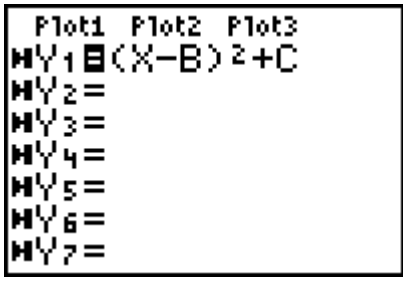
Around the Vertex in 80 Days

Name _____

Class _____

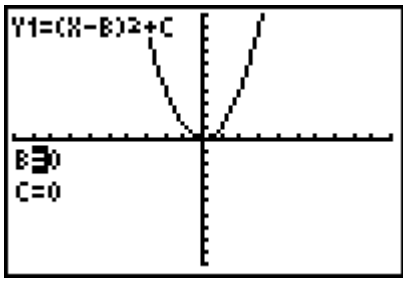
Problem 1 – Exploring Vertex Form

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 ZOOM and select **ZStandard** to get 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* 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

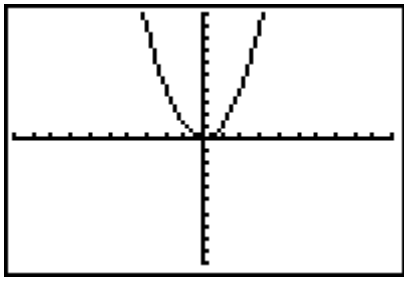
Use the vertex form of the equations to answer the questions below.

1. In which quadrants is *B* positive?

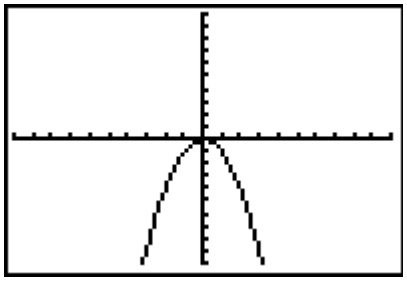
2. In which quadrants is *C* positive?

Problem 2 – Happy and Sad Parabolas

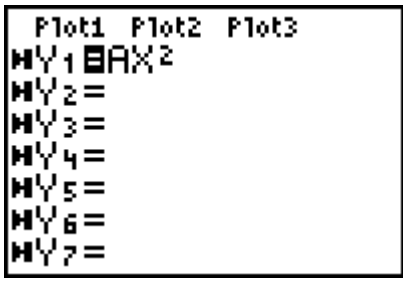
"Happy" parabola



"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. Tell whether the following parabolas open up or down.

$a(x) = 2.5x^2 - 5$ $\quad\quad$ $c(x) = -(x - 2)^2 - 5$

$b(x) = 6 + 3(x - 3)^2$ $\quad\quad$ $d(x) = 7(x + 1)^2 - 1$

Around the Vertex in 80 Days

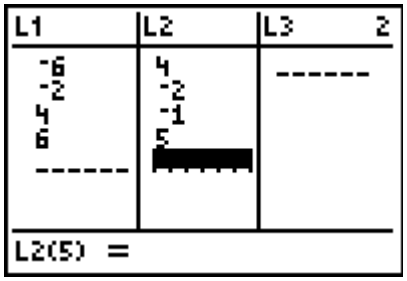
Name _____

Class _____

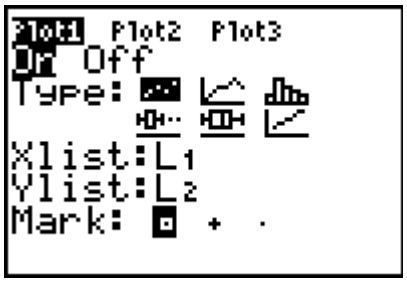
Extension – Parabola Hunt

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)

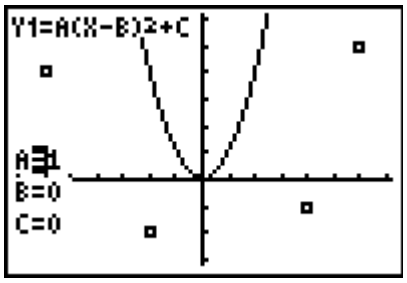


Now, set the calculator to graph these data points by pressing [2nd] [STAT PLOT], selecting **Plot1** and matching the screen to the right.



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

Around the Vertex in 80 Days

ID: 11684

Time required
15 – 20 minutes

Activity Overview

In this activity, students will use the Transformational Graphing Application to move a quadratic function in the coordinate plane to specific points to observe how the vertex form of the equation changes.

Topic: Quadratic Functions

- *Vertex Form*

Teacher Preparation and Notes

- *Check to see that the Transformational Graphing Application is already loaded on all the student graphing calculators. If not, go to education.ti.com/downloads to get the needed application.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "11684" in the quick search box.***

Associated Materials

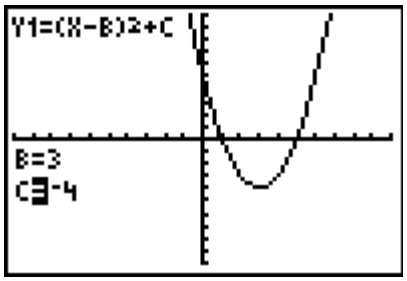
- *Alg2Week14_VertexFormQuad_worksheet_TI84.doc*

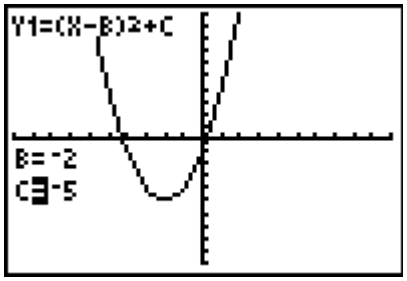
Suggested Related Activities

- *Head over Heels over Quadratics (TI-Nspire technology) — 9276*
- *Hose Problem (TI-Nspire CAS technology) — 9262*
- *Investigating Parabolas (TI-Nspire technology) — 9217*
- *Graphing Quadratic Functions (TI-84 Plus family) — 9406*

Problem 1 – Exploring Vertex Form

In this problem, students will adjust the values of variables *B* and *C* to move the parabola into each quadrant and record four different equations. To change the values, they can press a number followed by ENTER or use the left and right arrow keys. Students will determine the pattern of the signs of *B* and *C* in each quadrant and answer questions about what they observe.



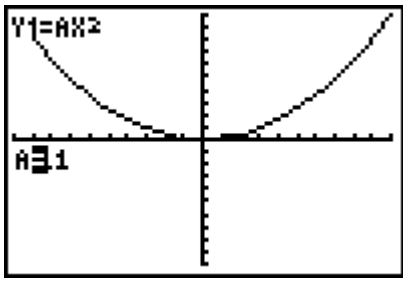


Discussion Questions:

- What happens to the equation when the vertex is on the *x*- or *y*-axis?
- When is the *B*-value positive? Negative?
- When is the *C*-value positive? Negative?
- What happens to the signs of *B* and *C* if the parabola opens downward?

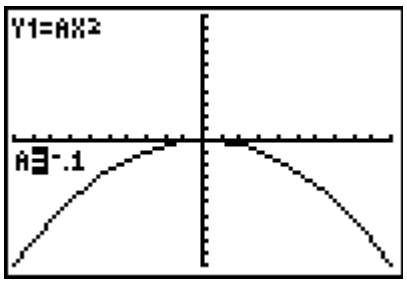
Problem 2 – Happy and Sad Parabolas

In this problem, students will make a parabola wider and narrower and observe the changes in the equation. Students will also make the parabola "sad" (or open down) with negative A-values. Students will record four equations for parabolas that open up and four for parabolas that open down. Students will determine patterns in the equations.



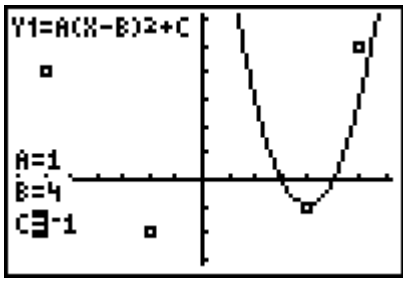
Discussion Questions:

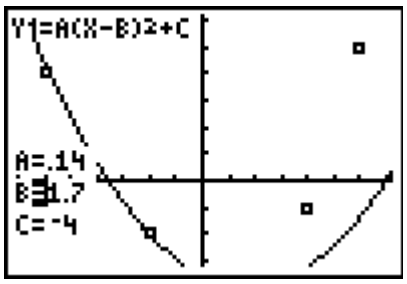
- How does making the parabola wider or narrower change the equation?
- What happens if we make *A* = 0?
- Which parabola is "wider" *A* = 2 or *A* = –3?



Extension – Parabola Hunt

In the extension, student must write equations for parabolas that open up and down at four given points representing the vertices of the parabolas. Students can use sliders to check their equations given the constraints of integer values for *A*, *B*, and *C*.





Discussion Questions:

- Have students compare their equations with a partner. Discuss whose parabola is wider/narrower.
- Is it possible to find a parabola that goes through more than one of the labeled points?

Student Solutions

1. Quadrant I & II
2. Quadrant I & IV
3. The coefficient of squared term changes.
4. "Happy" parabolas have values of *A* such that $A > 0$. "Sad" parabolas have values of *A* such that $A < 0$.
5. It is a "happy" parabola because the coefficient of the squared term is positive.
6. $a(x)$ opens up

   $b(x)$ opens up

   $c(x)$ opens down

   $d(x)$ opens up

Bonus: Sample answer through (–2, –2) and (4, –1) is $y = .025(x - 2)^2 - 2$