Exploring Quadratic Transformations with TI-Nspire **Teacher Guide**
Algebra II

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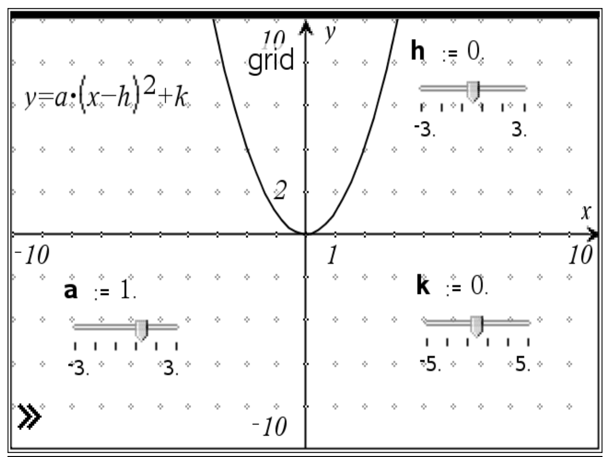
Activity Overview
Students will explore the characteristics of a quadratic function.

TN Algebra II Standards:
CLE 3103.3.2 Understand, analyze, transform and generalize mathematical patterns, relations and functions using properties and various representations. *(Level 4 on Webb's Depth of Knowledge)*
SPI 3103.3.10 Identify and/or graph a variety of functions and their translations.
✓ 3103.3.4 Analyze the effect of changing various parameters on functions and their graphs.
✓ 3103.3.11 Describe and articulate the characteristics and parameters of a parent function.

- **Open the TI-Nspire document Exploring Quadratic Transformations**
- **Press ctrl ▶ to move to page 1.2 and begin the lesson**

1. Write the **vertex form** of a quadratic function. ____.

2. Observe the characteristics of the quadratic parent graph on page 1.2.



List the characteristics observed:
Answers will vary. Teacher will be looking for:
"U" shape graph; opens upward; looks like a smile; the graph goes through (0, 0) or the origin; a = 1; h and k equal zero.

Exploring "*a*."
3. Increase and decrease the value of "*a*." Describe what is happening to the function.
Possible answers: The graph opens upward when a > 0. When a < 0, the graph opens downward. When 0< a < 1 and -1 < a < 0, the function is wider. When a < -1 and a > 1, the graph is stretched up or down.____

4. Complete the statements below.
When "*a*" positive, the function ***opens upward.***
Therefore, when "*a*" is positive, the graph has a __________ ***Maximum*** __________________.
(***Maximum*** *or Minimum)*
When "*a*" negative, the function ***opens downward.***
Therefore, when "*a*" is negative, the graph has a _______________ ***Minimum*** _____________.
(Maximum or ***Minimum****)*

5. What happens when $a = 0$ and $-1 < a < 1$? ***The graph is a horizontal line. y = 0 (Explain to the students mathematically by substituting zero in for a in the vertex form of the quadratic function.) Reinforce that when a is between -1 and 1, the function is wider.***

Exploring "*h*."

6. Increase and decrease the value of "*h*." Describe what is happening to the function.
The function moves ***left and right.***

7. Complete the statements below.
When "*h*" positive, the function ***moves right.***

When "*h*" negative, the function ***moves left.***

Exploring "*k*."

8. Increase and decrease the value of "*k*." Describe what is happening to the function.
The function moves ***up and down.***

9. Complete the statements below.
When "*k*" positive, the function ***moves up.***

When "*k*" negative, the function ***moves down.***

10. Use your TI-Nspire to discover **how to find the Vertex?**

Parameters: $a = 1$ $h = 0$ $k = 0$	This is called the **parent function**. Vertex form: $y = 1(x-0)^2 + 0$ Simplify $y = x^2$ Identify the coordinates of the minimum. ***(0, 0)***
Parameters: $a = 1$ $h = 3$ $k = 0$	How did the function move? ***The function moved to the right 3 units.*** Vertex form: $y = 1(x-3)^2$ Identify the coordinates of the minimum. ***(3, 0)***
Parameters: $a = -2$ $h = 1.5$ $k = 2$	How did the function move? ***The function moved to the right 1.5 units and up 2 units.*** Vertex form: $y = -2(x-1.5)^2 + 2$ Identify the coordinates of the minimum. ***(1.5, 2)***
Parameters: $a = .7$ $h = -2$ $k = -3.5$	How did the function move? ***The function moved left 2 units and down 3.5 units.*** Vertex form: $y = .7(x+2)^2 - 3.5$ Identify the coordinates of the minimum. ***(-2, -3.5)***

11. Define vertex. (Use *h*, *k* and vertex form in your definition) **Possible answer:** ***The vertex of a quadratic function is where the maximum or minimum is located at (h, k). You can also find the vertex from vertex for.***

Assessment:

On a piece of paper, do the following:

- Make a sketch of the quadratic functions.
- Identify the vertex.
- Is there a maximum or minimum? Why?

a.) $y = 2(x-2)^2 + 3$

Vertex: (2, 3); minimum

b.) $y = -(x+1)^2 + 4$

Vertex: (-1, 4); maximum

c.) $y = -\frac{1}{4}(x-5)^2 - 2$

Vertex: (5, -2); maximum

d.) $y = 4(x+2)^2$

Vertex: (-2, 0); minimum