21

COORDINATE GEOMETRY

21.1 ORDERED PAIR

*An **ordered pair** is a pair of objects taken in a specific order.*

An ordered pair is written by listing its two members in a specific order, separating them by a comma and enclosing the pair in parentheses. In the ordered pair (a, b), a is called the *first member* (or *component*) and b is called the *second member* (or *component*).

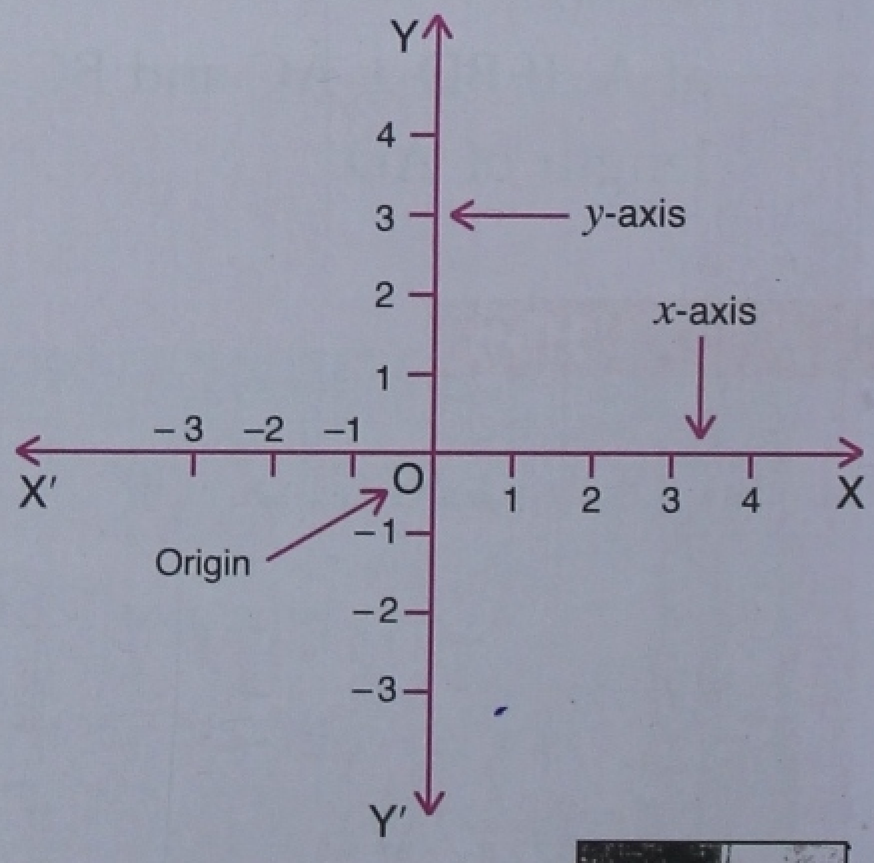
Equality of ordered pairs. *Two ordered pairs (a, b) and (c, d) are called* ***equal****, written as* $(a, b) = (c, d)$, *if and only if* $a = c$ *and* $b = d$.

Remarks

- The word 'ordered' implies that the order in which the two elements of the pair occur is meaningful. For example, if we have a sock and a shoe, the order in which they are put on matters.
- The ordered pairs (a, b) and (b, a) are different unless $a = b$.
- The two components of an ordered pair may be equal.

21.2 CARTESIAN COORDINATE SYSTEM

When two numbered lines perpendicular to each other (usually horizontal and vertical) are placed together so that the two origins (the points corresponding to zero) coincide and the lines are perpendicular, then the resulting configuration is called a **cartesian coordinate system** or a **coordinate plane.**



Rane Descartes

Rene' De'scartes (1596 – 1650), a French mathematician, was the first to realise that a straight line or a curve in a plane can be represented by an algebraic equation. As a result, a new branch of Mathematics called **Coordinate Geometry** came into existence.

Let X′OX and Y′OY, two number lines perpendicular to each other, meet at the point O (shown in the adjoining figure), then

(*i*) X′OX is called ***x*-axis.**

(*ii*) Y′OY is called ***y*-axis.**

(*iii*) X′OX and Y′OY taken together are called **coordinate axes.**

(*iv*) the point O is called the **origin**.

Recall that there is one and only one point on a number line associated with each real number. A similar situation exists for points in a plane and **ordered pairs** of real numbers.

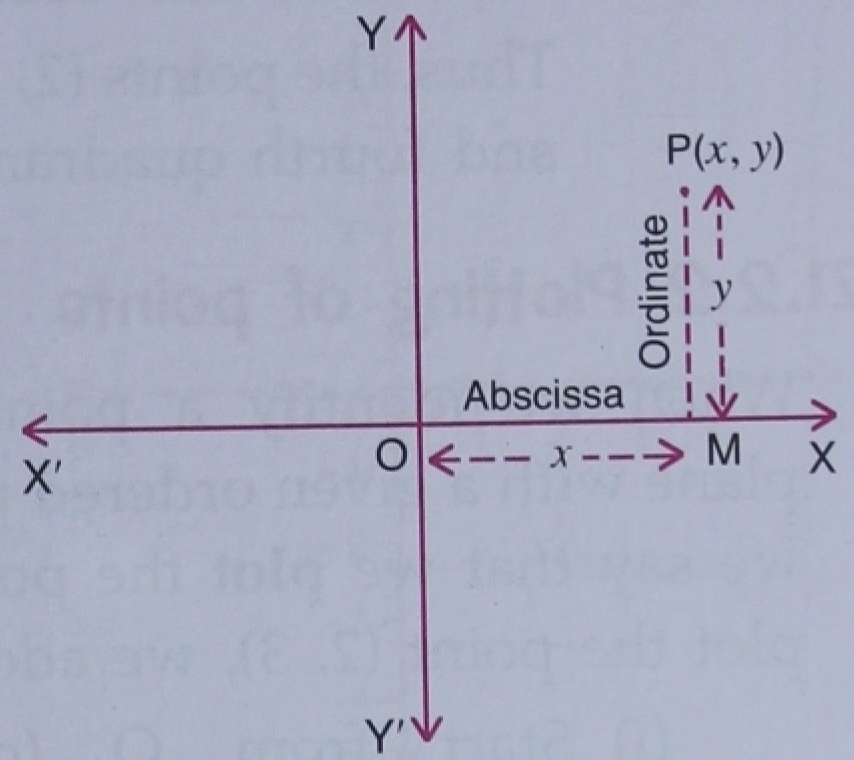
21.2.1 Coordinates of a point

Let P be any point in the coordinate plane. From P, draw PM perpendicular to X′OX, then

(*i*) OM is called ***x*-coordinate** or **abscissa** of P and is usually denoted by x.

(*ii*) MP is called ***y*-coordinate** or **ordinate** of P and is usually denoted by y.

(*iii*) x and y taken together are called **cartesian coordinates** or simply coordinates of P and are denoted by (x, y).



Remarks

- The coordinates of a point indicate its position with reference to coordinate axes.
- In stating the coordinates of a point, the ***abscissa*** precedes the ***ordinate***. The two are separated by a comma and are enclosed in the bracket ( ). Thus, a point P whose abscissa is 'x' and ordinate is 'y' is written as (x, y) or P (x, y).

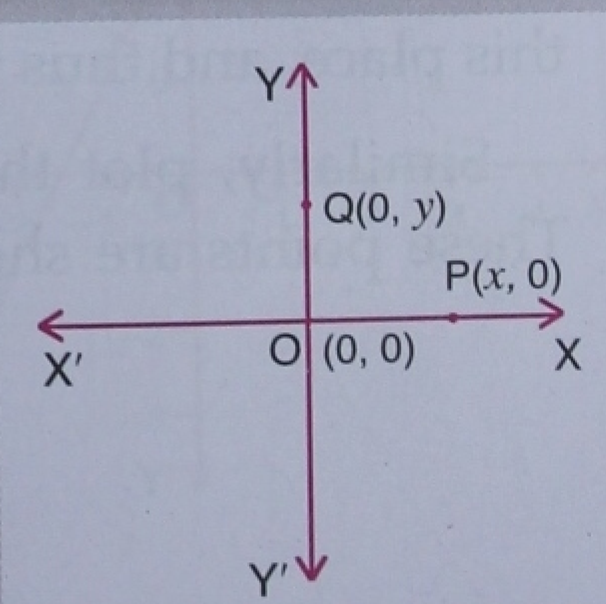
Convention for signs of coordinates

(*i*) The x-coordinate (abscissa) of a point is ***positive*** if it is measured to the right of O *i.e.* along OX and is ***negative*** if it is measured to the left of O *i.e.* along OX′.

(*ii*) The y-coordinate (ordinate) of a point is ***positive*** if it is measured upwards *i.e.* along OY and is ***negative*** if it is measured downwards *i.e.* along OY′.

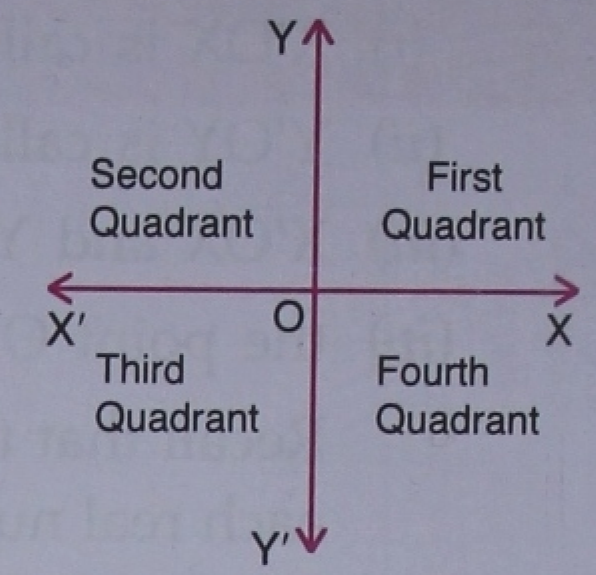
Remarks

- The coordinates of the origin O are (0, 0).
- For any point on x-axis, its ordinate is always zero and so the coordinates of any point P on x-axis are $(x, 0)$.
- For any point on y-axis, its abscissa is always zero and so the coordinates of any point Q on y-axis are $(0, y)$.



Quadrants

The horizontal and the vertical number lines X′OX and Y′OY divide the coordinate plane into four parts called **quadrants**.



(*i*) XOY is called the **first quadrant**. In this quadrant, $x > 0$, $y > 0$ *i.e.* abscissa and ordinate are both positive.

(*ii*) YOX′ is called the **second quadrant**. In this quadrant, $x < 0$, $y > 0$ *i.e.* abscissa is negative and ordinate is positive.

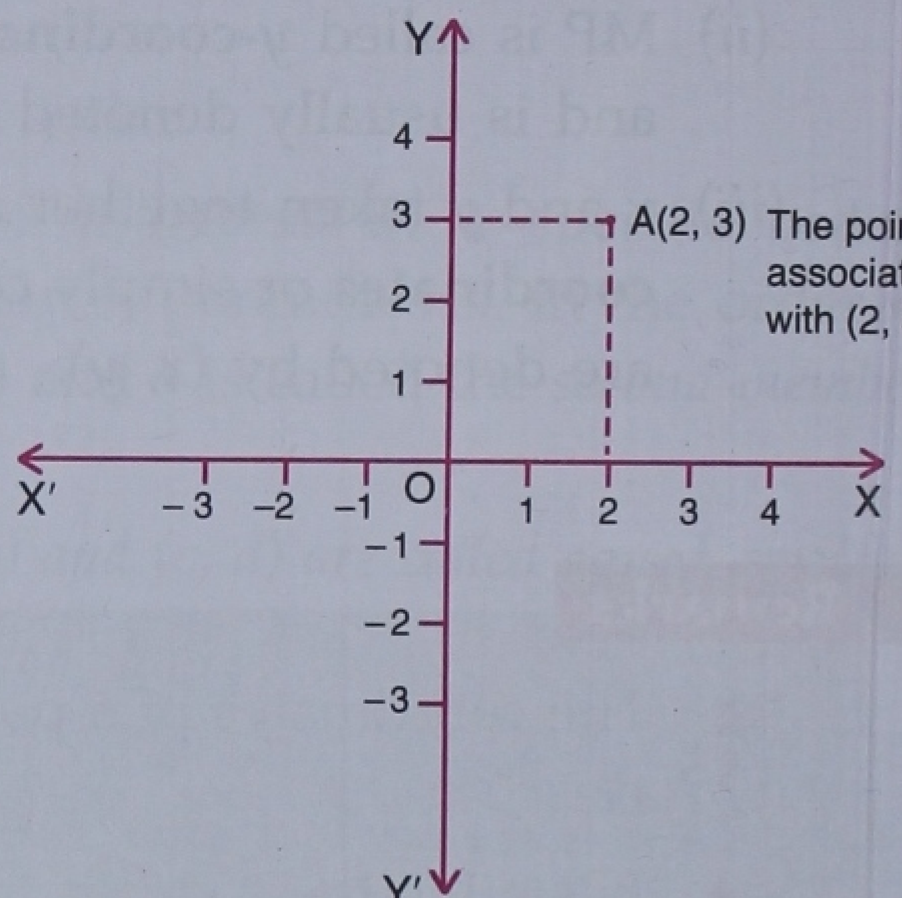
(*iii*) X′OY′ is called the **third quadrant**. In this quadrant, $x < 0$, $y < 0$ *i.e.* abscissa and ordinate are both negative.

(*iv*) Y′OX is called the **fourth quadrant**. In this quadrant, $x > 0$, $y < 0$ *i.e.* abscissa is positive and ordinate is negative.

Thus, the points (2, 3), (−2, 3), (−2, −3) and (2, −3) lie in the first, second, third and fourth quadrants respectively.

21.2.2 Plotting of points

When we identify a point in the coordinate plane with a given ordered pair of real numbers, we say that we **plot** the point. For example, to plot the point (2, 3), we adopt two steps :



(*i*) Start from O (origin) and move 2 units along the x-axis to the right.

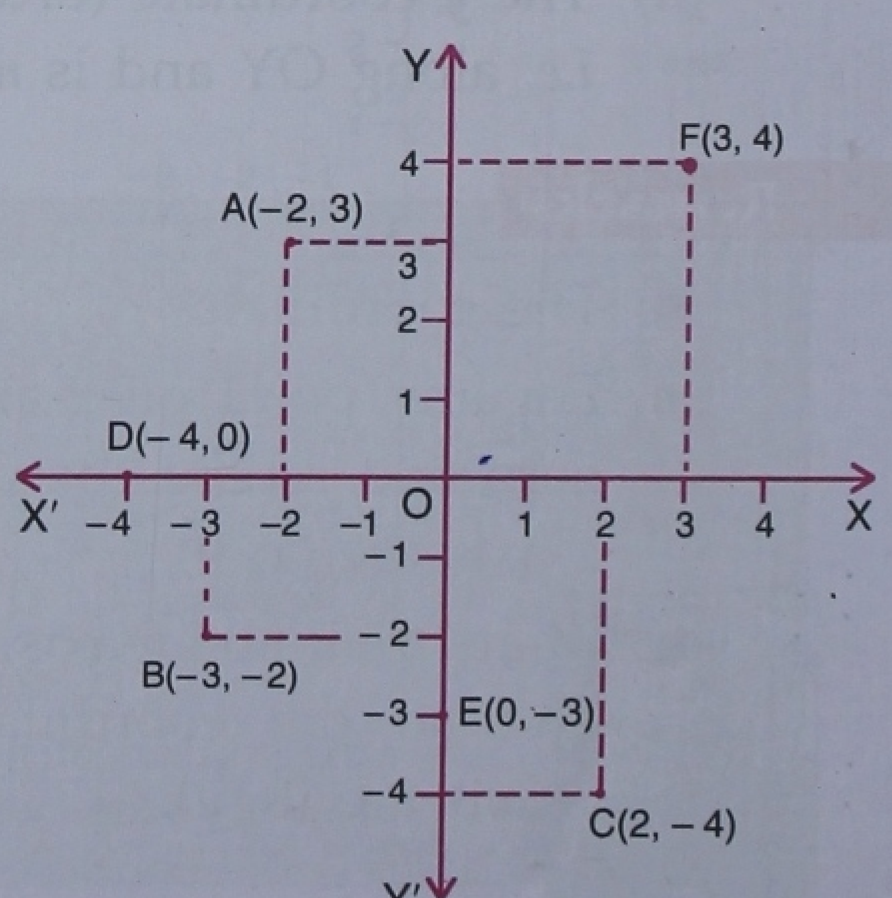
(*ii*) From this place, move 3 units upwards (parallel to y-axis) and mark a ***dot*** at that place. This point, say A, of the coordinate plane is the point associated with the given ordered pair (2, 3). Label this point as A (2, 3).

ILLUSTRATIVE EXAMPLES

Example 1. *Plot the points associated with the pairs A (−2, 3), B (−3, −2), C (2, −4), D (−4, 0), E (0, −3) and F (3, 4).*

Solution. To plot the point A (−2, 3) in the coordinate plane, start from the point O (origin) and move 2 units along the x-axis to the left, and from here move 3 units upwards. Mark a ***dot*** at this place, and thus the point A (−2, 3) is plotted.

Similarly, plot the other points in the plane. These points are shown in the adjacent figure.

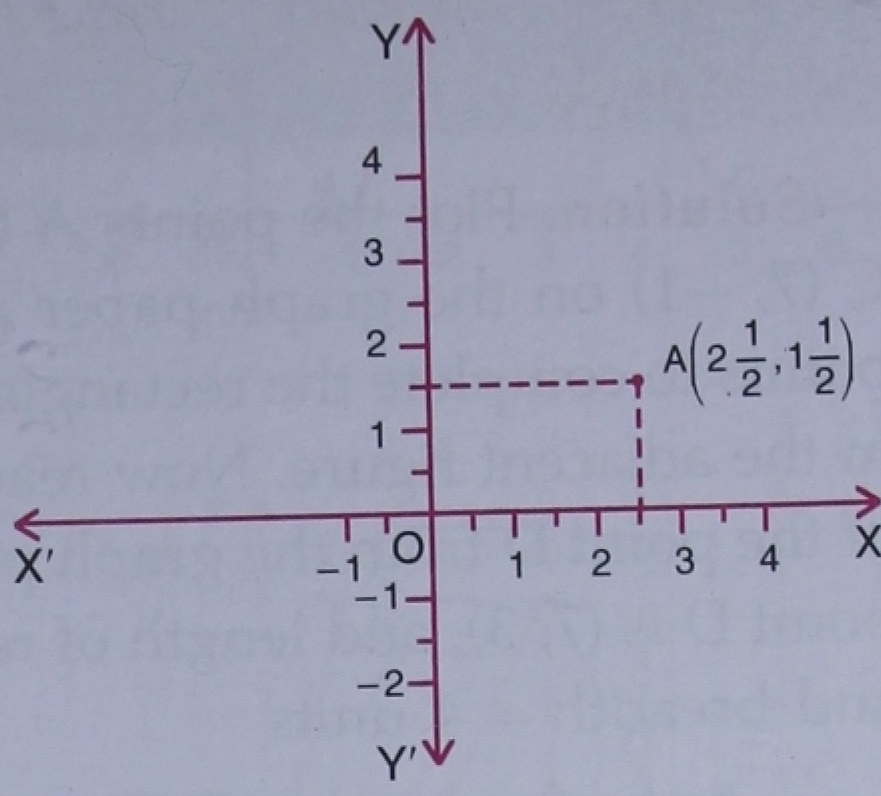


Example 2. *Plot the following points on a squared paper :*

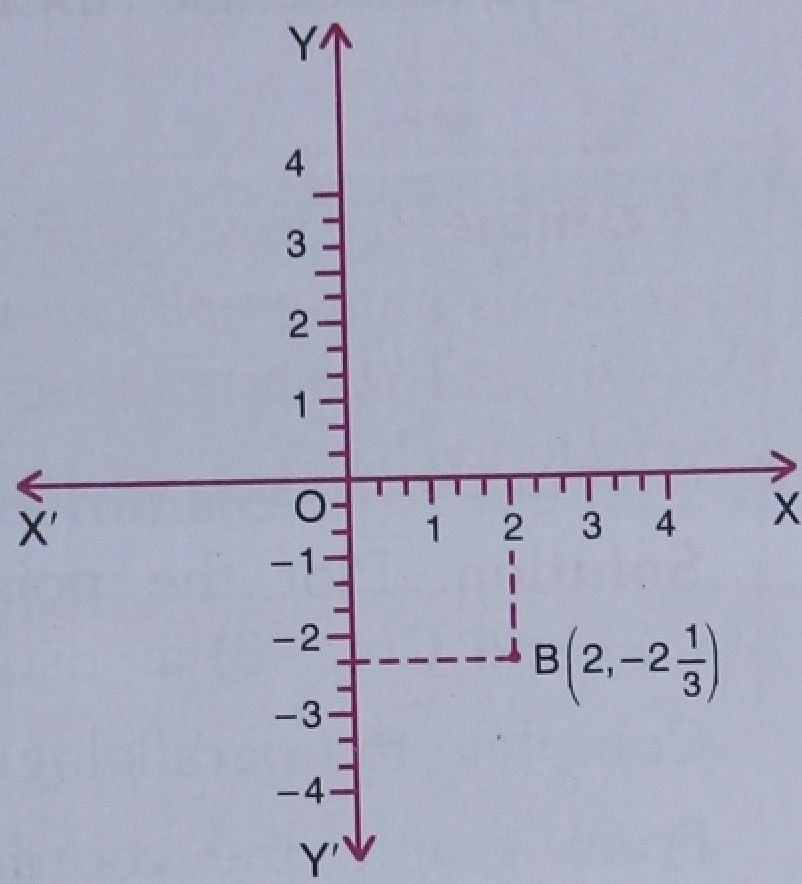
(i) $A\left(2\frac{1}{2}, 1\frac{1}{2}\right)$ *(ii)* $B\left(2, -2\frac{1}{3}\right)$ *(iii)* $\left(1\frac{1}{2}, 1\frac{1}{3}\right)$.

Solution.

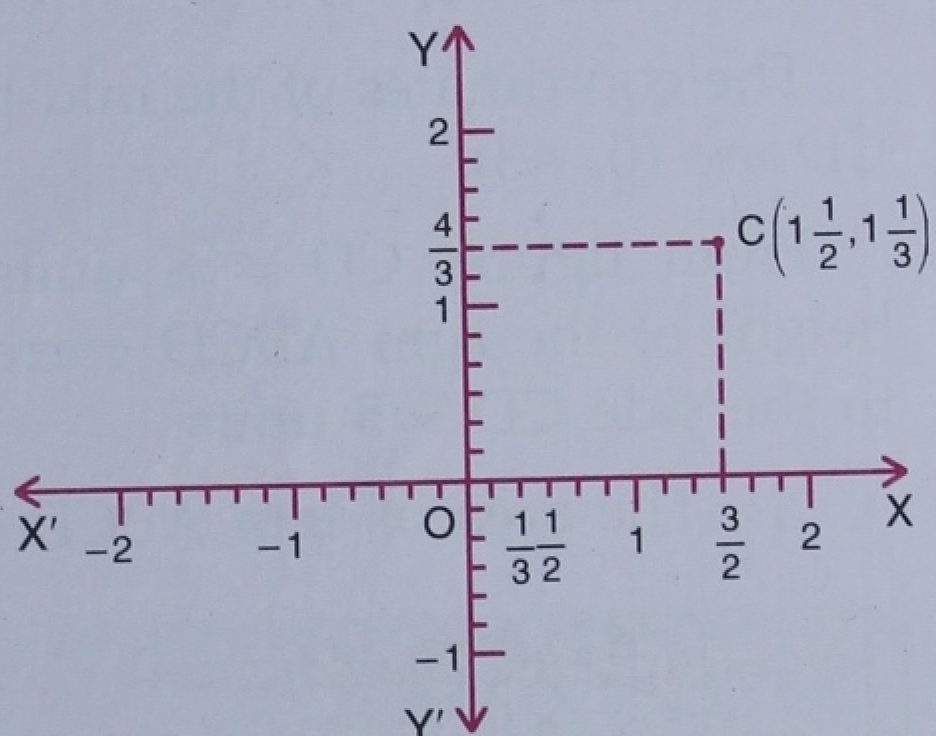
(*i*) To plot the point A $\left(2\frac{1}{2}, 1\frac{1}{2}\right)$ on a squared (graph) paper, mark the two coordinate axes in such a way that the fraction $\frac{1}{2}$ can easily be read. For this, take 2 divisions equal to one unit. The point A $\left(2\frac{1}{2}, 1\frac{1}{2}\right)$ is shown by a dot in the adjacent figure.



(*ii*) To plot the point B $\left(2, -2\frac{1}{3}\right)$ on a squared (graph) paper, mark the two coordinate axes in such a way that the fraction $\frac{1}{3}$ can easily be read. For this, take 3 divisions equal to one unit. The point B $\left(2, -2\frac{1}{3}\right)$ is shown by a dot in the adjacent figure.

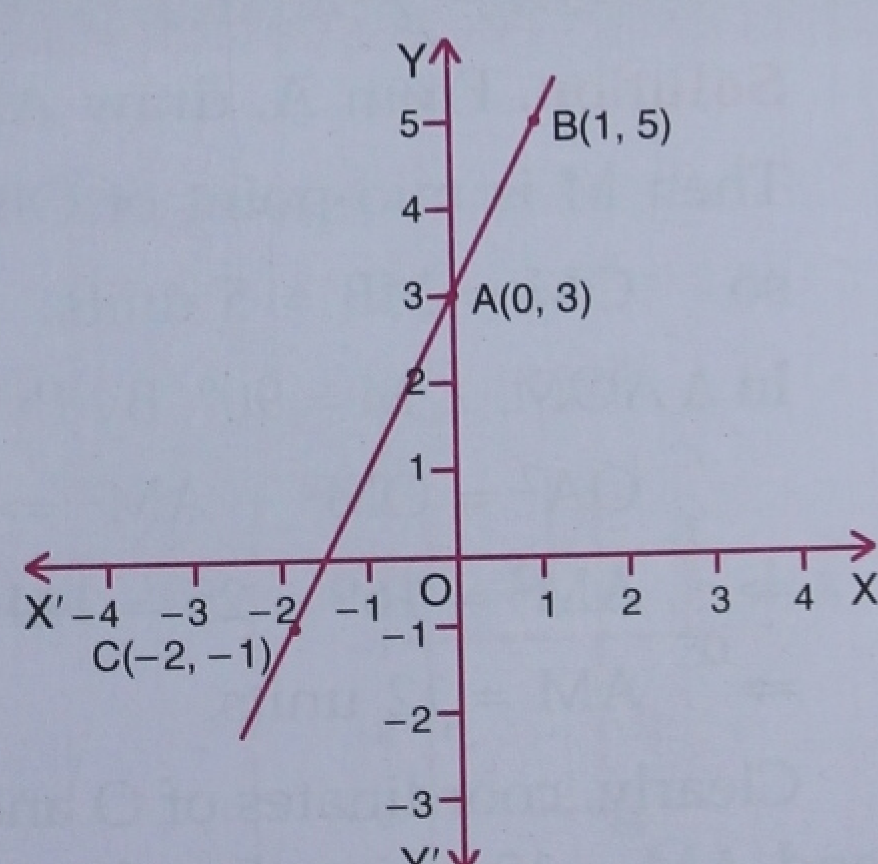


(*iii*) To plot the point C $\left(1\frac{1}{2}, 1\frac{1}{3}\right)$ on a squared paper, mark the coordinate axes in such a way that the fractions $\frac{1}{2}$ and $\frac{1}{3}$ both can easily be read. For this, take 6 divisions equal to one unit. The point C $\left(1\frac{1}{2}, 1\frac{1}{3}\right)$ is shown by a dot in the adjacent figure.

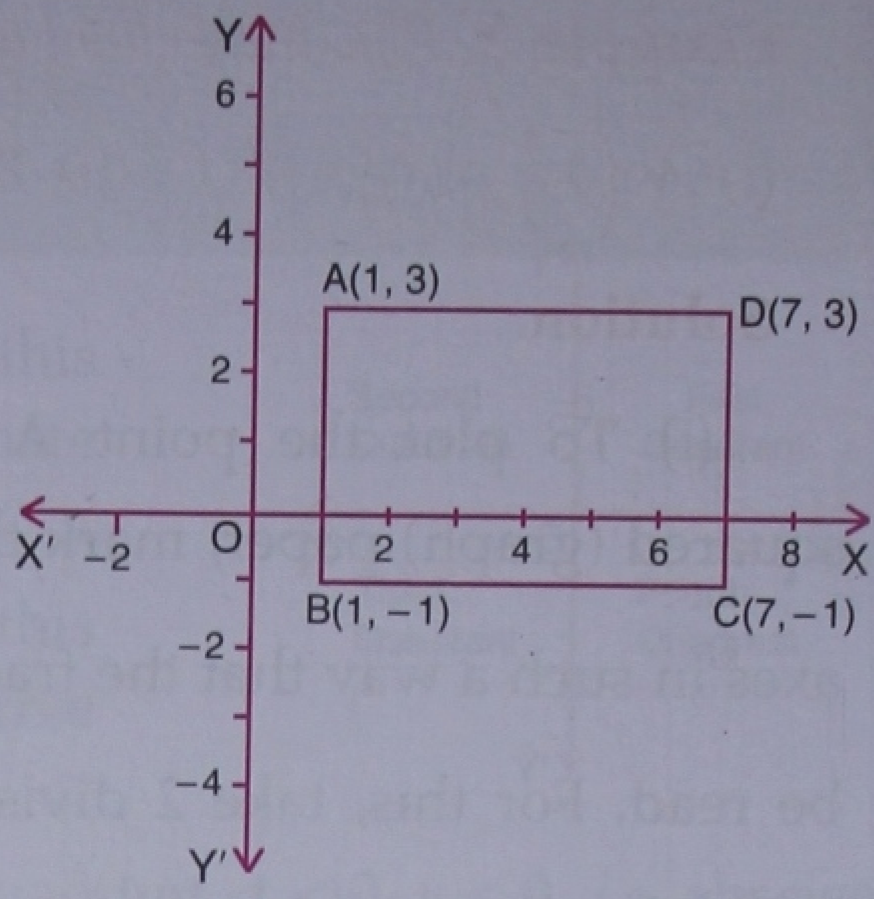


Example 3. *Plot the points A (0, 3), B (1, 5) and C (−2, −1) on a graph paper and check whether they are collinear (lie on the same straight line) or not.*

Solution. Plot the points A (0, 3), B (1, 5) and C (−2, −1) on the graph paper as usual. On joining the points A and B by a straight line, we find that the point C (−2, −1) lies on this line. Hence the given points A (0, 3), B (1, 5) and C (−2, −1) are collinear.



Example 4. *Three vertices (corners) of a rectangle are A(1, 3), B(1, –1) and C(7, –1). Plot these points on a graph paper and hence use it to find the coordinates of the fourth vertex. Also find the area of the rectangle.*



Solution. Plot the points A (1, 3), B (1, –1) and C (7, –1) on the graph paper as usual. Join the points to complete the rectangle ABCD as shown in the adjacent figure. Now read the coordinates of the point D from the graph paper. Clearly, the point D is (7, 3), and length of rectangle = 6 units and breadth = 4 units.

∴ Area of rectangle ABCD = (6 × 4) sq. units

= 24 sq. units.

Example 5. *Three vertices of a parallelogram are A(–2, 2), B(6, 2) and C(4, –3). Plot these points on a graph paper and hence use it to find the coordinates of the fourth vertex D. Also find the coordinates of the mid-point of the side CD. What is the area of the parallelogram?*

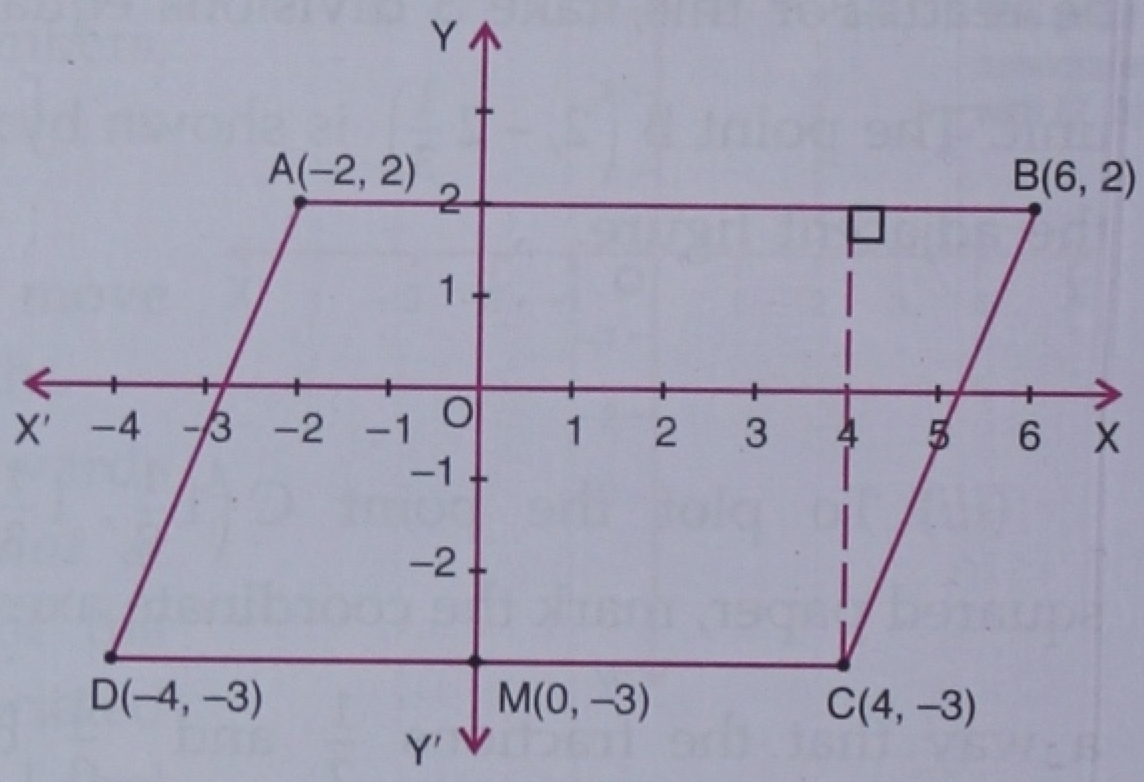
Solution. Plot the points A(–2, 2), B(6, 2) and C(4, –3) as usual.

Complete the parallelogram ABCD.

From graph, the coordinates of the point D are (–4, –3).

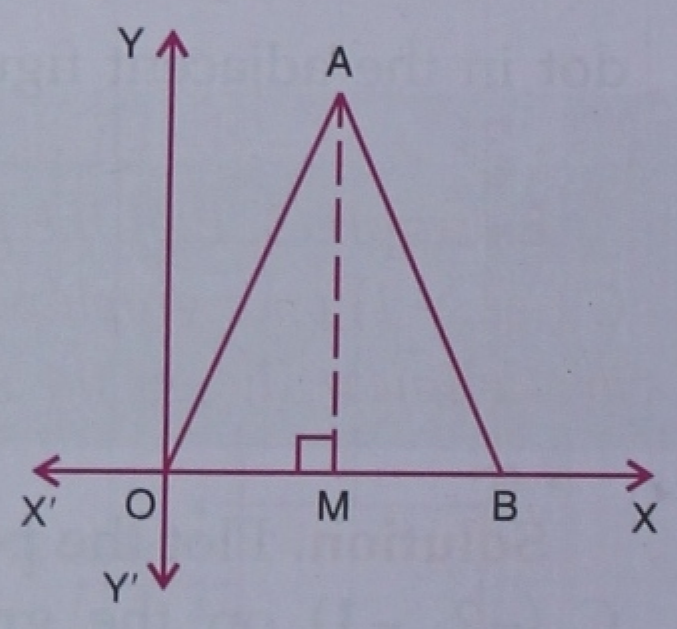
The coordinates of the mid-point M of CD are (0, –3).

From figure, CD = 8 units and the height of the ||gm ABCD corresponding to the side CD = 5 units.



∴ The area of ||gm ABCD = (8 × 5) sq. units = 40 sq. units.

Example 6. *The adjoining figure shows an isosceles triangle OAB with sides OA = AB = 13 units and OB = 10 units. Find the coordinates of the vertices.*



Solution. From A, draw AM ⊥ OB.

Then M is mid-point of OB,

so OM = MB = 5 units.

In Δ AOM, ∠ M = 90°. By Pythagoras theorem, we get

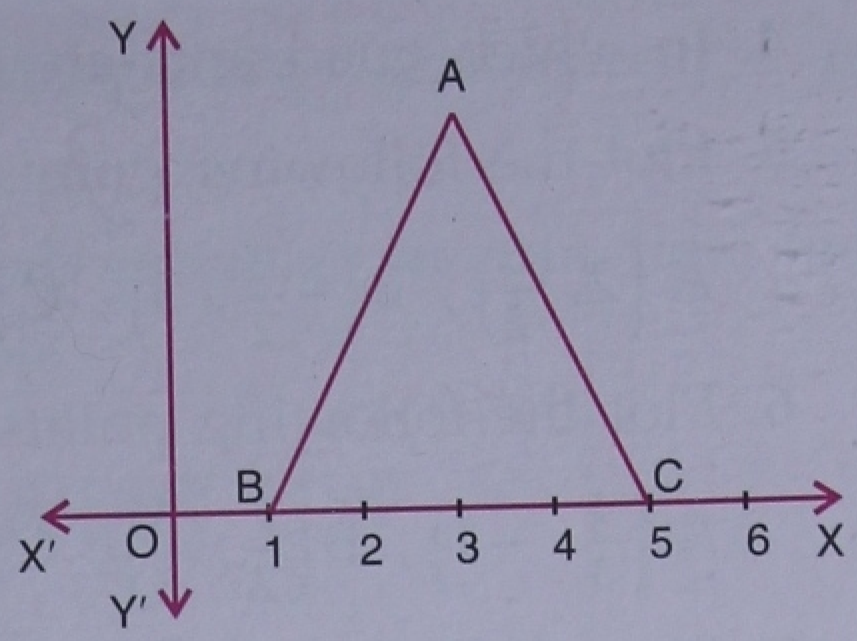
$OA^2 = OM^2 + AM^2 \Rightarrow 13^2 = 5^2 + AM^2$

$\Rightarrow \quad AM^2 = 169 - 25 = 144$

$\Rightarrow \quad AM = 12$ units.

Clearly, coordinates of O and B are (0, 0) and (10, 0) respectively. As OM = 5 units and AM = 12 units, therefore, coordinates of A are (5, 12).

Example 7. *In the adjoining figure, ABC is an equilateral triangle. Find the coordinates of the vertices.*



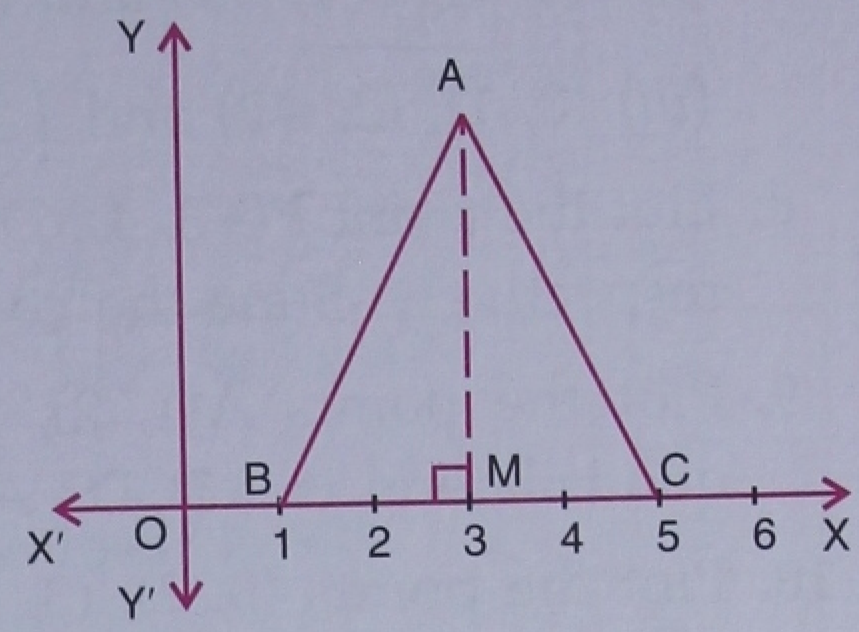
Solution. From figure, BC = 4 units.

As ABC is an equilateral triangle,

AB = AC = 4 units.

From A, draw AM ⊥ BC, then M is mid-point of BC.

So, $BM = \frac{1}{2}BC = \frac{1}{2} \times 4$ units = 2 units.



In ΔABM, ∠M = 90°. By Pythagoras theorem, we get

$$AB^2 = AM^2 + BM^2$$

$$\Rightarrow 4^2 = AM^2 + 2^2$$

$$\Rightarrow AM^2 = 16 - 4 = 12 \Rightarrow AM = 2\sqrt{3} \text{ units.}$$

From figure, OM = OB + BM = (1 + 2) units = 3 units.

Clearly, coordinates of B and C are (1, 0) and (5, 0) respectively.

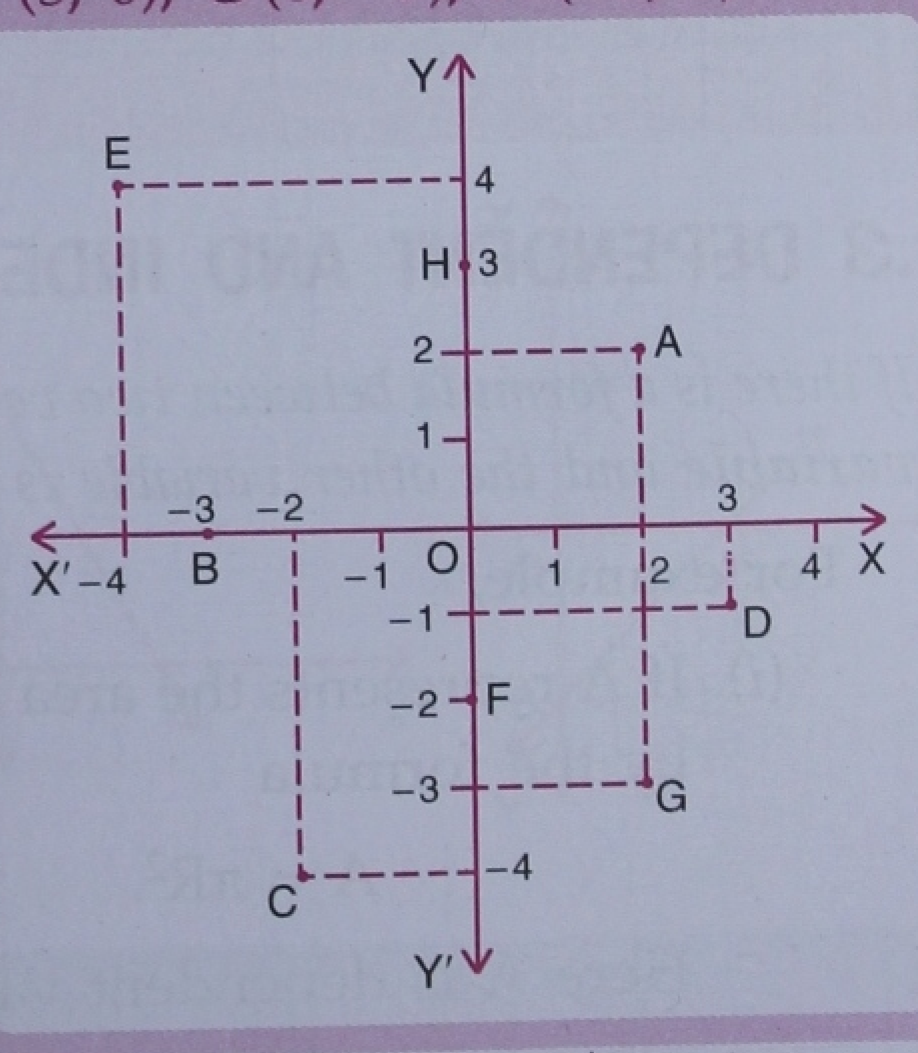
As OM = 3 units and BM = $2\sqrt{3}$ units, therefore, coordinates of A are $(3, 2\sqrt{3})$.

Exercise 21.1

1. Find the coordinates of points whose
   (*i*) abscissa is 3 and ordinate –4.
   (*ii*) abscissa is $-\frac{3}{2}$ and ordinate 5.
   (*iii*) whose abscissa is $-1\frac{2}{3}$ and ordinate $-2\frac{1}{4}$.
   (*iv*) whose ordinate is 5 and abscissa is –2.
   (*v*) whose abscissa is –2 and lies on *x*-axis.
   (*vi*) whose ordinate is $\frac{3}{2}$ and lies on *y*-axis.

2. Plot the following points on the same graph paper :
   A (3, 4), B (–3, 1), C (1, –2), D (–2, –3), E (0, 5), F (5, 0), G (0, –3), H (–3, 0).

3. Write the coordinates of the points A, B, C, D, E, F, G and H shown in the adjacent figure.



4. In which quadrants are the points A, B, C and D of problem 3 located?

5. Plot the following points on the same graph paper :

$A\left(2, \frac{5}{2}\right)$, $B\left(-\frac{3}{2}, 3\right)$, $C\left(\frac{1}{2}, -\frac{3}{2}\right)$ and $D\left(-\frac{5}{2}, -\frac{1}{2}\right)$.

6. Plot the following points on the same graph paper :

$A\left(\frac{4}{3}, -1\right)$, $B\left(\frac{7}{2}, \frac{5}{3}\right)$, $C\left(\frac{13}{6}, 0\right)$, $D\left(-\frac{5}{3}, -\frac{5}{2}\right)$.

7. Plot the following points and check whether they are collinear or not :

(*i*) (1, 3), (−1, −1) and (−2, −3) (*ii*) (1, 2), (2, −1) and (−1, 4)

(*iii*) (0, 1), (2, −2) and $\left(\frac{2}{3}, 0\right)$.

8. Plot the point P(−3, 4). Draw PM and PN perpendiculars to *x*-axis and *y*-axis respectively. State the coordinates of the points M and N.

9. Plot the points A(1, 2), B(−4, 2), C(−4, −1) and D (1, −1). What kind of quadrilateral is ABCD? Also find the area of the quadrilateral ABCD.

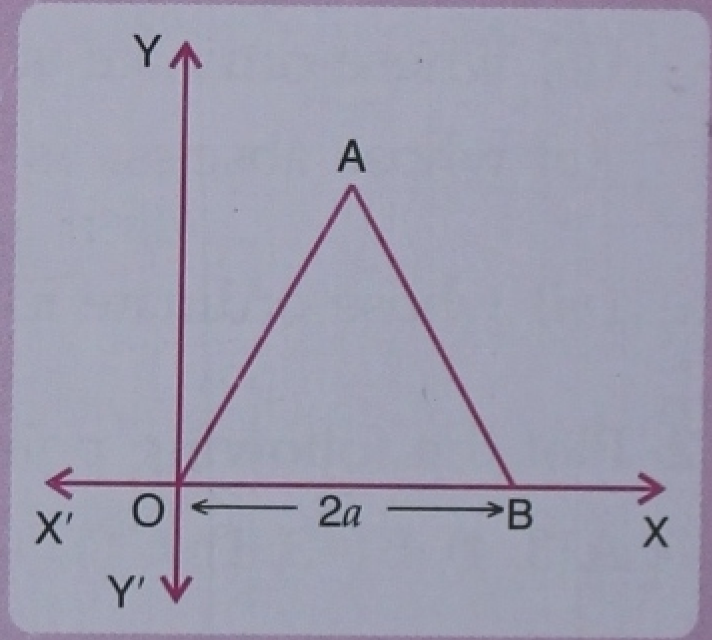
10. Plot the points (0, 2), (3, 0), (0, −2) and (−3, 0) on a graph paper. Join these points (in order). Name the figure so obtained and find the area of the figure obtained.

11. Three vertices of a square are A(2, 3), B(−3, 3) and C(−3, −2). Plot these points on a graph paper and hence use it to find the coordinates of the fourth vertex. Also find the area of the square.

12. Write the coordinates of the vertices of a rectangle which is 6 units long and 4 units wide if the rectangle is in the first quadrant, its longer side lies on the *x*-axis and one vertex is at the origin.

13. Repeat problem 11 assuming that the rectangle is in the third quadrant with all other conditions remaining the same.

14. The adjoining figure shows an equilateral triangle OAB with each side = $2a$ units. Find the coordinates of the vertices.



21.3 DEPENDENT AND INDEPENDENT VARIABLES

*If there is a formula between two variables, then the subject of the formula is called **dependent variable** and the other variable is called **independent variable**.*

For example,

(*i*) If A represents the area of a circle of radius R, then we know that A is given by the formula

$$A = \pi R^2.$$

Here A is dependent variable and R is independent variable.

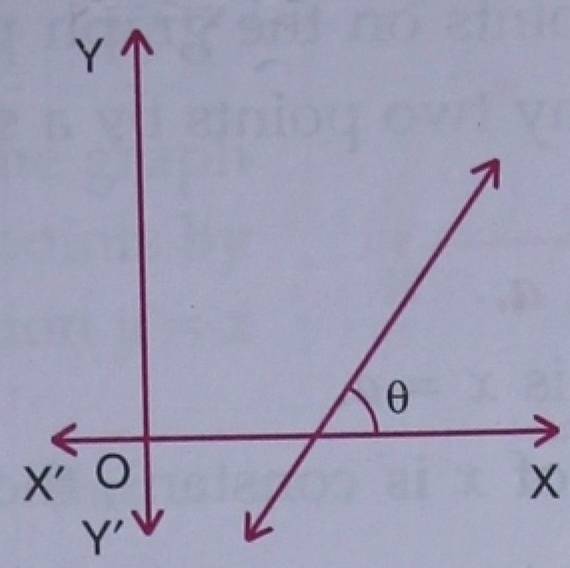
(*ii*) In the equation/formula $y = 3x + 5$, y is dependent variable and x is independent variable.

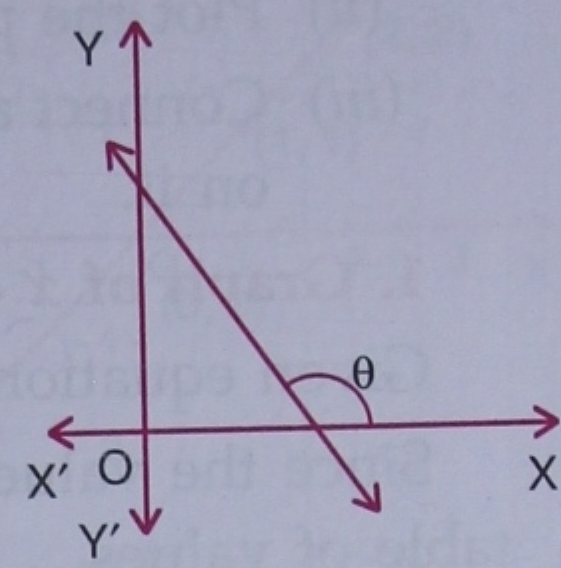
By giving different values to the independent variable, we can find the corresponding values of the dependent variable.

21.4 SOME TERMS CONNECTED WITH A STRAIGHT LINE

1. Inclination of a straight line.

The angle which a straight line makes with the positive direction of x-axis measured in the anticlockwise direction is called the ***inclination*** *(or* ***angle of inclination****) of the line. The inclination is usually denoted by* θ.





In particular :

(*i*) Inclination of a line parallel to y-axis or y-axis itself is 90°

(*ii*) Inclination of a line parallel to x-axis or the x-axis itself is 0°.

2. Horizontal, vertical and oblique lines.

(*i*) Any line parallel to x-axis is called a **horizontal line.**

(*ii*) Any line parallel to y-axis is called a **vertical line.**

(*iii*) A line which is neither parallel to x-axis nor parallel to y-axis is called an **oblique line.**

3. Slope (or gradient) of a straight line.

If $\theta\ (\neq 90°)$ *is the inclination of a line, then* $\tan\theta$ *is called its* ***slope*** *(or* ***gradient****).*

The slope of a line is usually denoted by m.

Thus, if $\theta\ (\neq 90°)$ is the inclination of a line, then $m = \tan\theta$.

Remarks

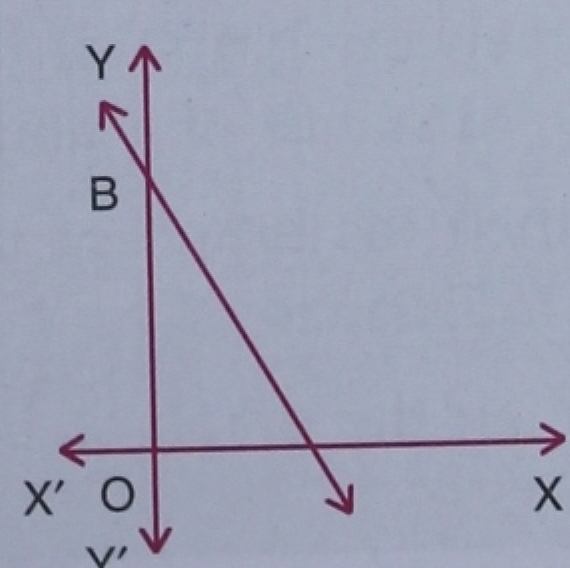
- Since the inclination of a line parallel to x-axis or the x-axis itself is 0°, the slope of a line parallel to x-axis or the x-axis itself is $m = \tan 0° = 0$.

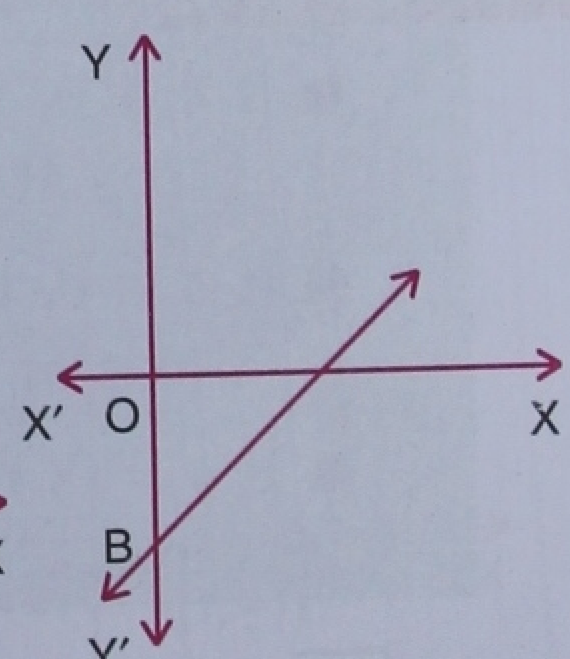
  Thus, the slope of a horizontal line or the x-axis is zero.
- Since $\tan\theta$ is not defined when $\theta = 90°$, slope of a vertical line is not defined.

4. Intercept made by a line on y-axis.

If a straight line meets y-axis at point B (as shown in the adjoining figure), then *OB is called y-intercept or the intercept made by the line on y-axis.*

The y-intercept is usually denoted by c. y-intercept is considered positive if it is measured above the origin and negative if it is measured below the origin.





Remark

A vertical line has no y-intercept.

APC

21.5 GRAPHS OF LINEAR EQUATIONS

Graph of every linear equation in two variables is a straight line.

To draw graphs of linear equations in two variables x and y, proceed as under :

(*i*) Make a table of values. Choose three values of x and find the corresponding values of y from the given linear equation. As far as possible, take the integral values of x.

(*ii*) Plot the points on the graph paper (coordinate plane).

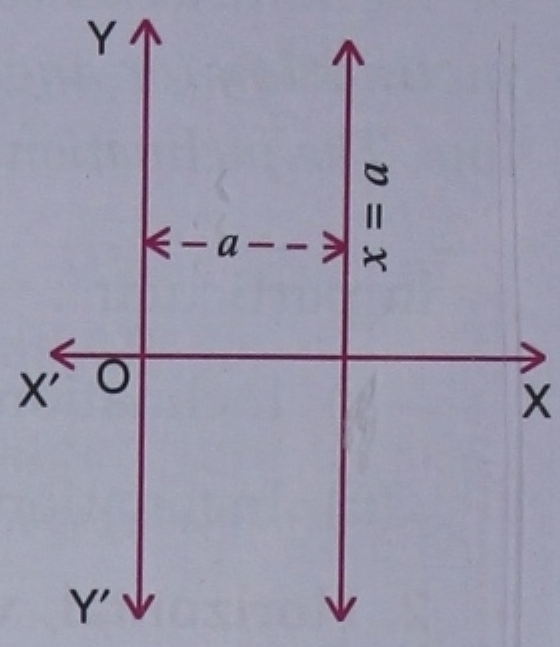
(*iii*) Connect any two points by a straight line and check that the third point lies on it.

1. Graph of $x = a$.

Given equation is $x = a$.

Since the value of x is constant, there is no need of table of values.

The graph of $x = a$ is a straight line parallel to y-axis (shown in the adjoining figure).



Remarks

- If $a > 0$, then the graph of the equation $x = a$ is a straight line parallel to y-axis at a distance a units to the right of y-axis.
- If $a < 0$, then the graph of the equation $x = a$ is a straight line parallel to y-axis at a distance $|a|$ units to the left of y-axis.
- If $a = 0$, then the graph of the equation $x = a$ *i.e.* $x = 0$ coincides with the y-axis.

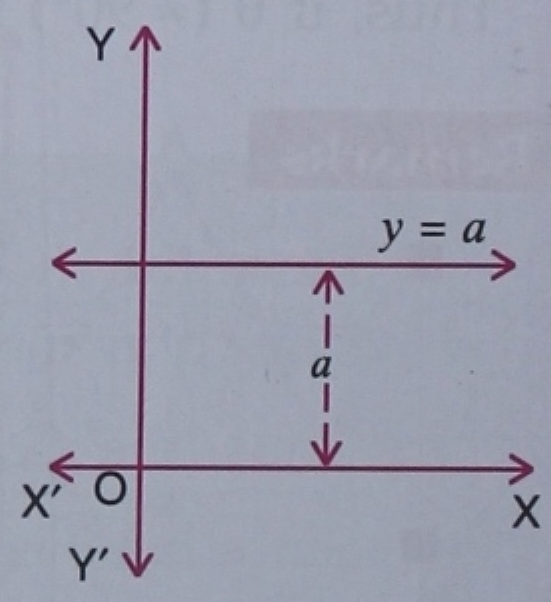
Hence the graph of x = 0 is the y-axis.

2. Graph of $y = a$.

Given equation is $y = a$.

Since the value of y is constant, there is no need of table of values.

The graph of $y = a$ is a straight line parallel to x-axis (shown in the adjoining figure).



Remarks

- If $a > 0$, then the graph of the equation $y = a$ is a straight line parallel to x-axis at a distance of a units above the x-axis.
- If $a < 0$, then the graph of the equation $y = a$ is a straight line parallel to x-axis at a distance of $|a|$ units below the x-axis.
- If $a = 0$, then the graph of the equation $y = a$ *i.e.* $y = 0$ coincides with the x-axis.

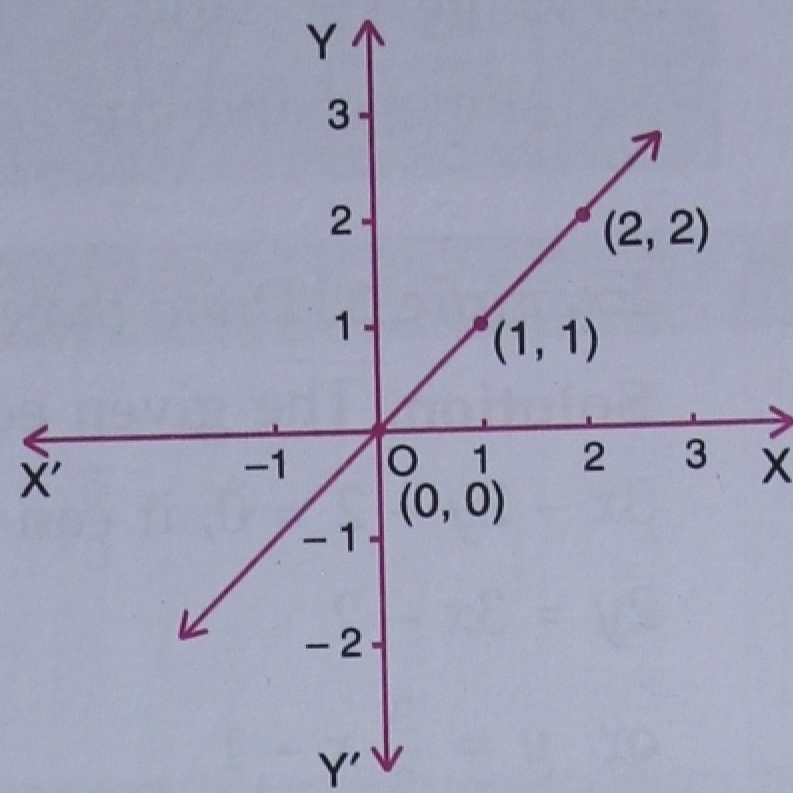
Hence the graph of y = 0 is the x-axis.

3. Graph of $y = x$.

Given equation is $y = x$, by giving suitable arbitrary values to x, find the corresponding values of y from the given equation. When $x = 0, y = 0$; $x = 1, y = 1$; $x = 2, y = 2$.

Table of values

x	0	1	2
y	0	1	2



Plot the points (0, 0), (1, 1) and (2, 2) on the graph paper (coordinate plane). Connect any two points by a straight line. The graph of the given equation $y = x$ is shown in the adjoining figure.

Observe that the third point lies on the straight line.

Remark

The graph of the equation $y = x$ is the bisector of $\angle XOY$.

4. Graph of $y = mx + c$.

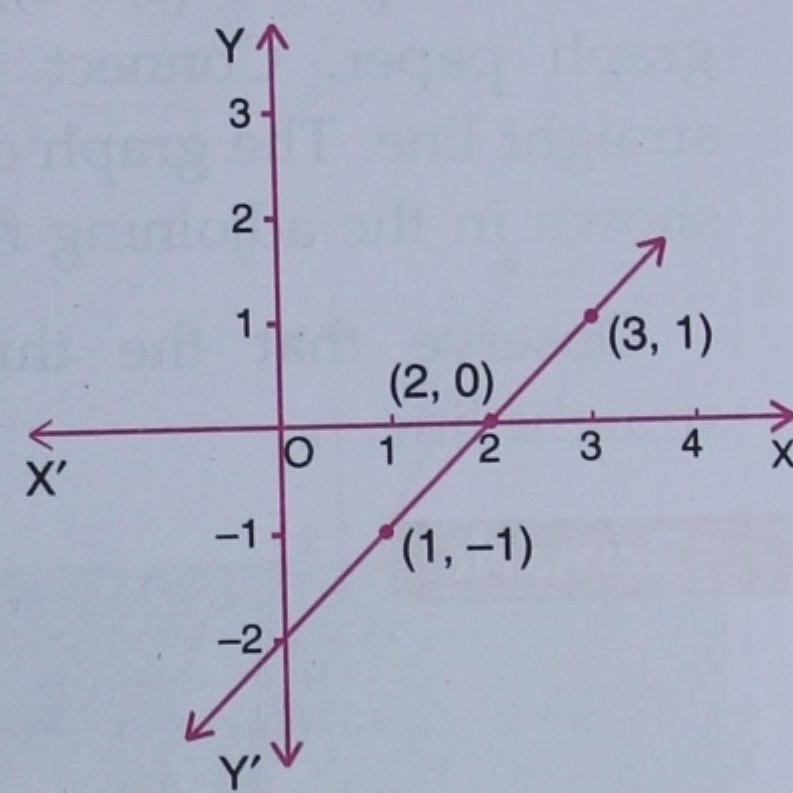
Study the following examples :

Example 1. *Draw the graph of $y = x - 2$.*

Solution. Given equation is $y = x - 2$.

Table of values

x	1	2	3
y	– 1	0	1



Plot the points (1, –1), (2, 0) and (3, 1) on the graph paper. Connect any two points by a straight line. The graph of the given equation is shown in the adjoining figure.

Observe that the third point lies on the straight line.

Remark

The equation $y = x - 2$ is of the form $y = mx + c$.

Here $m = 1$ and $c = -2$

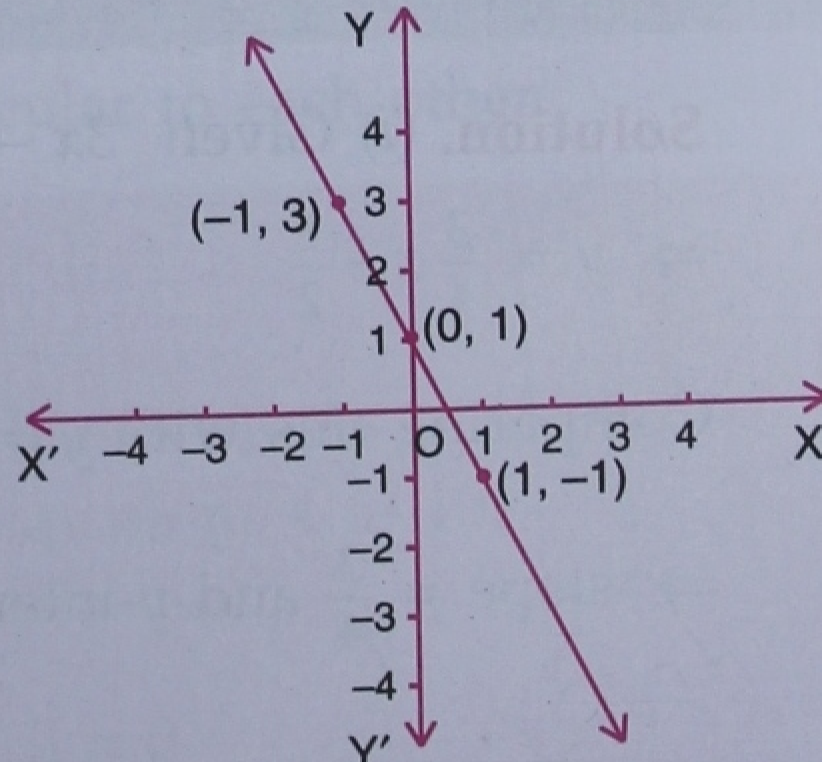
i.e. slope of the line = 1 and y-intercept = –2.

Example 2. *Draw the graph of $y = -2x + 1$.*

Solution. The given equation is $y = -2x + 1$.

Table of values

x	0	1	– 1
y	1	– 1	3



Plot the points (0, 1), (1, –1) and (–1, 3) on the graph paper. Connect any two points by a straight line. The graph of the given equation is shown in the adjoining figure.

Observe that the third point lies on the straight line.

Remark

The equation $y = -2x + 1$ is of the form $y = mx + c$.

Here $m = -2$ and $c = 1$

i.e. slope of the line $= -2$ and y-intercept $= 1$.

Example 3. *Draw the graph of $3x - 2y - 2 = 0$.*

Solution. The given equation is

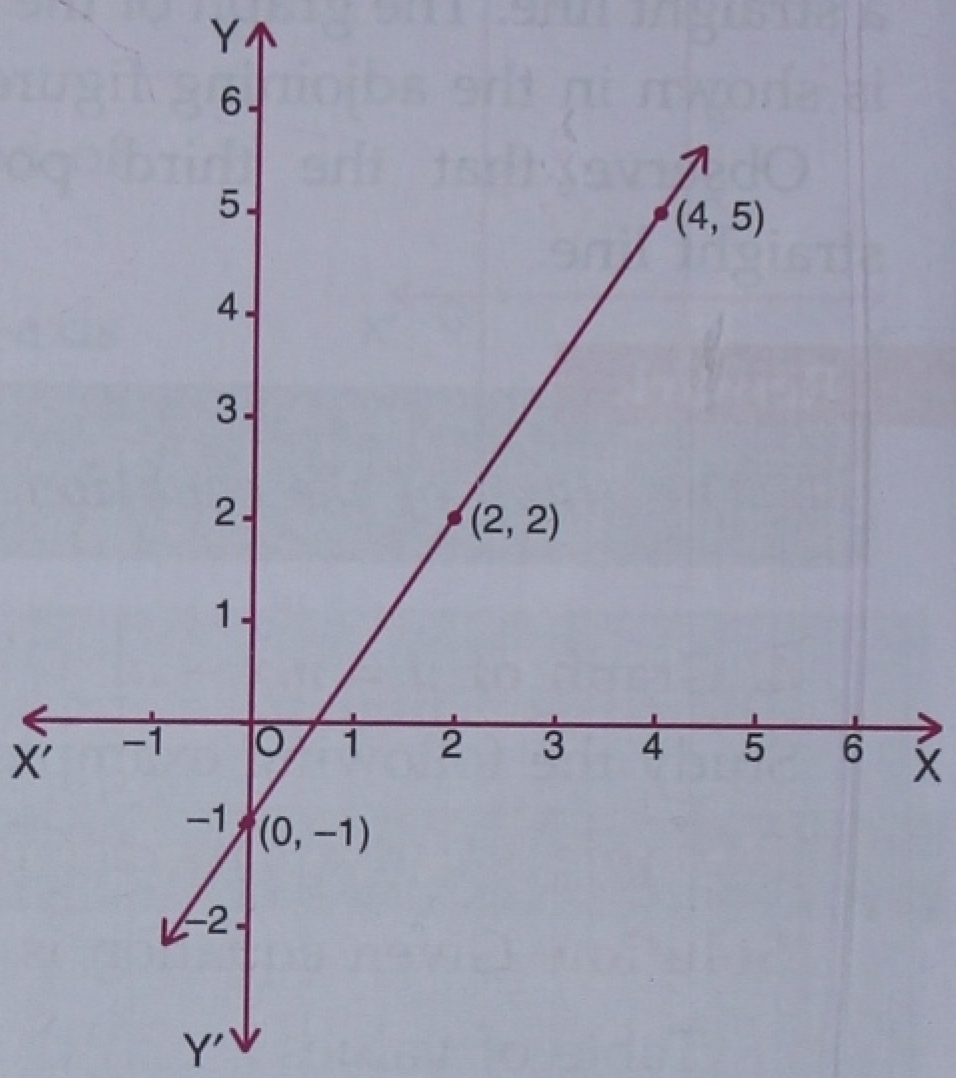
$3x - 2y - 2 = 0$, it can be written as

$2y = 3x - 2$

or $y = \frac{3}{2}x - 1$ $\quad$ ($y = mx + c$ form)

Table of values

x	0	2	4
y	-1	2	5



Plot the points $(0, -1)$, $(2, 2)$ and $(4, 5)$ on the graph paper. Connect any two points by a straight line. The graph of the given equation is shown in the adjoining figure.

Observe that the third point lies on the straight line.

Remark

The equation $y = \frac{3}{2}x - 1$ is of the form $y = mx + c$.

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

i.e. slope of the line $= \frac{3}{2}$ and y-intercept $= -1$.

Example 4. *Find the slope and the y-intercept of each of the following lines which are the graphs of :*

(i) $3x - 4y + 2 = 0$ $\quad$ *(ii)* $2x + 5y - 9 = 0$ $\quad$ *(iii)* $3y + 5 = 0$.

Solution. (*i*) Given $3x - 4y + 2 = 0 \Rightarrow 4y = 3x + 2$

$\Rightarrow y = \frac{3}{4}x + \frac{1}{2}$.

Comparing this with $y = mx + c$, we get $m = \frac{3}{4}$ and $c = \frac{1}{2}$

$\Rightarrow$ slope $= \frac{3}{4}$ and y-intercept $= \frac{1}{2}$.

(*ii*) Given $2x + 5y - 9 = 0 \Rightarrow 5y = -2x + 9$

$\Rightarrow y = -\frac{2}{5}x + \frac{9}{5}$.

Comparing this with $y = mx + c$, we get $m = -\frac{2}{5}$ and $c = \frac{9}{5}$

$\Rightarrow$ slope $= -\frac{2}{5}$ and y-intercept $= \frac{9}{5}$.

(*iii*) Given $3y + 5 = 0 \Rightarrow y = -\frac{5}{3}$.

It can be written as $y = 0.x - \frac{5}{3}$.

Comparing it with $y = mx + c$, we get $m = 0$ and $c = -\frac{5}{3}$

$\Rightarrow$ slope $= 0$ and y-intercept $= -\frac{5}{3}$.

Example 5. *Draw the graph of the following equations (on the same graph paper) :*

(i) $y = 2x + 1$ *(ii)* $x + 2y + 3 = 0$.

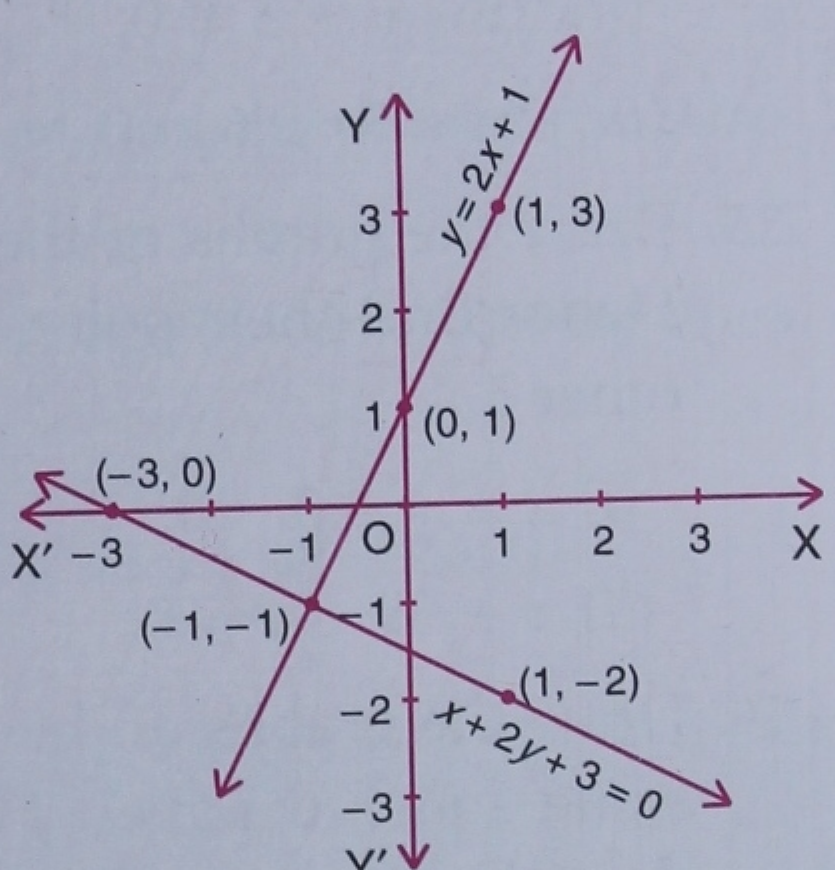
Hence find their point of intersection. Are these lines perpendicular to each other?

Solution. (*i*) Given equation is $y = 2x + 1$.

Table of values

x	0	1	–1
y	1	3	–1

Plot the points (0, 1), (1, 3) and (–1, –1). Connect any two points by a straight line. The graph is shown in the adjoining figure.



(*ii*) Given equation is $x + 2y + 3 = 0$, it can be written as

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

Table of values

x	1	–1	–3
y	–2	–1	0

Plot the points (1, –2), (–1, –1) and (–3, 0). Connect any two points by a straight line. The graph is shown in the above figure.

The lines intersect at the point (–1, –1). It may be checked by substitution.

From the figure we see that the lines are perpendicular to each other.

Exercise 21.2

Draw the graph of each of the following (1 to 10) linear equations. Also find slope and y-intercept of the lines represented by equations 4 to 10.

1. (*i*) $x = 0$ (*ii*) $y = 0$.

2. (*i*) $x + 5 = 0$ (*ii*) $2x + 3 = 0$.

3. (*i*) $y + 5 = 0$ (*ii*) $3y - 5 = 0$.

4. (*i*) $y = 2x$ (*ii*) $y = -5x$.

5. (*i*) $3x + y = 0$ (*ii*) $2y - 3x = 0$.

6. (*i*) $3y + 5x = 0$ (*ii*) $5y + 2x = 0$.

7. (*i*) $y = 2x + 3$ (*ii*) $x + y + 1 = 0$.

8. (*i*) $3x + y - 5 = 0$ (*ii*) $5x - y + 7 = 0$.

9. (*i*) $2x + 2y - 3 = 0$ (*ii*) $x + 2y + 1 = 0$.

10. (*i*) $2x - 3y + 5 = 0$ (*ii*) $3x + 4y - 12 = 0$.

11. Find the slope and the y-intercept of each of the following lines which are the graphs of :

(*i*) $5x - 3y - 6 = 0$ (*ii*) $4x + 3y - 7 = 0$ (*iii*) $5y - 4 = 0$.

12. Draw the graph of $2x - 3y + 6 = 0$. Hence find the coordinates of points where the graph (line) meets the coordinate axes.

13. Draw the graph of $4x - 3y + 12 = 0$. From the graph find the value of

(*i*) y when $x = -3, 3$ (*ii*) x when $y = 4, -4$.

14. Draw the graph of the following pairs of lines on the same squared paper and hence check whether they are parallel or not :

(*i*) $y = 5x + 1$, $y = 5x - 3$

(*ii*) $2x - y + 3 = 0$, $x - 2y + 1 = 0$

(*iii*) $2x + 3y - 6 = 0$, $2x + 3y + 6 = 0$.

15. Draw the graphs of the following pairs of lines on the same squared paper. Hence find their point of intersection. Are these lines perpendicular to each other ?

(*i*) $x + y - 3 = 0$, $x - y + 7 = 0$

(*ii*) $x + 3y - 4 = 0$, $3x - y - 2 = 0$.

16. Draw the graphs of the linear equations $x = -2$, $x = 5$, $y = 0$ and $y = 4$ on the same squared paper. Hence find the area of the quadrilateral enclosed by these lines.

CHAPTER TEST

1. A, B and C are three points whose coordinates are (2, 4) (– 3, – 2) and (2, k) respectively such that $\angle ACB = 90°$. Find k. Also find the area of Δ ABC.

2. Three vertices of a rectangle are A (2, –1), B (2, 7) and C (4, 7). Plot these points on a graph and hence use it to find the coordinates of the fourth vertex D. Also find the coordinates of
   (*i*) the mid-point of BC
   (*ii*) the mid-point of CD
   (*iii*) the point of intersection of the diagonals.
   What is the area of the rectangle ?

3. Three vertices of a parallelogram are A (3, 5) B (3, –1) and C (–1, –3). Plot these points on a graph paper and hence use it to find the coordinates of the fourth vertex D. Also find the coordinates of the mid-point of the side CD. What is the area of the parallelogram ?

Hint

Height of the parallelogram corresponding to the side CD is 4 units.

4. Draw the graphs of the following linear equations :
   (*i*) $y = 2x - 1$ (*ii*) $2x + 3y = 6$ (*iii*) $2x - 3y = 4$.
   Also find slope and y-intercept of these lines.

5. If the slope of the graph of $3y - ax + 5 = 0$ is 2, then find the value of a. Also find the y-intercept.

6. Find the slope, the inclination and the y-intercept of each of the following lines which are the graphs of :
   (*i*) $x - y + 2 = 0$ (*ii*) $\sqrt{3}x - y + 5 = 0$ (*iii*) $\sqrt{3}y - x + 4 = 0$.

Hint

(*a*) $x - y + 2 = 0 \Rightarrow y = x + 2$.
Here $m = 1 \Rightarrow \tan\theta = 1 \Rightarrow \theta = 45°$.

7. Draw the graph of the equation $3x - 4y = 12$. From the graph, find
   (*i*) the value of y when $x = -4$
   (*ii*) the value of x when $y = 3$.

8. Draw the graphs of the equations $2x + y - 3 = 0$ and $3x + 2y - 4 = 0$ on the same graph paper. Hence find their point of intersection. Are these lines perpendicular to each other ?