1. Which of the following is a condensed form of the following logarithmic expression where $x > 0, y > 0$?

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

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 an expanded form of the following logarithmic expression where $x > 0, y > 0$?

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

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

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

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

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

    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. A culture of 5 bacteria has grown exponentially to 20 bacteria in 4 hours. Determine the number of bacteria after 24 hours for this culture.

    a. 4096

    b. 20,480

    c. 81,920

    d. 240,576

    e. None of the Above

9. 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

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

    a. $x = -2$

    b. $x = 2$

    c. $x = -4$

    d. $x = 0$

    e. None of the Above

11. Ivana Calculate wants to invest her 2008 Tax Refund Check from the IRS. She worked really hard this year and is being reimbursed $2,000 from the Federal Government. She is not sure how to maximize her earnings. Which of the following plans would earn her the most interest after 10 years?

  a. Continuously, r=5%
  b. Quarterly, r=5%
  c. Biannually, r=10%
  d. Monthly, r=10%
  e. None of the Above

12. General Mutors Company has a new car coming out with the given expected depreciation function: G(t) is the car value in dollars at time t in years:

$$G(t) = \frac{300,000t^2(t^2-1)}{1-10,000t^2+1,000t^4}$$

Find $\lim_{t\to\infty} G(t)$.

  a. $0
  b. $30
  c. $300
  d. $3000
  e. None of the Above

13. Simplify to one expression with positive exponents:

$$\left[\frac{8!(uv)^{-8}\dfrac{u^{-80}}{v^{2008}}}{-(4!)uv^{-20}(\ln e^{v^u})} \right]^{-2}$$

  a. $\dfrac{-u^{89}v^{1996+u}}{1680}$

  b. $\dfrac{u^{178}v^{3992+2u}}{1680^2}$

  c. $-2u^{178}v^2$

  d. $1680u^{89}v^{1996+u}$

  e. None of the Above

14. Simplify when $n \neq 1$: $\left(\dfrac{(n-1)^{-2}}{(n^2-1)^{-3}} \right)^{Arc\cos(1)}$

  a. $\left(\dfrac{(n+1)^{3\pi}}{(n-1)^{2\pi}} \right)$

  b. $\left(\dfrac{(n+1)^{3\pi-1}}{(n-1)^{2\pi-1}} \right)$

  c. $\dfrac{(n^2-1)^2(n+1)}{(n-1)}$

  d. $(n^2-1)(n+1)^2$

  e. None of the Above

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

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

    b. $\dfrac{5}{2}$ d. 100

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

    a. 3^{-2008x} c. 5 e. None of the Above

    b. 3 d. $3^{4x^2-22x-2}$

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

    a. 2^{2008} c. $\dfrac{1}{8}^{-502}$ e. None of the Above

    b. 3^{1004} d. $\dfrac{1}{9}^{-251}$

18. Find x if $\ln e^{2\cos^2 x-1}=\cos x$, for $0<x\le\pi$.

    a. 0 c. $\dfrac{5\pi}{6}$ e. None of the Above

    b. $\dfrac{\pi}{6}$ d. $-\dfrac{\pi}{6}$

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

    a. $\dfrac{-5}{3}$ c. $\dfrac{3}{5}$ e. None of the Above

    b. $\dfrac{-2}{3}$ d. $\dfrac{-5}{6}$

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

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

    b. 4 d. $\dfrac{43}{4}$

21. $(1-i)^{24}=?$

    a. 2^4 c. $2^{12}+i$ e. None of the Above

    b. 2^{12} d. $2^{12}i$

22. Find the coefficient of the $x^3 y^5$ term of $(2x - y)^8$.
    - a. -8
    - b. 8
    - c. 2688
    - d. 448
    - e. None of the Above

23. Solve for x: $\log(\sin^2 x) + \log(\sec^2 x) - \log(1 + \tan^2 x) = 0, 0 \le x \le 2\pi$.
    - a. $x = \dfrac{\pi}{2}$
    - b. $x = \dfrac{\pi}{2}, \dfrac{3\pi}{2}$
    - c. $x = \pm\dfrac{\pi}{2}$
    - d. $x = 0$
    - e. None of the Above

24. Choose an answer that is a simplified form of the following expression: $e^{\frac{\pi i}{4}}$.
    - a. $\dfrac{\sqrt{2}}{2} - \dfrac{\sqrt{2}}{2}i$
    - b. $e^{\frac{-1}{4}}$
    - c. $\dfrac{\sqrt{2}}{2} + \dfrac{\sqrt{2}}{2}i$
    - d. $e^{\frac{1}{4}}$
    - e. None of the Above

25. $\left(-\dfrac{i}{2}\right)^{2008} =$
    - a. 2^{-2008}
    - b. -2^{2008}
    - c. $2i^{2008}$
    - d. $\dfrac{1}{2}^{-2008}$
    - e. None of the Above

26. Solve the equation for x: $6^x(6^{2x}) = 54$
    - a. $\dfrac{3\log 54}{\log 6}$
    - b. $\dfrac{\log 54}{3\log 6}$
    - c. $\dfrac{1}{3}\log_{54} 6$
    - d. $-3\dfrac{\log 54}{\log 6}$
    - e. None of the Above

27. 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

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

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

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

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

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

    e. None of the Above

29. Solve for x if the determinant has a value of 0: $\begin{vmatrix} x & e^{(\ln 5)} & e^{(\ln 6 - \ln 6)} \\ e^{(4\ln 6 - 4\ln 2)} & 0 & e^{(-\ln 5)} \\ e^{5\ln e} & 5^{\ln e^2} & e^{\pi i} \end{vmatrix}$

    a. 0

    b. $486 + \dfrac{e^5}{5}$

    c. $324 - \dfrac{e^5}{5}$

    d. e^2

    e. None of the Above

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

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

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

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

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

    e. None of the Above