Math-1010 Lesson 3-5
The Logarithm Function

Finding the Inverse: exchange the locations of ‘x’ and ‘y’ in the equation then solve for ‘y’.

$$f(x) = (x-2)^2$$

$$y = (x-2)^2$$

$$x = (y-2)^2$$

$$\sqrt{x} = \sqrt{(y-2)^2}$$

$$\pm\sqrt{x} = y-2$$

$$\pm\sqrt{x}+2 = y$$

$$y = 2 \pm \sqrt{x}$$

Domain, Range, and Inverse Functions

Domain: The input values (that have corresponding outputs)

Range: The output values (that have corresponding inputs)

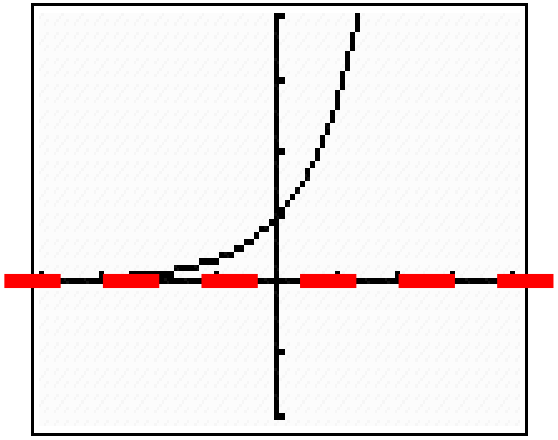
Inverse of a Function: A function resulting from an "exchange" of the inputs and outputs.

$$f(x): Domain, Range$$

$f^{-1}(x)$: Domain = range of f(x)

Range = domain of f(x)

Exponential Function



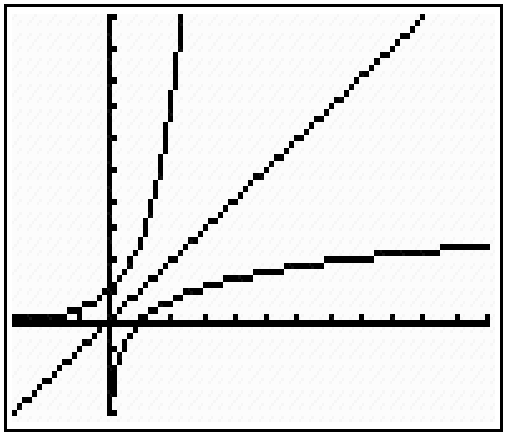
$$f(x) = 10^x$$

Domain = ? $(-\infty, \infty)$

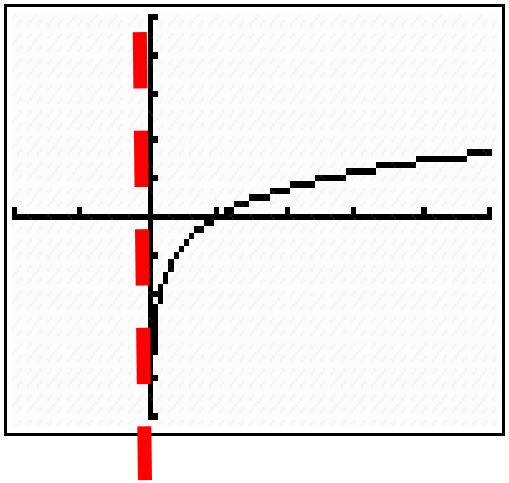
Range = ? $(0, \infty)$

Horizontal asymptote = ? **y = 0**

Inverse Functions



Logarithm Function



$$f(x) = \log x$$

Domain = ? $(0, \infty)$

Range = ? $(-\infty, \infty)$

Vertical asymptote = ? **x = 0**

Logarand

$$g(x) = 3\log x$$

Logarand

Vertical Asymptote: The value of ‘x’ that makes the logarand equal to zero.

Vertical asymptote = ? x = 0

Evaluating Logs on your calculator

$\log 8 = ?$

Push buttons:

log | 8) | = 0.903089987

$\ln 10 = ?$

Push buttons:

ln | 10) | = 2.302585093

$\log 0 = ?$

error

$\log(-3) = ?$

error

Exponential Form

$2^3 = 8$

base

Logarithm Form

Log$_{\square}$ $\square$ = $\square$

$\log_2 8 = 3$

base

"base 2 to the 3rd power is 8"

"log base 2 of 8 is 3"

$3^x = 9$

$\log_3 9 = x$

3 to what power is 9 ?

3 to what power is 9?

x = 2

Exponential Form		Logarithm Form
$5^x = 25$	Log$_{\square}$ $\square$ = $\square$	$\log_5 25 = x$
$4^x = 64$		$\log_4 64 = x$
$b^x = y$	Why did they use “b”?	$\log_b y = x$
$9^x = 81$		$\log_9 81 = x$
$10^x = 1000$		$\log_{10} 1000 = x$

Your Turn:

Log$_{\square}\square = \square$

Convert to logarithm form

1. $6^x = 36$
2. $5^x = 1$
3. $2^x = 16$
4. $2^5 = x$
5. $3^4 = x$

Convert to exponential form

$\log_{10} 100 = x$

$\log_3 27 = x$

$\log_9 1 = x$

$\log_4 x = 2$

$\log_2 x = 5$

Vocabulary

Common Logarithm: has a base of 10.

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

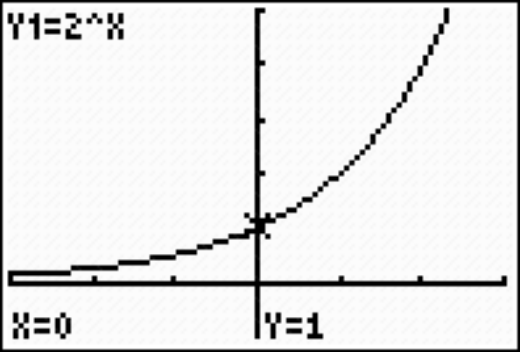
We usually write it in this form: $\log 100 = x$

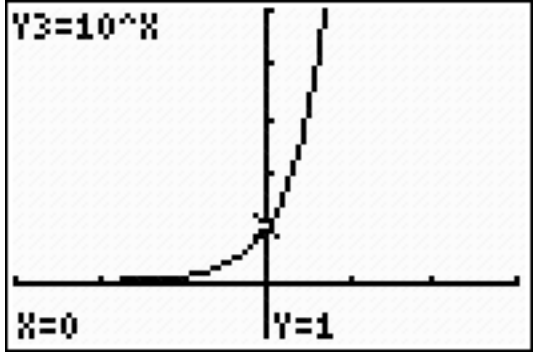
Natural Logarithm: has a base of e.

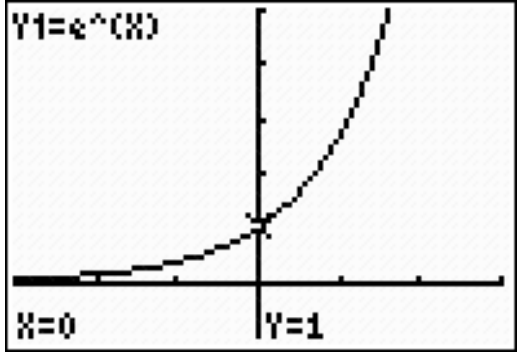
$$\log_e 2.718 = 1$$

We always write it in this form:

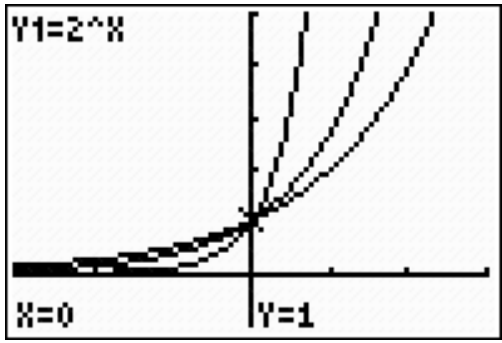
$$\ln 2.718 = 1$$

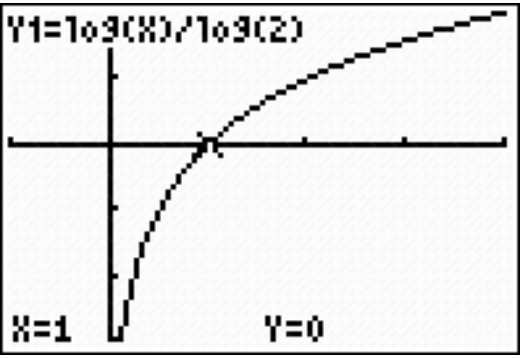


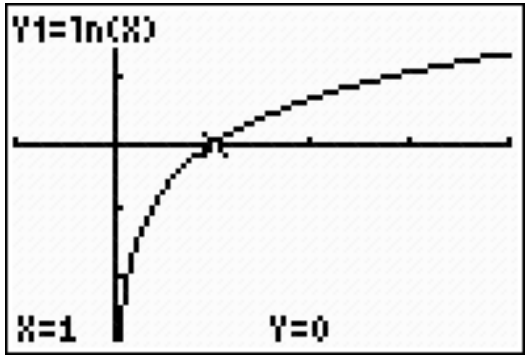


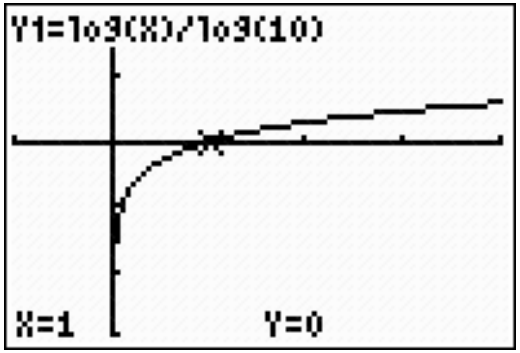


Base increasing: →

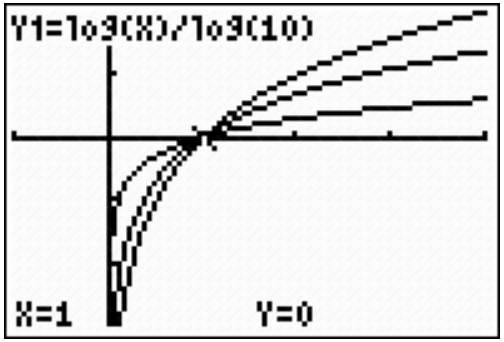








Base increasing: →



Your Turn:

What is the base?

11. $\log_2 8 = x$

12. $\ln 5 = x$

13. $\log 20 = x$

Evaluating Logs on your calculator

$\log 8 = ?$

Push buttons:

log 8) = 0.903089987

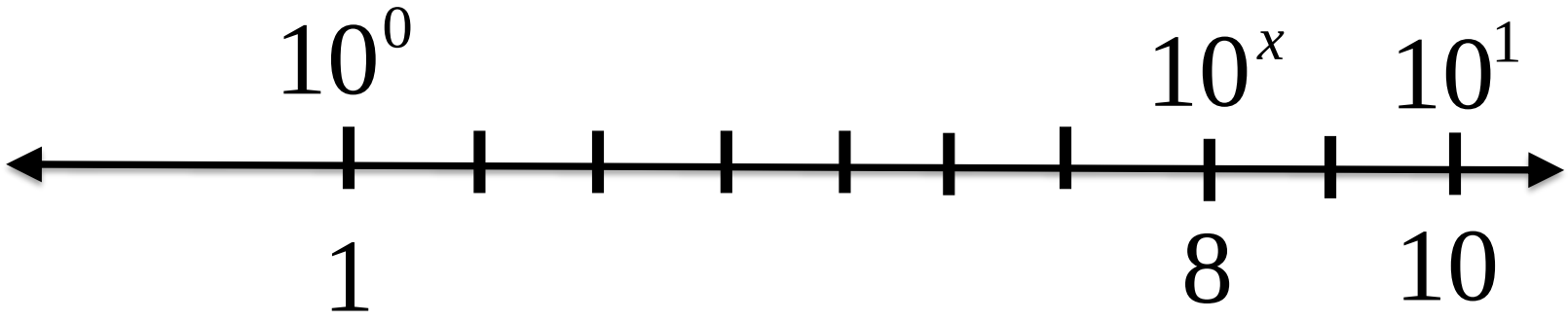
$\ln 10 = ?$

Push buttons:

ln 10) = 2.302585093

Estimate the value of the log:

$\log 8 = ?$ $\log 8 = x$ $10^x = 8$



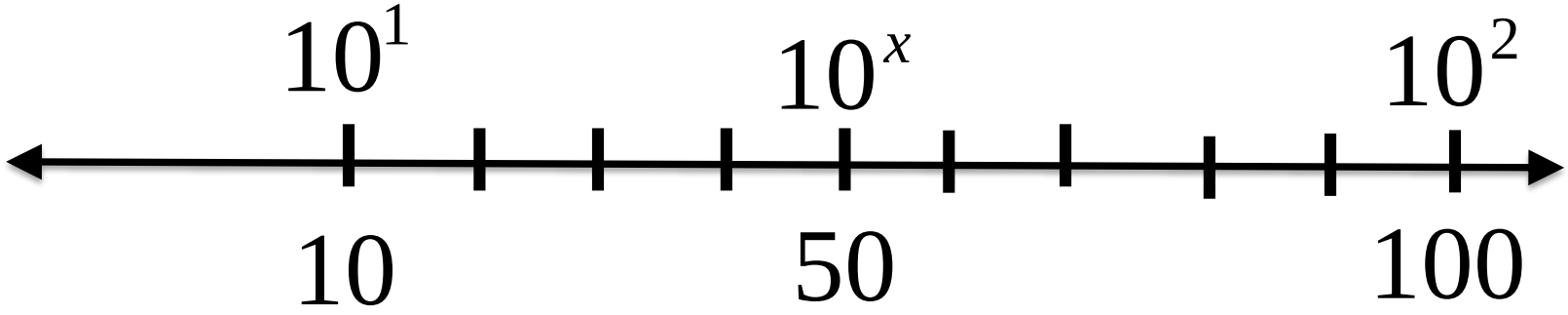
$x \approx 0.8$

$x \approx 0.9$

Find $\log 8$ on your calculator. $\log 8 = 0.903$

Estimate the value of the log:

$\log 50 = ?$ $\log 50 = x$ $10^x = 50$



$x \approx 1.5$

$x \approx 1.6$

Find $\log 50$ **on your calculator.** $\log 50 = 1.7$

Your Turn:

Estimate the value of the log:

14. $\log 8 = ?$ $\log 8 = x$ $10^x = 8$

15. $\log 10 = ?$

16. $\ln 5 = ?$

Finding the Inverse $f^{-1}(x) = ?$

$$f(x) = 2(5)^x \qquad f^{-1}(x) = \log_5\left(\frac{x}{2}\right)$$

$$x = 2(5)^y$$

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

Base: 5

"A log is an exponent"

$$y = \log_5\left(\frac{x}{2}\right)$$