

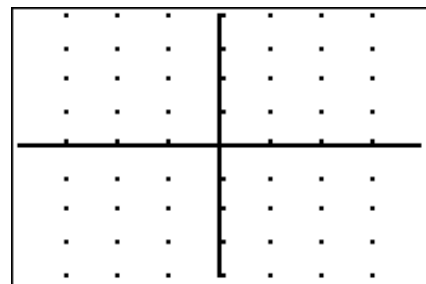
Discovering Inverse Trig Functions

Think about a non-trig function first.

Suppose $y=2x+1$. First graph this function in a zoom 4.(Decimal) window.

Record a picture of your graph.

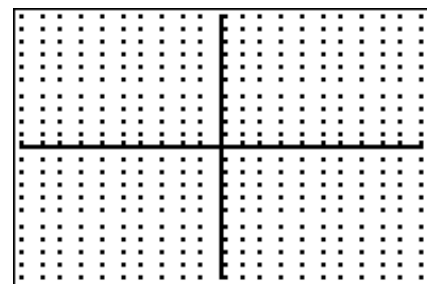
An inverse function is defined as another function that is the reflection of the first function about the line $y=x$. Add the line $y=x$ to your calculator and then try to draw the inverse function.



Can you find the equation of your inverse function?

Another way to find the inverse function is to solve for it analytically. First switch the x and y . (This actually reflects the original line over the line $y=x$.) Now solve the equation for y . Does it agree with your inverse function?

Try another equation. Suppose $y_1 = (x + 5)^2$. First create the graph of this function in a zoom 6(Standard) window. Record a copy of it at the right.



Add the line $y=x$ to the picture. Try to sketch the inverse function by reflecting the graph over the line $y=x$. Do you notice that this reflection is not a *function*. It is actually 2 functions.

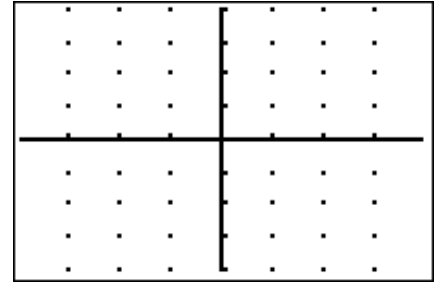
You can also have the calculator draw an inverse function. Return to the homescreen on the calculator and enter the command DRAW (2nd PRGM) and Y1. Press ENTER. The calculator will draw the inverse function. How close is your sketch?

Let's find the equation analytically. Switch the x and y . Now try to solve for y carefully. You should notice that you will have to take the square root of both sides. Remember the answer will be $\pm\sqrt{\quad}$. Write your two equations and enter them in y3 and y4. Change the type of line to a thick line. Graph the equations. Do your equations agree with your drawing? Do you understand why you had to write two functions?

It is possible to graph just part of y_1 so when the drawing of the inverse function will be a function too. Enter $y_1 = ((x + 5)^2)(x \geq 0)$. Now ask the calculator to draw the inverse function.

Now let's try finding the inverse function for some of the trig functions.

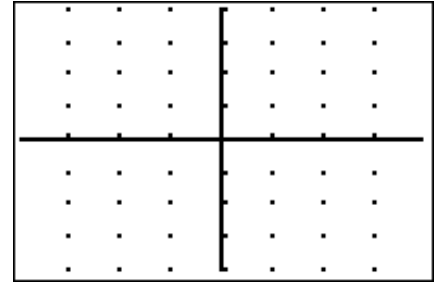
First enter $y_1 = \sin(x)$. Graph this function in a zoom 7.(Trig) window. Record a graph of this function. Enter the line $y = x$. Can you picture the inverse function? Try drawing the inverse function.



Will the drawing of the inverse function be a function? If not, can you pick a portion of the graph that will be a function?

Return to y_1 and enter the following.

$y_1 = (\sin(x))(x \geq \text{---})(x \leq \text{---})$ to select the portion of the graph. Regraph the function and make a new sketch. The portion you select should be able to be reflected about the line $y=x$ and remain a function.



When you have restricted the function, try drawing the inverse function by entering DrawInv Y1 on the homescreen.

To solve it analytically we do the same as before. First switch the x and y . Now try to solve for y .

$$y = \sin(x)$$

$$x = \sin(y)$$

Now what do you do? To solve this we introduce a new notation. $y = \arcsin(x)$ or $y = \sin^{-1}(x)$. Enter this equation in your calculator to see if you get the same picture as you drew or the calculator drew.

Repeat the same activity with $y = \cos(x)$ and $y = \tan(x)$.