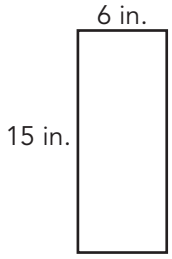
1 Taking Apart Numbers and Shapes

Writing Equivalent Expressions Using the Distributive Property

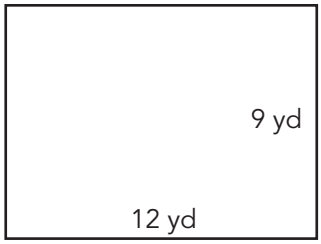
WARM UP

Calculate the area of each rectangle. Show your work.

1.



2.



LEARNING GOALS

- Write, read, and evaluate equivalent numeric expressions.
- Identify the adjacent side lengths of a rectangle as factors of the area value.
- Identify parts of an expression, such as the product and the factors.
- Write equivalent numeric expressions for the area of a rectangle by decomposing one side length into the sum of two numbers.
- Apply the properties of operations, such as the Distributive Property, to rewrite the product of two factors.

KEY TERMS

- numeric expression
- equation
- Distributive Property

You have learned how to operate with numbers using different strategies. Sometimes taking apart numbers before you operate can highlight important information or make calculations easier. How can you use these strategies to express number sentences in different ways?

Form of 24

Consider the number 24. What comes to mind?

1. Write five different numeric expressions for the number 24.

In mathematics, a group of symbols that make a mathematical statement is called an expression. A **numeric expression** is a mathematical phrase that contains numbers and operations.

2. Share your numeric expressions with your classmates.

a. Did you and your classmates use common strategies to write your expressions? Explain.

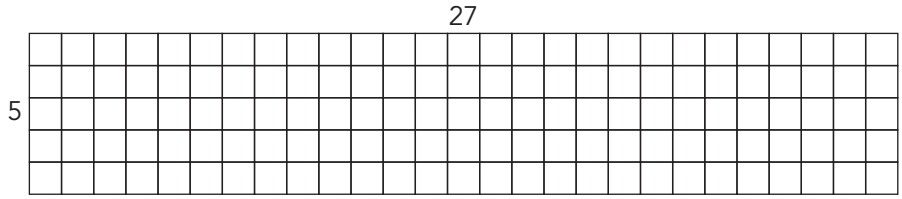
b. How many possible numeric expressions could you write for this number?

3. What do you notice about the collected set of numeric expressions representing 24?

ACTIVITY
1.1 Connecting Area Models and the Distributive Property

Consider the equation $5 \times 27 = 135$.

An area model to represent the product of 5 and 27 is shown. The area is 135 square units.



Let's think about other ways to represent this area.

1. Draw a line to split one side length of the area model into two parts to represent the area of 135 square units a different way. Label the dimensions of the smaller regions in the area model.

2. Calculate the area of each of the two smaller regions. How does the sum of the two smaller regions compare to the total area of 135 square units?

3. Rewrite the original equation $5 \times 27 = 135$ with an equivalent equation to represent the model you drew.

   a. How can you rewrite the original product by substituting the sum of the two lengths making up the split side?

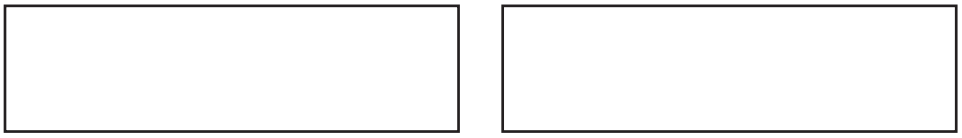
An **equation** is a mathematical sentence that uses an equals sign to show that two or more quantities are the same as one another.

Remember that an area model is a rectangular array of identical rows and identical columns.

b. How can you rewrite the total area as the sum of the areas of the two smaller regions?

Think about other ways you could split one of the factors and write a corresponding equation. What would the equation look like if you split one of the factors into more than two regions?

4. Mark and label at least 2 more ways you could divide the area model. Write the corresponding equations. Then verify that the sum of the smaller regions is still equal to 135.

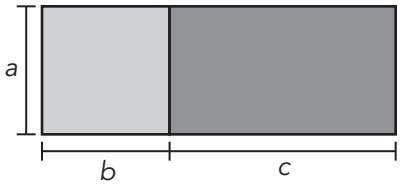


5. Reflect on the different ways you can rewrite the product of 5 and 27.
Select one of your area models to complete the example.

$5 \times 27 = 5(\_\_\_\_\_ + \_\_\_\_\_)$	How did you split the side length of 27?
$= (5 \cdot \_\_\_\_\_) + (5 \cdot \_\_\_\_\_)$	What are the factors of each smaller region?
$= \_\_\_\_\_ + \_\_\_\_\_$	What is the area of each smaller region?
$= \_\_\_\_\_$	What is the total area?

You just used the *Distributive Property!*

The **Distributive Property** of Multiplication over Addition states that for any numbers *a*, *b*, and *c*, $a(b + c) = ab + ac$.



6. Explain the Distributive Property using the area model shown.

WORKED EXAMPLE

An example of the Distributive Property.

$4\ (2 + 15) = 4 \cdot 2 + 4 \cdot 15$

You can read and describe the expression $4(2 + 15)$ in different ways. For example, you can say:

- four times the quantity of two plus fifteen,
- four times the sum of two and fifteen, or
- the product of four and the sum of two and fifteen.

You can describe the expression $4(2 + 15)$ as a product of two factors. The quantity $(2 + 15)$ is both a single factor and a sum of two terms.

7. Write an equation in the form $a(b + c) = ab + ac$ for the other area models you created in this activity.

NOTES

ACTIVITY 1.2

Interpreting a Real-World Situation Using the Distributive Property

Tyler is setting up the gym floor for an after-school program. He wants to include a rectangular area for playing volleyball and another for dodgeball. He also wants to have an area for kids who like to play board games or just sit and read. The gym floor is 50 feet by 84 feet, or 4200 square feet.

1. **Create a diagram to show how you would split up the gym floor. Represent your diagram using the Distributive Property and write an explanation for the areas assigned to each activity.**

TALK the TALK

Recognizing the Distributive Property

Identify each statement as true or false. If the statement is false, show how you would rewrite it to make it a true statement.

1. True False $3(2 + 4) = 3 \cdot 2 + 4$

2. True False $6(10 + 5) = 6 \cdot 10 + 6 \cdot 5$

3. True False $7(20 + 8) = 7 + 20 \cdot 8$

4. True False $4(5 + 10) = 20 + 10$

5. True False $2(6 + 11) = 12 + 22$

Assignment

Write

Describe how the Distributive Property can be explained in terms of composing and decomposing numbers.

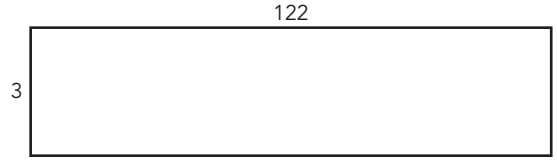
Remember

There are many ways to rewrite equivalent expressions using properties. The Distributive Property of Multiplication over Addition states that for any numbers a, b, and c, $a(b + c) = ab + ac$.

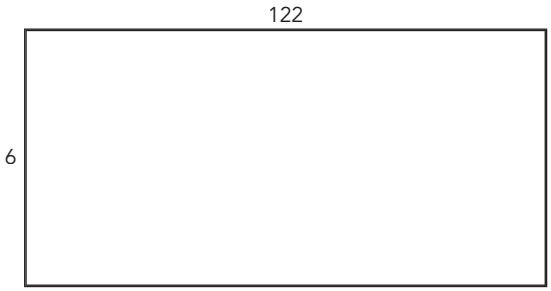
Practice

Decompose each rectangle into two or three smaller rectangles to demonstrate the Distributive Property. Then write each area in the form $a(b + c) = ab + ac$.

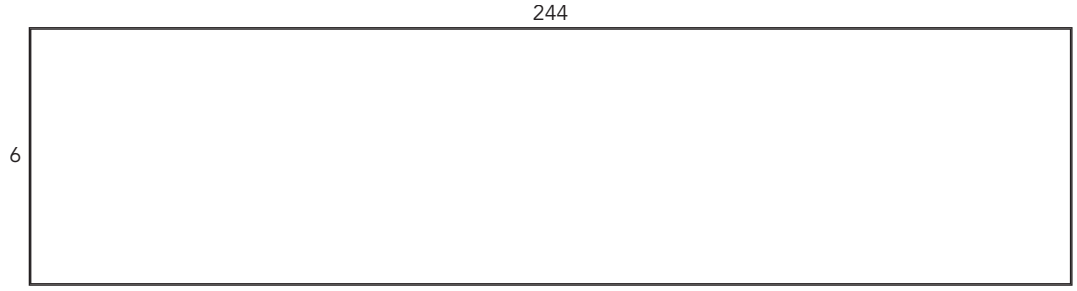
1.



2.



3.



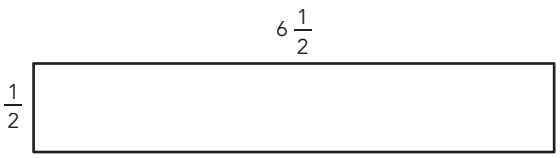
Evaluate each expression using the Distributive Property. Show your work.

4. $6(12 + 4)$
5. $10 + 4(2 + 20)$
6. $7(4 + 19)$

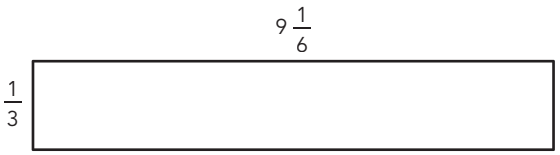
Stretch

Decompose each rectangle into two or three smaller rectangles to demonstrate the Distributive Property. Then write each area in the form $a(b + c) = ab + ac$.

1.



2.



Review

Calculate the area of each rectangle.

1. Width = 5 feet
   Length = $\frac{2}{3}$ foot

2. Width = 10 feet
   Length = $\frac{2}{3}$ foot

3. Width = 15 inches
   Length = $\frac{2}{3}$ inch

4. Width = 20 inches
   Length = $\frac{2}{3}$ inch