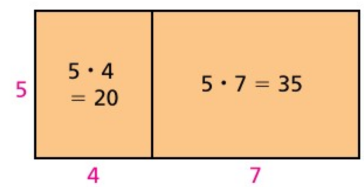
4.2 The Distributive Property

Recall that you can use the Distributive Property to rewrite an expression. The rewritten expression may be easier to calculate or may give new information.

An expression written as a sum of terms is in *expanded form*. If the terms have a common factor, then you can use the Distributive Property to write an equivalent expression. You can write the expression as a product of the common factor and the sum of the other two factors. This is called *factored form*.

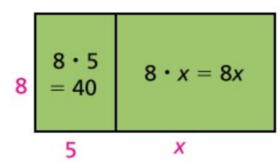
With integers: $20 + 35 = 55$

$$5 \cdot 4 + 5 \cdot 7 = 5 \cdot (4 + 7)$$



With a variable: $40 + 8x = 8 \cdot 5 + 8 \cdot x$

$$8 \cdot 5 + 8 \cdot x = 8 \cdot (5 + x)$$



You can also use the Distributive Property to rewrite expressions with negative numbers. Use the Distributive Property to multiply the first factor by each number in the second factor and add the two resulting products.

With integers: $-3 \cdot (4 + 8) = -3 \cdot 4 + (-3) \cdot 8$

With a variable: $-2 \cdot (x + 6) = -2 \cdot x + (-2) \cdot 6$

When you apply the Distributive Property to rewrite $5 \cdot x + 5 \cdot (-2.5)$ as $5 \cdot [x + (-2.5)]$, you are factoring out the common factor 5 from the two parts of the sum. When you write the equivalent expression $5 \cdot [x + (-2.5)]$, you can say you have factored the expression into the product of two terms, 5 and $[x + (-2.5)]$.

- Will the values of these expressions be the same or different?

$$-2 \cdot (-3 - 7) \qquad 2 \cdot (3 + 7)$$

Problem 4.2

A The checkbook shows Juan's bank account balance at the beginning of the week. During the week he withdraws \$19 and \$30. How much money does he have left at the end of the week?

1. Show two different ways to solve this problem.
2. Describe how the two ways are different.

B Use the Distributive Property to write each expression in expanded form.

1. $5 \cdot (3 + 2)$
2. $5 \cdot [3 + (-2)]$
3. $5 \cdot (3 - 2)$
4. $5 \cdot [3 - (-2)]$
5. For parts (1)–(4), find the value of each expression.

C Use the Distributive Property to write each expression in factored form.

1. $6 \cdot 2 + 6 \cdot 3$
2. $6 \cdot 2 - 6 \cdot 3$
3. $-6 \cdot 2 + (-6) \cdot 3$
4. $-6 \cdot 2 - (-6) \cdot 3$
5. $5x - 8x$
6. $-3x - 4x$
7. Explain how to factor an expression with subtraction.

Problem 4.2 continued

D **1.** If you apply the Order of Operations to $3\frac{1}{2} \cdot 15 - 3\frac{1}{2} \cdot 5$, you get $52\frac{1}{2} - 17\frac{1}{2} = 35$. What value do you get if you use the Distributive Property first to factor $3\frac{1}{2} \cdot 15 - 3\frac{1}{2} \cdot 5$?

2. If you apply the Order of Operations to $17(8.5 - 3.5)$, you get $17 \cdot 5 = 85$. What value do you get if you apply the Distributive Property first to $17(8.5 - 3.5)$?

3. What would you say to someone who is wondering whether to apply the Distributive Property or the Order of Operations first?

E Ling claims she has another way to show that $-1(-1) = 1$. Ling wrote her reasoning:

> By the Distributive Property, I know that -1[1 + (-1)] equals -1(1) + (-1)(-1).
> Because 1 + (-1) equals 0, I also know that -1[1 + (-1)] equals -1(0), or 0.
> So -1(1) + (-1)(-1) must equal 0. I know -1(1) equals -1,
> so -1 + (-1)(-1) must equal 0.
> Therefore, -1(-1) must equal 1.

Do you agree with Ling's reasoning? Does $(^{-}1)(^{-}1) = {}^{+}1$?

F In parts (1) and (2), use the Order of Operations and properties of operations to compute each expression. Give your answers as decimals.

1. **a.** $(1 + 5 + 3) \div 4$ **b.** $\frac{1}{4} + \frac{5}{4} + \frac{3}{4}$

2. **a.** $(1 + 5 - 2) \div 3$ **b.** $\frac{1}{3} + \frac{5}{3} - \frac{2}{3}$

3. What can you say about the expressions in parts (1) and (2)?

4. How would you describe the relationship between the Distributive Property and division?

ACE Homework starts on page 86.