8.1 Logarithms

Solve for x:

① $x+5=13$
$-5 \quad -5$
$x=8$

② $4x=14$
$\div 4 \quad \div 4$
$x=3.5$

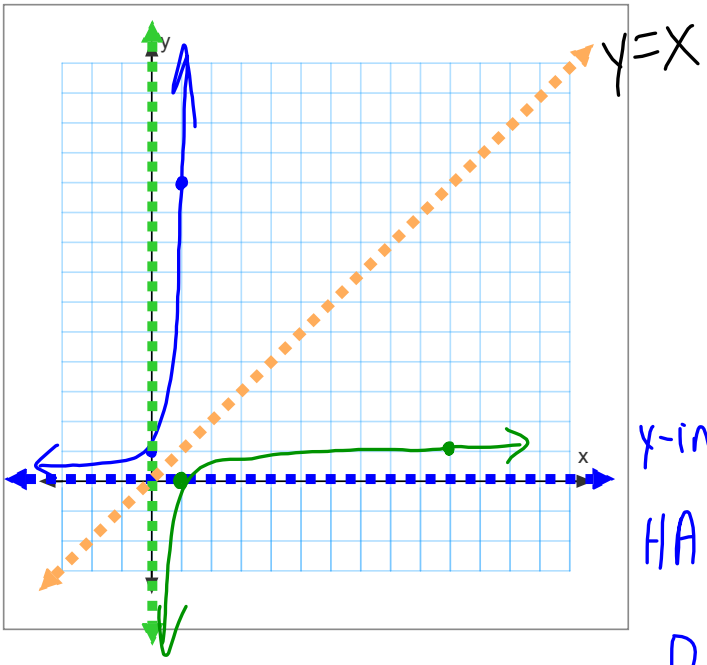
③ $\sqrt{x^2}=\sqrt{36}$
$x=\pm 6$

④ $2^x=8$
$2^x=2^3$
$x=3$
$\log_2 8=x$
$\log_2 8=3$

⑤ $2^x=10$
$\log_2 10 \doteq 3.3$
between 3 & 4
$2^{ANS}=10$

Graph $y=10^x$ and the inverse of $y=10^x$.

$x=10^y$



Inverses are reflections over the line $y=x$.

$y=10^x$	$x=10^y$
y-int $(0,1)$	x-int $(1,0)$
HA $y=0$	VA $x=0$
D: $x\in\mathbb{R}$	R: $y\in\mathbb{R}$
R: $y>0$	D: $x>0$

How do we graph $x=10^y$?

$y_1=10^x$ $y_2=\log_{10}x$

Try a few:

a) $\log_7 49 = 2$
(Think $7^? = 49$)

b) $\log_5 1 = 0$
check: $5^0 = 1$ ✓

c) $\log 10000 = 4$
(base is 10)

d) $\log_2 \sqrt{8} = x$

$2^x = \sqrt{8}$

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

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

$x = 3/2 = 1.5$

e) $\log_5 x = -3$ (verify)

$5^{-3} = x$

$\frac{1}{5^3} = x$

$\frac{1}{125} = x$

f) $\log_x 36 = 2$

$x^2 = 36$

$x = \sqrt{36}$

$x = \pm 6$

$\log_6 36 = 2$ ✓

$\log_{-6} 36 = 2$ ✗

The base of a log cannot be negative.

g) $\log_{64} x = 2/3$

$64^{2/3} = x$

$(\sqrt[3]{64})^2 = x$

$4^2 = x$

$16 = x$

h) Evaluate $\log_{10}(-100) =$ und.

Think: $10^? = -100$

The "argument" of a log can't be negative.

i) Evaluate $\log 0 =$ und.

Think: $10^? = 0$

$10^{-3000} = \frac{1}{10^{3000}} = \frac{1}{big} \neq 0$

The argument of a log cannot be 0.

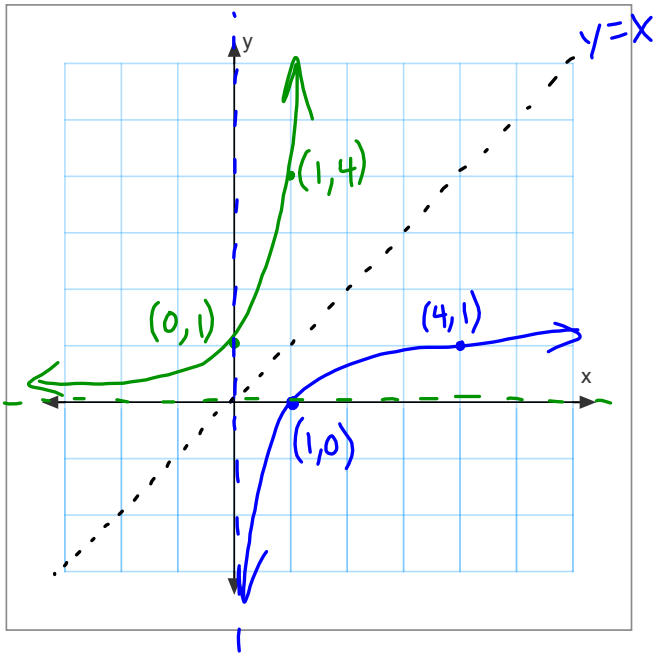
$\log_c y = x$ ← $y > 0$, $c > 0$

$\updownarrow$

$c^x = y$

ex) Sketch the inverse of $y = 4^x \rightarrow x = 4^y$

$\log_4 x = y$



D: $x > 0$

R: $y \in \mathbb{R}$

Read Key Ideas

pg. 380-382

#1b, 2-7, 9-12, 13*, 14-16

More tomorrow... applications, extend, natural log.