Name: _____ Date: _____

6.2 Logarithms

1. Rewrite each equation in logarithmic form:

   a) $3^5 = 243$ **b)** $\dfrac{1}{216} = 6^{-3}$

2. Rewrite each equation in exponential form:

   a) $\log_4 64 = 3$ **b)** $y = \log 30$

3. Evaluate without using a calculator.

   a) $\log_8 64$ **b)** $\log_2 \dfrac{1}{64}$

   c) $\log 100$ **d)** $\log 10^{-2.6}$

4. Use a graphical method to estimate the value of each, to one decimal place.
   a) $\log_2 5$ **b)** $\log_2 3$

5. Evaluate, correct to two decimal places, using a calculator:
   a) $\log_5 15$ **b)** $\log_2 0.8$

6. The age of a bone can be determined from the fraction of carbon-14 that remains in the bone. The age is calculated by using the formula $A = -19\ 000(\log R)$, where A is the age in years and R is the fraction of carbon-14 remaining.

   a) How old is a bone that has only $\dfrac{3}{4}$ of its original carbon-14?
   b) How old is a bone that has only 10% of its original carbon-14?
   c) Express the formula in exponential form.
   d) Use your answer to part c) to calculate the percent of carbon-14 remaining in a bone from an animal that died 100 years ago.

7. In the *Key Concepts* of this section, it is stated that "the value of $\log_b x$ is equal to the exponent to which the base, b is raised to produce x." Use this definition to explain why $\log_4 4^{20} = 20$.

8. The pH scale used to specify the acidity of a solution is given by the formula $pH = -\log(C)$, where C is the concentration of hydronium ions in a solution in moles per litre.
   a) A strong acid has a concentration of 2.6×10^{-3} mol/L. What is its pH?
   b) Express the formula in exponential form.
   c) Use your answer to part b) to determine the concentration of hydronium ions in a neutral solution (pH = 7).

9. Use a calculator.
   a) Evaluate the following, correct to two decimal places.
   $\log 3.16$, $\log(3.16^2)$, $\log(3.16^3)$, $\log(3.16^4)$
   Find a pattern in your answers.
   b) Use the pattern you found in part a) to calculate $\log(3.16^{10})$ and $\log(3.16^{2.5})$. Check your answers with a calculator.
   c) Use the pattern to calculate $\log(100^{50})$, $\log_2(32^5)$, and $\log \sqrt{1000}$

10. Use a calculator.
    a) Evaluate the following, accurate to one decimal place: $\log 4$, $\log 20$, and $\log 80$. Find a pattern in your answers.
    b) Use the pattern you found in part a) to calculate $\log(80 \times 4)$ and $\log(80 \times 20)$. Check your answers with a calculator.
    c) Use the pattern to calculate $\log_2(8 \times 32)$ and $\log_5(25\sqrt{5})$.