# Warm Up

Convert each logarithmic equation to an exponential equation. Then solve for the unknown.

1. $\log_{10} 0.1 = x$

2. $\log_2 16 = x$

3. $\log_{10} 10^9 = x$

4. $\log_2 \frac{1}{4} = x$

| Exponential Form $y = b^x$ | ⇄ | Logarithmic Form $x = \log_b y$ |
|---|---|---|
| $12^2 = 144$ | ⇄ | |
| | ⇄ | $\log_{16} 4 = \frac{1}{2}$ |
| $10^5 = 100{,}000$ | ⇄ | |
| | ⇄ | $\ln 20.086 \approx 3$ |
| $\left(\frac{2}{3}\right)^3 = \frac{8}{27}$ | ⇄ | |
| | ⇄ | $\log_9 27 = \frac{3}{2}$ |
| | ⇄ | $\log_2 x = 8$ |
| $6^x = 36$ | ⇄ | |
| $n^5 = 243$ | ⇄ | $\log_n 243 = 5$ |

**1. Arrange the given terms to create a true logarithmic equation.**

**a. 49, 2, 7**

**b. $-3, 6, \frac{1}{216}$**

**c. 4, 4, 1**

**d. 256, 4, 4**

## Worked Example

To solve for any unknown in a simple logarithmic equation, begin by converting it to an exponential equation.

| **Argument Is Unknown** | **Exponent Is Unknown** | **Base Is Unknown** |
|---|---|---|
| $\log_4 y = 3$ | $\log_4 64 = x$ | $\log_b 64 = 3$ |
| $4^3 = y$ | $4^x = 64$ | $b^3 = 64$ |
| $64 = y$ | $4^x = 4^3$ | $b^3 = 4^3$ |
| | $x = 3$ | $b = 4$ |

**3. Solve for the unknown in each logarithmic equation.**

a. $\log_8 64 = n$

b. $\log_n \frac{1}{16} = -2$

c. $\log_{\frac{1}{2}} 64 = n$

d. $\log n = -3$

# Practice

1. Solve for the unknown in each logarithmic equation.

   a. $\log 1000 = n$

   b. $\log_n \frac{1}{27} = -3$

   c. $\log_{\frac{1}{3}} 81 = n$

   d. $\log_8 16 = n$

4. Consider the function $h(x)$, which is formed by translating the function $g(x) = \log_3 x$ right 2 units and down 1 unit.

   a. Write $h(x)$ in terms of $g(x)$.

   b. Complete the table by determining the corresponding point on $h(x)$ for each reference point on $g(x)$.

| Reference Point on $g(x)$ | Corresponding Point on $h(x)$ |
|---|---|
| $(\frac{1}{3}, -1)$ | |
| (1, 0) | |
| (3, 1) | |
| (9, 2) | |

   c. Write $h(x)$ as a logarithmic function.

   d. List the domain, range, and any asymptotes of the logarithmic function $h(x)$.