## EE25btech11028 - J.Navya sri

### **Question:**

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

#### **Solution:**

Given points,

$$A = \begin{bmatrix} 3 \\ 2 \end{bmatrix}, \quad B = \begin{bmatrix} -2 \\ -3 \end{bmatrix}, \quad C = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$$
 (1)

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### 1. Collinearity check (using rank)

Form the matrix:

$$M = \begin{bmatrix} 3 & 2 & 1 \\ -2 & -3 & 1 \\ 2 & 3 & 1 \end{bmatrix} \tag{2}$$

Apply row operations:

$$R_2 \leftarrow R_2 + 2R_1, \quad R_3 \leftarrow 3R_3 - 2R_1 \quad \Rightarrow \quad \begin{bmatrix} 3 & 2 & 1 \\ 4 & 1 & 3 \\ 0 & 5 & 1 \end{bmatrix}$$
 (3)

$$R_2 \leftarrow 3R_2 - 4R_1 \implies \begin{bmatrix} 3 & 2 & 1 \\ 0 & -5 & 5 \\ 0 & 5 & 1 \end{bmatrix}$$
 (4)

$$R_3 \leftarrow R_3 + R_2 \implies \begin{bmatrix} 3 & 2 & 1 \\ 0 & -5 & 5 \\ 0 & 0 & 6 \end{bmatrix}$$
 (5)

Since all three rows are nonzero:

$$rank(M) = 3 (6)$$

 $\Rightarrow$  Points are not collinear, so they form a triangle.

## 2. Right-angle check

$$\overrightarrow{AB} = B - A = \begin{bmatrix} -5 \\ -5 \end{bmatrix}, \quad \overrightarrow{AC} = C - A = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$
 (7)

$$\overrightarrow{AB} \cdot \overrightarrow{AC} = (-5)(-1) + (-5)(1) = 0 \tag{8}$$

$$\Rightarrow \overrightarrow{AB} \perp \overrightarrow{AC}$$

So, the triangle is right-angled at

$$A = \begin{bmatrix} 3\\2 \end{bmatrix} \tag{9}$$

### 3. Final Answer

The given points form a triangle (rank 
$$= 3$$
). (10)

The triangle is right-angled at 
$$A = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$
. (11)

# **Graphical Representation:**

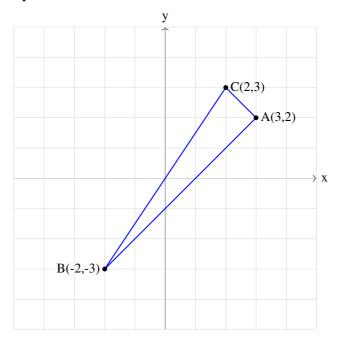


Fig. 0