

Chapter - 4

Linear equations in two variables

1- Notes - i

- $P(x)$ is said to be linear polynomial if degree $P(x) = 1$
- If $P(x)$ is a polynomial $ax + b$, where $a \neq 0$.
- If $P(x)$ is a polynomial then $P(x) = 0$ is called linear equation.
- $ax + b = 0$ is standard form of linear equation in one variables. $a \neq 0$.
- Value of variables which satisfy the equation is called solution/roots of two equation.
- Linear equation in one variable has only one solution.
- An equation is the form of



an eq. by $ax + by + c = 0$ is called a linear equation in two variables where a, b, c are constant and $a, b \neq 0$.

A linear equation in two variables has infinite solutions.

Graph of linear in two variables represent straight line.

All points lying on the straight line representing the equation are the solution of given equation.

Exercise - 4.1

The cost of a notebook is ₹10 and the cost of a pen is ₹5. Write a linear equation in two variables.

Let the notebook be ₹10
" " " " " ₹5
" " " " " ₹10
" " " " " ₹10

$$x = 2 + y$$

$$x - 2y = 0$$

Express the linear equation in the form of $ax + by + c = 0$.

$$2x + 3y = 12$$

$$2x + 3y - 12 = 0 \quad (1)$$

Comparing with given eq
 $a = 2, b = 3, c = -12$

$$x = \frac{y}{2} \quad 10 = 0$$

$$x = \frac{y}{2} \quad 10 = 0 \quad (1)$$

Comparing with given eq
 $a = 1, b = \frac{1}{2}, c = -10$

$$3x + 2y = 6$$

$$3x + 2y - 6 = 0 \quad (1)$$

Comparing with eq. given
 $a = 3, b = 2, c = -6$

$$x = 0$$

$\Rightarrow x - 3y = 0$ — (i)
 $\Rightarrow$ Comparing with given eq.
 $\Rightarrow a = 1, b = -3, c = 0$

5- $2x = -5y$

$\Rightarrow 2x + 5y = 0$ — (i)
 $\Rightarrow$ Comparing with given eq.
 $\Rightarrow a = 2, b = 5, c = 0$

6- $3x + 2 = 0$

$\Rightarrow 3x + 2 - 0 = 0$ — (i)
 $\Rightarrow$ Comparing with given eq.
 $\Rightarrow a = 3, b = 2, c = -0$

7- $y - 2 = 0$

$\Rightarrow y - 2 - 0 = 0$ — (i)
 $\Rightarrow$ Comparing with given eq.
 $\Rightarrow a = 1, b = -2, c = -0$

8- $5 = 2x$

$\Rightarrow 5 - 2x = 0$ — (i)
 $\Rightarrow$ Comparing with given eq.
 $\Rightarrow a = 5, b = -2, c = 0$

Exercise-4.2

1- Which one of the following options is true and why?

$\Rightarrow y = 3x + 5$ has

$\Rightarrow$ Infinitely many solutions.

2- Write 4 solution for each equation-

1- $2x + y = 7$

put on $x = 0, 1, 2, 3$.

$\Rightarrow 2 \times 0 + y = 7$

$\Rightarrow 2 \times 3 + y = 7$

$\Rightarrow 0 + y = 7$

$\Rightarrow 6 + y = 7$

$\Rightarrow y = 7 - 0$

$\Rightarrow y = 7 - 6$

$\Rightarrow y = 7, x = 0$

$\Rightarrow y = 1, x = 3$

$\Rightarrow 2 \times 1 + y = 7$

$\Rightarrow 2 + y = 7$

$\Rightarrow y = 7 - 2$

$\Rightarrow y = 5, x = 1$

$\Rightarrow 2 \times 2 + y = 7$

$\Rightarrow 4 + y = 7$

$\Rightarrow y = 7 - 4$

$\Rightarrow y = 3, x = 2$



2- $\pi x + y = 9$ Put on $x = 0, 1, 2, 3$

$\Rightarrow \pi \times 0 + y = 9$

$\Rightarrow 0 + y = 9$

$y = 9 - 0$

$y = 9, x = 0$

$\Rightarrow \pi \times 1 + y = 9$

$\Rightarrow \pi + y = 9$

$y = 9 - \pi, x = 1$

$\Rightarrow \pi \times 2 + y = 9$

$\Rightarrow 2\pi + y = 9$

$y = 9 - 2\pi$

$y = 9 - 2\pi, x = 2$

$\Rightarrow \pi \times 3 + y = 9$

$\Rightarrow \pi + y = 9 - \pi$

$y = 9 - \pi, x = 3$

3- $x = 4y$ Put on $x = 0, 1, 2, 3$

$\Rightarrow 0 = 4y$

$\Rightarrow y = 4 - 0$

$\Rightarrow y = 4, x = 0$

$\Rightarrow 2 = 4y$

$\Rightarrow y = 4 - 2$

$y = 2, x = 2$

$\Rightarrow 1 = 4y$

$\Rightarrow y = 4 - 1$

$\Rightarrow 3 = 4y$

$\Rightarrow y = 4 - 3$

$y = 1, x = 3$

3- check whether the following $x - 2y = 4$

1- $(0, 2)$

5- $(1, 1)$

$\Rightarrow 0 - 2 \times 2 = 4$

$\Rightarrow 0 - 4 = 4$

$\Rightarrow -4 = 4 + 4$

$\Rightarrow 0 = 8$ — No

$\Rightarrow 1 - 2 \times 1 = 4$

$\Rightarrow 1 - 2 = 4$

$\Rightarrow -1 = 4$

$\Rightarrow 4 + 1 = 5$ — No

2- $(2, 0)$

$\Rightarrow 2 - 2 \times 0 = 4$

$\Rightarrow 2 - 0 = 4$

$\Rightarrow -0 = 4 - 2$

$\Rightarrow -0 = 2$ — No

3- $(4, 0)$

$\Rightarrow 4 - 2 \times 0 = 4$

$\Rightarrow 4 - 0 = 4$

$\Rightarrow -0 = 4 - 4$

$\Rightarrow -0 = 0$ — Yes

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

$\Rightarrow \sqrt{2} - 2 \times 4\sqrt{2} = 4$

$\Rightarrow \sqrt{2} - 8\sqrt{2} = 4$

$\Rightarrow 2 = 4 + 8$

$\Rightarrow 2 = 12$

$\Rightarrow \frac{12}{2} = 6$ — No

4- find the value of k —

1- $2x + 3y = k$ $x=2, y=1$

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

$\Rightarrow 4 + 3 = k$

$\Rightarrow 7 = k$

Exercise - 4.3

1- Draw a graph on given linear equation.

a- $x + y = 4$

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

x	0	4	2
y	4	0	2

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

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

b- $x - y = 2$

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

$\Rightarrow$ Putting $x=4$
 $4 - y = 2$
 $y = 4 - 2$
 $y = 2$

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

x	0	2	4
y	-2	0	2



d- $3 = 2x + y$

⇒ Putting $x = 0$
 $3 = 2 \times 0 + y$
 $3 = 0 + y$
 $3 - 0 = y$
 $3 = y$

x	0	2	4
y	3	1	5

⇒ Putting $x = 2$
 $3 = 2 \times 2 + y$
 $3 = 4 + y$
 $1 = y$

⇒ Putting $x = 4$
 $3 = 2 \times 4 + y$
 $3 = 8 + y$
 $5 = y$

c- $y = 3x$

⇒ Putting $x = 0$
 $y = 3 \times 0$
 $y = 0$

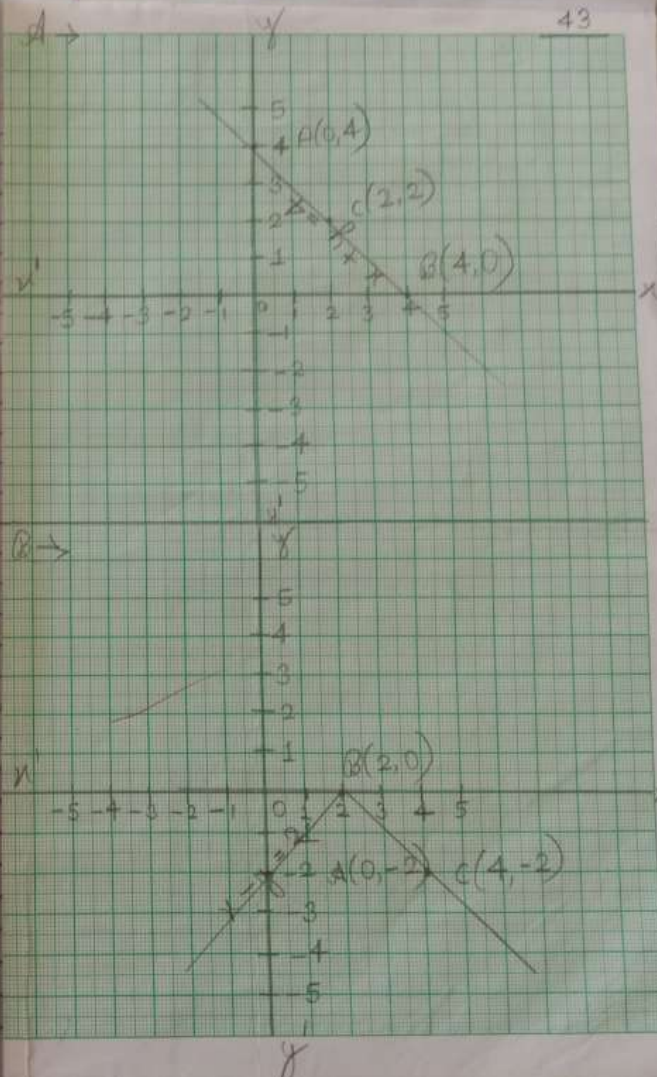
⇒ Putting $x = 1$
 $y = 3 \times 1$
 $y = 3$

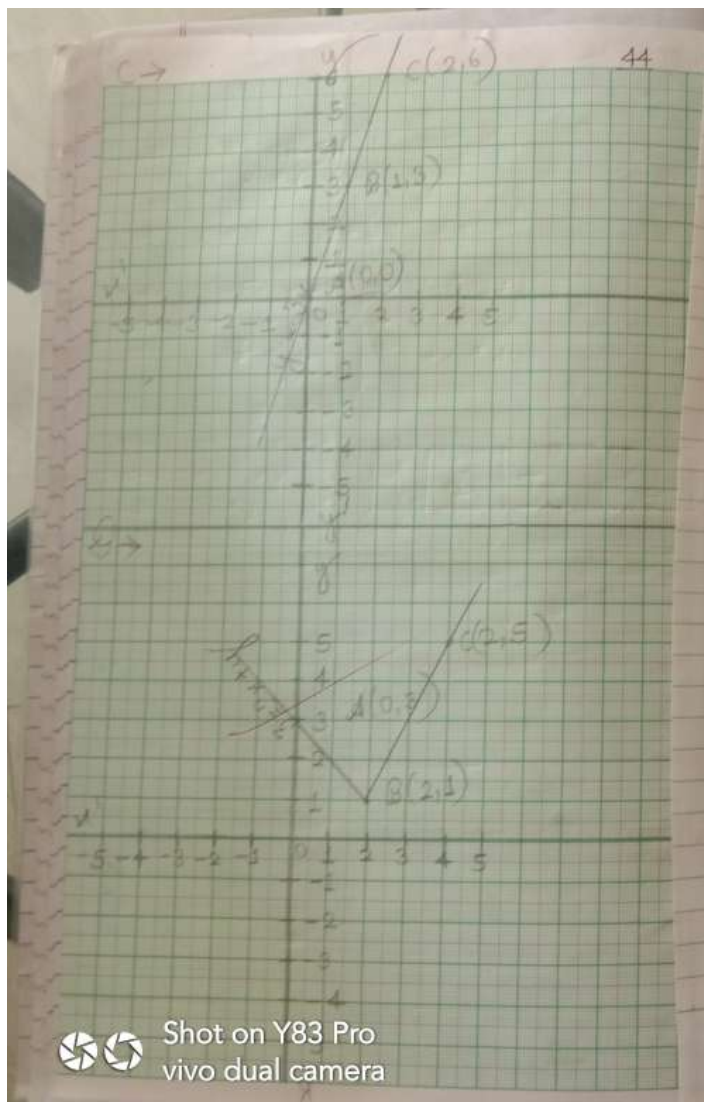
⇒ Putting $x = 2$
 $y = 3 \times 2$
 $y = 6$

x	0	2	1
y	0	6	3



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

⇒ Infinite lines are passing from the point (2, 14).

⇒ Given examples - (2, 14)

(i) - $x + y = 16$

(ii) - $x - y = 12$

(iii) - $2x + y = 18$

(iv) - $3x + y = 20$

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

⇒ Given eq. $3y = ax + 7$ (i)

∴ (3, 4) is the solution of eq.

∴ $x = 3$, $y = 4$ ⇒ $3 \times 4 = 3a + 7$

⇒ $12 - 7 = 3a$

$5 = 3a$

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

4- The Taxi fare in city 1 km = ₹8 and rest distance ₹5 per km. Taking graph x km and y fare.

⇒ Total distance = x

⇒ Total fare = y

⇒ $8x + 5(x - 1) = y$



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$$\Rightarrow 8 + 5x - 1 = y$$

$$\Rightarrow 7 + 5x = y$$

$$\Rightarrow x = 0, x = 1, x = 2$$

$$\begin{array}{l} \Rightarrow 7 + 5 \times 0 = y \\ \Rightarrow 7 + 0 = y \\ \Rightarrow 7 = y \end{array} \quad \begin{array}{l} \Rightarrow 7 + 5 \times 1 = y \\ \Rightarrow 7 + 5 = y \\ \Rightarrow 12 = y \end{array}$$

$$\begin{array}{l} \Rightarrow 7 + 5 \times 2 = y \\ \Rightarrow 7 + 10 = y \\ \Rightarrow 17 = y \end{array}$$

x	0	1	2
y	7	12	17

5 - choose equation for the graph -

Fig: - 4.6

$$(i) \Rightarrow y = x \quad (i)$$

$$\Rightarrow \text{Putting } (-1, 1) \text{ in eq. (i)}$$

$$\Rightarrow 1 = -1$$

$\Rightarrow$ which is not true.

$\therefore$ This equation is not for given graph.

$$(ii) \Rightarrow x + y = 0$$

$$\Rightarrow \text{Putting } (-1, 1) \text{ in eq. (ii)}$$

$$\Rightarrow -1 + 1 = 0$$

$$0 = 0$$

$$\text{LHS} = \text{RHS}$$

$$\Rightarrow \text{Putting } (0, 0) \text{ in eq. (ii)}$$

$$\Rightarrow 0 + 0 = 0$$

$$0 = 0$$

$$\text{LHS} = \text{RHS}$$

$$\Rightarrow \text{Putting } (1, -1) \text{ in eq. (ii)}$$

$$\Rightarrow 1 - 1 = 0$$

$$0 = 0$$

$\Rightarrow$ which is True.

$\Rightarrow$ This equation is for given graph.



(iii) $\Rightarrow y = 2x$

 $\Rightarrow$ Putting $(-1, 1)$ in eq. (iii)

$\Rightarrow 1 = 2x - 1$

$\Rightarrow 1 = -2$

 $\Rightarrow$ which is not true. $\Rightarrow$ This equation is not for given graph.

(iv) $\Rightarrow 2 + 3y = 7x$

 $\Rightarrow$ Putting $(-1, 1)$ in eq. (iv)

$\Rightarrow 2 + 3 \times 1 = 7 \times -1$

$\Rightarrow 2 + 3 = -7$

$\Rightarrow 5 = -7$

 $\Rightarrow$ which is not true. $\Rightarrow$ This equation is not for given graph.For fig 4.7

(i) $y = x + 2$

 $\Rightarrow$ Putting $(-1, 3)$ in eq. (i)

$\Rightarrow 3 = -1 + 2$

$\Rightarrow 3 = 1$

 $\Rightarrow$ which is not true. $\Rightarrow$ This equation is not for given graph.

(ii) $y = x - 2$

 $\Rightarrow$ Putting $(-1, 3)$ in eq. (ii)

$\Rightarrow 3 = -1 - 2$

$\Rightarrow 3 = -3$

 $\Rightarrow$ which is not true. $\Rightarrow$ This equation is not for given graph.

(iii) $y = -x + 2$

 $\Rightarrow$ Putting $(-1, 3)$ in eq. (iii)

$\Rightarrow 3 = -1 + 2$

$\Rightarrow 3 = 1$

 $\Rightarrow$ which is not true. $\Rightarrow$ This equation is not for given graph.

(iv) $x + 2y = 6$

 $\Rightarrow$ Putting $(-1, 3)$ in eq. (iv)

$\Rightarrow -1 + 2 \times 3 = 6$

$\Rightarrow -1 + 6 = 6$

$\Rightarrow -1 = 6 - 6$

$\Rightarrow -1 = 0$

 $\Rightarrow$ which is not true. $\Rightarrow$ This equation is not for this given graph.

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 in equation and draw graph.

$$\Rightarrow W \propto D$$

$$\Rightarrow W = FD$$

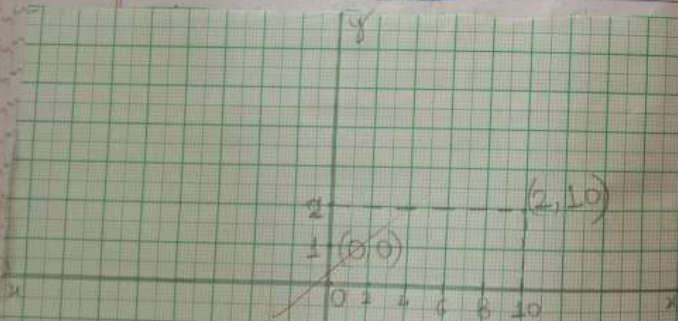
$$\Rightarrow \text{given } F = 5$$

$$(i) \Rightarrow \text{If } D \Rightarrow 0 \Rightarrow 0$$

$$\Rightarrow W \Rightarrow 0 \text{ — Ans}$$

$$(ii) \Rightarrow \text{If } D \Rightarrow 2$$

$$\Rightarrow W \Rightarrow 10 \text{ — Ans}$$



7- Yamini and Fatima, two students of class 9th and contributed ₹100 for flood victims towards the prime minister's relief fund. Draw a data and graph.

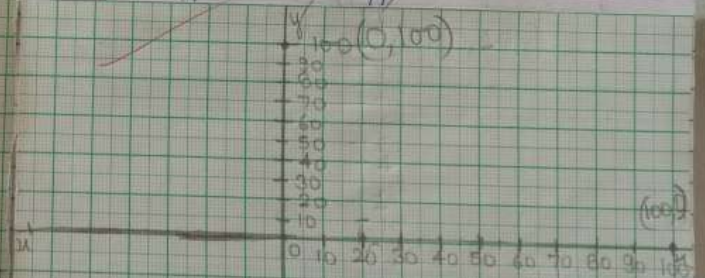
$\Rightarrow$ let x and y be the contribution of Yamini and Fatima —

$\Rightarrow$ Given,

$$x + y = 100$$

$$\Rightarrow \text{Putting } x = 0 \text{ } y = 100$$

$$\Rightarrow \text{Putting } x = 100 \text{ } y = 0$$



8- In countries U.S.A the temperature measured in fahrenheit whereas, India the temperature is measured in Celsius.

(i) Draw the graph by using $x = \text{Celsius}$ scale and $y = \text{Fahrenheit}$ scale.

(ii) If Temperature 30°C find in fahrenheit?

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

$$F = \frac{6}{3} \times \frac{9}{5} + 32$$

$$F = 54 + 32$$

$$F = 86^\circ\text{F}$$

(iii) If Temperature 95°F find in Celsius?

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

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

$$C = \frac{5}{9} \times \frac{7}{1}$$

$$C = 35^\circ\text{C}$$

(iv) If Temperature 0°C find in fahrenheit and in 0°F find in Celsius?

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

$$F = 0 \times \frac{9}{5} + 32$$

$$F = 0 + 32$$

$$F = 0 + 32$$

$$F = 32^\circ\text{F}$$

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

$$C = \frac{5}{9} \times (0 - 32)$$

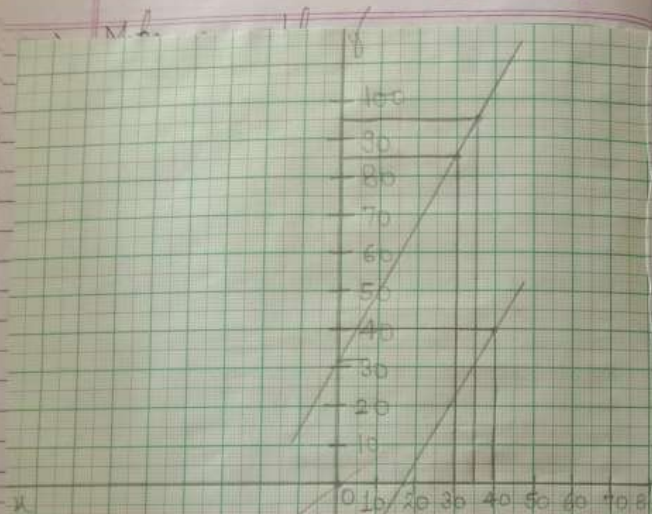
$$C = \frac{5}{9} \times 32$$

$$C = \frac{160}{9} = 17.7^\circ\text{C}$$

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

$\Rightarrow$ Yes, 40°C in both fahrenheit and Celsius.

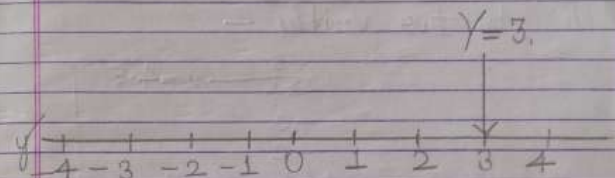




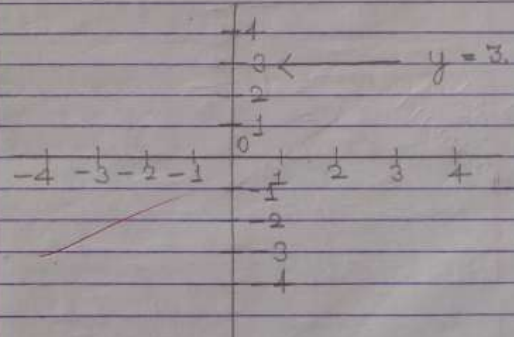
Exercise - 4.4

1- Give the geometrical representation of $y=3$ as an equation.

(i) In one variable.



(ii) In two variables.



2- Give geometrical representation

$$\Rightarrow 2x + 9 = 0$$

$$\Rightarrow 2x = -9$$

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

