

$|a| \rightarrow$ absolute value of "a"
 \rightarrow always positive

Transformations on the Quadratic Function

If we put all of the transformations on the quadratic equation together, we have:

if $|a| > 1 \rightarrow$ vert. stretch
 if $0 < |a| < 1 \rightarrow$ vert. comp.
 if $a > 0$, parabola opens up
 if $a < 0$, parabola is flipped (opens down)

if $h > 0 \rightarrow$ shift right
 if $h < 0 \rightarrow$ shift left

if $k > 0 \rightarrow$ shift up
 if $k < 0 \rightarrow$ shift down

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

The quadratic function also has the following properties:

if $a > 0$ (opens up)	if $a < 0$ opens down
Direction of Opening: <u>up</u>	Direction of Opening: <u>down</u>
Vertex: <u>(h, k)</u>	Vertex: <u>(h, k)</u>
Axis of Symmetry: <u>x = h</u>	Axis of Symmetry: <u>x = h</u>
<u>Minimum</u> Value: <u>y = k</u>	<u>Maximum</u> Value: <u>y = k</u>
Domain: <u>{x ∈ ℝ}</u>	Domain: <u>{x ∈ ℝ}</u>
Range: <u>{y ∈ ℝ y ≥ k}</u>	Range: <u>{y ∈ ℝ y ≤ k}</u>

For each of the following quadratic functions:

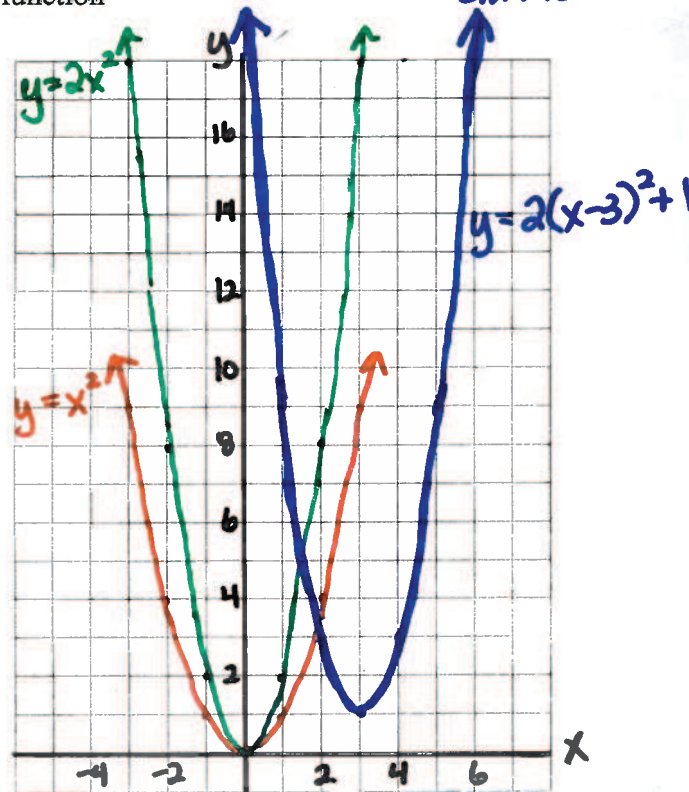
- list the transformations applied to $y = x^2$
- draw the graph of the function
- state the properties of the function

-state flips, stretch/comp. first then shifts

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

-vert. stretched by factor 2
 -shifted right 3 and up 1

Direction of Opening: up
 Vertex: (3, 1)
 Axis of Symmetry: x = 3
 Max (Min) Value: y = 1
 Domain: {x ∈ ℝ}
 Range: {y ∈ ℝ | y ≥ 1}



2. $y = -(x-4)^2 + 2$

- flip on x-axis

- shifted right 4 and up 2

Direction of Opening:

down

Vertex:

(4, 2)

Axis of Symmetry:

$x = 4$

Max/Min Value:

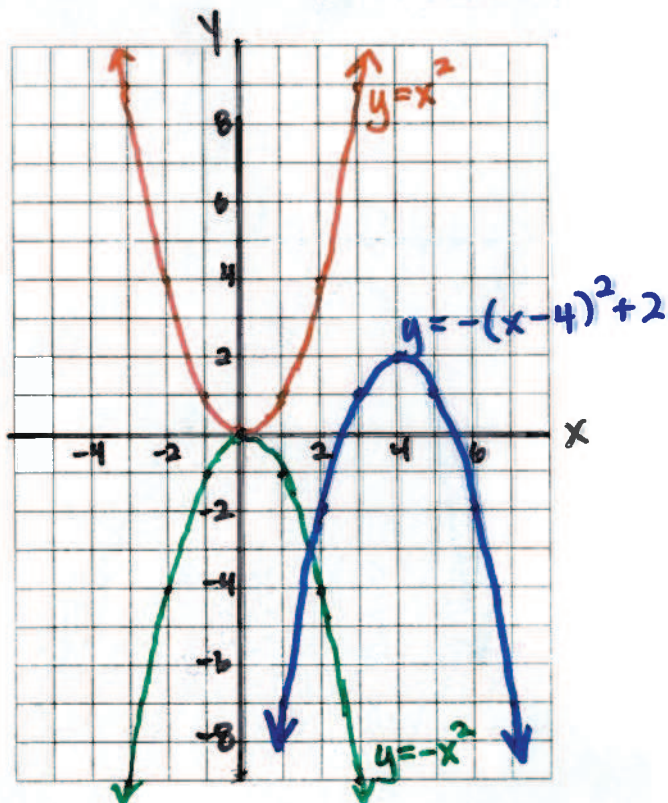
$y = 2$

Domain:

$\{x \in \mathbb{R}\}$

Range:

$\{y \in \mathbb{R} \mid y \leq 2\}$



3. $y = \frac{1}{2}(x+5)^2$

- vert. compression by factor 2.

- shifted left 5 units

Direction of Opening:

up

Vertex:

(-5, 0)

Axis of Symmetry:

$x = -5$

Max/Min Value:

$y = 0$

Domain:

$\{x \in \mathbb{R}\}$

Range:

$\{y \in \mathbb{R} \mid y \geq 0\}$

