Cluster 6: Applying the Operations to Area and Perimeter

Duration: 2-3 weeks

Content Standards:

This list includes standards that will be addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Please note the recommendations in the Important Considerations section of this cluster for more information.

NC.3.MD.5
Find the area of a rectangle with whole-number side lengths by tiling without gaps or overlaps and counting unit squares.

NC.3.MD.7
Relate area to the operations of multiplication and addition.

- 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.
- Multiply side lengths to find area of rectangles with whole-number side lengths in the context of problem solving, and represent whole-number products as rectangular areas in mathematical reasoning.
- Use tiles and/or arrays to illustrate and explain that the area of a rectangle can be found by partitioning it into two smaller rectangles, and that the area of the larger rectangle is the sum of the two smaller rectangles.

NC.3.MD.8
Solve problems involving perimeters of polygons, including finding the perimeter given the side lengths, and finding an unknown side length.

Mathematical Practices:

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning**.**

What is the mathematics?

Students will spend time in this unit learning about and applying the concepts of area of rectangles and perimeter of various shapes (with an emphasis on quadrilaterals). They will work with manipulatives to tile the areas of various quadrilaterals to build a foundation of area and perimeter. The focus of this cluster is NOT about the "formula" for area or perimeter; the focus is on understanding.

Students will:

- Understand that area is the amount of space inside a two-dimensional figure (e.g., the amount of carpet needed to cover the floor of a bedroom).
- Understand that perimeter is the distance around a two-dimensional figure (e.g., the amount of fencing that is needed to build a dog pen).
- Differentiate between the meaning/representation of a linear unit to measure perimeter and a square unit to measure area.

- Find the perimeter of a polygon by adding the side lengths and find the length of an unknown side.
- Find the area of a rectangle by tiling it with squares and understand that "area" means the number of square units that are needed to cover the space.
- Understand why multiplying the length times the width results in the total number of squares needed to tile a given rectangle. Make a connection back to the understanding of multiplication as equal groups using the language of rows and columns to connect to area and to the commutative property. For example, there are 4 rows with 5 squares in each rows or 5 columns with four squares in each column. (Note: The focus in third grade is NOT on the formula. Avoid telling students that area is length times width).
- Understand the distributive property in the context of area models. That is, students will be able to draw a model and explain how finding the area of a 9x8 rectangle (9 rows with 8 squares in each row) can be found by finding the area of two rectangles, a 5x8 rectangle and a 4x8 rectangle.

Important Considerations

- This unit falls after "Reasoning with Shapes and Their Attributes" so that students have a firm understanding of the attributes of quadrilaterals. For example, if one side of a square is 5 inches long, students will apply their knowledge that all sides of a square are equal and can determine the correct area. It also comes after Clusters 1, 3 and 4, which builds students' understanding of addition and multiplication concepts, making problem solving with area and perimeter easier for students.
- The focus of instruction is building an understanding of area and perimeter or what they are conceptually. Using real scenarios (e.g., carpet, fencing) should help students develop understanding.
- When finding area using square tiles or multiplying length times width, connections should be made to arrays that students used in Cluster 4 to make sense of multiplication.
- The formula (length times width) should not be taught in third grade; the formula is part of the fourth grade standards. Instead, focus on why multiplying the length by the width gives the area in square units (e.g., in a rectangle that measures 7 inches by 6 inches, there are 7 rows of square inch tiles with 6 tiles in each row).
- Student re-visit the meaning of properties as they work with the area of rectangles. For example, a connection can be made to the commutative property as student discover the number of unit squares within a rectangle is the same regardless of whether you describe them in terms of rows or columns. As students find the area of a larger rectangle by partitioning it into two smaller rectangles and then finding the sum of their areas, a connection can be made to the multiplication strategy of decomposing a factor into addends (distributive property).
- In fourth grade, students investigate how shapes with the same area can have different perimeters and vice versa. While investigations into this concept will occur in depth in fourth grade, explorations in third grade to deepen students' understanding of the meaning of area and perimeter are helpful. For example, students might investigate rectangles that have an area of 16 square units and discover that those rectangles have different perimeters. Similarly, students might build rectangles that have a perimeter of 14 units and determine the areas can vary. This begins their understanding that while area and perimeter are related and impact each other, there is not a direct correlation between the two. In other words, all shapes with a given perimeter do not have the same area and vice versa (both common misconceptions).