

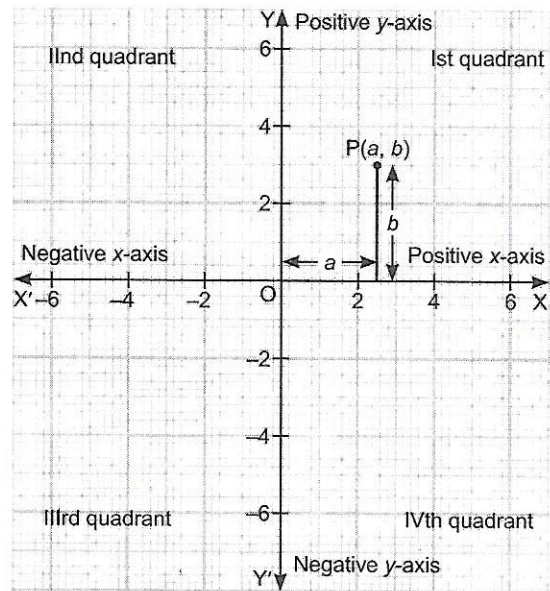
COORDINATE GEOMETRY

Coordinate Geometry

- **Coordinate geometry:** It provides a link between algebra and geometry through graphs of lines and curves. This enables the geometrical problems solved algebraically by using coordinate system, i.e. provides a geometric insight into algebra.
- **Cartesian System:** The system used for describing the position of a point in a plane with reference to two fixed mutually perpendicular lines is termed as the Cartesian system.

In a Cartesian system,

- (i) Horizontal line XX' is called x -axis, while vertical line YY' is called y -axis. The two axes XX' and YY' are known as the coordinate axes.
- (ii) The point where these two axes intersect each other is called Origin and is denoted by O .
- (iii) Since the positive numbers lie on the directions along OX and OY , so OX and OY are called the **positive directions** of the x -axis and the y -axis respectively.
- (iv) The negative numbers lie on the directions along OX' and OY' , so OX' and OY' are called the **negative directions** of the x -axis and the y -axis respectively.
- (v) The perpendicular distance from the y -axis measured along the x -axis is called **x -coordinate** or **abscissa**.
- (vi) The perpendicular distance from the x -axis measured along the y -axis is called **y -coordinate** or **ordinate**.
- (vii) In stating the coordinates of a point in the coordinate plane, the x -coordinate comes first, and then the y -coordinate. We place the coordinates in brackets, i.e. (x, y) .
- (viii) The order of x and y is important in the coordinate (x, y) . So, (x, y) is called an ordered pair. If $x \neq y$, then the ordered pair $(x, y) \neq$ ordered pair (y, x) . But if $x = y$, then $(x, y) = (y, x)$.
- (ix) Origin has zero distance from both the axes so that its abscissa and ordinate both are zero. Therefore, the coordinates of the origin are $(0, 0)$.
- (x) The coordinates of a point on the positive x -axis are of the form $(x, 0)$ and on the negative x -axis is $(-x, 0)$.
- (xi) The coordinates of a point on the positive y -axis are of the form $(0, y)$ and on the negative y -axis is $(0, -y)$.
- (xii) The axes XX' and YY' divide the plane into four parts. These four parts are called the **quadrants** numbered I, II, III and IV in anticlockwise direction from OX as shown in the graph.
- (xiii) **Relationship between the signs of the coordinates of a point and the quadrant of a point in which it lies:**



Quadrant	Abscissa (x -coordinate)	Ordinate (y -coordinate)	Coordinate of the point (x, y)	Reason Quadrant is enclosed by
I	+	+	$(+a, +b)$	positive x -axis and positive y -axis
II	-	+	$(-a, +b)$	negative x -axis and positive y -axis
III	-	-	$(-a, -b)$	negative x -axis and negative y -axis
IV	+	-	$(+a, -b)$	positive x -axis and negative y -axis

Here, '+' denotes a positive real number, while '-' represents a negative real number.

- (xiv) The plane consists of the axes and quadrants, are known as **Cartesian plane**, or the **coordinate plane**, or the **xy -plane**.
- (xv) The equation of x -axis is $y = 0$ and that of y -axis is $x = 0$.



SOLVED QUESTIONS BASED ON EXERCISES 3.1, 3.2 AND 3.3

Very Short Answer Type Questions [1 Mark]

- While writing the coordinates of a point, which coordinate comes first: y -coordinate or x -coordinate? [CBSE 2014]
Sol. x -coordinate.
- A policeman and a thief are equidistant from the jewel box. Upon considering jewel box as origin, the position of policeman is $(0, 5)$. If the ordinate of the position of thief is zero, then write the coordinates of the position of thief. [CBSE 2013]
Sol. Since both policeman and thief are equidistant from the jewel box (origin), so coordinates of the position of thief are $(5, 0)$ or $(-5, 0)$.
- Write two points lying on the x -axis, which are at equal distances from the origin. [CBSE 2014]
Sol. $P(4, 0)$ and $Q(-4, 0)$ or $P(5, 0)$ and $Q(-5, 0)$
 Note: Answer may differ.
- If $(a, b) = (0, 22)$, then find the value of a and b . [CBSE 2014]
Sol. Here the ordered pairs are equal.
 $\therefore a = 0$ and $b = 22$
- What do you mean by the ordinate of a point? [CBSE 2014]
Sol. Ordinate of a point is equal to the perpendicular distance from the x -axis measured along the y -axis.
- In which quadrant, the points $P(2, -3)$ and $Q(-3, 2)$ lie? [CBSE 2014]
Sol. $P(2, -3)$ lies in IVth quadrant and $Q(-3, 2)$ lies in IInd quadrant.
- Find the perpendicular distance of the point $P(5, 7)$ from the y -axis [CBSE 2014]
Sol. It is equal to 5 units.
- The point $P(a, b)$ lies in the IVth quadrant. Which is greater: a or b ? [CBSE 2014]
Sol. In the IVth quadrant, abscissa (x -coordinate) is positive and ordinate (y -coordinate) is negative.
 Hence, abscissa $>$ ordinate, i.e. $a > b$.
- Write any two points lying in the second quadrant. [CBSE 2014]
Sol. $P(-4, 5)$, $Q(-3, 8)$
 Note: Answer may be differ
- Write the coordinate of a point whose abscissa is -7 and ordinate is 2 .
Sol. $(-7, 2)$ as abscissa represents x -coordinate, while ordinate is y -coordinate.

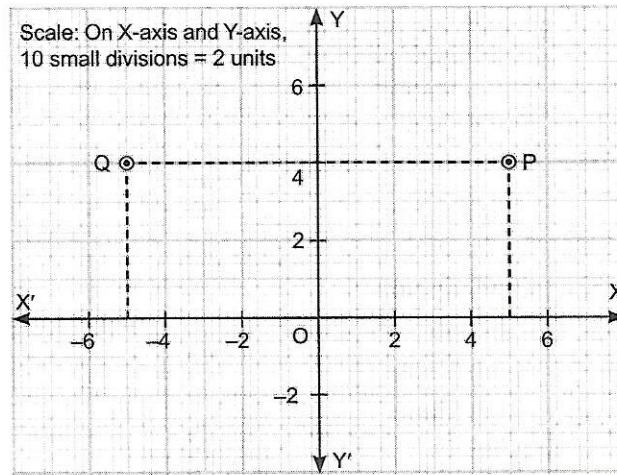
Short Answer Type Questions I [2 Marks]

- In which quadrant, will the point lies, if
 - the ordinate is 2 and the abscissa is -3
 - the abscissa is -4 and the ordinate is -2
 - the ordinate is -3 and the abscissa is 4
 - the ordinate is 3 and the abscissa is -2 [CBSE 2014]

- Sol. (i) Here, abscissa is negative and ordinate is positive, so the point is $(-3, 2)$. Hence it lies in IInd quadrant.
(ii) Here, abscissa and ordinate both are negative, the point is $(-4, -2)$, which lies in IIIrd quadrant.
(iii) Here, abscissa is positive and ordinate is negative. Therefore, the point $(4, -3)$ lies in IVth quadrant.
(iv) Here, abscissa is negative and ordinate is positive. Therefore, the point $(-2, 3)$ lies in IInd quadrant.

12. A point is at a distance of 4 units from the x -axis and 5 units from the y -axis. Represent the position of the point in the Cartesian plane and also write its coordinates. [CBSE 2015]

Sol.



The position of point is shown in the above graph. Two points are observed in the Cartesian plane. Hence, coordinates of points are $P(5, 4)$ and $Q(-5, 4)$ respectively.

13. If the coordinates of two points are $P(-2, 3)$ and $Q(-3, 5)$, then find (abscissa of P) – (abscissa of Q). [CBSE 2016]

Sol. The abscissa (x -coordinate) of point P is (-2) and that of Q is (-3) .
 \therefore (Abscissa of P) – (abscissa of Q) = $(-2) - (-3) = -2 + 3 = 1$ unit.

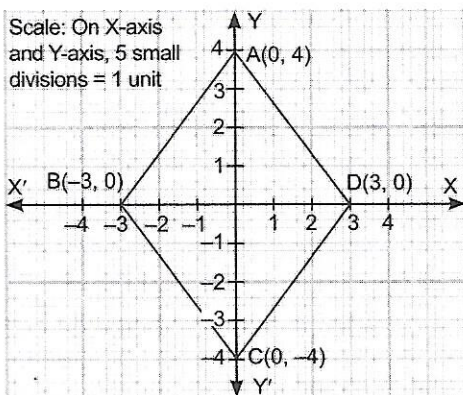
14. Find the distance of the following points from the y -axis: $P(3, 0)$, $Q(0, -3)$, $R(22, -5)$, $S(-3, -1)$.

Sol. Distance of the point from the y -axis is the x -coordinate of the given point. So, the distances of points P , Q , R and S from the y -axis are 3 units, 0 unit, 22 units and -3 units (negative sign indicates that the distance is measured along negative x -axis) respectively.

Short Answer Type Questions II [3 Marks]

15. (i) Plot the points $A(0, 4)$, $B(-3, 0)$, $C(0, -4)$, $D(3, 0)$
(ii) Name the figure obtained by joining the points A , B , C and D .
(iii) Also, name the quadrants in which sides AB and AD lie. [CBSE 2011]

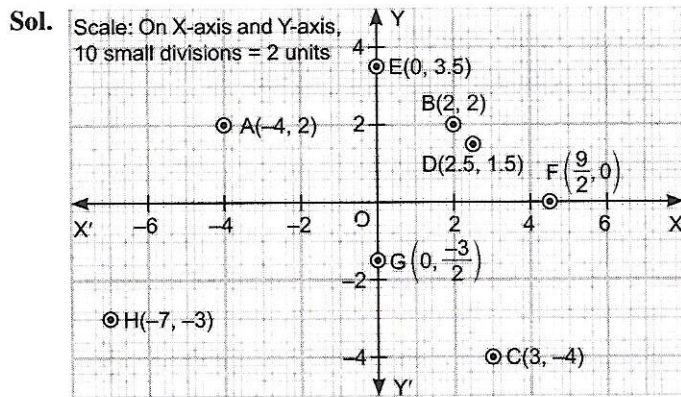
Sol.



(ii) Rhombus

(iii) IInd, Ist

16. Locate the points A(-4, 2), B(2, 2), C(3, -4), D(2.5, 1.5), E(0, 3.5), $F\left(\frac{9}{2}, 0\right)$, $G\left(0, \frac{-3}{2}\right)$ and H(-7, -3) in the Cartesian plane.

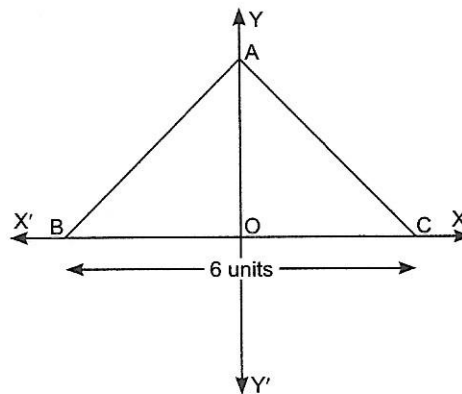


17. Write the coordinates of the following points:

- (i) lying on neither axes at a distance of 3 units from the x -axis and 5 units from the y -axis.
 (ii) lying on y -axis with the y -coordinate (-3).
 (iii) lying on the x -axis with x -coordinate 4.

Sol. (i) (5, 3) (ii) (0, -3) (iii) (4, 0)

18. Point A is chosen on y -axis in such a way that $\triangle ABC$ is an equilateral triangle. The base BC of the $\triangle ABC$ is shown in the figure. Find the coordinates of (i) the mid-point of BC (ii) the area of the triangle (iii) the vertices of a triangle. [HOTS]



Sol. (i) O is the mid-point of BC, but lies at the intersecting point of the coordinates axes. Hence, coordinates of mid-point of BC is (0, 0).

(ii) Given $\triangle ABC$ is an equilateral triangle.

$$\therefore AB = BC = CA = 6 \text{ units}$$

O is the perpendicular bisector of BC

$$\therefore OB = \frac{1}{2} BC = \frac{1}{2} \times 6 = 3 \text{ units}$$

Using Pythagoras theorem, in right-angled $\triangle AOB$ with $\angle O = 90^\circ$, we have

$$AB^2 = OB^2 + AO^2$$

$$\Rightarrow AO^2 = AB^2 - OB^2 = 6^2 - 3^2 = 36 - 9 = 27$$

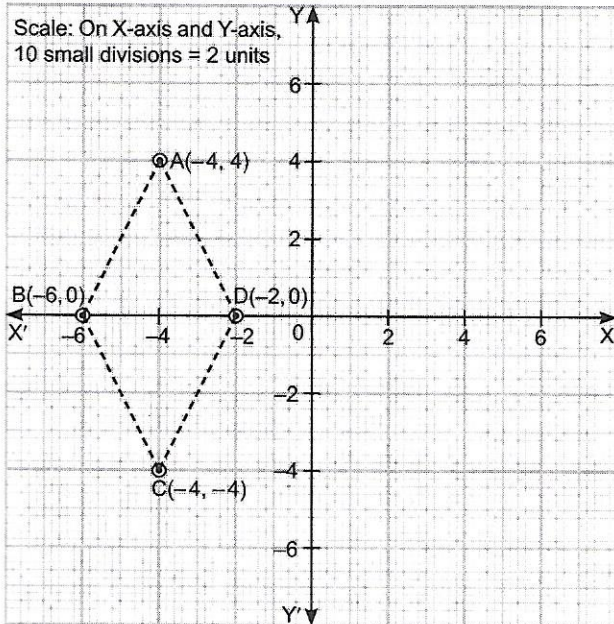
$$\therefore AO = \sqrt{27} = 3\sqrt{3} \text{ units}$$

$$\text{So, area of } \triangle ABC = \frac{1}{2} \times \text{Base} \times \text{Altitude} = \frac{1}{2} \times BC \times AO = \frac{1}{2} \times 6 \times 3\sqrt{3} = 9\sqrt{3} \text{ sq. units}$$

(iii) The coordinates of vertices of $\triangle ABC$ are A(0, $3\sqrt{3}$), B(-3, 0) and C(3, 0).

Long Answer Type Questions [4 Marks]

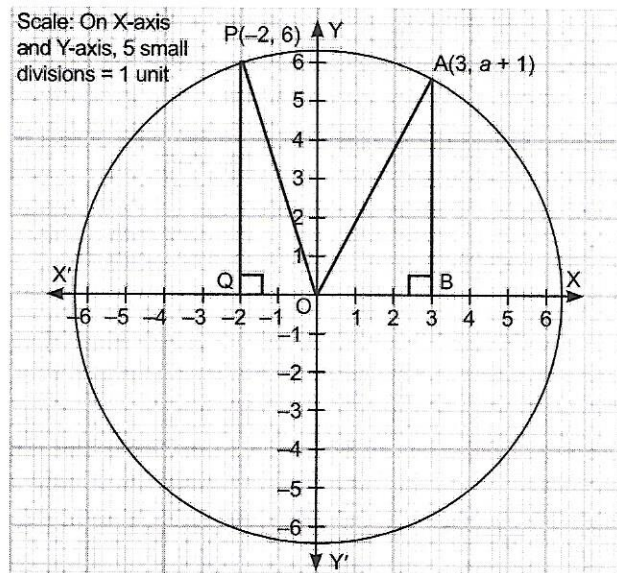
19. (i) Plot the following points in the coordinate plane: $A(-4, 4)$, $B(-6, 0)$, $C(-4, -4)$, $D(-2, 0)$
 (ii) Name the figure formed by joining the points A, B, C and D and also find its area. [CBSE 2011]



(ii) Rhombus

$$\begin{aligned}
 \text{Area of rhombus ABCD} &= \frac{1}{2} \times (\text{Product of its two diagonals}) \\
 &= \frac{1}{2} \times BD \times AC \\
 &= \frac{1}{2} \times 4 \times 8 = 16 \text{ sq units}
 \end{aligned}$$

20. Given area $(\Delta OAB) = \text{area} (\Delta OPQ)$. Find the ordinate of point A. [CBSE 2011; HOTS]



Sol. Coordinates of point P are $(-2, 6)$

\therefore In $\triangle OPQ$,

OQ = 2 units and

PQ = 6 units

In $\triangle OAB$,

OB = 3 units

and

AB = $(a + 1)$ units

Given:

area($\triangle OAB$) = area($\triangle OPQ$)

\Rightarrow

$$\frac{1}{2} \times OB \times AB = \frac{1}{2} \times OQ \times PQ$$

[Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$]

\Rightarrow

$$\frac{1}{2} \times 3 \times (a + 1) = \frac{1}{2} \times 2 \times 6 = 6$$

\Rightarrow

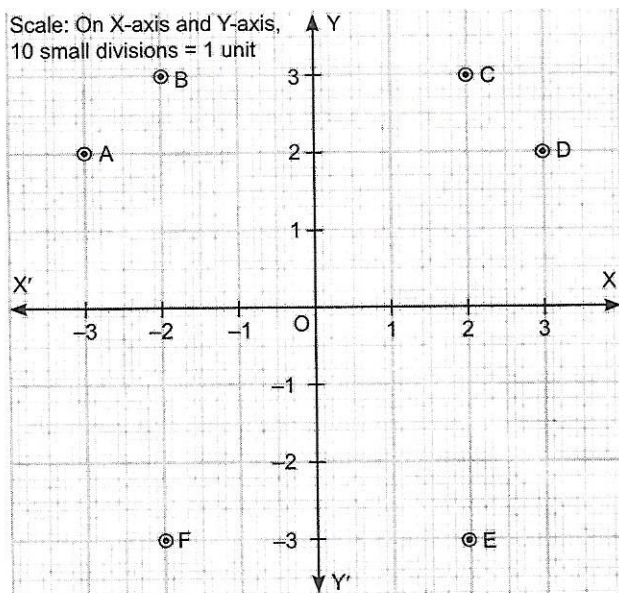
$$a + 1 = \frac{6 \times 2}{3} = 4$$

\therefore Ordinate of point A = $a + 1 = 4$



PRACTICE QUESTIONS BASED ON EXERCISES 3.1, 3.2 AND 3.3

- Which of the following points lie on the x -axis and which on the y -axis?
 $(1, 1), (0, -3), (-2, 0), (-1, 1), (0, 5), (6, 0)$
- What is the sign of x -coordinate of a point lying in third quadrant?
- Which of the following points lies on the x -axis?
 $A(0, 4), B(1, 0), C(0, -7)$ and $D(-5, 0)$
- If a point lies on the y -axis, then what will be its abscissa?
- Check whether the points $P(3, 5)$ and $Q(-3, -5)$ lie in the same quadrant or not?
- If the perpendicular distance of a point A from the x -axis is 6 units and foot of perpendicular lies on the negative direction of the x -axis, then write the ordinate of point A.
- In the given figure, identify the point whose coordinates is $(-3, 2)$.

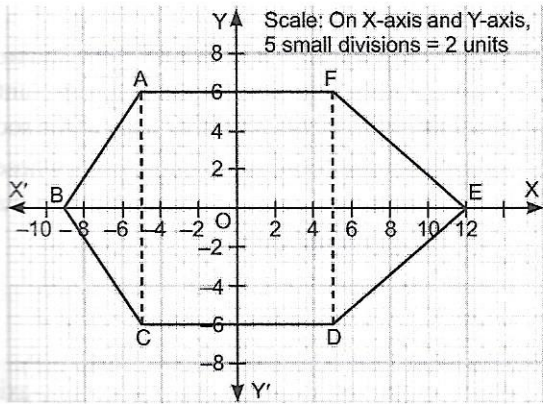


- Which whole number represents the y -coordinate of any point lying on the x -axis?
- Name the point where the two coordinate axes meet?
- If the coordinates of two points P and Q are $(2, -3)$ and $(-6, 5)$ respectively, then find the value of $(y\text{-coordinate of P}) - (y\text{-coordinate of Q})$.
- Plot the points $P(-1, -1), Q(2, 3)$ and $R(8, 11)$. Show that they are collinear. [CBSE 2011]
- Find the coordinates of a point:
 - whose ordinate is 6 and lies on the y -axis
 - whose abscissa is -3 and lies on the x -axis. [CBSE 2011]
- Which of the following points lies on the x -axis and which on the y -axis?
 $A(0, 2), B(5, 6), C(-3, 0), D(0, -3), E(0, 4), F(6, 0), G(3, 0)$ [CBSE 2011]
- Plot a point A $(-2, -3)$ and draw AP and AQ as perpendiculars to the x -axis and y -axis respectively. Write the coordinates of points P and Q.
- Write abscissa of the following points: $(4, 0), (5, 23), (23, 4)$ and $(0, 24)$. [CBSE 2016]
- Draw a quadrilateral whose vertices are: $(3, 2), (2, 3), (-4, 5)$ and $(5, -3)$. [CBSE 2014]
- In which quadrant the following points lie?
 $(3, 2), (2, -3), (-4, 4)$ and $(-2, -3)$
- Write the equation of the x -axis, the y -axis and the coordinates of the point where these two coordinate axes intersect each other.
- Plot the points $A(-2, 3), B(-2, 0), C(2, 0)$ and $D(2, 6)$ on the graph paper. Join them consecutively and find the lengths of AC and AD.
- $P(3, 2)$ and $Q(7, 7)$ are two points. Perpendiculars are drawn to the x -axis from P and Q meeting the x -axis at L and M respectively.

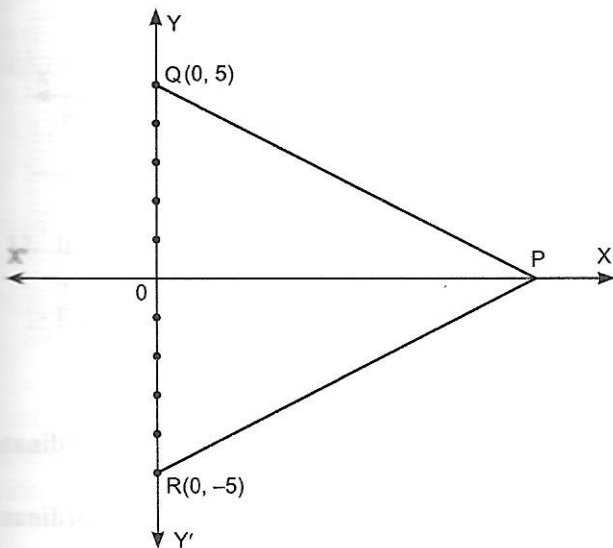
(i) Find the coordinates of L and M.

(ii) Find the lengths of LM. [CBSE 2014]

21. Write the coordinates of the point A, B, C, D, E and F of the figure formed on the graph. Also, write coordinates of the points of intersection of AC and DF with the x-axis.



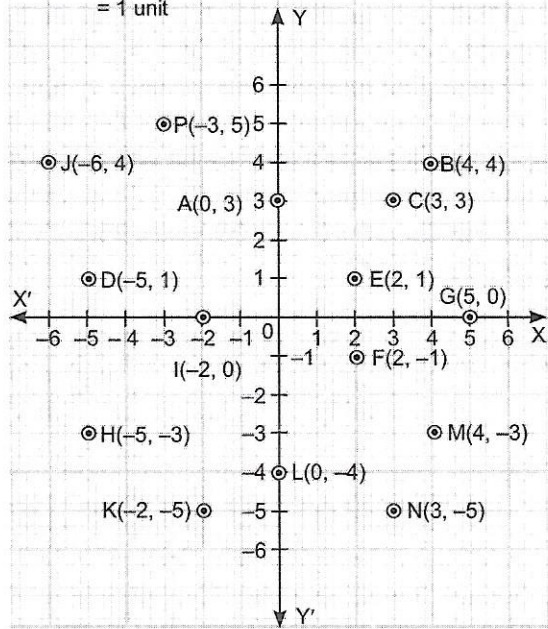
22. (i) Plot the points $A(-5, -2)$, $B(-2, -2)$, $C(6, 4)$ and $D(0, 4)$.
 (ii) Join the points to get AB, BC, CD and DA. Name the figure so obtained.
 (iii) Find the coordinates of a point where the line AB intersects the y-axis.
23. In the given figure, ΔPQR is an equilateral triangle with coordinates of Q and R as $(0, 5)$ and $(0, -5)$ respectively. Find the coordinates of vertex P. [HOTS]



24. From the figure, answer the following:
 (i) write the points whose abscissa is 0.
 (ii) write the points whose ordinate is 0.
 (iii) write the points whose abscissa is -5.

[NCERT Exemplar]

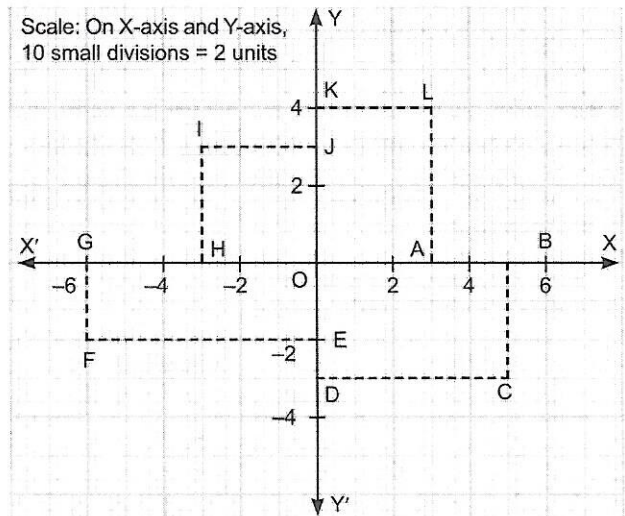
Scale: On X-axis and Y-axis, 5 small divisions = 1 unit



25. Plot the points $A(0, 3)$, $B(5, 3)$, $C(4, 0)$ and $D(-1, 0)$ on the graph paper. Identify the figure ABCD and find whether the point $E(2, 2)$ lies inside the figure or not? [HOTS]

Value Based Questions

1. Consider the following figure and answer the following questions:



- (i) Find the coordinates of point F and C.
 (ii) Find the abscissa of point I.
 (iii) Find the area of rectangle IJOH. If this was dumped yard earlier and under Swachh Bharat Abhiyan, a group of students converts it into a play ground, state what values are depicted by the group of students?

- Draw points A (0, 4), B (-4, 0), C(0, -4) and D(4, 0) on a graph paper. If a student starts from point A to B, then B to C, then C to D and then D to A, find total distance travelled by him. What type of quadrilateral is formed? If this area is used for planting some trees, then how many trees can be planted assuming 10 plants can be accommodated in 10 square units area? What value can be promoted among students?
- A traffic police signal board is in the shape of a triangle marked with "SCHOOL AHEAD" displayed on the road side. The vertices of this triangle are R(-3a, 0), Q(3a, 0) and P(0, 3a√3).

- Plot these points on the graph. Join PR and PQ. What type of triangle is formed?
 - What values can the traffic police develop among the people?
- A triangular park has (5, 4), (0, 0) and (5, 0) vertices.
 - Find the area of this park by plotting them on the graph.
 - If 10 plants can be planted in one square unit area. Then, how many plants can be planted in the park. How is this beneficial to the society?
 - Write the coordinates of the point whose sign cannot be changed? What values in our life this point indicates?

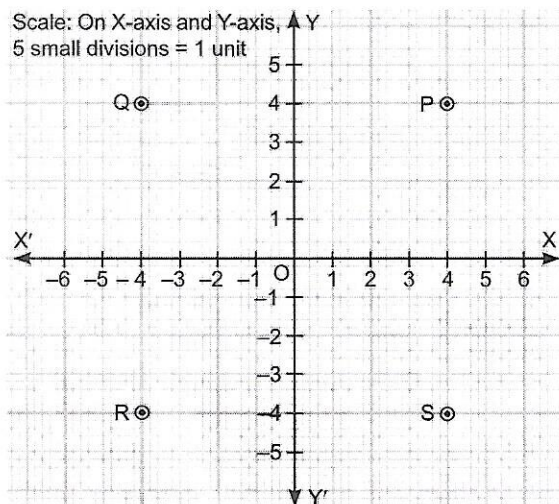
INTEGRATED EXERCISE

Very Short Answer Type Questions [1 Mark]

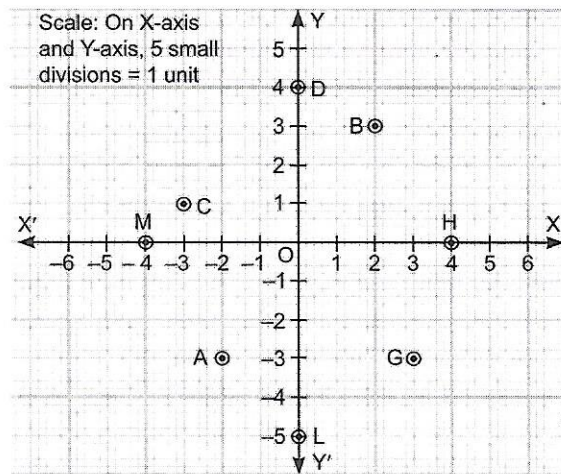
- In which quadrant, the points (-4, 2) and (2, -5) lie?
- What is the distance of point (0, -5) from the origin?
- In which quadrant, the ordinate of a point is negative?
- Out of the following points P(4, 1), Q(7, 0), R(0, 5), S(0, 3) and T(1, 0) when are plotted on the graph paper, which points lies on the x-axis?
- Plot the points O(0, 0), A(3, 0), B(3, 4) and C(0, 4) on the graph paper. State the figure formed by joining them.

Short Answer Type Questions I [2 Marks]

- Write the coordinates of points P, Q, R and S from the figure.

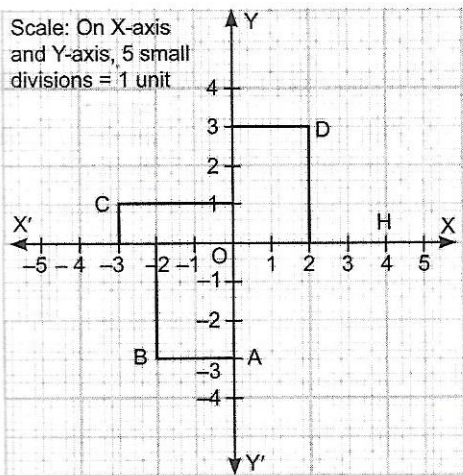


- Which of the following points lies on the y-axis?
A(1, 1), B(1, 0), C(0, 1), D(0, 0), E(0, -1), F(-1, 0), G(0, 5), H(-7, 0) and I(3, 3) [NCERT Exemplar]
- Find the coordinates of the point
 - which lies on the x-axis and the y-axis.
 - whose ordinate is -5 and which lies on y-axis.
- See the given figure and write the following:



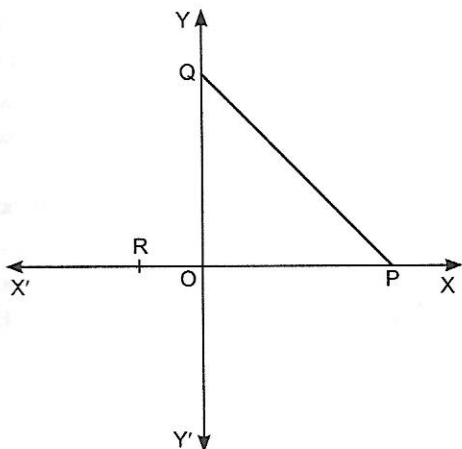
- The coordinates of B
- The coordinates of C
- The point identified by the coordinates (-2, -3)
- The point identified by the coordinates (3, -3)
- The abscissa of the point D
- The ordinates of the point H
- The coordinates of the point L
- The coordinates of the point M.

10. Write the coordinates of the points A, B, C and D given in figure.

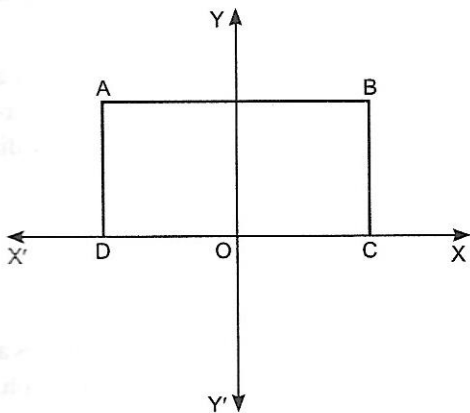


Can you find any two points which when joined by a line, then the line passes through the origin ?

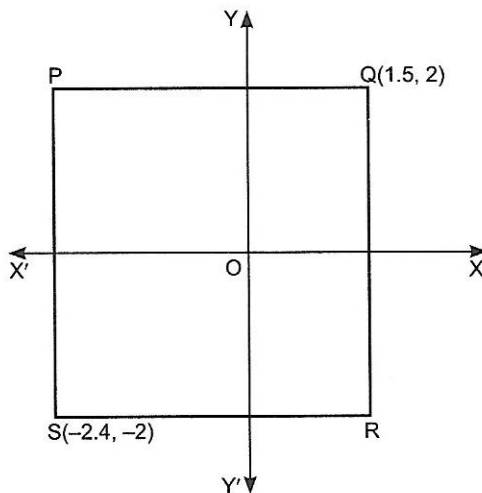
11. In the given figure, POQ is a triangle with coordinate of P and O as $(\sqrt{13}, 0)$ and $(0, 0)$ respectively. If $PQ = 7$, find the coordinate of Q. [HOTS]



12. In the given figure, ABCD is a rectangle with length 8 cm and breadth 4 cm. O is the mid-point of CD. Find the coordinates of A, B, C and D. [HOTS]



13. In the given figure, PQRS is a square. Find the (i) side of a square and (ii) coordinates of points P and R. [HOTS]

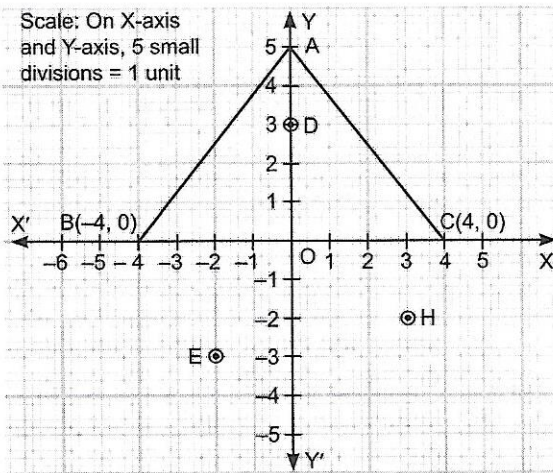


Short Answer Type Questions II [3 Marks]

14. In which quadrant will the points lie (i) the ordinate is 3 and abscissa is -4 , (ii) the abscissa is -5 and ordinate is -3 , (iii) the ordinate is 4 and abscissa is 5?
15. Plot the points (x, y) given in the following table: [NCERT Exemplar]

x	2	4	-3	-2	3	0
y	4	2	0	5	-3	0

16. A point lies on positive direction of x -axis at a distance of 7 units from the y -axis. What are its coordinates? What will be the coordinates, if it lies on negative direction of the y -axis at a distance of 7 units from the x -axis. [NCERT Exemplar]
17. Observe the given figure and answer the following questions:



- (i) The coordinates of point C.
 - (ii) The point whose coordinates are $(-2, -3)$.
 - (iii) The abscissa of point D.
 - (iv) The ordinate of point H.
 - (v) Write the coordinate of a point(s) in the third quadrant which have same abscissa and ordinate.
18. Mark the points $(3, 3)$, $(3, -3)$, $(-3, -3)$ and $(-3, 3)$ on a graph paper and join these points. Name the figure that you obtain. Also, find the area of the figure so obtained. [HOTS]
19. Plot the points $A(-3, 2)$, $B(-5, -4)$, $C(-2, -4)$ and $D(0, 2)$. What figure do you get on joining the points in order? [CBSE 2013]
20. Plot the points $A(-2, -2)$, $B(4, -2)$, $C(8, 3)$ and $D(-3, 3)$ on the graph paper. Join them in order and identify the figure so formed. Join AC and BD. Also, write the coordinates of the points of intersection of AC with the y -axis. [CBSE 2016]
21. Write the coordinates of the vertices of a rectangle whose length and breadth are 6 units and 5 units respectively, with its one vertex at the origin. The longer side lies on the x -axis and one of the vertices lies in the third quadrant. [HOTS]
22. (i) What is the name of each part of the plane formed by horizontal and vertical lines drawn to determine the position of any point in the Cartesian plane.
(ii) What is the abscissa of all the points lying on the x -axis and the y -axis respectively.

- (iii) Write the coordinates of the point left of the y -axis, right of y -axis and on x -axis at a distance of 5 units. [HOTS]

Long Answer Type Questions [4 Marks]

23. (i) Plot the following points on a graph paper:

x	y
1	5
2	8
3	11
4	14
5	17

Join these points. What do you observe?

- (ii) Find the coordinates of points where the line intersects the y -axis on producing.
24. Plot the points $A(1, -1)$ and $B(4, 5)$.
- (i) Draw the line segment joining these points. Write the coordinates of a point on this line segment between the points A and B.
 - (ii) Extend this line segment and write the coordinates of a point on this line which lies outside the line segment AB. [NCERT Exemplar; HOTS]
25. The three vertices of a rectangle are $(3, 2)$, $(-4, 2)$ and $(-4, 5)$. Plot these points and find the coordinates of the fourth vertex. [NCERT Exemplar]



ASSESS YOURSELF

- Is $P(3, 2)$ and $Q(2, 3)$ represents the same point? Justify.
- If $a < 0$ and $b < 0$, then in which quadrant the point $A(a, b)$ lies?
- Write the perpendicular distance of the point $P(4, 3)$ from the y -axis.
- Write the signs of respective x -coordinate and y -coordinate of a point lying in the IVth quadrant.
- Define quadrant.
- Write the coordinates of a point
 - (i) above the x -axis lying on the y -axis at a distance of 3 units.
 - (ii) below the x -axis and on the y -axis at a distance of 8 units.
- (iii) right of origin and on the x -axis at a distance of 2 units.
7. Draw the line XOX' and YOY' as the axes on the plane of a paper and plot the following points: $A(5, 3)$, $B(-3, 2)$, $C(-5, -5)$ and $D(3, -6)$.
8. Plot the point $P(2, -3)$ on the graph paper and from it, draw PM and PN perpendicular to the x -axis and the y -axis respectively. Write the coordinates of points M and N .
9. Find the value of x and y , if
 - (i) $(x + 3, 5) = (5, y)$
 - (ii) $(2, 2y - 3) = (x, 7)$
10. Find the area of the triangle whose vertices are $(0, 4)$, $(0, 0)$ and $(2, 0)$ by plotting them on graph.

11. Plots the points (x, y) given in the following table on the plane.

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

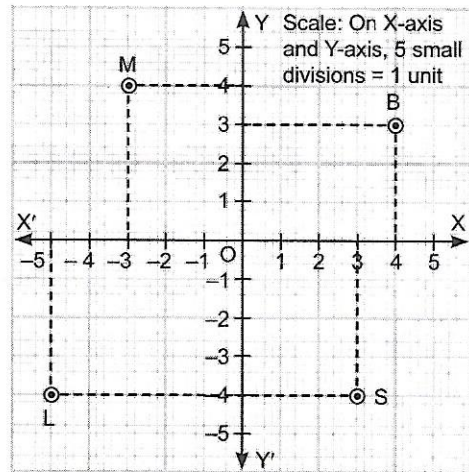
12. Taking 0.5 cm as 1 unit, plot the following points on the graph paper:

A(1, 3), B(-3, -1), C(1, -4), D(-2, 3), E(0, 8) and F(1, 0).

13. What will be the position of point P(3, 2), if
- ordinate is multiplied by (-1)
 - abscissa is multiplied by (-2)
 - abscissa and ordinate both are added to (-5) .

14. Plot the points E(4, 2), L(-1, 3), I(0, 2) and N(2, 0) on the Cartesian plane. Join these points in order. Name the shape thus obtained. What would you say about point L, I and N?

15. See the given figure and complete the following statements:



- The abscissa and the ordinate of the point B are ____ and ____, respectively. Hence, the coordinates of B are (____, ____).
- The x -coordinate and the y -coordinate of the point M are ____ and ____, respectively. Hence, the coordinates of M are (____, ____).
- The x -coordinate and the y -coordinate of the point L are ____ and ____, respectively. Hence, the coordinates of L are (____, ____).
- The x -coordinate and the y -coordinate of the point S are ____ and ____, respectively. Hence, the coordinates of S are (____, ____).