Lesson 6.7 Warm Up (Clickers)

1. Simplify: $\sqrt{5x}\sqrt{8x^3}$

2. Solve: $\sqrt{(x+4)} - 2 = x$

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

Lesson 6.7 Inverse Relations & Functions

Essential Understanding: The inverse of a function may or may not be a function.

If a relation pairs element a of its domain to element b of its range, the inverse relation pairs b with a. So, if (a, b) is an ordered pair of a relation, then (b, a) is an ordered pair of its inverse. If both a relation and its inverse happen to be functions, they are inverse functions.

A What is the inverse of relation s?

Relation s

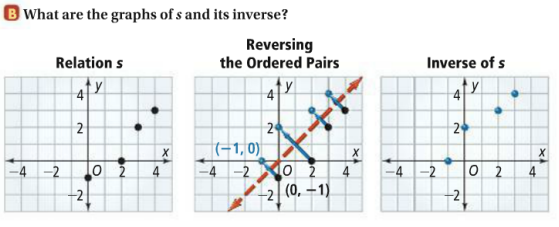
x	y
0	−1
2	0
3	2
4	3

Switch the x and y values to get the inverse.

Inverse of Relation s

x	y
−1	0
0	2
2	3
3	4

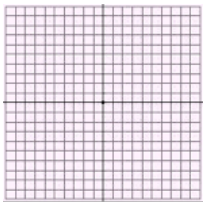
B What are the graphs of s and its inverse?



Ex. What are the graphs of t and its inverse?

Relation *t*

x	0	1	2	3
y	−5	−4	−3	−3



*Is t a function? Is the inverse of t a function? Explain.

As you have seen in the previous graphs, the graphs of a relation and its inverse are the reflections of each other in the line y = x. If you describe a relation or function by an equation in x and y, you can switch x and y to get an equation for the inverse.

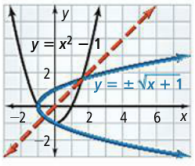
Ex. What is the inverse of the relation described by $y=x^2 - 1$?

Ex. What is the inverse of y = 3x - 5?

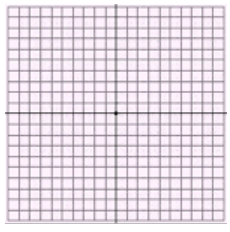
1 What is the inverse of y = 2x + 8?

Ex. What are the graphs of $y = x^2 - 1$ and its inverse

$y = +/-\sqrt{(x + 1)}$?



Ex. What are the graphs $y = 2x + 8$ and its inverse?



The inverse of a function f(x) is denoted by f^{-1}. You read f^{-1} as "the inverse of f" or as "f inverse". The notation f(x) is used for functions, but the relation f^{-1} may not even be a function.

Ex. Consider the function $f(x) = \sqrt{x - 2}$.

a. What are the domain and range of f?

b. What are the domain and range of f^{-1}?

c. Is f^{-1} a function? Explain.

2 Given f(x) = 6 - 4x. What is the domain?

3 Given f(x) = 6 - 4x. What is the range?

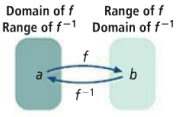
4 Given f(x) = 6 - 4x. What is the domain of g inverse?

5 Is g inverse a function?

Yes

No

You know that for any function f, each x-value in the domain corresponds to exactly one y-value in the range. For a **one-to-one function**, it is also true that each y-value in the range corresponds to exactly one x-value in the domain. A one-to-one function f has an inverse f^{-1} that is also a function. If f maps a to b, then f^{-1} must map b to a.



Take note

Key Concept Composition of Inverse Functions

If f and f^{-1} are inverse functions, then

$(f^{-1} \circ f)(x) = x$ and $(f \circ f^{-1})(x) = x$ for x in the domains of f and f^{-1}, respectively.

This says that the composition of a function and its inverse is essentially the identity function, $id(x) = x$, or $y = x$.

Ex. For $f(x) = \frac{1}{x-1}$, what is each of the following?

Is f(x) one-to-one?

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

b. $(f \circ f^{-1})(x)$

c. $(f^{-1} \circ f)(x)$

Ex. Let $g(x) = \frac{4}{x+2}$. Is g(x) one-to-one?