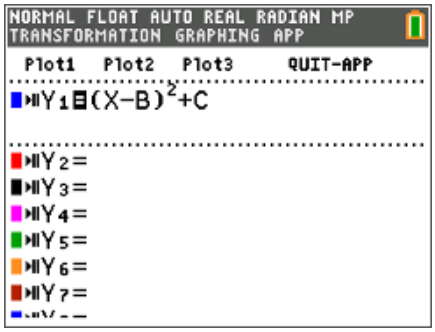
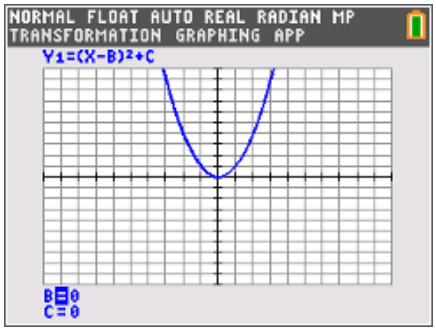
Problem 1 – Exploring Vertex Form

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 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.



Change the values for *B* and *C* by using the ▲ and ▼ keys to select the variable to change and the ◀ and ▶ 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

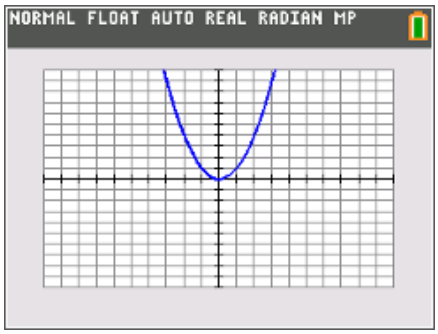
Use the vertex form of the equations to answer the questions below.

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

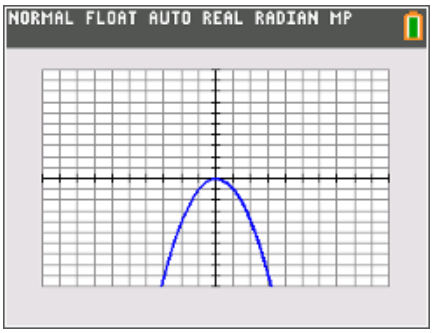
2. In which quadrants is the value of *C* positive?

Problem 2 – Happy and Sad Parabolas

"Happy" parabola

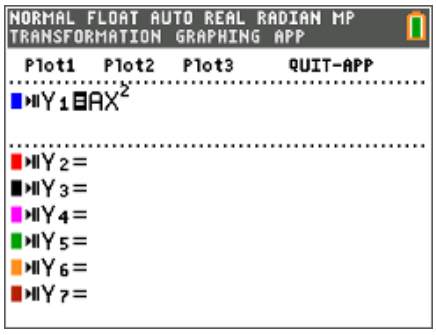


"Sad" parabola



Press [y=] and enter **AX²** 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)?

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.

$a(x) = 2.5x^2 - 5$

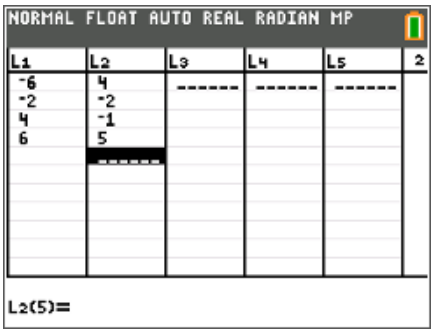
$b(x) = 6 + 3(x - 3)^2$

$c(x) = -(x - 2)^2 - 5$

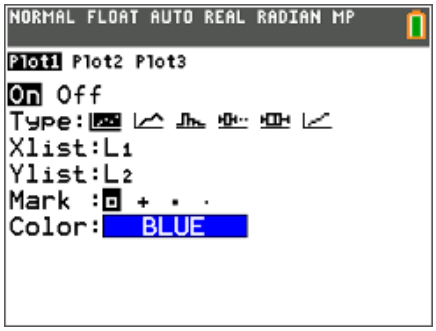
$d(x) = 7(x + 1)^2 - 1$

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)

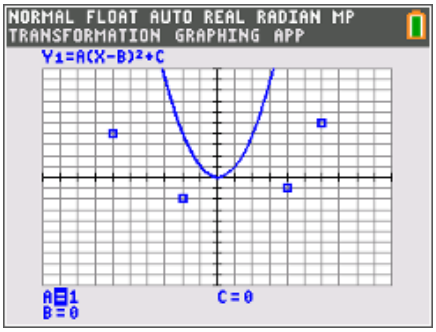


Now, set the calculator to graph these data points by pressing [2nd] [y=] [stat plot], selecting **Plot1** and matching the screen to the right.



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*.

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.