Tutoring Worksheet for Basic Logarithms

1. Evaluate the following logarithmic expressions:

a. $\log_8 64$ b. $\log_3\left(\frac{1}{27}\right)$ c. $10^{\log 5}$ d. $\ln\left(\frac{1}{e}\right)$

2. Expand the following logarithmic expressions completely so that it is in a form where there is not a logarithm of a product, quotient, or power:

a. $\log_3(x\sqrt{y})$ b. $\log\left(\frac{x^2y^4}{z^3}\right)$ c. $\log_2\left(\frac{x(x^2+1)}{\sqrt{x^2-1}}\right)$

3. Rewrite as a single logarithm:

a. $\log_4 6 + 3\log_4 2$ b. $\log_5(x^3-1) - 2\log_5 3$ c. $2(\log_7 x + 2\log_7 y - 3\log_7 z)$

4. Solve the following equations using logarithms:

a. $2^{3x} = 34$ b. $4(1+10^x) - 1 = 11$ c. $\log_2(2-x) = 3$

5. **Application:** Using Newton's Law of Cooling, $T(t) = T_s + D_0e^{-kt}$, where D_0 is the initial temperature difference between an object and its surroundings, the surroundings temperature is T_s, t is the time the temperature is taken, and k is a positive constant depending on the type of object, solve the following:

   A cup of coffee has a temperature of $200^\circ F$ and is placed in a room that has a temperature of $70^\circ F$. After 10 minutes, the temperature of coffee is $150^\circ F$.

   A. Find a formula for the temperature of the coffee at time t.

   B. Find the temperature of the coffee after 15 minutes.

   C. When will the coffee have cooled to $100^\circ F$?

Answers – Tutoring Worksheet for Basic Logarithms

1. a) 2 b) –3 c) 5 d) –1

2. a) $\log_3 x + \frac{1}{2}\log_3 y$ b) $2\log x + 4\log y - 3\log z$

   c) $\log_2 x + \log_2(x^2+1) - \frac{1}{2}\log_2(x^2-1)$

3. a) $\log_4 48$ b) $\log_5(8(x^3-1))$

   c) $\log_7\left(\frac{xy^2}{z^3}\right)^2$

4. a) $x \approx 1.7$ b) $x \approx 0.3$ c) $x = -6$

5. a) $T(t) = 70 + 130e^{-0.04855t}$

   b) $T(15) = 70 + 130e^{-0.04855(15)} \approx 133^\circ F$

   c) $t \approx 30.2$