

General Education Math Lesson Plan – Determining Functions Using Regression: Lesson Two

Standard: 8.PRF.2e1 Distinguish between functions and non-functions, using equations, graphs or tables.

What's the Function?

This activity allows students to look for functions within a given set of data. After analyzing the data, students should be able to determine what type of function best represents the data.

Learning Objectives

By the end of this lesson, students will be able to:

- Analyze data to determine the type of function that most closely describes the data
- Demonstrate an understanding of how modifying parameters changes the graphs of functions by writing equations for those functions

Materials

A TI-83 or TI-84 calculator is required for these experiments. The remaining materials are listed by experiment:

1. [Activity Sheets](#)
2. Counting M&M's Activity Sheet (Exponential Decay)
 - M&Ms
 - Paper plate
 - Cup or other container
3. Inflating a Balloon Activity Sheet (Power Function)
 - Uninflated balloon (which when inflated is as nearly spherical as possible)
 - Tape measure with centimeters
4. Stacking Cups Activity Sheet (Linear Function)
 - Paper or plastic cups
 - Ruler with centimeters

5. Volume of a Box Activity Sheet(Cubic Function)

- Grid paper cut into 20 cm x 20 cm squares (enough paper for each group to do 3–6 experiments)

6. Weather Patterns Activity Sheet (Sinusoidal, Periodic Function)

- Internet access to look up local temperature averages OR table of weather data for Washington, DC.

Instructional Plan

Before participating in this lesson, students should understand the relationships between various functions and their graphs. Their knowledge should cover linear, quadratic, higher-degree-polynomial, exponential, and trigonometric functions. They should also be able to use a graphing calculator to edit data, create scatter plots, and draw functions over those plots.

Instructions for using TI-83 and TI-84 calculators for regression are available [here](#).

Structure

Each experiment in this section stands alone. Consider selecting the activities that apply functions that students have already seen.

Options for presenting these activities:

- Use a single experiment and have students perform the activity in pairs or groups. Then, share results as a class.
- Provide each group with the materials for each activity.
- Have different groups perform different activities. Groups can make presentations on their experiment, their graph of the data, and the function determined.
- Set up activity stations. Give students ten minutes to perform the experiment, and maybe start the calculations. After the ten minutes, rotate the groups to the next station until all students have done each activity.

Activity 1: Counting M&M's (Exponential Decay)

Be sure that students have at least 35 M&M's so that they can do the experiment repeatedly. Students will pour the candies onto a plate, and remove the ones that have the “M” face up, and put out the rest of the candies back into the cup. Doing this repeatedly yields an exponential decay function. Remind the student not to eat the candy, and that it has been used by other students in other classes.

Activity 2: Inflating a Balloon with Breath (Power Function)

Students measure the circumference of a balloon while counting the breaths used to fill it up. Encourage students to do some practice breaths before starting to measure the balloon. Get team members involved in determining how big a breath should be, and in helping the student blowing up the balloon to practice being consistent.

(This lesson is adapted from [Navigations through Mathematical Connections 9-12.](#))

Activity 3: Height of Cups (Linear)

Students measure the height of the stack of cups as they put on or take off cups. An alternative procedure is to stack cups on the floor, measuring the distance between the top of the stack and the surface of a desk.

(This lesson is adapted from [Navigating through Algebra 6-8.](#))

Activity 4: Volume of a Box (Cubic Function)

Students find the volume of a box made from a 20 cm x 20 cm grid with squares of equal size cut out from each corner of the grid. Different-sized corners yield boxes of different volumes. Students graph the length against the volume.

- You could extend this activity by asking students to find the length, width, and surface area of each box in addition to its volume. The problem would then include linear, quadratic, and cubic models.
- The post office uses the concept of girth to limit the size of boxes sent in the mail ($\text{length} + \text{width} \leq 108$ inches). Ask students to find the box with the greatest volume for the least surface area that meets postal regulations.

Activity 5: Weather Patterns (Sinusoidal or Periodic)

Students gather data about local temperatures over a year. To minimize the data but still give meaningful results, students can use the temperature on the 1st and 15th of each month.

- This information reduces the domain to 24 values but still yields a fairly smooth curve.
- You can find the average monthly temperature for many cities in almanacs on the Internet. Alternatively, give students this table of weather data for [Washington, DC](#). The temperatures in this table reflect the *average* high temperatures for the dates within one week of the listed date. For example, the temperature listed for Jan 15 reflects the average high temperature for all days from Jan 8 through Jan 22.

- Alternatively, all of the temperature data for Washington, DC, in 2011 can be found in the [Washington Temperatures spreadsheet](#) (Excel).
- This activity works best when the calculator is in radian mode.

Activity: Create a universally designed version of the above lesson

UDL Planning	My Ideas
Representation - adaptations in materials (e.g., adapt for sensory impairments)	
Expression - how will student show learning (e.g., use of assistive technology; alternative project)	
Engagement - how will student participate in the activity	