Key

Transformations

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

A negative out front means it reflects over the x-axis

Inside ( ) means horizontal shift:
+ moves to left
- moves to right

>1= vertical stretch (narrow)

Between 0 and 1 = vertical compression/ shrink (wide)

Outside of ( ) means vertical shift:
+ moves up
- moves down

Example

$f(x) = -2(x-5)^2 + 7$

1. (-) negative up front; it reflects over x axis
2. 2 is >1: there is a vertical stretch (it will be skinnier)
3. -5 is in ( ); moves right 5 spaces
4. +7 outside ( ); moves up 7 spaces

Example

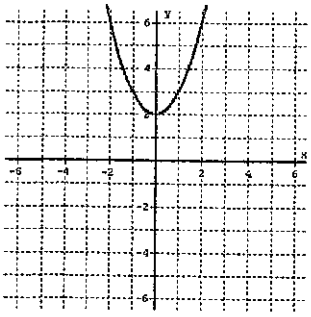
$f(x) = \frac{1}{2}(x+1)^2 - 9$

1. ½ is between 0 and 1; there is a shrink
2. +1 is in ( ); it moves left 1 space
3. -9 is outside ( ); moves down 9

Directions: Describe each transformation and name the vertex.

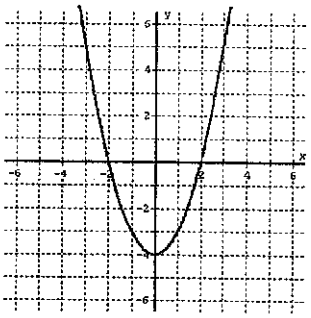
Graph	Vertex	Describe the transformation(s)
$y = x^2 + 4$	(0,4)	up 4
$y = x^2 - 1$	(0,-1)	down 1
$y = 2x^2$	(0,0)	Vertical Stretch → skinny
$y = -x^2 + 6$ $a=1$ $b=0$ $c=6$	$\frac{-0}{2(1)}=$ (0,6)	reflect over x-axis;
$y = \frac{1}{4}(x - 3)^2$	(3,0)	horizontal shift: vt 3 Vertical compression / shrink
$y = -3(x + 2)^2$	(-2,0)	horizontal shift left 2 Vertical Stretch; reflect over x-axis
$y = (x - 1)^2 + 3$	(1,3)	up 3, rt 1
$y = 2(x + 6)^2$	(-6,0)	vertical stretch Left 6
$y = (x - 3)^2 - 5$	(3,-5)	right 3 down 5
$y = -\frac{1}{2}(x + 4)^2 + 5$	(-4,5)	reflect over x-axis vertical compression left 4, up 5

Transformations of $y = f(x) = x^2$



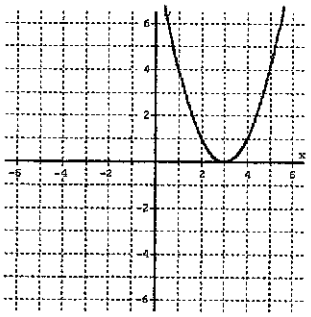
Vertical Shift – Up 2

$y = x^2 + 2$



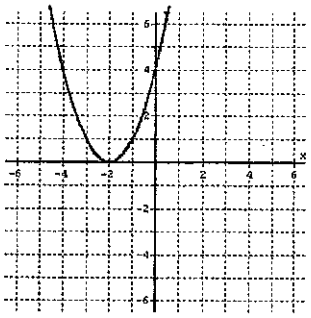
Vertical Shift – Down 4

$y = x^2 - 4$



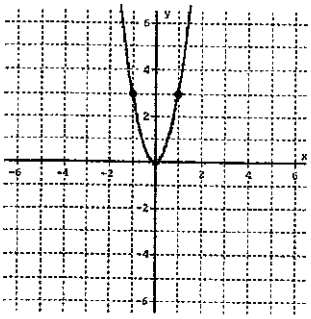
Horizontal Shift – Right 3

$y = (x - 3)^2$



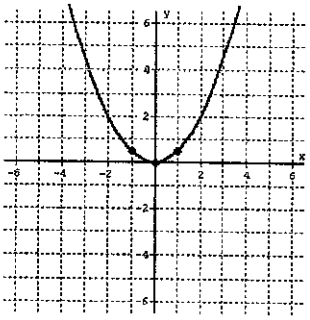
Horizontal Shift – Left 2

$y = (x + 2)^2$



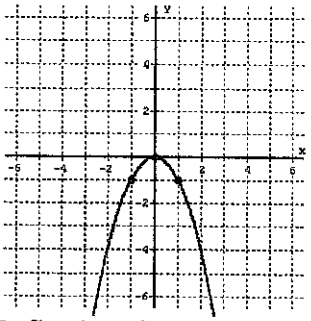
Vertical Stretch
Steeper / Narrower

$y = 3x^2$



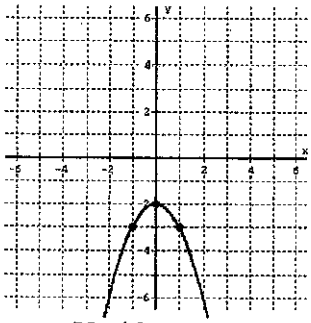
Vertical Compression
Flatter / Wider

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



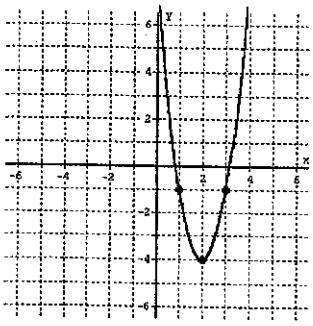
Reflection about the x-axis
Upside Down

$y = -x^2$



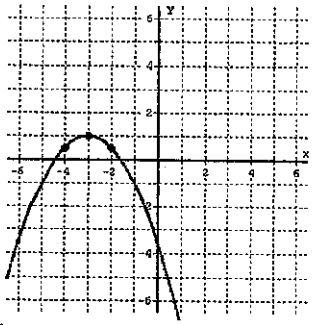
Upside Down
and Down 2

$y = -x^2 - 2$



Steeper, Opens Up, Right 2, Down 4

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



Wider, Opens Down, Left 3, Up 1

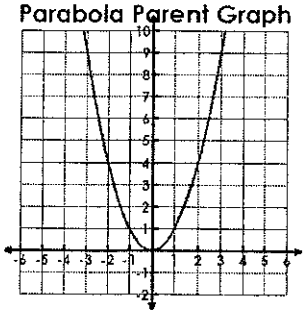
$y = -\frac{1}{2}(x + 3)^2 + 1$

Name: _____ Date: _____

Transformations of Vertex Form

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

Parabola Parent Graph



What does *a* do?
- reflect across the x-axis. (–a)
- vertical stretch (a >1)
- vertical shrink (0<a<1)

What does *h* do?
- moves left (+h)
- moves right (–h)

What does *k* do?
- moves up (+k)
- moves down (–k)

Determine what transformations are applied in the following functions.

1. $f(x) = (x-3)^2 + 5$

Right 3
up 5

2. $f(x) = -(x-2)^2 + 7$

Reflect over x-axis
right 2
up 7

3. $f(x) = \frac{1}{3}(x+3)^2 - 2$

Vertical Compression/shrink
Left 3
Down 2

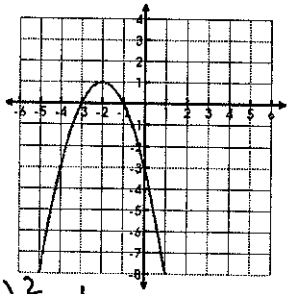
4. $f(x) = 4(x-3)^2 + 8$

Vertical stretch
right 3
up 8

Vertex: (h,k)	Axis of Symmetry: $x = h$

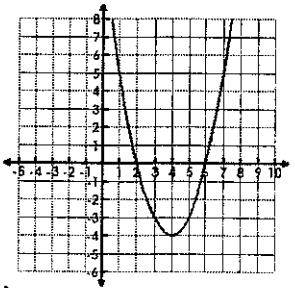
Given the graph of the quadratic, find a, h, & k. Then write the equation in vertex form.

5.



- a = -1
- h = -2
- k = 1
- f(x) = $-(x+2)^2+1$

6.



- a = 1
- h = 4
- k = -4
- f(x) = $(x-4)^2 - 4$