CO-ORDINATE GEOMETRY

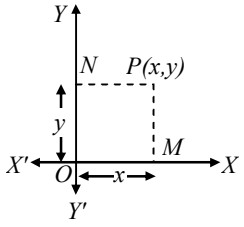
CONTENTS

➢ CO-ORDINATE GEOMETRY

It is a branch of geometry which sets up a definite correspondence between the position of a point in a plane and a pair of algebraic numbers, called co-ordinates.

➢ CARTESIAN CO-ORDINATES (RECTANGULAR CO-ORDINATES)

In Cartesian co-ordinates the position of a point P is determined by knowing the distances from two perpendicular lines passing through the fixed point. Let O be the fixed point called the origin and XOX′ and YOY′, the two perpendicular lines through O, called Cartesian or Rectangular co-ordinates axes.



Draw PM and PN perpendiculars on OX and OY respectively. OM (or NP) and ON (or MP) are called the x-coordinate (or abscissa) and y-coordinate (or ordinate) of the point P respectively.

Axes of Co-ordinates

In the figure OX and OY are called as x-axis and y-axis respectively and both together are known as axes of co-ordinates.

Origin

It is point O of intersection of the axes of co-ordinates.

Co-ordinates of the Origin

It has zero distance from both the axes so that its abscissa and ordinate are both zero. Therefore, the coordinates of origin are (0, 0).

Abscissa

The distance of the point P from y-axis is called its abscissa. In the figure OM = PN is the Abscissa.

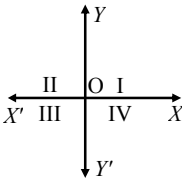
Ordinate

The distance of the point P from x-axis is called its ordinate. ON = PM is the ordinate in the figure.

Quadrant

The axes divide the plane into four parts. These four parts are called quadrants. So, the plane consists of axes and quadrants. The plane is called the cartesian plane or the coordinate plane or the xy-plane. These axes are called the co-ordinate axes.

A quadrant is $\frac{1}{4}$ part of a plane divided by co-ordinate axes.



(i) XOY is called the first quadrant

(ii) YOX′ the second.

(iii) X′OY′ the third.

(iv) Y′OX the fourth

as marked in the figure.

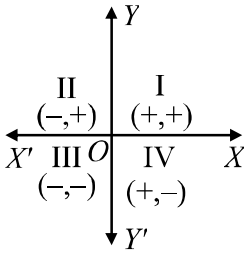
➢ RULES OF SIGNS OF CO-ORDINATES

(i) In the first quadrant, both co-ordiantes i.e., abscissa and ordinate of a point are positive.

(ii) In the second quadrant, for a point, abscissa is negative and ordinate is positive.

(iii) In the third quadrant, for a point, both abscissa and ordinate are negative.

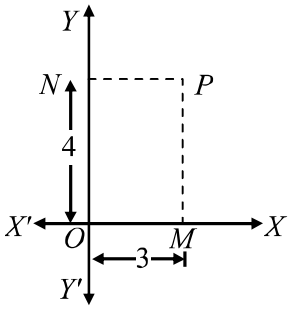
(iv) In the fourth quadrant, for a point, the abscissa is positive and the ordinate is negative.



Quadrant	x-co-ordinate	y-cordinate	Point
First quadrant	+	+	(+,+)
Second quadrant	–	+	(–,+)
Third quadrant	–	–	(–,–)
Fourth quadrant	+	–	(+,–)

❖ EXAMPLES ❖

Ex.1 From the adjoining figure find



(i) Abscissa

(ii) Ordinate

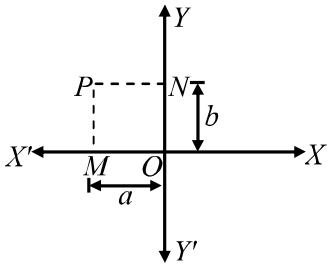
(iii) Co-ordinates of a point P

Sol. (i) Abscissa = PN = OM = 3 units

(ii) Ordinate = PM = ON = 4 units

(iii) Co-ordinates of the point P = (Abscissa, ordinate) = (3, 4)

Ex.2 Determine (i) Abscissa (ii) ordinate (iii) Co-ordinates of point P given in the following figure.



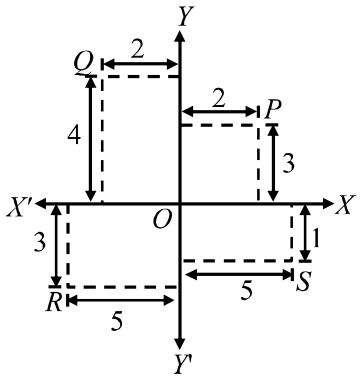
Sol. (i) Abscissa of the point P = – NP = –OM = – a

(ii) Ordinate of the point P = MP = ON = b

(iii) Co-ordinates of point P = (abscissa, ordinate)

= (–a, b)

Ex.3 Write down the (i) abscissa (ii) ordinate (iii) Co-ordinates of P, Q, R and S as given in the figure.



Sol. **Point P**

Abscissa of P = 2; Ordinate of P = 3

Co-ordinates of P = (2, 3)

Point Q

Abscissa of Q = – 2; Ordinate of Q = 4

Co-ordinate of Q = (–2, 4)

Point R

Abscissa of R = – 5; Ordinate of R = – 3

Co-ordinates of R = (–5, –3)

Point S

Abscissa of S = 5; Ordinate of S = – 1

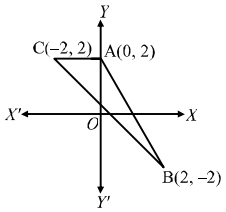
Co-ordinates of S = (5, – 1)

Ex.4 Draw a triangle ABC where vertices A, B and C are (0, 2), (2, – 2), and (–2, 2) respectively.

Sol. Plot the point A by taking its abscissa O and ordinate = 2.

Similarly, plot points B and C taking abscissa 2 and –2 and ordinates – 2 and 2 respectively.

Join A, B and C. This is the required triangle.

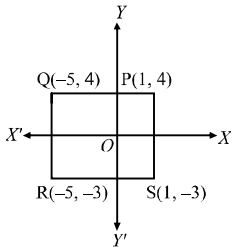


Ex.5 Draw a rectangle PQRS in which vertices P, Q, R and S are (1, 4), (–5, 4), (–5, –3) and (1, – 3) respectively.

Sol. Plot the point P by taking its abscissa 1 and ordinate – 4.

Similarly, plot the points Q, R and S taking abscissa as –5, –5 and 1 and ordinates as 4, – 3 and –3 respectively.

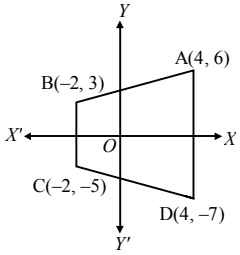
Join the points PQR and S. PQRS is the required rectangle.



Ex.6 Draw a trapezium ABCD in which vertices A, B, C and D are (4, 6), (–2, 3), (–2, –5) and (4, –7) respectively.

Sol. Plot the point A taking its abscissa as 4 and ordinate as 6.

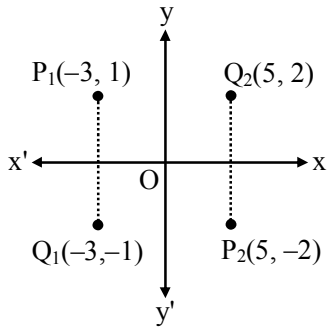
Similarly plot the point B, C and D taking abscissa as – 2, –2 and 4 and ordinates as 3, – 5, and –7 respectively. Join A, B, C and D ABCD is the required trapezium.



➢ MIRROR IMAGE OF COORDINATES OF A POINT

◈ With respect to x axis :

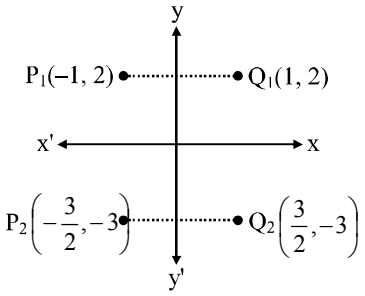
In image of a point P(x, y) with respect to x axis, the change in only sign of ordinate of point so the image is Q(x, –y).



P_1 (–3, 1) & P_2 (5, –2) are two points in II & IV quadrant respectively then their images are Q_1 (–3, –1) & Q_2 (5, 2) in III & I quadrant respectively.

◈ With respect to y axis :

In image of a point P(x, y) the change in sign of its abscissa so the image is Q(–x, y).



$P_1(-1, 2) \xrightarrow{\text{image}} Q_1(1, 2)$

$P_2\left(-\frac{3}{2}, -3\right) \xrightarrow{\text{image}} Q_2\left(\frac{3}{2}, -3\right)$

❖ EXAMPLES ❖

Ex.7 Find the images of the following points with respect to x axis,

$(1,\ 2),\ \left(\frac{3}{8}, \frac{4}{3}\right),\ \left(-\frac{2}{3}, 3\right),\ (2,\ 5),\ (5,\ 0),\ (0,\ 7),\ (-3, -4)$

Sol. The images are $(1, -2),\ \left(\frac{3}{8}, -\frac{4}{3}\right),\ \left(-\frac{2}{5}, -3\right),\ (2, -5),\ (5, 0),\ (0, -7),\ (-3, 4)$ respectively.

Ex.8 Find the images, of points (0, 0), (3, 0), (0, 2), (5, 1), (–2, 3), (–3, –3), (6, –7) with respect to y axis.

Sol. The images are (0, 0), (–3, 0), (0, 2), (–5, 1), (2, 3), (3, –3), (–6, –7) respectively.