Algebra II
Lesson 5: Inverse Functions
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Many actions are reversible. A light can be turned on and a light can be turned off. In mathematics this concept of reversing a calculation and arriving at the original result is associated with an inverse. A function can be described as a "DO" and the inverse can be described as the "UNDO." Put another way, an inverse relation is an exact opposite of what a function does and has a special symbol; $\boldsymbol{f^{-1}(x)}$.

Write an equation to describe the operations: Subtract 7 from x and divide the result by 2 1 → 2 2 — 1 Inverse $y = \frac{x-7}{2}$	Now, state the inverse actions. This is performed by stating the reverse order and applying the inverse operation at each step. ÷ inverse x ; − inverse + multiply by 2 & add 7 $y = 2x + 7$

There are 2 basic steps to formulating an inverse relation.

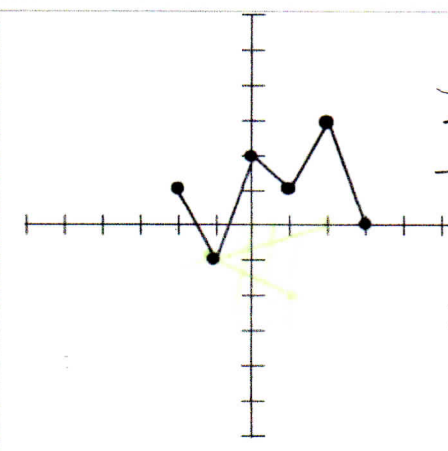
- Step 1 Switch the x and y in the equation
- Step 2 Solve for the new "y", and replace y with $f^{-1}(x)$

Example: Find the inverse function for $y = x + 3$ $x = y + 3$ $x - 3 = y$ $f^{-1}(x) = x - 3$	Step 1: switch x and y solve Step 2: replace y $with$ $f^{-1}(x)$
Find the inverse of the function switch x & y $y = x^2 + 3$ $x = y^2 + 3$ $x - 3 = y^2$ $\sqrt{y^2} = \sqrt{x-3}$ $f^{-1}(x) = y = \pm\sqrt{x-3}$	$y = 3x + 10$ switch spots $x = 3y + 10$ $\frac{1}{3}(x - 10) = 3y\left(\frac{1}{3}\right)$ $\frac{x-10}{3} = y = f^{-1}(x)$

DOMAIN AND RANGE

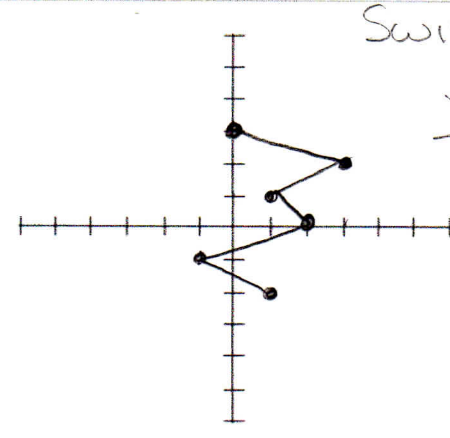
The domain of f equals the range of f^{-1}. The range of f equals the domain of f^{-1}. OH!! So when given a table of values or even a graph, to find the inverse switch the x and y $values$! When your are required to plot an inverse, remember, the inverse of a function has all the same points as the original function, except that the **x's and y's have been switched**. Exampe: $f(x) = \{\ (1,0), (-3,5), (0,4)\ \therefore$
$f(x)^{-1} = \{\ (0,1), (5,-3), (4,0)\ \}$. Switch the x and y-values. $f^{-1}(x) = \{(0,1), (5,-3)\ (4,0)\}$

Graph the inverse of the function *f(x)* graphed below. Is the inverse a function? Explain



X	y
-2	1
-1	-1
0	2
1	1
2	3
3	0

Switch X & y #D



X	y
1	-2
-1	-1
2	0
1	1
3	2
0	3

For each of the following functions – 1) find the inverse, 2) find the domain and range of the inverse, 3) determine whether the inverse is a function, and 4) then evaluate (if given) for $\boldsymbol{f^{-1}(-1), f(2)}$, and $\boldsymbol{f^{-1}(3)}$.

$f^{-1}(x)$ function no repeat x's

$f^{-1}(-1)=0$

$f^{-1}(2)=5$

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

x	$f^{-1}(x)$
1	-2
0	-1
-1	0
-3	1
-5	2

$f^{-1}(x)$

D: $\{-5,-3,-1,0,1\}$

R: $\{-2,-1,0,1,2\}$

p	f(p)
-3	3
-2	6
1	3
2	0
3	-9

p	$f^{-1}(p)$
3	-3
6	-2
3	1
0	2
-9	3

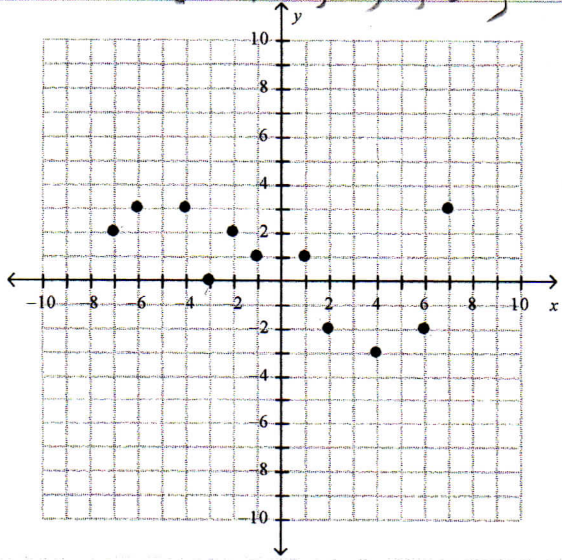
$f^{-1}(3)=-3$

not function repeat x

$f^{-1}(p)$

D: $\{-9,0,3,6\}$

R: $\{-3,-2,1,2,3\}$



x	f(x)
-7	2
-6	3
-4	3
-3	0
-2	2
-1	1
1	1
2	-2
4	-3
6	-2
7	3

x	$f^{-1}(x)$
2	-7
3	-6
3	-4
0	-3
2	-2
1	-1
1	1
-2	2
-3	4
-2	6
3	7

$f^{-1}(x)$. not function

$f^{-1}(2) = -7, -2$

$f^{-1}(3) = -6, -4, 7$

D $f^{-1}(x)$ $\{-3,-2,0,1,2,3\}$

R $f^{-1}(x)$ $\{-7,-6,-4\ -3,-2,-1,1,2,4,6,7\}$