1. Which of the following is condensed form of the following logarithmic expression?

$$\frac{1}{4}\log x^2 - 2\log y + \log 4$$

a. $\log\dfrac{4x}{y}$
b. $\log\dfrac{4x^2}{y^2}$
c. $\log\dfrac{4\sqrt{x}}{y^2}$
d. $\log(\sqrt{x} - y^2 + 4)$
e. None of the Above

2. Solve for x: $\dfrac{e^x}{e^x - 1} = 5$

a. $\ln\dfrac{5}{4}$
b. $\ln\dfrac{4}{5}$
c. $\ln\dfrac{1}{4}$
d. $\ln\dfrac{-1}{4}$
e. None of the Above

3. The temperature T of a loaf of bread t minutes after being removed from the oven can be modeled by the equation $T = T_R + 5e^{\ln\left(\frac{3}{8}t\right)}$, where T_R is the room temperature. Determine how many minutes it will take a loaf of bread to cool down to 90°F at a room temperature of 75°F.

a. $5\,\text{min}$
b. $8\,\text{min}$
c. $10\,\text{min}$
d. $16\,\text{min}$
e. None of the Above

4. A sum of money is invested in the Mullionaire's Club Bank at 10% compounded continuously. Determine after how many years there will be a 150% increase in the original investment.

a. $(0.1)\ln 1.5$ years
b. $10\ln 1.5$ years
c. $\ln 15$ years
d. 1.5 years
e. None of the Above

5. If x and y are both distinct positive integers, solve for the smallest possible value for x + y given: $9^x = (x^y)(9^y)$

a. 0
b. 3
c. 5
d. 7
e. None of the Above

6. Which of the following is expanded form of the following logarithmic expression?

$$\log_b \sqrt[3]{4x^5 y^7}$$

a. $\frac{1}{3}[\log_b 4 + 5\log_b x + 7\log_b y]$

b. $-\frac{1}{3}[\log_b 4 + 5\log_b x + 7\log_b y]$

c. $3[4\log_b + 5\log_b x + 7\log_b y]$

d. $\frac{1}{3}[4\log_b + 5\log_b x + 7\log_b y]$

e. None of the Above

7. Determine the characteristic and mantissa: $\log = 2.6385$.

a. $characteristic = 6385$, $mantissa = 2$

b. $characteristic = -8$, $mantissa = -0.6385$

c. $characteristic = 2$, $mantissa = 0.6385$

d. $characteristic = 8$, $mantissa = 0.6385$

e. None of the Above

8. Which of the following exponential equations represents an exponential decay?

a. $y = 2e^{0.21t}$

b. $y = 2e^{-0.21t}$

c. $y = 5(2)^t$

d. $y = 4 - 4(2)^{-t}$

e. None of the Above

9. Find the vertical asymptote of the logarithmic equation: $f(x) = -\log_3(x+2) - 4$.

a. $x = -2$ **c.** $x = -4$ **e.** None of the Above

b. $x = 2$ **d.** $x = 0$

10. Simplify: $\frac{(\log 243)(\log 625)(\log 216)}{(\log 36)(\log 729)(\log 25)}$

a. $\frac{2}{5}$ **c.** 3 **e.** None of the Above

b. $\frac{5}{2}$ **d.** 100

11. Simplify: $3^{-x}(9^{2x^2}(27^{-7x}(243^{-\frac{2}{5}})))$

a. 3^{-2008x}
b. 3
c. 5
d. $3^{4x^2-22x-2}$
e. None of the Above

12. Which of the numbers listed below is the largest?

a. 2^{2008}
b. 3^{1004}
c. $\frac{1}{8}^{-502}$
d. $\frac{1}{9}^{-251}$
e. None of the Above

13. If $64^{-x} = 1024$, then find x.

a. $\frac{-5}{3}$
b. $\frac{-2}{3}$
c. $\frac{3}{5}$
d. $\frac{-5}{6}$
e. None of the Above

14. Find the product of the solutions of the equation: $8^{4x^2+43x-62} = 64$

a. $\frac{-43}{4}$
b. 4
c. -16
d. $\frac{43}{4}$
e. None of the Above

15. Find the coefficient of the x^3y^5 term of $(2x-y)^8$.

a. -8
b. 8
c. 2688
d. 448
e. None of the Above

16. $(-\frac{i}{2})^{2008}$ =

a. 2^{-2008}
b. -2^{2008}
c. $2i^{2008}$
d. $\frac{1}{2}^{-2008}$
e. None of the Above

17. Solve the equation for x: $6^x(6^{2x}) = 54$

a. $\frac{3\log 54}{\log 6}$

b. $\frac{\log 54}{3\log 6}$

c. $\frac{1}{3}\log_{54} 6$

d. $-3\frac{\log 54}{\log 6}$

e. None of the Above

18. Find the sum of the roots of: $x^{\frac{4}{3}} - 91x^{\frac{2}{3}} + 1728 = 0$

a. $3\sqrt{3} + 512$

b. $81\sqrt{3} + 512$

c. 7

d. 25

e. None of the Above

19. Find the domain of: $y = \log(16x^3 - 8x^2 + 30x - 15)$

a. $\left(\frac{-15}{8}, \frac{1}{2}\right)$

b. $\left[\frac{-15}{8}, \frac{1}{2}\right] \cup \left[\frac{15}{8}, \infty\right)$

c. $\left(\frac{-15}{8}, \infty\right)$

d. $\left(\frac{1}{2}, \infty\right)$

e. None of the Above

20. $\left[\frac{(x^2 - y^2)^{-3}}{-(x+y)^{-4}}\right]^{\frac{-2}{3}} =$

a. $\frac{(y-x)^2}{(x+y)^{\frac{2}{3}}}$

b. $\frac{-(x-y)^3}{(x+y)^2}$

c. $\frac{(x-y)^2}{(x+y)^{\frac{2}{3}}}$

d. $\frac{-(x-y)^2}{(y-x)^{\frac{2}{3}}}$

e. None of the Above

21. Eric Exponent has a dream of being an architect. His first assignment at Sacramento University involves using a special type of logarithmic graph paper. The vertical lines of the paper have a scale of $\frac{1}{\log a}$ where *a* is a positive integer from 1 to 1,000 inclusive. The horizontal lines have a scale of a^{-1} where *a* is a positive integer from 1 to 1,000 inclusive. Find the sum of the x and y coordinates of the points on the logarithmic graph paper when a = 10, a = 100, and a = 1000.

a. 1
b. $\frac{29}{15}$
c. $\frac{1766}{3000}$
d. $\frac{5833}{3000}$
e. None of the Above

22. Solve for A+B+C+D+E when A,B,C,D,E are digits from 0-9 and not necessarily distinct: $AB^C = DED$, $A + B = 4$

a. 9
b. 14
c. 16
d. 17
e. None of the Above

23. A young mathematician walked in the Magical Mu rainforest in the far-away country of AlphaLand. She passed many amazing creatures in the forest like the Parallel Lions, the Intigers, and the Polar Bears. Let L = the number of lions in the forest, T = the number of tigers in the forest, and B = the number of bears in the forest. The populations are represented by the following models: $L = 4^x, T = 5^{2(x-1)}, B = 10^{x+2}$ where x = time in months. How many animal legs are in the forest after $\frac{1}{4}$ year?

a. 100,576
b. 402,756
c. 402,800
d. 462,756
e. None of the Above

24. If $a^{2b} = 5$, find the value of $3a^{6b} + 8$

a. 383
b. 133
c. 88
d. 53
e. None of the Above

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

a. $\frac{3}{2}$
b. log(0.75)
c. 4
d. 6
e. None of the Above

26. $6^6 + 6^6 + 6^6 + 6^6 + 6^6 + 6^6 =$

a. 6^6
b. 6^7
c. 36^6
d. 6^{36}
e. None of the Above

27. Simplify. $i^{45} - i^{28} + i^{16} - i^7$; write answer in a+bi form. Find a + b.

a. 0
b. 1
c. 2
d. 3
e. None of the Above

28. What will an account's value grow to be if the interest rate is 2% compounded continuously if the original investment is \$120 and the account will remain untouched for 100 years? (round to the nearest dollar)

$\boxed{e \approx 2.72}$

a. \$653
b. \$888
c. \$889
d. \$2415
e. None of the Above

29. What is the domain of $f(x) = \log_8 |x^2 - 25|$?

a. All real numbers
b. (5, ∞)
c. (8, ∞)
d. (– ∞, 5) ∪ (5, ∞)
e. None of the Above

30. If $(2\log_a b)(\log_5 a) = 6$, and $a > 0$, then b =?

a. 125
b. 5
c. 243
d. $\frac{243}{a}$
e. None of the Above