SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
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✖ Puzzle: Find the Complex Number z

Problem:

Consider the complex number $z = a + bi$, where a and b are real numbers. The following conditions are given:

1. The modulus of z is 5:

$$|z| = 5$$

2. The argument of z is $\theta = \frac{\pi}{3}$.

Question:

Determine the real and imaginary parts of z, i.e., find a and b.

↓

🧠 Solution:

1. **Modulus and Argument Form:**

   A complex number z in polar form is expressed as:

   $$z = r(\cos\theta + i\sin\theta)$$

   where $r = |z|$ is the modulus, and θ is the argument.

2. **Substitute the Given Values:**

   Given $|z| = 5$ and $\theta = \frac{\pi}{3}$, substitute these into the polar form:

   $$z = 5\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$$

3. **Evaluate the Trigonometric Functions:** ↓

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$$z = 5\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$$

3. **Evaluate the Trigonometric Functions:**

From trigonometric values:

$$\cos\frac{\pi}{3} = \frac{1}{2}, \quad \sin\frac{\pi}{3} = \frac{\sqrt{3}}{2}$$

4. **Final Expression for z:**

Substituting these values:

$$z = 5\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)$$

Simplifying:

$\downarrow$

Simplifying:

$$z = \frac{5}{2} + i\frac{5\sqrt{3}}{2}$$

Therefore, the real part $a = \frac{5}{2}$ and the imaginary part $b = \frac{5\sqrt{3}}{2}$.

✅ **Answer:**

The complex number z is:

$$z = \frac{5}{2} + i\frac{5\sqrt{3}}{2}$$

with real part $a = \frac{5}{2}$ and imaginary part $b = \frac{5\sqrt{3}}{2}$. $\downarrow$