Exercise 4.1

Question 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 ₹ x and that of a pen to be ₹ y).

Answer 1:

Here, the cost of notebook = ₹ x and the cost of pen = ₹ y

According to question, Cost of notebook = 2 × Cost of Pen

$\Rightarrow x = 2y \quad \Rightarrow x - 2y = 0$

Question 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)** $5 = 2x$

Answer 2:

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

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

Hence, here $a = 2,\ b = 3$ and $c = -9.3\overline{5}$.

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

$\Rightarrow x - \frac{1}{5}y - 10 = 0$

Hence, here $a = 1,\ b = -\frac{1}{5}$ and $c = -10$.

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

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

Hence, here $a = -2,\ b = 3$ and $c = -6$.

(iv) $x = 3y$

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

Hence, here $a = 1,\ b = -3$ and $c = 0$.

(v) $2x = -5y$

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

Hence, here $a = 2,\ b = 5$ and $c = 0$.

(vi) $3x + 2 = 0$

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

Hence, here $a = 3,\ b = 0$ and $c = 2$.

(vii) $y - 2 = 0$

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

Hence, here $a = 0,\ b = 1$ and $c = -2$.

(viii) $5 = 2x$

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

Hence, here $a = 2,\ b = 0$ and $c = -5$.

Exercise 4.2

Question 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

Answer 1:

(iii) Infinitely many solutions

Because a line has infinite many points and each point is a solution of the linear equation.

Question 2:

Write four solutions for each of the following equations:

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

Answer 2:

(i) $2x + y = 7 \Rightarrow y = 7 - 2x$

Putting $x = 0$, we have, $y = 7 - 2 \times 0 = 7$, therefore, $(0, 7)$ is a solution of the equation.

Putting $x = 1$, we have, $y = 7 - 2 \times 1 = 5$, therefore, $(1, 5)$ is a solution of the equation.

Putting $x = 2$, we have, $y = 7 - 2 \times 2 = 3$, therefore, $(2, 3)$ is a solution of the equation.

Putting $x = 3$, we have, $y = 7 - 2 \times 3 = 1$, therefore, $(3, 1)$ is a solution of the equation.

Hence, $(0, 7)$, $(1, 5)$, $(2, 3)$ and $(3, 1)$ are the four solutions of the equation $2x + y = 7$.

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

Putting $x = 0$, we have, $y = 9 - \pi \times 0 = 9$, therefore, $(0, 9)$ is a solution of the equation.

Putting $x = 1$, we have, $y = 9 - \pi \times 1 = 9 - \pi$, therefore, $(1, 9 - \pi)$ is a solution of the equation.

Putting $x = 2$, we have, $y = 9 - \pi \times 2 = 9 - 2\pi$, therefore, $(2, 9 - 2\pi)$ is a solution of the equation.

Putting $x = 3$, we have, $y = 9 - \pi \times 3 = 9 - 3\pi$, therefore, $(3, 9 - 3\pi)$ is a solution of the equation.

Hence, $(0, 9)$, $(1, 9 - \pi)$, $(2, 9 - 2\pi)$ and $(3, 9 - 3\pi)$ are the four solutions of the equation $\pi x + y = 9$.

(iii) $x = 4y$

Putting $y = 0$, we have, $x = 4 \times 0 = 0$, therefore, $(0, 0)$ is a solution of the equation.

Putting $y = 1$, we have, $x = 4 \times 1 = 4$, therefore, $(4, 1)$ is a solution of the equation.

Putting $y = 2$, we have, $x = 4 \times 2 = 8$, therefore, $(8, 2)$ is a solution of the equation.

Putting $y = 3$, we have, $x = 4 \times 3 = 12$, therefore, $(12, 3)$ is a solution of the equation.

Hence, $(0, 0)$, $(4, 1)$, $(8, 2)$ and $(12, 3)$ are the four solutions of the equation $x = 4y$.

Question 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)** $(1, 1)$

Answer 3:

(i) $(0, 2)$

Given equation: $x - 2y = 4$

In $x - 2y = 4$, putting $x = 0$ and $y = 2$, we have, $0 - 2 \times 2 = -4 \neq 4$

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

(ii) $(2, 0)$

Given equation: $x - 2y = 4$

In $x - 2y = 4$, putting $x = 2$ and $y = 0$, we have, $2 - 2 \times 0 = 2 \neq 4$

Hence, $(2, 0)$ is not a solution of the equation.

(iii) $(4, 0)$
Given equation: $x - 2y = 4$
In $x - 2y = 4$, putting $x = 4$ and $y = 0$, we have, $4 - 2 \times 0 = 4$
Hence, $(4, 0)$ is a solution of the equation.

(iv) $(\sqrt{2}, 4\sqrt{2})$
Given equation: $x - 2y = 4$
In $x - 2y = 4$, putting $x = \sqrt{2}$ and $y = 4\sqrt{2}$, we have, $\sqrt{2} - 2 \times 4\sqrt{2} = -7\sqrt{2} \neq 4$
Hence, $(\sqrt{2}, 4\sqrt{2})$ is not a solution of the equation.

(v) $(1, 1)$
Given equation: $x - 2y = 4$
In $x - 2y = 4$, putting $x = 1$ and $y = 1$, we have, $1 - 2 \times 1 = -1 \neq 4$
Hence, $(1, 1)$ is not a solution of the equation.

Question 4:

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

Answer 4:

Given equation: $x = 2$, $y = 1$
In $2x + 3y = k$, putting $x = 2$ and $y = 1$, we have,

$2 \times 2 + 3 \times 1 = k$

$\Rightarrow k = 7$

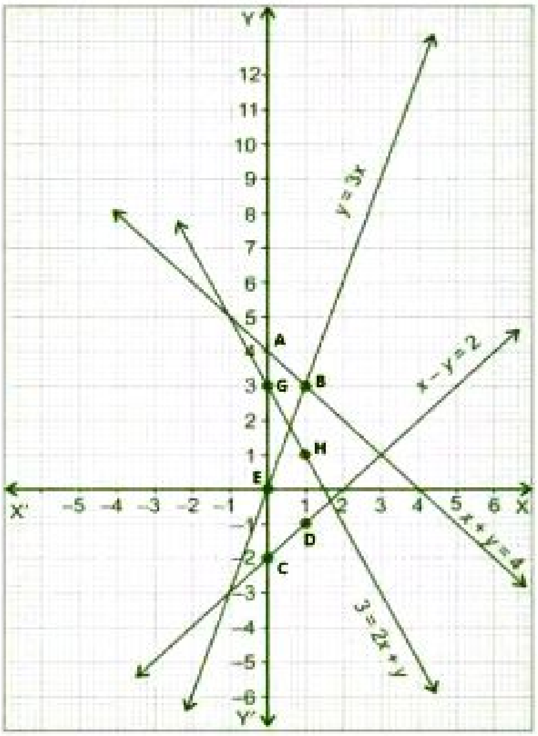
Hence, the value of k is 7.

Exercise 4.3

Question 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)** $3 = 2x + y$

Answer 1:



(i) $x + y = 4$

$\Rightarrow y = 4 - x$

Putting $x = 0$, we have, $y = 4 - 0 = 4$

Putting $x = 1$, we have, $y = 4 - 1 = 3$

Hence, A(0, 4) and B(1, 3) are the solutions of the equation.

(ii) $x - y = 2$

$\Rightarrow y = x - 2$

Putting $x = 0$, we have, $y = 0 - 2 = -2$

Putting $x = 1$, we have, $y = 1 - 2 = -1$

Hence, C(0, −2) and D(1, −1) are the solutions of the equation.

(iii) $y = 3x$

Putting $x = 0$, we have, $y = 3 \times 0 = 0$

Putting $x = 1$, we have, $y = 3 \times 1 = 3$

Hence, E(0, 0) and B(1, 3) are the solutions of the equation.

(iv) $3 = 2x + y$

$\Rightarrow y = 3 - 2x$

Putting $x = 0$, we have, $y = 3 - 2 \times 0 = 3$

Putting $x = 1$, we have, $y = 3 - 2 \times 1 = 1$

Hence, G(0, 3) and H(1, 1) are the solutions of the equation.

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

Answer 2:
Equation of two lines passing through (2, 14) are given by: $x + y = 16$ and $8x - y = 2$.

There are infinite number of lines that can pass through (2, 4) as infinite number of lines passes through a point.

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

Answer 3:
Given equation of line: $3y = ax + 7$.

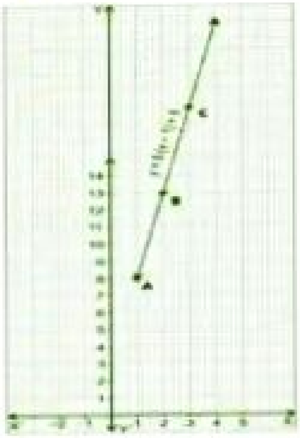
Putting $x = 3$ and $y = 4$, we have, $3 \times 4 = a \times 3 + 7$

$\Rightarrow 12 = 3a + 7 \quad \Rightarrow 12 - 7 = 3a$

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

Question 4:
The taxi fare in a city is as follows: For the first kilometre, 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.

Answer 4:
Given that: Distance travelled = x km and total fare = ₹ y
Total fare = Fare for first km + Fare for remaining distance
Therefore, the equation: $y = 8 + 5 \times (x - 1) \Rightarrow y = 5x + 3$
For the graph:
Putting $x = 1$, we have, $y = 5 \times 1 + 3 = 8$
Putting $x = 2$, we have, $y = 5 \times 2 + 3 = 13$
Putting $x = 3$, we have, $y = 5 \times 3 + 3 = 18$
Hence, A(1, 8), B(2, 13) and C(3, 18) are solutions of the equation.



Question 5:
From the choices given below, choose the equation whose graphs are given in Figure 4.6 and Figure 4.7.

For figure 4.6
(i) $y = x$
(ii) $x + y = 0$
(iii) $y = 2x$
(iv) $2 + 3y = 7x$

For figure 4.7
(i) $y = x + 2$
(ii) $y = x - 2$
(iii) $y = -x + 2$
(iv) $x + 2y = 6$

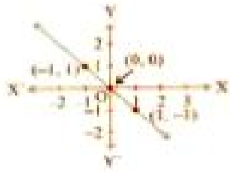


Fig. 4.6

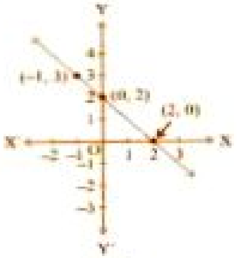


Fig. 4.7

Answer 5:
For the figure 4.6
$x + y = 0$ is the correct equation as it satisfies the points $(-1, 1)$, $(0, 0)$ and $(1, -1)$.

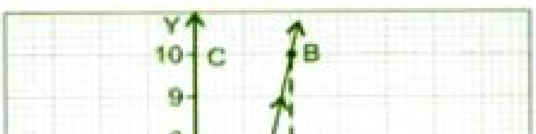
For the figure 4.7
$y = -x + 2$ is the correct equation as it satisfies the points $(-1, 3)$, $(0, 2)$ and $(2, 0)$.

Question 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.

Answer 6:
Let, the work done = y and let the distance = x
Given: the constant force = 5 units
Work done by the body is directly proportional to is distance travelled. Therefore, $y \propto x$

$$\Rightarrow y = kx$$

Here, k is proportionality constant and given k = 5 units.
Hence, $y = 5x$
For the graph:
Putting $x = 0$, we have, $y = 5 \times 0 = 0$
Putting $x = 1$, we have, $y = 5 \times 1 = 5$
Putting $x = 2$, we have, $y = 5 \times 2 = 10$
Hence, A(0, 0), B(1, 5) and C(2, 10) are the three solutions of the given equation.



(i) If the distance travelled is 2 units, the work done is 10 units.
(ii) If the distance travelled is 0 units, the work done is 0 units.

Question 7:

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.

Answer 7:

Let the contribution by Yamini = ₹ x

Let the contribution by Fatima = ₹ y

According to question, $x + y = 100$

$\Rightarrow y = 100 - x$

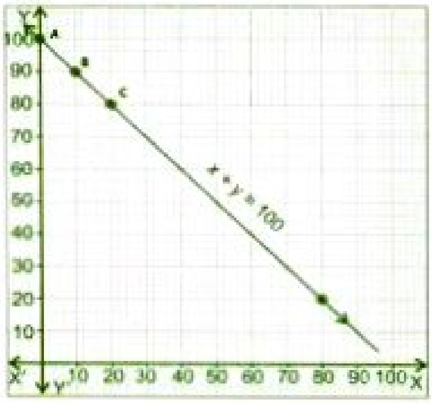
For the graph:

Putting $x = 0$, we have, $y = 100 - 0 = 100$

Putting $x = 10$, we have, $y = 100 - 10 = 90$

Putting $x = 20$, we have, $y = 100 - 20 = 80$

Hence, A(0, 100), B(10, 90) and C(20, 80) are the solutions of equation.



Question 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:

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

(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.

Answer 8:

(i) Taking Celsius on x-axis and Fahrenheit on y-axis, the linear equation is given by: $y = \left(\frac{9}{5}\right)x + 32$

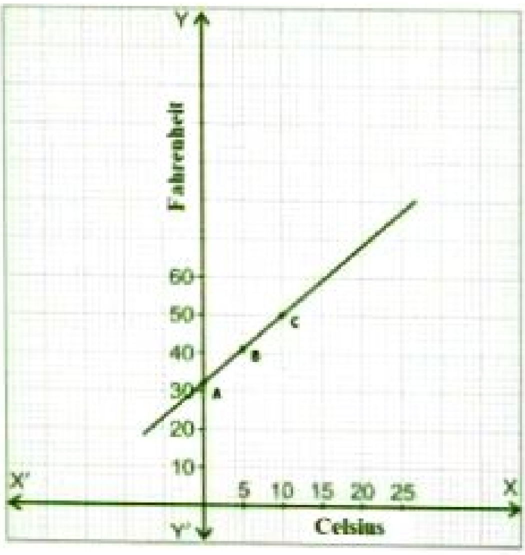
For plotting the graph:

Putting $x = 0$, we have, $y = \left(\frac{9}{5}\right) \times 0 + 32 = 32$

Putting $x = 5$, we have, $y = \left(\frac{9}{5}\right) \times 5 + 32 = 41$

Putting $x = 10$, we have, $y = \left(\frac{9}{5}\right) \times 10 + 32 = 50$

Hence, A(0, 100), B(5, 41) and C(10, 50) are the solutions of the equation.



(ii) If the temperature is 30°C, then

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

Hence, if the temperature is 30°C, the temperature in Fahrenheit is 86°F.

(iii) If the temperature is 95°F, then

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

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

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

$\Rightarrow C = 35°$

If the temperature is 95°F, the temperature in Celsius is 35°C.

(iv) If temperature is 0°C, then

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

If the temperature is 0°F, then

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

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

$\Rightarrow -32 \times \frac{5}{9} = C$

$\Rightarrow -\frac{160}{9} = C$

$\Rightarrow C = -17.8°$

If the temperature is 0°C, the temperature in Fahrenheit is 32°F and if the temperature is 0°F, the temperature in Celsius is −17.8°C.

(v) Let $x°$ be the temperature which is numerically the same in both Fahrenheit and Celsius, then

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

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

$\Rightarrow (x - 32) \times 5 = 9x$

$\Rightarrow 5x - 160 = 9x$

$\Rightarrow 4x = -160$

$\Rightarrow x - 40°$

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