

## CUTTING THE WOOD

### Performance Standard (6B/6C/6D).G

Analyze the instructions for cutting a board into fractional parts to determine why following those instructions did not produce the desired results and reword the directions to prevent the error in the future:

- *Mathematical knowledge:* Solve word problems using fractions; demonstrate the effects of multiplying or dividing by a fraction less than or greater than one.
- *Strategic knowledge:* Solve word problems involving proportions.
- *Explanation:* Explain completely and clearly what was done and why it was done.

### Procedures

1. *In order to investigate, represent, and solve problems using number facts, operations and their properties, algorithms, and relationships (6B), compute and estimate using mental mathematics, paper-and-pencil methods, calculators, and computers (6C), and solve problems using comparison of quantities, ratios, proportions, and percents (6D),* students should experience sufficient learning opportunities to develop the following:
  - Demonstrate and describe the effects of multiplying or dividing by a fraction less than or greater than one.
  - Select, use and justify operations, methods, and tools to compute or estimate with integers and familiar rational numbers.
  - Work flexibly with fractions, decimals, and percents to solve number sentences and word problems (e.g. 50% of 10 is the same as  $\frac{1}{2}$  of 10 is the same as  $0.5 \times 10$ ).
  - Create and explain a variety of equivalent ratios that represent a given situation.
  - Develop, use, analyze and explain methods for solving numeric or word problems involving proportions.
2. Provide each student a copy of the "Cutting the Wood" task sheets and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Ask them to solve the problem, showing all their work and explaining their reasoning. (Do not help the students or guide them in their thinking during the assessment).
4. Evaluate each student's work using the rubric and its guide to determine the performance level. Score Part A and Part B separately using the following as a guide:
  - Minor errors in computation would include errors in computing with whole numbers or with the whole numbers within the algorithm for computing with fractions (e.g. an error in multiplying the numerators of two fractions), or errors that involve counting.
  - Major errors in computation would include major procedural errors in multiplication of fractions (e.g. multiplying only the numerators, cross multiplying). Other major errors include taking  $\frac{1}{4}$  of the wrong number. (e.g. taking  $\frac{1}{4}$  of 64 for Keisha's board length.)
  - Part A should show board lengths of 16 inches for Jan, 12 inches for Keisha, 9 inches for Chad, leaving 27 inches for the student. A 4 in mathematical knowledge should reflect a perfect scale drawing, as well as correct answers, while a 3 will have the answers basically correct, but the scale may be off.
  - In part B the key idea is whether he/she understand that each student should have gotten  $\frac{1}{4}$  of the original board, and that Mr. Ramirez's directions needed to reflect that.

### Examples of Student Work follow

### Time Requirements

- One class period

### Resources

- Copies of the "Cutting the Wood" task sheets
- Paper and pencils
- Ruler or straight edge may be used
- Mathematics Rubric

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### CUTTING THE WOOD

In your industrial arts class, you are making birdhouses out of wood. You and three of your friends – Jan, Keisha, and Chad – are getting the wood you need. Your teacher, Mr. Ramirez, gives your group one piece of wood that is 64 inches long, and hands each of you a sheet of paper that says, “Measure the board and cut off  $\frac{1}{4}$  of it.”

Jan goes first. She measures the board, and cuts off  $\frac{1}{4}$  of it. She hands the rest to Keisha.

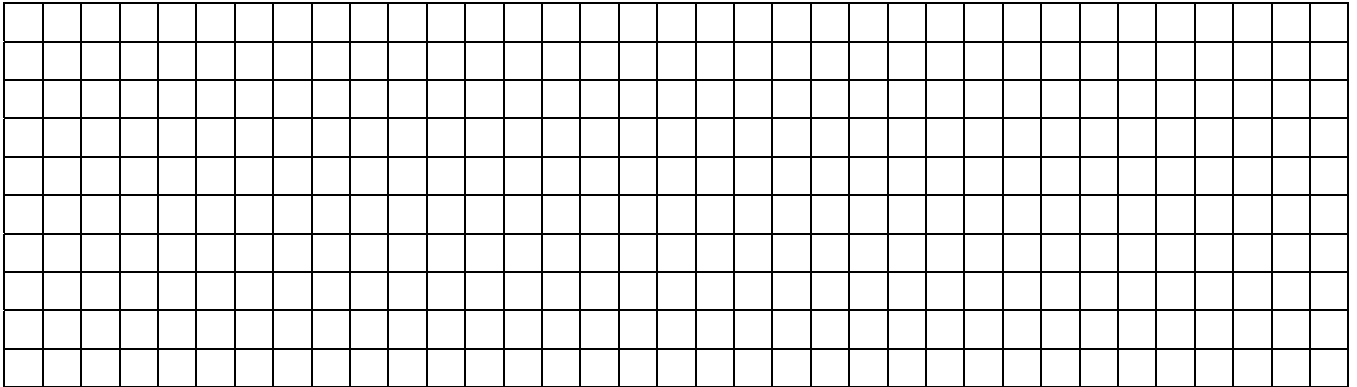
Then Keisha measures the board and cuts off  $\frac{1}{4}$  of it. She hands the rest to Chad.

Chad measures the board and cuts off  $\frac{1}{4}$  of it. He gives the rest of it to you.

At this point, you figure that what’s left is yours. But as your group starts to look at their pieces, they realize there is a problem. You don’t all have the same size piece of wood. Keisha and Chad complain they don’t have enough, and you have more than you need. Jan finds that she has just the right amount to make her birdhouse.

#### PART A

**Draw a picture of the 64-inch board on the grid below and show where the students cut it. Show all your calculations. Make sure to label all parts of your diagram and the scale you used. Also provide a written description of what you did and why you did it.**



Work space:

Written Description:

## CUTTING THE WOOD

### PART B

Analyze what happened when the wood was cut, and then answer the following questions. Make sure to show all your work and support your reasoning. You should use words, pictures and calculations to help you support your answers and reasoning.

- 1) How much wood do you think Mr. Ramirez wanted each person to have? Why?
- 2) What caused the problem?
- 3) How can Mr. Ramirez change his instructions so that other students don't make the same error?

Adapted from Arizona's State Assessment Program as included in the National Council of Supervisor's of Mathematics *Great Tasks and More* (1996).

Name \_\_\_\_\_

Date 04/04/01

Cutting the Board

In your Industrial Arts class, you are making birdhouses out of wood. You and three of your friends – Jan, Keisha, and Chad – are getting the wood you need. Your teacher, Mr. Ramirez, gives your group one piece of wood that is 64 inches long, and hands each of you a sheet of paper that says "Measure the board and cut off 1/4 of it."

Jan goes first. She measures the board, and cuts off 1/4 of it. She hands the rest to Keisha.

Then, Keisha measures the board and cuts off 1/4 of it. She hands the rest to Chad.

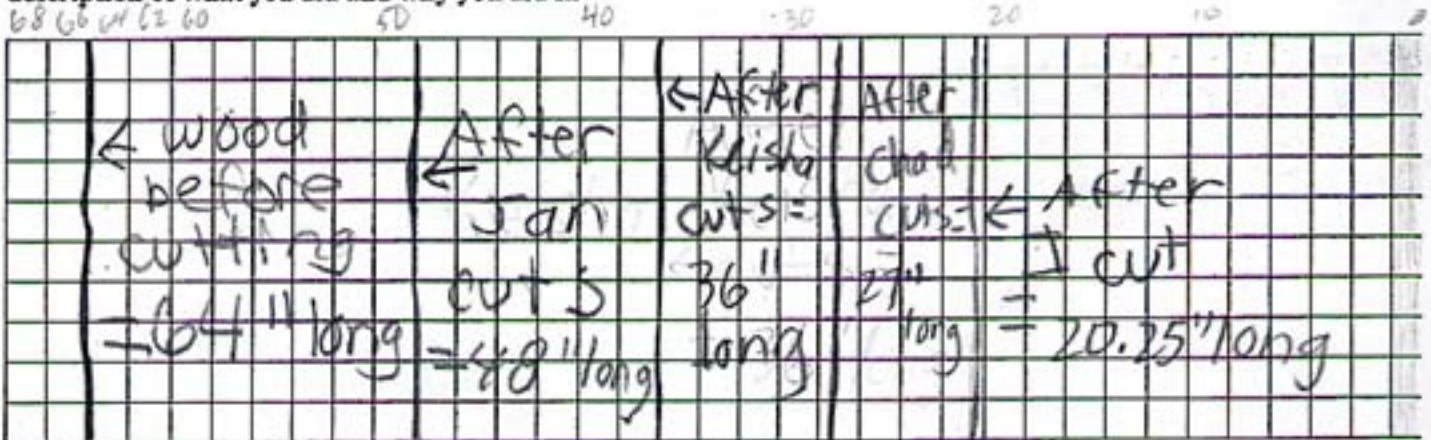
Chad measures the board and cuts off 1/4 of it. He gives the rest of it to you.

48" long  
36" long  
27" long

At this point, you figure that what's left is yours. But as your group starts to look at their pieces they realize there is a problem. You don't all have the same size piece of wood. Keisha and Chad complain they don't have enough, and you have more than you need. Jan finds that she has just the right amount to make her birdhouse.

PART A.

Draw a picture of the 64-inch board on the grid below and show where the students cut it. Show all your calculations. Make sure to label all parts of your diagram and the scale you used. Also provide a written description of what you did and why you did it.



4 squares = 1 square = 2 inches  
Work space:

$$64 \div 4 = 16 \quad 64 - 16 = 48$$

$$48 \div 4 = 12 \quad 48 - 12 = 36$$

$$36 \div 4 = 9 \quad 36 - 9 = 27$$

$$27 \div 4 = 6.75 \quad 27 - 6.75 = 20.25$$

Written Description:

To solve this I first needed to figure the length of the board after Jan cuts 1/4 of the wood off. I divided 64 by 4, which equals 16. Then I took 64-16 and got 48. So when Jan handed Keisha the board, it was 48 inches long. I again divided by 4 then subtracted that amount from the 48. I got 36 and repeated the division of four and subtraction for 36 and then for Chad's board and my board. I ended up with my board being 20.25 inches long.

64

**PART B.**

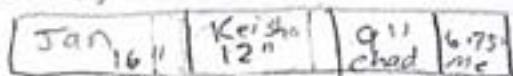
Analyze what happened when the wood was cut, and then answer the following questions. Make sure to show all your work and support your reasoning. You should use words, pictures and calculations to help you support your answers and reasoning.

1) How much wood do you think Mr. Ramirez wanted each person to have? Why?

I know because Jan had 16" and the problem stated that she had enough to build the birdhouse.  
 Mr. Ramirez wanted everyone to have 16" of wood and

2) What caused the problem?

Mr. Ramirez thought that since he wanted them all to have 16" of wood and  $64 \div 4 = 16$  then each kid should cut  $\frac{1}{4}$ . He didn't consider that each time the wood would be smaller, so one fourth would be a smaller length.



64"

$\frac{1}{4}$  of 64 = 16  
 $\frac{1}{4}$  of 48 = 12  
 $\frac{1}{4}$  of 36 = 9  
 $\frac{1}{4}$  of 27 = 6.75

3) How can Mr. Ramirez change his instructions so that other students don't make the same error?

He could say, "divide the 64" of wood into four equal pieces, and everyone in the group of 4 should keep one."

64" ↓



Adapted from Arizona's State Assessment Program as included in the National Council of Supervisor's of Mathematics Great Tasks and More (1996).



Jan 3-30-01

**PART B.**

Analyze what happened when the wood was cut, and then answer the following questions. Make sure to show all your work and support your reasoning. You should use words, pictures and calculations to help you support your answers and reasoning.

- 1) How much wood do you think Mr. Ramirez wanted each person to have? Why?

He wanted everyone to have 16 in. This would have been fair & the kids could then make their bird houses without them turning out different.

- 2) What caused the problem?

Keisha cut  $\frac{1}{4}$  of the remaining wood so she got less than Jan. Chad made the same mistake. That left you with 27 in.

- 3) How can Mr. Ramirez change his instructions so that other students don't make the same error?

He could give Jan a paper telling her to cut  $\frac{1}{4}$  & then have her go 1<sup>st</sup>. He could tell Keisha to take  $\frac{1}{3}$  of the remaining wood & have her go 2<sup>nd</sup> because  $\frac{1}{3}$  of 48 is 16 &  $\frac{1}{4}$  of 64 is 16. He could then tell Chad to cut  $\frac{1}{2}$  of the remainder & have him go 3<sup>rd</sup> because  $\frac{1}{2}$  of 36 is 18 &  $\frac{1}{4}$  of 64 is 16. You would then get the last 16 in of wood.