Grade IX

Lesson : 4 Linear Equations in Two variables [4.1 to 4.4]

LINEAR EQUATION

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Linear equations in one variable

Any equation of the form: $ax + b = 0$, where $a \neq 0$, a and b are real numbers.
e.g. $x + 2 = 0$, $x + \sqrt{2} = 0$
$\sqrt{3}y + \sqrt{6} = 0$, $\sqrt{3}x + \sqrt{6} = 0$ etc

Linear equations in two variable

Any equation of the form: $ax + by + c = 0$, where a, b and c are real numbers and a and b are not both zero
e.g. $x + y + 7 = 0$,
$\sqrt{2}\,x - \sqrt{3}\,y + 7 = 0$, etc.,

Objective Type Questions

I. Multiple choice questions

1. A linear equation in two variables is of the form ax+by +c= 0, where

a) a≠ 0, b ≠0 b) a=0, b ≠0 c) a≠ 0, b = 0 d) a=0, c=0

a) a≠ 0, b≠0

2. Express 5x=-8y in the form of ax+by+c=0

5x=-8y

Or 5x+8y+0 = 0

3. Tell whether the equation $x(x+4)-x^2$ + 3y +5=0 is a liner equation in 2 variables or not.

$x(x+4)-x^2$ + 3y +5=0

Or x^2+4x-x^2+3y+5 =0

Or 4 x +3y+5 =0

This equation is in the form ax + by + c = 0, where a=4, b=-3, c= 5. Hence, this is a linear equation in two variables.

4. Tell whether the equation

$x(x+2)-x^2$ + y(y-3)-y^2 =0 is an equation of linear equation in 2 variables or not.

$x(x+2)-x^2$ + y(y-3)-y^2 =0

Or $x^2+2x-x^2+y^2$- 3y – y^2=0

⟹ 2x-3y =0

⟹ 2x-3y+0 =0

This equation is in the form ax +by +c= 0, where a=2, b=-3, c=0. Hence this is a linear equation in two variables.

5. Express the following linear equations in the form ax +by +c = 0 and indicate the value of a,b and c in each case :

i) $3x+4y = 5$ **ii) $3x = \frac{8}{3}y+10$** **iii) $5y = 10x-7$**

iv) $2x + 8 = 11y$ **v) $x = 5y$** **vi) $\frac{3}{5}x = 2y$**

vii) $8x = 7$ **viii) $4y= \frac{8}{3}$** **ix) $5 = 6y$**

x) $12 = \frac{5}{2}x$

i) $3x+4y = 5 \Rightarrow 3x+4y-5 =0$

This equation is in the form ax+by+c=0 Now, on comparing, we have

a=3, b=4, c=5

ii) $3x = \frac{8}{3}y+10 \Rightarrow 3x - \frac{8}{3}y-10$

This equation is in the form ax+by+c=0 Now, on comparing, we have

a=3, b= $\frac{-8}{3}$, c=-10

iii) $5y = 10x-7 \Rightarrow -10x+5y+7=0$

This equation is in the form ax+by+c=0 Now, on comparing, we have

a=-10, b= 5, c=7

iv) $2x+8=11y \Rightarrow 2x-11y+8=0$

This equation is in the form ax+by+c=0 Now, on comparing, we have

a=2, b= -11, c=8

v) $x=5y \Rightarrow x-5y=0 \Rightarrow 1x-5y +0 =0$

This equation is in the form ax+by+c=0 Now, on comparing, we have

a=1, b= -5, c=0

vi) $\frac{3}{5}x = 2y \Rightarrow \frac{3}{5}x - 2y=0 \Rightarrow \frac{3}{5}x - 2y+0=0$

This equation is in the form ax+by+c=0 Now, on comparing, we have

a=$\frac{3}{5}$, b= -2, c=0

vii) $8x = 7 \Rightarrow 8x -7=0 \Rightarrow 8x+0.y-7=0$

This equation is in the form ax+by+c=0 Now, on comparing, we have a=8, b= 0, c=-7

viii) 4y= $\frac{8}{3} \Rightarrow$ 4y- $\frac{8}{3}$=0$\Rightarrow$ 0.x+4y- $\frac{8}{3}$=0

This equation is in the form ax+by+c=0 Now, on comparing, we have

a=0, b= 4, c=- $\frac{8}{3}$

ix) 5=6y$\Rightarrow$ -6y +5=0$\Rightarrow$0.x-6y+5=0

This equation is in the form ax+by+c=0 Now, on comparing, we have

a=0, b= -6, c=5

x)12=$\frac{5}{2}x \Rightarrow -\frac{5}{2}x$+12 =0 $\Rightarrow -\frac{5}{2}x$ +0.y -12=0

This equation is in the form ax+by+c=0 Now, on comparing, we have

A =$-\frac{5}{2}$, b= 0, c=-12

6.A rabbit covers y meters distance by walking 10 metres in slow motion and the remaining by x jumps, each jump contains 2 metres. Express this information in linear equation.

Distance covered by rabbit in x jumps is 2xx, i.e. 2x metres.

According to question,

Y=10 +2x

I Short answer questions

7. The cost of a pen is three times the cost of a pencil. Write a linear equation in two variables to represent this statement.

(Take the cost of a pen to be Rs. x and that of a pencil by Rs. y)

Let the cost of a pen to be Rs. x and that of a pencil by Rs. y.

According to question,

x=3y $\Rightarrow x - 3y$ = 0

Hence, this is required equations.

8. Age of x is more than the age of y by 10 years. Express this statement in linear equation.

According to question,

x=y + 10

$\Rightarrow x$-y-10=0 $\Rightarrow$1.x-1.y-10=0

This equation is in the form ax+by+c=0 where a=1, b= -1, c=-10

Hence this is required linear equation.

9. Write the linear equation such that each point on its graph has an ordinate 3 times its abscissa.

Let x be the abscissa and y the ordinate

According to question, y=3x $\Rightarrow$ y-3x =0

Hence this is required linear equation.

10. When a number is divided by another number, quotient and remainder obtained are9 and1 respectively. Express this information in linear equation.

Let the dividend be y and the divisor be x

We know that,

Dividend = Divisor x Quotient + Remainder

∴ According to question,

y=9x+1

11. The sum of a two –digit number and the number obtained by reversing the order of its digits is88. Express this information in linear equation.

Let unit's digit be x and ten's digit be y

Then original number be (10y +x)

after reversing the order of digits new number be (10x+y)

According to question,

10y + x + 10x+y=88

11x+11y=88

x+y=8 (dividing both sides by11)

12. In a one-day International Cricket match, placed between India and England in Kanpur, two Indian batsmen, Yuvaraj Singh and M.S. Dhoni scored 200 runs in a partnership including 5 extra runs. Express this information in the form of an equation.

Let x be the number of runs scored by Yuvaraj Singh and y be the number of runs scored by M.S. Dhoni.

According to the questions,

x+y+5=200

Or, x+y+5-200= 0

Or, x +y-195=0

Hence, this is the required equation.

13. Write a linear equation on which the point of the form (a,-a) always lies.

Here x=a, y =-a

That means for x=a, we get y =-a and vice versa.

Therefore, x+y=0 and $-x$-y =0 are equations for which the point of the form (a, -a) always lies.

II. Multiple choice questions

1. The Linear equation 3y-5=0, represented as ax+by+c, has

a) a unique solution **b) infinitely many solutions**

c) two solutions **d) no solution**

b) infinitely many solutions

2. x=5, y= -2 is a solution of the linear equation

a) 2x+y=9 **b) 2x-y =12** **c) x+3y =1** **d) x+3y = 0**

Substituting x=5 and y=-2 in LHS of2x-y=12we have

LHS=2x5-(-2)= 10 + 2 = 12 = RHS

∴ Correct option is (b)

3. Let y varies directly as x. If y= 24, when x=8 then the linear equation is

a) 3y=x **b) y=x** **c) y= 4x** **d) y=3x**

d) y=3x

4. Write one solution of $\pi x + y = 5$.

$\pi x + y = 5$.

y = 5 $-\pi x$ ......(i)

On putting x = 0 in(i), we have

Y = 5- π x 0

⇒Y = 5 – 0 ⇒ $y = 5$

Hence, x = 0, y=5 is a solution of $\pi x + y = 5$

5.Find a, if linear equation 3x-ay=6 has one solution as (4,3)

On putting x = 4 andy y = 3in the equation 3x-ay=6, we have

3 x 4 – a x 3 = 6

⇒12-3a=6 ⇒ $12 - 6 = 3a$ ⇒ $3a = 6$.

$$\Rightarrow \quad a = \frac{6}{3} \Rightarrow a = 2$$

Hence, a = 2.

6. Find the value of b, if x = 5, y=0 is a solution of the equation 3x+5y=b

On putting x = 5 and y = 0 in the equation 3x+5y = b, we have

3 x 5 + 5 x 0 = b

15 + 0 = b ⇒ b = 15

Hence, b = 15.

7. For what value of k, x = 2 and y = -1 is a solution of x + 3y – k = 0

On putting and y = -1 in the equation x + 3y – k = 0,

We have,

2 + 3 x (-1) – k = 0

⇒ 2 – 3 – k = 0 ⇒ $-1 - k = 0$

⇒ $k = -1$

8. If a line represented by the equation 3x+ay=8 passes through (1,1), then find the value of a.

3x+ay=8 ......(i)

On putting x = 1 and y = 1 in (i) we have

3 x 1 + a x 1 = 8 ⇒ 3 + a = 8

⇒ a = 8 – 3 ⇒ a = 5

9. Find the value of β, so that x = 1 and y = 1 is a solution of the equation $5\beta x + 30\beta y = 70$.

Ans: On putting x = 1 and y = 1 is equation

$5\beta x + 30\beta y = 70$, we have

$5\beta \times 1 + 30\beta \times 1 = 70 \Rightarrow 5\beta + 30\beta = 70$

$\Rightarrow \quad 35\beta = 70 \Rightarrow \beta = \frac{70}{35} \Rightarrow \beta = 2$

10. How many solution(s) of the linear equation 2x-5y=7 has?

A linear equation in two variables has infinitely many solutions, therefore, the linear equation 2x-5y=7 has infinitely many solutions.

11. If (2,0) is a solution of the linear equation 2x + 3y = k, then find the value of k.

On putting x = 2 and y = 0 in the equation 2x + 3y = k, we have

2 x 2 + 3 x 0 = k

4 + 0 = k ⇒ k = 4

II Short answer questions

12. Find two solutions for the equation 4x + 3y = 24. How many solutions of this equation are possible?

4x + 3y = 24

On putting x = 0, we have

4 x 0 + 3y = 24 ⇒ 0 + 3y = 24 ⇒ 3y = 24

$\Rightarrow \quad y = \frac{24}{3} \Rightarrow y = 8$

On putting y = 0, we have

$4x + 3 \times 0 = 24 \Rightarrow 4x + 0 = 24 \Rightarrow 4x = 24$

$\Rightarrow \quad x = \frac{24}{4} \Rightarrow x = 6$

Therefore, two solutions are (0,8) and (6,0).

Given equation is a linear equation in two variables. Therefore, it has infinitely many solutions.

13. Write 3x+2y=18 in the form of y = mx +c. Find the value of m and c. Is (4,3) lies on this linear equation?

Given: 3x+2y=18

$\Rightarrow \quad y = \frac{18-3x}{2} = -\frac{3}{2}x + 9$.....(i)

On comparing, we get

$m = \frac{3}{2}\ and\ c = 9$

Substitute x = 4 in (i), we get

$y = -\frac{3}{2} \times 4 + 9 = -6 + 9 = 3$

Hence, point (4,3) lies on 3x+2y=18

III Short answer questions

14. Determine the point on the graph of the linear equation 2x+5y=19, whose ordinate is $1\frac{1}{2}$ times its abscissa.

Let x be the abscissa and y be the ordinate of the given line 2x+5y=19

According to the questions,

$y = 1\frac{1}{2}x$

$\Rightarrow \quad y = \frac{3}{2}x$

On putting $y = \frac{3}{2}x\ in 2x + 5y = 19$, we have

$2x + 5 \times \frac{3}{2}x = 19 \Rightarrow 4x + 5x = 38$

$\Rightarrow \quad 19x = 38 \Rightarrow x = \frac{38}{19} \Rightarrow x = 2$

$y = \frac{3}{2}x \Rightarrow y = \frac{3}{2} \times 2 \Rightarrow y = 3$

Hence, the required point is (2,3)

15. For what value of c, the linear equation $2x$ + cy = 8, has equal values of x and y for its solution

Given equation is $2x + cy = 8$ .....(i)

It is given the value of x is equal to the value of y,

i.e. $x = y$

On putting $x = y$ in (i), we have

$$2x + cx = 8 \Rightarrow cx = 8 - 2x$$

$$\Rightarrow \quad c = \frac{8-2x}{x}, x \neq 0$$

This is the required value of c.

16. The angles of a triangle are, $2x$, $3x$ and $5x$. Find x and the angles of the triangle.

$\because$ Sum of angles of a triangle is 180^0

$\therefore$ $2x + 3x + 5x = 180^0$

$10x = 180^0$

$x = 18^0$

The angles of the triangle are

$2x = 2 \times 18 = 36^0$; $3x = 3 \times 18 = 54^0$ and $5x = 5 \times 18 = 90^0$

Hence, angles are $36^0, 54^0$ *and* 90^0

I Long answer questions

17. For what value of p; $x = 2$, y = 3 is a solution of (p+1) x – (2p+3)y – 1 = 0?

i. Write the equation.

ii. How many solutions of this equation are possible?

iii. Is this line passes through the point (-2,3)? Give justification.

Given : (p+1) x – (2p+3) y – 1 = 0 .....(i)

Put x = 2 and y = 3 in (i) we get

⇒ (p+1) 2 – (2p+3) 3 – 1 = 0

⇒ $2p + 2 - 6p - 9 - 1 = 0$

⇒ $-4p + 2 - 10 = 0$

⇒ $-4p = 8$

⇒ $p = -2$

(i) Substitute the value of p in (i), we get

(-2+1)x – [2(-1)+3] y-1=0

⇒ $-x - y - 1 = 0$

⇒ $x + y + 1 = 0$....(ii)

(ii) Since the given equation is a linear equation in two variables. Therefore, it has infinitely many solutions.

(iii) Substitute x = -2 and y = 3 in L.H.S. of (ii) we have

L.H.S. = -2 + 3 + 1 = 2 $\neq R.H.S.$

Hence, the line x + y + 1 = 0 will not pass through the point (-2,3).

18. (i) if the point (4,3) lies on the linear equation $3x$ – ay = 6, find whether (-2,-6) also lies on the same line?

(ii) Find the coordinate of the point lies on above line

a. abscissa is zero **b. Ordinate is zero**

(i) If point (4,3) lies on 3x-ay= 6, then

3 x 4 – a x 3 = 6

⇒ $12 - 3a = 6$

⇒ $-3a = 6 - 12 = -6$

⇒ $3a = 6$

⇒ $a = 2$

So, linear equation became $3x$ – 2y = 6....(i)

Substitute x = -2 and y = -6 and L.H.S., of (i), We get

L.H.S., = 3 x (-2)-2 x (-6)

= -6 + 12 =6

= R.H.S

Hence (-2,-6) lies on the line $3x$-2y=6

(ii) (a) when abscissa is zero, it means x = 0

From (i) we get

3 x 0 – 2 x y = 6

⇒ $-2y = 6$

⇒ $y = -3$

$\therefore$ *Required point is* $(0, -3)$

(b) When ordinate is zero i.e.y = 0

From (i) we get

$3x$+ – 2 x 0 = 6⇒ $x = 2$

$\therefore$ *Required point is* $(2, 0)$

III Multiple choice questions

1. If point (3,0) lies on the graph of the equation $2x$+3y =k, then the value of k is

a) 6 **b) 3** **c) 2** **d) 5**

On putting x=3 and y=0 in the equation $2x$+3y =k, we have

2x3+3x0=k

⇒ 6+0=k⇒ k =6

∴ Correct option is (a)

2. The graph of the linear equation $3x$ +5y=15 cuts the x-axis at the point

a) (5,0) **b) (3,0)** **c) (0,5)** **d) (0,3)**

At x–axis, y=0

On putting y =0 in $3x$ +5y=15 we have

⇒ $3x$+5x0=1

⇒ $3x$ = 15 ⇒ x=5

∴ Correct option is (a)

3. For one of the solutions of the equation ax+by+c=0, $x$is negative and y is positive then surely a portion of line lies in the

a) first quadrant **b) second quadrant** **c) third quadrant** **d) fourth quadrant**

b) second quadrant

4. If we multiply or divide both sides of alinear equation with a non-zero number, then the solution of the linear equation:

a) changes **b) remains the same**

c) changes in case of multiplication only **d) changes in case of division only**

If we multiply or divide both sides of a linear equation with a non-zero number, then graph will be same in both cases. Thus, the solution of the linear equation remains the same.

∴ Correct option is (b)

5. How many linear equations in x and y can be satisfied by x=1 and y = 2?

a) Only one **b) Two** **c) Infinitely many** **d) Three**

As point (1,2) lies on graph and through one point infinite lines can pass. So, we get infinitely many linear equations.

∴ Correct option is (c)

6. Is the point (0,3) lie on the graph of the linear equation 3x + 4y=12?

3x + 4y=12

On putting x=0 and y=3 in the given linear equation we have

3x 0 + 4x3=12

⟹ 0+12=12

⟹12=12, true

So, the point (0,3) lies on the graph of the linear equation 3x+4y=12

7. At what point the graph of the linear equation x+y=5 cuts the x-axis?

At x-axis y=0

On putting y=0 in x+y=5, we have

x+0=5⟹x=5

Therefore the graph of the linear equation x+y=5 cuts the x axis at (5,0)

8. At what point the graph of the linear equation 2x-y =7 cuts the y-axis.

At y- axis x = 0

On putting x=0 in 2x – y=7, we have

2x0 – y=7

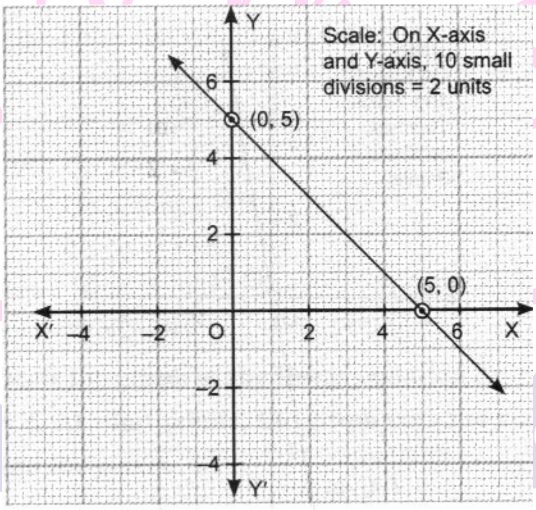
⟹ 0 – y=7

⟹ y = -7

Therefore, the graph of the linear equation 2x – y=7 cuts the y-axis at (0,-7).

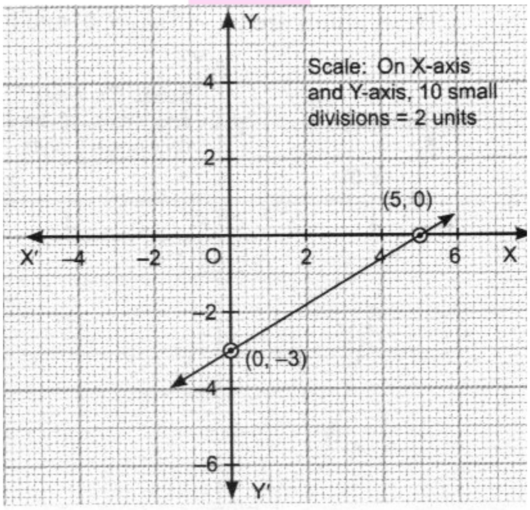
9. **Draw the graph using the values of x, y as given in the table**

x	0	5
Y	5	0



10. **Draw the graph using the values of x, y as given in the table**

x	0	5
Y	-3	0



IV Short Answer Questions

11. Draw the graph of each of the following linear equations in two variables

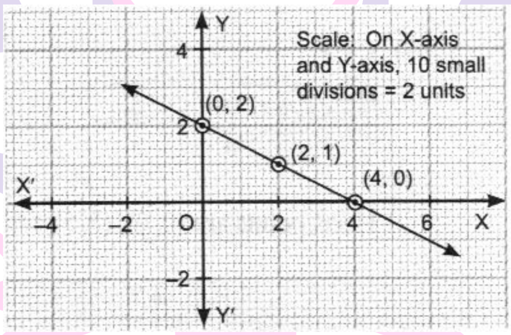
i) x+2y = 4   **ii) 3x+2y = 6**   **iii) 5x– y=10**

iv) y= x   **v) y= - x**   **vi) y=5 x**   **vii) 15 + 3x+y=0**

i) x+2y = 4

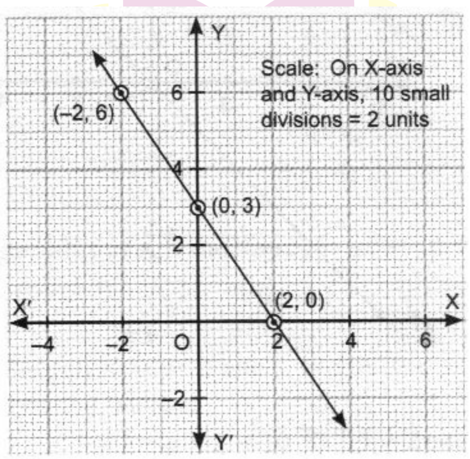
x	0	4	2
Y	2	0	1

Here, points are (0,2), (4,0) and (2,1)



ii) 3x+2y = 6

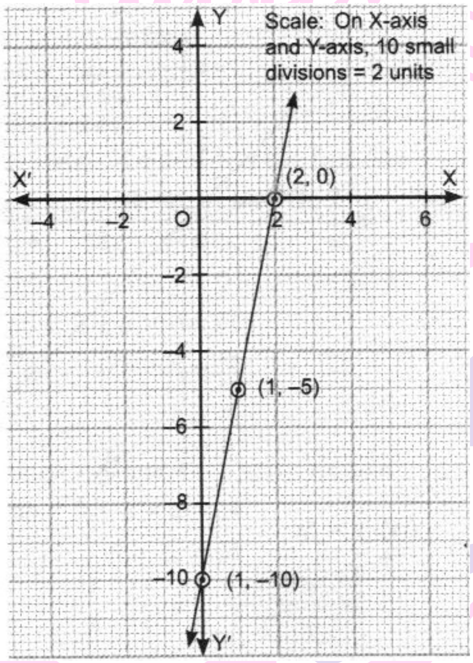
x	0	2	-2
Y	3	0	6



iii) $5x - y=10$

x	0	2	1
Y	-10	0	-5

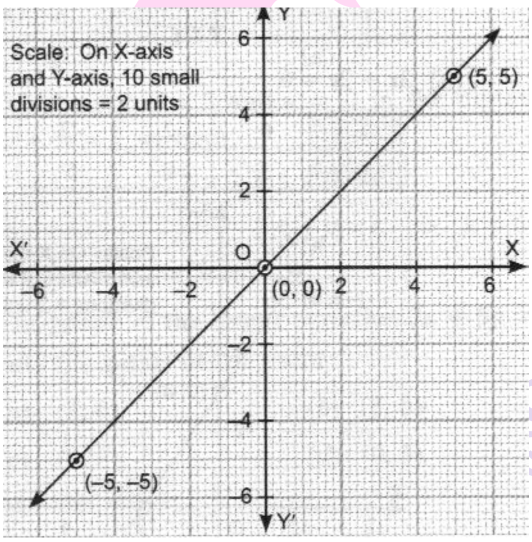
Here, points are (0, -10), (2,0) and (1, -5).



iv) y= x

x	0	5	-5
Y	0	5	-5

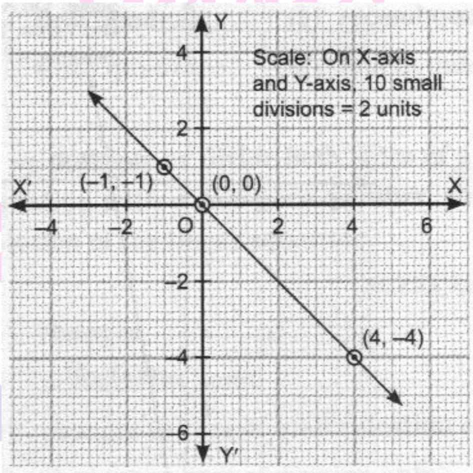
Here, points are (0,0), (-1, 1) and (4, -4)



v) y= - x

x	0	-1	4
Y	0	1	-4

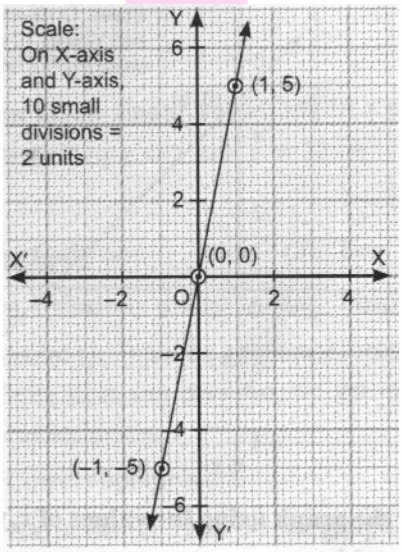
Here, Points are (0,0) (-1,1) and (4,-4)



vi) y=5 x

x	0	1	-1
Y	0	5	-5

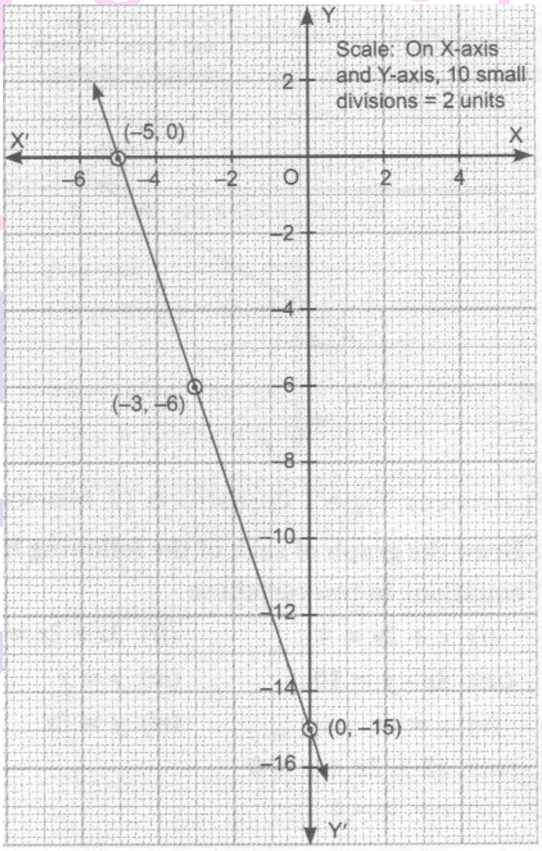
Here, Points are (0,0) (1, 5) and (-1,5)



vii) 15 + 3 x+y=0

x	0	1	-1
Y	0	5	-5

Here, Points are (0,0) (1, 5) and (-1,-5)



12. Find the solution of the linear equation

x +2y = 8. Which represents a point on the

i) x – axis ii) y – axis

(i) For x – axis, y=0

On putting y = 0 in x +2y = 8, we have

x + 2 x 0 = 8 ⟹ x = 8

(ii) For y – axis, x = 0

On putting x = 0 in x +2y = 8, we have

0 + 2y = 8 ⟹ y = 4

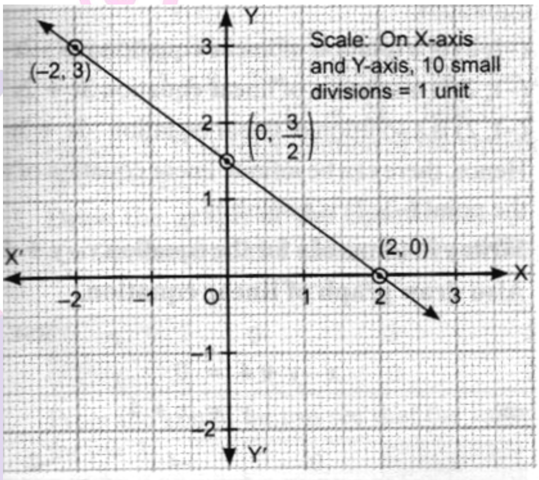
Hence , point(8,0) is a point on x – axis and the y- axis.

13. Draw the graph of the linear equation 3 x+4y= 6. Atwhat points, the graph cuts the x-axis and the y-axis.

$3x + 4y = 6$

x	0	2	-2
Y	$\frac{3}{2}$	0	3

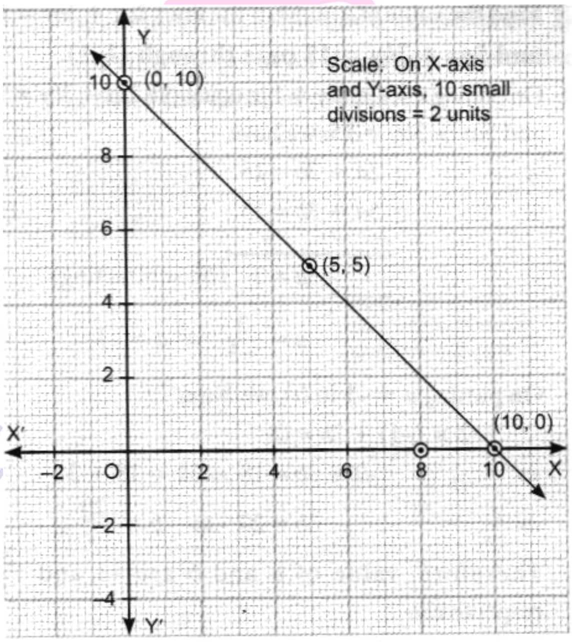
We notice, the graph cuts the x-axis at (2,0) and the y-axis at $(0, \frac{3}{2})$



14. Draw the graph of the linear equation whose solutions are represented by the points having the sum of the coordinates as 10 units.

Given the solutions are represented by the points having the sum of the coordinates as 1o units. Therefore linear equation is x+ y = 10.

x	0	10	5
Y	10	0	5



15. Find the value of a, if the line 5y=ax + 10, will pass through (i) (2,3), (ii) (1,1)

5y=ax + 10

(i) On putting $x = 2$ and y = 3 in the given equation, we have

$5 \times 3 = a \times 2 + 10 \Rightarrow 15 = 2a + 10$

$\Rightarrow 15 - 10 = 2a$

$\Rightarrow 2a = 5$

$\Rightarrow a = \frac{5}{2}$

(ii) On putting $x = 1$ and y = 1 in the given equation, we have

$5 \times 1 = a \times 1 + 10$

$\Rightarrow 5 = a + 10 \Rightarrow a = 5 - 10 \Rightarrow a = -5$

16. Find the value of a and b, if the line 6bx+ ay = 24 passes through (2,0) and (0,2).

6bx + ay = 24 ......(i)

On putting $x = 2$ and y = 0 (i), we have

$6b \times 2 + a \times 0 = 24$

$\Rightarrow 12b + 0 = 24 \Rightarrow 12b = 24$

$\Rightarrow b = \frac{24}{12} \Rightarrow b = 2$

On putting $x = 0$ and y = 2 in (i) we have

$6b \times 0 + a \times 2 = 24$

$\Rightarrow 0 + 2a = 24 \Rightarrow 2a = 24$

$\Rightarrow a = \frac{24}{2} \Rightarrow a = 12$

Hence, value of a and b are 12 and 2 respectively.

17. Find the value of a and b, if the lines 2ax + 3by = 18 and 5ax + 3by = 15 pass through (1.1).

On putting x = 1 and y = 1 in equations 2ax + 3by = 18 and 5ax + 3by = 15 , we have

2a + 3b = 18 .....(i)

5a + 3b = 15 .....(ii)

\- \- -

-3a = 3 (on subtracting)

$\Rightarrow \quad a = \frac{3}{-3} \Rightarrow a = -1$

On putting a = -1 in (i) we have

2 x (-1) + 3b = 18

$\Rightarrow \quad -2 + 3b = 18 \Rightarrow 3b = 18 + 2$

$\Rightarrow \quad 3b = 20 \Rightarrow b = \frac{20}{3}$

Therefore, value of a and b are -1 and $\frac{20}{3}$respectively.

V Short Answer Questions

18. Find the value of a, if the line 3y=ax + 7, will pass through:

(i). (3,4) **(ii). (1,2)** **(iii). (2 ,-3)**

3y=a x + 7

(i) Putting x = 3 and y = 4 in the given equation of line, we have

3 x 4 = a x 3 + 7

$\Rightarrow \quad 12 = 3a + 7 \Rightarrow 3a = 12 - 7$

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

(ii). Putting x = 1 and y = 2 in the given equation of line, we have

3 x 2 = a x 1 + 7

$\Rightarrow \quad 6 = a + 7 \Rightarrow a = 6 - 7 \Rightarrow a = -1$

(iii). Putting x = 2 and y = -3 in the given equation of line, we have

$3 \times (-3) = a \times 2 + 7$

$\Rightarrow \quad -9 = 2a + 7 \Rightarrow 2a = -9 - 7$

$\Rightarrow 2a = -16 \Rightarrow a = \frac{-16}{2} \Rightarrow a = -8$

19. Show that the points A (1,2), B (-1,-16) and C (0,-7) lie on the graph of the linear equation y = 9 x - 7

y = 9 x - 7

or 9 x – y = 7 ....(i)

On Putting x = 1 and y = 2 in (i) we have

$9 \times 1 - 2 = 7 \Rightarrow 9 - 2 = 7$

$\Rightarrow \quad 7 = 7 \ true$

Therefore (1,2) is a solution of linear equation y = 9 x - 7

On Putting x = -1 and y = -16 in (i) we have

$9 \times (-1) - (-16) = 7 \Rightarrow -9 + 16 = 7$

$\Rightarrow \quad 7 = 7 \ true$

Therefore (-1,-16) is a solution of linear equation y = 9 x – 7

On Putting x= 0 and y = 7 in (i) we have

$9 \times 0 - (-7) = 7 \Rightarrow 0 + 7 = 7$

$\Rightarrow \quad 7 = 7 \ true$

Therefore (0,-7) is a solution of linear equation y = 9 x– 7

20. Find the equation of any two lines passing through the point (-1,2). How many such lines can be there?

Here (-1,2) is a solution of infinite number of linear equations.

(-1, 2) is a solution of linear equation y = -2x

(-1, 2) is a solution of linear equation 3 x + 2y = 1

(-1, 2) is a solution of linear equation -5 x + 3y = 11

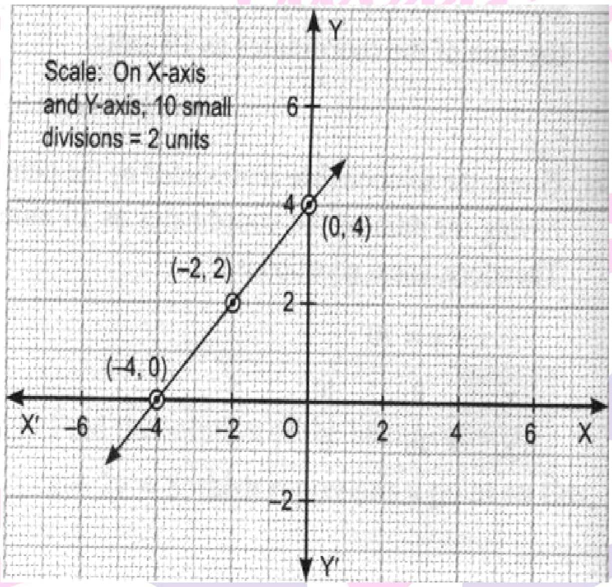
Hence, there can be infinite linear equation of which the point (-1,2) is a solution

21. Write y in terms of x for the equation x – y + 4= 0. Also draw graph of linear equation.

x – y + 4= 0

$\Rightarrow$ $y = x + 4$

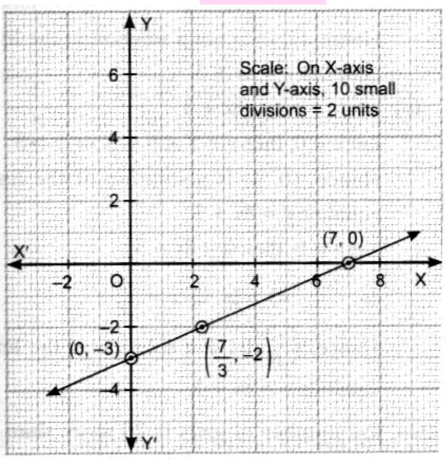
x	0	-4	-2
Y	4	0	2



22. Draw the graph of linear equation 3x – 7y = 21. Check whether (8,1) is a solution of the given equation or not.

3x – 7y = 21 ...(i)

x	0	7	7/3
Y	-3	0	-2



On putting x = 8 and y = 1 in (i) we have

3 x 8 – 7 x 1 = 21 $\Rightarrow$ 24 – 7 = 21

17 = 21 false ($\because$ 17 $\neq$ 21)

Hence, (8,1) is not a solution of the equation 3x – 7y = 21.

23. Draw the graphof the equation x – y = 3. If y = 3, then find the value ofx from the graph.

x – y = 3

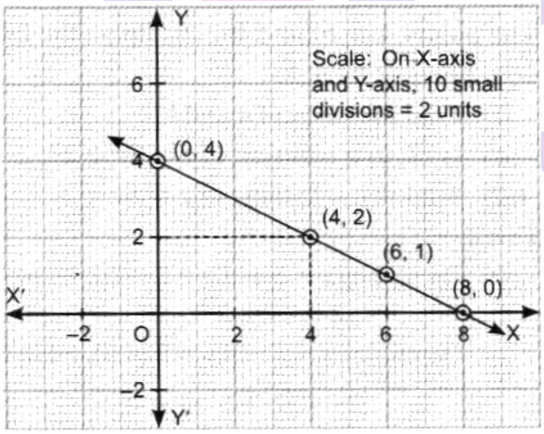
x	0	3	5
Y	-3	0	2

From the graph, we can see that the value of x is 6 for y=3.

24. Draw the graph of the linear equation x + 2y = 8 and find the point on the graph where abscissa is twice the value of ordinate.

x + 2y = 8

x	0	8	6
Y	4	0	1



Given, x = 2y

Putting x = 2y in (i), we have

2y + 2y = 8 ⇒ 4y = 8 ⇒ y = 2

∴ x = 2 × 2 ⇒ x = 4

Hence, point (4,2) is the required point on the graph.

II Long answer Questions

25. Which of the following points

$\mathbf{A}\left(0,\frac{17}{3}\right)$, $B(2,6), C(1,5)$ *and* $D(5,1)$ *lie on the linear equation* $2(x+1)+3(y-2)=13$.

$2(x+1)+3(y-2)=13.$

$\Rightarrow \quad 2x+2+3y-6=13 \Rightarrow 2x+3y=13+4$

$\Rightarrow \quad 2x+3y=17 \quad \ldots\ldots(i)$

On putting x = 0 and y = $\frac{17}{3}$ *in* (i) *we have*

$2 \times 0 + 3 \times \frac{17}{3} = 17$

$\Rightarrow \quad 0+17=17 \Rightarrow 17=17$, *true*

Therefore, $\left(0,\frac{17}{3}\right)$ *lies on the given linear equation* $2(x+1)+3(y-2)=13$

On putting x = 2 and y = 6 in (i), we have

$2 \times 2 + 3 \times 6 = 17$

$\Rightarrow \quad 4+18=17 \Rightarrow 22=17$, *false*

Therefore (2,6) does not lie on the given linear equation $2(x+1)+3(y-2)=13$.

On putting x = 1 and y = 5 in (i) we have

$2 \times 1 + 3 \times 5 = 17$

$\Rightarrow \quad 2+15=17 \Rightarrow 17=17$ *true*

Therefore (1,5) lies on the given linear equation

$2(x+1)+3(y-2)=13$

On putting x = 5 and y = 1, in (i) we have

$2 \times 5 + 3 \times 1 = 17 \Rightarrow 10+3=17$

$\Rightarrow \quad 13=17$ *false*

Therefore, (5,1) does not lie on the given linear equation $2(x+1)+3(y-2)=13$.

26. The points A(a,b) and B(b,0) lie on the linear equation y = 8x + 3

(i) Find the value of a and b

(ii) Is (2,0) a solution of y = 8x + 3?

(iii) Find two solution of y = 8x + 3.

Given y = 8x + 3 .....(i)

(i) On putting x = a and y = b in (i) we have

b = 8a + 3 .....(ii)

On putting x = b and y = 0 in (i) we have

$0 = 8b + 3 \Rightarrow \quad b = \frac{-3}{8}$

By putting $b = \frac{-3}{8}$ $in\ (ii), we\ have$

$\frac{-3}{8} = 8a + 3$

$\Rightarrow \frac{-3}{8} - 3 = 8a \Rightarrow \frac{-27}{8} = 8a \Rightarrow a = \frac{-27}{64}$

(ii) On putting x = 2 and y = 0 in (i), we have

0 = 8 x 2 + 3

$\Rightarrow$ 0 = 16 + 3 $\Rightarrow$ 0 = 19, $false$

Hence, (2,0) is not a solution of the linear equation y = 8x + 3

(iii) y = 8x + 3

Let x = 0, then y = 8 x 0 + 3 $\Rightarrow y = 3$

Hence, (0,3) is a solution of the linear equation y = 8x + 3

Let y = 0, then 0 = 8x + 3

$\Rightarrow \quad -3 = 8x \Rightarrow x = \frac{-3}{8}$

Hence, $\left(\frac{-3}{8}, 0\right)$ is a solution of the linear equation y = 8x + 3.

27. In a class, number of girls is x and that of boys is y. Also, the number of girls is 10 more than the number of boys. Write the given data in the form of a linear equation in two variables. Also, represent it graphically. Find graphically the number of girls, if the number of boys is 20.

Given number of girls and boys are x and y respectively

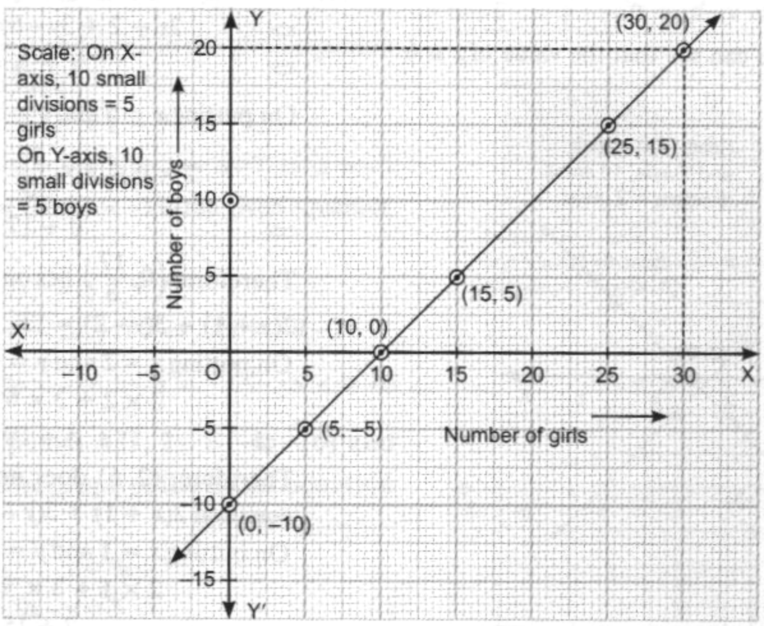
According to the question,

$x - y = 10$

x	0	10	5	15	25
Y	-10	0	-5	5	15

Hence, from the graph, if the number

of boys is 20, then number of girls is 30.



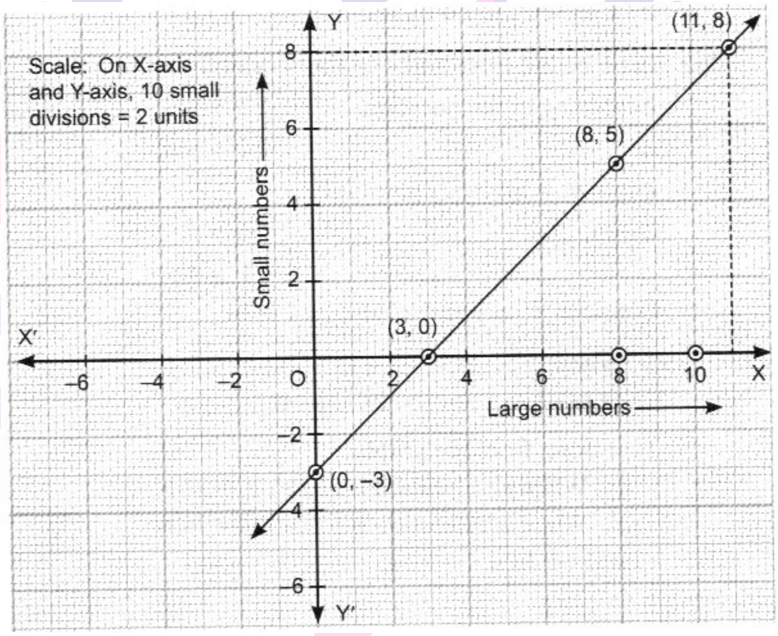
28. The difference between two numbers is 3. Write the given data in form of a linear equation in two variables. Also, represent it graphically, if smaller number is 8, then find graphically the value of the larger number.

Let x be the larger number and y be the smaller number

According to the question x – y = 3

x	0	3	8
Y	-3	0	5

From graph, we notice, if smaller number is 8, then value of the larger number is 11.



29. The following observed values of x and y are thought to satisfy a linear equation. Write the linear equation.

x	6	-6
Y	-2	10

Draw the graph using the values of x, y as given in the above table. At what points the graph of the linear equation (i) cuts the x axis (ii) cuts the y axis

The linear equation in two variables is of the form

$ax + by = c$ ......(i)

Since, point (6, -2) satisfy the linear equation, So 6a – 2b = c ......(ii)

Since point (-6, 10) satisfy the linear equation

So -6a – 10b = c ......(iii)

On adding (ii) and (iii) we get

$8b = 2c \Rightarrow b = \frac{c}{4}$

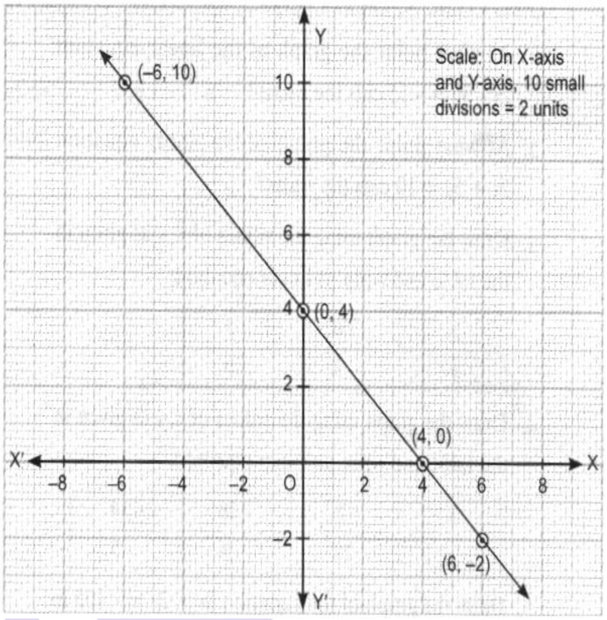
Now on multiply (ii) by 5 and adding (iii), we get

We get

30a – 10b = 5c .....(iv)

-6a + 10b = c .....(iii)

$24a = 6c \Rightarrow a = \frac{1}{4}c$



Now putting the values of a and b in eq. (i) we get

$\frac{c}{4}x + \frac{c}{4}y = c \Rightarrow x + y = 4$

From the graph, we notice, (i) graph cuts the x-axis at point (4,0) and (ii) graph cuts the y-axis at (0,4)

30. The force exerted to pull a cart is directly proportional to the acceleration produced in the body. Express the statement as a linear equation of two variables and draw the graph of the same by taking the constant mass equal to 6kg. Read from the graph, the force required when the acceleration produced is (i) $5m/sec^2$, (ii). $6m/sec^2$,

Let F be the force and a be the acceleration.

According to the question, F ∝ a

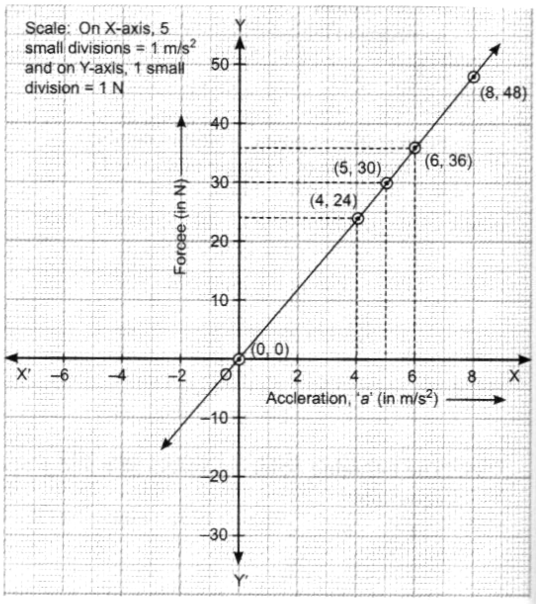
$\Rightarrow$ $F = ma$

Where m = arbitrary constant

Given, m = 6

∴ $F = 6a$

Consider 'F as y and 'a' as x.$\Rightarrow y = 6x$



a or x	0	4	8
F or y	0	24	48

Therefore from the graph,

(i) When acceleration is $5m/s^2$, F = 30 N

(ii) When acceleration is $6m/s^2$,F = 36 N

V Short Answer Questions

1. The graph of $x = \pm a$ is a straight line parallel to the

a) x-axis **b) y-axis** **c) line y = x** **d) line x + y = 0**

For whatever be the value of y, x remains equal to a. So the graph of $x = \pm a$ is straight line parallel to the y-axis

∴ Correct option is (b)

2. Represent the following equations on the number line:

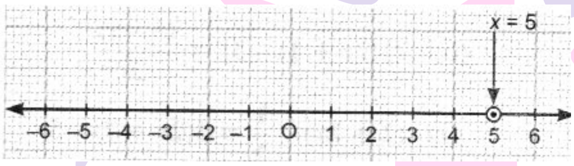
(i) x = 5 **(ii) y = 2** **(iii) x = -3**

(iv) y = 7 **(v) y = -4** **(vi) x – 5 = 2**

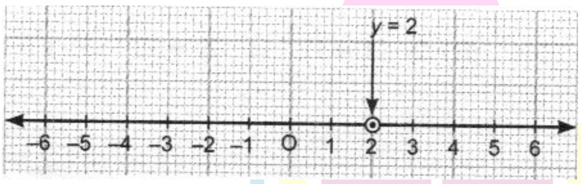
(vii) y = 2y – 4 **(viii) 1 + x = 2 (x+5)** **(ix) 2y – 1 = 11**

(x) $2\left(y - \frac{1}{2}\right) = 1$

(i) x = 5



(ii) y = 2

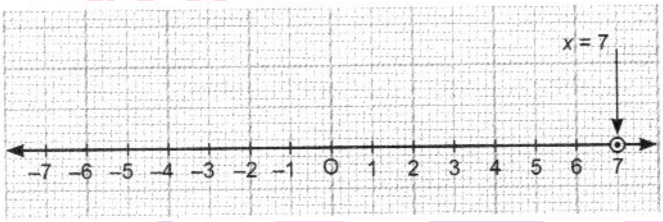


(iii) x = -3

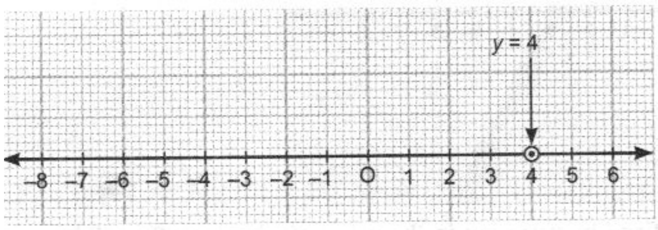
(iv) y = 7

(v) y = -4

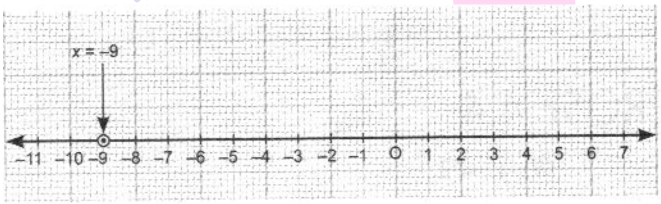
(vi) $x - 5 = 2 \Rightarrow x = 7$



(vii) $y = 2y - 4 \Rightarrow 2y - y = 4 \Rightarrow y = 4$

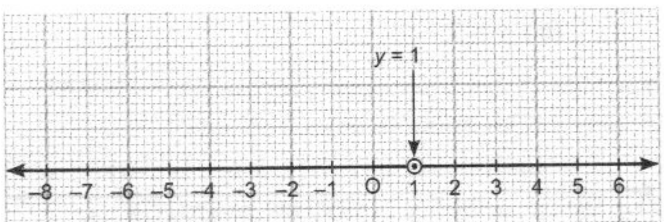


(viii) $1 + x = 2(x+5) \Rightarrow 1 + x = 2x + 10 \Rightarrow x = -9$



(ix) $2y - 1 = 11 \Rightarrow 2y = 12 \Rightarrow y = 6$

(x) $2\left(y - \frac{1}{2}\right) = 1 \Rightarrow 2y - 1 = 1 \Rightarrow y = \frac{2}{2} \Rightarrow y = 1$



3. Give the geometric representations of the following equation in one variable

(i) $3(2x+5) = 5$

(ii) $\frac{2}{3}(3x-5) = 2(2x+1) - 11$

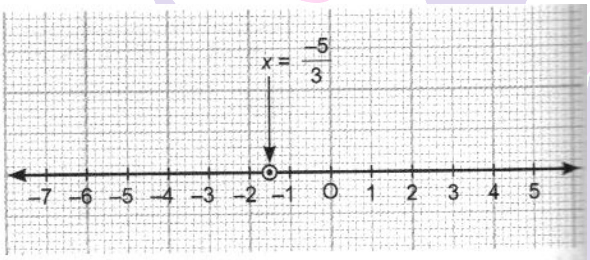
(i) $3(2x+5) = 5$

$\Rightarrow \quad 6x + 15 = 5$

$\Rightarrow \quad 6x = -10 \Rightarrow 3x = -5$

$\Rightarrow \quad x = \frac{-5}{3}$

Geometrical representation of $x = \frac{-5}{3}$ in one variable is given by the number line.



(ii) $\frac{2}{3}(3x-5) = 2(2x+1) - 11$

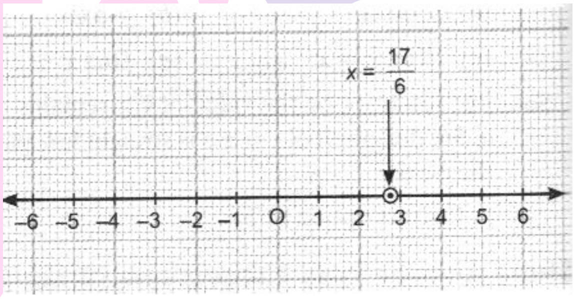
$\Rightarrow \quad 2(3x - 5) = 3[2(2x + 1) - 11]$

$\Rightarrow \quad 6x - 10 = 6(2x + 1) - 33]$

$\Rightarrow \quad 6x - 10 = 12x + 6 - 33$

$\Rightarrow \quad -10 - 6 + 33 = 6x$

$\Rightarrow \quad 17 = 6x \Rightarrow x = \frac{17}{6}$



4. Represent the following equations on the Cartesian plane.

(i) $x = 3$ **(ii) $x = -5$** **(iii) $y = 7$**

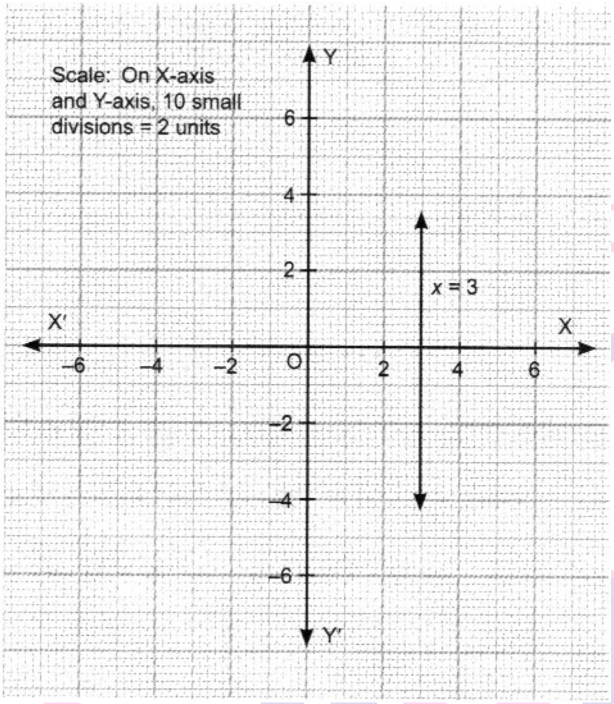
(iv) $y = -2$ **(v) $x+5 = 10$** **(vi) $x+15 = 7$**

(vii) $y + 7 = -2$ **(viii) $\frac{1}{2}(y-3) = \frac{1}{3}(1-y)$**

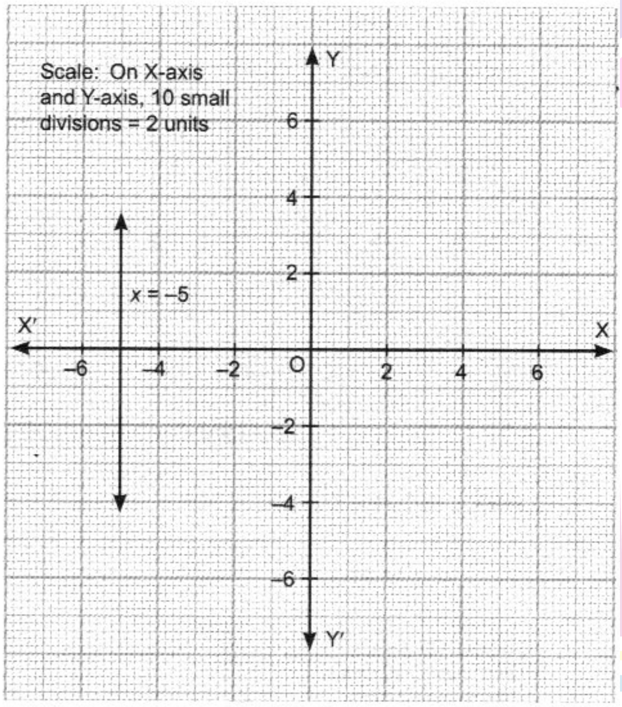
(ix) $2\,[(2x+1)-3] = \frac{(5-x)}{3}$

(x) $(2+2x) - \frac{1}{2} = 3(2x+7) - 5$

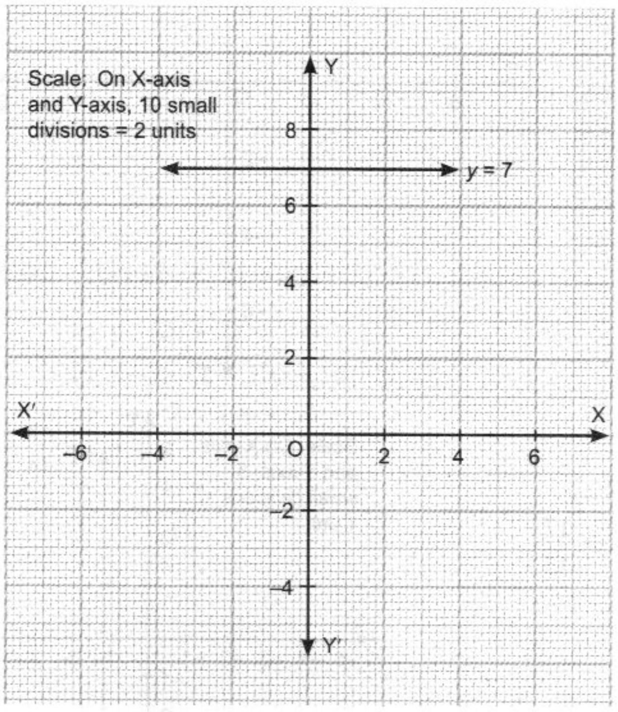
(i) x = 3


Scale: On X-axis
and Y-axis, 10 small
divisions = 2 units
Y
6
4
2
x = 3
X'
X
–6
–4
–2
O
2
4
6
–2
–4
–6
Y'

(ii) x = -5

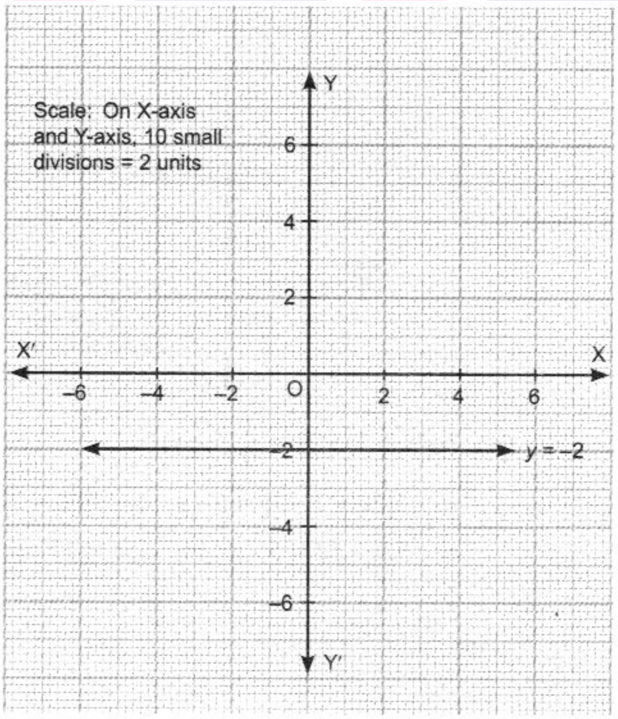

Scale: On X-axis
and Y-axis, 10 small
divisions = 2 units
Y
6
4
2
x = –5
X'
X
–6
–4
–2
O
2
4
6
–2
–4
–6
Y'

(iii) y = 7



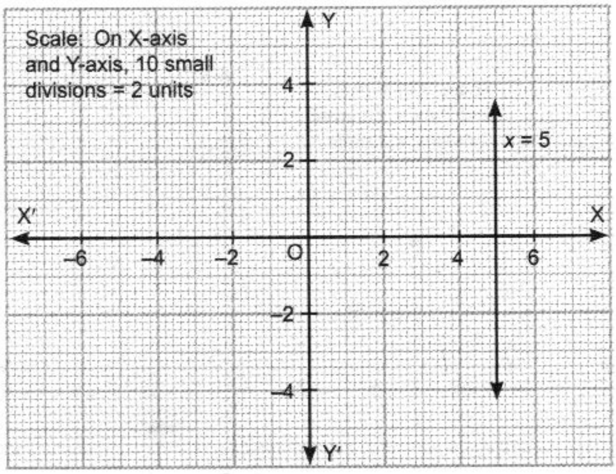
Scale: On X-axis
and Y-axis, 10 small
divisions = 2 units
Y
8
y = 7
6
4
2
X'
X
–6
–4
–2
O
2
4
6
–2
–4
Y'

(iv) y = -2

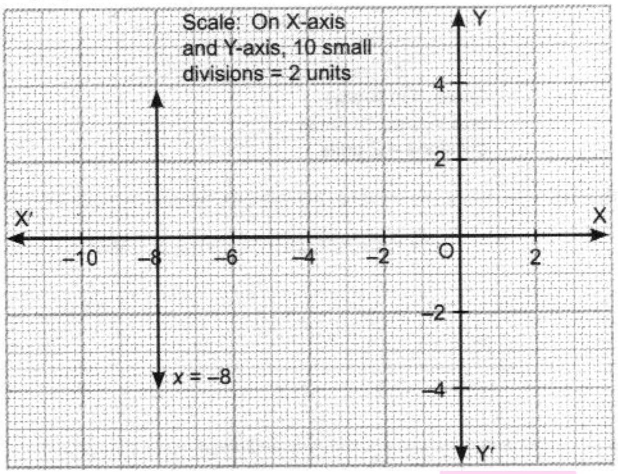


Scale: On X-axis
and Y-axis, 10 small
divisions = 2 units
Y
6
4
2
X'
X
–6
–4
–2
O
2
4
6
–2
y = –2
–4
–6
Y'

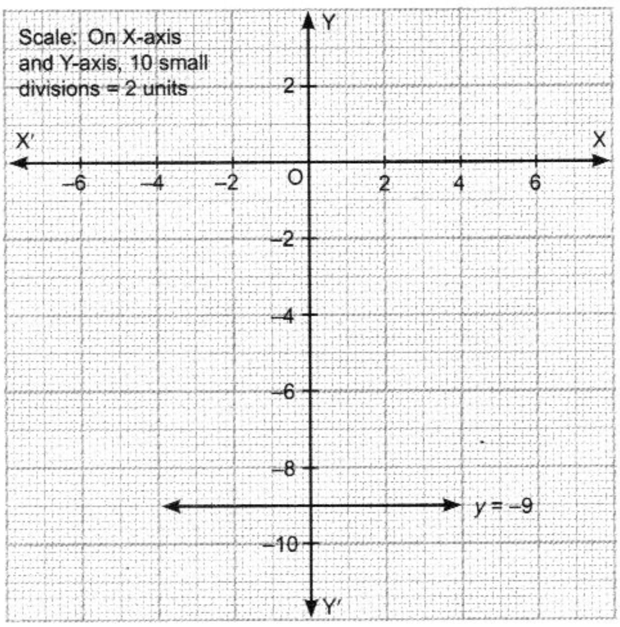
(v) $x + 5 = 10 \Rightarrow x = 5$



(vi) $x + 15 = 7 \Rightarrow x = -8$

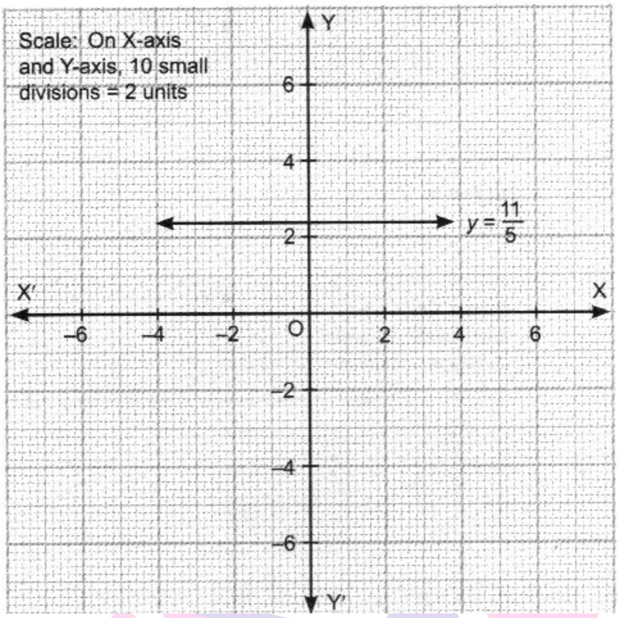


(vii) $y + 7 = -2 \Rightarrow y = -9$



(viii) $\frac{1}{2}(y-3) = \frac{1}{3}(1-y) \Rightarrow 3(y-3) = 2(1-y)$

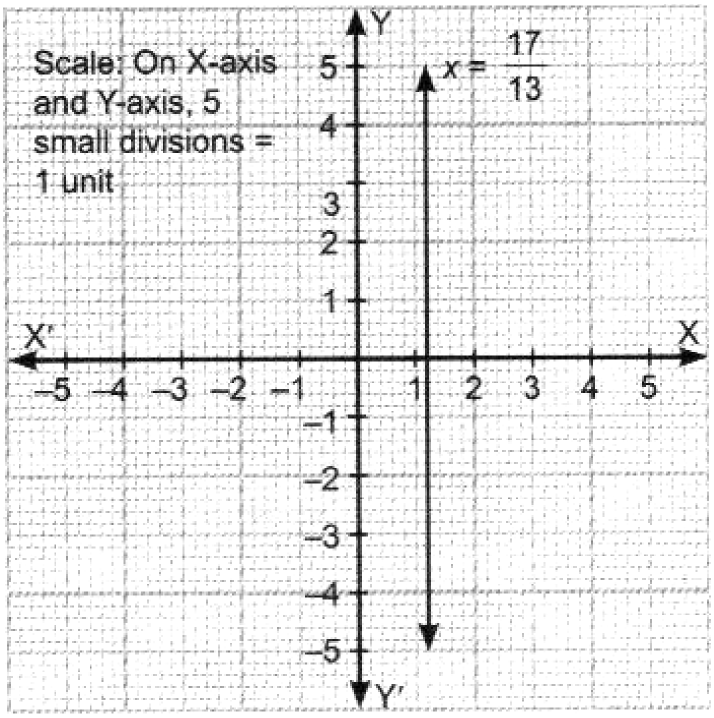
$$\Rightarrow 3y - 9 = 2 - 2y \Rightarrow 5y = 11 \Rightarrow y = \frac{11}{5}$$



(ix) $2[(2x+1)-3] = \frac{1}{3}(5-x)$

$\Rightarrow 6[2x + 1 - 3] = 5 - x \Rightarrow 6[2x - 2] = 5 - x$

$\Rightarrow 12x - 12 = 5 - x \Rightarrow 13x = 17 \Rightarrow x = \frac{17}{13}$

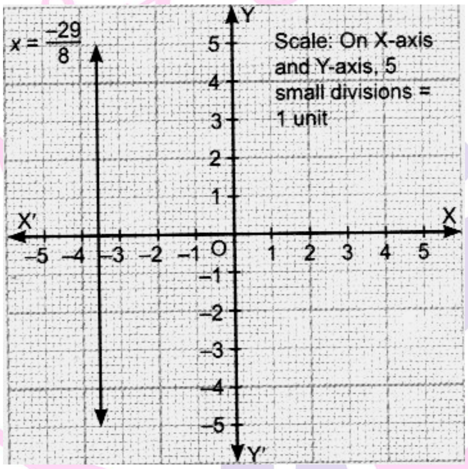


(x) $(2+2x) - \frac{1}{2} = 3(2x + 7) - 5$

$\Rightarrow 4 + 4x - 1 = 6(2x + 7) - 10 \Rightarrow 3 + 4x = 12x + 42 - 10$

$\Rightarrow 3 = 8x + 32 \Rightarrow 8x = -29$

$\Rightarrow x = \frac{-29}{8}$



5. Give the geometric representation of the following equation in two variables.

(i) $2(3x-1) + 7 = \frac{1}{3}[2(x + 7) - 1] + 6$

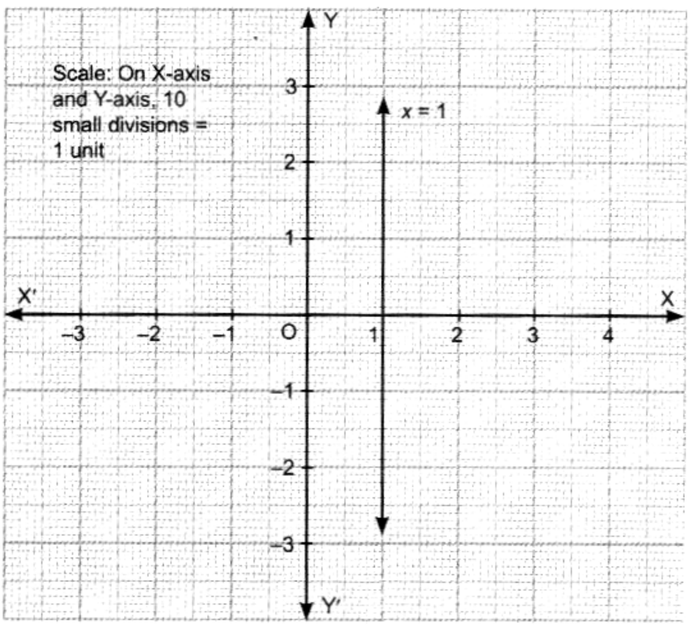
(ii) $\frac{1}{2}[y - (2y + 2)] = 5[y + 1]$

(i) $2(3x-1) + 7 = \frac{1}{3}[(2x + 14) - 1] + 6$

$\Rightarrow \quad 6(3x - 1) + 21 = 2x + 13 + 18$

$\Rightarrow \quad 18x - 6 + 21 = 2x + 31$

$\Rightarrow \quad 16x = 31 - 15 \Rightarrow x = \frac{16}{16} = 1$



(ii) $\frac{1}{2}[y - (2y - 2)] = 5(y + 1)$

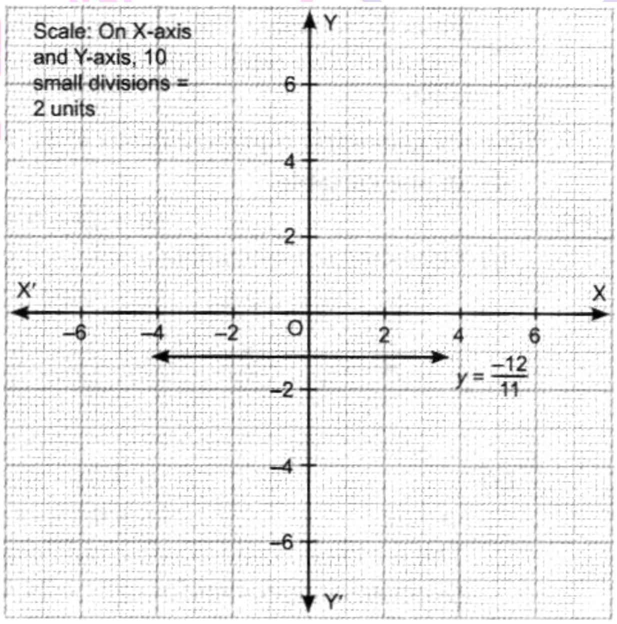
$\Rightarrow \quad y - (2y + 2) = 10(y + 1)$

$\Rightarrow \quad y - 2y - 2 = 10y + 10$

$\Rightarrow \quad -y - 2 = 10y + 10$

$\Rightarrow \quad 11y = -12$

$\Rightarrow \quad y = \frac{-12}{11}$



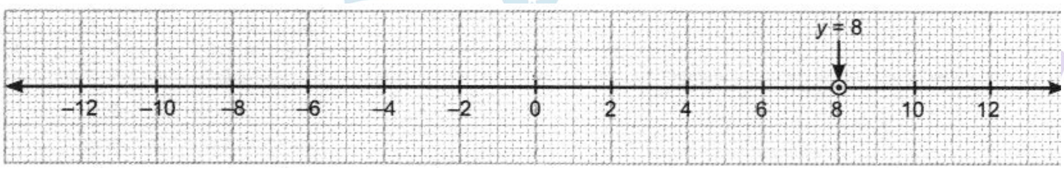
VII Short Answer Questions

6. Give the geometric representations of y = 8 as an equation

(i) in one variable **(ii) in two variable**

y = 8

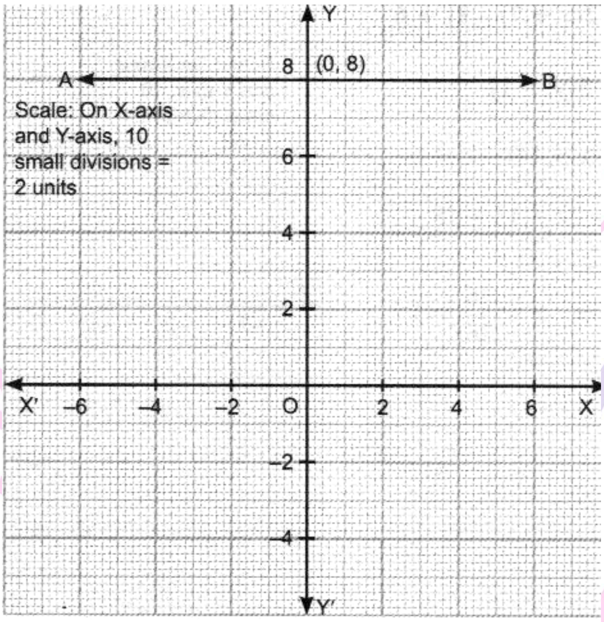
(i) Geometrical representation of y = 8 in one variable is given by the number line.



(ii) Geometrical representation of y = 8 in two variable is given by the Cartesian plane.

Y=8 or 1 . y +0.x =8 or 0.x+1 . y =8

This is a linear equation in two variables, i.e. x and y



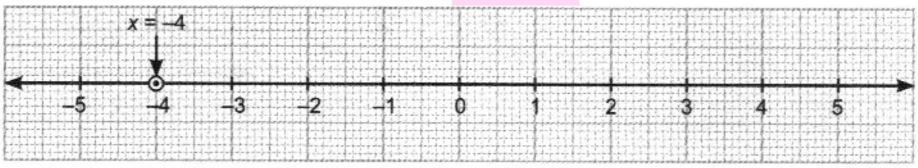
From (i) we notice, the value of y will remain fixed by variation in the value of x because 0. x will be zero everytime. As a result of which, we get a line AB parallel to x-axis, separated by y = 8 everywhere from the x-axis.

7. Give the geometric representations of $6x+24=0$ as an equation

(i)in one variable **(ii) in two variable**

$6x+24=0 \Rightarrow 6x = -24 \Rightarrow x = -4$

(i) Geometric representations of x = -4 in one variable is given by the number line.

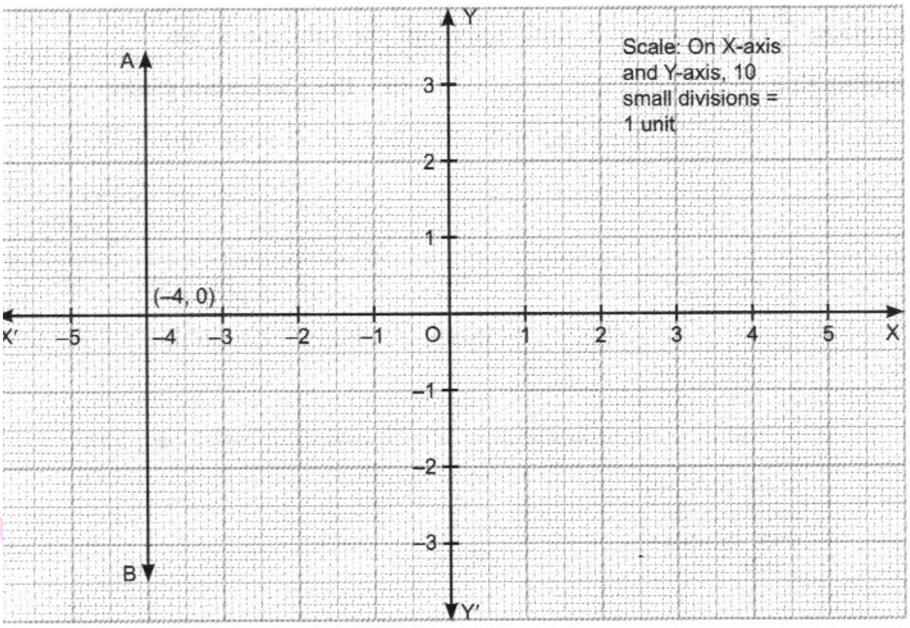


(ii) $6x+24=0 \Rightarrow 6x = -24 \Rightarrow x = -4$

$\Rightarrow$ $5x + 0.y = -4$

This is a linear equation in two variable, i.e. in x and y.

Geometrical representation of $6x$+24= 0 in two variables is given by the Cartesian plane.



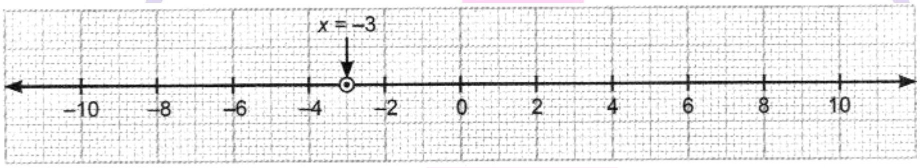
From (i), we notice, the value of x will remain fixed by variation in the value of y because 0. y will be zero everytime. As a result of which, we get a line AB parallel to y=axis, separated by x = -4 everywhere from y-axis.

8. Solve the equation 2x+1=2$\left(\frac{1}{2}x - 1\right)$ and represent the solution(s) on

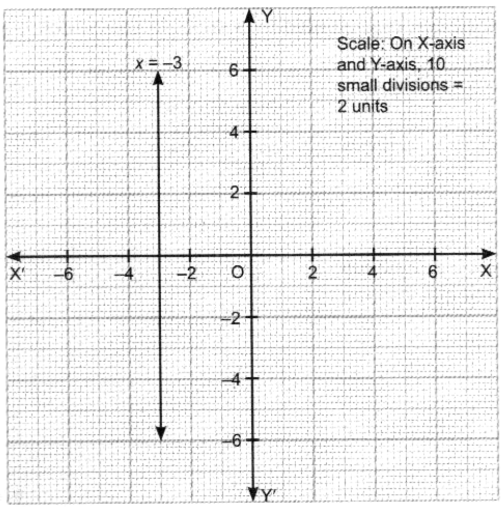
(i) the number line **(ii) the Cartesian plane**

(i) 2x+1=2$\left(\frac{1}{2}x - 1\right) \Rightarrow 2x + 1 = x - 2 \Rightarrow x = -3$

x=-3



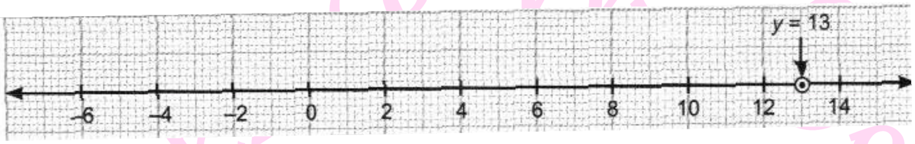
(ii)



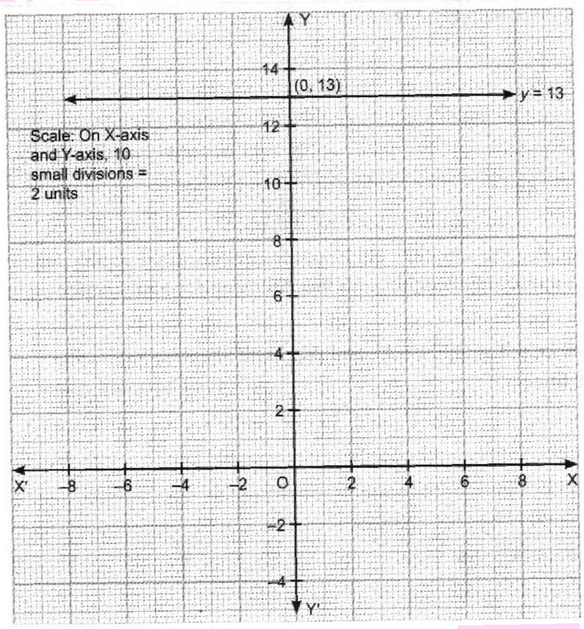
9. Solve the equation $\frac{3}{2}(y-1) = y + 5$, *and represent the solution(s) on*

(i) the number line **(ii) the Cartesian plane**

$$\frac{3}{2}(y-1) = y + 5 \Rightarrow 3y - 3 = 2y + 10 \Rightarrow y = 13$$



(ii)



10. Draw the graph of the equation represented by a straight line which is parallel to the x-axis and at a distance 3 unit below it.

Any straight line parallel to x-axis is given by

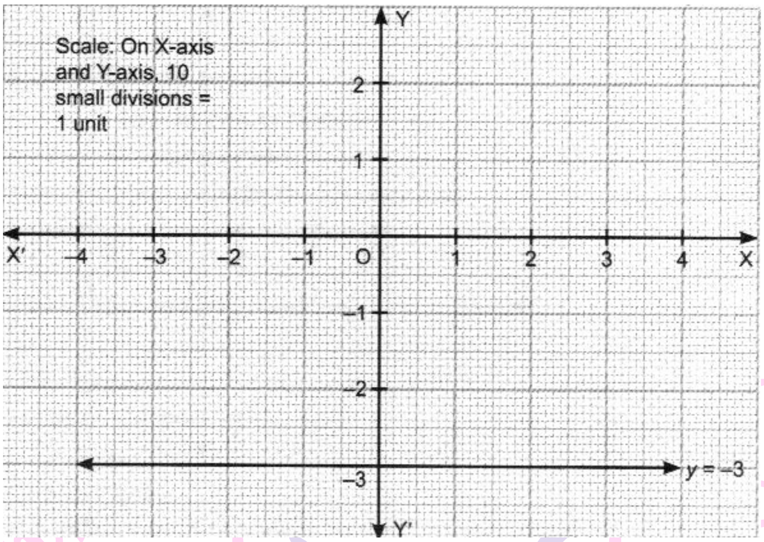
y = $\pm a$ $(i.e.\, y = a \text{ or } y = -a)$

y = a for above the x-axis and y =-a below the x-axis.

Hence, a = 3 units, below x-axis

$\therefore y = -3$

Hence, y = -3 is a straight line equation which is parallel to x-axis and at a distance of 3 units below it.



11. Express the linear equation $5x=20$ in the form ax + by + c = 0 and find the values of a, b and c, also draw the graph of this equation in two variables.

$5x = 20$

$\Rightarrow \quad 5x - 20 = 0$

$\Rightarrow \quad 5x + 0.y - 20 = 0$

On comparing with ax + by + c = 0, we have

a = 5, b = 0. C = -20

Again, we have $5x = 20 \Rightarrow x = 4$

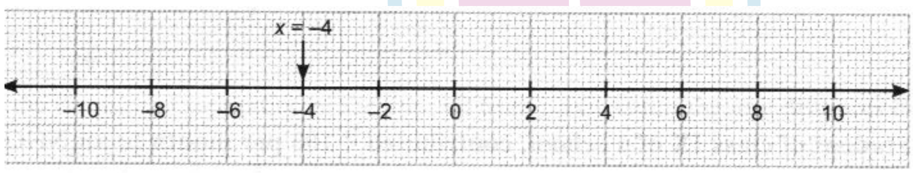
Hence, graph of $x = 4$ is a straight line parallel to

y=axis

12. How many solution(s) of the equation $2x+1=x-3$ are there on the

(i) Number line **(ii) Cartesian plane**

(i) $2x+1=x-3 \Rightarrow 2x - x = -3 - 1 \Rightarrow x = -4$

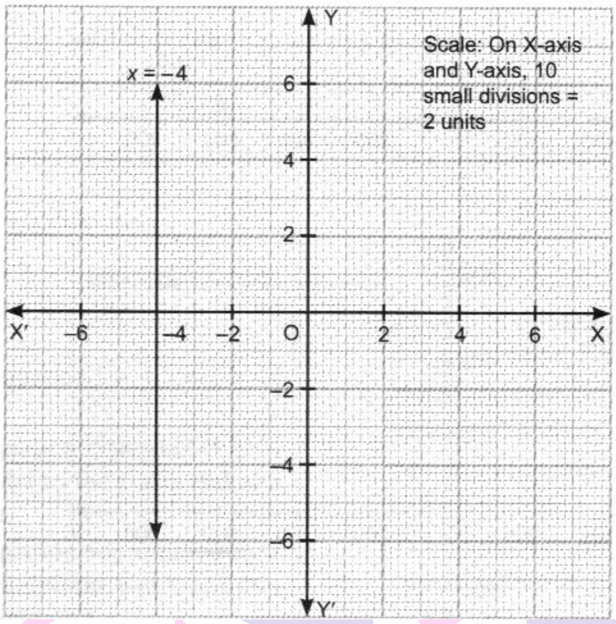


On the number line, x = -4 is the only solution of the equation $2x + 1 = x - 3$

(ii) x = -4

There are infinite solutions of the equation $2x+1=x-3$ on the Cartesian plane.

Points (-4,1),(-4,2), (-4,3), (-4,4), ... satisfy the given equation. Hence, there are infinite solutions.



III Long Answer Questions

13. Draw the graph of the equation $\frac{1}{2}(y-5)+6=\frac{3}{5}(y+5)+2$ on the cartesain plane. Explain the number of solutions(s) and also, determine the position of the point where graph cuts the y-axis

$$\frac{1}{2}(y-5) + 6 = \frac{3}{5}(y+5) + 2$$

$$\Rightarrow \frac{y-5+12}{2} = \frac{3(y+5)+10}{5}$$

$$\Rightarrow \frac{y+7}{2} = \frac{3y+15+10}{5}$$

$$\Rightarrow \frac{y+7}{2} = \frac{3y+25}{5}$$

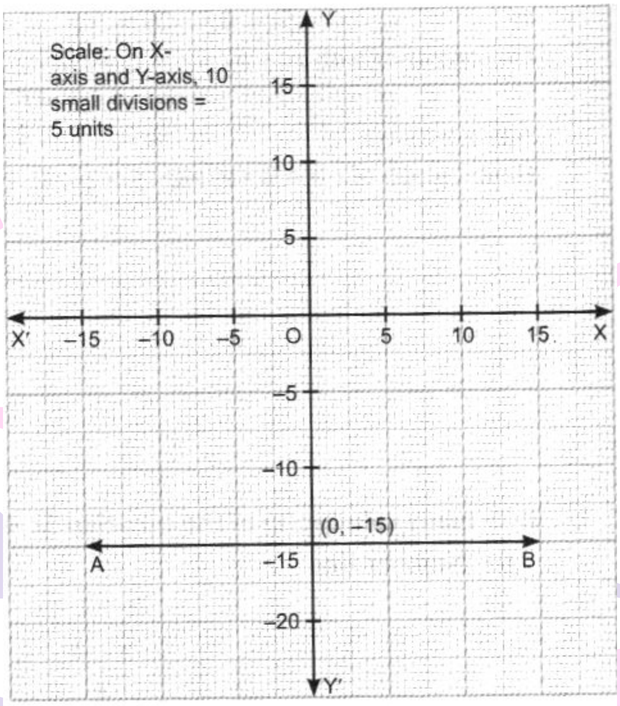
$$\Rightarrow 5[y+7] = 2[3y+25]$$

$$\Rightarrow 5y + 35 = 6y + 50$$

$$\Rightarrow 6y - 5y = 35 - 50$$

$$\Rightarrow y = -15$$

From the graph, we notice, the line AB can have infinite solutions. From the graph, we have (0,-15), (1,-15), (2,-15), ...upto ∞ points. Hence, there are infinite solutions. Graph cuts the y-axis at (0,-15)



14. Reshma, a student of class IX of a school, contributed Rs.100 per month to an NGO to help the blind children.

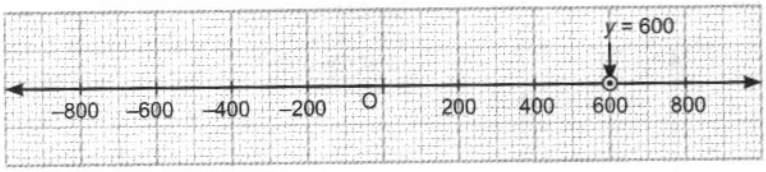
Taking total contribution as Rs. Y for 6 months.

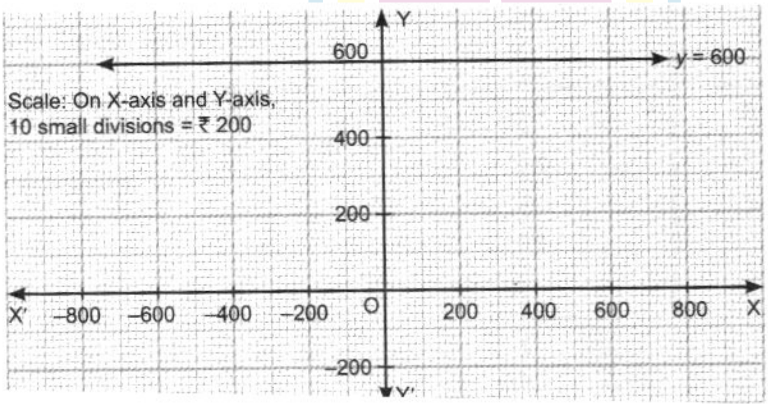
(i) Form a linear equation of the above information.

(ii) Draw it on the number line and also, on the Cartesian plane.

(i) According to question. $y = 6 \times 100 \Rightarrow y = 600$

(ii)





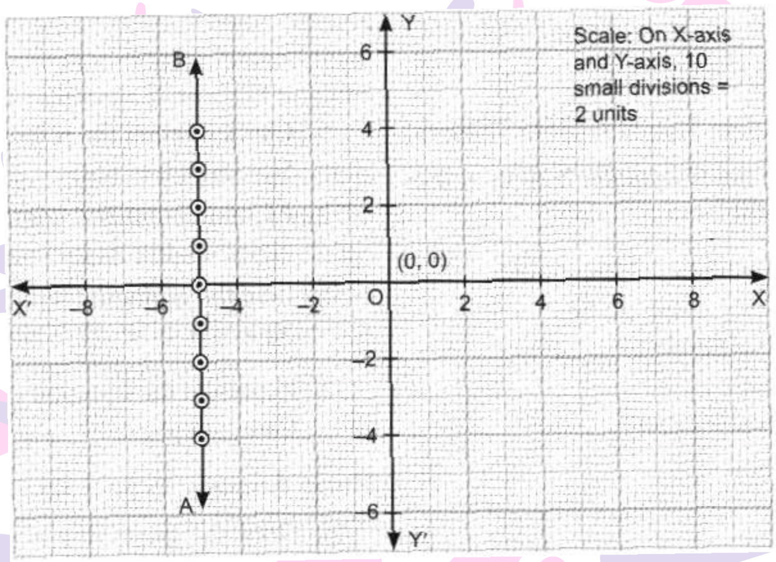
15. The following observed values of x and y are given by the table.

x	-5	-5	-5	-5	-5	-5	-5	-5	-5
Y	0	-1	-2	-3	-4	1	2	3	4

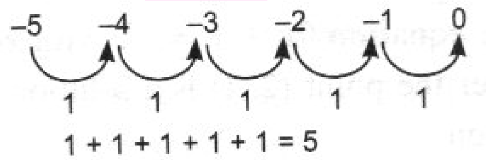
(i) Draw the graph of this information

(ii)Determine the distance of separation between the line formed and the y-axis.

(i) Given points are (-5,0), (-5,-1), (-5,-2), (-5,-3), (-5,-4), (-5,1), (-5,2), (-5,3), and (-5,4)



(ii) To find the distance of separation of the line AB from y-axis, count the unit distances from -5 to 0.



Hence, the distance of separation between the line AB and the y-axis is 5 units