

For all questions, answer *E. NOTA* should be interpreted as *None of the above*.

1. Evaluate: $\sqrt{2070 - \sqrt{2070 - \sqrt{2070 - \dots}}}$
 - A. 45
 - B. 46
 - C. $\sqrt{2024}$
 - D. $\sqrt{2070}$
 - E. NOTA

2. Give the solution set for x :

$$2(\log_x 36)^2 - 4(\log_x 36) - 16 = 0$$
 - A. $\{\sqrt{6}\}$
 - B. $\{\frac{1}{6}\}$
 - C. $\{6\}$
 - D. $\{36\}$
 - E. NOTA

3. Evaluate: $3^{\log_7 49^{-2}}$
 - A. 6
 - B. $\frac{1}{81}$
 - C. -81
 - D. 81
 - E. NOTA

4. Evaluate: $[\log 2008 + \log_{2008} 2008^{2008}]$
 where $[x]$ is the greatest integer function.
 - A. 2010
 - B. 2011
 - C. 2012
 - D. 2013
 - E. NOTA

5. If $f(x) = \log(2008 - x)$, evaluate

$$f(0) \cdot f(1) \cdot \dots \cdot f(2006) \cdot f(2007).$$
 - A. 1
 - B. $\log 2008$
 - C. 10
 - D. 1000
 - E. NOTA

6. How many **proper** divisors does 2008^{2008} have?
 - A. $2008^2 \cdot 3$
 - B. $2009^2 \cdot 4$
 - C. $(2008 \cdot 3 + 1) \cdot 2009$
 - D. $2008 \cdot 2009 \cdot 3 + 2008$
 - E. NOTA

7. Solve for x : $(\log_2(\log_3(\log_2 x)))^2 = 1$
 - A. 2^8
 - B. $\pm 2^8$
 - C. 2^9
 - D. $\pm 2^9$
 - E. NOTA

8. If $f(x) = \log_x(x + 2)$, evaluate

$$f(2) \cdot f(3) \cdot \dots \cdot f(13) \cdot f(14).$$
 - A. 4
 - B. $\log_5 31$
 - C. $\log_6 240$
 - D. $4(1 + \log_3 5)$
 - E. NOTA

9. If $\log_d p = 2008$, give the numerical value for

$$\log_{d^2}(\sqrt[4]{p^7}).$$
 - A. 1757
 - B. 3514
 - C. $\sqrt{3514}$
 - D. $(\sqrt{2008})^{\frac{7}{4}}$
 - E. NOTA

10. Simplify: $4^4 + 4^4 + 4^4 + 4^4$
 - A. 4^{16}
 - B. 2^{256}
 - C. 1024
 - D. 2048
 - E. NOTA

11. A radioactive substance decays exponentially. Its half-life is the time required for the quantity to decay to half of its initial value and obeys the relation $t_{1/2} = \frac{\ln 2}{\lambda}$, where λ is the decay constant. If the substance decays from 2008 grams to 251 grams in 12 hours, what is its half-life?
- A. 3 hours
 B. 4 hours
 C. $6\frac{6}{7}$ hours
 D. $2\sqrt[8]{12}$ hours
 E. NOTA
12. Solve for x if $\log_{\sqrt{2}}(x - 2) + \log_{\sqrt{2}}(x - 6) = 10$.
- A. {10}
 B. {-2,10}
 C. {2,6}
 D. {-8, -4}
 E. NOTA
13. Simplify: $\ln(e \cdot \sqrt{e} \cdot \sqrt[4]{e} \cdot \sqrt[8]{e} \cdot \dots)$
- A. 2
 B. e
 C. e^2
 D. e^e
 E. NOTA
14. For how many integer values of x is $\ln(2008 - x^3)$ defined?
- A. 12
 B. 13
 C. 14
 D. ∞
 E. NOTA
15. If $a = \ln 2$ and $b = \ln 3$, express $6^{\frac{\ln 1}{24}}$ in terms of a and b .
- A. $(e^{ab})^{(-3a-b)}$
 B. $(e^{a+b})^{(-3a-b)}$
 C. $(e^{ab})^{\left(\frac{ab}{3}\right)}$
 D. $(e^{a+b})^{\left(\frac{1}{3a+b}\right)}$
 E. NOTA
16. Find the sum of the solutions to:
- $$(x^2 - 9x + 19)^{x^2 - 8x + 12} = 1$$
- A. 11
 B. 15
 C. 20
 D. 21
 E. NOTA
17. Find the value of $x - y$ if:
- $$2^x = 8^{y+5} \text{ and } 81^x = 27^{5-y}.$$
- A. 0
 B. 3
 C. 6
 D. 9
 E. NOTA
18. Find the value of $b - a$ if a and b are the solutions to $e^x + \frac{243}{e^x} = 36$ and $a < b$.
- A. $\ln 2$
 B. $\ln 3$
 C. $\ln 18$
 D. 18
 E. NOTA
19. Simplify: $\frac{8^{m+3} - 2^{3m+6}}{2^{3m+4}}$
- A. 0
 B. m
 C. 28
 D. 36
 E. NOTA
20. $(5^{-1} - 4^{-1})^{-1} =$
- A. 20
 B. -20
 C. $\frac{1}{20}$
 D. 1
 E. NOTA

21. Which of the following statements is true of all logarithmic functions f ?

- A. $f(x)f(y) = f(x + y)$
- B. $f(x)f(y) = f(xy)$
- C. $f(x^y) = f(x)f(y)$
- D. $f(xy) = f(x) + f(y)$
- E. NOTA

22. Simplify: $i^{2009} + i^{2008} - i^{2007}$.

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

23. Find the domain of $f(x) = \log(\sqrt[3]{2x^2 + 3x - 2})$.

- A. $(-\infty, -2]$
- B. $(-\infty, -2) \cup (\frac{1}{2}, \infty)$
- C. $[-2, \frac{1}{2}]$
- D. $[\frac{1}{2}, \infty)$
- E. NOTA

24. Let $f(x)$ be an exponential function of the form $f(x) = a \cdot b^x$ such that $f(0) = 4$ and $f(3) = 108$.

Find $f(2) - f(1)$.

- A. 3
- B. 6
- C. 9
- D. 24
- E. NOTA

25. Given $f(0) = \frac{1}{3}$ and $f(n) = 3^n \cdot f(n - 1)$ for $n > 0$, find $\log_3 f(5)$.

- A. 5
- B. 14
- C. 15
- D. 120
- E. NOTA

26. Evaluate:

$$\sum_{i=1}^{1001} [\log i],$$

where $[x]$ is the ceiling function (the smallest integer larger than or equal to x).

- A. 2889
- B. 2890
- C. 2893
- D. 2894
- E. NOTA

27. Find the coefficient of x^4 in the expansion of $(2x - 2)^5$.

- A. 160
- B. 80
- C. -80
- D. -160
- E. NOTA

28. Find the product of the solutions to:

$$3^{(2x^2)} - 2^{(x-2)} = 0$$

- A. $\log_2 3$
- B. $\log_3 2$
- C. $\frac{1}{2} \log_2 3$
- D. $-\frac{1}{2} \log_3 2$
- E. NOTA

29. At how many points do $f(x) = x^2$ and $g(x) = 2^x$ intersect?

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

30. Solve for x if

$$\frac{1}{\log_2 x} + \frac{1}{\log_3 x} + \dots + \frac{1}{\log_{99} x} + \frac{1}{\log_{100} x} = 1$$

- A. 2
- B. 100
- C. 100!
- D. $\frac{100(101)}{2}$
- E. NOTA