HW 9-1H
Secondary 3H

Name: Key
Date: _____ Class: _____

Find the exact value of the following without a calculator

1. $\log_2 8 = \log_2 2^3 = \boxed{3}$

2. $\log_4\left(\frac{1}{16}\right) = \log_4 4^{-2} = \boxed{-2}$

3. $\log 10{,}000{,}000{,}000{,}000 =$
$\log 10^{13} = \boxed{13}$

4. $\log 0.000000001 =$
$\log 10^{-9} = \boxed{-9}$

Write the given exponential equation in logarithmic form.

5. $5^3 = 125$
$3 = \log_5 125$

6. $\left(\frac{1}{10}\right)^{-2} = 100$
$-2 = \log_{1/10} 100$

7. $3^m = n$
$m = \log_3 n$

8. $\left(\frac{1}{2}\right)^p = q$
$p = \log_{1/2} q$

Write the given logarithmic equation in exponential form.

9. $\log_6 1296 = 4$
$6^4 = 1296$

10. $\log_{\frac{1}{4}} \frac{1}{64} = 3$
$\left(\frac{1}{4}\right)^3 = \frac{1}{64}$

11. $\log_8 x = y$
$8^y = x$

12. $\log_{\frac{2}{3}} c = d$
$\left(\frac{2}{3}\right)^d = c$

Write the given exponential equation in logarithmic form.

13. $10^5 = 100000$
$5 = \log 100000$

14. $e^4 \approx 54.6$
$4 = \ln 54.6$

Write the given logarithm in exponential form.

15. $\ln 5 \approx 1.6$
$e^{1.6} = 5$

16. $\log 1{,}000{,}000 = 6$
$10^6 = 1{,}000{,}000$

13. If $f(x) = \log_3 x$, find $f(243)$, $f\left(\frac{1}{27}\right)$, and $f(\sqrt{27})$.

$f(243) = \log_3 243$
$= \log_3 3^5$
$= \boxed{5}$

$f\left(\frac{1}{27}\right) = \log_3 \frac{1}{27}$
$= \log_3 3^{-3}$
$= \boxed{-3}$

$f(\sqrt{27}) = \log_3 \sqrt{27}$
$= \log_3 (27)^{1/2}$
$= \log_3 (3^3)^{1/2}$
$= \log_3 3^{3/2}$
$= \boxed{3/2}$

14. If $f(x) = \log_6 x$, find $f(36)$, $f\left(\frac{1}{6}\right)$ and $f\left(6\sqrt[3]{6}\right)$

$f(36) = \log_6 36$
$= \log_6 6^2$
$= \boxed{2}$

$f\left(\frac{1}{6}\right) = \log_6 \left(\frac{1}{6}\right)$
$= \log_6 6^{-1}$
$= \boxed{-1}$

$f(6\sqrt[3]{6}) = \log_6 6\sqrt[3]{6}$
$= \log_6 6^1 \cdot 6^{1/3}$
$= \log_6 6^{4/3}$
$= \boxed{4/3}$

Use a scientific (graphing) calculator to find the common logarithm and the natural logarithm of the given number. Verify each result by evaluating the appropriate exponential expression.

16. 19

$\log 19 = 1.279$ $\quad 10^{1.279} = 19.0$ ✓
$\ln 19 = 2.944$ $\quad e^{2.944} = 19.0$ ✓

17. 9

$\log 9 = .954$ $\quad 10^{.954} = 9$ ✓
$\ln 9 = 2.197$ $\quad e^{2.197} = 9$ ✓

18. 0.6

$\log 0.6 = -.222$ $\quad 10^{-.222} = 0.6$ ✓
$\ln 0.6 = -.511$ $\quad e^{-.511} = 0.6$ ✓

19. 0.31

$\log 0.31 = -0.509$ $\quad 10^{-0.509} = 0.31$ ✓
$\ln 0.31 = -1.171$ $\quad e^{-1.171} = 0.31$ ✓

20. The acidity level, or pH, of a liquid is given by the formula $\text{pH} = \log \frac{1}{[\text{H}^+]}$ where $[\text{H}^+]$ is the concentration (in moles per liter) of hydrogen ions in the liquid. What is the pH of iced tea with a hydrogen ion concentration of 0.000158 mole per liter?

$\text{pH} = \log\left(\frac{1}{0.000158}\right) = \boxed{3.8}$

25. Justify Reasoning Evaluate each expression without using a calculator. Explain your reasoning.

a. $\ln e^2 = 2$

b. $10^{\log 7} = 7$

26. The loudness L, measured in decibels, of a sound of intensity x, measured in watts per square meter is $L(x) = 10 \log \frac{x}{10^{-12}}$. A whisper has an intensity level of 10^{-10} watt per square meter. How many decibels is a whisper?

$L(10^{-10}) = 10 \log\left(\frac{10^{-10}}{10^{-12}}\right) =$ 20 decibels

Review

For the following sequences: a) Write a recursive rule, b) write an explicit rule, c) find the 10th term

1. -4, 1, 6, 11, ...

a) Recursive:

2. 2, 6, 18, 54, ...

a) Recursive