# 3 Coordinate Geometry

Chapter

In the Chapter

- To locate the position of an object or a point in a plane, we require two perpendicular lines. One of them is horizontal, and the other is vertical.
- The plane is called the Cartesian, or coordinate plane and the lines are called the coordinate axis.
- The horizontal line is called the x-axis, and the vertical line is called the y-axis.
- The coordinate axis divide the plane into four parts called quadrants.
- The point of intersection of the axis is called the origin.
- The distance of a point from the y-axis is called its x-coordinate, or abscissa, and the distance of the point from the x-axis is called its y-coordinate, or ordinate.
- If the abscissa of a point is x and the ordinate is y, then (x, y) are called the coordinates of the point.
- The coordinates of a point on the x-axis are of the form $(x, 0)$ and that of the point on the y-axis are $(0, y)$.
- The coordinates of the origin are $(0, 0)$.
- The coordinates of a point are of the form $(+, +)$ in the first quadrant, $(-, +)$ in the second quadrant, $(-, -)$ in the third quadrant and $(+, -)$ in the fourth quadrant, where + denotes a positive real number and – denotes a negative real number.
- If $x \neq y$, then $(x, y) \neq (y, x)$, and $(x, y) = (y, x)$, if $x = y$.
- **Number line :** On the number lines, distances from a fixed point are marked in equal units positively in the direction and negatively in the other.

  The point from which distances are marked is called the zero origin. We use the number line to represent the numbers by marking equidistant points on a line. If one unit distance represents the number '1' then 4 units distance represents number '4'. The point in the positive direction at the distance r from the origin represents the number r. The point in the negative direction at the distance r from the origin, represents the number r.
- **Cartesian System :** The system used for describing the position of a point in a plane is also known as the Cartesian system.
- **Cartesian Plane :** In a plane to locate the position of a point we take two lines XOX' and YOY' intersecting each other at right angles at O.
- **Origin :** O is called the origin of the Cartesian system. Its co-orinate is $(0, 0)$.
- Horizontal line X'X is called **x-axis** and the vertical line Y'Y is called the **y-axis**. The point where X'X and Y'Y cross each other is called the origin and is denoted by O.

  Since the positive numbers lie on the directions OX and OY, therefore OX and OY, are called the positive directions of x-axis and the y-axis respectively.

  In a similar manner OX' and OY' are called the negative directions of x-axis and y-axis respectively.
- **Quadrant :** The two axis divide the plane into 4 parts and each is called a quadrant numbered I, II, III and IV anti-clockwise and OX.
  (i)   OX and OY are the part of 1st quadrant *i.e.,* XOY plane.
  (ii) OY and OX' enclose the IInd quadrant or YOX'-plane.
  (iii) OX' and OY' enclose the IIIrd quadrant i.e. X'OY'-plane.

(66)

(iv)   OY' and OX enclose the IVth quadrant i.e., XOY'-plane.

● **Relationship between the Signs of the Coordinates of a point and the Quadrant in which It Lies.**

(i)   If a point is in the Ist quadrant, then the point will be in the form (+, +), since the Ist quadrant is enclosed by the positive X-axis and the positive Y-axis.

(ii)   If a point is in the IInd quadrant, then the point will be in the form (–, +), since the IInd quadrant is enclosed by the negative X-axis and the positive Y-axis.

(iii) If a point is in the IIIrd quadrant, then the point will be in the form (–, –),since the IIIrd quadrant is enclosed by the negative X-axis and the negative Y-axis

(iv)   If a point is in the IVth quadrant, then the point will be in the form (+, –), since the IVth quadrant is enclosed by the positive X-axis and the negative Y-axis (see figure.)
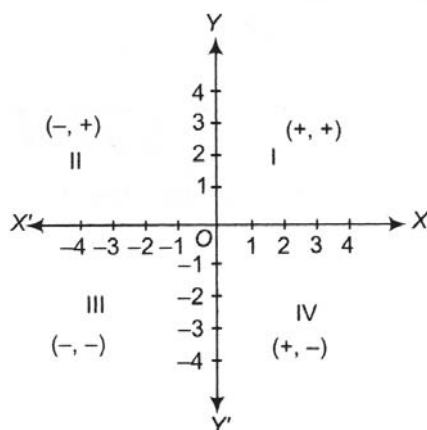

NCERT TEXT BOOK QUESTION (SOLVED)

EXERCISE 3.1

Q.1. How will you describe the position of a table lamp on your study table to another person?

Ans. We consider the table lamp as a point and table as a plane. Choose any two perpendicular edges of the table. Measure the distance of the table lamp from the longer edge, suppose it is 30 cm. Again, measure the distance of the table lamp from the shorter edge and suppose it is 15 cm. Now we write the position of the table lamp as (30, 15) or (15, 30).
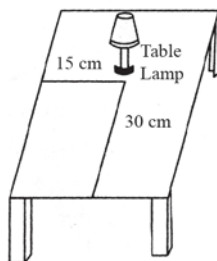
**Q.2. (Street Plan) : A city has two main roads which cross each other at the centre of the city.** These two roads are along the North-South direction and East-West direction. All the other streets of the city run parallel to these roads and are 200 m apart. There are 5 streets in each direction. Using 1cm = 200 m, draw a model of the city on your notebook. Represent the roads/streets by single lines.

There are many cross- streets in your model. A particular cross-street is made by two streets, one running in the North - South direction and another in the East - West direction. Each cross street is referred to in the following manner : If the 2_{nd} street running in the North - South direction and 5_{th} in the East - West direction meet at some crossing, then we will call this cross-street (2, 5). Using this convention, find:

(i) how many cross - streets can be referred to as (4, 3).

(ii) how many cross - streets can be referred to as (3, 4).

Ans. The street plan is shown below :
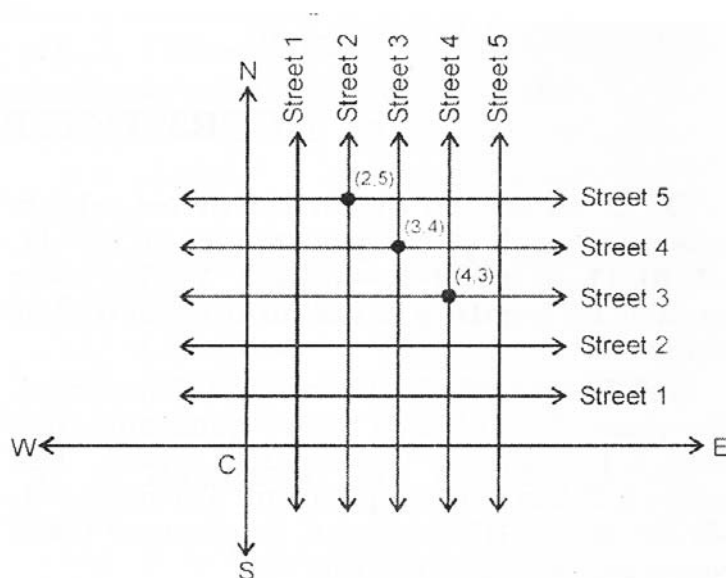
(i) There is only one cross-street, we can refer as (4, 3).

(ii) Also there is only cross-street which we can refer as (3, 4).

Hence, both the cross-streets are marked in the figure above. They are uniquely found because of the two reference lines we have used for locating them.

EXERCISE 3.2

Q.1. Write the answer of each of the following questions:

(i) What is the name of horizontal and the vertical lines drawn to determine the position of any point in the Cartesian plane?

(ii) What is the name of each part of the plane formed by these two lines?

(iii) Write the name of the point where these two lines intersect.

Ans. (i) Horizontal line is known as x-axis and vertical line is known as y-axis.

(ii) Quadrants.

(iii) Horizontal and vertical lines intersect at the origin.
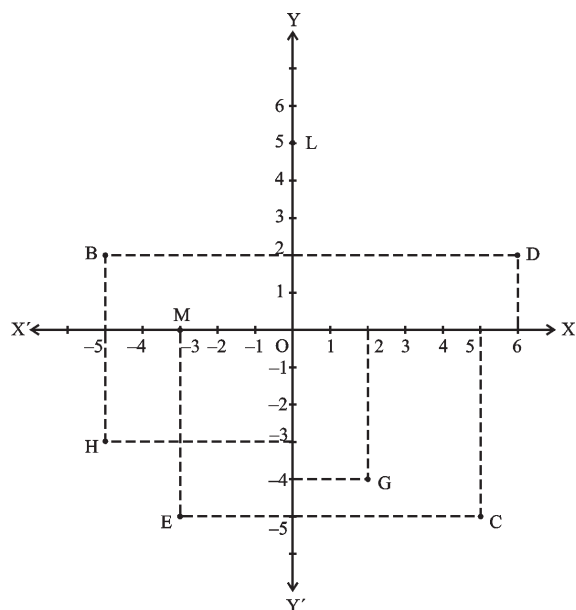
Q.2. 2. See Fig., and write the following:

(i) The coordinates of B.

(ii) The coordinates of C.

(iii) The point identified by the coordinates (–3, –5).

(iv) The point identified by the coordinates (2, – 4).

(v) The abscissa of the point D.

(vi) The ordinate of the point H.

(vii) The coordinates of the point L.

(viii) The coordinates of the point M.

Ans. (i) The coordinates of B = (–5, 2) and B lies in II quadrant. (Abscissa = –5, Ordinate = 2).

(ii) The coordinates of C = (5, – 5)

(iii) The point identified by the coordinates (–3, –5) is E.

(iv) The point identified by the coordinates (2, –4) is G.

(v) The abscissa of the point D = 6.

(vi) The ordinate of the point H = –3.

(vii) The coordinates of the point L = (0, 5) Lies on y-axis)

(viii) The coordinate of the point M = (–3, 0) (Lies on x-axis)

EXERCISE 3.3

Q.1. In which quadrant or on which axis do each of the points (– 2, 4), (3, – 1), (– 1, 0), (1, 2) and (– 3, – 5) lie? Verify your answer by locating them on the Cartesian plane.

Ans. The point (–2, 4) lies in the II quadrant. The point (3, –1) lies in the IV quadrant. The point (–1, 0) lies on the negative x-axis. The point (1, 2) lies in the I quadrant. The point (–3, –5) lies in the III quadrant locations of these points as shown in the fig.
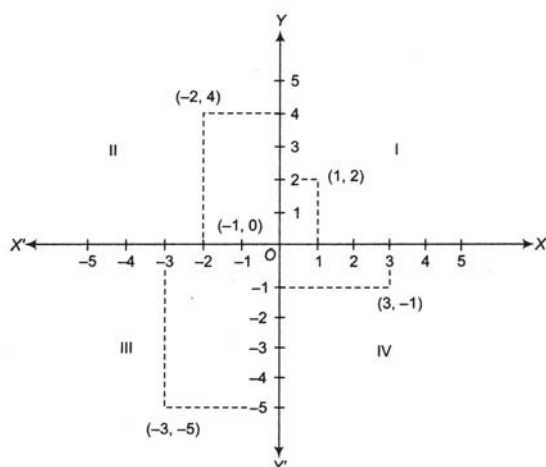
Q.2. Plot the points (x, y) given in the following table on the plane, choosing suitable units of distance on the axis.

x	– 2	–1	0	1	3
y	8	7	– 1.25	3	– 1

Ans. We plot the points A(–2, 8), B(–1, 7), C(0, 1.25), D(1, 3) and E(3, –1) on the graph paper as shown below :
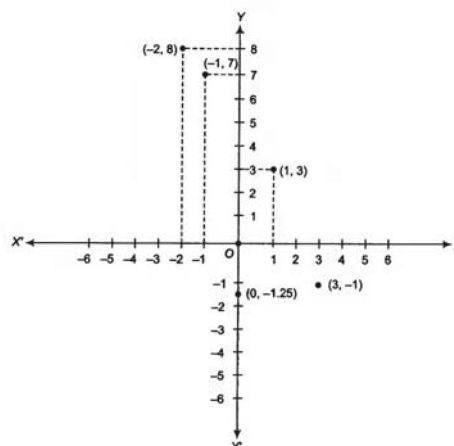
Additional Questions

Q.1. Without plotting the points indicate the quadrant in which they will lie, if :

(i) ordinate is 5 and abscissa is –3

(ii) abscissa is –5 and ordinate is –3

(iii) abscissa is –5 and ordinate is 3

(iv) ordinate is 5 and abscissa is 3.

Ans. (i) Since abscissa is –3, i.e., x-coordinate is –3 and ordinate or y-coordinate is 5.

∴ Sign of the coordinates of point is (–, +). Hence the point will lie in the II quadrant.

(ii) Here, x-coordinate = –5 and y-coordinate = –3.

∴ Sign of point is (–, –)

Hence, the point (–5, –3) will lie in the IIIrd quadrant.

(iii) Here, sign of point is (–, +).

So, the point (–5, 3) will lie in the II quadrant.

(iv) Here, sign of the point is (+, +)

So, the point (3, 5) lie in the I quadrant.

Q.2. Which of the following points lie on 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), I(3, 3)

Ans. Since a point on the y-axis is of the form (0, y). So points C(0,1), D(0,0), E(0,–1) and G(0, 5) will lie on y-axis.

Q.3. In which quadrant or on which axis each of the following points lie?

(–3, 5), (4, –1), (2, 0), (2, 2), (–3, –6)

Ans.

Point	Sign of coordinate	quadrantal axis
(–3, 5)	(–, +)	II
(4, –1)	(+, –)	IV
(2, 0)	(+, 0)	x-axis
(2, 2)	(+, +)	I
(–3, –6)	(–, –)	III

Q.4. See Fig. and complete the following statements:

(i) The abscissa and the ordinate of the point B are _ _ _ and _ _ _, respectively.

Hence, the coordinates of B are (_ _, _ _).

(ii) The x-coordinate and the y-coordinate of the point M are _ _ _ and _ _ _, respectively. Hence, the coordinates of M are (_ _, _ _).

(iii) The x-coordinate and the y-coordinate of the point L are _ _ _ and _ _ _, respectively. Hence, the coordinates of L are (_ _, _ _).

(iv) The x-coordinate and the y-coordinate of the point S are _ _ _ and _ _ _, respectively. Hence, the coordinates of S are (_ _, _ _).
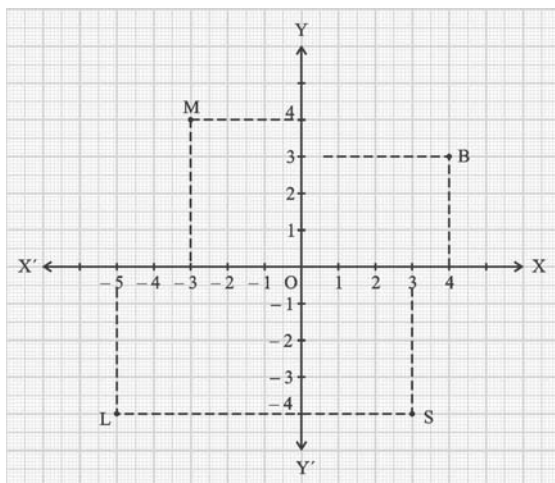
Ans. (i) Since the distance of the point B from the y - axis is 4 units, the x - coordinate or abscissa of the point B is 4. The distance of the point B from the x - axis is 3 units; therefore, the y - coordinate, i.e., the ordinate, of the point B is 3.

Hence, the coordinates of the point B are (4, 3). As in (i) above :

(ii) The x - coordinate and the y - coordinate of the point M are –3 and 4, respectively.

Hence, the coordinates of the point M are (–3, 4).

(iii) The x - coordinate and the y - coordinate of the point L are –5 and – 4, respectively.

Hence, the coordinates of the point L are (–5, – 4).

(iv) The x - coordinate and the y- coordinate of the point S are 3 and – 4, respectively.

Hence, the coordinates of the point S are (3, – 4).

Q.5. A point lies on the 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 y-axis at a distance of –7 units form x-axis?

Ans. Since a point lies on the x-axis at a distance of 7 units form the y-axis.

So, its abscissa = 7

and ordinate = 0

Hence, the point is (7, 0) is similarly, the required point is (0, 7).

Q.6. Find the coordinates of the point :

(i) which lie on x and y axis both.

(ii) whose ordinate is –4 and which lies on y-axis.

(iii) whose abscissa is 5 and which lies on x-axis.

Ans. (i) The origin O(0, 0) lies on both the axis.

(ii) Ordinate i.e., y-coordinate = –4.

∴ Required point which lies on the y-axis would be (0, –4)

[Points on y-axis is of the form (0, y)]

(iii) Here, Abscissa (i.e., x-coordinate) = 5 and the point lies on the x-axis.

∴ $y = 0$

Hence, required point is (5, 0)

Q.7. A point lies on x-axis at a distance of 9 units from y-axis. What are its coordinate. What will be its coordinate if it lies on y-axis at a distance of –9 units from x-axis.

Ans. Since the point lies on x-axis. So, coordinate of point will be (9, 0) because distance from y-axis represents x-coordinate and distance from x-axis represents y-coordinate.

∴ Coordinate of the point at a distance of –9 units which lies on x-axis would be (0, –9)

Hence the required points on X=axis and Y-axis irrespectively are : (9, 0) and (0, –9).

Q.8. The perpendicular distance of a point from the x-axis is 4 units and the perpendicular distance from the y-axis is 5 units. Write the co-ordinates of

such a point if it lies in the :

    (a) I Quadrant   **(b) II Quadrant**

    (c) III Quadrant   **(d) IV Quadrant**

    Ans. (a) (4, 5), (b) (4,–5), (c) (–4, –5), (d) –4, 5)

    Q.9. What are the co-ordinates of a point that is:

    (i) the mirror image of point (0, 4) in x-axis.

    (ii) mirror image of point (–3, –5) in y-axis.

   **Ans.** we know that the mirror image of a point (x, y) in x-axis is (x, –y) and along y-axis is (–x, y).

    (i) (0, 4) $\leftrightarrow$ (0, –4)

    (ii) (–3, –5) $\leftrightarrow$ (3, –5).

Q.10. Plot the following ordered pairs (x, y) of numbers as points in the Cartesian plane. Use the scale 1cm = 1 unit on the axis.

x	– 3	0	– 1	4	2
y	7	–3.5	– 3	4	– 3

The pairs of numbers given in the table can be represented by the points (– 3, 7), (0, –3.5), (– 1, – 3), (4, 4) and (2, – 3). The locations of the points are shown by dots in Fig..
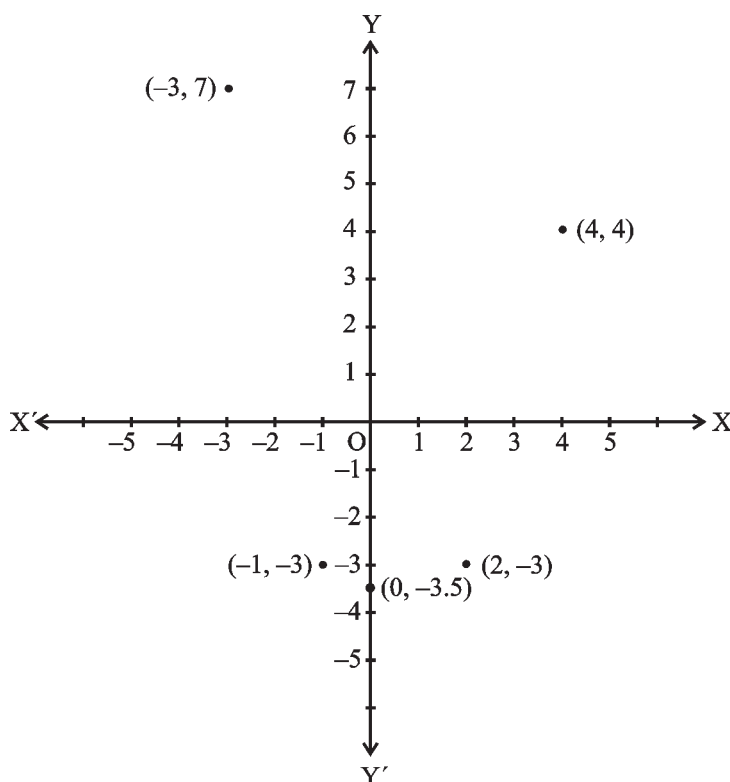
Multiple Choice Questions

Q.1. **The point which lies on y-axis at a distance of 5 units in the negative direction of y-axis is :**

    (a) (0, 5)   (b) (5, 0)

    (c) (0, –5)   (c) (–5, 0)

Ans. (c)

Q.2. **x-coordinate is known as :**

    (a) ordinate   (b) abscissa

    (c) ordered pair   (d) none of these

Ans. (b)

Q.3. **If the coordinates of the two points are P(–2, 3) and Q(–3, 5), then (abscissa of P) – (abscissa of Q) is :**

    (a) –5   (b) 1

    (c) –1   (d) –2

Ans. (b)

Q.4. **Which of the following points lie on the negative side of x-axis?**

(a) (–4, 0)　　　　(b) (–3, 2)

(c) (0, –4)　　　　(d) (5, –7)

Ans. (A)

Q.5. Point (–3, 5) lies in the

(a) First quadrant

(b) Second quadrant

(c) Third quadrant

(d) Fourth quadrant

Ans. (b)

Q.6. Abscissa of all the points on x-axis is :

(a) 0　　　　　　(b) 1

(c) 2　　　　　　(d) any number

Ans. (d)

Q.7. The coordinates of a point are (–3, –7). It lies :

(a) to the left of the y-axis

(b) to the right of they y-axis

(c) above the x-axis

(d) all the above

Ans. (a)

Q.8. The perpendicular distance of the point P (7, 5) from the y-axis is :

(a) 5　　　　　　(b) 12

(c) 7　　　　　　(d) 2

Ans. (c)

Q.9. The coordinates of two points A and B are (4, 3)

and (4, –5) respectively. The coordinates of the point at which the line segment AB meets the x-axis are :

(a) (0, 4)　　　　(b) (4, 0)

(c) (3, 0)　　　　(d) (5, 0)

Ans. (b)

Q.10. A point is at a distance of 3 units from the x-axis and 5 units form the y-axis. Which of the following may be the coordinates of the point ?

(a) (5, 3)　　　　(b) (4, 5)

(c) (6, 5)　　　　(d) all the above

Ans. (a)

Q.11. Point (–10, 0) lies :

(a) on the negative direction of the x-axis

(b) on the negative direction of the y-axis

(c) in the third quadrant

(d) in the fourth quadrant

Ans. (a)

Q.12. If y coordinate of a point is zero, then this point always lies :

(a) in I quadrant

(b) in II quadrant

(c) on x-axis

(d) on y-axis

Ans. (c)