Sandbox for Geoffrey

Mr. and Mrs. Hesslink want to build a sandbox for their son Geoffrey. They bought 5 boards to create the sandbox frame. Each board is 8 feet long. Plastic must also be purchased for the bottom of the sandbox. However, they are not sure how much to buy. First they must determine the size the sandbox is going to be.

What are all of the possible rectangular sandboxes that they could make using all of the wood they purchased?

Which one do you think they should build? Why?

How much plastic do the Hesslinks need to buy to cover the bottom of the sandbox?

Grade Levels 3 - 5

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Context

This task was given to students as an assessment following a unit on area and perimeter. The students had experiences finding the area and perimeter of geoboard shapes and trains of pattern blocks. They solved Pick's Theorem and other problem-solving tasks related to area and perimeter. Similar problems were done in cooperative groups and discussed as a whole class.

What This Task Accomplishes

This task asks the students to determine the possible perimeters for 40 feet of wood, as well as calculate the area of the rectangles in order to determine the largest one. After finding the area, they then determine the amount of plastic needed. This task also helps students to see the relationship between area and perimeter. There is an underlying pattern in the dimensions possible that allows students to know when they have found all possible combinations.

What the Student Will Do

Students first need to determine the amount of wood they have to work with. Then most students begin to draw rectangles that use 40 feet of wood. Once they have found a pattern, they create a chart to help them organize the possibilities so that they know when they have found all possible rectangles. Next students will usually use their table or chart to find the rest of the rectangles so they are able to determine the one with the largest area. After choosing the sandbox they prefer and supporting their decision, they need to state how much plastic is needed.

Time Required for Task

One - two, 45-minute periods

Interdisciplinary Links

This task could be linked to a unit on playgrounds, toddler care or recreation.

Teaching Tips

Students were invested in finding a solution because the task was an actual problem my husband and I needed to solve. Personalize this task for your own students. Substitute a different family and child's name that the students in your class are familiar with or use one from a popular television program with which the students can identify.

Suggested Materials

- Calculators
- Graph paper

Possible Solutions

There are 10 possible rectangular boxes

1' x 19', 2' x 18', 3' x 17', 4' x 16', 5' x 15', 6' x 14', 7' x 13', 8' x 12', 9' x 11', 10' x 10'.

Most students will choose the 10' x 10' because it is the largest in area. It will require 100 square feet of plastic.

Benchmark Descriptors

Novice
Novice solutions will show no evidence of strategy and no evidence of mathematical reasoning. They might obtain a solution, but have no evidence to support it. There may be diagrams present, as most students begin with drawing diagrams as a strategy, but there will be little or no mathematical language.

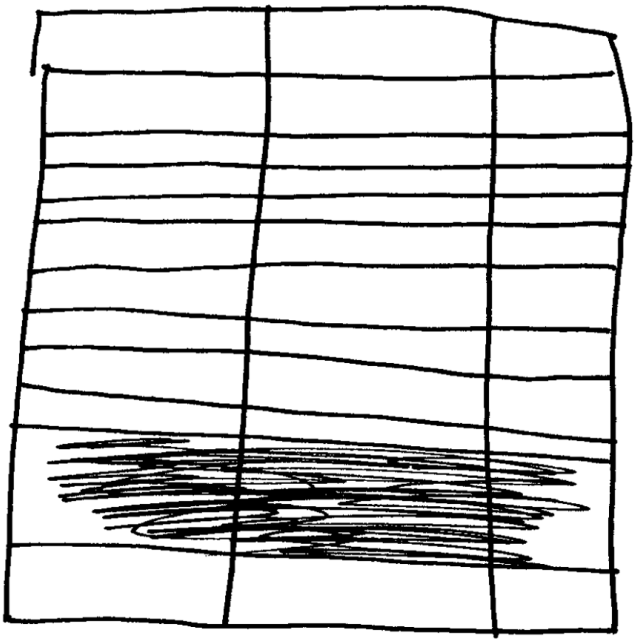
Apprentice
Apprentice solutions may have an approach that would work, but may have flaws in their reasoning. They may not work systematically and therefore miss some of the possible solutions. They may neglect to find the amount of plastic needed or may make mistakes in calculations.

Practitioner
Practitioner solutions will have an approach that works and a correct answer for all parts of the problem. They will use appropriate math language throughout and have a well-labeled and

accurate representation to communicate an aspect of their solution. Practitioners may also begin to recognize some simple patterns in their solutions.

Expert
Expert solutions will have an approach that may be sophisticated and will have correct answers for all part of the problem. The Expert will use precise math language and use representations as a tool in determining a solution. The Expert will also go beyond the task requirements and make mathematically relevant observations and connections.

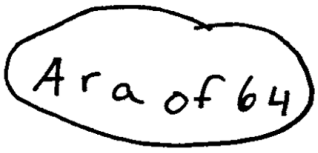
Novice



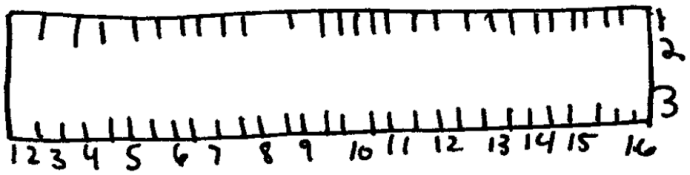
The student does not seem to have a strategy for solving the problem.

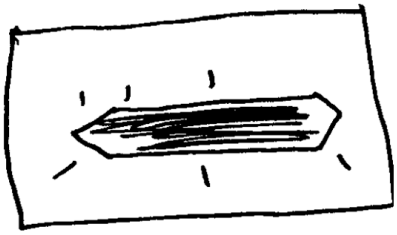
It is unclear what this has to do with the student's solution.

There is no evidence of how the student obtained this solution.



This diagram will not work using 40 feet of wood.





Apprentice

I think they should build
12 x 8 = 96 sq ft. I think they should
make this one because it the best
one. The area of the plastic
is 6 sq ft.

The student uses accurate math language such as "area" and "sq. ft.".

The student reaches an incorrect answer.

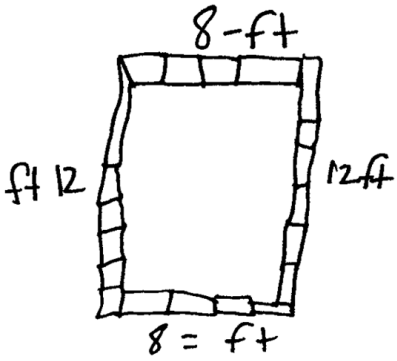
Apprentice

d = m	sq ft	What the L rg rectangle
15 x 5 =	75 sq ft.	75
16 x 4 =	64 sq ft	64
12 x 8 =	96 sq ft.	96
14 x 6	84 sq ft	84
10 x 4 =	40 sq ft	40
14 1 3 =	42 sq ft	43

The student does not try 10' x 10', which is the correct solution.

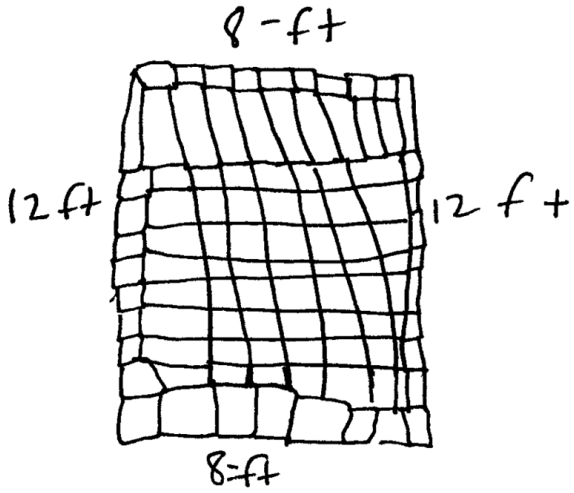
A 10' x 4' box does not equal 40 feet of wood.

A 14' x 3' box does not equal 42 feet of wood.



you need the plastic to= the area of the gard box

The student uses a chart in which to record data.



The student attempts to use diagrams to find a solution.

Practitioner

I would give Geoffrey 10x10 because it has an area of 100 and you need 100 sq. feet of plastic Rule Multiply lenght x with to get the area 10x10 is the biggest and there is no other sandbox. I knew that when you times LxW=A.

The student uses accurate and appropriate math language.

# of sand Boxes	Lenght	width	area
1	19	1	19 sq ft.
2	18	2	36 Sq.ft
3	17	3	51 sq.ft
4	16	4	64 Sq.f
5	15	5	75 sq.ft
6	14	6	84 sqft.
7	13	7	91 sq ft.
8	12	8	96 sq ft.
9	11	9	99 sq ft.

The student explains the reasoning behind the solution.

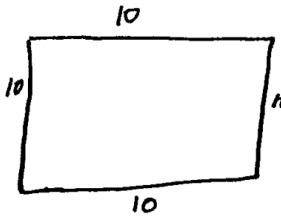
The student correctly lists all possibilities in this labeled chart.

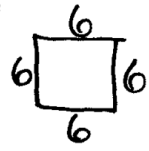
Expert

I think they should built the length 10 width for the sandbox and they could by 100 square feet plastic. A pattern I found is that the length goes down each and I, the width goes up 1.

Title: Boards for Sandbox

Length	Width	area
16	4	64
15	5	75
14	6	84
13	7	91
12	8	96
11	9	99
10	10	100
9	11	99
7	3	21
8	2	16
9	1	9





length	width	area
8	4	32
7	5	35
6	6	36
5	7	35

The student makes mathematically relevant observations.

It I used length x width for a formula worked because I found out the area by length If Mr. Hesslink bought 3 boards that were 5 feet long the sandbox would be different. the box needs 24 feet. Mr Hesslink would want to have length is 6 the width 6 and the plastic coould be 36 square feet.

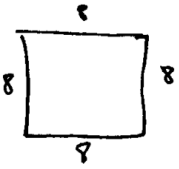
The student creates accurate and appropriate math representations.

The student recreates the problem and solves it again.

By recreating problems, students are more likely to discover underlying math concepts. This student may be encouraged to compare the two solutions and what they have in common, constructing the notion that the closer to a square a rectangle is, the greater the area.

If Mr. Hesslink bought 4 boards that were 8 feet long it would be 32 feet long Mr. Hesslink would have the length 8, the width 8, and the plastic would be 64 square feet

Length	Width	area
8	8	64
9	7	63



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