English Spanish

1.4 The Distributive Property

Essential Question How do you multiply two 2-digit numbers using mental math?

1 ACTIVITY: Finding Products Involving Multiples of 10

Working with a partner, take turns using mental math to find the product.

Read the expression to your partner. Then ask your partner to write the answer.

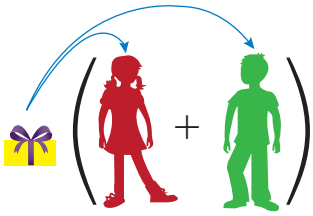
a. 10×20 **b.** 10×30 **c.** 10×13 **d.** 24×10

e. 20×25 **f.** 30×12 **g.** 13×40 **h.** 30×70

In Activity 1, you used mental math to find simple products. You can use the *Distributive Property* and mental math to find more complicated products.

The Meaning of a Word Distribute

When you **distribute** something to each person in a group, you give that thing to each person in the group.



2 ACTIVITY: Using Mental Math

Work with a partner. Use the Distributive Property and mental math to find the product.

a. Sample: 6×23

$6 \times 23 = 6 \times (20 + 3)$ Write 23 as the sum of 20 and 3.

$= (6 \times 20) + (6 \times 3)$ Distribute the 6 over the sum.

$= 120 + 18$ Find the products.

$= 138$ Add.

∴ So, $6 \times 23 = 138$.

b. 4×17 **c.** 8×26 **d.** 7×33 **e.** 9×47

English Spanish

3 ACTIVITY: Two Ways to Multiply

Work with a partner. Find the product two different ways. Compare the two methods.

a. Sample: 63×28

Method 1

$$\begin{array}{r} 63 \\ \times\ 28 \\ \hline 504 \\ +\ 1260 \\ \hline 1764 \end{array}$$

Method 2

28 is 20 + 8.

63 is 60 + 3.

$$\begin{array}{rl} 63 & \\ \times\ 28 & \\ \hline 1200 & \text{Multiply 20 and 60.} \\ 60 & \text{Multiply 20 and 3.} \\ 480 & \text{Multiply 8 and 60.} \\ +\ 24 & \text{Multiply 8 and 3.} \\ \hline 1764 & \text{Add.} \end{array}$$

b. 32×45

c. 37×61

d. 28×57

e. 17×43

4 ACTIVITY: Using Mental Math

Work with a partner. Use the Distributive Property and mental math to find the product.

a. Sample: 60×49

$$\begin{aligned} 60 \times 49 &= 60 \times (50 - 1) && \text{Write 49 as the difference of 50 and 1.} \\ &= (60 \times 50) - (60 \times 1) && \text{Distribute the 60 over the difference.} \\ &= 3000 - 60 && \text{Find the products.} \\ &= 2940 && \text{Subtract.} \end{aligned}$$

∴ So, $60 \times 49 = 2940$.

b. 20×19

c. 40×29

d. 25×39

e. 15×47

What Is Your Answer?

5. IN YOUR OWN WORDS How can you multiply two 2-digit numbers using mental math? Use an example in your answer.

Practice Use what you learned about the Distributive Property to complete Exercises 4–7 on page 26.

English Spanish

1.4 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

Key Idea

Distributive Property

Words To multiply a sum or difference by a number, multiply each number in the sum or difference by the number outside the parentheses. Then evaluate.

Numbers $3(7 + 2) = 3 \times 7 + 3 \times 2$

$3(7 - 2) = 3 \times 7 - 3 \times 2$

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

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

EXAMPLE 1 Using Mental Math

Use the Distributive Property and mental math to find 8×53.

$8 \times 53 = 8(50 + 3)$ Write 53 as $50 + 3$.

$= 8(50) + 8(3)$ Distributive Property

$= 400 + 24$ Multiply.

$= 424$ Add.

On Your Own

Now You're Ready
Exercises 4–11

Use the Distributive Property and mental math to find the product.

1. 5×41 **2.** 12×32 **3.** 9×19 **4.** $6(37)$

EXAMPLE 2 Simplifying Algebraic Expressions

Use the Distributive Property to simplify the expression.

a. $4(n + 5)$

$4(n + 5) = 4(n) + 4(5)$ Distributive Property

$= 4n + 20$ Multiply.

b. $12(y - 3)$

$12(y - 3) = 12(y) - 12(3)$ Distributive Property

$= 12y - 36$ Multiply.

On Your Own

Use the Distributive Property to simplify the expression.

5. $7(a + 2)$ **6.** $10(9 + b)$ **7.** $6(b - 7)$ **8.** $3(d - 11)$

English Spanish

EXAMPLE 3 Standardized Test Practice

Which expression is equivalent to $9(6 + x + 2)$?

(A) $9x + 8$ (B) $9x + 54$ (C) $9x + 56$ (D) $9x + 72$

$$\begin{aligned} 9(6 + x + 2) &= 9(6) + 9(x) + 9(2) && \text{Distributive Property} \\ &= 54 + 9x + 18 && \text{Multiply.} \\ &= 9x + 54 + 18 && \text{Commutative Property of Addition} \\ &= 9x + 72 && \text{Add 54 and 18.} \end{aligned}$$

∴ The correct answer is (D).

On Your Own

Now You're Ready
Exercises 12–27

Use the Distributive Property to simplify the expression.

9. $2(n + 5 + 12)$ **10.** $15(y + 3 + 7)$ **11.** $5(10 + z + 9)$

12. $3(x + 11 + 4)$ **13.** $7(2 + 6 + d)$ **14.** $8(20 + 25 + w)$

EXAMPLE 4 Real-Life Application

José is x years old. His brother, Felipe, is 2 years older than José. Their aunt, Maria, is three times as old as Felipe. Write and simplify an expression that represents Maria's age in years.

Name	Description	Expression
José	He is x years old.	x
Felipe	He is 2 years *older* than José. So, *add* 2 to x.	$x + 2$
Maria	She is three *times* as old as Felipe. So, *multiply* 3 and $(x + 2)$.	$3(x + 2)$

$$\begin{aligned} 3(x + 2) &= 3(x) + 3(2) && \text{Distributive Property} \\ &= 3x + 6 && \text{Multiply.} \end{aligned}$$

∴ Maria's age in years is represented by the expression $3x + 6$.

On Your Own

15. Alexis is x years old. Her sister, Gloria, is 7 years older than Alexis. Their grandfather is five times as old as Gloria. Write and simplify an expression that represents their grandfather's age in years.

English Spanish

1.4 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

Vocabulary and Concept Check

1. **WRITING** One meaning of the word *distribute* is to give something to each member of a group. How can this help you remember the Distributive Property?
2. **OPEN-ENDED** Write an algebraic expression in which you use the Distributive Property and then the Associative Property of Addition to simplify.
3. **WHICH ONE DOESN'T BELONG?** Which expression does *not* belong with the other three? Explain your reasoning.

$2(x + 2)$ $5(x - 8)$ $4 + (x \cdot 4)$ $8(9 - x)$

Practice and Problem Solving

Use the Distributive Property and mental math to find the product.

1

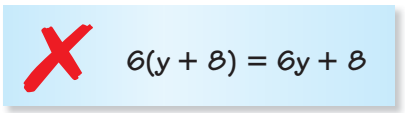
4. 3×21
5. 9×76
6. $12(43)$
7. $5(88)$
8. 18×52
9. 8×27
10. $8(63)$
11. $7(28)$

Use the Distributive Property to simplify the expression.

2 3

12. $3(x + 4)$
13. $10(b - 6)$
14. $6(s - 9)$
15. $7(8 + y)$
16. $8(12 + a)$
17. $9(n + 1)$
18. $12(6 - k)$
19. $18(w + 5)$
20. $9(3 + c + 4)$
21. $7(8 + x + 2)$
22. $8(g + 5 + 2)$
23. $6(10 + z + 3)$
24. $6(x + 4) + 3$
25. $5 + 8(3 + x)$
26. $9 + 8(x + 2)$
27. $5(8 + x) + 12$

28. **ERROR ANALYSIS** Describe and correct the error in rewriting the expression.



29. **ART MUSEUM** A class of 30 students visits an art museum and a special exhibit while there.

   a. Use the Distributive Property to write and simplify an expression for the cost.
   b. Estimate a reasonable value for x. Explain.
   c. Use your estimate for x to evaluate both expressions in part (a). Are the values the same?

30. **FITNESS** Each day, you run on a treadmill for r minutes and lift weights for 15 minutes. Which expressions can you use to find how many minutes of exercise you do in 5 days? Explain your reasoning.

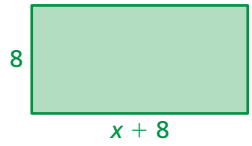
$5(r + 15)$ $5r + 5 \cdot 15$ $5r + 15$ $r(5 + 15)$

English Spanish

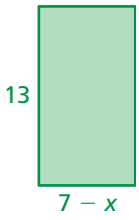
31. **SPEED** A cheetah can run 103 feet per second. A zebra can run x feet per second. Use the Distributive Property to write and simplify an expression for how much farther the cheetah can run in 10 seconds.

GEOMETRY **Use the Distributive Property to write and simplify an expression for the area of the rectangle.**

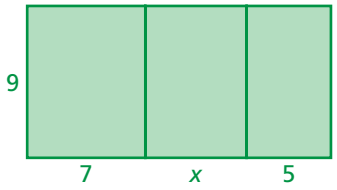
32.



33.



34.



ALGEBRA **Find the value of x that makes the expressions equivalent.**

35. $4(x - 5); 32 - 20$ **36.** $2(x + 9); 30 + 18$ **37.** $7(8 - x); 56 - 21$

Use the Distributive Property to rewrite the expression as a product.

38. $4x + 36$ **39.** $6 + 2x$ **40.** $75 - 5x$ **41.** $7 + 14x + 21$

42. **REASONING** Simplify the expressions and compare.

a. $4(x + 6)$ **b.** $(x + 6) + (x + 6) + (x + 6) + (x + 6)$

c. Compare the expressions and results in parts (a) and (b). What do you notice? Explain.

43. **FUNDRAISER** An art club sells 42 large candles and 56 small candles.

a. Use the Distributive Property to write and simplify an expression for the profit.

b. A large candle costs \$5 and a small candle costs \$3. What is the club's profit?

Profit = Price − Cost

44. Puzzle Add one set of parentheses to the expression $7 \cdot x + 3 + 8 \cdot x + 3 \cdot x + 8 - 9$ so that it is equivalent to $2(9x + 10)$.

Fair Game Review What you learned in previous grades & lessons

Evaluate the expression when $x = 5$ and $y = 24$. SECTION 1.1

45. $x + 9$ **46.** $y \div 3$ **47.** xy **48.** $y - x$

Tell whether the fraction is in simplest form. If not, simplify it. SKILLS REVIEW HANDBOOK

49. $\frac{8}{12}$ **50.** $\frac{6}{35}$ **51.** $\frac{38}{62}$ **52.** $\frac{16}{27}$

53. **MULTIPLE CHOICE** What is the surface area of a cube that has a side length of 8 feet? SKILLS REVIEW HANDBOOK

(A) 64 ft^2 (B) 192 ft^2 (C) 384 ft^2 (D) 512 ft^2