1. Find the largest integral value of x for which $5^{x+2} < 5^x + 5$.

   A. -2   B. -1   C. 0   D. 1   E. NOTA

2. Given:

   $$A = \left(2^{-1} - 3^{-1}\right)^{-1}$$

   $$B = \left(\frac{1}{2} + \frac{1}{3}\right)^{-1}$$

   $$C = \left[3\sqrt{125} - 2\sqrt{45} - \sqrt{80}\right]^2 \quad \text{Find: } \frac{ABC}{D}.$$

   $$D = \left(3\sqrt{5} + 3\right)\left(3\sqrt{5} - 3\right)$$

   A. $\frac{50}{9}$ B. 5   C. $\frac{100}{9}$ D. 25   E. NOTA

3. Solve for y: $(x > 0, \ x \neq 1)$ $\left[\dfrac{x^{3k-2}}{x^{2k+1}}\right]\left[\dfrac{x^{k-3}}{\left(x^{k+1}\right)^2}\right] = x^y$

   A. k - 7   B. k - 4   C. k - 3   D. -8   E. NOTA

4. Given: $\log A = 2.5, \ \log B = 1.2, \ \log C = 3.6$ Find: $\log \dfrac{10A}{B} + \log \dfrac{A^3}{100C}$

   A. $\frac{8}{5}$ B. $\frac{21}{10}$ C. $\frac{21}{5}$ D. $\frac{47}{10}$ E. NOTA

5. If $x^{x^3} = 3$, what is the value of x?

   A. 1   B. -1   C. $\sqrt[3]{3}$ D. $\sqrt[3]{\dfrac{1}{3}}$ E. NOTA

6. If $2^{x-3} = 1$, and $5^{y+2} = 1$, what is the value of $2^x 5^y$?

   A. $\frac{4}{25}$ B. $\frac{8}{25}$ C. $\frac{4}{5}$ D. $\frac{8}{5}$ E. NOTA

7. Solve for x: $\log_2(x+1) = 2\log_2(x-1)$.

   A. 0, 3   B. 0   C. 1   D. 3   E. NOTA

8. Evaluate $2\left(\log_8 12\right) - \dfrac{1}{2}\left(\log_8 81\right)$.

A. $\dfrac{4}{3}$ B. $\dfrac{8}{3}$ C. 4 D. 8 E. NOTA

9. If $t > 0$ and $a = \dfrac{b}{(1+t)^x}$, then x equals

A. $\log\left[\dfrac{b}{(a(1+t))}\right]$ B. $\dfrac{\log\left(\dfrac{b}{a}\right)}{\log(1+t)}$ C. $\log\left[\dfrac{b-a}{(t+1)}\right]$ D. $\log\left(\dfrac{b}{a}\right) - \log(1+t)$ E. NOTA

10. Given $\log 2 = 0.301$, and $\log 3 = 0.477$. Find $\log(0.75)$.

A. 0.8751 B. -0.1078 C. -0.125 D. -1.078 E. NOTA

11. If $2^x = 4^{y+1}$, and $x^2 = (y+1)^4$, find the sum of the possible values of x.

A. 0 B. 2 C. 4 D. infinite E. NOTA

12. A function is defined on the set of positive integers as follows:

$$M(n) = \begin{cases} \log p & \text{if } n = p^m \text{ for some prime p and some integer m} \geq 1 \\ 0 & \text{otherwise} \end{cases}$$

Calculate $M(4) + M(6) + M(9)$

A) $\log 2$ B) $\log 3$ C) $\log 6$ D) 0 E) NOTA

13. Given that $\log 2 = a$, $\log 5 = b$, and $\log 7 = c$, then $\log \dfrac{50}{7}$ can be expressed as:

A) $\dfrac{ab^2}{c}$ B) $\dfrac{a+2b}{c}$ C) $a + 2b - c$ D) $ab^2 - c$ E) NOTA

14. Reduce to lowest terms: $\dfrac{9^{x+2}}{\left(3^{x-1}\right)^x} \div \dfrac{\left(27^x\right)^{x+1}}{81^{x^2-1}}$

A) -1 B) 0 C) 1 D) 3 E) NOTA

15. The base 3 logarithm of $\left(9\sqrt{27}\right)\left(\sqrt[3]{3}\right)$ is what?

A) $\dfrac{10}{3}$ B) $\dfrac{23}{6}$ C) $\dfrac{17}{6}$ D) $\dfrac{16}{3}$ E) NOTA

16. Simplify: $\left[27^{\frac{2}{3}} + 64^{\frac{2}{3}}\right]^{\frac{3}{2}} - 10^2$

    A) -9   B) 25   C) 191   D) 225   E) NOTA

17. Solve for x if $8^{3x+2} = 4^{5x-1}$

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

18. If $3^x + 3^{-x} = \dfrac{10}{3}$, the sum of the possible solutions is:

    A) -2   B) 0   C) 2   D) 3   E) NOTA

19. Solve: $6x^{\frac{-1}{2}} - 17x^{\frac{-1}{4}} = -5$

    A. $\left(\dfrac{1}{3}, \dfrac{5}{2}\right)$ B. $\left(\dfrac{2}{5}, 3\right)$ C. $\left(\dfrac{16}{625}, 81\right)$ D. $\left(\dfrac{1}{81}, \dfrac{625}{16}\right)$ E. NOTA

20. If $x = \left(\log_9 3\right)^{\log_2 16}$, then $\log_4 x =$

    A. -2   B. $\dfrac{1}{2}$ C. $-\dfrac{1}{2}$ D. 2   E. NOTA

21. If $\ln x^2 = \left(\ln x\right)^2$, then x equals

    A. 1   B. e C. $1, e$ D. $1, e^2$ E. NOTA

22. If $A = \log_8 225$ and $B = \log_2 15$, then the ratio of A to B is

    A. 2:8   B. 8:2   C. 2:3   D. 3:2   E. NOTA

23. If $\dfrac{e^x + e^{-x}}{e^x - e^{-x}} = 2$, find x.

    A. $\dfrac{1}{2}\ln 3$ B. $\dfrac{1}{3}\ln 2$ C. $\ln 2$ D. $\ln 3 - \ln 2$ E. NOTA

24. Find the greatest integer x for which $3^{20} > (32)^x$.

    A. 5   B. 6   C. 7   D. 8   E. NOTA

25. If $\ln x^4 = (\ln x)^3$, find x.

    A. $e^2, \dfrac{1}{e^2}, 1$ B. $e^2, \dfrac{1}{e^2}, e$ C. $e^3, \dfrac{1}{e^3}, 1$ D. $e^3, \dfrac{1}{e^3}, e$ E. NOTA

26. If $\log_b 2 = 0.2789$, $\log_b 3 = 0.4421$ and $\log_b 7 = 0.7831$, find $\log_b \dfrac{14}{3b}$.

    A. -0.3801   B. 0.7364   C. 0.6199   D. 0.5119   E. NOTA

27. Solve for x: $\ln(x-2) - 1 = \ln(x+2)$.

    A. $\dfrac{2+2e}{1-e}$ B. $\dfrac{2+2e}{1+e}$ C. $\dfrac{2-2e}{1+e}$ D. $\dfrac{2-2e}{1-e}$ E. NOTA

28. Solve for (x, y) $\begin{cases} \log_y(9-4x) = 1 \\ \log_{4+2y} 3x = 1 \end{cases}$

    A. $(2, -1)$ B. $(2, 1)$ C. $(-3, 1)$ D. $\varnothing$ E. NOTA

29. Find the sum of the roots of the equation: $8e^x + \dfrac{27}{e^x} = 35$.

    A. $\dfrac{-35}{8}$ B. $\ln \dfrac{27}{8}$ C. $\ln \dfrac{35}{8}$ D. $\dfrac{27}{8}$ E. NOTA

30. For all positive numbers x distinct from 1, $\dfrac{1}{\log_3 x} + \dfrac{1}{\log_4 x} + \dfrac{1}{\log_5 x} =$

    A. $\dfrac{1}{\log_{60} x}$ B. $\dfrac{1}{\log_x 60}$ C. $\dfrac{1}{(\log_3 x)(\log_4 x)(\log_5 x)}$ D. $\dfrac{12}{(\log_3 x)(\log_4 x)(\log_5 x)}$ E. NOTA