UNIT 7 – CO-ORDINATE GEOMETRY

23

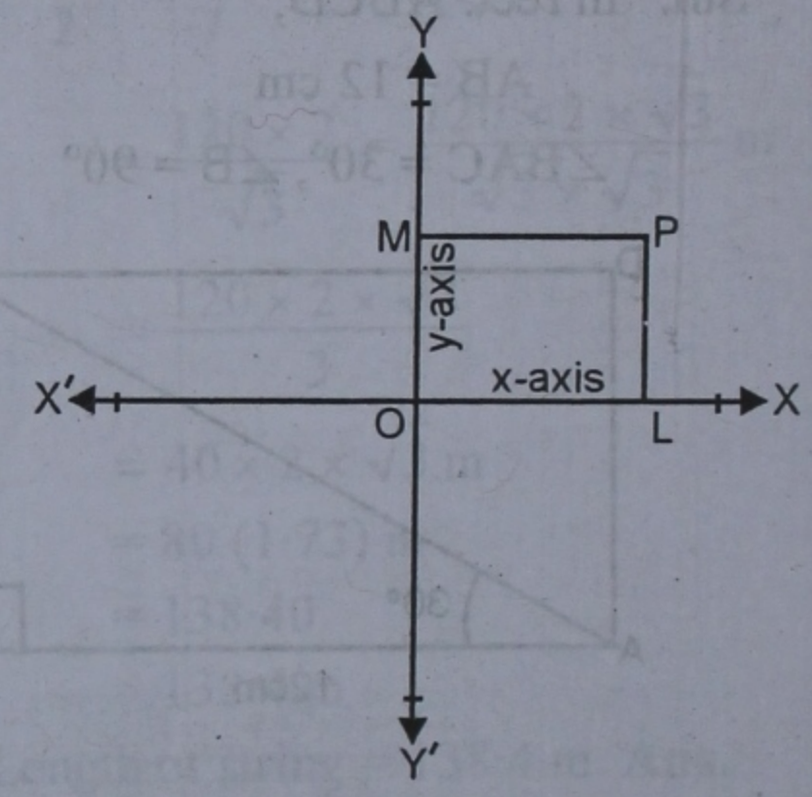
Co-Ordinate Geometry

POINTS TO REMEMBER

1. **Variable.** A symbol which may be assigned different values is called a variable.
2. **Constant.** A symbol which has a fixed value is called a constant.
3. **Ordered pair.** A pair of two numbers say a and b, listed in a specific order with 'a' at the first place and 'b' at the second place is called an ordered pair and is written as (a, b).

   Note. $(a, b) \neq (b, a)$ unless $a = b$.
4. **Co-ordinate Axes.** On a graph paper, two lines XOX′ and YOY′ drawn perpendicular to each other, are called the co-ordinate axes. The co-ordinate axes intersect at point say O, which is called origin.

   Horizontal line XOX′ is called x-axis and Vertical line YOY′ is called y-axis.



5. **Co-ordinates of a Point.** Let P is a point on the graph having XOX′ and YOY′ co-ordinates axes. Draw PL ⊥ XOX′ and PM ⊥ YOY′ then the distance PM is called x-co-ordinates or abscissa of P and PL is called the y-co-ordinates or ordinate of P.

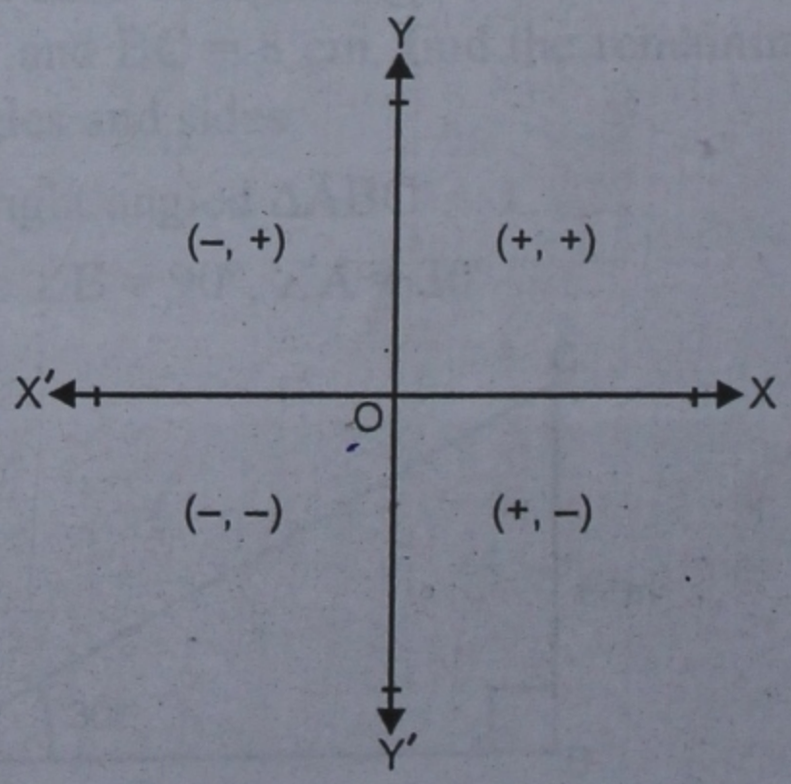
   Note. Co-ordinates of origin O are (0, 0).
6. **Quadrants.** Co-ordinates divide the graph paper into four regions or parts and each region is called a quadrant.

(*i*) The region XOY is called the first quadrant. In this quadrant, x and y, both are positive.

(*ii*) The region YOX′ is called the second quadrant O. In it x is negative and y is positive.

(*iii*) The region X′OY′ is called the third quadrant. In this x and y both are negative.

(*iv*) The region XOY′ is called the fourth quadrant on it, x is positive and y is negative.



7. Co-ordinates of a point on x-axis are $(x, 0)$ and co-ordinates of point on y-axis are $(0, y)$.
8. **Graph of a linear equation**

   The equation can be in form of $ax + by + c = 0$ or $y = mx + c$,

(*i*) We choose some convenient values of x and then by substituting them, we get corresponding values of y.

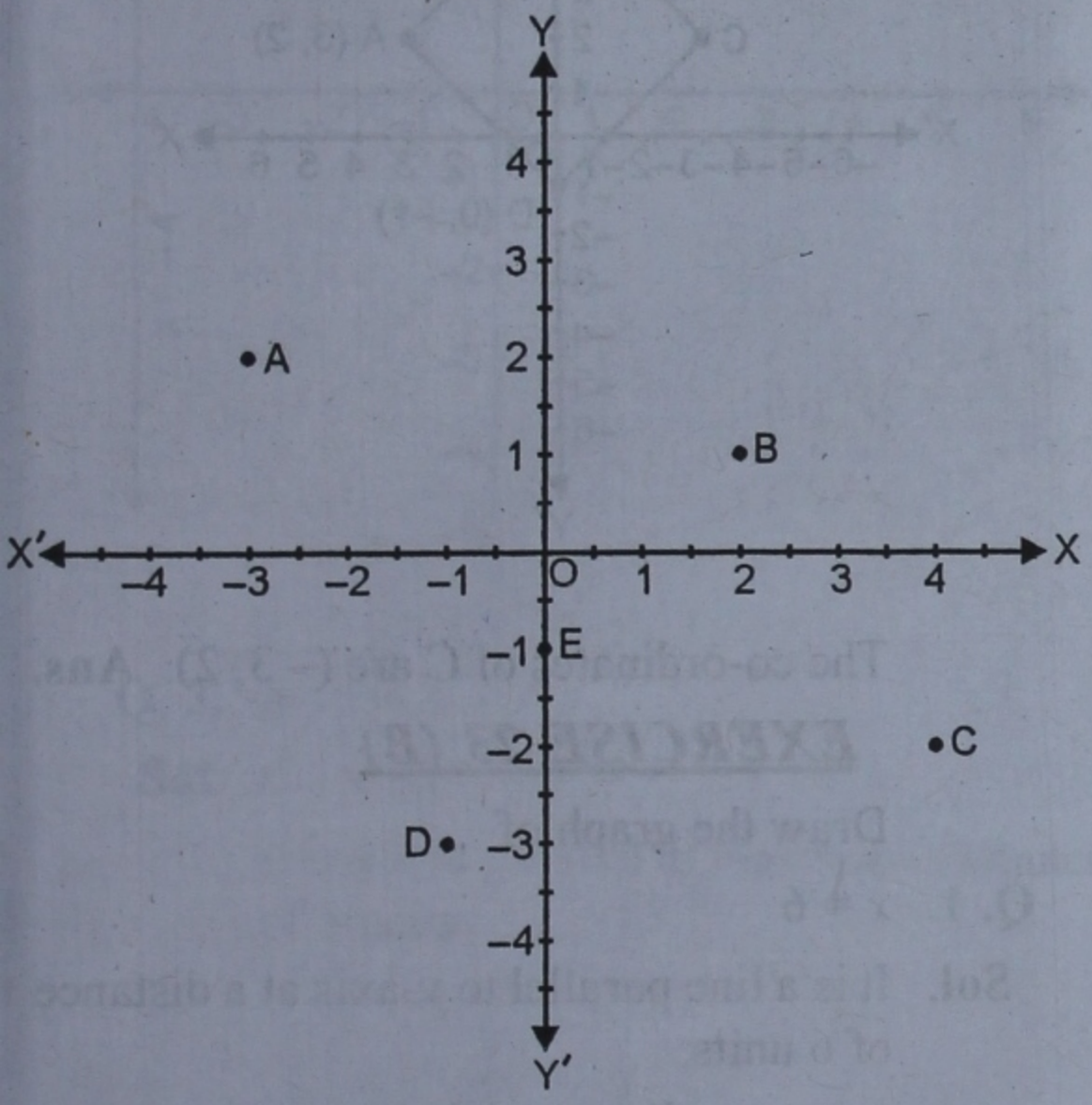
(*ii*) We put these value in a table.

(*iii*) Then we plot these points on the graph and by pointing them, we get a line which is the required graph of the given equation.

(*iv*) In equation $y = mx + c$, m is called the slope of the line and c is the y-intercept of the line.

EXERCISE 23 (A)

Q. 1. Write down the co-ordinates of each of the following points A, B, C, D, E shown below on the graph paper.

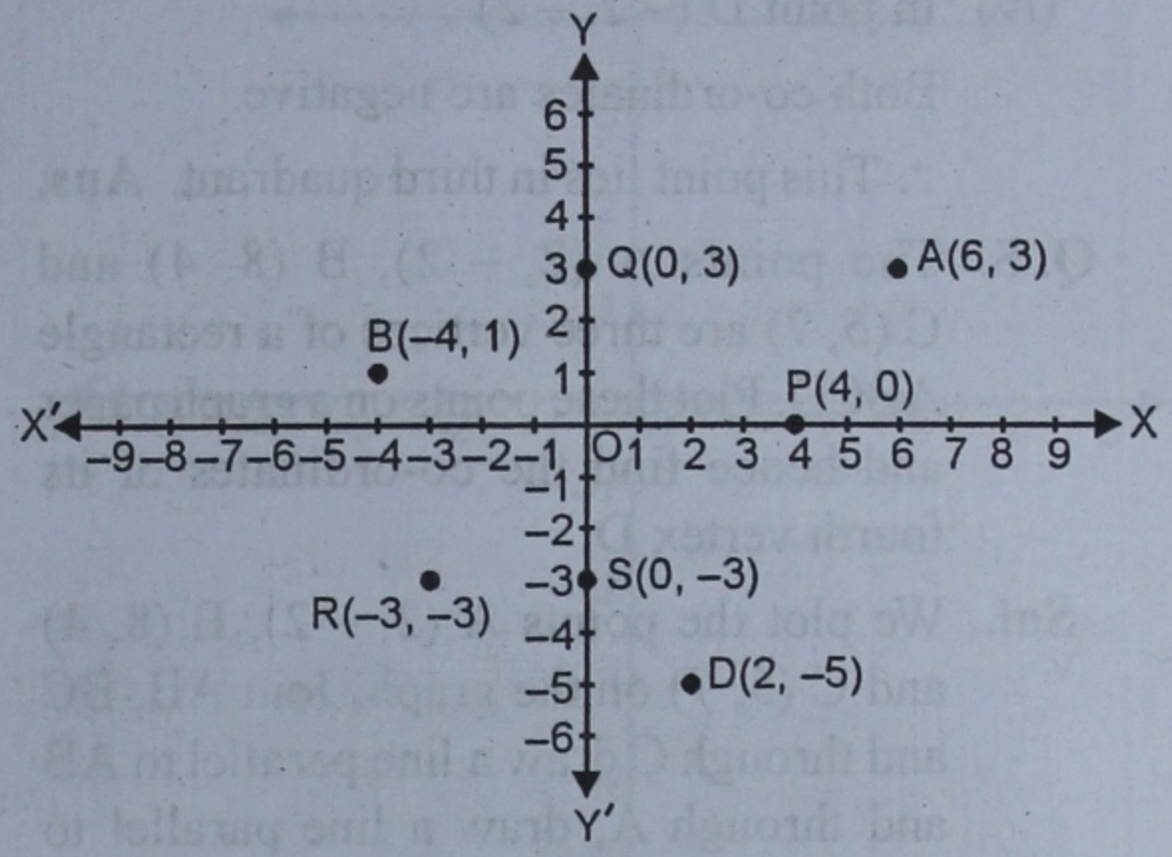


Sol. Co-ordinates of A are (– 3, 2)
Co-ordinates of B are (2, 1)
Co-ordinates of C are (4, – 2)
Co-ordinates of D are (– 1, – 3)
and Co-ordinates of E are (0, – 1) **Ans.**

Q. 2. Plot each of the following points on a graph paper.

(*i*) A (6, 3) (*ii*) B (– 4, 1)
(*iii*) C (– 2, – 5) (*iv*) D (2, – 5)
(*v*) P (4, 0) (*vi*) Q (0, 3)
(*vii*) R (– 3, – 3) (*viii*) S (0, – 3)

Sol. We plot the given points on the graph after drawing the co-ordinate axes XOX′ and YOY′ as shown.



Q. 3. On which axis does the following points lie ?

(*i*) (5, 0) (*ii*) (0, – 2)
(*iii*) (0, 3) (*iv*) (– 3, 0)

Sol. (*i*) In point (5, 0), y co-ordinate is zero.
∴ This point lies on x-axis.

(*ii*) In point, x co-ordinate is zero.
∴ This point lies on y-axis.

(*iii*) In point (0, 3), x co-ordinate is zero.
∴ This point lies on y-axis.

(*iv*) In point (– 3, 0), y co-ordinate is zero.
∴ This point lies on x-axis.

Q. 4. In which quadrant, does the given point lie ?

(*i*) A (– 3, 2) (*ii*) B (– 5, – 3)
(*iii*) C (2, – 7) (*iv*) D (– 2, – 2)

Sol. (*i*) In point, A (– 3, 2)
x co-ordinate is negative and y co-ordinate is positive.
∴ This point lies in 2nd quadrant.

(*ii*) In point B (– 5, – 3)

Both co-ordinates are negative.

∴ This point lies in third quadrant.

(*iii*) In point C (2, – 7)

x co-ordinate is positive but *y* co-ordinate is negative.

∴ This point lies in the fourth quadrant.

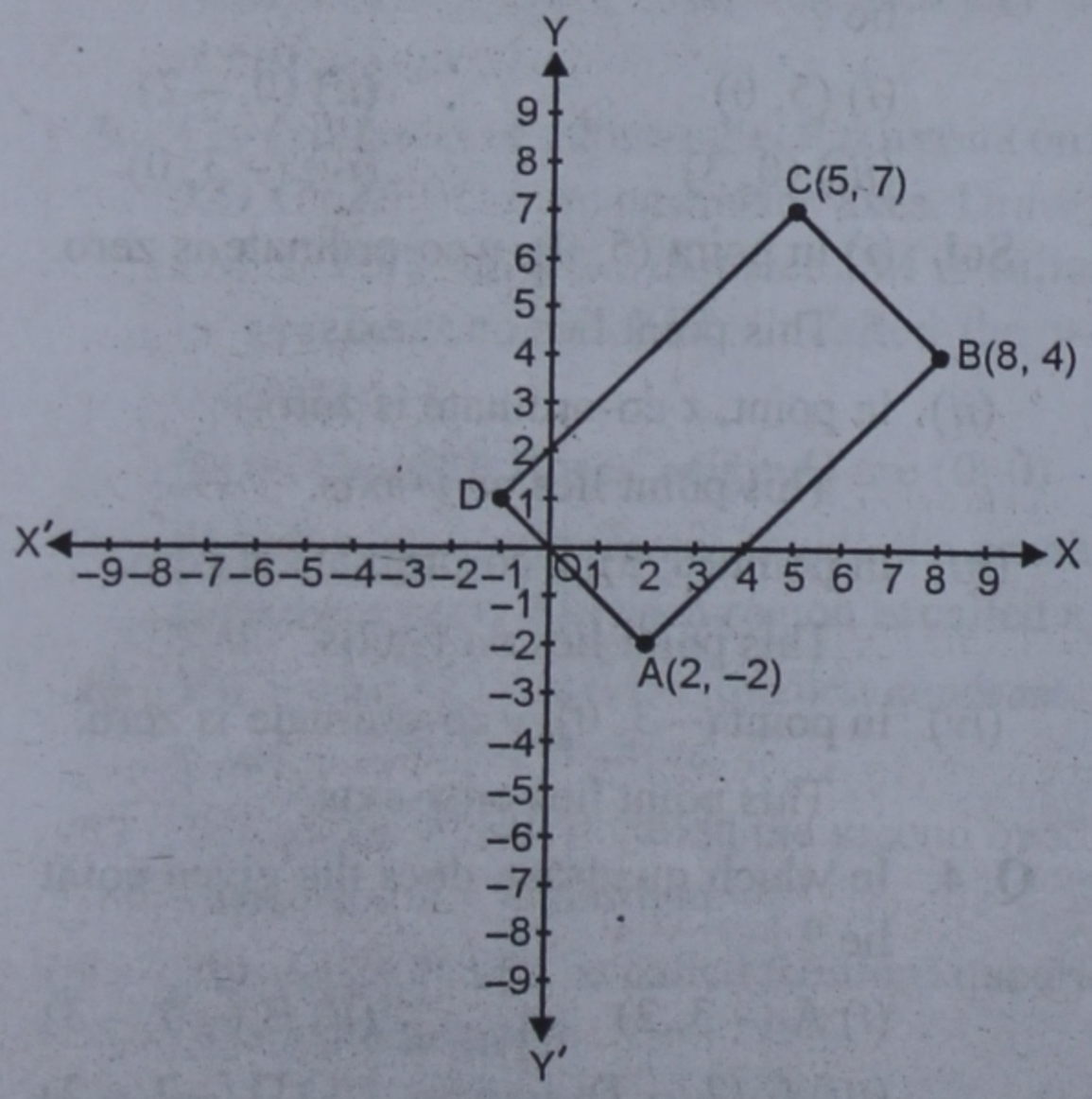
(*iv*) In point D (– 2, – 2)

Both co-ordinates are negative.

∴ This point lies in third quadrant. **Ans.**

Q. 5. The points A (2, – 2), B (8, 4) and C (5, 7) are three vertices of a rectangle ABCD. Plot these points on a graph paper and hence find the co-ordinates of its fourth vertex D.

Sol. We plot the points A (2, – 2), B (8, 4) and C (5, 7) on the graph. Join AB, BC and through C draw a line parallel to AB and through A, draw a line parallel to BC which intersect each other at D.



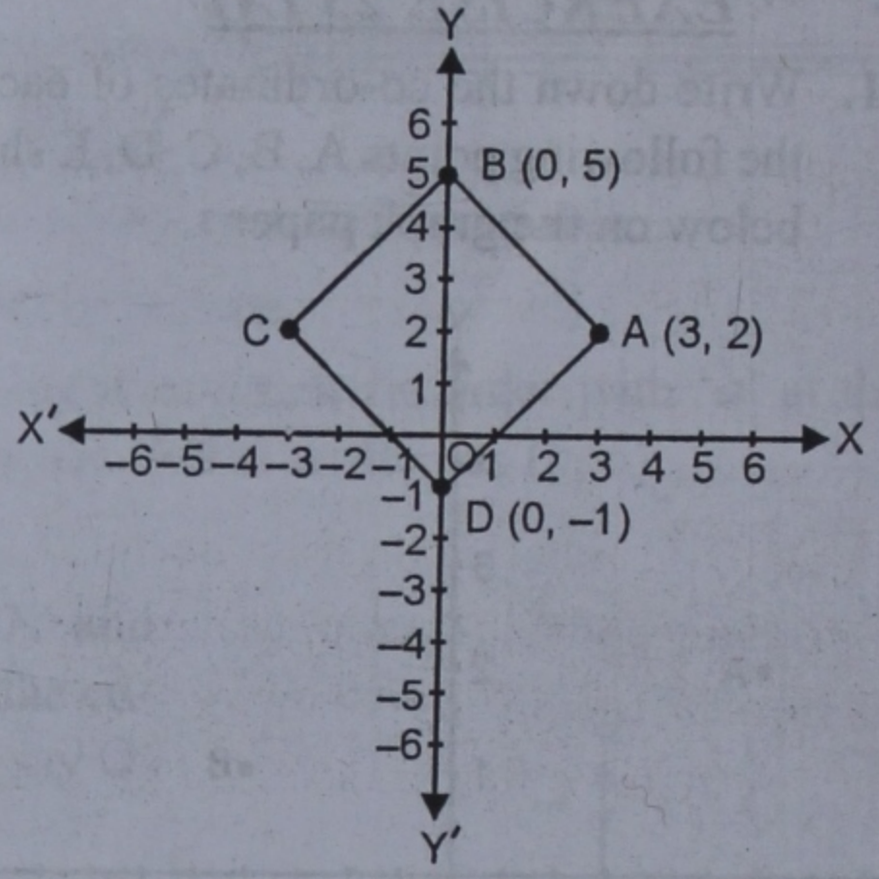
∴ D is the fourth vertex of the rectangle ABCD.

The co-ordinates of D are (– 1, 1). **Ans.**

Q. 6. The points A (3, 2), B (0, 5) and D (0, – 1) are the three vertices of a square ABCD. Plot these points on a graph paper and hence find the co-ordinates of the vertex C.

Sol. We plot the points A (3, 2), B (0, 5) and D (– 1, 1) on the graph. Join AB and AD.

∴ Through D and B, draw perpendiculars meeting each other at C.



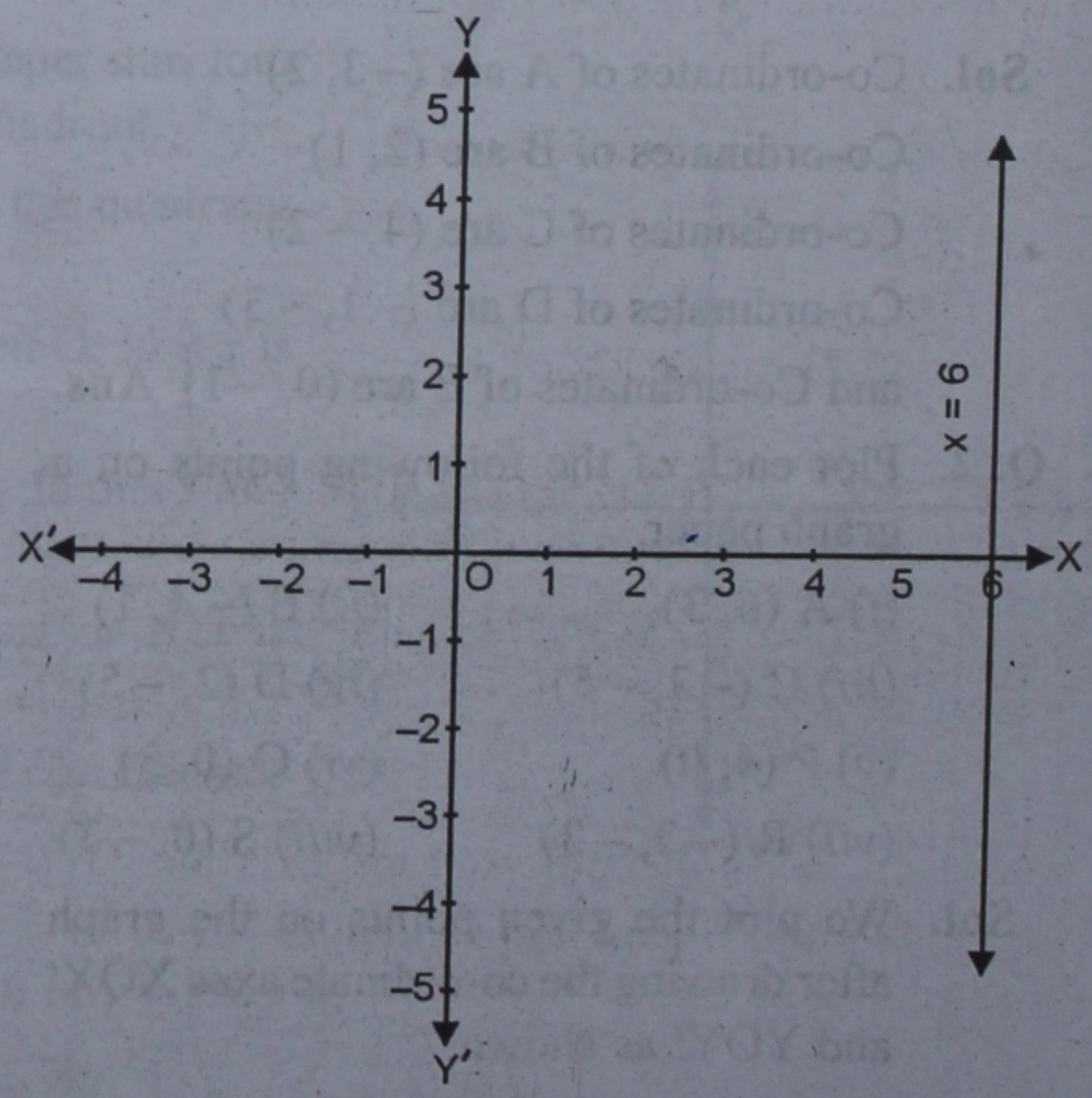
The co-ordinates of C are (– 3, 2). **Ans.**

EXERCISE 23 (B)

Draw the graph of

Q. 1. $x = 6$

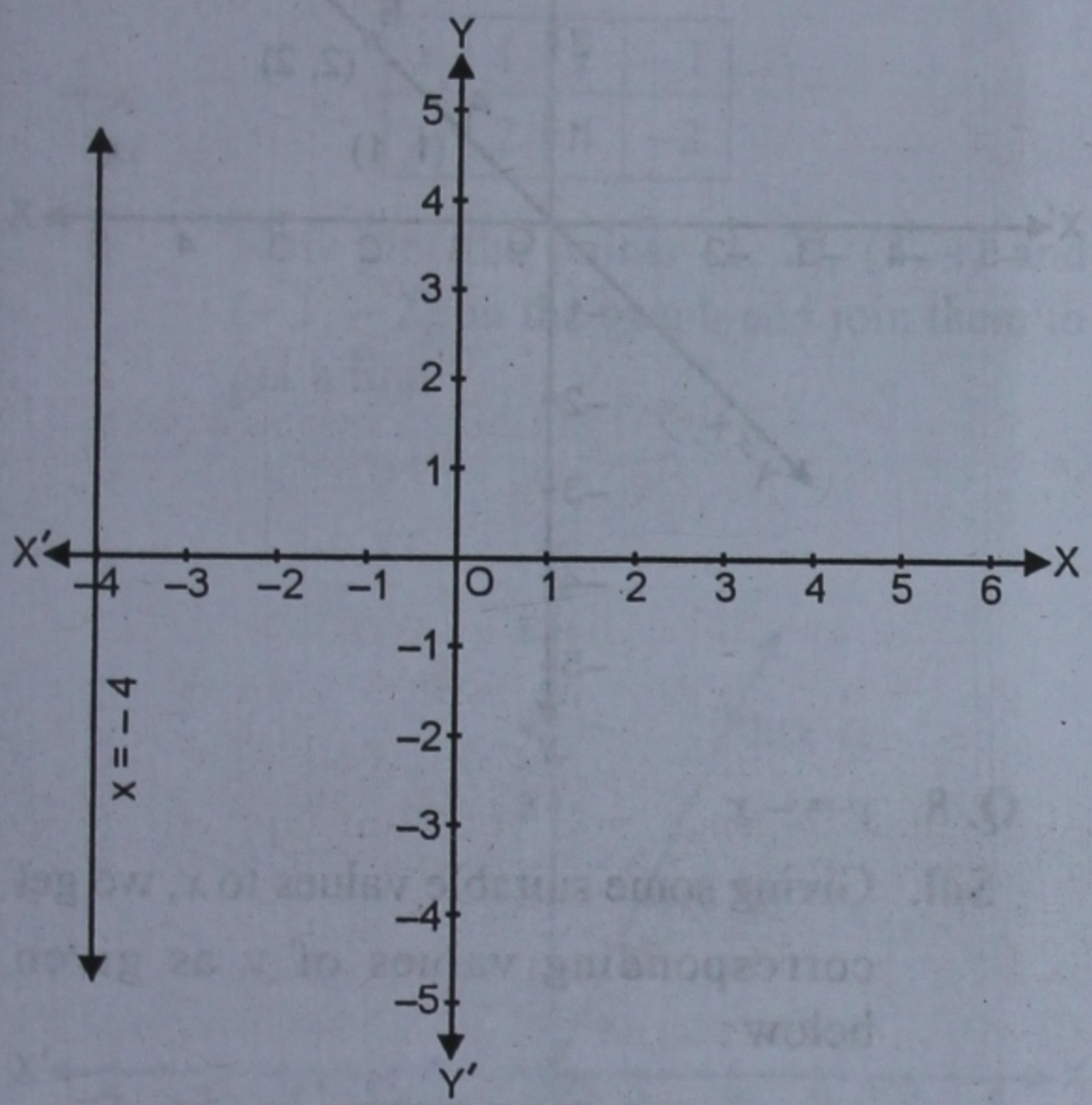
Sol. It is a line parallel to *y*-axis at a distance of 6 units.



Q. 2. $x + 4 = 0$

Sol. $x + 4 = 0 \quad \Rightarrow \quad x = -4$

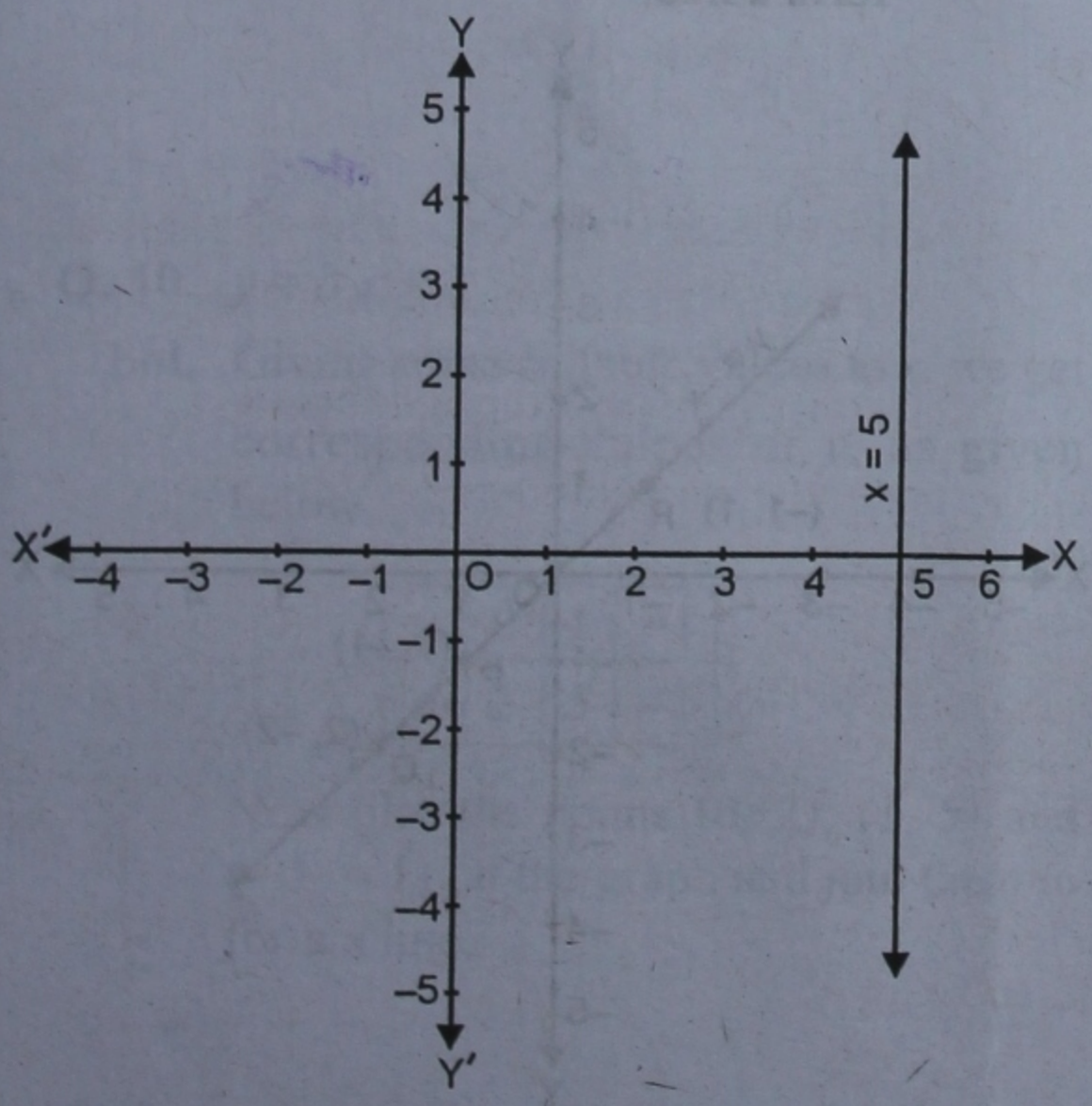
It is a line parallel to y-axis at a distance of -4 units.



Q. 3. $x - 5 = 0$

Sol. $x - 5 = 0$

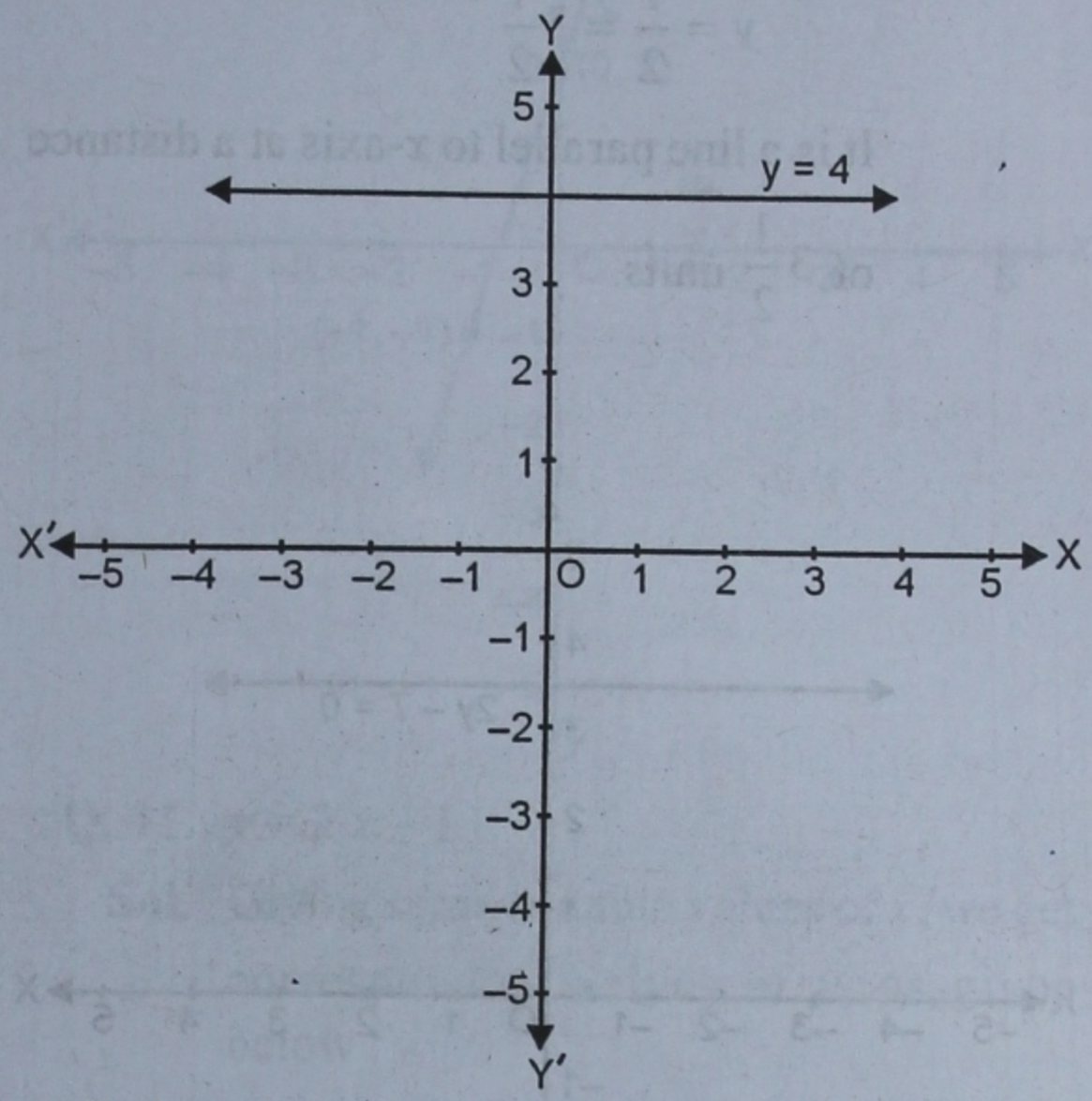
It is a line parallel to y-axis at a distance of 5 units.



Q. 4. $y = 4$

Sol. $y = 4$

It is a line parallel to x-axis at a distance of 4 units.

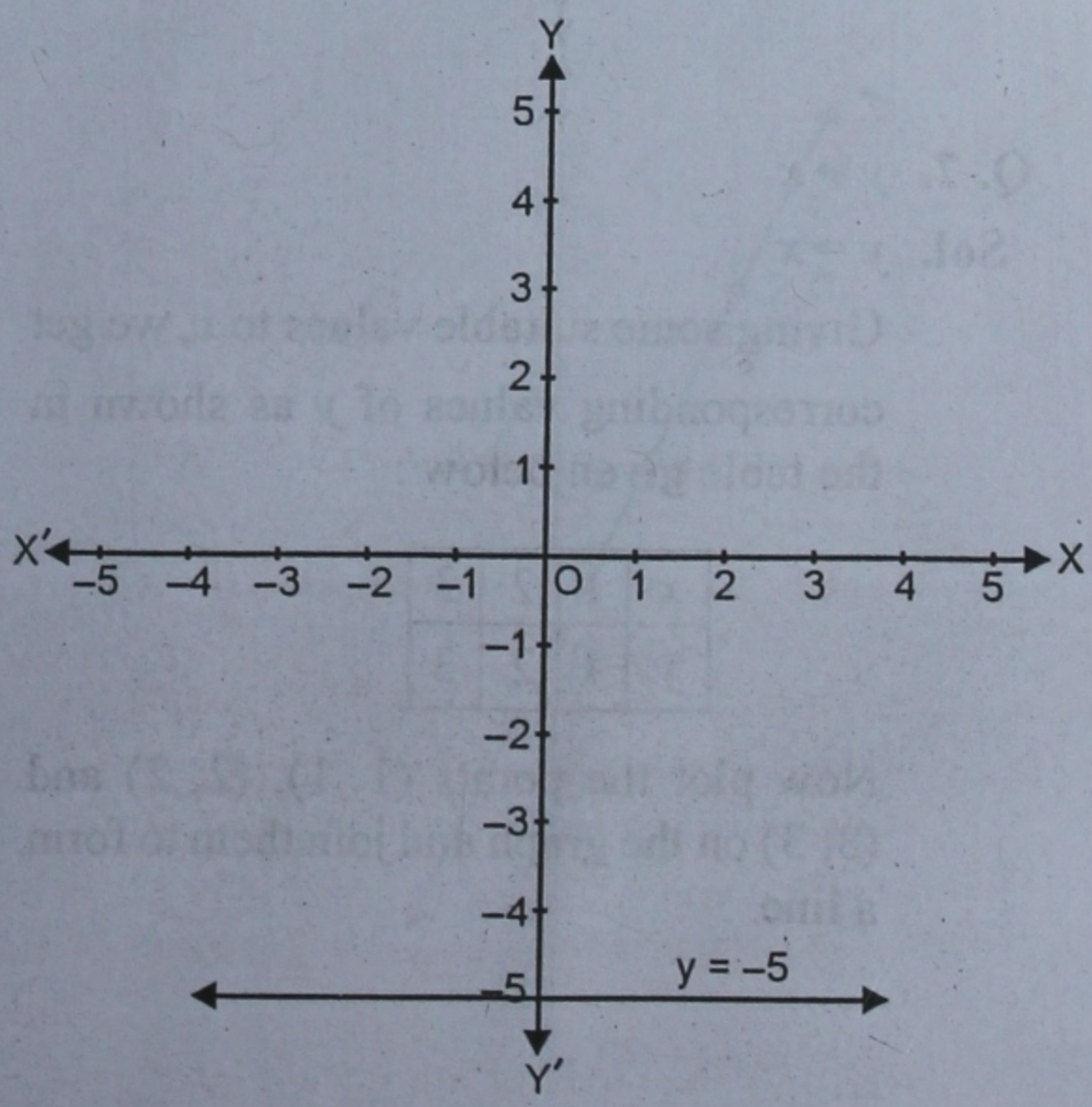


Q. 5. $y + 5 = 0$

Sol. $y + 5 = 0$

$\Rightarrow \quad y = -5$

It is a line parallel to x-axis at a distance of -5 units.



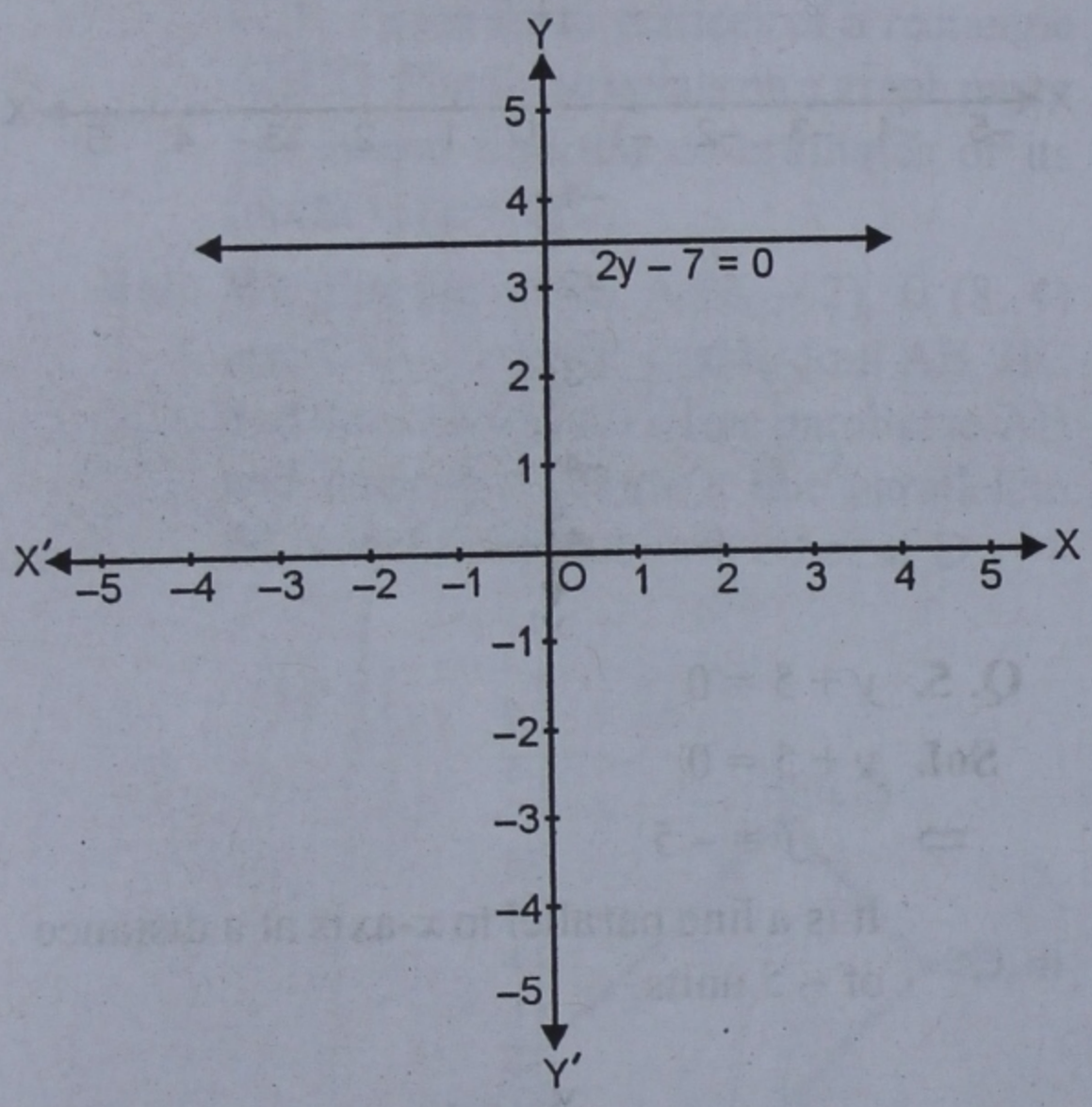
Q. 6. $2y - 7 = 0$

Sol. $2y - 7 = 0$

$\Rightarrow 2y = 7$

$$y = \frac{7}{2} = 3\frac{1}{2}$$

It is a line parallel to x-axis at a distance of $3\frac{1}{2}$ units.



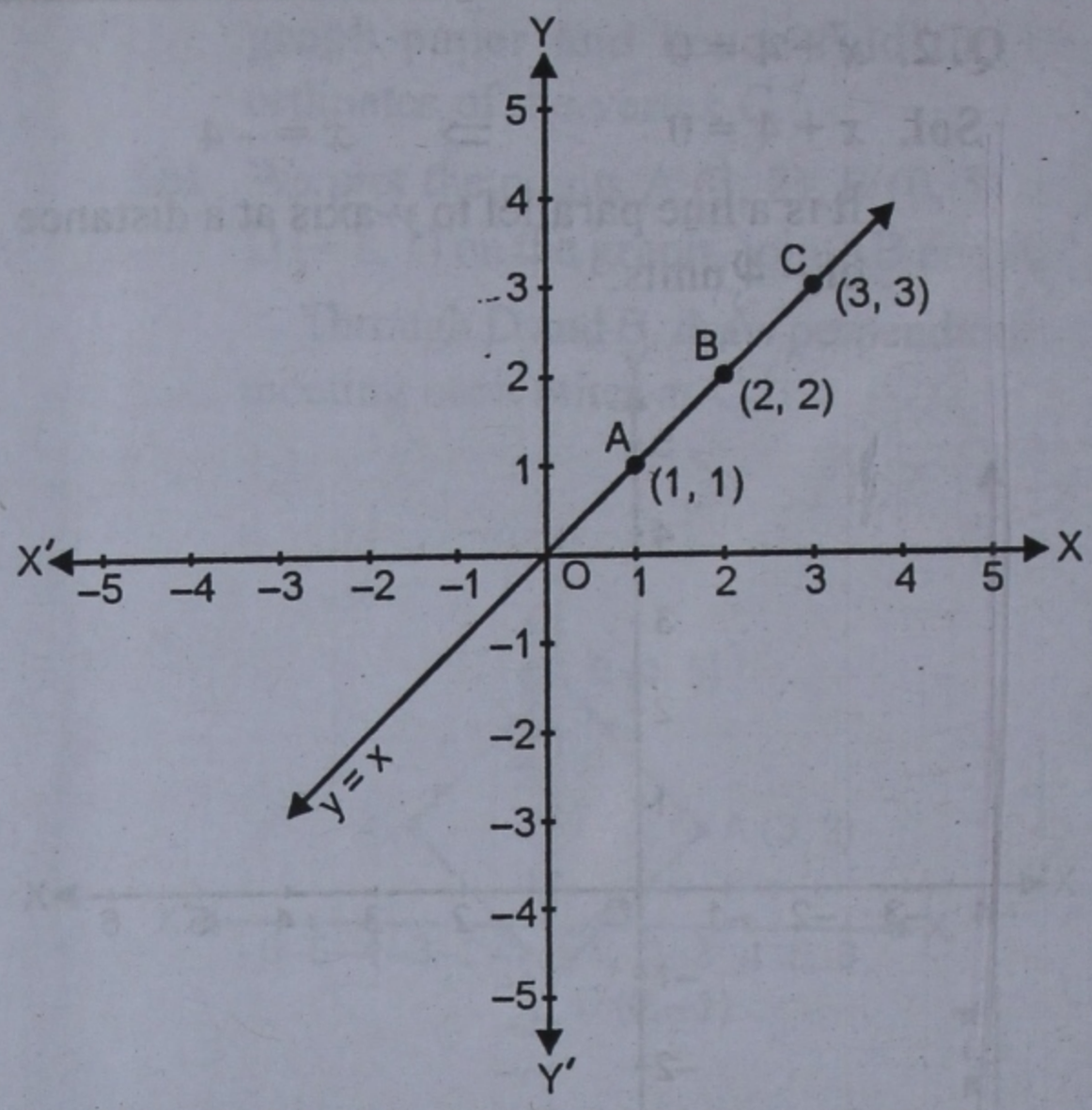
Q. 7. $y = x$

Sol. $y = x$

Giving some suitable values to x, we get corresponding values of y as shown in the table given below :

x	1	2	3
y	1	2	3

Now plot the points (1, 1), (2, 2) and (3, 3) on the graph and join them to form a line.

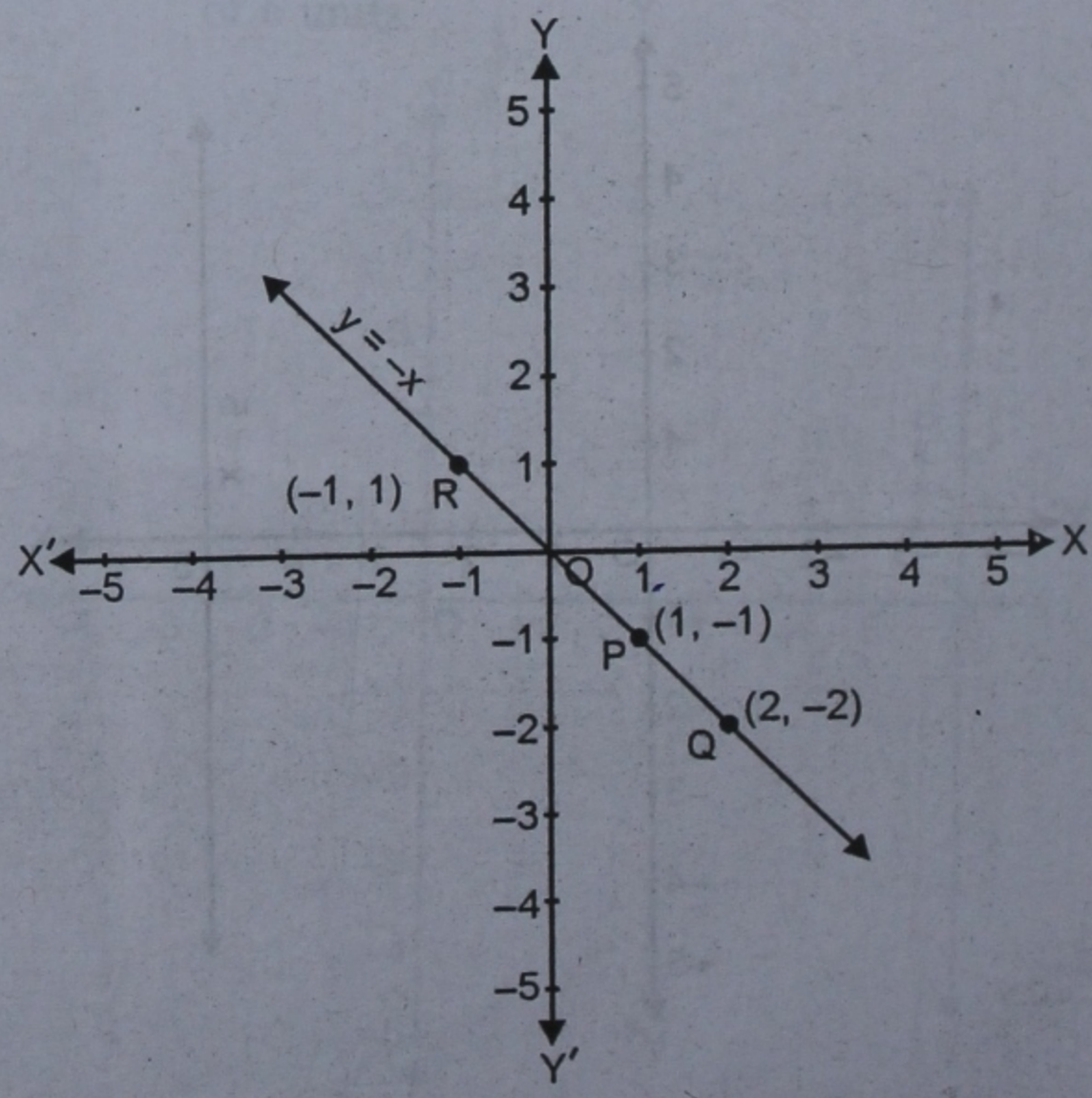


Q. 8. $y = -x$

Sol. Giving some suitable values to x, we get corresponding values of y as given below :

x	1	2	−1
y	−1	−2	1

Now plot the points (1, − 1), (2, − 2) and (− 1, 1) on the graph and join them to form a line.

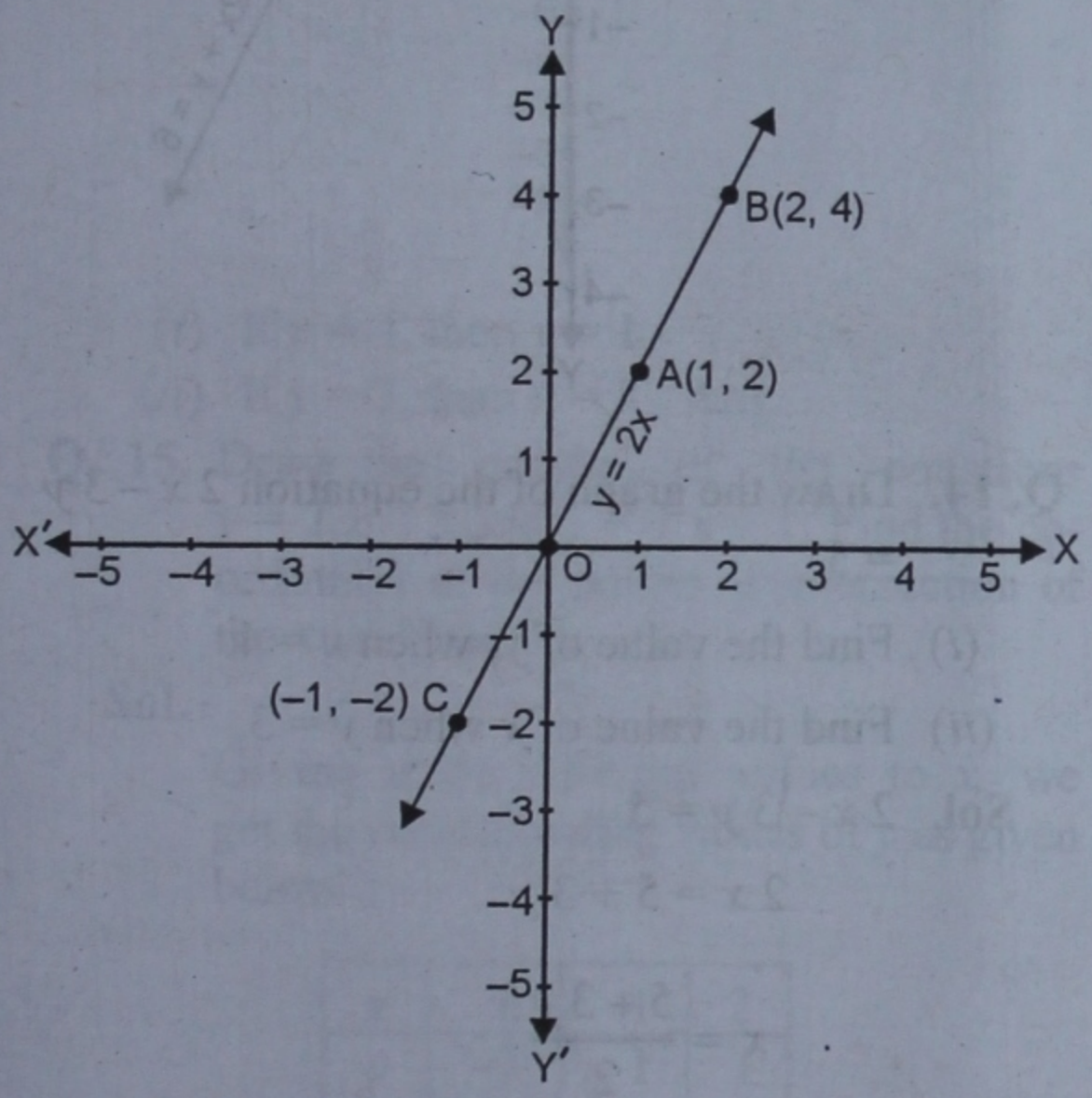


Q. 9. $y = 2x$

Sol. Giving some suitable values to x, we get corresponding values of y as shown in the table :

x	1	2	–1
y	2	4	–2

Now plot the points (1, 2), (2, 4) and (– 1, – 2) on the graph and join them to get a line.

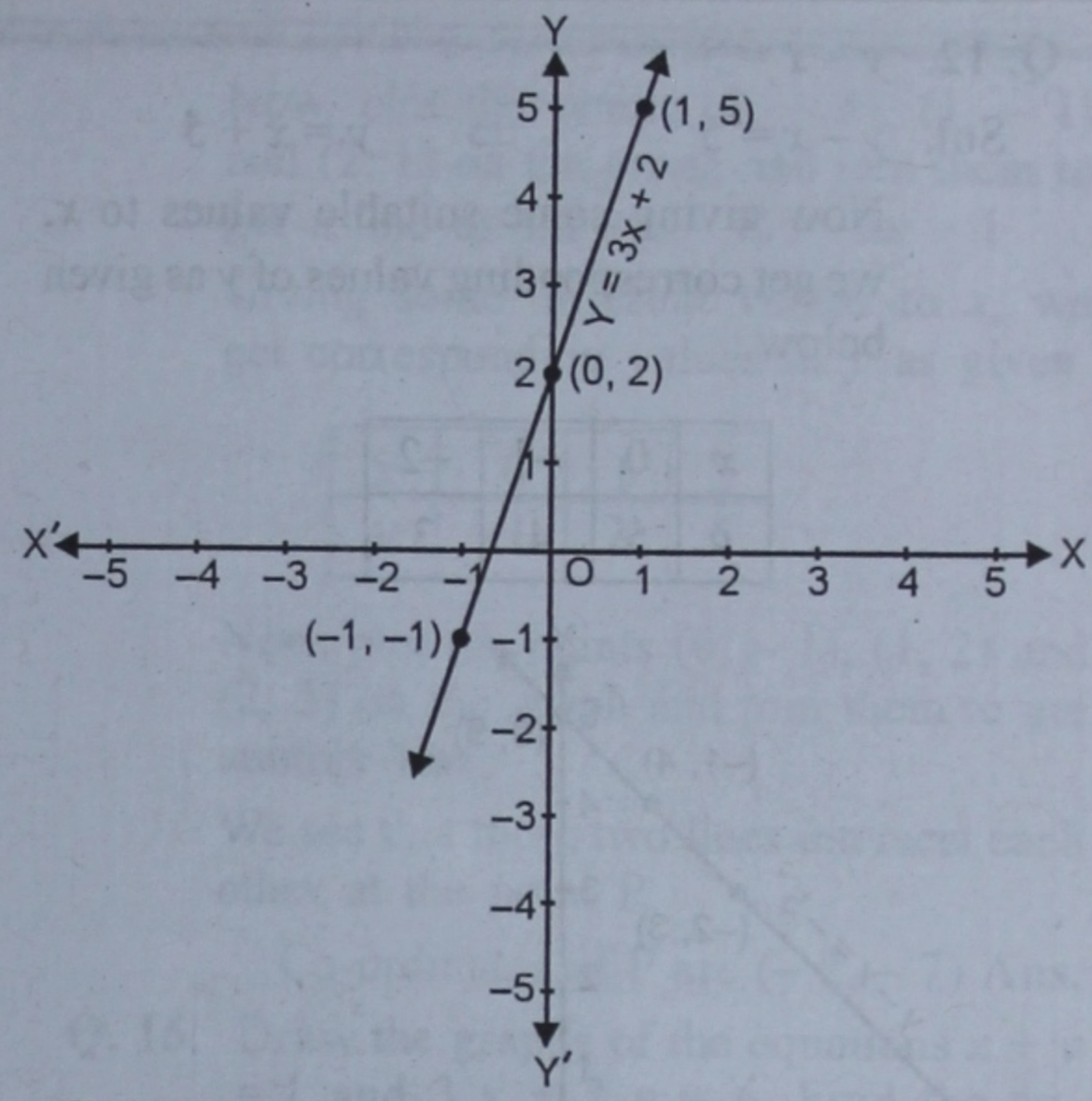


Q. 10. $y = 3x + 2$

Sol. Giving some suitable values to x, we get corresponding values of y, as given below :

x	0	1	–1
y	2	5	–1

Now plot the points (0, 2), (1, 5) and (– 1, – 1) on the graph and join them to form a line.

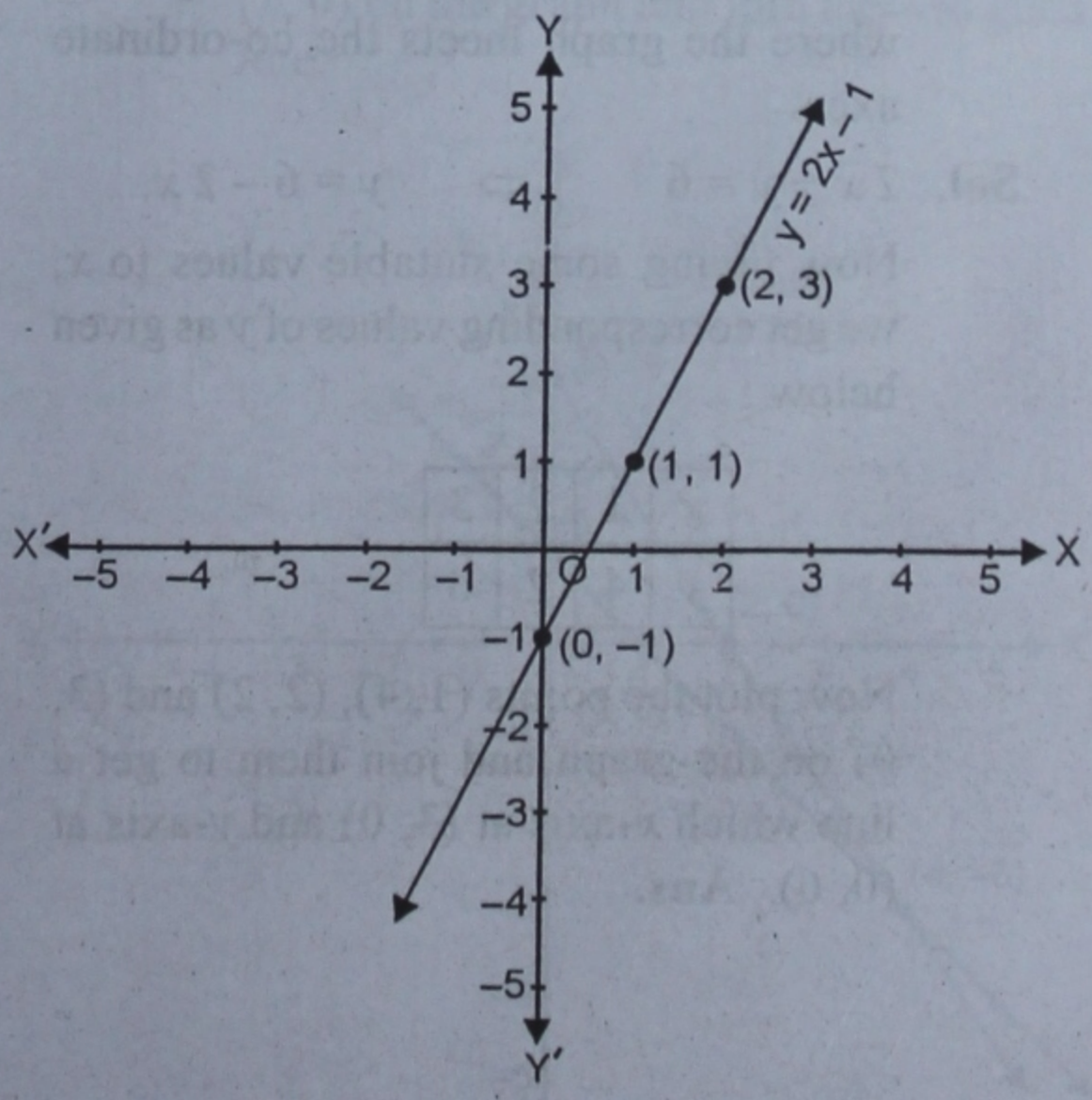


Q. 11. $y = 2x - 1$

Sol. Giving some suitable values of x, we get corresponding values of y, as given below :

x	1	0	2
y	1	–1	3

Now plot the points (1, 1), (0, – 1) and (2, 3) on the graph and join them to form a line.

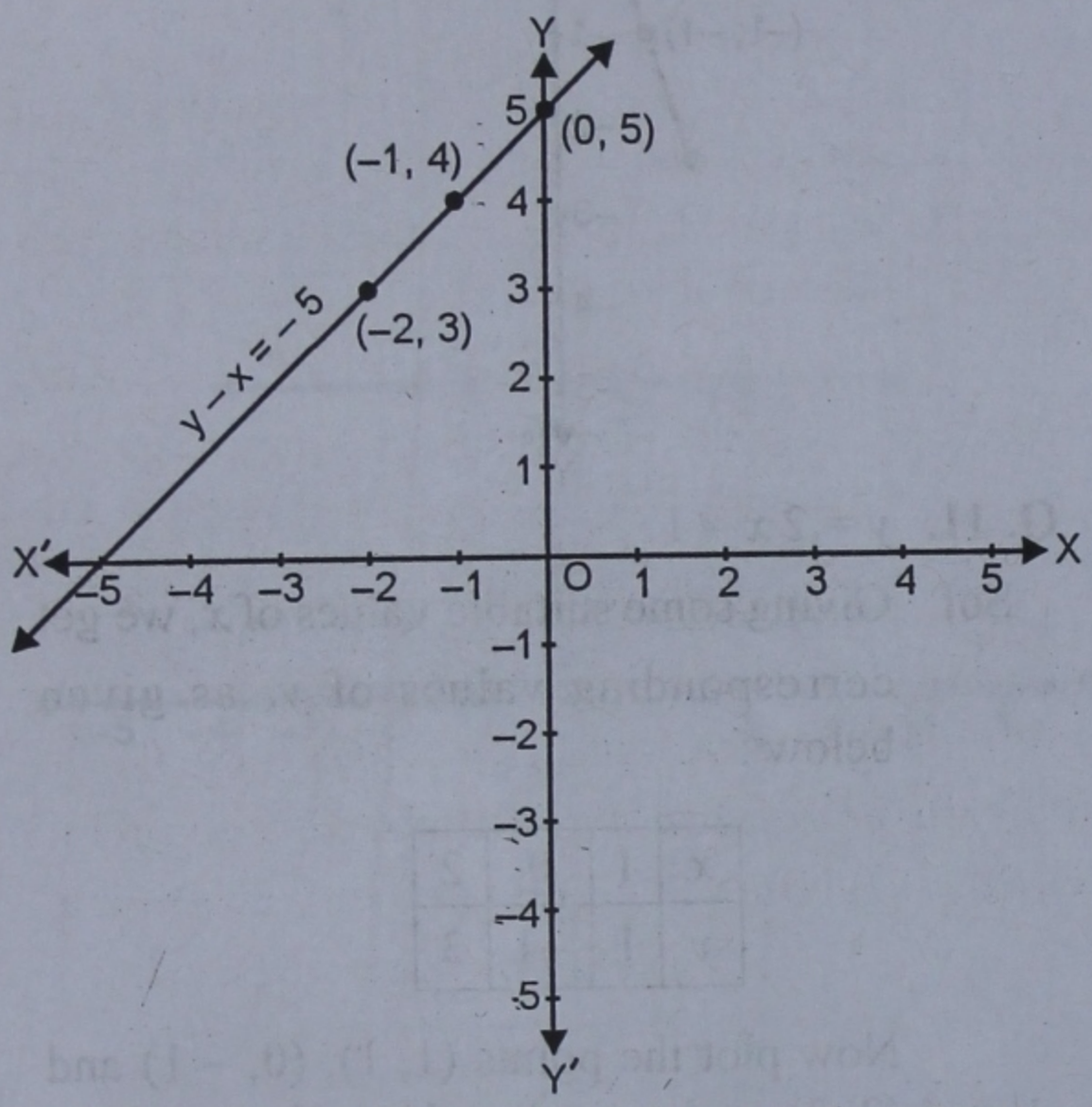


Q. 12. $y - x = 5$

Sol. $y - x = 5 \quad \Rightarrow \quad y = x + 5$

Now giving some suitable values to x, we get corresponding values of y as given below :

x	0	–1	–2
y	5	4	3



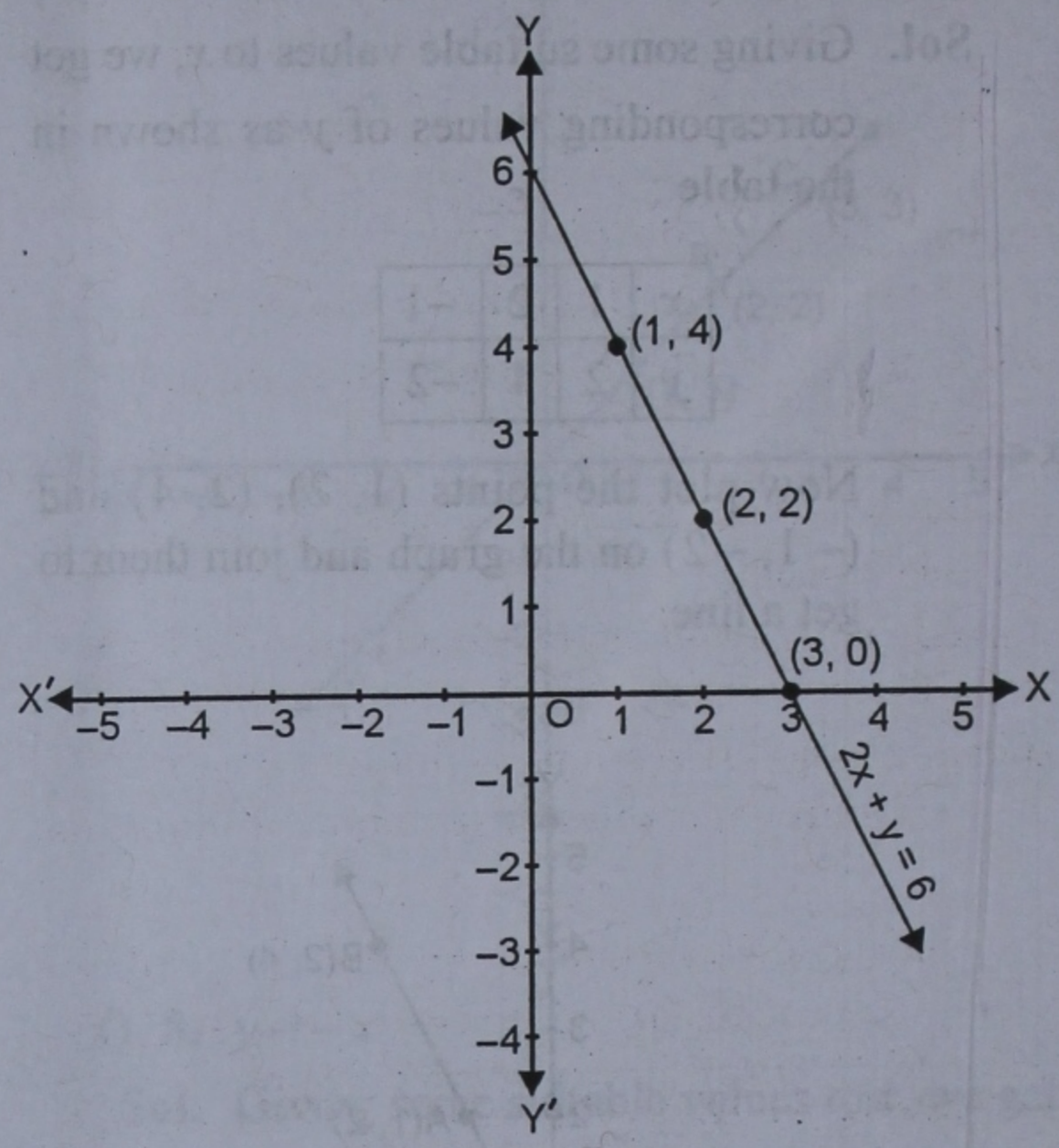
Q. 13. Draw the graph of the equation, $2x + y = 6$. Find the co-ordinates of the points, where the graph meets the co-ordinate axes.

Sol. $2x + y = 6 \quad \Rightarrow \quad y = 6 - 2x$

Now giving some suitable values to x, we get corresponding values of y as given below :

x	1	2	3
y	4	2	0

Now plot the points (1, 4), (2, 2) and (3, 0) on the graph and join them to get a line which x-axis at (3, 0) and y-axis at (0, 6). **Ans.**



Q. 14. Draw the graph of the equation $2x - 3y = 5$.

(*i*) Find the value of y, when $x = 4$.

(*ii*) Find the value of x when $y = 3$.

Sol. $2x - 3y = 5$

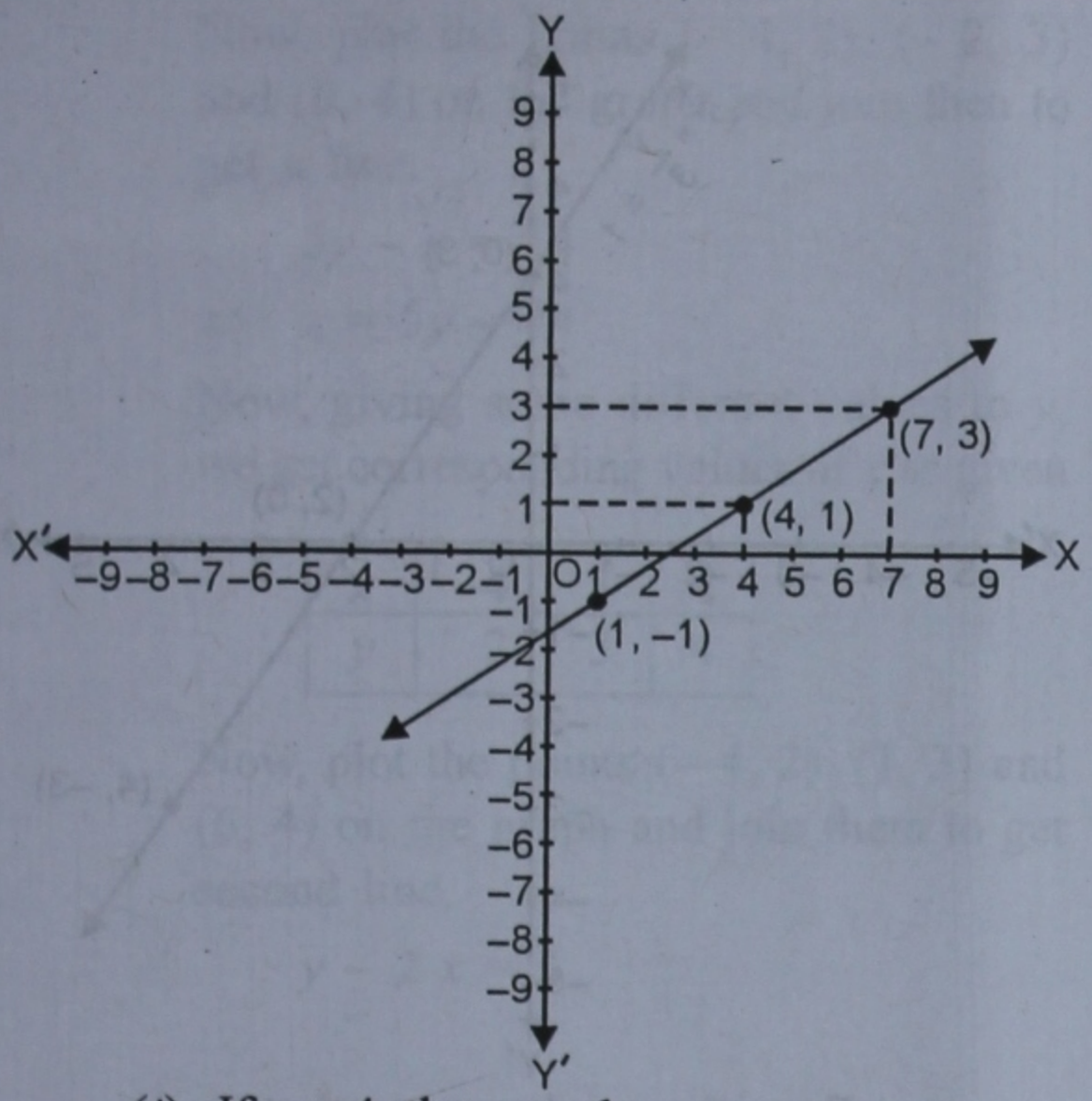
$$2x = 5 + 3y$$

$$x = \frac{5 + 3y}{2}$$

Giving some suitable values to y, we get the corresponding values of x as given below :

x	4	1	7
y	1	–1	3

Now plot the points (4, 1), (1, – 1) and (7, 3) on the graph and join them to get a line.



(*i*) If $x = 4$, then $y = 1$.

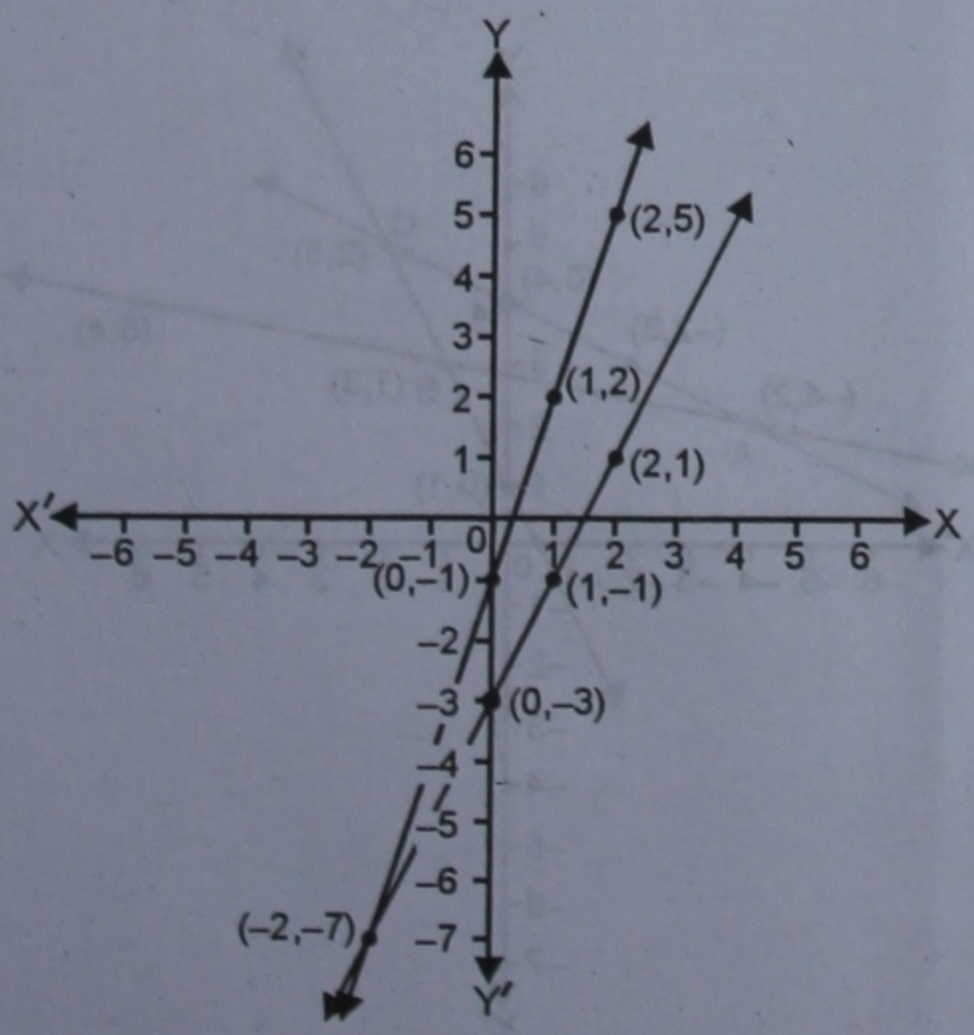
(*ii*) If $y = 3$, then $x = 7$. **Ans.**

Q. 15. Draw the graphs of the equations $y = 2x - 3$ and $y = 3x - 1$. Find the co-ordinates of the points of intersection of the two lines.

Sol. $y = 2x - 3$

Giving some different values to x, we get the corresponding values of y as given below :

x	0	1	2
y	–3	–1	1



Now, plot the points (0, – 3), (1, – 1) and (2, 1) on the graph and join them to get a line as shown $y = 3x - 1$

Giving some different values to x, we get corresponding values of y as given

x	0	1	2
y	–1	2	5

Now, plot the points (0, – 1), (1, 2) and (2, 5) on the graph and join them to get another line.

We see that these two lines intersect each other at the point P.

∴ Co-ordinates of P are (– 2, – 7) **Ans.**

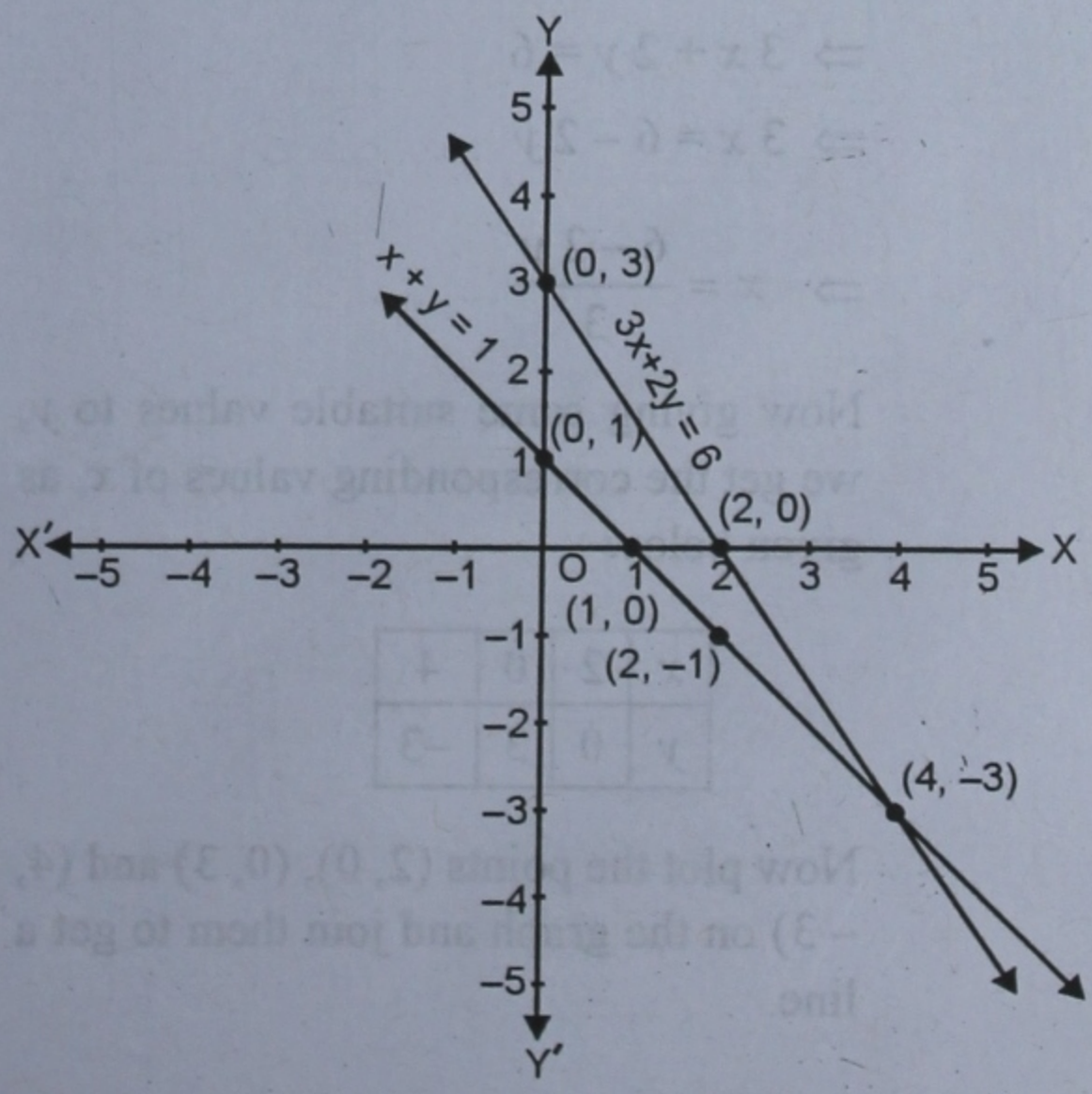
Q. 16. Draw the graphs of the equations $x + y = 1$ and $3x + 2y = 6$. Find the co-ordinates of the point of intersection of the two lines.

Sol. $x + y = 1 \Rightarrow x = 1 - y$

Giving some suitable values to y, we get corresponding values of x as given below :

x	0	2	1
y	1	–1	0

Now plot the points (0, 1), (2, – 1) and (1, 0) on the graph and join them to get a line.



Again, $3x + 2y = 6$

$2y = 6 - 3x$

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

Now giving some suitable values to x, we get the corresponding values of y as given below :

x	0	2	4
y	3	0	–3

Now plot the points (0, 3), (2, 0) and (4, – 3) on the graph and join them to get a line.

We see that these two lines intersect each other at the point (4, – 3).

∴ Co-ordinates are (4, – 3). **Ans.**

Q. 17. Draw the graph of the equation : $\frac{x}{2} + \frac{y}{3} = 1$. Use the graph to find :

(*i*) the value of y, when $x = 0$.

(*ii*) the value of x, when $y = 0$.

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

$\Rightarrow 3x + 2y = 6$

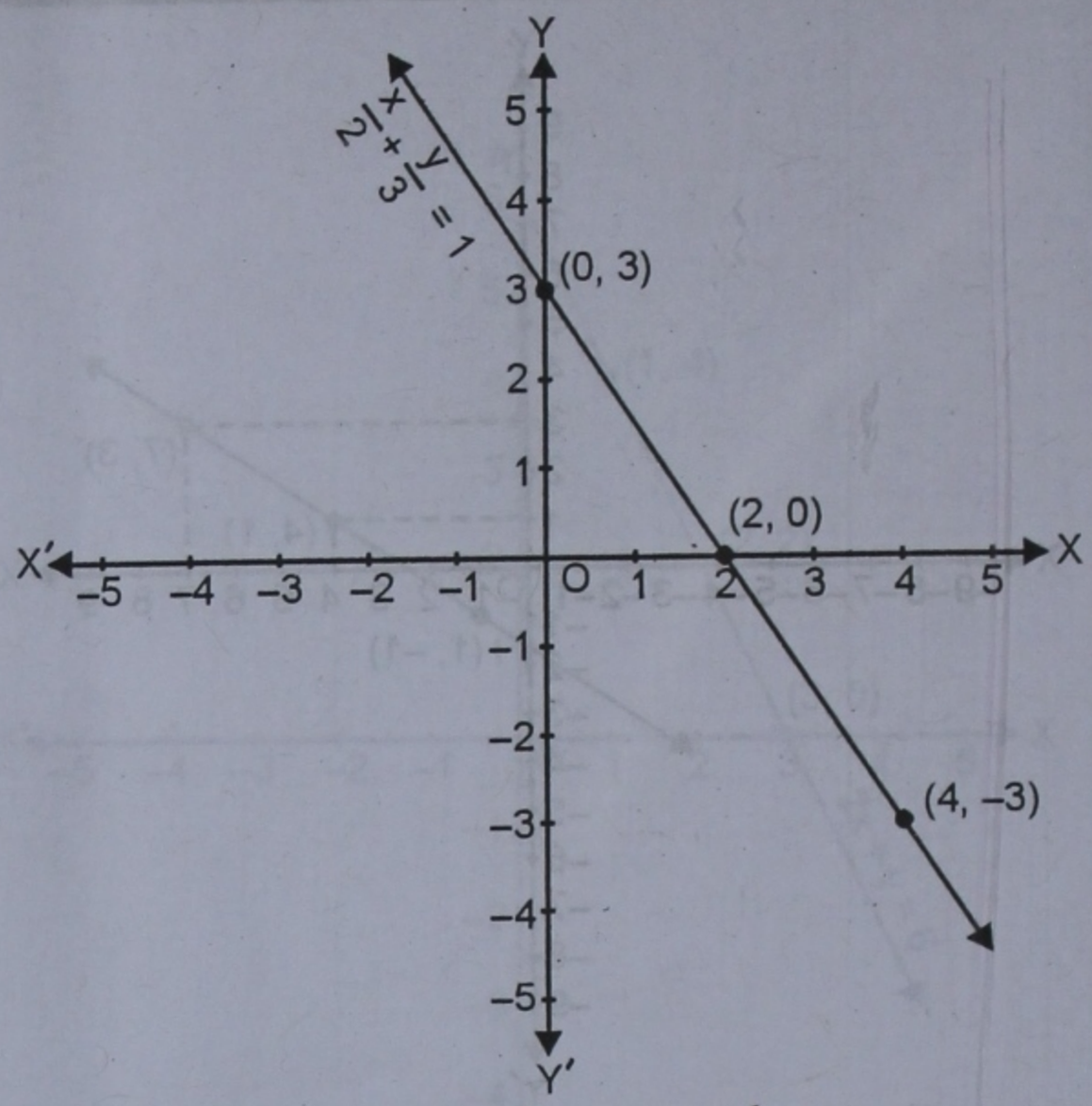
$\Rightarrow 3x = 6 - 2y$

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

Now giving some suitable values to y, we get the corresponding values of x, as given below :

x	2	0	4
y	0	3	–3

Now plot the points (2, 0), (0, 3) and (4, – 3) on the graph and join them to get a line.



From the graph, we see that

(*i*) if $x = 0$, then $y = 3$

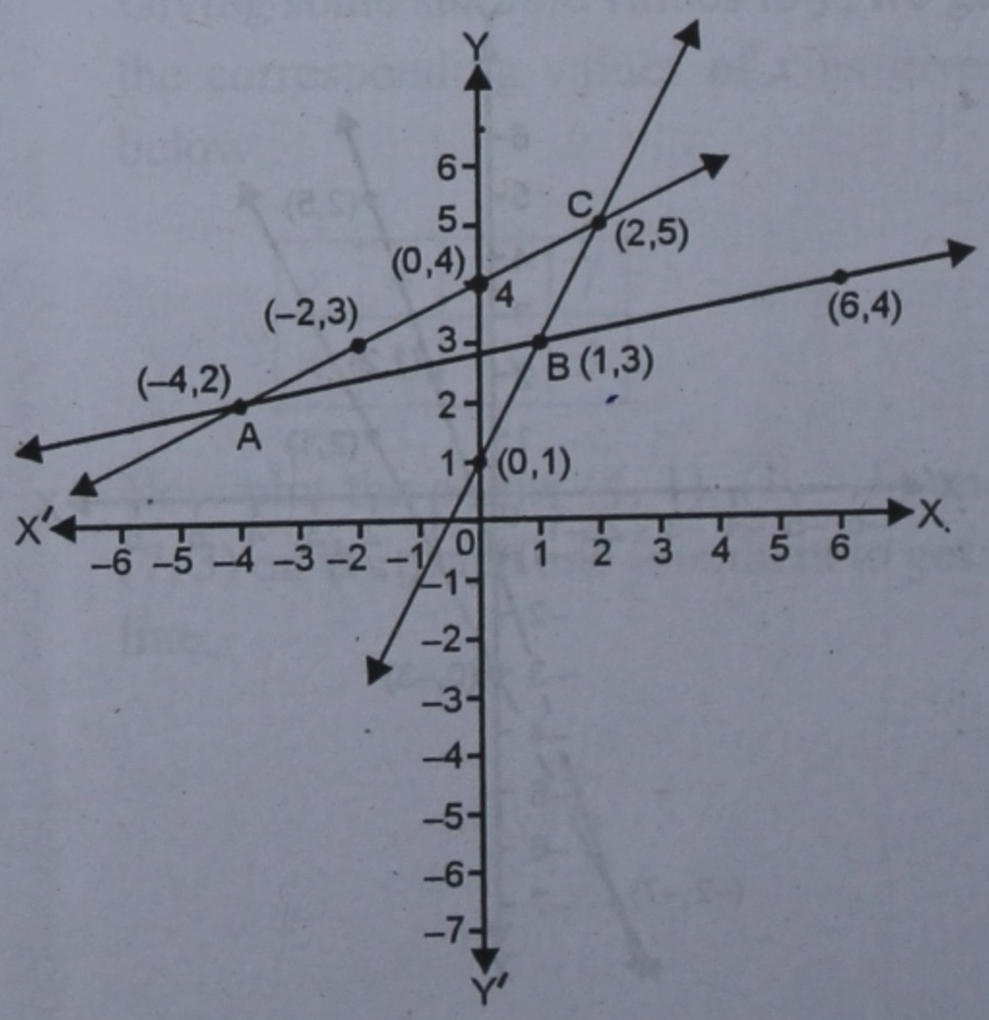
(*ii*) and if $y = 0$, then $x = 2$. **Ans.**

Q. 18. Draw the graphs of each of the equations $2y - x = 8$, $5y - x = 14$, $y - 2x = 1$. Obtain the vertices of the triangle so formed.

Sol. $2y - x = 8 \Rightarrow x = 2y - 8$

Giving some different values to y, we get corresponding values of x as given below :

x	–4	–2	0
y	2	3	4



x	2	0	4
y	0	3	–3

Now, plot the points (– 4, 2), (– 2, 3) and (0, 4) on the graph and join then to get a line.

$$5y - x = 14$$

$$\Rightarrow \quad x = 5y - 14$$

Now, giving some different values to y, we get corresponding values of x as given

x	–4	1	6
y	2	3	4

Now, plot the points (– 4, 2), (1, 3) and (6, 4) on the graph and join them to get second line.

$$y - 2x = 1$$

$$\Rightarrow \quad y = 2x + 1$$

Now, giving some different values to x, we get the corresponding values of y as given :

x	0	1	2
y	1	3	5

Now, plot the points (0, 1), (1, 3) and (2, 5) on the graph and join them to get third line.

We see that these lines intersect at each other at A, B and C.

Now, the co-ordinates of A are (– 4, 2), of B are (1, 3) and of C are (2, 5) **Ans.**