

**PROPERTIES OF LOGARITHMS**

**Directions:** Write each exponential equation in logarithmic form.

1.)  $3^3 = 27$  \_\_\_\_\_ 2.)  $4^3 = 64$  \_\_\_\_\_ 3.)  $7^{-2} = \frac{1}{49}$  \_\_\_\_\_

4.)  $36^{\frac{1}{2}} = 6$  \_\_\_\_\_ 5.)  $10^{-2} = \frac{1}{100}$  \_\_\_\_\_ 6.)  $e^3 = 20.09$  \_\_\_\_\_

**Directions:** Write each logarithmic equation in exponential form.

7.)  $\log_5 125 = 3$  \_\_\_\_\_ 8.)  $\log_8 64 = 2$  \_\_\_\_\_ 9.)  $\log_{\frac{1}{1000}} = -3$  \_\_\_\_\_

10.)  $\log_9 27 = \frac{3}{2}$  \_\_\_\_\_ 11.)  $\ln 4 = 1.386$  \_\_\_\_\_ 12.)  $\ln \frac{1}{2} = -0.693$  \_\_\_\_\_

**Directions:** Evaluate each logarithmic expression.

13.)  $\log_4 64 =$  \_\_\_\_\_ 14.)  $\log_{125} 5 =$  \_\_\_\_\_ 15.)  $\log_4 \frac{1}{16} =$  \_\_\_\_\_

16.)  $\log_3 \frac{1}{243} =$  \_\_\_\_\_ 17.)  $\log 10000 =$  \_\_\_\_\_ 18.)  $\log_2 \sqrt[4]{8} =$  \_\_\_\_\_

**Directions:** Use the properties of logarithms and natural logarithms to simplify each expression.

19.)  $5^{\log_5 7} =$  \_\_\_\_\_ 20.)  $e^{\ln 8} =$  \_\_\_\_\_ 21.)  $10^{\log 6} =$  \_\_\_\_\_

22.)  $\log_2 2^5 =$  \_\_\_\_\_ 23.)  $\ln e^2 =$  \_\_\_\_\_ 24.)  $\log 10^3 =$  \_\_\_\_\_

**Directions:** Evaluate each logarithm by using the *change-of-base formula*. Round your result to four decimal places.

25.)  $\log_3 7 =$  \_\_\_\_\_ 26.)  $\log_7 4 =$  \_\_\_\_\_ 27.)  $\log_{\frac{1}{4}} 5 =$  \_\_\_\_\_

28.)  $\log_9 0.4 =$  \_\_\_\_\_ 29.)  $\log_{20} 0.125 =$  \_\_\_\_\_ 30.)  $\log_{15} 1250 =$  \_\_\_\_\_

**Directions:** Expand each logarithmic expression. Do not leave any exponents in your final answer.

31.)  $\ln\left(\frac{x^4\sqrt{y}}{z^5}\right)$

32.)  $\log_2\left(\frac{\sqrt{xy^4}}{z^4}\right)$

33.)  $\log_5\left(\frac{125x^2}{y^2z^3}\right)$

34.)  $\log_{10}\left(\frac{xy^4}{100z^5}\right)$

35.)  $\ln^4\sqrt{x^3(x^2+3)}$

36.)  $\ln\sqrt{x^2(x+2)}$

**Directions:** Use the laws of logarithms to express each of the following as single logarithm.

37.)  $\ln x - 3\ln(x+1)$

38.)  $2\ln 8 + 5\ln(z-4)$

39.)  $\log x - 2\log y + 3\log z$

40.)  $3\log_3 x + 4\log_3 y - 4\log_3 z$

41.)  $\ln x - 4[\ln(x+2) + \ln(x-2)]$

42.)  $4[\ln z + \ln(z+5)] - 2\ln(z-5)$