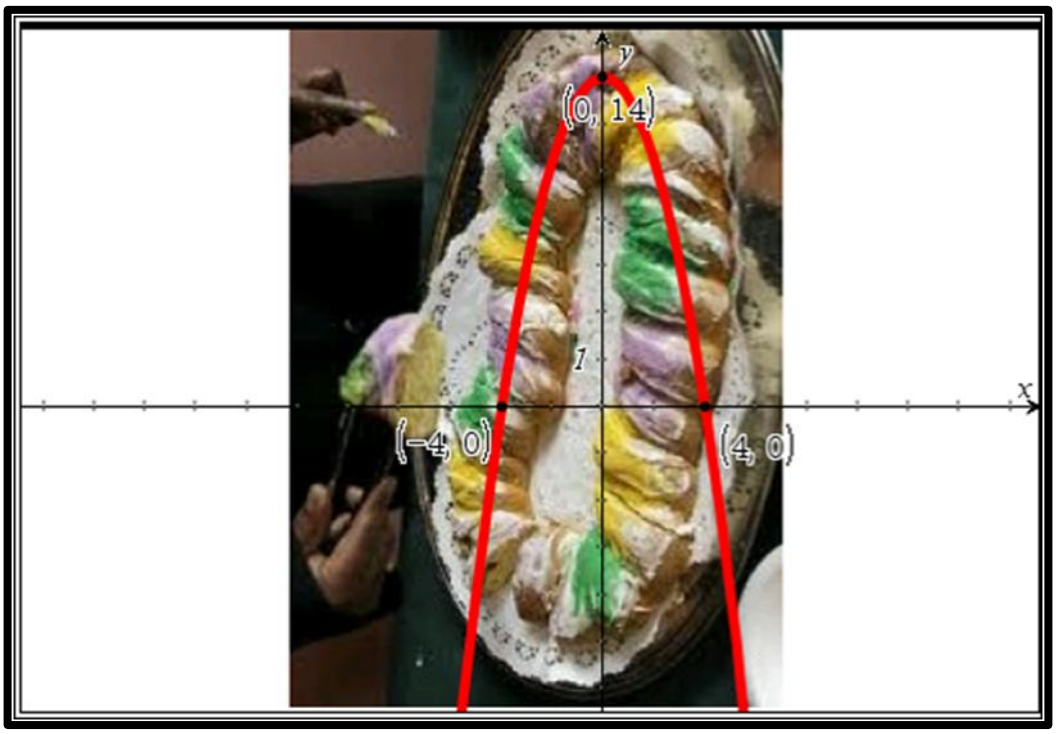
New Orleans' King Cake

A king cake is part of the Mardi Gras tradition in New Orleans. The most traditional king cake is a ring of twisted bread with icing or sugar, usually colored purple, green, and gold (the traditional Mardi Gras colors).

The cake has a small trinket baked inside and the person who gets the piece of cake with the trinket has various privileges and obligations.

The diagram below shows a picture of a King Cake. The units are in inches.



1) Use the information from the diagram above to write an equation of the parabola shown
   a) in vertex form
   b) in factored form
   c) in standard form.

2) Explain how you determined the equations above.

3) Explain what information you can gain from each of the equations above.

4) Assuming the cake is perfectly symmetric, write an equation to represent the bottom half of the king cake. Explain your reasoning.

For questions 5 and 6, the cake is to remain symmetric with respect to the x- and y-axes, and each change should occur on the original cake dimensions.

5) If you wanted to make the cake two inches wider horizontally without altering its length vertically, what would you change? Explain your reasoning.

6) If you wanted to make the cake two inches longer vertically without altering its width horizontally, what would you change? Explain your reasoning.

New Orleans' King Cake - Answers

A king cake is part of the Mardi Gras tradition in New Orleans. The most traditional king cake is a ring of twisted bread with icing or sugar, usually colored purple, green, and gold (the traditional Mardi Gras colors).

The cake has a small trinket baked inside and the person who gets the piece of cake with the trinket has various privileges and obligations.

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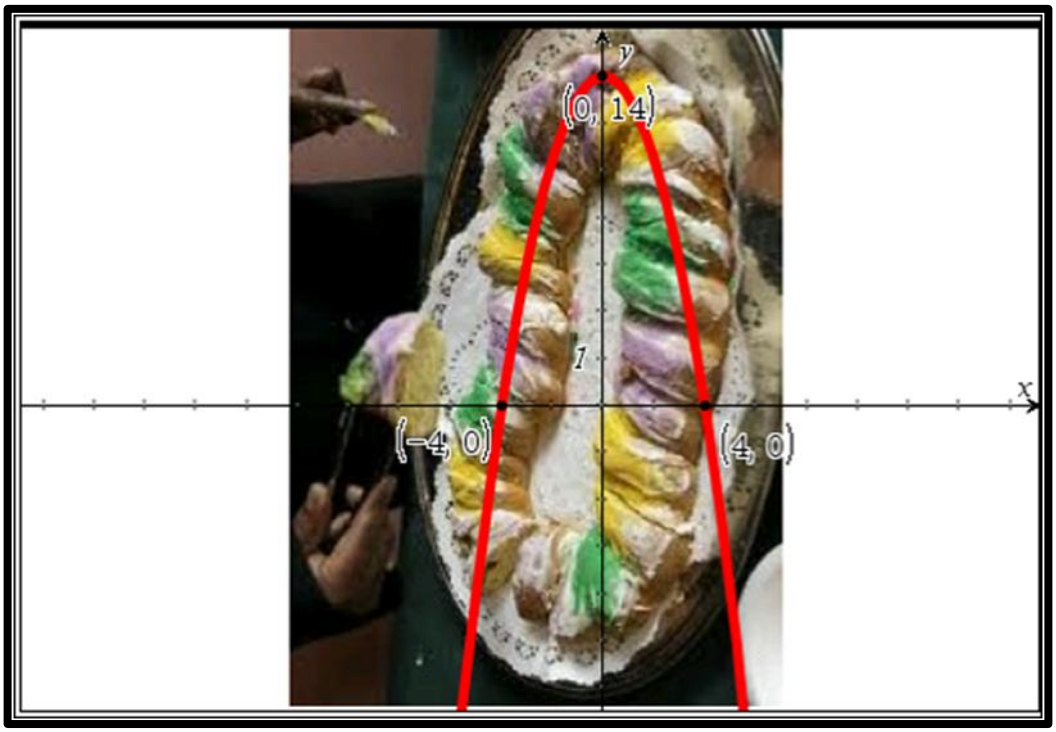

1) Use the information from the diagram above to write an equation of the parabola shown

d) in vertex form $y = -\frac{7}{8}x^2 + 14$

e) in factored form $y = -\frac{7}{8}(x+4)(x-4)$

f) in standard form. $y = -\frac{7}{8}x^2 + 14$

2) Explain how you determined the equations above.

a. use vertex to determine h and v values, use one of the intercepts to determine a value

b. factor out $-\frac{7}{8}$ to get $(x^2 - 16)$

c. due to the vertex having an x-value of 0, the standard form is identical to the vertex form

3) Explain what information you can gain from each of the equations above.

a. Vertex form – allows us to quickly see the vertex of the parabola is (0,14) and the shape will be "skinnier" than the parent graph of $y = x^2$
b. Factored form – allows us to quickly see the x-intercepts, or roots, of the parabola

4) Assuming the cake is perfectly symmetric, write an equation to represent the bottom half of the king cake. Explain your reasoning.

$$y = \frac{7}{8}x^2 + 14$$

For questions 5 and 6, the cake is to remain symmetric with respect to the x- and y-axes, and each change should occur on the original cake dimensions.

5) If you wanted to make the cake two inches wider horizontally without altering its length vertically, what would you change? Explain.

Students have to notice that in order to create a cake two inches wider, we only need to increase each x-intercept by 1. (1 on left and 1 on right) The a-value would have to change to $-\frac{14}{25}$.

6) If you wanted to make the cake two inches longer vertically without altering its width horizontally, what would you change? Explain.

Students have to notice that in order to create a cake two inches longer, we only need to increase the vertex by 1. (1 on top and 1 on bottom) The v-value would have to change to 15, and this would cause the a-value to change to $-\frac{15}{16}$.

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Teacher's Notes

For this activity, students should already know:

- Vertex form of a quadratic function
- Standard form of a quadratic function
- Factored form of a quadratic function
- Basic factoring skills
- How to alter a quadratic function to create a different vertex
- How to alter a quadratic function to alter its width
- How to alter a quadratic equation to represent a reflection of it about the x-axis

Purpose of the activity:

- Students relate parabola to real word objects
- Students implement their knowledge of altering parabolas to fit certain criteria

Where to go from here:

- Scenarios where the parabola is not symmetric to either the x- or y-axes
- Translating the parabola to the left or right and up or down
- Dealing with quadratic functions that require completing the square in order to factor
- Dealing with quadratic functions that require the quadratic formula to determine the roots
- Scenarios where the data has to be collected in order to create the quadratic equation prior to answering questions, determining predictions, etc.