Linear Equations in Two Variables

Exercise 4.1(Page 68 of Grade 9 NCERT Textbook)

Q1. 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 ₹x and that of a pen to be ₹y.)

Solution:

- Let the cost of one notebook be ₹x
- Let the cost of one pen be ₹y

Given: Cost of notebook is twice the cost of pen
Therefore, we can write the required linear equation in two variables considering the given information as,

Cost of notebook = 2 × Cost of pen
$\Rightarrow x = 2y$

Since any linear equation of two variables is expressed as: $ax + by + c = 0$,
$\therefore x - 2y = 0$ is the required linear equation in two variables which represents the given information.

Q2. Express the following linear equations in the form $ax + by + c = 0$ and indicate the values of a, b, 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) $5 = 2x$

Solution:

(i) Consider $2x+3y=9.3\bar{5}$ --------------- Equation (1)

=> $2x+3y-9.3\bar{5}=0$

Comparing this equation with the standard form of the linear equation in two variables, $ax + by + c = 0$ we have,

- $a=2$
- $b=3$
- $c=-9.3\bar{5}$

(ii) Consider $x-\frac{y}{5}-10=0$ --------------- Equation (1)

Comparing this equation with the standard form of the linear equation in two variables, $ax + by + c = 0$ we have,

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

(iii) Consider $-2x+3y=6$ --------------- Equation (1)

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

Comparing this equation with the standard form of the linear equation in two variables, $ax + by + c = 0$ we have,

- $a=-2$
- $b=3$
- $c=-6$

(iv) Consider $x=3y$ --------------- Equation (1)

=> $1x-3y+0=0$

Comparing this equation with the standard form of the linear equation in two variables, $ax + by + c = 0$, we have

- $a=1$
- $b=-3$
- $c=0$

(v) Consider $2x=-5y$ --------------- Equation (1)

=> $2x+5y+0=0$

Comparing this equation with the standard form of the linear equation in two variables, $ax + by + c = 0$ we have,

- $a=2$
- $b=5$
- $c=0$

(vi) Consider $3x+2=0$ ---------------- Equation (1)

We can re-write Equation (1) as shown below,

$$3x+0y+2=0$$

Comparing this equation with the standard form of the linear equation in two variables, $ax + by + c = 0$ we have,

- $a=3$
- $b=0$
- $c=2$

(vii) Consider $y-2=0$ ---------------- Equation (1)

We can re-write Equation (1) as shown below,

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

Comparing this equation with the standard form of the linear equation in two variables, $ax + by + c = 0$ we have,

- $a=0$
- $b=1$
- $c=-2$

(vii) $5=2x$ ---------------- Equation (1)

$$2x+0y-5=0$$

Comparing this equation with the standard form of the linear equation in two variables, $ax + by + c = 0$ we have,

- $a=2$
- $b=0$
- $c=-5$

Linear Equations in Two Variables

Exercise 4.2 (Page 70 of Grade 9 NCERT Textbook)

Q1. 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

Difficulty Level:
Easy

What is known/given?
Linear equation $y = 3x + 5$

What is Unknown?
Number of solutions of the given equation.

Reasoning:
We can check number of solutions by putting different values of x and get different values of y.

Solution:
We know that

- $y = 3x + 5$ is a linear equation in two variables in the form of $ax + by + c = 0$
- For $x = 0$, $y = 0 + 5 = 5$ Therefore, (0, 5) is one solution.
- For $x = 1$, $y = 3 \times 1 + 5 = 8$ Therefore, (1, 8) is another solution.
- For $y = 0$, $3x + 5 = 0$, $x = -\frac{5}{3}$ Therefore, $\left(-\frac{5}{3}, 0\right)$ is another solution.

Clearly, for different values of x, we get various value for y.

Thus, any value substituted for x in the given equation will constitute another solution for the given equation.

So, there is no end to the number of different solutions obtained on substituting real values for x in the given linear equation. Therefore, a linear equation in two variables has infinitely many solutions.

Hence (iii) is the correct answer

Q2. Write four solutions for each of the following equations:

(i) $2x+y=7$

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

(iii) $x=4y$

Difficulty Level:

Easy

What is known/given?

Linear equations

What is Unknown?

Four solutions of each equation.

Reasoning:

We can find any number of solutions by putting different values of x and get different values of y.

Solution:

(i) $2x+y=7$

Given,

Linear Equation, $2x+y=7$

$\therefore y=7-2x$ ---------- Equation (1)

Let us now take different values of x and substitute in Equation (1), we get

For $x=0$, we get $y=7-2(0) \Rightarrow y=7$. Hence, we get $(x, y)=(0, 7)$

For $x=1$, we get $y=7-2(1) \Rightarrow y=5$. Hence, we get $(x, y)=(1, 5)$

For $x=2$, we get $y=7-2(2) \Rightarrow y=3$. Hence, we get $(x, y)=(2, 3)$

For $x=3$, we get $y=7-2(3) \Rightarrow y=1$. Hence, we get $(x, y)=(3, 1)$

Therefore, the four solutions of the given equation are (0,7), (1,5), (2, 3) and (3,1)

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

Given,

Linear Equation, $\pi x+y=9$

$\therefore y=9-\pi x$ ------------- Equation (1)

Let us now take different values of x and substitute in Equation (1), we get

For $x=0$, $y=9-\pi(0) \Rightarrow y=9$. Hence, we get $(x, y)=(0, 9)$

For $x=1$, $y=9-\pi(1) \Rightarrow 9-\pi$. Hence, we get $(x, y)=(1, 9-\pi)$

For $x=2$, $y=9-\pi(2) \Rightarrow 9-2\pi$. Hence, we get $(x, y)=(2, 9-2\pi)$

For $x=3$, $y=9-\pi(3) \Rightarrow 9-3\pi$. Hence, we get $(x, y)=(3, 9-3\pi)$

Therefore, the four solutions of the given equation are
$(0,9),\ (1,9-\pi),\ (2,9-2\pi),\ (3,9-3\pi)$

(iii) $x = 4y$

Given,
Linear Equation, $x = 4y$

$\therefore\ y = \frac{x}{4}$ ------------ Equation (1)

Let us now take different values of x and substitute in Equation (1), we get

For $x = 0,\ y = \frac{0}{4} = 0.$ Hence, we get $(x, y) = (0, 0)$

For $x = 0,\ y = \frac{1}{4}.$ Hence, we get $(x, y) = \left(0, \frac{1}{4}\right)$

For $x = 2,\ y = \frac{2}{4} = \frac{1}{2}.$ Hence, we get $(x, y) = \left(2, \frac{1}{2}\right)$

For $x = 3,\ y = \frac{3}{4}.$ Hence, we get $(x, y) = \left(3, \frac{3}{4}\right)$

Therefore, the four solutions of the given equation are $(0, 0)$, $\left(1, \frac{1}{4}\right)$, $\left(2, \frac{1}{2}\right)$ and $\left(3, \frac{3}{4}\right)$

Q3. 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)

Difficulty Level:
Easy

What is known/given?
Linear equation $x - 2y = 4$

What is Unknown?
Given values are solution or not of the equation.

Reasoning:
We can substitute the values in the given equation and can check whether LHS is equal to RHS or not.

Solution:

Given: $x-2y=4$ is a Linear Equation of the form

$ax+by+c=0$ ------------- Equation (1)

(i) Consider (0, 2)

By Substituting x = 0 and y = 2 in the given Equation (1)

$$x-2y=4$$
$$0-2(2)=4$$
$$0-4=4$$
$$-4\neq 4$$
$$L.H.S\neq R.H.S$$

Therefore, (0, 2) is not a solution of this equation.

(ii) Consider (2, 0)

By Substituting, x = 2 and y = 0 in the given Equation (1),

$$x-2y=4$$
$$2-2(0)=4$$
$$2-0=4$$
$$2\neq 4$$
$$L.H.S\neq R.H.S$$

Therefore, (2, 0) is not a solution of this equation.

(iii) Consider (4, 0)

By Substituting, x = 4 and y = 0 in the given Equation (1)

$$x-2y=4$$
$$4-2(0)=4$$
$$4-0=4$$
$$4=4$$
$$L.H.S=R.H.S$$

Therefore, (4, 0) is a solution of this equation.

(iv) ($\sqrt{2}$, 4 $\sqrt{2}$)

By Substituting, $x=\sqrt{2}$ and y= 4$\sqrt{2}$ in the given Equation (1)

$$x-2y=4$$
$$\sqrt{2}-8\sqrt{2}=4$$
$$-7\sqrt{2}\neq 4$$
$$L.H.S\neq R.H.S$$

Therefore, ($\sqrt{2}$,4$\sqrt{2}$) is not a solution of this equation.

(v) (1, 1)

By Substituting, $x = 1$ and $y = 1$ in the given Equation (1)

$$x - 2y = 4$$
$$1 - 2(1) = 4$$
$$1 - 2 = 4$$
$$-1 \neq 4$$
$$L.H.S \neq R.H.S$$

Therefore, (1, 1) is not a solution of this equation.

Q4. Find the value of k, if $x = 2$, $y = 1$ is a solution of the equation $2x + 3y = k$.

Difficulty Level:

Easy

What is known/given?

Linear equation $2x + 3y = k$.

What is Unknown?

Value of k.

Reasoning:

We can find value of k by substituting the values of x *and* y in the given equation.

Solution:

Given: $2x + 3y = k$ is the Linear Equation ---------------- Equation (1)

- $x = 2$
- $y = 1$
- $k = ?$

By substituting the values of x and y in Equation (1),

$$2x + 3y = k$$
$$\Rightarrow \quad 2(2) + 3(1) = k$$
$$\Rightarrow \quad 4 + 3 = k$$
$$\Rightarrow \quad \text{Hence, } k = 7$$

Therefore, the value of k is 7.

Linear Equations in Two Variables

Exercise 4.3 (Page 74 of Grade 9 NCERT Textbook)

Q1. 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) $3 = 2x + y$

Difficulty Level:
Easy

What is known/given?
Linear equations

What is Unknown?
How to draw graph

Reasoning:
First of all, we can draw table for different values of x and y and then with the help of the values we can plot graph for each equation.

Solution:
(i) $x + y = 4$
Re-write the equation as

$$x + y = 4$$
$$\Rightarrow \; y = 4 - x \quad ----------------- \quad \text{Equation}(1)$$

By substituting the different values of x in the Equation (1), we get different values for y

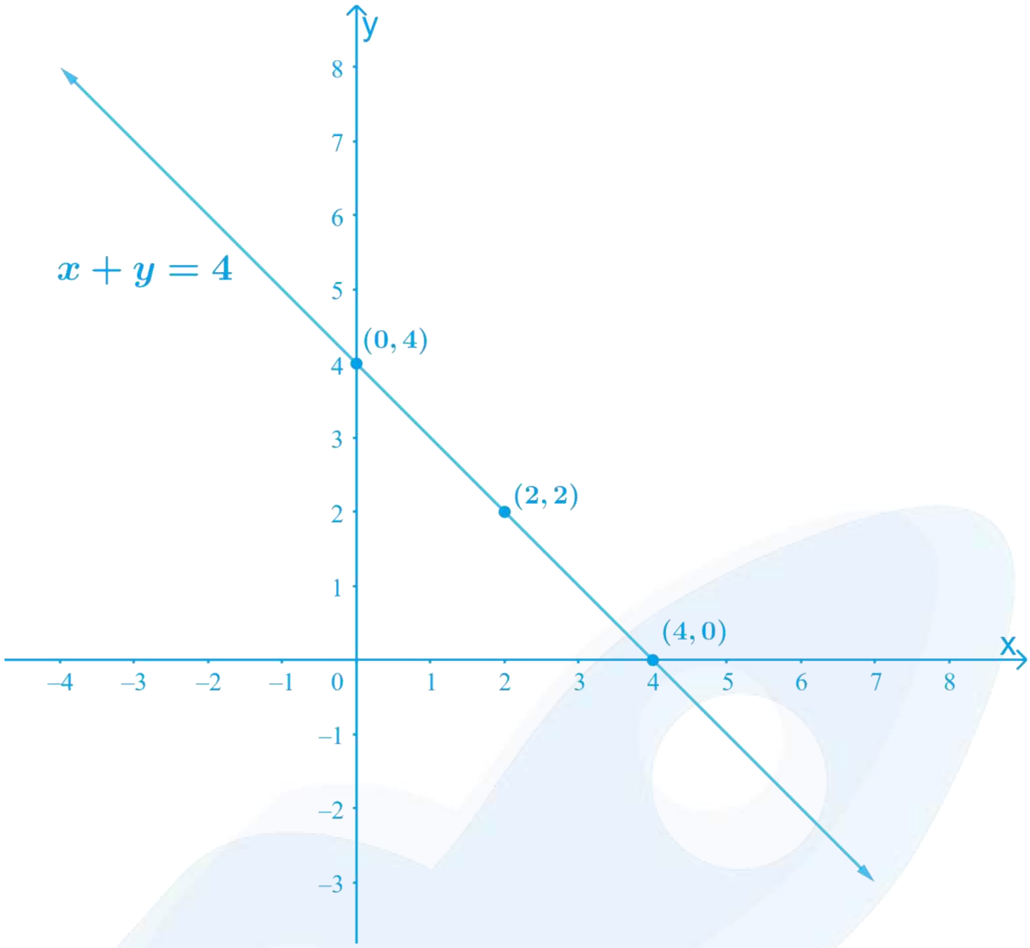
- When $x = 0$, we have: $y = 4 - 0 = 4$
- When $x = 2$, we have: $y = 4 - 2 = 2$
- When $x = 4$, we have: $y = 4 - 4 = 0$

Thus, we have the following table with all the obtained solutions:

x	0	2	4
y	4	2	0

By Plotting the points (0, 4) (2, 2) and (4, 0) on the graph paper and drawing a line joining the corresponding points, we obtain the Graph.

The graph of the line represented by the given equation is as shown.



(ii) $x - y = 2$

Re-write the equation as

$$x - y = 2$$

$$\Rightarrow \quad y = x - 2 \quad \text{-------------------} \quad \text{Equation } (1)$$

By substituting the different values of x in the Equation (1) we get different values for y

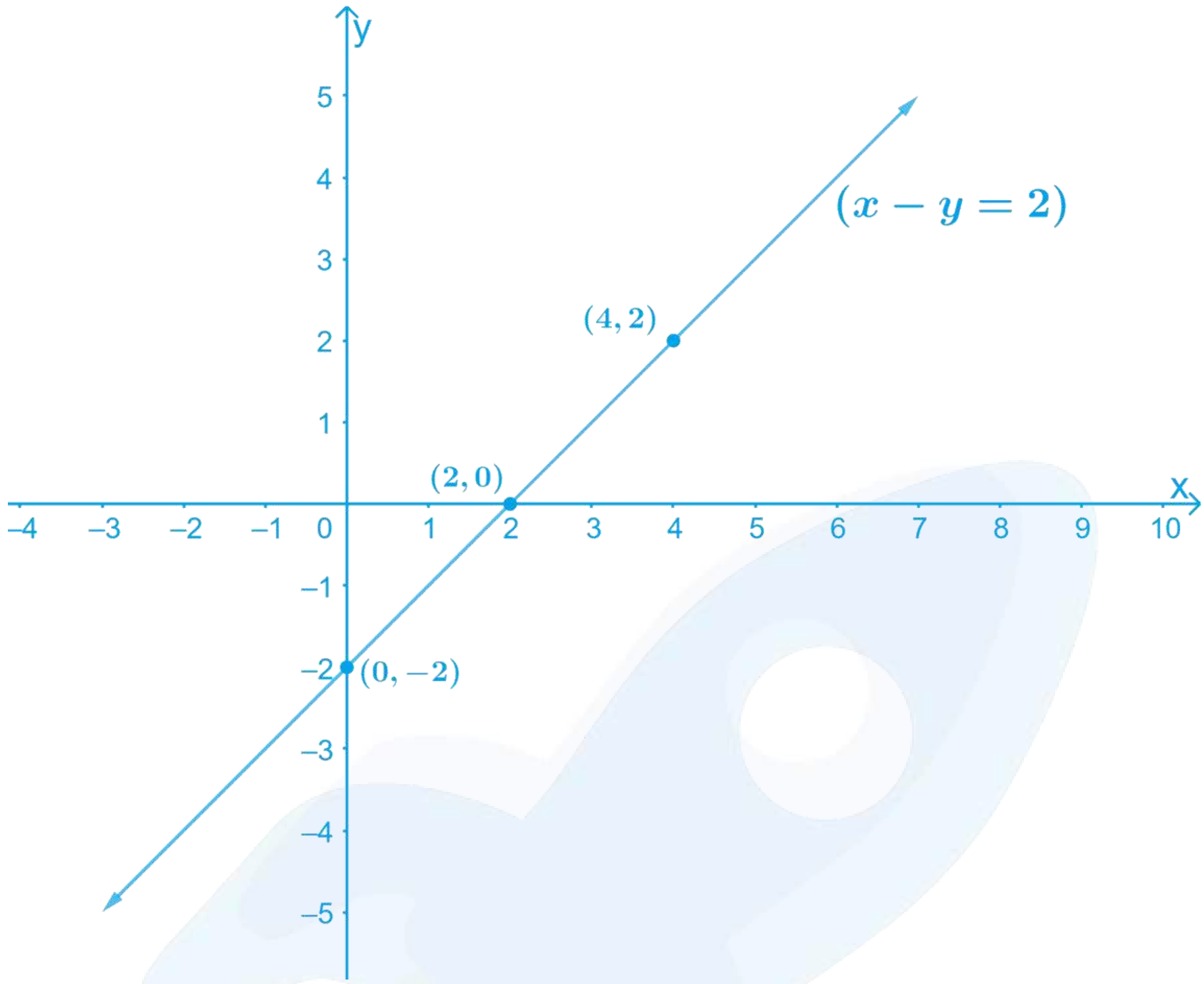
- When $x = 0$, we have $y = 0 - 2 = -2$
- When $x = 2$, we have $y = 2 - 2 = 0$
- When $x = 4$, we have $y = 4 - 2 = 2$

Thus, we have the following table with all the obtained solutions:

x	0	2	4
y	–2	0	2

By Plotting the points (0, –2), (2, 0) and (4, 2) on the graph paper and drawing a line joining the corresponding points, we obtain the Graph.

The graph of the line represented by the given equation is as shown



(iii) $y = 3x$

By substituting the different values of x in the Equation (1) we get different values for y

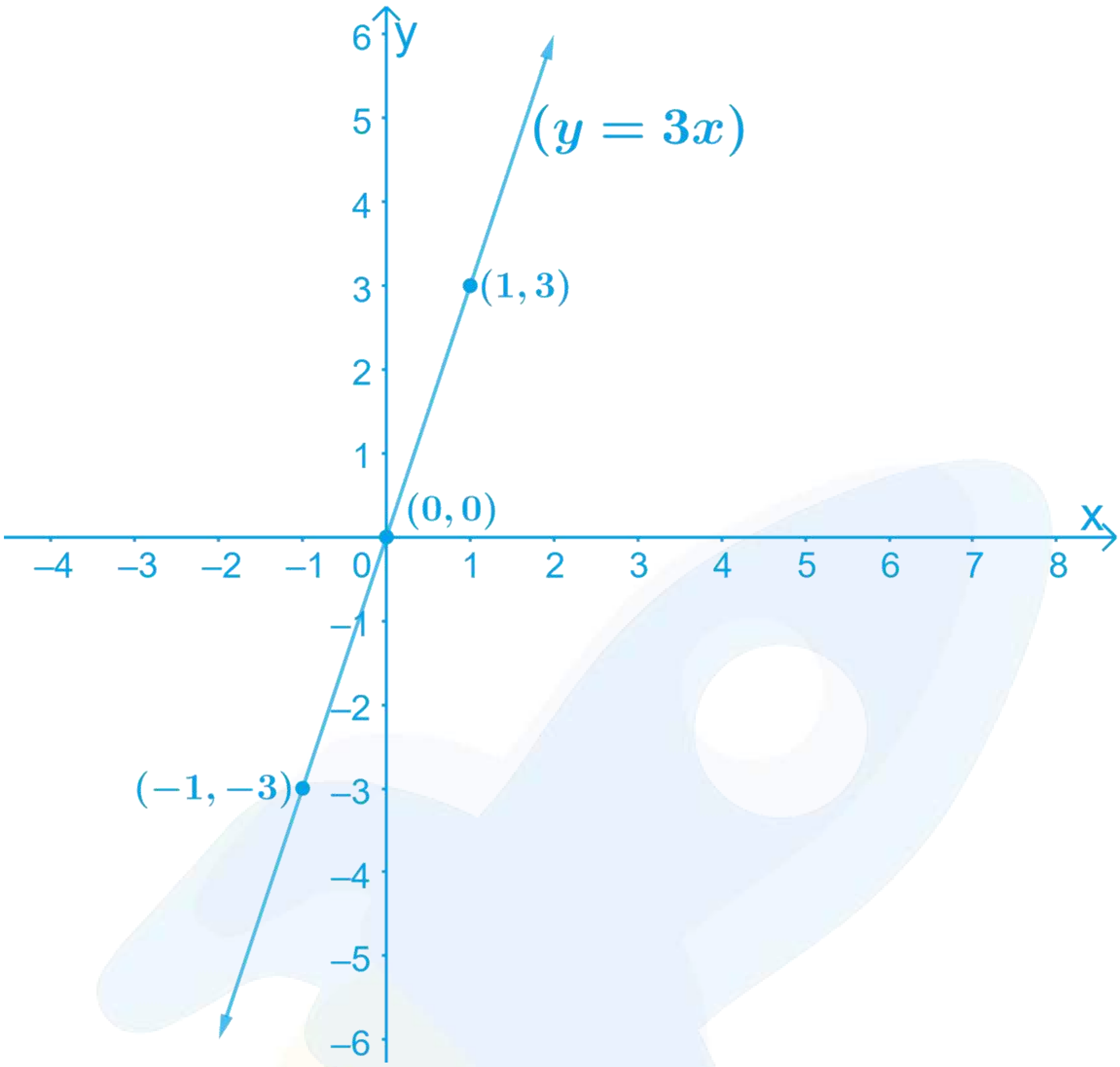
- When $x = 0$, we have: $y = 3(0) = 0$
- When $x = 1$, we have: $y = 3\ (1) = 3$
- When $x = –1$, we have: $y = 3(–1) = –3$

Thus, we have the following table with all the obtained solutions:

x	0	1	–1
y	0	3	–3

By Plotting the points (0, 0), (1, 3) and (–1, –3) on the graph paper and drawing a line joining the corresponding points, we obtain the Graph.

The graph of the line represented by the given equation is as shown:



(iv) $3 = 2x + y$

$$3 = 2x + y$$

Re-write the equationas $y = 3 - 2x$ ------------------ Equation (1)

By substituting the different values of x in the Equation (1) we get different values for y

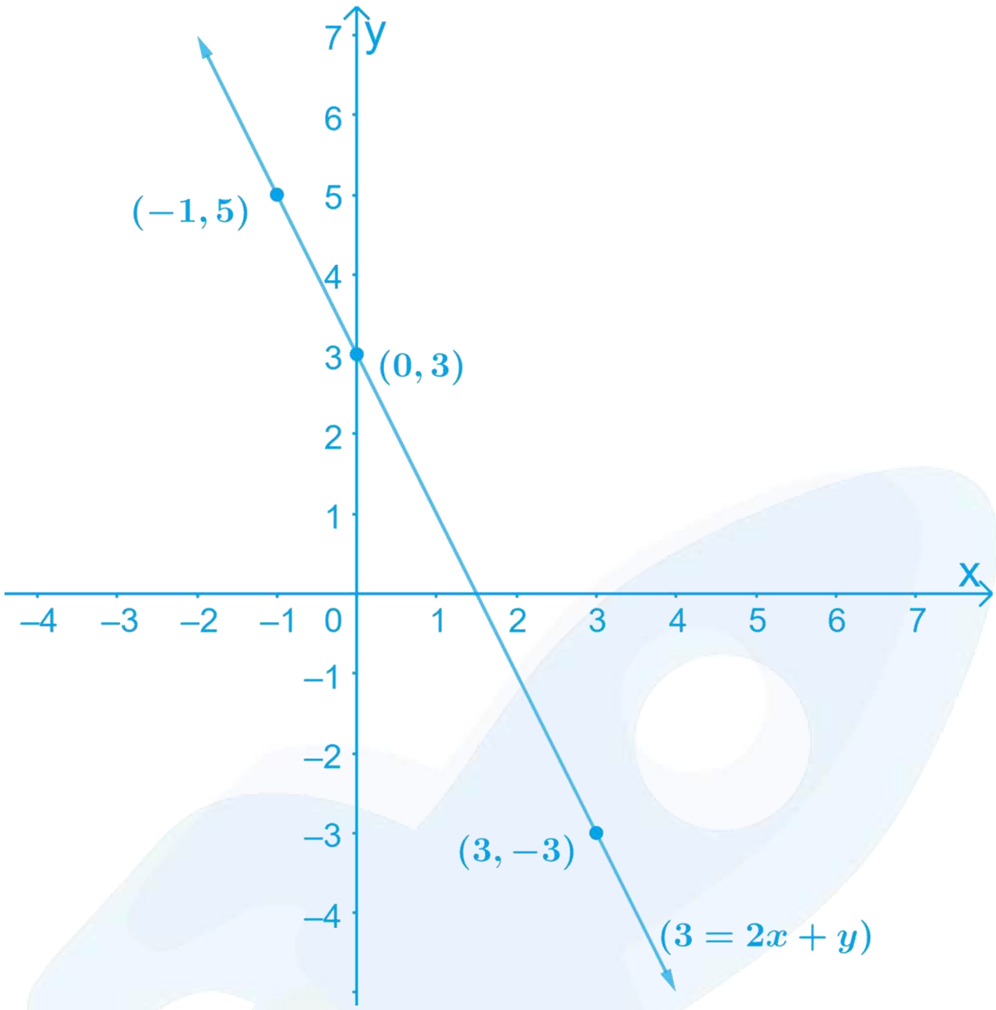
- When $x = 0$, we have: $y = 3 - 2(0) = 3 - 0 = 3$
- When $x = 3$, we have: $y = 3 - 2(3) = 3 - 6 = -3$
- When $x = -1$, we have: $y = 3 - 2(-1) = 3 + 2 = 5$

Thus, we have the following table with all the obtained solutions:

x	0	3	–1
y	3	–3	5

By Plotting the points (0, 3), (3, –3) and (–1, 5) on the graph paper and drawing a line joining the corresponding points, we obtain the Graph.

The graph of the line represented by the given equation is as shown.



Q2. Give the equations of two lines passing through (2, 14). How many more such lines are there, and why?

Difficulty Level:
Easy

What is known/given?
Point (2, 14) at which line passes through

What is Unknown?
Equation of line and number of lines which can passes through the given point.

Reasoning:
We can think for those equations which could satisfy the given point.

Solution:

- It can be observed that point (2, 14) satisfies the equation $7x - y = 0$ and $x - y + 12 = 0$.

Therefore, $7x - y = 0$ and $x - y + 12 = 0$ are two lines passing through point (2, 14).

As it is known that through one-point, infinite number of lines can pass through, therefore, there are infinite lines of such type passing through the given point.

Q3. If the point (3, 4) lies on the graph of the equation $3y = ax + 7$, find the value of a.

Difficulty Level:
Easy

What is known/given?
Linear equation $3y = ax + 7$.

What is Unknown?
Value of a.

Reasoning:
We can find value of a by substituting the values of x and y in the given equation

Solution:
Given:

- $3y = ax + 7$ is the Linear Equation -----------Equation (1)
- Point (3, 4) lies on the Equation (1)

By Substituting the value of $x = 3$ and $y = 4$ in the Equation (1),

$$3y = ax + 7$$
$$3(4) = a(3) + 7$$
$$12 - 7 = 3a$$
$$5 = 3a$$

Hence, the value $a = \frac{5}{3}$

Q4. The taxi fare in a city is as follows: For the first kilometer, the fare is ₹8 and for the subsequent distance it is ₹5 per km. Taking the distance covered as x km and total fare as ₹y, write a linear equation for this information, and draw its graph.

Difficulty Level:
Medium

What is known/given?
Distance covered is x km and total fare is ₹y. Also fare of first kilometer is ₹8 and for subsequent distance is ₹5

What is Unknown?

Linear equation for given condition and also graph of it.

Reasoning:

We know fare for first km and add the fare of subsequent distance and the result will form linear equation. After that by finding the solution for linear equation we can draw graph of it.

Solution:

Given,

- Let the Total distance covered = x km
- Let the Total fare covered = ₹y
- Therefore, subsequent distance = $(x - 1)$ km
- Fare for the subsequent distance = ₹5 $(x - 1)$
- Fare for 1st kilometer = ₹8

The linear equation for the above information is given by,

$$\text{Total fare } (y) = \left[8 + (x - 1)5\right]$$

$$y = 8 + 5x - 5$$

$$y = 5x + 3$$

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

Re-write the equation by transposing as $y = 5x + 3$ ------------ Equation (1)

By substituting different values of x in the Equation (1) we get different values for y

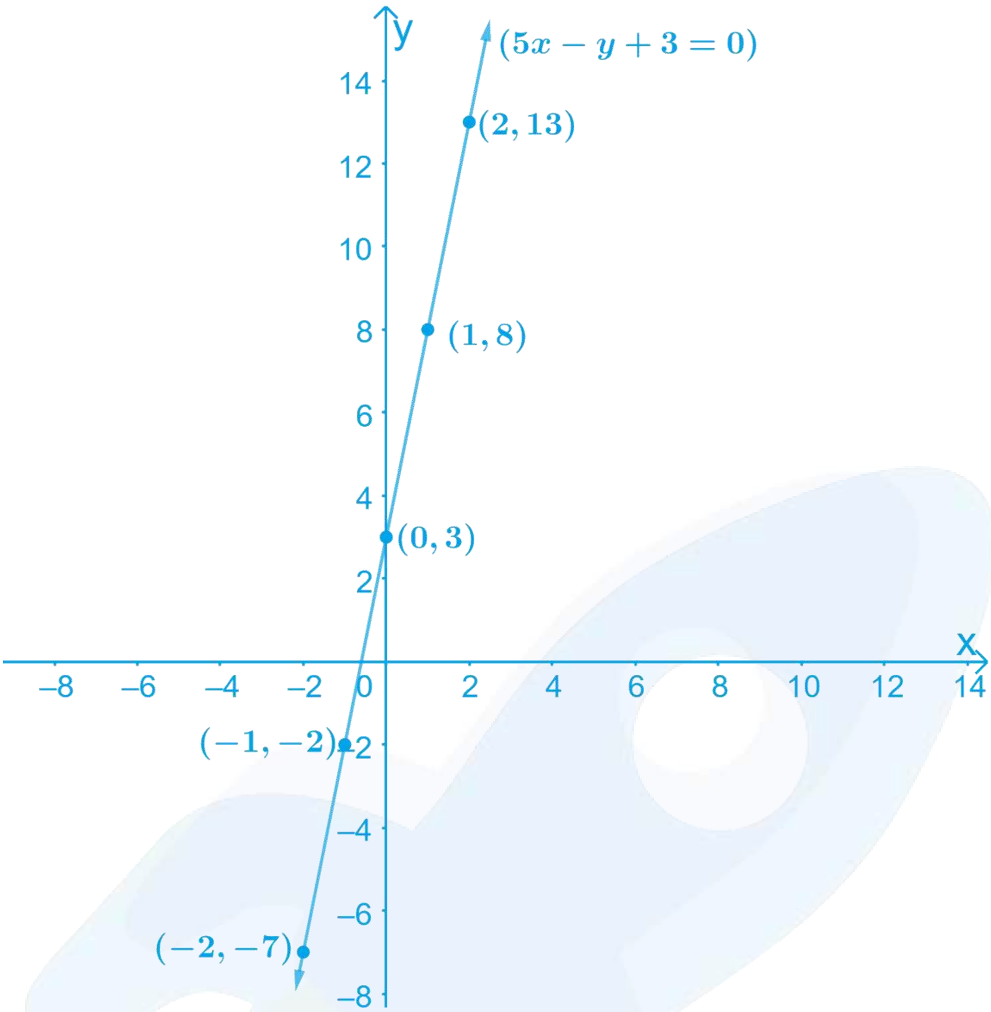
- When $x = 0$, $y = 5 \times 0 + 3 = 0 + 3 = 3$
- When $x = 1$, $y = 5 \times (1) + 3 = 5 + 3 = 8$
- When $x = 2$, $y = 5 \times (2) + 3 = 10 + 3 = 13$
- When $x = -1$, $y = 5 \times (-1) + 3 = -5 + 3 = -2$
- When $x = -2$, $y = 5 \times (-2) + 3 = -10 + 3 = -7$

Thus, we have the following table with all the obtained solutions:

x	0	1	2	−1	−2
y	3	8	13	−2	−7

By Plotting the points (0, 3), (1, 8), (2, 13), (−1, −2), (−2, −7) on the graph paper and drawing a line joining them, we obtain the required graph

The graph of the line represented by the given equation as shown:

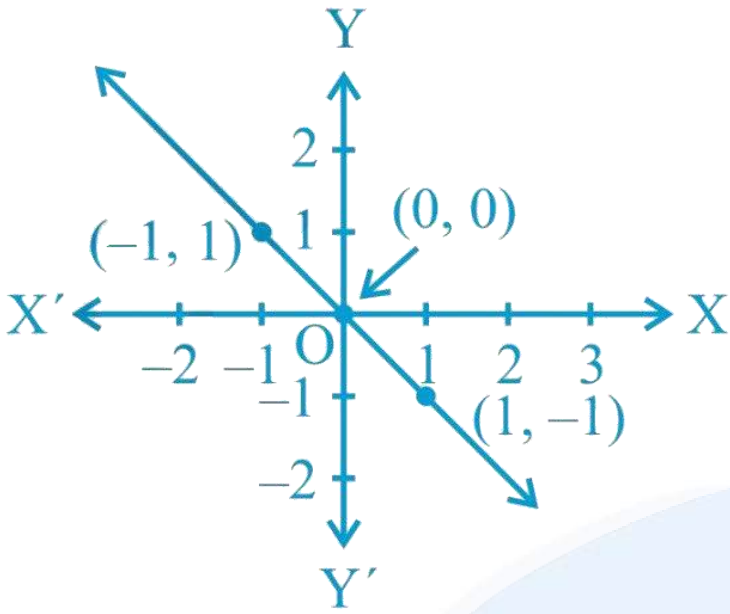


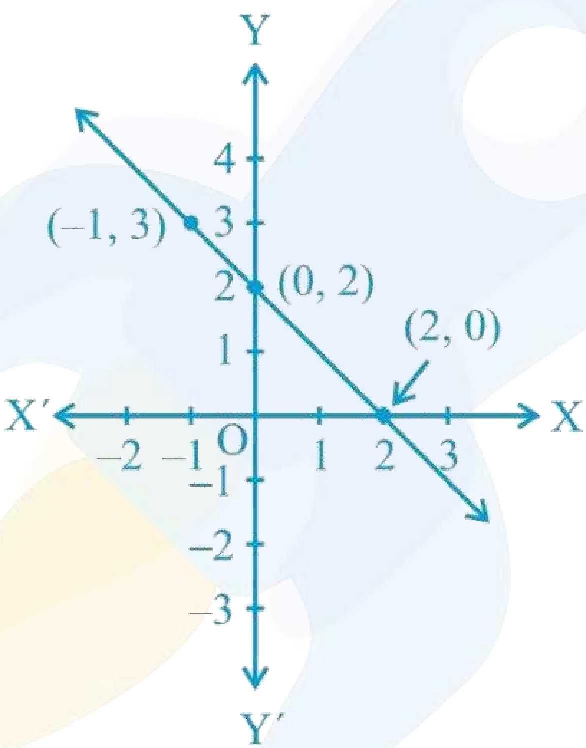
Here, the variable *x* and *y* are representing the distance covered and the fare paid for that distance respectively and these quantities may not be negative.

Hence, only those values of *x* and *y* which are lying in the 1st quadrant will be considered.

Q5. From the choices given below, choose the equation whose graphs are given in the following figures.

For the first figure		For the second figure	
(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)	$x + 2y = 6$





Difficulty Level:
Medium

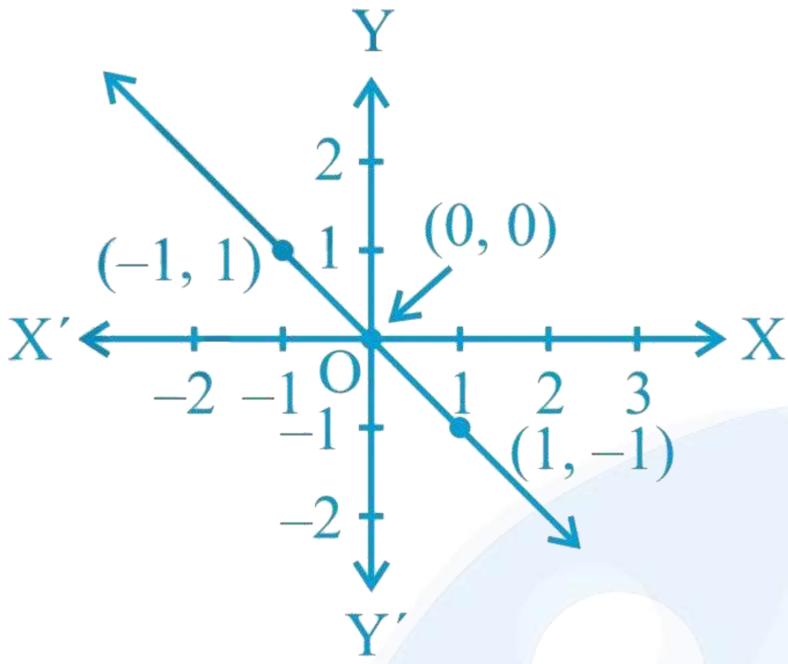
What is known/given?
Graph and equations

What is Unknown?
Given equations is of which graph

Reasoning:
We can check by substituting coordinate values in given equations

Solution:

For the First Figure:

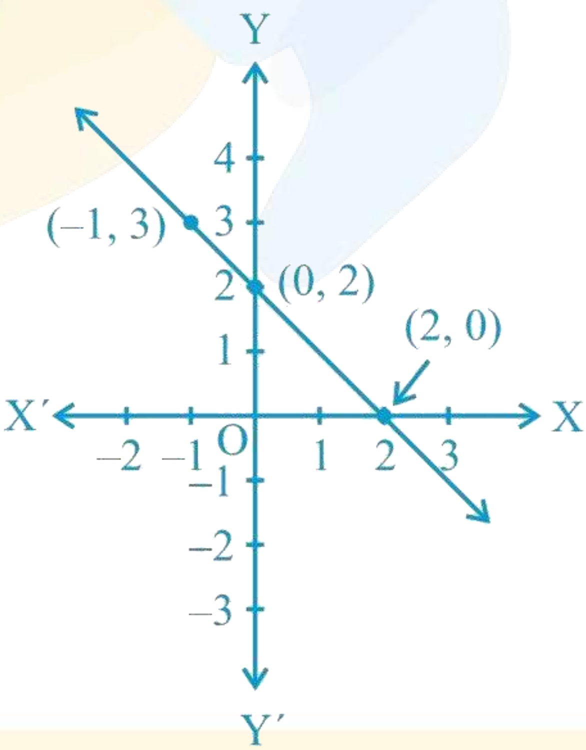


- Points on the given line are (−1, 1), (0, 0), and (1, −1).
- It can be observed that the coordinates of the points of the graph satisfy the equation $x + y = 0$.

Therefore, $x + y = 0$ is the equation corresponding to the graph as shown in the first figure.

Hence, (ii) is the correct answer.

For the Second Figure:



- Points on the given line are (−1, 3), (0, 2), and (2, 0).
- It can be observed that the coordinates of the points of the graph satisfy the equation $y = -x + 2$.

Therefore, $y = -x + 2$ is the equation corresponding to the graph shown in the second figure. Hence, (iii) is the correct answer.

Q6. 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

Difficulty Level:
Medium

What is known/given?
Force is directly proportional to the distance travelled by the body

What is Unknown?
Formation of linear equation in two variables and graph for it.

Reasoning:
First, we can consider distance travelled and work done as x and y and then apply the direct proportion property. After forming equation, we can find solution and draw graph for it.

Solution:
- Let the distance travelled and the work done by the body be x and y respectively.
- The constant force applied on the body is 5 units.
- Work done $\propto$ distance travelled

Hence, $y \propto x$

$$y = kx \quad ----------- \quad \text{Equation (1)}$$

Where, k is the constant force applied on the body

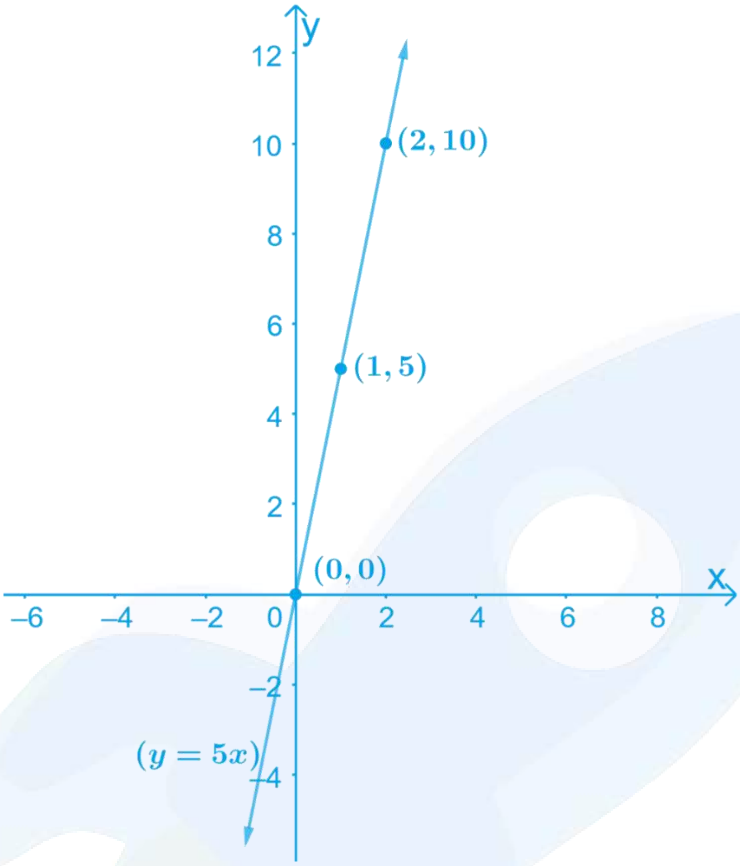
Considering the value of k = 5 units to solve for x and y
By substituting different values for x in the Equation (1) we get different values for y
- When x= 0, y = 0
- When x= 1, y = 5
- When x = 2, y= 10

Thus, we have the following table with all the obtained solutions:

x	0	1	2
y	0	5	10

By Plotting (0, 0), (1,5) and (2, 10) on the graph paper and drawing a line joining them we obtain the required graph

The graph of the line represented by the given equation is as shown.



(i) From the graphs, it can be observed that the value of y corresponding to $x = 2$ is 10 units. This implies that the work done by the body is 10 units when the distance travelled by it is 2 units.

(ii) From the graphs, it can be observed that the value of y corresponding to $x = 0$ is 0. This implies that the work done by the body is 0 units when the distance travelled by it is 0 unit.

Q7. Yamini and Fatima, two students of Class IX of a school, together contributed ₹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 ₹x and ₹y.) Draw the graph of the same.

Difficulty Level:

Easy

What is known/given?

Yamini and Fatima together contributed ₹ 100

What is Unknown?

Yamini and Fatima contributions and graph for the same.

Reasoning:

We can let Yamini and Fatima contributions as ₹x and ₹y and form linear equation. Then find x and y value to draw graph.

Solution:

- Let the amount that Yamini and Fatima have contributed individually be ₹x and ₹y respectively towards the Prime Minister's Relief fund.
- The total amount contributed by Yamini and Fatima together is = ₹100

Therefore, $x + y = 100$

On transposing, $y = 100 - x$

This is a linear equation in two variables of the form $ax + by + c = 0$

- Let us consider this as, $y = 100 - x$ -----------Equation (1)

By substituting different values of x in the Equation (1), we get different values for y

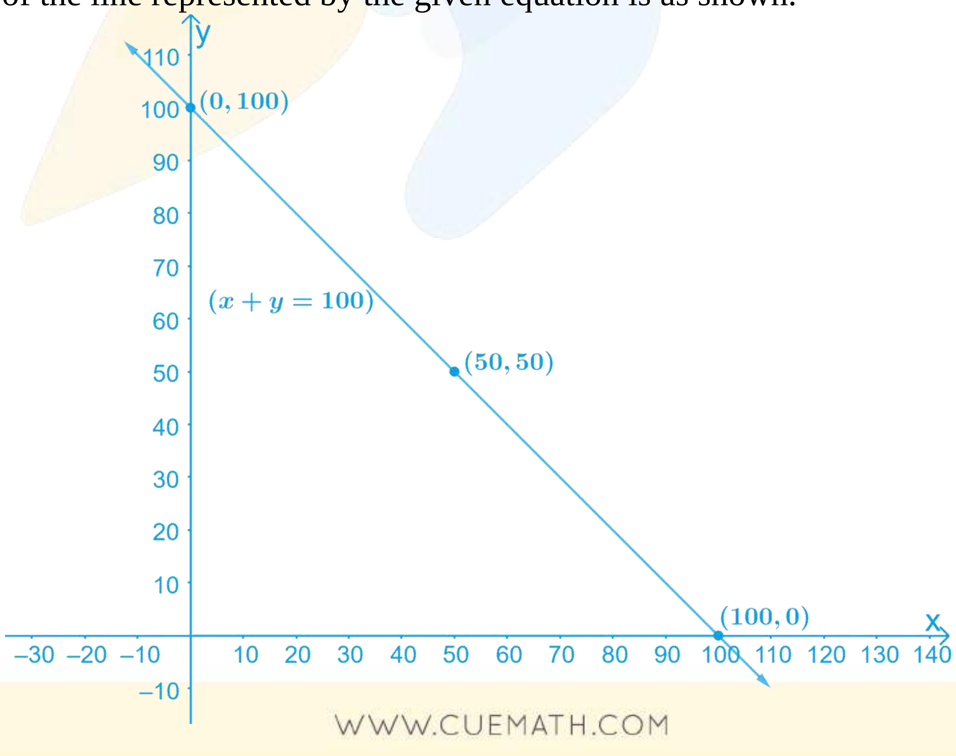
- When $x = 0$, $y = 100$
- When $x = 50$, $y = 50$
- When $x = 100$, $y = 0$

Thus, we have the following table with all the obtained values of x and y:

x	0	50	100
y	100	50	0

By Plotting the points (0, 100), (100, 0) and (50, 50) on the graph paper and drawing a line joining them, we obtain the required graph

The graph of the line represented by the given equation is as shown.



Here, variable x and y are representing the amount contributed by Yamini and Fatima respectively and these quantities cannot be negative. Hence, only those values of x and y which are lying in the 1st quadrant are considered.

Q8. In countries like USA and Canada, the 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:

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

(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.

Solution:

(i) Given,

$$F = \left(\frac{9}{5}\right)C + 32 \text{ ------------------ Equation (1)}$$

Equation (1) represents a linear equation of the form $ax + by + c = 0$ where C and F are the two variables.

By substituting different values for C in the Equation (1), we obtain different values for F

When C = 0, $F = \left(\frac{9}{5}\right)C + 32 = \left(\frac{9}{5}\right)0 + 32 = 32$

When C = – 40, $F = \left(\frac{9}{5}\right) \times (-40) + 32 = -72 + 32 = -40$

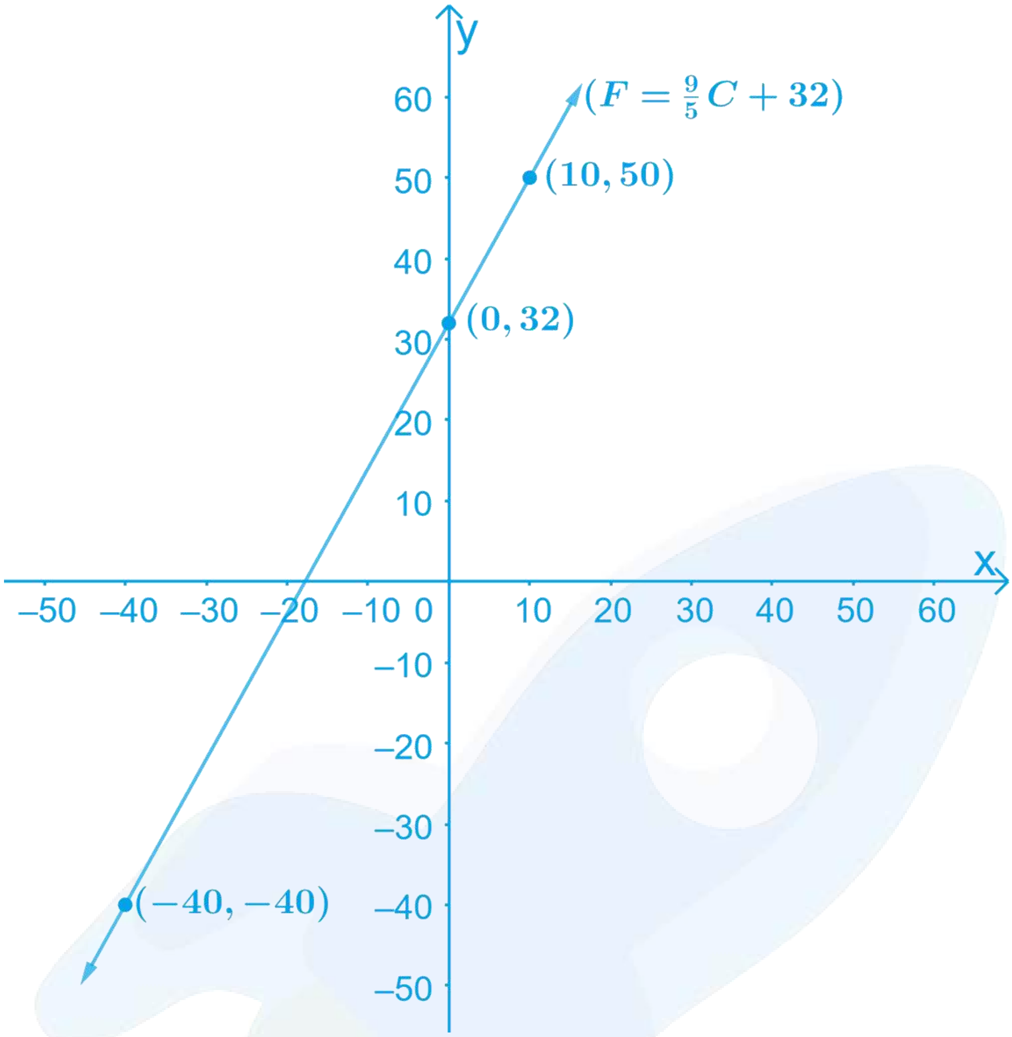
When C = 10, $F = \left(\frac{9}{5}\right) \times (10) + 32 = 18 + 32 = 50$

Thus, we have the following table with all the obtained solutions:

x	0	-40	10
y	32	-40	50

By Plotting the points (– 40, – 40) and (10, 50) on the graph point. On joining these points by line segment, we obtain the required graph

The graph of the line represented by the given equation as shown.



(ii) Given: Temperature = 30 °C

To find: F=?

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

By Substituting the value of C = 30° C in the Equation above,

$$F = \left(\frac{9}{5}\right)C + 32$$
$$= \left(\frac{9}{5}\right)30 + 32$$
$$= 54 + 32$$
$$= 86$$

Therefore, the temperature in Fahrenheit is 86° F.

(iii) Given, Temperature = 95 °F

To find, C =?

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

By Substituting the value of temperature in the above Equation,

$$95=\left(\frac{9}{5}\right)C+32$$

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

$$63=\left(\frac{9}{5}\right)C$$

$$C=\frac{63\times5}{9}$$

$$C=35$$

Therefore, the temperature in Celsius is 35° C.

(iv) We know that, $F=\left(\frac{9}{5}\right)C+32$

If $C=0°$ C, then by Substituting this value in the above Equation,

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

$$F=0+32$$

$$F=32$$

Therefore, if C = 0° C, then F = 32° F

If $F=0°$ F, then by Substituting this value in the above Equation,

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

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

$$C=\frac{-32\times5}{9}$$

$$C=-17.77$$

Therefore, if $F=0°$ F, then $C=-17.8°$ C

(v) We know that, $F=\left(\frac{9}{5}\right)C+32$

Let us consider, F = C

By Substituting this value in the Equation above,

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

$$\left(\frac{9}{5}-1\right)F+32=0$$

$$\left(\frac{4}{5}\right)F=-32$$

$$F=\frac{-32\times5}{4}$$

Hence, F = –40

Yes, there is a temperature, −40°, which is numerically the same in both Fahrenheit and Celsius.

Linear Equations in Two Variables

Exercise 4.4 (Page 77 of Grade 9 NCERT Textbook)

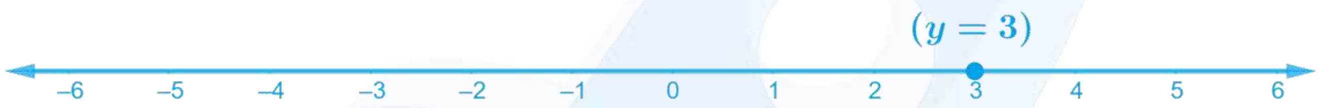
Q1. Give the geometric representation of $y = 3$ as an equation
(i) in one variable
(ii) in two variables

Solution:

(i) Given,

- Considering $y = 3$ is the equation in one variable.
- The representation of the solution on the number when $y = 3$ is treated as an equation in one variable.

In one variable, $y = 3$ represents a point as shown in following figure.



(ii) Given:

- Considering $y = 3$ is the equation in two variables

We know that $y = 3$ can be written as, $0.x + y = 3$.

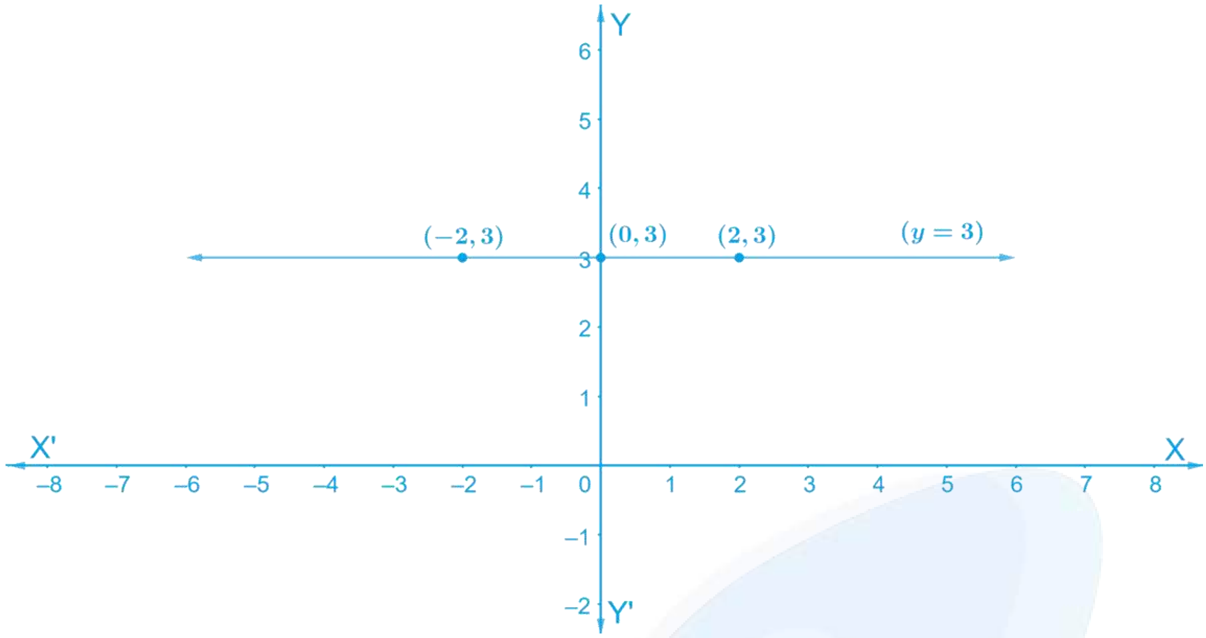
In two variables, $y = 3$ represents a straight line passing through point (0, 3) and parallel to x-axis. It is a collection of all the points on the plane, having their y-coordinate as 3.

Hence,

- When, $x = 0$, we get $y = 3$;
- When $x = 2$, we get $y = 3$;
- When $x = - 2$, we get y = 3 are the solutions for the equations.

Plotting the points (0, 3) (2, 3) and (–2, 3) and on joining them we get the graph AB as a line parallel to x-axis at a distance of 3 units above it.

The graphical representation is shown below:



Q2. Give the geometric representations of $2x + 9 = 0$ as an equation

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

Solution:

(i) Given: $2x + 9 = 0$ is the Linear Equation ------------ Equation (1)

$$2x + 9 = 0$$
$$2x = -9$$
$$x = -\frac{9}{2}$$
$$x = -4.5$$

Hence, in one variable $2x + 9 = 0$ represents a point as shown in the following figure.

(ii) Given: $2x + 9 = 0$ is the Linear Equation ------------ Equation (1)

We know that $2x + 9 = 0$ can be written as $2x + 0y + 9 = 0$ as a linear equation in variables x and y.

Value of y is always 0. However, x must satisfy the relation $2x + 9 = 0$ i.e. $x = \frac{-9}{2} = -4.5$

Hence,

- When, $y = 0$, we get $x = –4.5$;
- When $y = 2$, we get $x = –4.5$;
- When $y = –2$, we get $x = –4.5$ are the solutions for the equations.

Hence three solution of the given equation are, $y = 0$; $y = 2$ and, $y = –2$.

Therefore, plotting the point and on joining them we get the graph AB as a line parallel to *y*-axis at a distance of on the left of *y*-axis It is a collection of all points of the plane, having their *x*-coordinate as 4.5.