Amazing Area
3-4

OBJECTIVE:
Have you ever wondered how to measure the surface of something? With this game of comparative measuring you can use your amazing area squares to test your measuring powers.

Common Core State Standards:

2.G.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.

3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.
   a. 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.
   b. 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.

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

3.MD.7 Relate area to the operations of multiplication and addition.
   a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.
   b. Multiply side lengths to find areas of rectangles with whole number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.
   c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths $a$ and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.
   d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.

4.OA.4 Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number.

4.G.3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Area Measuring Tools:
- Small Paper Plates
- Medium Paper Plates
- Large Paper Plates
- Square Sticky Notes of various sizes.

Length Measuring Tools:
- Ruler
- Measuring tape
Launch:

Decide on some objects for which you would like to find the area such as: a table, a desk, the floor, a square or rectangular rug, a cover of a book.

Have learners work in pairs. Give one pair of students only one size of plate to use. Half of the pairs will receive one size of square plates and the other half of the pairs will receive a different size of square plates. Ask learners to think about the following questions:

1. Compare the different measuring tools. What relationships do you notice between the tools?

2. If you use both sizes of plates to measure the surface of the table, will you use more big plates or more small plates to cover the table? Why do you think so?

3. About how many more of the different size plates do you think you will need?

4. If you do not have enough plates to cover the surface of your object, how can you still determine how many plates you will need to cover the object?
Amazing Area:
5. In the same pairs, decide on a measuring tool (either large or small plates). What will be your unit of measure?

6. Use your amazing area plates to measure the surface of the table. As learners measure, make sure that plates are lined up so they do not overlap and so there are no gaps.

7. Count and write down the number of amazing area plates you used (small or large) in the appropriate column of the table.

8. What is the area of the table?

9. Find a pair that was using another size amazing area plate and trade plates.

10. What is your unit of measure?

11. Use your new amazing area plates to cover the table.

12. Count and write down the number of amazing area plates you used (small or large) in the appropriate column of the table.

13. What is the area of the table? (How many plates did it take to cover the whole table?)

14. Compare the two different measures of area with the pair with whom you traded plates.

15. Are your areas the same or different? Why might they be different?

Help learners find something else to measure, maybe a desk or a section of the classroom.

16. Do you think it will take more or less plates to cover this new object than it did the table?

17. Repeat problems 10 through 15 for your new object, measuring with two different sizes of plates.
Sharing the Area:
Discuss the following with learners (the intent is that they will recognize the need for a standardized unit).
18. If you want to talk about how much fabric you would need to make a table cloth, how much carpet you need to cover the floor, or how much paper you need to cover your book, will it be convenient to share the numbers of plates you use? Why or why not?

19. What ideas do you have for a measure of area that you could use that other people would be more likely to have available?

20. What measuring tools have you used to find the length of something?

21. How might those tools be helpful in finding area?

22. Find the box full of square inches. How do these compare with measuring tools you have used for measuring length?

23. How could you make a square foot from the square inches?

26. Use the square inches to cover one of the plates. How many did you use?

27. Use a ruler to measure a side length of one plate. How could you use this length measurement to find how many square inches would cover the plate?

28. How could you use the area measurement of the plate to find the area of the table you measured?

29. Use a ruler or a measuring tape to measure in inches the length and width of the table you measured in problem 28. How could you use these length measurements to find the area of the table?

30. Find the area of the table using both the area of the plate and the length measurements from problem 29. How did these compare?

31. Are these responses the same? If not, what might be causing the differences between them?

A sample chart is provided to help learners record their measurements.
Extensions:

**Measure More:** Ask learners to choose different things to measure. Compare the lengths they are finding with the lengths they have already measured. If the numbers are the same but the tools are different, ask students why it takes, for example, 6 small plates to cover a book and 6 large plates to cover a table. Why are the numbers the same? Learners need to determine that the measuring tool matters.

**Which Tool is Best?** Ask learners to choose objects to measure then choose the best tool to use to measure the object. Ask if small plates would be a good tool to use to measure a table? Why or why not? If they use different tools to measure the same objects, ask why the numbers are different and which tool is more accurate. Learners who measure accurately with informal tools can move up to the use of rulers or measuring tapes.

**Compare Perimeter and Area:** Use 12 same-size square paper plates. Arrange them to make different sizes of rectangles or squares. Find the perimeter of each square or rectangle. What is the area of each square or rectangle? Do all of the squares or rectangles have the same perimeter? Try this again with a different number of square paper plates.