



Math Objectives

- Students will explore transformations of a quadratic function.

Vocabulary

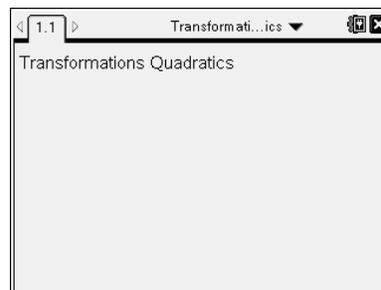
- quadratic function
- parabola
- vertex

About the Lesson

- The teacher has the option of having the student create the document. Send students *Transformations_of_a_Quadratic_Function_Create.doc* if you wish to do so. It is suggested that the students create the document for the activity.
- Otherwise, give each student *Transformations_Quadratics.tns*.

TI-Nspire™ Navigator™ System

- Use Screen Capture to observe students' work as they proceed through the activity.
- Use Live Presenter to have a student illustrate how he or she used a certain tool.



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handheld is set to Medium.
- You can hide the function entry line by pressing **ctrl** **G**.

Lesson Materials:

Create Instructions

Transformations_of_a_Quadratic_Function_Create.pdf

Student Activity

Transformations_of_a_Quadratic_Function_Student.pdf

Transformations_of_a_Quadratic_Function_Student.doc

TI-Nspire document

Transformations_Quadratics.tns

Visit www.mathnspired.com for lesson updates and tech tip videos. (optional)

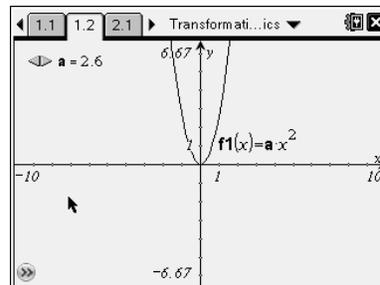


Discussion Points and Possible Answers

Tech Tip: If students experience difficulty dragging a point, check to make sure that they have moved the arrow until it becomes a hand (☞). Press **(ctrl)**  to grab the point and close the hand (☞).

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Step 1: Use the slider to change the value of the parameter variable. To do so, move the cursor so that it hovers above the  button on the slider. Press  to click on one of the arrows. Observe the changes in the graph. Press **(esc)**.



Step 2: Observe the graph as you grab the slider and move **a** to the following values: 5, 1, 0.2, 0, -0.2, -1, and -5.

Answer these questions.

1. What do you observe about the vertex of each of the parabolas?

Answer: The vertex is at the origin for each of the parabolas, with the exception of when **a** = 0. For that special case, the parabola becomes the horizontal line $y = 0$.

2. How does the value of **a** affect whether the graph opens up or down?

Answer: If **a** > 0, the parabola opens upward. If **a** < 0, the parabola opens downward.

3. How does the value of **a** affect the shape of the graph?

Answer: As the absolute value of **a** gets larger, the opening of the parabola gets more narrow, As the absolute value of **a** gets smaller, the opening of the parabola gets wider.



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[[Insert Screenshot 2.1]]

Step 3: Observe the graph as you click on the slider and have c become the following values: 4, 2, 0, -2, and -4.

Answer these questions.

4. What did you observe about the vertex of each of the parabolas?

Answer: The vertex of the parabola moves up and down, depending upon whether the constant is positive or negative

5. How does the value of c affect the shape and whether the graph opens up or down? Explain.

Answer: The value of c does not affect the shape of the graph; it only affects where the graph is placed

6. How does the value of c affect the graph?

Answer: If $c > 0$, the entire parabola is shifted up c units. If $c < 0$, the entire parabola is shifted down the absolute value of c units.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students can explain:

- How the value of the parameter a affects the graph of $y = a \cdot x^2$.
- How the value of the parameter c affects the graph of $y = x^2 + c$.

Assessment

For each of the following, answer the following questions:

- a. In which direction does the graph open?
- b. Is the parabola wider, narrower, or the same as $y = x^2$?
- c. Is the graph shifted up, down, or not at all compared to $y = x^2$?
- d. What are the coordinates of the vertex of the parabola?



1. $y = 4x^2$

- Answers:**
- a. upward
 - b. narrower
 - c. not at all
 - d. (0, 0)

2. $y = x^2 + 4$

- Answers:**
- a. upward
 - b. same
 - c. up
 - d. (0, 4)

3. $y = -\frac{1}{2}x^2 + 3$

- Answers:**
- a. downward
 - b. wider
 - c. up
 - d. (0, 3)

4. $y = 2x^2 - 3$

- Answers:**
- a. upward
 - b. narrower
 - c. down
 - d. (0, -3)