EXPLORATIONS

Activity 1

Objectives

- To graphically represent data from a data table in a scatter plot
- To extrapolate from a given set of data
- To develop an understanding of the amount of trash generated per person in the U.S.
- To design a plan to address the garbage problem

The Garbage Problem

In this activity you will

- examine data about garbage production.
- observe comparisons in the data.
- make predictions based on the data.
- sketch a graph based on your predictions.
- design a plan to help deal with potential garbage problems.

Introduction

Have you ever stopped to think about how much stuff you throw away every day? Probably not! As our population grows, the amount of trash that we produce also grows. Are we ready to handle such an increase? This is something that we need to think about and plan for!

Problem

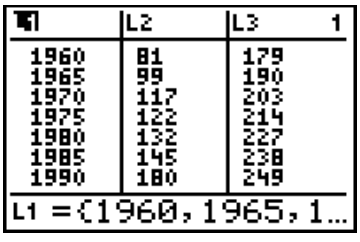
How much garbage do people produce each year? Does the amount change as the population changes? The data table below shows a comparison between population and the amount of garbage produced for the years 1960 through 1995.

The data reflect the amount of garbage produced in the United States as the population of the United States has grown. Observe patterns in the data. When did garbage production slow down? When did it speed up? Make predictions about garbage collection for the years 2000 and 2005.

Year	Garbage (billions of kg per year)	Population (in millions)
1960	81	179
1965	99	190
1970	117	203
1975	122	214
1980	132	227
1985	145	238
1990	180	249
1995	208	262

Procedure

1. Before entering data in the lists, clear any existing data from the lists.
   a. Press 2nd [MEM]. (MEM is above the + key on the TI-83 Plus.)
   b. Select **4:ClrAllLists**, and then press ENTER.
   c. This takes you to the Home screen. You will see **4:ClrAllLists** with a blinking cursor following it. Press ENTER, and the TI-83 Plus displays **Done**. Your lists are now cleared.
2. Press STAT and then press ENTER (or select **1:Edit** after you press STAT).
3. Enter the years from the data table in **L1**, starting with 1960 and ending with 1995.
   a. Your cursor should be highlighting the first row in **L1**. Press **1 9 6 0** and then press ENTER. Notice the cursor is now in the second row of **L1**.
   b. Enter the next number, and then press ENTER. Repeat this process until you have entered all of the data from the **Year** column.



4. Press ▶. The cursor should now be highlighting the first row in **L2**. Enter the data from the **Garbage** column in **L2**.

5. Press ▶ to move to **L3**. Enter the data from the **Population** column in **L3**.

Make sure you have the same number of entries in all three lists, and that they all align as they do in the data table on page 2.

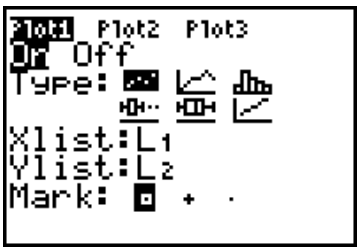
Make a numerical comparison between the data in **L1** and the data in **L2**.

✎ *Answer question 1 on the Data Collection and Analysis page.*

6. Make a graph of garbage production versus year.

   a. Press [2nd] [STAT PLOT] to access the STAT PLOTS menu. (STAT PLOT is above the [Y=] key on the TI-83 Plus.) The STAT PLOTS menu allows you to choose what type of graph is best for your data.

   b. Press [ENTER] to select **1:Plot1**. Set your TI-83 Plus as shown at the right.



   c. The cursor will be flashing on the word **On**. To turn this plot on, press [ENTER].

   d. Press ▼ to move to **Type**. The cursor will be flashing on the first option. This is a scatter plot. A scatter plot allows you to plot the independent variable versus the dependent variable. To choose this option, press [ENTER].

   e. Press ▼ to move to **Xlist**. The **Xlist** can also be referred to as the *independent variable.* If **L1** is not in your **Xlist**, enter **L1** by pressing [2nd] [L1]. ([L1] is above the [1] key on the TI-83 Plus.)

   f. Press ▼ to move to **Ylist**. The **Ylist** can also be referred to as the *dependent variable*. Enter **L2** for the **Ylist** by pressing [2nd] [L2].

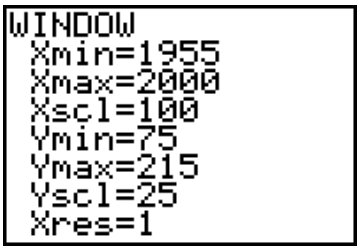
   g. Press ▼ to move to **Mark**. The mark is the type of mark you want to represent each data point on your graph. There are not many data points for this graph, so choose the first option, since it is larger. Your cursor should be blinking on this option. To choose it, press [ENTER].

✎ *Answer question 2 on the Data Collection and Analysis page.*

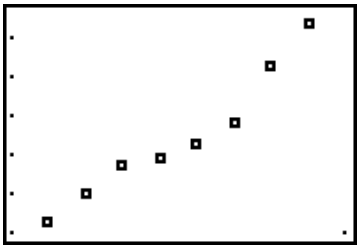
7. Set the WINDOW appropriate for your data. You are telling the TI-83 Plus how you want the graph scaled so that you can best view the data.

a. Press [WINDOW]. ([WINDOW] is along the top row of keys on the TI-83 Plus.)

b. Press [▼] to select the settings, and set the window as shown at the right. These settings are appropriate for the garbage collection data.



8. Press [GRAPH] to see how your data is plotted. Label the axes on the graph at the right.



9. Press [TRACE]. Using [◄] and [►], move the cursor from point to point. Notice that the ordered pairs (data points) are shown at the bottom of the screen. Find the two consecutive points where there was the least increase in garbage production. Find the two consecutive points where there was the greatest increase in garbage production.

✎ *Answer question 3 on the Data Collection and Analysis page.*

10. Graph garbage production versus population. Before you do this, decide which will be your independent variable, and which will be your dependent variable.

✎ *Answer question 4 on the Data Collection and Analysis page.*

11. Press [2nd] [STAT PLOT] to access the STAT PLOTS menu. Make the necessary changes, keeping in mind your choices for independent and dependent variables.

12. Reset your window to make it appropriate for your new data.

✎ *Complete the table under question 5 on the Data Collection and Analysis page, indicating what you chose for your window settings.*

13. Press [GRAPH].

✎ *Sketch your graph under question 6 on the Data Collection and Analysis page, making sure to label your X and Y axes.*

14. Press [TRACE]. Press [►] a few times to move the cursor to the last plotted point on your graph. Make note of the ordered pair.

✎ *Answer question 7 on the Data Collection and Analysis page.*

15. Using this final data point, calculate the amount of garbage generated per person during that year.

✎ *Answer question 8 on the Data Collection and Analysis page.*

16. Assume the rate of garbage production is the same today as it was in 1995.

✎ *Answer question 9 on the Data Collection and Analysis page.*

Data Collection and Analysis

Activity 1: The Garbage Problem

Name _____

Date _____

Data Analysis

1. What number pattern do you observe in **L1**? Explain.

What number pattern do you observe in **L2**? Explain.

2. Why are you using the years as the independent variable (**Xlist**)?

Why are you using the garbage production as the dependent variable (**Ylist**)?

3. Between which years did the rate of garbage production slow down?

Between which years did the rate of garbage production speed up the most?

From your graph, predict what the garbage production would be in the years 2000 and 2005. Be sure to indicate the units of production.

4. Independent variable:

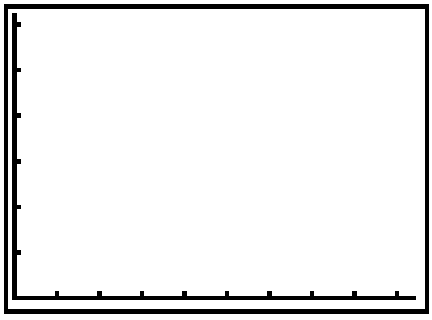
Dependent variable:

Explain.

5. Complete the table.

Xmin		**Ymin**	
Xmax		**Ymax**	
Xscl		**Yscl**	
Xres	**1**		

6. Sketch your graph in the grid below.



7. What is the ordered pair?

X: **Y:**

What labels should be applied to each of these numbers?

X: **Y:**

8. What is the amount of garbage generated per person during the year?

9. How much garbage does your family generate in a day?

A week?

A month?

A year?

How much garbage would your class produce in a year?

How much garbage would your school produce in a year?

Questions for Discussion and Writing

1. What are some potential problems we may be facing now and in the future if the current trend in garbage production continues?

2. Design a plan to help deal with these potential problems.

3. What economic, ecological, and social factors could have attributed to a slowing in the rate of garbage production between 1970 and 1975?

Teacher Notes

Activity 1

The Garbage Problem

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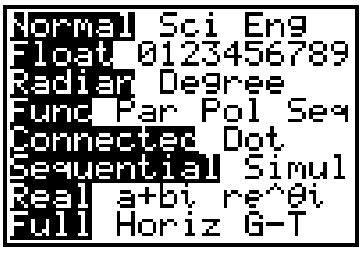
Concepts

- Environmental impact of trash accumulation
- Dependent vs. Independent variables

When starting a new activity with the TI-83 Plus, have the students do the following:

- Set all the FORMAT defaults. Press [2nd] [FORMAT] and press [▼] to move down to any row that is not highlighted on the left. Press [ENTER] to select the leftmost option. Continue until everything on the left is highlighted.

- Turn off all the plots. Press [2nd] [STAT PLOT] and press [▼] to move down to 4:PlotsOff. Press [ENTER] twice.
- Set all the MODE defaults. Press [MODE] and then press [▼] to move down until you are on the left side of a row that is not highlighted. Press [ENTER]. Continue until everything on the left is highlighted.



- Clear functions from the Y= Editor. Press [Y=] and move the cursor to any line that contains a function. Press [CLEAR] to erase the function. Repeat for all lines that contain functions.

When students are entering data into lists, remind them that the cursor should be in the list and not in the heading for the list.

Listed below are definitions for the WINDOW settings on the TI-83 Plus.

Xmin Defines the minimum boundary to display on the x-axis.

Xmax Defines the maximum boundary to display on the x-axis.

Xscl Defines the distance between tick marks on the x-axis.

Ymin Defines the minimum boundary to display on the y-axis.

Ymax Defines the maximum boundary to display on the y-axis.

Yscl Defines the distance between tick marks on the y-axis.

Xres Sets the pixel resolution (1 through 8) for function graphs. The default is 1.

Procedure

5. When looking for a numerical pattern in the lists, tell the students to look at the entries in **L1** and then compare them to the entries in **L2**. **L1** has a constant rate of change from entry to entry but **L2** does not have a constant rate of change. **L2** is increasing and then starts to slow down during the last two entries.

7. Setting the window by looking at the data is an important concept for the students to grasp. Take the time and have the students manually set the window before showing them **ZoomStat**, which will automatically set the window based on the data you are graphing.

Data Analysis – Answer Key

1. **L1**: The numbers (years) increase by five each time.
L2: The numbers increase, but not by a constant number.

2. You are using the years as the **Xlist** because time is independent of garbage production. You are using the garbage production as the **Ylist** because the amount of garbage produced depends on the time.

3. The rate of garbage production slowed down between 1970 and 1975. Garbage production sped up the most between 1985 and 1990. The garbage production in the year 2000 is predicted to be about 220-225 billion kg. The garbage production in the year 2005 is predicted to be about 240 billion kg.

4. The independent variable is the population, and the dependent variable is the garbage production. This is because the garbage production depends on the population, not the other way around.

5. **Xmin**= about 170 **Xmax**= about 265

Xscl= probably 10 **Ymin**= about 75

Ymax= about 210 **Yscl**= probably 10

Xres (leave at 1)

6. Graphs will vary.

7. **X:** 262
   Y: 208
   X label: millions of people
   Y label: billions of kg of garbage
8. 794 kg of garbage per person.
9. All answers will vary.

Questions for Discussion and Writing – Answer Key

1. Possible answers include: running out of landfill space, running out of raw materials for packaging, and so on.
2. Possible answers include: recycling, less packaging of materials, and so on.
3. This is a good problem to have the students research by going to the library, using the Internet, or asking their parents.

   Possible factors were the environmental movement and awareness, recycling, couples having fewer children, and so on.