MBF 3C1 Name: _____

Changing Quadratic Relations: The Values of 'h' and 'k'

Investigate $y = x^2 + k$

Function	Value of k in $y = x^2 + k$	Direction of Opening	Vertex	Axis of Symmetry	Same shape as $y = ax^2$?
a. $y = x^2$	0	up	(0, 0)	$x = 0$	
b. $y = x^2 + 2$	2	up	(0,2)	x=0	yes
c. $y = x^2 + 4$	4	up	(0,4)	x=0	yes
d. $y = x^2 - 1$	-1	up	(0,-1)	x=0	yes
e. $y = x^2 - 3$	-3	up	(0,-3)	x=0	yes

How does the value of k affect the basic parabola?

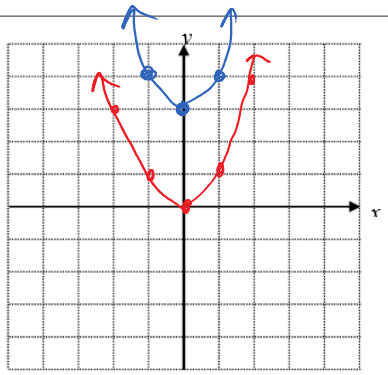
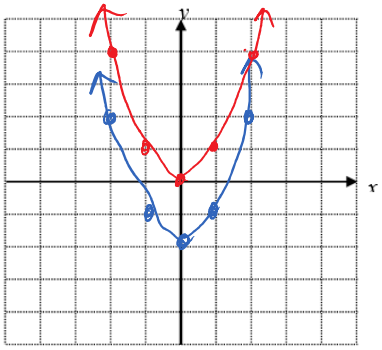
- when k is greater than 0, the parabola shifts up
- when k is less than 0, the parabola shifts down

The value of k describes the vertical translation of the parabola.

It is known as the optimal value or y-coordinate of vertex

Example 1

For each of the following, (i) state the transformations, and (ii) graph the parabola.

	$y = x^2 + 3$	$y = x^2 - 2$
(i) TRANSFORMATIONS	a=1 → nothing k=3 → shift up	a=1 → nothing k=-2 → shift down
(ii) GRAPH		

MBF 3C1 Name: _____

Investigate $y = (x - h)^2$

✶ **To determine the value of *h*, remove it from the brackets by setting the expression equal to zero and solving.** ✶

Function	Value of *h* in $y = (x - h)^2$	Direction of Opening	Vertex	Axis of Symmetry	Same shape as $y = ax^2$?
a. $y = x^2$	0	up	(0, 0)	$x = 0$	
b. $y = (x-2)^2$	$x-2=0$, $x=2$	up	(2,0)	$x=2$	yes
c. $y = (x-4)^2$	$x-4=0$, $x=4$	up	(4,0)	$x=4$	yes
d. $y = (x+1)^2$	$x+1=0$, $x=-1$	up	(-1,0)	$x=-1$	yes
e. $y = (x+3)^2$	$x+3=0$, $x=-3$	up	(-3,0)	$x=-3$	yes

How does the value of *h* affect the basic parabola?

- when *h* is greater than 0, the parabola shifts ___right___ (h pos., # in bracket neg.)
- when *h* is less than 0, the parabola shifts ___left___ (h neg, # in bracket pos.)

The value of *h* describes the ___horizontal translation___ of the parabola.

It provides the value for the ___axis of symmetry___ and is the ___x-coordinate of the vertex___

Example 2

For each of the following, (i) state the transformations, and (ii) graph the parabola.

	$y = (x+2)^2 - 3$	$y = (x-3)^2 + 1$
(i) TRANSFORMATIONS	$a=1$ → nothing $h=-2$ → shift left $k=-3$ → shift down	$a=1$ → nothing $h=3$ → shift right $k=1$ → shift up
(ii) GRAPH