

Topic Test: Complex Numbers

- 1 Evaluate: $i^{45} + i^{35} - \sqrt{-121} + (4+3i)^2 - (2-i)(4+i)$
- A) $7-4i$ B) $2+17i$ C) $5+11i$
D) $-2+15i$ E) NOTA
- 2 Determine the sum: $(i+3)+1+\frac{1}{i+3}+\dots$
- A) $\frac{-2}{5} + \frac{-1}{5}i$ B) $\frac{22}{5} + \frac{4}{5}i$ C) $\frac{7}{5} + \frac{-1}{5}i$
D) $\frac{-7}{5} + \frac{1}{5}i$ E) NOTA
- 3 Determine the dot product of $5j-2k$ and $-3j-4k$
- A) -7 B) -23 C) $26k$
D) $-26k$ E) NOTA
- 4 Simplify: $\left(\frac{1}{2} + \frac{\sqrt{3}i}{2}\right)^{-6i}$
- A) $\frac{1}{10}$ B) $\frac{7}{429}$ C) $\frac{211}{12870}$
D) $\frac{4}{23}$ E) NOTA
- 5 Multiply $3-2i$ by its conjugate.
- A) $-13-12i$ B) $2-3i$ C) $-3+2i$
D) $13+0i$ E) NOTA
- 6 If $5^x = \log_3 3.5 + \log_3 7 + \log_3 14 + \log_3 49$ then $x=$
- A) $\log_5 \log_3 7$ B) $\log_5 \log_3 7 + 1$ C) $\log_5 \log_3 7 - 1$
D) $\log_5 \log_3 7 \pm 1$ E) NOTA
- 7 What is the sum of the real solutions to the equation $x^{\log x} = \frac{x^3}{100}$?
- A) 3 B) 11 C) 101
D) 110 E) NOTA

Topic Test: Complex Numbers

- 8 Which of the following expressions is equivalent to $\frac{3-2i}{4+7i}$, where $i = \sqrt{-1}$
- A) $\frac{2}{33} - \frac{29}{33}i$ B) $\frac{2}{33} + \frac{29}{33}i$ C) $\frac{-2}{65} - \frac{29}{65}i$
D) $\frac{-2}{65} + \frac{29}{65}i$ E) NOTA
- 9 Two points, $(8, 60^\circ)$ and $(4\sqrt{2}, 45^\circ)$, are given using polar coordinates. What is the distance between them?
- A) $\sqrt{3}$ B) $2\sqrt{3}$ C) $4\sqrt{3} + 4$
D) $4\sqrt{3} - 4$ E) NOTA
- 10 What is the slope of the line in the complex plane what is perpendicular to the line containing $3-i$ and i ?
- A) $-2/3$ B) $2/3$ C) $-3/2$
D) $3/2$ E) NOTA
- 11 Simplify: $\frac{3+2i}{-2+5i}$
- A) $\frac{4+19i}{21}$ B) $\frac{4-19i}{21}$ C) $\frac{4+19i}{29}$
D) $\frac{4-19i}{29}$ E) NOTA
- 12 If Q is randomly selected from the first 11 whole numbers, what is the probability that i^Q equals 1?
- A) $\frac{1}{11}$ B) $\frac{2}{11}$ C) $\frac{3}{11}$
D) $\frac{4}{11}$ E) NOTA
- 13 What is the fifth root of $32 \text{ cis}(250^\circ)$?
- A) $4 \text{ cis } 50^\circ$ B) $2 \text{ cis } 70^\circ$ C) $2 \text{ cis } 250^\circ$
D) $2 \text{ cis } 266^\circ$ E) NOTA
- 14 What is i^{2003} ?
- A) 1 B) -1 C) I
D) $-i$ E) NOTA

Topic Test: Complex Numbers

15 In an Argand field, a line segment is drawn from the origin to the complex number $5 \operatorname{cis} 25^\circ$. Another line segment is drawn for the origin to the complex number $9 \operatorname{cis} 15^\circ$. What is the scalar projection of the shorter segment to the longer one?

- A) $1.8 \sin 10^\circ$ B) $45 \cos 10^\circ$ C) $1.8 \cos 40^\circ$
D) $5 \cos 10^\circ$ E) NOTA

16 Evaluate \sqrt{i}

- A) $\frac{\sqrt{3}}{3} - \frac{\sqrt{3}}{3}i$ B) $\frac{\sqrt{3}}{3} + \frac{\sqrt{3}}{3}i$ C) $\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i$
D) $\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i$ E) NOTA

17 Find the value of $\frac{1}{i^5} + \frac{1}{i^6} + \frac{1}{i^7}$

- A) -1 B) $-i$ C) 1
D) I E) NOTA

18 Evaluate $i^{(3x^4+2x^3-8x^2-6x+1)}$ for $x = 4$

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

19 Given $\frac{8 \operatorname{cis} \left(\frac{19\pi}{18} \right)}{4 \operatorname{cis} \left(\frac{7\pi}{18} \right)} =$

- A) $1 - \sqrt{3}i$ B) $\sqrt{3} - i$ C) $-1 + \sqrt{3}i$
D) $-\sqrt{3} + i$ E) NOTA

20 Simplify: $(2 - 2i)^8$

- A) 4096 B) $4096i$ C) $-4096i$
D) -4096 E) NOTA

Topic Test: Complex Numbers

- 21 Which of the following expressions is equivalent to $\frac{9-5i}{2-3i}$?
- A) $\frac{-3}{5} - \frac{17}{5}i$ B) $\frac{-33}{5} - \frac{17}{5}i$ C) $\frac{3}{13} + \frac{17}{13}i$
D) $\frac{33}{13} + \frac{17}{13}i$ E) NOTA
- 22 What is the fourth root of $8+8\sqrt{3}i$?
- A) $4\text{cis}\left(\frac{\pi}{6}\right)$ B) $2\text{cis}\left(\frac{\pi}{12}\right)$ C) $2\text{cis}\left(\frac{\pi}{24}\right)$
D) $4\text{cis}\left(\frac{\pi}{12}\right)$ E) NOTA
- 23 What is the value of $(1+i)^{12}$?
- A) 4096 B) 128 C) 64
D) 1024 E) NOTA
- 24 Given $\frac{(a+bi)^{\frac{1}{3}}}{(2+i)^{\frac{1}{3}}} = \sqrt{3}+i$, find $a+b$
- A) 0 B) -8 C) 8
D) 16 E) NOTA
- 25 The US Capitol Building contains an elliptical room, 96ft by 46 ft on the longest and shortest axes, in which someone standing at one focus can overhear even the most faint conversation occurring at the other focus. How many feet (to the nearest hundredth) away from a pair of senators at one focus could the Speaker of the House stand in order to eavesdrop on them?
- A) 42.13 B) 53.23 C) 80.41
D) 84.26 E) NOTA

Topic Test: Complex Numbers

26 Planet Mu has an elliptical orbit about its star, with the star as one of the foci. Mu's distance from its star varies between 5 million and 25 million miles. Which one of the following defines Mu's orbit with a relation (units in millions) that places its star at the origin and its other focus on the positive x -axis?

- A) $5x^2 + 9y^2 + 100x - 625 = 0$ B) $5x^2 + 9y^2 + 100y - 625 = 0$
 C) $5x^2 + 9y^2 - 100x - 625 = 0$ D) $5x^2 + 9y^2 - 100y - 625 = 0$
 E) NOTA

27 $\sqrt{-1}\sqrt{-4} =$

- A) 2 B) -2 C) $2i$
 D) $-2i$ E) NOTA

28 Simplify: $i + (2i)^2 + (3i)^3 + (4i)^4 + (5i)^5$

- A) $2 + 3i$ B) $2 + 2i$ C) $252 + 3099i$
 D) $254 + 3099i$ E) NOTA

29 If $q(x) = i^x$, then find $q(3)q(675)q(444)q\left(\frac{1}{2}\right)$

- A) $\frac{1}{i^2}$ B) $-(-1)^{\frac{1}{4}}$ C) -1
 D) 1 E) NOTA

30 Find $(0.5 + 0.5i)^{10}$

- A) $2(0.5)^{10}$ B) $\frac{1}{32}i$ C) $(0.5)^{10} + (0.5)^{10}i$
 D) Undefined E) NOTA

31 Which of the following is not a fourth root of $1296i$?

- A) $6\text{cis}(22.5^\circ)$ B) $6\text{cis}(12.5^\circ)$ C) $6\text{cis}(202.5^\circ)$
 D) $6\text{cis}(292.5^\circ)$ E) NOTA

32 How many of the following are true?

I. $\frac{1}{i} = -i$

II. The distance between i and -1 on the complex plane is not $\sqrt{2}$.

III. The discriminant of $2x^2 + x + 5 = 0$ is $\sqrt{39}i$

IV. The discriminant of shows that $2x^2 + x + 5 = 0$ has complex roots, while $x^2 - 5x + 6 = 0$ does not.

V. $-i$ is not a root of $x^2 + 1 = 0$

- A) 1 B) 2 C) 3
 D) 4 E) NOTA

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Answers

| | |
|-----|-----------------|
| 1. | D |
| 2. | B |
| 3. | A |
| 4. | B |
| 5. | D |
| 6. | B |
| 7. | D |
| 8. | C |
| 9. | D |
| 10. | D |
| 11. | D |
| 12. | C |
| 13. | D |
| 14. | D |
| 15. | D |
| 16. | D |
| 17. | A |
| 18. | A |
| 19. | C |
| 20. | C |
| 21. | D |
| 22. | B |
| 23. | E $64i$ |
| 24. | C |
| 25. | D |
| 26. | C |
| 27. | B |
| 28. | C |
| 29. | B |
| 30. | B |
| 31. | E all are roots |
| 32. | B |