4-5 Logarithmic Functions

if $f: x \longmapsto a^x$, then $f^{-1}: x \longmapsto \log_a x$

if $f(x) = a^x$, then $f^{-1}(x) = \log_a x$

$y = \log_a x$ is the inverse of $y = a^x$

$y = a^x$ is the inverse of $y = \log_a x$

* check to see if two functions are inverses

Ex) $f(x) = 2^x$ $\qquad$ $g(x) = \log_2 x$

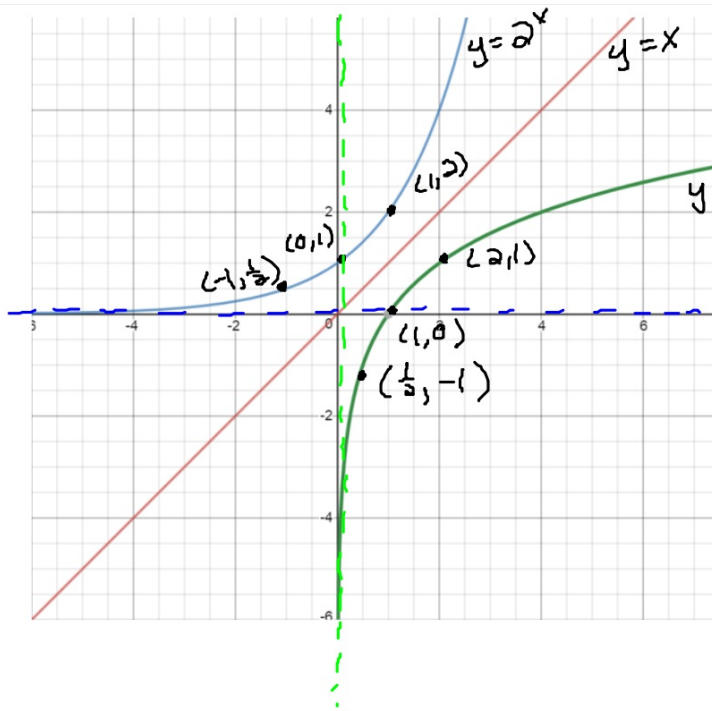$f(g(x)) = 2^{\log_2 x} = x$

$g(f(x)) = \log_2 2^x = x$

* new important rule !!

you can take the log of both sides of an equation

* $\qquad x = 2^y \implies \log x = \log 2^y \implies \log x = y \log 2$

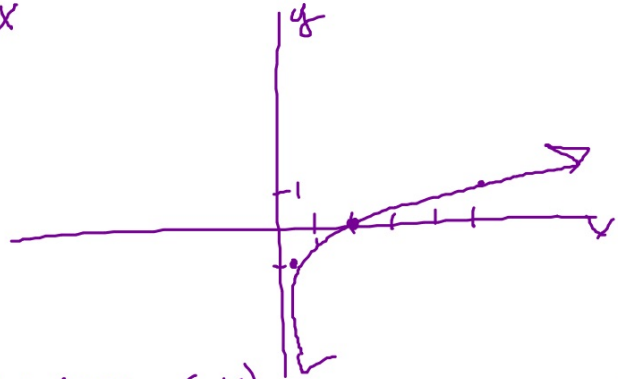$y = \log_a x$

Points: $(\frac{1}{a}, -1)$

$(a, 1)$

$(1, 0)$

D: $(0, \infty)$

R: $\mathbb{R}$

Asympt: $x = 0$

$y = 2^x$

$y = x$

$(1, 2)$

$(0, 1)$

$(-1, \frac{1}{2})$

$(2, 1)$

$y = \log_2 x$
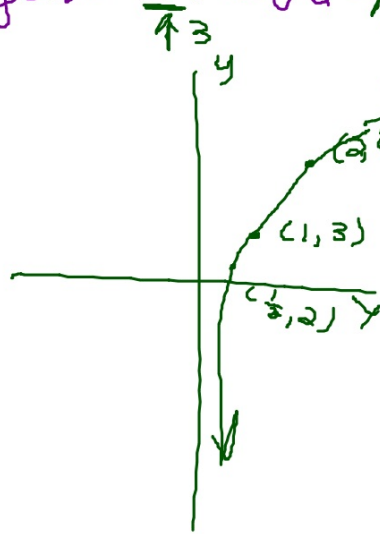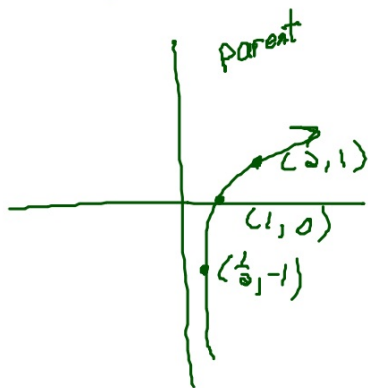
$(1, 0)$

$(\frac{1}{2}, -1)$

$y = a^x$

Points: $(0, 1)$

$(1, a)$

$(-1, \frac{1}{a})$

D: $\mathbb{R}$

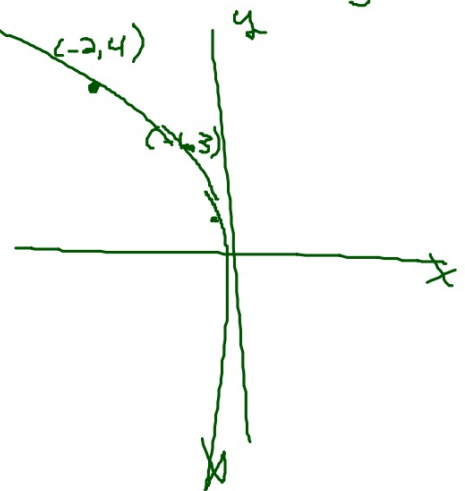R: $(0, \infty)$

asympt: $y = 0$

Ex1) Graph $y = \log_5 x$

Points: $(1, 0)$
$\left(\frac{1}{5}, -1\right)$
$(5, 1)$

Ex2) Graph $g(x) = 3 + \log_2(-x)$

$\uparrow 3$

horizontal $\Rightarrow$ reflect over y-axis

parent

$(2, 1)$
$(1, 0)$
$\left(\frac{1}{2}, -1\right)$

$(2, 4)$
$(1, 3)$
$\left(\frac{1}{2}, 2\right)$

$(-2, 4)$
$(-1, 3)$

HW 4J p. 119 all