Coordinate Geometry

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Contents

Introduction

- In this chapter, we will study some basic concepts of Coordinate Geometry.
- The system used for describing the position of a point in a plane is also known as the Coordinate Geometry.
- You will learn about the two axes known as x-axis and y-axis.
- You will learn the meaning of basic terms related to Coordinate Geometry like origin, quadrants, Cartesian plane or the Coordinate plane.
- You will learn how find the coordinates of a point marked on a plane.
- You will learn how to plot a point in a plane.

Cartesian Plane

➢ In the Fig. 1.1, the horizontal line X'X is called the x-axis and the vertical line Y'Y is called the y-axis. The point where X'X and Y'Y cross is called the **origin**, and is denoted by O. Since the positive numbers lie on the directions OX and OY, OX and OY are called **positive directions** of the x-axis and y-axis, respectively. Similarly, OX' and OY' are called the **negative directions** of the x-axis and y-axis, respectively.
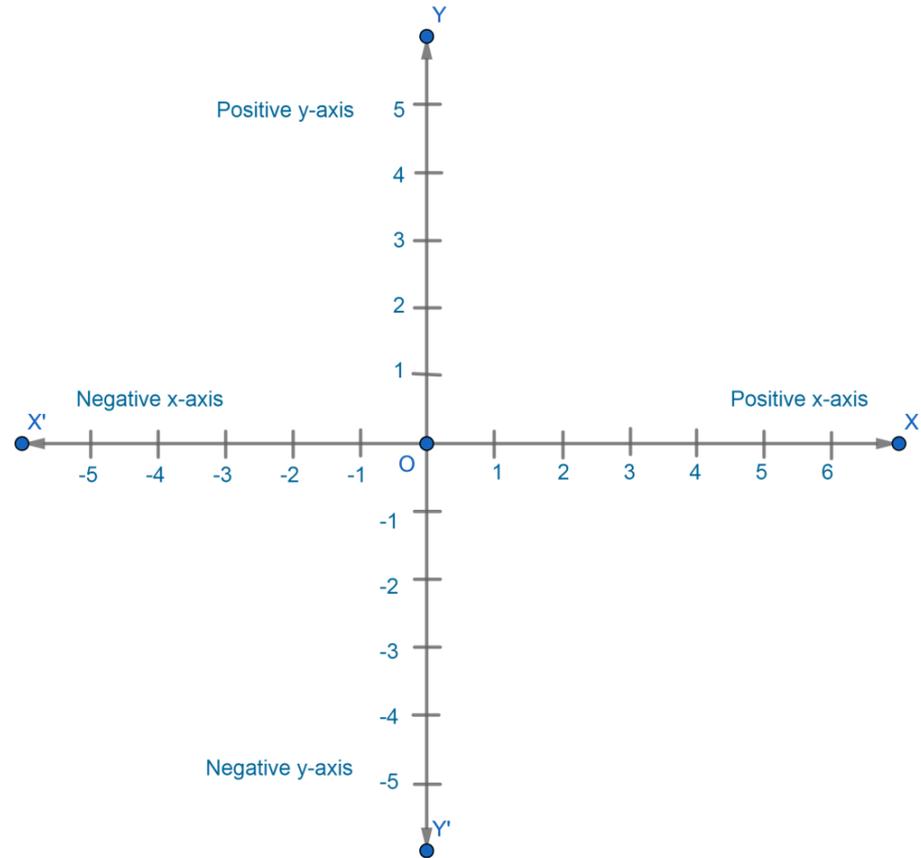

Positive y-axis

Negative x-axis

Positive x-axis

Negative y-axis

Fig. 1.1

Cartesian Plane (Contd..)

➢ In Fig. 1.2, the axes (i.e. x-axis and y-axis) divide the plane into four parts. These four parts are called the **quadrants** (one fourth part), number I, II, III and IV anticlockwise from OX. So, the plane consists of the axes and these quadrants. We call the plane, the **Cartesian plane**, or the **coordinate plane**, or the **xy-plane**. The axes are called the coordinate axes. The axes are called the **coordinate axes**.
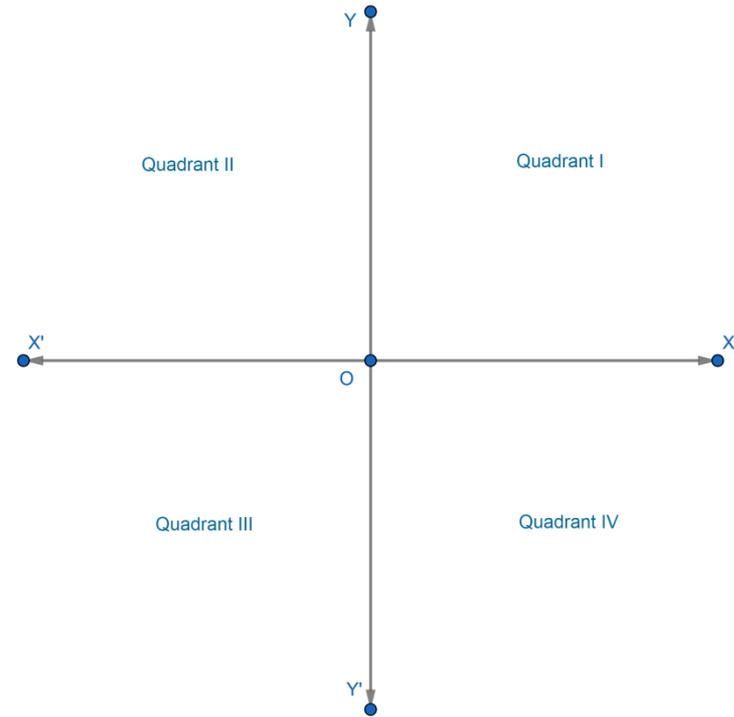
Fig. 1.2

Cartesian Plane (Contd..)

To understand x and y coordinates, let us understand Fig. 1.3. We find that:

- The perpendicular distance of point P from y-axis is measured along the positive direction of x-axis is PN=OM=4 units.

- The perpendicular distance of point P from x-axis is measured along the positive direction of y-axis is PM=ON=3 units.

- The perpendicular distance of point Q from y-axis is measured along the negative direction of x-axis is SQ=OR=4 units.

- The perpendicular distance of point Q from x-axis is measured along the negative direction of y-axis is RQ=OS=2 units.
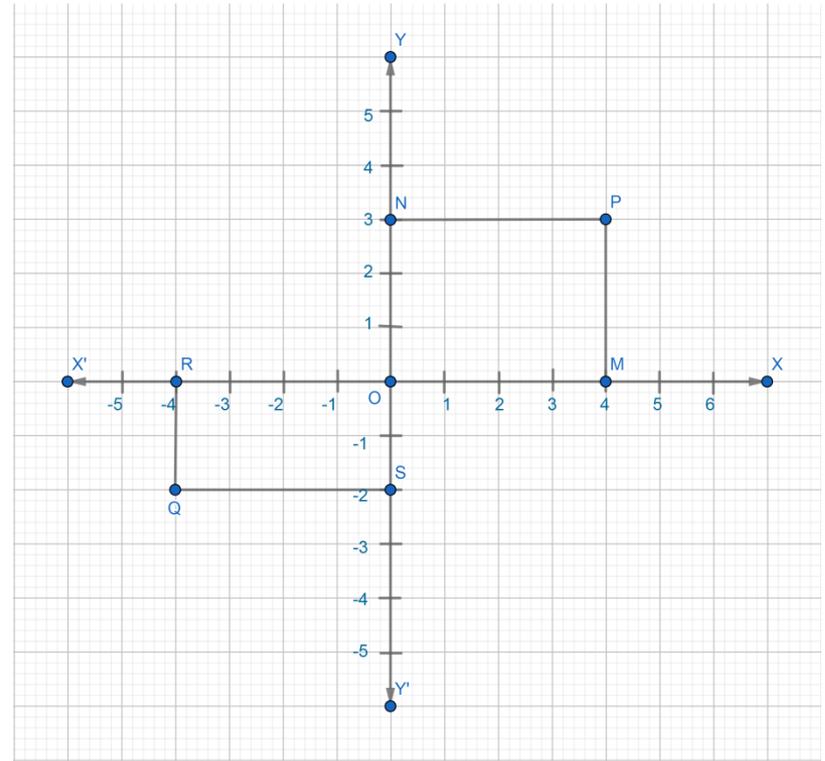
Fig. 1.3

Cartesian Plane (Contd..)

We write the coordinates of a point, using the following conventions:

- The **x-coordinate** of a point is its perpendicular distance from the y-axis measured along the x-axis (positive along the positive direction of the x-axis and negative along the negative direction of the x-axis). In Fig. 1.3, for the point P, it is +4 and for Q, it is -4. The x-coordinate is also called the **abscissa**.

- The **y-coordinate** of a point is its perpendicular distance from the x-axis measured along the y-axis (positive along the positive direction of the y-axis and negative along the negative direction of the y-axis). In Fig. 1.3, for the point P, it is +3 and for Q, it is -2. The y-coordinate is also called the **ordinate.**

- 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.

- Hence, in Fig. 1.3, the coordinates of P are (4, 3) and coordinates of Q are (-4, -2).

- The coordinates of the origin are (0, 0) since it has zero distance from both x-axis and y-axis. 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).

- If x≠y, then (x, y)≠(y, x), and (x, y)=(y, x), if x=y.

Cartesian Plane (Contd..)

Following is the relationship between the signs of the coordinates of a point and the quadrant of a point in which it lies:

i) If a point is in the **1st quadrant**, then the point will be in the form (+, +), since the 1st quadrant is enclosed by the positive x – axis and the positive y–axis.

(ii) If a point is in the **2nd quadrant**, then the point will be in the form (–, +), since the 2nd quadrant is enclosed by the negative x – axis and the positive y–axis.

(iii) If a point is in the **3rd quadrant**, then the point will be in the form (–, –), since the 3rd quadrant is enclosed by the negative x – axis and the negative y–axis.

(iv) If a point is in the **4th quadrant**, then the point will be in the form (+, –), since the 4th quadrant is enclosed by the positive x – axis and the negative y – axis (see Fig. 1.4).
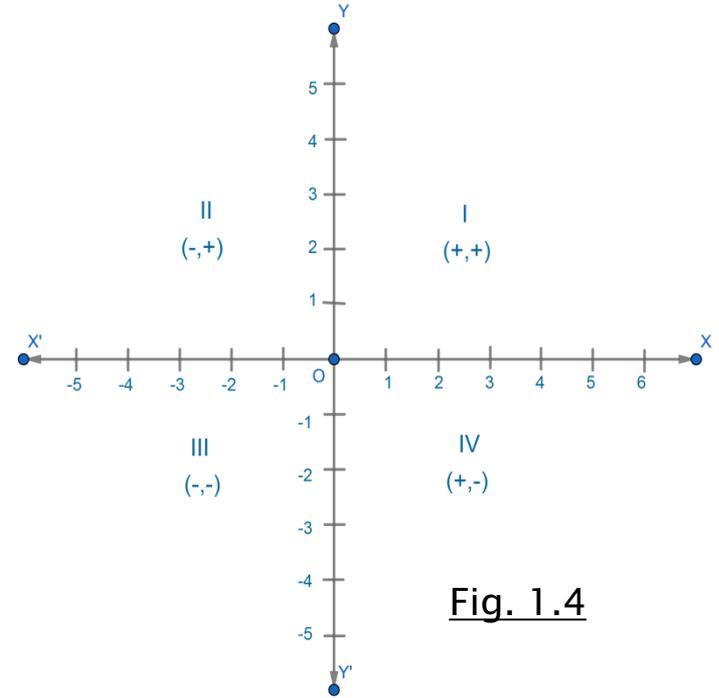

Fig. 1.4

Plotting a Point in the Plane if its Coordinates are Given

➤ We will learn how to plot a point in the plane when we know its coordinates. We call this process "plotting the point".

▸ Let the coordinates of a point be (3, 5). We want to plot this point in the coordinate plane. We draw the coordinate axes and choose our units such that 1 cm represents one unit on both the axes. The coordinates of the point (3, 5) tell us that the distance of this point from the y-axis along the positive x – axis is 3 units and the distance of the point from the x – axis along the positive y-axis is 5 units. Starting from the origin O, we count 3 units on the positive x – axis and mark the corresponding point as A. Now, starting from A, we move in the positive direction of the y-axis and count 5 units and mark the corresponding point as P (see Fig. 1.5 on next page). You see that the distance of P from the y-axis is 3 units and from the x – axis is 5 units. Hence, P is the position of the point. Note that P lies in the 1st quadrant, since both the coordinates of P are positive.

➤ Similarly, you can plot the point Q (5, – 4) in the coordinate plane. The distance of Q from the x – axis is 4 units along the negative y-axis, so that its y – coordinate is – 4 (see Fig. 1.5 on next page). The point Q lies in the 4th quadrant.

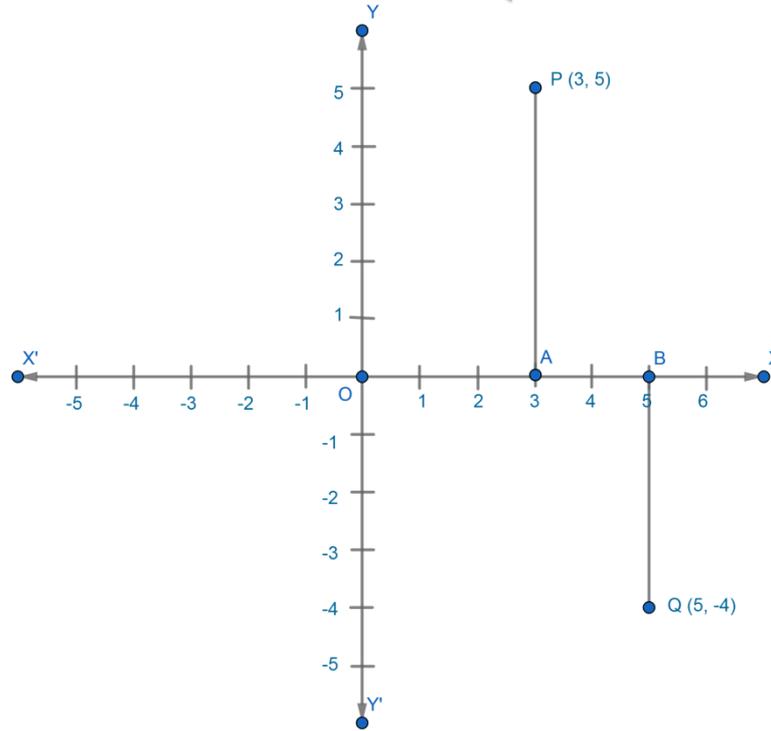# Plotting a Point in the Plane if its Coordinates are Given (Contd..)

Fig. 1.5

Summary

- 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 axes.
- The horizontal line is called the x-axis, and the vertical line is called the y-axis.
- The coordinate axes divide the plane into four parts called quadrants.
- The point of intersection of the axes 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).

Summary (Contd..)

- 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≠y, then (x, y)≠(y, x), and (x, y)=(y, x), if x=y.

THANK YOU