NOTES: SECONDARY 2 HONORS

COMPLETE THE SQUARE (4.4)

STARTER

1. Find the x-intercepts of $f(x) = 2x^2 - 9x + 4$.

2. Determine the vertex of $f(x) = -2(x+3)^2 - 1$

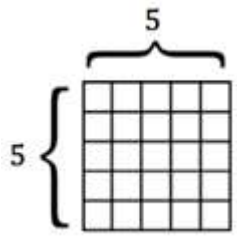
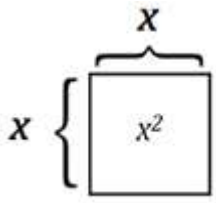
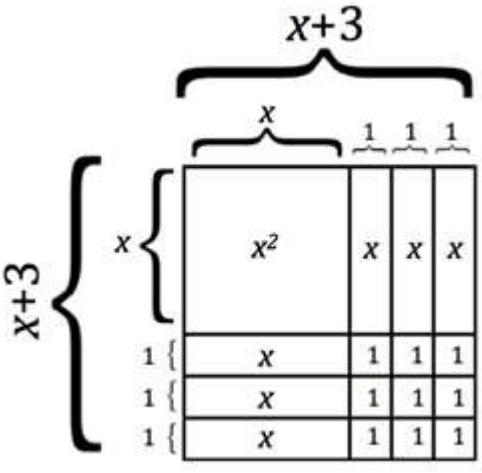
3. Identify the max/min value of $f(x) = -2(x+3)^2 - 1$

4. Find the zeros of $f(x) = 2(x+3)^2 - 36$

5. Factor $4x^2 - 36x + 81$

6. Factor $ax^2 + 2ab + b^2$

PERFECT SQUARES

$5^2 = 25$	
x^2	
$(x+3)^2 = x^2 + 6x + 9$	

RECALL:

Standard Form: $ax^2 + bx + c$

Vertex Form: $a(x-h)^2 + k$ where $(x-h)^2$ represents the _____ portion of the quadratic expression.

QUESTION: What does complete the square give us?

STEPS TO COMPLETE THE SQUARE As we go through the steps, look at the equation $2x^2 + 4x = 9$	
Step 1: Set the equation equal to zero. $ax^2 + bx + c = 0$	
Step 2: Separate the x^2 and the x terms from the "c" term. Leave blanks for the missing values. $(ax^2 + bx + \_\_\_\_\_) + c - \_\_\_\_\_ = 0$	
Step 3: Factor out the "a" (or the number in front of x^2). Don't forget to divide/multiply the missing value next to "c" by "a". We need to keep the expression equivalent. $a\left(x^2 + \frac{b}{a}x + \_\_\_\_\_\right) + c - (a)\_\_\_\_\_ = 0$	
Step 4: Take your new "b" (or the number in front of "x") and divide it by 2.	
Step 5: Take the result from step #4 and square it.	
Step 6: Add the result from step 4 to <u>both</u> missing values. (Remember you are adding to one side and subtracting from the other.)	
Step 7: Factor the perfect square trinomial. This should always factor into $(x + \textit{your answer from step 3})^2$	
Step 8: Simplify as much as you can.	

<u>Example</u>: For the following functions

a. Rewrite the function in vertex form of $f(x) = a(x-h)^2 + k$

b. Determine the vertex.

c. Determine if the vertex is a maximum or a minimum and state the maximum or minimum value.

d. Determine the y-intercept. (Remember y-intercept is a point)

e. Determine the x-intercept(s). (Remember x-intercept is a point)

f. Sketch the graph of the function with its axis of symmetry (label the vertex and intercepts on the graph).

1. $f(x) = x^2 - 4x - 32$

2. $f(x) = x^2 + 6x + 7$

3. $f(x) = x^2 - 5x - 7$

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

When do you factor and when do you complete the square?

Example: The height $h(t)$, in feet, of a "weeping willow" firework display, t seconds after having been launched from a $80\,ft$ high rooftop, is given by $h(t) = -16t^2 + 64t + 80$.

a. Find the zeros of the function and explain the meaning in the context of the problem.

b. Find the vertex of the function and explain the meaning in the context of the problem.

Example: The value of some stock can by represented by $V(x) = 2x^2 - 8x + 10$, in thousands of dollars, where x is the number of months after January 2013. Find the vertex of the function and explain the meaning in the context of the problem.

Example: A projectile is thrown upward so that its distance above the ground after t seconds is $h(t) = -12t^2 + 540t$. When does it reach its maximum height? When does it hit the ground?