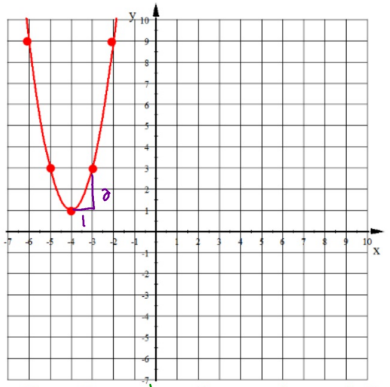
SEC 7-7 Exploration

By definition a Relation is a set of ordered pairs
(a bunch of points)

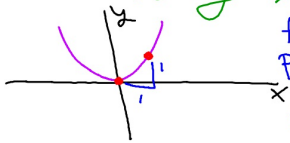
What is a function?

A relation such that every x-value is paired with one and only one y-value.

1. Plot the following points and connect them to form a parabola.
$(-6,9),(-5,3),(-4,1),(-3,3),(-2,9)$



Parent Quadratic function: $y = x^2$



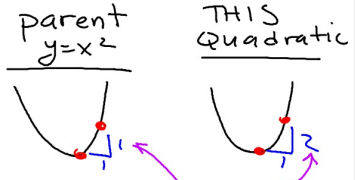
first "good" PT from the vertex is 1 RT & 1 up

2. Write the equation of this parabola.

Vertex Form:
$y = a(x - h)^2 + k$

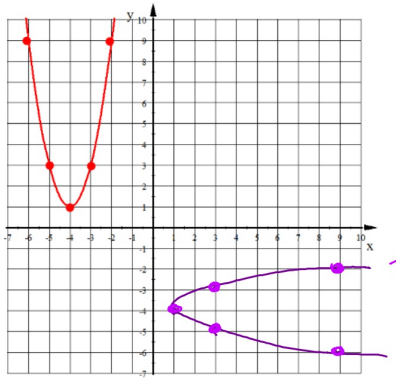
Vertex: (h,k) $(-4, 1)$

$y = 2(x + 4)^2 + 1$



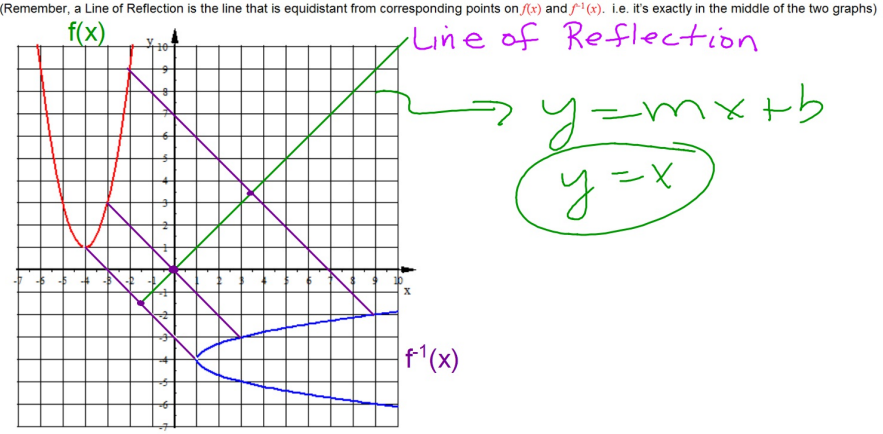
THIS QUADRATIC IS 2x taller
$a = 2$

3. Take each ordered pair and switch the position of each number then plot this point on the same graph that you used for the parabola. Do this with all five points and connect them with a smooth curve. Example: $(-6,9)$ becomes $(9,-6)$



THE inverse $f^{-1}(x)$ IS A sideways parabola

4. You have just created the **inverse relation** of $f(x)$. The inverse is denoted by the symbol $f^{-1}(x)$
The graph of $f^{-1}(x)$ is actually a reflection of $f(x)$ over a line. What is this line of reflection?
(Remember, a Line of Reflection is the line that is equidistant from corresponding points on $f(x)$ and $f^{-1}(x)$. i.e. it's exactly in the middle of the two graphs)



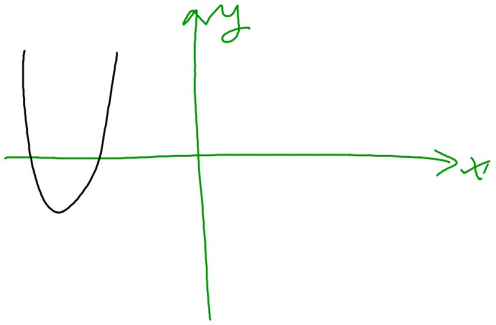
The concept of an Inverse Relation is all about...

switching X and Y

Graphing an inverse using the graphing calculator.

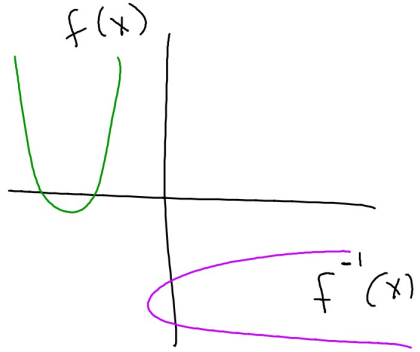
Graph the following in a Standard Window.

$Y_1 = 2(x+5)^2 - 3$



To draw the inverse relation:

1. Press 2nd
2. Press PRGM (DRAW)
3. Choose option 8: DrawInv
4. Press ALPHA then TRACE
5. Choose Y_1
6. Press ENTER



Is the inverse relation to

$Y_1 = 2(x+5)^2 - 3$

a function?

No, the inverse fails the Vertical Line Test

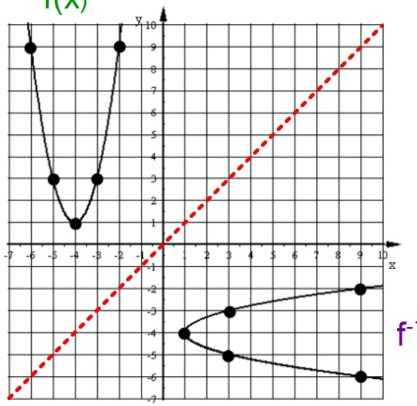
Is the inverse relation to

$Y_1 = 0.5(X+5)^2(X+1)^2$

a function?

No, the inverse fails the Vertical Line Test

f(x)

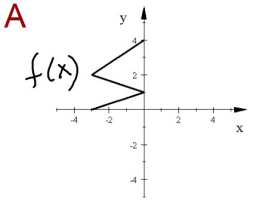


Is $f^{-1}(x)$ a function?

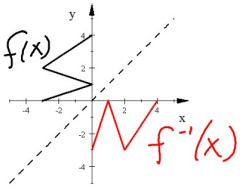
No, the inverse fails the Vertical Line Test

Will the inverse relation be a function?

A



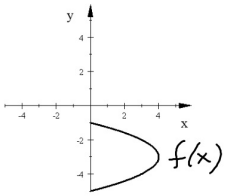
If you graph the inverse you get the following:



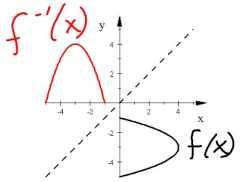
No, the Inverse is NOT a function

Will the inverse relation be a function?

B



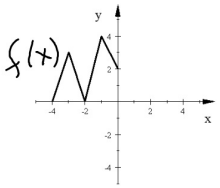
If you graph the inverse you get the following:



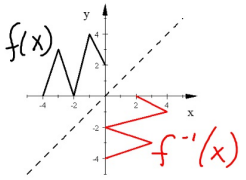
Yes, the inverse IS a function

Will the inverse relation be a function?

C



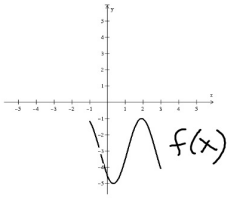
If you graph the inverse you get the following:



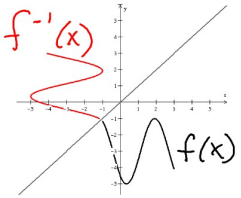
No, the Inverse is NOT a function

Will the inverse relation be a function?

D

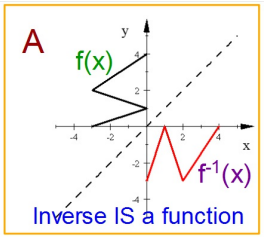


If you graph the inverse you get the following:



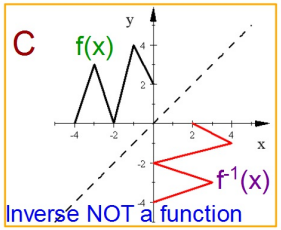
Yes, the inverse IS a function

A



Inverse IS a function

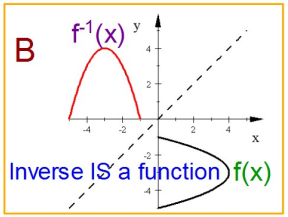
C



Inverse NOT a function

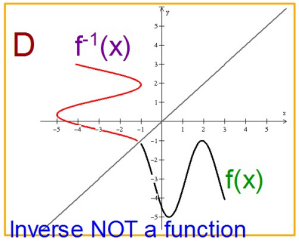
Given the graph of an orginal relation, how do you tell if the inverse relation is a function without actually graphing the inverse?

B



Inverse IS a function

D



Inverse NOT a function

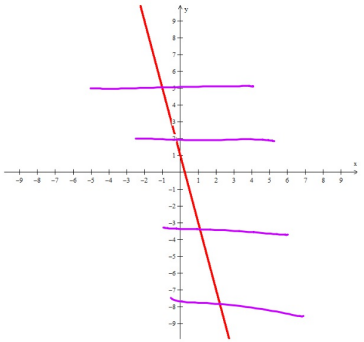
Horizontal Line Test: a visual test to determine if the inverse relation will be a function.

If any horizontal line can intersect a graph more than once then the graph of the inverse is NOT a function

3. Use what you may know about the graph of each or graph them using the graphing calculator to determine if the inverse relation of each is a function or not.

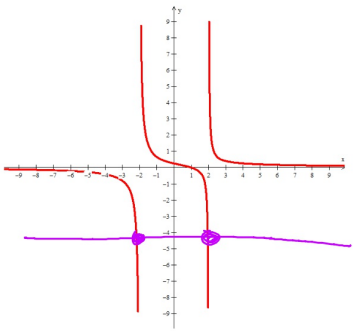
a) $f(x) = -4x + 1$

Yes, the inverse is a function because no Horizontal Line will touch the orginal graph more than once so no Vertical Line will touch the inverse more than once.



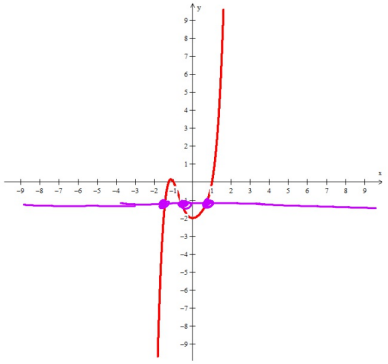
b) $y = \dfrac{x-1}{x^2-4}$

No, the inverse is not a function because there is a Horizontal Line that will touch the orginal graph more than once which meant that there is Vertical Line that will touch the inverse more than once.



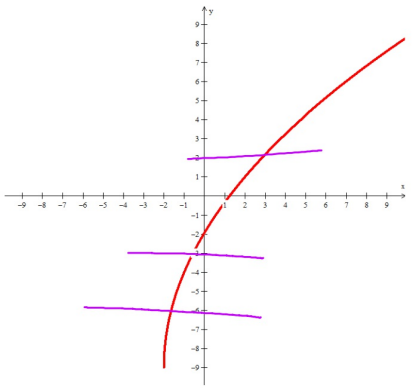
c) $y = x^5 - x^3 + 2x^2 - 2$

No, the inverse is not a function because there is a Horizontal Line that will touch the orginal graph more than once which meant that there is Vertical Line that will touch the inverse more than once.



d) $f(x) = 5\sqrt{x+2} - 9$

Yes, the inverse is a function because no Horizontal Line will touch the orginal graph more than once so no Vertical Line will touch the inverse more than once.

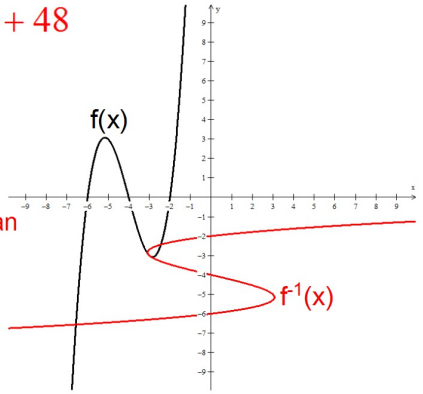


e) Is the inverse relation of each a function?

a) $y = x^3 + 12x^2 + 44x + 48$

No.
The original function fails the Horizontal Line Test.

If you graph the inverse you can see that the Inverse fails the Vertical Line Test.



Original Relation		Inverse Relation
f(x)	Becomes	$f^{-1}(x)$
The point (a,b)	Becomes	The point (b,a)
Domain of f(x)	Becomes	Range of $f^{-1}(x)$
Range of f(x)	Becomes	Domain of $f^{-1}(x)$
Graph of f(x)	Reflect over y=x Becomes	Graph of $f^{-1}(x)$