Plastic Waste—notes for instructor

This exercise challenges students to use data from the EPA (and US census data) to answer questions about how much plastic waste is produced. This model can be molded to varying levels of mathematical maturity, depending on your student audience. Students should discuss the assumptions they make no matter which model they use.

Some options for the instructor:

-Edit the handout for students. You can make this a very open-ended question (as it currently is) or give them more instruction.

-students can use the “trendline” function in Excel to do linear fits (and logistic fits with a graphing calculator), or one can use this exercise to talk about how regression works

-give students the data from the Excel file **or** make them get the data themselves

-restrict students to use linear models **or** let them choose an appropriate model (or both, and asking them what advantages one has over the other)

-have students fit the data about plastic waste **or** ask them to consider that the amount of waste produced should be proportional to the population (In that case, should they use an exponential model or linear model for population growth?). This is a difference between just “fitting” data or thinking about the modeling aspect of the problem

-This problem can be further extended by asking students what should be done to reduce the waste. For example, what recycling rate would we have to employ to limit the amount of plastic going into to landfills to less than *x* tons per year? Is this feasible?

The attached Excel file shows multiple ways to answer the question (none of which is necessarily “the” correct answer).

Here’s what’s in the Excel file:

* Sheet 1, titled “Rates Over Time,” contains the “raw” data from the EPA website.
* Sheet 2, titled “Plastic Rates and Plots,” contains the data that pertains to plastic and shows plots of the data.
* Sheet 3, titled “Linear Fits 2005 to 2010,” shows an example of linear fits to the data for plastics generated and plastics recycled. One can make the assumption that plastics that are not recycled go into landfills, and therefore they can predict amounts of plastic waste in the future.
* Sheet 4, titled ”Logistic Fits for Data,” shows an example of using logisitic equations to fit the data. Logisitic models might be considered more appropriate (as linear models eventually approach infinity as time approached infinity).
* Sheet 5, titled “Population dependent model,” shows an example of using population data to predict waste as below.

$$population×\frac{lbs waste}{person∙day}×\frac{tons waste}{2000 lbs waste}×\frac{365 days}{1 year}×\left(percent of plastic waste\right)×\left(1-percent plastic recylcled\right)= \frac{tons plastic in landfills}{year}$$