

Vertical Translations

Notice how the graph of this function relates to its table of values.

The term “ q ” added to the function has an impact on the graph.

If the function changes to $y = x^2 + 1$, how does the graph change? (Try it 😊)

You can see that the graph of the function is translated vertically up one unit.

You can also see this in the table of values for $y = x^2 + 1$, where all the output values are increased by one compared to $y = x^2$.

For example, 5 is one more than the original y -value that was 4, 2 is one more than 1, and so on...

Another way to look at this is that the vertex is now one unit higher than it was originally.

If you change “ q ” to +3, how does the graph of the function change?

You can see that the function graph is translated vertically up 3 units compared to the original basic function $y = x^2$.

All the output values in the table are now 3 greater than the original $y = x^2$ output values.

The vertex has been shifted up by 3 units.

If you change “ q ” to -4 , how does the graph of the function change?

You can see that the function graph is translated vertically down 4 units compared to $y = x^2$.

All the output values in the table are now 4 less than the $y = x^2$ output values.

The vertex has been shifted down 4 units.

This translation is often generalized as $y = x^2 + q$, where q represents the number of units vertically translated up or down.

Positive values of q translate the function upwards, while negative values of q translate the function downwards.

Activity

Drag the slider q to -2. How have the y -values for your new function changed compared to $y = x^2$?

Then drag the slider q so that the equation of the function is $y = x^2 + 4$. How does the graph compare to $y = x^2$?