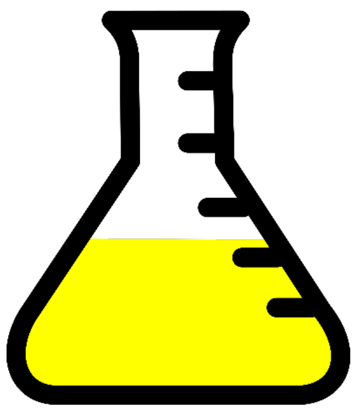
Exploring Quadratic Functions Through Experiments



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Parabolas Everywhere

There are many examples of parabolas in the real world. Parabola shapes are seen in fountains, bridges, roller coasters, etc. When designing these structures, engineers must consider the height and the path before building. In this activity, characteristics of some real-world parabolas will be analyzed.

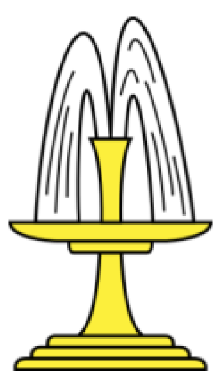
1. Select a photo of a real-world parabola. Lay the centimeter grid transparency over the picture. Add x and y axes to your grid.

2. Draw 8 points along the path of the parabola. Estimate the coordinates of each point.

3. Use the calculator and quadratic regression to get an equation that represents the path. Let x represent the horizontal distance from the beginning of the path and y represent the height to the point on the path.

4. Make a poster with an analysis of your quadratic function. Show a graph, table, and equation. Include mathematical and real-world information about intercepts, maximum/minimum, domain/range, etc. Show your work.

5. How did you decide where to place the grid when setting up your axes? If you placed the grid in another location, how would your equation change?



Cereal Investigations

Follow the directions below to explore the relationship between the diameter of a lid and the amount of cereal needed to cover the inside of the lid.

Materials: 6 lids of different sizes, cereal, centimeter ruler

Directions:

1. Select a lid. Measure its diameter in centimeters. *Make sure the ruler goes through the center of the lid when measuring.*

2. Fill the inside of the lid with a layer of cereal pieces. Count the number of pieces needed.

3. Record this information in the table.

Diameter of Lid (cm)	Number of Pieces of Cereal Needed to Cover the Lid

4. Repeat the steps 1-3 for 5 additional lids.

Analysis:

1. Make a graph of your data. Does the graph appear to be more linear or quadratic? Explain.

2. Find the equation for the curve of best fit.

3. Draw the graph of your equation on your grid paper.

4. What does the y-intercept represent in this situation?

5. How many pieces of cereal would be needed to cover a lid that measures 20 cm in diameter?

6. How many pieces of cereal would be needed to cover a lid that measures 40 cm in diameter?

7. What happens to the amount of cereal needed when the diameter doubles?

8. If 250 pieces of cereal are needed to cover the inside of a lid, what is the diameter of the lid?

9. Are there any parts of the graph that don't make sense in this situation? Explain.

Leaky Bottle Experiment

Materials: clear 2-liter plastic bottle with a hole in the bottom, metric ruler, marker, tape, stopwatch

Roles: Timekeeper, Bottle Holder, Data Recorder, Data Reader

Directions:

1. Make a mark on the side of the container at a height of 15 cm.

2. Fill the container with water to this mark, keeping a finger on the hole so the water does not leak out.

3. Attach ruler to the container with tape.

4. When the timekeeper says go, the bottle holder will remove finger from the hole and let water run out.

5. The timekeeper will call out the time every 10 seconds.

6. As the timekeeper calls out the time, the data reader reads aloud the water level to the nearest millimeter.

7. The recorder records the data. Stop measuring the water level before it reaches the rounded portion at the bottom of the bottle.

Record data in the table below:

Time (seconds)	**Height (centimeters)**

Analysis:

1. Make a scatterplot of the data. Label axes appropriately.

2. Use a graphing calculator to find the quadratic regression equation that best fits your data. Write the equation below.

3. Graph the equation on your scatterplot. Is it a good fit? Explain.

4. Use your equation to predict when the container would be empty. What characteristics of the container may affect your prediction?

5. How long would it take the container to drain if you started with a water height of 20 cm?