Chapter 13: Linear Equations in two variable

Exercise 13.1

1) 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) $2x+3y=12$

→ Given eqn is $2x+3y=12$

It can be written as $2x+3y-12=0$ —— ①

On compairing eqn ① with $ax+by+c=0$

we get $a=2, b=3, c=-12$

ii) $x-y/2-5=0$

→ Given equation is $x-y/2-5=0$

It can be written as $2x-y-10=0$ —— ①

on compairing eqn ① with $ax+by+c=0$

we get, $a=2, b=-1, c=-10$

iii) $2x+3y=9.35$

→ Given equation is $2x+3y=9.35$

It can be written as $2x+3y-9.35=0$ —— ①

On compairing eqn ① with $ax+by+c=0$

we get, $a=2, b=3, c=-9.35$

iv) $3x=-7y$

Given equation is $3x=-7y$

It can be written as $3x+7y=0$ —— ①

on compairing eqn ① with $ax+by+c=0$

we get, $a=3, b=7$

v) $2x+3=0$

→ Given equation is $2x+3=0$ ---①

It can be written as $2x+0y+3=0$ ---①

On compairing equn① with $ax+by+c=0$

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

vi) $y-5=0$

→ Given equation is $y-5=0$

It can be written as $0x+y-5=0$ ---①

On compairing equn① with $ax+by+c=0$

we get $a=0, b=1, c=-5$

vii) $4=3x$

→ Given equation is $4=3x$

It can be written as $3x+0y.-4=0$ ---①

On compairing equn① with $ax+by+c=0$

we get $a=3, b=0, c=-4$

viii) $y=x/2$

→ Given equation is $y=x/2$

It can be written as $2y=x$

$\Rightarrow x-2y+0=0$ ---①

On compairing equn① with $ax+by+c=0$

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

2.) Write each of the following as an equation in two variables;

→ i) $2x=-3$

Given equn is $2x=-3$

It can be written in two variables as $2x+0y+3=0$

ii) $y=3$

→ Given equation is $y=3$

It can be written in two variables as $0x+y-3=0$ /

iii) $5x = 7/2$

→ Given eqn is $5x = 7/2$

It can be written in two variables as $10x = 7$

$$10x + 0y - 7 = 0$$

iv) $y = 3/2x$

→ Given equation is $y = 3/2(x)$

$$2y = 3x$$

It can be written in two variables as $3x - 2y + 0 = 0$

3) The cost of ball pen is Rs. 5 less than half of the cost of fountain pen. Write this statement as a linear equation in two variables.

→ Let us consider, the cost of ball pen is x and the cost of fountain pen is y.

Then, from given condition

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

$$2x = y - 10$$

$$\boxed{2x - y + 10 = 0}$$ this is required linear equation in two variables.

Exercise 13.2

1) Write two solutions for each of the following equations:

i) $3x + 4y = 7$

→ Given eqn is $3x + 4y = 7$ i.e. $3x + 4y - 7 = 0$ ——— (1)

$3x = -4y + 7$ & $4y = 7 - 3x$

$x = \frac{-4}{3}y + 7/3$ & $y = \frac{7}{4} - \frac{3}{4}x$

put $\boxed{x = 1}$ $\quad y = \frac{7}{4} - \frac{3}{4} = \frac{(7-3)}{4} = \frac{4}{4} = 1$

$$(x, y) \equiv (1, 1)$$

put $\boxed{x=2}$ $\Rightarrow$ $y = \frac{7}{4} - \frac{3}{4}x$

$y = \frac{7}{4} - \frac{6}{4} = \frac{1}{4}$

$(x,y) \equiv (2, 1/4)$

Thus, the two required solutions of given equn ① are $(1,1)$ & $(2, 1/4)$.

ii) $x = 6y$

→ Given equn is $x = 6y$ —— ①

$y = x/6$

put $\boxed{x=1}$ $\Rightarrow$ $y = 1/6$ $(x,y) \equiv (1, 1/6)$

put $\boxed{x=2}$ $\Rightarrow$ $y = 2/6$ $(x,y) \equiv (2, 1/3)$

$y = 1/3$

put $\boxed{x=0}$ $y = 0$ $(x,y) \equiv (0,0)$

The, the required solutions of given equn ① are $(1, 1/6)$, $(2, 1/3)$, $(0,0)$.

iii) $x + \pi y = 4$

→ Given equn is $x + \pi y = 4$ —— ①

$x = 4 - \pi y$

put $\boxed{y=0}$ $\Rightarrow$ $x = 4$ $(x,y) \equiv (4,0)$

put $\boxed{y=1}$ $\Rightarrow$ $x = 4 - \pi$ $(x,y) \equiv (4-\pi, 1)$

Thus, the required solutions of equn ① are $(4,0)$, $(4-\pi, 1)$.

iv) $2/3\,x - y = 4$

Given equn is $\frac{2}{3}x - y = 4$ —— ①

$y = \frac{2}{3}x - 4$

put $\boxed{x=0}$ $\Rightarrow$ $y = 0 - 4 = -4$ $(x,y) \equiv (0,-4)$

put $\boxed{x=3}$ $\Rightarrow$ $y = 2 - 4 = -2$ $(x,y) \equiv (3,-2)$

The required solutions of given equn ① are $(0,-4)$ & $(3,-2)$.

2) Write two solutions of the form $x=0, y=a$ & $x=b, y=0$ for each of the following equations:

i) $5x-2y=10$

→ Given eqn is $5x-2y-10=0$ —— ①

put $x=0 \Rightarrow$ $0-2y-10=0$

$-2y=10$

$\boxed{y=-5}$ $(x,y) \equiv (0,-5)$

put $y=0 \Rightarrow$ $5x-0-10=0$

$5x=10$

$\boxed{x=2}$ $(x,y) \equiv (2,0)$

Thus, the required two solutions of eqn ① are $(0,-5), (2,0)$

ii) $-4x+3y=12$

→ Given eqn is $-4x+3y=12$ — ①

put $x=0 \Rightarrow$ $0+3y=12$

$\boxed{y=4}$ $(x,y) \equiv (0,4)$

put $y=0 \Rightarrow$ $-4x+0=12$

$-4x=12$

$\boxed{x=-3}$ $(x,y) \equiv (-3,0)$

Thus, for given eqn ① the required two solutions are $(0,4)$ & $(-3,0)$

iii) $2x+3y=24$

→ Given eqn is $2x+3y=24$ —— ①

put $x=0 \Rightarrow$ $0+3y=24$

$\boxed{y=8}$ $(x,y) \equiv (0,8)$

put $y=0 \Rightarrow$ $0+2x=24$

$\boxed{x=12}$ $(x,y) \equiv (12,0)$

Thus, the required two solutions of eqn ① are $(0,8)$ and $(12,0)$.

3.) Check which of the following are solutions of the equation $2x-y=6$ and which are not.

i) $(3,0)$

→ Given equn is $2x-y=6$ —— ①

put $x=3$ & $y=0$ in equn ①

$$2(3)-0=6$$
$$6=6$$

Thus, $(3,0)$ is the solution of equn ①.

ii) $(0,6)$

→ Given equn is $2x-y=6$ — ①

put $x=0$ & $y=6$ in equn ①

$$0-6=6$$
$$-6\neq 6$$

Thus, $(0,6)$ is not the solution of equn ①.

iii) $(2,-2)$

→ Given equn is $2x-y=6$ — ①

put $x=2$ and $y=-2$ in ①

$$\Rightarrow \quad 2(2)-(-2)=6$$
$$4+2=6$$
$$6=6$$

Thus, $(2,-2)$ is the solution of equn ①

iv) $(\sqrt{3},0)$

→ Given equn is $2x-y=6$ — ①

put $x=\sqrt{3}$ & $y=0$ in equn ①

$$2(\sqrt{3})-0=6$$
$$2\sqrt{3}\neq 6$$

Thus, $(\sqrt{3},0)$ is not the solution of equn ①.

v) $(1/2,-5)$

→ Given equn is $2x-y=6$ — ①

put $x=1/2$ & $y=-5$ in equn ①

$$2(1/2)-(-5)=6$$
$$1+5=6$$
$$6=6$$

Thus, $(1/2,-5)$ is the solution of equn ①.

4.) If $x=-1$, $y=2$ is a solution of the equation $3x+4y=k$, find the value of k.

→ Given equation is $3x+4y=k$ —— ①

Given, $x=1$ & $y=2$ i.e. $(-1,2)$ is a solution of eqn ①.

$$\Rightarrow \quad 3(-1)+4(2)=K$$
$$-3+8=k$$
$$\boxed{5=K}$$

Thus, the value of k is found to be 5.

5.) find the value of λ, if $x=-\lambda$ and $y=5/2$ is a solution of the equation $x+4y-7=0$.

→ Given eqn is $x+4y-7=0$ —— ①

Given that, $(x,y)\equiv(-\lambda, 5/2)$ is the solution of eqn ①.

$$\Rightarrow \quad -\lambda+4(5/2)-7=0$$
$$-\lambda+2(5)-7=0$$
$$-\lambda+10-7=0$$
$$-\lambda+3=0$$
$$\boxed{\lambda=3}$$

Thus, the value of λ is found to be 3.

6.) If $x=(2\alpha+1)$ and $y=(\alpha-1)$ is a solution of equation $2x-3y+5=0$, find the value of α.

→ Given equation is $2x-3y+5=0$ —— ①

Given that, $x=(2\alpha+1)$ & $y=(\alpha-1)$ is the solution of eqn ①.

$$\Rightarrow \quad 2(2\alpha+1)-3(\alpha-1)+5=0$$
$$4\alpha+2-3\alpha+3+5=0$$
$$\alpha+10=0$$
$$\boxed{\alpha=-10}$$

Thus, the value of α is found to be -10.

7) If $x=1$ and $y=6$ is a solution of the equation $8x-ay+a^2=0$, find the value of a.

→ Given eqn is $8x-ay+a^2=0$ —①

Here, given that $x=1$ & $y=6$ is a solution of eqn ①.

$$\Rightarrow \quad 8(1)-a(6)+a^2=0$$
$$8-6a+a^2=0$$
$$a^2-6a+8=0$$
$$a^2-4a-2a+8=0$$
$$a(a-4)-2(a-4)=0$$
$$(a-4)(a-2)=0$$
$$\boxed{a=4} \text{ or } \boxed{a=2}$$

Thus, the values of a found to be 4 and 2.

Exercise 13.3

1) Draw the graph of each of the following linear equations in two variables:

i) $x+y=4$

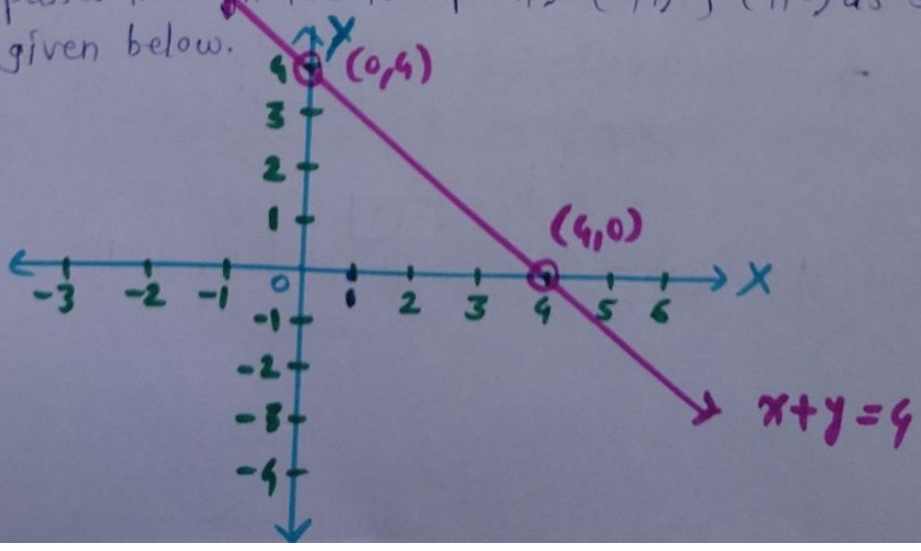
→ Given eqn is $x+y=4$ —①

$$x=4-y \text{ or } y=4-x$$

put $\boxed{x=0} \Rightarrow \boxed{y=4}$ $(0,4)\equiv(x,y)$

put $\boxed{x=4} \Rightarrow \boxed{y=0}$ $(4,0)\equiv(x,y)$

The eqn ① passes through the two points $(0,4)$ & $(4,0)$ as shown in graph given below.



ii) $x-y=2$

→ Given eqn is $x-y=2$ —①

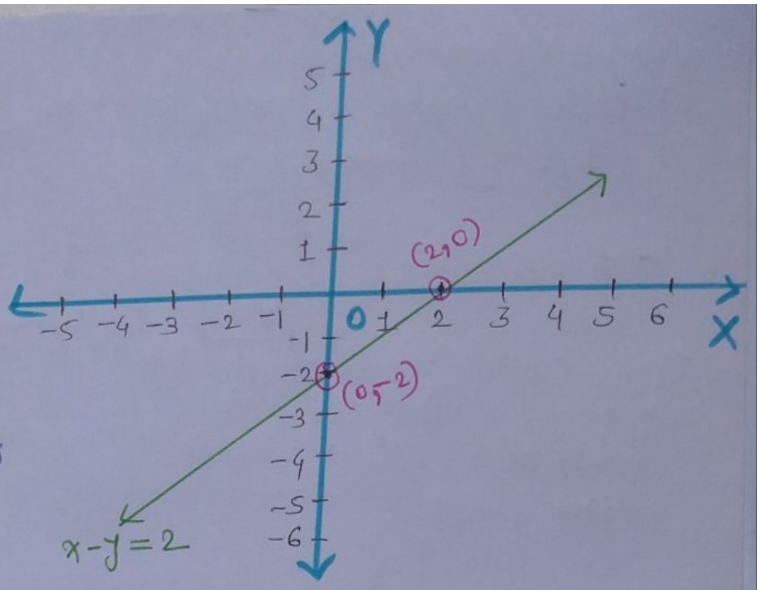
put $x=0$ $\quad 0-y=2$

$y=-2$

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

$x=2$

Thus, eqn ② represents the line which passes through two points $(0,-2)$ and $(2,0)$ as shown in the graph.



iii) $-x+y=6$

→ Given eqn is $-x+y=6$ —①

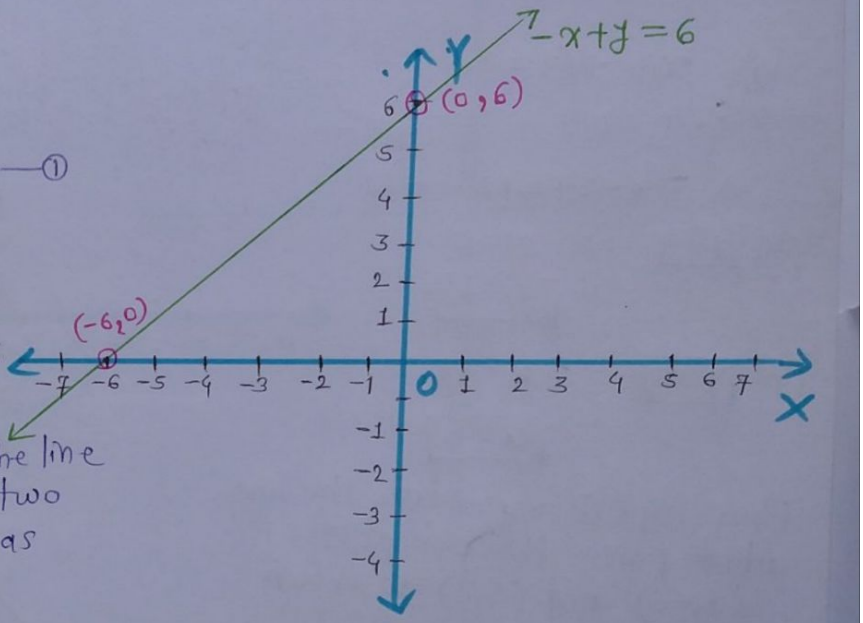
put $x=0$ $\Rightarrow 0+y=6$

$y=6$

put $y=0$ $\Rightarrow -x+0=6$

$x=-6$

Thus, eqn ① represents the line which passes through two points $(0,6)$ & $(-6,0)$ as shown in the graph.



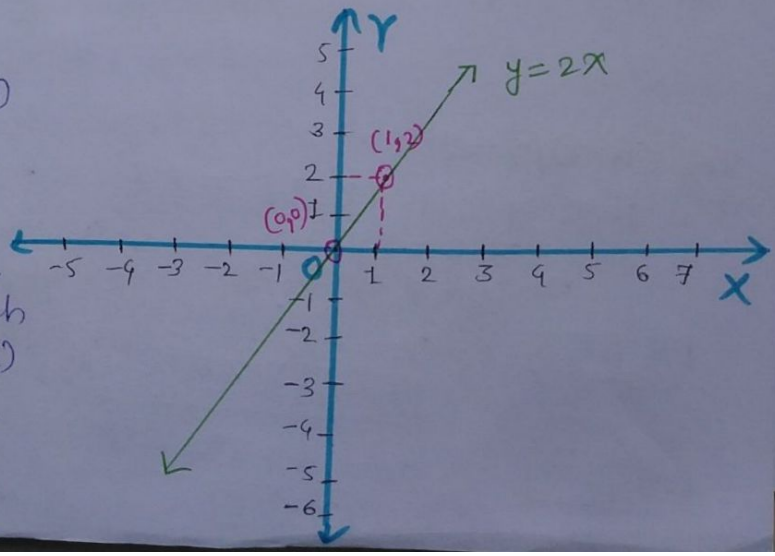
iv) $y=2x$

→ Given eqn is $y=2x$ —①

put $x=0$ $\quad y=0$

put $x=1$ $\quad y=2$

Thus, eqn ① represents the line which passes through two points $(0,0)$ and $(1,2)$ as shown in the graph.



v) $3x+5y=15$

→ Given equation is $3x+5y=15$ —①

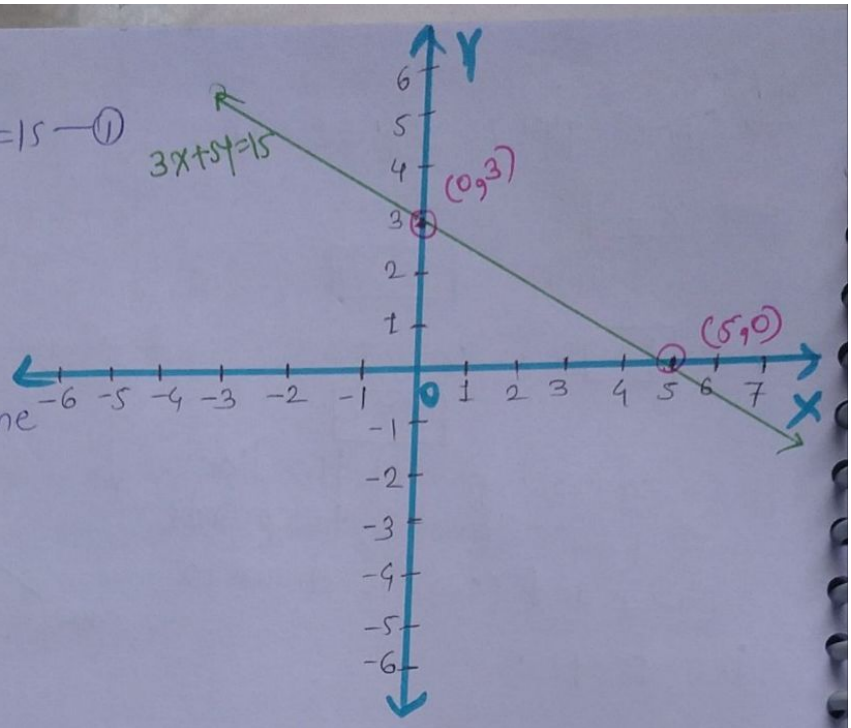
put $x=0$ $\quad 0+5y=15$

$y=3$

and put $y=0$ $\quad 3x=15$

$x=5$

Thus, equn ① represents the line which passes through points $(0,3)$ and $(5,0)$ as shown in the graph.



vi) $x/2-y/3=2$

→ Given equn is $\frac{x}{2}-\frac{y}{3}=2$

$\Rightarrow 3x-2y=12$ —①

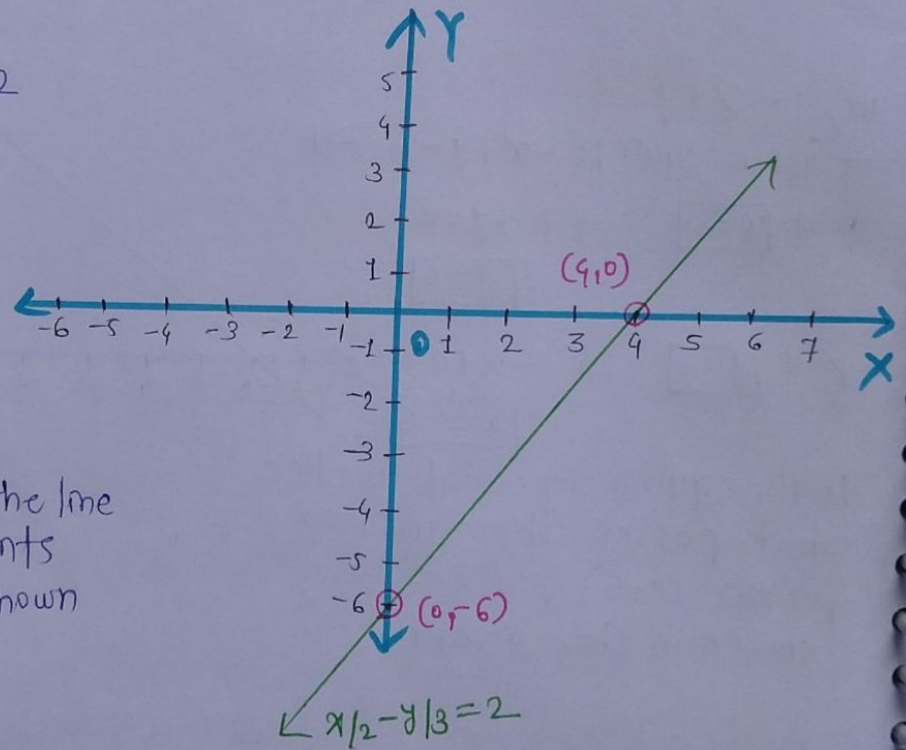
put $x=0$ $\quad 0-2y=12$

$y=-6$

put $y=0$ $\quad 3x=12$

$x=4$

Thus, equn ① represents the line which passes through points $(0,-6)$ and $(4,0)$ as shown in the graph.



vii) $(x-2)/3=y-3$

→ Given equn is $(x-2)/3=y-3$

$x-2=3y-9$

$x-3y+7=0$ —①

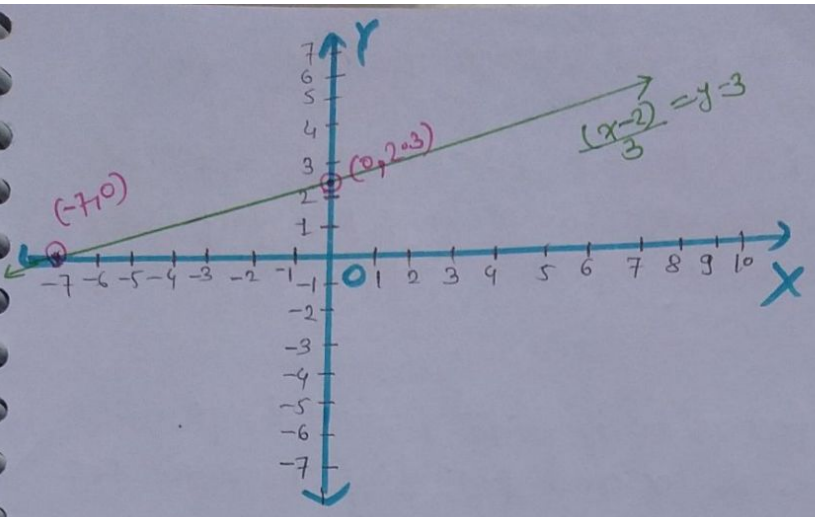
put $x=0$ $\quad -3y=-7$

$y=7/3=2.3$

put $y=0$ $\quad x-0+7=0$

$x=-7$

Thus, equn ① represents the line which passes through points $(0,2.3)$ & $(-7,0)$ as shown in the graph.



viii) $2y = -x+1$

→ Given eqn is $2y = -x+1$ — ①

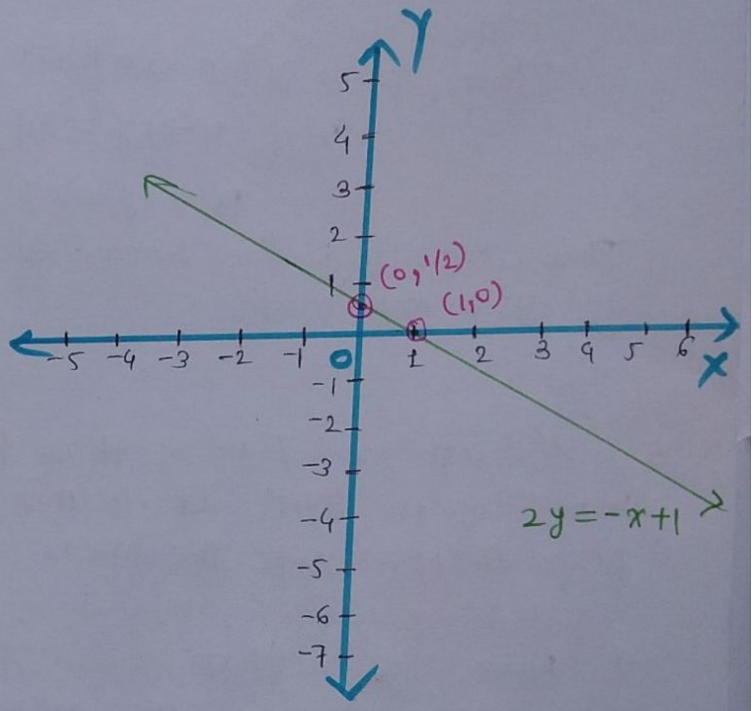
put $\boxed{x=0}$ $\quad 2y = 0+1$

$\boxed{y = 1/2}$

put $\boxed{y=0}$ $\quad 0 = -x+1$

$\boxed{x=1}$

Thus, eqn ① represents the line which passes through points $(0, 1/2)$ & $(1,0)$ as shown in the graph.



2) Give the equations of two lines passing through $(3,12)$. How many more such lines are there and why?

→ Here, given that $x=3$, $y=12$

We can write the eqn, $x+y=15$ which passes through given point $(3,12)$.

Again, the point $(3,12)$ passes through line $y-x=9$ also.

So, we can say there are infinite lines which passes through the point $(3,12)$.

4) A leading library has a fixed charge for the first three days and an additional charge for each day thereafter. Aarushi paid Rs. 27 for a book kept for 7 days. If fixed charges are Rs x and per day charges are Rs. y. Write the linear equation representing the above information.

→ Here, given that
Aarushi paid Rs. 27 for a book kept for 7 days.
And fixed charges are Rs. x and per day charges are Rs. y.
Then, from given condition,

$$x + (7-3)y = 27$$
$$x + 4y = 27 \quad \text{——①}$$

Thus, equn ① is the linear equation in two variables for a given information.

5) A number is 27 more than the number obtained by reversing its digits. If its unit d and ten's digit are x & y respectively, write the linear equation representing the statement.

→ Here, given that
The number 27 is more than the no. obtained by reversing its digits.
Then, if x is a unit digit & y is the ten's digit then the number should be $10y + x$.
And, after reversing its digit we will get a number $10x + y$.
from given condition,

$$10y + x = 10x + y + 27$$
$$10y - y + x - 10x = 27$$
$$+9y - 9x = 27$$
$$y - x = 3$$
$$\boxed{x - y + 3 = 0}$$

Thus, this is required equation in two variables.

6) The sum of a two digit no. & the no. obtained by reversing the order of its digit is 121. If unit's & ten's digit of a number are x & y respectively, then write the linear equation representing the above statement.

→ Here, given that
The sum of a two digit no. & the no. obtained by reversing the order of its digit is 121.
Let 'x' is the unit digit & y is the ten's digit then the given number should be $(10y + x)$.
After reversing the digits, the new number formed is $(10x + y)$.
But, given that, the sum of two numbers is 121.
Then, from given condition,

$$(10y + x + 10x + y) = 121$$

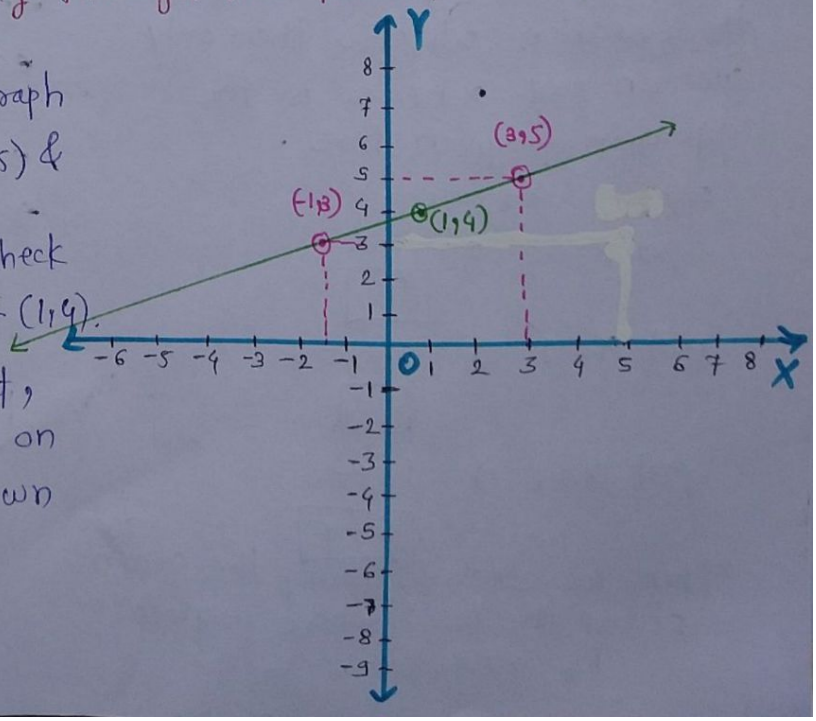
$$11y + 11x = 121$$

$$\boxed{x + y = 11}$$

This is the required linear equation in two variables formed from the given data.

7) Plot the points (3, 5) & (−1, 3) on a graph paper & verify that the straight line passing through the points, also passes through the point (1, 4).

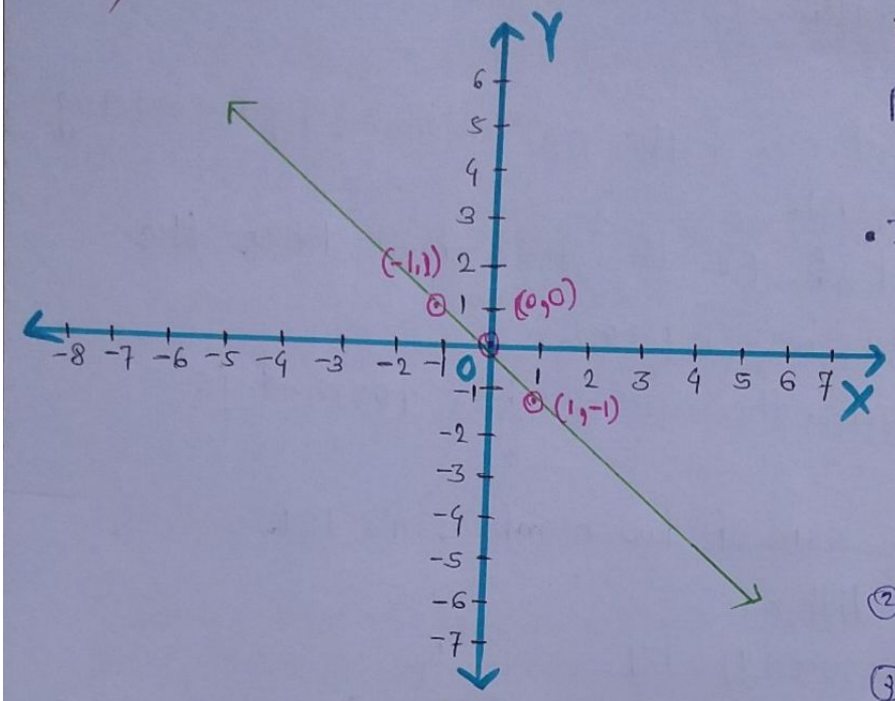
→ • First we will plot the graph passing through points (3, 5) & (−1, 3) as shown in fig.
• After that, we will check where is the third point (1, 4).
• Now, we will see that, the point (1, 4) is also on the same lines as shown in the graph.



8) From the choices given below, choose the equations whose graph is given in fig.

i) $y=x$ ii) $x+y=0$ iii) $y=2x$ iv) $2+3y=7x$

→



i) • From graph, The line is passing through three points $(0,0)$, $(-1,1)$ & $(1,-1)$.

• If the eqn $y=x$ has these three points on it then the above points are the solutions of given eqn.

① $y=x$ $\quad (x,y)\equiv(0,0)$

$\boxed{0=x}$

② $\boxed{1=x}$ $\quad (x,y)\equiv(1,1)$

③ $\boxed{-1=x}$ $\quad (x,y)\equiv(-1,-1)$

Thus, we conclude that, $y=x$ is not the eqn of line which is represented in graph.

ii) $x+y=0$

→ The points through which the lines passes are $(-1,1)$, $(0,0)$ & $(1,-1)$. If these points satisfies the equation $x+y=0$ then only we can say $x+y=0$ is the equation of given line.

$\Rightarrow \quad x+y=0$

put $x=0 \quad 0+y=0$

$\boxed{y=0}$

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

$\boxed{y=1}$

put $x=1 \Rightarrow 1+y=0$

$\boxed{y=-1}$

Thus, we conclude that, the graph shows the line whose equation is $x+y=0$.

iii) $y=2x$

→ • The points through which the line passes are $(-1,1)$, $(0,0)$ & $(1,-1)$.

• If these points satisfies the equation $y=2x$ then only we can say $y=2x$ is the equation of given line.

$\Rightarrow \quad y=2x$

put $x=0 \quad \boxed{y=0}$

put $x=-1 \Rightarrow \boxed{y=-2}$

put $x=1 \Rightarrow \boxed{y=2}$

Thus, we conclude that, the graph shows the equation $y=2x$ is not the equation of given line in the graph.

iv) $2+3y=7x$

→ Given equn is $2+3y=7x$

- The line shown in graph is passes through points $(0,0)$, $(-1,1)$ and $(1,-1)$.
- If these points are the solution of line of equation $2+3y=7x$ then only we can say the graph represents the line $2+3y=7x$.

Now, $2+3y=7x$

put $x=0$ $\quad 2+3y=0$

$3y=-2$

$\boxed{y=-2/3}$

put $x=1$ $\quad 2+3y=7$

$3y=5$

$\boxed{y=5/3}$

put $x=-1$ $\quad 2+3y=-7$

$3y=-9$

$\boxed{y=-3}$

Thus, we conclude that, these points are not the solutions of equation $2+3y=7x$.

And hence it is not the equation of line represented in the graph.

10.) If the point $(2,-2)$ lies on the graph of linear equation, $5x+ky=4$, find the value of k.

→ Given that,

The point $(2,-2)$ lies on the graph of linear equation $5x+ky=4$.

That means, $(2,-2)$ is the solution of equation $5x+ky=4$.

$\Rightarrow \quad 5(2)+k(-2)=4$

$10-2k=4$

$-2k=4-10$

$-2k=-6$

$\boxed{k=3}$

Thus, the value of k is found to be 3.

Exercise 13.4

1.) Give the geometric representation of following equations:

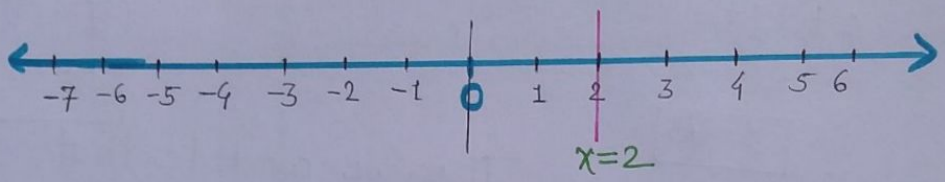
a) on the number line b) on the cartesian plane

i) $x=2$ ii) $y+3=0$ iii) $y=3$ iv) $2x+9=0$

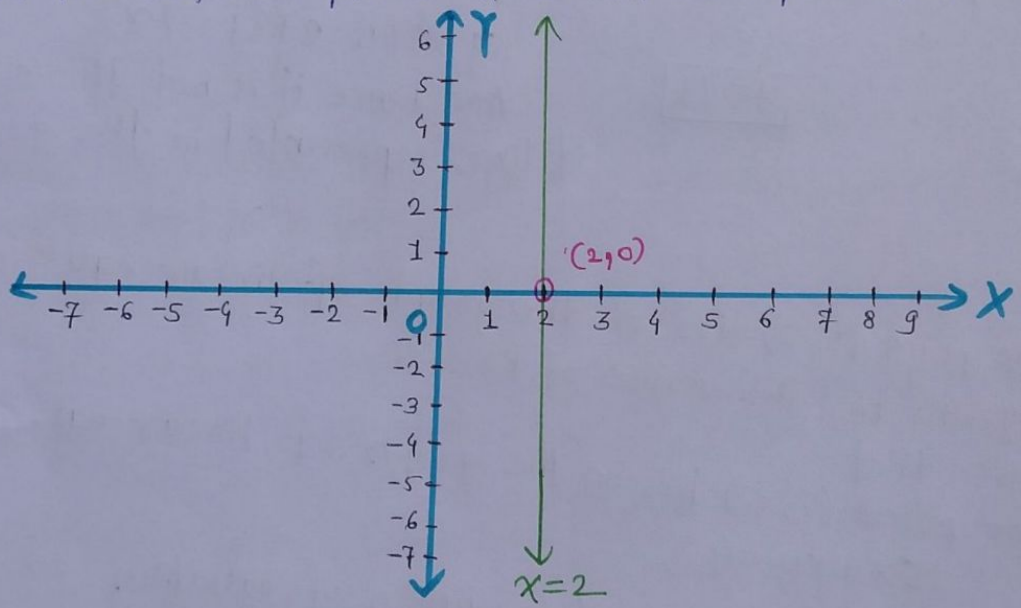
v) $3x-5=0$

→ i) $x=2$

a) on the number line $x=2$ can be represented as

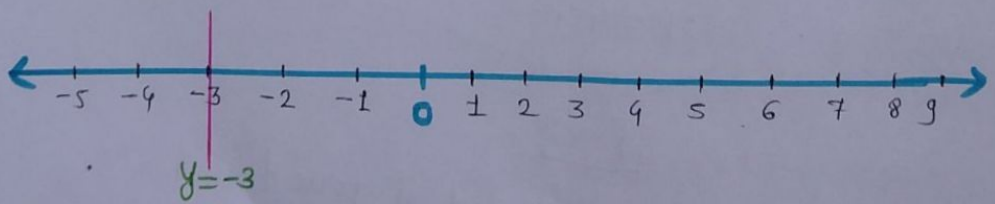


b) on the cartesian plane $x=2$ can be represented as

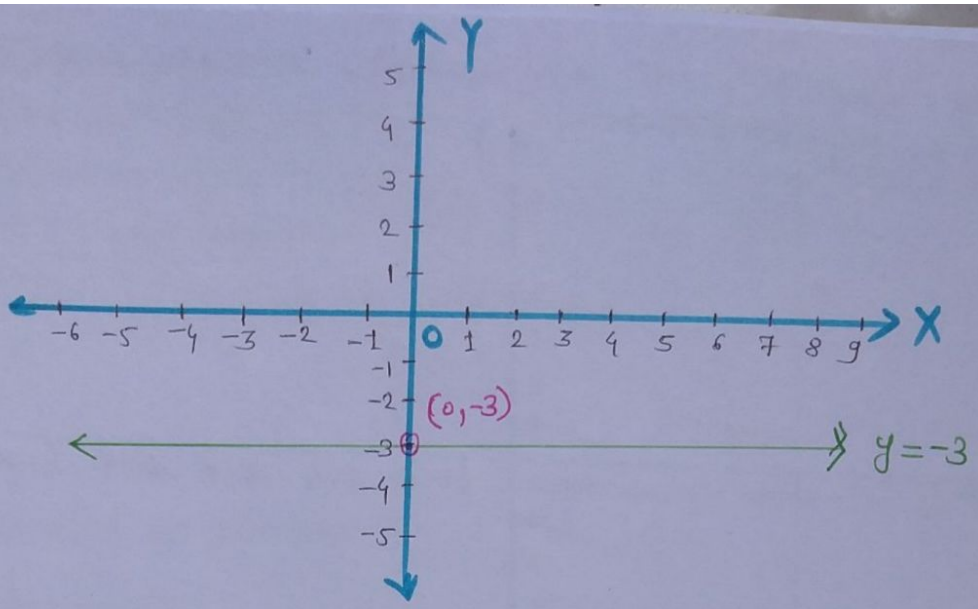


ii) $y+3=0$

→ a) on the number line $y=-3$ can be represented as

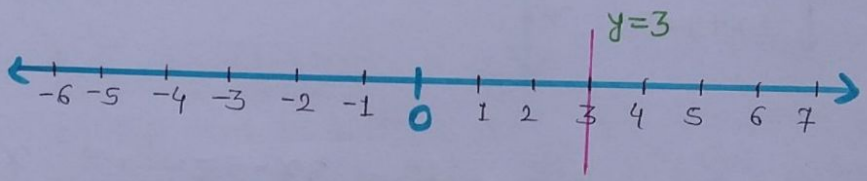


b) on the cartesian plane $y=-3$ can be represented as

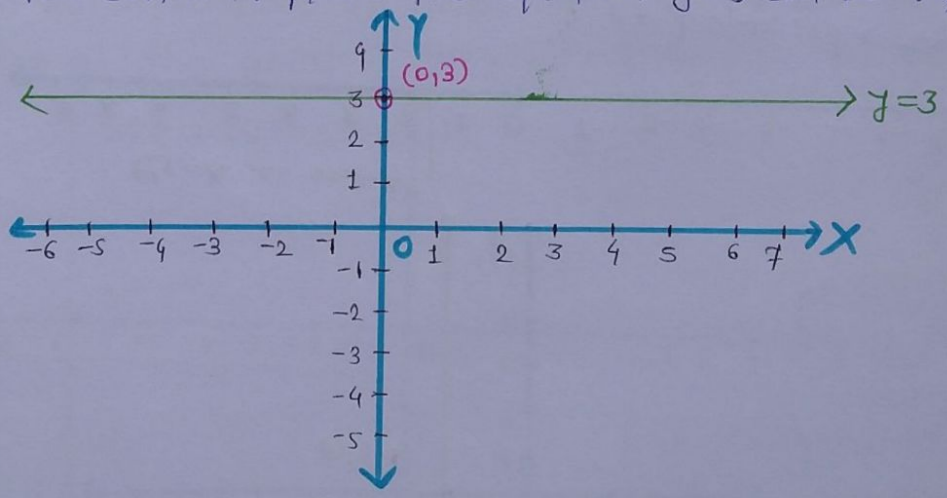


iii) $y=3$

→ a) on number line the equation $y=3$ can be represented as

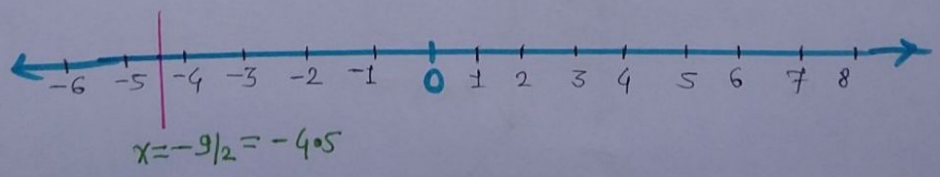


b) on the cartesian plane the equation $y=3$ can be represented as

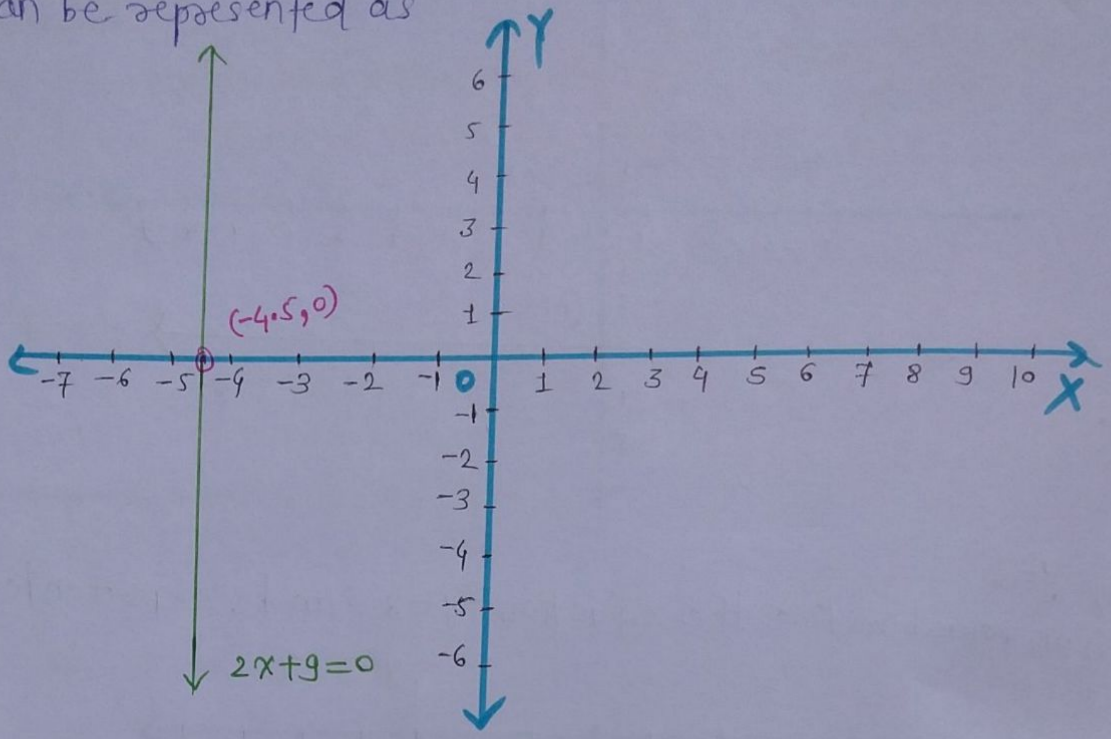


iv) $2x+9=0$

→ a) on the number line the equation $2x+9=0$ i.e. $x=-9/2$ i.e. $x=-4.5$ can be represented as

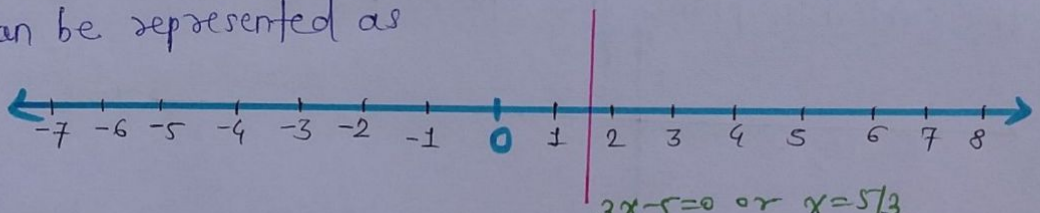


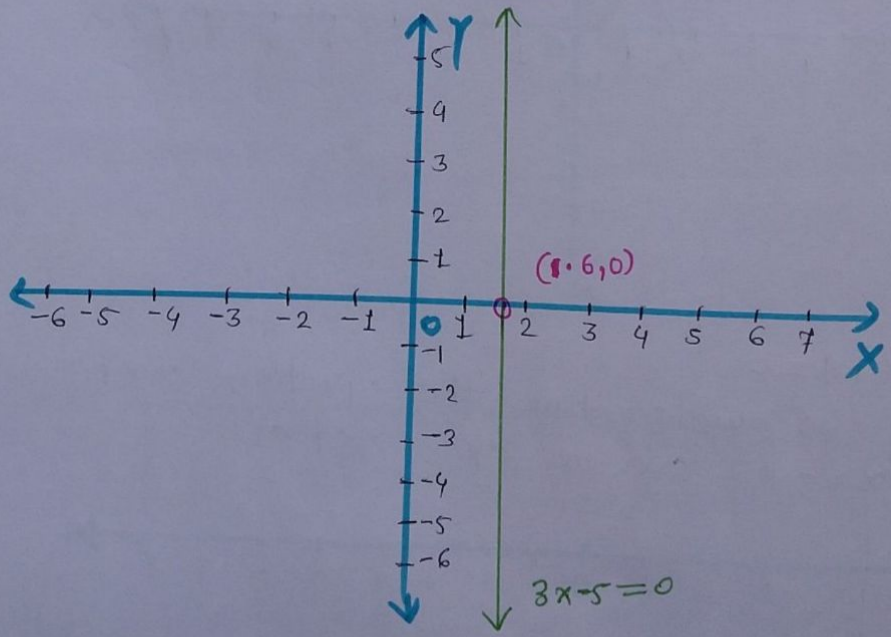
b) on the cartesian plane the equation $2x+9=0$ or $x=-9/2=-4.5$ can be represented as



v) $3x-5=0$

→ a) on the number line the equation $3x-5=0$ i.e. $x=5/3=1.6$ can be represented as





2.) Give the geometrical representation of $2x+13=0$ as an equation in i) one variable ii) two variables

→ Given equation is $2x+13=0$ ——— ①

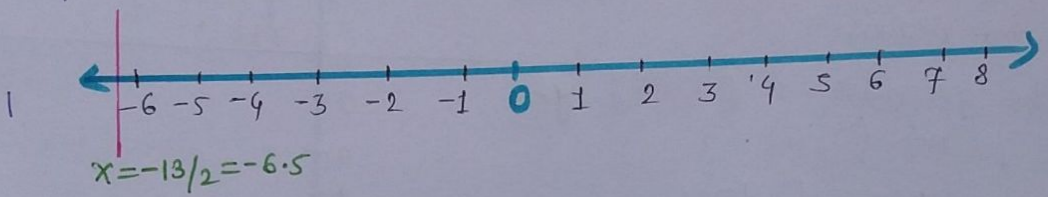
i) In one variable:

The equn ① can be written as $2x=-13$

$x=-13/2$

$\boxed{x=-6.5}$

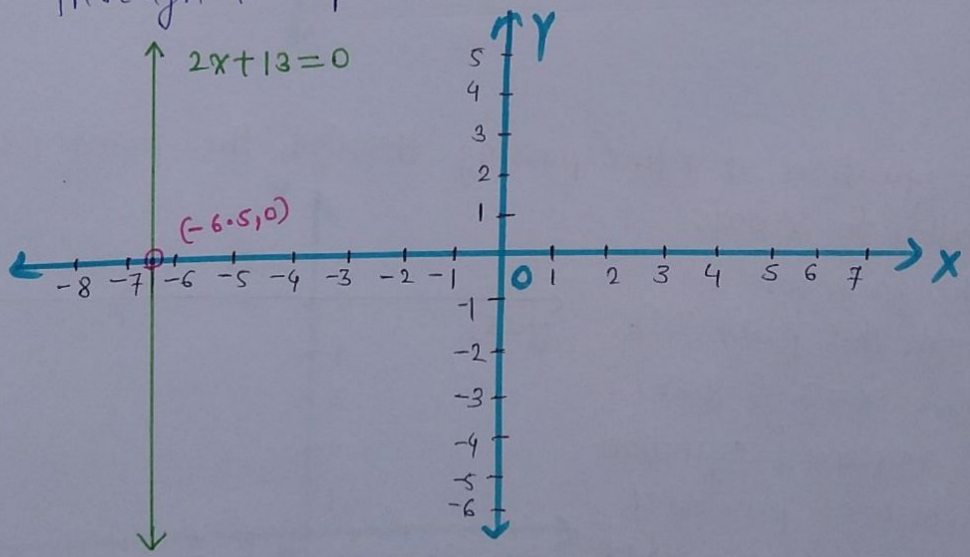
This is the required equn in one variable which can be represented on number line as given below:



ii) In two variables!

The equn ① can be written as $2x+0y+13=0$

And this is the required equation in two variable which can be represented on cartesian plane & which passes through the point $(-13/2, 0)$ or $(-6.5, 0)$ as shown below.



Exercise VSAQs

1.) Write the equation representing the X-axis.

→ The equation of X-axis is $y=0$.

2.) Write the equation representing the Y-axis.

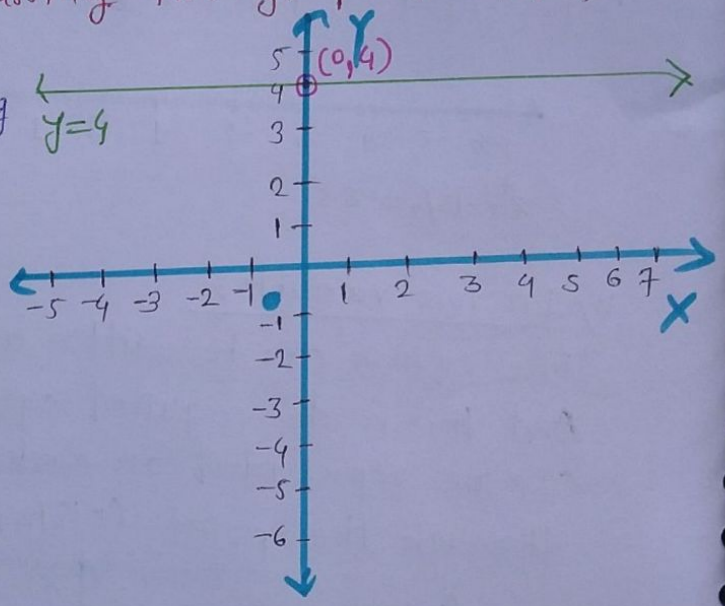
→ The equation of Y-axis is $x=0$.

3.) Write the equn of a line passing through point $(0,4)$ & parallel to X-axis.

→ • Here, the given line is passing through the point $(0,4)$.

• That means, $x=0$ & $y=4$

• Thus, the required equation is $y=4$ & which is parallel to X-axis as represented in the graph given below.

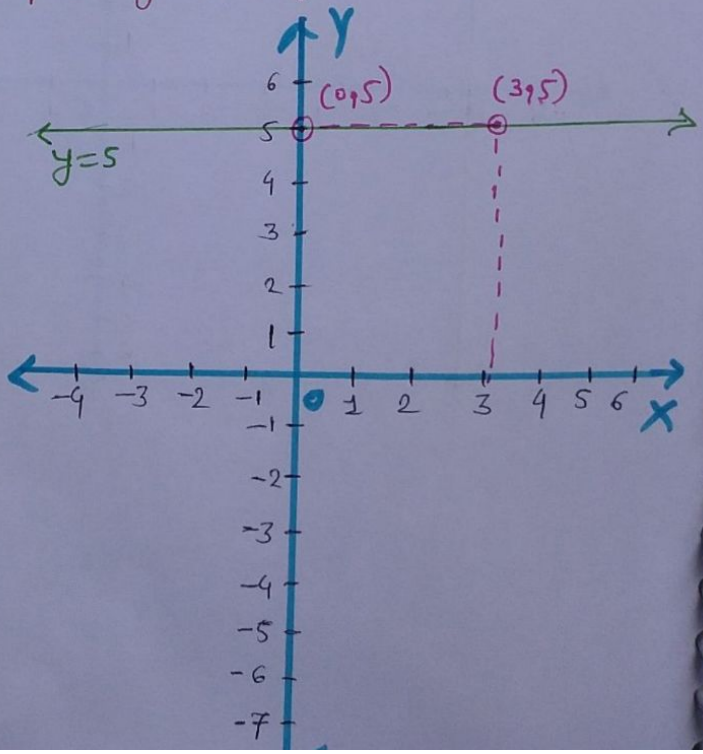


4.) Write the equation of a line passing through the point $(3,5)$ and parallel to X-axis.

→ • Here, the given line is passing through the point $(3,5)$.

That means, $x=3$ & $y=5$

• Thus, the required equation is $y=5$ & which is parallel to X-axis as represented in the graph given below.



5.) Write the equation of a line parallel to y-axis & passing through the point $(-3,-7)$.

→ Here, the given line is passing through the point $(-3,-7)$.

That means, $x=-3$ & $y=-7$.

- Thus, the required equation is $x=-3$ which is parallel to y-axis as represented in the graph shown below.