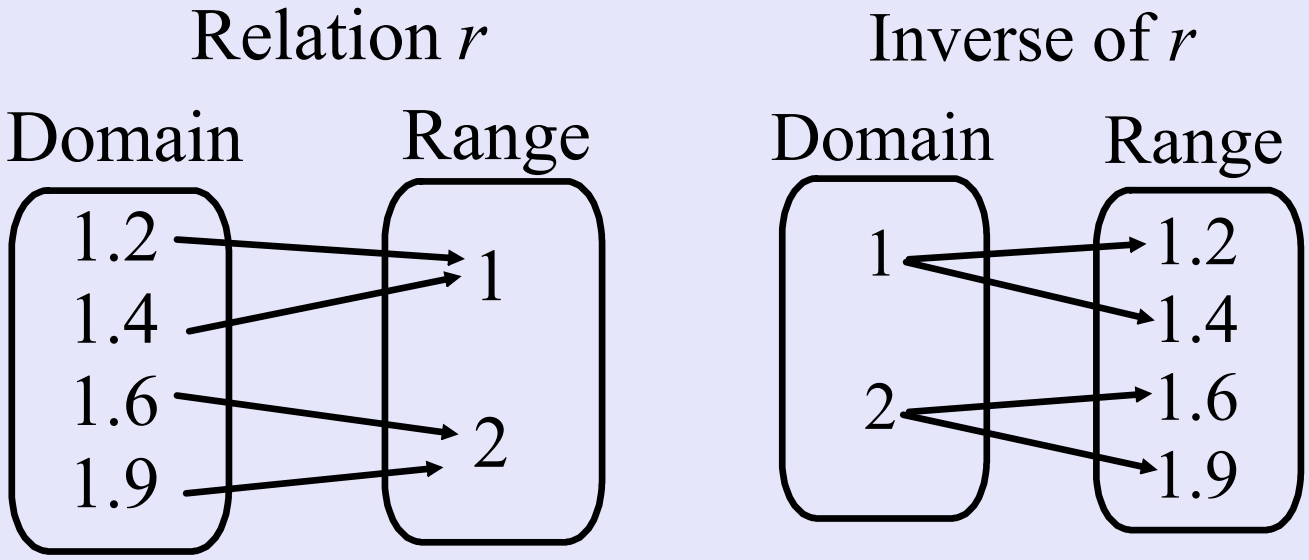
Algebra 2

Ch. 8 Handout 8.3

Logarithmic Functions as Inverses

If a relation maps element *a* of its domain to element of *b* of its range, the inverse relation "undoes" the relation and maps *b* back to *a*. So, if (a, b) is an ordered pair of a relation then (b, a) is an ordered pair of its inverse.



The inverse of function *f* is denoted by _____. If a function *f* pairs *a* with *b*, then $f^{-1}(x)$ must pairs *b* with *a*.

The range of the relation is the domain of the inverse, and the domain of the relation is the range of the inverse.

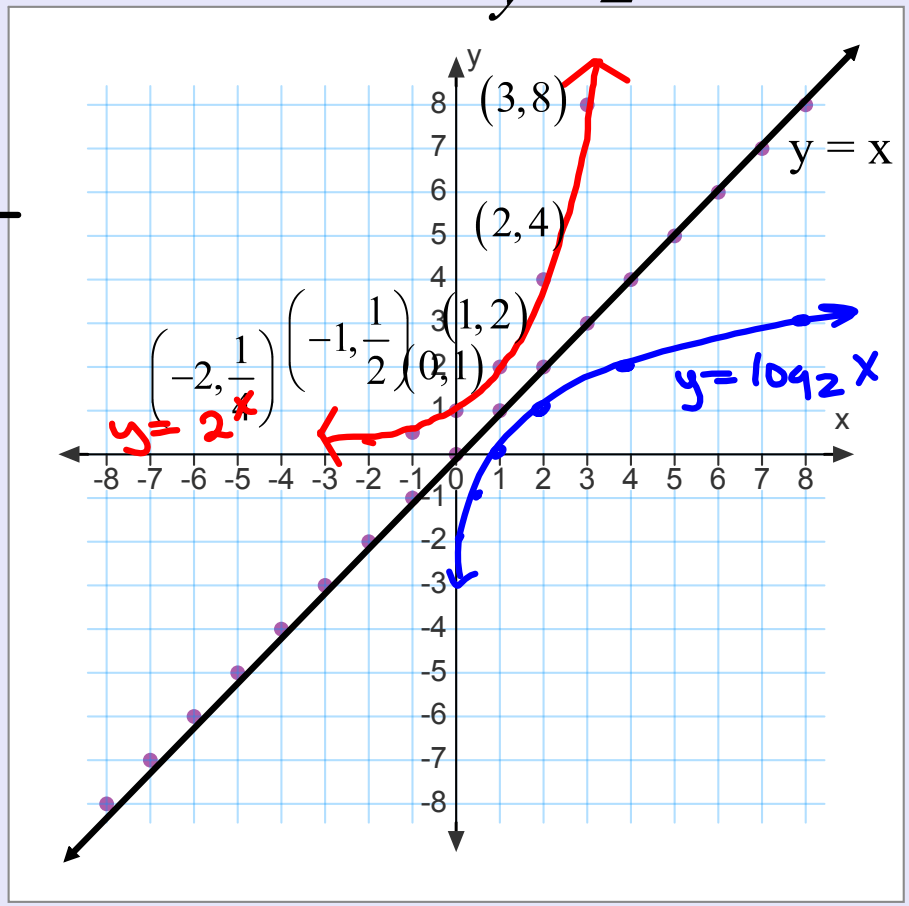
Function ⟶ Inverse Function

(a , b) ⟶ (b , a)

Exponential Function

$y = 2^x$

x	$y = 2^x$	y
3	$y = 2^3$	8
2	$y = 2^2$	4
1	$y = 2^1$	2
0	$y = 2^0$	1
-1	$y = 2^{-1}$	$\frac{1}{2}$
-2	$y = 2^{-2}$	$\frac{1}{4}$



Logarithmic Function

$y = \log_2 x$

x	$y = \log_2 x$	y
8		3
4		2
2		1
1		0
$\frac{1}{2}$		-1
$\frac{1}{4}$		-2

Logarithmic ⟶

The logarithm to the base b of a positive number y is defined as follows:

Exp. ⟷ logarithm

If $y = b^x$, then $\log_b y = x$.

Logarithmic Function	Exponential Form
$\log_b y = x$	$b^x = y$
$\log_2 8 = 3$	$2^3 = 8$
$\log_3 9 = 2$	$3^2 = 9$
$\log_{\frac{1}{2}} 4 = -2$	$\left(\frac{1}{2}\right)^{-2} = 4$
$\log_3 \frac{1}{9} = -2$	$3^{-2} = \frac{1}{9}$

1. Write each equation in exponential form.

a) $\log_4 \frac{1}{64} = -3$

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

b) $\log_3 729 = 6$

$3^6 = 729$

2. Write each equation in logarithmic form.

a) $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$

$\log_{1/2} \frac{1}{8} = 3$

b) $10^0 = 1$

$\log_{10} 1 = 0$

Evaluate each logarithm.

3) $\log_3 81 = x$

$3^x = 81$

$3^x = 3^4$

$x = 4$

81
9 9
3 3 3 3

$81 = 3^4$

4) $\log_{64} \frac{1}{32} = x$

$(64)^x = \frac{1}{32}$

$(2^6)^x = \frac{1}{2^5}$

$2^{6x} = 2^{-5}$

$\frac{6x}{6} = \frac{-5}{6}$

$x = -\frac{5}{6}$

32
8 4
2 4 2 2
2 2

$32 = 2^5$

64
8 8
2 4 2 4
2 2 2 2

$64 = 2^6$

Evaluate each logarithm.

5) $\log_9 27 = x$

$(9)^x = 27$

$(3^2)^x = 3^3$

$3^{2x} = 3^3$

$2x = 3$

$x = 3/2$

$9 = 3^2$

$27 = 3^3$

6) $\log_{10} 100 = x$

$10^x = 100$

$10^x = 10^2$

$x = 2$

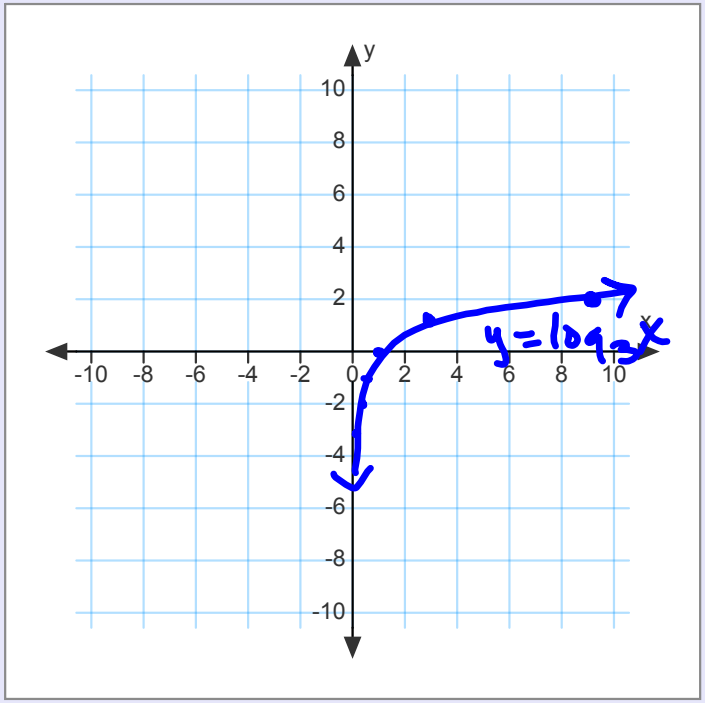
$100 = 10^2$

7) Graph the logarithm: $y = \log_3 x$

$\log_3 x = y$

$3^y = x$

x	$3^y = x$	y
27	$3^3 = x$	3
9	$3^2 = x$	2
3	$3^1 = x$	1
1	$3^0 = x$	0
1/3	$3^{-1} = x$	-1
1/9	$3^{-2} = x$ $x = \frac{1}{3^2}$	-2
1/27	$3^{-3} = x$ $x = \frac{1}{3^3}$	-3



The inverse of an exponential function is a logarithmic function.

True or False

$\log_3 x = 7$ is an example of a logarithmic equation, where as $\log_4 x$ is a logarithmic expression.

True or False

Evaluate $\log_7 1$.

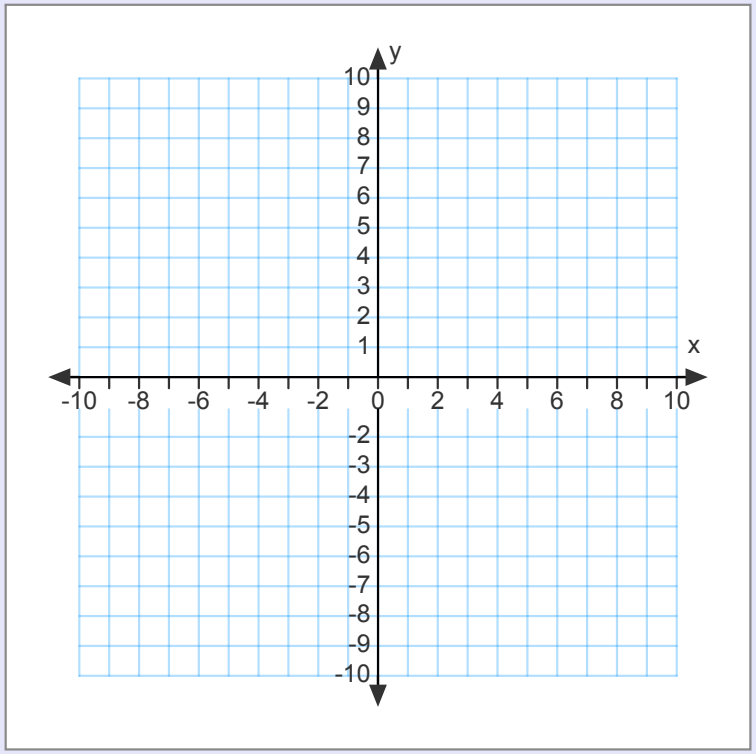
Evaluate $\log_4 256$.

Evaluate: $\log_2 \frac{1}{16}$

Evaluate $\log_2 4\sqrt{2} = x$

Evaluate: $\log_6(-36)$

Graph: $y = \log_5(x-1)+2$



Assignment

8.3 Pgs 450-452 7-25 odds, 35, 37, 53-61 odds