**Function in Vertex Form**

Let's take a closer look at the equation, $y = (x - 2)^2 - 5$.

First, what are the values for $p$ & $q$ in this equation?

Now look at the vertex. What do you notice about its ($x$, $y$) values?

They appear to be the same as the values for $p$ & $q$.

Let's look at the another equation that we examined earlier, $y = (x + 3)^2 - 1$

This function can also be stated as $y = (x - - 3))^2 - 1$

{say it as: $y$ = ($x$ minus negative 3)$^2$ -1} ...to match this form of the function.

Can we find the same pattern in this example?

What are $p$ & $q$ in this equation?

Are these two values also found at the vertex?

It looks like once again, the ($x$, $y$) values of the vertex are the same as the values for $p$ & $q$.

Do you wonder why they are the same?

We can find out by understanding the horizontal and vertical translations.

Let's begin with the basic function $y = x^2$.

Its vertex is at the origin,

How many units and in what direction along the $x$-axis has the function

$y$ = ($x$ minus negative 3)$^2$ -1 moved?

**...** how many units and in what direction along the $y$-axis has the function moved?

So what must the ($x$, $y$) values at its new vertex be?

The $(x, y)$ values at the vertex of the basic function are (0, 0).

The function $y = (x - p)^2 + q$ moves $p$ units along the $x$-axis

… and $q$ units along the $y$-axis

So the $(x, y)$ values at the vertex must be $p$ and $q$.

Now we can see why $p$ & $q$ are always the $(x, y)$ values at the vertex of the function

$y = (x - p)^2 + q$.