



Hands on the Giant

Topic
Proportional reasoning

Key Question
How tall is the giant?

Focus
Students will seek to determine the approximate height of a giant given only an example of a giant hand print.

Guiding Documents

NCTM Standards

- *Develop the process of measuring and concepts related to units of measurement*
- *Collect, organize, and describe data*
- *Use problem solving approaches to investigate and understand mathematical content*
- *Develop and apply a variety of strategies to solve problems, with emphasis on multi-step and non routine problems*
- *Verify and interpret results with respect to original problem*
- *Acquire confidence in using mathematics meaningfully*
- *Understand and apply reasoning processes with special attention to spatial reasoning and reasoning with proportions and graphs*
- *Validate their own thinking*

Project 2061 Benchmarks

- *Tools such as thermometers, magnifiers, rulers, or balances often give more information about things than can be obtained by just observing things without their help.*
- *Length can be thought of as unit lengths joined together, area as a set of unit squares, and volume as a set of unit cubes.*
- *Make sketches to aid in explaining procedures or ideas.*

Math

Measurement
length
Ratio and proportion
Estimation
Problem solving

Science
Life science
human body ratios

Integrated Processes

Predicting
Observing
Comparing and contrasting
Collecting and recording data
Interpreting data
Generalizing
Applying

Materials

Large chart paper or butcher paper
Tools for measuring length such as rulers, metric tape measures, meter sticks
Non-standard measurement tools such as chalkboard erasers or pencils
Scissors
Colored markers
Paper hand print of the giant's hand (see *Management*)

Background Information

This problem, when encountered by adult learners, seems to signal the immediate use of a proportional equation such as—the measure of my hand is to the measure of my height as the measure of the giant's hand is to X (the measure of the giant's height). Cross multiply and solve for X.

It may be more enlightening to have students avoid using a proportional equation, even if they know how, and solve the problem by doing it in some other way.

The problem focuses on the application of proportional reasoning that underlies the ultimate proportional equation. The power of this activity is in the multiple responses one can observe in a classroom and how it helps to convey what students know and understand about proportional reasoning. The emphasis is on looking at how students communicate what they know (or do not know).

The focus is not that students use the same unit of measure to express their answer or that they even use a standard unit. Very young students have solved the problem by suggesting the giant is 10 giant hands tall

based on the idea that they could use their own hand (laid end to end) to measure their own height and that the giant must be the same number of hands tall. Their answer of 10 giant hands is valid with that explanation. Other students reason that if the giant's hand is three times bigger than their hand, then the giant must be three times taller or three students tall.

Notice that it is appropriate to compare the student's hand to the giant's hand and the student's height to the giant's height. It also makes sense to compare the student's hand to the student's height and the giant's hand to the giant's height. The giant's height can be expressed in number of student hands, number of giant hands, number of student heights, or in some standard unit of measure such as centimeters, meters, inches, or feet.

Management

1. This experience is intended for small groups of three or four students.
2. Each group should use one large piece of chart paper to picture and write about how they solved the problem.
3. Encourage them to use words, pictures, and symbols to show their thinking and what they did to find out how tall the giant was. Examples of four different responses, representing a composite of student explanations, have been included for teacher reference only.
4. To make the giant's hand, use a marker to draw around your hand on a transparency. Put the transparency on the overhead projector, trace the outline on newsprint or other paper, and cut it out. Use this pattern to make one giant hand for each group.

Procedure

1. Introduce the problem with this scenario: *During the night, a giant entered our classroom and, while groping in the dark for the light switch, the giant left a large smudge that looked like a hand print on the wall. Not wishing to leave this mark for someone else to clean up, I began to remove its trace from the wall when suddenly I began to wonder how tall this giant could be. I quickly made a paper copy of the giant's hand print. Can you help me find the approximate height of the giant?*

2. Distribute a giant hand print and a large piece of chart paper to each group of students. Make available the measurement devices listed.
3. Instruct the groups to use the large chart paper to show how they solved the problem, including the question and a step-by-step description of what they did. They should use words, pictures, symbols, and numbers to explain their thinking.
4. Have each group share its solution with the whole class.
5. Give each student the activity page for independent reflection and response. Three questions are included: What did you learn? What mathematics did you do? How did you feel about the problem and finding a solution?

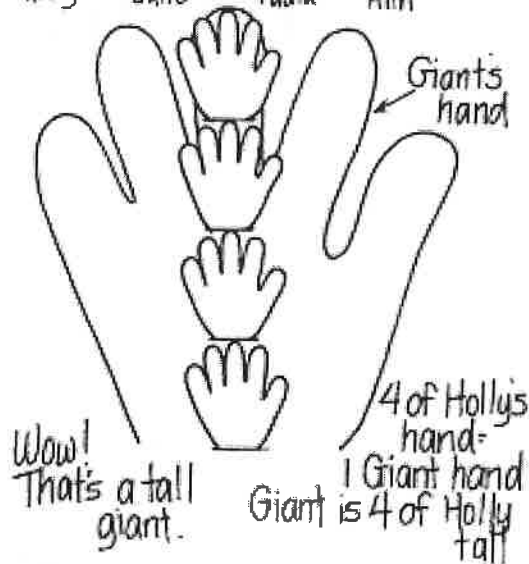
Discussion

1. How many different ways are there to find how tall the giant is? Describe them.
2. What does it mean to measure a *hand*? [length of hand or width of hand]
3. How are hands used to measure height? [laid end to end or side by side]
4. What other ways of measuring were used? How did they affect the answer?
5. Could this giant stand up in our room? If we asked the giant to lie down on the floor, show me where his feet would be and how far away his head would be.
6. What assumptions did your group make to solve the problem? [that the hand to height relationship of the giant was similar to that of a student]
7. What changes in procedure were made by your group as you worked to solve the problem? What procedures did not work?
8. How are you sure that your estimate of the giant's height is fairly accurate?
9. What kinds of mathematics did you use in solving the problem?

Extensions

1. See other related AIMS activities such as *Designing the Giant's Coat* (AIMS magazine: Volume II, No. 6, pp.11-14).
2. Distribute a tiny hand print and ask students to consider finding the approximate height of a mini-person. Is the process the same or different?

How big is the giant ?



Wow! That's a tall giant.

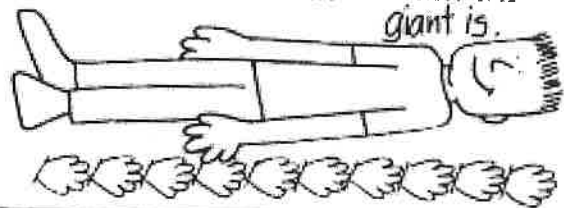
How tall is the giant ?

A student lies down on the ground. Draw a line at the top of his head and bottom of feet. Student takes his hand to measure his height in hands.

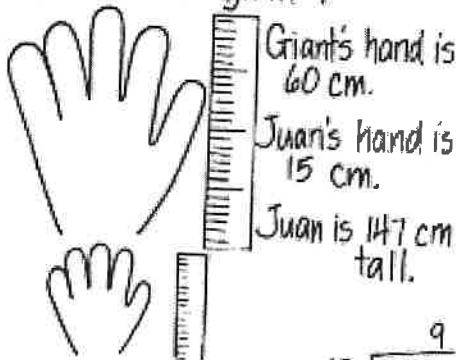
Steve is 10 of his own hands tall.

So the giant is 10 giant hands tall

Use giant's hands - hand over hand to find out how tall the giant is.



How tall is the giant ?



We found that Juan is almost 10 hands tall.

So the giant is 10 times taller than his hand. 600 cm tall

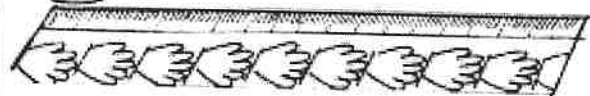
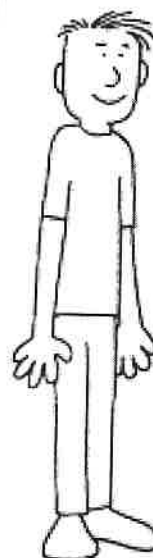
$$\begin{array}{r} 9 \\ 15 \overline{) 147} \\ \underline{135} \\ 12 \end{array}$$

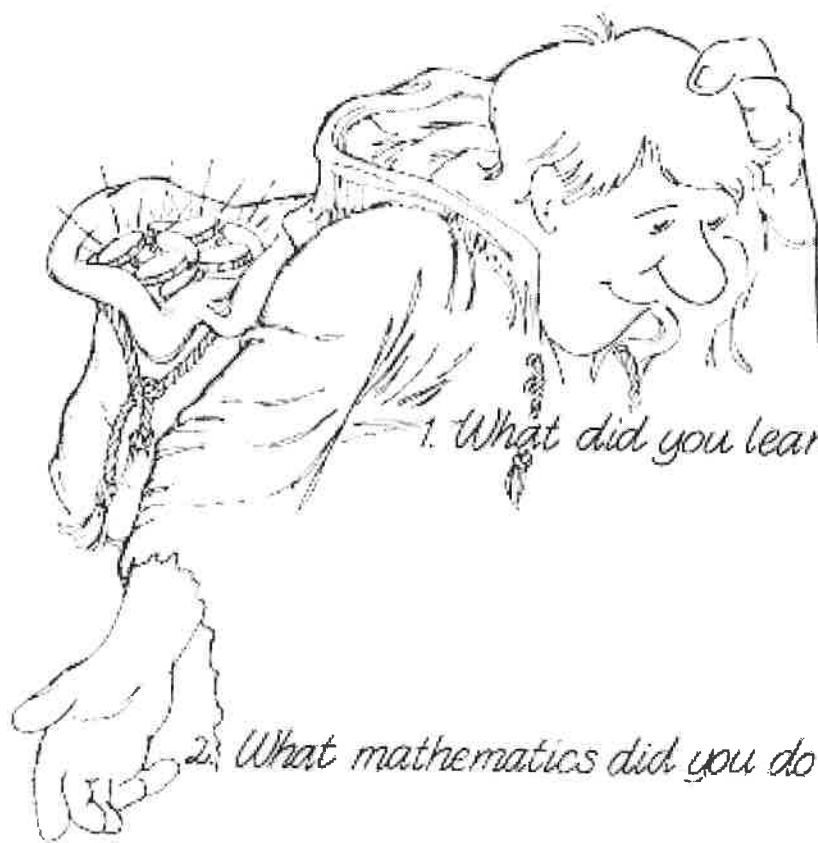
How tall is the giant ?

Have Tasha stand by the wall and mark her height. Use her hands to find how many hands tall she is. (9½)

Mark a beginning point on floor. Move the giant's hand end to end on the floor and mark the place for 9½ giant hands.

Use measuring tape to find how tall giant is. (570 cm)





Hands on the Giant

1. What did you learn?

2. What mathematics did you do?

3. How did you feel about the problem and finding a solution?

