

Day 5 – Writing Equations of Parabolas from a Graph

Vertex Form

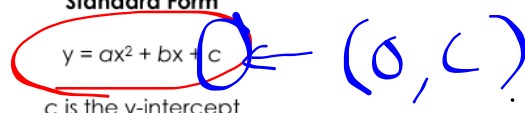
$$y = a(x - h)^2 + k$$

(h, k) is the vertex

Standard Form

$$y = ax^2 + bx + c$$

c is the y-intercept



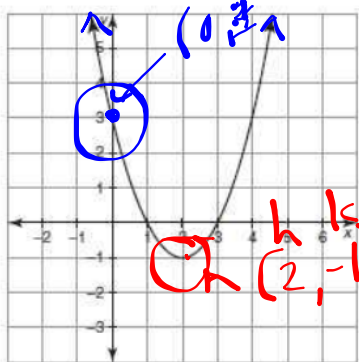
a always determines the way the graph opens

Writing Equations of Parabolas Given a Graph

For the following graphs:

- A. Create an equation in both ~~intercept~~ and vertex form to describe the parabola. Assume there are no stretches or shrinks with each graph. $a = 1, -1$
- B. Once you created both equations, convert both to standard form. Check to make sure the y-intercepts match both the graph and the equations in standard form.
- C. Put all three equations into your graphing calculator. Do you get the same graph for all three equations?

a.



Vertex Form

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

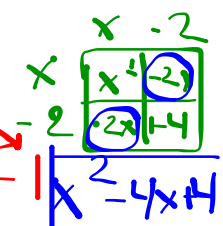
$$VF: y = (x - 2)^2 - 1$$

Standard Form

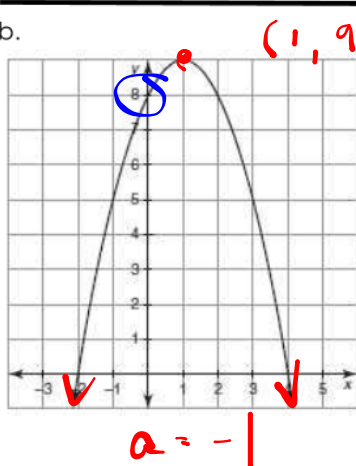
$$y = (x - 2)(x - 2)$$

$$SF: y = x^2 - 4x + 4 - 1$$

$$SF: y = x^2 - 4x + 3$$



b.



Vertex Form

$$y = -(x - 1)^2 + 9$$

Standard Form

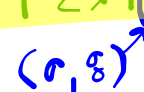
$$y = -(x - 1)(x - 1) + 9$$

$$y = -(x^2 - x - x + 1) + 9$$

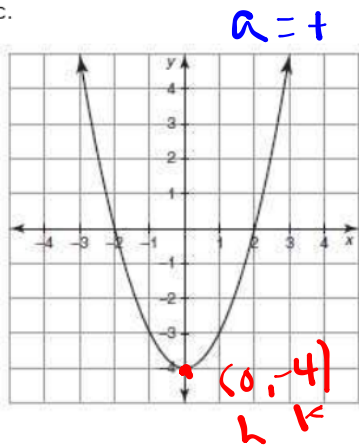
$$y = -(x^2 - 2x + 1) + 9$$

$$y = -x^2 + 2x - 1 + 9$$

$$SF: y = -x^2 + 2x + 8$$



Algebra 1
c.



Unit 6: Quadratic Functions $y = a(x-h)^2 + k$ Notes
Vertex Form

$$y = +(x-0)^2 + -4$$

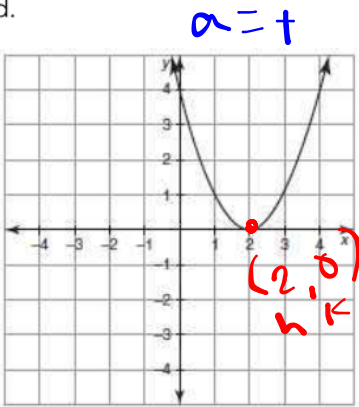
$$VF: y = x^2 - 4$$

Standard Form

$$SF: y = x^2 - 4$$

Same when expanded

d.



Vertex Form

$$y = +(x-2)^2 + 0$$

$$VF: y = (x-2)^2$$

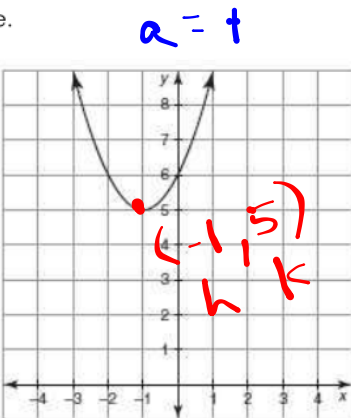
Standard Form

$$y = (x-2)(x-2)$$

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

$$SF: y = x^2 - 4x + 4$$

e.



Vertex Form

$$y = +(x+1)^2 + 5$$

$$VF: y = (x+1)^2 + 5$$

Standard Form

$$y = (x+1)(x+1) + 5$$

$$y = x^2 + 2x + 1 + 5$$

$$SF: y = x^2 + 2x + 6$$

 Converting between Forms

Vertex to Standard – Expand your squared binomial, multiply the binomials, and add constants. Multiply a value through last.

a. $y = (x-5)^2 - 12$

expand
 $y = (x-5)(x-5) - 12$
 $y = x^2 - 10x + 25 - 12$
 $y = x^2 - 10x + 13$

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

expand
 $y = -3(x+1)(x+1) + 4$
 $y = -3(x^2 + 2x + 1) + 4$
 $y = -3x^2 + -6x - 3 + 4$
 $y = -3x^2 - 6x + 1$

Standard to Vertex - Determine your vertex (h, k) and keep the same a-value.

a. $y = x^2 + 4x + 3$

a: 1
 b: 4 $x = \frac{-b}{2a}$
 c: 3 $x = \frac{-4}{2(1)} = -2$

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

$$y = 4 + -8 + 3 = -1$$

$$\begin{pmatrix} -2 & -1 \\ h & k \end{pmatrix}$$

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

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

b. $y = x^2 + 6x - 5$

a: 1
 b: 6 $x = \frac{-b}{2a} = -3$
 c: -5 $y = (-3)^2 + 6(-3) - 5$
 $y = 9 + -18 - 5$
 $y = -14$

$$\begin{pmatrix} -3 & -14 \\ h & k \end{pmatrix}$$

$$y = 1(x+3)^2 + -14$$

$$y = (x+3)^2 - 14$$