Name: Key

Math 20-1
Quadratic Functions and Equations
Assignment 3: Analyzing Quadratic Functions- Part 2

1. Describe how the graphs of the following functions relate to the graph of $y = x^2$

a. $y = -3x^2$	b. $y = x^2 - 15$
vertical stretch by a factor of 3, reflection in x-axis	horizontal translation 15 units down
c. $y = -\frac{2}{3}(x+4)^2 - 1$	d. $\frac{2y}{2} = \frac{(x-8)^2}{2} + \frac{12}{2}$
vertical stretch by a factor of 2/3, reflection in x axis, horizontal translation 4 units left + vertical translation 1 unit down.	$y = \frac{1}{2}(x-8)^2 + 6$ vertical stretch by a factor of $\frac{1}{2}$, horizontal translation 8 units right + vertical translation 6 units up.

2. The following transformations are applied to the graph $y = x^2$ in the order given. Write the equation of the image function for each.

a. A reflection in the x-axis and a vertical stretch by a factor 4 about the x-axis.

$y = x^2 \rightarrow y = -x^2 \rightarrow y = -4x^2$

b. A vertical stretch by a factor of $\frac{3}{5}$ about the x-axis, and a translation of 5 units down.

$y = x^2 \rightarrow y = \frac{3}{5}x^2 \rightarrow y = \frac{3}{5}x^2 - 5$

c. A vertical stretch by a factor of 8 about the x-axis, a reflection in the x-axis, a vertical translation of 3 units up, and a horizontal translation 9 units left.

$y = x^2 \rightarrow y = 8x^2 \rightarrow y = -8x^2 \rightarrow y = -8(x+9)^2 + 3$

d. A vertical stretch by a factor of c about the x-axis, a reflection in the x-axis, and a translation of e units right and f units down.

$y = x^2 \rightarrow y = cx^2 \rightarrow y = -cx^2 \rightarrow y = -c(x-e)^2 - f$

3. Complete the following table.

Function	Vertex	Max/Min Value	Equation of Axis of Symmetry	Domain	Range
$y = 3x^2$	$(0,0)$	min 0	$x = 0$	$x \in R$	$y \mid y \geq 0, y \in R$
$y = 2x^2 + 1$	$(0,1)$	min 1	$x = 0$	$x \in R$	$y \mid y \geq 1, y \in R$
$y = -(x+7)^2$	$(-7,0)$	max 0	$x = -7$	$x \in R$	$y \mid y \leq 0, y \in R$
$y - 10 = (x+5)^2$	$(-5,10)$	min 10	$x = -5$	$x \in R$	$y \mid y \geq 10, y \in R$
$y + 3 = -3(x-1)^2 + 2$	$(1,-1)$	max -1	$x = 1$	$x \in R$	$y \mid y \leq -1, y \in R$

4. The following transformations are applied, in order, to the graph $y = x^2$:
   - A reflection in the x-axis
   - A vertical stretch of factor 3 about the x-axis
   - A translation of 5 units right and 2 units down

a. Find the equation of the image function after each transformation.

$$y = x^2 \rightarrow y = -x^2 \rightarrow y = -3x^2 \rightarrow y = -3(x-5)^2 - 2$$

b. At the end of all the transformations, the point P(4, y) is on the final graph of the parabola. Find the y-coordinate for the final graph when $x = \cancel{8}\ 4$

$$y = -3(x-5)^2 - 2$$
$$y = -3(4-5)^2 - 2$$
$$y = -3(-1)^2 - 2$$
$$y = -3 - 2$$
$$\underline{y = -5}$$

5. Write the equation of a quadratic function which is the image of $y = x^2$ after a vertical stretch about the x-axis by the given factor of a, and after a translation which results in the given vertex.

a. $a = 3$, Vertex (4, -1)

$$y = 3(x-4)^2 - 1$$

b. $a = \frac{1}{2}$, Vertex (-3, 2)

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

c. $a = -4$, Vertex (0, 5)

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

d. $a = -\frac{1}{3}$, Vertex (-6, -3)

$$y = -\frac{1}{3}(x+6)^2 - 3$$