4 LINEAR EQUATIONS IN TWO VARIABLES

A. SUMMATIVE ASSESSMENT

4.1 LINEAR EQUATIONS

An equation of the form $ax + by + c = 0$, where a, b, c are real numbers, is called a *linear equation* in x and y. For example, $3x + 2y = 9$, $4x - 5y = 1$ and $\frac{3}{4}x - 2y = 5$ are linear equations in x and y.

TEXTBOOK'S EXERCISE 4.1

Q.1. *The cost of a notebook is twice the cost of a pen. Write a linear equation in two variables to represent this statement.*

(*Take the cost of a notebook to be Rs x and that of a pen to be Rs y.*) **[2011 (T-II)]**

Sol. Cost of a notebook = x and cost of a pen = y

Then according to given statement

$$x = 2y \quad \text{or} \quad x - 2y = 0.$$

Q.2. *Express the following linear equations in the form ax + by + c = 0 and indicate the values of a, b and c in each case :*

(i) $2x + 3y = 9.3\overline{5}$ (ii) $x - \frac{y}{5} - 10 = 0$

(iii) $-2x + 3y = 6$ (iv) $x = 3y$

(v) $2x = -5y$ (vi) $3x + 2 = 0$

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

Sol. (i) $2x + 3y = 9.3\overline{5}$

$\Rightarrow 2x + 3y - 9.3\overline{5} = 0$

So, $a = 2$, $b = 3$, $c = -9.3\overline{5}$

(ii) $x - \frac{y}{5} - 10 = 0$

So, $a = 1$, $b = \frac{-1}{5}$, $c = -10$.

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

$\Rightarrow -2x + 3y - 6 = 0$.

So, $a = -2$, $b = 3$, $c = -6$.

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

So, $a = 1$, $b = -3$, $c = 0$.

(v) $2x = -5y \Rightarrow 2x + 5y + 0 = 0$

So, $a = 2$, $b = 5$, $c = 0$.

(vi) $3x + 2 = 0 \Rightarrow 3x + 0 \cdot y + 2 = 0$

So, $a = 3$, $b = 0$, $c = 2$.

(vii) $y - 2 = 0$

$\Rightarrow 0 \cdot x + 1 \cdot y - 2 = 0$

So, $a = 0$, $b = 1$, $c = -2$.

(viii) $5 = 2x \Rightarrow 5 - 2x = 0$

$\Rightarrow -2x + 0 \cdot y + 5 = 0$

So, $a = -2$, $b = 0$, $c = 5$.

OTHER IMPORTANT QUESTIONS

Q.1. *Which of the following is not a form of linear equation in two variables ?*

(*a*) $ax + by + c = 0$ (*b*) $ax + 0y + b = 0$

(*c*) $0x + ay + b = 0$ (*d*) $0x + 0y + 5 = 0$

Sol. (*d*) $0x + 0y + 5 = 0$ is not a form of linear equation in two variables because it is reduced to $5 = 0$, which is not true.

Q.2. *The general form of a linear equation in two variables is :* **[Imp.]**

(*a*) *$ax + by + c = 0$, where a, b, c are real numbers and $a, b \neq 0$*

(*b*) *$ax + b = 0$, where a, b are real numbers and $a \neq 0$*

(*c*) *$ax^2 + bx + c = 0$, where a, b, c are real numbers and $a, b \neq 0$*

(*d*) *none of these*

Sol. (*a*) An equation which can be put in the form $ax + by + c = 0$, where a, b, c are real numbers and a, $b \neq 0$ is called a linear equation in two variables.

Q.3. *Express the following equations in the form $ax + by + c = 0$ and indicate the values of a, b and c.* **[2011 (T-II)]**

(i) $5x = -y$ (ii) $y = -4x$

Sol. (i) $5x = -y$ can be written as

$5x + y + 0 = 0$

$\therefore a = 5, b = 1$ and $c = 0$

(ii) $y = -4x$ can be written as

$y + 4x + 0 = 0$

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

$\therefore a = 4, b = 1$ and $c = 0$

Q.4. *Frame a linear equation in the form $ax + by + c = 0$ by using the given values of a, b and c.*

(i) $a = -2, b = 3, c = 4$

(ii) $a = 5, b = 0, c = 7$

Sol. (i) The given equation is

$$ax + by + c = 0$$

Putting $a = -2$, $b = 3$ and $c = 4$, we get, $-2x + 3y + 4 = 0$, which is the required linear equation.

(ii) The given equation is $ax + by + c = 0$

Putting $a = 5$, $b = 0$ and $c = 7$, we get $5x + 0y + 7 = 0$, which is the required linear equation.

PRACTICE EXERCISE 4.1A

1 Mark Questions

1. Which of the following is not a linear equation? **[2011 (T-II)]**

(a) $ax + by + c = 0$

(b) $0x + 0y + c = 0$

(c) $0x + by + c = 0$

(d) $ax + 0y + c = 0$

2. Age of 'x' exceeds age of 'y' by 7 yrs. This statement can be expressed as linear equation as : **[2011 (T-II)]**

(a) $x + y + 7 = 0$ (b) $x - y + 7 = 0$

(c) $x - y - 7 = 0$ (d) $x + y - 7 = 0$

3. Linear equation in one variable is : **[2011 (T-II)]**

(a) $2x = y$ (b) $y^2 = 3y + 5$

(c) $4x - y = 5$ (d) $3t + 5 = 9t - 7$

4. The condition that the equation $ax + by + c = 0$ represent a linear equation in two variables is : **[2011 (T-II)]**

(a) $a \neq 0, b = 0$ (b) $b \neq 0, a = 0$

(c) $a = 0, b = 0$ (d) $a \neq 0, b \neq 0$

2 Marks Questions

Write each of the following equations in the form of $ax + by + c = 0$. Also, write the values of a, b and c (Q.5 to 10) :

5. $2x + 3y = 4.37$ **6.** $x - 4 = \sqrt{3}y$

7. $4 = 5x - 3y$ **8.** $2x = y$

9. $\sqrt{7}y = 2x$ **10.** $5x + 8 = -6y$

Write each of the following equations as equations in two variables (Q.11 to 14) :

11. $x = 17$ **12.** $y = -5$

13. $7x = -8$ **14.** $5y = 11$

15. The cost of a book is four times the cost of a notebook. Express this statement as linear equation in two variables.

16. The cost of 6 eggs is the same as the cost of one bread. Express this statement as a linear equation in two variables.

17. The cost of a table exceeds the cost of the chair by Rs 150. Write a linear equation in two variables to represent this statement. Also, find two solutions of the same equation. **[2011 (T-II)]**

4.2 SOLUTION OF A LINEAR EQUATION

1. A linear equation in two variables can be solved in the same way as a linear equation in one variable. The pair of values of x and y which satisfies the given equation is called *solution* of the equation in two variables.

2. A linear equation in two variables has infinitely many solutions.

TEXTBOOK'S EXERCISE 4.2

Q.1. *Which one of the following options is true, and why?*

$y = 3x + 5$ *has*

(i) a unique solution (ii) only two solutions (iii) infinitely many solutions

Sol. (iii) infinitely many solutions. It is because a linear equation in two variables has infinitely many solutions. We keep changing the value of x and solve the linear equation for the corresponding value of y.

Q.2. *Write four solutions for each of the following equations :*

(i) $2x + y = 7$ *(ii)* $\pi x + y = 9$ *(iii)* $x = 4y$

Sol. (i) $2x + y = 7$

Let $x = 1$. Then, $2 \times 1 + y = 7$

$\Rightarrow y = 7 - 2 = 5$

$\Rightarrow (1, 5)$ is a solution.

Let $x = 2$. Then, $2 \times 2 + y = 7$

$\Rightarrow y = 7 - 4 = 3 \Rightarrow (2, 3)$ is another solution.

Let $x = 3$. Then, $2 \times 3 + y = 7$

$\Rightarrow y = 7 - 6 = 1 \Rightarrow (3, 1)$ is another solution.

Let $x = 4$. Then, $2 \times 4 + y = 7$

$\Rightarrow y = 7 - 8 = -1 \Rightarrow (4, -1)$ is another solution.

Therefore, (1, 5), (2, 3), (3, 1) and (4, –1) are all solutions of $2x + y = 7$

(ii) $\pi x + y = 9$.

Let $x = \frac{1}{\pi}$. Then, $\pi \times \frac{1}{\pi} + y = 9$

$\Rightarrow y = 9 - 1 = 8$. $\therefore \left(\frac{1}{\pi}, 8\right)$ is a solution.

Let $x = \frac{2}{\pi}$. Then, $\pi \times \frac{2}{\pi} + y = 9$

$\Rightarrow y = 9 - 2 = 7$. $\therefore \left(\frac{2}{\pi}, 7\right)$ is a solution.

Let $x = \frac{3}{\pi}$. Then, $\pi \times \frac{3}{\pi} + y = 9$

$\Rightarrow y = 9 - 3 = 6$. $\therefore \left(\frac{3}{\pi}, 6\right)$ is a solution.

Let $x = \frac{4}{\pi}$. Then, $\pi \times \frac{4}{\pi} + y = 9 \Rightarrow y = 5$.

$\therefore \left(\frac{4}{\pi}, 5\right)$ is a solution.

Therefore, $\left(\frac{1}{\pi}, 8\right)$, $\left(\frac{2}{\pi}, 7\right)$, $\left(\frac{3}{\pi}, 6\right)$ and $\left(\frac{4}{\pi}, 5\right)$ are all solutions of the equation $\pi x + y = 9$.

(iii) $x = 4y$

Let $x = 8$

Then, $8 = 4y \Rightarrow y = 2$.

$\therefore$ (8, 2) is a solution.

Let $x = 12$. Then, $12 = 4y$,

$\Rightarrow y = 3$. $\therefore$ (12, 3) is a solution.

Let $x = 16$. Then, $16 = 4y$,

$\Rightarrow y = 4$. $\therefore$ (16, 4) is a solution.

Let $x = 20$. Then, $20 = 4y$, $\Rightarrow y = 5$.

$\therefore$ (20, 5) is a solution.

Therefore, (8, 2), (12, 3), (16, 4) and (20, 5) are all solutions of $x = 4y$.

Q.3. *Check which of the following are solutions of the equation* $x - 2y = 4$ *and which are not :*

(i) (0, 2) *(ii)* (2, 0) *(iii)* (4, 0)

(iv) $(\sqrt{2}, 4\sqrt{2})$ *(v)* (1, 1)

Sol. $x - 2y = 4$

(i) When $x = 0$, $y = 2$, then

$0 - 4 = -4$. $\Rightarrow$ RHS $\neq$ LHS.

Therefore, it is not a solution.

(ii) When $x = 2$, $y = 0$ then
$2 - 0 = 4$. $\Rightarrow$ RHS $\neq$ LHS.
Therefore, (2, 0) is not a solution.

(iii) When $x = 4$, $y = 0$, then $4 - 2 \times 0 = 4$.
LHS = RHS
Therefore, (0, 2) is a solution.

(iv) When $x = \sqrt{2}$, $y = 4\sqrt{2}$, then
$\sqrt{2} - 8\sqrt{2} = 4$.
$\Rightarrow$ LHS $\neq$ RHS
Therefore, $(\sqrt{2}, 4\sqrt{2})$ is not a solution.

(v) When $x = 1$, $y = 1$, then $1 - 2 \times 1 = 4$.
LHS $\neq$ RHS
Therefore, (1, 1) is not a solution.

Q.4. *Find the value of k, if $x = 2$, $y = 1$ is a solution of the equation $2x + 3y = k$.* **[2011 (T-II)]**

Sol. $x = 2$, $y = 1$ is a solution of
$2x + 3y = k$.
Thus, $2 \times 2 + 3 \times 1 = k$
$\Rightarrow 4 + 3 = 7 = k \Rightarrow k = 7$.

OTHER IMPORTANT QUESTIONS

Q.1. *Equation $y = 2x + 3$ has*: **[2011 (T-II)]**

(*a*) unique solution (*b*) no solution
(*c*) only two solution
(*d*) infinitely many solutions

Sol. (*d*) infinitely many solutions. It is because a linear equation in two variables has infinitely many solutions. We keep changing the value of x and solve the linear equation for the corresponding value of y.

Q.2. *For the equation $x - 2y = 4$,* check which of the following is a solution? **[2011 (T-II)]**

(*a*) (0, 2) (*b*) (2, 0)
(*c*) (4, 0) (*d*) (1, 1)

Sol. (*c*) Substituting $x = 4$ and $y = 0$ in LHS of $x - 2y = 4$, we get $4 - 2 \times 0 = 4$ = RHS.
Hence, (4, 0) is solution of $x - 2y = 4$.

Q.3. *Which of the following is a solution of the equation $-5x + 2y = 14$?* **[2011 (T-II)]**

(*a*) $x = 5, y = 1$ (*b*) $x = 0, y = -7$
(*c*) $x = -2, y = 2$ (*d*) $x = 1, y = -3$

Sol. (*c*) For $x = -2$, $y = 2$,
LHS $= -5 \times (-2) + 2 \times 2 = 10 + 4 = 14$ = RHS

Q.4. *Which of the following is not a solution of the equation $2x + y = 7$?* **[2011 (T-II)]**

(*a*) (1, 5) (*b*) (3, 1)
(*c*) (1, 3) (*d*) (0, 7)

Sol. (*c*) When $x = 1$, $y = 3$, $2 \times 1 + 3 = 5$
$\Rightarrow$ LHS $\neq$ RHS
Therefore, (1, 3) is not a solution.

Q.5. *If (2, 0) is a solution of linear equation $2x + 3y = k$, then the value of k is :* **[2011 (T-II)]**

(*a*) 4 (*b*) 6 (*c*) 5 (*d*) 2

Sol. (*a*) On putting $x = 2$, $y = 0$ in equation $2x + 3y = k$, we get $2 \times 2 + 3 \times 0 = k \Rightarrow k = 4$

Q.6. *The value of k for which $x = 1$, $y = -1$ is a solution of $kx - 2y = 0$* is : **[2011 (T-II)]**

(*a*) 12 (*b*) –2 (*c*) 5 (*d*) –8

Sol. (*b*) On putting $x = 1$, $y = -1$ in equation $kx - 2y = 0$, we get $k(1) - 2(-1) = 0$
$\Rightarrow k + 2 = 0 \Rightarrow k = -2$

Q.7. *On putting $x = 4$, $y = -5$ in the equation $3x - 2y - 2k = 0$, the value of k is :* **[Imp.]**

(*a*) 5 (*b*) 2 (*c*) 11 (*d*) –11

Sol. (*c*) On putting $x = 4$, $y = -5$ in equation $3x - 2y - 2k = 0$, we get
$(3 \times 4) - [2 \times (-5)] - 2k = 0$
$\Rightarrow 12 - [-10] - 2k = 0 \Rightarrow 12 + 10 = 2k$
$\Rightarrow k = 11$.

Q.8. *If $x = -1$, $y = 4$ is a solution of the equation $mx - y = -6$, then the value of m is :* **[Imp.]**

(*a*) 1 (*b*) 2 (*c*) –2 (*d*) 0

Sol. (*b*) $x = -1$ and $y = 4$ is a solution of the equation $mx - y = -6$
So, $m(-1) - 4 = -6$
$\Rightarrow -m = -6 + 4 = -2 \Rightarrow m = 2$

Q.9. *A linear equation in two variables has :* **[2011 (T-II)]**

(*a*) *a unique solution* (*b*) *two solutions* (*c*) *no solution* (*d*) *infinitely many solutions*

Sol. (*d*) A linear equation in two variables has infinitely many solutions.

Q.10. *The solution of* $4x - y = 5$ *is* :

(*a*) $x = 2, y = 3$ (*b*) $x = 3, y = 7$
(*c*) $x = 4, y = 11$ (*d*) all the above

Sol. (*d*) For, $x = 2$, $y = 3$,
LHS $= 4 \times 2 - 3 = 5 =$ RHS
For, $x = 3$, $y = 7$, LHS $= 4 \times 3 - 7 = 5 =$ RHS
For, $x = 4$, $y = 11$, LHS $= 4 \times 4 - 11 = 5 =$ RHS.

Q.11. *How many linear equations in x and y can be satisfied by* $x = 1$ *and* $y = 2$? **[Imp.]**

(*a*) only one (*b*) two
(*c*) infinitely many (*d*) three

Sol. (*c*) There are infinitely many equations which are satisfied by $x = 1$ and $y = 2$.

Q.12. $x = 5$, $y = 2$ *is a solution of the linear equation* :

(*a*) $x + 2y = 7$ (*b*) $5x + 2y = 7$
(*c*) $x + y = 7$ (*d*) $5x + y = 7$

Sol. (*c*) Substituting $x = 5$ and $y = 2$ in LHS of $x + y - 7 = 0$, we get
$5 + 2 - 7 = 0 \Rightarrow 7 - 7 = 0 =$ RHS
Hence, $x = 5$ and $y = 2$ is the solution of $x + y = 7$.

Q.13. *Find the value of p from the equation* $3x + 4y = p$, *if its one solution is* $x = 2$, $y = 1$. **[Imp.]**

Sol. Substituting $x = 2$ and $y = 1$ in equation $3x + 4y = p$, we get
$3 \times 2 + 4 \times 1 = p \Rightarrow 6 + 4 = p \Rightarrow p = 10$.

Q.14. *Find whether the given ordered pair is a solution of the given linear equation :*
(i) $2x - 4y = 32$; $(8, -4)$ (ii) $4x - 2y = 10$; $(3, -1)$

Sol. (i) The given equation is $2x - 4y - 32 = 0$
Putting $x = 8$ and $y = -4$, we get
LHS $= 2 \times 8 - 4 \times (-4) - 32$
$= 16 + 16 - 32 = 0 =$ RHS
Since, LHS = RHS, therefore, $(8, -4)$ is the solution of the given equation.
(ii) The given equation is $4x - 2y - 10 = 0$
Putting $x = 3$ and $y = -1$, we get
LHS $= 4 \times 3 - 2 \times (-1) - 10 = 12 + 2 - 10 \neq 0$
Since, LHS $\neq$ RHS, therefore, $(3, -1)$ is not a solution of the given equation.

Q.15. *For what value of p, the linear equation* $2x + py = 8$ *has equal values of x and y for its solution?* **[HOTS]**

Sol. We have, $2x + py = 8$ .... (i)
For equal values of x and y put $x = y$ in equation (i)
$2x + px = 8 \Rightarrow px = 8 - 2x$
$\Rightarrow p = \dfrac{8 - 2x}{x}$, $x \neq 0$.

PRACTICE EXERCISE 4.2 A

1 Mark Questions

1. $x = 5$, $y = -2$ is the solution of linear equation : **[2011 (T-II)]**

(*a*) $2x + y = 9$ (*b*) $x + 3y = 1$
(*c*) $2x - y = 12$ (*d*) $x + 3y = 0$

2. If the point (2 – 1) lies on the graph of the equation $3x + ky = 4$, then the value of k is : **[2011 (T-II)]**

(*a*) 1 (*b*) – 1 (*c*) 2 (*d*) – 2

3. Which of the following pair is a solution of the equation $2x - 3y = 7$? **[2011 (T-II)]**

(*a*) (5, 1) (*b*) (1, 5)
(*c*) (0, 2) (*d*) (2, –3)

4. Which of the following is a solution of the equation $4x + 3y = 16$? **[2011 (T-II)]**

(*a*) (2, 3) (*b*) (1, 4)
(*c*) (2, 4) (*d*) (1, 3)

5. A solution of the equation $2x - 3y = 5$ is :

(*a*) (1, 1) (*b*) (4, 1) (*c*) (1, 4) (*d*) (2, –3)

6. If $x = 1$ and $y = 2$ is a solution of the equation $3x + 5y - k = 0$, then value of k is :

(*a*) –13 (*b*) 7 (*c*) –7 (*d*) 13

7. If $x = -2$ and $y = 3$ is a solution of the equation $3x - 5y = a$, then value of a is :

(*a*) 19 (*b*) –21 (*c*) –9 (*d*) –18

2 Marks Questions

8. Which of the following are solutions of the equation $x + 3y = 7$ and which are not?

$(2, 5)$, $\left(0, \frac{7}{3}\right)$, $(4, 3)$, $(1, 2)$, $(4, 1)$, $(3, 1)$, $(7, 0)$, $(2, 1)$

9. Which of the following are solutions of the equation $y - 2x = 5$ and which are not?

$(2, 1)$, $(-2, 1)$, $(0, 5)$, $(1, -2)$, $\left(6, \frac{1}{2}\right)$, $\left(\frac{-5}{2}, 0\right)$

10. If $(2, 5)$ is a solution of the equation $2x + 3y = m$, find the value of m.

11. Find the value of b if $(-3, 4)$ is a solution of the equation $3x - 4y = 5b$.

4.3 GRAPH OF A LINEAR EQUATION IN TWO VARIABLES

In order to draw the graph of a linear equation in two variables we may follow the following method :

(i) Express y in terms of x.

(ii) Choose at least two convenient values of x and find the corresponding values of y, satisfying the given equation.

(iii) Write down these values of x and y in the form of a table.

(iv) Plot the ordered pairs (x, y) from the table on a graph paper.

(v) Join these points by a straight line and extend it in both the directions.

This line is the graph of the given equation.

TEXTBOOK'S EXERCISE 4.3

Q.1. *Draw the graph of each of the following linear equations in two variables :*

(i) $x + y = 4$ *(ii)* $x - y = 2$

(iii) $y = 3x$ *(iv)* $3 = 2x + y$

Sol. (i) $x + y = 4$

For $x = 0$, $y = 4$

For $x = 1$, $y = 3$

So, we have the points $(0, 4)$ and $(1, 3)$.

(ii) $x - y = 2$

For $x = 0$, $y = -2$

For $x = 1$, $y = -1$

So, we have the points $(0, -2)$ and $(1, -1)$.

(iii) $y = 3x$

For $x = 0$, $y = 0$

For $x = 1$, $y = 3$

So, we have the points $(0, 0)$ and $(1, 3)$.

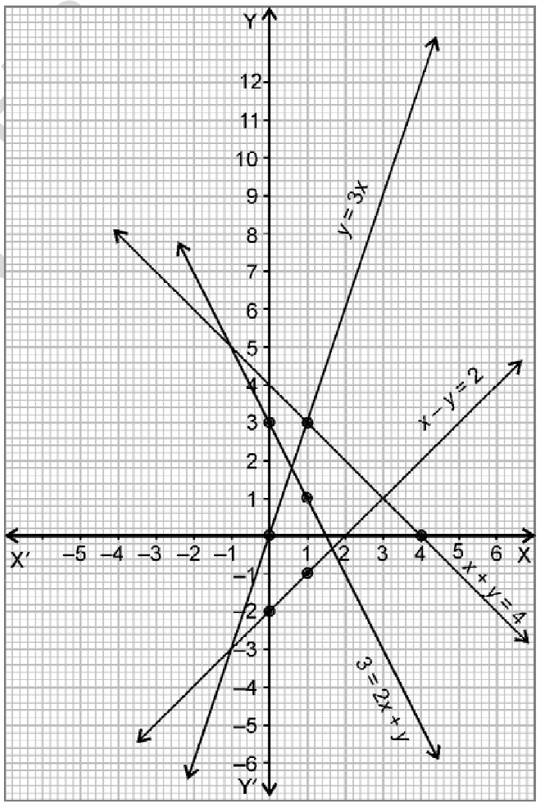
(iv) $3 = 2x + y$

For $x = 0$, $y = 3$

$x = 1$, $y = 1$

So, we have the points

$(0, 3)$ and $(1, 1)$.



We get four lines, each one from (i), (ii), (iii) and (iv) when we join the points thus obtained.

Q.2. *Give the equations of two lines passing through* (2, 14). *How many more such lines are there, and why?* **[2011 (T-II)]**

Sol. Let $x + y = k$ be such a line, then

$2 + 14 = k \Rightarrow k = 16.$

$\therefore\ x + y = 16$ passes through (2, 14).

Let $2x + 3y = k'$ be another line through (2, 14).

$2 \times 2 + 3 \times 14 = k' \Rightarrow k' = 4 + 42 = 46$

$\Rightarrow 2x + 3y = 46$ passes through (2, 14).

There are infinitely many such lines, as through a point infinite number of straight lines can be drawn.

Q.3. *If the point* (3, 4) *lies on the graph of the equation* $3y = ax + 7$, *find the value of* a. **[2011 (T-II)]**

Sol. (3, 4) lies on $3y = ax + 7$

Therefore, substituting 3 for x and 4 for y in the above equation, we have

$3 \times 4 = a \times 3 + 7 \Rightarrow 3a + 7 = 12 \Rightarrow 3a = 5$

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

Q.4. *The taxi fare in a city is as follows : For the first kilometre, the fare is Rs* 8 *and for the subsequent distance it is Rs* 5 *per km. Taking the distance covered as x km and total fare as Rs y, write a linear equation for this information, and draw its graph.* **[2011 (T-II)]**

Sol. Total fare $y = 1 \times 8 + (x - 1)\,5$,

where x is in km and y in Rs.

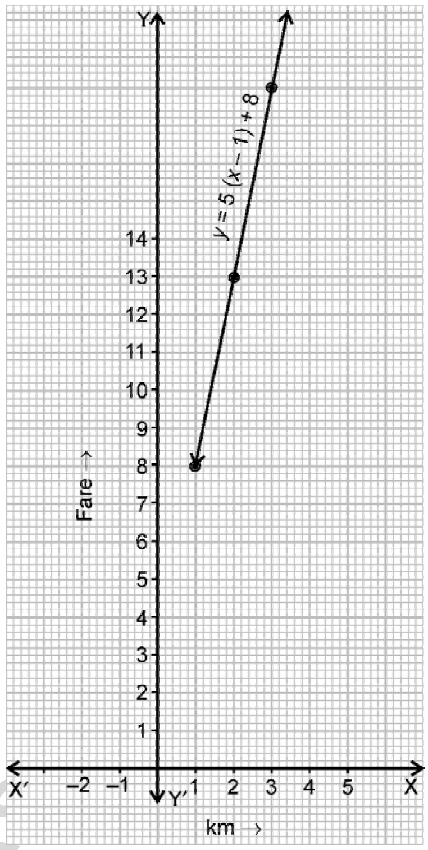
So, the required equation is $y = 5\,(x - 1) + 8$

Now, for $x = 1$, $y = 8$

For, $x = 2$, $y = 5 + 8 = 13$

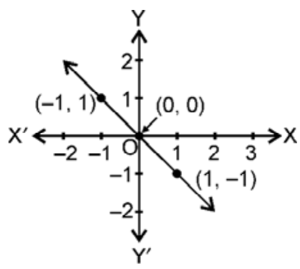
So, the points are (1, 8) and (2, 13).

Joining these points, we get the graph of the linear equation $y = 5(x - 1) + 8$.

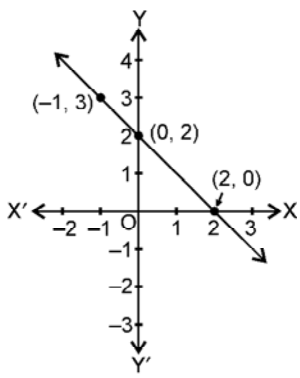


Q.5. *From the choices given below, choose the equation whose graphs are given in Fig. A and Fig. B.*

For Fig. A	*For Fig. B*
(i) $y = x$	*(i)* $y = x + 2$
(ii) $x + y = 0$	*(ii)* $y = x - 2$
(iii) $y = 2x$	*(iii)* $y = -x + 2$
(iv) $2 + 3y = 7x$	*(iv)* $x + 2y = 6$



A



B

Sol. For fig. A

(ii) $x + y = 0$ is the correct choice.
This can be verified by putting
$$x = 1,\ y = -1 \text{ in } x + y = 0$$

For fig. B

(iii) $y = -x + 2$ is the correct choice.

This can be verified by putting $x = -1$, $y = 3$ in $y = -x + 2$

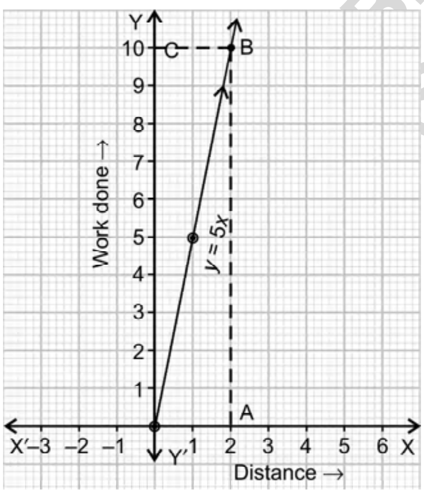
Q.6. *If the work done by a body on application of a constant force is directly proportional to the distance travelled by the body, express this in the form of an equation in two variables and draw the graph of the same by taking the constant force as* 5 *units. Also read from the graph the work done when the distance travelled by the body is :*

(i) 2 *units* *(ii)* 0 *units.* **[2011 (T-II)]**

Sol. Let y = work done, x = distance travelled, and
F = constant force = 5 units
Then, $y \propto x \Rightarrow y = Fx \Rightarrow y = 5x$.
For, $x = 0$, $y = 0$; for $x = 1$, $y = 5$;
for $x = 2$, $y = 10$;
for $x = 3$, $y = 15$; for $x = 4$, $y = 20$.

(i) Let A represent $x = 2$ on the x-axis. From A, draw AB $\perp$ on x-axis, meeting the graph at B. From B, draw BC $\perp$ y-axis, meeting y-axis at C. The ordinate of C is 10.

So, when the distance travelled is 2 units



the work done is 10 units.

(ii) From the graph, it is clear that for $x = 0$, $y = 0$. So, when the distance travelled is 0 units, the work done is also 0 units.

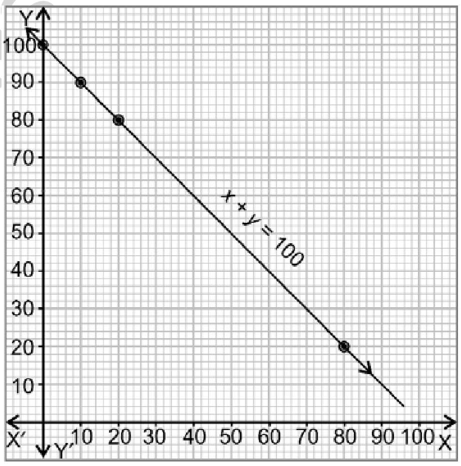
Q.7. *Yamini and Fatima, two students of Class IX of a school, together contributed Rs* 100 *towards the Prime Minister's Relief Fund to help the earthquake victims. Write a linear equation which satisfies this data. (You may take their contributions as Rs x and Rs y.) Draw the graph of the same.* **[2011 (T-II)]**

Sol. $x + y = 100$ is the linear equation satisfying the given data.

For, $x = 0$, $y = 100$
$x = 10$, $y = 90$
$x = 20$, $y = 80$

So, the points are (0, 100), (10, 90) and (20, 80)

Joining these points, we get the graph of the linear equation $x + y = 100$



Q.8. *In countries like USA and Canada, temperature is measured in Fahrenheit, whereas in countries like India, it is measured in Celsius. Here is a linear equation that converts Fahrenheit to Celsius :* **[2011 (T-II)]**

$$F = \left(\frac{9}{5}\right)C + 32$$

(i) *Draw the graph of the linear equation above using Celsius for x-axis and Fahrenheit for y-axis.*

(ii) *If the temperature is* 30°C, *what is the temperature in Fahrenheit?*

(iii) *If the temperature is* 95°F, *what is the temperature in Celsius?*

(iv) *If the temperature is* 0°C, *what is the temperature in Fahrenheit and if the temperature is* 0°F, *what is the temperature in Celsius?*

(v) *Is there a temperature which is numerically the same in both Fahrenheit and Celsius? If yes, find it.*

Sol. $F = \left(\frac{9}{5}\right)C + 32$

(i) For, C = 0, F = 32
For, C = 5, F = 41
For, C = 10, F = 50

(ii) For 30°C, corresponding Fahrenheit temperature is 86°F.

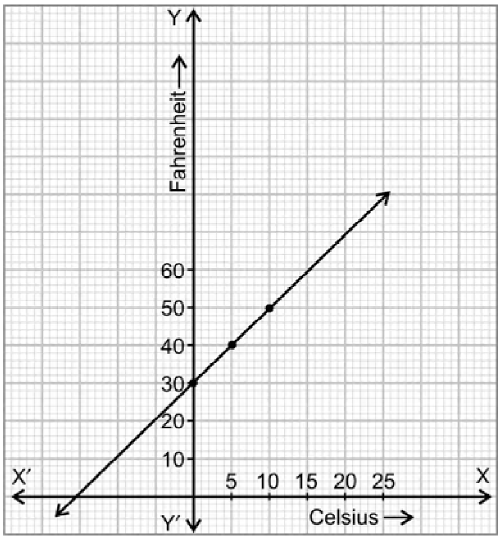
(iii) For F = 95, $\Rightarrow 95 = \left(\frac{9}{5}\right)C + 32$

$\Rightarrow \left(\frac{9}{5}\right) C = 95 - 32 = 63$

$\Rightarrow C = \frac{5}{9} \times 63 = 35°C$

(iv) For C = 0°

$F = \left(\frac{9}{5}\right) \times 0 + 32 = 32°F.$



For F = 0°

$0 = \left(\frac{9}{5}\right) C + 32 \Rightarrow C = \frac{-32 \times 5}{9} = \frac{-160}{9}$

$= -17.8°C.$

(v) Let F = x, C = x.

Then, $x = \left(\frac{9}{5}\right) x + 32 \Rightarrow x - \frac{9}{5}x = 32$

$\Rightarrow x \left(1 - \frac{9}{5}\right) = 32 \Rightarrow x \quad \frac{4}{5} \quad = 32 \Rightarrow x$

$= \frac{-32 \times 5}{4} = -40°C$

Thus, – 40°C and – 40°F are equal temperatures.

OTHER IMPORTANT QUESTIONS

Q.1. The equation of the line whose graph passes through the origin, is :

(*a*) $2x + 3y = 1$ (*b*) $2x + 3y = 0$
(*c*) $2x + 3y = 6$ (*d*) none of these

Sol. (*b*) $2x + 3y = 0 \Rightarrow 2x = -3y$

$\Rightarrow x = -\frac{3}{2}y$, which is of the form $x = my$.

Q.2. *If the point* $\left(3, \frac{1}{3}\right)$ *lies on the graph of the equation* $3y = ax - 2$, *then the value of a is :*

(*a*) – 1 (*b*) 1 (*c*) 3 (*d*) – 3 **[Imp.]**

Sol. (*b*) Putting $x = 3$ and $y = \frac{1}{3}$ in the given equation, we get

$3 \times \frac{1}{3} = 3a - 2 \Rightarrow 1 = 3a - 2 \Rightarrow 3a = 3$
$\Rightarrow a = 1.$

Q.3. *The equation of y-axis is :*
(a) $y = 0$ (b) $x = 0$
(c) $y = a$ (d) $x = a$

Sol. (b) $x = 0$ is the equation of y-axis.

Q.4. *If the point* (2, – 3) *lies on the graph of the equation* $2y = ax - 7$, *then the value of a is :*

(a) 1 (b) $\frac{1}{2}$ (c) $-\frac{1}{2}$ (d) $\frac{1}{4}$ **[Imp.]**

Sol. (b) Since, the point (2, – 3) lies on the graph of the equation $2y = ax - 7$, therefore, $2 \times (-3) = (a \times 2) - 7 \Rightarrow -6 = 2a - 7$ $\Rightarrow 2a = 1 \Rightarrow a = \frac{1}{2}$.

Q.5. *The equation of x-axis is :* **[2011 (T-II)]**
(a) $y = 0$ (b) $x = 0$
(c) $y = a$ (d) $x = a$

Sol. (a) The equation of x-axis is $y = 0$.

Q.6. *Any point on the x-axis is of the form :* **[2011 (T-II)]**
(a) (x, y) (b) $(0, y)$
(c) $(x, 0)$ (d) (x, x)

Sol. (c) On x-axis y-coordinate will be 0.

Q.7. *Any point on the line* $y = x$ *is of the form :* **[2011 (T-II)]**
(a) (a, a) (b) $(0, a)$
(c) $(a, 0)$ (d) $(a, -a)$

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

Q.8. *The point of the form* $(a, -a)$ *always lies on the line :* **[2011 (T-II)]**
(a) $x = a$ (b) $y = -a$
(c) $y = x$ (d) $x + y = 0$

Sol. (d) The point $(a, -a)$ always lies on the line $x + y = 0$.

Q.9. *Which of the following equations does not pass through the origin ?*
(a) $y = \frac{2}{3}x$ (b) $y = mx$
(c) $y = x$ (d) $y = 1$

Sol. (d) The line $y = 1$ does not pass through the origin, because (0, 0) does not satisfy the given equation.

Q.10. *The linear equation* $F = \left(\frac{9}{5}\right) C + 32$ *is used to convert the temperature from Fahrenheit to Celsius or vice-versa. The temperature numerically same in both Fahrenheit and Celsius is :* **[HOTS]**
(a) – 32° (b) – 40°
(c) 40° (d) none of these

Sol. (b) Given that $F = \left(\frac{9}{5}\right)C + 32$

On putting $F = C = x$, we get $x = \left(\frac{9}{5}\right)x + 32$
$\Rightarrow 5x = 9x + 160 \Rightarrow 5x - 9x = 160 \Rightarrow -4x = 160$
$\Rightarrow x = -40$

Q.11. *Equation of the line* $y = 0$ *represents* : **[2011 (T-II)]**
(a) y-axis (b) x-axis
(c) both x-axis and y-axis
(d) origin

Sol. (b) The equation of x-axis is $y = 0$

Q.12. *If the line represented by the equation* $3x + \alpha y = 8$ *passes through the points* (2, 2), *then the value of* α *is :* **[2011 (T-II)]**
(a) 4 (b) 1 (c) 3 (d) 0

Sol. (b) Since the point (2, 2) lies on the graph of the equation $3x + \alpha y = 8$, therefore, $3 \times 2 + 2 \times \alpha = 8$
$\Rightarrow 6 + 2\alpha = 8 \Rightarrow 2\alpha = 8 - 6 = 2 \Rightarrow \alpha = 1$

Q.13. *The graph of the linear equation* $2x + 3y = 9$ *cuts y-axis at the point* : **[2011 (T-II)]**
(a) $\left(\frac{9}{2}, 0\right)$ (b) (0, 9)
(c) (0, 3) (d) (3, 1)

Sol. (c) The graph of the linear equation $2x + 3y = 9$, cuts the y-axis at the point where $x = 0$. On putting $x = 0$ in the given equation, we have $3y = 9$, which gives $y = 3$. Thus, required point is (0, 3).

Q.14. *If the point* (2, –1) *lies on the graph of the equation* $3x + ky = 4$, *then the value of k is :* **[2011 (T-II)]**
(a) 1 (b) – 1

(*c*) 2 (*d*) – 2

Sol. (*c*) Since the point (2, –1) lies on the graph of the equation $3x + ky = 4$, therefore, $3 \times 2 - k \times 1 = 4$

$\Rightarrow 6 - k = 4 \Rightarrow k = 2$

Q.15. *If the points* (1, 0) *and* (2, 1) *lie on the graph of* $\frac{x}{a} + \frac{y}{b}$, *then the values of a and b are* : **[HOTS]**

(*a*) $a = 1$ and $b = 1$
(*b*) $a = 1$ and $b = -1$
(*c*) $a = -1$ and $b = 1$
(*d*) $a = 0$ and $b = -1$

Sol. (*b*) Since, the points (1, 0) and (2, 1) lie on the graph of the equation $\frac{x}{a} + \frac{y}{b} = 1$

Therefore, $\frac{1}{a} + \frac{0}{b} = 1 \Rightarrow \frac{1}{a} = 1 \Rightarrow a = 1$

And, $\frac{2}{a} + \frac{1}{b} = \Rightarrow \frac{1}{b} \Rightarrow \frac{2}{a} = 1 - 2 = -1$

$\Rightarrow b = -1$

Q.16. *The coordinates of the point where the line* $3x - 5 = y + 4$ *meets the x-axis are* :

(*a*) (3, 0) (*b*) (0, 3)
(*c*) (– 3, 0) (*d*) (0, – 3)

Sol. (*a*) The y-coordinate of the point, where the given line meets the *x*-axis is zero.
So, putting $y = 0$ in $3x - 5 = y + 4$, we get $3x - 5 = 4 \Rightarrow 3x = 9 \Rightarrow x = 3$
Therefore, required point is (3, 0).

Q.17. *If the points* (0, 1) *and* (1, 0) *lie on the graph of the equation* $y = mx + c$, *then the values of m and c are* : **[Imp.]**

(*a*) $m = 1, c = 1$ (*b*) $m = -1, c = -1$
(*c*) $m = -1, c = 1$ (*d*) $m = 0, c = -1$

Sol. (*c*) Since, (0, 1) and (1, 0) lie on the graph of the equation $y = mx + c$,
therefore, $1 = 0 + c \Rightarrow c = 1$ and $0 = m + c$
$\Rightarrow m = -c = -1.$

Q.18. *The force (y) applied on a body is directly proportional to the acceleration (x) produced in the body. The linear equation to represent the given information is* :

(*a*) $xy = k$ (*b*) $y = kx$
(*c*) $x = ky$ (*d*) none of these

Sol. (*b*) From the given information, $y \propto x$ or $y = kx$, where k is any constant.

Q.19. *The point of the form* (*a*, *a*) *always lies on* : **[2011 (T-II)]**

(*a*) *x*-axis
(*b*) *y*-axis
(*c*) on the line $y = x$
(*d*) on the line $x + y = 0$

Sol. (*c*) Substituting $x = a$ and $y = a$ in the line $y = x$ we get, $a = a$.
Therefore, the point (*a*, *a*) lies on the line $y = x$.

Q.20. *The graph of the linear equation* $2x + 3y = 6$ *is a line which meets the x-axis at the point* : **[Imp.]**

(*a*) (0, 2) (*b*) (2, 0)
(*c*) (3, 0) (*d*) (0, 3)

Sol. (*c*) The given equation is $2x + 3y = 6$.
At the *x*-axis $y = 0$
So, putting $y = 0$ is the given equation, we get $2x + 0 = 6 \Rightarrow x = 3$
Hence, line $2x + 3y - 6 = 0$ meets the *x*-axis at the point (3, 0).

Q.21. *The graph of the linear equation* $y = x$ *passes through the point* : **[Imp.]**

(*a*) $\left(\frac{3}{2}, \frac{-3}{2}\right)$ (*b*) $\left(0, \frac{3}{2}\right)$
(*c*) (1, 1) (*d*) $\left(\frac{-1}{2}, \frac{1}{2}\right)$

Sol. (*c*) Graph of the linear equation $y - x = 0$.
Putting $x = 1$, $y = 1$, we get
LHS = $1 - 1 = 0$ = RHS
Hence, graph of the linear equation $y = x$ passes through the point (1, 1).

Q.22. *Write whether the following statement is true or false* :

The coordinates of points given in the table represent some of the solutions of the equation $2x + 2 = y$ **[Imp.]**

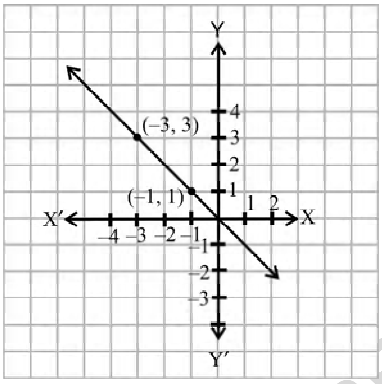
x	0	1	2	3	4
y	2	4	6	8	10

Sol. True, on looking at the coordinates, we observe that each y-coordinate is two units more than double the x-coordinate. Hence, statement is true.

Q.23. *Every point on the graph of a linear equation in two variables does not represent a solution of the linear equation. Is it true ? Justify your answer.* **[Imp.]**

Sol. False, every point on the graph of a linear equation in two variables is a solution of the linear equation. Moreover, every solution of the linear equation is a point on the graph of the linear equation. Hence, given statement is false.

Q.24. *Check whether the graph represents the linear equation $x + y = 0$ or not.* **[Imp.]**



Sol. The given line passes through (–1, 1) and (–3, 3)

Now, putting $x = -1$, $y = 1$ in $x + y = 0$, we get $-1 + 1 = 0 \Rightarrow 0 = 0$. True

Again, putting $x = -3$, $y = 3$ in $x + y = 0$, we get $-3 + 3 = 0 \Rightarrow 0 = 0$. True.

Hence, the graph represents a linear equation $x + y = 0$.

Q.25. *Check whether the point* (0, 3) *lies on the graph of the linear equation* $3x + 4y = 12$. **[Imp.]**

Sol. Putting $x = 0$, $y = 3$ in the equation, we get LHS $= 3 \times 0 + 4 \times 3 = 12 =$ RHS

Hence, we can say that the point (0, 3) lies on the linear equation $3x + 4y = 12$.

Q.26. *Mayank and Sujata two students of class IX together contributed Rs 1000 towards PM Relief fund. Write a linear equation satisfying the data and draw the graph of the same.* **[2011 (T-II)]**

Sol. Let the contributions of Mayank and Sujata be Rs x and Rs y respectively.

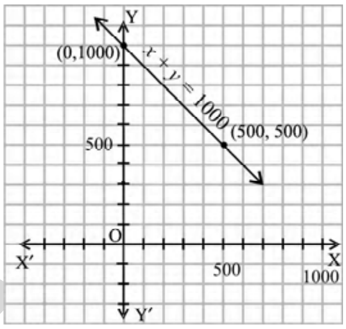
As per question, $x + y = 1000$

This is the required linear equation.

Now, $x + y = 1000 \Rightarrow y = 1000 - x$

Table of solutions

x	0	500
y	1000	500

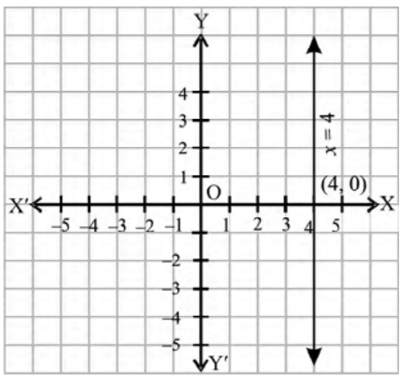


Joining the above points, we get the graph of the linear equation $x + y = 1000$.

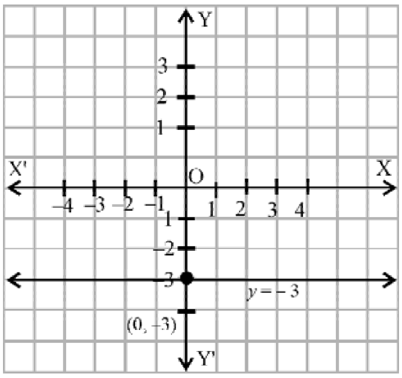
Q.27. *Draw the graph of :*

(i) $x = 4$ (ii) $y = -3$

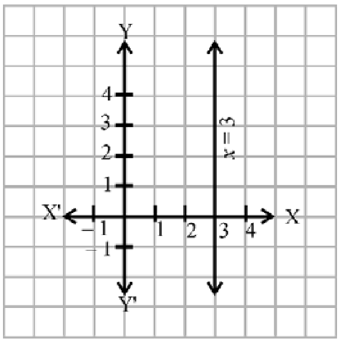
Sol. (i) The given equation is $x = 4$, here y-coordinate is 0. The graph of this equation is clearly a line parallel to y-axis at a distance of 4 units from it on the right of the origin.



(ii) The given equation is $y = -3$, here x-coordinate is 0. The graph of this equation is clearly a line parallel to x-axis at a distance of 3 units below the x-axis.



Q.28. *Check whether the graph represents the linear equation* $x = 3$.



Sol. The given line is parallel to y-axis and also is at a distance of 3 units from the y-axis. So, it represent the linear equation $x = 3$.

Q.29. *Draw the graph of* $3x - 2y = 0$

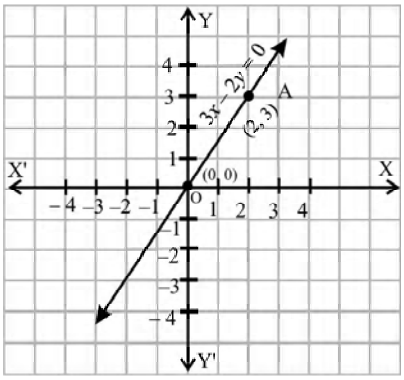
Sol. The given equation is $3x - 2y = 0$. To draw the graph of this equation, we need at least two points lying on the graph. From the equation, we have $3x = 2y$.

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

For $x = 0$, $y = 0$, we plot the point O (0, 0)

For $x = 2$, $y = 3$, we plot the point A (2, 3)

Now, we join points O and A to obtain the graph of $3x - 2y = 0$



Q.30. *Check whether the graph of the linear equation* $x + 2y = 7$ *passes through the point* (0, 7). **[Imp.]**

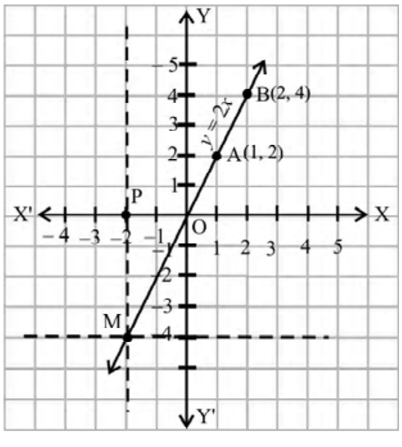
Sol. If the graph of the linear equation $x + 2y = 7$ passes through the point (0, 7), it will satisfy the given equation. Putting $x = 0$ and $y = 7$, we get, LHS $= 0 + 2 \times 7 - 7 \neq 0$

$\therefore$ LHS $\neq$ RHS

Hence, graph of the linear equation does not pass through the point (0, 7).

Q.31. *Draw the graph of the equation* $y = 2x$. *From the graph, find the value of* y *when* $x = -2$.

Sol. The given equation is $y = 2x$. To draw the graph of this equation, we need at least two points lying on the graph.



For $x = 0$, $y = 0$, we plot the point O (0, 0)
For $x = 1$, $y = 2$, we plot the point A (1, 2)
For $x = 2$, $y = 4$, we plot the point B (2, 4)

The given : $x = -2$. Take a point P on the

x-axis such that OP = – 2. Draw PM, parallel to the y-axis, meeting the graph at M.

PM = – 4.

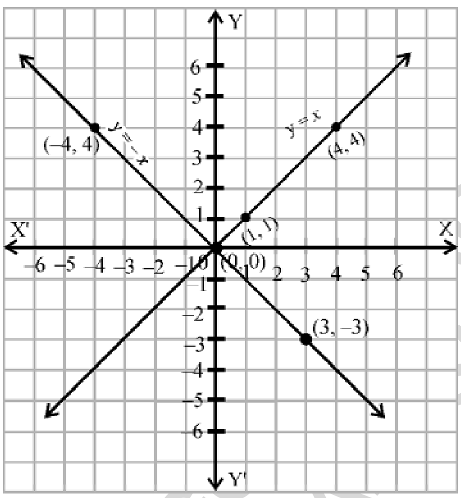
$\therefore$ When $x = -2$, then $y = -4$.

Q.32. *Find the points where the graph of the equation* $3x + 4y = 12$ *cuts the x-axis and the y-axis.* **[Imp.]**

Sol. The graph of the linear equation $3x + 4y = 12$, cuts the x-axis at the point where $y = 0$. On putting $y = 0$ in the linear equation, we have $3x = 12$, which gives $x = 4$. Thus, the required point is (4, 0). The graph of the linear equation $3x + 4y = 12$ cuts the y-axis at the point where $x = 0$. On putting $x = 0$ in the given equation, we have $4y = 12$, which gives $y = 3$. Thus, the required point is (0, 3).

Q.33. *Draw the graph of the linear equations* $y = x$ *and* $y = -x$ *on the same cartesian plane. What do you observe ?* **[HOTS]**

Sol. The given equation is $y = x$. To draw the graph of this equation, we need at least two points lying on the graph.



For $x = 1$, $y = 1$, therefore, (1, 1) lies on the graph.

For $x = 4$, $y = 4$, therefore, (4, 4) lies on the graph.

By plotting the points (1, 1) and (4, 4) on the graph paper and joining them by a line, we obtain the graph of $y = x$.

The given equation is $y = -x$. To draw the graph of this equation, we need at least two points lying on the graph.

For $x = 3$, $y = -3$, therefore, (3, – 3) lies on the graph.

For $x = -4$, $y = 4$, therefore, (– 4, 4) lies on the graph.

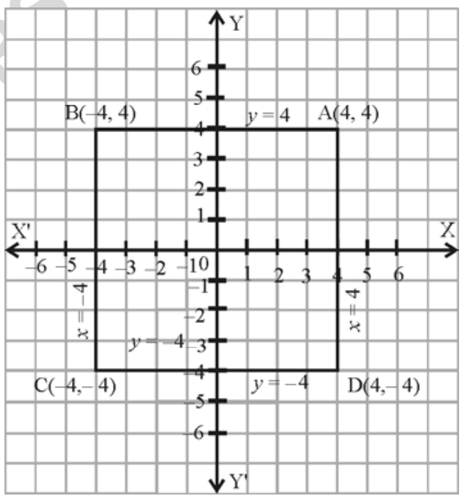
By plotting the points (3, – 3) and (– 4, 4) on the graph paper and joining them by a line, we obtain the graph of $y = -x$.

We observe that, the graph of the line $y = x$ and $y = -x$ intersect at the point O (0, 0).

Q.34. Draw a square whose sides are represented by $x = 4$, $x = -4$, $y = 4$, $y = -4$.

Sol. The graph of $x = 4$ will be a line parallel to y-axis at a distance of 4 units in its right. Similarly, the graph of $x = -4$ will be a line parallel to y-axis at a distance of 4 units in its left. In the same way we can draw $y = 4$ and $y = -4$ lines parallel to x-axis at a distance of 4 units above and below x-axis respectively.

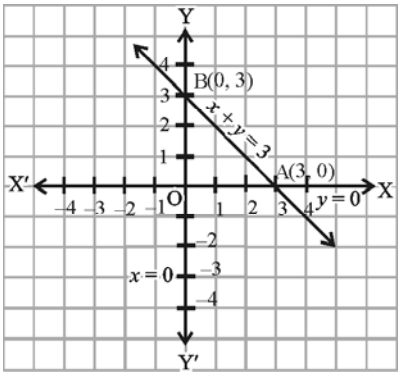
Thus, ABCD is the required square.



Q.35. *Draw a triangle whose sides are represented by* $x = 0$, $y = 0$ *and* $x + y = 3$. **[Imp.]**

Sol. The equation $x = 0$ represents the y-axis i.e., one side of the triangle.

Similarly, the equation $y = 0$ represents the x-axis i.e., another side of the triangle.



$x + y = 3$

For $x = 0$, $y = 3$; For $y = 0$, $x = 3$

Thus, (0, 3) and (3, 0) are two points on the line $x + y = 0$

Joining these points we get the third side of the triangle. So, ΔOAB is the required triangle.

Q.36. *Determine the point on the graph of the linear equation* $2x + 5y = 19$ *whose ordinate is* $1\frac{1}{2}$ *times of its abscissa.* **[Imp.]**

Sol. As the y-coordinate of the point is $\frac{3}{2}$ times of the x-coordinate so, $y = \frac{3}{2}x$.

Now putting $y = \frac{3}{2}x$ or $x = \frac{2}{3}y$, in $2x + 5y = 19$, we get, $x = 2$ and $y = 3$.

Q.37. *Find three solutions of* $5x - y + 6 = 0$ *after reducing it to* $y = mx + c$ *form.*

Sol. The given equation is $5x - y + 6 = 0$.

It can be written in the form of $y = mx + c$, as $y = 5x + 6$.

For $x = 0$, $y = 6$, therefore, (0, 6) is the solution of the given equation.

For $x = 1$, $y = 11$, therefore (1, 11) is the solution of the given equation.

And, for $x = 2$, $y = 16$, therefore (2, 16) is the solution of the given equation.

Hence, the three solutions for the given equation are (0, 6), (1, 11) and (2, 16).

Q.38. *Draw the graph of the linear equation whose solutions are represented by the points having the sum of the coordinates as* 10 *units.*

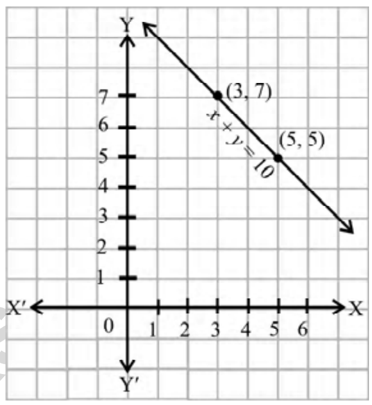
Sol. As per question, the sum of the coordinates is 10 units.

Let x and y be two coordinates, then we get, $x + y = 10$

For $x = 5$, $y = 5$, therefore, (5, 5) lies on the graph.

For $x = 3$, $y = 7$, therefore, (3, 7) lies on the graph.

Joining the above points, we get graph of the linear equation $x + y = 10$.



Q.39. *Find the solution of the linear equation* $2x + 5y = 20$ *which represents a point on*

(i) *x-axis* (ii) *y-axis.* **[Imp.]**

Sol. We have, $2x + 5y = 20$ .... (i)

(i) When the point is on the x-axis, put $y = 0$ in (i)

$2x + 5 \times 0 = 20 \Rightarrow 2x = 20 \Rightarrow x = 10$

Therefore the required point is (10, 0).

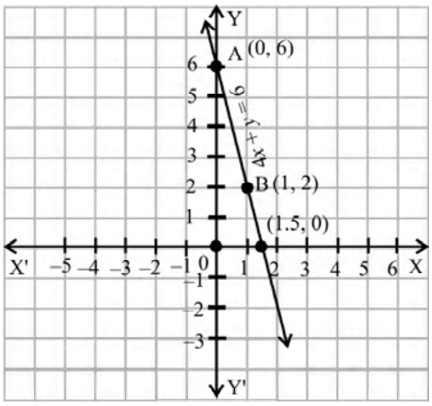
(ii) When the point is on the y-axis, put $x = 0$ in (i)

$2 \times 0 + 5y = 20 \Rightarrow 5y = 20 \Rightarrow y = 4$

Therefore, the required point is (0, 4).

Q.40. *Draw the graph of the linear equation* $4x + y = 6$. *At what points the graph of the equation cuts the x-axis and the y-axis?* **[2011 (T-II)]**

Sol. The given equation is $4x + y = 6$. To draw the graph of this equation, we need at least two points lying on the graph.



From the equation, we have, $y = 6 - 4x$.

For $x = 0$, $y = 6$, therefore, (0, 6) lies on the graph.

For $x = 1$, $y = 2$, therefore, (1, 2) lies on the graph.

Now, plot the point A (0, 6) and B (1, 2) and join them to get the line AB. We can see that the graph (line AB) cuts the y-axis at the point (0, 6) and x-axis at the point (1.5, 0).

Q.41. *Draw the graphs of the equations $x + y = 6$ and $2x + 3y = 16$ on the same graph paper. Find the coordinates of the points where the two lines intersect.* **[2011 (T-II)]**

Sol. The given equation is $x + y = 6$. To draw the graph of this equation, we need at least two points lying on the graph. Similarly we can draw the graph of the equation $2x + 3y = 16$.

If $x + y = 6$, then, $y = 6 - x$.

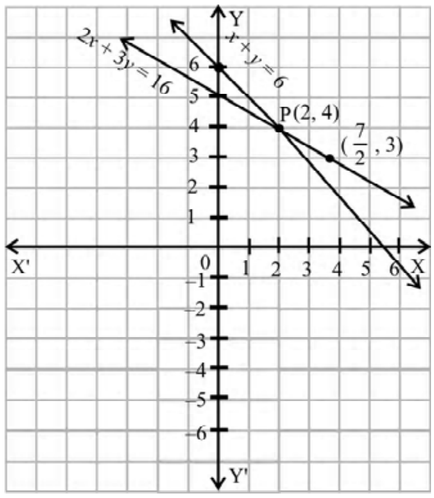
For $x = 0$, $y = 6$, therefore (0, 6) lies on the graph.

For $x = 2$, $y = 4$, therefore (2, 4) lies on the graph.

If $2x + 3y = 16$, then $3y = 16 - 2x$.

For $x = 2$, $y = 4$, therefore (2, 4) lies on the graph.

For $x = \frac{7}{2}$, $y = 3$, therefore $(\frac{7}{2}, 3)$ lies on the graph.



By plotting the points (0, 6) and (2, 4) on the graph paper and joining them by a line, we obtain the graph of $x + y = 6$. Similarly, by plotting the poins $(\frac{7}{2}, 3)$ and (2, 4) on the graph paper and joining them by a line, we obtain the graph of $2x + 3y = 16$.

Clearly, lines represented by the equations $x + y = 6$ and $2x + 3y = 16$ intersect at the point P whose coordinates are (2, 4).

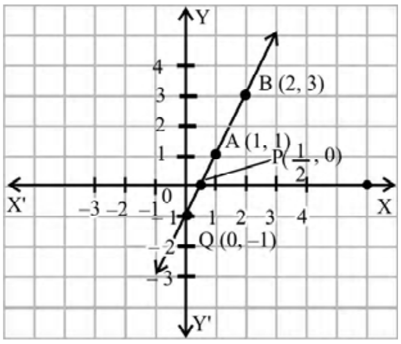
Q.42. *The given values of x and y are thought to satisfy a linear equation. Draw the graph using the values of x and y as given in the table.*

x	1	2
y	1	3

At what point the graph of the linear equation :

(i) cuts the x-axis ? *(ii) cuts the y-axis ?*

Sol. From the table, we get two points A (1, 1) and B (2, 3) which lie on the graph of the linear equation. We first plot the points A and B and join them as shown in the figure. From the figure we see that the graph cuts the x-axis at the $P\left(\frac{1}{2}, 0\right)$ and the y-axis at the point Q(0, – 1).



Q.43. *Show that the points A* (1, 2), *B* (– 1, –16) *and C* (0, – 7) *lie on the graph of linear equation* $y = 9x - 7$.

Sol. For point A (1, 2), putting $x = 1$, $y = 2$, $2 = 9 \times 1 - 7 \Rightarrow 2 = 2$, therefore, (1, 2), lies on the graph of $y = 9x - 7$.

For point B (– 1, – 16), putting $x = -1$, $y = -16$, $-16 = 9 \times -1 - 7$

$\Rightarrow -16 = -16$, therefore (– 1, – 16), lies on the graph of $y = 9x - 7$.

For point C (0, – 7), putting $x = 0$, $y = -7$, $-7 = 9 \times 0 - 7 \Rightarrow -7 = -7$, therefore, (0, – 7), lies on the graph of $y = 9x - 7$.

Hence, we can say that, these given points lie on the graph of linear equation.

Q.44. *The force exerted to pull a cart is directly proportional to the acceleration produced in the body. Express the statement as a linear equation of two variables and draw the graph of the same by taking the constant mass equal to 6 kg. Read from the graph, the force required when the acceleration produced is (i)* 5 *m/sec*^{2} *(ii)* 6 *m/sec*^{2}. **[HOTS]**

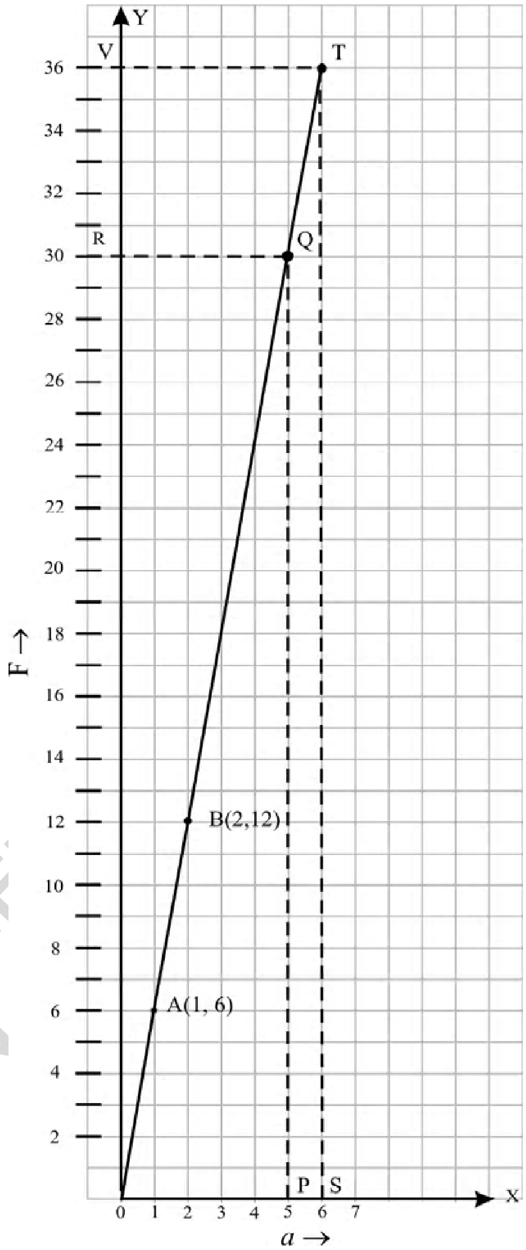
Sol. $F \propto a$, where F is the force exerted and a is the acceleration produced.

$\Rightarrow F = ma$, where m is a constant.

$\therefore F = 6a$

When $a = 1$, F = 6, when $a = 2$, F = 12, when $a = 0$, F = 0

(i) From $a = 5$ on the x-axis, draw a vertical line to meet the graph at Q. From Q draw a horizontal line to meet the y-axis at R. The



ordinate of R is 30. Hence, when $a = 5$ cm/sec^2, F = 30 newtons.

(ii) Similarly, when $a = 6$ cm/sec^2, F = 36 newtons.

Q.45. *The linear equation that converts Fahrenheit (F) to Celsius (C) is given by the relation*

$$C = \frac{5F - 160}{9}$$ **[2011 (T-II)]**

(i) *If the temperature is 86°F, what is the temperature in Celsius ?*

(ii) *If the temperature is 35°C, what is the temperature in Fahrenheit ?*

(iii) *If the temperature is 0°F, what is the temperature in Celsius ?*

(iv) *What is the numerical value of the temperature which is same in both the scales ?*

Sol. (i) $C = \frac{5F - 160}{9}$

$$C = \frac{5 \times 86 - 160}{9} = \frac{430 - 160}{9} = 30° \text{ C.}$$

(ii) $C = \frac{5F - 160}{9} \Rightarrow 35 = \frac{5F - 160}{9}$

$\Rightarrow 5F - 160 = 315$

$\Rightarrow 5F = 475 \Rightarrow F = 95°F.$

(iii) $C = \frac{5F - 160}{9}$

$$\Rightarrow C = \frac{5 \times 0 - 160}{9} = \frac{-160}{9} = -\left(\frac{160}{9}\right)^{\circ} C$$

(iv) Let the temperature on both the scales numerically be x. Then,

$C = \frac{5F - 160}{9} \Rightarrow x = \frac{5x - 160}{9}$

$\Rightarrow 9x = 5x - 160 \Rightarrow 4x = -160$

$\Rightarrow x = -40$

Hence, numerical value of the required temperature is – 40.

PRACTICE EXERCISE 4.3A

1 Mark Questions

1. For the equation $y = 8x - 3$, which of the following statements is true :

(*a*) It has no solution

(*b*) It has a unique solution

(*c*) It has two solutions

(*d*) It has infinite number of solutions

2. The equation in the form of $y = mx + c$ will always : **[2011 (T-II)]**

(*a*) Intersect x-axis

(*b*) Intersect y-axis

(*c*) Passes through the origin

(*d*) Intersect both the axes

3. If (1, 3) is a solution of the equation of $3x + 5y = b$, then the value of 'b' is :

(*a*) 15 (*b*) 16 (*c*) 17 (*d*) 18

2 Marks Questions

4. Draw the graph of each of the following linear equations :

(*a*) $4x - 3y = 0$ (*b*) $\frac{1}{3}x - \frac{2}{5}y = 0$

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

3 Marks Questions

5. Draw the graph of the equation $5x - 3y = 1$. Find four solutions of the equation. Using the graph check whether $x = 2$ and $y = 3$ is a solution of the equation.

6. Draw the graph of the equation $2y - x = 7$ and determine from the graph whether $x = 3$, $y = 2$ is its solution or not.

7. Draw the graph of the line $x - 2y = 3$.

From the graph find coordinates of the points when (i) $x = -5$ (ii) $y = 0$

8. Draw the graph of the line $3x + 4y = 18$. With the help of this graph find the value of y when $x = 2$.

9. Draw the graph of the equation $2x - 3y = 5$. From the graph, find the value of y when $x = 4$ **[2011 (T-II)]**

10. Draw the graph of the equation $3x + 2y = 6$. Find area of the triangle formed with the line, x-axis and y-axis. **[2011 (T-II)]**

11. Draw the graph $x + 2y = 6$ and find the points where the line cuts the x-axis and y-axis. **[2011 (T-II)]**

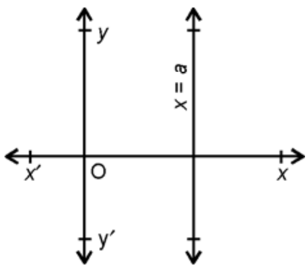
12. If the point (4, 3) lies on the graph of the equation $3x - ay = 6$, find whether (–2, –6) also lies on the same graph. Find the coordinates of the points where the graph cuts x-axis and y-axis. **[2011 (T-II)]**

13. Draw the graph of equation $x - y = 1$ and $2x + y = 8$ on the same axes. Shade the area bounded by these lines and x-axis. **[2011 (T-II)]**

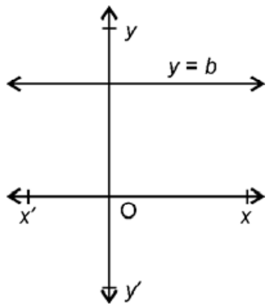
14. Draw the graph of the equation $y = -x + 1$ and find the point where the graph meets the axes. **[2011 (T-II)]**

4.4 EQUATIONS OF LINES PARALLEL TO *X*-AXIS AND *Y*-AXIS

(i) Equation of a line parallel to the y-axis at a distance a from it is $x = a$.



(ii) Equation of a line parallel to the x-axis at a distance b from it is $y = b$.



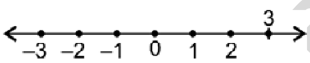
TEXTBOOK'S EXERCISE 4.4

Q.1. *Give the geometric representations of* $y = 3$ *as an equation*

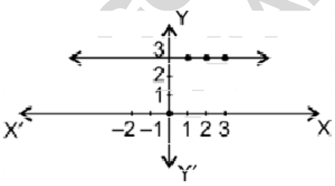
(i) in one variable *(ii) in two variables*

Sol. (i) $y = 3$

As an equation in one variable, it is the number 3 on the number line.



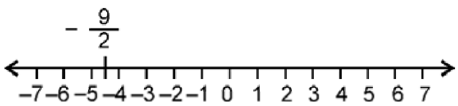
(ii) As an equation in two variables, it can be written as $0 \cdot x + y = 3$. Value of x can be any number but of y will continue to be 3. It is a line parallel to x-axis and 3 units above it.



Q.2. *Give the geometric representations of* $2x + 9 = 0$ *as an equation*

(i) in one variable *(ii) in two variables*

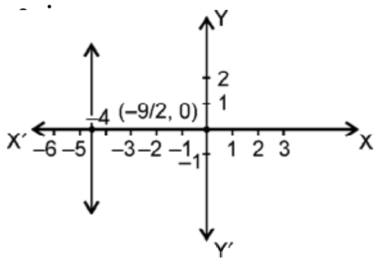
Sol. (i) $2x + 9 = 0$



As an equation in one variable.

$$2x = -9 \Rightarrow x = \frac{-9}{2}$$

(ii) $2x + 0 \cdot y + 9 = 0$ is an equation in two variables. Value of y can be any number but x remains $\frac{-9}{2}$.



It is a line parallel to y-axis and $\frac{9}{2}$ units to the left of 0.

OTHER IMPORTANT QUESTIONS

Q.1. *The graph of* $x = 15$ *is a straight line :* **[2011 (T-II)]**

(*a*) intersecting both the axes
(*b*) parallel to y-axis.
(*c*) parallel to x-axis
(*d*) passing through the origin.

Sol. (*b*) Here, the linear equation $x = 15$ does not contain y. So, its graph is a line parallel to y-axis.

Q.2. *Equation of line parallel to x-axis and* 2 *units above the origin is :* **[2011 (T-II)]**

(*a*) $x = 2$ (*b*) $x = -2$
(*c*) $y = 2$ (*b*) $y = -2$

Sol. (*c*) Clearly, the equation of line parallel to x-axis and 2 units above the origin is $y = 2$.

Q.3. *Which of the following represents a line parallel to x-axis?* **[2011 (T-II)]**

(*a*) $x + y = 7$ (*b*) $x + 3 = 0$
(*c*) $y + 2 = 3y - 5$ (*d*) $5x + 3 = 4$

Sol. (*c*) Since $y + 2 = 3y - 5$ does not contain x, therefore it represents a line parallel to x-axis.

Q.4. *The graph of* $y = m$ *is a straight line parallel to :* **[Imp.]**

(*a*) x-axis (*b*) y-axis
(*c*) both axes (*d*) none of these

Sol. (*a*) Here, the linear equation $y = m$ does not contain x. So, its graph is a line parallel to x-axis.

Q.5. *Which of the following lines is not parallel to y-axis ?*

(*a*) $x = -1$ (*b*) $x - 2 = 0$
(*c*) $x + 3 = 0$ (*d*) $y + 1 = 0$

Sol.(*d*) The equation of a line parallel to y-axis is of the form $x = a$. Here, the line $y + 1 = 0$ is not of the form $x = a$.

So, it is not parallel to y-axis.

Q.6. *Which of the following is parallel to x-axis?*

(*a*) $x = a$ (*b*) $y = a$
(*c*) $x = 3 + y$ (*d*) $y = 0$

Sol. (*d*) $y = a$ is parallel to x-axis.

Q.7. *Which of the following is not true about the equation* $2x + 1 = x - 3$?

(*a*) the graph of the line is parallel to y-axis
(*b*) $x = -4$ is the solution of the equation
(*c*) point $(-4, 0)$ lies on the line
(*d*) the graph is at right side of the y-axis

Sol. (*d*) We have, $2x + 1 = x - 3$
$\Rightarrow 2x - x = -3 - 1 \Rightarrow x = -4$. Therefore, the graph of the given equation lies to the left side of the y-axis.

Q.8. *The graph of* $y = 6$ *is a line :* **[Imp.]**

(*a*) parallel to x-axis at a distance 6 units from the origin

(*b*) parallel to y-axis at a distance 6 units from the origin

(*c*) making an intercept 6 on the x-axis.

(*d*) making an intercept 6 on both the axes.

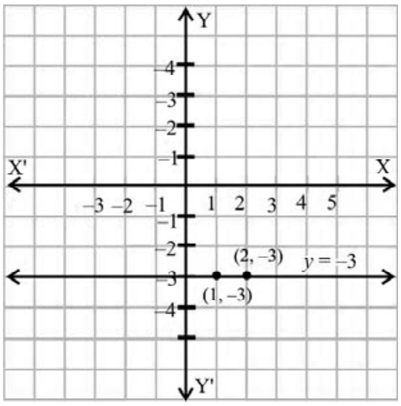
Sol. (*a*) The graph of $y = 6$ is clearly a line parallel to x-axis at a distance of 6 units from the origin.

Q.9. *At what point does the graph of the linear equation* $x + y = 5$ *meet a line which is parallel to the y-axis, at a distance of* 2 *units from the origin in the positive direction of x-axis ?* **[Imp.]**

Sol. The coordinates of the points lying on the line parallel to the y-axis, at a distance 2 units from the origin and in the positive direction of the x-axis are of the form $(2, a)$. Putting $x = 2$, $y = a$ in the equation $x + y = 5$, we get $a = 3$. Hence, the required point is $(2, 3)$.

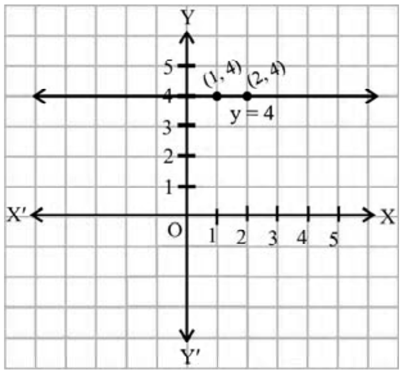
Q.10. *Draw the graph of the equation represented by a straight line which is parallel to the x-axis and at a distance of* 3 *units below it.*

Sol. We know that, any straight line parallel to x-axis is given by $y = k$, where k is the distance of the line from the x-axis. Here, $k = -3$. Therefore, the equation of the line is $y = -3$. To draw the graph of this equation, plot the points (1, – 3) and (2, – 3) and join them. This is the required graph.



Q.11. *Draw the graph of the equation represented by the striaght line which is parallel to the x-axis and is 4 units above it.*

Sol. We know that, any straight line parallel to x-axis is given by $y = k$, where k is the distance of the line from the x-axis. Here $k = 4$. Therefore, the equation of the line is $y = 4$. To draw the graph of this equation, plot the points (1, 4) and (2, 4) and join them. This is the required graph.



PRACTICE EXERCISE 4.4A

2 Marks Questions

Draw graphs of the following equations :

1. $x = 4$ **2.** $y = 3$ **3.** $x = -5$

4. $y = -3$ **5.** $2x = 3$ **6.** $3y = -4$

7. $y = x$ **8.** $y = -x$ **9.** $2x + y = 0$

10. $3x - 2y = 0$ **11.** $0.2x + 0.3y = 0$

12. $\frac{3}{2}x = \frac{2}{3}y$ **13.** $\frac{2}{3}x = 0.5y$

14. $x = 0$ **15.** $y = 0$

B. FORMATIVE ASSESSMENT

Activity

Objective : To draw the graph of a linear equation.

Materials Required : Graph paper, geometry box, etc.

Procedure : Let us draw the graph of the equation $x + 2y = 11$

1. Write the given equation $x + 2y = 11$ as $y = \frac{11 - x}{2}$

2. Give some suitable values to x and find the corresponding values of y.

When $x = 1$, then $y = \frac{11-1}{2} = \frac{10}{2} = 5$

When $x = 3$, then $y = \frac{11-3}{2} = \frac{8}{2} = 4$

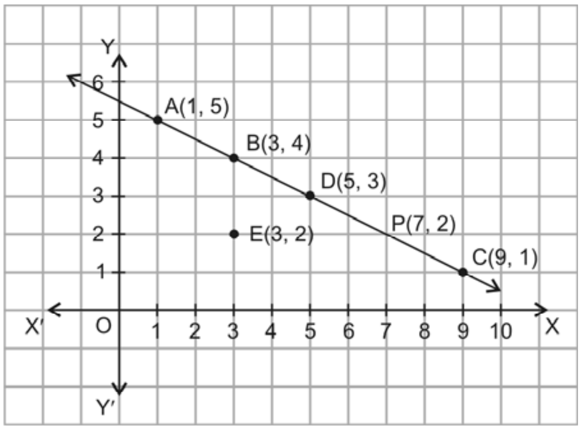
When $x = 9$, then $y = \frac{11-9}{2} = \frac{2}{2} = 1$

3. Put the corresponding values of x and y in the tabular form as shown below.

x	1	3	9
y	5	4	1

4. Now plot the points A (1, 5), B (3, 4) and C(9, 1) on a graph paper.
5. Join AB and extend it on both sides to obtain the required graph of the equation $x + 2y = 11$. Also check whether the point C(9, 1) lies on the line or not.
6. Pick another point on this line say D(5, 3). Check whether it is a solution of the given equation or not.
7. Now take any point not lying on the line AB say E(3, 2). Check whether it is a solution of the given equation or not.

Observations :



1. After joining AB, if we extend it on both sides, we see that the point C(9, 1) lies on the line AB. It means every point whose coordinates satisfy the given equation lies on the line AB.
2. The point D(5, 3) lies on the line AB.
   Also, $5 + 2 \times 3 = 5 + 6 = 11$. So, (5, 3) is a solution of the given equation.
   Similarly, the point P(7, 2) lies on the line AB.
   Also, $7 + 2 \times 2 = 7 + 4 = 11$. So, (7, 2) is solution of the given equation.
   It implies every point (a, b) on the line AB gives a solution $x = a$, $y = b$ of the given equation.
3. The point E(3, 2) does not lie on the line AB.
   Also, $3 + 2 \times 2 = 3 + 4 = 7 \neq 11$. It implies any point which does not lie on the line AB is not a solution of the given equation.

Conclusion : From the above activity, we can conclude that :

(i) Every point on the line satisfies the equation of the line.
(ii) Every solution of the equation is a point on the line.
(iii) Any point which does not lie on the line is not a soluton of the equation.

Do Yourself : Draw the graphs of each of the following equations :

1. $2x + y = 5$ **2.** $2x - y = 0$ **3.** $4x - y = -8$ **4.** $5x - 3y = 9$

In each case verify that :

(i) Every point on the line satisfies the equation.
(ii) Every solution of the equation is a point on the line.
(iii) Any point which does not lie on the line is not a solution of the equation.

ANSWERS

Practice Exercise 4.1A

1. (*b*) **2.** (*c*) **3.** (*d*) **4.** (*d*)

5. $2x + 3y - 4.37 = 0$, where $a = 2$, $b = 3$ and $c = -4.37$

6. $x - \sqrt{3}\,y - 4 = 0$, where $a = 1$, $b = -\sqrt{3}$ and $c = -4$

7. $-5x + 3y + 4 = 0$, where $a = -5$, $b = 3$ and $c = 4$

8. $2x - y + 0 = 0$, where $a = 2$, $b = -1$ and $c = 0$

9. $-2x + \sqrt{7}\,y + 0 = 0$, where $a = -2$, $b = \sqrt{7}$ and $c = 0$

10. $5x + 6y + 8 = 0$, where $a = 5$, $b = 6$ and $c = 8$

11. $x + 0.y - 17 = 0$ **12.** $0.x + y + 5 = 0$ **13.** $7x + 0.y + 8 = 0$ **14.** $0.x + 5y - 11 = 0$

15. $y = 4x$, where x is the cost of a notebook and y the cost of a book.

16. $y = 6x$, where x is the cost of one egg and y the cost of a bread.

17. $x - y + 150 = 0$; (50, 200), (100, 250)

Practice Exercise 4.2A

1. (*c*) **2.** (*c*) **3.** (*a*) **4.** (*b*)

5. (*b*) **6.** (*d*) **7.** (*b*) **8.** Solutions : $\left(0, \frac{7}{3}\right)$, (1, 2), (4, 1), (7, 0); Not solutions : (2, 5), (4, 3), (3, 1), (2, 1).

9. Solutions : (–2, 1) (0, 5), $\left(\frac{-5}{2}, 0\right)$; Not solutions : (2, 1), (1, –2), $\left(6, \frac{1}{2}\right)$ **10.** 19 **11.** –20

Practice Exercise 4.3A

1. (*d*) **2.** (*c*) **3.** (*d*)