ACTIVITY 3: DEVELOPING A MATHEMATICAL MODEL

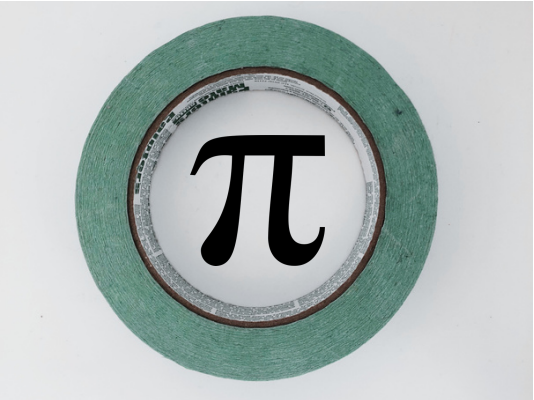

Image Credit: Gary Abud, Jr.

The purpose of this activity is for students to develop a mathematical model for the relationship between the circumference and diameter of a circle. They will accomplish this by taking measurements of several different circles, graphing the circumferences by the diameters of each, and deriving an equation that algebraically represents their graph data.

First, inform students that they will be working with their groups to collect and plot data for the measurements of some different circles. They will need a meter stick, one meter of string, at least five different circles of varying size, and a notebook to record their measurements.

Show them one of the circles and ask them if they could measure the circumference or diameter of the circle. Have them discuss a procedure using the available supplies. Invite a few students to share. Ask them now if they notice any relationship between circumference and diameter for circles.

Help them to notice that the larger the diameter, the larger the circumference seems to be. Ask them to hypothesize how many times bigger it might be and whether that is true for all circles.

Next, allow students time to take the measurements of their circles' circumference and diameter using the string and meter stick. They should record their measurements in a data table.

Then, give students time to graph their data (on chart paper or large dry erase boards) with circumference on the y-axis and diameter on the x-axis. Monitor students to see if they need help scaling their graph or drawing a best-fit line for their data. Have students determine the slope of their best-fit line, as well as the y-intercept value, and then write an equation in slope intercept form (e.g., y=mx+b) with the correct units to represent their line of best fit.

Last, give students a chance to do a gallery walk and see other groups' graphs and equations. Engage students in a discussion about what their graphs and equations, including the slope* and y-intercept, tell us about the relationship between circumference and diameter of circles. Help students to draw a class consensus from all groups' data about this relationship. Inform them that what they've done here is modeled the relationship, and their graph or equation can be used to explain or predict something about circles in general.

Have students test their models by predicting the circumference of a circle that has a diameter five times as big as their largest circle they measured, or what the diameter would be for a circle that had a circumference half as big as the smallest circle that they measured.

Revisit their hypotheses about how many times bigger they predicted the circumference would be compared to the diameter of a circle. Ask how many groups thought their hypothesis was supported by their data. Explain that this is one way scientists use mathematical models.

**Note: the slope value should come very close to 22/7 or ~3.14 (e.g., the number π). You can explain to students that pi is the ratio of circumference to diameter of a circle.*

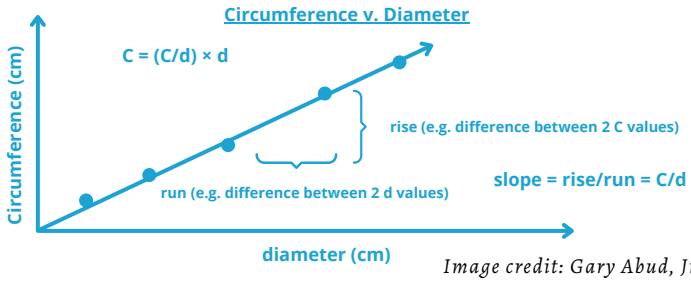

Image credit: Gary Abud, Jr.