

Mu Alpha Theta National Convention: Seattle, 1997
Alpha Logarithms and Exponents Topic Test

1. Which of the following is equal to $\log_8 49$
I. $2\log_8 7$
II. $\frac{4}{3}\log_4 7$
III. $4\log_{16} 7$
(A) I (B) I & II (C) I & III (D) I, II & III (E) NOTA

2. If $0 < a < 2\pi$, which of the following is equivalent to $\log(\cot a)$?
(A) $\log(\tan a)$ (B) $e^{\tan a}$ (C) $\log(\sin 2a) - \log 2$
(D) $\log(\cos a) - \log(\sin a)$ (E) NOTA

3. Solve for x: $\log_2(\log_3(\log_4 x)) = 0$?
(A) 64 (B) 16 (C) 256 (D) 4 (E) NOTA

4. What is the positive difference between the roots of
 $(\log_2 x^2)(\log_2 x) - 10\log_2 x + 2\log_2 16 = 0$?
(A) 3 (B) 4 (C) 14 (D) 16 (E) NOTA

5. The amount of radioactive iodine in a sample falls from 438 grams to 372 grams over 12 hours. What is the half-life of the radioactive iodine, to the nearest hour?
(A) 51 (B) 52 (C) 53 (D) 54 (E) NOTA

6. Evaluate $\log_8 216 - \log_4 \frac{9}{8}$
(A) $\frac{5}{2}$ (B) 2 (C) 3 (D) $\frac{8}{3}$ (E) NOTA

7. If \$47,500 is invested at a 4% annual rate compounded continuously, how many years (to the nearest year) will it take for it to quadruple?
(A) 32 (B) 35 (C) 37 (D) 41 (E) NOTA

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8. For what value(s) of d does $8^d = 16^{-\frac{5}{4}} \times 4^{\frac{7}{2}} \times \sqrt{2\sqrt{2}} \times \sqrt[6]{8}$
- (A) $\frac{11}{12}$ (B) 1 (C) $\frac{13}{12}$ (D) $\frac{7}{6}$ (E) NOTA
9. Determine the product of the values of x for which $3(\log_8 x^{\log_8 x}) - 5\log_8 x + 2 = 4$.
- (A) 8 (B) 16 (C) 32 (D) 64 (E) NOTA
10. Which of the following is equivalent to $\frac{a^{2n-1}b^{2n+1}}{a^{3n+1}(b^2)^{n-1}}$?
- (A) $(a^{-1}b^2)^{n+1}$ (B) $\frac{b^{2-n}}{a^{2n}}$ (C) $\frac{b^3}{a^{n+2}}$ (D) $\frac{b^{n-1}}{a^{1+n}}$ (E) NOTA
11. If a , b , and c are all rational numbers and $60^a 24^b 75^c = 36000$, what is $a+b+c$?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) NOTA
12. If $\log_b 13 = a$ and $\log_b 22 = c$ and $13^x = 22$, what is x in terms of a and c ?
- (A) ac (B) $\frac{c}{a}$ (C) $a+c$ (D) $c-a$ (E) NOTA
13. Express in simplest form: $8 + 4\sqrt{2} + \frac{6}{3+\sqrt{2}} - \frac{2}{7-7\sqrt{2}}$
- (A) $\frac{530+170\sqrt{2}}{49}$ (B) $\frac{532+170\sqrt{2}}{49}$
 (C) $\frac{78+23\sqrt{2}}{7}$ (D) $\frac{76+24\sqrt{2}}{7}$ (E) NOTA
14. Evaluate: $\left(\left(12^{\log_{12} 49} \right)^{\log_7 4} \right)^{\log_{16} 36}$
- (A) 4 (B) 16 (C) 6 (D) 36 (E) NOTA

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15. Solve for x: $\left(\left[\left(3^{\log_x 2}\right)\left(2^{\log_x 3}\right)\right]^{\log_2 x}\right)^{\log_3 x^2} = 256$
- (A) 3 (B) 4 (C) 12 (D) 16 (E) NOTA
16. The half-life of Plutonium is 14,000 years. How long, to the nearest year, would it take for a 50 kg sample of Plutonium to have only 15kg of radioactive Plutonium in it?
- (A) 24,315 (B) 24,316 (C) 24,317 (D) 24,318 (E) NOTA
17. If $\log 2 = a$, $\log 3 = b$, and $\log 7 = c$, what is the value of $\log_{42} 24$?
- (A) $2a + c$ (B) $4a + 2b + c$ (C) $\frac{a+b+c}{3a+b}$ (D) $\frac{3a+b}{a+b+c}$ (E) NOTA
18. If $\log_b(xy) > 0$, and $b > 0$, which of the following statements must be true?
- I. $xy < b$
II. $xy > 0$
III. $xy > 1$
- (A) I (B) II (C) II & III (D) I, II & III (E) NOTA
19. Find x if $\log_{27} 81 + \log_9 x - \log_{27} x = \log_3 243$
- (A) 3^{22} (B) 3^{17} (C) 3^{26} (D) 3^{38} (E) NOTA
20. Determine the coefficient of the third term in the expansion of $(5x - 3)^4$.
- (A) 6 (B) 1350 (C) -575 (D) -225 (E) NOTA
21. Evaluate $\log_{16} 3584 - \log_{64} 7\sqrt{7}$
- (A) $\frac{3}{2}$ (B) $\frac{9}{4}$ (C) $\frac{4}{3}$ (D) $\frac{16}{9}$ (E) NOTA
22. For what value(s) of x does $(21^{n+3})(14^{3n-5}) = (6^{3n+2})(49^{2n-3})(9^{2-n})x$?
- (A) $\frac{157}{256}$ (B) $\frac{2401}{3456}$ (C) $\frac{256}{343}$ (D) $\frac{2744}{2187}$ (E) NOTA

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23. Simplify: $\sqrt[6]{x^{30}}$

(A) x^5 (B) $|x|^5$ (C) $-x^5$ (D) $(-x)^5$ (E) NOTA

24. Simplify: $(\sqrt[7]{x^{25}})(\sqrt[5]{x^6})$

(A) $\sqrt[7]{x^{30}}$ (B) $\sqrt[12]{x^{31}}$ (C) $\sqrt[13]{x^{32}}$ (D) $\sqrt[35]{x^{167}}$ (E) NOTA

25. Evaluate $\sqrt{22 + \sqrt{22 + \sqrt{22 + \dots}}}$

(A) $\frac{1 + \sqrt{89}}{2}$ (B) $7 - \sqrt{3}$ (C) $2 + \sqrt{10}$ (D) 5 (E) NOTA

26. For what value(s) of x does $4^{3x-2} = 8^{2x+7}$?

(A) 4 (B) $\frac{9}{2}$ (C) 5 (D) $\frac{11}{2}$ (E) NOTA

27. Find y if $\log_4 y = 8$.

(A) $\frac{3}{2}$ (B) 2 (C) 4096 (D) 65536 (E) NOTA

28. Find the sum, to the nearest hundredth, of all the values of x for which $2^{x+3} 3^{x-2} 6^{3x+1} = 31104$.

(A) 1.21 (B) 2.49 (C) 2.97 (D) \emptyset (E) NOTA

29. Evaluate: $\sum_{n=1}^{20} \log\left(\frac{2n+3}{2n-1}\right)$

(A) $\log 23$ (B) 2.5 (C) $\log 161$ (D) $\log 483$ (E) NOTA

Evaluate: $\prod_{n=1}^{31} \log_{n+1}(n+2)$

(A) $\frac{15}{4}$ (B) 5 (C) $\frac{31}{3}$ (D) $\frac{31}{2}$ (E) NOTA