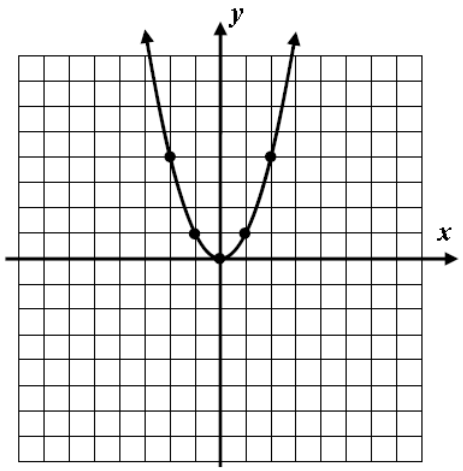
Quadratics HW #6 Name_____

COMPLETING THE SQUARE AND SHIFTING PARABOLAS

Parabolas, and graphs more generally, can be moved horizontally and vertically by simple manipulations of their equations. This is known as **shifting** or **translating** a graph. You worked with this extensively in Common Core Algebra I. The first exercise will review how to use a method known as **completing the square** to identify shifts and the turning point of a parabola.

***Exercise* #1:** The function $y = x^2$ is shown already graphed on the grid below. Consider the quadratic whose equation is $y = x^2 - 8x + 18$.



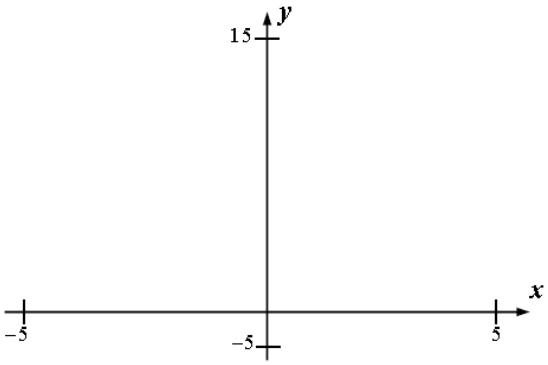
(a) Using the method of completing the square, write this equation in the form $y = (x-h)^2 + k$.

(b) Describe how the graph of $y = x^2$ would be shifted to produce the graph of $y = x^2 - 8x + 18$.

(c) Sketch the graph of $y = x^2 - 8x + 18$ by using its **vertex form** in (a). What are the coordinates of its turning point (vertex)?

***Exercise* #2:** Using your calculator and the window shown below, sketch the graphs of the simple quadratics $y = x^2$, $y = 3x^2$, and $y = \frac{1}{2}x^2$.

Every quadratic of the form $y = ax^2$ has a turning point at:



The **algorithm** of completing the square works best when $a = 1$ and b is even in the form $y = ax^2 + bx + c$. But, it does work in every case, even the messy ones.

***Exercise* #3:** Place each of the following quadratic functions in vertex form and identify the turning point.

(a) $y = 3x^2 + 12x - 2$

(b) $y = 2x^2 + 6x + 1$

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1. Which of the following equations would result from shifting $y = x^2$ five units right and four units up?

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

   (2) $y = (x+5)^2 + 4$ (4) $y = (x+4)^2 - 5$ _____

2. Which of the following represents the turning point of the parabola whose equation is $y = (x+3)^2 - 7$?

   (1) $(3, -7)$ (3) $(-7, -3)$

   (2) $(-3, 7)$ (4) $(-3, -7)$ _____

3. Which of the following quadratic functions would have a turning point at $(6, -2)$?

   (1) $y = (x+6)^2 - 2$ (3) $y = 5(x-6)^2 - 2$

   (2) $y = 3(x+2)^2 - 2$ (4) $y = 2(x-1)^2 + 6$ _____

4. Which of the following is turning point of $y = x^2 + 12x - 4$?

   (1) $(12, -4)$ (3) $(6, 104)$

   (2) $(-6, -40)$ (4) $(-4, 12)$ _____

5. In vertex form, the parabola $y = x^2 - 10x + 8$ would be written as

   (1) $y = (x-5)^2 - 33$ (3) $y = (x-10)^2 - 92$

   (2) $y = (x-5)^2 - 17$ (4) $y = (x-10)^2 - 108$ _____

6. The turning point of the parabola $y = x^2 + 5x - 2$ is

   (1) $(2.5, 12.75)$ (3) $(-2.5, -8.25)$

   (2) $(-5, -10.5)$ (4) $(-2.5, -17.5)$ _____

7. Write each of the following quadratic functions in its vertex form by completing the square. Then, identify its turning point.

   (a) $y = x^2 + 12x + 50$ (b) $y = -3x^2 + 30x + 7$