

# Linear Equations in Two Variables

---

## Linear equation in two variables:

An equation of the form,  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are constants, such that  $a$  and  $b$  are both not zero and  $x$  and  $y$  are variables is called a linear equation in two variables.

For example,  $2x + 3y + 10 = 0$ ,  $3x + 7y = 0$

- Real life situations can be expressed mathematically as linear equations in two variables.

**Example:** The age of Ram is 3 more than twice the age of Mohan. Write a linear equation in two variables to represent this statement.

**Solution:** Let the age of Mohan be  $x$  years and the age of Ram be  $y$  years.  
Thus, the given condition can be expressed as  $y = 2x + 3$

## Solution of a linear equation in two variables:

The values of the variables in a linear equation, which satisfy the equation are the solutions of that linear equation.

- A linear equation in two variables has infinitely many solutions.
- Solution of linear equation in two variables can be found by substitution method.

**Example:** Find two different solutions of the equation  $4x + 5y = 20$ .

**Solution:** Given equation is  $4x + 5y = 20$ .

If we take  $x = 0$ , we obtain:

$$4 \times 0 + 5y = 20$$

$$\Rightarrow 5y = 20$$

$$\Rightarrow y = 4$$

So,  $(0, 4)$  is a solution of the given equation.

If we take  $y = 0$ , we obtain:

$$4x + 5 \times 0 = 20$$

$$\Rightarrow 4x = 20$$

$$\Rightarrow x = 5$$

So,  $(5, 0)$  is a solution of the given equation.

- The geometrical representation of the linear equation,  $ax + by + c = 0$ , is a straight line.
- In order to represent a linear equation in two variables graphically, its two or three different points are calculated and then the corresponding points are plotted and joined on

the coordinate plane.

**Example:** Represent  $x + 3y = 6$  on a graph paper.

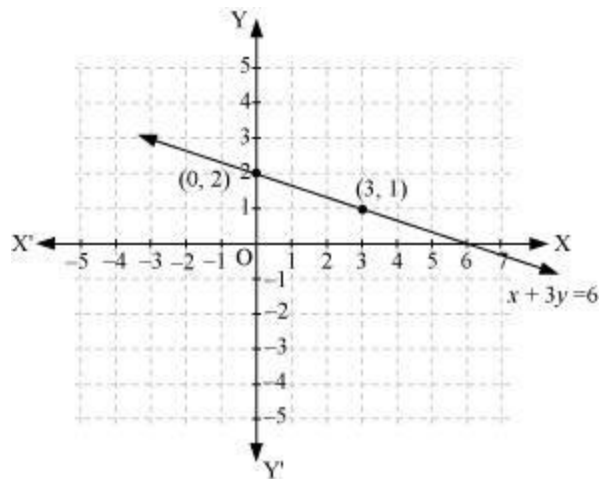
**Solution:** The given equation is  $x + 3y = 6$

$$\text{For } x = 0, 3y = 6 \Rightarrow y = \frac{6}{3} = 2$$

$$\text{For } x = 3, 3 + 3y = 6 \Rightarrow 3y = 3 \Rightarrow y = 1$$

$x$	0	3
$y$	2	1

By plotting  $(0, 2)$  and  $(3, 1)$  on coordinate plane and then joining them, the given equation can be represented as:



- An equation of the form,  $y = mx$ , represents a line passing through the origin.
- **Graphical solution of linear equation in two variables:**

Every point on the graph of a linear equation in two variables is a solution of the linear equation and moreover, every solution of the linear equation is a point on the graph of the linear equation.

**Example:** A bag contains some Re 1 coins and some Rs 2 coins. The total worth of coins is Rs 45. Find the number of Re 1 coins, if there are 10 coins of Rs 2.

**Solution:** Let there be  $x$  coins of Re 1 and  $y$  coins of Rs 2.

$$\text{Thus, } 1x + 2y = 45$$

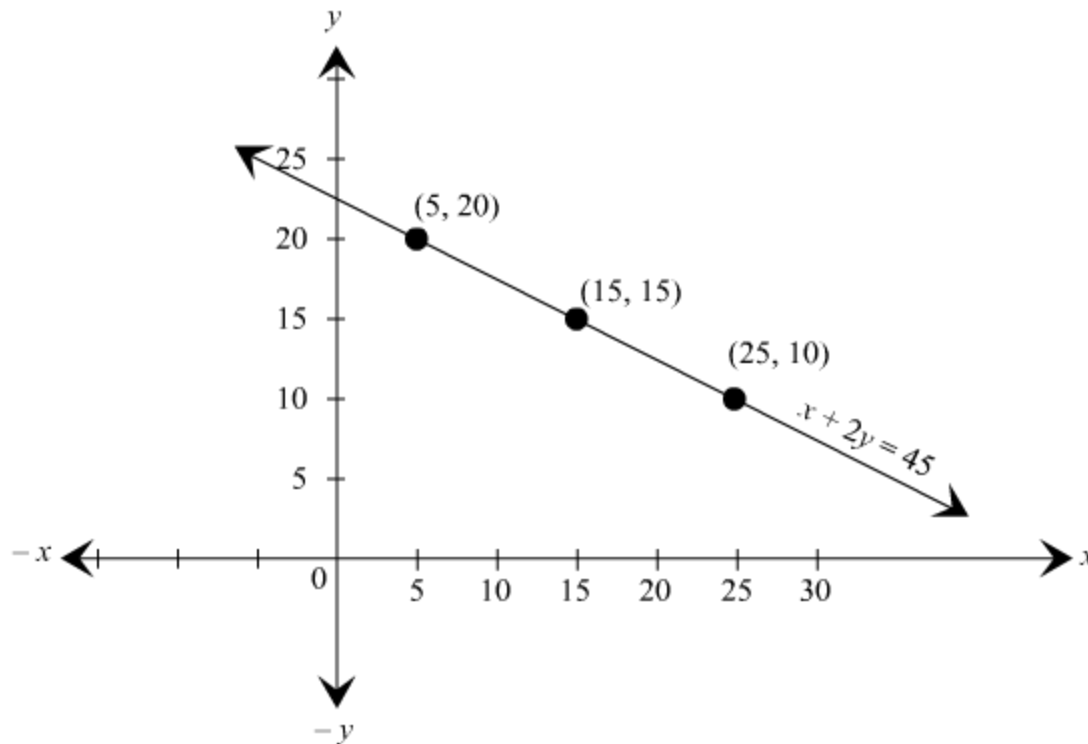
$$\Rightarrow x + 2y = 45$$

This is the required linear equation of the given information. The three solutions of this equation have been given in the tabular form as follows:

$x$	5	15	25
-----	---	----	----

$y$	20	15	10
-----	----	----	----

By plotting the points (5, 20), (15, 15) and (25, 10), we obtain the following graph.



From the above graph, it can be seen that the value of  $x$  corresponding to  $y = 10$  is 25. Therefore, there are 25 coins of Re 1, if there are 10 coins of Rs 2.

- The graph of  $x = a$  is a straight line parallel to the  $y$ -axis, situated at a distance of  $a$  units from  $y$ -axis.
- The graph of  $y = b$  is a straight line parallel to the  $x$ -axis, situated at a distance of  $b$  units from  $x$ -axis.

**Example:** Represent the equation  $2y + 5 = 0$ , on Cartesian plane.

**Solution:**  $2y + 5 = 0$

$$\Rightarrow 2y = -5$$

$$\Rightarrow y = \frac{-5}{2} = -2.5, \text{ which is of the form } y = b.$$

The graph of this equation can be drawn as follows:

