2.4.23

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Question:

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

Solution: Let the position vectors of the points be:

$$\mathbf{A} = (3, 2), \quad \mathbf{B} = (-2, -3), \quad \mathbf{C} = (2, 3)$$

Step 1: Check if the points are collinear

Calculate area of the triangle using vector cross product magnitude:

$$\text{Area} = \frac{1}{2} |(\mathbf{B} - \mathbf{A}) \times (\mathbf{C} - \mathbf{A})| \tag{1}$$

Compute vectors:

$$\mathbf{B} - \mathbf{A} = (-2 - 3, \ -3 - 2) = (-5, -5) \tag{2}$$

$$\mathbf{C} - \mathbf{A} = (2 - 3, \ 3 - 2) = (-1, 1) \tag{3}$$

Calculate the 2D cross product magnitude:

$$|(\mathbf{B} - \mathbf{A}) \times (\mathbf{C} - \mathbf{A})| = |(-5)(1) - (-5)(-1)|$$
$$= |-5 - 5| = 10 \tag{4}$$

Therefore,

$$\text{Area} = \frac{1}{2} \times 10 = 5 \neq 0 \tag{5}$$

Since area $\neq 0$, points are not collinear and hence form a triangle.

Step 2: Calculate the side lengths

Length of side AB:

$$|\mathbf{B} - \mathbf{A}| = \sqrt{(-5)^2 + (-5)^2} = \sqrt{50} \tag{6}$$

Length of side BC:

$$|\mathbf{C} - \mathbf{B}| = \sqrt{(2 + 2)^2 + (3 + 3)^2} = \sqrt{16 + 36} = \sqrt{52} \tag{7}$$

Length of side *AC*:

$$|\mathbf{C} - \mathbf{A}| = \sqrt{(-1)^2 + 1^2} = \sqrt{2} \tag{8}$$

Step 3: Determine the type of triangle

Since

$$\sqrt{50} \neq \sqrt{52} \neq \sqrt{2}$$

all sides are unequal.

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Final Answer

</div>

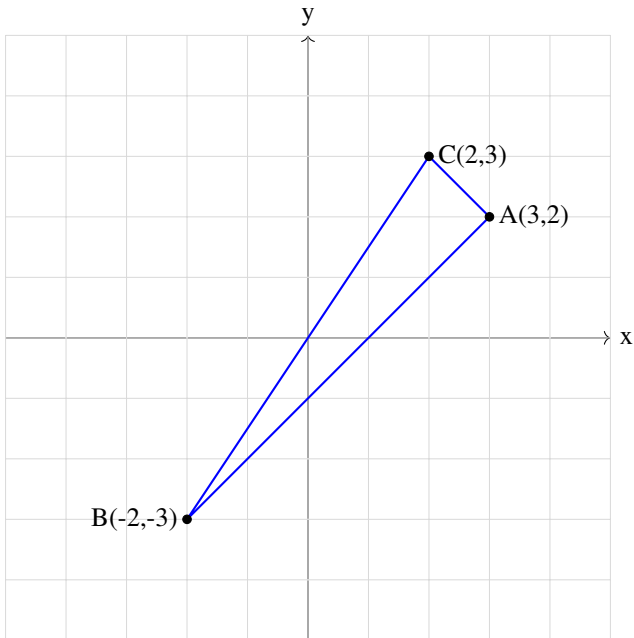Yes, the points form a scalene triangle.

Graphical Representation:

Fig. 0