Unit 5

MATHEMATICS IN THIS UNIT
Area of Different Shapes

Taken from the *Math Trailblazers* digital Teacher Guide

Area

Concept of Area. Area is the amount of surface needed to cover something—the amount of carpet to cover a floor, wallpaper to cover a wall, or skin to cover a body. Area is measured in square units, such as square inches or square meters. For example, ecologists measure the amount of rain forest destroyed each day in square miles. Neurobiologists measure the area of individual connections between nerve cells in square microns. (One square micron is $\frac{1}{100{,}000{,}000}$ of a square centimeter.)

Concept Development. In third grade, students find the area of flat surfaces. Building on the ideas they developed in first and second grades, they begin this unit by finding the area of shapes with straight sides. Then, they learn to measure the area of shapes with curved sides. The activities in this unit provide a context in which to develop a working definition of area.

Students are confronted with a series of problems that cannot be solved by measuring length or width but only by measuring area:

- How many tiles will it take to cover a floor?
- Can two or more different shapes have the same area?
- Can two amateur detectives identify a classmate by measuring the area of a footprint?
- How much material will it take to make a raincoat?

In the lab in Lesson 4 *Which Picks Up More?* students decide which of several brands of paper towels is the most absorbent. The lab provides an opportunity for students to use their knowledge of area and the scientific process to explore many facets of a problem. They identify the variables and collect, record, and represent the data. Students identify the most absorbent towel by interpreting those data representations.

The activities in this unit focus on the concept of area as covering a surface. This concept gives students the background they need to solve problems similar to those in this unit. It also provides the framework for more advanced work with area in mathematics and science. In later units in Grade 3, students will use the array model to develop multiplication concepts such as factors, multiples, primes, and the distributive property. See Figure 1. In later grades, the concepts in this unit will help students as they find the surface area of three-dimensional figures.

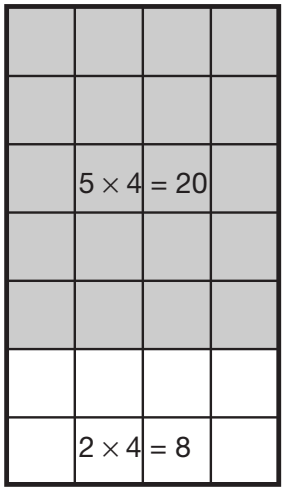

Figure 1: *A example of the distributive property: a rectangle shows that* $7 \times 4 = 5 \times 4 + 2 \times 4$

Time

Concept of Time. The analog clock is a complex instrument to learn to read. Not only are there two or more scales involved (hours, minutes, and seconds), but the hands that measure these scales move in a circular motion. A child's difficulty in reading time may stem from an approach that focuses on both hands simultaneously but does not distinguish between how the two hands are read. The hour hand shows the approximate time, to the nearest hour, and the minute hand shows the number of minutes after and before the hour. When looking at the hour hand the focus is on where it is pointing. With the minute hand, the focus is on how far it has moved since the start of the hour or how far it has to go to get to the next hour (Van de Walle, Karp, Bay-Williams, 2010).

Concept Development. This unit begins with a review of the hour hand. Students observe that the hour hand moves slowly from one hour to the next as the minute hand makes a complete circle and that it is in different positions as the minute hand moves. Students practice estimating and showing approximate time by marking the position of the hour hand alone.

Students then review the movement of the minute hand, determining how many minutes have passed since the last hour or how many minutes until the next hour. The focus is on parts of 60, rather than parts of 12. Students connect the numbers 1 to 12 to the 60 minute scale by skip counting by fives to determine the number of minutes past an hour.

Finally, students explore measuring the length or duration of time (elapsed time) using their individual clocks. Students will learn to read an analog clock and measure durations of time more quickly when frequent references are made to the time throughout their day and they are reminded to look at the clock. For example:

- **It's 9 o'clock, time for math.**
- **You're back from art class. What time is it?**
- **In 30 minutes, we will go to lunch. If it is 11 o'clock now, what time will it be when we eat lunch?**
- **It is 1:10 now. If I read to you for 15 minutes, what time will it be when we finish?**

Math Facts and Mental Math

Subtraction Facts. Students review the following subtraction facts to maintain and increase fluency and to learn to apply subtraction strategies to larger numbers. See Mathematics In This Unit in Unit 2 for more about subtraction facts development.

Group 7: 14 – 7, 14 – 6, 14 – 8, 12 – 6, 12 – 7, 12 – 5, 10 – 5, 13 – 7, 13 – 6
Group 8: 15 – 7, 16 – 8, 17 – 8, 18 – 9, 18 – 10, 8 – 4, 7 – 4, 6 – 3, 15 – 8

Multiplication Facts. Students work on developing number sense for the multiplication facts for the square numbers in this unit by writing a story, drawing a picture, and writing number sentences for math facts. See Figure 2. For more about the multiplication facts development see Mathematics In This Unit in Unit 3.

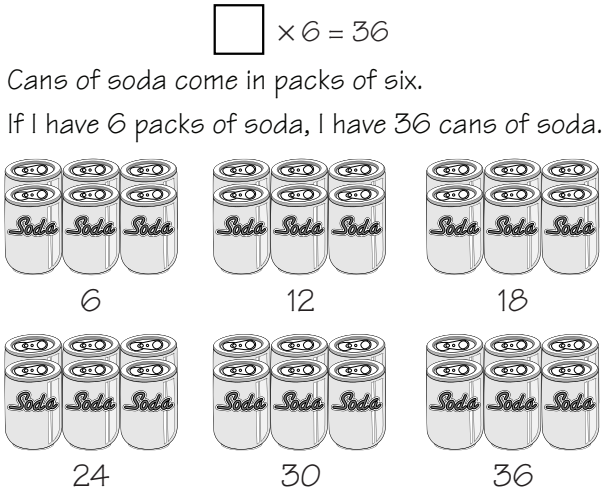

Figure 2: *Example story and picture for* □ × 6 = 36

Algebra in the Early Grades

"We advocate an early emphasis on developing children's ability to conceive of, reason about, and manipulate complex ideas and relationships as an equal complement to numerical reasoning and computation" (Smith and Thompson, 2008).

In this unit, students have the opportunity to reason about and manipulate the complex ideas and relationships and lay some groundwork for developing conceptual models for numerical computation and properties. Students reason with graphs, tables, and diagrams as they analyze how the area of the water spots varies between different paper towel brands.

This unit also helps lay the foundation with the concept of area so students can represent relationships and properties with area models. For example, students will use area models to partition numbers and support use of the distributive property.

Resources

- Izsák, Andrew. "You Have to Count the Squares: Applying Knowledge in Pieces to Learning Rectangular Area." *The Journal of the Learning Sciences.* 14(3), pp. 361–403, 2005.
- *Principles and Standards for School Mathematics.* National Council of Teachers of Mathematics, Reston, VA, 2000.
- Reyes, R.E., M.M. Lindquist, D.V. Lambdin, N.L. Smith, M.N. Suydam. *Helping Children Learn Mathematics, 7th Ed.* John Wiley & Sons, Inc., Hoboken, NJ, 2004.
- Smith, John P. and P. Thompson. "Quantitative Reasoning and the Development of Algebraic Reasoning." *Algebra in the Early Grades,* Jo Kaput, D. Carraher, M. Blanton, eds. Lawrence Erlbaum Associates, New York, NY, 2008.
- Thompson, C.S. and John Van de Walle. "A Single-Handed Approach to Telling Time." *Arithmetic Teacher*, 28 (8), pp. 4–9, April, 1981.
- Van de Walle, John A., K.S. Karp, J.M. Bay-Williams. *Elementary and Middle School Mathematics: Teaching Developmentally, 7th. Ed.* Allyn and Bacon, Boston, MA, 2010.