Key

Inverses Homework

Concept – Verifying that 2 Functions are Inverses of Each Other

Directions – Find f(g(x)) and g(f(x)) and verify that they are inverses of each other (both f(g(x)) and g(f(x)) equal x).

1. $f(x)=\sqrt{x-4}$
   $g(x)=x^2+4$

f(g(x))

$f(x^2+4)$

$=\sqrt{x^2+4-4}$

$=\sqrt{x^2}$

$=x$ ☺

g(f(x))

$g(\sqrt{x-4})$

$=(\sqrt{x-4})^2+4$

$=x-4+4$

$=x$ ☺

2. $f(x)=\frac{x+3}{x-2}$
   $g(x)=\frac{2x+3}{x-1}$

f(g(x))

$f\left(\frac{2x+3}{x-1}\right)$

$=\frac{\frac{2x+3}{x-1}+3\cdot\frac{(x-1)}{(x-1)}}{\frac{2x+3}{x-1}-2\left(\frac{x-1}{x-1}\right)}$

$=\frac{5x}{x-1}\div\frac{5}{x-1}$

$\frac{5x}{x-1}\cdot\frac{x-1}{5}=x$ ✓

g(f(x))

$g\left(\frac{x+3}{x-2}\right)$

$=\frac{2\left(\frac{x+3}{x-2}\right)+3\left(\frac{x-2}{x-2}\right)}{\left(\frac{x+3}{x-2}\right)-1\left(\frac{x-2}{x-2}\right)}$

$=\frac{5x}{x-2}\div\frac{5}{x-2}$

$=\frac{5x}{x-2}\cdot\frac{x-2}{5}$

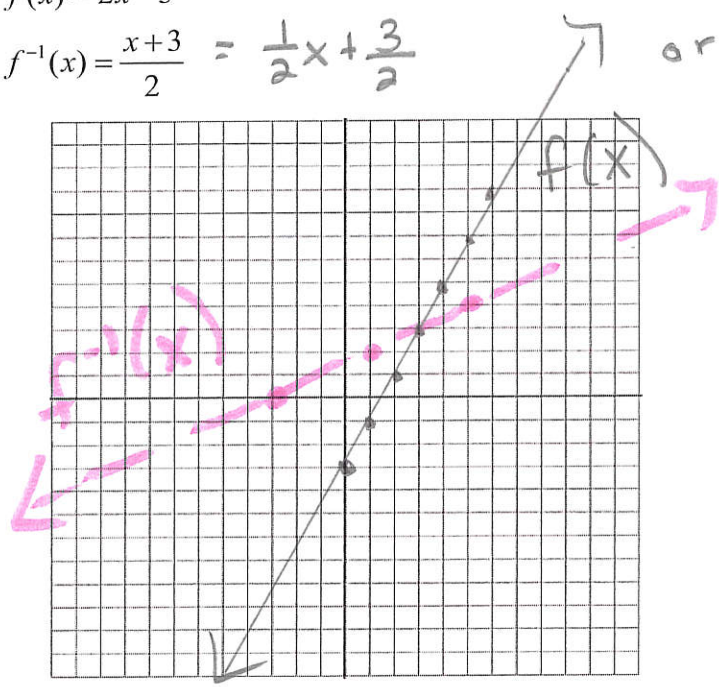
$=x$ ☺

Concept – Use Graphs of Functions To Determine Whether a Function has an Inverse

Directions – Plot f(x) and $f^{-1}(x)$ on the coordinate plane.

$f(x)=2x-3$

$f^{-1}(x)=\frac{x+3}{2}=\frac{1}{2}x+\frac{3}{2}$



or

x	y
0	-3
2	1
4	5

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

x	y
-3	0
1	2
5	4

Describe the relationship between the graphs of f(x) and $f^{-1}(x)$.

reflection over line $y=x$

Find the domain and range of f(x) and $f^{-1}(x)$.

$(-\infty,\infty)$

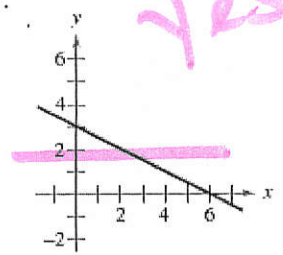
What do you observe?

Points → (x, y) values interchanged

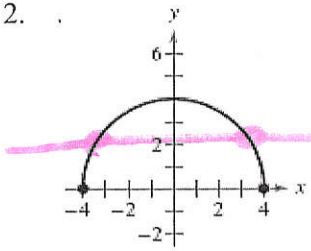
Inverses Homework

Horizontal Line Test and One-to-One Functions

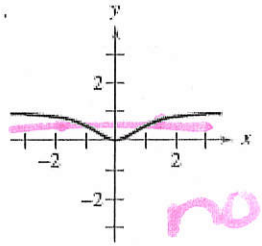
Part 1 – Does this function have an inverse function? (I.E. is it One-to-One?)

1. 

yes!

2. 

no

3. 

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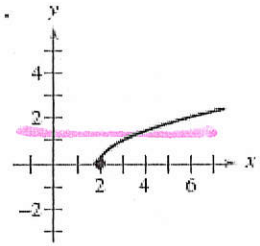
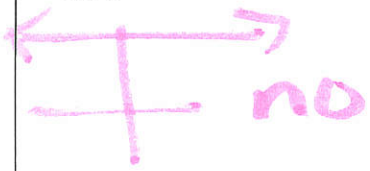
4. 

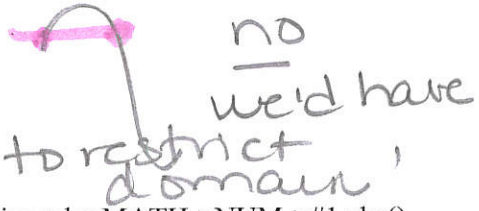
yes

Part 2 – Use a graphing calculator to graph the function and determine if it is One-To-One (I.E. it has an inverse function)

5. $g(x)=10$


no

6. $h(x)=-2x\sqrt{16-x^2}$


no
we'd have to restrict domain

7. $f(x)=|x+4|-|x-4|$ (hint – abs() is under MATH->NUM->#1 abs()

Finding Inverses Algebraically

Directions – Find the inverse of the given function algebraically. Then verify that $f(f^{-1}(x))=x$ and $f^{-1}(f(x))=x$.

1. $f(x)=6x-8$

$y=6x-8$

$x=6y-8$

$\frac{x+8}{6}=y$

$f^{-1}(x)=\frac{x+8}{6}$

$f(g(x))$

$f\left(\frac{x+8}{6}\right)$

$=6\left(\frac{x+8}{6}\right)-8=\frac{6x-8+8}{6}$

$=(x)$ ✓ (x) ✓

$g(f(x))$

$g(6x-8)$

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

$y=(x-2)^2$

$x=(y-2)^2$

$\pm\sqrt{x}=y-2$

$f^{-1}(x)=\pm\sqrt{x}+2$

$f(g(x))$

$f(\pm\sqrt{x}+2)$

$=(\pm\sqrt{x}+2-2)^2$

$=(\pm\sqrt{x})^2$

$=x$ ✓

$g(f(x))$

$=g(x-2)^2$

$=\pm\sqrt{(x-2)^2}+2$

$=x-2+2$

$=-x+2+2$ only (+)

*. $f(x)=\frac{x+1}{x-2}$

$y=\frac{x+1}{x-2}$

$x=\frac{y+1}{y-2}$ $(y-2)$

$(y-2)$

$xy-2x=y+1$

$xy-y=2x+1$

$y(x-1)=2x+1$

$y=\frac{2x+1}{x-1}$

$f^{-1}(x)=\frac{2x+1}{x-1}$