## Unit 4: Problem Solving and Understanding Area as it Relates to Multiplication

UNIT 4 GOALS

- ➤ Recognize area as an attribute of plane figures and understand concepts of area measurement.
- ➤ Measure areas by counting squares.
- ➤ Relate area to the operations of multiplication and addition.
- ➤ Fluently multiply and divide within 100.
- ➤ Solve two-step word problems using addition, subtraction, multiplication, & division.
- ➤ Practice telling time to the nearest minute and finding elapsed time.

Tiling

Students will be introduced to area. They will use square tiles to tile rectangular regions to determine the area. When "tiling" there are no gaps or overlaps of the tiles. The units for area are always square units (square inches, square centimeters, etc.)
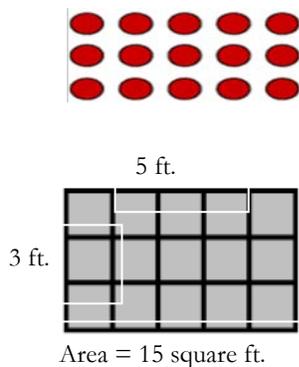
3 units

4 units

Area = 12 square units
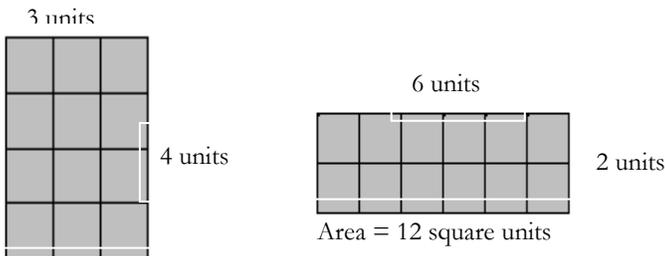
6 units

2 units

Area = 12 square units

Arrays and Area
Students will understand how **arrays** connect to **area.**

A 3 by 5 array

5 ft.

3 ft.

Area = 15 square ft.

VOCABULARY

Area – the total number of square units that cover a figure.
Area Model – a model that uses square units to show a multiplication problem.
Array - An arrangement of objects, pictures, or numbers in columns and rows. Arrays are useful representations of multiplication concepts.
Square Unit – a unit of area equal to the area of a square with one one-unit sides.

### Relate area to the operations of multiplication and addition.

In the example below a student shows two different ways to find the area of the given array.

- Looking at the rows, the student notices there are three rows with five units in each row.
  - o 3 rows of 5 units = 15 units squared for the area of the array
- Looking at the columns of the array, the student notices there are five columns with three units in each column.
  - o 5 columns of 3units = 15 units squared for the area of the array.

$$3 + 3 + 3 + 3 + 3 = 5 \times 3$$
column
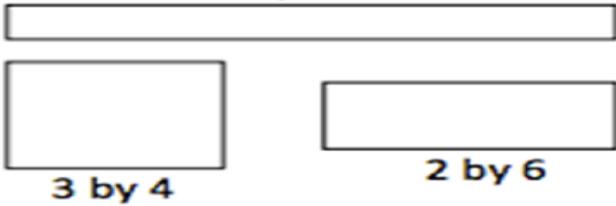row → 5 + 5 + 5 + 5
$$= 3 \times 5$$
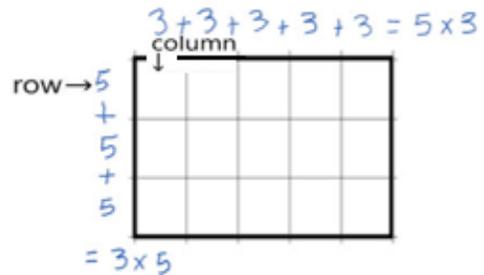
Explain your answer.
Example: Amy skip-counts by sixes to find the total square units in the rectangle below. She says there are 36 square units. Is she correct?
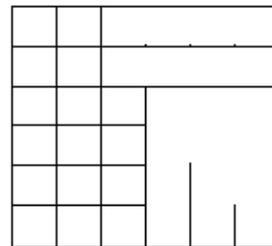
Yes, Amy is correct because 6 units x 6 units= 36 square units.

She can also skip count by sixes: 6, 12, 18, 24, 30, 36

1 by 12

3 by 4

2 by 6

Students will learn, through concrete experience, that each of these rectangles has the same area, and relate their learning to multiplication.
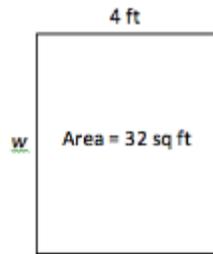

Applications of Area Using Side Lengths of Figures:
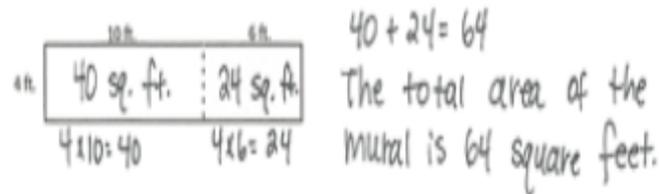
Example 1:

How can we find the value of w?

$32 \div 4 = w$

The value of w is 8 feet.

4 ft

w   Area = 32 sq ft

Example 2:

An artist paints a 4 x 16 mural on a wall. What is the total area of the mural? Use the distributive property to solve.

10 ft.	6 ft.
4 ft. 40 sq. ft.	24 sq. ft.
4 x 10 = 40	4 x 6 = 24

$40 + 24 = 64$

The total area of the mural is 64 square feet.

Solve two-step word problems using addition, subtraction, multiplication, & division.

Example:
Lacey eats 6 cookies each day at school. On Friday, she drops 2 cookies and only eats 4. Write and solve an equation to show the total number of cookies Lacey eats this week.

6 cookies   4 cookies

Lacey	6	6	6	6	4

? cookies

$4 \times 6 = 24$
$24 + 4 = 28$

Lacey ate **28** cookies.
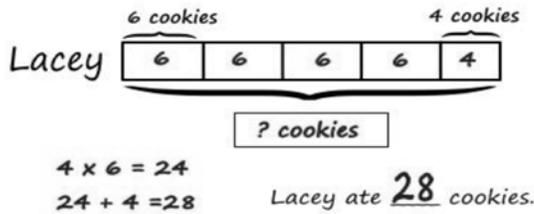
We go to school for 5 days a week. Lacey has 6 cookies to eat each day, but on Friday she drops some. So for 4 out of the 5 days she ate 6 cookies. $4 \times 6 = 24$. On Friday she only ate 4 cookies, $24 + 4 = 28$.

Continue to work on fluency of multiplication facts:

Students will also begin to explore the use of smaller facts to solve a larger fact by using arrays.

This array shows how dividing the problem into two smaller factors can make it easier to solve.

Students already know 5 x 4 and 2 x 4.

So they know 7 x 4.

7 x 4 is $(5 \times 4) + (2 \times 4)$

Or $20 + 8$

$7 \times 4 = \underline{}$

$(5 \times 4) = \underline{20}$

$(2 \times 4) = \underline{8}$
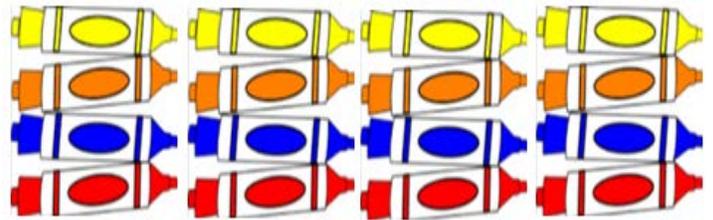
$(7 \times 4) = (5 \times 4) + (2 \times 4)$

$= \underline{20} + \underline{8}$

$= \underline{28}$

Continue to work on fluency of division facts:
Example word problem:
Grace has 16 markers. The picture shows how she placed them on her table. Write a division sentence to represent how she equally grouped her markers.

There are **4** markers in each row.

$\underline{16 \div 4 = 4}$

I can write the total number of markers Grace has, 16, since a division equation begins with the total.

The 4 represents the number of equal groups. I know there are 4 equal groups because the array shows 4 rows of markers.

This 4 represents the size of the group. I know this because the array shows 4 markers in each row.