$

All the points on BO satisfy $\boldsymbol{x = 2y}$.

All the points on CA satisfy $\boldsymbol{x + 2y = 4}$.

Hence, the equations of the diagonals BO and CA respectively are $\boldsymbol{x = 2y, x + 2y = 4}$.

34. (d) $\boldsymbol{x - y = 2, x + y = 4}$

Points lying on AC are (4, 2), (3, 1), (2, 0).

Points lying on BD are (2, 2) (3, 1) and (4, 0).

Point M (3, 1) lies on both AC and BD.

x-coordinate of M is 3 and its y-coordinate is 1

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

All the points on AC satisfy $\boldsymbol{x - y = 2}$.

So, the equation of AC is $x - y = 2$.

All the points on BD satisfy $\boldsymbol{x + y = 4}$.

So, the equations of the diagonals AC and BD respectively are $\boldsymbol{x - y = 2, x + y = 4}$.

35. (c) **4 sq units**

AC divides the square into two congruent triangles ABC and ADC.

$$AC = 4 \text{ units and } BO = 2 \text{ units.}$$
$$\text{ar}(\Delta ABC) = \frac{1}{2} AC \times BO$$
$$= \frac{1}{2} \times 4 \times 2 \text{ sq units} = 4 \text{ sq units.}$$

Since $\quad \Delta ADC \cong \Delta ABC$

$\therefore \quad \text{ar}(\Delta ADC) = \text{ar}(\Delta ABC) = $ **4 sq units**.

SHORT ANSWER QUESTIONS

1. $\boldsymbol{x + 3y = 9}$.

Substituting $x = 0$ in $x + 3y = 9$, we get

$$0 + 3y = 9 \quad \Rightarrow \quad y = 3$$

$\therefore$ $\boldsymbol{x = 0, y = 3}$ is a solution of $x + 3y = 9$.

Substituting $y = 0$ in $x + 3y = 9$, we get

$$x + 3(0) = 9 \quad \Rightarrow \quad x = 9$$

$\therefore$ $\boldsymbol{x = 9, y = 0}$ is a solution of $\boldsymbol{x + 3y = 9}$.

$$3x + 2y = 6$$

Substituting $x = 0$ in $3x + 2y = 6$, we get

$$3(0) + 2y = 6 \quad \Rightarrow \quad y = 3$$

$\therefore$ $\boldsymbol{x = 0, y = 3}$ is a solution of $3x + 2y = 6$

Substituting $y = 0$ in $3x + 2y = 6$, we get

$$3x + 2(0) = 6 \quad \Rightarrow \quad 3x = 6 \quad \Rightarrow \quad x = 2$$

$\therefore$ $\boldsymbol{x = 2, y = 0}$ is a solution of $3x + 2y = 6$.

Yes, the given pair of linear equations has a common solution $\boldsymbol{x = 0, y = 3}$ (of the form $\boldsymbol{x = 0, y = b}$)

2. $x + 2 = 0 \quad \Rightarrow \quad 1 \cdot x + 0 \cdot y + 2 = 0$

So, x is –2 for all values of y.

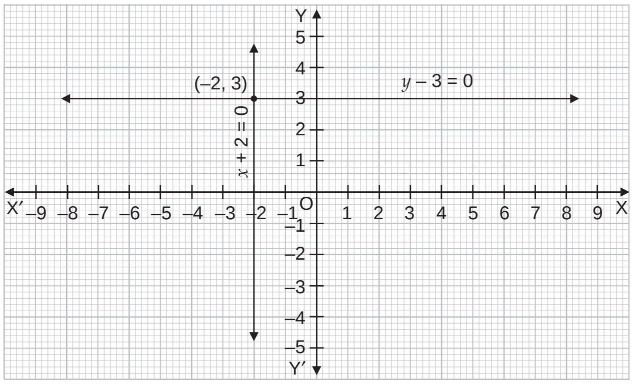
$\therefore$ Graph of $x + 2 = 0$ is a line parallel to the y-axis at a distance of 2 units to its left (as shown in the figure)

$y - 3 = 0 \;\Rightarrow\; 0 \cdot x + 1 \cdot y - 3 = 0$

So, $y = 3$ for all values of x.

$\therefore$ Graph of $y - 3 = 0$ is a line parallel to the x-axis at a distance of 3 units above it (as shown in the figure).

Clearly, the graph lines intersect at **(–2, 3)**. Since the graph of $x + 2 = 0$ is parallel to the y-axis and graph of $y - 3 = 0$ is parallel to the x-axis and the coordinate axis are mutually perpendicular.



So, we see that the graph lines are also perpendicular to each other.

3. $y = x$

$\therefore$ $x = 6 \Rightarrow y = 6$

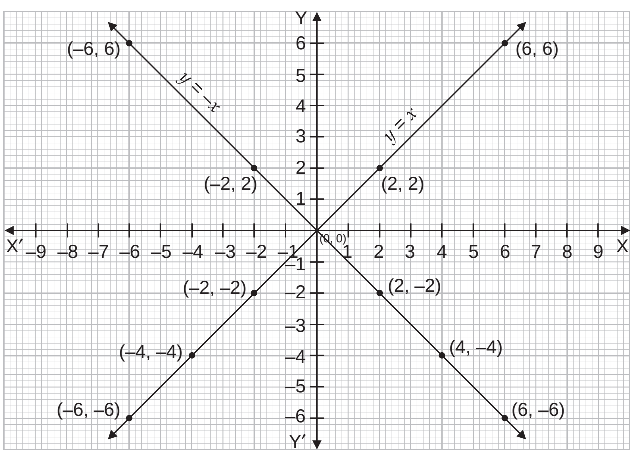
$x = 2 \Rightarrow y = 2$

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

So, we have the following table for $y = x$.

x	6	2	–6
y	6	2	–6

Plot the points (6, 6), (2, 2) and (–6, –6) on a graph paper and draw a line passing through them to obtain the graph of $y = x$.



$y = -x$

$\therefore$ $x = -6 \Rightarrow y = -(-6) \Rightarrow y = 6$

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

$x = 6 \Rightarrow y = (-6)$

So, we have the following table for $y = -x$.

x	–6	–2	6
y	6	2	–6

Plot the points (–6, 6), (–2, 2), (6, –6) and draw a line passing through them to obtain the graph of $y = -x$.

Both graph lines pass through the origin.

4. A point on the graph of $x + 2y = 7$ has its x-coordinate $= \frac{3}{2}$ times its ordinate.

Thus, if (x, y) are the coordinates of this point, then $x = \frac{3}{2}y$.

Putting $x = \frac{3}{2}y$ in $x + 2y = 7$, we get

$$\frac{3}{2}y + 2y = 7$$

$\Rightarrow$ $3y + 4y = 14$

$\Rightarrow$ $7y = 14$

$\Rightarrow$ $y = 2$

$\therefore$ $x = \frac{3}{2} \times 2 = 3$

Hence, the coordinates of the point on the graph of the given equation whose x-coordinate is $\frac{3}{2}$ times its ordinate are **(3, 2)**.

5. $y \propto x \Rightarrow y = kx$

$y = 9$ when $x = 3$

Putting $y = 9$ and $x = 3$ in $y = kx$, we get

$9 = k \times 3$

$k = 3$

Hence, $\boldsymbol{y = 3x}$.

$\therefore$ $x = 4 \Rightarrow y = 3 \times 4 = 12$

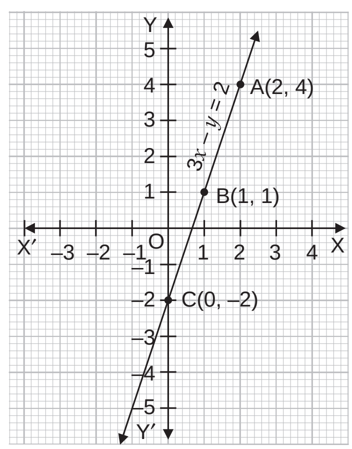
When $x = 4$, then $y = 12$.

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

$\therefore$ $x = 2 \Rightarrow y = 3 \times 2 - 2 = 4$

$x = 1 \Rightarrow y = 3 \times 1 - 2 = 1$

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



Thus, we have the following table for

$3x - y = 2$

x	2	1	0
$y = 3x - 2$	4	1	–2

Plot points A (2, 4), B (1, 1) and C (0, –2) on a graph paper and draw a line passing through A, B and C.

We observed that the points A (2, 4), B (1, 1) and C (0, –2) lie on the same graph line of the linear equation $3x - y = 2$.

7. $y = \dfrac{x-3}{2}$

When $x = -1$, then $y = \dfrac{(-1)-3}{2} = \dfrac{-4}{2} = -2$

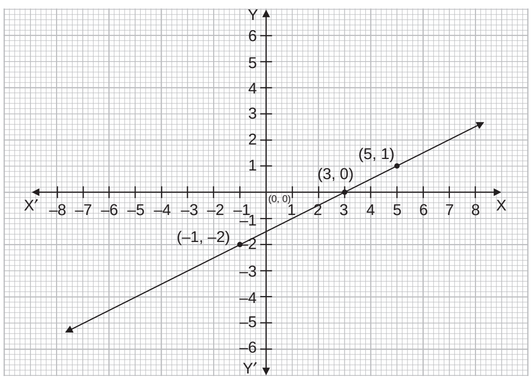
When $x = 3$, then $y = \dfrac{3-3}{2} = \dfrac{0}{2} = 0$

When $x = 5$, then $y = \dfrac{5-3}{2} = \dfrac{2}{2} = 1$

Hence, the complete table is as follows

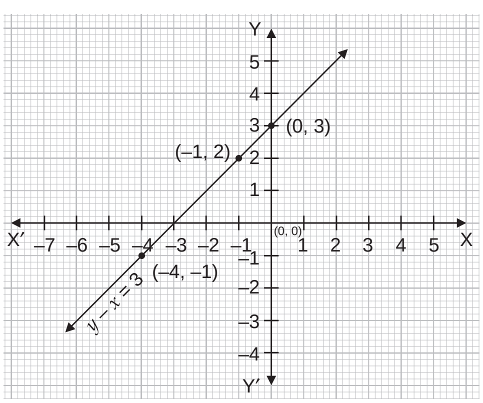
x	–1	3	5
$y = \dfrac{x-3}{2}$	–2	0	1

Plot points (–1, –2), (3, 0) and (5, 1) and draw a line passing through these points (as shown below).



8. Corresponding equations.

$-x = 0$	–4	–1
$y = 3$	–1	2
$3 - 0 = 0$	$-1 = -4 + 3$	$-1 = 2 - 3$
$\Rightarrow$ $\boldsymbol{y - x = 3}$	$\Rightarrow$ $\boldsymbol{y = x + 3}$	$\Rightarrow$ $\boldsymbol{x = y - 3}$



9. $2x + 3y - 4 = 0$

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

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

Comparing it to $y = mx + c$, we get

$m = \left(\dfrac{-2}{3}\right)$ and $c = . \dfrac{4}{3}$

$\therefore$ Slope $= m = \dfrac{\mathbf{-2}}{\mathbf{3}}$

10. Sum of coordinates = 5

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

$\therefore$ $x = 0 \Rightarrow y = 5 - 0 = 5$

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

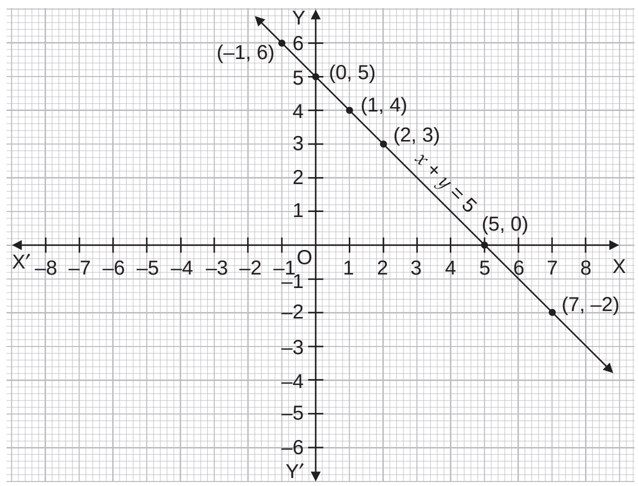
$x = 5 \Rightarrow y = 5 - 5 = 0$

$x = 7 \Rightarrow y = 5 - 7 = -2$

So, we have the following table for $x + y = 5$

x	0	2	5	7
y	5	3	0	–2

Plot points (0, 5), (2, 3), (5, 0), (7, –2) on a graph paper and draw a line passing through them to obtain the graph of $x + y = 5$.



VALUE-BASED QUESTIONS

1. **(i)** Total number of senior citizens = y.

Number of senior citizens to whom Shamali read the news = 16

Shamali played indoor games with the rest of senior citizens.

$\Rightarrow$ Shamali played indoor games with $y - 16$ senior citizens. …(1)

It is also given that the number of senior citizens with whom Shamali played indoor games = x …(2)

From (1) and (2), we get

$x = y - 16$

$\Rightarrow$ $\boldsymbol{x + 16 = y}$.

(ii) The equation in the standard form is

$$x - y + 16 = 0$$

(iii) Given, total number of senior citizen = 3 times the number of senior citizens Shamali played indoor games with.

$\Rightarrow$ $y = 3x$ ...(1)

Also, $x + 16 = y$ [From (1)]

$\Rightarrow$ $x = y - 16$

Substituting $x = y - 16$ in equation (1), we get

$y = 3(y - 16)$

$\Rightarrow$ $y = 3y - 48$

$\Rightarrow$ $48 = 2y$

$\Rightarrow$ $y = 24$

Hence, the total number of senior citizens in the old age home is **24**.

(iv) Empathy, concern for senior citizens, caring and helpfulness.

2. It is given that the water is collected in an underground tank at rate of 1500 cm^3 per minute.

$\Rightarrow$ In one minute the water collected = 1500 cm^3

$\therefore$ In y minutes the water collected = $1500y$ cm^3 ...(1)

(i) In y minutes the water collected = x cm^3 ...(2)

From (1) and (2), we get

$x \text{ cm}^3 = 1500y \text{ cm}^3$

$\Rightarrow$ $x = 1500y$

(ii) Environment awareness, problem-solving and decision making.

3. (i) Boy walks across the road at the speed of 1.5 m/s.

$\Rightarrow$ He covers 1.5 m in 1 second.

$\therefore$ He covers x m wide road in $\frac{1}{1.5} \times x$ seconds

$= \frac{x}{1.5}$ seconds.

$\therefore$ He crosses the road in $\frac{x}{1.5}$ seconds ... (1)

It is also given that the boy crosses the road in y_1 seconds. ... (2)

From (1) and (2), we get

$$\frac{x}{1.5} = y_1$$

$$\Rightarrow \quad \frac{x}{\frac{3}{2}} - y_1 = 0$$

$$\Rightarrow \quad \frac{2x}{3} - y_1 = 0$$

$$\Rightarrow \quad \mathbf{2x - 3y_1 = 0}$$

(ii) Boy walks across the road at the speed of 0.5 m/s.

$\Rightarrow$ He covers 0.5 m in 1 second

$\therefore$ He covers x m wide road in $\frac{1}{0.5} \times x$ seconds.

$\therefore$ He crosses the road in $\frac{x}{0.5}$ seconds ... (1)

It is also given that he takes y_2 seconds to cross the road. ... (2)

From (1) and (2), we get

$$\frac{x}{0.5} = y_2$$

$$\Rightarrow \quad \frac{x}{\frac{1}{2}} - y_2 = 0$$

$$\Rightarrow \quad \mathbf{2x - y_2 = 0}$$

(iii) Time taken by the boy to cross the road on the first day = y_1 seconds.

Time taken by the boy to cross the road on the second day = y_2 seconds

$$y_1 \text{ seconds} = \frac{x}{1.5} \text{ seconds}$$

and $$y_2 \text{ seconds} = \frac{x}{0.5} \text{ seconds}$$

Then, the required ratio is

$$y_1 \text{ seconds} : y_2 \text{ seconds}$$

or $$\frac{x}{1.5} \text{ seconds} : \frac{x}{0.5} \text{ seconds}$$

or $$\frac{1}{1.5} : \frac{1}{0.5}$$

or $$\frac{2}{3} : \frac{2}{1}$$

or $$\frac{1}{3} : 1$$

or $$\mathbf{1 : 3}$$

(iv) Empathy, helpfulness, compassion, sensitivity and responsibility.

UNIT TEST

Multiple-Choice Questions

1. (d) **3**

Since $x = 1, y = 1$ is a solution of $9kx + 12ky = 63$

$\therefore$ $x = 1, y = 1$ satisfy the given solution.

$\Rightarrow$ $9k(1) + 12k(1) = 63$

$\Rightarrow$ $9k + 12k = 63$

$\Rightarrow$ $21k = 63$

$\Rightarrow$ $k = \mathbf{3}$

2. (c) $\mathbf{3y - 2x = 4}$

Putting $x = 4$ and $y = 4$ in $3y - 2x = 4$, we get

L.H.S. = $3 \times 4 - 2 \times 4 = 12 - 8 = 4$ = R.H.S.

$\therefore$ $x = 4, y = 4$ is a solution of the linear equation $\mathbf{3y - 2x = 4}$

The given values of x and y do not satisfy any other equation.

So, they are not a solution of the other equations.

3. (c) **(–2, 0), (0, 4)**

y-coordinate of all the points on the x-axis is 0.

$\therefore$ y-coordinate of the point where the graph line of the given equation intersects the x-axis is also 0.

Putting $y = 0$ in $y = 2x + 4$, we get

$$0 = 2x + 4.$$

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

$$\Rightarrow \quad x = -2$$

So, the graph line intersects the x-axis at $(-2, 0)$ x-coordinate of all the points on the y-axis is 0.

$\therefore$ x-coordinate of the point where the graph line of the given equation intersects the y-axis is also 0.

Putting $x = 0$ in $y = 2x + 4$, we get

$$y = 2 \times 0 + 4$$

$$\Rightarrow \quad y = 4$$

So, the graph line intersects the y-axis at $(0, 4)$.

Hence, the coordinates of the points where the graph of the equation $y = 2x + 4$ intersects the x-axis and y-axis respectively are **(–2, 0), (0, 4)**.

4. (b) **(2, 3)**

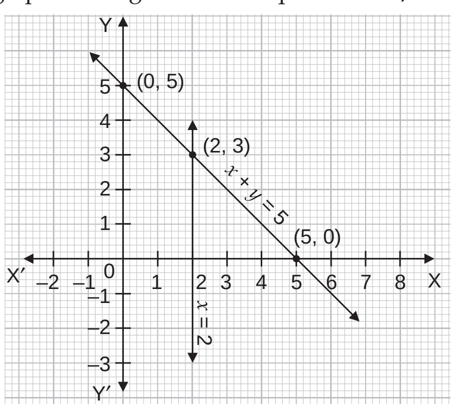
Point of intersection of the graphs of linear equations $x + y = 5$ and $x = 2$ satisfies both the equations.

Putting $x = 2$ in $x + y = 5$, we get

$$2 + y = 5$$

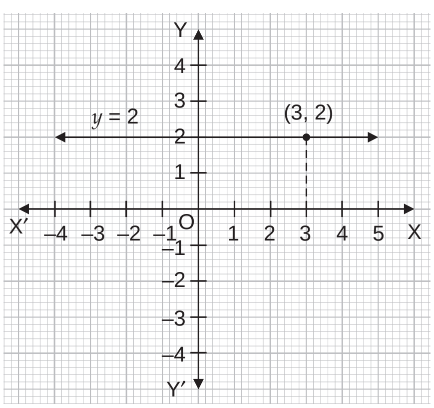
$$\Rightarrow \quad y = 3$$

Hence, the coordinates of the point of intersection of the graph of the given linear equation is **(2, 3)**.



5. Line which passes through (3, 2) has ordinate 2.

So, the distance between this point and the x-axis is 2 units.



For a line passing through (3, 2) and parallel to the x-axis, the y-intersect remains constant at 2, i.e. for all values of x-coordinates, the y-coordinate is always 2.

Hence, the required equation of the line parallel to x-axis and passing through the point (3, 2) is $\boldsymbol{y = 2}$.

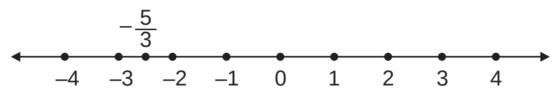
6. (i) Geometric representation of $2x + 5 = 0$ as an equation in one variable

$$2x + 5 = 0$$

$$\Rightarrow \quad 2x = -5$$

$$\Rightarrow \quad x = \frac{-5}{2}.$$

The representation of the solution on the number line is shown in the figure given below where $x = \frac{-5}{2}$ is treated as an equation in one variable.



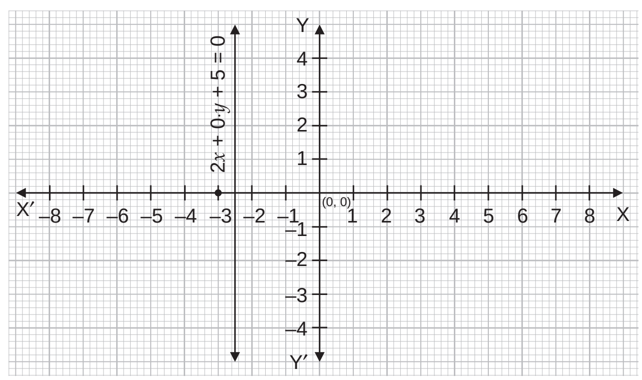
(ii) Geometric representation of $2x + 5 = 0$ in two variables $2x + 5 = 0$

$$\Rightarrow \quad x = -\frac{5}{2}$$

$$\Rightarrow \quad x + \frac{5}{2} = 0$$

$$\Rightarrow \quad 1 \cdot x + 0 \cdot y + \frac{5}{2} = 0,$$

which is a linear equation in two variables.



We see that for all values of y, $x = -\frac{5}{2}$.

Thus, the graph line of the equation $1 \cdot x + 0 \cdot y + \frac{5}{2} = 0$ is a line parallel to the y-axis at a distance of $\frac{5}{2}$ units to the left of it (as shown in the graph).

7. Since the required line is parallel to the x-axis.

$\therefore$ its distance from the x-axis is constant.

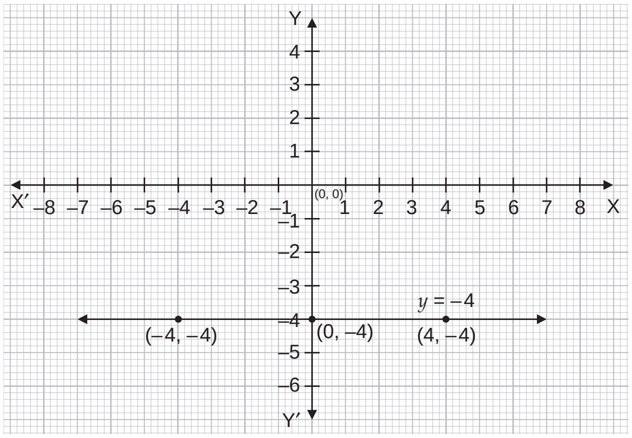
Also the line parallel to the x-axis lies 4 units below it, i.e. its y-intercept is -4, which is constant i.e., for all values of x-coordinates, the y-coordinate is always -4.

$\therefore$ $y = -4$ is the equation of the required line.

So, we have the following table for $y = -4$.

x	4	0	–4
y	–4	–4	–4

Plot the points (4, –4), (0, –4), (–4, –4) and draw a line passing through these points to get the required graph line which is at a distance of 4 units below it.



8. $x - 2y = 3$

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

When $\quad x = 7, \quad \Rightarrow \quad y = \frac{7-3}{2} = \frac{4}{2} = 2$

When $\quad x = 3, \quad \Rightarrow \quad y = \frac{3-3}{2} = \frac{0}{2} = 0$

When $\quad x = -1 \quad \Rightarrow \quad y = \frac{-1-3}{2} = \frac{-4}{2} = -2$

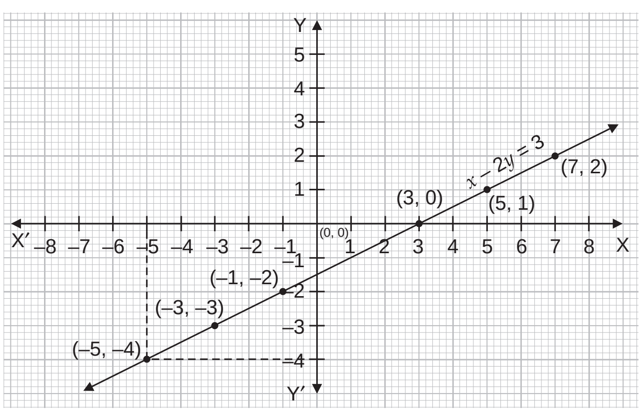
When $\quad x = -3 \quad \Rightarrow \quad y = \frac{-3-3}{2} = \frac{-6}{2} = -3$

When $\quad x = -5 \quad \Rightarrow \quad y = \frac{-5-3}{2} = \frac{-8}{2} = -4$

Thus, the table for $x - 2y = 3$ is

x	7	3	–1	–3	–5
y	2	0	–2	–3	–4

Plot the points (7, 2), (3, 0), (–1, –2), (–3, –3) and (–5, –4) on a graph paper.



Draw a line passing through these points to obtain the required graph line.

(i) When $y = 0$, $x = 3$, so the coordinates of the point having $y = 0$ are (3, 0).

(ii) When $x = -5$, $y = -4$, so the coordinates of the point having $x = -5$ are (–5, –4).

9. $2x + 3y = 11$

$$\Rightarrow \qquad 3y = 11 - 2x \quad \Rightarrow \quad y = \frac{11-2x}{3}$$

$$\therefore \qquad x = 1 \quad \Rightarrow \quad y = \frac{11-2\times1}{3} = \frac{9}{3} = 3$$

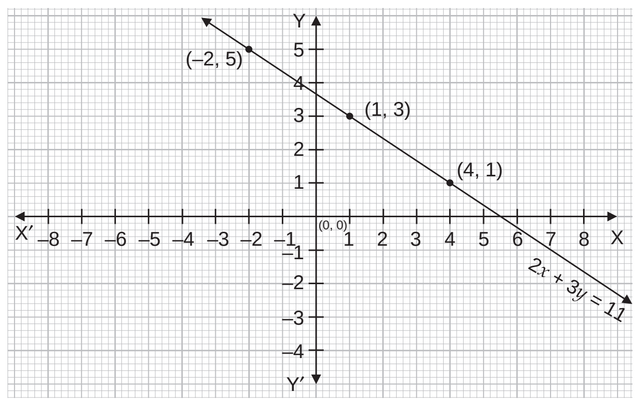
$$x = 4 \quad \Rightarrow \quad y = \frac{11-2\times4}{3} = \frac{11-8}{3} = \frac{3}{3} = 1.$$

Thus, we have the following table for $2x + 3y = 11$

x	1	4
y	3	1

Plot points (1, 3) and (4, 1) on a graph paper.

Draw a line passing through these points to obtain the required graph line.



Since the point (–2, 5) lies on the graph line of the given equation,

$\therefore$ it is a solution of line given equation.

10. $3x - 2y + 12 = 0$

$$\Rightarrow \qquad 3x + 12 = 2y$$

$$\therefore \qquad y = \frac{3x+12}{2}$$

Since the ordinate of all the points on the x-axis is 0,

$\therefore$ The x-coordinate of the required point where the graph line cuts the x-axis is obtained by putting $y = 0$ in given equation. Putting $y = 0$ in $3x - 2y + 12 = 0$, we get $3x - 2 \times 0 + 12 = 0$.

$$\Rightarrow \qquad 3x + 12 = 0$$

$$\Rightarrow \qquad 3x = -12$$

$$\Rightarrow \qquad x = -4$$

So, the point where the graph line cuts the x-axis is **(–4, 0)**.

Since the abscissa of all the points on the y-axis is 0,

$\therefore$ the y-coordinate of the required point where the graph line cuts the y-axis is obtained by putting $x = 0$ in the given equation.

Putting $x = 0$ in $3x - 2y + 12 = 0$, we get

$$3 \times 0 - 2y + 12 = 0$$
$$\Rightarrow \quad 2y = 12$$
$$\Rightarrow \quad y = 6$$

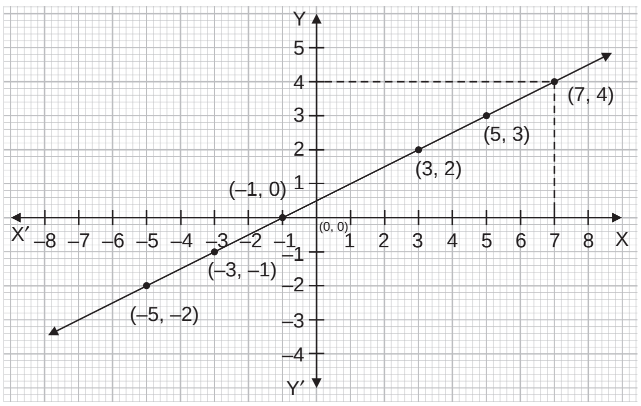
So, the point where the graph line cuts the y-axis is **(0, 6)**.

11. From the graph, we observe that

When $y = -1$, $x = -3$ $\Rightarrow$ $\boldsymbol{a = -3}$

When $x = -5$, $y = -2$ $\Rightarrow$ $\boldsymbol{b = -2}$

When $y = 4$, $x = 7$ $\Rightarrow$ $\boldsymbol{c = 7}$.



Linear relationship between the variables x and y is

$$\boldsymbol{x = 2y - 1}$$

12. Speed = 60 km/h.

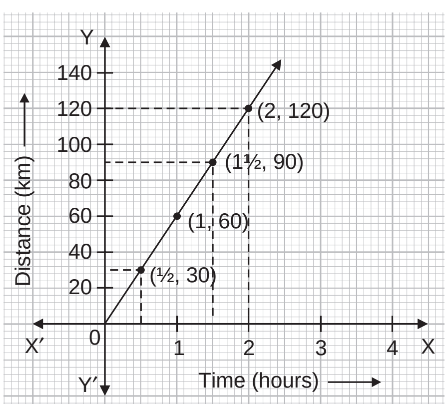
Let x represent the time taken (in hours) and y represent the distance covered (in km).

Thus, we have the following table.

x	$\frac{1}{2}$	1	$1\frac{1}{2}$
y	30	60	90

Plot the points $(\frac{1}{2}, 30)$, $(1, 60)$, $(1\frac{1}{2}, 90)$ on a graph paper.

Draw a line passing through these points to obtain the required distance-time graph.



(i) The ordinate corresponding to abscissa $1\frac{1}{2}$ is 90.

$\therefore$ The distance travelled in $1\frac{1}{2}$ hours is 90 km.

(ii) The abscissa corresponding to 120 is 2.

$\therefore$ She will take 2 hours to cover 120 km.

13. $4x - 3y + 12 = 0$

$$\Rightarrow \quad 4x + 12 = 3y \quad \Rightarrow \quad y = \frac{4x+12}{3}$$

$$\therefore \quad x = -6 \Rightarrow y = \frac{4(-6)+12}{3} = \frac{-24+12}{3} = \frac{-12}{3} = -4$$

$$x = -3 \Rightarrow y = \frac{4(-3)+12}{3} = \frac{-12+12}{3} = \frac{0}{3} = 0$$

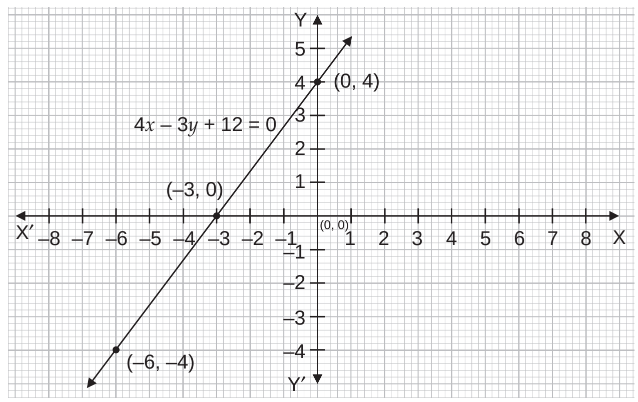
$$x = 0 \Rightarrow y = \frac{4(0)+12}{3} = \frac{12}{3} = 4$$

Thus, we have the following table for $4x - 3y + 12 = 0$

x	–6	–3	0
y	–4	0	4

Plot the points (–6, –4), (–3, 0), (0, 4) on a graph paper.

Draw a line passing through these points to obtain the required graph.



Area of the triangle formed by the graph line and the coordinate axis

$$= \frac{1}{2} \times \text{base} \times \text{altitude}$$

$$= \frac{1}{2} \times 3 \times 4 = \textbf{6 sq units}.$$

14. (i) $3y - x = 5$

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

$$\therefore \quad x = 1 \quad \Rightarrow \quad y = \frac{5+1}{3} = \frac{6}{3} = 2$$

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

Thus, we have the following table for $3y - x = 5$.

x	1	–2
y	2	1

Plot the points (1, 2) and (–2, 1) on a graph paper and draw a line through these points to obtain the graph line of the equation $3y - x = 5$.

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

$$\therefore \quad x = 3 \Rightarrow y = \frac{1-2\times 3}{5} = \frac{-5}{5} = -1$$

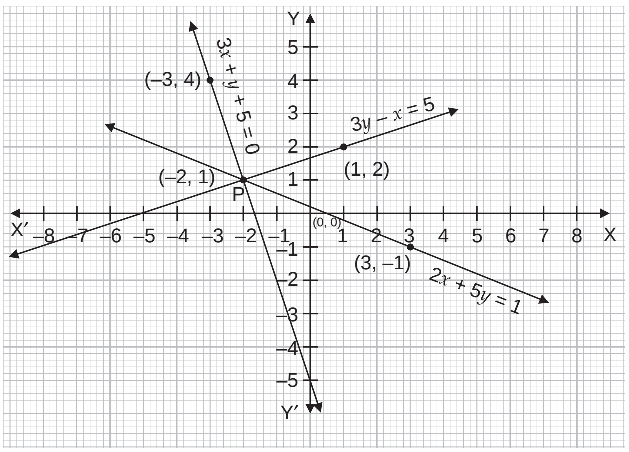
$$x = -2 \Rightarrow y = \frac{1-2\times(-2)}{5} = \frac{5}{5} = 1$$

Thus, we have the following table for $2x + 5y = 1$.

x	3	–2
y	–1	1

Plot the points (3, –1) and (–2, 1) on a graph paper.

Draw a line through these points to obtain the graph line of the equation $2x + 5y = 1$.



(i) The two graph lines intersect at **P (–2, 1).**

(ii) $\mathbf{3x + y + 5 = 0}$ (Sample answer, many now answers are possible)

[Putting $x = -2$ and $y = 1$ in $3x + y + 5 = 0$, we get

L.H.S. $= [3 \times (-2)] + 1 + 5 = -6 + 1 + 5$

$= -6 + 6 = 0 =$ R.H.S.]