Inverse Relations (1.5)

Math Learning Target:

"I know how to find the equation and graph of an inverse relation, and I can state its properties.
Also, I know under what conditions the inverse relation is a function."

Simply stated, an **inverse** is something that is the opposite or reverse of something else. For example, the inverse of the operation addition is subtraction and vice versa. When a mathematical operation does something with terms, its inverse operation undoes it.

Do: $3+4=7$ Undo: $7-4=3$

The idea of an inverse applies to relations too! If the relation is a function, a function accepts one input and produces one output.
The **inverse function** accepts that output (as an input) and produces one output (the original function's input!).

Do: $y=x-7$ Undo: $x=y+7$

Note: not all inverse relations are functions.

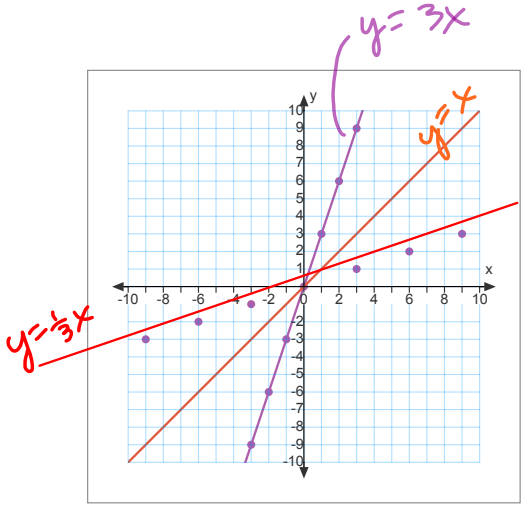
Ex. 1: $y=3x$

a) Using a table of values, graph
b) Using a table of values, graph its inverse relation.
c) State the equation of the inverse relation.

x	$y=3x$
-3	-9
-2	-6
-1	-3
0	0
1	3
2	6
3	9

x	y
-9	-3
-6	-2
-3	-1
0	0
3	1
6	2
9	3

$y=x$



c) $y=3x$

$x=3y$

$\frac{x}{3}=y$

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

Ex. 2:

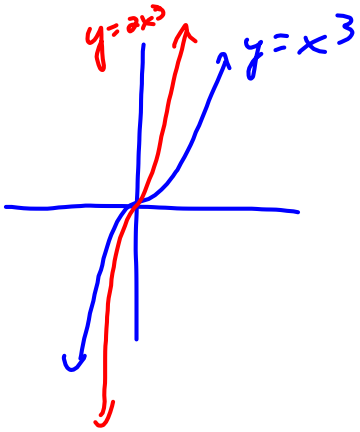
a) Determine the equation of the inverse relation of $f(x) = (x-3)^2 + 4$
b) Without graphing, is the inverse relation a function? Explain.

a) $y = (x-3)^2 + 4$
$x = (y-3)^2 + 4$
$x - 4 = (y-3)^2$
$\pm\sqrt{x-4} = y-3$
$\pm\sqrt{x-4} + 3 = y$

b) the inverse is not a function because for every x value, there are 2 y-values (pos+neg)
∴ not unique

Ex. 3: Given: $h(x) = 2x^3$
Find: $h^{-1}(-8)$

$y = 2x^3$
$x = 2y^3$
$\frac{x}{2} = y^3$
$\sqrt[3]{\frac{x}{2}} = y$
$\therefore h^{-1}(x) = \sqrt[3]{\frac{x}{2}}$



$h^{-1}(-8) = \sqrt[3]{\frac{(-8)}{2}}$
$= \sqrt[3]{-4}$

All properties of the independent variable in a relation correspond to the properties of the dependent variable in its inverse, and vice versa.

Entertainment: Page 43 #1cd, 2d, 3, 4**, 6d, 10e, 12c, 13ab, 14, 16.
To start #4, create a table of values for $y = x^3$ then graph it.

Optional Quizzes

http://courseware.cemc.uwaterloo.ca/8/assignments/113/4
http://courseware.cemc.uwaterloo.ca/8/assignments/113/5
Quiz Answers Incorrect?
http://courseware.cemc.uwaterloo.ca/8/assignments/113/6
http://courseware.cemc.uwaterloo.ca/8/assignments/113/7