

LESSON

41

Using Formulas •
Distributive Property

WARM-UP

Facts Practice: Proportions (Test 1)

Mental Math:

a. 5×140

b. 1.54×10

c. $\frac{3}{5} = \frac{15}{x}$

d. $5^2 - 4^2$

e. Estimate: 39×29

f. $\frac{3}{10}$ of 70

g. Find the sum, difference, product, and quotient of $\frac{2}{3}$ and $\frac{1}{2}$.

Problem Solving:

Six blocks were used to build this three-step shape. How many blocks would be needed to build a nine-step shape?



NEW CONCEPTS

Using
formulas

In Lesson 20 it was stated that the area (A) of a rectangle is related to the length (l) and width (w) of the rectangle by this formula:

$$A = lw$$

This formula means “the area of a rectangle equals the product of its length and width.” If we are given measures for l and w , we can replace the letters in the formula with numbers and calculate the area.

Example 1 Find A in $A = lw$ when l is 8 ft and w is 4 ft.

Solution We replace l and w in the formula with 8 ft and 4 ft respectively. Then we simplify.

$$A = lw$$

$$A = (8 \text{ ft})(4 \text{ ft})$$

$$A = 32 \text{ ft}^2$$

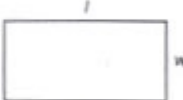
Notice the effect on the units when the calculation is performed. Multiplying two units of length results in a unit of area.

Example 2 Evaluate $2(l + w)$ when l is 8 cm and w is 4 cm.

Solution In place of l and w we substitute 8 cm and 4 cm. Then we simplify.

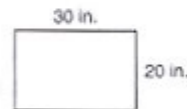
$$\begin{aligned} & 2(l + w) \\ & 2(8 \text{ cm} + 4 \text{ cm}) \\ & 2(12 \text{ cm}) \\ & \mathbf{24 \text{ cm}} \end{aligned}$$

Distributive property There are two formulas commonly used to relate the perimeter (p) of a rectangle to its length and width.

$$\begin{aligned} p &= 2(l + w) \\ p &= 2l + 2w \end{aligned}$$


Both formulas describe how to find the perimeter of a rectangle if we are given its length and width. The first formula means “add the length and width and then double this sum.” The second formula means “double the length and double the width and then add.”

Example 3 Use the two perimeter formulas to find the perimeter of this rectangle.



Solution In both formulas we replace l with 30 in. and w with 20 in. Then we simplify.

$$\begin{aligned} p &= 2(l + w) & p &= 2l + 2w \\ p &= 2(30 \text{ in.} + 20 \text{ in.}) & p &= 2(30 \text{ in.}) + 2(20 \text{ in.}) \\ p &= 2(50 \text{ in.}) & p &= 60 \text{ in.} + 40 \text{ in.} \\ p &= \mathbf{100 \text{ in.}} & p &= \mathbf{100 \text{ in.}} \end{aligned}$$

Both formulas in example 3 yield the same result because the two formulas are equivalent.

$$2(l + w) = 2l + 2w$$

These equivalent expressions illustrate the **distributive property of multiplication over addition**, often called simply the **distributive property**. Applying the distributive property, we distribute, or “spread,” the multiplication over the terms that are being added (or subtracted) within the parentheses. In this case we multiply l by 2, giving us $2l$, and we multiply w by 2, giving us $2w$.

$$2(l + w) = 2l + 2w$$

The distributive property is often expressed in equation form using variables:

$$a(b + c) = ab + ac$$

The distributive property also applies over subtraction.

$$a(b - c) = ab - ac$$

Example 4 Show two ways to simplify this expression:

$$6(20 + 5)$$

Solution One way is to add 20 and 5 and then multiply the sum by 6.

$$6(20 + 5)$$

$$6(25)$$

$$150$$

Another way is to multiply 20 by 6 and multiply 5 by 6. Then add the products.

$$6(20 + 5)$$

$$(6 \cdot 20) + (6 \cdot 5)$$

$$120 + 30$$

$$150$$

LESSON PRACTICE

- Practice set**
- Find A in $A = bh$ when b is 15 in. and h is 8 in.
 - Evaluate $\frac{ab}{2}$ when a is 6 ft and b is 8 ft.