

King Fahd University of Petroleum and Minerals
College of Computing and Mathematics
Information and Computer Science Department
ICS 560: Foundations of Quantum Computing

Semester 251

Quiz #1

Name: Key Answer ID #..... Date: 19/09/2025

Show all the necessary steps to earn full marks.

1. Compute $(2 + 5i)(4 - 3i)(i - 1)$.

$$\begin{aligned} & (23 + 14i)(i - 1) \\ & = -37 + 9i \end{aligned}$$

(2)

2. Find the modulus of $z = -7 + 24i$.

$$\begin{aligned} |z| &= \sqrt{(-7)^2 + (24)^2} \\ &= \sqrt{49 + 576} \\ &= \sqrt{625} = \underline{\underline{25}} \end{aligned}$$

(2)

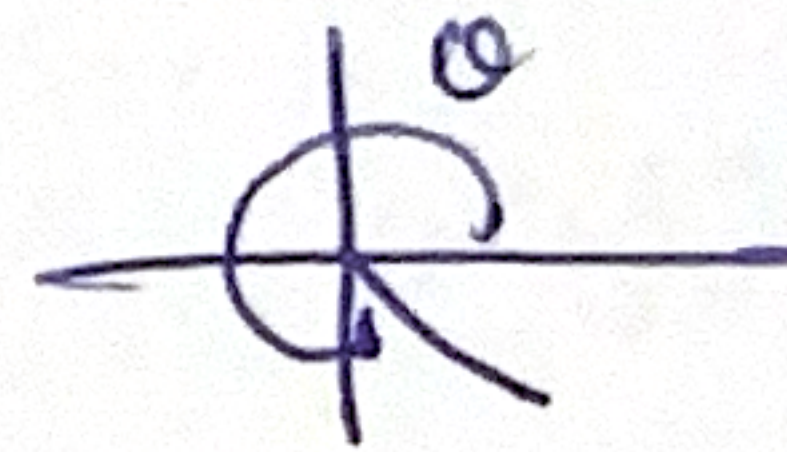
3. Convert $z = -3 - \sqrt{3}i$ into polar form (ρ, θ) .

$$\rho = \sqrt{9+3} = \sqrt{12} = 2\sqrt{3}$$

$$\theta = \tan^{-1}\left(\frac{-\sqrt{3}}{-3}\right) = \frac{11\pi}{6}$$

$$\therefore (\rho, \theta) = (2\sqrt{3}, \frac{11\pi}{6})$$

②

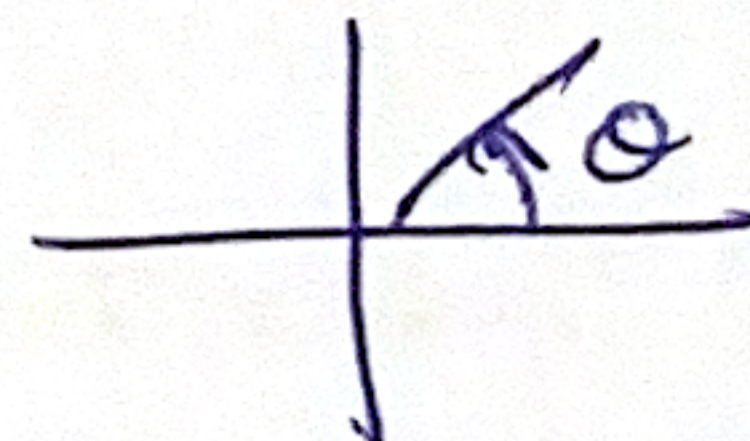


4. Express $z = 3 + 3\sqrt{3}i$ in Euler's form.

$$\rho = \sqrt{9+27} = \sqrt{36} = 6$$

$$\theta = \tan^{-1}\left(\frac{3\sqrt{3}}{3}\right) = \frac{\pi}{3}$$

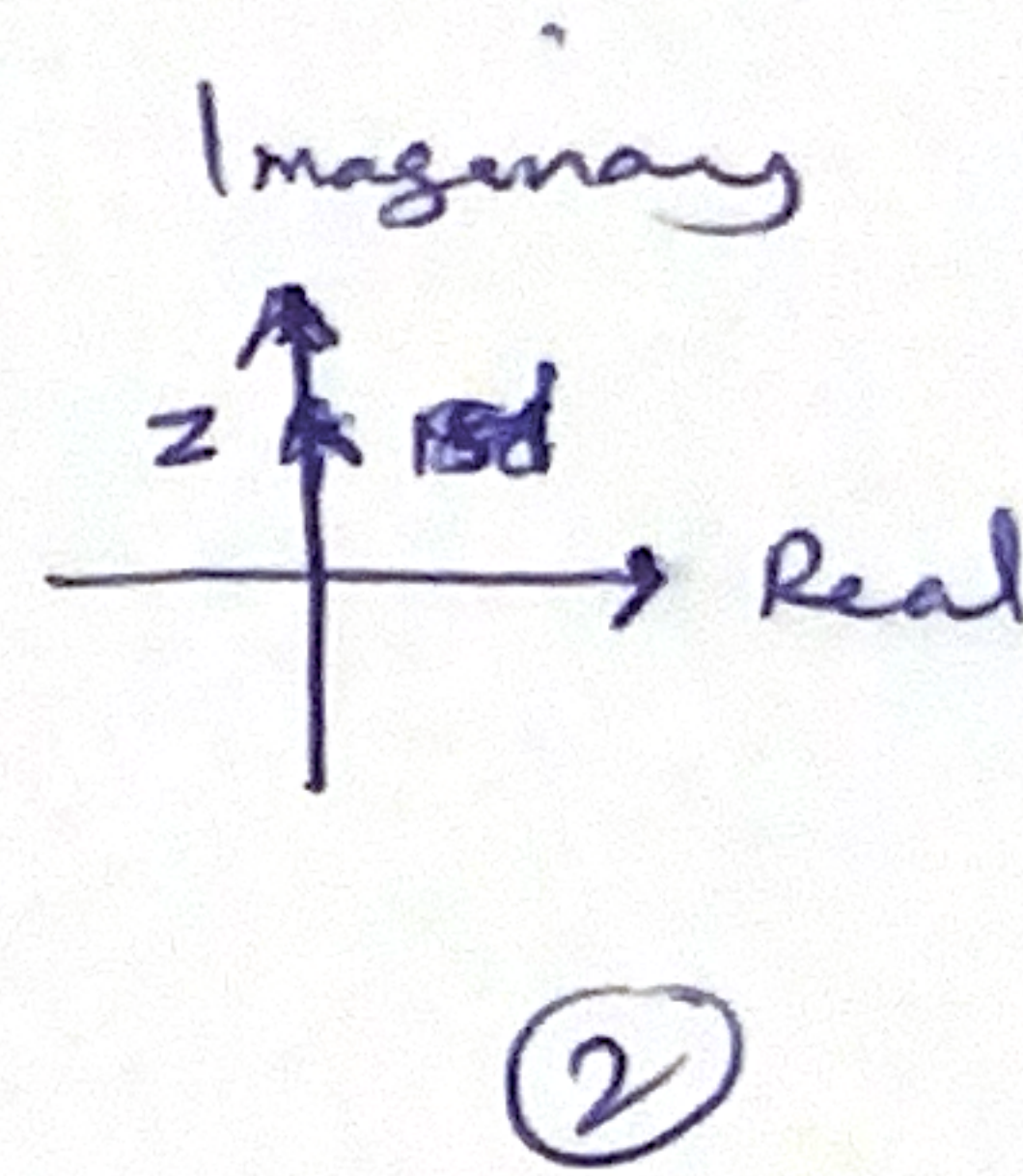
$$\therefore Z = \rho e^{i\theta} = 6 e^{i\pi/3}$$



②

5. Compute the fourth roots of $z = 81i$.

$$\begin{aligned}\therefore \theta &= \frac{\pi}{2}, \rho = 81 \\ \therefore Z &= 81 e^{i\pi/2} \\ Z^{1/4} &= 3 e^{i\pi/8}\end{aligned}$$



6. Multiple Choice Questions:

1) Which of the following is the multiplicative identity in a complex vector space?

- (A) $1 + 0i$
- B) $1 + i$
- C) 0
- D) $1 - i$

2) Which pair of vectors are linearly dependent?

- A) $(1, 2), (2, 3)$
- (B) $(1, i), (2, 2i)$
- C) $(1, 0), (0, 1)$
- D) $(1, 2), (3, 5)$

3) If $z_1 = (2, \pi/3), z_2 = (3, \pi/4)$ in polar form, their product is:

- A) $(5, \frac{\pi}{7})$
- B) $(6, \frac{\pi}{12})$
- ✓ C) $(\frac{6\sqrt{7}\pi}{12}, \frac{7\pi}{12})$
- D) $(9, \pi/12)$