

**For all questions, NOTA means “None of these answers” is correct.**

- The geometric mean between two positive integers is 16. Which of the following could not be their sum?
  - 34
  - 68
  - 130
  - 257
  - NOTA
- For how many integral values of  $x$  is  $|3x - 9| \leq 6$ ?
  - 3
  - 4
  - 5
  - infinitely many
  - NOTA
- Let  $f(x) = x^2 + 2$ ,  $g(x) = 2 - x^3$ , and  $h(x) = 3x$ . What is the value of  $f(g(h(0)))$ ?
  - 2
  - 4
  - 6
  - 8
  - NOTA
- Let  $f(x) = x^2 - x - 12$ . The function  $f$  intersects  $\overleftrightarrow{PQ}$  at two distinct points,  $P$  and  $Q$ . The  $x$ -coordinate of  $P$  is  $-3$ , and the  $x$ -coordinate of  $Q$  is  $0$ . What is the slope of  $\overleftrightarrow{PQ}$ ?
  - $-4$
  - $-\frac{1}{4}$
  - $\frac{1}{4}$
  - 4
  - NOTA

- What is the area bounded by the graphs of  $y = |x|$  and  $y = -|2x| + 6$ ?
  - 4
  - 8
  - 12
  - 16
  - NOTA
- Let  $x = 297\frac{123}{321}$  and  $y = 856\frac{678}{789}$ . What is the value of  $(x + y)^2 - (x - y)^2 - 4(xy + y) + 5y$ ?
  - 0
  - 1
  - $297\frac{123}{321}$
  - $856\frac{678}{789}$
  - NOTA
- What is the value of  $\sqrt{-2} \cdot \sqrt{-6}$ ?
  - $-3\sqrt{2}$
  - $-2\sqrt{3}$
  - $3\sqrt{2}$
  - $2\sqrt{3}$
  - NOTA
- When  $x^3 + 3x^2 - bx + 5$  is divided by  $x - 2$ , the remainder is 1. What is the value of  $b$ ?
  - $-12$
  - $-4$
  - 4
  - 12
  - NOTA

9. For which values of  $x$  is  $f(x)$  negative?

$$f(x) = (x-1)(x-3)^2(x-5)$$

- A. (1,3) only
- B.  $(1,3) \cup (3,5)$  only
- C. (3,5) only
- D.  $(-\infty,1) \cup (3,5)$  only
- E. NOTA

10. What is the value of  $\sum_{n=1}^{\infty} 6\left(\frac{3}{4}\right)^{n-1}$  ?

- A. 6
- B. 12
- C. 18
- D. 24
- E. NOTA

11. What is the value of

$$(\log_2 3 \cdot \log_3 4 \cdot \log_4 5 \cdot \dots \cdot \log_{99} 100) \cdot \log 2 ?$$

- A. 1
- B. 2
- C. 10
- D. 100
- E. NOTA

12. If  $w = \log 9^{100}$ ,  $x = \log 27^{200}$ ,  
 $y = \log 4^{205}$ , and  $z = \log(15000)^4$ , then  
 which of the following is true?

- A.  $z > x > w > y$
- B.  $x > y > w > z$
- C.  $y > x > w > z$
- D.  $x > y > z > w$
- E. NOTA

13. What is the value of  $(10^c)^9 \cdot (9^p)^2$  ?

- A.  $10^c 2$
- B.  $10^p 2$
- C.  $10^c 3$
- D.  $10^p 3$
- E. NOTA

14. If  $x^{\sqrt{\ln x}} = e^8$ , what is the value of  $x$ ?

- A. 2
- B. 4
- C.  $e^2$
- D.  $e^4$
- E. NOTA

15. For what value of  $n$  is  $\begin{vmatrix} 2 & 0 & n \\ 1 & -1 & -2 \\ -3 & 2 & 0 \end{vmatrix} = 5$  ?

- A.  $-13/3$
- B. -3
- C. 3
- D.  $13/3$
- E. NOTA

16. What is the value of  $\sqrt{6 - \sqrt{6 - \sqrt{6 - \dots}}}$  ?

- A. -3
- B. 1
- C. 2
- D. 3
- E. NOTA

17. If  $3^x = 81^y$ , then what is the value of  
 $\log_2 y - \log_2 x$  ?

- A. -2
- B. 0
- C.  $1/4$
- D. 2
- E. NOTA

18. What is the constant term when  $(2x + \frac{1}{x})^6$  is expanded?
- A. 8  
B. 32  
C. 160  
D. 960  
E. NOTA
19. Rationalize the denominator and simplify:  $\frac{1}{\sqrt{2} + \sqrt{3} + \sqrt{5}}$ .
- A.  $\frac{2\sqrt{3} + 3\sqrt{2} - \sqrt{30}}{6}$   
B.  $\frac{2\sqrt{3} + 3\sqrt{2} + \sqrt{30}}{6}$   
C.  $\frac{2\sqrt{3} + 3\sqrt{2} - \sqrt{30}}{12}$   
D.  $\frac{2\sqrt{3} + 3\sqrt{2} + \sqrt{30}}{12}$
20. What are the last two digits of  $5^{2009}$ ?
- A. 05  
B. 15  
C. 25  
D. 75  
E. NOTA
21. If  $x$  and  $y$  are positive integers and  $x^2 - y^2 = 2003$ , then what is the value of  $y$ ?
- A.  $\sqrt{1001}$   
B.  $\sqrt{2003}$   
C. 1001  
D. 2003  
E. NOTA
22. Which of the following is true about the two circles  $(x+4)^2 + y^2 = 36$  and  $(x+1)^2 + y^2 = 9$ ?
- A. They do not intersect.  
B. They intersect at exactly 1 point.  
C. They intersect at exactly 2 points  
D. They intersect at infinitely many points.  
E. NOTA
23. A bag contains apples, oranges, and pears. The ratio of apples to oranges is 2:3, and the ratio of oranges to pears is 4:5. What is the ratio of apples to pears?
- A. 2:15  
B. 2:5  
C. 3:5  
D. 8:15  
E. NOTA
24. Susan and Lamar are 120 miles apart and begin traveling toward each other at the same time. Susan travels at 40 MPH toward Lamar, while Lamar travels at 60 MPH toward Susan. How many miles must Lamar travel before he meets up with Susan?
- A. 58 miles  
B. 60 miles  
C. 72 miles  
D. 80 miles  
E. NOTA

25. In one month, a stock's value decreases by 20%. The following month the stock decreases by 50% from its value the previous month. By what percent would the stock have to increase to return to its value two months earlier?
- A. 60%  
B. 70%  
C. 150%  
D. 250%  
E. NOTA
26. If  $a_1 = 2$  and  $a_{n+1} = \frac{a_n + 1}{a_n - 1}$  for integer values of  $n$  where  $n \geq 1$ , then what is  $a_{999}$ ?
- A.  $1/3$   
B.  $1/2$   
C. 2  
D. 3  
E. NOTA
27. How is  $0.\overline{76}$  expressed as a simplified fraction?
- A.  $\frac{19}{25}$   
B.  $\frac{23}{30}$   
C.  $\frac{76}{99}$   
D.  $\frac{33}{43}$   
E. NOTA
28. A survey was taken to study the relationship between gender and whether a person is left-handed or right-handed. Of all respondents, 17% were male, and 33% of the male respondents were left-handed. Of the female respondents, 90% were right-handed. What is the probability that a respondent of the survey was left-handed?
- A. 0.0561  
B. 0.1391  
C. 0.8609  
D. 0.9439  
E. NOTA
29. How many zeros are at the end of the value of  $100!$  when is written standard notation?
- A. 23  
B. 24  
C. 25  
D. 26  
E. NOTA
30. For all integers  $n$ ,  $\boxed{n} = -n$  if  $n$  is positive or 0, and  $\boxed{n} = 2n$ , if  $n$  is negative. What is the value of  $\boxed{5} + \boxed{-1}$ ?
- A.  $\boxed{4}$   
B.  $\boxed{5}$   
C.  $\boxed{7}$   
D.  $\boxed{8}$   
E. NOTA