Horizontal Translations

Let's look at how functions can be transformed in other ways by observing the transformation of the basic function $y = x^2$.

Again, you can see how the graph of the basic function relates to its table of values.

The term "*p*" is introduced into the function.

If the equation changes to $y = (x - 3)^2$, How does the original graph of the basic function $y = x^2$ change?

You can see that the graph of the function is translated horizontally right three units.

Consider the *x* -values in both tables [$y = x^2$ AND $y = (x - 3)^2$] and compare them.

What do you notice about differences in the inputs?

1 is 3 greater than -2, 2 is 3 greater than -1, 3 is 3 greater than 0,

and so on…

If you look back at all the inputs for the equation $y = (x - 3)^2$, they are always 3 greater than inputs for the original equation.

The vertex has shifted 3 units to the right.

Now let's change "*p*" to -4. Since the function is $(x - p)^2$, that changes the function to $y = (x + 4)^2$ How does the graph of function change?

You can see that the graph is translated horizontally left 4 units.

Notice this in the table of values for $y = (x + 4)^2$. How do the input values in the new $y = (x + 4)^2$ table compare to the input values for the basic $y = x^2$ equation?

In order for the equations to have the same output values, the inputs in the in the new

$y = (x + 4)^2$ table must be 4 less than the inputs in the original basic equation.

The vertex has been shifted 4 units to the left.

So, the value of "*p*" determines the direction and amount of shift in the transformed function.

The value of "*p*" is "opposite" to the direction the shift.

In this example, *x* plus 4 means **left** 4 units.

If the form of the equation is generalized as $y=(x - p)^2$, then *p* represents the amount of horizontal translation of the vertex either right or left.

Activity

Drag the slider *p* to the value -3. How have the "*x*"-values changed compared to the basic function $y = x^2$. How has the graph changed?