Inverse Relations:

The inverse of a relation is the relation you get when you interchange the numbers in the ordered pairs.

$R = \{(1,2),(2,2),(3,4)\}$ **Domain? Range?**

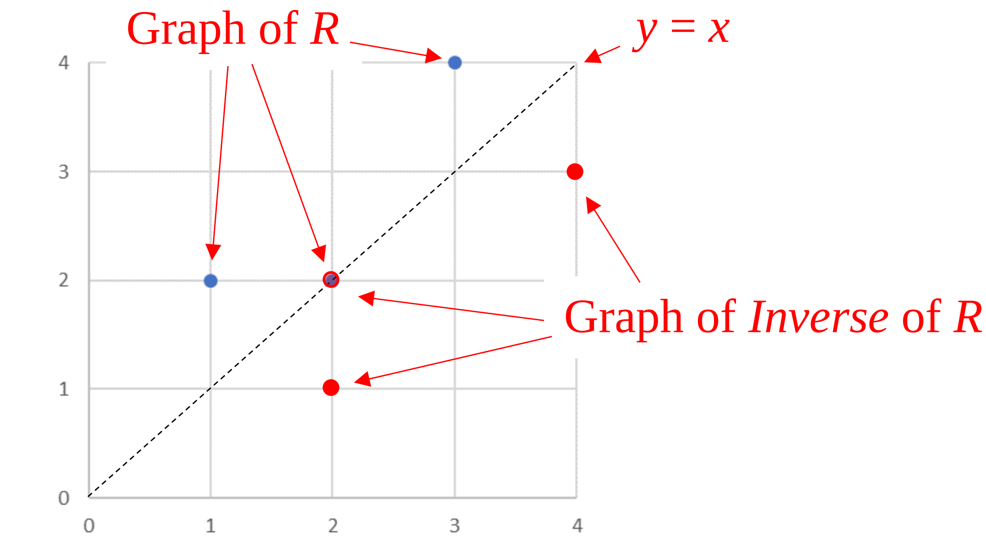
$S = \{(1,1),(2,3),(3,4)\}$ **Domain? Range?**

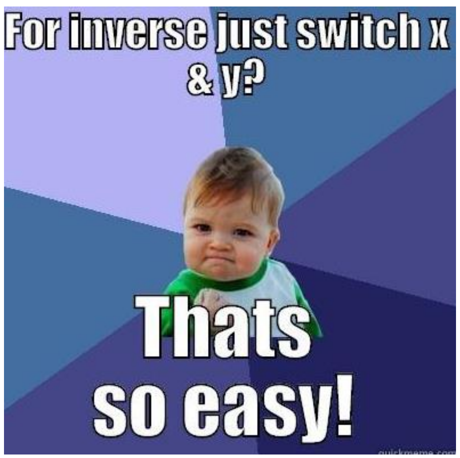
$\textit{Inverse of } R = \{(\quad,\quad),(\quad,\quad),(\quad,\quad)\}$ **Domain? Range?**

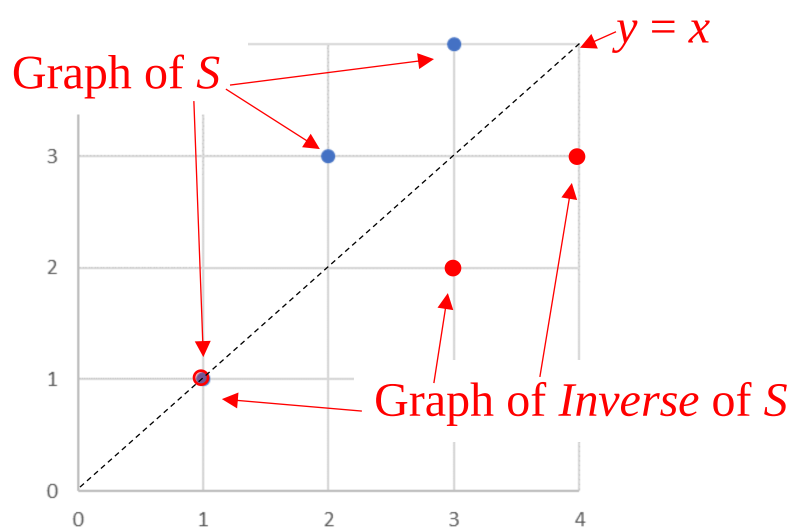
$\textit{Inverse of } S = \{(\quad,\quad),(\quad,\quad),(\quad,\quad)\}$ **Domain? Range?**

What's the connection between the graphs of relations and their inverses?

Check them out.

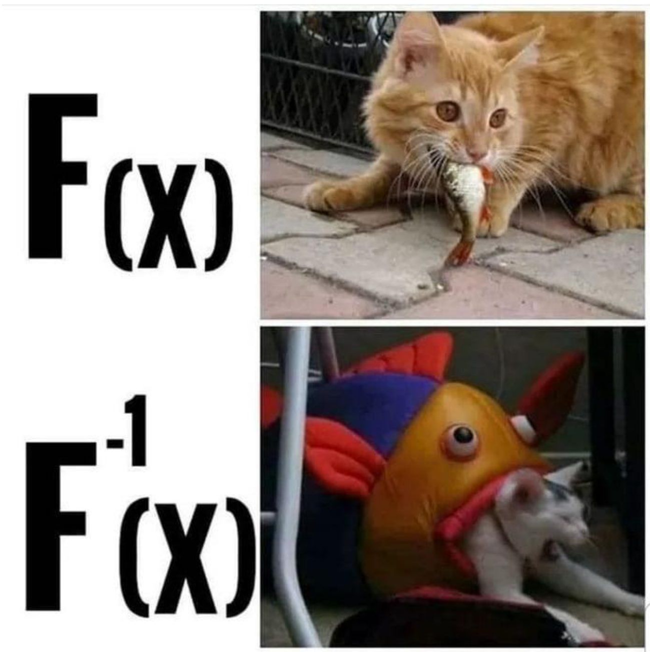




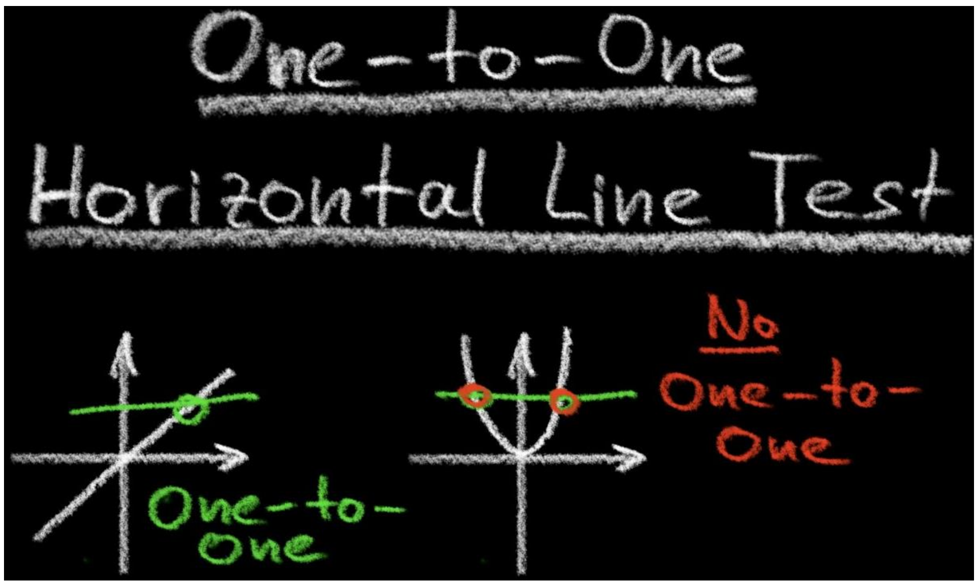


When the relation *f*, is a function, and its inverse is also a function, then the function *f* is said to be invertible, and there is a special notation for its inverse function, f^{-1}.

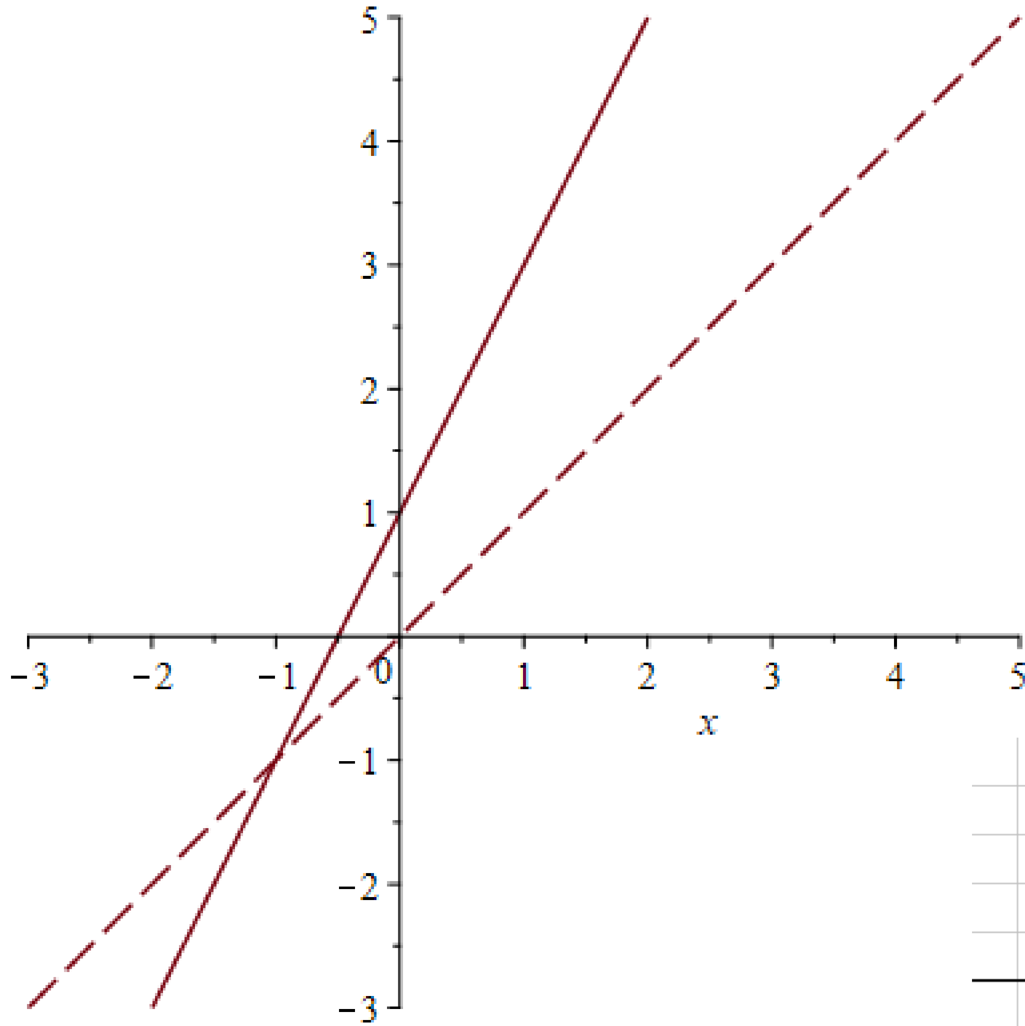
Is R invertible? Is S invertible? Why/Why not?

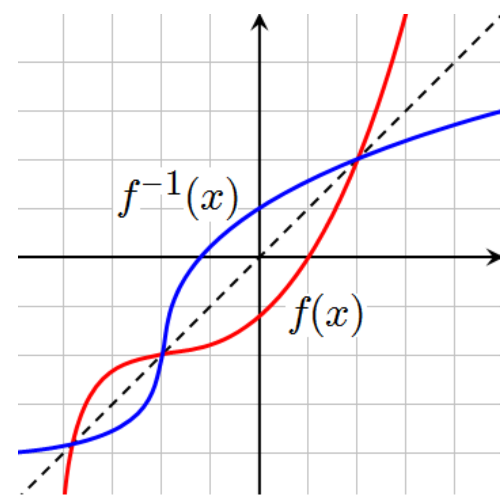


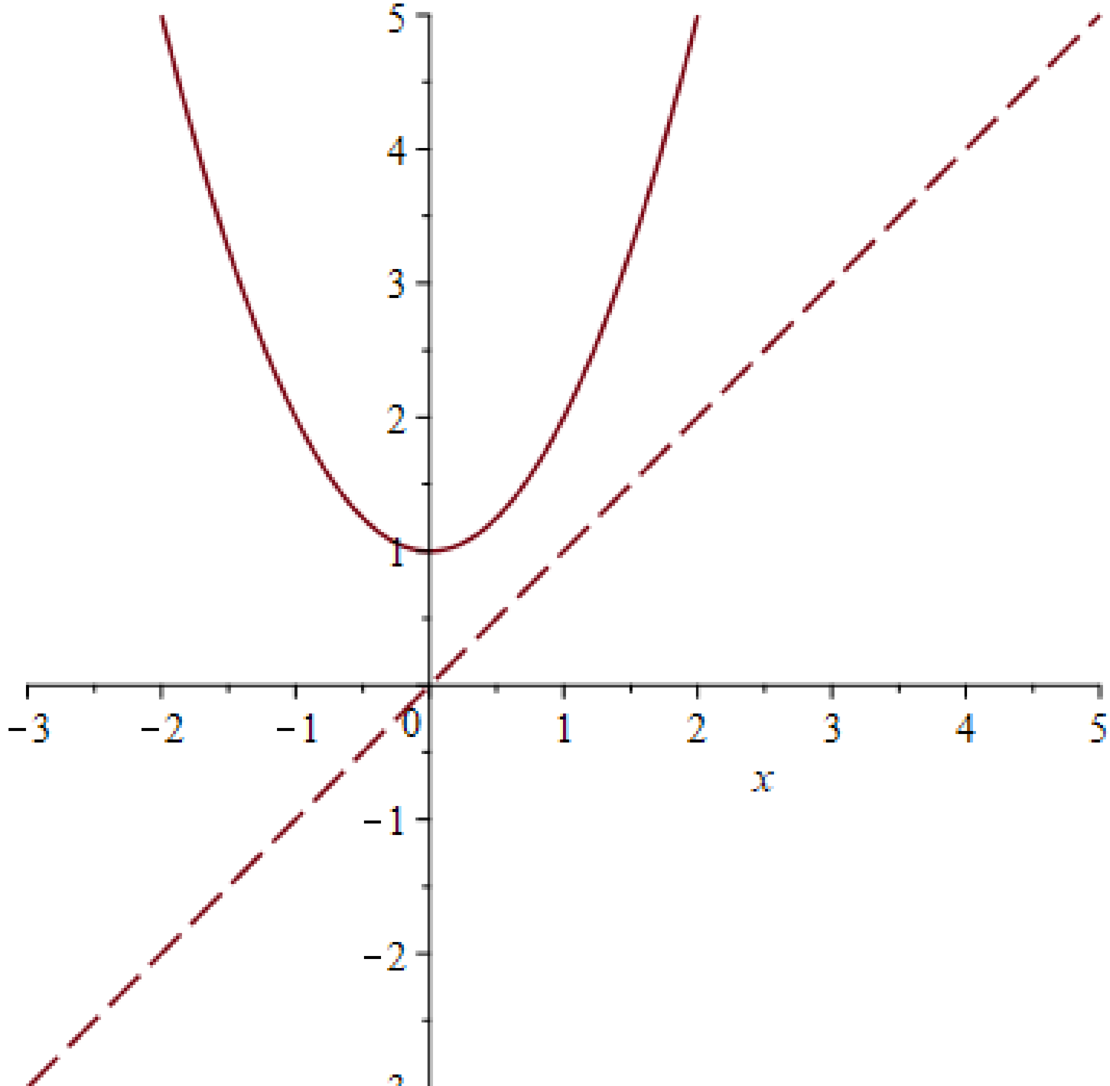
One-to-one functions and the Horizontal Line Test.

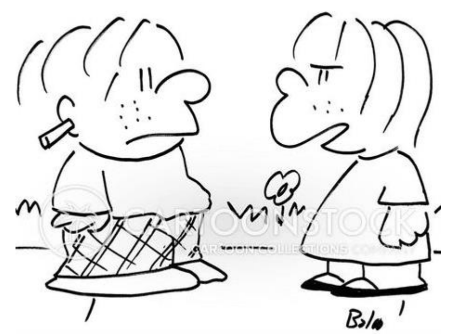


Determine if the following functions are one-to-one, and therefore have an inverse function. Graph the inverse function, as well.









"You have to *study* for tests, dummy — you can't just put a memory stick in your ear!"

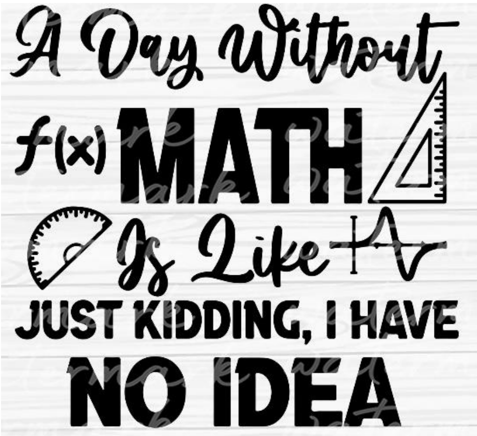
Finding formulas for inverse functions:

Sometimes you can eyeball the function formula and find a formula for the inverse function:

1. $f(x) = 2x$

2. $f(x) = x - 1$

3. $f(x) = 3x + 1$



There is a definite procedure for finding a formula for an inverse function.

1. Replace $f(x)$ **with *y*.**

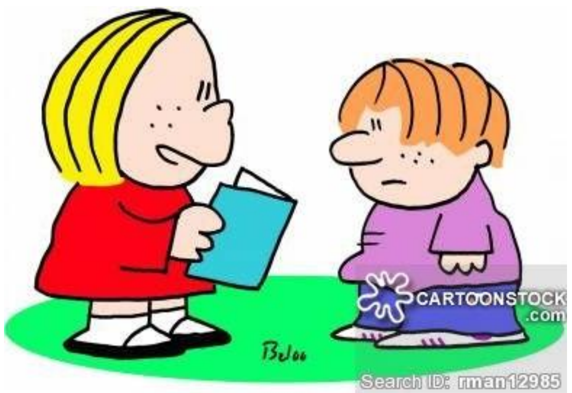
2. Interchange *x* and *y*.

3. Solve for *y*.

4. Replace y with $f^{-1}(x)$**.**

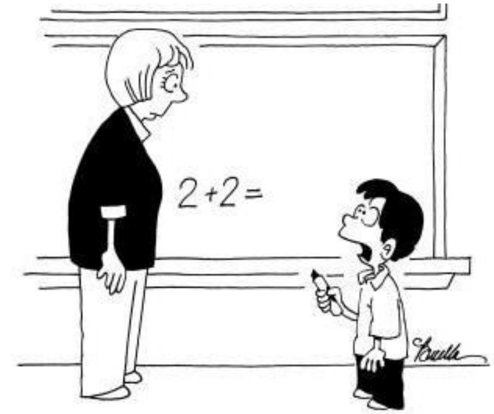
Examples:

1. $f(x) = 3x + 1$



"Algebra is like arithmetic, only X-rated."

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

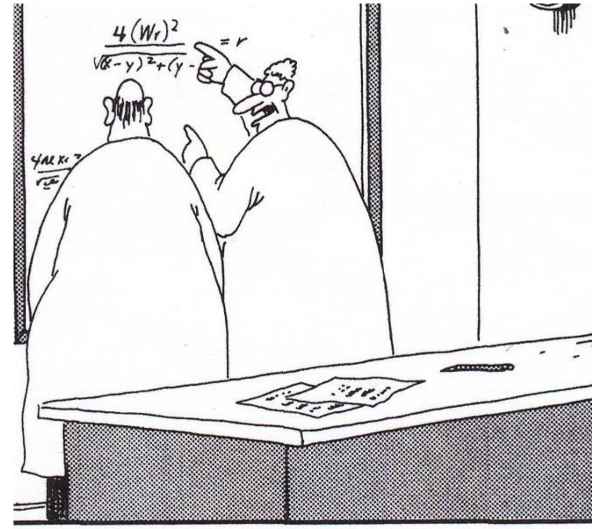


"I plan on becoming an automobile mechanic when I grow up. Would you settle for an estimate?

3. $f\left(x\right)=x^3-1$

"I don't need to learn how to subtract. I'm going to work for the government."

4. $f(x)=\dfrac{x+4}{x-3}$



"Yes, yes, I *know* that, Sidney... *every*body knows *that!*... But look: Four wrongs *squared*, minus two wrongs to the fourth power, divided by this formula, *do* make a right."

5. $f\left(x\right)=x^2; x\geq 0$

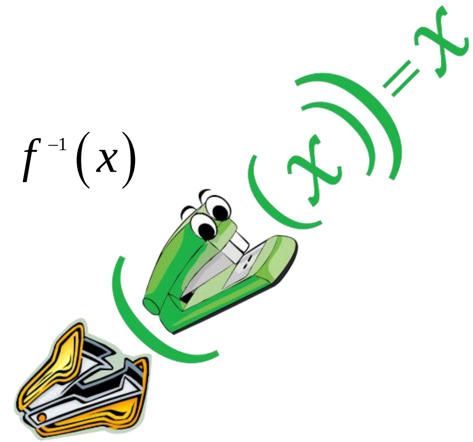
"True, we have encouraged you to use your imagination, but not in math."

Composition Property of Inverse Functions:

$$\left(f \circ f^{-1}\right)(x) = f\left(f^{-1}(x)\right) = x \text{ **for all } x \text{ in the domain of** } f^{-1}(x)$$

And

$$\left(f^{-1} \circ f\right)(x) = f^{-1}\left(f(x)\right) = x \text{ **for all } x \text{ in the domain of** } f(x)\text{.}$$

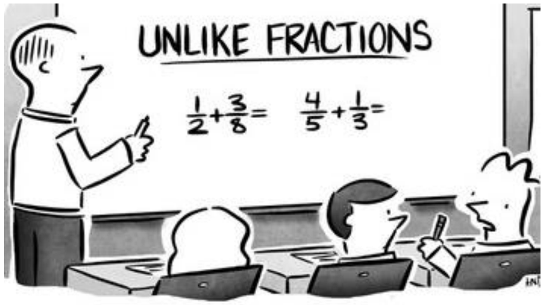


Example:

For $f = \{(1,2),(2,3)\}$ **and** $f^{-1} = \{(2,1),(3,2)\}$

$f\left(f^{-1}(2)\right) =$ **and** $f\left(f^{-1}(3)\right) =$

$f^{-1}\left(f(1)\right) =$ **and** $f^{-1}\left(f(2)\right) =$



"I don't remember liking them in the first place."

Are the functions $f\left(x\right)=2x-1$ **and** $g\left(x\right)=\frac{1}{2}x+1$ **inverses?**

Are the functions $f\left(x\right)=\sqrt{x}$ **and** $g\left(x\right)=x^2$ **inverses?**