DAY 2

Now we shall discuss here with three points $i.e.$ triangle or collinear points.

When three points are given then we have:

- **Collinear Points:** Sum of two distances is same as third.
- **Non- collinear points:** When three non-collinear points are there then they form a triangle. In triangle about length of sides, we are known to four types of triangles**:**
  - **Equilateral Triangle:** When all three sides/distances are equal.
  - **Isosceles Triangle:** When two sides/distances are equal.
  - **Scalene Triangle:** When all sides/distances are different.
  - **Right Angle Triangle:** Here we use Pythagoras Theorem $i.e.$

    $(\boldsymbol{largest\ side})^2 = \boldsymbol{Sum\ of\ squares\ of\ other\ two\ sides}.$

    Now we shall discuss some examples.

1. Do the points $(3,2),(-2,-3)$ and $(2,3)$ form a triangle? If so name the type formed?

[Example 1]

Sol :- Let the points be $A(3,2), B(-2,-3)$ and $C(2,3)$

$$\text{Now } AB = \sqrt{\left(3-(-2)\right)^2 + \left(2-(-3)\right)^2} = \sqrt{(3+2)^2+(2+3)^2}$$

$$= \sqrt{5^2+5^2} = \sqrt{25+25} = \sqrt{50} = 7.07(\text{approx})$$

$$BC = \sqrt{(-2-2)^2+(-3-3)^2} = \sqrt{(-4)^2+(-6)^2}$$

$$= \sqrt{16+36} = \sqrt{52} = 7.21(\text{approx})$$

$$\text{and } AC = \sqrt{(3-2)^2+(2-3)^2} = \sqrt{(1)^2+(-1)^2}$$

$$= \sqrt{1+1} = \sqrt{2} = 1.41(\text{approx})$$

For Triangle: Sum of two sides > Third side, which is true

Now $\mathbf{AB^2 = 50, BC^2 = 52 \text{ and } AC^2 = 2}$

$\Rightarrow \quad \mathbf{AB^2 + AC^2 = BC^2}$

By converse of Pythagoras Theorem, Triangle is right angled

2. Check whether $(6,6),(5,2)$ and $(2,5)$ are vertices of an isosceles triangle.

Sol:- Let the points be $P(6,6), Q(5,2)$ and $R(2,5)$

$$\text{Now } PQ = \sqrt{(6-5)^2+(6-2)^2} = \sqrt{(1)^2+(4)^2}$$

$$= \sqrt{1+16} = \sqrt{17}$$

$$QR = \sqrt{(5-2)^2+(2-5)^2} = \sqrt{(3)^2+(-3)^2}$$

$$= \sqrt{9+9} = \sqrt{18}$$

$$\text{and } PR = \sqrt{(6-2)^2+(6-5)^2} = \sqrt{(4)^2+(1)^2}$$

$$= \sqrt{16+1} = \sqrt{17}$$

Here $PQ = PR$ $i.e.$ any two sides/distances are equal.

$\Rightarrow$ Given sides are vertices of an isosceles triangle.

3. Check whether $(1, 3), (5, 3)$ and $(5, 9)$ are collinear or not.

Sol:- Let the points be A(1,3), B(5,3) and C(5,9)

$$\text{Now } AB = \sqrt{(1-5)^2+(3-3)^2} = \sqrt{(-4)^2+(0)^2}$$
$$= \sqrt{16+0} = \sqrt{16} = 4$$
$$BC = \sqrt{(5-5)^2+(3-9)^2} = \sqrt{(0)^2+(-6)^2}$$
$$= \sqrt{0+36} = \sqrt{36} = 6$$
$$\text{and } AC = \sqrt{(1-5)^2+(3-9)^2} = \sqrt{(-4)^2+(-6)^2}$$
$$= \sqrt{16+36} = \sqrt{52} = \sqrt{2\times2\times13} = 2\sqrt{13}$$

Here Sum of two distances/sides $\neq$ Third distance/side.

$\Rightarrow$ Given points are not collinear.

4. Check whether $A(3, 1), B(6, 4)$ and $C(8, 6)$ are lie on a line. **[Example 3]**

Sol:- $\text{Now } AB = \sqrt{(3-6)^2+(1-4)^2} = \sqrt{(-3)^2+(-3)^2}$

$$= \sqrt{9+9} = \sqrt{18} = \sqrt{2\times3\times3} = 3\sqrt{2}$$
$$BC = \sqrt{(6-8)^2+(4-6)^2} = \sqrt{(-2)^2+(-2)^2}$$
$$= \sqrt{4+4} = \sqrt{8} = \sqrt{2\times2\times2} = 2\sqrt{2}$$
$$\text{and } AC = \sqrt{(3-8)^2+(1-6)^2} = \sqrt{(-5)^2+(-5)^2}$$
$$= \sqrt{25+25} = \sqrt{50} = \sqrt{2\times5\times5} = 5\sqrt{2}$$

Here $AB + BC = 3\sqrt{2} + 2\sqrt{2} = 5\sqrt{2} = AC$

$\Rightarrow$ Given points are collinear.

EXERCISE

1. Name the triangle whose vertices are $P(5,3), Q(2,1)$ and $R(-3,0)$.
2. Check whether the vertices $A(8,4), B(5,7)$ and $C(-1,1)$ are of a right angled triangle.
3. Show that the points $(7,10), (-2,5)$ and $(3,-4)$ are the vertices of an isosceles triangle.
4. Show that points $(12,8), (-2,6)$ and $(6,0)$ are the vertices of a right angled triangle.
5. Check the following points are collinear or not:
   i) $(1,3), (5,3), (15,4)$ ii) $(4,3), (5,1), (1,9)$ iii) $(2,5), (-1,2), (4,7)$
6. Ex 7.1, Q 3,4,5