

Mu Alpha Theta National Convention 2004
Alpha Logs, Exponents & Radicals

For all questions, answer E. "NOTA" means none of the above answers is correct.

- Find x if $\log_x 64 = -\frac{2}{3}$
A. 16 B. 512 C. $\frac{1}{512}$ D. $\frac{1}{16}$ E. NOTA
- The expression $\log\left(1 + \frac{27}{x^3}\right)$ is equivalent to:
A. $\log 1 + 3 \log 3 - 3 \log x$ B. $\log(x^3) + \log 27 - 3 \log x$
C. $\log(x+3) + \log(x^2+9) - 3 \log x$ D. $\log(x+3) + \log(x^2-3x+9) - 3 \log x$
E. NOTA
- Write as a single logarithm: $5 \log_4 x + 2 \log_4(x+3)$
A. $10 \log_4[x(x+3)]$ B. $\log_4[x(x+3)^{10}]$ C. $\log_4[x^5(x+3)^2]$
D. $\log_4[x(x+3)]$ E. NOTA
- Evaluate $\log_8 13$ (round to hundredths)
A. .81 B. 2.08 C. 2.56 D. 1.23 E. NOTA
- Write $3^4 = 81$ in logarithmic form.
A. $\log_3 81 = 4$ B. $\log_4 81 = 3$ C. $\log_{81} 3 = 4$ D. $\log_{81} 4 = 3$ E. NOTA
- $e^{(2+\ln a)} =$
A. $e^2 + a$ B. ae^2 C. $2 + a$ D. a^2 E. NOTA
- Find $\log_4(\log_2(\log_{\sqrt{3}} 9))$
A. 2 B. $\frac{1}{4}$ C. $\frac{1}{2}$ D. 0 E. NOTA
- Simplify $a^{2 \log_a 7} + 3 \log_a(a^2)$
A. $14 + 3a^2$ B. $14 + a^5$ C. $49 + a^6$ D. $49 + 3a^2$ E. NOTA

Alpha Division – Logs, Exponents & Radicals – page 2

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- Solve for x : $\log(x^2-1) = 2 + \log(x+1)$
A. 98 B. 99 C. 100 D. 101 E. NOTA

10. Find the x intercept of $y = 4 - \ln(3 - x)$
 A. $e^4 - 3$ B. $3 - e^4$ C. $e^{4/3}$ D. $\frac{4}{3}$ E. NOTA
11. What principal invested at 7% compounded continuously for 4 years will yield \$980 ?
 A. \$978.68 B. \$740.67 C. \$1296.67 D. \$559.78 E. NOTA
12. Find the doubling time for a quantity experiencing continuous growth that has increased by 3% per year.
 A. $\frac{\log 2}{\log 1.03}$ B. $\frac{\log 2}{\log .03}$ C. $\frac{2}{\log .03}$ D. $\frac{\log 1.03}{2}$ E. NOTA
13. Solve: $(\log_2 x)^2 - \log_2 x - 6 = 0$
 A. $x = 3, x = -2$ B. $x = 9, x = 4$ C. $x = 8, x = \frac{1}{4}$ D. $x = 3$ E. NOTA
14. If $\log 2 = a$ and $\log 5 = b$, find $\log 20$
 A. $a^2 b$ B. $2ab$ C. $2a + b$ D. $a^2 + b$ E. NOTA
15. Find x if $\frac{e^x + e^{-x}}{e^x - e^{-x}} = 2$
 A. 1 B. $\frac{\ln 3}{2}$ C. $2 \ln 3$ D. $\ln 3$ E. NOTA
16. Simplify $\log_3 5 \cdot \log_5 9$
 A. $\log_{15} 45$ B. $\log_8 14$ C. 3 D. 2 E. NOTA
17. Which function grows most rapidly as x increases from 2 to 4?
 A. 2^x B. $\ln(4x)$ C. 3^x D. x^2 E. NOTA

Alpha Division – Logs, Exponents & Radicals – page 3

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18. The function $f(x) = 3(4.7)^x$ is approximately equivalent to:
 A. $f(x) = 3e^{1.5x}$ B. $f(x) = 3e^{4.7x}$ C. $f(x) = 47e^{3x}$ D. $f(x) = 1.5e^{3x}$
 E. NOTA
19. Rationalize $\frac{\sqrt{3}}{\sqrt{14 - \sqrt{x}}}$
 A. $\frac{\sqrt{42} + \sqrt{3x}}{14 - x}$ B. $\frac{\sqrt{42} - \sqrt{3x}}{14 + x}$ C. $\frac{\sqrt{3}}{14 - x}$ D. $\frac{\sqrt{14} - \sqrt{x}}{3}$ E. NOTA

20. If $\log_b 2 = .6$, find $\log_b \left(\frac{1}{2b}\right)$
 A. -1.2 B. $\frac{1}{1.2}$ C. 1.6 D. -1.6 E. NOTA
21. Solve $5^{x-6} = 3^{2x+1}$
 A. $x = \ln\left(\frac{3}{5^6} - \frac{5}{3^2}\right)$ B. $x = \ln 3 - \ln 5$ C. $x = \frac{\ln 3 + 6 \ln 5}{\ln 5 - 2 \ln 3}$
 D. $x = 3 \ln 3 + 5 \ln 5$ E. NOTA
22. Each time a ball is dropped, it rebounds to 80% of its original height. If the ball is dropped from 100 cm, after approximately how many rebounds will the height be 1 cm?
 A. 12 B. 13 C. 15 D. 21 E. NOTA
23. If $f(x) = \log_b x$, contains (2,1) and (4,2), find b
 A. $b = 2$ B. $b = 3$ C. $b = 4$ D. $b = 5$ E. NOTA
24. Simplify: $\frac{2^{-1}(16x^5)^{1/4}}{2x^{1/4}}$
 A. $\frac{x}{4}$ B. $\frac{x}{2}$ C. $\frac{1}{2}$ D. $x^{3/2}$ E. NOTA
25. If $b^x = 7$, find b^{-2x}
 A. $\frac{1}{49}$ B. -14 C. 14 D. 49 E. NOTA
26. Given: $f(x) = x^2 - 1$ and $g(x) = \sqrt{x-1}$. If $h(x) = \sqrt{x^2 - 2}$, then $h(x) = ?$
 A. $f \circ g$ B. $g \circ g$ C. $g \circ f$ D. $f \circ f$ E. NOTA

Alpha Division – Logs, Exponents & Radicals – page 4

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27. $\sqrt[4]{3} \cdot \sqrt[5]{3} =$
 A. $3^{1/20}$ B. $3^{9/20}$ C. $9^{9/20}$ D. $9^{1/20}$ E. NOTA
28. Find the domain of $f(x) = \ln\left(\frac{x}{x+1}\right)$
 A. all reals B. $(-\infty, -1) \cup (-1, 0) \cup (0, \infty)$ C. \emptyset D. $(-\infty, -1) \cup (0, \infty)$
 E. NOTA
29. Simplify $(\sqrt[3]{4c^2d^3})^3 (\sqrt{2cd})^2$
 A. $8c^7d^8$ B. $8c^7d^7$ C. $6c^8d^{11}$ D. $8c^8d^{11}$ E. NOTA
30. If $f(x) = \log x$, then $\frac{f(x+h) - f(x)}{h}$

- A. $\frac{1}{h} \log\left(1 + \frac{h}{x}\right)$ B. $\frac{1}{h} \log\left(1 + \frac{x}{h}\right)$ C. $\frac{1}{h} \log\left(1 - \frac{h}{x}\right)$ D. $\frac{1}{h} \log\left(1 - \frac{x}{h}\right)$
E. NOTA

Tie Breakers:

1. Solve $\log_2(x^2 + 1) - \log_4(x^2) = 1$

2. Solve for x : $\frac{e^x - e^{-x}}{2} = t$

3. Find $\lim_{n \rightarrow \infty} \left(1 + \frac{1}{2n}\right)^{2n}$