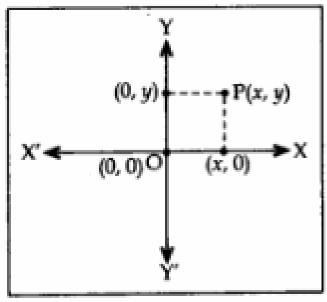
Chapter- 7

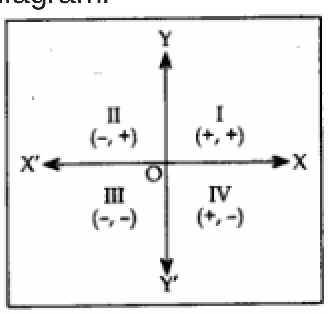
COORDINATE GEOMETRY

STUDY NOTES

- Position of a point P in the Cartesian plane with respect to co-ordinate axes is represented by the ordered pair (x, y).

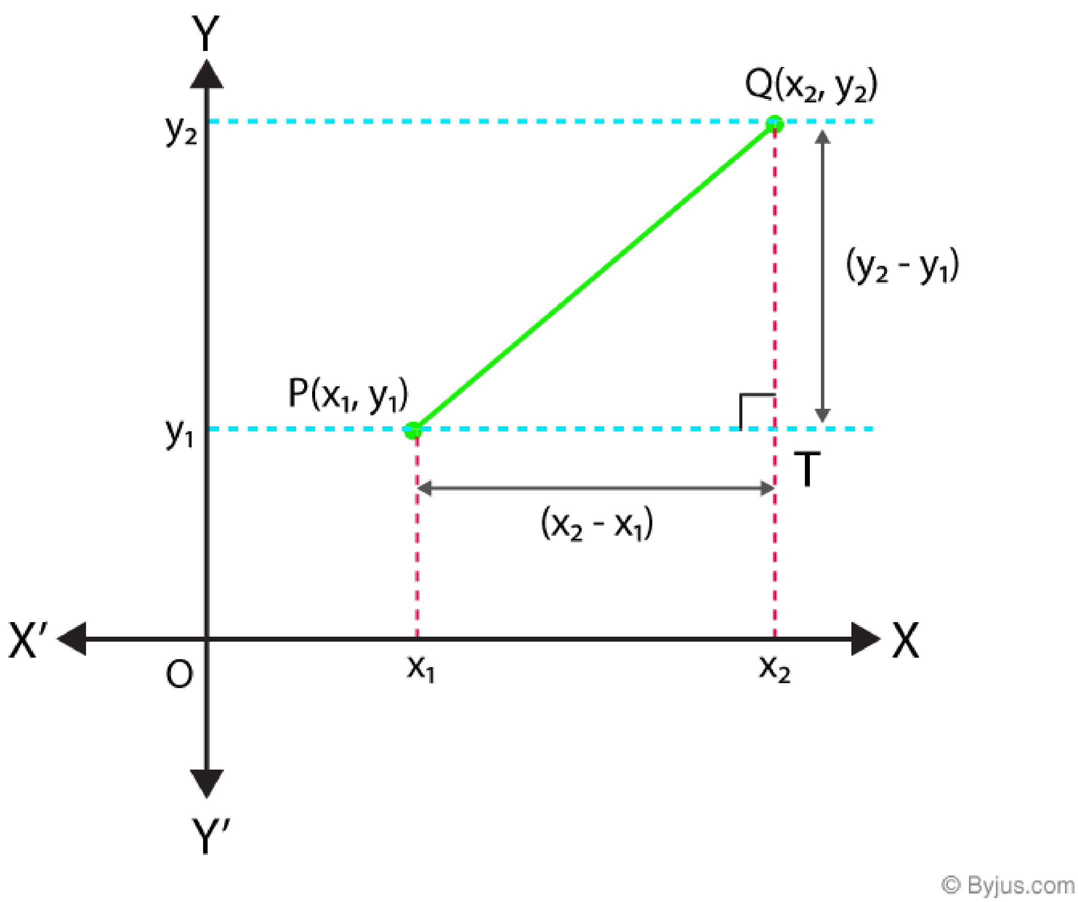


- The line X'OX is called the X-axis and YOY' is called the Y-axis.
- The part of intersection of the X-axis and Y-axis is called the origin O and the co-ordinates of O are (0, 0).
- The perpendicular distance of a point P from the Y-axis is the 'x' co-ordinate and is called the abscissa.
- The perpendicular distance of a point P from the X-axis is the 'y' co-ordinate and is called the ordinate.
- Signs of abscissa and ordinate in different quadrants are as given in the diagram:



- Any point on the X-axis is of the form (x, 0).
- Any point on the Y-axis is of the form (0, y).

Distance between Two Points Using Pythagoras Theorem



Finding distance between 2 points using
Pythagoras Theorem
Let P(x1, y1) and Q(x2, y2) be any two points on the cartesian plane.
Draw lines parallel to the axes through P and Q to meet at T.

ΔPTQ is right-angled at T.

By **Pythagoras Theorem**,
PQ2 = PT2 + QT2

$= (x2 - x1)^2 + (y2 - y1)^2$

$PQ = \sqrt{[(x2 - x1)^2 + (y2 - y1)^2]}$

Distance Formula

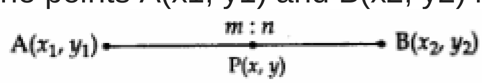
Distance between any two points (x1, y1) and (x2, y2) is given by
$d = \sqrt{[(x2 - x1)^2 + (y2 - y1)^2]}$
Where d is the distance between the points (x1,y1) and (x2,y2).

Problems based on geometrical figure.

To show that a given figure is a

- Parallelogram – prove that the opposite sides are equal.
- Rectangle – prove that the opposite sides are equal, and the diagonals are equal.
- Parallelogram but not rectangle – prove that the opposite sides are equal, and the diagonals arenot equal.
- Rhombus – prove that the four sides are equal.
- Square – prove that the four sides are equal, and the diagonals are equal.
- Rhombus but not square – prove that the four sides are equal, and the diagonals are not equal.
- Isosceles triangle – prove any two sides are equal.
- Equilateral triangle – prove that all three sides are equal.
- Right triangle – prove that sides of triangle satisfy Pythagoras theorem.

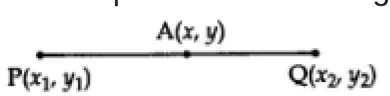
Section formula. The coordinates of the point which divides the line segment joining the points A(x1, y1) and B(x2, y2) internally in the ratio m : n are:



$$P(x, y) = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$$

The above formula is section formula. The ratio m: n can also be written as mn : 1 or k : 1, The
co-ordinates of P can also be written as P(x,y) = kx2+x1k+1,ky2+y1k+1

The mid-point of the line segment joining the points P(x1, y1) and Q(x2, y2) is



$$A(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Here m : n = 1 :1.

Points of Trisection

To find the points of trisection P and Q which divides the line segment joining A(x1, y1) and B(x2, y2) into three equal parts:

i) **AP : PB = 1 : 2**

P=(x2+2x13,y2+2y13)
ii) **AQ : QB = 2 : 1**
Q=(2x2+x13,2y2+y13)

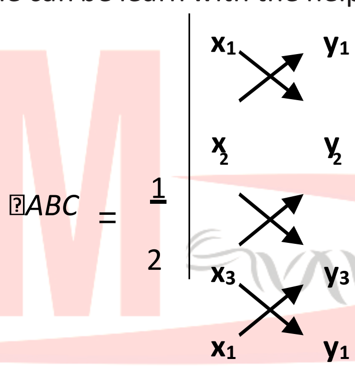
Centroid of a triangle

If A(x1, y1),B(x2, y2) and C(x3, y3) are the vertices of a ΔABC, then the coordinates of its centroid(P) is given by
p(x, y)=(x1+x2+x33,y1+y2+y33)

Area of a Triangle. The area of a triangle formed by points A(x1 y1), B(x2, y2) and C(x3, y3) is given by | ∆ |,
where ∆ = 12[x1(y2−y3)+x2(y3−y1)+x3(y1−y2)]

Trick to remember the formula

The formula of area of a triangle can be learn with the help of following arrow diagram:

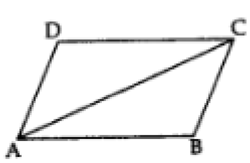


Find the sum of products of numbers at the ends of the lines pointing downwards and then subtractthe sum of products of numbers at the ends of the line pointing upwards, multiply the difference by $\frac{1}{2}$

i.e. $Area\ of\ \Delta\ ABC = \frac{1}{2}[(x_1y_2 + x_2y_3 + x_3y_1) - (x_1y_3 + x_3y_2 + x_2y_1)]$

where ∆ represents the absolute value.

Area of a quadrilateral, ABCD = ar(∆ABC) + ar(∆ADC)



Collinearity Condition

If three points A, B and C are collinear and B lies between A and C, then,

- AB + BC = AC. AB, BC, and AC can be calculated using the distance formula.
- The ratio in which B divides AC, calculated using section formula for both the x and y coordinates separately will be equal.
- Area of a triangle formed by three collinear points is zero.