Linear Equations in Two Variables

CHAPTER 4

NCERT FOCUS

SOLUTIONS

EXERCISE - 4.1

1. Let the cost of a note book = ₹ x
and the cost of a pen = ₹ y
According to the condition, we have
[Cost of a notebook] = 2 × [Cost of a pen]
i.e. $(x) = 2 \times (y) \Rightarrow x = 2y \Rightarrow x - 2y = 0$
Thus, the required linear equation is $x - 2y = 0$.

2. (i) We have, $2x + 3y = (9.3\overline{5})$
$\Rightarrow 2x + 3y + (-9.3\overline{5}) = 0$
Comparing it with $ax + by + c = 0$, we get $a = 2$, $b = 3$ and $c = -9.3\overline{5}$.

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

$\Rightarrow x + \left(-\frac{1}{5}\right)y + (-10) = 0$

Comparing it with $ax + by + c = 0$, we get

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

(iii) We have, $-2x + 3y = 6$
$\Rightarrow (-2)x + 3y + (-6) = 0$
Comparing it with $ax + by + c = 0$, we get $a = -2$, $b = 3$ and $c = -6$.

(iv) We have, $x = 3y \Rightarrow x + (-3)y + 0 = 0$
Comparing it with $ax + by + c = 0$, we get $a = 1$, $b = -3$ and $c = 0$.

(v) We have, $2x = -5y \Rightarrow 2x + 5y + 0 = 0$
Comparing it with $ax + by + c = 0$, we get $a = 2$, $b = 5$ and $c = 0$.

(vi) We have, $3x + 2 = 0 \Rightarrow 3x + 0y + 2 = 0$
Comparing it with $ax + by + c = 0$, we get $a = 3$, $b = 0$ and $c = 2$.

(vii) We have, $y - 2 = 0 \Rightarrow 0x + 1y + (-2) = 0$
Comparing it with $ax + by + c = 0$, we get $a = 0$, $b = 1$ and $c = -2$.

(viii) We have, $5 = 2x \Rightarrow 5 - 2x = 0$
$\Rightarrow -2x + 0y + 5 = 0 \Rightarrow (-2)x + 0y + 5 = 0$
Comparing it with $ax + by + c = 0$, we get $a = -2$, $b = 0$ and $c = 5$.

EXERCISE - 4.2

1. Option (iii) is true. For every value of x, we get a corresponding value of y and vice-versa. Therefore, the linear equation has infinitely many solutions.

2. (i) $2x + y = 7$
When $x = 0$, $2(0) + y = 7 \Rightarrow 0 + y = 7 \Rightarrow y = 7$
$\therefore$ Solution is (0, 7).
When $x = 1$, $2(1) + y = 7 \Rightarrow y = 7 - 2 \Rightarrow y = 5$
$\therefore$ Solution is (1, 5).
When $x = 2$, $2(2) + y = 7 \Rightarrow y = 7 - 4 \Rightarrow y = 3$
$\therefore$ Solution is (2, 3).
When $x = 3$, $2(3) + y = 7 \Rightarrow y = 7 - 6 \Rightarrow y = 1$
$\therefore$ Solution is (3, 1).
Thus, the four solutions are (0, 7), (1, 5), (2, 3) and (3, 1).

(ii) $\pi x + y = 9$
When $x = 0$, $\pi(0) + y = 9 \Rightarrow y = 9$
$\therefore$ Solution is (0, 9).
When $x = 1$, $\pi(1) + y = 9 \Rightarrow y = 9 - \pi$
$\therefore$ Solution is $(1, (9 - \pi))$.
When $x = 2$, $\pi(2) + y = 9 \Rightarrow y = 9 - 2\pi$
$\therefore$ Solution is $(2, (9 - 2\pi))$.
When $x = -1$, $\pi(-1) + y = 9 \Rightarrow -\pi + y = 9 \Rightarrow y = 9 + \pi$
$\therefore$ Solution is $(-1, (9 + \pi))$.
Thus, the four solutions are (0, 9), $(1, (9 - \pi))$, $(2, (9 - 2\pi))$ and $(-1, (9 + \pi))$.

(iii) $x = 4y$
When $x = 0$, $4y = 0 \Rightarrow y = 0$
$\therefore$ Solution is (0, 0).

When $x = 1$, $4y = 1 \Rightarrow y = \frac{1}{4}$

$\therefore$ Solution is $\left(1, \frac{1}{4}\right)$.

When $x = 4$, $4 = 4y \Rightarrow y = \frac{4}{4} = 1 \Rightarrow y = 1$
$\therefore$ Solution is (4, 1).
When $x = -4$, $4y = -4$

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

$\therefore$ Solution is (–4, –1).
Thus, the four solutions are (0, 0), (1, 1/4), (4, 1) and (–4, –1).

3. (i) (0, 2) means $x = 0$ and $y = 2$
Putting $x = 0$ and $y = 2$ in $x - 2y = 4$, we get
L.H.S. = 0 – 2(2) = – 4. But R.H.S. = 4
$\Rightarrow$ L.H.S. ≠ R.H.S.
$\therefore$ $x = 0$, $y = 2$ is not a solution.
(ii) (2, 0) means $x = 2$ and $y = 0$
Putting $x = 2$ and $y = 0$ in $x - 2y = 4$, we get
L.H.S. = 2 – 2(0) = 2 – 0 = 2. But R.H.S. = 4
$\Rightarrow$ L.H.S. ≠ R.H.S.
$\therefore$ (2, 0) is not a solution.

(iii) (4, 0) means $x = 4$ and $y = 0$

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

L.H.S. = 4 – 2(0) = 4 – 0 = 4 = R.H.S.

$\therefore$ (4, 0) is a solution.

(iv) $(\sqrt{2}, 4\sqrt{2})$ means $x = \sqrt{2}$ and $y = 4\sqrt{2}$

Putting $x = \sqrt{2}$ and $y = 4\sqrt{2}$ in $x - 2y = 4$, we get

L.H.S. = $\sqrt{2} - 2(4\sqrt{2}) = \sqrt{2} - 8\sqrt{2} = \sqrt{2}(1-8) = -7\sqrt{2}$

But R.H.S. = 4

$\Rightarrow$ L.H.S. $\neq$ R.H.S. $\therefore$ $(\sqrt{2}, 4\sqrt{2})$ is not a solution.

(v) (1, 1) means $x = 1$ and $y = 1$

Putting $x = 1$ and $y = 1$ in $x - 2y = 4$, we get

L.H.S. = 1 – 2(1) = 1 – 2 = –1. But R.H.S. = 4

$\Rightarrow$ L.H.S. $\neq$ R.H.S. $\therefore$ (1, 1) is not a solution.

4. We have $2x + 3y = k$

Putting $x = 2$ and $y = 1$ in $2x + 3y = k$, we get

$2(2) + 3(1) = k \Rightarrow 4 + 3 = k \Rightarrow 7 = k$

Thus, the required value of k is 7.

EXERCISE - 4.3

1. (i) We have, $x + y = 4 \Rightarrow y = 4 - x$

$\therefore$ When $x = 0$, then $y = 4 - 0 = 4$

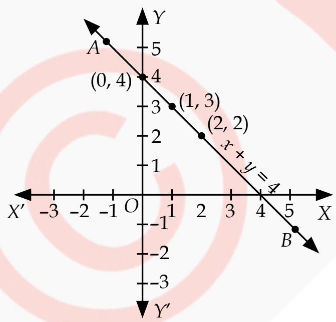
When $x = 1$, then $y = 4 - 1 = 3$

When $x = 2$, then $y = 4 - 2 = 2$

Thus, we have the following solution table :

x	0	1	2
y	4	3	2

Plot the points (0, 4), (1, 3) and (2, 2) on a graph paper and join them by a straight line.



Thus, the line AB is the required graph of $x + y = 4$.

(ii) We have, $x - y = 2 \Rightarrow y = x - 2$

$\therefore$ When $x = 0$, then $y = 0 - 2 = -2$

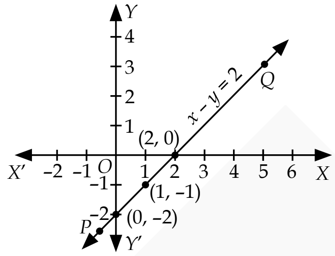
When $x = 1$, then $y = 1 - 2 = -1$

When $x = 2$, then $y = 2 - 2 = 0$

Thus, we have the following solution table :

x	0	1	2
y	–2	–1	0

Now, let us plot the points (0, –2), (1, –1) and (2, 0) on a graph paper and join them by a straight line.



Thus, the line PQ is required graph of $x - y = 2$.

(iii) We have, $y = 3x$

$\therefore$ When $x = 0$, then $y = 3(0) \Rightarrow y = 0$

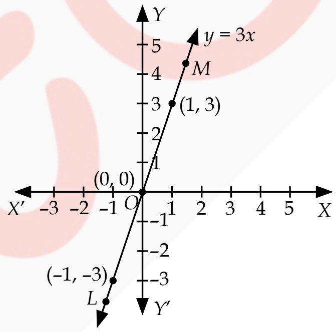
When $x = 1$, then $y = 3(1) \Rightarrow y = 3$

When $x = -1$, then $y = 3(-1) \Rightarrow y = -3$

Thus, we get the following solution table:

x	0	1	–1
y	0	3	–3

Now, let us plot the points (0, 0), (1, 3) and (–1, –3) on a graph paper and join them by a straight line.



Thus, the line LM is the required graph of $y = 3x$.

(iv) We have, $3 = 2x + y \Rightarrow y = 3 - 2x$

$\therefore$ When $x = 0$, then $y = 3 - 2(0) \Rightarrow y = 3$

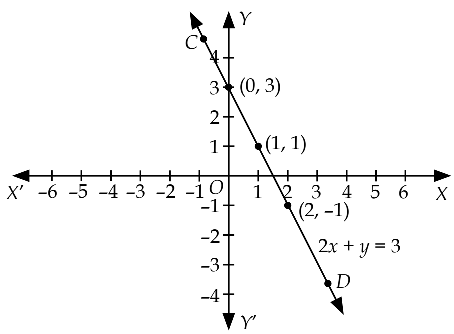
When $x = 1$, then $y = 3 - 2(1) \Rightarrow y = 1$

When $x = 2$, then $y = 3 - 2(2) = 3 - 4 = -1 \Rightarrow y = -1$

Thus, we have the following solution table :

x	0	1	2
y	3	1	–1

Now, let us plot the points (0, 3), (1, 1) and (2, – 1) on a graph paper and join them by a straight line.



Thus, the line CD is the required graph of $3 = 2x + y$.

2. (2, 14) means $x = 2$ and $y = 14$

Following equations will pass through (2, 14) as (2, 14) is a solution of these equations.

(i) $x + y = 16$ (ii) $7x - y = 0$

There are infinite number of lines which can pass through (2, 14), because infinite number of lines can pass through a point.

3. The given equation of line is $3y = ax + 7$

$\because$ (3, 4) lies on the given line.

$\therefore$ It must satisfy the equation $3y = ax + 7$

Putting $x = 3$ and $y = 4$ in the given equation, we get

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

$\Rightarrow 3a = 12 - 7 = 5 \Rightarrow a = \frac{5}{3}$

Thus, the required value of a is 5/3.

4. Here, total distance covered = x km and total taxi fare = ₹ y

Clearly, fare for the 1st km = ₹ 8 and for remaining $(x - 1)$ km distance = ₹ $5 \times (x - 1)$

$\therefore$ Total taxi fare = ₹ 8 + ₹ $5(x - 1)$

Now, according to the condition, we get

$y = 8 + 5(x - 1) \Rightarrow y = 8 + 5x - 5 \Rightarrow y = 5x + 3$,

which is the required linear equation representing the given information.

Graph : We have $y = 5x + 3$

$\therefore$ When $x = 0$, then $y = 5(0) + 3 \Rightarrow y = 3$

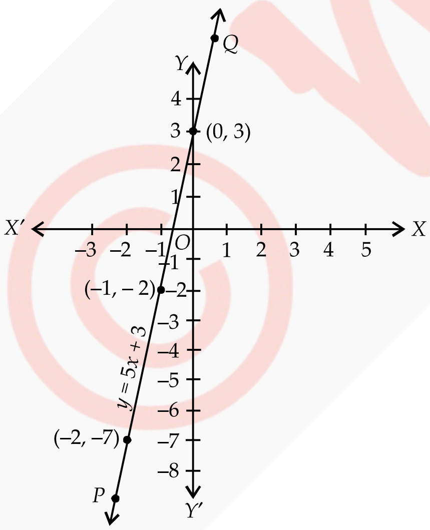
When $x = -1$, then $y = 5(-1) + 3 \Rightarrow y = -2$

When $x = -2$, then $y = 5(-2) + 3 \Rightarrow y = -7$

Thus, we have the following solution table:

x	0	–1	–2
y	3	–2	–7

Now, let us plot the points (0, 3), (–1, –2) and (–2, –7) on a graph paper and join them, by a straight line, as shown below.



Thus, the line PQ is the required graph of $y = 5x + 3$.

5. For Fig. (1), the correct linear equation is $x + y = 0$

[$\because$ (–1, 1) is satisfying only $x + y = 0$]

For Fig. (2), the correct linear equation is $y = -x + 2$

[$\because$ (–1, 3) is satisfying only $y = -x + 2$]

6. Constant force is 5 units. Let the distance travelled by the body = x units and work done = y units. Then, according to question, we have $y \propto x$

$\Rightarrow y = kx$, where k is a constant force

$\Rightarrow y = 5 \times x \Rightarrow y = 5x$, which is the required equation

[$\because$ It is given that the constant force is 5 units]

When $x = 0$, then $y = 5(0) = 0$

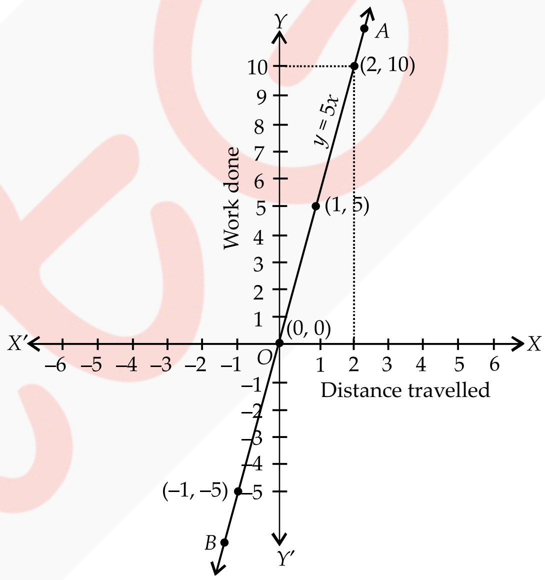
When $x = 1$, then $y = 5(1) = 5$

When $x = -1$, then $y = 5(-1) = -5$

Thus, we have the following solution table:

x	0	1	–1
y	0	5	–5

Now, let us plot the points (0, 0), (1, 5) and (–1, –5) on a graph paper and join them, by a straight line, as shown below :



(i) Given, distance travelled = 2 units *i.e.*, $x = 2$.

From the graph, it is clear that if $x = 2$, then $y = 10$ units

$\Rightarrow$ Work done = 10 units

(ii) Given, distance travelled = 0 unit *i.e.*, $x = 0$

$\therefore$ From the graph, it is clear that if $x = 0$, then $y = 0$

$\Rightarrow$ Work done = 0 unit

7. Let the contribution of Yamini = ₹ x

and the contribution of Fatima = ₹ y

Then, we have $x + y = 100 \Rightarrow y = 100 - x$

$\therefore$ When $x = 0$, $y = 100 - 0 = 100$

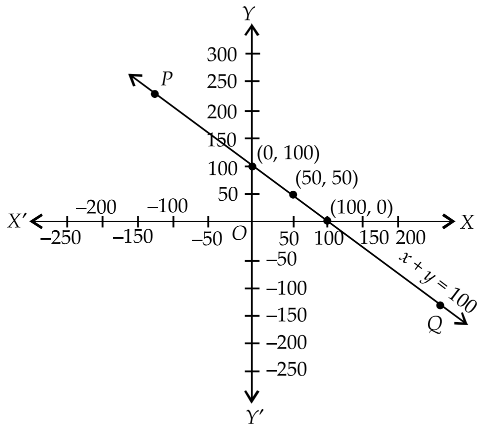
When $x = 50$, $y = 100 - 50 = 50$

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

Thus, we have the following solution table:

x	0	50	100
y	100	50	0

Now, let us plot the points (0, 100), (50, 50) and (100, 0) on a graph paper and join them by a straight line as shown below.



Thus, the line PQ is the required graph.

8. (i) We have $F = \left(\frac{9}{5}\right)C + 32$

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

When C = –15, then $F = \left(\frac{9}{5}\right)(-15) + 32 = -27 + 32 = 5$

When C = – 10, then $F = \frac{9}{5}(-10) + 32 = -18 + 32 = 14$

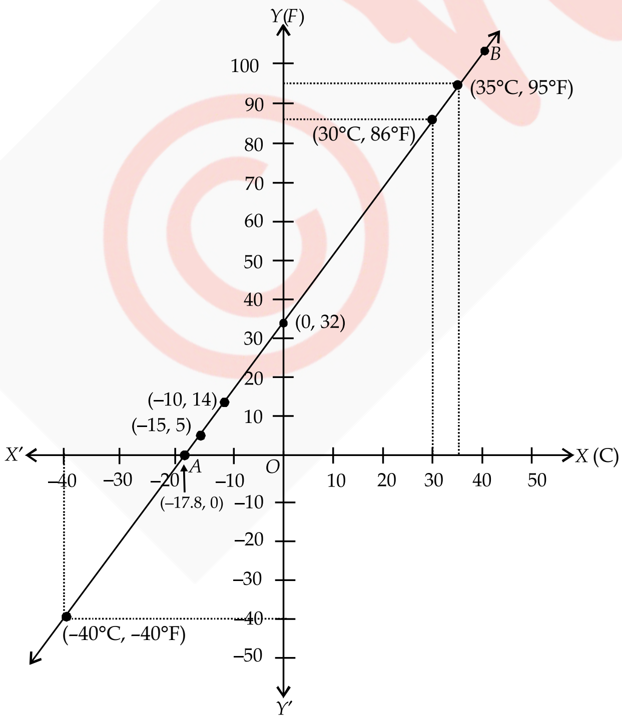
Thus, we have the following solution table:

C	0	–15	–10
F	32	5	14

Let us take Celsius along x-axis and Fahrenheit along y-axis.

Now, plot the points (0, 32), (–15, 5) and (–10, 14) on a graph paper and join them by a straight line as shown below.

(ii) From the graph, we have 86°F corresponding to 30°C



(iii) From the graph, we have 35°C corresponding to 95°F.

(iv) From the graph, we have 0°C = 32°F and 0°F = – 17.8°C

(v) When F = C (numerically), then from given equation, we get

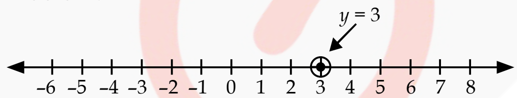
$$F = \frac{9}{5}F + 32 \Rightarrow F - \frac{9}{5}F = 32 \Rightarrow -\frac{4}{5}F = 32 \Rightarrow F = -40$$

Thus, temperature – 40° is same in both Fahrenheit and Celsius.

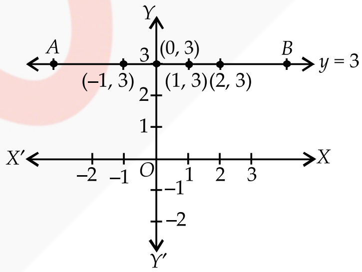
EXERCISE - 4.4

1. Given, equation is $y = 3$.

(i) If $y = 3$ is treated as an equation in one variables, then it will represent a point on the number line, as shown below.



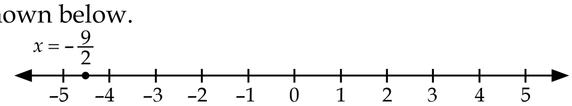
(ii) If $y = 3$ is treated as an equation in two variable, then it will represent a line parallel to x-axis and passing through (0, 3), as shown below.



2. Given, equation is

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

(i) If $x = -9/2$ is treated as an equation in one variable, then it will represent a point on the number line, as shown below.



(ii) If $x = -\frac{9}{2}$ is treated as an equation in two variables, then it will represent a line parallel to y-axis and passing through $\left(-\frac{9}{2}, 0\right)$ as shown below.