LESSON PLAN – Find the area of non-rectangular figures with partial square units by counting unit squares

Subject/Topic/Unit: Math/Area/Healthy Living

Grade Level: Third Grade

I.   Main Ideas/Conceptual Understanding/Goals

Area is an expression of how much surface is covered.
Partial units can be combined to create a whole.
Areas of regular and irregular shapes can be determined by counting square units.

II.   Specific Objectives

Students will be able to find the area of non-rectangular figures with partial square units by counting unit squares.

CCSS.MATH.CONTENT.3.MD.C.5a
A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.

CCSS.MATH.CONTENT.3.MD.C.5b
A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.

CCSS.MATH.CONTENT.3.MD.C.6
Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

CCSS.MATH.PRACTICE.2. Reason abstractly and quantitatively.

CCSS.MATH.PRACTICE.6. Attend to precision.

Vocabulary: area, square units (unit squares), appropriate unit

III.   Procedures

A. Introduction/Motivation

Lesson Overview: This lesson is designed to enhance learners' understanding of area as the number of square units and the size of different units. In the main task, learners will determine the area of non-rectangular figures (cotton material for exercise clothing) by selecting appropriate units and tiling squares. Since the figures are irregular, learners will need to use their understanding of fractions find the area of portions of whole square units. Learners will be expected to reason that two partial unit squares can be combined to create a whole unit square, but will not be expected to determine the precise size of the fractional unit squares. The knowledge and skills that learners develop in this lesson will lay the foundation for their subsequent work with area and volume.

Warm-up:

The teacher should have the warm-up power point slide displayed for the learners to see at the beginning of the class. The teacher should provide each learner with a Student Worksheet and several sheets of 1 inch grid paper for this lesson. In the warm-up the learners are expected to estimate the number of square inches in the soles of both of their sneakers. The teacher can use the guiding questions to illicit student thinking during the warm-up.

Warm-up question:

According to the Center for Disease Control and Prevention (CDC), children and adolescents should do 60 minutes or more of physical activity each day. In an effort to meet these recommendations you have been walking and running every day. Unfortunately, the soles of your sneakers have become worn out. You are going to take your shoes to Larry's Shoe Repair to replace the soles. About how many square inches of rubber will Larry need to replace the soles of both of your sneakers? Trace your footprint on a piece of 1 inch graph paper to determine your answer.

Guiding questions:

Before actually tracing your footprint, what is your estimate for the number of square inches in your footprint?

Do you need to trace both of your footprints?

What happens when part of a figure does not cover a complete square unit?

What to wear to workout

When you exercise, you should wear loose-fitting clothes that allow you to move freely. In the summer, wearing lighter colors will help you keep cooler. Dark clothes, which trap light, will help keep you warmer in the winter. Wear layers when it is really cold. It is good to wear hats or baseball caps for shade in sunny weather, and wool or ski caps in the winter to keep your head and body warm. Never wear rubbery or plastic clothing (yes, it's out there!) because it won't allow your sweat to escape and your body can get too hot.

Shoes are also very important. Make sure they are sturdy, fit well, and have heavy cushioned soles and arch supports. If you plan to run, getting shoes fitted by a sports shoe salesperson can be helpful. The wrong fit can be uncomfortable or even hurt you. **Socks** can be important also. They help absorb sweat to help you avoid blisters. And, they might help keep your shoes from smelling badly!

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After the warm-up and before the main task the teacher should discuss the information above with students.

B. Study/Learning

Main Task:

The teacher should have the main task power point slide displayed for the learners to see after the warm-up. After presenting the question the teacher should pass out some more 1 inch grid paper as well as a variety of clean kids' socks. The teacher should circulate around the room asking learners the guiding questions during the main task. The learners should be able to construct viable arguments to support why their answers are reasonable. The learners should be able to precisely communicate the number of square inches of cloth that it will need for their pair of socks. Learners can work on the main task either individually or in small groups. Once the teacher notices that most learners have solved the task, the teacher should draw the classes' attention to the front of the room for a whole-class debriefing discussion.

Main task question:

Now that you have your sneakers ready, you need a pair of cotton socks to wear when you exercise. Use your 1 inch grid paper to determine how much cotton you will need for your pair of cotton socks. It is up to you to decide whether you would like to wear shorter (ankle) socks or longer (mid-calf) socks.
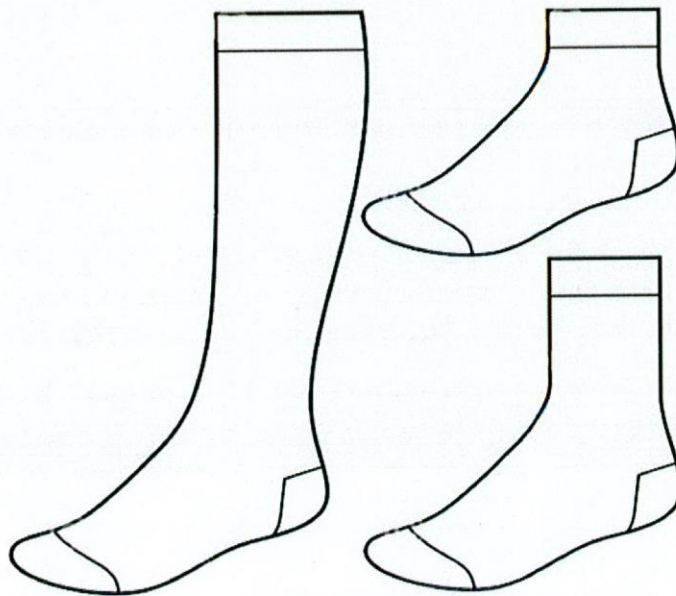
Guiding Questions:

How would you describe what you are trying to find out?

Have you tried making an estimate?

What strategies will you use or what tools might you need?

Which parts of the sock (left, right, top, bottom) do you need to measure?

Do you need to measure both the left and right side? Both socks?

How will you count partial square units?

How would changing the size of the unit change your work? How would this be the same or different if you used square centimeters instead of square inches?

Common Misconceptions/Errors:

Students exclude partial square units in their total.

Students miscount square units because they are not as structured as a rectangular array (e.g., they recount some squares or do not count some squares).

Students count squares more than once because of overlapping.

C. Culmination

Task Debrief: Once the teacher notices that most learners have solved the task, the teacher should draw the classes' attention to the front of the room for a whole-class debriefing discussion. The teacher should use the task debrief to facilitate classroom discussion about the task and as an opportunity for learners to share their different approaches to the task. The teacher should pose the same guiding questions used while circulating during the task. The learners should be able to construct viable arguments to support why their sis reasonable. The learners should be able to precisely communicate the number of square inches that they need to make a pair of cotton socks.

Closing Questions: Ask students to write their answers to the closing questions on their worksheets.

1. How to you count partial square units?

Indicators of understanding: Learners understand that area is an expression of how much surface is covered. Learners also understand that irregular shapes may include partial square units. Finally, learners understand that partial units can be combined to form full unit squares.

Big Idea: After the task debrief the teacher should ask learners what they think the most important mathematical concepts that the learned in the lesson were. The teacher should guide the learners to summarize the big idea of the lesson to be that area is a measurement of how much surface if covered. Additionally, area can be found by counting square units. Finally, partial units can be combined to create a whole.

D. Follow-up

Ticket out the door: What is the area of this shape?

Student Practice Sheet: There are three levels of practice sheets for the learners. Practice Sheet A is intended for learners who do not fully understand the big idea(s) of the lesson, Practice Sheet B is intended for learners who showed understanding but would benefit from added practice, and Practice Sheet C is intended for learners who displayed strong understanding of the big idea(s) and are ready to develop a deeper understanding.

IV.   Materials/Resources

Interactive whiteboard or computer with projector

1 inch graph paper (several sheets per student)

Variety of kids' socks

Lesson Plan power point

Student Worksheets (1 per student)

Practice Sheets (A, B, and C)

V.   Evaluation related to objectives

Warm-up question

Main task question

Task Debrief questions

Closing questions

Big idea summary

Ticket out the door

Practice sheets (A, B, and C)