Warm Up: (Do Now)

Solve each of the following equations for the indicated variable:

a) $\cancel{4x} - 3y = 21$
$\cancel{-4x} \quad -4x$

y

$\frac{-3y}{-3} = \frac{-4x + 21}{-3}$

$\boxed{y = \frac{-4x+21}{-3}}$

$\boxed{y = \frac{4}{3}x - 7}$

b) $P = 2L + \cancel{2W}$
$-2W \quad \cancel{-2W}$

L

$\frac{2L}{2} = \frac{P - 2W}{2}$

$\boxed{L = \frac{P-2W}{2}}$

$\boxed{L = \frac{1}{2}P - W}$

c) $\frac{V}{\pi h} = \frac{\cancel{\pi} r^2 \cancel{h}}{\cancel{\pi} \cancel{h}}$

r

$\sqrt{r^2} = \sqrt{\frac{V}{\pi h}}$

$\boxed{r = \pm\sqrt{\frac{V}{\pi h}}}$

d) $\frac{9}{5} \cdot C = \frac{5}{9}(F - 32) \cdot \frac{9}{5}$

F

$\frac{9}{5}C = F - \cancel{32}$
$+32 \quad +\cancel{32}$

$\boxed{F = \frac{9}{5}C + 32}$

E) $L \cdot k = \frac{c^2 + D}{\cancel{L}} \cdot \cancel{L}$

C

$Lk = c^2 + \cancel{D}$
$-D \quad -\cancel{D}$

$\sqrt{Lk - D} = \sqrt{c^2}$

$\boxed{c = \pm\sqrt{Lk - D}}$

F) $(g+h) \cdot P = \frac{EJ}{\cancel{g+h}} \cdot \cancel{(g+h)}$

E

$\frac{P(g+h)}{J} = \frac{E\cancel{J}}{\cancel{J}}$

$\boxed{E = \frac{P(g+h)}{J}}$

$\boxed{E = \frac{Pg + Ph}{J}}$

Dec 5-12:01 AM

Functions 9b - Inverse Functions: From Equations & Graphing

Standards: F-BF.4 - Find Inverse Functions (4a,4b,4c,4d)

GLO: #3 - Complex Thinker

Math Practice: #7 - Look for and make use of structure

Learning Targets:

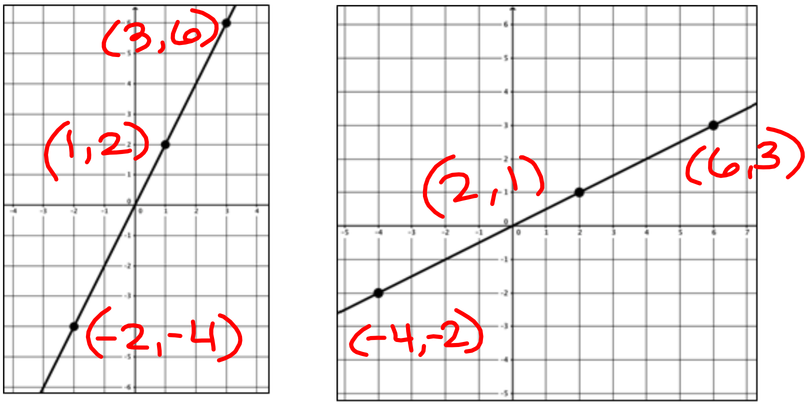
-How do you write an inverse function from an equation?

-How do you verify inverses?

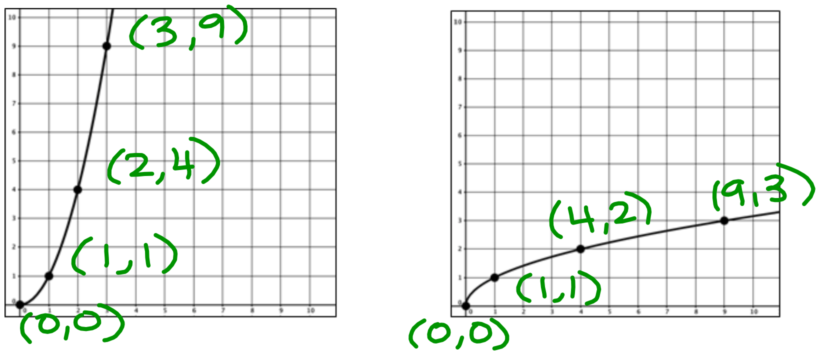
Oct 30-9:18 PM

Example 1: Label all the coordinates of the marked points in the graphs below. What do you notice about the x & y values?

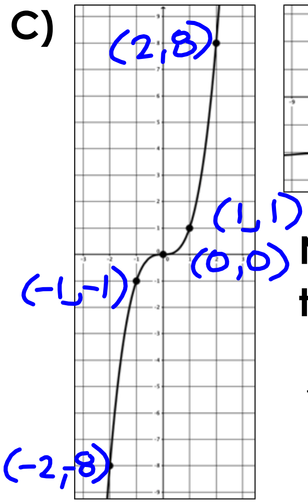
A)

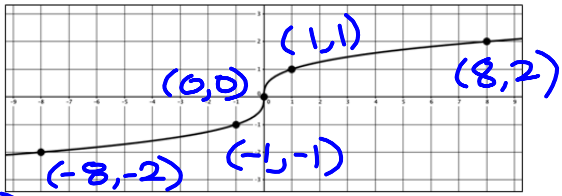


B)



C)





Notice: The graphs on the right are the inverses of the graphs on the left.

(erase to show)

The x -value of a point on $f(x)$ becomes the y -value of a point on $f^{-1}(x)$.

AND

The y -value of a point on $f(x)$ becomes the x -value of a point on $f^{-1}(x)$.

DOMAIN & **RANGE** switch from $f(x)$ to $f^{-1}(x)$.

(inputs) (outputs)

(x-values) (y-values)

Jan 22-4:07 PM

Steps to find the symbolic representation for an inverse function:

- Write the function expression using y for $f(x)$.
- Switch the x and y variables
- Solve for y.
- Finalize answer using inverse function notation $f^{-1}(x)$

The resulting equation is the inverse equation.

Make sure you use inverse notation!

Example: Find the inverse of $f(x) = 5x - 2$

$y = 5x - 2$ Write $f(x)$ as y

$x = 5y - 2$ Switch the x & y

$x + 2 = 5y$ Add 2 to both sides

$\frac{x+2}{5} = y$ Divide both sides by 5

$\boxed{f^{-1}(x) = \frac{x+2}{5}}$ Use function notation

OR $f^{-1}(x) = \frac{1}{5}x + \frac{2}{5}$

Practice:

a) $f(x) = 2x + 6$

① $y = 2x + 6$

② $x = 2y + \cancel{6}$

③ $-6 \quad -\cancel{6}$

$\frac{x-6}{2} = \frac{\cancel{2}y}{\cancel{2}}$

$y = \frac{x-6}{2}$

④ $\boxed{f^{-1}(x) = \frac{x-6}{2}}$

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

b) $f(x) = \frac{7x-3}{4}$

① $y = \frac{7x-3}{4}$

② $4(x) = \left(\frac{7y-3}{\cancel{4}}\right)\cancel{4}$

③ $4x = 7y - \cancel{3}$

$+3 \quad +\cancel{3}$

$\frac{4x+3}{7} = \frac{\cancel{7}y}{\cancel{7}}$

$y = \frac{4x+3}{7}$

④ $\boxed{f^{-1}(x) = \frac{4x+3}{7}}$

$f^{-1}(x) = \frac{4}{7}x + \frac{3}{7}$

Dec 3-12:00 AM

Example: Find the inverse of $f(x)=2(x+3)^2-1$

$y=2(x+3)^2-1$ Write *f(x)* as *y*

$x=2(y+3)^2-1$ Switch the x's and y's

$x+1=2(y+3)^2$ Add 1 to both sides

$\frac{x+1}{2}=(y+3)^2$ Divide both sides by 2

$\pm\sqrt{\frac{x+1}{2}}=y+3$ Square Root both sides

$\pm\sqrt{\frac{x+1}{2}}-3=y$ Subtract 3 on both sides

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

Practice:

a) $f(x)=\frac{1}{2}x^2-7$

① $y=\frac{1}{2}x^2-7$

② $x=\frac{1}{2}y^2-\cancel{7}$

③ $+7 \quad +\cancel{7}$

$2(x+7)=(\cancel{\tfrac{1}{2}}y^2)\cancel{2}$

$\sqrt{2x+14}=\cancel{\sqrt{y^2}}$

$y=\pm\sqrt{2x+14}$

④ $\boxed{f^{-1}(x)=\pm\sqrt{2x+14}}$

b) $f(x)=3(x-1)^2+2$

① $y=3(x-1)^2+2$

② $x=3(y-1)^2+\cancel{2}$

$-2 \quad -\cancel{2}$

③

$\frac{x-2}{3}=\frac{\cancel{3}(y-1)^2}{\cancel{3}}$

$\sqrt{\frac{x-2}{3}}=\cancel{\sqrt{(y-1)^2}}$

$\pm\sqrt{\frac{x-2}{3}}=y-\cancel{1}$

$+1 \quad +\cancel{1}$

$y=\pm\sqrt{\frac{x-2}{3}}+1$

④ $\boxed{f^{-1}(x)=\pm\sqrt{\frac{x-2}{3}}+1}$

Example 4: Use the table to determine the value of the following compositions.

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

input

$f(-1) = -4$

$f^{-1}(-4) = -1$

output

$\boxed{f^{-1}(f(-1)) = -1}$

B) $f^{-1}(f(11))$

$f(11) = 3$

$f^{-1}(3) = 11$

$\boxed{f^{-1}(f(11)) = 11}$

C) $f(f^{-1}(-4))$

$f^{-1}(-4) = -1$

$f(-1) = -4$

$\boxed{f(f^{-1}(-4)) = -4}$

D) $f(f^{-1}(2)) = 2$

x	$f(x)$
-1	-4
3	-2
4	5
8	-1
11	3

Notice the final values in Example 4 are the same as the inputs...which makes sense since we know inverse functions undo each other. So we know...

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

for any x in the appropriate domains.

(erase to show)

As a result, we can **verify** the equation for an inverse function:

If $f(f^{-1}(x)) = x$ and $f^{-1}(f(x)) = x$, then our inverse function is **correct**.

Example 5: Here are the function and inverse from Example 2. Check they are inverses with composition.

$f(x) = 5x - 2$ $\qquad f^{-1}(x) = \dfrac{x+2}{5}$

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

$\dfrac{(5x-2)+2}{5}$

$\dfrac{5x\underbrace{-2+2}}{5}$

$\dfrac{\cancel{5}x}{\cancel{5}}$

x

$\boxed{f^{-1}(f(x)) = x \quad \checkmark}$

$\cancel{5\left(\dfrac{x+2}{5}\right)}-2$

$x\underbrace{+2-2}$

x

$\boxed{f(f^{-1}(x)) = x \quad \checkmark}$

Practice: Find the inverse of $f(x) = x^2 + 7$.
Then, compose the original function with your answer to confirm that they are indeed inverses.

Find inverse.

1. $y = x^2 + 7$
2. $x = y^2 + \cancel{7}$
   $-7 \quad -\cancel{7}$
3. $\sqrt{x-7} = \cancel{\sqrt{}}y^{\cancel{2}}$
   $y = \pm\sqrt{x-7}$
4. $\boxed{f^{-1}(x) = \pm\sqrt{x-7}}$

Verify.

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

$\pm\sqrt{(x^2+7)-7}$

$\pm\sqrt{x^2 \underbrace{+7-7}}$

$\cancel{\pm}\cancel{\sqrt{}}x^{\cancel{2}}$

x

$\boxed{f^{-1}(f(x)) = x \quad \checkmark}$

OR

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

$(\cancel{\sqrt{}}x-7)^{\cancel{2}} + 7$

$x \underbrace{-7+7}$

x

$\boxed{f(f^{-1}(x)) = x \quad \checkmark}$

Jan 22-4:31 PM