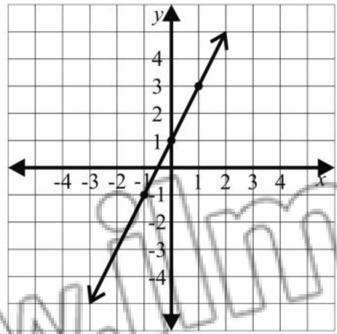


UNIT 8
LINEAR GRAPHS & THEIR APPLICATION

Ordered Pair (U.B + K.B)

(LHR 2013, 17, GRW 2013, 17, MTN 2015, FSD 2017, SGD 2016, 17)

An ordered pair of real numbers x and y is a pair (x, y) in which elements are written in specific order. i.e.

(i) (x, y) is an ordered pair in which first element is x and second is y. such that $(x, y) \neq (y, x)$ where $x \neq y$.

(ii) $(2,3)$ and $(3,2)$ are two different ordered pairs.

(iii) $(x, y) = (m, n)$ only if $x = m$ and $y = n$

Recognizing an Ordered Pair (U.B)

In the class room the seat of a student is the example of an ordered pair. For example, the seat of the student A is 5^{th} place in the 3^{rd} row, so it corresponds to the ordered pair (3, 5). Here 3 shows the number of the row and 5 shows its seat number in this row.

Cartesian Plane (K.B)

A Cartesian plane establishes one-to-one correspondence between the set of ordered pairs R × R = {(x, y)| x, y ∈ R} and the points of the Cartesian plane.

In plane two mutually perpendicular straight lines are drawn. The lines are called the **coordinate axes**. The point O, where the two lines meet is called **origin**. This plane is called the **coordinate plane** or the **Cartesian plane**.

Identification of Origin Co-ordinates Axes (K.B)

X-axis

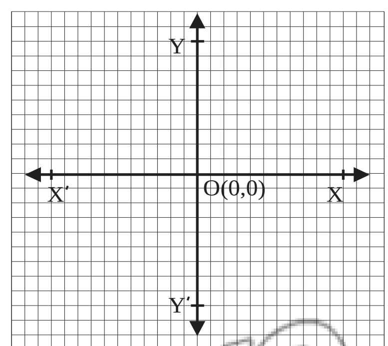
The horizontal line XOX' is called the x-axis

Y-axis

The vertical line YOY' is called the y-axis.

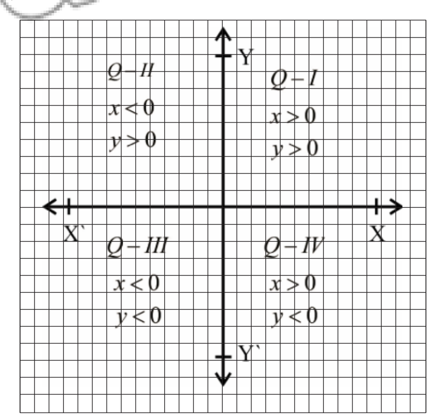
Origin

The point O where the x-axis and y-axis meet is called the origin and it is denoted by $O(0,0)$.



Note (K.B)

The signs of the coordinates of the points (x, y) are shown below:



For example:

(1) The point $(-3,-1)$ lies in III quadrant.

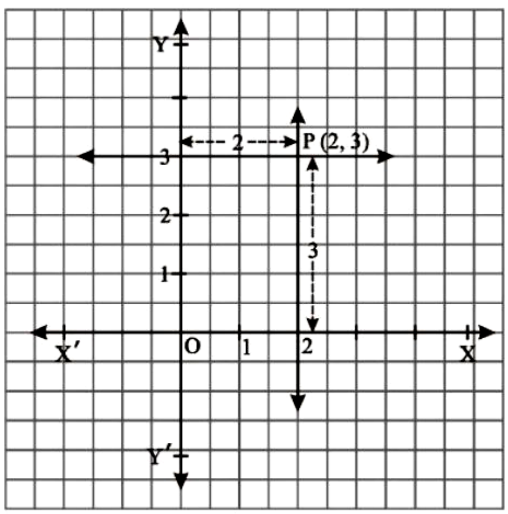
(2) The point $(2,-3)$ lies in IV quadrant.

(3) The point $(2,5)$ lies in I[st] quadrant.

(4) The point $(2,0)$ lies on x-axis

Location of the point P(*a*, *b*) in the Plane corresponding to the Ordered Pair (*a*,*b*)

Let (a, b) be an ordered pair of R × R.



In the reference system, the real number *a* is measured along *x-axis*, OA = *a* units away from the origin along OX (if *a* > 0) and the real number *b* along y-axis, OB = b units away from the origin along OY (if *b* > 0). From B on OY, draw the line parallel to *x*-axis and from A on OX draw line parallel to *y*-axis. Both the lines meet at the point P. Then point P corresponds to the ordered pair (*a*, *b*).

In the graph shown above 2 is the *x*-coordinate and 3 is the *y*-coordinate of the point P which is denoted by P(2, 3).

Abscissa **(K.B)**

The *X*-coordinate of the point is called abscissa of the point $P(x,y)$.

For example:

In (2,3), 2 is called abscissa.

Ordinate **(K.B)**

The *Y*-coordinate of the point is called its ordinate of the point $P(x,y)$.

For example:

In (2,3), 3 is called ordinate.

Note **(K.B)**

(1) Each point P of the plane can be identified by the coordinates of the pair (x,y) and is represented by $P(x,y)$.

(2) All the points of the plane have *Y*-coordinate, $y=0$ if they lie on the *X*-axis i.e., $P(-2,0)$ lies on the *x*-axis.

(3) All the points of the plane have *X*-coordinate $x=0$ if they lie on the *y*-axis i.e., $Q(0,3)$ lies on the *y*-axis.

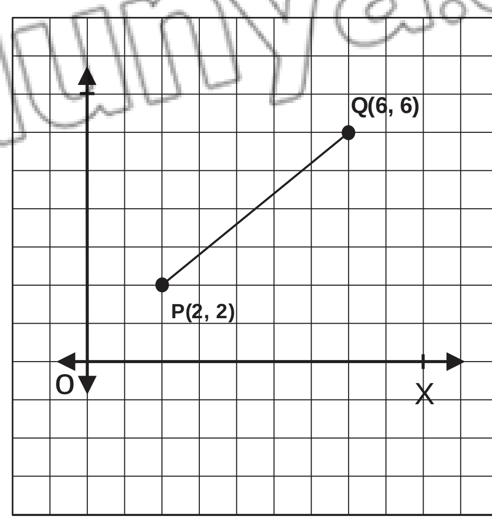
Drawing Different Geometrical Shapes in Cartesian Plane **(K.B)**

(a) Line-Segments

Example # 1

Let P(2, 2) and Q(6, 6) be two points.

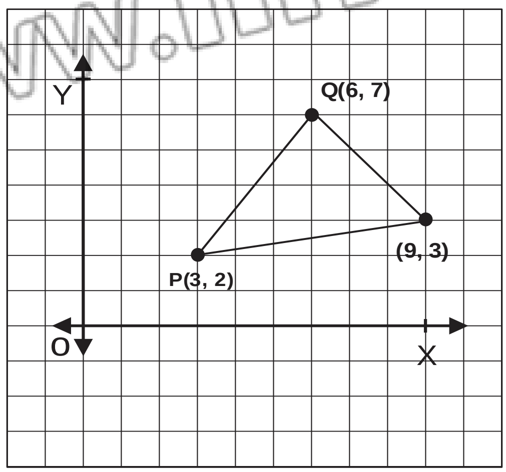
1. Plot points P and Q.
2. By joining the points P and Q, we get the line segment PQ. It is represented by $\overline{PQ}$.



(b) Triangle **(K.B)**

Example # 1

Plot the points P(3,2), Q(6, 7) and R(9, 3). By joining them, we get a triangle PQR.

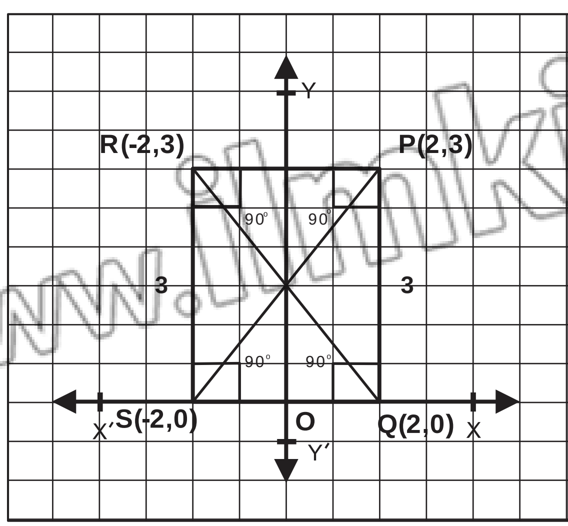


(c) Rectangle **(K.B)**

Example:

Plot the points P(2, 3), Q(2, 0), S(–2, 0) and R(–2, 3). Joining the points P, Q , S and R, we get a rectangle PQSR.

Scale:
Along y-axis,
2(length of square) = 1 unit



Construction of a Table for Pairs of Values Satisfying a Linear Equation in Two variables.

Let $2x + y = 1 \rightarrow (i)$

$at\ x = -1, \quad y = (-2)(-1) + 1 = 2 + 1 = 3$

$at\ x = 0, \quad y = (-2)(0) + 1 = 0 + 1 = 1$

$at\ x = 1, \quad y = (-2)(1) + 1 = -2 + 1 = -1$

$at\ x = 3, \quad y = (-2)(3) + 1 = -6 + 1 = -5$

We express equation (i) in the form

$y = -2x + 1 \rightarrow (ii)$

The pairs (x, y) which satisfy (ii) are tabulated below.

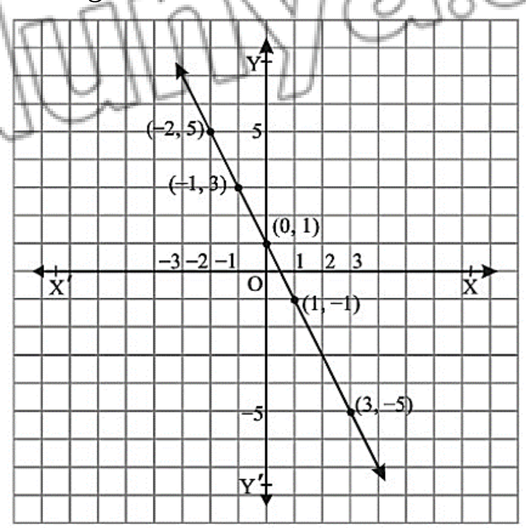
X	y	(x, y)
–1	3	(–1, 3)
0	1	(0, 1)
1	–1	(1, –1)
3	–5	(3, –5)

Similarly all the points can be computed, the ordered pairs of which do satisfy the equation (i).

Plotting the points to get the graph

(K.B)

Now we plot the points obtained in the table. Joining these points we get the graph of the equation. The graph of $y = -2x + 1$ is shown in the figure.



Scale of Graph (K.B)

To draw the graph of an equation we choose a scale e.g., I cm represents 5 meters or 1 small square length represents 10 or 5 meters. It is selected by keeping in mind the size of the paper. Some times the same scale is used for both x and y coordinates and some times we used different scales for x and y-coordinated depending on the values of the coordinates.

Drawing Graphs of the following Equations (K.B)

(a) $y=c$, where c is constant.

(b) $x=a$, where a is constant.

(c) $y=mx$, where m is constant.

(d) $y=mx+c$, where m and c both are constants.

By drawing the graph of an equation is meant to plot those points in the plane, which form the graph of the equation (by joining the plotted points).

(a) The equation $y=c$ is formed in the plane by the set,

$S=\{(x,c): x\, lies\, on\, the\, x-axis\}\subseteq R\times R$.

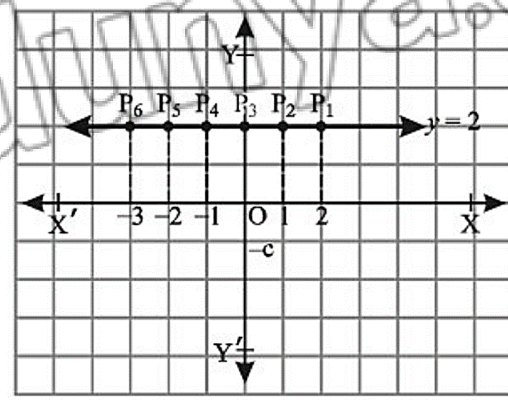
The procedure is explained with the help of following examples.

Consider the equation $y=2$

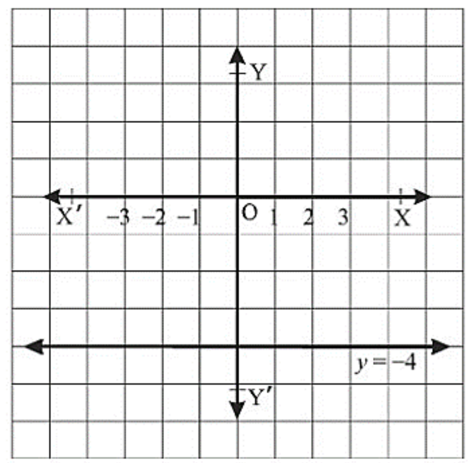
The S is tabulated as;

x	……	−3	−2	−1	0	1	2	……
y	2	2	2	2	2	2	2	2

The points of S are plotted in the plane



Similarly graph of $y=-4$ is shown as:



So, the graph of the equation of the type $y=c$ is obtained as:

(i) The straight line

(ii) The line is parallel to $x-axis$

(iii) The line is above the $x-axis$ at a distance c units if $c>0$

(iv) The line (shown as $y=-4$) is below the $x-axis$ at the distance c units as $c<0$

(v) The line is that of $x-axis$ at the distance c units if $c=0$

(b) **The equation $x=a$ is drawn in the plane by the points of set $s=\{(a,y), y\in\mathbb{R}\}$** **(U.B)**

x	a	a	a	a	a	a	A	a	--------
y	…	−2	−1	0	1	2	3	4	--------

The points of S are plotted in the plane as, $\ldots(a,-2),(a,-1),(a,0),(a,1),(a,2),\ldots etc.$

The point $(a,0)$ on the graph of the equation $x=a$ lies on the $x-axis$ while (a,y) is above the $x-axis$ if $y>0$ and below the $x-axis$ if $y<0$. By joining the points, we get the line.

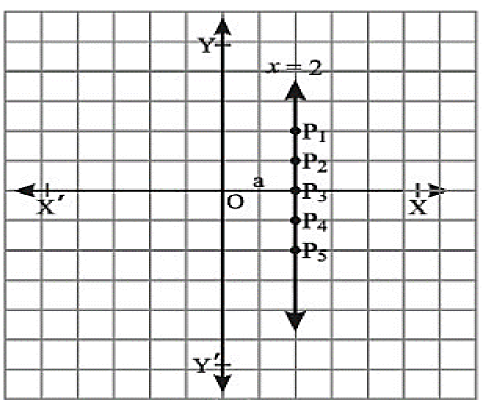
The procedure is explained with the help of following examples.

Consider the equation $x=2$

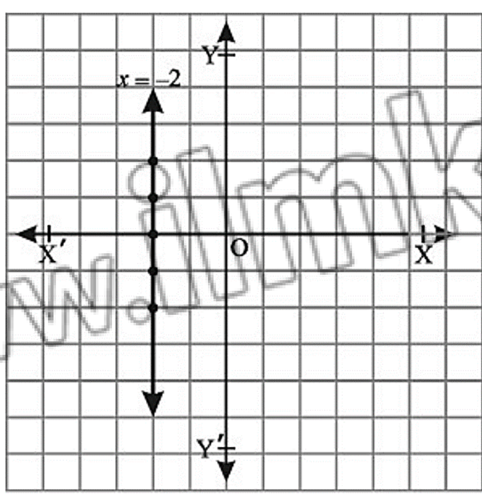
Table for the points of equation is as under.

x	2	2	2	2	2	2	…2…
y	…	–2	–1	0	1	2	…

Thus, graph of the equation $x=2$ is shown as



Similarly graph for equation $x=-2$ is shown as



So, the graph of the equation of the type $x=a$ is obtained as:

(i) The straight line

(ii) The line parallel to the y-axis

(iii) The line is on the right side of y-axis at distance "a" units if $a > 0$.

(iv) The line $x=-2$ is on the left side of y-axis at the distance a units as $a < 0$

(v) The line is y-axis if $a = 0$

(c) **The equation** $y=mx,(\text{for } a \text{ fixed } m\in R)$ **is formed by the points of the set**

$W=\{(x,mx): x\in \mathbb{R}\}$

i.e.,

$W=\{\ldots,(-2,-2m,),(-1,-m),(0,0),(1,m),(2,2m),\ldots\}$

The points corresponding to the ordered pairs of the set W are tabulated below.

Table of points for equation is as under:

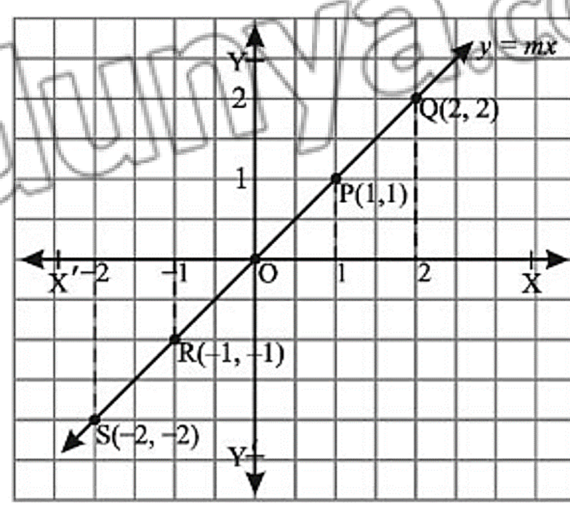
x	……	–2	–1	0	1	2	…
y	……	$-2m$	$-m$	0	m	$2m$	…

The procedure is explained with the help of following examples.

Consider the equation $x=y$, where $m=1$

x	……..	–2	–1	0	1	2	…
y	……..	–2	–1	0	1	2	…

The points are plotted in the plane as follows.



By joining the plotted points the graph of the equation of the type $y = mx$ is,

(i) The straight line

(ii) It passes through the origin O (0,0)

(iii) m is the slope of the line

(iv) The graph of line splits the plane into two equal parts.

(v) If $m = 1$ then the line becomes the graph of the equation $y = x$.

(vi) If $m = -1$ then line is the graph of the equation $y = -x$.

(vii) The line meets both the axes at the origin and no other point.

(d) Generalized form of the equation
i.e., $y = mx + c,\quad where\ m, c \neq 0.$

The points corresponding to the ordered pairs of the set.

$S = \{x, mx + c\} : m, c(\neq 0 \in \mathbb{R})$ are tabulated below

x	0	1	2	3	…	x	…
y	c	$m+c$	$2m+c$	$3m+c$	...	$mx+c$	…

The procedure is explained with the help of following examples.

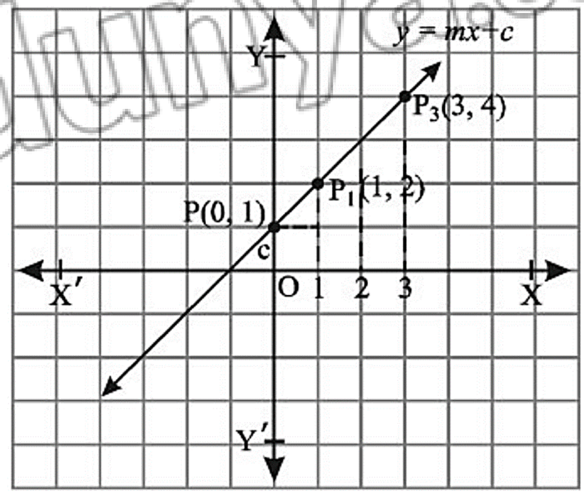
Consider the equation

$y = x + 1,\quad where\ m = 1, c = 1$

We get the table

x	…0	1	2	3	...	…	…
y	…1	2	3	4	…	…	…

These points are plotted in plane as below



We see that

(i) $y = mx + c$ represents the graph of a line.

(ii) It does not pass through the origin O(0,0).

(iii) It has intercept c units along the $y-axis$ away from the origin.

(iv) m is the slope of the line whose equation is $y = mx + c.$

In particular if

(i) $c = 0$, then $y = mx$ passes through the origin.

(ii) $m = 0,$ the line $y = c$ is parallel to $x-axis.$

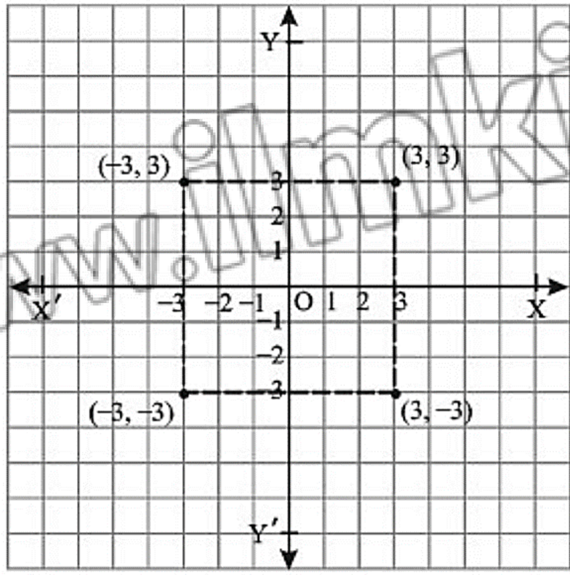
Drawing Graph from a given Table of Discrete Values (U.B)

If the points are discrete the graph is just the set of points. The points are not joined.

For example, the following table of discrete values is plotted as

X	3	3	–3	–3
Y	3	–3	3	–3

So, the dotted square shows the graph of discrete values.



Solving Real Life Problems: (K.B)

We often use the graph to solve the real life problems. With the help of graph, we can determine the relation or trend between the both quantities.

We learn the procedure of drawing graph of real life problems with the help of following **Examples:**

Equation $y = x + 16$ shows the relationship between the ages of two persons i.e., if the age of one person is x, then the age of other person is y. Draw the graph.

Solution:

We know that $y = x + 16$ **(A.B)**

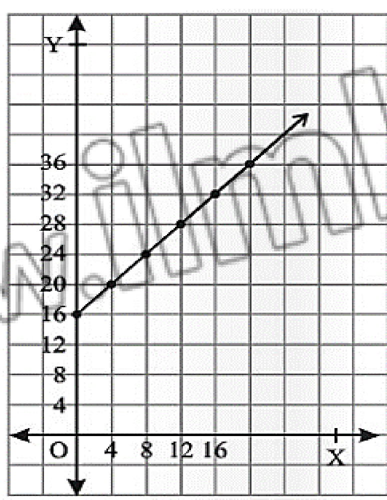


Table of points for equation is given as:

X	0	4	8	12	16	…
Y	16	20	24	28	32	…

By plotting the points we get the graph of a straight line as shown in the figure.

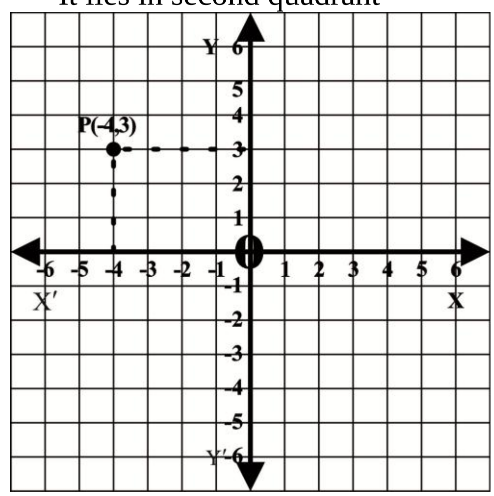
Exercise 8.1

Q.1

(i) Determine the quadrant of coordinate plane in which the following points lies

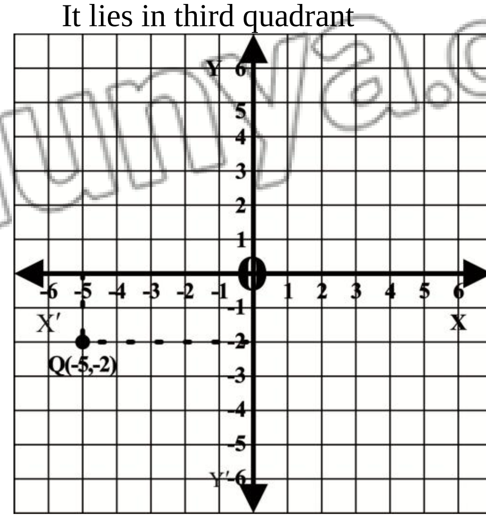
P (–4, 3) **(LHR 2013, D.G.K 2013)**

It lies in second quadrant



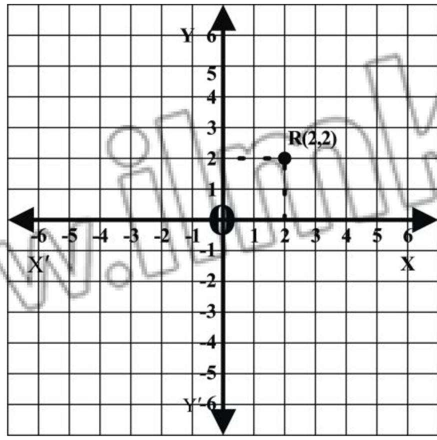
Q (–5, –2) **(LHR 2015, GRW 2013)**

It lies in third quadrant



R (2, 2)

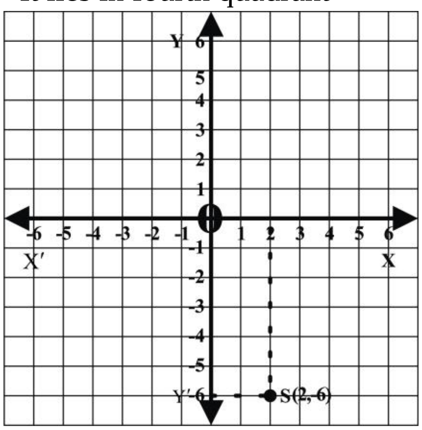
It lies in first quadrant



S (2, –6)

(LHR 2013, GRW 2013, D.G.K 2013)

It lies in fourth quadrant



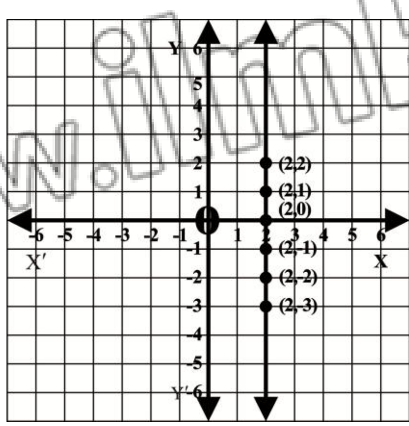
Q.2 Draw the graph of each of the following i.e.

(i) $x = 2$

(LHR 2015, 16, GRW 2016, SGD 2013)

The table for the points of equation $x = 2$ is as under

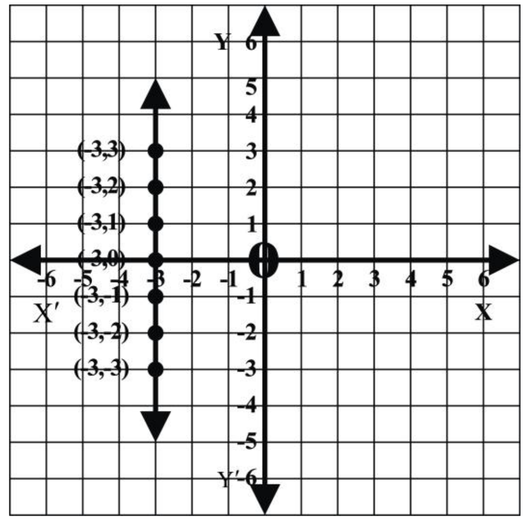
x	2	2	2	2	2	2
y	-3	-2	-1	0	1	2



(ii) $x = -3$

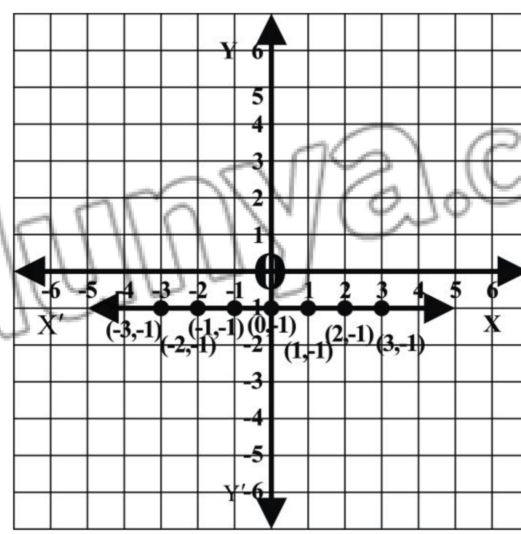
The table for the points of equation $x = -3$ is as under **(A.B)**

x	-3	-3	-3	-3	-3	-3	-3
y	-3	-2	-1	0	1	2	3



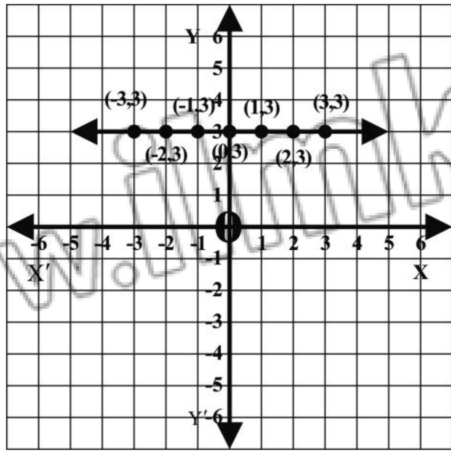
(iii) $y = -1$ **(A.B)**

x	-1	-1	-1	-1	-1	-1	-1
y	-3	-2	-1	0	1	2	3



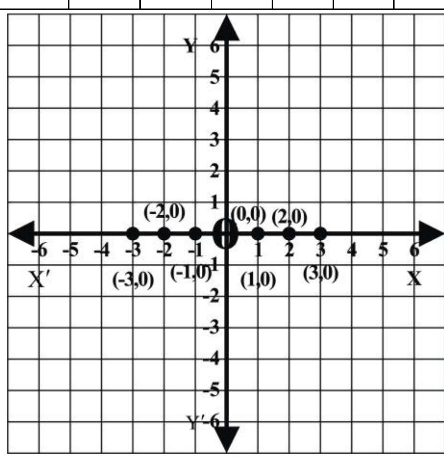
(iv) $0\,y = 3$ **(A.B)**

x	3	3	3	3	3	3	3	3
y	-3	-2	-1	0	1	2	3	4



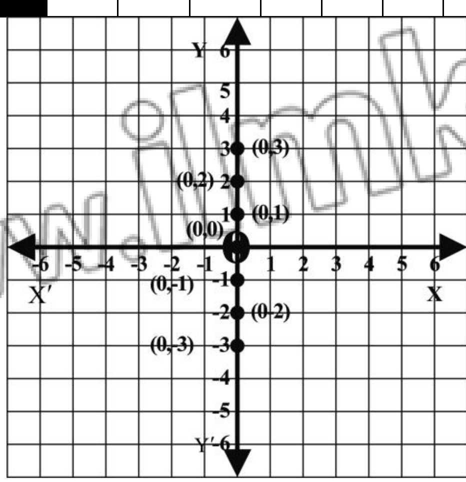
(v) $y = 0$

x	-3	-2	-1	0	1	2	3	4
y	0	0	0	0	0	0	0	0



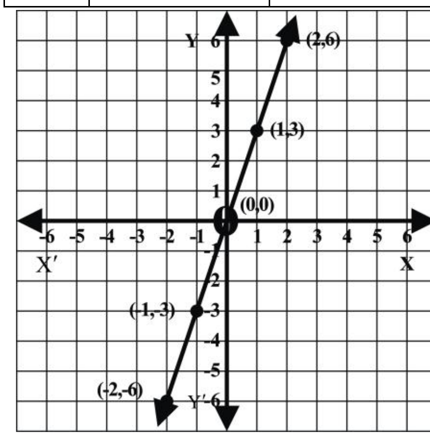
(vi) $x = 0$

X	0	0	0	0	0	0	0
Y	-3	-2	-1	0	1	2	3



(vii) $y = 3x$

x	$y = 3x$	xy
….	….	….
–2	3(–2) = –6	(–2,–6)
–1	3(–1) = –3	(–1,–3)
0	3(0) = 0	(0,0)
1	3(1) = 3	(1, 3)
2	3(2) = 6	(2, 6)
…	…	…



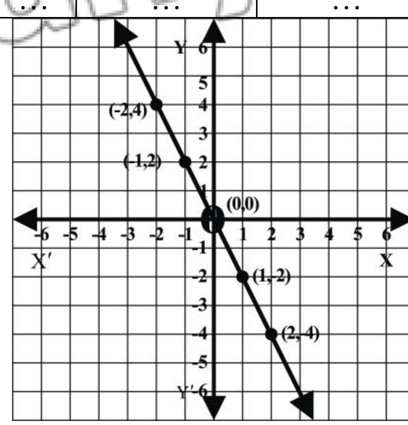
(viii) $-y = 2x$

Multiply both sides by (–)

$-(-y) = -2x$

$y = -2x$

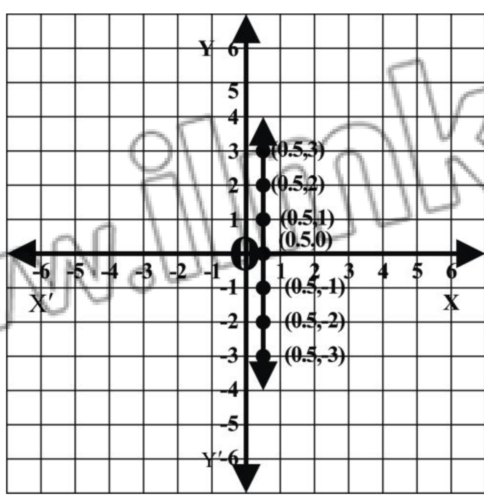
x	$y = -2x$	(x, y)
….	….	….
–2	–2(–2) = 4	(–2, 4)
–1	–2(–1) = 2	(–1, 2)
0	–2(0) = 0	(0, 0)
1	–2(1) = –2	(1, –2)
2	–2(2) = –4	(2, –4)
…	…	…



(ix) $\frac{1}{2} = x$

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

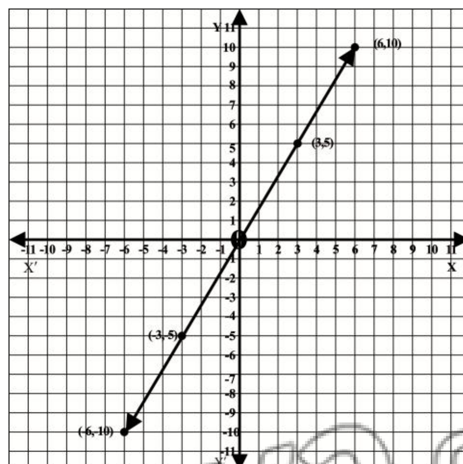
x	y	(x, y)
$\frac{1}{2} = 0.5$	–3	(0.5, –3)
$\frac{1}{2} = 0.5$	–2	(0.5, –2)
$\frac{1}{2} = 0.5$	–1	(0.5, –1)
$\frac{1}{2} = 0.5$	0	(0.5, 0)
$\frac{1}{2} = 0.5$	1	(0.5, 1)
$\frac{1}{2} = 0.5$	2	(0.5, 2)
$\frac{1}{2} = 0.5$	…..	…..



(x) $3y = 5x$

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

x	$y = \frac{5}{3}x$	(x, y)
-6	$\frac{5}{\cancel{3}} \times -\cancel{6}^{2} = -10$	(–6, –10)
–3	$\frac{5}{\cancel{3}} \times -\cancel{3} = -5$	(–3, –5)
0	$\frac{5}{3} \times 0 = 0$	(0, 0)
3	$\frac{5}{\cancel{3}} \times \cancel{3} = 5$	(3, 5)
6	$\frac{5}{\cancel{3}} \times \cancel{6}^{2} = 10$	(6, 10)

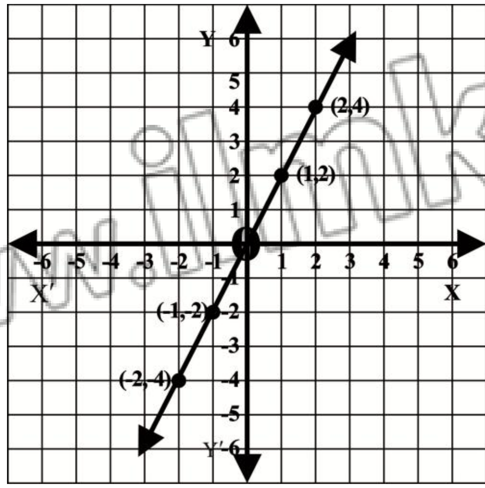


(xi) $2x - y = 0$

$2x = y$ or $y = 2x$

(LHR 2014, SWL 2015, SGD 2015, FSD 2017)

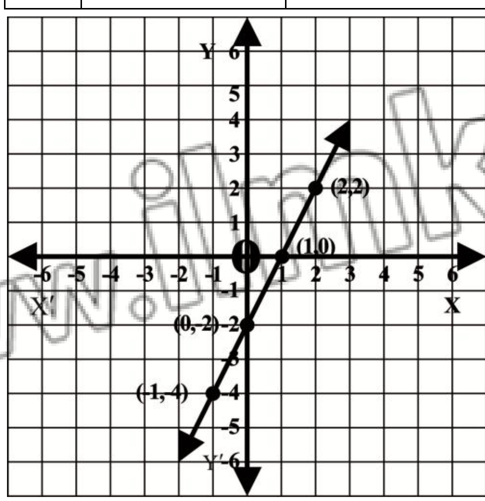
x	$y = 2x$	
–2	2(–2)= –4	(–2, –4)
–1	2(–1)= –2	(–1, –2)
0	2(0)= 0	(0, 0)
1	2(1)= 2	(1, 2)
2	2(2)= 4	(3, 4)



(xii) $2x - y = 2$

$2x - 2 = y$ or $y = 2x - 2$

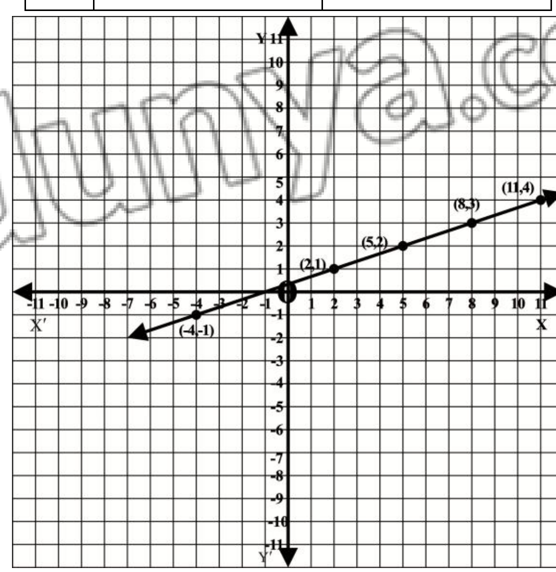
x	$y = 2x - 2$	(x, y)
–1	2(–1)–2= –4	(–1, –4)
0	2(0)–2= –2	(0, –2)
1	2(1)–2= 0	(1, 0)
2	2(2)–2= 2	(2, 2)



(xiii) $x - 3y + 1 = 0 \Rightarrow x + 1 = +3y$

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

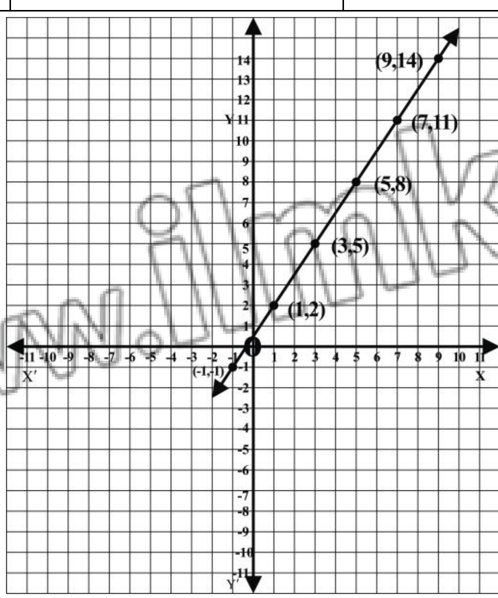
x	$y = \frac{x+1}{3}$	
–4	$y = \frac{-4+1}{3} = -1$	(–4, –1)
2	$y = \frac{2+1}{3} = 1$	(2, 1)
5	$y = \frac{5+1}{3} = 2$	(5, 2)
8	$y = \frac{8+1}{3} = 3$	(8, 3)
11	$y = \frac{11+1}{3} = 4$	(11, 4)



(xiv) $3x-2y+1=0$

$$y=\frac{3x+1}{2}$$

x	$y=\frac{3x+1}{2}$	(x, y)
–1	$y=\frac{3(-1)+1}{2}=\frac{-2}{2}=-1$	(–1, 1)
1	$y=\frac{3(1)+1}{2}=\frac{4}{2}=2$	(1, 2)
3	$y=\frac{3(3)+1}{2}=\frac{10}{2}=5$	(3, 5)
5	$y=\frac{3(5)+1}{2}=\frac{16}{2}=8$	(5, 8)
7	$y=\frac{3(7)+1}{2}=\frac{22}{2}=11$	(7, 11)
9	$y=\frac{3(9)+1}{2}=\frac{28}{2}=14$	(9, 14)



Q.3 Are the following lines (i) parallel to $x-axis$ (ii) parallel to $y-axis$

Solution:

(i) $2x-1=3$ **(K.B)**

$2x=3+1$

$2x=4$

$x=\frac{4}{2}$

$x=2$ it is a line parallel to y-axis

(ii) $x+2=-1$

$x=-1-2$

$x=-3$ it is a line parallel to $y-axis$

(iii) $2y+3=2$ **(K.B)**

$2y=2-3$

$2y=-1$

$y=\frac{-1}{2}$ it is a line parallel to $x-axis$

(iv) $x+y=0$

$x=-y$ It is neither parallel to $x-axis$ nor $y-axis$

(v) $2x-2y=0$ **(K.B)**

$2x=2y$

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

$x=y$

$y=x$

It is neither parallel to $x-axis$ nor $y-axis$

Q.4 Find the value of m and c of the following lines by expressing them in the form $y=mx+c$

Solution:

(a) $2x+3y-1=0$

$3y=-2x+1$

$y=\frac{-2x+1}{3}$

$y=\frac{-2x}{3}+\frac{1}{3}$

$m=-\frac{2}{3}$ and $c=\frac{1}{3}$

(b) $x-2y=-2$

$x+2=2y$

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

Or

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

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

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

So, $m=\frac{1}{2}$ $c=1$

(c) $3x+y-1=0$

(FSD 2014, 15, SGD 2015, D.G.K 2016)

$y=1-3x$

or

$y=-3x+1$

$m=-3$ $c=1$

(d) $2x-y=7$

(LHR 2017, MTN 2014, 16, 17, RWP 2016)

$2x-7=y$

Or

$y=2x-7$

$m=2$ $c=-7$

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

(FSD 2017, SWL 2016, BWP 2016, 17, D.G.K 2017)

$y=2x-3$

$m=2$ $c=-3$

(f) $2x=y+3$

(FSD 2017, SWL 2016, BWP 2016, 17, D.G.K 2017)

$2x-3=y$

Or

$y=2x-3$

$m=2$ $c=-3$

Q.5 Verify whether the following point lies on the line 2x–y + 1 =0 or not

Solution:

(i) (2, 3)

(GRW 2014, MTN 2016, SGD 2016, D.G.K 2016)

$2x-y+1=0$

$2(2)-3+1=0$

$4-3+1=0$

$2\neq 0$

$\therefore$ The point does not lie on the line

(ii) (0, 0)

$2x-y+1=0$

$2(0)-0+1=0$

$0-0+1=0$

$1\neq 0$

$\therefore$ The point does not lie on the line

(iii) (–1, 1)

(LHR 2014, GRW 2016, SWL 2015)

$2x-y+1=0$

$2(-1)-1+1=0$

$-2-1+1=0$

$-2\neq 0$

$\therefore$ The point does not lie on the line

(iv) (2, 5)

(GRW 2016, SGD 2015, MTN 2014, 15)

$2x-y+1=0$

$2(2)-5+1=0$

$4-5+1=0$

$0=0$

$\therefore$ It lies on the line

(v) (5, 3)

$2x-y+1=0$

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

$10-3+1=0$

$8\neq 0$

$\therefore$ It does not lie on the line

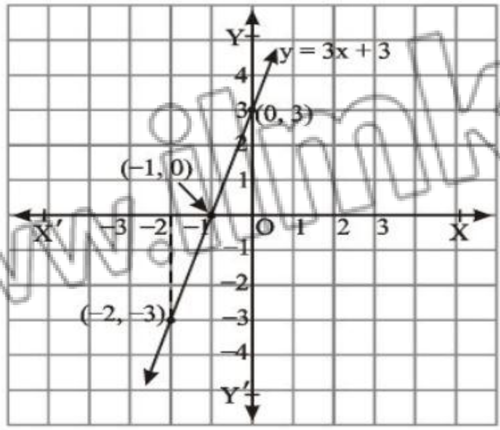
Conversion Graphs **(U.B)**

Let $y=f(x)$ be an equation in two variables x and y.

We demonstrate the ordered pairs which lie on the graph of the equation $y=3x+3$ and are tabulated below:

x	…0	–1	–2...
y	…3	0	–3...
(x,y)	…$(0,3)$	$(-1,0)$	$(-2,-3)$...

By plotting the points in the plane corresponding to the ordered pairs $(0,3),(-1,0)$ and $(-2,-3)$ etc. we form the graph of the equation $y=3x+3$.



Exercise 8.2

Q.1

Draw the conversion graph between liters and gallons using the relation 9 liters = 2 gallons (approximately) and taking liters along horizontal axis and gallons along vertical axis from the graph read.

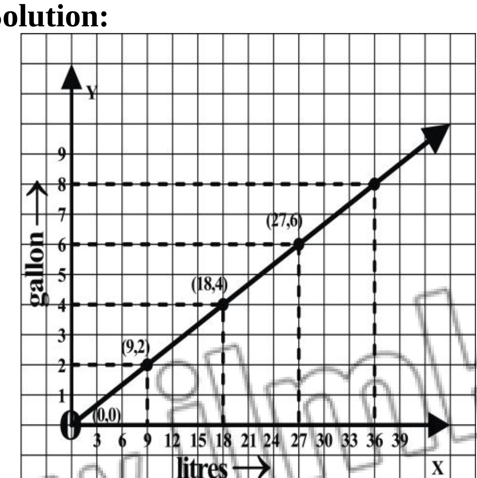
(i) The number of gallons in 18 liters.

(ii) The number of liters in 8 gallons.

We know 9 liters = 2 gallons

$1\text{liters} = \frac{2}{9}$ gallons

Solution:



$y = \frac{2}{9}x$

x	0	9	18	27
y	0	2	4	6

18 litters=4 gallons

Scale **(U.B)**

Along *X-axis*

3 litters = 1 box

Along *Y-axis*

1 gallon = 1 box

(i) The number of gallons in 18 liters.

Ans: =4 Gallons

(ii) The number of liters in 8 gallons.

Ans: =36 Liters

Q.2 On 15-03-2008 **the exchange rate of Pakistani currency and Saudi Riyal was as under 1SRial = 16.70 rupees** **(U.B)**

If Pakistani currency *y* is an expression of S. Riyal *x* expressed under. The rule *y* = 16.70 *x* then draw the conversion graph between these two currencies by taking S. riyal along *x* axis.

1SR = 16.70 Rupees

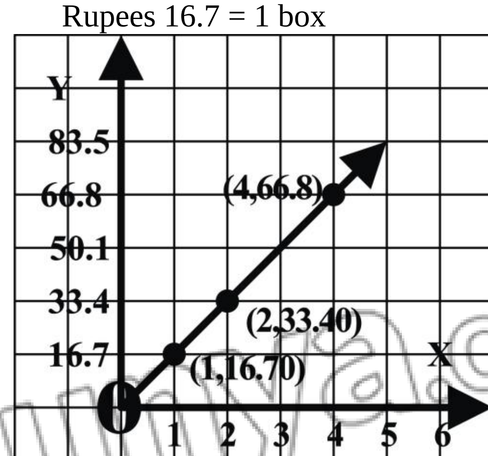
Scale

Along *X-axis*

1 SR =1 box

Along *Y-axis*

Rupees 16.7 = 1 box



x	1	2	3	4
y	16.70	33.4	50.1	66.8

Q.3 **Sketch the graph of each of the following lines.**

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

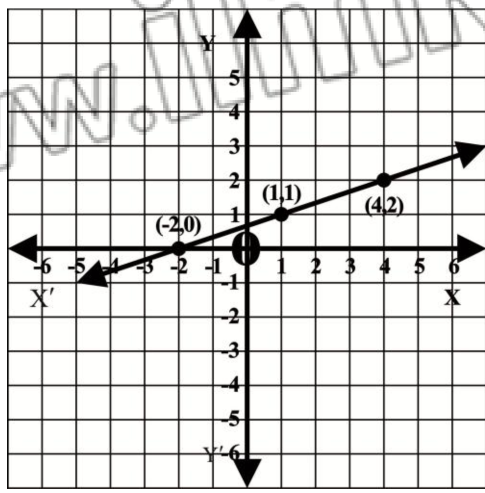
$x + 2 = 3y$

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

Or

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

x	1	4	-2
$y=\frac{x+2}{3}$	1	2	0



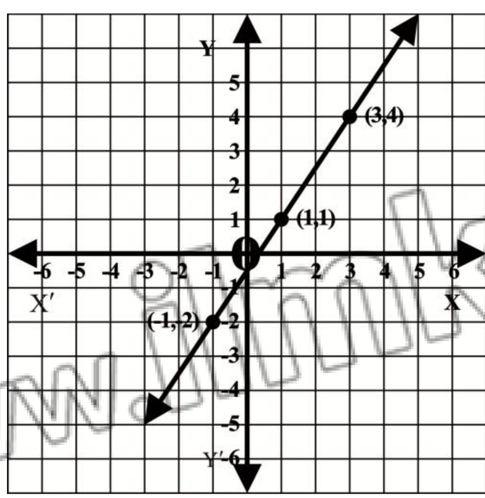
(b) $3x-2y-1=0$

$3x-1=2y$

$\frac{3x-1}{2}=y$

$y=\frac{3x-1}{2}$

x	1	3	–1
y	1	4	–2

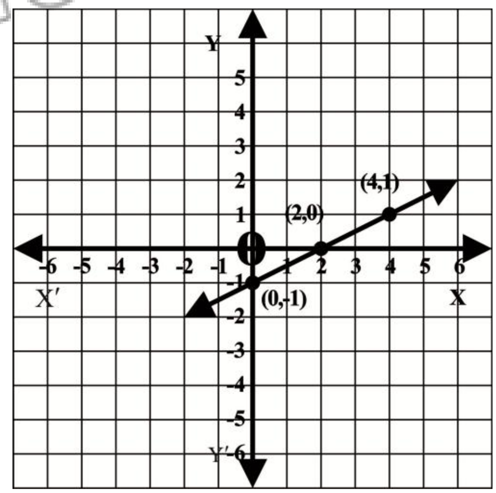


(c) $2y-x+2=0$

$2y=x-2$

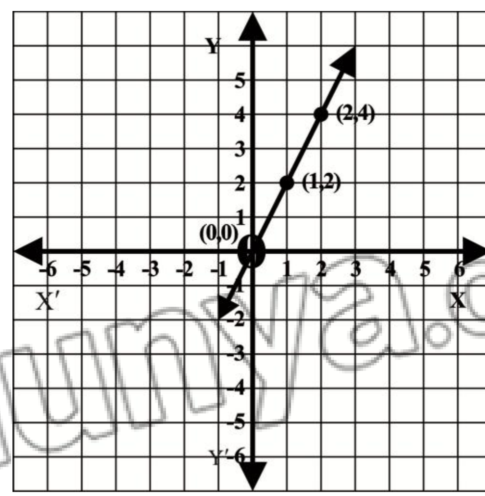
$y=\frac{x-2}{2}$

x	0	2	4
y	–1	0	1



(d) $y-2x=0$

X	0	1	2
Y	0	2	4

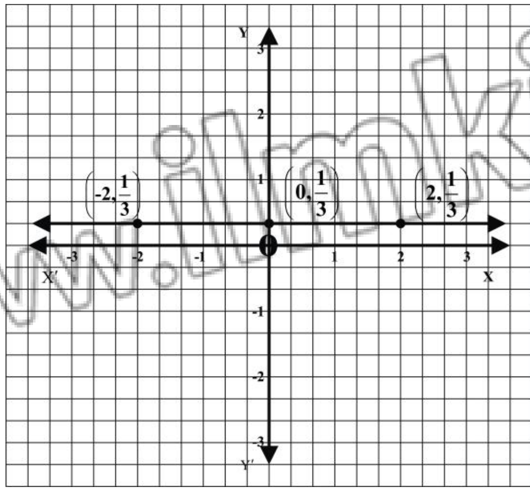


(e) $3y-1=0$

$3y=1$

$y=\frac{1}{3}$

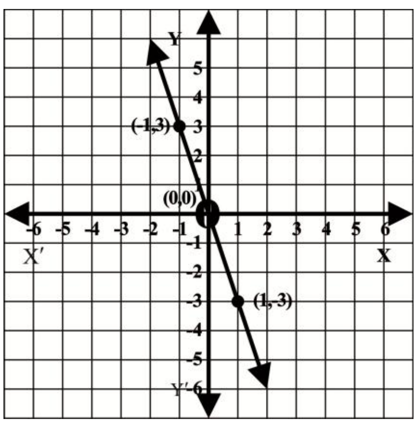
x	-2	0	2
y	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$



$y + 3x = 0$

$y = -3x$

X	1	–1	0
y	–3	3	0



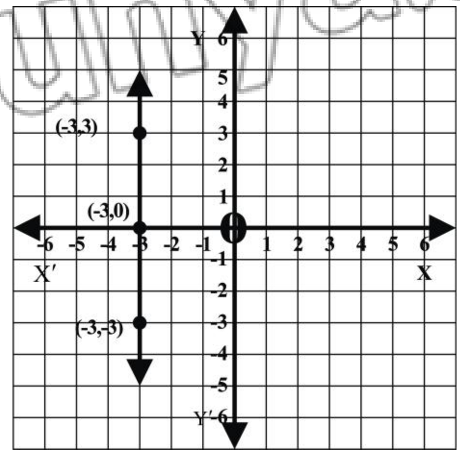
$2x + 6 = 0$

$2x = -6$

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

$x = -3$

X	-3	-3	-3
Y	3	0	-3



Q.4 Draw the graph for following relations

(i) One mile $= 1.6km$

$y = 1.6x$

Scale

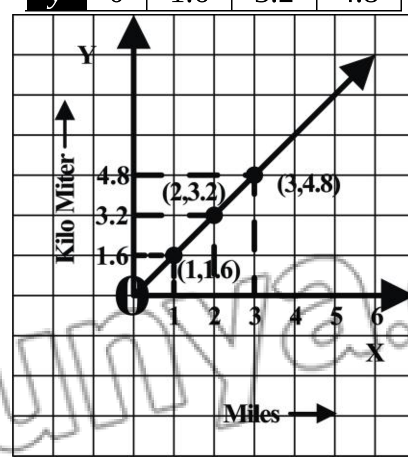
Along *x-axis*

1 Big Square = 1 Unit

Along *y-axis*

1 Big Square = 1.6 Units

x	0	1	2	3
y	0	1.6	3.2	4.8



(ii) One acre $= 0.4$ hectare

$y = 0.4x$

x	2	4
y	0.8	1.6

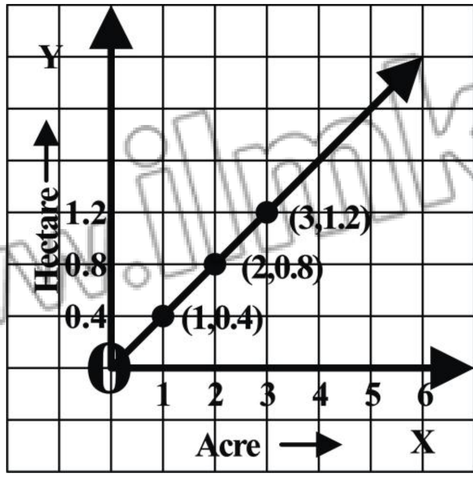
Scale

Along *x-axis*

1 Big Square= 1 Unit

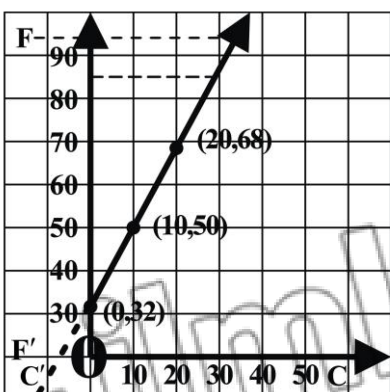
Along *y-axis*

1 Big Square = 0.4 Units



(iii) $F=\frac{9}{5}c+32$

C	$F=\frac{9}{5}C+32$
5	$\frac{9}{5}\times 5+32=41$
10	$\frac{9}{5}\times 10+32=50$
15	$\frac{9}{5}\times 15+32=59$
20	$\frac{9}{5}\times 20+32=68$



10° = Length of square

Where value of c = x and value of f = y

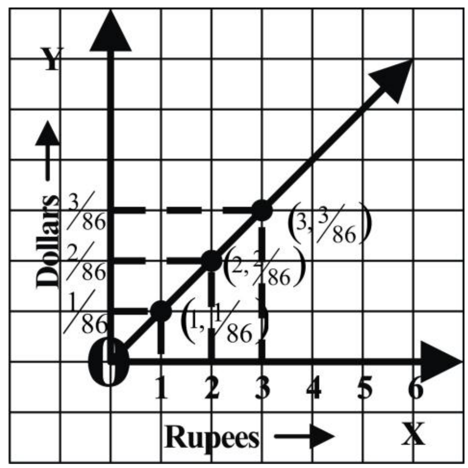
X	5	10	15	20
Y	41	50	59	68

(iv) 1Rupee = $\frac{1}{86}\$$

Scale
Along *x-axis*
1 Big Square = 1 Unit
Along *y-axis*
1 Big Square = $1/86$ Units

$y=\frac{1}{86}x$

x	0	1	2	3
y	0	$1/86$	$2/86$	$3/86$



Graphical Solution of Linear Equations in two Variables

We solve here simultaneous linear equations in two variables by graphical method.
Let the system of equations be,

$2x-y=3,$ ….(i)

$x+3y=3.$ ….(ii)

Table of Values

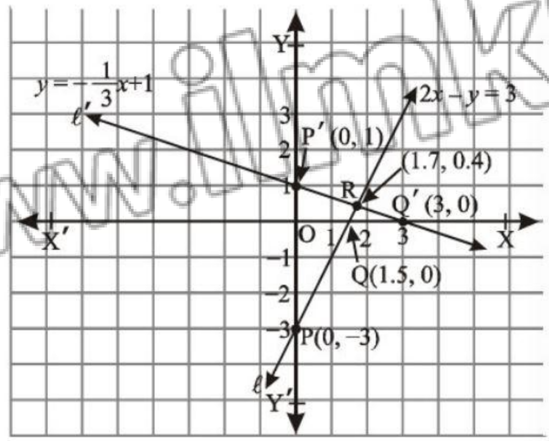
$y=2x-3$

x	…0	1.5…
y	…–3	0…

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

x	…0	3	…
y	…1	0	…

By plotting the points we get the following graph.



The solution of the system is the point R where the lines ℓ and ℓ' meet at.
i.e., $R(1.7, 0.4)$ such that $x = 1.7$ and $x = 0.4.$

Exercise 8.3

Q.1 $x + y = 0 —— (\text{I})$ and

$2x - y + 3 = 0 - (\text{II})$

From equation I
from equation II

$y = -x$

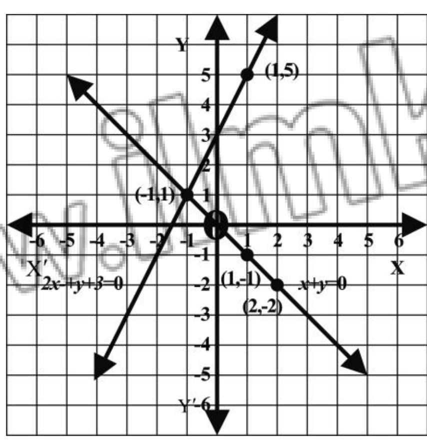
$2x - y + 3 = 0$

$2x + 3 = y$

$y = 2x + 3$

x	$y = -x$	(x,y)
1	–1(1) = –1	(1,-1)
2	-(2)=-2	(2,-2)

x	$y = 2x+3$	(x,y)
1	2(1)+3 = 5	(1,5)
–1	2(-1)+3=1	(-1,1)



The point of intersection is a solution set

Solution Set $= \{(-1,1)\}$

Q.2 $x - y + 1 = 0$

$x - 2y = -1$

$x + 1 = y$

$x + 1 = 2y$

$y = x + 1$

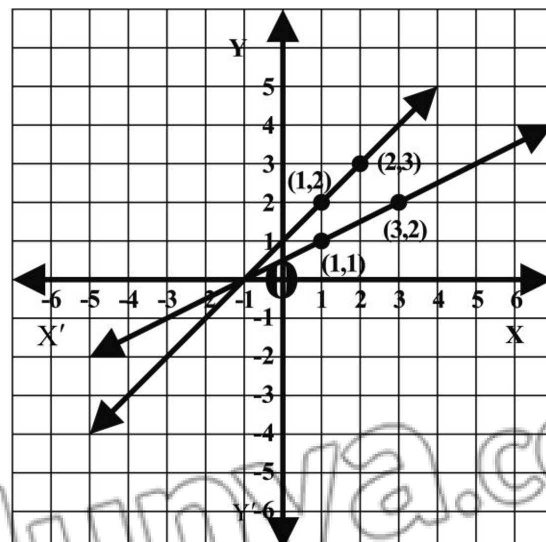
$\frac{x+1}{2} = y$

Or

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

x	$y = x+1$	(x,y)
1	1+1 = 2	(1,2)
2	2+1 = 3	(2,3)

x	$y = \frac{x+1}{2}$	(x,y)
1	$\frac{1+1}{2} = \frac{2}{2} = 1$	(1,1)
3	$\frac{3+1}{2} = \frac{4}{2} = 2$	(3,2)



Point of intersection is a solution set

Solution Set $= \{(-1,0)\}$

Q.3 $2x + y = 0$

$x + 2y = 2$

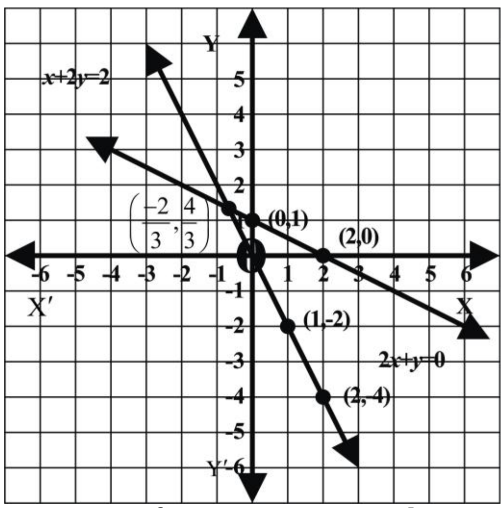
$y = -2x$

$2y = 2 - x$

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

x	$y=-2x$	(x,y)
1	$-2(1)=-2$	(1,-2)
2	$-2(2)=-4$	(2,-4)

x	$y=\frac{2-x}{2}$	(x,y)
0	$\frac{2-0}{2}=\frac{2}{2}=1$	(0,1)
2	$\frac{2-2}{2}=\frac{0}{2}=0$	(2,0)



Point of intersection is a solution

Solution Set $=\left(\frac{-2}{3},\frac{4}{3}\right)$

Q.4 $x+y-1=0$

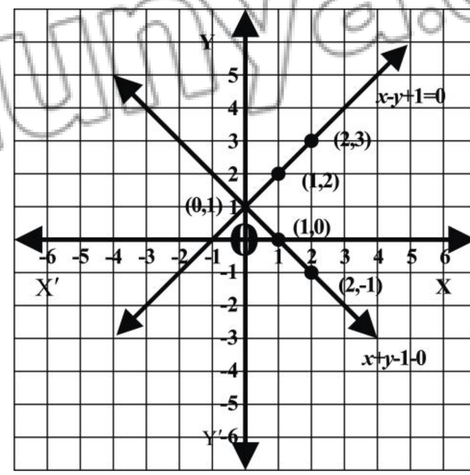
$x-y+1=0$

$y=1-x$

$x+1=y$ Or $y=x+1$

x	$y=1-x$	x,y
1	$1-1=0$	(1,0)
2	$1-2=-1$	(2,-1)

x	$y=x+1$	x,y
1	$1+1=2$	(1,2)
2	$2+1=3$	(2,3)



Point of intersection is a solution set

Solution Set $=\{(0,1)\}$

Q.5 $2x+y-1=0$

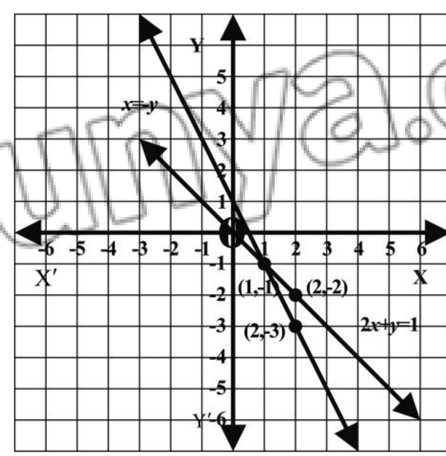
$x=-y$

$y=1-2x$

$y=-x$

x	$y=1-2x$	(x,y)
1	$1-2(1)=-1$	(1,-1)
2	$1-2(2)=-3$	(2,-3)

x	$y=-x$	(x,y)
1	$-(1)=-1$	(1,-1)
2	$-(2)=-2$	(2,-2)



Point of intersection is a solution set

Solution Set $=\{(1,-1)\}$

Review Exercise 8

Q.1 Choose the correct answer

(i) **If** $(x-1, y+1) = (0,0)$**, then** (x, y) **is** **(U.B)**

(LHR 2014, 17, GRW 2013, SGD 2013, 17)

(a) (1,-1) **(b)** (-1,1)
(c) (1,1) **(d)** (-1,-1)

(ii) **If** $(x,0) = (0,y)$ **Then** (x,y) **is** **(U.B)**

(a) (0,1) **(b)** (1,0)
(c) (0,0) **(d)** (1,1)

(iii) **Point** $(2,-3)$ **lies in quadrant** **(K.B)**

(GRW 2017, FSD 2016, SWL 2013, SGD 2014, 15, 17, BWP 2014, 17, D.G.K 2013, 15, 16, 17)

(a) I **(b)** II
(c) III **(d)** IV

(iv) **Point** $(-3,-3)$ **lies in quadrant** **(K.B)**

(LHR 2016, 17, GRW 2016, SWL 2014, 16, 17, MTN 2016, BWP 2013, D.G.K 2015, 17)

(a) I **(b)** II
(c) III **(d)** IV

(v) **If** $y = 2x+1, x = 2$ **Then** y **is** **(A.B)**

(FSD 2013, MTN 2013, 14, 15, 17, BWP 2013, 14, RWP 2014, D.G.K 2014)

(a) 2 **(b)** 3
(c) 4 **(d)** 5

(vi) **Which order pair satisfy the equation** $y = 2x$ **(A.B)**

(LHR 2016, GRW 2014, RWP 2014, MTN 2016, SWL 2017, FSD 2013, 17, SGD 2016, D.G.K 2016)

(a) (1,2) **(b)** (2,1)
(c) (2,2) **(d)** (0,1)

ANSWER KEYS

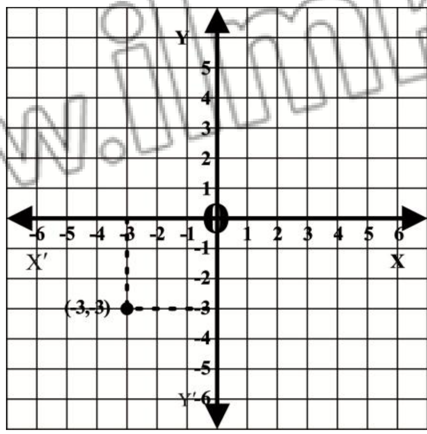
1	2	3	4	5	6
a	c	d	c	d	a

Q.2 Identify the following statement as true or false.

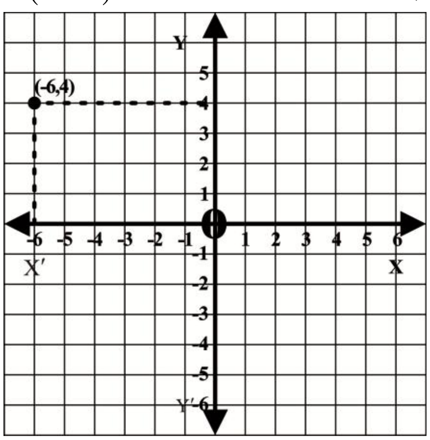
1. **The point O (0,0) is in quadrant II.** **False**
2. **The point p (2,0) lies on *x*-axis.** **True**
3. **The graph of** $x = -2$ **is a vertical line.** **True**
4. **3-y =0 is a horizontal line.** **True**
5. **The point Q (-1,2) is in quadrant III.** **False**
6. **The point R (-1,-2) is in quadrant IV.** **False**
7. ***y* = *x* is a line on which origin lies.** **True**
8. **The point p (1,1) lies on the line *x* + y = 0.** **False**
9. **The point S (1,-3) lies in quadrant III.** **False**
10. **The point R (0,1) lien on the *x*-axis.** **False**

Q.3 Draw the following points on the graph paper

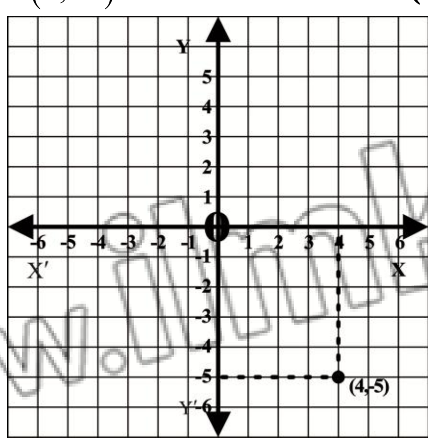
(i) $(-3,-3)$ => **(K.B)**



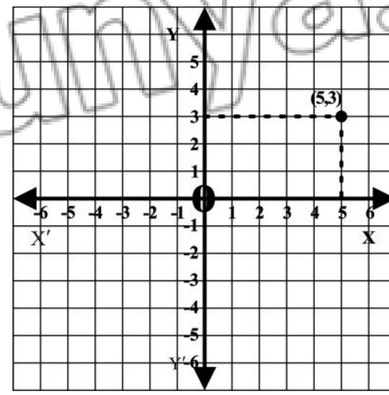
(ii) $(-6,4)$ => **(K.B)**



(iii) $(4,-5)$ => **(K.B)**



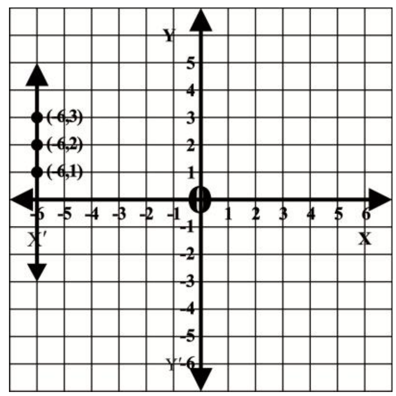
(iv) $(5,3)$ **(K.B)**



Q.4 Draw the graph of the following

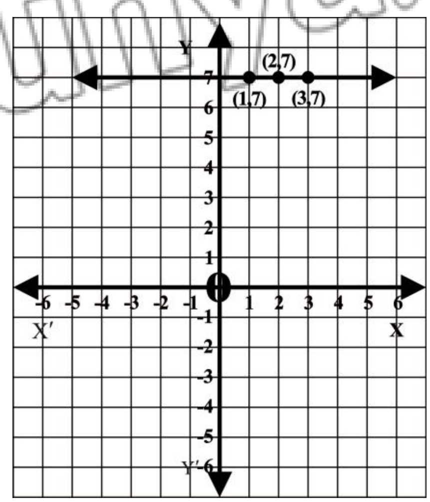
(i) $x=-6$

x	-6	-6	-6
Y	1	2	3



(ii) $y=7$ **(K.B)**

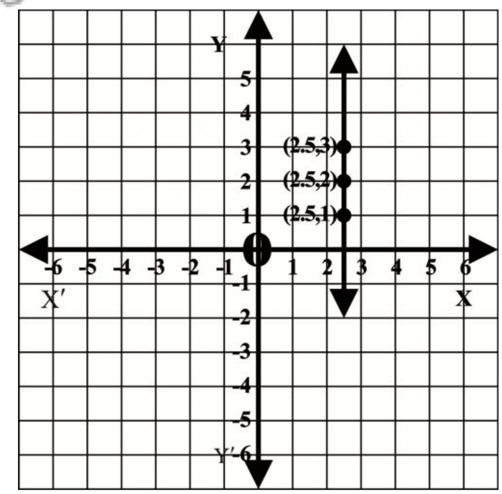
x	1	2	3
y	7	7	7



(iii) $x = \frac{5}{2}$ **(K.B)**

$x = 2.5$

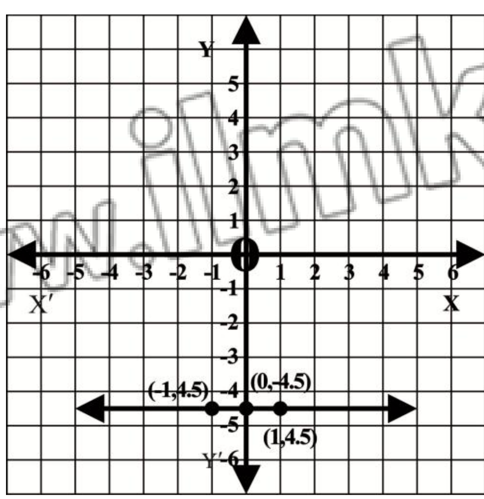
x	2.5	2.5	2.5
y	1	2	3



(iv) $y = -\frac{9}{2}$ **(K.B)**

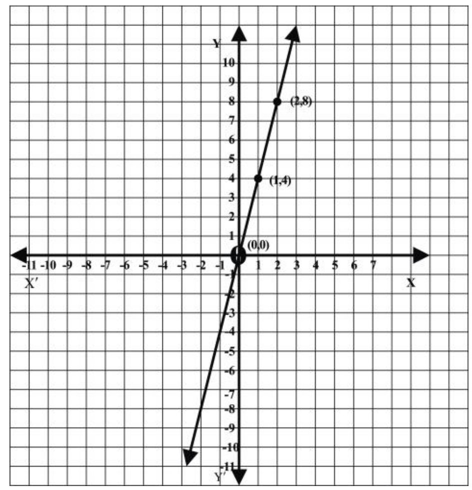
$y = -4.5$

x	-1	0	1
y	-4.5	-4.5	-4.5



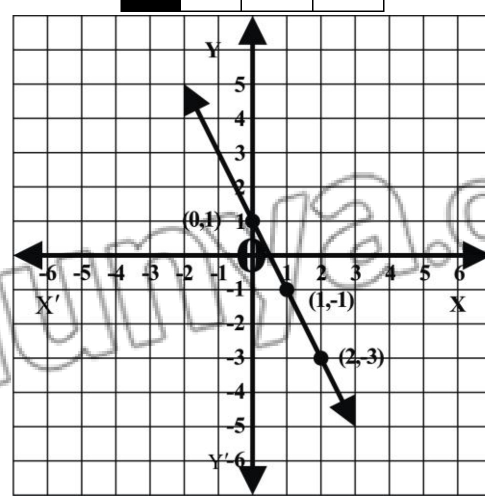
(v) $y = 4x$

x	0	1	2
$y = 4x$	4×0 = 0	4×1=4	4×2=8



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

x	0	1	2
y	1	-1	-3



Q.5 Draw the following graph

(i) $y = 0.62x$

x	$y = 0.62x$	xy
1	0.62×1= 0.62	(1, 0.62)

2	0.62×2= 1.24	(2, 1.24)
3	0.62×3= 1.86	(3, 1.86)

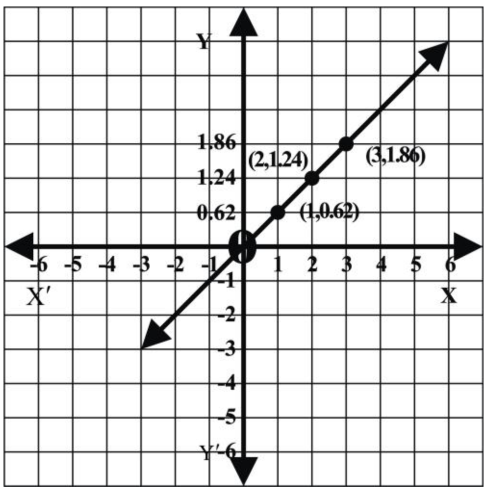
Scale

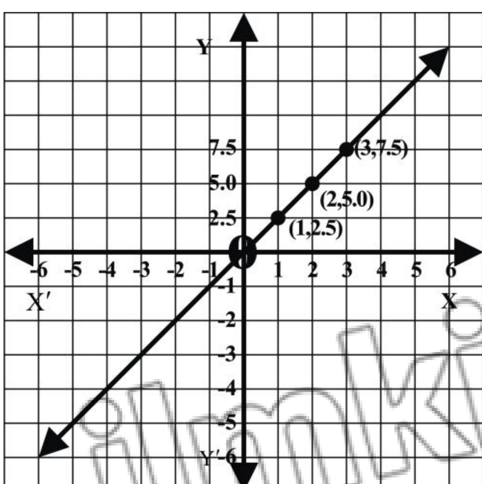
Along *x-axis*

1 Big Square= 1 Unit

Along *y-axis*

1 Big Square = 0.62 Units





(i) $x - y = 1$ $\qquad$ $x + y = \frac{1}{2}$

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

or $y = x - 1$ $\qquad$ $y = \frac{1 - 2x}{2}$

(ii) $y = 2.5x$

x	$y = 2.5x$	(x, y)
1	2.5(1) = 2.5	(1, 2.5)
2	2.5(2) = 5.0	(2, 5)
3	2.5(3) = 7.5	(3, 7.5)

Scale

Along *x-axis*

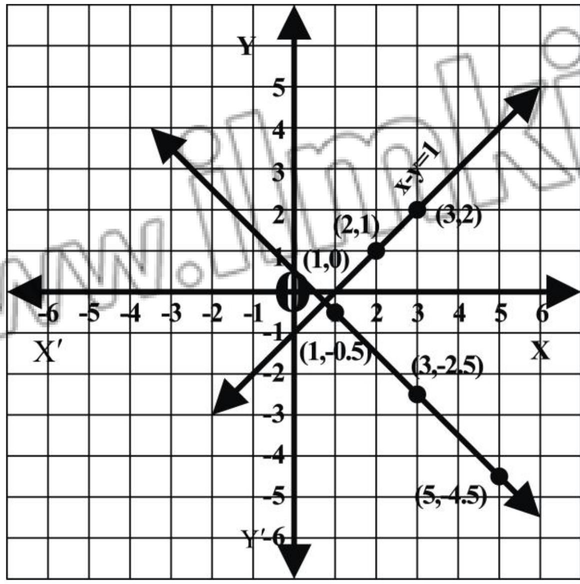
1 Big Square= 1 Unit

Along *y-axis*

1 Big Square = 2.5 Units

x	$y = x–1$	
1	1–1 = 0	(1, 0)
2	2–1=1	(2, 1)
3	3–1=2	(3, 2)

x	$y = \frac{1-x}{2}$	
1	$\frac{1-2}{2} = -\frac{1}{2}$	$\left(1, \frac{-1}{2}\right)$
3	$\frac{1-6}{2} = \frac{-5}{2}$	$\left(3, \frac{-5}{2}\right)$
5	$\frac{1-10}{2} = \frac{-9}{2}$	$\left(5, \frac{-9}{2}\right)$



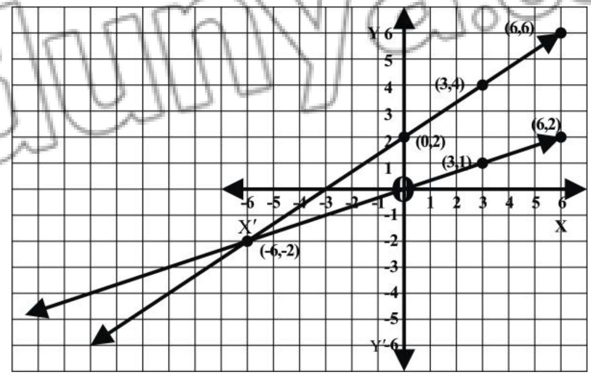
Point of intersection is a solution set

Solution Set $=\left\{\left(\frac{3}{4},-\frac{1}{4}\right)\right\}$

(ii) $x=3y$

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

x	$y=\frac{1}{3}x$	(x, y)
3	$\frac{1}{\cancel{3}}\times\cancel{3}=1$	(3, 1)
6	$\frac{1}{\cancel{3}}\times\cancel{6}^{2}=2$	(6, 2)



$$2x-3y=-6$$

$$2x+6=3y$$

$$\frac{2x+6}{3}=y$$

$$y=\frac{2x+6}{3}$$

Point of intersection is a solution set

Solution Set $=\{(-6,-2)\}$

x	$y=\frac{2x+6}{3}$	
0	$\frac{2(0)+6}{3}=\frac{\cancel{6}^{2}}{\cancel{3}}=2$	(0, 2)
3	$\frac{2(3)+6}{3}=\frac{\cancel{12}^{4}}{\cancel{3}}=4$	(3, 4)
6	$\frac{2(6)+6}{3}=\frac{\cancel{18}^{6}}{\cancel{3}}=6$	(6, 6)

(iii) $\frac{1}{3}(x+y)=2$ $\frac{1}{2}(x-y)=-1$

$x+y=6$ $x-y=-2$

$y=6-x$ $x+2=y$

x	$y = 6 - x$	(x, y)
1	6–1 = 5	(1, 5)
2	6–2=4	(2, 4)
3	6–3=3	(3, 3)

x	$y = x + 2$	(x, y)
1	1+2 = 3	(1, 3)
2	2+2 = 4	(2, 4)
3	3+2 = 5	(3, 5)

Point of intersection is a solution set

Solution Set $=\{(2,4)\}$