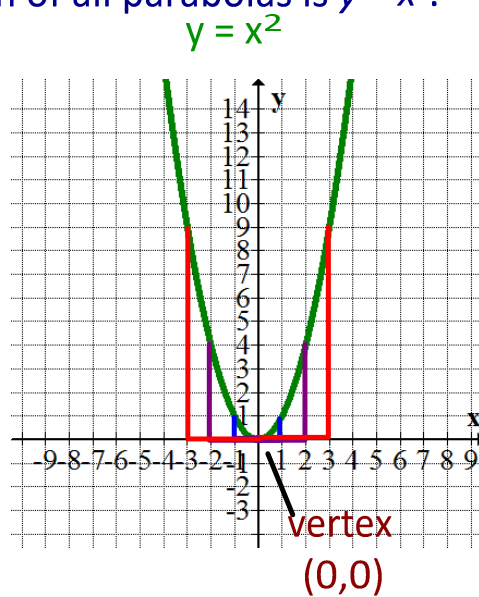


The base graph of all parabolas is  $y = x^2$ .

$x$	$y = x^2$
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



Pattern:  
*from the vertex*  
 over 1, up 1  
 over 2, up 4  
 over 3, up 9  
 ...

The Equation of a parabola in **vertex form** is

$$y = a(x - h)^2 + k$$

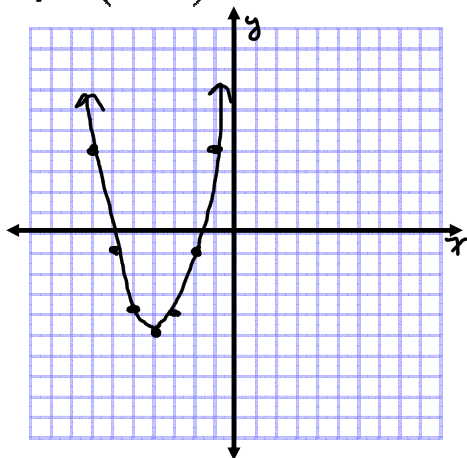
We investigated how **a**, **h**, and **k** make changes to the graph of  $y = x^2$

- a:** vertical stretch if  $a > 1$  stretch  
 $a > 0$  &  $a < 1$  compression
- h:** horizontal shift  
 ex.  $x - 3 = 3$  right if  $a < 0$  (negative)  
 $x + 2 = 2$  left reflected
- k:** vertical shift (up/down)

### How to Graph Using the Pattern Method

1. Identify and plot the Vertex  $(h, k)$
2. Determine the step pattern *(take normal pattern, multiply by a)*
3. graph the step points
4. Reflect each point across the  $y$ -axis
5. Draw a smooth curve between points

**Ex 1:** Sketch  $y = (x+4)^2 - 5$  opens: up  
 vertex:  $(-4, -5)$   $a=1$   $h=-4$   $k=-5$



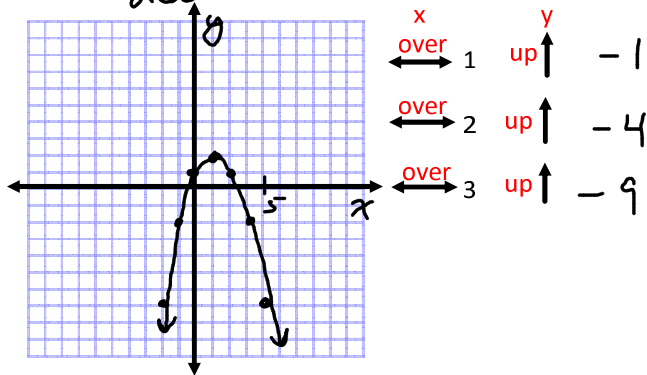
x	y
over 1	up 1
over 2	up 4
over 3	up 9

**Ex 2:** Sketch  $y = -(x-1)^2 + 2$

$$a = -1 \quad h = 1 \quad k = 2$$

vertex:  $(1, 2)$

opens: down

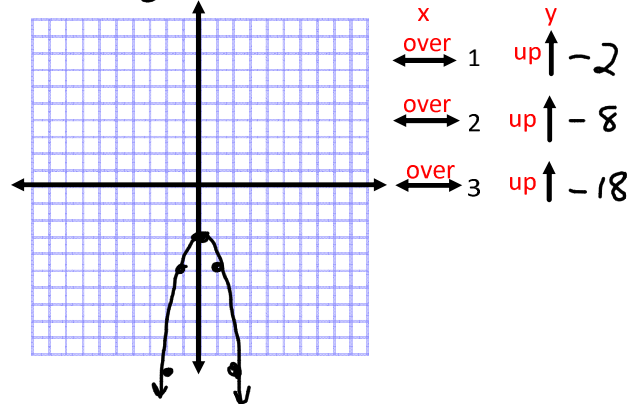


**Ex 3:** Sketch  $y = -2x^2 - 3$

$$a = -2 \quad h = 0 \quad k = -3$$

vertex:  $(0, -3)$

opens: down



Ex. 4 Write the equation of a quadratic relation that has undergone the following transformations:

- a) translated down 3 units and 7 units left

$$y = (x + 7)^2 - 3$$

- b) vertically stretched by a factor of 4 and translated 5 units down

$$y = 4x^2 - 5$$

- c) reflected over the x-axis and vertically compressed by a factor of 5

$$y = -\frac{1}{5}x^2$$

- d) vertically stretched by a factor of 3, translated 4 units left,  
translated ~~6 units up~~ 5 units down

$$y = 3(x + 4)^2 - 5$$

HOMEWORK: Handout!!!