Types of Quadratic Equations - Investigating into Vertex Form

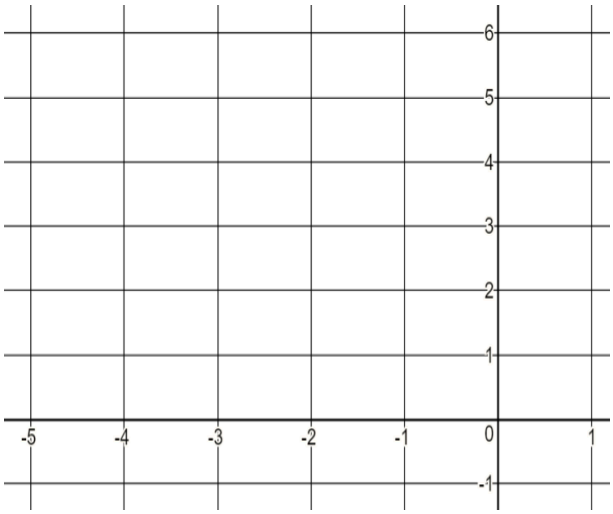
Standard Form	Factored (or Intercept) Form	Vertex Form
$y = ax^2 + bx + c$	$y = a(x - p)(x - q)$	$y = a(x - h)^2 + k$

Warm-Up:

This quadratic equation is given in **vertex form**:

$y = (x + 2)^2 + 1$

a. Change it to **standard form**.
b. Find the y-intercept by setting x = 0.
c. Use x = -b/2a to find the vertex.
d. Use d = b/a to find the distance from the y-intercept to another point on the parabola.
e. Plot the 3 points and connect to graph the parabola.



Investigation

1. Using Desmos, add the vertex form equation, creating sliders for a, h, and k. Keeping a = 1, change the values of h and k. Observe what happens.

2. Explain the effect of changing h.

3. Explain the effect of changing k.

4. What part of the parabola do h and k represent?

5. For each vertex form quadratic, state the vertex.
Then, change to a standard form equation and use the $x_{vertex} = \frac{-b}{2a}$ formula to verify the vertex.

$y = (x + 3)^2 + 5$ $y = (x + 1)^2 - 4$ $y = (x - 2)^2 + 7$ $y = (x - 7)^2 - 1$

6. Based on what you discovered above, write a vertex form equation (where a = 1) for the parabola with each vertex.

a) vertex: (2, 1)

b) vertex: (-3, 4)

c) vertex: (6, -2)

d) vertex: (0, 3)

e) vertex: (-7, 0)

f) vertex: (0, 0)

Practice:

For **1** to **6**, state the coordinates of the vertex of each quadratic function and determine if the quadratic is concave up or concave down.

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

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

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

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

5 $y = -x^2 + 2$

6 $y = 3x^2 - 1$

Your goal is to take $y = (x + 3)^2 - 2$ and flip it upside down but keep the same x-intercepts.

Vlad argues that you just have to make "a" negative, giving you the equation: $y = -(x + 3)^2 - 2$

Olga argues that you have to make the entire function negative, so $y = -(x + 3)^2 + 2$

Who is right, who is wrong? (use Desmos to help)