

**Unit 4 Worksheet**

Evaluate or simplify each expression without a calculator.

1)  $\log_5 \frac{1}{125}$

$-3$

2)  $\log_{1/2} 32$

$-5$

3)  $\log_3 \sqrt{3}$

$\frac{1}{2}$

4)  $\log 1000$

$3$

Use Common Logarithms or Natural Logarithms and a calculator to evaluate to four decimal places.

5)  $\log_5 17$

$\frac{\log 17}{\log 5} = \frac{\ln 17}{\ln 5} \approx$

6)  $\log_{1.2} 5.4$

$\frac{\log 5.4}{\log 1.2} = \frac{\ln 5.4}{\ln 1.2} \approx$

Use the properties of logarithms to expand each logarithmic expression.

7)  $\ln \left( \frac{x^3 y^2}{z^5} \right)$

$\ln x^3 + \ln y^2 - \ln z^5$

$3 \ln x + 2 \ln y - 5 \ln z$

8)  $\log \left( \frac{y \sqrt{x^2 + 1}}{(x+1)^3} \right)$

$\log y + \log (x^2 + 1)^{1/2} - \log (x+1)^3$

$\log y + \frac{1}{2} \log (x^2 + 1) - 3 \log (x+1)$

Use the properties of logarithms to condense each logarithmic expression.

9)  $\frac{1}{2} \log (x+5) - \frac{1}{3} \log x + \log (y+4)$

$\log (x+5)^{1/2} - \log x^{1/3} + \log (y+4)$

$\log \frac{\sqrt{x+5} (y+4)}{\sqrt[3]{x}}$

10)  $\log_2 (x-4) + 5 \log_2 (x+1) - 3 \log_2 (x^2 - 16)$

$\log_2 (x-4) + \log_2 (x+1)^5 - \log_2 (x^2 - 16)^3$

$\log_2 \frac{(x-4)(x+1)^5}{(x+4)^3 (x-4)^3}$

$\log_2 \frac{(x+1)^5}{(x+4)^3 (x-4)^2}$

Solve. Find the exact answer.

11)  $4^{x-3} = \left( \frac{1}{8} \right)^{x-1}$

$2^{2(x-3)} = 2^{-3(x-1)}$

$2x - 6 = -3x + 3$

$5x = 9$

$x = \frac{9}{5}$

12)  $3 - e^{2x+1} = -7$

$-e^{2x+1} = -10$

$e^{2x+1} = 10$

$\ln e^{2x+1} = \ln 10$

$2x+1 = \ln 10$

$2x = \ln 10 - 1$

$x = \frac{\ln 10 - 1}{2}$

Solve. Find the exact answer.

13)  $4^{x+3} - 7 = 5$

$$4^{x+3} = 12$$

$$\log_4 4^{x+3} = \log_4 12$$

$$x+3 = \log_4 12$$

$$x = \frac{\ln 12}{\ln 4} - 3$$

15)  $\log_3(x+8) + \log_3 x = 2$

$$\log_3 x(x+8) = 2$$

$$3^{\log_3(x^2+8x)} = 3^2$$

$$x^2 + 8x = 9$$

$$x^2 + 8x - 9 = 0$$

$$(x+9)(x-1) = 0$$

$$x = -9, 1$$

$$x = 1$$

~~9, -1~~

14)  $\ln(x+7) - \ln(x+3) = \ln 8$

$$e^{\ln \frac{(x+7)}{(x+3)}} = e^{\ln 8}$$

$$\frac{x+7}{x+3} = 8$$

$$x+7 = 8(x+3)$$

$$x+7 = 8x+24$$

16)  $7 - \ln(x-4) = 2$   $e^{-7x} = 17$

$$-\ln(x-4) = -5$$

$$\ln(x-4) = 5$$

$$e^{\ln(x-4)} = e^5$$

$$x-4 = e^5$$

$$x = e^5 + 4$$

$$x = -\frac{17}{7}$$

17) The half-life of lead-210 is 22 years. If 50 grams are present now, how much will be present in 17 years?

$$A = A_0 e^{kt}$$

$$25 = 50 e^{22k}$$

$$0.5 = e^{22k}$$

$$\ln 0.5 = \ln e^{22k}$$

$$\frac{\ln 0.5}{22} = k$$

$$k \approx -0.0315$$

$$A = 50 e^{-0.0315(17)}$$

$$A = 29.27 \text{ grams}$$

$$29.27 \text{ grams}$$

18) Find the accumulated amount of an investment of \$9000 at 4% compounded monthly for 6 years.

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

$$A = 9000 \left(1 + \frac{0.04}{12}\right)^{12(6)}$$

$$A = \$11,436.68$$