EXPLORATIONS

Activity 6

Stepping Stones

Concepts/Skills

- Measurement
- Proportional reasoning
- Computation
- Problem solving

Materials

- TI–15
- Student Activity pages (pp. 40 - 43)
- Decimeter cube (clear plastic measuring cube)
- Centimeter cubes (1,000)
- Chart paper
- Markers
- Using TI-15 (p. 44)

Overview

Students will use volume formulas and proportional reasoning to calculate the amount of concrete needed to make stepping stones of a specific size.

Focus

- Show students the decimeter cube and some centimeter cubes. Pose the question, "How many centimeter cubes do you think it will take to fill this cube?"

- Line up ten centimeter cubes inside the decimeter cube on one edge. Have students estimate how many cubes it takes to fill the bottom of the cube. Record the estimates, then put one hundred centimeter cubes on the bottom of the decimeter cube. Ask students how knowing the number of cubes on one side (10) can help them determine the total on the bottom of the cube (100).

- Line up ten centimeter cubes along one vertical edge of the cube. Have students estimate how many centimeter cubes it will take to fill the decimeter cube. Record the estimates. Fill the decimeter cube with centimeter cubes. (This will take some time. You may want to use ten 100 flats from the base 10 blocks. Make sure students understand that the 100 flat is the same as 100 centimeter cubes.)

- Ask students how they can calculate the volume of the box using the information they have.

- Show students another box that is *not* a cube. Ask them how they can calculate the volume of this box without filling it with centimeter cubes. Discuss their answers and allow them to discover the formula for finding the volume of a rectangular prism.

First Things First

For students not ready for the open-ended problem, start with the *First Things First* activity page.

Presenting the Problem

Have the students read the *Stepping Stones* activity page. Discuss with them the parameters of the problem. Help them connect the volume formula with the problem.

Discuss with the students the final products they are to produce. Make sure they understand the information that needs to be on the final chart.

Evaluating the Results

After the charts have been displayed, have the teams view each poster. After completing the gallery walk, have each team present how they arrived at the numbers on their chart. Allow teams to question each other about the methods and formulas used.

Discuss with the class how the TI-15 was used to help solve the problem.

Activity 6

Stepping Stones: First Things First

The Problem

Sam's aunt, Miss Petunia Littlefield, has a favorite lemonade recipe. It calls for 11 parts water, 1 part lemon juice, and 2 parts sugar. She would like Sam to make some lemonade for her.

As he looks at the problem, Sam thinks, "There are 14 parts altogether. I could divide a glass into 14 equal parts. Then I could put in the glass $\frac{11}{14}$ water, $\frac{1}{14}$ lemon juice, and $\frac{2}{14}$ sugar. That sounds way too complicated. There must be an easier way." Just as Sam's head was beginning to hurt, Miss Littlefield says, "Sam! I forgot to give you the 2 tablespoon measuring spoon I use to measure everything for the lemonade." Sam measured 11 measuring spoons of water, 1 measuring spoon lemon juice, and 2 measuring spoons sugar, and mixed it in a measuring cup. How many total tablespoons of ingredients did Sam use?

Working the Problem

1. Enter **2 ⊠ 11 ⊞ 2 ⊠ 1 ⊞ 2 ⊠ 2 [Enter]**. What is your answer?

   Explain your result.

2. Sam noticed that there were 26 tablespoons of lemonade in the measuring cup. When the sugar dissolved, it took up less space.

   What is the ratio between the amount of the lemonade and the total amount of the ingredients? Enter the ratio as a fraction.

   Enter **26 [n] 28 [d] [Enter]**. Write the result.

   To simplify the ratio, enter [Simp] [Enter]. What is the result?

   Does it make sense? How do you know?

3. Complete the table. Calculate how much of each ingredient you need and the total number of tablespoons used.

Number of Servings	Water (tablespoons)	Lemon juice (tablespoons)	Sugar (tablespoons)	Total Number of tablespoons
1	22	2	4	28
2				
3				
4				

How many tablespoons of lemonade are in 4 servings? Remember, it makes less than the total number of tablespoons. (You may want to use the ratio between the number of tablespoons of ingredients and the actual number of tablespoons of lemonade made.)

What is your answer?

Explain your result.

Activity 6

Stepping Stones

### The Problem: How much concrete is needed to make 40 stepping stones?

The Parents Club at Garden View Elementary School wants to create a walkway through the gardens surrounding the school. Students are going to make stepping stones for the walkway. The Parents Club has asked your team to calculate how much concrete is needed to make 40 stepping stones.

The Facts

♦ Each stepping stone will be 20 cm square and 5 cm thick.

♦ The stepping stones are made in a square form. Before the concrete is poured, decorative objects can be placed in the bottom of the form. For example, colored aquarium gravel can be used to create designs. Remember: the top of the form is actually the bottom of the stepping stone. The colored gravel is the top of the stepping stone after it is removed from the square form.
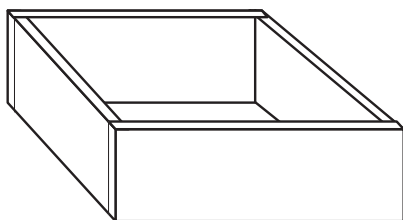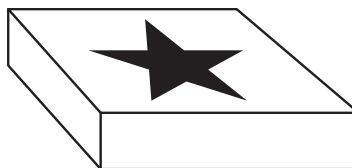
Form   **Finished Stepping Stone**

♦ Aquarium gravel is fairly small. A layer 5-mm thick is enough to create a design in the stepping stone.

♦ Concrete comes in many forms. For stepping stones, you need cement, sand, and water.

♦ Each batch of concrete is mixed using 4 parts sand, 1 part cement, and $\frac{1}{2}$ part water. The amount of water may vary depending on the wetness of the sand.

♦ The actual amount of wet concrete is about $\frac{2}{3}$ the total volume of the cement, sand, and water.

♦ 1,000 cubic centimeters = 1 liter

♦ 1,000,000 cubic millimeters = 1 liter

The Task

1. Your team will:

   – Calculate the volume of one stepping stone.

   – Calculate the volume of aquarium gravel for one stepping stone.

   – Calculate the amount of concrete for one stepping stone.

   – Calculate the total amount of aquarium gravel needed for the project.

   – Calculate the total amount of concrete needed for the project.

   – Calculate the amount of each component of the concrete needed for the project.

   – Create a chart showing the calculations and the final information.

2. Each individual on the team will write an explanation of the calculations. The explanation will answer the following questions.

   – How did your team calculate the answers to the problem? Do you agree with the calculations?

   – How accurate are the calculations? Did your team round any of the numbers? How would rounding numbers affect the answers?

   – If the Parents Club wants to make 50 stepping stones, how do you change the calculations for them? Explain your answer.

3. Your team will present the results of your calculations.

Using the TI-15

Activity 6

Stepping Stones

6 [n] 8 [d̄] [Enter]

$$\frac{N}{D} \rightarrow \frac{n}{d}$$

$$\frac{6}{8} = \qquad \frac{6}{8}$$

[Simp] [Enter]

$$\frac{6}{8} \triangleright S \qquad \frac{3}{4}$$