



Activity

5-6

Inverse Relations and Functions



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EXPLORE & REASON

Each number path will lead you from a number in the domain, the set of all real numbers, to a number in the range.

Number Path $f: x \rightarrow f(x)$

- Start with x .
- Subtract 3.
- Multiply by -2 .
- Add 5.

Number Path $g: x \rightarrow g(x)$

- Start with x .
- Add 1.
- Square the value.
- Subtract 2.

A. Follow the number paths to find $f(1)$ and $g(1)$.

B. Identify all possible values of x that lead to $f(x) = 7$ and all values that lead to $g(x) = 7$.

C. **Communicate Precisely** Based on the two number paths, under what conditions can you follow a path back to a unique value in the domain? © MP.6

HABITS OF MIND

Model With Mathematics Write a rule for Number Path f . Write a rule for the process of following the number path backward. How do the two rules compare? © MP.4

EXAMPLE 1 Try It! Represent the Inverse of a Relation

1. Identify the inverse relation. Is it a function?

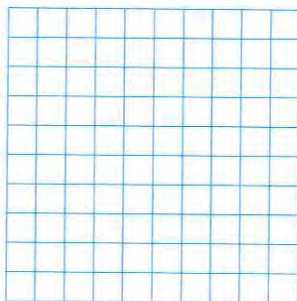
x	-1	0	1	2	3	4
y	9	7	5	3	1	-1

EXAMPLE 2 Try It! Find an Equation of an Inverse Relation

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

a. Write an equation to represent the inverse of f .

- b. Sketch the graphs of
- f
- and its inverse on the same coordinate axes and determine if the inverse of
- f
- is a function.

**HABITS OF MIND**

Communicate Precisely Think of $f(x) = 2x + 1$ as a number path: start with x , multiply by 2, and add 1. How could you describe the path from the result back to x ? © MP.6

EXAMPLE 3 Try It! Restrict a Domain to Produce an Inverse Function

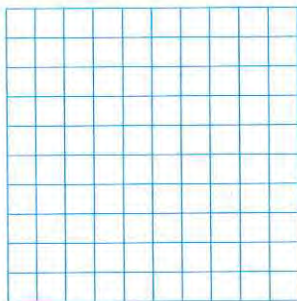
3. Find the inverse of each function by identifying an appropriate restriction of its domain.

a. $f(x) = x^2 + 8x + 16$

b. $f(x) = x^2 - 9$

**EXAMPLE 4** **Try It!** Find an Equation of an Inverse Function

4. Let $f(x) = 2 - \sqrt[3]{x+1}$.

a. Sketch the graph of f .b. Verify that the inverse will be a function and write an equation for $f^{-1}(x)$.**EXAMPLE 5** **Try It!** Use Composition to Verify Inverse Functions5. Use composition to determine whether f and g are inverse functions.

a. $f(x) = \frac{1}{4}x + 7$, $g(x) = 4x - 7$

b. $f(x) = \sqrt[3]{x-1}$, $g(x) = x^3 + 1$

HABITS OF MIND**Construct Arguments** Dana says that the functions $f(x) = (x - 2)^2 + 5$ and $g(x) = \sqrt{x - 5} + 2$ are inverses. Keegan says that the functions are inverses only if the domain is restricted. Is either person correct? Explain. © MP.3**EXAMPLE 6** **Try It!** Rewrite a Formula6. The manufacturer of a gift box designs a box with length and width each twice as long as its height. Find a formula that gives the height h of the box in terms of its volume V . Then give the length of the box if the volume is 640 cm^3 .**HABITS OF MIND****Make Sense and Persevere** In the formula $V = \frac{4}{3}\pi r^3$, which variable is the dependent variable? In the formula $r = \sqrt[3]{\frac{3}{4\pi}V}$, which variable is the dependent variable? © MP.1

Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How can you find the inverse of a function and verify the two functions are inverses?

2. **Error Analysis** Abi said the inverse of $f(x) = 3x + 1$ is $f^{-1}(x) = \frac{1}{3}x - 1$. Is she correct? Explain. © MP.3

3. **Construct Arguments** Is the inverse of a function always a function? Explain. © MP.3

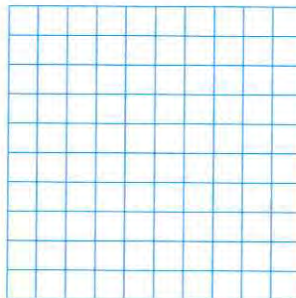
Do You KNOW HOW?

Consider the function $f(x) = -\frac{1}{2}x + 5$.

4. Write an equation for the inverse of $f(x)$.

5. Use composition to determine whether the inverse of $f(x)$ is a function.

6. Sketch a graph of f and its inverse.



7. How can you verify by the graph of f and its inverse that they are indeed inverses?

8. Is the inverse of $f(x)$ a function? Explain.