

NOTA means "none of these answers."

Note: In all problems $i = \sqrt{-1}$

5
1. Simplify: $\frac{i + 3}{i - 2}$

A. $-\frac{5}{3} - \frac{5}{3}i$ B. $-1 - i$ C. $\frac{7}{5} + i$ D. $1 + i$ E. NOTA

2. If $3xi + 12 = 6i(x - 1)$, find x :

A. 2 B. $2i$ C. $1 - 2i$ D. $2 - 4i$ E. NOTA

3. $f(1) = i$, $f(2) = 3i$, $f(n + 1) = 2f(n) - f(n - 1)$ for $n \geq 2$, find $f(1996)$.

A. $3989i$ B. $3991i$ C. $3993i$ D. $3995i$ E. NOTA

4. Given: $2(2x + y) - 3(x - y)i = 12 - 18i$, find $x + y$

A. 2 B. 3 C. 4 D. 6 E. NOTA

5. One of the roots of a polynomial with real coefficients is $2 - i$. Which of the following could be the given polynomial?

A. $x^2 + 4x + 5$ B. $x^2 - 4x + 5$ C. $x^2 + 4x - 5$

D. $x^2 - 4x - 5$ E. NOTA

6. Find the product of $(1 - i)^{11}$.

A. $16 + 16i$ B. $11 - 11i$ C. $1 - i$

D. $-32 - 32i$ E. NOTA

7. Simplify: $\frac{\sqrt{-12}}{\sqrt{3}} \cdot \sqrt{-18}$

- A. $6\sqrt{2}$ B. $6\sqrt{2}i$ C. $-6\sqrt{2}$ D. $-6\sqrt{2}i$ E. NOTA

8. $f(x) = 2ix^3 - 4x^2 + 5ix - 3$, find $f(2i)$.

- A. 19 B. 35 C. -61 D. -93 E. NOTA

9. Write $-3 + \sqrt{3}i$ in polar form.

- A. $2\sqrt{3} \operatorname{cis} 120^\circ$ B. $-2\sqrt{3} \operatorname{cis} 120^\circ$ C. $2\sqrt{3} \operatorname{cis} 150^\circ$
D. $-2\sqrt{3} \operatorname{cis} 30^\circ$ E. NOTA

10. $\sum_{n=1}^{10} (2i)^n$

- A. $-820 - 410i$ B. $-820 + 410i$ C. $820 - 410i$
D. $820 + 410i$ E. NOTA

11. Which of the following is a complex solution to $x^3 - 8x^2 + 25x - 26 = 0$

- A. $2 - 3i$ B. $3 + 2i$ C. $-2 + i$ D. $3 - i$ E. NOTA

12. Which of the following is/are true if $z = a + bi$ and $\bar{z} = a - bi$?

- I. $z\bar{z}$ is a real number
II. $z + \bar{z}$ is a real number
III. $z - \bar{z}$ is a pure imaginary number

- A. I only B. II only C. II and III only
D. I, II, and III E. NOTA

13. Solve: $x^2 = i$

A. $\{\sqrt{2} + i, \sqrt{2} - i\}$

B. $\left\{\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i, -\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i\right\}$

C. $\left\{\frac{1}{2} + \frac{\sqrt{2}}{2}i, -\frac{1}{2} - \frac{\sqrt{2}}{2}i\right\}$

D. $\left\{-\frac{1}{2} + \frac{\sqrt{2}}{2}i, -\frac{1}{2} - \frac{\sqrt{2}}{2}i\right\}$

E. NOTA

14. Simplify: $i^{123} - i^{39} + i^{-3} - i$

A. $3i$

B. $2i$

C. i

D. 0

E. NOTA

15. Find the product of $(1 + i)^{-12}(1 - \sqrt{3}i)^5$.

A. $\frac{\sqrt{3}}{4} + \frac{1}{4}i$

B. $-\frac{\sqrt{3}}{4} + \frac{1}{4}i$

C. $\frac{\sqrt{3}}{4} - \frac{1}{4}i$

D. $-\frac{\sqrt{3}}{4} - \frac{1}{4}i$

E. NOTA

16. If $e^{i2x} = \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i$, for $0 \leq x \leq 2\pi$, find the values of x .

A. $\frac{\pi}{4}, \frac{5\pi}{4}$

B. $\frac{7\pi}{8}, \frac{15\pi}{8}$

C. $\frac{3\pi}{4}, \frac{7\pi}{4}$

D. $\frac{5\pi}{8}, \frac{13\pi}{8}$

E. NOTA

17. Evaluate: $|5 - 12i|$

- A. $5 + 12i$ B. $\sqrt{119}i$ C. 13 D. 7 E. NOTA

18. Find the value(s) of k for which $3x^2 - 4kx + 1$ has non-real solutions:

- A. $\left\{-\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}\right\}$ B. $\{-1, 1\}$ C. $\{-\sqrt{2}, \sqrt{2}\}$
 D. $\left\{-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right\}$ E. NOTA

19. If $x = \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i$ and $y = \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i$, find $x^5 + y^5$.

- A. 0 B. $\frac{1}{2}$ C. $-\sqrt{2}$ D. $-\frac{\sqrt{2}}{2}$ E. NOTA

20. If $\frac{2-i}{4+i} - \frac{2i}{3-i} = a + bi$, find $a + b$.

- A. $-\frac{49}{85}$ B. $-\frac{29}{85}$ C. $\frac{29}{13}$ D. $\frac{63}{85}$ E. NOTA

21. Find the distance between the number $2 + 3i$ and $4 - 4i$ in the complex plane:

- A. $-\sqrt{45}i$ B. $\sqrt{37}$ C. $\sqrt{53}$ D. $2\sqrt{14}$ E. NOTA

22. One solution for i^i is:

- A. $\frac{\pi}{16}$ B. $\frac{\pi}{15}$ C. $e^{-\frac{\pi}{2}}$ D. $e^{-\frac{\pi}{e}}$ E. NOTA

23. Which of the following is **not** a polar form of $3 - 3i$?

A. $3\sqrt{2} \operatorname{cis}(-45^\circ)$

B. $3\sqrt{2} \operatorname{cis}(-405^\circ)$

C. $3\sqrt{2} \operatorname{cis}(675^\circ)$

D. $3\sqrt{2} \operatorname{cis}(765^\circ)$

E. NOTA

24. Which of the following is a fourth root of $16 \operatorname{cis} 120^\circ$?

A. $1 + \sqrt{3}i$

B. $-\sqrt{3} + i$

C. $-\sqrt{3} - i$

D. $-1 - \sqrt{3}i$

E. NOTA

25. Which of the following is equivalent to $2(\cos 4 + i \sin 4)$?

A. $2e^{4i}$

B. $4i$

C. $2e^{4i\pi}$

D. $4e^{2i}$

E. NOTA

26. Simplify $2(\cos \alpha + i \sin \alpha)(\cos \alpha - i \sin \alpha)$.

A. $2 \cos^2 2\alpha$

B. $\sin^2 2\alpha$

C. $\cos 2\alpha$

D. 2

E. NOTA

27. Find the multiplicative inverse of i .

A. 1

B. -1

C. i

D. $-i$

E. NOTA

28. Find the area of the triangle formed by the 3 cube roots of -1 in the complex plane. (All answers are in square units.)

A. $\frac{3}{8}$

B. $\frac{3\sqrt{3}}{8}$

C. $\frac{3\sqrt{3}}{4}$

D. $\frac{3}{4}$

E. NOTA

29. What best describes the geometric shape that the 4 fourth roots of -1 form in the complex plane?

A. parallelogram

B. rhombus

C. rectangle

D. square

E. NOTA

30. One of the factors of $3ix^2 - 11x - 6i$ is:

A. $3x - 2$

B. $3ix - 2$

C. $3x - 2i$

D. $2ix + 1$

E. NOTA