

Exercise 1.3 MCQs on Complex Numbers & Related Concepts

Multiple Choice Questions

1. 1. What is the coordinate of the complex number $3 - 2i$ on the Argand plane?

- A) (2, 3)
- B) (3, -2)
- C) (-3, 2)
- D) (-2, -3)

2. 2. What is the value of i^4 ?

- A) i
- B) -1
- C) 1
- D) $-i$

3. 3. The conjugate of $5 + 4i$ is:

- A) $5 - 4i$
- B) $-5 + 4i$
- C) $-5 - 4i$
- D) $4 + 5i$

4. 4. For $z = a + bi$, $z = \bar{z}$ if and only if:

- A) $a = b$
- B) $b = 0$
- C) $a = 0$
- D) $a = -b$

5. 5. Simplify $\sqrt{-9}$:

- A) 3
- B) $3i$
- C) $-3i$
- D) -3

6. 6. Which of the following is purely imaginary?

- A) 0

- B) $2 + 3i$
- C) $-4i$
- D) $1 - i$

7. The multiplicative inverse of $1 - 2i$ is:

- A) $(1 + 2i)/5$
- B) $(1 - 2i)/5$
- C) $(1 + 2i)/3$
- D) $(2 - i)/5$

8. Which expression is always real for $z = a + bi$?

- A) $z - \bar{z}$
- B) $z + \bar{z}$
- C) $i \cdot z$
- D) z^2

9. Simplify $(2 + 3i) + (1 - 4i)$:

- A) $3 - i$
- B) $1 + 7i$
- C) $3 + 7i$
- D) $1 - i$

10. Compute $(2 + 3i)(2 - 3i)$:

- A) 13
- B) -5
- C) $4 + 9i$
- D) $13 + 0i$

11. Simplify $z^2 + \bar{z}^2$ when $z = 1 + i$:

- A) 2
- B) 0
- C) $4i$
- D) -2

12. Rationalize the denominator: $1/(2 + i)$:

- A) $(2 - i)/5$
- B) $(2 + i)/5$
- C) $(2 - i)/3$
- D) $(2 + i)/3$

13. 13. Simplify $(1 + 2i)/(1 - 2i)$:

- A) $-3/5 + 4/5 i$
- B) $3/5 - 4/5 i$
- C) $-1 + i$
- D) $1 - i$

14. 14. Which gives the correct plot for $3/5 - 4/5 i$?

- A) (0.4, 0.8)
- B) (0.6, -0.8)
- C) (-0.6, 0.8)
- D) (0.6, 0.4)

15. 15. Simplify $2/(\sqrt{5} + i\sqrt{8})$:

- A) $(2\sqrt{5} - 2i\sqrt{8})/13$
- B) $(2\sqrt{5} + 2i\sqrt{8})/13$
- C) $(\sqrt{5} - i\sqrt{8})/6$
- D) $(2\sqrt{8} - 2i\sqrt{5})/13$

16. 16. Simplify $3/(\sqrt{6} - \sqrt{12})$:

- A) $-(\sqrt{6} + 2\sqrt{3})/2$
- B) $(\sqrt{6} + 2\sqrt{3})/2$
- C) $-(\sqrt{6} - 2\sqrt{3})/4$
- D) $(\sqrt{6} - 2\sqrt{3})/4$

17. 17. Evaluate $(-\frac{1}{2} + (\sqrt{3}/2)i)^3$:

- A) 1
- B) -1
- C) i
- D) -i

18. 18. Evaluate $(-\frac{1}{2} - (\sqrt{3}/2)i)^3$:

- A) 1
- B) -1
- C) -i
- D) i

19. 19. If $z = 2 + 3i$, what is z^{-1} ?

- A) $(2 - 3i)/13$
- B) $(3 - 2i)/13$

- C) $(2 + 3i)/13$
- D) $(-2 + 3i)/13$

20. Which expression yields a real result for any z ?

- A) $z - \bar{z}$
- B) $z + \bar{z}$
- C) $z * \bar{z}$
- D) $1/z$

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Answer Key with Explanations

1. Answer: B

Real part = 3, Imaginary part = -2, so point is (3, -2).

2. Answer: C

$$i^4 = (i^2)^2 = (-1)^2 = 1.$$

3. Answer: A

Conjugate flips the sign of the imaginary part: $5 - 4i$.

4. Answer: B

z equals its conjugate only when imaginary part $b = 0$ (purely real).

5. Answer: B

$$\sqrt{-9} = 3i.$$

6. Answer: C

$-4i$ has no real part, only imaginary.

7. Answer: A

$$1/(1-2i) = (1+2i)/(1^2+(-2)^2) = (1+2i)/5.$$

8. Answer: B

$z + \bar{z} = 2a$, which is real.

9. Answer: A

$$(2+1) + (3i-4i) = 3 - i.$$

10. Answer: A

$$(2+3i)(2-3i) = 2^2 + 3^2 = 4 + 9 = 13.$$

11. Answer: B

$$z^2 = 2i, \bar{z}^2 = -2i, \text{ sum} = 0.$$

12. Answer: A

$$\text{Multiply by } (2-i): (2-i)/(4+1) = (2-i)/5.$$

13. Answer: A

Multiply by conjugate: $(-3+4i)/5$.

14. Answer: B

Real = $3/5 = 0.6$, Imag = $-4/5 = -0.8$.

15. Answer: A

Multiply numerator and denominator by $(\sqrt{5} - i\sqrt{8})$: gives $(2\sqrt{5} - 2i\sqrt{8})/13$.

16. Answer: A

Multiply by $(\sqrt{6}+\sqrt{12})$: result = $-(\sqrt{6}+2\sqrt{3})/2$.

17. Answer: A

This is one of the cube roots of unity = 1.

18. Answer: A

Also a cube root of unity = 1.

19. Answer: A

$z^{-1} = \text{conj}/(a^2+b^2) = (2 - 3i)/13$.

20. Answer: C

$z \cdot \bar{z} = a^2+b^2$ is always real.

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