

## Mapping Notation

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

HT left by "h" units  
 VSE or VSC by a factor of "a"  
 VT up by "k" units  
 HT right by "h" units  
 VT down by "k" units  
 R in the x-axis

### 1. Converting the equation in vertex form to mapping notation.

#### Strategy:

- identify all transformations and describe them in words
- input the values of "h", "+/-", "a" and "k" into the mapping notation matrix

#### Mapping notation rules:

- HT right by "h" units = + "h"
- HT left by "h" units = - "h"
- R in the x-axis = -y
- VSE by a factor of "a" = ay
- VSC by a factor of "a" = ay
- VT up by "k" units = + "k"
- VT down by "k" units = - "k"

Example 1: Express transformations to  $y = x^2$  using the mapping notation

	Equation in vertex form	Transformations in words	Mapping notation
A	$y = -3x^2$ $y = -3(x-0)^2 + 0$	<ul style="list-style-type: none"> <li>• R in the x-axis</li> <li>• VSE by a factor of 3</li> </ul>	$(x, y) \rightarrow (x, -3y)$
B	$f(x) = 0.5(x+1)^2$ $y = +0.5(x+1)^2 + 0$	<ul style="list-style-type: none"> <li>• VSC by a factor of 0.5</li> <li>• HT left by 1 unit</li> </ul>	$(x, y) \rightarrow (x-1, 0.5y)$ OR $(x, y) \rightarrow (x-1, \frac{y}{2})$
C	$y = (x-5)^2 + 4$ $y = +1(x-5)^2 + 4$	<ul style="list-style-type: none"> <li>• HT right by 5 units</li> <li>• VT up by 4 units</li> </ul>	$(x, y) \rightarrow (x+5, y+4)$
D	$y = -x^2 - 7$ $y = -1(x-0)^2 - 7$	<ul style="list-style-type: none"> <li>• R in the x-axis</li> <li>• VT down by 7 units</li> </ul>	$(x, y) \rightarrow (x, -y-7)$
E	$g(x) = -7(x+10)^2 - 3$ $y = -7(x+10)^2 - 3$	<ul style="list-style-type: none"> <li>• R in the x-axis</li> <li>• VSE by a factor of 7</li> <li>• HT left by 10 units</li> <li>• VT down by 3 units</li> </ul>	$(x, y) \rightarrow (x-10, -7y-3)$

Example 2: Express transformations to  $y = x^2$  using the equation in vertex form

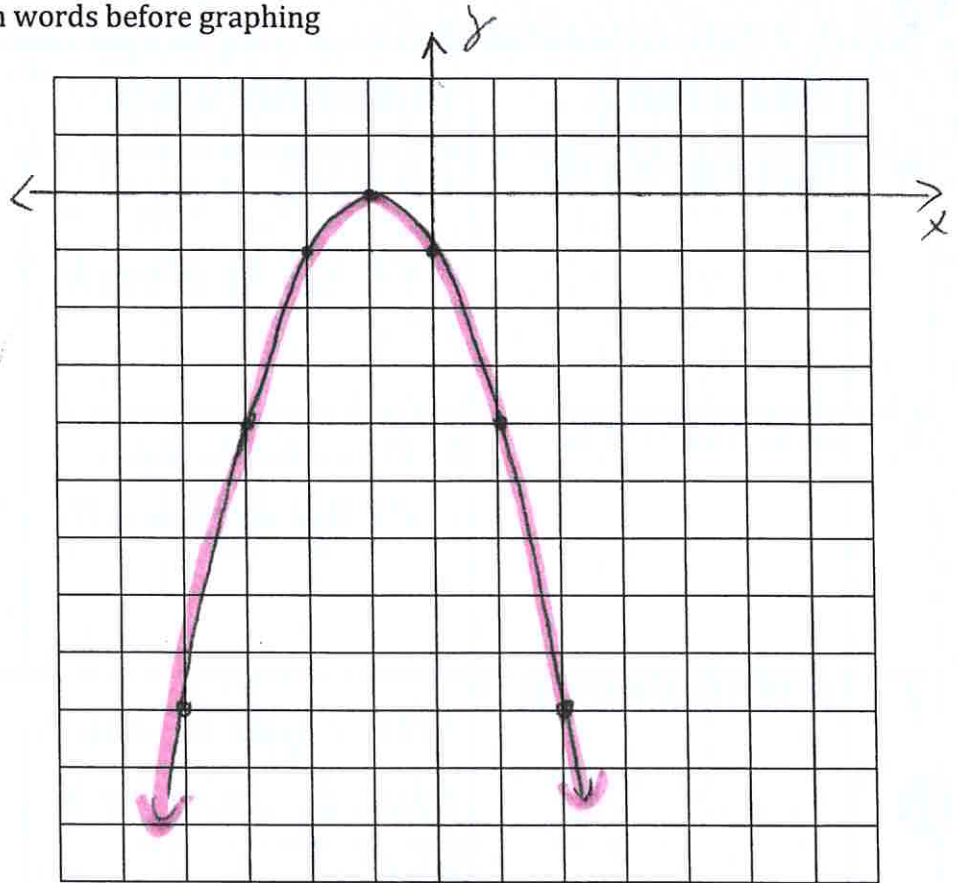
	Mapping notation	Transformations in words	Equation in vertex form
A	$(x, y) \rightarrow (x, -y + 10)$	<ul style="list-style-type: none"> <li>• R in the x-axis</li> <li>• VT up by 10 units</li> </ul>	$y = -(x-0)^2 + 10$ $\therefore y = -x^2 + 10$
B	$(x, y) \rightarrow (x, -y + 8)$	<ul style="list-style-type: none"> <li>• R in the x-axis</li> <li>• VT up by 8 units</li> </ul>	$\therefore y = -x^2 + 8$
C	$(x, y) \rightarrow (x + 5, 3y - 1)$	<ul style="list-style-type: none"> <li>• HT right by 5 units</li> <li>• VSE by a factor of 3</li> <li>• VT down by 1 unit</li> </ul>	$y = +3(x-5)^2 - 1$ $\therefore y = 3(x-5)^2 - 1$
D	$(x, y) \rightarrow (x - 3, 0.5y + 7)$	<ul style="list-style-type: none"> <li>• HT left by 3 units</li> <li>• VSE by a factor of <math>\frac{1}{2}</math></li> <li>• VT up by 7 units</li> </ul>	$y = \frac{1}{2}(x+3)^2 + 7$ <p>OR</p> $y = 0.5(x+3)^2 + 7$
E	$(x, y) \rightarrow (x - 5, y)$	<ul style="list-style-type: none"> <li>• HT left by 5 units</li> </ul>	$y = 1(x+5)^2 + 0$ $\therefore y = (x+5)^2$

## 2. Graphing a parabola using the mapping notation.

Strategy: Describe all transformations in words before graphing

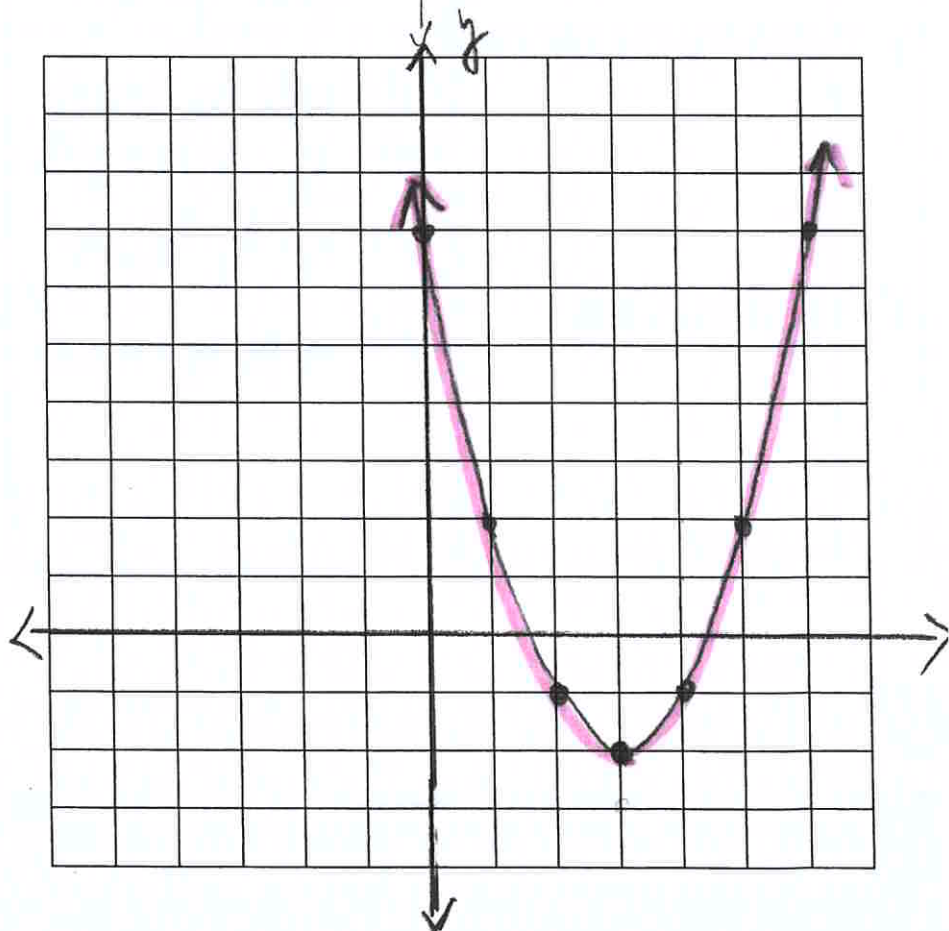
Ex. 1: Graph  $(x, y) \rightarrow (x - 1, -y)$

- HT left by 1 unit
- R in the  $x$ -axis



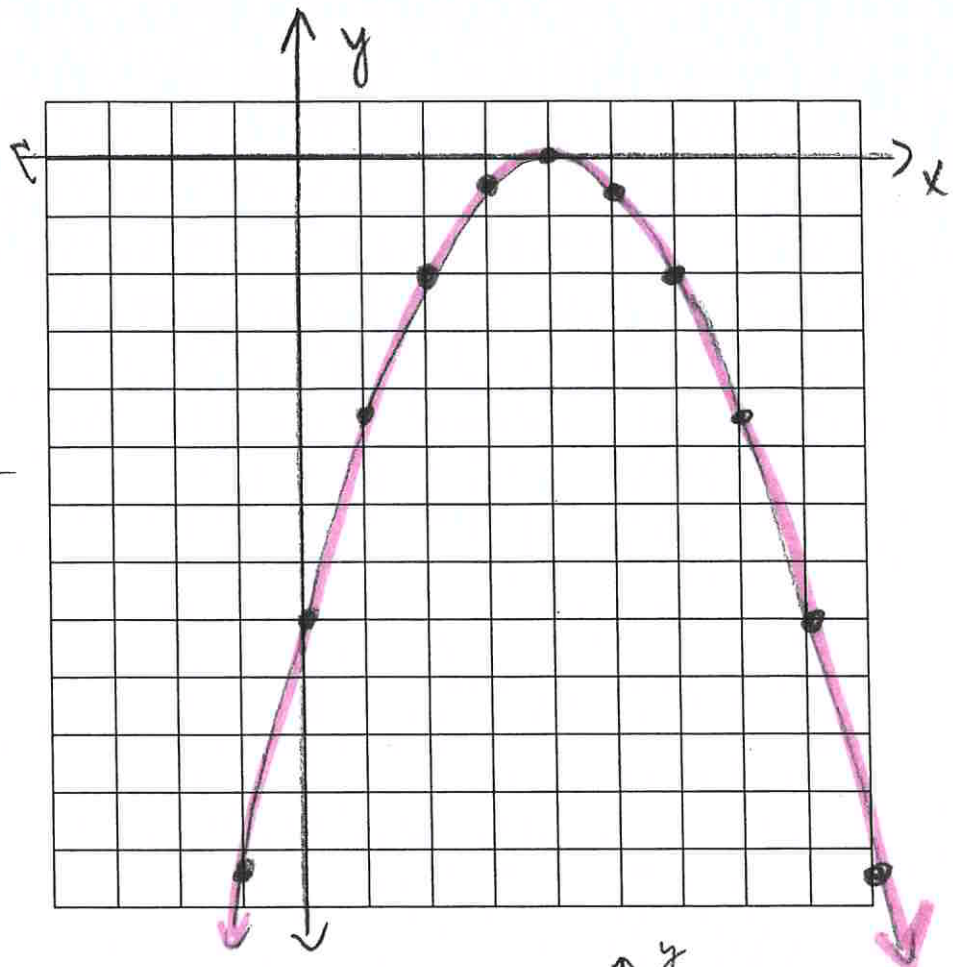
Ex. 2: Graph  $(x, y) \rightarrow (x + 3, y - 2)$

- HT right by 3 units
- VT down by 2 units



Ex. 3: Graph  $(x, y) \rightarrow (x + 4, -0.5y)$

- HT right by 4 units
- R in the  $x$ -axis
- VSC by a factor of  $\frac{1}{2}$



Ex. 4:  $(x, y) \rightarrow (x - 5, 2y - 7)$

- HT left by 5 units
- VSE by a factor of 2
- VT down by 7 units

