8.5: Restrict Your Twitter!

Restricting the Domain to Make a Function Invertible



You have 10 minutes to try and complete this challenge... or complete more than anyone in the class!

Can you create the Twitter Bird logo on <u>Desmos</u> or some other graphing utility? There are 12 algebraic expressions, each with a restricted domain.

- Save the image (a full-size version on the last page of this lesson)
- Add image (Plus sign on Desmos)
- Move the image so the bottom-left corner is at the origin
- Type in the function
- Add the restriction to the end of your equation in curly brackets { }
 - Example: $y = .25(x 2)^2 \{0 < x < 5\}$ will restrict a parabola to a domain of 0 < x < 5



Thanks to Jennifer Silverman. You can submit your Desmos designs too!

II. Restricting the Domain of a Function

You may recall that a function can be a simple mapping that assigns each element in the domain to a corresponding element in the range. The function f shown below pairs each element in the domain set with one element in the range.

1. The function f with domain {1,2,3,4,5} is shown in the table below.

x	f(x)		
1	7		
2	3		
3	1		
4	9		
5	5		

- a. What is f(1)? Explain how you know.
- b. What is $f^{-1}(1)$? Explain how you know.
- c. What is the domain of f^{-1} ? Explain how you know.
- d. Construct a table for the function f^{-1} , the inverse of f.

2. Complete the mapping diagram to show that $f(f^{-1}(x)) = x$.



3. Complete the mapping diagram to show that $f^{-1}(f(x)) = x$.



- 4. The graph of *f* is shown below.
 - a. Select several ordered pairs on the graph of f, and use those to construct a graph of f^{-1} .



b. Draw the line y = x, and use it to construct the graph of f^{-1} below.



- c. The algebraic function for *f* is given by $f(x) = x^3 + 2$. Is the formula for $f^{-1}(x) = \sqrt[3]{x} 2$? Explain why or why not.
- 5. The graph of $f(x) = \sqrt{x-3}$ is shown below. Construct the graph of f^{-1} .



- 6. Your classmate Morgan used the procedures learned in the previous lesson to define $f^{-1}(x) = x^2 + 3$. How does the graph of this function compare to the one you made in Exercise 5?
- 7. Construct the inverse of the function *f* given by the table below. Is the inverse a function? Explain your reasoning.

x	-3	-2	-1	0	1	2	3
f(x)	4	-1	-4	-5	-4	-1	4

8. The graphs of several functions are shown below. Which ones are invertible? Explain your reasoning.





- 9. Given the function $f(x) = x^2 4$.
 - a. Select a suitable domain for f that will make it an invertible function. State the range of f.
 - b. Write a formula for f^{-1} . State the domain and range of f^{-1} .
 - c. Verify graphically that f, with the domain you selected, and f^{-1} are indeed inverses.
 - d. Verify that f and f^{-1} are indeed inverses by showing that $f(f^{-1}(x)) = x$ and $f^{-1}(f(x)) = x$.

10. Three pairs of functions are given below. For which pairs, are *f* and *g* inverses of each other? Show work to support your reasoning. If a domain is not specified, assume it is the set of real numbers.

a.
$$f(x) = \frac{x}{x+1}, x \neq -1 \text{ and } g(x) = \frac{-x}{x-1}, x \neq 1$$

b.
$$f(x) = \sqrt{x} - 1, x \ge 0$$
 and $g(x) = (x + 1)^2$

c.
$$f(x) = -0.75x + 1$$
 and $g(x) = -\frac{4}{3}x - \frac{4}{3}$

Lesson Summary

COMPOSITION OF A FUNCTION AND ITS INVERSE: To verify that two functions are inverses, show that f(g(x)) = x and g(f(x)) = x.

Invertible Function: The domain of a function f can be restricted to make it invertible.

A function is said to be invertible if its inverse is also a function.

Twitter Logo – For Opening Activity

