CHAPTER 4

IX-MATHEMATICS-NCERT
4. LINEAR EQUATIONS IN TWO VARIABLES (Notes)
PREPARED BY: BALABHADRA SURESH

https://sureshmathsmaterial.com/

1. If a linear equation has two variables then it is called a linear equation in two variables.
2. The general form of linear equation in two variables x, y is $ax + by + c = 0$. Where a, b, c are real numbers, and a, b are not both zero.
3. The process of finding solution(s) is called solving an equation.
4. A linear equation in two variables has infinitely many solutions. Every solution of the linear equation can be represented by a unique point on the graph of the equation.
5. The graphs of x = a and y = a are lines parallel to the y-axis and x-axis, respectively

Example 1 : Write each of the following equations in the form ax + by + c = 0 and indicate the values of a, b and c in each case:

(i) $2x + 3y = 4.37$

Sol: $2x + 3y = 4.37 \Rightarrow 2x + 3y - 4.37 = 0$

$a = 2, b = 3, c = -4.37$

(ii) $x - 4 = \sqrt{3}y$

$Sol: x - 4 = \sqrt{3}y \Rightarrow x - \sqrt{3}y - 4 = 0$

$a = 1, b = -\sqrt{3}, c = -4$

(iii) $4 = 5x - 3y$

$Sol: 5x - 3y - 4 = 0$

$a = 5, b = -3, c = -4$

(iv) $2x = y$

$Sol: 2x - y = 0$

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

Example 2 : Write each of the following as an equation in two variables:

(i) **$x = -5$**

$Sol: 1.x + 0.y + 5 = 0$

(ii) **$y = 2$**

$Sol: 0.x + 1.y - 2 = 0$

(iii) **$2x = 3$**

$Sol: 2.x + 0.y - 3 = 0$

(iv) **$5y = 2$**

$Sol: 0.x + 5.y - 2 = 0$

EXERCISE 4.1

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

Sol: Let the cost of a notebook = ₹ x and cost of a pen = ₹ y

The cost of a notebook = 2× the cost of a pen

$$x = 2y$$
$$x - 2y = 0$$

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

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

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

(ii) **$x - 5y - 10 = 0$**

Sol: $1.x - 5.y - 10 = 0$

$a = 1, b = -5, c = -10$

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

Sol: $-2.x + 3.y - 6 = 0$

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

(iv) **$x = 3y$**

Sol: $x - 3y = 0$

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

(v) **$2x = -5y$**

Sol: $2x + 5y + 0 = 0$

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

(vi) **$3x + 2 = 0$**

Sol: $3x + 0.y + 2 = 0$

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

(vii) **$y - 2 = 0$**

Sol: $0.x + 1.y - 2 = 0$

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

(viii) **$5 = 2x$**

Sol: $2x + 0.y - 5 = 0$

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

Solution of a Linear Equation

(i) Any pair of values of 'x' and 'y' which satisfy the linear equation in two variables $ax + by + c = 0$ is called its solution.

(ii) A linear equation in two variables has infinitely many solutions.

Example 3 : Find four different solutions of the equation x + 2y = 6.

Sol: Given equation $x + 2y = 6$.

(i) $Let\ x = 0 \Rightarrow 0 + 2y = 6$

$\Rightarrow 2y = 6$

$\Rightarrow y = \dfrac{6}{2} = 3$

$Solution: (0,3)$

(ii) $Let\ x = 2 \Rightarrow 2 + 2y = 6$

$\Rightarrow 2y = 6 - 2$

$\Rightarrow 2y = 4$

$\Rightarrow y = \dfrac{4}{2} = 2$

$Solution: (2,2)$

$(iii)\ Let\ x = 4 \Rightarrow 4 + 2y = 6$

$\Rightarrow 2y = 6 - 4$

$\Rightarrow 2y = 2$

$\Rightarrow y = \dfrac{2}{2} = 1$

$Solution: (4,1)$

$(vi)\ Let\ x = 6 \Rightarrow 6 + 2y = 6$

$\Rightarrow 2y = 6 - 6$

$\Rightarrow 2y = 0$

$\Rightarrow y = \dfrac{0}{2} = 0$

$Solution: (6,0)$

Hence, four different solutions for equation are $(0,3); (2,2); (4,1); (6,0)$

Example 4 : Find two solutions for each of the following equations:

(i) $\mathbf{4x + 3y = 12}$

$Sol: Let\ x = o \Rightarrow 4 \times 0 + 3y = 12$

$\Rightarrow 3y = 12$

$\Rightarrow y = \dfrac{12}{3} = 4$

$Solution: (0,4)$

$Let\ y = 0 \Rightarrow 4x + 3 \times 0 = 12$

$\Rightarrow 4x = 12$

$\Rightarrow x = \dfrac{12}{4} = 3$

$Solution: (3,0)$

Hence, two different solutions for equation are $(0,4); (3,0)$

(ii) $\mathbf{2x + 5y = 0}$

$Sol: Let\ x = o \Rightarrow 2 \times 0 + 5y = 0$

$\Rightarrow 5y = 0$

$\Rightarrow y = 0$

$Solution: (0,0)$

$Let\ x = 1 \Rightarrow 2 \times 1 + 5y = 0$

$\Rightarrow 2 + 5y = 0$

$$\Rightarrow 5y = -2$$

$$\Rightarrow y = \frac{-2}{5}$$

$Solution: \left(1, \frac{-2}{5}\right)$

Hence, two different solutions for equation are $(0,0); \left(1, \frac{-2}{5}\right)$

(**iii**) $3y + 4 = 0$

$Sol: 3y + 4 = 0$

$$\Rightarrow 3y = -4$$

$$\Rightarrow y = \frac{-4}{3}$$

$Solutions: \left(0, \frac{-4}{3}\right), \left(1, \frac{-4}{3}\right)$

EXERCISE 4.2

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 is true

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

(*i*)$2x + y = 7$

$(a) Let\ x = 0 \Rightarrow 2 \times 0 + y = 7$

$$\Rightarrow y = 7$$

$Solution: (0,7)$

$(b) Let\ x = 2 \Rightarrow 2 \times 2 + y = 7$

$$\Rightarrow 4 + y = 7$$

$$\Rightarrow y = 7 - 4$$

$$\Rightarrow y = 3$$

$Solution: (2,3)$

$(c) Let\ x = 4 \Rightarrow 2 \times 4 + y = 7$

$$\Rightarrow 8 + y = 7$$

$$\Rightarrow y = 7 - 8$$

$$\Rightarrow y = -1$$

$Solution: (4,-1)$

$(d) Let\ y = 0 \Rightarrow 2x + 0 = 7$

$$\Rightarrow 2x = 7$$

$$\Rightarrow x = \frac{7}{2}$$

$Solution: \left(\dfrac{7}{2}, 0\right)$

Hence, four different solutions for equation are $(0,7); (2,3); (4,-1); \left(\dfrac{7}{2}, 0\right)$

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

(a) Let $x = 0 \Rightarrow \pi \times 0 + y = 9$

   $\Rightarrow 0 + y = 9$

   $\Rightarrow y = 9$

   $Solution: (0,9)$

(b) Let $x = 1 \Rightarrow \pi \times 1 + y = 9$

   $\Rightarrow \pi + y = 69$

   $\Rightarrow y = 9 - \pi$

   $Solution: (1, 9 - \pi)$

(c) Let $x = -1 \Rightarrow \pi \times (-1) + y = 9$

   $\Rightarrow -\pi + y = 69$

   $\Rightarrow y = 9 + \pi$

   $Solution: (-1, 9 + \pi)$

(d) Let $y = 0 \Rightarrow \pi x + 0 = 9$

   $\Rightarrow \pi x = 9$

   $\Rightarrow x = \dfrac{9}{\pi}$

   $Solution: \left(\dfrac{9}{\pi}, 0\right)$

Hence, four different solutions for equation are $(0,9); (1, 9 - \pi); (-1, 9 + \pi); \left(\dfrac{9}{\pi}, 0\right)$

(iii)$x = 4y$

(a) Let $x = 0 \Rightarrow 0 - 4y = 0$

   $\Rightarrow -4y = 0$

   $\Rightarrow y = 0$

   $Solution: (0,0)$

(b) Let $x = 4 \Rightarrow 4 = 4y$

   $\Rightarrow y = \dfrac{4}{4} = 1$

   $Solution: (4,1)$

(c) Let $x = 2 \Rightarrow 2 = 4y$

   $\Rightarrow y = \dfrac{2}{4}$

   $\Rightarrow y = \dfrac{1}{2}$

   $Solution: \left(2, \dfrac{1}{2}\right)$

(d) Let $y = -1 \Rightarrow x = 4 \times (-1)$

   $\Rightarrow x = -4$

   $Solution: (-4, -1)$

Hence, four different solutions for equation are $(0,0); (4,1); \left(2, \dfrac{1}{2}\right) (-4, -1)$

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

   $(i)(0, 2)(ii)(2, 0)(iii)(4, 0)(iv)\left(\sqrt{2}, 4\sqrt{2}\right)(v)(1, 1)$

Sol: $(i)(0, 2)$

   $LHS = x - 2y = 0 - 2 \times 2 = 0 - 4 = -4 \neq RHS$

   $\therefore (0, 2)$ is not a solution to the equation.

(ii) $(2, 0)$

   $LHS = x - 2y = 2 - 2 \times 0 = 2 - 0 = 2 \neq RHS$

   $\therefore (2, 0)$ is not a solution to the equation.

(iii) $(4, 0)$

LHS = $x - 2y = 4 - 2 \times 0 = 4 - 0 = 4 =$ RHS

∴ $(4, 0)$ is a solution to the equation

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

LHS = $x - 2y = \sqrt{2} - 2 \times 4\sqrt{2} = \sqrt{2} + 8\sqrt{2} = 9\sqrt{2} \neq$ RHS

∴ $\left(\sqrt{2}, 4\sqrt{2} \right)$ is not a solution to the equation.

(v) $(1, 1)$

LHS = $x - 2y = 1 - 2 \times 1 = 1 - 2 = -1 \neq$ RHS

∴ $(1,1)$ is not a solution to the equation.

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

Sol: Given equation: $2x + 3y = k$

If $x = 2, y = 1$ is a solution of the given equation then

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

$4 + 3 = k$

$k = 7$

Some more problems for brain boosting:

1. **If x = 3, y = 2 is a solution of the equation 5x- 7y = k, find the value of k and write the resultant equation.**

Solution : If $x = 3, y = 2$ is a solution of the equation $5x - 7y = k$ then

$5 \times 3 - 7 \times 2 = k$

$15 - 14 = k$

$1 = k$

$k = 1$

The resultant equation is $5x - 7y = 1$.

2. **If x = 2k + 1 and y = k is a solutions of the equation 5x + 3y - 7 = 0, find the value of k.**

Solution : It is given that $x = 2k + 1$ and $y = k$ is a solution of the equation $5x + 3y - 7 = 0$

by substituting the value of x and y in the equation we get.

$5(2k + 1) + 3k - 7 = 0$

$10k + 5 + 3k - 7 = 0$

$13k - 2 = 0$

$13k = 2$

$k = \dfrac{2}{13}$

https://sureshmathsmaterial.com/