

For all questions, answer choice (E) NOTA means that none of the given answers is correct. Good Luck!

- Find the equation of the line with slope 2 that goes through the point (4,-5).
 (A) $2x + y = 13$ (B) $2x - y = 13$ (C) $2x + y = -13$ (D) $2x - y = -13$ (E) NOTA
- Find the discriminant of the quadratic $5x^2 + 4 + 9x = 0$.
 (A) 1 (B) -164 (C) -176 (D) -29 (E) NOTA
- Evaluate $|5 - 12i|$.
 (A) -13 (B) 13 (C) $5 + 12i$ (D) $13i$ (E) NOTA
- If $x + \frac{1}{x} = 3$, then what is $x^4 + \frac{1}{x^4}$?
 (A) 81 (B) 51 (C) 79 (D) 47 (E) NOTA
- Given that $f(x) = \frac{5 + 12x}{5x + 12}$, find the inverse of $f(x)$.
 (A) $f^{-1}(x) = \frac{5 - 12x}{5x - 12}$ (B) $f^{-1}(x) = \frac{5x + 12}{5 + 12x}$ (C) $f^{-1}(x) = \frac{5x - 12}{5 - 12x}$ (D) $f^{-1}(x) = \frac{5 + 12x}{5x + 12}$ (E) NOTA
- Sid is taking a run and he gets tired. He takes a break after 1 mile, then he takes another after half a mile, then after a quarter of a mile, with each distance being half of the distance before. How far does he travel altogether, in miles, if he can run infinitely?
 (A) 0 (B) 1 (C) 2 (D) ∞ (E) NOTA
- Find the determinant of the following matrix:

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$
 (A) 5 (B) 0 (C) -5 (D) 123456789 (E) NOTA
- How many solutions does the equation $\frac{2015(x-1)(x-2)(x-3)(x-4)}{(x-1)(x-3)(x-5)} = \frac{x(x-1)(x-2)(x-3)(x-4)}{(x-1)(x-3)(x-5)}$ have?
 (A) 0 (B) 1 (C) 2 (D) 3 (E) NOTA
- Find the remainder when $3x^3 + 7x^2 - 9x + 5$ is divided by $x - 2$.
 (A) 39 (B) -39 (C) 27 (D) -27 (E) NOTA
- Order the conics by increasing eccentricity, if parabolas are P, circles are C, ellipses are E, and hyperbolas are H.
 (A) C, E, P, H (B) E, C, P, H (C) H, P, C, E (D) C, E, H, P (E) NOTA
- If $a = \log 2$, $b = \log 3$, and $c = \log 5$, which of the following is equal to $\log(2250)$?
 (A) $2a + 3b - c$ (B) $2a + 3b + c$ (C) $a + 2b + 3c$ (D) $a + b + c$ (E) NOTA
- What is the units digit of $2^{2015} + 3^{123456789} + 5^x + 6^{2x+0y+1a+5} + 19^{123}$?
 (A) 1 (B) 3 (C) 5 (D) 7 (E) NOTA

13. Find the sum of all real solutions to the equation $(x^2 + x - 3)^{(x^2 + x - 6)} = 1$.
- (A) 4 (B) -4 (C) 2 (D) -2 (E) NOTA
14. Bob and Joe are good at Geometry! If Joe can do a geometry problem in 4 minutes, and Bob can do a problem in 15 minutes, then how long would it take them to do a full Mu Alpha Theta test together (30 questions) (in minutes)?
- (A) 60 (B) $\frac{180}{19}$ (C) $\frac{1800}{19}$ (D) $\frac{360}{19}$ (E) NOTA
15. Identify the following conic (be as specific as possible):
- $$3x^2 + 18x + 4y^2 + 16y + 47 = 4$$
- (A) Circle (B) Ellipse (C) Parabola (D) Hyperbola (E) NOTA
16. How many of the following are even functions?
- $f(x) = 7^{x^2}$
 - $f(x) = \frac{3}{x^2 - 5}$
 - $f(x) = x^3 - 2x$
 - $f(x) = 0$
- (A) 1 (B) 2 (C) 3 (D) 4 (E) NOTA
17. Let $\phi = \prod_{i=1}^{100} 9^i$. Evaluate $\log_3 \phi$.
- (A) 5050 (B) 10100 (C) 2525 (D) 20200 (E) NOTA
18. Find $\frac{x + \sqrt{x^2 - 1}}{x - \sqrt{x^2 - 1}} - \frac{x - \sqrt{x^2 - 1}}{x + \sqrt{x^2 - 1}}$ if $x = \frac{2}{\sqrt{2}}$.
- (A) $2\sqrt{2}$ (B) $4\sqrt{2}$ (C) $\frac{7}{3}$ (D) $\frac{8}{3}$ (E) NOTA
19. Let $f(x) = (x - 1)^{2015} + (x - 1)^{2013} + (x - 1)^{2011} + \dots + (x - 1)^3 + (x - 1)$. What is the sum of the roots of $f(x)$?
- (A) 2015 (B) -2015 (C) 2013 (D) 2011 (E) NOTA
20. Simplify: $(\frac{\log 3}{\log 2} + \frac{\log 9}{\log 4})(\frac{\log 4}{\log 3} + \frac{\log 2}{\log 9})$
- (A) 2 (B) 4 (C) 5 (D) 6 (E) NOTA
21. If $2(7^2 + 24^2)^{2015} + 3(15^2 + 20^2)^{2015} = 5^x$, find x .
- (A) 2015 (B) 2016 (C) 4030 (D) 4031 (E) NOTA
22. Determine the value of $||3 - 4i| - 12i^{2015}|$.
- (A) 13 (B) -13 (C) 7 (D) -7 (E) NOTA

23. An arithmetic sequence has 2015 terms, and the 1008th term is 12. What is the sum of all of the terms in the sequence?
- (A) 24192 (B) 24180 (C) 24168 (D) 12096 (E) NOTA
24. Compute: $\frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} + \dots + \frac{1}{98 \times 99} + \frac{1}{99 \times 100}$
- (A) 0.01 (B) 0.95 (C) 0.98 (D) 0.99 (E) NOTA
25. Find the number of distinct permutations of the letters in the word INVITATIONAL.
- (A) $\frac{12!}{2!2!3!}$ (B) 12! (C) $\frac{12!}{2!2!2!}$ (D) $\frac{12!}{3!2!2!2!}$ (E) NOTA
26. Evaluate: $\sum_{n=0}^{\infty} \frac{1}{n^2 + 3n + 2}$
- (A) ∞ (B) 1 (C) 2 (D) 5 (E) NOTA
27. N is the number of 1's in the number A and 1's are the only digits in A. If N is 2015, what are the last 3 digits of $A^2 - 5$?
- (A) 315 (B) 316 (C) 317 (D) 318 (E) NOTA
28. If $x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8$ and x_9 are roots of the 9th-degree Raj function $R(x) = 4x^9 + a_8x^8 + a_7x^7 + a_6x^6 + a_5x^5 + a_4x^4 + a_3x^3 + a_2x^2 + a_1x + a_0$, find a_8 if:
- $$\begin{aligned} x_1 + x_2 + x_3 + x_4 &= 6 \\ x_2 + x_3 + x_4 + x_5 &= 3 \\ x_3 + x_4 + x_5 + x_6 &= -7 \\ x_4 + x_5 + x_6 + x_7 &= -5 \\ x_5 + x_6 + x_7 + x_8 &= 9 \\ x_6 + x_7 + x_8 + x_9 &= -6 \\ x_7 + x_8 + x_9 + x_1 &= -2 \\ x_8 + x_9 + x_1 + x_2 &= 8 \\ x_9 + x_1 + x_2 + x_3 &= -14 \end{aligned}$$
- (A) 8 (B) 2 (C) 9 (D) 21 (E) NOTA
29. Calculate the number of digits in 7^{2015} given that $\log 7 = 0.80$.
- (A) 1700 (B) 1600 (C) 1612 (D) 1613 (E) NOTA
30. Find the sum of the integers contained within the domain of $y = \frac{\sqrt{|x| - 4}}{x^2 + 2x - 15}$.
- (A) $-\infty$ (B) ∞ (C) 2 (D) 0 (E) NOTA