

Vertical Translation

Vertical Translation

$$y - k = x^2$$

- After looking at the effect that the Horizontal Translation (HT) has on the shape of a parabola, we can use those ideas when looking at the Vertical Translation (VT). We saw before that the HT affects the base graph $y = x^2$ by shifting the graph left or right. Similarly, the VT results in a translation or shift of $y = x^2$ up or down.
- Example:
Let's look at the following functions. We will use a mapping rule to generate a table of values for the image function and then graph all three functions on the same axes.

(a.) $y = x^2$

(b.) $y - 3 = x^2$

(c.) $y + 5 = x^2$

$(x, y) \rightarrow (x, y + 3)$

$(x, y) \rightarrow (x, y - 5)$

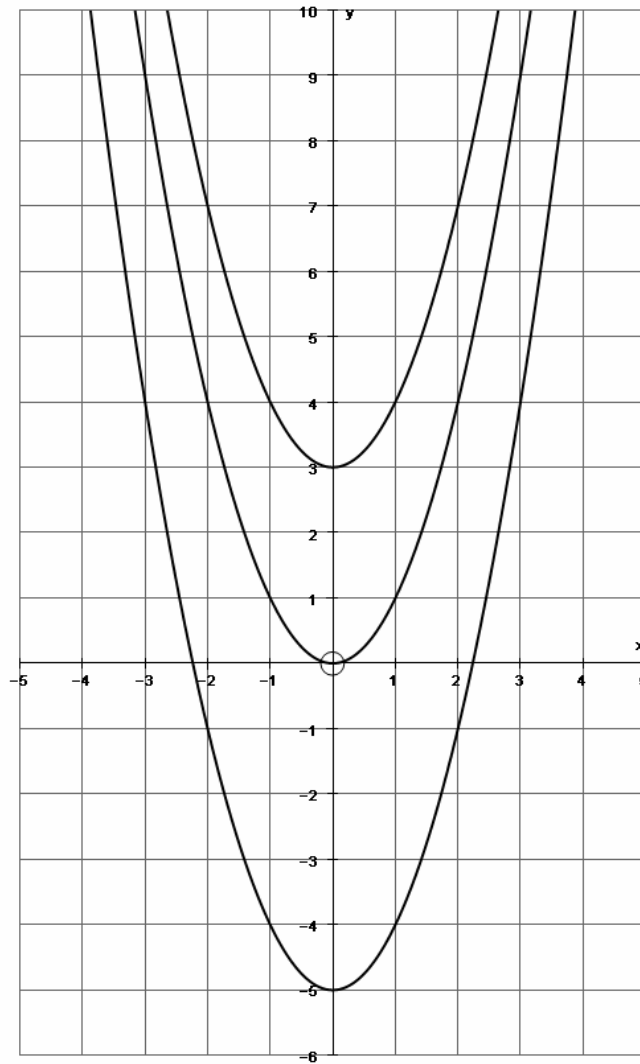
x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

x	y
-3	12
-2	7
-1	4
0	3
1	4
2	7
3	12

x	y
-3	4
-2	-1
-1	-4
0	-5
1	-4
2	-1
3	4

|-----|
add 3

|-----|
subtract 5



When there is $y - 3$ in the equation, then there is a VT of 3 units. This will result in a graph that is shifted 3 units up from $y = x^2$.

When there is $y + 5$ in the equation, then there is a VT of -5 units. This will result in a graph that is shifted 5 units down from $y = x^2$.

Summary

Equation:

$$y - k = x^2$$

$$\boxed{VT = k}$$

Mapping Rule:

$$(x, y) \rightarrow (x, y + k)$$

- The Vertical Translation is the **OPPOSITE** of the value added to y in the equation.
- The Vertical Translation is the **SAME** as the value added to y in the mapping rule.
- When $VT > 0$, the graph is shifted k units **UP** from $y = x^2$.
- When $VT < 0$, the graph is shifted k units **DOWN** from $y = x^2$.