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) $-2x+3y=12$

(ii) $x-\frac{y}{2}-5=0$

(iii) $2x+3y=9\cdot3\overline{5}$

(iv) $3x=-7y$

(v) $2x + 3 = 0$

(vi) $y - 5 = 0$

(vii) $4 = 3x$

(viii) $y=\frac{x}{2}$

Sol:

(i) We have

$-2x+3y=12$

$\Rightarrow \quad -2x+3y-12=0$

On comparing this equation with $ax+by+c=0$ we obtain $a=-2, b=3$ and $c=-12$.

(ii) Given that

$x-\frac{y}{2}-5=0$

$1x-\frac{y}{2}-5=0$

On comparing this equation with $ax+by+c=0$ we obtain $a=1, b=\frac{-1}{2}$ and $c=-5$

(iii) Given that

$2x+3y=9\cdot3\overline{5}$

$\Rightarrow \quad 2x+3y-9\cdot3\overline{5}=0$

On comparing this equation with $ax+by+c=0$ we get $a=2, b=3$ and $c=-9\cdot3\overline{5}$

(iv) $3x=-7y \Rightarrow 3x+7y+0=0$

On comparing this equation with $ax+by+c=0$ we get $a=3, b=7$ and $c=0$.

(v) We have

$2x+3=0$

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

On comparing this equation with $ax+by+c=0$ we get $a=2, b=0$ and $c=3$

(vi) Given that

$y-5=0$

$\Rightarrow \quad 0x+1y-5=0$

On comparing this equation with $ax+by+c=0$ we get $a=0, b=1$ and $c=-5$

(vii) We have

$4 = x$

$-3x + 0 \cdot y + 4 = 0$

On comparing the equation with $ax + by + c = 0$ we get $a = -3, b = 0$ and $c = 4$

(viii) Given that,

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

$\Rightarrow 2y = x$

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

On comparing this equation with $ax + by + c = 0$ we get $a = 1, b = -2$ and $c = 0$

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

(i) $2x = -3$

(ii) $y = 3$

(iii) $5x = \frac{7}{2}$

(iv) $y = \frac{3}{2}x$

Sol:

(i) We have

$2x = -3$

$\Rightarrow 2x + 3 = 0$

$\Rightarrow 2x + 0 \cdot y + 3 = 0$

(ii) We have,

$y = 3$

$y - 3 = 0$

$\Rightarrow 0 \cdot x + 1 \cdot y - 3 = 0$

(iii) Given

$5x = \frac{7}{2}$

$10x - 7 = 0$

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

(iv) We have

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

$3x - 2y = 0$

$3x - 2y + 0 = 0$

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.

Sol:

Let us assume the cost of the ball pen be Rs. x and that of a fountain pen to be y. then according to given statements

We have

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

$\Rightarrow 2x = y - 10$

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

Exercise – 13.2

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

(i) $3x + 4y = 7$

(ii) $x = 6y$

(iii) $x + \pi y = 4$

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

Sol:

(i) Given that $3x + 4y = 7$

Substituting $x = 0$ in this equation, we get

$3 \times 0 + 4y = 7$

$\Rightarrow y = \frac{7}{4}$

So, $\left(0, \frac{7}{4}\right)$ is a solution of the given equation substituting $x = 1,$ in given equation, we get

$\Rightarrow 3 \times 1 + 4y = 7$

$\Rightarrow 4y = 7 - 3$

$\Rightarrow = 4$

$\Rightarrow y = 1$

So, $(1,1)$ is a solution of the given equation

$\therefore \left(0, \frac{7}{4}\right)$ and $(1,1)$ are the solutions for the given equation.

(ii) We have

$x = 6y$

Substituting $y = 0$ in this equation, we get $x = 6 \times 0 = 0$

So, $(0,0)$ is a function of the given equation substituting $y=1,$ in the given equation, we set $x=6\times1=6$

So, $(6,1)$ is a solution of the given equation.

$\therefore$ we obtain $(0,0)$ and $(6,1)$ as solutions of the given equation.

(iii) We have

$x+\pi y=4$

Substituting $y=0$ in this equation, we get

$x+\pi(0)=4$

$\Rightarrow x=4$

So, $(y,0)$ is a solution of the give equation.

$\therefore$ we obtain $(4,0)$ and $(4-x)$ as solutions of the given equation.

(iv) Given that

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

Substituting $y=0$ in this equation we get

$\frac{2}{3}x-0=4$

$\Rightarrow x=4\times\frac{3}{2}$

$\Rightarrow x=6$

So, $(6,0)$ is a solution of the given equation

Substituting $y=1$ in the given equation, we get

$\frac{2}{3}\times-1=4$

$\frac{2}{3}x=5\Rightarrow x=\frac{15}{2}$

So, $\left(\frac{15}{2},1\right)$ is a solution of the given equation.

$\therefore$ We obtain $(6,0)$ *and* $\left(\frac{15}{2},1\right)$ as solutions of the given equation.

2. Write two solutions of the form x = 0, y = a and x = b, y = 0 for each of the following equations:

(i) $5x-2y=10$ (ii) $-4x+3y=12$ (iii) $2x+3y=24$

Sol:

(i) Given that

$5x-2y=10$

Substituting $x=0$ in the equation $5x-2y=10$

We get $5\times 0-2y=10$

$\Rightarrow y=\frac{-10}{2}=-5$

Thus $x=0$ and $y=-5$ is a solution of $5x-2y=10$

Substituting $y=0$, we get

$\Rightarrow 5x-2\times 0=10$

$\Rightarrow 5x=10$

$\Rightarrow x=2$

Thus, $x=2$ and $y=0$ is a solution of $5x-2y=10$

Thus $x=0, y=-5$ and $x=2, y=0$ are two solutions of $5x-2y=10$

(ii) Given that,

$-4x+3y=12$

Substituting $x=0$ in the equation

$-4x+3y=12$, we get

$\Rightarrow -4\times 0+3y=12$

$\Rightarrow 3y=12$

$\Rightarrow y=4$

Thus $x=0$ and $y=4$ is a solution of $-4x+3y=12$

Substituting $y=0$ in the equation

$-4x+3y=12$, we get

$\Rightarrow -4x+3\times 0=12$

$\Rightarrow -4x=12$

$\Rightarrow x=\frac{12}{-4}=-3$

Thus, $x=-3$ and $y=0$ is a solution of $-4x+3y=12$.

Thus $x=0, y=4$ and $x=-3, y=0$ are two solutions of $-4x+3y=12$

(iii) Given that

$2x+3y=24$

Substituting $x=0$ in the given equation

$2x+3y=24$, We get

$\Rightarrow 2\times 0+3y=24$

$\Rightarrow 3y=24$

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

Thus, $x = 0$ and $y = 8$ is a solution of $2x + 3y = 24$

Substituting $y = 0$ in $2x + 3y = 24$, we get $2x + 3 \times 0 = 24$

$\Rightarrow 2x = 24$

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

Thus $x = 12$ and $y = 0$ is a solution of $2x + 3y = 24$

Thus $x = 0, y = -8$ and $x = 12, y = 0$ are two solutions of $2x + 3y = 24$

3. Check which of the following are solutions of the equation 2x – y = 6 and which are not:

(i) (3, 0) (ii) (0, 6) (iii) (2, −2) (iv) $(\sqrt{3}, 0)$ (v) $\left(\frac{1}{2}, -5\right)$

Sol:

In the equation $2x - y = 6$ we get

$\text{LHS} = 2x - y$ and $\text{RHS} = 6$

(i) Substituting $x = 3$ and $y = 0$ in $2x - y = 6$, we get

$LHS = 2 \times 3 - 0 = 6 - 0 = 6 = \text{RHS}$

So, $x = 3, y = 0$ or $(3, 0)$ is a solution of $2x - y = 6$

(ii) Substituting $x = 0$ and $y = 6$ in $2x - y = 6$, we get

$LHS = 2 \times 0 - 6 = -6 \neq RHS$

So, $(0, 6)$ is not a solution of the equation $2x - y = 6$

(iii) Substituting $x = 2, y = -2$ in $2x - y = 6$, we get

$LHS = 2 \times 2(-2) = 4 + 2 = 6 = RHS$

So, $(2, -2)$ is a solution of $2x - y = 6$

(iv) Substituting $x = \sqrt{3}$ and $y = 0$ in $2x - y = 6$, we get

$LHS = 2 \times \sqrt{3} - 0 = 2\sqrt{3} \neq RHS$

So, $(\sqrt{3}, 0)$ is not a solution of the equation $2x - y = 6$

(v) Substituting $x = \frac{1}{2}$ and $y = -5$ in $2x - y = 6$, we get

$LHS = 2 \times \frac{1}{2} - (-5) = 1 + 5 = 6 = RHS$

So, $\left(\frac{1}{2}, -5\right)$ is a solution of the $2x - y = 6$

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

Sol:

Given that

$3x+4y=k$

It is given that $x=-1$ and $y=2$ is a solution of the equation $3x+4y=k$

$\therefore 3\times(-1)\times 4\times 2=k$

$\Rightarrow -3+8=k$

$\Rightarrow k=5$

$\Rightarrow k=5$

5. Find the value of λ, if x = $-\lambda$ and y = $\frac{5}{2}$ is a solution of the equation x + 4y – 7 = 0.

Sol:

Given that

$x+4y-7=0$

It is given that $x=-\lambda$ and $y=\dfrac{5}{2}$ is a solution of the equation $x+4y-7=0$

$\therefore -1+4\times\dfrac{5}{2}-7=0$

$\Rightarrow -\lambda+10-7=0$

$\Rightarrow -\lambda=-3$

$\Rightarrow \lambda=3$

6. If x = 2α + 1 and y = α – 1 is a solution of the equation 2x−3y + 5 = 0, find the value of α.

Sol:

We have

$2x-3y+5=0$

It is given that $x=2\alpha+1$ and $=\alpha-1$ is a solution of the equation $2x-3y+5=0$

$\therefore 2(2\alpha+1)-3(\alpha+1)5=0$

$\Rightarrow 4\alpha+2-3\alpha+3+5=0$

$\Rightarrow \alpha+10=0$

$\Rightarrow \alpha=-10$

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

Sol:

Given that

$8x-ay+a^2=0$

It is given that $x=1$ and $y=6$ is a solution on the equation $8x-ay+a^2=0$

$\therefore 8\times1-a\times6+a^2=0$

$\Rightarrow 8-6a+a^2=0$

$\Rightarrow a^2-6a+8=0$

$\Rightarrow a^2-4a-2a+8=0$

$\Rightarrow a(a-4)(a-2)=0$

$\Rightarrow a-4=0$ or $a-2=0$

$a-4=0$ or $a=2$

Hence $a=4$ *or* $a=2$

Exercise – 13.3

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

(i) x + y = 4

(ii) x – y = 2

(iii) –x + y = 6

(iv) y = 2x

(v) 3x + 5y = 15

(vi) $\frac{x}{2}-\frac{y}{3}=3$

(vii) $\frac{x-2}{3}=y-3$

(viii) $2y=-x+1$

Sol:

(i) We have $x+y=4$

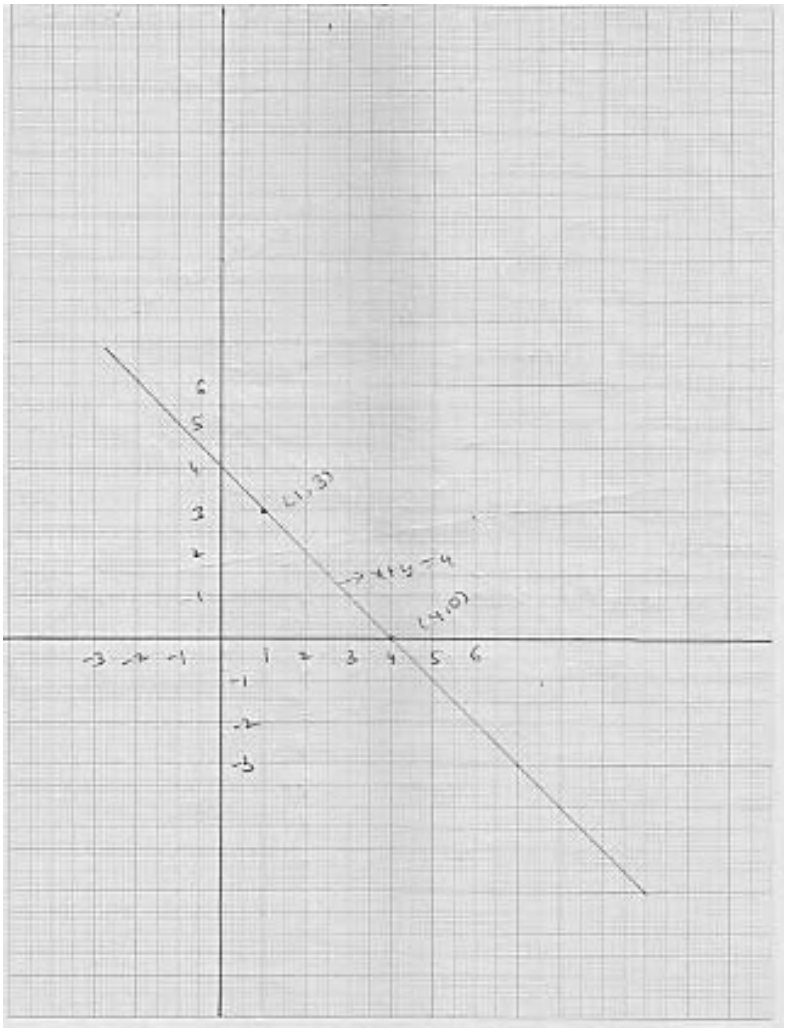
$x=4-y$

Putting $y=0$, we get $x=4-0=4$

Putting $y=3$, we get $x=4-3=1$

Thus, we get the following table giving the two points on the line represented by the equation $x+y=4$

Graph for the equation $x+y=4$



(ii) We have

$x - y = 2$

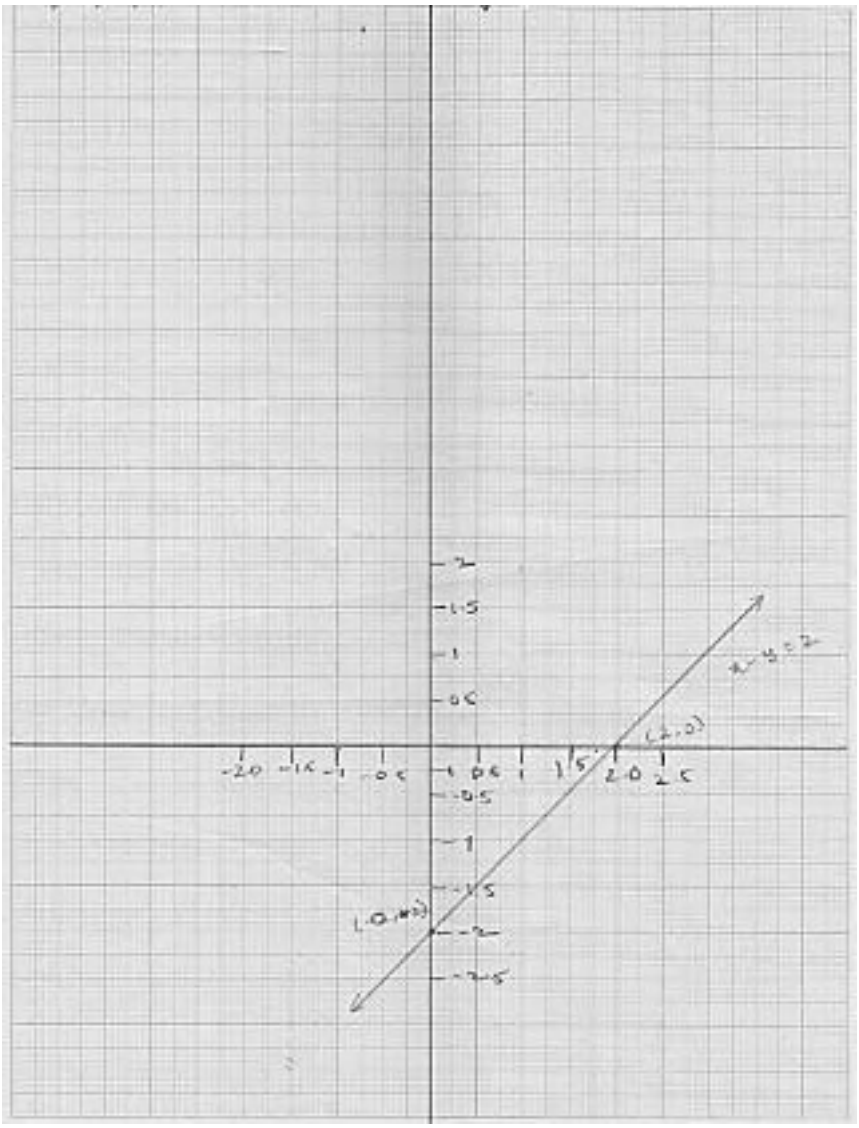
$x = 2 + y \qquad .....(i)$

Putting $y = 0$, we get $x = 2 + 0 = 2$

Putting $y = -2$, we get $x = 2 - 2 = 0$

Thus, we get the following table giving the two points on the line represented by the equation $x - y - 2$

Graph for the equation $x - y = 2$



(iii) We have

$-x + y = 6$

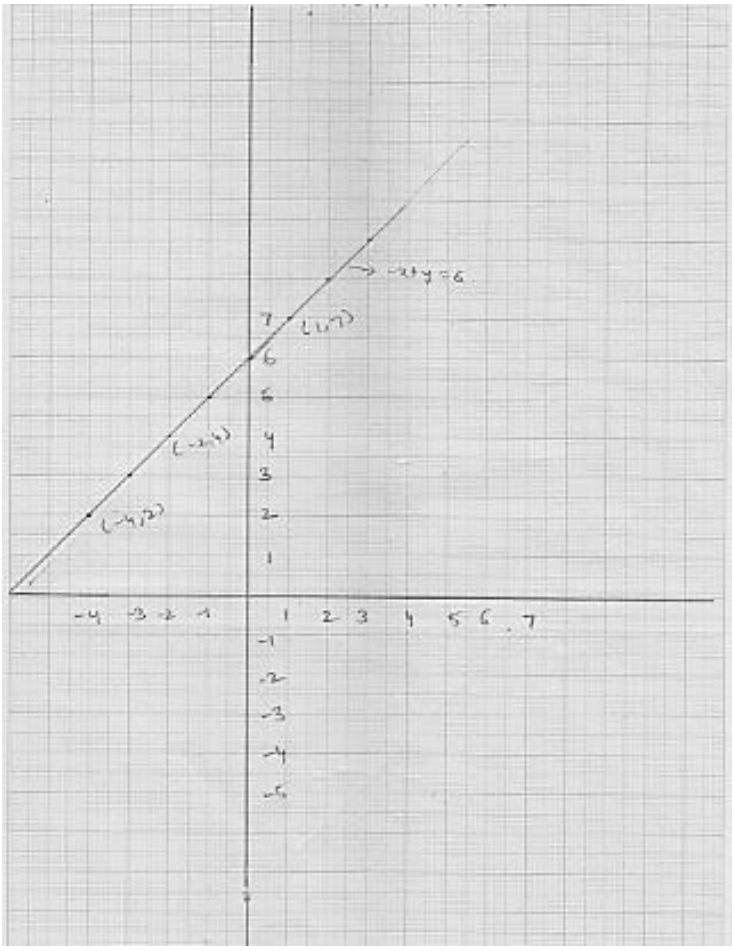
$\Rightarrow x = 6 + x$

Putting $y = -4$, we get $y = 6 - 4 = 2$

Putting $x = -3$ we get $y = 6 - 3 = 3$

Thus, we get the following table giving the two points on the line represented by the equation $-x + y = 6$

Graph for the equation $-x + y = 6$.



(iv) We have

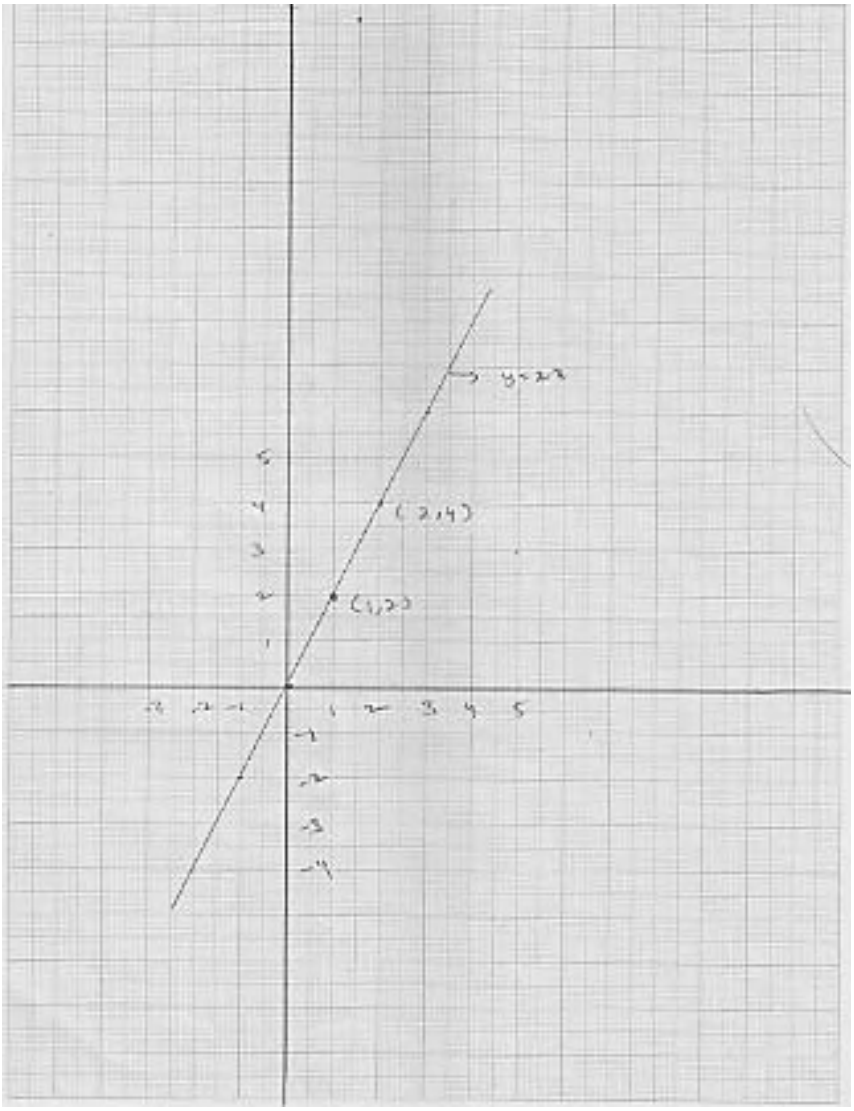
$y = 2x$ .....(i)

Putting $x = 0$, we get $y = 2 \times 0 = 0$

Putting $x = 1$ we get $y = 2 \times 1 = 2$

Thus, we get the following table giving the two points on the line represented by the equation $y = 2x$

Graph for the equation $y = 2x$



(v) We have

$3x+5y=15$

$3x=15-5y$

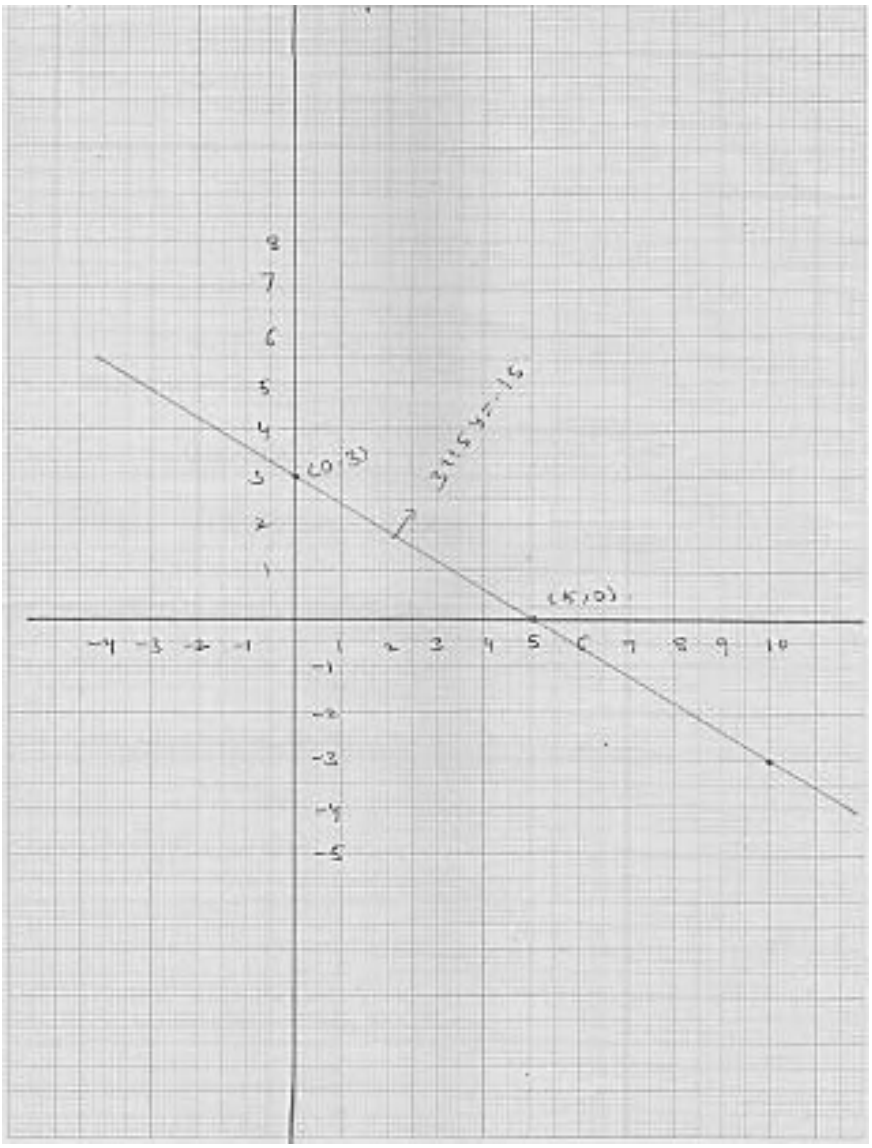
$x=\frac{15-5y}{3}$

Putting $y=0$, we get $x=\frac{15-5\times 0}{3}=5$

Putting $y=3$ we get $x=\frac{15-5\times 3}{3}=0$

Thus, we get the following table giving the two points on the line represented by the equation $3x+5y-15$

Graph for the equation $3x+5y-15$



(vi) We have

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

$$\Rightarrow \frac{3x-2y}{6}=2$$

$$\Rightarrow 3x-2y=12$$

$$\Rightarrow 3x=12+2y$$

$$\Rightarrow x+\frac{12+2y}{3}$$

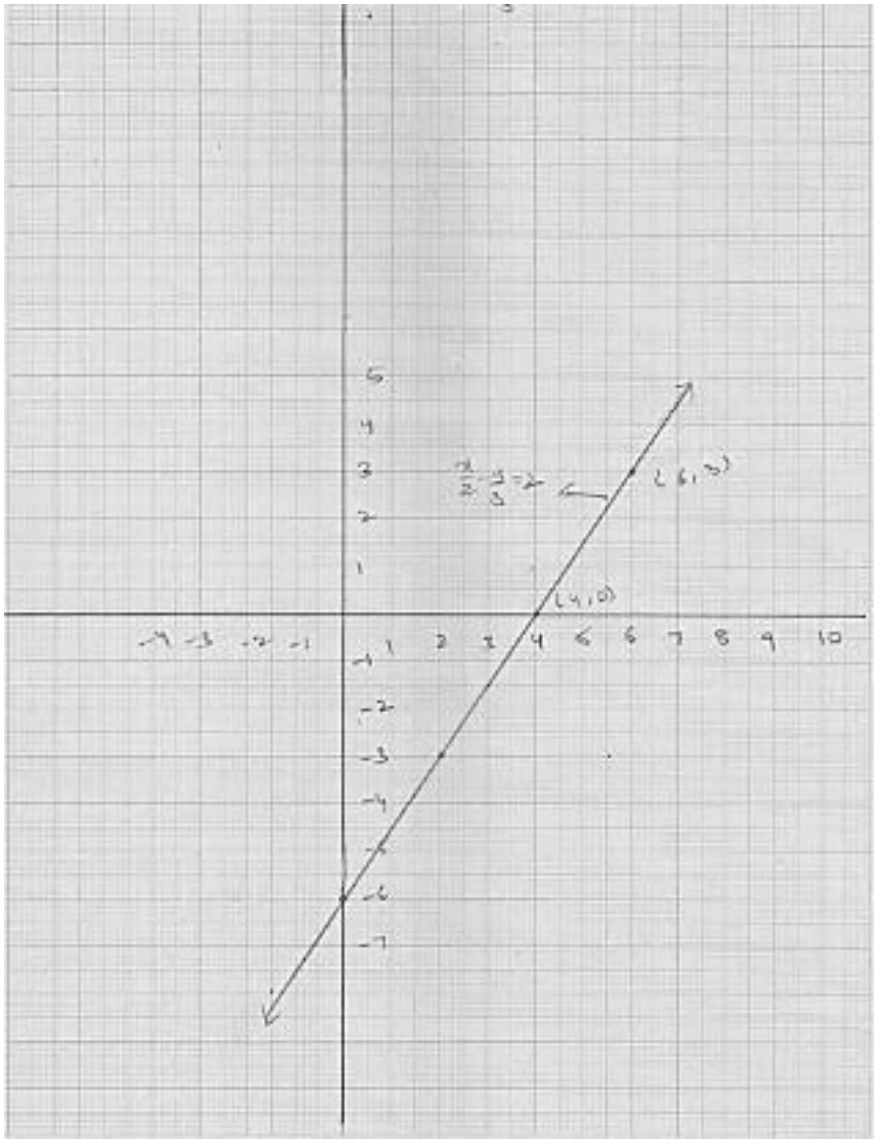
Putting $y=-6$, we get $x=\frac{12+2(-6)}{3}=0$

Putting $y = -3$, we get $x = \dfrac{12 + 2(-3)}{3} = 2$

Putting $y = 0$ we get $x = \dfrac{12 + 0}{3} = 4$

Thus, we get the following table giving the two points on the line represented by the equation $\dfrac{x}{2} - \dfrac{y}{3} = 2$

Graph for the equation $\dfrac{x}{2} - \dfrac{y}{3} = 2$



(vii) We have,

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

$$\Rightarrow x-2=3(y-3)$$

$$\Rightarrow x-2=3y-9$$

$$\Rightarrow x=3y-9+2$$

$$\Rightarrow x=3y-7$$

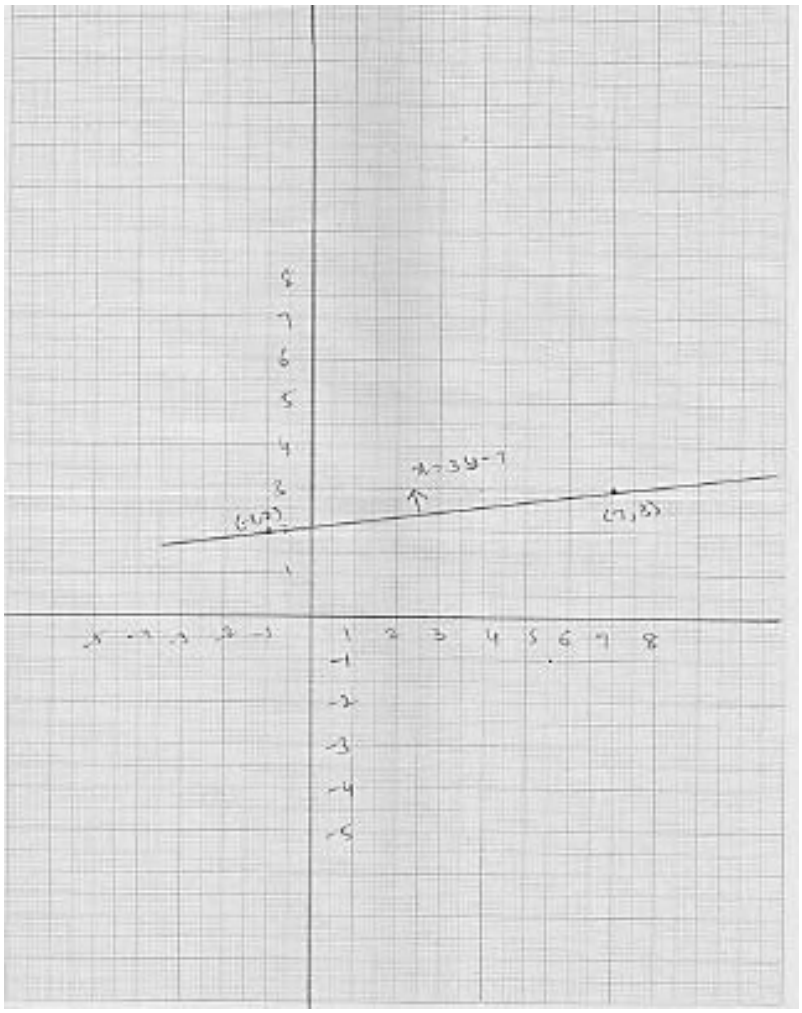
Putting $y=0$, we get $x-0=-7\Rightarrow x=-7$

Putting $y=2$, we get $x-3(2)=-7\Rightarrow x=-1$

Putting $y=3$, we get $x=3(3)-7\Rightarrow x=2$

Thus, we get the following table giving the two points on the line represented by the equation $\frac{x-2}{y}=y-3$

Graph for the equation $\frac{x-2}{y}=y-3$



(viii) We have

$2y = -x + 1$

$\Rightarrow x - 1 = 2y$ .....(1)

Putting $y = 0$, we get $x = 1 - 2 \times 0 = 1$

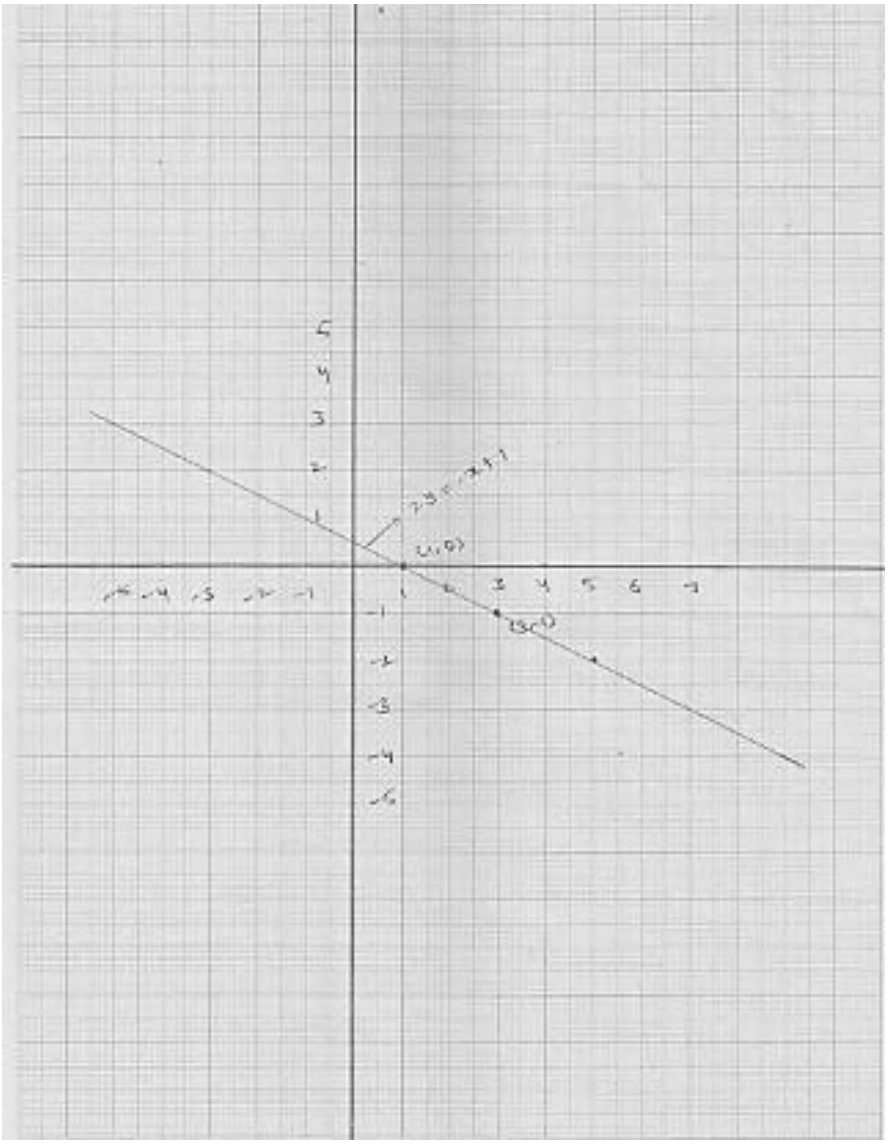
Putting $y = -1$, we get $x = 1 - 2(-1) = 3$

Thus, we have the following table giving the two points on the line represented by the equation

$2y = x + 3$

$2y = -x + 1$

Graph for the equation $2y = -x + 1$



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

Sol:

The equation of two lines passing through $(3,12)$ are

$4x - y = 0$

$3x - y + 3 = 0 \quad .....(i)$

There are infinitely many lines passing through $(3,12)$

3. A three-wheeler scooter charges Rs 15 for first kilometer and Rs 8 each for every subsequent kilometer. For a distance of x km, an amount of Rs y is paid. Write the linear equation representing the above information.

Sol:

Total fare of Rs *y* for covering distance of *x* kilometers is given by

$$y = 15 + 8(x - 1)$$

$$\Rightarrow \quad y = 15 + 8x - 8$$

$$\Rightarrow \quad y = 8x + 7$$

This is the required linear equation for the given information

4. A lending 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 seven days. If fixed charges are Rs x and per day charges are Rs y. Write the linear equation representing the above information.

Sol:

Total charges paid by Aarushi is given by

$$27 = x + 4y$$

$$\Rightarrow \quad x + 4y = 27$$

This is the required linear equation for the given information.

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

Sol:

Total original number is $10y + x$

The new number is obtained after reversing the order of digits is $10x + y$

According to question

$$\Rightarrow \quad 10y + x = 10x + y + 27$$

$$\Rightarrow \quad 9y - 9x = 27$$

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

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

This is the required linear equation for the given information.

6. The sum of a two digit number and the number obtained by reversing the order of its digits is 121. If units and ten's digit of the number are x and y respectively then write the linear equation representing the above statement.

Sol:

Total original number is $10y + x$

The new number is obtained after reversing the order of digits is $(10x + y)$

According to problem

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

$\Rightarrow \quad 11x + 11y = 121$

$\Rightarrow \quad 11(x + y) = 121$

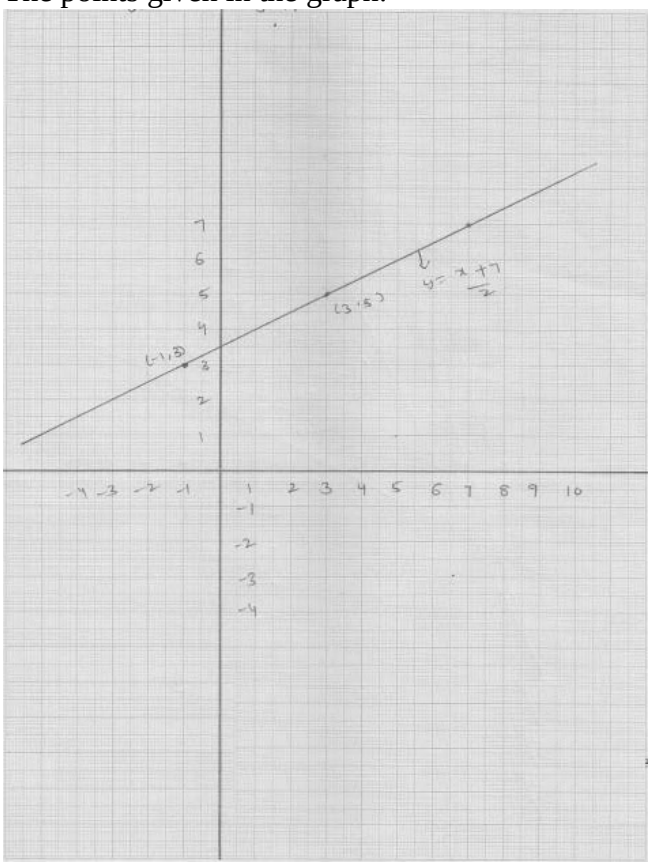
$\Rightarrow \quad x + y = 11$

Thus is the required linear equation for the given information

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

Sol:

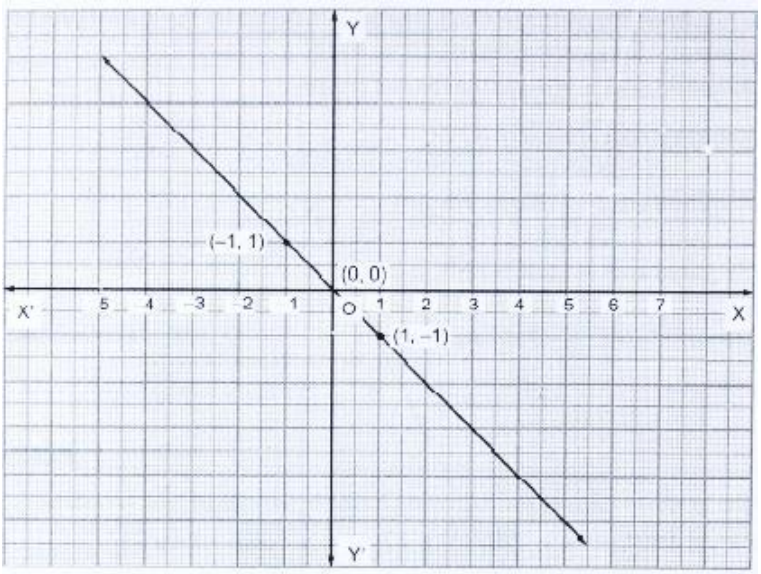
The points given in the graph:



It is clear from the graph the straight lines passes through these points also pass a through $(1, 4)$.

8. From the choices given below, choose the equation whose graph is given in Fig. below.

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



[Hint: Clearly, (-1, 1) and (1, -1) satisfy the equation x + y = 0**]**

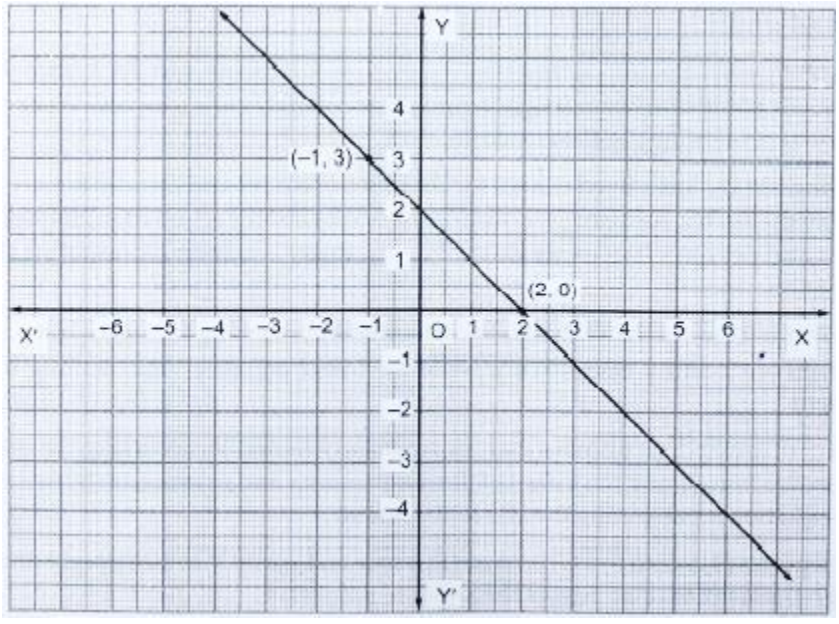
Sol:

Clearly $(-1,1)$ and $(1,-1)$ satisfy the equation $x+y=0$

$\therefore$ The equation whose graph is given by $x+y=0$

9. From the choices given below, choose the equation whose graph is given in fig. below.

(i) y = x + 2 (ii) y = x – 2 (iii) y = −x + 2 (iv) x + 2y = 6



[Hint: Clearly, (2, 0) and (−1, 3) satisfy the equation y = −x + 2]

Sol:

Clearly $(2,0)$ and $(-1,3)$ satisfy the equation $y=-x+2$

$\therefore$ The equation whose graph is given by $y=-x+2$

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

Sol:

It is given that $(2,-2)$ is a solution of the equation $5x+ky=4$

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

$\Rightarrow \quad 10-2k=4$

$\Rightarrow \quad -2k=4-10$

$\Rightarrow \quad -2k=-6$

$\Rightarrow \quad k=3.$

11. Draw the graph of the equation 2x + 3y = 12. From the graph, find the coordinates of the point: (i) whose y-coordinates is 3. (ii) whose x-coordinate is -3.

Sol:

Graph of the equation $2x+3y=12$:

We have,

$2x+3y=12$

$\Rightarrow \quad 2x=12-3y$

$\Rightarrow \quad x=\dfrac{12-3y}{2}$

Putting $y=2$, we get $x=\dfrac{12-3\times 2}{2}=3$

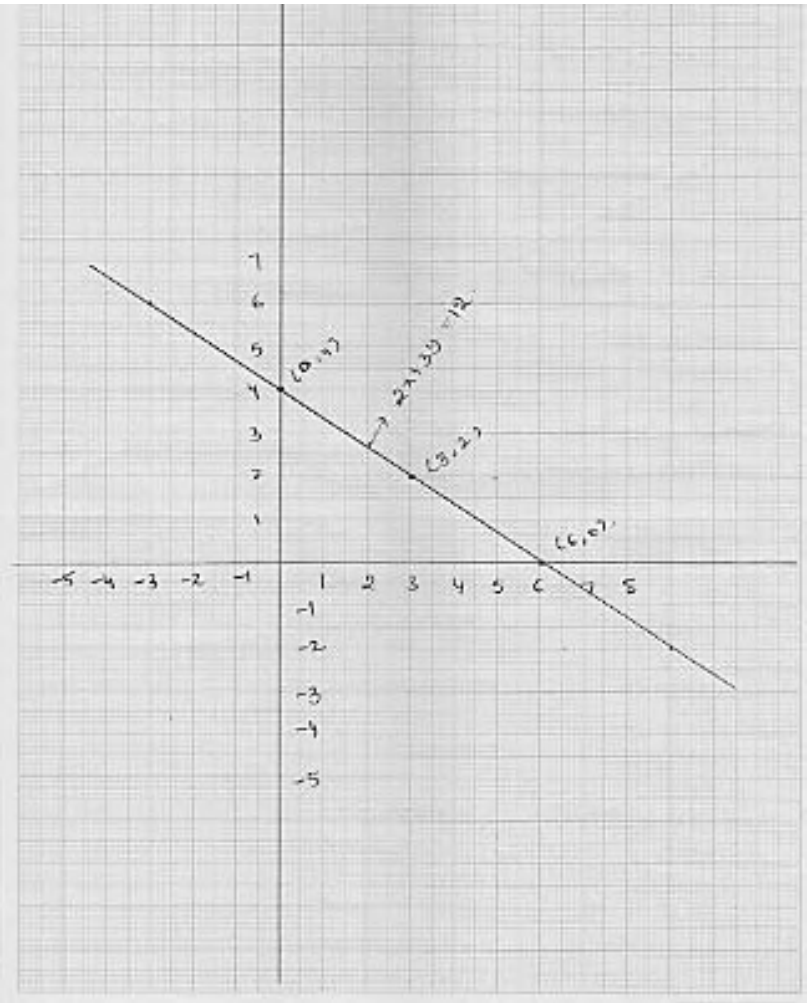
Putting $y=-4$, we get $x=\dfrac{12-3\times 4}{2}=0$

Thus, $(3,0)$ and $(0,4)$ are two points on the line $2x+3y=12$

The graph of line represents by the equation $2x+3y=12$

x	0	3
y	4	2

Graph of the equation $2x+3y=12$



(i) To find coordinates of the points when $y = 3$, we draw a line parallel to $x-axis$ and passing through $(0,3)$ this lines meets the graph of $2x+3y=12$ at a point p from which we draw a line parallel to $y-axis$ which process $x-axis$ at $x=\frac{3}{2}$, so the coordinates of the required points are $\left(\frac{3}{2},3\right)$.

(ii) To find the coordinates of the points when $x=-3$ we draw a line parallel to $y-axis$ and passing through $(-3,0)$. This lines meets the graph of $2x+3y=12$ at a point p from which we draw a line parallel to $x-axis$ crosses $y-axis$ at $y=6$, so, the coordinates of the required point are $(-3,6)$.

12. Draw the graph of each of the equations given below. Also, find the coordinates of the points where the graph cuts the coordinate axes:

(i) $6x - 3y = 12$ (ii) $-x + 4y = 8$ (iii) $2x + y = 6$ (iv) $3x + 2y + 6 = 0$

Sol:

(i) We have

$$6x - 3y = 12$$

$$\Rightarrow \quad 3(2x - y) = 12$$

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

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

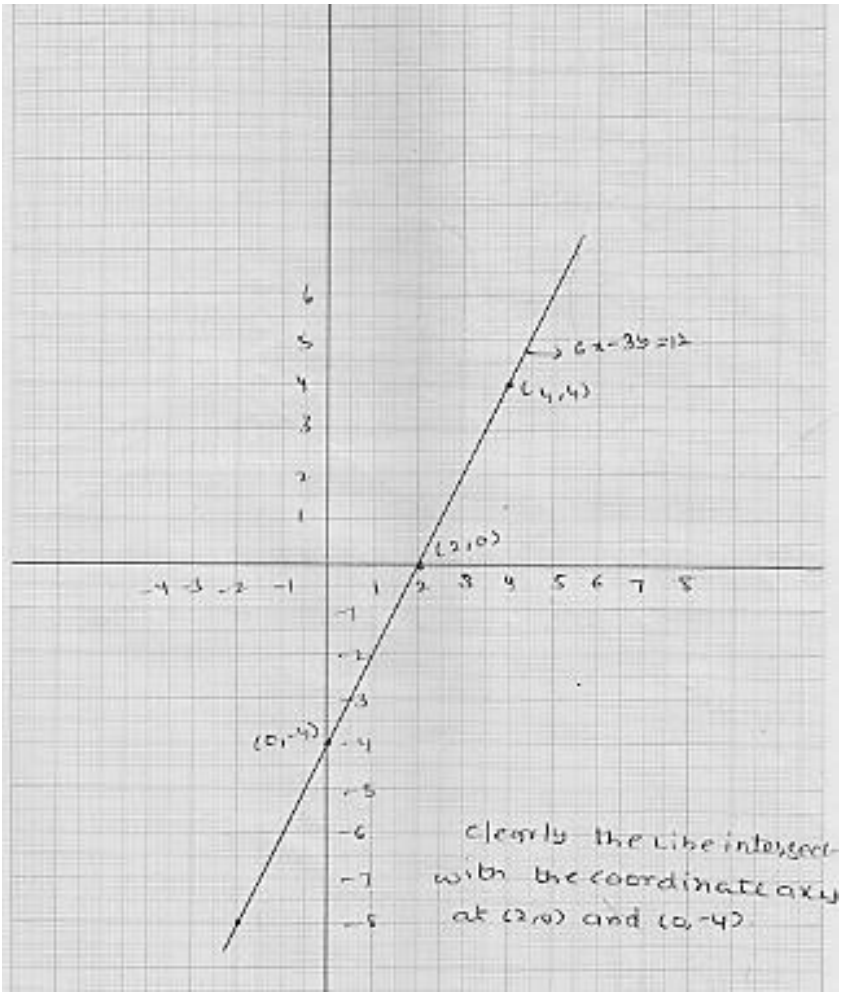
$$\Rightarrow \quad y = 2x - 4 \qquad .....(i)$$

Putting $x = 0$ in (i), we get $y = -4$

Putting $x = 2$ in (i), we get $y = 0$

Thus, we obtain the following table giving coordinates of two points on the line represented by the equation $6x - 3y = 12$.

The graph of the line $6x - 3y = 12$



(ii) We have

$-x+4y=8$

$\Rightarrow \quad 4y-8=x$

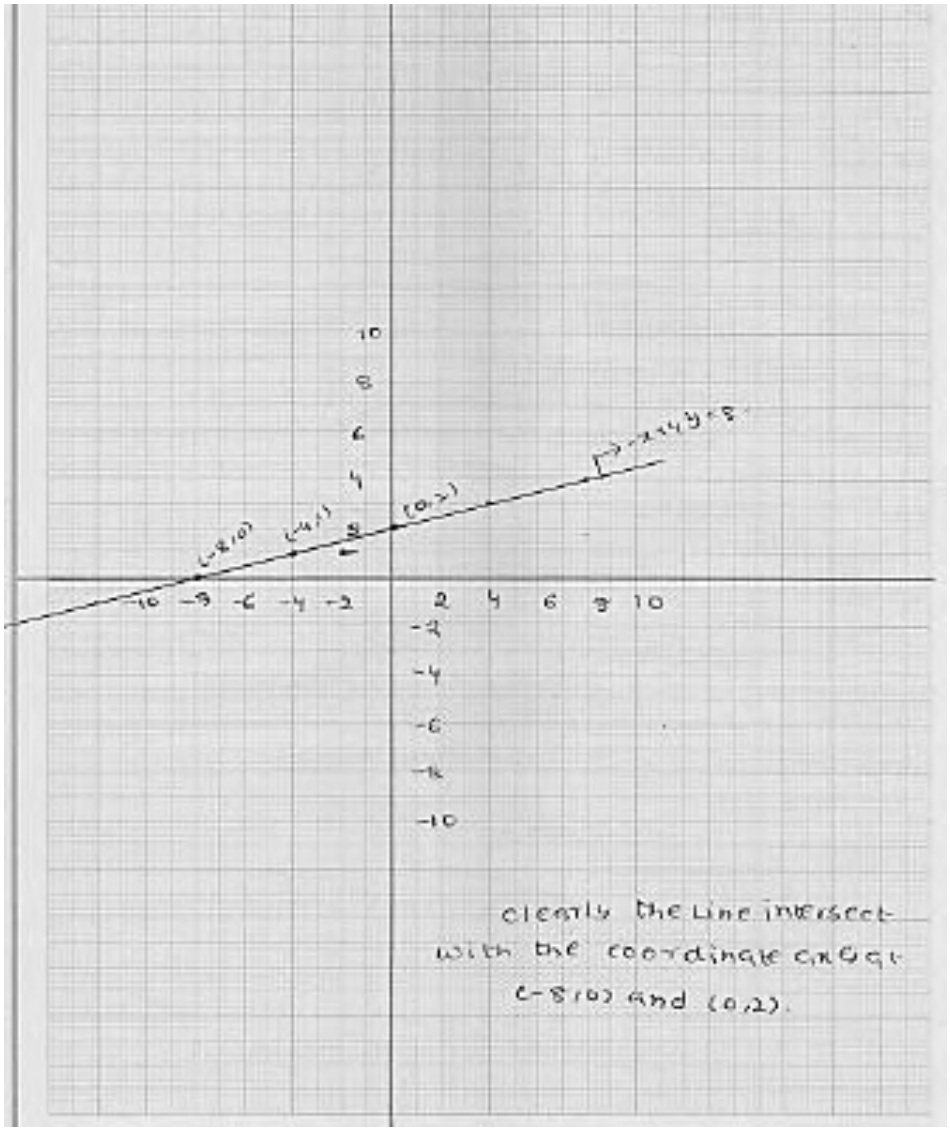
$\Rightarrow \quad x=4y=8$

Putting $y=1$ in (i), we get $x=4\times1-8=-4$

Putting $y=2$ in (i), we get $x=4\times2-8=0$

Thus, we obtain the following table giving coordinates of two points on the line represented by the equation $-x+4y=-8$

Graph of the equation $-x+4y=8$



(iii) We have

$2x+y=6$

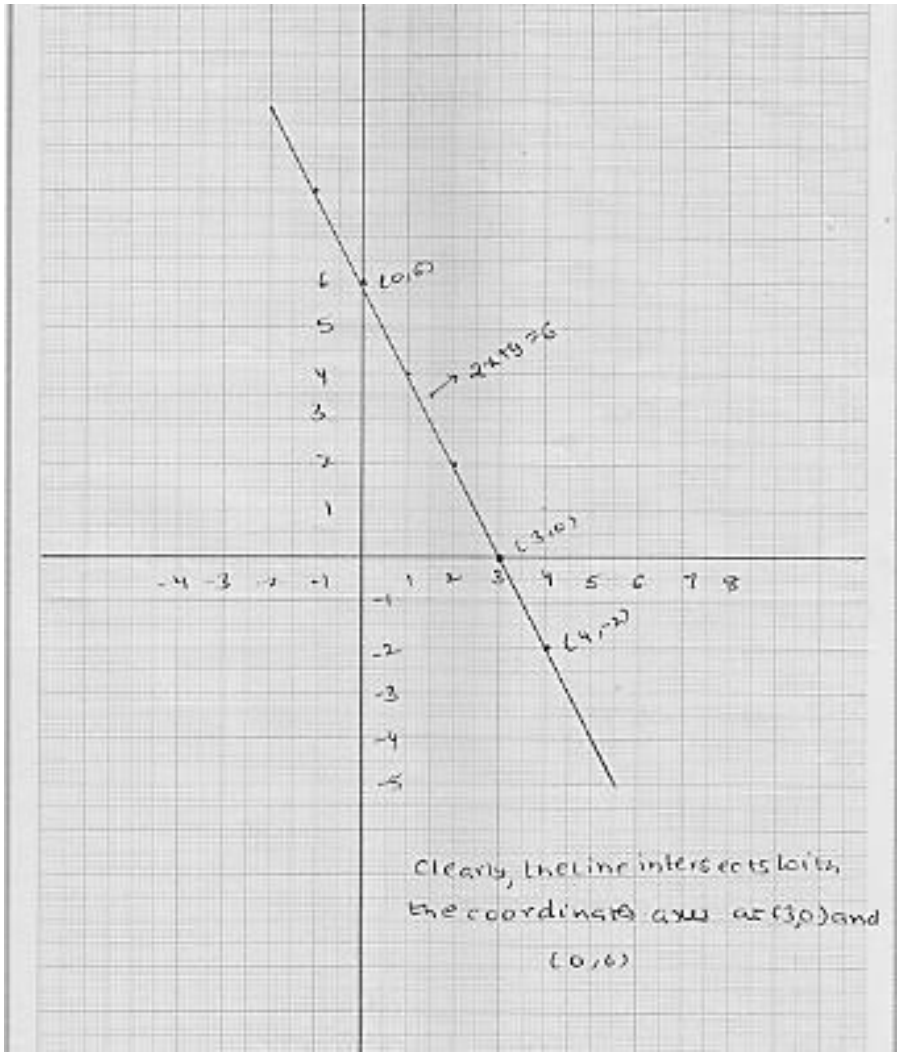
$\Rightarrow \quad y=6-2x \qquad .....(i)$

Putting $x = 3$ in (i), we get $y = 6 = 2 \times 3 = 0$

Putting $x = 4$ in (i), we get $y = 6 - 2 \times 4 = -2$

Thus, we obtain the following table giving coordinates of two points on the line represented by the equation $2x + y = 6$

Graph of the equation $2x + y = 6$



(iv) We have

$$3x + 2y + 6 = 0$$

$$\Rightarrow \quad 2y = -6 - 3x$$

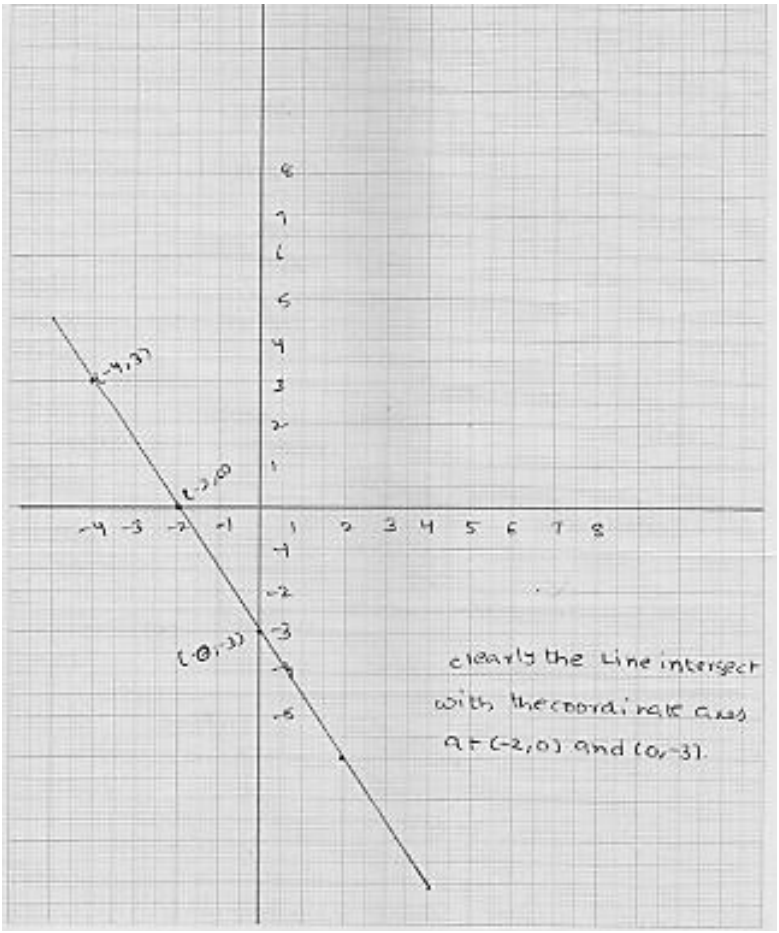
$$\Rightarrow \quad y = \frac{-6 - 3x}{2}$$

Putting $x = -2$ in (i), we get $x = \frac{6 - 3(-2)}{2} = 0$

Putting $x = -4$ in (i), we get $y = \frac{6 - 3(-4)}{2} = 3$

Thus, we obtain the following table giving coordinates of two points on the line represented by the equation $3x+2y+6=0$

Graph of the equation $3x-2y+6=0$



13. Draw the graph of the equation 2x + y = 6. Shade the region bounded by the graph and the coordinate axes. Also, find the area of the shaded region.

Sol:

We have

$2x+y=6$

$y=6-2x$ .....(i)

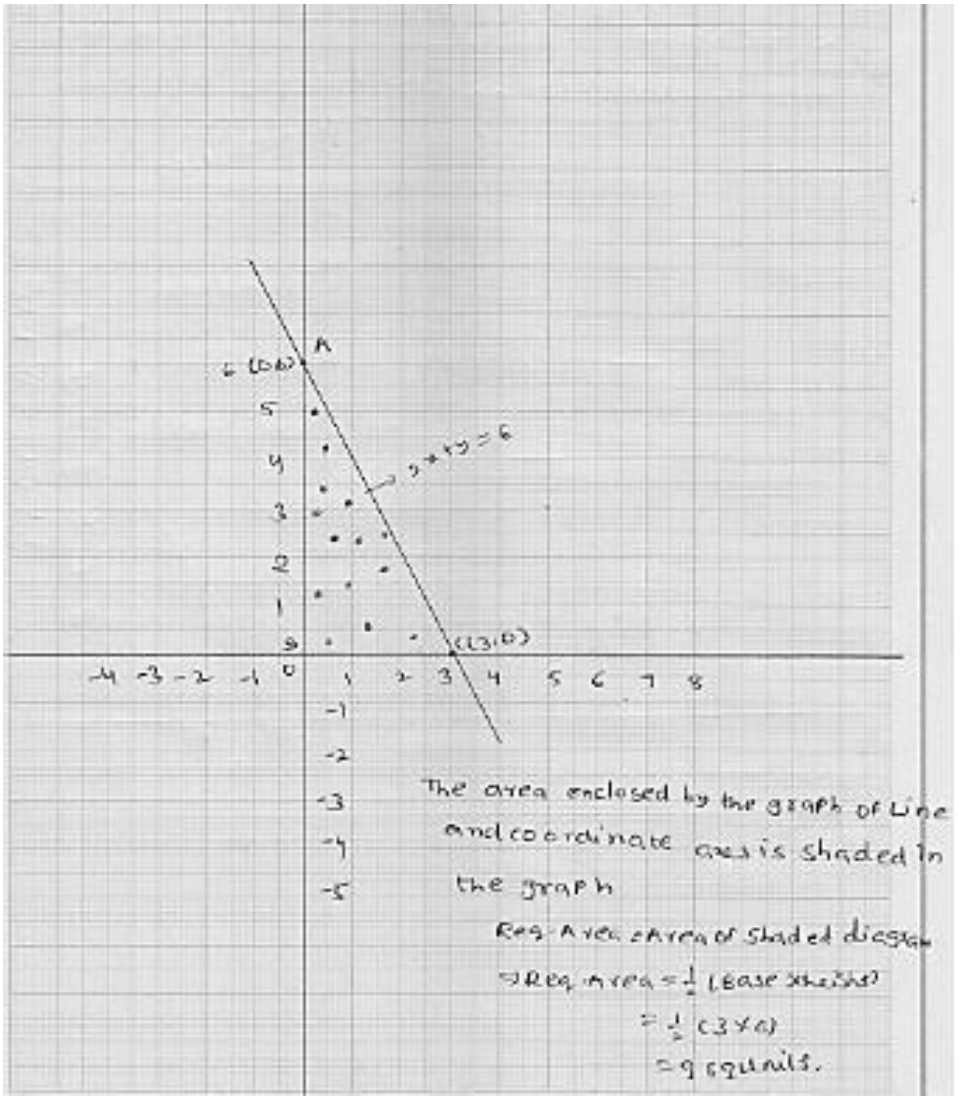
Putting $x=3$ in (i), we get $y=6-2\times3=0$

Putting $x=0$ in (i), we get $y=6-2\times0=6$

Thus, we obtained the following table giving coordinates of two points on the line represented by the equation $2x+y=6$

x	3	0
y	0	6

The graph of line $2x+y=6$



14. Draw the graph of the equation $\frac{x}{3}+\frac{y}{4}=1$. Also, find the area of the triangle formed by the line and the co-ordinates axes.

Sol:

We have

$$\frac{x}{3}+\frac{y}{4}=1$$

$$\Rightarrow \quad 4x+3y=12$$

$$\Rightarrow \quad 4x=12-3y$$

$$\Rightarrow \quad x=\frac{12-3y}{4}$$

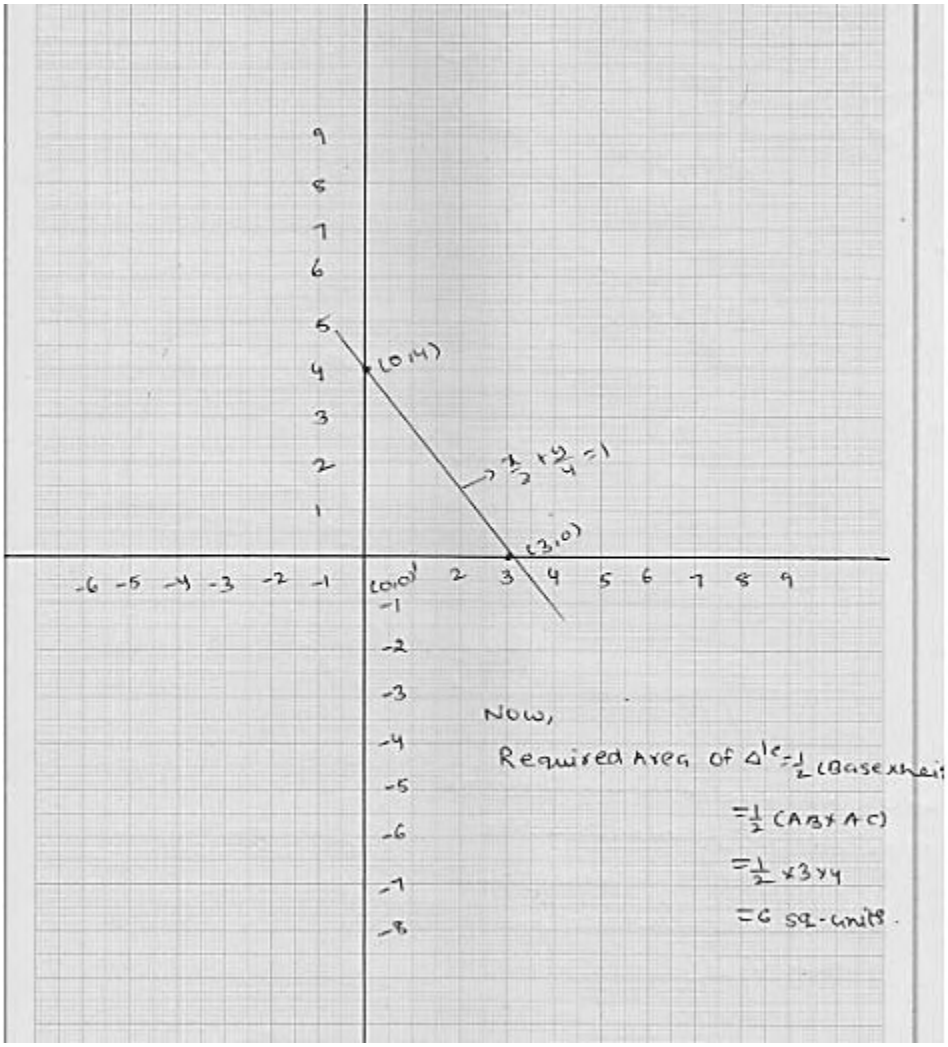
Putting $y=0$ in (i), we get $x=\frac{12-3\times 0}{4}=3$

Putting $y = -4$ in (ii), we get $x = \frac{12 - 3\times 4}{4} = 0$

Thus, we obtained the following table giving coordinates of two points on the line represents by the equation $\frac{x}{3} + \frac{y}{4} = 1$.

x	0	3
y	4	0

The graph of line $\frac{x}{3} + \frac{y}{4} = 1$.



15. Draw the graph of y = | x |.

Sol:

We have

$y = |x| \qquad .....(i)$

Putting $x = 0$, we get $y = 0$

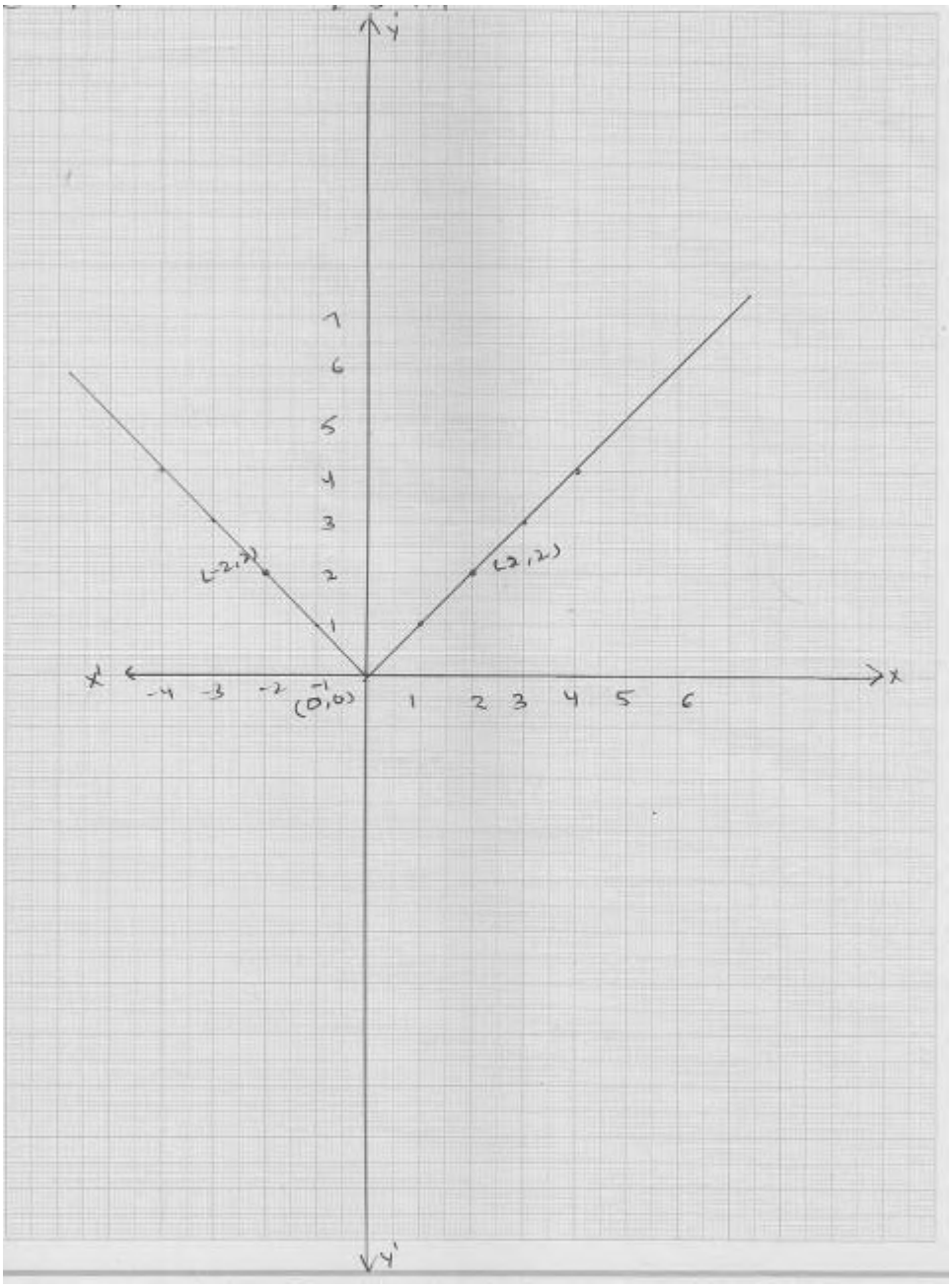
Putting $x = 2$, we get $y = 2$

Putting $x = 2$, we get $y = -12$

Thus, we have the following table for the two points on graph of $|x|$

x	0	2	-2
y	0	2	2

Graph of line equation $y = |x|$



16. Draw the graph of y = | x | + 2.

Sol:

We have

$y = |x| + 2 \qquad .....(i)$

Putting $x = 0$, we get $y = 2$.....

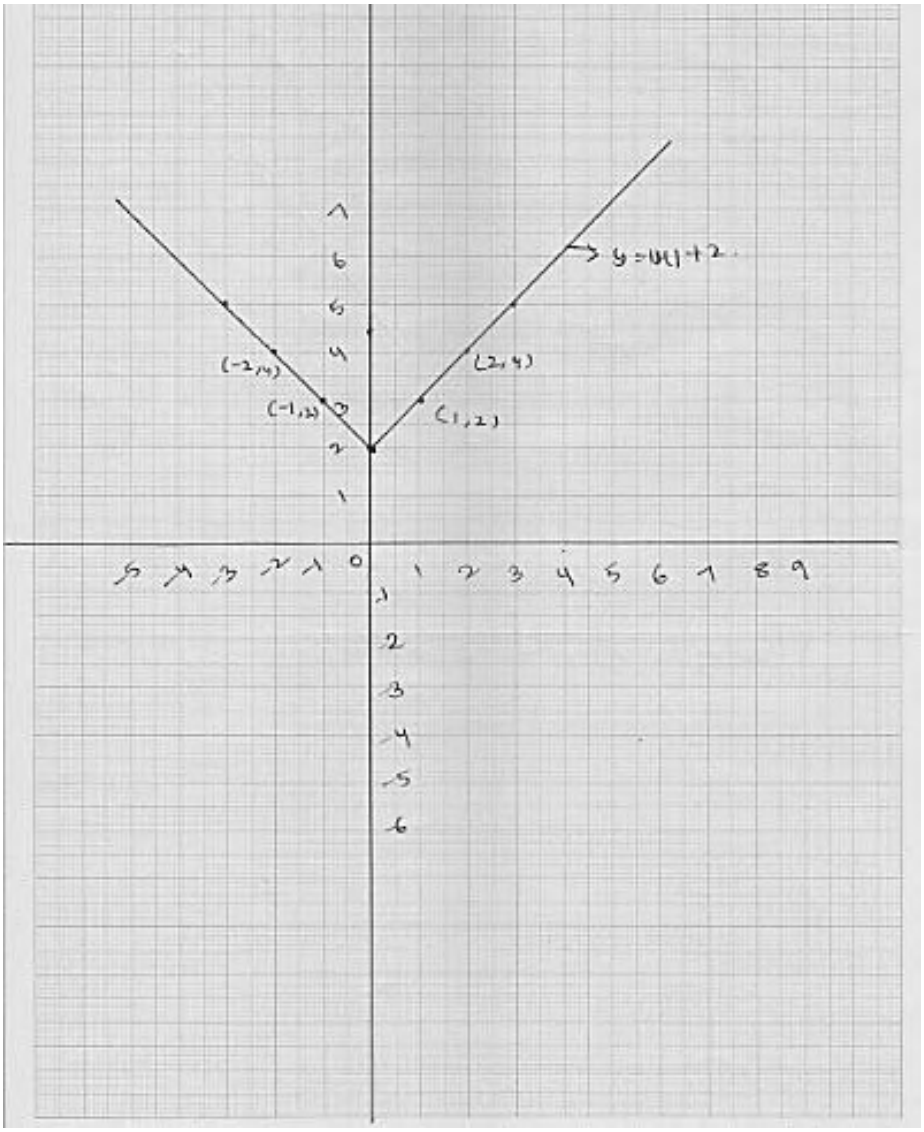
Putting $x = 1$, we get $y = 3$

Putting $x = -1$, we get $y = 3$

Thus, the we have the following table for the points on graph of $|x| + 2$

x	0	1	1
y	2	3	3

Graph of line equation $y = |x| + 2$



17. Draw the graphs of the following linear equations on the same graph paper: 2x + 3y = 12, x – y = 1.

Find the coordinates of the vertices of the triangle formed by the two straight lines and the y-axis. Also, find the area of the triangle.

Sol:

Graph of the equation $2x+3y-12=0$

We have

$2x+3y=12$

$\Rightarrow \quad 2x=12-3y$

$\Rightarrow \quad x=\frac{12-3y}{2}$

Putting $y=4$, we get $x=\frac{12-3\times 4}{2}=0$

Putting $y=2$, we get $x=\frac{12-3\times 2}{2}=3$

Thus, we have the following table for the p table for the points on the line $2x+3y=12$

x	0	3
y	4	2

Plotting points $A(0,4), B(3,2)$ on the graph paper and drawing a line passing through them we obtain graph of the equation.

Graph of the equation

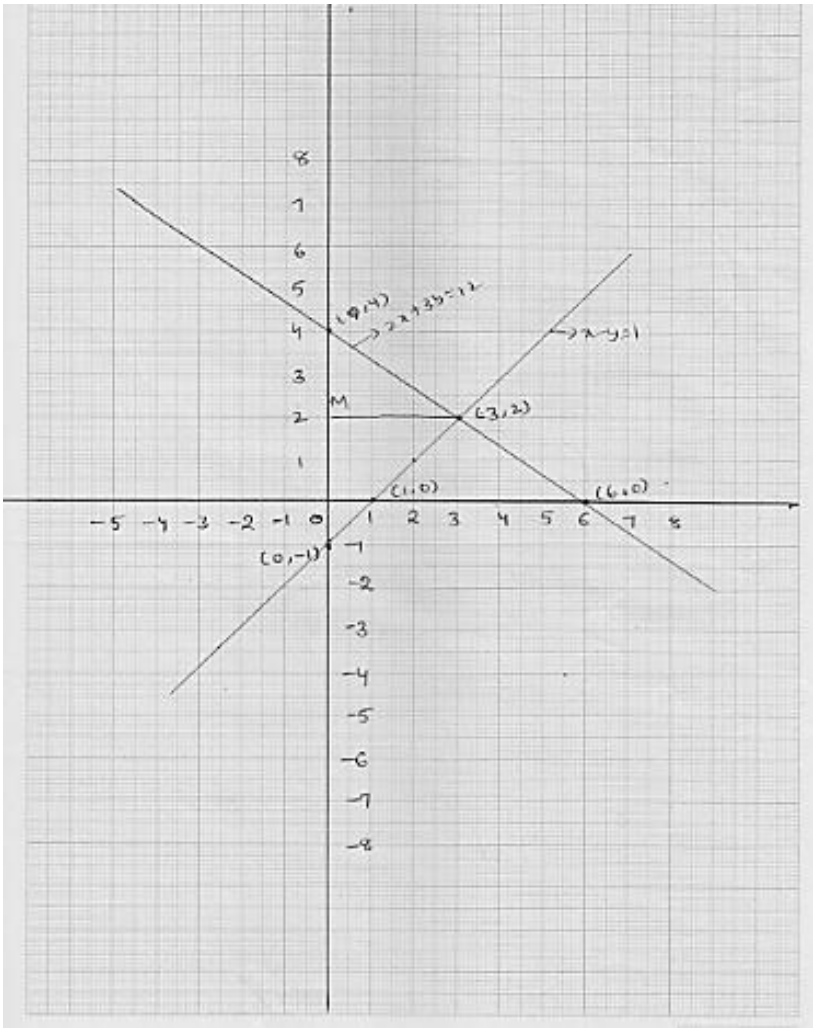
Graph of the equation $x-y-1$:

We have $x-y=1 \Rightarrow x=1+y$

Thus, we have the following table for the points the line $x-y=1$

x	1	0
y	0	-1

Plotting points $C(1,0)$ and $D(0,-1)$ on the same graph paper drawing a line passing through the m, we obtain the graph of the line represents by the equation $x-y=1$.



Clearly two lines intersect at $A(3,2)$.

The graph of time $2x+3y=12$ intersect with $y-axis$ at $B(0,4)$ and the graph of the line $x-y=1$ intersect with $y-axis$ at $C(0,-1)$.

So, the vertices of the triangle formed by thee two straight lines and $y-axis$ are $A(3,2)$ and $B(0,4)$ and $C(0,-1)$

Now,

Area of $\Delta ABC = \frac{1}{2}[\text{Base} \times \text{Height}]$

$= \frac{1}{2}(BC \times AB)$

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

$= \frac{15}{2}$ sq.units

18. Draw the graphs of the linear equations 4x − 3y + 4 = 0 and 4x + 3y − 20 = 0. Find the area bounded by these lines and x-axis.

Sol:

We have

$$4x-3y+4=0$$

$$\Rightarrow \quad 4x-3y=4$$

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

Putting $y=0$, we get $x=\frac{3\times 0-4}{4}=-1$

Putting $y=4$, we get $x=\frac{3\times 4-4}{4}=2$

Thus, we have the following table for the p table for the points on the line $4x-3y+4=0$

x	-1	2
y	0	4

We have

$$4x+3y-20=0$$

$$\Rightarrow \quad 4x=20-3y$$

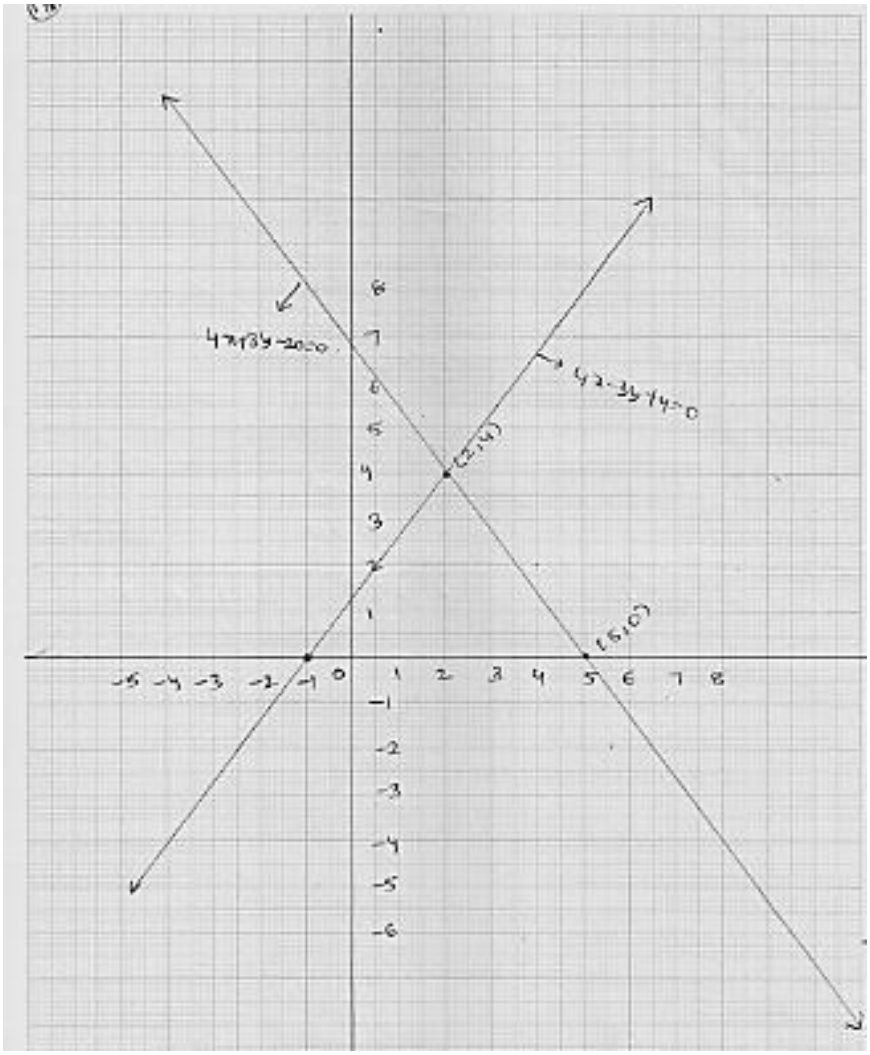
$$\Rightarrow \quad x=\frac{20-3y}{4}$$

Putting $y=0$, we get $x=\frac{20-3\times 0}{4}=5$

Putting $y=4$, we get $x=\frac{20-3\times 4}{4}=2.$

Thus, we have the following table for the p table for the points on the line $4x-3y-20=0$

x	0	2
y	0	4



Clearly, two lines intersect at $A(2,4)$.

The graph of the lines $4x-3y+4=0$ and $4x+3y-20=0$ intersect with $y-axis$ at $a+B(-1,0)$ and $c(5,0)$ respectively

$\therefore$ Area of $\Delta ABC = \frac{1}{2}[\text{Base} \times \text{height}]$

$= \frac{1}{2}(BC \times AB)$

$= \frac{1}{2}(6 \times 4)$

$= 3 \times 4$

$= 12$ sq.units

$\therefore$ Area of $\Delta ABC = 12$ sq.units

19. The path of a train A is given by the equation 3x + 4y − 12 = 0 and the path of another train B is given by the equation 6x + 8y − 48 = 0. Represent this situation graphically.

Sol:

We have,

$$3x + 4y - 12 = 0$$

$$\Rightarrow \quad 3x = 12 - 4y$$

$$\Rightarrow \quad 3x = \frac{12 - 4y}{3}$$

Putting $y = 0$, we get $x = \frac{12 - 4 \times 0}{3} = 4$

Putting $y = 3$, we get $x = \frac{12 - 4 \times 3}{3} = 0$

Thus, we have the following table for the points on the line $3x + 4y - 12 = 0$:

x	4	0
y	0	3

We have

$6x + 8y - 48 = 0$

$6x + 8y = 48$

$6x = 48 - 8y$

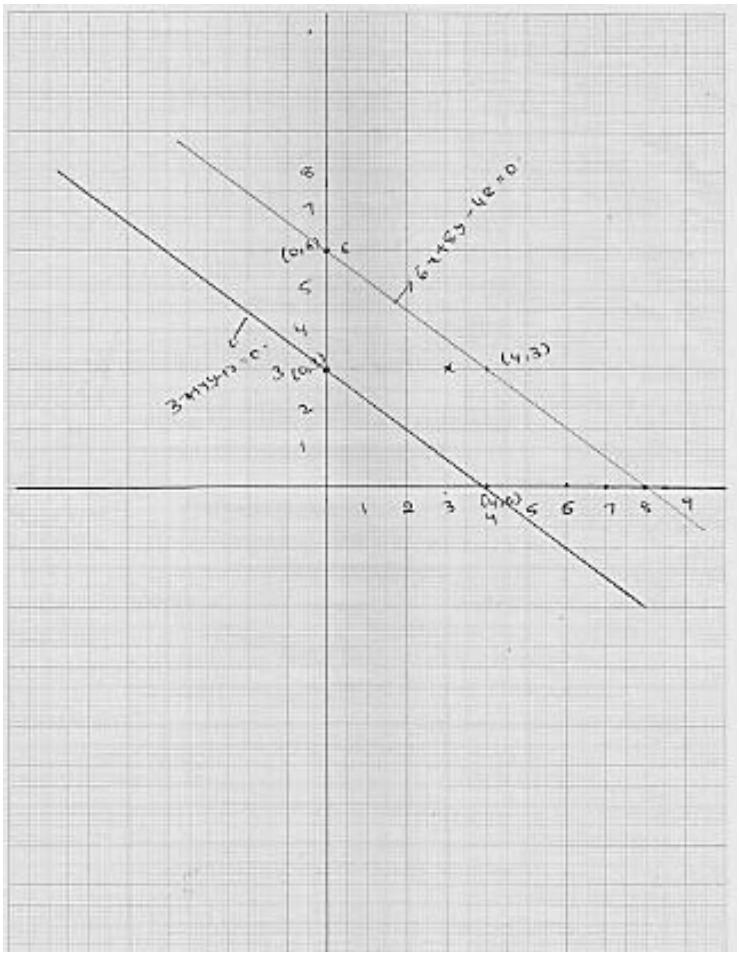
$x = 48 - \frac{8y}{6}$

Putting $y = 6$, we get $x = \frac{48 - 8 \times 6}{6} = 0$

Putting $y = 4$, we get $x = \frac{48 - 8 \times 3}{6} = 4$

Thus, we have the following table for the points on the line $6x + 8y - 48 = 0$

x	0	4
y	6	3



20. Ravish tells his daughter Aarushi, "Seven years ago, I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be". If present ages of Aarushi and Ravish are x and y years respectively, represent this situation algebraically as well as graphically.

Sol:

It is given that seven year ago Harish was seven times a sold as his daughter

$\therefore 7(x-y)=y-7$

$\Rightarrow 7x-49=y-7$

$\Rightarrow 7x-42=y \qquad .....(i)$

It is also given that after three years from now Ravish shall be three times a sold as her daughter

$\therefore 3(x+3)=y+3 \Rightarrow 3x+9=y+3 \Rightarrow 3x+6=y \qquad .....(ii)$

Now, $y=7x-42$ [using (i)]

Putting $x=6$, we get $y=7\times 6-42=0$

Putting $x=5$, we get $y=7\times 5-42=-7$

Thus, we have following table for the points on the Line $7x - 42 = y$:

x	6	5
y	0	-7

We have,

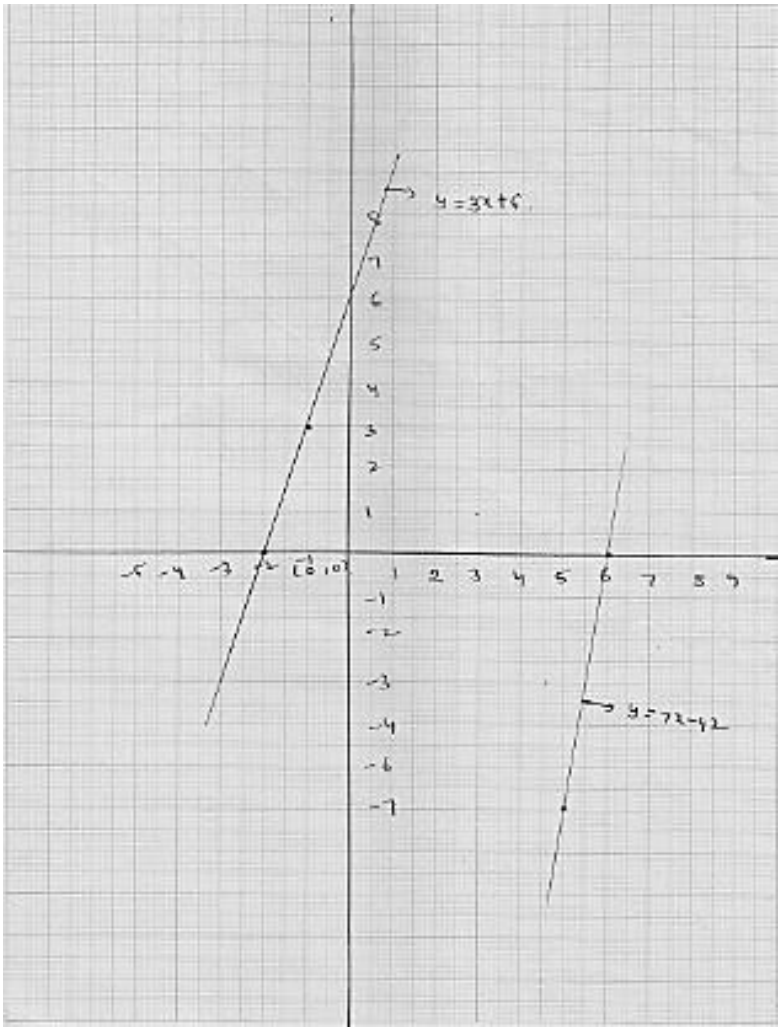
$y = 3x + 6$ [using (ii)]

Putting $x = -2$, we get $y = 3 \times (-2) + 6 = 0$

Putting $x = -1$, we get $y = 3 \times (-1) + 6 = 3$

Thus, we have following table for the points on the Line $y = 3x + 6$:

x	-1	-2
y	3	0



21. Aarushi was driving a car with uniform speed of 60 km/h. Draw distance-time graph. From the graph, find the distance travelled by Aarushi in

(i) $2\frac{1}{2}$ Hours (ii) $\frac{1}{2}$ Hour

Sol:

Let x be the time and y be the distance travelled by Aarushi

It is given that speed of car is $60km/h$

We know that $\text{speed} = \frac{\text{distance}}{\text{speed}}$

$\Rightarrow 60 = \frac{y}{x}$

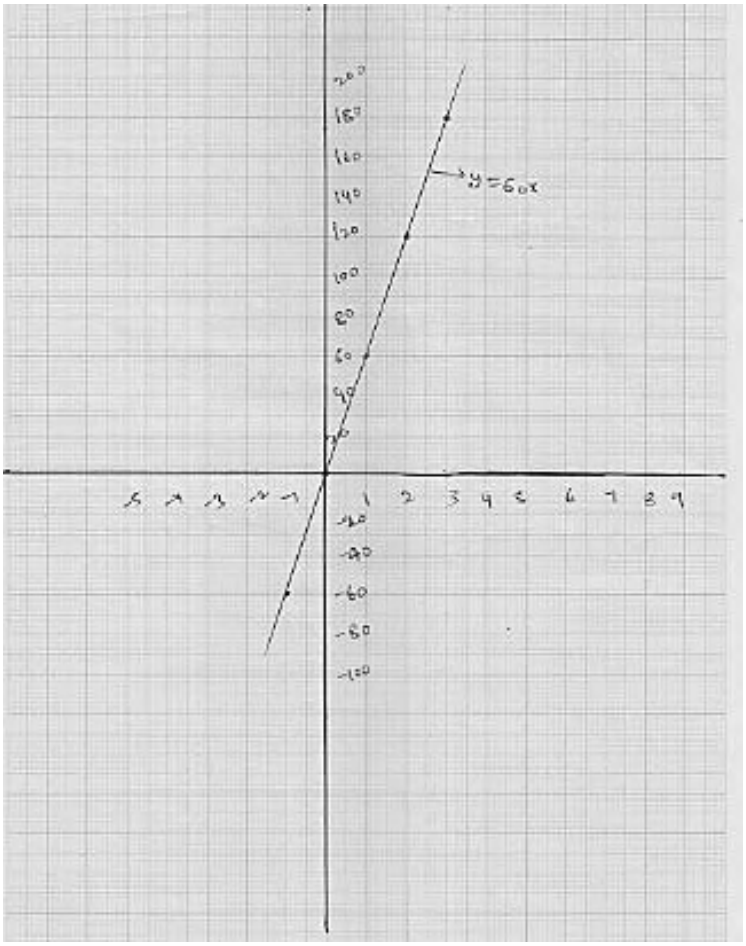
$\Rightarrow y = 60x$

Putting $x = 1$, we get $y = 60$

Putting $x = 2$, we get $y = 120$

Thus, we have the following table for the points on the line $y = 60x$

x	1	2
y	60	120



Exercise – 13.4

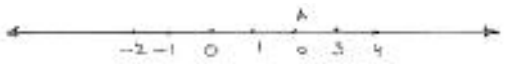
1. Give the geometric representations of the following equations

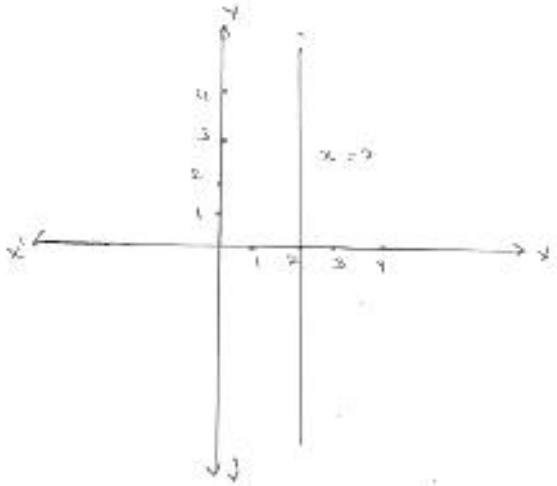
(a) on the number line (b) on the Cartesian plane:

(i) x = 2 (ii) y + 3 =0 (iii) y = 3 (iv) 2x + 9 = 0 (v) 3x – 5 = 0

Sol:

(i)



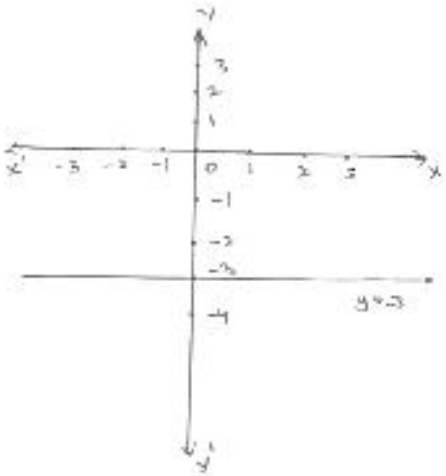


$x = 2$

Point A represents $x = 2$ number line

On Cartesian plane, equation represents all points on $y - axis$ for which $x = 2$

(ii)



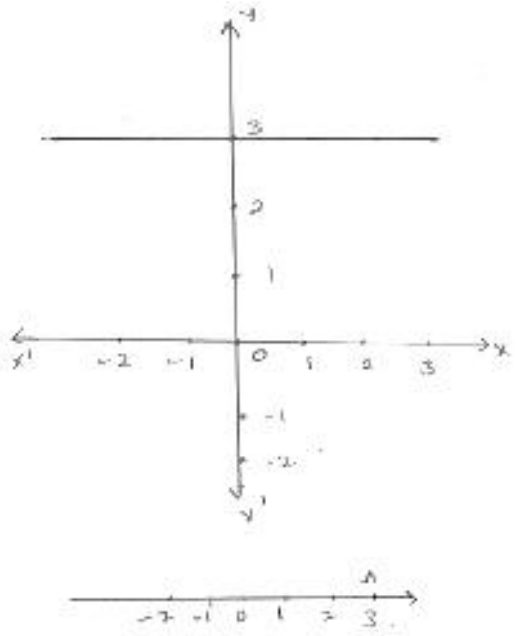
$y+3=0$

$y=-3$

Point A represents -3 on number line

On Cartesian plane equation represents all the points on $x-axis$ for which $y=-3$.

(iii)

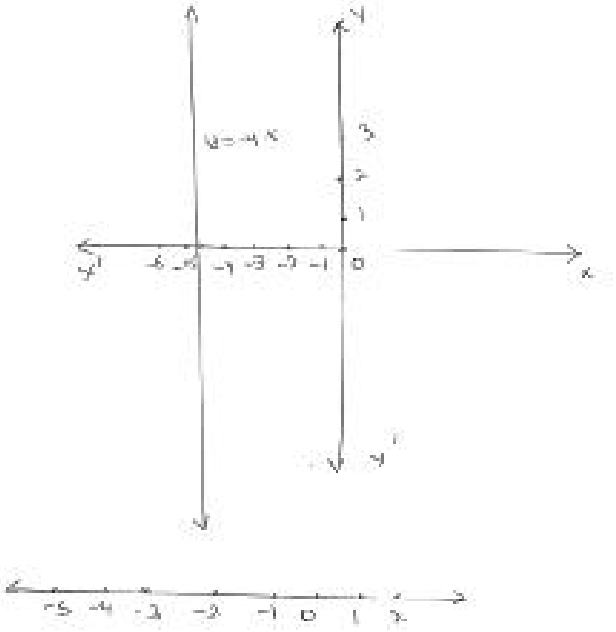


$y=3$.

Point A represents 3 on number line

On Cartesian plane, equation represents all points on $x-axis$ for which $y=3$

(iv)



$2x+9=0$

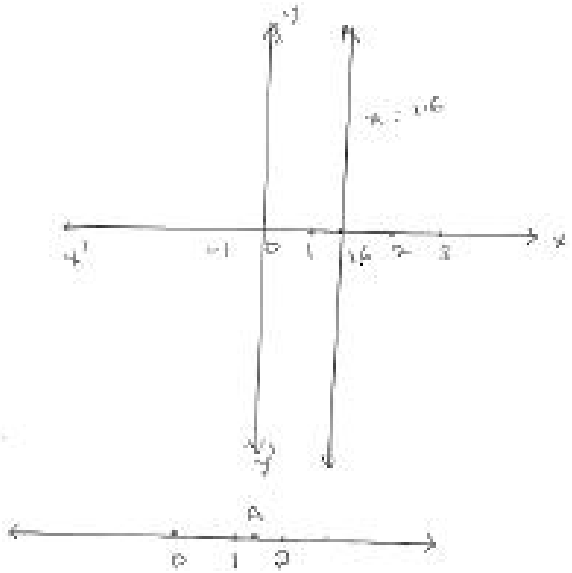
$2x=-9$

$x=\frac{-9}{2}=-4\cdot5$

Point A represents $-4\cdot5$ on number line

On Cartesian plane, equation represents all points on $y-axis$ for which $x=-4\cdot5$

(v)



$3x-5=0$

$3x=5$

$x=\frac{5}{3}=1\cdot6$ (Approx)

Point A represents $1\frac{1}{2}(\text{or})\frac{5}{3}$ on number line

On Cartesian plane, equation represents all points on $y-axis$ for which $x=16$

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

Sol:

(i)

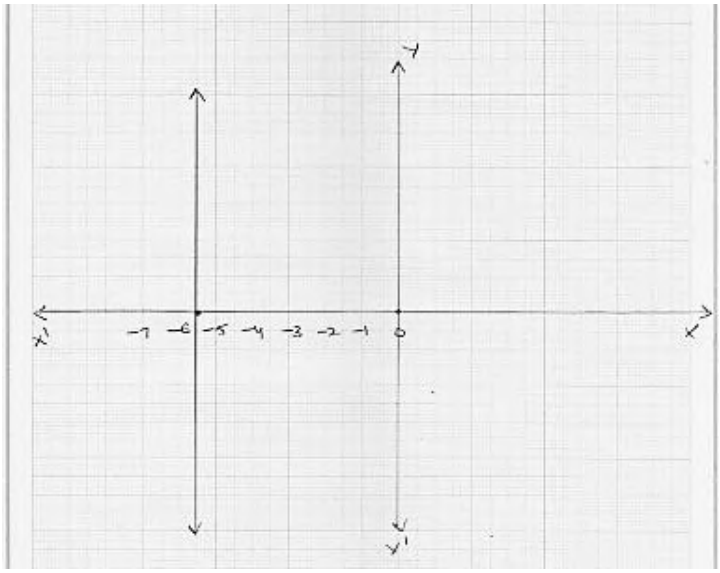
One variable representation of $2x+13=0$

$2x=-13$

$x=\frac{-13}{2}=-6\frac{1}{2}$

Points A represents $\frac{-13}{2}$

(ii)



Two variable representation of $2x+13=0$

$2x+0y+13=0$

$2x+13=0$

$2x=-13$

$x=\frac{-13}{2}$

$x=-6\cdot5$

On Cartesian plane, equation represents all points $y-axis$ for which $x=-6\cdot5$.

3. Solve the equation 3x + 2 = x − 8, and represent the solution on (i) the number line (ii) the Cartesian plane.

Sol:

(i)

$3x+2=x-8$

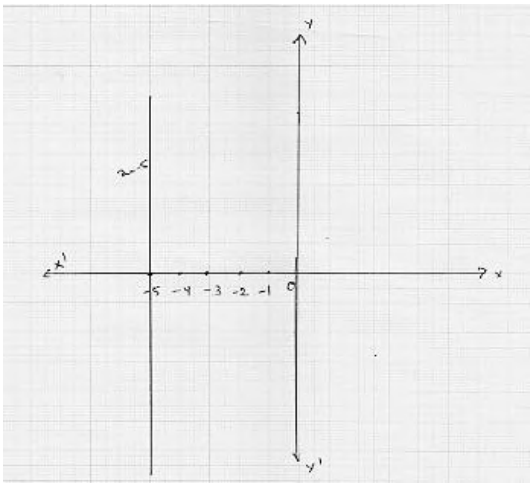
$\Rightarrow 3x-x=8-2$

$\Rightarrow 2x=-10$

$\Rightarrow x=-5$

Points A represents -5 on number line

(ii)



On Cartesian plane, equation represents all points on $y-axis$ for which $x=5$

4. Write the equation of the line that is parallel to x-axis and passing through the point
(i) (0, 3) (ii) (0, -4) (iii) (2, -5) (iv) (3, 4)

Sol:

(i) The equation of the line that is parallel to $x-axis$ and passing through the point $(0,3)$ is $y=3$.

(ii) The equation of the line that is parallel to $x-axis$ and passing through the point $(0,-4)$ is $y=4$.

(iii) The equation of the line that is parallel to $x-axis$ and passing through the point $(2,-5)$ is $y=-5$

(iv) The equation of the line that is parallel to $x-axis$ and passing through the point $(-4,-3)$ is $y=-3$

5. Write the equation of the line that is parallel to y-axis and passing through the point
(i) (4, 0) (ii) $(-2, 0)$ (iii) (3, 5) (iv) $(-4, -3)$

Sol:

(i) The equation of the line that is parallel to $y-axis$ and passing through $(4,0)$ will be $x=4$

(ii) The equation of the line that is parallel to $y-axis$ and passing through $(-2,0)$ will be $x=-2$

(iii) The equation of the line that is parallel to $y-axis$ and passing through $(3,5)$ will be $x=3$

(iv) The equation of the line that is parallel to $y-axis$ and passing through $(-4,-3)$ will be $x=-4$.