Mu Alpha Theta National Convention: Denver, 2001

Logarithms and Exponents Topic Test – Theta Division

1. Solve for x: $3^{2x-1} = 27$

   (A) 1 (B) 2 (C) $\frac{3}{2}$ (D) $\frac{2}{3}$ (E) NOTA

2. Evaluate: $\log_2 16$

   (A) 4 (B) 3 (C) 8 (D) 14 (E) NOTA

3. Which of the following is equivalent to $\frac{\ln 6}{\ln 2} - \log_2 6$?

   (A) 0 (B) $\frac{\log_2 6}{2}$ (C) 1 (D) $\frac{3\log_2 6}{2}$ (E) NOTA

4. Which of the following is equivalent to $\left(\sqrt[4]{x^3}\right)^{\frac{4}{6}}$?

   (A) $\sqrt{x}$ (B) $-\sqrt{x}$ (C) $\frac{1}{\sqrt{x}}$ (D) $\sqrt{x^2}$ (E) NOTA

5. Evaluate: $\log_3 36 - \log_3 12$

   (A) $\log_3 24$ (B) 1 (C) 3 (D) 2 (E) NOTA

6. Evaluate: $\log_3 81$

   (A) 3 (B) 2 (C) 4 (D) 9 (E) NOTA

7. Solve for x: $\log_4(\log_3(\log_2 x)) = 0$

   (A) 4 (B) 8 (C) 12 (D) 16 (E) NOTA

8. Solve for x: $\sqrt{x^2 + 6x + 9} = 4$

   (A) 7 and -1 (B) -7 and 1 (C) 3 (D) 3 and -7 (E) NOTA

9. Which of the following is equivalent to: $\frac{1}{2}\ln(16)+\ln(2)+\frac{1}{3}\ln(8^2)$?

(A) $4\ln 2$ (B) $\frac{5}{\log_2 e}$ (C) $\ln\left(2^3\right)$ (D) $\ln 16-\ln 4$ (E) NOTA

10. Evaluate: $3^3+3^3+3^3$

(A) 3^4 (B) 3^9 (C) 9^3 (D) $3\cdot 4^2+3$ (E) NOTA

11. Evaluate: $\frac{1}{\log_3 24}+\frac{2}{\log_5 24}-\frac{1}{\log_{75} 24}$

(A) 3 (B) 2 (C) 1 (D) 0 (E) NOTA

12. Simplify: $\frac{3^{2x}3^{1-x}9^{\frac{x}{2}}}{27^{\frac{2}{3}x-1}}$

(A) 3^{1-x} (B) 27 (C) 81 (D) 3^{2x+1} (E) NOTA

13. Which of the following is equivalent to $\log_8 xy^2-\frac{\frac{2}{3}}{\log_x \frac{1}{2}}$

(A) $\frac{2\log_8 xy}{3}$ (B) $\log_2\left(xy^{\frac{2}{3}}\right)$ (C) $\log_x\left(8y^2+2^{\frac{2}{3}}\right)$ (D) $6\log_2 xy$ (E) NOTA

14. Simplify: $\sqrt[5]{x^{10}}$

(A) x^2 (B) $-x^2$ (C) $-x^{\frac{1}{2}}$ (D) $x^{\frac{1}{2}}$ (E) NOTA

15. If x and y are positive, and $\log_y 2x=\log_{2x} y=z$, what is the value of z?

(A) $\log_y x$ (B) $\log_{2x} y^2$ (C) 2 (D) 1 (E) NOTA

16. Given that $\sqrt{\log_2 x} = \log_x 2$, solve for x, where $x > 0$.

(A) 1 (B) 2 (C) 4 (D) 8 (E) NOTA

17. Solve for z: $\log_{2z} 256 = 2$

(A) 25 (B) 5 (C) 2 (D) 8 (E) NOTA

18. Which of the following is equivalent to $a^{\ln b}$?

(A) $a^{b \ln a}$ (B) $e^{a \ln b}$ (C) $\ln\left(e^{\ln a}\right)$ (D) $b^{\ln a}$ (E) NOTA

19. Solve for x: $4^x = 8$

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

20. What choices of B and C, respectively, would make the following equalities true?
$\frac{\log C}{\log B} = \frac{C}{B} = \frac{3}{2}$.

(A) $\left(\frac{3}{2}\right)^2 and \left(\frac{3}{2}\right)^3$ (B) $\left(\frac{2}{3}\right)^4 and \left(\frac{2}{3}\right)^5$ (C) $\left(\frac{3}{2}\right)^4 and \left(\frac{3}{2}\right)^3$ (D) $\left(\frac{2}{3}\right)^2 and \left(\frac{2}{3}\right)^3$ (E) NOTA

21. Evaluate: $\log_{21} 7 + \log_{21} 3$

(A) $\log_{21} 10$ (B) $\frac{1}{2}$ (C) $\log_{21} \frac{7}{3}$ (D) 1 (E) NOTA

22. If x is an integer such that $x > 1$, which of the following is always less than or equal to $\log_2(x!)$

(A) $x \log_2 x$ (B) $\log_2 \sqrt{\left(\frac{x}{2}\right)^x}$ (C) x^2 (D) $\frac{x!}{\log_2 x}$ (E) NOTA

23. Evaluate: $\log_8 32 - \log_8 16$

(A) $\frac{4}{3}$ (B) $\frac{1}{3}$ (C) $\frac{3}{4}$ (D) $\frac{5}{4}$ (E) NOTA

24. If $\log_y x = \frac{2}{3}$, what is $\log_x y$?

(A) 1 (B) $\frac{2}{3}$ (C) $\frac{3}{2}$ (D) $\log_x 2y$ (E) NOTA

25. Which of the following is equivalent to $\frac{\log_4 12}{\log_2 3}$?

(A) $\frac{\log_4 12}{1-\log_3 4}$ (B) $\frac{1}{\log_2 3}+\frac{1}{2}$ (C) $\frac{1}{\log_2 3}+1$ (D) $\log_2 \frac{144}{3}$ (E) NOTA

26. Solve for y: $\frac{2}{3}\log_5 125 = y$

(A) 3 (B) 1 (C) 5 (D) 2 (E) NOTA

27. Which of the following is equivalent to $a^{\ln\frac{d}{c}}$?

(A) $\left(\ln\frac{d}{c}\right)^a$ (B) $\frac{c^{\ln a}}{a^{\ln d}}$ (C) $\frac{d^{\ln a}}{a^{\ln c}}$ (D) $\ln\left|\left(\frac{d}{c}\right)^a\right|$ (E) NOTA

28. If x and y are positive, then $\log x - \log y = \log\frac{y}{x} =$

(A) 0 (B) 1 (C) $\log_x y$ (D) $\log y^2$ (E) NOTA

29. Simplify: $\frac{\left(x^{\frac{5}{3}}\right)\left(x^{\frac{12}{5}}\right)}{\sqrt[15]{x}}$

(A) $\frac{x^4}{\sqrt[15]{x}} =$ (B) $x^{\frac{11}{15}}$ (C) x^4 (D) x^5 (E) NOTA

30. Solve for x: $\log_x 5 + \log_x 125 = 4$

(A) 25 (B) 2 (C) 4 (D) 5 (E) NOTA

31. Given that $18^{x^2+2x+4} = \left(54\sqrt{2}\right)^{x^2+4}$, solve for *x*.

(A) 2 (B) {4,2} (C) 3 (D) {5,3} (E) NOTA

32. Solve for *x*: $\log_2\left(\log_2\left(\log_3 x\right)\right) = 1$

(A) 81 (B) 27 (C) 64 (D) 192 (E) NOTA

33. Solve for *x*: $10c^{\log_{10} c^{x^2}} = m^{\log_{10} m + \log_m 10}$

(A) $\pm 10cm$ (B) $\pm\sqrt{\log_m c}$ (C) $\pm\log_c m$ (D) $\pm\log_m c$ (E) NOTA

34. $x^y = y$, and $\log_3 y = z$. Solve for *x* with respect to *z*:

(A) $3^{\frac{z}{3^z}}$ (B) $\frac{z}{3^z}$ (C) $10^{\frac{z}{10^z}}$ (D) $\frac{z}{10^z}$ (E) NOTA

35. If $x > 0$, which of the following is always less than $(4+x)^x$?

I. 4
II. 1
III. 4^{x+1}
IV. 2

(A) I, II, III, & IV (B) II & IV only
(C) II only (D) I,II, & III only (E) NOTA

36. Given that $x^{\log_x y} = x^x$, solve for *y* with respect to *x*.

(A) x (B) $1+x^3$ (C) $\left(\frac{1}{x}\right)^x$ (D) x^x (E) NOTA

37. If *a*, *b*, and *c* are rational and $250^a 25^b 10^c = 10000$, evaluate $3a+2b+c$.

(A) 3 (B) 4 (C) 1 (D) 5 (E) NOTA

38. What is the sum of all the positive integral factors of 1280?

(A) 3293 (B) 2576 (C) 4346 (D) 3066 (E) NOTA

39. How many real roots does the equation $x^4 = 16e^4$ have?

(A) 4 (B) 3 (C) 2 (D) 1 (E) NOTA

40. Evaluate: $\sqrt{132 + \sqrt{132 + \sqrt{132 + \cdots}}}$

(A) 11 (B) 6 (C) 12 (D) $\frac{91}{6}$ (E) NOTA