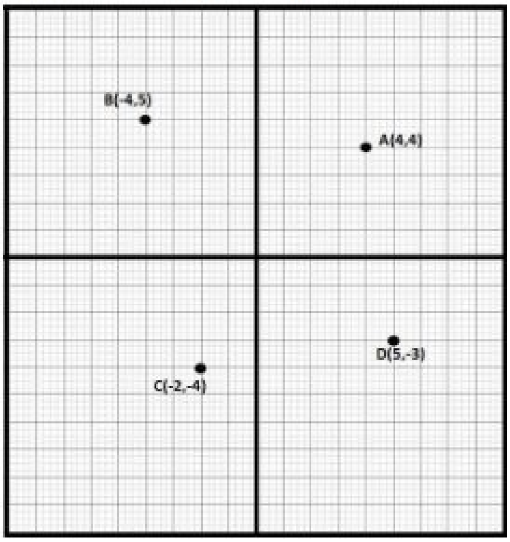
Coordinate geometry

Plotting in graph

Plotting points in coordinate plane

Plotting points are the process of locating a point whose co-ordinates are given. The plotting of points can be done on graph paper.
Suppose we have to plot points A(4, 4), B(-4, 5), C(-2, -4) and D(5, -3). The points A(4, 4) lies in the 1st quadrant. To plot this point count 4 units along OX to the right side of 0 and then count 4 units upward and mark the point thus obtained as shown in the figure and then write A(4, 4) near it. The point B(-4, 5) lies in the 2nd quadrant. Count 4 units from origin along OX' to the left of O and then count 5 unit upward.
Marks the point thus obtained as shown in the figure and then write B(-4, 5) near it. The point C(-2, -4) line x origin n the third quadrant. Count 2 units from origin O along OX' to the left of O and then 4 units downward. Mark the point thus obtained as shown in the figure and write C(-2, -4) near it. The point D(5, -3) lies in the 4th quadrant. Count 5 unit from origin O along OX to the right of O and then 3 units downward. Mark the point so obtained as shown in the figures.



Plotting in Graph

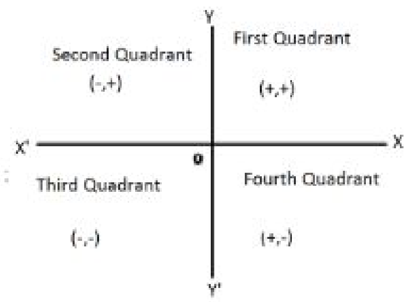
Distance formula

Meaning

Co-ordinate Geometry is a branch of geometry which is used to identify a point on a plane. It was invented by RENE DESCARTES.

Rectangular Co-ordinate Axis

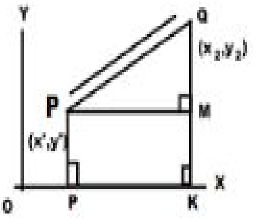
The two mutually perpendicular number lines which are used to find the position of a point on a plane is called rectangular axis. In the graph, XOX' is called x-axis and the point YOY' is called y-axis. The two lines XOX' and YOY' are also called rectangular co-ordinate axis which divide the plane into four equal parts which are called quadrant.



Plotting points in co-ordinate plane

Plotting points is the process of locating a point whose co-ordinates are given. The plotting of points can be done on graph paper.

Distance Between Two Points



Distance between two points

If the elements or co-ordinates of any two points are given, the distance between them can be found with the help of distance formulae.

Suppose that,

$P(x_1, y_1)$ and $Q(x_2, y_2)$ are any two points in the co-ordinates plane and 'd' is the distance between them.

Now,

Draw PT and QK perpendicular on x-axis and PM perpendicular to QK.

Then,

$OK = x_2$, $KQ = y_2$, $OT = x$, $PT = y$.

$PM = TK = OK - OT = (x_2 - x_1)$

Also,

$OM = OK - MK = QK - PT$

$= (y_2 - y_1)$ [$\therefore$ $MK = PT$]

Since, $\angle PMQ$ is a right angle, so $\triangle PMQ$ is a right angle triangle.

Now,

$\triangle PMQ$ using Pythagoras Theorem,

$PQ^2 = PM^2 = QM^2$

$= (x_2 - x_1)^2 + (y_2 - y_1)^2$

or, $PQ = (x_2 - x_1)^2 + (y_2 - y_1)^2$ .... $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$\therefore$ Distance (d) $= (x_2 - x_1)^2 + (y_2 - y_1)^2$ .... $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Again,

The distance of a point A(x, y) from the origin O(0, 0) is,

or, $OA = (x - 0)^2 + (y - 0)^2$ .... $\sqrt{(x - 0)^2 + (y - 0)^2}$

$\therefore$ $OA = x^2 + y^2$ .... $\sqrt{x^2 + y^2}$

Again,

Slope of the line = PQ = $\tan\theta$

$\frac{OM}{PQ} = \frac{y_2 - y_1}{x_2 - x_1}$

Types of triangle using the co-ordinates of the vertices

a)	Scalene	No sides are equal i.e. in ΔABC, AB≠BC, BC≠CA and CA≠AB.
b)	Isosceles	Two sides are equal i.e. in ΔABC, AB=BC or BC=CA or AB=AC.
c)	Equilateral	All sides are equal i.e. in ΔABC, AB = BC = CA.
d)	Right-Angled Triangle	Sum of squares of two shorter sides is equal to the square of the longest side.
e)	Right Angled Isosceles Triangle	Two shorter sides are equal and the sum of the squares of two shortest sides is equal to the square of the longest side.

Types of quadrilateral using the co-ordinates of the vertices

a)Parrallelogram	Opposite sides are equal. In quadrilateral ABCD, AB=CD and BC=AD
b)Rectangle	Opposites sides are equal and diagonals are equal i.e. in quadrilateral, ABCD, AB=CD, AD=BC and AC=BD.
c)Rhombus	All sides are equal but diagonals are not equal i.e. in quadrilateral, ABCD, AB=BC=CD=DA and AC≠BD.
d)Square	All sides are equal and diagonals are also equal i.e. in quadrilateral ABCD, AB=BC=CD=DA and AC=BD.

Section formula

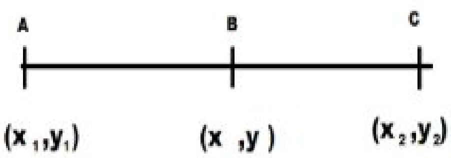
Section Formulae

Simply, section formulae refer to the external and internal division of a line segment by a given point.
Section formulae have two types. They are,

1. Section formulae for an internal division.
2. Section formulae for an external division.

Section Formulae for Internal Division

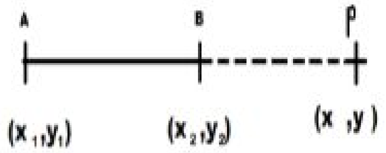
Let's take a line with two ends point A(x_1, y_2) and B(x_2, y_2) which are joined by the line segment AB. Consider P(x, y) be any point on AB which divides the line internally in the ratio m_1:m_2
i.e. AP:PB = m_1:m_2
The formula for the section formulae in internal division is (x, y) = $(\frac{m_1x_2+m_2x_1}{m_1+m_2}),(\frac{m_1y_2+m_2y_1}{m_1+m_2})$



Section formula for internal division

Section Formulae for External Division

If the point P(x, y) divides AB externally in the ratio of m_1:m_2 then the divided segment BP is measured in opposite direction and hence m_2 is taken as negative.



Section formula for external division

∴ The section formulae for external division is,

(x, y) = $\left(\frac{m_1 x_2 - m_2 x_1}{m_1 - m_2}\right), \left(\frac{m_1 y_2 - m_2 y_1}{m_1 - m_2}\right)$

In special case, the midpoint formulae is also used'

m_1:m_2 = 1:1 i.e. $m_1 = m_2$

∴ x = $\frac{x_1 + x_2}{2}$ and y = $\frac{y_1 + y_2}{2}$

Thus, co-ordinates P(x, y) are P$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ which is called mid-point formulae.