NOTES 7-3 LOGARITHMIC FUNCTIONS

**** $2^y = 4$ and $2^y = 8$ can be solved by guess/check, but to solve $2^y = 6$, logarithms are needed – more on that later.

Definition of Logarithm of Base *a*

$a > 0$
$a \neq 1$

**** $\log_a x = y$ means $a^y = x$

(the answer in a logarithm is an exponent)

Rewriting Exponential and Logarithmic Equations

Logarithmic form	Exponential form
$\log_c w = r$	$c^r = w$
$\log_f g = k$	$f^k = g$
$\log_b a = t$	$b^t = a$

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Evaluating logs

answer ↓ | work

$\log_2 16 =$ 4 because $2^{4} = 16$

$\log_{10} 10 =$ 1 because $10^{1} = 10$

$\log_3 1 =$ 0 because $3^{0} = 1$

$\log_6 216 =$ 3 because $6^{3} = 216$

$\log_8 64 =$ 2 because $8^{2} = 64$

$\log_{13} 169 =$

$\log_5 \frac{1}{5} =$ −1 because $5^{-1} = \frac{1}{5}$

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1. $\log_2 16 = 4$

2. The log base 2 of 16 is 4.

3. The log base 2 of 16 is 4 because $2^4 = 16$.

1. $\log_{\square} \square = \square$

2. The log base ___ of ___ is ___.

3. The log base ___ of ___ is ___ because _____.

1. $\log_{\square} \square = \square$

2. The log base ___ of ___ is ___.

3. The log base ___ of ___ is ___ because _____.

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1. $\log_2 16 = 4$
2. The log base 2 of 16 is 4.
3. The log base 2 of 16 is 4 because $2^4 = 16$.

1. $\log_{3} 9 = 2$
2. The log base 3 of 9 is 2.
3. The log base 3 of 9 is 2 because $3^2 = 9$.

1. $\log_{12} 144 = 2$
2. The log base 12 of 144 is 2.
3. The log base 12 of 144 is 2 because $12^2 = 144$.

1. $\log_2 16 = 4$
2. The log base 2 of 16 is 4.
3. The log base 2 of 16 is 4 because $2^4 = 16$.

1. $\log_5 125 = 3$
2. The log base 5 of 125 is 3.
3. The log base 5 of 125 is 3 because $5^3 = 125$.

1. $\log_6 \frac{1}{36} = -2$
2. The log base 6 of $\frac{1}{36}$ is -2.
3. The log base 6 of $\frac{1}{36}$ is -2 because $6^{-2} = \frac{1}{36}$.

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1. $\log_2 16 = 4$
2. The log base 2 of 16 is 4.
3. The log base 2 of 16 is 4 because $2^4 = 16$.

1. $\log_{8} 4 = \frac{2}{3}$
2. The log base 8 of 4 is $\frac{2}{3}$.
3. The log base 8 of 4 is $\frac{2}{3}$ because $8^{\frac{2}{3}} = 4$.

1. $\log_{36} \frac{1}{6} = -\frac{1}{2}$
2. The log base 36 of $\frac{1}{6}$ is $-\frac{1}{2}$.
3. The log base 36 of $\frac{1}{6}$ is $-\frac{1}{2}$ because $36^{-\frac{1}{2}} = \frac{1}{6}$.

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Answer

Work

$\log_2 16 =$

$\log_3 27 =$

→ $\log_{16} 4 = \frac{1}{2}$

$16^{\square} = 4$

$16^x = 4$

$\left(\frac{1}{2}\right)^x = 16$

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

$\log_9 3 =$

→ $\log_{\sqrt{5}} 25 = 4$

$\left(\sqrt{5}\right)^x = 25$

$\left(5^{\frac{1}{2}x}\right) = 5^2$

$\frac{1}{2}x = 2$

$x = 4$

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Common log – uses base 10 (and is a calculator button), but the base is not written

log 1000 = 3 because $10^3 = 1000$

log .01 = -2 because $10^{\square} = .01 = \frac{1}{100}$

PRACTICE Evaluate the logarithms.

1. $\log_4 16$

2. $\log_5 1$

3. $\log 100$ (10) 2

4. $\log_4 2$

5. $\log_3 (-1)$ undefined

$3^{\square} = -1$

Domain (input) $x > 0$ $(0, \infty)$

6. ~~$\log_4 4^{x+2}$~~

$4^{\square} = 4^{x+2}$

$x + 2$

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Solve. (Rewrite in exponent form first.)

$\log_4 x = 2$

$4^2 = x$

$16 = x$

$\log_x 243 = 5$

$(x^5)^{1/5} = (243)^{1/5}$

$x = 3$

$\log_5 (x - 4) = 0$

$5^0 = x - 4$

$1 = x - 4$

$x = 5$

5.) $\log_{\frac{1}{2}} 4 = \underline{-2}$

$\left(\frac{1}{2}\right)^x = \frac{4}{1}$

10.) $\log_x \frac{1}{64} = -3$

$\left(x^{-3}\right)^{-\frac{1}{3}} = \left(\frac{1}{64}\right)^{-1/3}$

$\boxed{\frac{1}{4}}^3 = \frac{1}{64}$

flip

$x = \boxed{4}$

32.) $\log_{x+2} 16 = 2$

$\sqrt[2]{(x+2)^2} = \sqrt[2]{16}$

$x + 2 = \pm 4$

$x + 2 = 4$

$\boxed{x = 2}$

~~$x + 2 = -4$~~

~~$x = -6$~~

base: $-6 + 2 = -4$

can't be neg.