

Vertical Reflection

Vertical Reflection

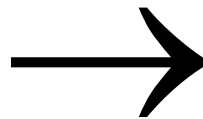
$$-y = x^2$$

- So far, we have explored how a horizontal translation (HT), vertical translation (VT) and a vertical stretch (VS) effect the base graph of $y = x^2$. We will now look at the situation when the image graph is a **reflection in the x-axis**. The mapping rule for a reflection in the x-axis is given by: $(x, y) \rightarrow (x, -y)$. This rule is telling us to keep the x-values the same in the image table of values, but to multiply all y-values by -1 in the image table of values.
- Example:
We will use a mapping rule to generate a table of values for the $-y = x^2$ function and then graph it and the $y = x^2$ function on the same axes.

Table of
Values for
 $y = x^2$

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

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

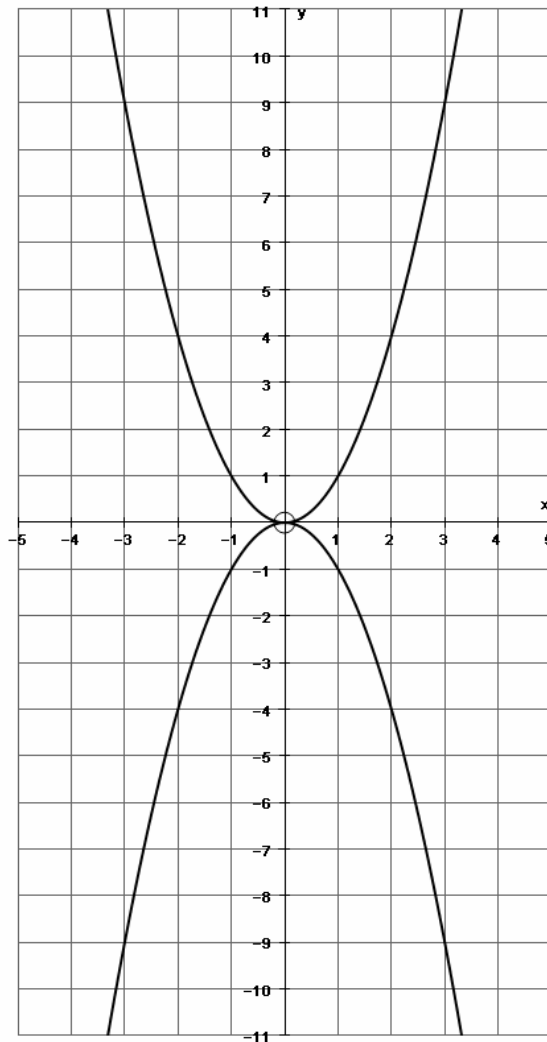


New Table of
Values for
 $-y = x^2$

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

same x – value

y – value multiplied by -1



Summary

Equation:
 $-y = x^2$

Mapping Rule:
 $(x, y) \rightarrow (x, -y)$

- When there is a $-y$ in the function, the result will be a **REFLECTION** in the x-axis.

- The Vertical Stretch factor is always positive and, therefore, does **NOT** tell us if there is a reflection in the x-axis.

$$\boxed{VS = |a|}$$

- Example 1:

(a.) In the function $-3y = x^2$, the mapping rule will be

$$(x, y) \rightarrow (x, -\frac{1}{3}y), \text{ where the } VS = \frac{1}{3}.$$

(b.) In the function $-\frac{1}{6}y = x^2$, the mapping rule will be

$$(x, y) \rightarrow (x, -6y), \text{ where the } VS = 6.$$

- Example 2:

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.) $-2y = x^2$

(c.) $-\frac{1}{2}y = x^2$

$$(x, y) \rightarrow (x, -\frac{1}{2}y)$$

$$(x, y) \rightarrow (x, -2y)$$

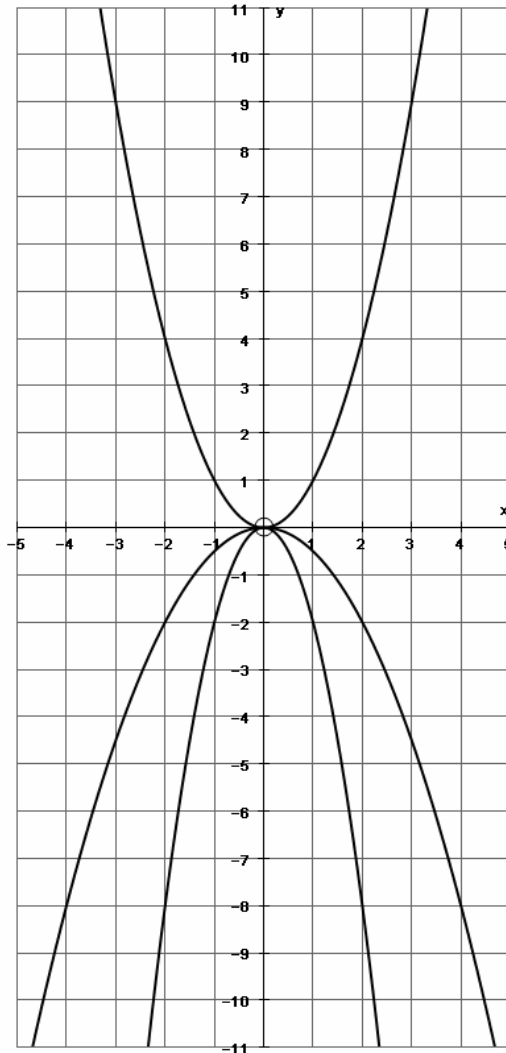
$$VS = \frac{1}{2}$$

$$VS = 2$$

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

x	y
-3	-4.5
-2	-1
-1	-0.5
0	0
1	-0.5
2	-1
3	-4.5

x	y
-3	-18
-2	-8
-1	-2
0	0
1	-2
2	-8
3	-18



Summary

Equation:

$$\frac{1}{a}y = x^2$$

$$VS = |a|$$

Mapping Rule:

$$(x, y) \rightarrow (x, ay)$$

- The VS is the **RECIPROCAL** of the numerical coefficient of y in the function.
- The VS is the **SAME** as the numerical coefficient of y in the mapping rule.
- The Vertical Stretch factor is always positive.
- When $VS > 1$, the graph is “thinner” than $y = x^2$.
- When $0 < VS < 1$, the graph is “wider” than $y = x^2$.
- When there is a $-y$ in the equation, the result will be a **REFLECTION** in the x-axis.