

Mathematics: The Language of STEM

Composite Shapes – Area of a Deck

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CONTENT AND TASK DECISIONS

Grade Level(s): 5th Grade

Description of the Task: Students use area concepts to decide how many boards are needed to build a deck top in two phases.

Indiana Mathematics Content Standards: 5.M.3 Develop and use formulas for the area of triangles, parallelograms, and **trapezoids**. Solve real-world and other mathematical problems that involve perimeter and area of triangles, parallelograms and **trapezoids**, using appropriate units for measures.

Indiana Mathematics Process Standards: PS.7: Look for and make use of structure. PS.1: Make sense of problems and persevere in solving them.

Mathematics Content Goals: Students will understand more deeply that area is a measurement of a surface. The unit of measurement in the task can be seen as rectangular sections rather than squares. Students will be able to use knowledge of multiple shapes to find the area of a composite shape.

Language Objectives: Students will identify and compare shapes. Students discuss and practice methods to find area of shapes. Students prepare arguments and listen to evidence to make a decision.

Materials: Deck Blueprints, Deck pictures, writing utensils, graph paper, rulers, scrap paper, scissors, calculators

Optional: wood board as realia

THE LESSON

Before: Mr. and Mrs. Fixit like to have family and friends over to their house for dinners together. Recently, they've noticed the deck needs more space to host their friends and family. They've decided on a design that will hold more people. *Show blueprints. Don't explain the design, allow students to realize information and make judgements. Ask students, what do you notice about this design? As you think about hosting on this deck, what are some opinions you have about this design?*

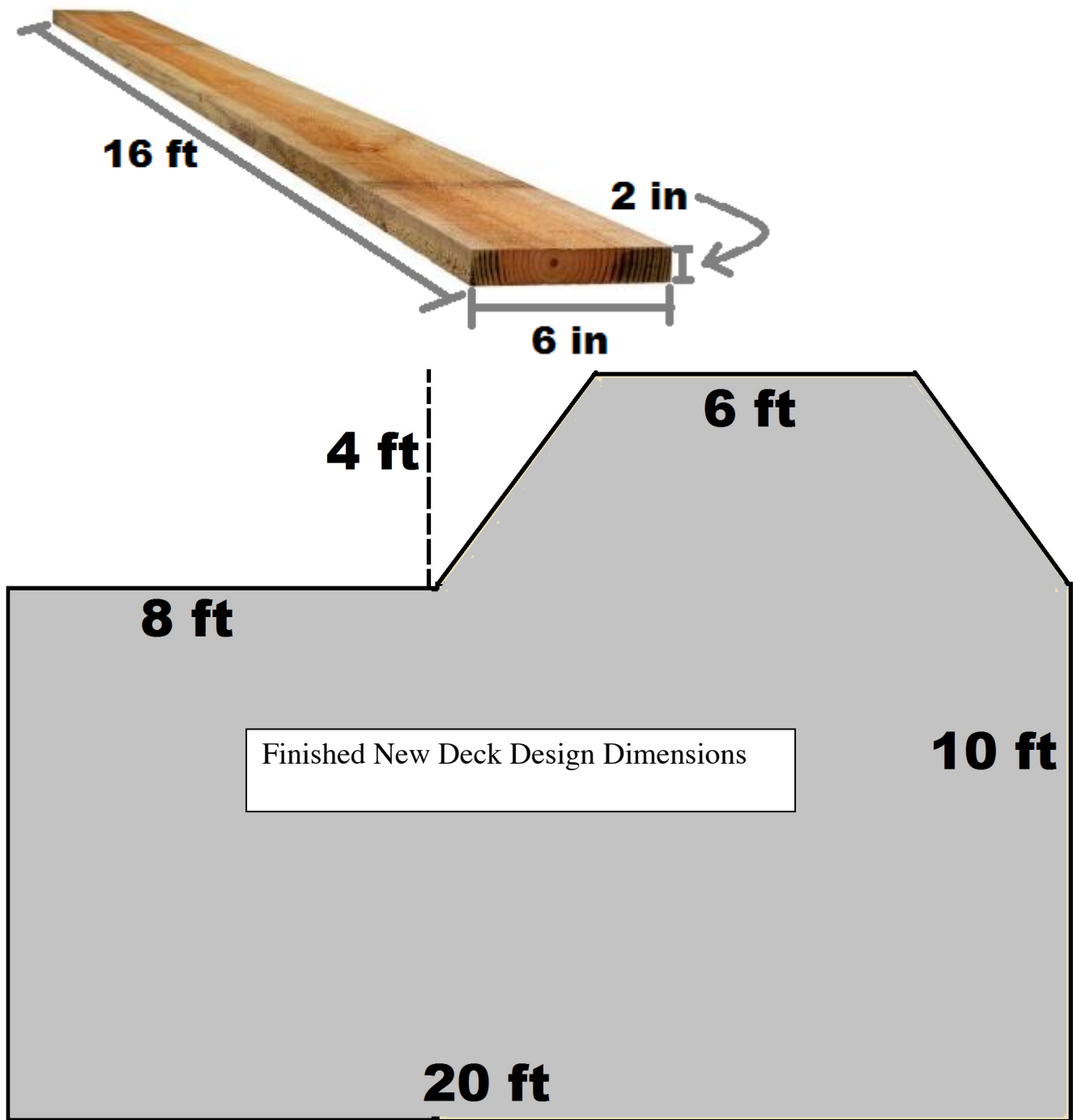
Phase 1: The next step for Mr. and Mrs. Fixit was to think about how many boards they would need of decking. (These boards make the floor of the deck). They only wanted to buy flooring for the **new** deck addition. The Fixits wanted to use the old (existing deck) boards to save some money. How many boards might they need to cover the new addition to our deck? We will compare your number of boards to the number of boards the Fixits purchased.

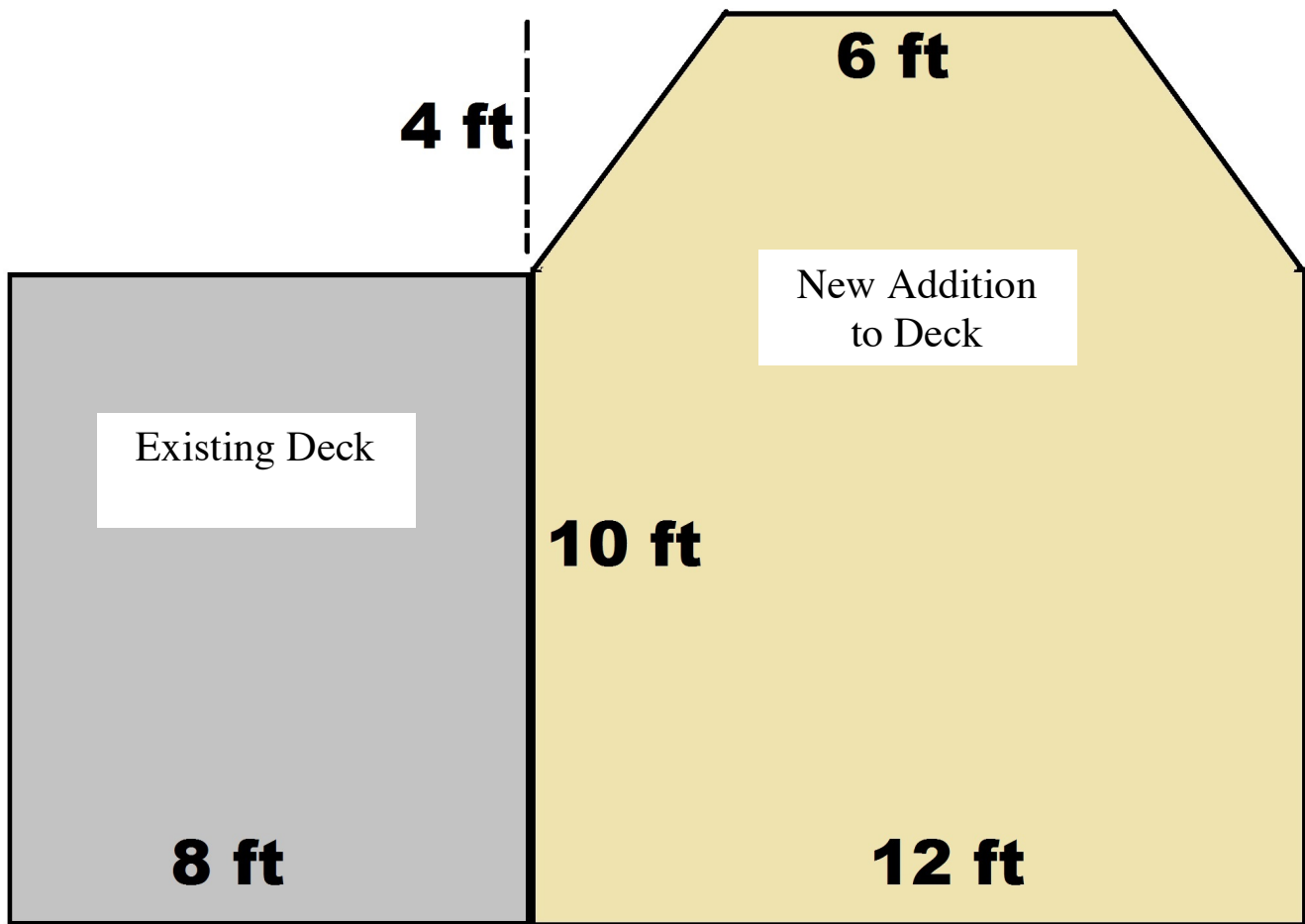
Expectations

Using what you know, models, and the tools available, your group will share how many decking boards are needed and be able to convince us that this number is reasonable.

Your group must have a visual way to convince us your number is reasonable. This could be model or

your thoughts written out in an organized way.





During: Students will work in teams to decide how many decking boards are appropriate to cover the new addition to the deck.

Listen for students...

noticing the rectangle and trapezoid shapes present in the design

finding the boards needed for the deck addition only

discussing area in terms of squares

finding patterns and similarities in shapes

considering that two 6in boards will create one foot

deciding which way to lay the boards

planning to use boards that have been cut and are no longer the original 16ft

(ex. 12ft used of a 16ft board leaves 4ft to use)

not measuring area, but other measurements of the deck

using the 2 inch depth that will not affect the deck dimensions

*May want to select three varied strategies from student groups to share thoughts with the whole class

Check in/Phase 1 “After”: After enough work time for students to have a defensible number of boards, have groups share their thinking. This could be done by pairing groups to share with each other, all groups sharing with the whole class, or the three teacher chosen groups share their findings with the

class.

Discuss strength and reasoning in strategies and allow groups to see strengths, weaknesses, similarities, and differences in their strategies.

Task adjustment: The Fixit family bought 30 boards. As you think about the work you've done and the number of boards you've recommended, what do you think of their purchase of 30 boards?

(If the work matches what happened to us over the summer, 30 should be too much ☺)

The Fixits had already stained the 30 boards they had purchased. They cannot be returned. With the extra boards, the Fixits wondered, "Can we use the nice new decking boards to cover the entire deck?" As a team, decide if the Fixits have enough decking boards to cover the entire deck or if you think they need to purchase more boards.

Expectations

Using what you know, the strategies you've seen, models, and the tools available, your group will take a stance on whether or not the Fixits need to purchase more decking boards.

Be able to tell how many boards are still needed, or how many extra they will have.

Your group must have a visual way to convince us your number is reasonable. This could be a model or your thoughts written out in an organized way.

Listen for students...

noticing the shapes present in the design

finding the boards needed for the **entire deck**

discussing area in terms of squares

discussing area in terms of rectangular boards

finding patterns and similarities in shapes

considering that two 6in boards will create one foot

deciding which way to lay the boards

planning to use boards that have been cut and are no longer the original 16ft

(ex. 12ft used of a 16ft board leaves 4ft to use)

organizing by square feet or by board coverage

not measuring area, but other measurements of the deck

using the 2 inch depth that will not affect the deck dimensions

*May want to select three varied strategies from student groups to share thoughts with the whole class

Extensions

Look for opportunities for students to take other considerations into account.

Will each board be cut perfectly? Or might you need another board for mistake cuts?

Will the boards cut at an angle be useful in other areas, or will the angles not match?

How long will the hand railing be?

Where is the best place to put a table, chairs, and grill? About how much area of the deck would each item take up?

What is the perimeter of the deck?

How would you have designed the deck differently? How would your changes effect the area of the deck?

Find the cost of different types and qualities of wood boards. Which would you use? How much would that cost?

After: Student groups move to sides of the room to establish whether they think 30 boards is too many or not enough. Depending on how the students side, the too many groups and the not enough groups can share their strategies within their side of the room and work on a list of reasons or decisions they made that helped them reach this conclusion. The list will then be shared with the opposite groups.

Promote a mathematical community of learners

While listening to the opposing side, groups should listen for strategies and reasoning that makes sense to them, or they agree with. In this portion of the lesson, students should work as a community of learners, discussing, justifying, and challenging various solutions to the problem all have just worked on.

Listen actively without evaluation

Ask students on opposite sides to restate what they have heard.

Make connections

Ask students to look for ways their strategies and solutions are similar and notice how they are different. Prompt students to ask each other questions.

Summarize main ideas

Keep a running list of ideas, statements and numbers that both sides can agree on.

ASSESSMENT

Individually, on a notecard or other small page, students write whether or not 30 boards was sufficient for the entire deck and what convinces them to hold this opinion. Students include an argument or evidence that was convincing, or helped them make their decision.

*(When we built this deck, had **just** the right amount! In my opinion, it could be argued that we had enough boards, because we did in fact cover this deck. However, had we used less “scraps” or had made a few more mistakes while cutting, we would have been headed back to Menards for more boards!)*