**Inverse Functions**

* Inverse functions are essentially functions that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_each other
	+ Think of the function $f\left(x\right)=x^{2}$. How do you “undo” squaring x? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- $x^{2}$ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are inverse functions
* In an inverse function, the \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_ values switch places
* When the x and y values switch, this results in a reflection over \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The inverse of the function f is labeled \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. We read this as “f inverse” or “f prime.”

***For each table below create a table that represents the inverse. Label the inverse correctly using function notation.***

 **x**

 **x**

 **h(x)**

 **x**

 **f(x)**

 **x**

1. Does $f(x)$ represent a function? \_\_\_\_\_\_\_\_\_\_\_\_
2. Does $f^{-1}(x)$ represent a function? \_\_\_\_\_\_\_\_\_\_
3. Find $f\left(0\right):$ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What is $f^{-1}\left(-3\right)?$ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. What is $f^{-1}\left(4\right)?$ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Does $h(x)$ represent a function? \_\_\_\_\_\_\_\_\_\_\_\_
7. Does $h^{-1}(x)$ represent a function? \_\_\_\_\_\_\_\_\_\_
8. Find $h\left(0\right):$ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. What is $h^{-1}\left(9\right)?$ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. What is $h^{-1}\left(0\right)?$ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* In the examples above, you were asked to evaluate the inverse function for a given input. Is there a pattern that you could use to evaluate the inverse of a function without creating an inverse table? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ If the point $(-5, 3)$ is a point on $f(x)$, what point would be on $f^{-1}\left(x\right)?$ \_\_\_\_\_\_\_\_\_\_\_\_\_
	+ If the point $(8, 1)$ is a point on $g(x)$, what point would be on $g^{-1}\left(x\right)?$ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Use the table of** $f\left(x\right)$ **below to answer the following questions:**

1. $f^{-1}\left(9\right)=$ \_\_\_\_\_\_\_
2. $f^{-1}(-2)$ = \_\_\_\_\_\_\_\_

***The function*** $f(x)$ ***is shown on the graph below. Using the same approach, you used with the tables, find the inverse values requested below:***

1. $f^{-1}\left(7\right)= $\_\_\_\_\_\_\_
2. $f^{-1}\left(0\right)= $\_\_\_\_\_\_\_
3. $f^{-1}\left(-3\right)= $\_\_\_\_\_\_\_
4. $f^{-1}\left(-5\right)= $\_\_\_\_\_\_\_

***Proving that two functions are inverses:***

* If two functions are inverses, they are essentially \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ functions. Because these two functions are opposites of one another, they should cancel each other out.
	+ For any set of inverse functions $f\left(x\right) and g(x)$, $f\left(g\left(x\right)\right)=$ \_\_\_\_\_\_\_ and $g\left(f\left(x\right)\right)=$ \_\_\_\_\_\_\_.
		- Another way of writing $f(g\left(x\right))$ is $f∘g$ and another way of writing $g\left(f\left(x\right)\right)$ is $g∘f$

**Each pair of functions below represent inverses of one another. Prove in two ways that these equations are inverses.**

$$f\left(x\right)=2x g\left(x\right)=\frac{x}{2}$$

* Before proving functions are inverses, if may be helpful to review some inverse operations.
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are inverse operations that cancel each other out.
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are inverse operations that cancel each other out.
	+ The same is true for \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ etc.

**Steps to finding the inverse**

|  |  |
| --- | --- |
| **1. Replace f(x) with y****2. Switch x and y****3. Solve for y****4. Replace y with f­­­ -1­(x)** | **Example: f(x) = 3x+1** |

**Practice**

1.$f\left(x\right)=x^{2}-1 $ 2. $j\left(x\right)=3x^{3}+4$

3. $g\left(x\right)=\frac{1}{9}x+13$ 4. $v\left(x\right)=\sqrt{x-4}$