What Are They and What Do They Do?

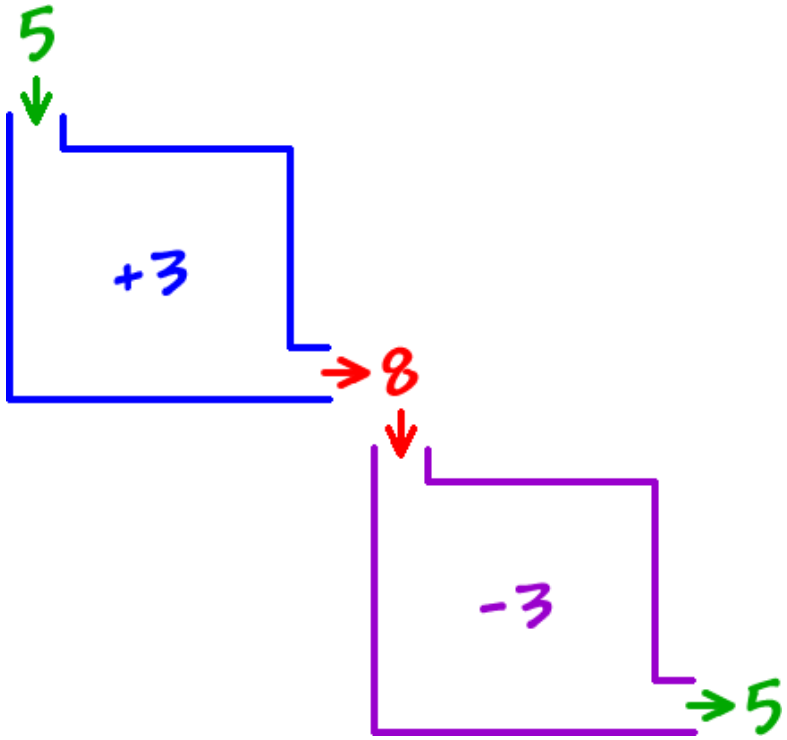
Inverse functions undo each other!

Think of a number...

OK, now add 3 to it... Now, subtract 3 from that. What do you get?

The number you started with!

Check it out:



So, these guys are inverse functions:

$f(x) = x + 3$ $g(x) = x - 3$

add the 3 on... **takes the 3 off**

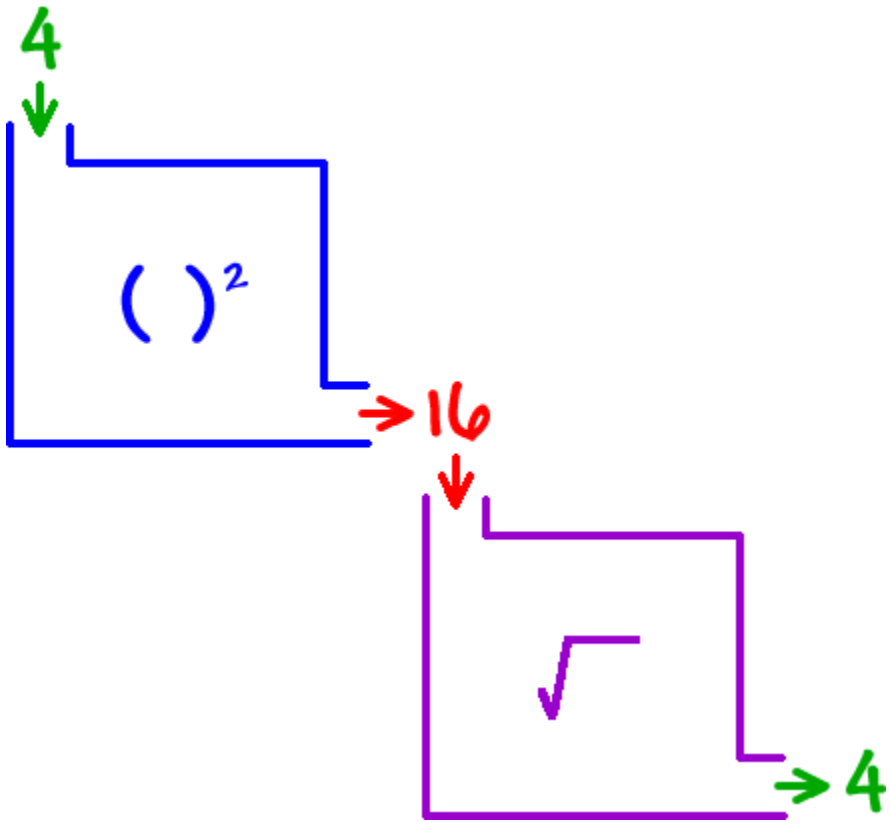
Let's do another one:

Think of a number -- make it positive...

Now, square it... Then, take the square root of that. What do you get?

The number you started with!

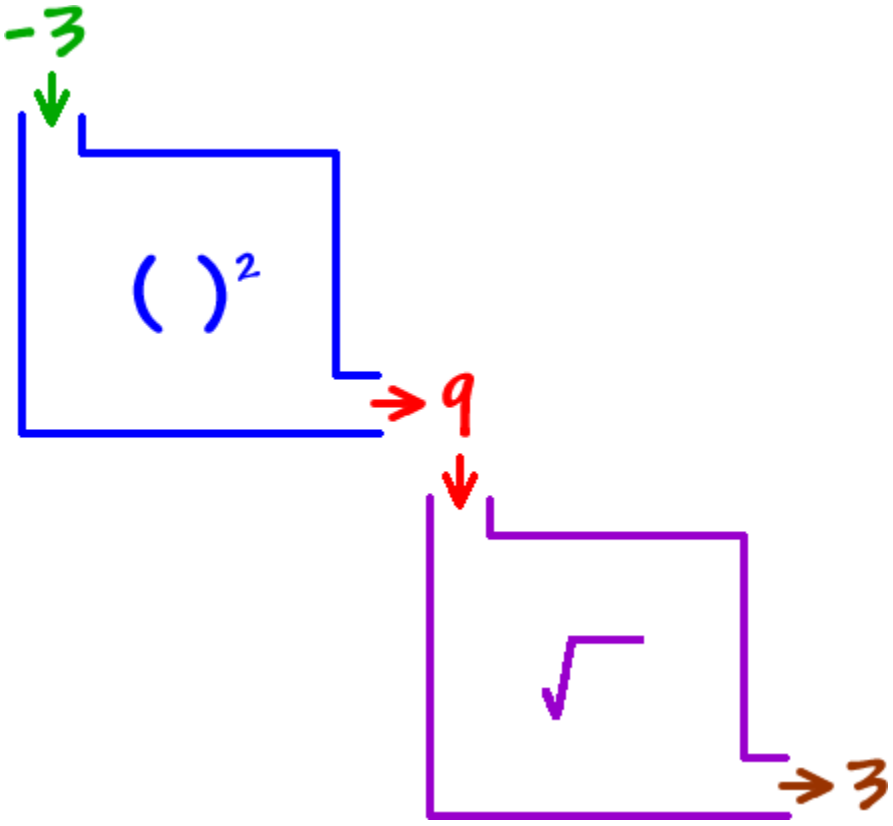
Check it out:



So, these guys are inverse functions:

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

What if we try sticking a negative number in the last example?



A -3 went in... but, a 3 came out! These don't work for negative numbers. So, for this one, we have to say

These are inverse functions only when $x \geq 0$ **:**

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

The official notation for the inverse function of a guy named f(x) is

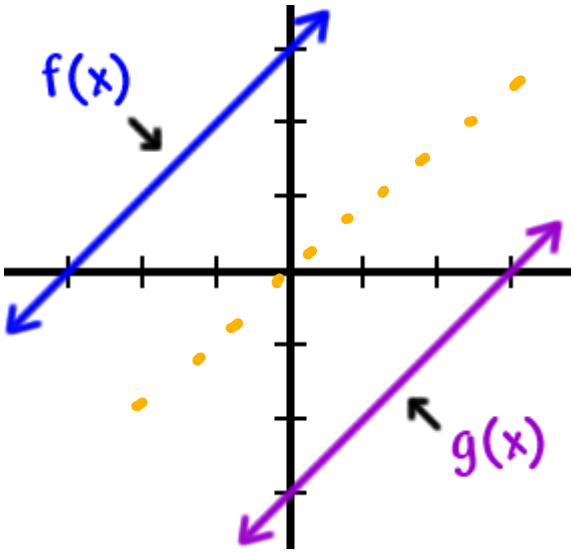
$$f^{-1}(x)$$

(read as "f inverse of x.")

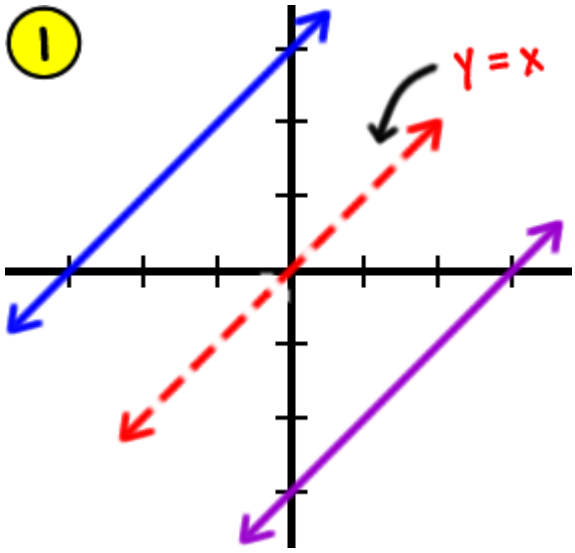
The Picture: Two Big Things to Know

Let's graph the inverse functions we had in the last section on the same graph and see what happens:

$f(x) = x + 3$ **and** $g(x) = x - 3$

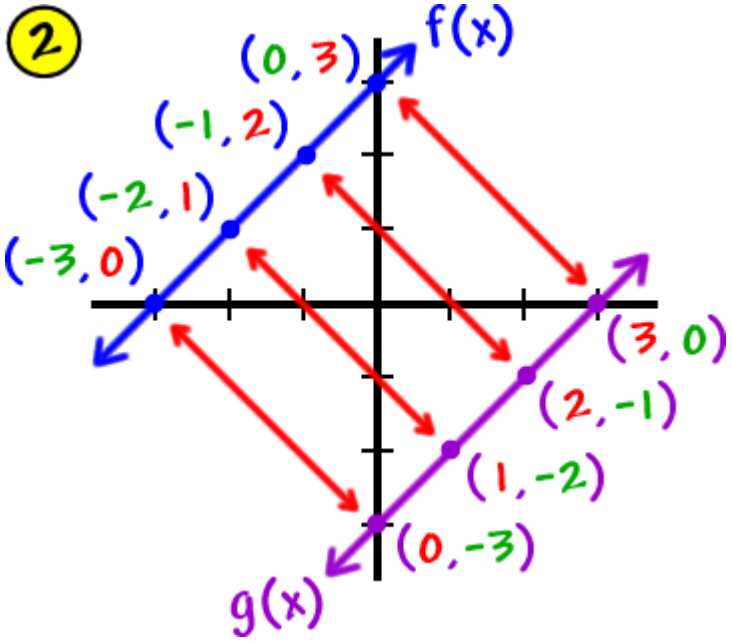


There are two big things I want you to notice:



They are mirror images over the line $y = x$.

(In other words, they are symmetric with respect to the line $y = x$.)



Notice that every point on f(x) has a reversed partner on g(x).
(0, 3) has (3, 0) as a partner and so on.

So, just remember this:

Every (x, y) has a (y, x) partner.

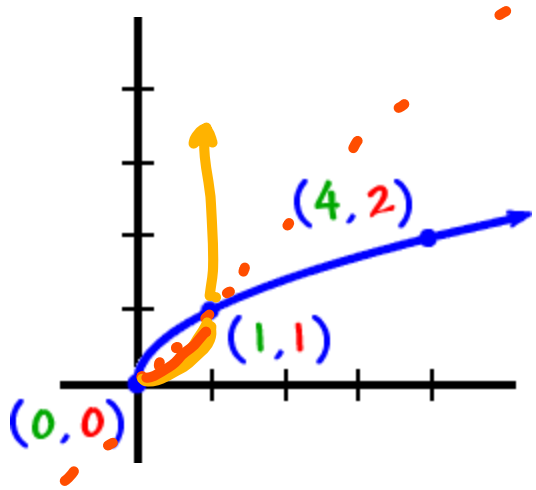
Let's look at another example:

With the two previous things in mind, can you draw the inverse of this?

$$g(x) = \sqrt{x}$$

Since we don't know what the graph of $g(x) = \sqrt{x}$ **looks like yet let's plot a few points:**

x	y
0	0
1	1
4	2
9	3

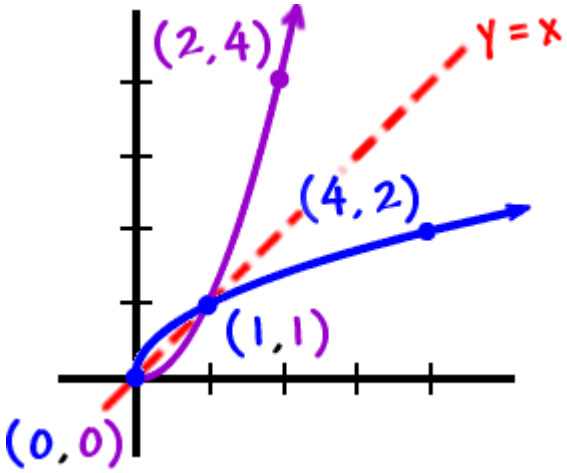


It's just a half a parabola lying on its side!

Cool! So, what are the two things?

1. **They are symmetric with respect to** $y = x$
2. **Every** (x, y) **has a** (y, x) **partner**

Now, you can graph the inverse!



Hey! It's half of Standard Parabola Guy!

$f(x) = x^2$

$f(x) = x^2$ **And** $g(x) = \sqrt{x}$

YOUR TURN:

Graph the inverse of this function: