# CHAPTER – 3
# COORDINATE GEOMETRY

## 3.1 CO-ORDINATE SYSTEM

In two dimensional coordinate geometry, we u se generally two types of co-ordinate system.

(i) Cartesian or Rectangular co-ordinate system.

(ii) Polar co-ordinate system.

In cartesian co-ordinate system we represent any point by ordered pair (x,y) where x and y are called X and Y co-ordinate of that point respectively.

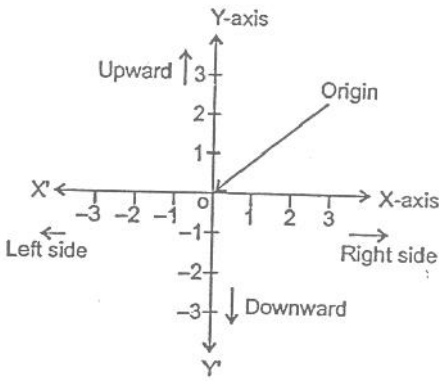
In polar co-ordinate system we represent any point by ordered pair $(r, \theta)$ where 'r' is called radius vector and $'\theta'$ is called vectorial angle of that point.



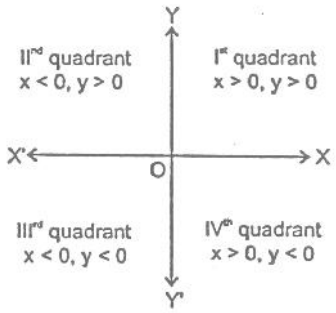
### CARTESIAN CO-ORDINATE SYSTEM

**(a) Rectangular Co-ordinate Axes :**

Let X'OX and Y'OY are two lines such that X'OX is horizontal and Y'OY is vertical lines in the same plane and they intersect each other at O. This intersecting point is called origin. Now choose a convenient unit of length and starting from origin as zero, mark off a number scale on the horizontal line X'OX, positive to the right of origin O and negative to the left of origin O. Also mark off the same scale on the vertical line Y'OY, positive upwards and negative downwards of the origin. The line X'OX is called X-axis and the line Y'OY is known as Y-axis and the two lines taken together are called the co-ordinate axis.



**(b) Quadrants :**



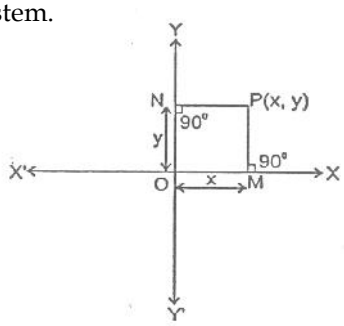

The co-ordinates axes X'OX and Y'OY divide the place of graph paper into four parts XOY, X'OY, X'OY and XOY'. These four parts are called the quadrants. The part XOY, X'OY, X'OY' and XOY' are known as the first, second, third and fourth quadrant respectively.

**(c) Cartesian Co-ordinates of a Point :**

Let X'OX and Y'OY be the co-ordinate axis and P be any point in the plane. To find the position of P with respect of X'OX and Y;OY, we draw two perpendiculars from P on both co-ordinate axes. Let PM and PN be the perpendiculars on X-axis and Y-axis reservedly. The length of the line segment OM is called the x-coordinate be the or abscissa of point P. Similarly the length of line segment ON is called they-coordinate or ordinate of point P.

Let OM = x and ON = y. The position of the point P in the plane with respect to the coordinate axis is represented by the ordered pair (x,y). The ordered pair (x,y) is called the coordinates of point P. "Thus, for a given point, the abscissa and ordinate are the distance of the given point from Y-axis and X-axis respectively".

The above system of coordinating on ordered pair (x,y) with every point in plane is called the Rectangular Cartesian coordinates system.




**(b) Convention of Signs :**

As discussed earlier that regions XOY, X'OY, X'OY' and XOY' are known as the first, second, third and fourth quadrants respectively. The ray OX is taken as positive X-axis, OX' as negative X-axis, OY as positive Y-axis and OY' as negative Y-axis. Thus we have,

In first quadrant : X > 0, y > 0 (Positive quadrant)

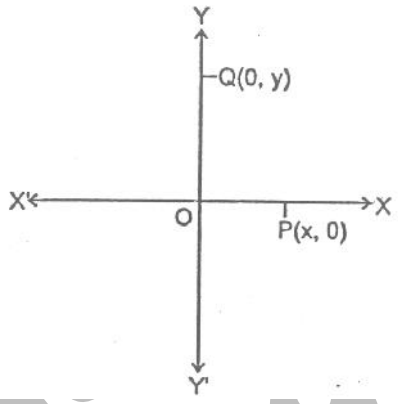
In second quadrant: X < 0, Y > 0

In third quadrant : X < 0, Y < 0 (Negative quadrant)

In fourth quadrant: X > 0, Y < 0

**(e) Points on Axis :**

In point P lies on X-axis then clearly its distance from X-axis will be zero, therefore we can say that its coordinate will be zero. In general, if any point lies on X-axis then its y-coordinate will be zero. Similarly if any point Q lies on Y-axis, then its distance from Y-axis will be zero therefore we can say its x-coordinate will be zero. In general, if any point lies on Y-axis then its x-coordinate will be zero.




**(f) Plotting of Points :**

In order to plot the points in a plane, we may use the following algorithm m.

**Step I:** Draw two mutually perpendicular lines on the graph paper, one horizontal and other vertical.

**Step II:** Mark their intersection point as O (origin).

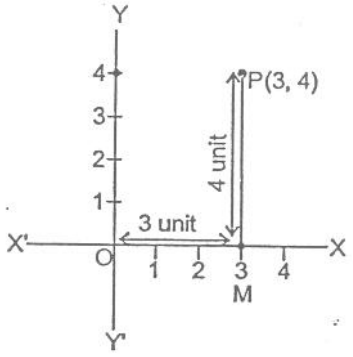
**Step III:** Choose a suitable scale on X-axis and Y-axis and mark the points on both the axis.

**Step IV:** Obtain the coordinates of the point which is to be plotted. Let the point be P(a,b). To plot this point start from the origin and |a| units move along OX, OX' according as 'a' is positive or negative respectively. Suppose we arrive at point M. From point M move vertically upward or downward |b| through units according as **'b'** is positive or negative. The point where we arrive finally is the required point P(a,b).

**ILLUSTRATIONS :**

**Ex.1** Plot the point (3,4) on a graph paper.

**Sol.** let X'IX and Y'OY be the coordinate axis. Here given point is P(3,4), first we move 3 units along OX as 3 is positive then we arrive a point M. Now from M we move vertically upward as 4 is positive. Then we arrive at P(3,4).



**Ex.2** Write the quadrants for the following points.

(i) A(3,4) (ii) B(-2,3) (iii) C(-5,-2) (iv) D(4,-3) (v) E(-5,-5)

**Sol.** (i) Here both coordinates are positive therefore point A lies in I$^{st}$ quadrant.

(ii) Here x is negative and y is positive therefore point B lies in II$^{nd}$ quadrant.

(iii) Here both coordinates are negative therefore point C lines in III$^{rd}$ quadrant.

(iv) Here x is positive and y is negative therefore point D lies in IV$^{th}$ quadrant.

(v) Point E lies in III quadrant.

**Ex.3** Plot the following points on the graph paper.

(i) A(2 ,5) (ii) B(-5,-7) (iii) C(3,-2) (iv) D (0,5) (v) E(5,0)

**Sol.** Let XOX′ and YOY′ be the coordinate axis. Then the given points may be plotted as given below :