7.2 - Transforming Quadratics

* Completing the Square Questions
* Some Parabola Reminders
* Transformations on Parabolas
* Tying the two concepts together
* Assignment Time and Reading Time
7.1 Quadratic Functions

**Quadratic Function (in general form)**
- a function where a, b, and c are real number with $a \neq 0$, in the form
  
  $$y = ax^2 + bx + c$$

**Quadratic Function Graph**
- the graph of a quadratic function is a U-shaped curve (parabola)
- the "center line" of the parabola is called the axis (of symmetry)
- where the axis intersects the graph is called the vertex
- if $a > 0$, the parabola opens upward and has a single minimum point
- if $a < 0$, the parabola opens down and has a single maximum point

[these extrema happen at the vertex of a parabola]

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7.1 Quadratic Functions

**Quadratic Function: Standard Form (or "vertex form")**
- standard form is easiest to use when graphing
  
  $$y = a(x - h)^2 + k$$

- the vertex of the parabola is at $(h, k)$; the axis is the vertical line $x = h$
- to get from general (abc) to Standard (vertex) form,
  
  you will often need to...
  
  complete the square

**Maximum/Minimum**
- for a parabola, the maximum/minimum occurs at the vertex
  
  the vertex is along the axis (of symmetry)
  
  the equation for the axis is $x = -b/2a$

so... if a quadratic is in general form, you can find the min/max at

$(-b/2a, ?)$
Example 1: Write $y = 2x^2 + 8x + 7$ in standard form

\[ y = 2(x + 2)^2 - 1 \]

Vertical and Horizontal Shifts

if $c$ and $d$ are positive real numbers in the equation
\[ y = (x - c)^2 + d \]

the parabola is shifted up $d$ units and to the right $c$ units

**be careful with negatives in determining shifts**

Reflections

"if flipped over the y-axis, the $x$ is negative;
(really no effect for parabolas, and probably wont see)"

"if flipped over the x-axis, the function is negative"
(this will occur "outside the parenthesis")
7.2b: Nonrigid Transformations

-a nonrigid transformation changes the shape of a parent graph by a vertical stretch or a vertical shrink. The graph’s overall behavior doesn’t change.

**Vertical Stretch and Shrink**

if \( a \) is a positive real number in the quadratic

\[
y = ax^2
\]

- and \( a > 1 \), then the graph is stretched "by a factor of \( a' \)
- and \( 0 < a < 1 \), then the graph shrinks "by a factor of \( a' \)

**If \( a \) is negative, consider a reflection and a vertical stretch or shrink**

All transformations should be performed on the "parent graph" in the order

**OF THE COMPOSITION OF THEIR FUNCTION**

**in other words, the order in which you would replace**

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Example 1:

\[
y = 4(x - 3)^2
\]

\[
y = 4(x^2 - 3)
\]

\[
y = 4x^2 - 3
\]

\[
y = 4x^2 - 12
\]

the first is the parent parabola shifted right 3
then stretched by a factor of 4

the second is the parent parabola shifted down 3 units
then stretched by a factor of 4

the third is the parent parabola stretched by a factor of 4 then shifted down 3 units
Example 1: Find the transformations on \( f(x) = x^2 \) in the function \( g(x) = 2x^2 + 8x + 7 \)

\[
g(x) = 2(x + a)^2 - 1
\]
- left 2
- stretch vertically 2
- down 1

Example 2: Find the max/min by finding the axis...
\[ f(x) = -x^2 + 6x - 8 \]

vertex \((3, 1)\)

\[ f(3) \]

axis: \[ x = -\frac{b}{2a} \]

\[ x = -\frac{6}{2(-1)} \]

\[ x = 3 \]

max = 1
Assignment (Due "TBD")

1) Read all parts of 7.1 and 7.2

2) Chapter 7 Problems Packet
   a) 7.1 (finish all parts now)

   b) 7.3 (without g/c) / 7.6

*) Looking for:
neat, complete, organized, and well labeled

3) Grades...Online Stuff....