Déjà Vu, It's Algebra 2!

Lesson 18

Inverse and Logarithmic Functions

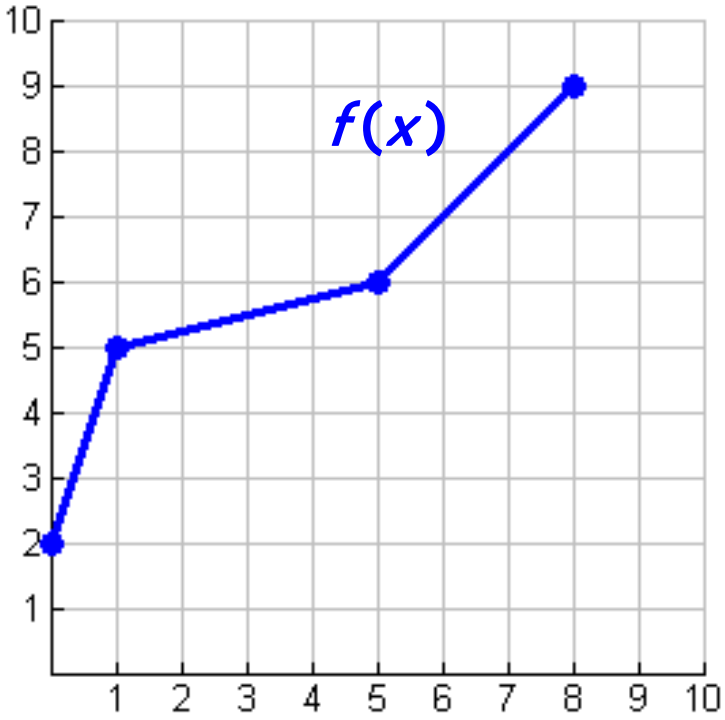
A function $y = f(x)$ is defined by the ordered pairs listed in the following table.

$f(x)$

x	0	1	5	8
y	2	5	6	9

$f^{-1}(x)$

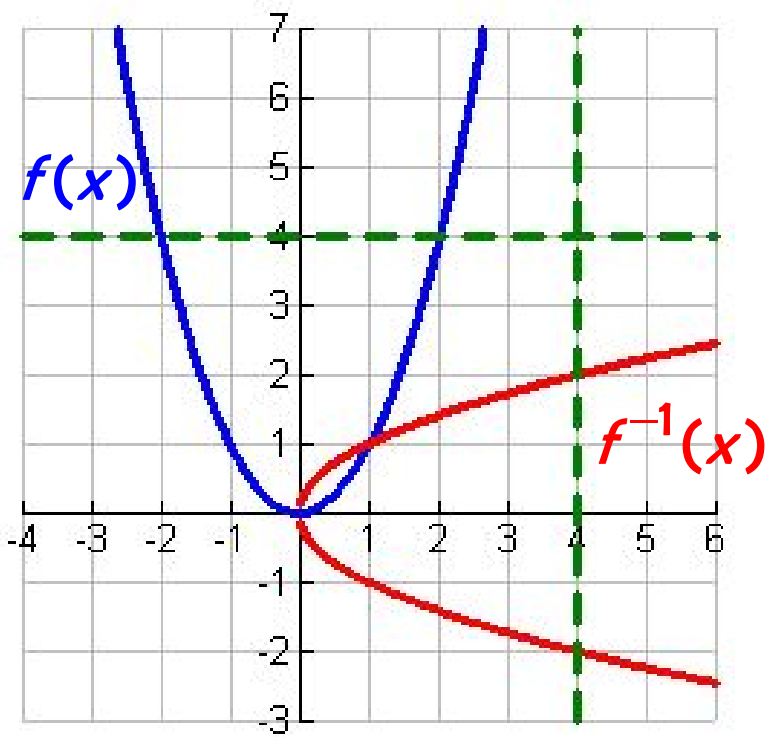
x				
y				



$f(x)$	$f^{-1}(x)$
D: $[0,8]$	
R: $[2,9]$	

Summary regarding inverse functions:

- All x and y values interchange
- The Domain and Range interchange
- The x-axis and y-axis interchange
- Inverse functions are reflections across the line $y = x$
- Because a vertical line becomes a horizontal line when reflected across $y = x$, an inverse will pass the vertical line test for functions if and only if the function passes the horizontal line test! Such functions are called one-to-one. This means not all functions have inverses that are functions!!



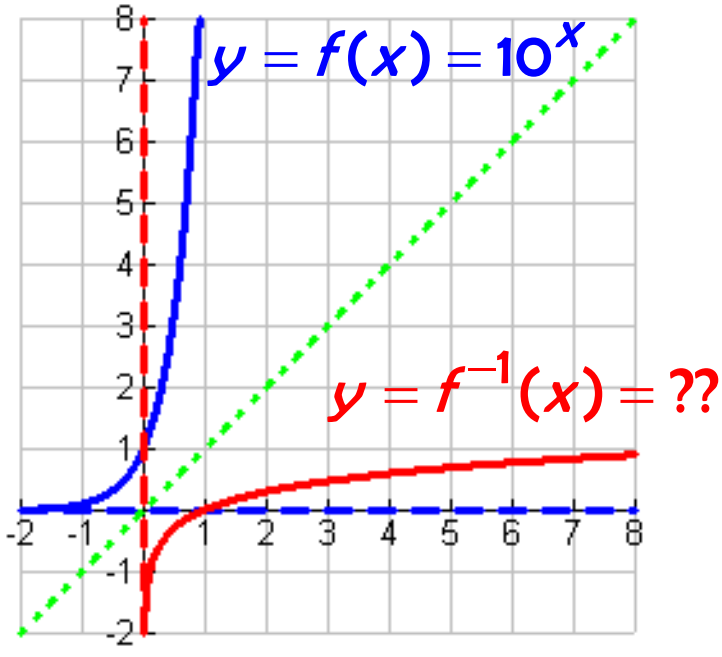
- Algebraically, you can find an equation of an inverse by interchanging the x and y values, then resolve for y.

Example:

Find the inverse function $f^{-1}(x)$ for the function $f(x) = 3(x-5)$, then verify by graphing.

Example:

Find the inverse of the exponential function $y = 10^x$.



A Logarithm (or Log for short) is the exponent to which a specified base is raised to obtain a given value.

Example:

Find the value of x in each of the following.

a) $2^x = 32$

b) $10^x = 10,000$

c) $\left(\frac{1}{3}\right)^x = \frac{1}{27}$

Here's a very important Theorem which will allow us to convert between log and exponential equations:

$$y = b^x \Leftrightarrow \log_b y = x$$

$$b > 0, b \neq 1$$

Log equation	Exponential equation
$\log_2 64 = 6$	$2^6 = 64$
$\log_7 7 = 1$	$7^1 = 7$
$\log_3 1 = 0$	$3^0 = 1$
$\log_5 0.04 = -2$	$5^{-2} = \frac{1}{25} = 0.04$
$\log_3 81 = x$	$3^x = 81$
$\log_4 4^x = x$	$4^x = 4^x$
$\log_8 x = \log_8 x$	$8^{\log_8 x} = x$

Basic properties of logs:

1. $\log_b 1 = 0$
2. $\log_b b^x = x$
3. $b^{\log_b x} = x$

Déjà RE-Vu

Decoding/Decrypting a message:

The following message was coded with the following exponential function $f(x) = 2^x$

$[8192; 2; 1048576; 256][512; 524288][64; 2097152; 16384]$

If x corresponds to a letter in the alphabet, and $f(x)$ is the transformed value, decipher the message.

x	$f^{-1}(x) =$	Letter of Alphabet
8192		
2		
1048576		
256		
512		
524288		
64		
2097152		
16384		

References:

All images TI-83+ calculator or TI-Interactive Software

http://www.gilwellmississauga.org/upcoming_events.html
http://blog.wired.com/photos/uncategorized/smiley_face.jpg