Coordinate Geometry

• **Distance formula**

The distance between the points P (x_1, y_1) and Q (x_2, y_2) is given by
PQ=x2-x12+y2-y12

Example 1:
Find the values of *l*, if the distance between the points (–5, 3) and (*l*, 6) is 5 units.

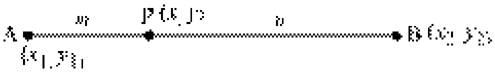
Solution:
The given points are A (–5, 3) and B (*l*, 6).
It is given that AB = 5 units
By distance formula we have

λ--52+6-32=5⇒λ+52+9=25⇒λ2+25+10λ+9=25⇒λ2+10λ+9=0⇒λ+9λ+1=0⇒λ=-1, or λ=-9

Required values of *l* are –1 or –9.

• The distance of a point (*x*, *y*) from the origin O (0, 0) is given by OP=x2+y2 .

• **Section formula:**



The co-ordinates of the point P (*x*,*y*), which divides the line segment joining the points A (x_1, y_1) and B (x_2, y_2) internally in the ratio *m*:*n*, are given by:

P x, y=mx2+nx1m+n, my2+ny1m+n

Example: In what ratio does the point (–4, 7) divide the line segment joining the points P (–1, 1) and Q (–6, 11).

Solution: Let the point (–4, 7) divide the line segment joining the points P (–1, 1) and Q(–6, 11) in the ratio λ : 1.
Thus, by section formula, we have:

-6λ+-1λ+1,11λ+1λ+1=-4, 7⇒-6λ-1λ+1=-4, 11λ+1λ+1=7⇒-6λ-1=-4λ-4⇒2λ=3⇒λ=32

Therefore, the required ratio is 3:2.

• The **mid-point** of the line segment joining the points A (x_1, y_1) and B (x_2, y_2) is x1+x22, y1+y22 .
[Note: Here, *m* = *n* = 1]

• If A (x_1, y_1), B (x_2, y_2) and C (x_3, y_3) are the vertices of ΔABC, then the coordinates of its **centroid** are given by the point x1+x2+x33, y1+y2+y33 .

- **Area of a triangle**

The area of a triangle whose vertices are (x_1, y_1), (x_2, y_2) and (x_3, y_3) is given by the numerical value of the expression
12x1y2-y3+x2y3-y1+x3y1-y2

Example 1:
Find the area of the triangle whose vertices are P (–2, 2), Q (2, 0) and R (8, 5).

Solution:
We have P (–2, 2), Q (2, 0) and R (8, 5) as the given points.

Let (x_1, y_1) = (–2, 2); (x_2, y_2) = (2, 0); (x_3, y_3) = (8, 5)
area of ΔPQR = 12x1y2-y3+x2y3-y1+x3y1-y2⇒area of ΔPQR = 12-20-5+25-2+82-0⇒area of ΔPQR = 1210+6+16⇒area of ΔPQR = 12×32⇒area of ΔPQR=16 square units

Example 2:
If the points (–4, 1), (2, 4) and (p, 6) are collinear, then find the value of p.

Solution:
Since (–4, 1), (2, 4), (p, 6) are collinear, the area of the triangle formed by these points is zero.
∴ 12-44-6+26-1+p1-4=0⇒8+10-3p=0⇒18-3p=0⇒3p=18⇒p=183⇒p=6