

EXPLORATIONS

Activity 5

Concepts/Skills:

Scientific notation, problem solving skills

Calculator:

TI-30Xa SE or TI-34

Keeping up with Trash

Objectives:

Student uses scientific notation in finding answers to real-life problems.

Getting Students Involved

Tie this activity to recycling efforts in the school or in the city where you live. In some cities, garbage must be sorted, with recyclable materials put in different containers (perhaps several). In other cities, recyclable materials can be taken to central drop-off points.

- ◆ How many pounds of paper products do you think are recycled each day in the U.S.? *About 180 million pounds (1.8×10^8).*

Write students' guesses on the blackboard or on an overhead.

Briefly discuss the range of answers, since the guesses will likely be quite variable.

As a class, try to identify the guesses that seem most reasonable.

Ask students why they think those guesses are most reasonable.

Making Mathematical Connections

Review the limits on the calculator display.

Review the basics of scientific notation and ways to get the calculator to display numbers in scientific notation.

► Transparency Master E: Show Scientific Notation

- ◆ What is the largest number that can be displayed on your screen without going into scientific notation? *9,999,999,999*

- ◆ What happens if you add one to that number? What value does that exponent indicate?
The calculator will display: 1^{10} (10,000,000,000).
- ◆ What is the largest exponent that can be displayed on your screen?
99
- ◆ How can you display 900,000 in scientific notation?
Possible answer: 9, [EE], 5.
- ◆ How can you display 99,888,777,666 on the calculator?
Possible answer: 9, [EXP], 5.
It is impossible, since that many digits cannot be shown in the display.

Be sure that students know the following information:

- number of seconds in a minute is 60
- number of minutes in an hour is 60
- number of hours in a day is 24
- number of days in a week is 7

Carrying Out the Investigation

The data presented in this activity comes from *Statistical Abstract of the United States: 1997*, published by the U.S. Department of Commerce.

If students are not sure how to begin to solve the problems, pose a simpler problem as a model:

- If you drank 5 glasses of water each day, how many glasses would you drink in a week?
- ◆ How did you find your answer? *Multiply 5 and 7.*

Then use the transparency for this activity (page 37) as a beginning point of the discussion.

Be sure that the students have the first activity page available during this discussion.

The problems on the transparency match the first three problems on the student page, so students can record important parts of the discussion on their own pages.

- ◆ How could you use a similar strategy to solve the “aluminum” problems?
Multiply the appropriate numbers.

If students are keying in the same data repeatedly for each problem, call their attention to calculator memory functions.

► Transparency Master B: **Store and Recall Values**

- ◆ Could you store anything in your calculator to save time?
- ◆ How can you store information in your calculator and then retrieve it?

Store the amount of aluminum recycled in a day.

Use the [STO] and [RCL] keys.

Making Sense of What Happened

Use the transparency at the end of this activity (page 37) to begin the discussion.

Ask students to tell you how to solve each problem on the transparency.

Probe their answers to be sure that everyone in the class understands the solution strategies.

- ◆ What is the same about the keystrokes you used to compute all of the answers? What is different about the keystrokes?
- ◆ How can you use the [STO] and [RCL] keys to save time?

Same: Start with the value for aluminum, then enter an operation, then enter the time value, then press [=].

Different: Use different operations and time values.

Store the value for aluminum and recall it for each problem.

Continuing the Investigation

Have students investigate the number of pounds of newsprint recycled in a day. The library or the Internet may be good sources of this information.

Have students determine how much money is typically paid at recycling centers per pound for each type of trash. If the city collects recycled products, students can call city hall to find out how much they are paid for various products. How much money would be paid per day? Per week? Per year? Per hour?

Solutions

1. Week: $38,356,164$ lb. or 3.8356164×10^7 lb. scientific
Possible keystrokes: **5479452 [x] 7 [=]**
- Month: $164,383,560$ lb. or 1.6438356×10^8 lb. scientific
Possible keystrokes: **5479452 [x] 30 [=]**
- Year: $1,999,999,980$ lb. or 1.99999998×10^9 lb. scientific
Possible keystrokes: **5479452 [x] 365 [=]**

2. Hour: 228,310.5 lb. or 2.283105×10^5 lb. scientific

Possible keystrokes: **5479452 ÷ 24 =**

Minute: 3805.18 lb. or 3.80518×10^3 lb. scientific

Possible keystrokes: **228310.5 ÷ 60 =**

This is a good time to talk about the significance of the decimal digits displayed by the calculator. At most, two decimal places should be used.

Second: 63.42 lb. or 6.342×10^1 lb. scientific

Possible keystrokes: **3805.18 ÷ 60 =**

3. 0.020655041 lb. or 2.0655041×10^{-2} lb. scientific

Possible keystrokes: **5479452 ÷ 265284000 =**

Again, these digits are not all meaningful. 0.02 lb. is a more appropriate answer.

4. The first number keyed in is 5479542. The second thing keyed in is the operation (either \times or \div). The third thing keyed in is a value associated with the time period. The fourth thing keyed in is the **=** key.

Across problems, the operation changes and the value associated with the time period changes.

5. Change the amount of trash recycled daily.

6. By storing the initial value in memory, you can avoid keying in all the digits of that value for each problem. Use the recall capability of the calculator to recall the value when needed.

7. Week: 118904107 or 1.18904107×10^8 scientific

Possible keystrokes for the TI-34: **16986301 STO CE/C RCL × 7 =**

Possible keystrokes for the TI-30Xa SE: **16986301 STO (1, 2, or 3) CE/C, RCL (1, 2, or 3) × 7 =**

Month: 509589030, 5.0958903×10^8 scientific

Possible keystrokes for the TI-34: **RCL × 30 =**

Possible keystrokes for the TI-30Xa SE: **RCL (1, 2, or 3) × 30 =**

Year: 6199999865, 6.199999865×10^9 scientific

Possible keystrokes for the TI-34: **RCL × 365 =**

Possible keystrokes for the TI-30Xa SE: **RCL (1, 2, or 3) × 365 =**

- 8.** Only two decimal places are given; more accuracy than that is not necessary.

Hour: 707762.54

Keystrokes: **RCL ÷ 24 =** or **54 ÷ 24 =**

Minute: 11796.04

Keystrokes: **707762.54 ÷ 60 =**

Second: 196.60

Keystrokes: **11796.04 ÷ 60 =**

- 9.** 0.064 lb. per person

- 10.** Week: 1250410959

Month: 5358904110

Year: 6.52 106.52 10

Use the same keystrokes as #7.

- 11.** Hour: 7442922.38

Minute: 124048.71

Second: 2067.48

Use the same keystrokes as #8.

- 12.** 0.673 lb. per person

- 13.** Aluminum: 19th day, or January 19

Glass: 6th day, or January 6

Paper products: 56th day, or February 26

Since 10^{10} is the first number that involves a two-digit exponent, you can divide 10^{10} by the amount of trash recycled per day and then round up to the next whole number to find the day when the calculator would first show a two digit exponent.