G7A-2 investigation   Name_____
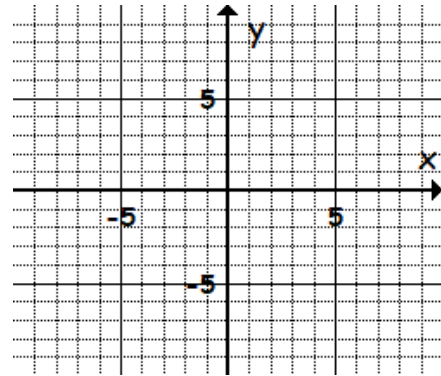Completing the Square

You know how to graph a circle when the equation is in graphing form.
For example, graph $(x-3)^2 + (y + 2)^2 = 25$
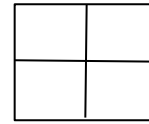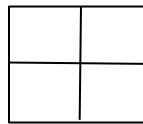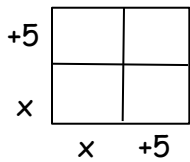
Center: _____   radius: _____

What if it is not in graphing form? How could we graph
          $x^2 - 6x + 7 + y^2 + 4y + 8 = 27$?

To do so, we need to rewrite the equation in graphing form, we
need to think back to algebra and your work with quadratic equations and **completing the square**.

1.   Multiply the following factors and write it in standard form: $ax^2 + bx + c$.

a) $(x + 5)^2 =$ _____   b) $(x + 7)^2 =$ _____   c) $(x - 5)^2 =$ _____

d) $(y - 3)^2 =$ _____   e) $(y + 1)^2 =$ _____   f) $(y - 2)^2 =$ _____

2.   Based on your observations in #1, factor the following **perfect square trinomials**.

a) $x^2 + 8x + 16 = ($ $)^2$ b) $x^2 - 2x + 1 = ($ $)^2$ c) $x^2 + 6x + 9 =$ _____

d) $y^2 - 14y + 49 =$ _____   e) $y^2 - 12y + 36 =$ _____   f) $y^2 + 4y + 4 =$ _____

3. Now rewrite these circle equations in graphing form and write the center and radius of the circle:

          a) $x^2 - 6x + 9 + y^2 + 4y + 4 = 36$ b) $x^2 + 10x + 25 + y^2 - 12y + 36 = 49$

graphing form: _____   _____

          center: _____   _____

          radius: _____   _____

Can you rewrite this one now? $x^2 - 6x + 7 + y^2 + 4y + 8 = 27$

This one will take more work to put it into graphing form.

4.   Based on your observations in #1 and #2, fill in the blanks to make each trinomial a **perfect square trinomial.**   Then rewrite in factored form.

a) $x^2 + 10x +$ ____ $= ($ $)^2$ b) $x^2 - 8x +$ _____ $=$

c) $y^2 + 12y +$ _____ $=$ d) $y^2 - 18y +$ _____ $=$

How did you know what to write in the blank? _____

e) $x^2 +$ _____$x + 64 = ($ $)^2$ f) $x^2 +$ _____$x + 121 =$

g) $y^2 -$ _____$y + 144 =$ h) $y^2 +$ _____$y + 1 =$

How did you know what to write in the blank? _____

5. Using this knowledge we can rewrite ANY equation of a circle into graphing form.

Example: $x^2 - 6x + 7 + y^2 + 4y + 8 = 27$

Step 1:   Complete the squares. $x^2 - 6x +$ ____ $+ y^2 + 4x +$ ____
               (What do you wish was there?)

Step 2: Add or subtract to make the numbers $x^2 - 6x + 7 + y^2 + 4y + 8 = 27$
               what you wish they were   + ___   - ___   + ____ - ___

Don't forget you have to do the same thing to both sides of the equation.

Step 3:   Rewrite the equation in graphing form: _____

Center: _____ Radius: _____

6.   Rewrite in graphing form:

a) $x^2 + 12x + 30 + y^2 - 14y + 42 = 3$ b) $x^2 + 10x + 30 + y^2 + 2y + 4 = 72$

Center: _____ Radius: _____   Center: _____ Radius: _____