Around the Vertex in 80 Days

**Student Activity** 

Name \_\_\_\_\_ Class

## Problem 1 – Exploring Vertex Form

To get the Transformational Graphing Application started, press apps and select **Transfrm.** 

Now press y= and enter  $(X-B)^2+C$  to match the screen to the right.

Press  $\boxed{\text{zoom}}$  and select **ZStandard** to view the graph displayed in a normal window. Notice that the variables *B* and *C* are listed to the left along with the equation.

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Change the values for *B* and *C* by using the  $\square$  and  $\square$  keys to select the variable to change and the  $\square$  and  $\square$  keys to change the value. Make changes to *B* and *C* so that the graph of the parabola's vertex will be in Quadrant I and write down the resulting equation in the table below. Find three other parabola equations whose vertices are also located in Quadrant I and record their equations in the table as well. Repeat this for the remaining three quadrants.

Quadrant I	Quadrant II	Quadrant III	Quadrant IV

Use the vertex form of the equations to answer the questions below.

- 1. In which quadrants is the value of *B* positive?
- 2. In which quadrants is the value of C positive?



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## Problem 2 – Happy and Sad Parabolas





"Sad" parabola

Press y= and enter **AX**<sup>2</sup> to match the screen to the right. Then press graph.

Make the "happy" parabola wider, narrower, and "sad" by changing the value of *A*.

Record four "happy" and four "sad" parabolas.

"Happy" Parabolas	"Sad" Parabolas

3. How does the equation change when the parabola is wider or narrower?

4. For what values of A is the parabola "happy" (opens up) or "sad" (opens down)?

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- 5. Is  $f(x) = 3.5(x-2)^2 + 5$  a "happy" or "sad" parabola? How do you know?
- 6. Determine whether the following parabolas open up or down.

$$a(x) = 2.5x^2 - 5$$
  
 $b(x) = 6 + 3(x - 3)^2$   
 $c(x) = -(x - 2)^2 - 5$   
 $d(x) = 7(x + 1)^2 - 1$ 

## Extension – Parabola Hunt

Enter the following data points into lists L1 and L2 of the graphing calculator by pressing stat enter. (-6, 4), (-2, -2), (4, -1), (6, 5)

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Now, set the calculator to graph these data points by pressing 2nd [y= [stat plot], selecting **Plot1** and matching the screen to the right.

Now press y= and enter  $A(X-B)^2+C$  next to Y1.

View the finished screen by pressing zoom and selecting **ZoomStat**.

For each of the points given on the graph, find an equation of a "happy" parabola so that the vertex of the parabola is located at the given point. Then, find an equation of a "sad" parabola at each vertex point. Check your answer using your graphing calculator and values for *A B*, and *C*.



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Point 1	Point 2	Point 3	Point 4

Compare your equations with a classmate. Using all of your equations listed above, rank the parabolas from widest to narrowest.

## **Bonus Problem**

Find the equation of a parabola that passes through any two of the labeled points on the graph.