## 5-Minute Check

Over Lesson 5–2

Given $f(x) = 3x + 2$ and $g(x) = 2x^2 - 1$, find $[f \circ g](x)$ and $[g \circ f](x)$.

$f(g(x))$

$g(f(x))$

$f[g(x)] = 6x^2 - 1$

$g[f(x)] = 18x^2 + 24x + 7$

Let $f(x) = x - 3$ and $g(x) = x^2$. Find $(f \circ g)(1)$?

$f(x^2 - 3)$

$f(1)$

$1 - 3$

$-2$

MP

## Mathematical Practices

7 Look for and make use of structure.

8 Look for and express regularity in repeated reasoning.

## Content Standards

F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

F.BF.4.a Find inverse functions. Solve an equation of the form $f(x) = c$ for a simple function $f$ that has an inverse and write an expression for the inverse.

## KeyConcept Inverse Relations

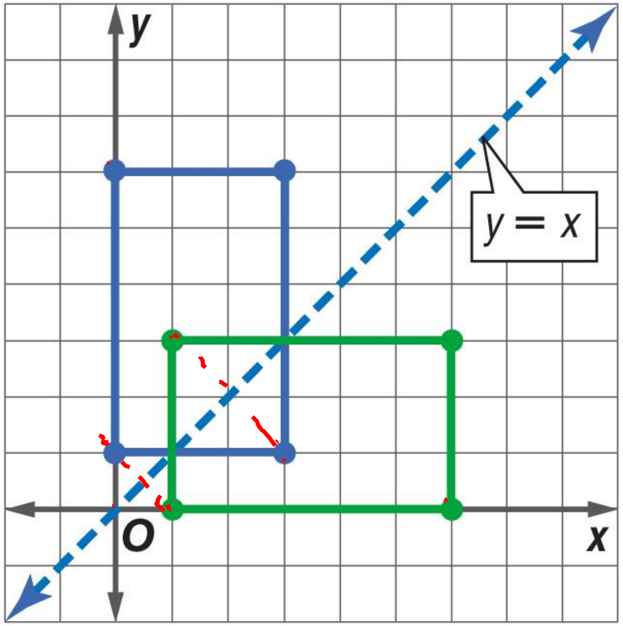
| | |
|---|---|
| Words | Two relations are inverse relations if and only if whenever one relation contains the element $(a, b)$, the other relation contains the element $(b, a)$. |
| Example | $A$ and $B$ are inverse relations. |
| | $A = \{(1, 5), (2, 6), (3, 7)\}$ $\quad$ $B = \{(5, 1), (6, 2), (7, 3)\}$ |

**GEOMETRY** **The ordered pairs of the relation {(1, 3), (6, 3), (6, 0), (1, 0)} are the coordinates of the vertices of a rectangle. Find the inverse of this relation.**

$\{(3, 1), (3, 6), (0, 6), (0, 1)\}$

## Example 1 Find an Inverse Relation

Plotting the points shows that the ordered pairs also describe the vertices of a rectangle. Notice that the graph of the relation and the inverse are reflections over the graph of $y = x$.



## KeyConcept Property of Inverses

$f^{-1}$ is inverse of $f$

| | |
|---|---|
| Words | If $f$ and $f^{-1}$ are inverses, then $f(a) = b$ if and only if $f^{-1}(b) = a$. |
| | in out |
| Example | Let $f(x) = x - 4$ and represent its inverse as $f^{-1}(x) = x + 4$. |
| | Evaluate $f(6)$. / Evaluate $f^{-1}(2)$. |
| | $f(x) = x - 4$ / $f^{-1}(x) = x + 4$ |
| | $f(6) = 6 - 4$ or $2$ / $f^{-1}(2) = 2 + 4$ or $6$ |
| | Because $f(x)$ and $f^{-1}(x)$ are inverses, $f(6) = 2$ and $f^{-1}(2) = 6$. |

An Inverse Function is found by exchanging domain (x) and range (y).

$f(x) = x - 4$

$y = x - 4$

$x = y - 4$

$-y = -x - 4$

$y = x + 4$

## Example 2 Find and Graph an Inverse

**Find the inverse of $f(x) = -\frac{1}{2}x + 1$.**

**Then graph the function and its inverse.**

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

**Step 1** Replace $f(x)$ with $y$ in the original equation.

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

**Step 2** Interchange $x$ and $y$.

$-2\left(x - 1 = -\frac{1}{2}y\right)-2$

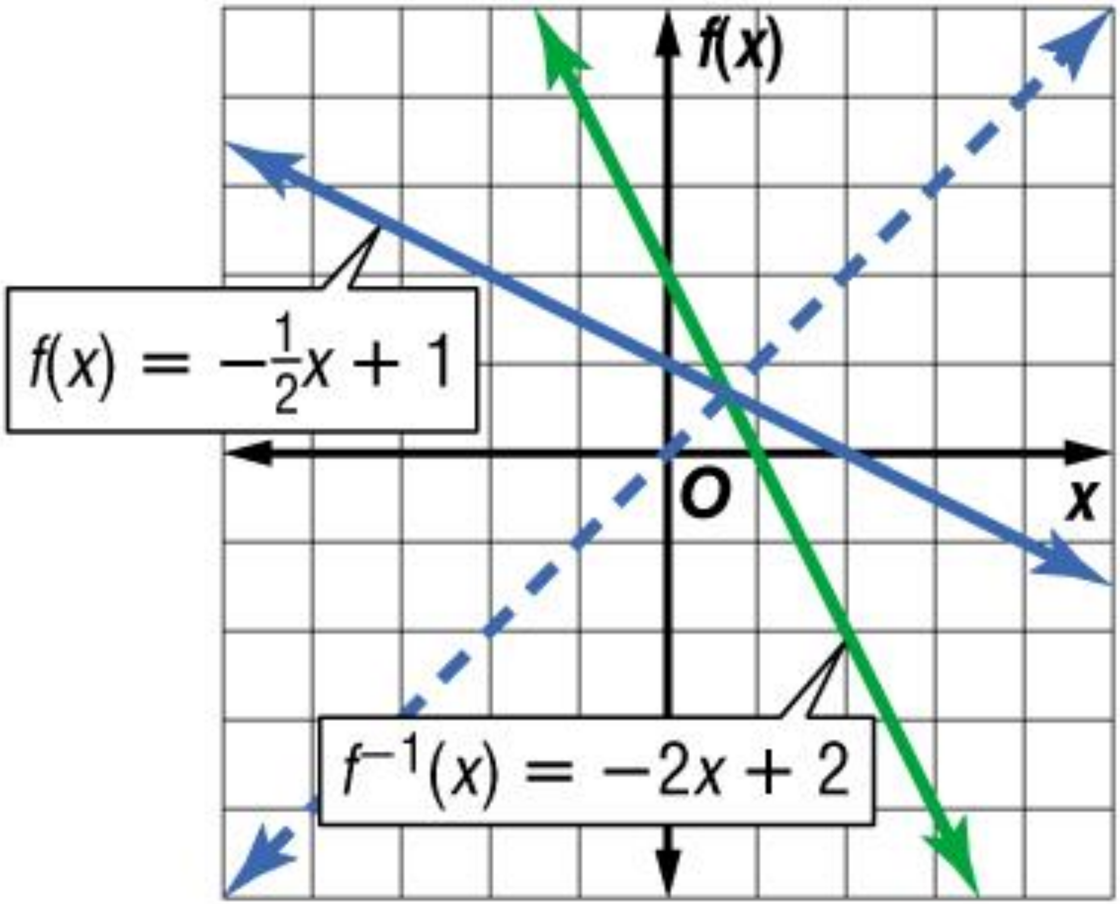
**Step 3** Solve for $y$.

$-2x + 2 = y$

$f^{-1}(x) = -2x + 2$

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

## Example 2 Find and Graph an Inverse



# GLENCOE ALGEBRA 2

To determine whether a pair of functions are inverses, you can use composition of functions:

**KeyConcept** **Inverse Functions**

| | |
|---|---|
| **Words** | Two functions $f$ and $g$ are inverse functions if and only if both of their compositions are the identity function. |
| **Symbols** | $f(x)$ and $g(x)$ are inverses if and only if $[f \circ g](x) = x$ and $[g \circ f](x) = x$. |

$$f(x) = 3x + 9 \quad and \quad g(x) = \frac{1}{3}x - 3$$

$f \circ g(x)$ $\quad f(g(x))$

$3\left(\frac{1}{3}x - 3\right) + 9$

$x - 9 + 9$

$x$

$g \circ f(x)$ $\quad g(f(x))$

$\frac{1}{3}(3x + 9) - 3$

$x + 3 - 3$

$x$