Properties of Logarithms - Part 1

Logarithmic Form	Exponential Form
$\log_a x = y$	$x = a^y$

$a^y = x$

Properties of Logarithms

1. $\log_a 1 = 0$
2. $\log_a a = 1$
3. $\log_a a^x = x$
4. If $\log_a x = \log_a y$, then $x = y$.
5. $\log_a (u \bullet v) = \log_a u + \log_a v$
6. $\log_a \frac{u}{v} = \log_a u - \log_a v$
7. $\log_a u^n = n \bullet \log_a u$
8. $\log_a \sqrt[n]{u} = \frac{1}{n} \bullet \log_a u$ $\quad \log_a u^{\frac{1}{n}} = \frac{1}{n} \log_a u$
9. $\log_a x = \frac{\log_{10} x}{\log_{10} a}$ where $a \neq 10$ (Change-of-Base Formula)

Directions: Write the logarithmic equation in exponential form.

1. $\log_3 9 = 2$

a x y

$x = a^y$

$\boxed{9 = 3^2}$

2. $\log_{16} 4 = \frac{1}{2}$

a x y

$x = a^y$

$\boxed{4 = 16^{\frac{1}{2}}}$

3. $\log_{10} 1 = 0$

x a y

$x = a^y$

$\boxed{1 = 10^0}$

4. $\log_8 \frac{1}{64} = -2$

a x y

$x = a^y$

$\boxed{\frac{1}{64} = 8^{-2}}$

Directions: Evaluate each logarithmic expression without a calculator.

5. $\log_2 64 = x$

$2^x = 64$

$2^6 = 64$

$\boxed{x = 6}$

6. $\log_3 81 = x$

$3^x = 81$

$3^4 = 81$

$\boxed{x = 4}$

7. $\log_9 3 = x$

$9^x = 3$

$\sqrt{9} = 3$

$9^{1/2} = 3$

$\boxed{x = 1/2}$

8. $\log_{10} \frac{1}{1000} = x$

$10^x = \frac{1}{1000}$

$10^3 = 1000$

$10^{-3} = \frac{1}{1000}$

$\boxed{x = -3}$

9. $\log_6 1 = x$

$6^x = 1$

$6^0 = 1$

$\boxed{x = 0}$

10. $\log_6 6 = x$

$6^x = 6$

$6^1 = 6$

$\boxed{x = 1}$

Directions: Solve each equation for *x* using the properties of logarithms.

11. $\log_8 x = \log_8 9$

Property 4

$\boxed{x = 9}$

12. $\log_7 7 = x$

Property 2

$\boxed{x = 1}$

13. $\log_6 6^4 = x$

Property 3

$\boxed{x = 4}$

14. $\log_8 1 = x$

Property 1

$\boxed{x = 0}$

Directions: Evaluate each logarithm using the Change-of-Base formula. Round your answer to the nearest thousandth.

15. $\log_3 7 = x$

$\cancel{3^x = 7}$

$\frac{\log 7}{\log 3} = \frac{.845}{.477} = \boxed{1.771}$

16. $\log_{\frac{1}{4}} 9 = x$

$\cancel{\frac{1}{4}^x = 9}$

$\frac{\log 9}{\log .25} = \frac{.954}{-.602} = \boxed{-1.585}$