Lesson 1.04 Inverses of Functions

Students will be able to:

- Content Objective: Interpret the relationship between a function and its inverse algebraically and graphically.
- Language Objective: Discuss the relationship between one-to-one functions and their inverses.

Warm Up

Consider the functions given by $f(x) = \frac{3x+7}{2}$ and $g(x) = \frac{2x-7}{3}$, calculate the following:

a. $g(2)$ b. $(f(g(2))$ c. $(f+g)(x)$

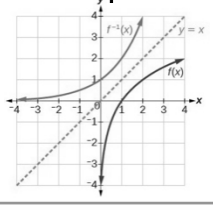
Vocabulary Review

Inverse Function

Definition
An inverse function is a second function that technically undoes the work of the first.

Notation
The inverse of $f(x)$ is represented as _____

Example
The inverse of $f(x) = 3x + 2$
is $f^{-1}(x) = \frac{x-2}{3}$

Example


Graphic Organizer

How to find the inverse of a function

1. Replace f(x) with ____in the equation
2. Interchange ___ and ___
3. Solve for ___

Skill 1: Algebraically

Find the inverse of the following functions:

a. $a(x) = 2x + 3$

b. $m(x) = x^2 + 3$

Exercise 1: Algebraically

Find the inverse of the following functions:

a. $k(x) = 4x - 1$

b. $f(x) = \frac{3}{x} - 1$

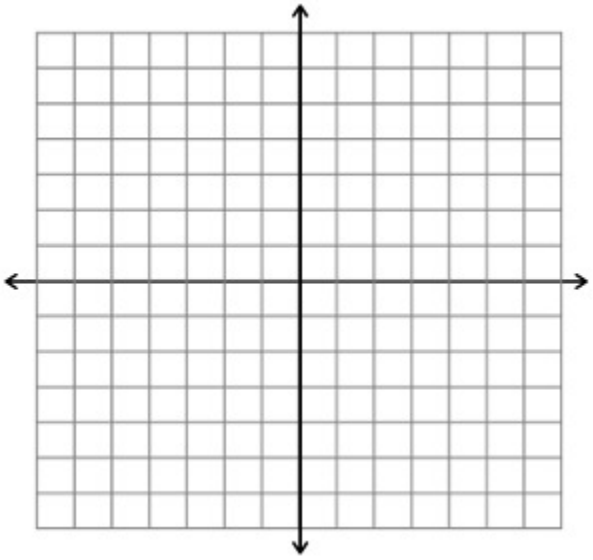
Skill 2: Graphing Inverses

Fill in the table and graph both $f(x) = 2x + 2$ and $f^{-1}(x)$ on the same axes below.

$$f(x) = 2x + 2$$

x	-2	-1	0	1	2
$f(x)$	-2	0	2	4	6

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



a. Evaluate $f^{-1}(4)$

b. Evaluate $f^{-1}(0)$

c. What is the y-intercept of $f^{-1}(x)$?

d. Determine the equation for $f^{-1}(x)$

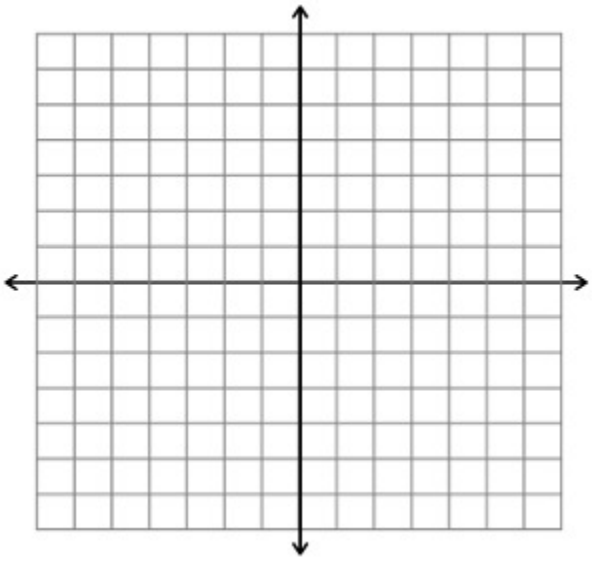
Exercise 2: Graphing Inverses

Fill in the table and graph both $f(x) = x^2$ and $f^{-1}(x)$ on the same axes below.

$$f(x) = x^2$$

x	-2	-1	0	1	2
$f(x)$	4	1	0	1	4

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



a. Evaluate $f^{-1}(4)$

b. Evaluate $f^{-1}(1)$

c. What is the y-intercept of $f^{-1}(x)$?

d. Determine the equation for $f^{-1}(x)$

Talk it Out

Is the inverse of $f(x)$ in exercise 2 considered a function? What can we conclude? Discuss with a partner.

Check Point

If the point $(-4,6)$ lies on the graph of $f(x)$, which of the following points lies on the graph of its inverse?

a. $(-4, -6)$

b. $(-6, 4)$

c. $(6, -4)$

d. $(6, 4)$

1.04- Problem Set

Name: _____

1. **Multiple Choice**

Which of the following points lies on the graph of the inverse of $(-4,-1)$?

a. $(-4,-1)$

b. $(-1,-4)$

c. $(4,1)$

d. $(1,4)$

2. Determine the inverses of the equations below.

a. $y=\frac{2}{3}x+8$ b. $y=\frac{x+7}{4}$ c. $y=x^3-2$

Before completing #3, it's important to make note of the following notation:

$$f\big(g(x)\big)=(f\circ g)(x)$$

"f of g of x" or "f following g of x"

3. Fill in the table for the inverses and evaluate each of the following.

x	$f(x)$
1	4
2	7
3	6
4	3
5	2
6	5
7	1

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

x	$g(x)$
-1	-6
-2	-4
-3	-2
-4	0
-5	2
-6	4
-7	6

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

a. $g(-6)$ b. $(f\circ g)(-5)$ c. $g^{-1}(4)$

d. $(f\circ g)(-7)$ e. $g^{-1}\big(g^{-1}(0)\big)$ f. $(f^{-1}\circ f)(4)$