

Example 4

$$f(x) = -\frac{1}{2}(x+8)^2 + 14$$

$$= -\frac{1}{2}(x+8)(x+8) + 14$$

$$= -\frac{1}{2}[x(x+8) + 8(x+8)] + 14$$

$$= -\frac{1}{2}[x^2 + 8x + 8x + 64] + 14$$

$$= -\frac{1}{2}[x^2 + 16x + 64] + 14$$

$$= -\frac{1}{2}x^2 - 8x - 32 + 14$$

$$f(x) = -\frac{1}{2}x^2 - 8x - 18$$

Vertex:  $(-8, 14)$       Y-Int:  $(0, -18)$

## Converting Quadratic Equations between Standard and Vertex Forms

### What am I learning today?

How to convert a quadratic between different equation types

### How will I show that I learned it?

Convert a quadratic equation from vertex form to standard form and from standard form to vertex form

## Forms of quadratics:

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

$$y = 5x^2 + 3x - 2$$

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

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

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

$$y = 6x^2 + 7$$

## Converting Quadratics from Standard to Vertex Form

*Let's Review – How did we label a, b, and c in quadratic trinomials?*

Ex. 1  $x^2 + 9x - 3$

Ex. 2  $2x^2 - 5x - 3$

Ex. 3  $-\frac{1}{3}x^2 - 4$

Ex. 4  $3x^2 + x$

VF!

	a	b	c
$x^2 + 9x - 3$	1	9	-3
$2x^2 - 5x - 3$	2	-5	-3
$-(1/3)x^2 - 4$	$-\frac{1}{3}$	0	-4
$3x^2 + x$	3	1	0

To convert from STANDARD FORM to VERTEX FORM:  $y = ax^2 + bx + c \rightarrow y = a(x - h)^2 + k$

1. Label a, b, and c.
2. Find the X-VALUE OF THE VERTEX, "h", by plugging "a" and "b" into the formula  $h = -\frac{b}{2a}$
3. Plug your "h" back in for the X-VALUES in your equation. Solve for Y. This is "k", the Y-VALUE OF THE VERTEX.
4. Label a, h, and k.
5. Plug into the vertex form  $y = a(x - h)^2 + k$ .

$$y = a \left( x - \frac{h}{h} \right)^2 + k$$

Example 1

$$f(x) = x^2 + 6x + 8$$

$$h = -\frac{b}{2a} = -\frac{6}{2(1)} = -\frac{6}{2} = -3$$

$$a = 1$$

$$b = 6$$

$$c = 8$$

$$k: (\text{plug in!}) = \underline{\underline{(-3)^2}} + 6(-3) + 8$$

$$= -1$$

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

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

Vertex:  $\underline{\underline{(-3, -1)}}$   
V.F.

Y-Int:  $\underline{\underline{(0, 8)}}$   
S.F.

Example 2  $f(x) = 2x^2 - 4x + 5$ 

$$h = \frac{4}{2(2)} = \frac{4}{4} = 1$$

$$a = 2$$

$$b = -4$$

$$c = 5$$

$$k = 2(1)^2 - 4(1) + 5 = 3$$

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

Vertex:  $(1, 3)$       Y-Int:  $(0, 5)$ 

$$f(0) = 2(0 - 1)^2 + 3 = 5$$

Example 3  $f(x) = -x^2 + 6x + 9$ 

$$h = \frac{-6}{2(-1)} = \frac{-6}{-2} = 3$$

$$a = -1$$

$$b = 6$$

$$c = 9$$

$$k = -(3)^2 + 6(3) + 9 = 18$$

$$f(x) = -1(x - 3)^2 + 18$$

Vertex:  $(3, 18)$       Y-Int:  $(0, 9)$

Example 4  $f(x) = -\frac{1}{2}x^2 - 10x$

$a = -\frac{1}{2}$

$b = -10$

$c = 0$

$$h = \frac{10}{2(-\frac{1}{2})} = \frac{10}{-1} = -10$$

$$k = -\frac{1}{2}(-10)^2 - 10(-10) = 50$$

$$f(x) = -\frac{1}{2}(x+10)^2 + 50$$

Vertex:  $(-10, 50)$       Y-Int:  $(0, 0)$