

ACTIVITY 5

Mapping Perimeter and Area

TEKS 6.8 Measurement. The student solves application problems involving estimation and measurement of length, area, time, temperature, capacity, weight and angles. The student is expected to: **(A)** estimate measurements and evaluate reasonableness of results; **(B)** select and use appropriate units, tools or formulas to measure and solve problems involving length (including perimeter and circumference), area, time, temperature, capacity and weight.

Objective: Students will investigate perimeter and area by measuring maps. Students will record and graph data. Students will make observations about how perimeter and area change when multiplied by a scale factor.

Number of students: Students can work in pairs.

Materials:

- Recording sheet
- Large 1-inch grid paper
- Fold-up city or state maps

Steps:

Step 1: Start with the map completely folded. Measure the length and width of the map to the nearest inch and record that information on the recording sheet. Find the perimeter of the folded map. Record the perimeter of that map on the recording sheet.

Step 2: Trace the map on the 1-inch grid paper. Estimate the area of the folded map by counting the number of 1-inch squares. Record the area of the map on the recording sheet. The units for area are square inches.

Step 3: Next, unfold the map so that the length is twice as long as the original length. Then unfold the map so that the width is twice as long. Trace the map on the 1-inch grid paper.

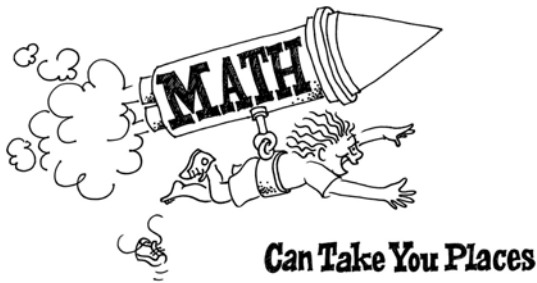
Step 4: Now it is time to make a prediction. How long is the new perimeter? How many square inches is the new area? Write your prediction on the recording sheet. Share your predictions with at least two other students in the class

Teacher Note: After a few minutes, have a class discussion about the predictions, allowing students to explain their reasoning.

Step 6: Find the new perimeter and area and write that information on the recording sheet.

Step 7: Unfold the map so that the new length is three times as long as the original length and the width is three times as long as the original width. Make your prediction about the new length, width, perimeter and area.

Step 8: Trace the unfolded map on the 1-inch grid paper and record the new measurements on the recording sheet.



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Step 9: Can you find a pattern for each measurement? Write an explanation about how each new length, width, perimeter and area compares to the original measurements of the folded map. Discuss your ideas with two other students.

Teacher Note: Students should conclude that as the length and width change by a given scale factor, the perimeter changes by the same scale factor. However, as the length and width increase by a scale factor, the area changes by that scale factor squared or by that scale factor times itself.

Let's say the original length is 2 inches and the original width is 3 inches.

$$\begin{aligned}\text{Perimeter} &= 2(2 \text{ inches} + 3 \text{ inches}) \\ \text{Perimeter} &= 10 \text{ inches or } 1(10 \text{ inches})\end{aligned}$$

$$\begin{aligned}\text{Area} &= 2 \text{ inches} \cdot 3 \text{ inches} \\ \text{Area} &= 6 \text{ square inches or } 1^2 \cdot (2 \cdot 3)\end{aligned}$$

If the length and width will increase by a **scale factor of 2** when the map is unfolded the first time, the new dimensions are as follows:

$$\text{Length} = 4 \text{ inches and the Width} = 6 \text{ inches}$$

$$\begin{aligned}\text{Perimeter} &= 2(4 \text{ inches} + 6 \text{ inches}) \\ \text{Perimeter} &= 20 \text{ inches or } \mathbf{2(10 \text{ inches})}\end{aligned}$$

$$\begin{aligned}\text{Area} &= 4 \text{ inches} \cdot 6 \text{ inches} \\ \text{Area} &= 24 \text{ inches or } \mathbf{2^2 \cdot (2 \cdot 3)}\end{aligned}$$

If the length and width will increase by a **scale factor of 3** when the map is unfolded the first time, the new dimensions are as follows:

$$\text{Length} = 6 \text{ inches and the Width} = 9 \text{ inches}$$

$$\begin{aligned}\text{Perimeter} &= 2(6 \text{ inches} + 9 \text{ inches}) \\ \text{Perimeter} &= 30 \text{ inches or } \mathbf{3(10 \text{ inches})}\end{aligned}$$

$$\begin{aligned}\text{Area} &= 6 \text{ inches} \cdot 9 \text{ inches} \\ \text{Area} &= 54 \text{ inches or } \mathbf{3^2 \cdot (2 \cdot 3)}\end{aligned}$$

Extensions/Modifications:

To clarify the scale factor, have students create charts that list the length, width, perimeter and area of the map at the different stages.