QUADRATIC TRANSFORMATIONS

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

1. Being specific, name 3 ways that a parabola changes with different types of "*a*" values.

① $-a \rightarrow$ reflected over x-axis ② $|a|>1$ vert. stretch (narrow) ③ $0<|a|<1$ vert comp. (wide)

2. If "*h*" is positive how does the parabola move? If negative?

slides right slides left

3. If "*k*" is positive how does the parabola move? If negative?

slides up slides down

4. What conclusion can you make about the variables of *h* and *k* together?

h,k is the vertex of the parabola

Describe how the following equations transformed from $y = x^2$.

5. $y = 3x^2 - 5$ $a=3$ vert. stretch $k=-5$ slides 5 down

6. $y = 1/2(x + 1)^2$ $a=\frac{1}{2}$ vert. comp. $h=-1$ slides 1 left

7. $y = -2(x - 3)^2 + 4$ $a=-2$ refl. x-axis, vert stretch $h=3$ right 3 $k=4$ up 4

8. $y = -(x + 5)^2 - 3$ $a=-1$ refl. x-axis $h=-5$ left 5 $k=-3$ down 3

Write the quadratic equations under the specific transformations from f(x) to form h(x).

9. $f(x) = x^2$ $1(x-0)^2+0$
   - translated 1 unit to the right
   - translated 5 units down

	f(x)	Transformation	h(x)
a	1	No Change	1
h	0	1 right Add 1 →	1
k	0	5 down subtr. 5 →	-5

h(x) = $(x-1)^2-5$

10. $f(x) = x^2$
    - vertical compression of ½
    - reflect across the x-axis
    - translated 3 units up

	f(x)	Transformation	h(x)
a	1	comp and refl. mult by $-\frac{1}{2}$ →	$-\frac{1}{2}$
h	0	No change →	0
k	0	up 3 add 3 →	+3

h(x) = $-\frac{1}{2}(x-0)^2+3 \rightarrow h(x) = -\frac{1}{2}x^2+3$

11. $f(x) = x^2 + 5$ $1(x-0)^2+5$
    - reflected over the x-axis
    - translated 2 units to the left

	f(x)	Transformation	h(x)
a	1	refl. x-axis mult by -1 →	-1
h	0	2 left Add 2 →	+2
k	5	No Change	+5

h(x) = $-(x+2)^2+5$

12. $f(x) = 2(x + 3)^2 + 1$
    - vertical stretch of 3
    - translated 4 units to the right
    - translated 2 units up

	f(x)	Transformation	h(x)
a	2	stretch mult by 3 →	6
h	-3	4 right Add 4 →	+1
k	+1	2 up Add 2 →	+3

h(x) = $6(x-1)^2+3$