Teacher's Version of Tasks 1-3 RP.3

Developed by Debbie Cavino and Erin Wheeler

Materials: Graph Paper
Rulers
Copies of the Tasks 1, for the students

Based on the following tasks from Illustrative Mathematics
Converting Square Units- http://www.illustrativemathematics.org/illustrations/79
Dana's House- http://www.illustrativemathematics.org/illustrations/118

Task 1 Commentary- The purpose of this task is to provide students with an opportunity to apply Mathematical Practice 3 (Construct Viable Arguments and Critique the Reasoning of Others) while exploring the relationship between linear and square measurements. Students will also be applying the use of a rate to convert measurement in this task. Small measurements were given in this task so students could concretely model the situation to determine how the mathematics connects to the context of the problem. (MP4) The simple numbers and scaffolding of this task are designed to prepare students for the "Converting Square Units" task. After Task 1 students should be able to recognize why Jada's reasoning in Task 2 is incorrect.

Task 2 Commentary- "Converting Square Units" This task from Illustrative Mathematics is scaffolded to help students convert the measurements to feet before finding the amount of square feet. This will help them find the correct amount of square feet. Their correct response to part c and their experiences from Task 1 will help them explain the common mistake that Jada made in her reasoning.

Task 3 Commentary- "Dana's House" This task extends the thinking from Task 1 and 2 to use the converted measurements to calculate the percent of the lot not covered by her house. Converting measurements is one tool we have to understand how the size of Dana's House relates to the size of the lot. A percentage is another tool that makes this relationship even easier to see. The sketches drawn in step a and step c are designed to give students experience modeling the information given in the problem. The picture gets us started, but then we revisit it when the math has given us more information about the relationship between the house and the lot. We can now draw a much better picture. It's important that students pay attention to what we know along with what we don't know from the problem. In step a, we really don't know how the proportional sizes of the house and the lot relate because the units obscure that relationship. That's ok because as long as we know that the house sits on the lot, we have a place to get started. In step c, we have enough information to recognize that a house that is 1/3 the size of the lot is an unreasonable. However, we have no idea how the house is positioned within the lot. The problem doesn't tell us that.

Task 1

General Question:

Mr. Marks has a table that is 12 inches by 24 inches. He wants to display class projects lying flat on the table without overlapping. What is the greatest number of projects he can fit on the table?

Bill's Solution

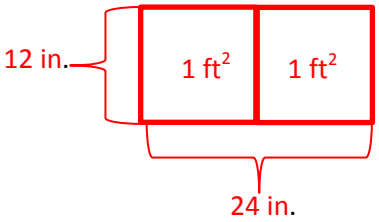
Bill thought that 24 projects would fit. He said, "I took 12 in. x 24 in. to get that the area was 288 square inches. There are 12 inches in a foot so I divided 288 in^2 by 12 to get 24 ft^2.

Donna's Solution

Donna found a different answer. She said, "I know that 12 inches equals 1 foot and 24 inches equals 2 feet. Then I multiplied 1 foot times 2 feet to get 2 square feet. He only has room for 2 projects."

a) Using graph paper draw a model of Mr. Mark's table. Let 1 square = 

Students should draw a rectangle that measures 12 by 24 units on the graph paper.



b) Using the illustration how many square foot projects can fit on the table?
Two projects can fit on the table.

c) Who was correct? Bill or Donna? (circle one)

Explain how their work connects to your illustration.

The picture shows that the rectangle's dimensions are 12in by 24in. This is the same as saying the dimensions are 1ft by 2ft. The rectangle's area is 2 square feet. (1 x 2)

d) Who was incorrect? Bill or Donna? (circle one)

What was common mistake made?

Bill mixed up the difference of square units and linear units. He divided the area in square inches by 12 inches, but there are more square inches in a square foot. A square foot has the dimensions of 12in x 12in so it equals 144 square inches.

e) How would you convince them that their method would not work?

I would draw a diagram and label the measurements. Then I would show Bill how to break up the area into square feet on the diagram. I could also use the diagram to show Bill that he could divide the area in square inches by the number of square inches in a square foot.

Task 2 Converting Square Units (6.RP.A3)

Jada has a rectangular board that is 60 inches long and 48 inches wide.

1. How long is the board measured in feet?
   (show how a rate could be used to convert the measurement)

   $60 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 5 \text{ ft}$

2. How wide is the board measured in feet?
   (show how a rate could be used to convert the measurement)

   $48 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 4 \text{ ft}$

   Find the area of the board in square feet.

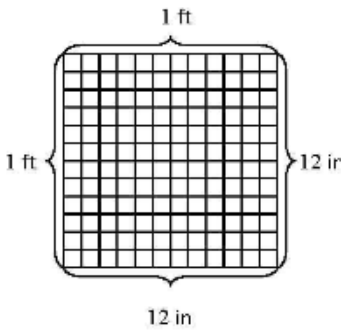
   $5 \times 4 = 20 \text{ ft}^2$

3. Jada said,

   To convert inches to feet, I should divide by 12.
   The board has an area of $48 \text{ in} \times 60 \text{ in} = 2{,}880 \text{ in}^2$.
   If I divide the area by 12, I can find out the area in square feet.
   So the area of the board is $2{,}880 \div 12 = 240 \text{ ft}^2$.

   What went wrong with Jada's reasoning? Explain.

   While it is true that you convert inches to feet by dividing by 12, that doesn't work for converting square inches to square feet. Because a square foot is 12 inches on each side, there are $12^2 = 144$ square inches per square foot (see the picture).

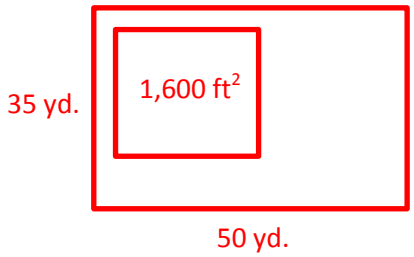


$$2{,}880 \text{ in}^2 \times \frac{1 \text{ ft}^2}{144 \text{ in}^2} = 2{,}880 \div 144 \text{ in}^2 = 20 \text{ ft}^2$$

Task 3 Dana's House (6.RP.A3)

The lot that Dana is buying for her new one story house is 35 yards by 50 yards. Dana's house plans show that her house will cover 1,600 square feet of land.

a) Draw a sketch of information provided. (label your drawing)



The pictures at this point will be varied because it isn't obvious how the size of the house relates to the size of the lot because of the different units. But they should recognize that house sits within the lot.

To have a better idea of how the size of the house compares to the size of the lot what could I do? (have measurements based on the similar units- ft and ft^2 or yd and yd^2)

b) Show how you could use a rate to convert the measurements.

$35 \text{ yd} \times \frac{3 \text{ ft}}{1 \text{ yd}} = 105 \text{ ft}$

$50 \text{ yd} \times \frac{3 \text{ ft}}{1 \text{ yd}} = 150 \text{ ft}$

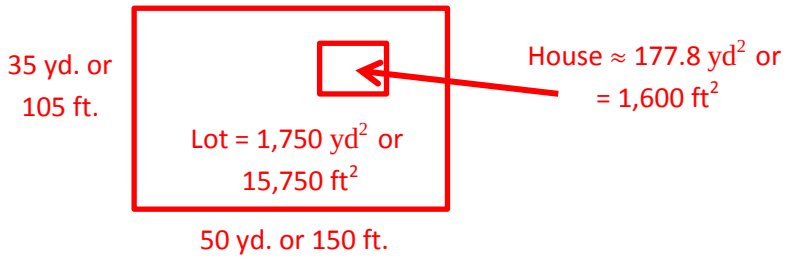
$(\text{lot} = 15{,}750 \text{ ft}^2)$

or

$1{,}600 \text{ ft}^2 \times \frac{1 \text{ yd}^2}{9 \text{ ft}^2} = 1{,}600 \div 9 \approx 177.8 \text{ yd}^2$

$(\text{lot} = 1{,}750 \text{ yd}^2)$

c) Based on your conversion, revise your sketch to better illustrate the relationship between the size of the house to the size of the lot. (label your drawing)



d) Show how you can calculate the percent of Dana's lot that is not be covered by the house?

$$\frac{1{,}750 - 177.8}{1{,}750} \approx 0.898 \approx 90\%$$

or

$$\frac{15{,}750 - 1600}{15{,}750} \approx 0.898 \approx 90\%.$$

e) Write a sentence that explains what your percent shows

90% of the lot is not covered by Dana's house. (Did it matter if you were working with square feet or square yards when you calculated the percent? No the percent is based on the relationship of the size of the house and the size of the lot. The units do not change that relationship.)

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What was common mistake made?

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Task 2

Jada has a rectangular board that is 60 inches long and 48 inches wide. (6.RP.A3 Converting Square Units)

1. How long is the board measured in feet?
   (show how a rate could be used to convert the measurement)

   _____

2. How wide is the board measured in feet?
   (show how a rate could be used to convert the measurement)

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3. Find the area of the board in square feet.

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4. Jada said,

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   The board has an area of $48 \text{ in} \times 60 \text{ in} = 2{,}880 \text{ in}^2$.
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   So the area of the board is $2{,}880 \div 12 = 240 \text{ ft}^2$.

   What went wrong with Jada's reasoning? Explain.

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Task 3 (6.RP.A3 Dana's House)

The lot that Dana is buying for her new one story house is 35 yards by 50 yards. Dana's house plans show that her house will cover 1,600 square feet of land.

a) Draw a sketch of information provided. (label your drawing)

b) Show how you could use a rate to convert the measurements.

c) Based on your conversion, revise your sketch to better illustrate the relationship between the size of the house to the size of the lot. (label your drawing)

d) Show how you can calculate the percent of Dana's lot that is not be covered by the house?

e) Write a sentence that explains what your percent shows

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