

# Logarithmic Functions

Rewrite Exponential as Log	Rewrite Logarithm as Exponential
$5^2 = 25$ $\log_5 25 = 2$	$\log_7 49 = 2$ $7^2 = 49$
$6^2 = 36$ $\log_6 36 = 2$	$\log_7 49 = 2$ $7^2 = 49$

**Example 1:**  
Write the exponential equations in logarithmic form.

a.  $2^4 = 16$       b.  $2^{-1} = \frac{1}{2}$   
 $\log_2 \frac{1}{2} = -1$

**Example 2:**  
Write the logarithmic equations in exponential form.

a.  $\log_3 9 = 2$       b.  $\log_6 1 = 0$       c.  $\log_5 \left(\frac{1}{25}\right) = -2$   
 $6^0 = 1$        $5^{-2} = \frac{1}{25}$

**Example 3:**  
Evaluate the expression.

a.  $\log_4 64 = 3$       b.  $\log_5 5 = 1$   
c.  $\log_2 0.125 = -3$  (base)       $\log_7 1 = 0$   
e.  $\log_{32} 2 = \frac{1}{5}$        $\log_{\frac{1}{4}} 256 = -4$

**Special Logarithmic Values**

Common log

Natural log

**Example 4:**  
Evaluate using a calculator.

a.  $\log_{10} 7 = 0.845$       b.  $\ln 0.25 = -1.386$

Change of base

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$$\frac{\log \#}{\log \text{base}}$$

**Example 5:**  
Evaluate the following using your calculator.

a.  $\log_4 8$       b.  $\log_7 21$

Example 6:

Solve the following:

a.  $3^x = 12$

$$\log_3 12 = x$$

$$\frac{\log 12}{\log 3} \quad (x = 2.26)$$

d.  $7^{x+2} = 282$

$$\log_7 282 = x + 2$$

$$= x + 2$$

b.  $10^x + 3 = 23$

$$\frac{-3 \quad -3}{10^x = 20}$$

c.  $e^x = 41$

$$\log_e 41 = x$$

$$\ln 41 = x$$

$$(3.71 = x)$$

e.  $\log_4 38 = x$

f.  $\log_{12} 870 = x + 2$

$$= x + 2$$