6-2 Inverse Functions & Relations

relations: set of ordered pairs.
domain: set of all 1st coordinates in a relation. x, input, independent
range: set of all 2nd coordinates in a relation. y, output, dependent
inverse relation: a relation where the domain and range values are reversed. (y,x) y x

function: a relation whose domain does not repeat. (5, 200) (10, 200)

Example: $\mathcal{R} = \{(1, 2), (3, 4), (5, 6)\}$
domain: {1, 3, 5}
range: {2, 4, 6}
inverse: {(2, 1), (4, 3), (6, 5)}

Is the relation a function? yes
Is the inverse a function? yes

~~$16x^2+9$~~

$f \circ g = 2(4x+3)^2 - (4x+3) + 1$

$2(16x^2+24x+9) - 4x - 3 + 1$

$32x^2+48x+18-4x-2$

$32x^2+44x+16$

Definition of Inverse Functions: Two functions are inverse functions **IFF** both of their compositions are the identity function. That is, if f(x) and g(x) represent functions, then f and g are inverses **IFF**

$f \circ g(x) = x$ *and* $g \circ f(x) = x$

- denoted by f^{-1}, which reads "f inverse" or " the inverse of f"
- not all inverses are functions, they are then called inverse relations.

$f^{-1}(x)$ $\quad 2^{-1} = \frac{1}{2}$

Example: Determine whether the following functions are inverses of each other.

$h(x) = 2x + 8$ $\quad g(x) = \frac{x - 8}{2}$

$h \circ g$

$h(g(x))$

$h\left(\frac{x-8}{2}\right) = 2\left(\frac{x-8}{2}\right) + 8$

$h \circ g = x$

$h \circ g = x$

yes, inverses

$g \circ h = g(h(x))$

$g(2x+8) = \frac{2x+8-8}{2}$

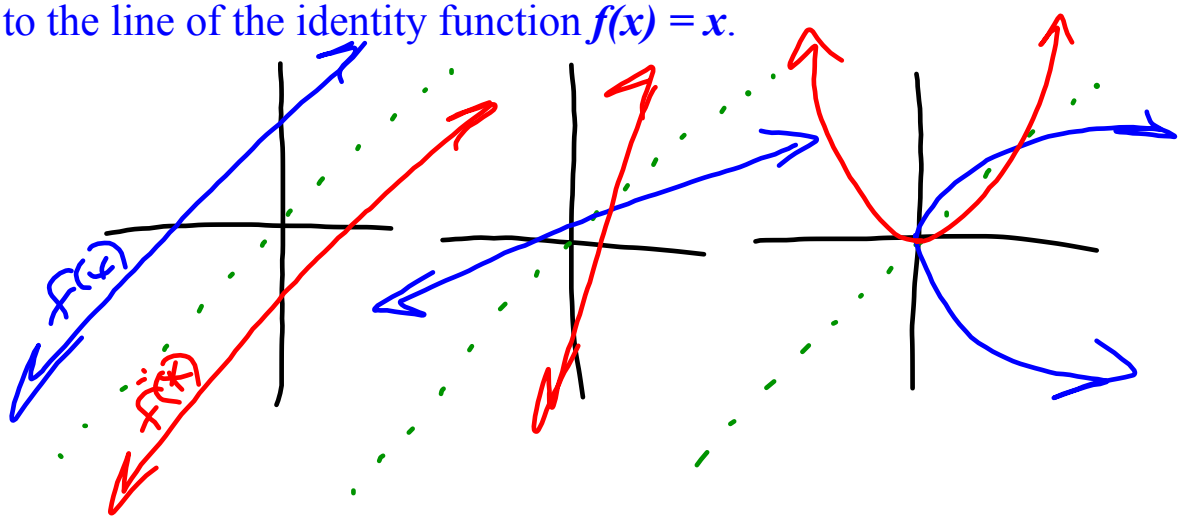
$g \circ h = \frac{2x}{2}$

$g \circ h = x$

To find an inverse function:

- replace f(x) with y.
- interchange the x and y variables.
- solve for the ***new*** y.
- check your answer by compositions or by graphing.

The graphs of all **functions** and their **inverses** are symmetrical to the line of the identity function ***f(x) = x***.



Determine the inverse function of f(x) = 2x + 3. Then graph the function and its inverse.

$y = 2x + 3$

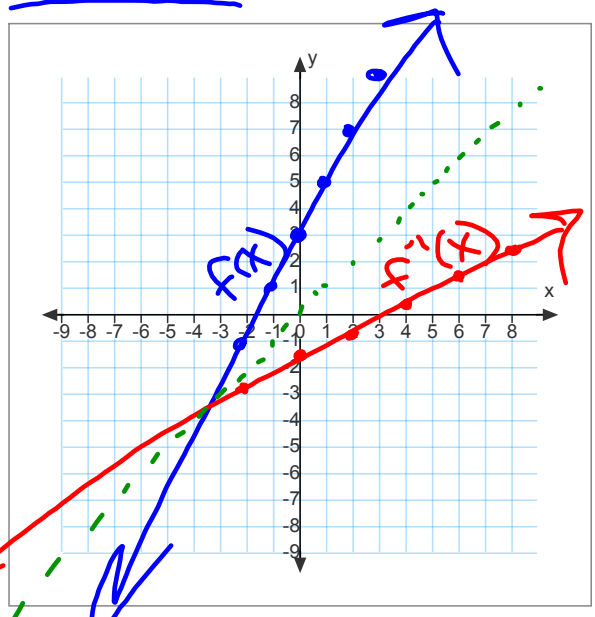
$x = 2y + 3$

$2y + 3 = x$

$2y = x - 3$

$y = \frac{1}{2}x - \frac{3}{2}$

$f^{-1}(x) = \frac{1}{2}x - \frac{3}{2}$



$y = x$

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