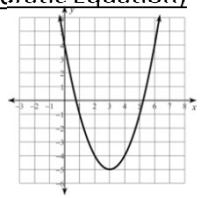
SM3-A HANDOUT 2-7 (Vertex Form Quadratic Equation)

$y = x^2 - 6x + 4$ *Non-factorable*

The x-intercepts are *"ugly"*

What is the vertex form equation? $y =$_____



Standard Form Equation

$y = x^2 - 6x + 4$

Vertex Form Equation

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

How could you get the x-intercepts from the *vertex form equation*?

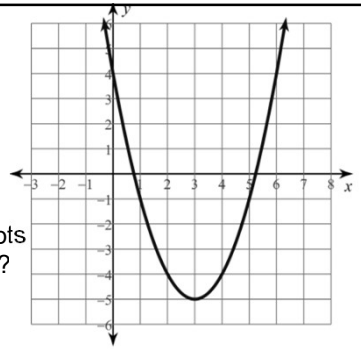
Set 'y' to zero. Isolate the square, "undo" the square.

$0 = (x-3)^2 - 5$

$5 = (x-3)^2$

$\pm\sqrt{5} = x - 3$

$x = 3 \pm \sqrt{5}$



Find the X-intercepts from the Vertex Form Equations

$y = -2(x-3)^2 + 4$ Set y = 0 (y-value of an x-int. is 0)

Add 8 (left/right)

Divide by 4 (left/right)

$2 = (\_\_\_\_)^2$ What number, squared, equals 2?

$2 = \left(\sqrt{2}\right)^2$ $2 = \left(-\sqrt{2}\right)^2$

$\pm\sqrt{2} = x - 5$ The expression inside of the parentheses equals either _____ or _____

$x = 5 \pm \sqrt{2}$ Add 5 (left/right)

Find the X-intercepts from the Vertex Form Equations

$y = (x-5)^2$

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

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

What have we learned?

1. The quadratic formula can give us x-intercepts (only if you have the ***standard form equation***).

Lots of numbers and calculations. Easy to make a mistake.

2. If you "isolate the square, undo the square" on the ***vertex form equation***, you can also find x-intercepts.

You have to know how to simplify square roots.

$y = (x-2)^2 - 12$

$0 = (x-2)^2 - 12$

$12 = (x-2)^2$

$x = 2 \pm \sqrt{12}$

$x = 2 \pm \sqrt{4*3}$

$x = 2 \pm \sqrt{4}\sqrt{3}$

$x = 2 \pm 2\sqrt{3}$

3. You can convert ***standard form quadratic equations*** into ***intercept form quadratic equations*** by: *factoring*

$y = 2x^2 + 16x + 24$ $\rightarrow y = 2(x+6)(x+2)$

4. You can convert ***intercept form quadratic equations*** into ***vertex form quadratic equations*** by:

a) Finding the x-coordinate of the vertex (half way between x-intercepts) $x = -6, -2$ Vertex: $(-4, \_\_\_)$

b) Substituting the x-value into the equation to find the y-coordinate of the vertex. $y = 2(-4+6)(-4+2)$

$y = 2(2)(-2) = -8$ Vertex: $(-4, -8)$

c) Using the VSF and the vertex to write the vertex form equation.

VSF = 2, Vertex: $(-4, -8)$ $y = 2(x+4)^2 - 8$

How can we convert ***Standard Form Quadratic Equations*** directly into ***Vertex form***? (without converting to ***Intercept Form*** first?)

The quadratic formula:

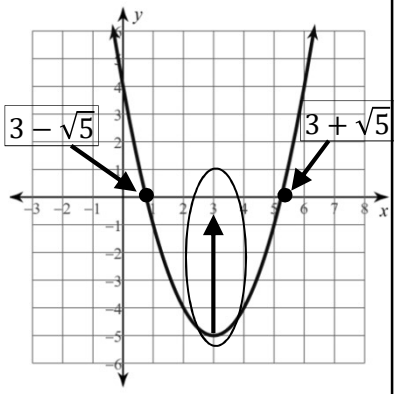
$y = x^2 - 6x + 4$

$x = \frac{-b}{2a} \pm \frac{\sqrt{b^2-4ac}}{2a}$

$x = 3 \pm \sqrt{5}$

The x-coordinate of the vertex is 3.

x-coord. of vertex = $\frac{-b}{2a}$



What is the vertex form equation?

$y = 2x^2 + 16x + 24$ x-coord. of vertex = $\frac{-b}{2a}$

a = 2 b = 16

$\frac{-b}{2a} = \frac{-16}{2(2)} = -4$

Vertex: $(-4, f(-4))$

What is the y-coordinate of the vertex?

$f(-4) = 2(-4)^2 + 16(-4) + 24$

$f(-4) = -8$ Vertex: $(-4, -8)$

What is the Vertex form equation?

VSF $= 2$, vertex $= (-4, -8)$ $y = 2(x+4)^2 - 8$

What is the vertex form equation?

$y = x^2 - 6x + 13$

a = 1 b = -6

x-coord. of vertex = $\frac{-b}{2a}$

$y = 3x^2 + 6x - 12$

We converted these *standard form equations* into *vertex form*. What are the x-intercepts of the following equations?

$y = 2x^2 + 16x + 24$ → $y = 2(x + 4)^2 - 8$

$y = x^2 - 6x + 13$ → $y = (x - 3)^2 + 4$

$y = 3x^2 - 6x - 12$ $y = 3(x + 1)^2 - 15$

Convert the following *non-factorable* standard form equations into vertex form. Find the x-intercepts.

$y = x^2 - 2x - 12$

$y = x^2 + 20x + 99$

$y = x^2 - 14x + 50$