Chapter 9 Day 4:

Today you will learn how to rewrite a quadratic in Vertex Form. This process is known as completing the square.

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

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

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

$2(x-3)(x-3)+1$ FOIL

$2(x^2 - 3x - 3x + 9) + 1$

$2(x^2 - 6x + 9) + 1$

$2x^2 - 12x + 18 + 1$

$y = 2x^2 - 12x + 19$

First I will take you through a problem, then I will give you the steps. This way the steps will make more sense:)

$y = a(x-h)^2 + k$ ($a=1$)

Example: Write this equation in Vertex Form using Completing the Square.

$$y = x^2 - 16x + 15$$

$y = x^2 - 16x + 64 + 15 - 64$

$\div 2$

$y = (x-8)^2 - 49$

$V = (8, -49)$

Steps to follow:

1. Factor out a GCF
2. Rewrite the problem placing a +___ and -___ in the appropriate places.
3. Below this line begin to write a ( )^2
4. Now fill the parenthesis with the letter used in the problem and 1/2 of the b term.
5. Now square the number that you just found and write it in the blanks above.
6. Combine the last two numbers and write them after your ( )^2

Ex: $y = x^2 + 10x - 3$

$y = x^2 + 10x + 25 - 3 - 25$

$y = (x+5)^2 - 28$

$V = (-5, -28)$

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

$V = (h, k)$

Example: Write this equation in Vertex Form using Completing the Square.

$$y = n^2 - 6n - 72$$

$y = n^2 - 6n + 9 - 72 - 9$

$\frac{1}{2}$ of -6 is -3

$y = (n-3)^2 - 81$

$V = (3, -81)$

Example: Write this equation in Vertex Form using Completing the Square.

$$f(x) = x^2 - 7x + 1$$

$\frac{1}{2} \cdot 7 = \frac{7}{2}$

$f(x) = x^2 - 7x + \frac{49}{4} + 1 - \frac{49}{4}$ ($\frac{4}{4}$)

$f(x) = \left(x - \frac{7}{2}\right)^2 - \frac{45}{4}$ $(x-3.5)^2 - 11.25$

$V = \left(\frac{7}{2}, \frac{-45}{4}\right)$ $(3.5, -11.25)$

$85 \times 85 = 7225$

$25 \times 25 = 625$

$3.5 \times 3.5 = 12.25$

Example: Write this equation in Vertex Form using Completing the Square.

$$f(z) = z^2 + 11z + \frac{21}{4}$$

$f(z) = z^2 + 11z + \frac{121}{4} + \frac{21}{4} - \frac{121}{4}$

$f(z) = \left(z + \frac{11}{2}\right)^2 - \frac{100}{4}$

$f(z) = \left(z + \frac{11}{2}\right)^2 - 25$

$V = \left(\frac{-11}{2}, -25\right)$

Example: Change f(x) from Vertex Form into Standard Form.

$$f(x) = 3(x-5)^2 - 72$$

$3(x-5)(x-5)-72$

$3(x^2-5x-5x+25)-72$

$3(x^2-10x+25)-72$

$3x^2-30x+75-72$

$f(x) = 3x^2-30x+3$

$x^2+14x+\underline{49}$

7^2