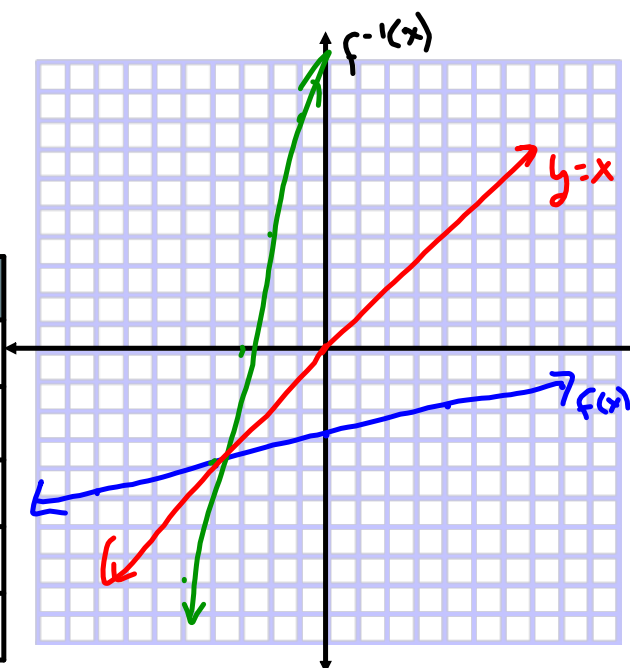


Warm Up

$$y = \frac{1}{4}x - 3$$

X	Y
-8	-5
-4	-4
0	-3
4	-2
8	-1

X	Y
-5	-8
-4	-4
-3	0
-2	4
-1	8



Find the inverse

$$y = \frac{1}{4}x - 3$$

$$x = \frac{1}{4}y - 3$$

$$4(x+3) = \frac{1}{4}y \cdot 4$$

$$y = 4x + 12$$

$$f^{-1}(x) = 4x + 12$$



## Inverse Functions

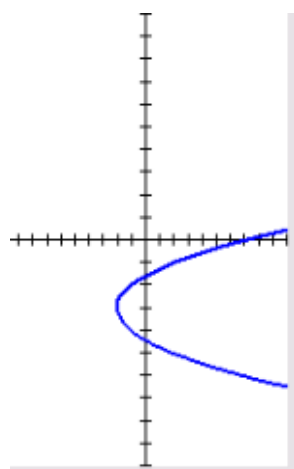
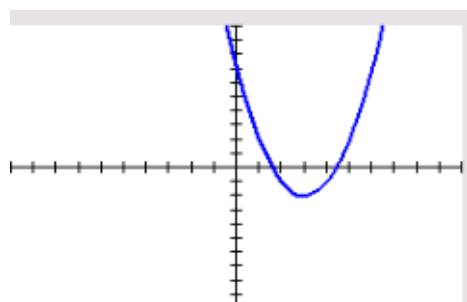
Functions  $f$  and  $g$  are inverses of each other provided:

$$f(g(x)) = x \quad \text{and} \quad g(f(x)) = x$$

The function  $g$  is denoted by  $f^{-1}$ , read as "f inverse".

Given any function, you can always find its inverse relation by switching  $x$  and  $y$ . Then solve for  $y$ .

**Recall:** How can you tell whether a relation is a function?



One-to-One

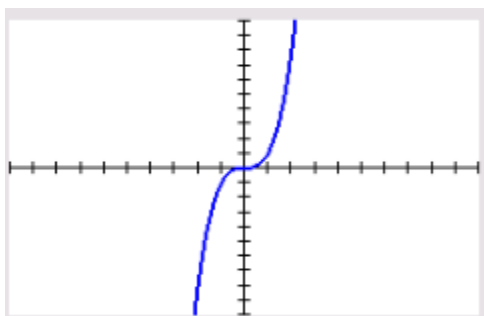
Both the original and the inverse are functions.

### Vertical line test (Intersects one time)

If a vertical line intersects the graph of a function  $f$  more than once, then the inverse of  $f$  is itself a function.

### Horizontal line test (Intersects one time)

If a horizontal line intersects the graph of a function  $f$  more than once, then the inverse of  $f$  is itself a function.



Vertical line Test

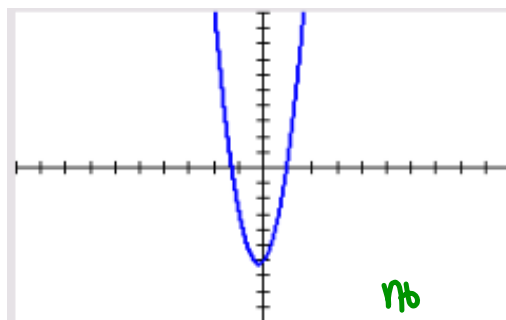
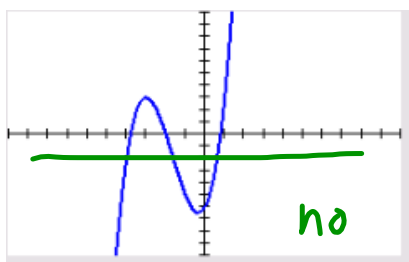
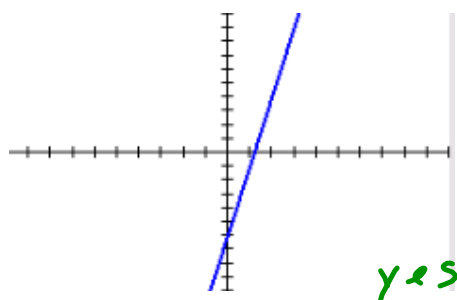
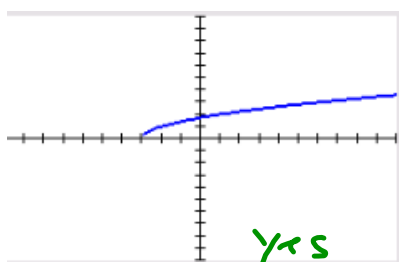


Horizontal line test



If both horizontal and vertical line tests hold true, then it is one-to-one. *yes*

Is it a one-to-one function?



## Inverse Functions

*Verify* that the two functions are inverses of one another.

Now you try...

$$f(x) = 3x - 5 \qquad f^{-1}(x) = \frac{1}{3}x + \frac{5}{3}$$

# Notes! Graphing Inverse Functions

## Four Representations: Graphing--

Steps to graphing an inverse function:

1. Find the inverse function
2. Create a table
3. Evaluate the range
4. Plot inverse points
5. Verify using the  $y=x$  reflection line.



$$5.6 \quad y = (x - 2)^2$$

Not one-to-one

Numerically (table)

a. Make a table of values for  $f(x)$

$x$	-1	0	1	2	3
$f(x)$	9	4	1	0	1

b. Make a table of values for  $f^{-1}(x)$

$x$	9	4	1	0	1
$f^{-1}(x)$	-1	0	1	2	3

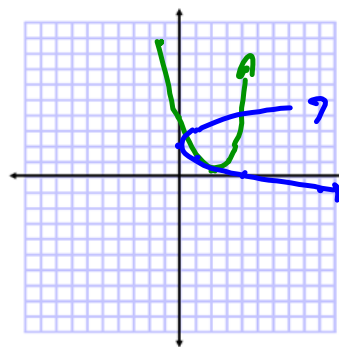
Graphically (Graph)

In BLACK graph  $f(x)$

In BLUE graph  $f^{-1}(x)$

In ANOTHER COLOR graph  $f(f^{-1}(x))$

LABEL YOUR GRAPHS!



Analytically (Equation)

a. Find  $f^{-1}(x)$  algebraically.

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

$$\sqrt{x} = \sqrt{(y-2)^2} \quad f^{-1}(x) = 2 \pm \sqrt{x}$$

b. Show that  $f(f^{-1}(x)) = x$

$$f^{-1}(x) = 2 \pm \sqrt{x}$$

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

c. Show that  $f^{-1}(f(x)) = x$

$$y = x$$

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

$$x$$

Verbally (Words)

a. Explain how you know from the graph that  $f(x)$  and  $f^{-1}(x)$  are inverses.

b. Explain how you know from the algebra that  $f(x)$  and  $f^{-1}(x)$  are inverses.

c. Explain how you know from the tables that  $f(x)$  and  $f^{-1}(x)$  are inverses.

Is it one-to-one? No

Is the inverse a function? No



## Attachments

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4 representations (Inverses) WS #5.pdf