

Graphing Quadratics Using Transformational Form

- When graphing functions in Transformational Form, we can use its different components (HT, VS, etc.) to create a mapping rule and generate a table of values for the function and then graph it. This is called the Mapping Rule Method.
- We are now going to put the different transformational components together in order to graph a quadratic function.
- Step 1: Identify the transformations of the equation (reflection in the x-axis, HT, VT, VS).

The transformational form of an equation is of the form:

$$\frac{1}{a}(y - k) = (x - h)^2$$

where: a = vertical stretch (VS)
 k = vertical translation (VT) up or down and
 vertex = (h ,k)
 h = horizontal translation (HT) left or right

It may be easier to remember the formula if we write it as:

$$\frac{1}{VS}(y - vt) = (x - ht)^2$$

Notice that the vertical components are on the “y-side” of the equation and the horizontal components are on the “x-side”. It is also important to remember that if there is a negative sign in front of the $\frac{1}{a}$ (or $\frac{1}{VS}$), then there is a reflection in the x-axis.

- Step 2: Write the mapping rule for the given function.

The resulting mapping rule from the equation is of the form:

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

or

$$(x, y) \rightarrow (x + HT, VSy + VT)$$

- Step 3: Create a new table of values for the given function.

This mapping rule is then applied to the table of values for the base parabola $y = x^2$ to create a new table of values for the desired function.

- Step 4: Graph the function using the new table of values generated with the mapping rule.
- Example 1:

Sketch the graph of the function $\frac{1}{4}(y - 1) = (x + 2)^2$ using the Mapping Rule Method.

Solution:

Step 1: Identify the transformations of the equation (reflection in the x-axis, HT, VT, VS).

R (Reflection in the x-axis): No

S (Stretch): VS = 4

T (Translations): HT = -2, VT = 1

Step 2: Write the mapping rule for the given function.

The mapping rule is: $(x, y) \rightarrow (x - 2, 4y + 1)$

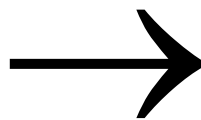
Step 3: Create a new table of values for the given function.

The standard base table of values for

$$y = x^2:$$

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

$$(x, y) \rightarrow (x - 2, 4y + 1)$$

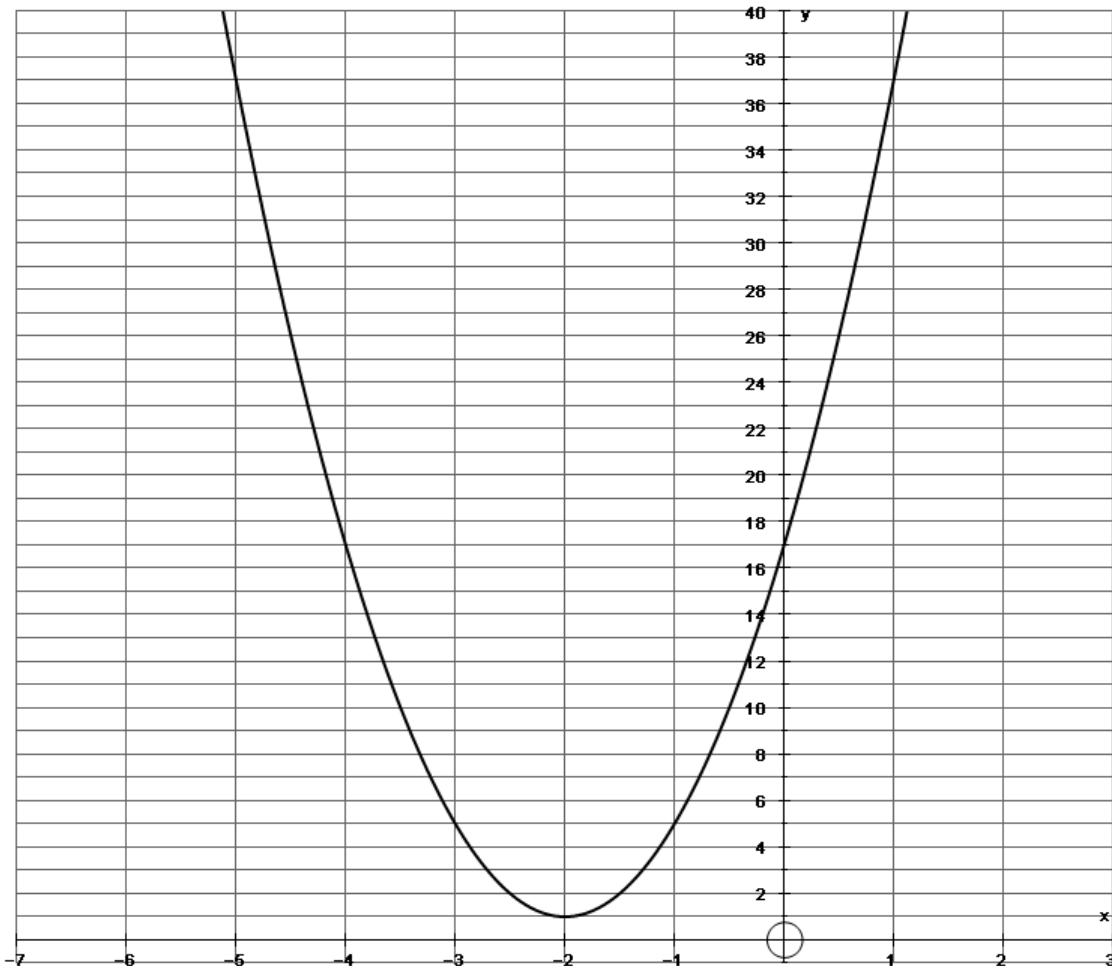


The newly generated table of values for

$$\frac{1}{4}(y - 1) = (x + 2)^2:$$

x	y
-5	37
-4	17
-3	5
-2	1
-1	5
0	17
1	37

Step 4: Graph the function using the new table of values generated with the mapping rule.



- Example 2:

Sketch the graph of the function $-\frac{1}{2}(y + 6) = (x - 5)^2$ using the Mapping Rule Method.

Solution:

Step 1: Identify the transformations of the equation (reflection in the x-axis, HT, VT, VS).

R (Reflection in the x-axis): Yes

S (Stretch): VS = 2

T (Translations): HT = 5, VT = -6

Step 2: Write the mapping rule for the given function.

The mapping rule is: $(x, y) \rightarrow (x + 5, -2y - 6)$

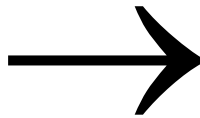
Step 3: Create a new table of values for the given function.

The standard base table of values for

$$y = x^2:$$

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

$$(x, y) \rightarrow (x + 5, -2y - 6)$$



The newly generated table of values for

$$-\frac{1}{2}(y + 6) = (x - 5)^2:$$

x	y
2	-24
3	-14
4	-8
5	-6
6	-8
7	-14
8	-24

Step 4: Graph the function using the new table of values generated with the mapping rule.

