

Chapter 3

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**Chapter
3****Algebraic Expressions and Properties**

Dear Family,

Many families enjoy exploring their own towns and cities instead of going far away on vacation. Some of those activities may include visiting a movie theater, a local museum, or community theater. Making sure you have enough money to take the outing is important.

Before you head out to watch your favorite movie on the Big Screen, you can use an expression to estimate the cost. For example, if one ticket costs you \$7, you can use the expression, $7x$, where x is the number of tickets you will need, to determine the amount of money you will need to take to the theater.

You and your student can discuss how to calculate the amount of money that will be needed to enjoy the following local family activity. For example, you might ask your student:

- "A family is going to visit the local art museum. The cost for children is \$5.50. The cost for adults is \$8. What is the expression used to determine how much money it costs for a child to visit the museum? What is the expression used to determine how much money it costs for an adult to visit the museum?" Your student may answer, "The expressions will be $5.5x$, where x is the number of children attending, and $8y$, where y is the number of adults attending."
- "A family has 3 children and 2 adults visiting the museum. How much money will the family spend on each type of ticket?" Your student may answer "The cost for the children is 5.5×3 , which is \$16.50. The cost for the adults is 8×2 , which is \$16."

You and your student can then talk about how to find the total cost of visiting the art museum. This process can be used to find the cost of visiting a number of other family activities. Have your student practice finding the cost of visiting other local attractions. Which attraction costs the least? Which attraction costs the most?

Enjoy exploring your city as a family!

Capítulo
3**Expresiones algebraicas y propiedades**

Estimada familia,

Muchas familias disfrutan de explorar sus pueblos y ciudades en vez de viajar a lugares distantes durante sus vacaciones. Algunas de esas actividades podrían ser ir al cine, visitar un museo local, o ir al teatro comunitario. El asegurarse de tener suficiente dinero para visitar dichos lugares es importante.

Antes de ir a ver tu película favorita en la pantalla grande, puedes usar una expresión para hacer un estimado del costo. Por ejemplo, si un boleto te cuesta \$7, puedes usar la expresión, $7x$, donde x es el número de boletos que necesitarás, para determinar la cantidad de dinero que deberás llevar a la sala de cine.

Usted y su estudiante pueden dialogar sobre cómo calcular la cantidad de dinero que se necesitará para disfrutar de la siguiente actividad familiar local. Por ejemplo, podría preguntarle a su estudiante:

- "Una familia visitará el museo de arte local. El costo de la entrada por niño es de \$5.50. El costo por adulto es de \$8. ¿Qué expresión se usa para determinar la cantidad de dinero necesaria para que un niño visite el museo? ¿Qué expresión se usa para determinar la cantidad de dinero necesaria para que un adulto visite el museo?" Puede que su estudiante responda, "Las expresiones serán $5.5x$, donde x es el número de niños que irán al museo y $8y$, donde y es el número de adultos que irán."
- "Una familia consta de 3 niños y 2 adultos que visitarán el museo. ¿Cuánto dinero gastará la familia en cada tipo de boleto?" Su estudiante podría contestar "El costo por niño es 5.5×3 , lo cual es \$16.50. El costo por adulto es 8×2 lo cual es \$16."

Usted y su estudiante pueden hablar sobre cómo hallar el costo total de visitar el museo de arte. Este proceso se puede usar para hallar el costo de visitar otras actividades familiares. Haga que su estudiante practique cómo hallar el costo de visitar otras atracciones locales. ¿Cuál es la atracción que cuesta menos? ¿Cuál es la que cuesta más?

¡Disfruten explorando su ciudad en familia!

Activity
3.1**Start Thinking!**

For use before Activity 3.1

Have you ever read a newspaper article? A good article should answer the five Ws: Who? What? When? Where? Why?

How is a newspaper article similar to a word problem you would solve in math class?

Activity
3.1**Warm Up**

For use before Activity 3.1

Evaluate the expression.

1. $7 + 64$

2. $139 - 25$

3. $150 - 67$

4. 5×18

5. 52×9

6. $250 \div 5$

How would you plan a trip in a car? You want to travel to Washington, D.C. What information might you need to make your plans? What math is involved?

Write and evaluate an expression for the problem.

1. You buy 2 scarves for \$15 each. How much do you spend?
2. It takes you 15 minutes to bike 5 miles. How long does it take you to bike 1 mile?
3. Four friends split a lunch bill for \$24. How much does each person spend?
4. You have traveled 70 miles of a 200-mile trip. How much farther do you have to travel?

3.1 Practice A

Identify the terms, coefficients, and constants in the expression.

1. $3 + c + e$

2. $5m + 9$

3. $3p^2 + 7$

Evaluate the expression when $c = 4$, $d = 6$, and $e = 10$.

4. $7d$

5. $c + d$

6. $15 - d$

7. $10 \cdot e$

8. $\frac{24}{c}$

9. $9 + e$

10. $16 \div c$

11. $30d$

12. $\frac{60}{d}$

Evaluate the expression when $m = 5$ and $n = 8$.

13. $4m - 7$

14. $4n - 3m$

15. $\frac{6m}{n - 3}$

16. Describe and correct the error in evaluating the expression when $m = 10$.

\times	$3m - 6 = 3 \cdot 10 - 6$
	$= 3 \cdot 4$
	$= 12$

17. Twenty-five students go to lunch. Pizza costs \$3 and sandwiches cost \$2. Twelve students buy pizza. What is the total amount of money spent on sandwiches?

18. Each student in your class must do 14 homework problems. There are 23 students in the class. How many problems will your teacher have to grade?

19. A summer job pays \$5 per hour.

a. You work for 12 hours. How much do you make?

b. After working 24 hours, do you have enough money to buy an MP3 player that costs \$100?

20. You can read 52 pages per hour.

a. You read for an hour and a half. How many pages have you read?

b. You must read 130 pages for homework. Can you complete the assignment in two hours? Explain your reasoning.

3.1 Practice B

Write each expression using exponents.

1. $m \cdot m \cdot m \cdot m$

2. $f \cdot g \cdot g \cdot g$

3. $7.4 \cdot x \cdot x \cdot y \cdot y$

Evaluate the expression when $c = 6$, $d = 8$, and $e = 16$.

4. $c + 12$

5. $\frac{d + e}{c}$

6. $3e - c$

7. $4d + 3$

8. $48 \div d$

9. $\frac{2d}{e}$

10. Copy and complete the table.

x	5	8	12
$9x - 5$			
$x^2 + 4$			
$2x^2 + 3x$			

Evaluate the expression when $m = 9$ and $n = 12$.

11. $mn - 4 \cdot 2$

12. $3n - 4m$

13. $\frac{m^2}{3} - 7$

14. On a field trip, your class stops to get ice cream cones. Each cone costs \$3. There are 68 students in your class. How much will the ice cream cones cost?
15. You earn money by washing windows at \$14 per house or washing cars at \$5 per car. How many cars would you have to wash to make the same amount for washing windows at 10 houses?
16. Your basketball team made 10 three-pointers, 8 two-point field goals, and 12 one-point foul shots. Your opponents made 8 three-pointers, 12 two-point field goals, and 11 one-point foul shots. Who won? By how many points did they win?
17. There are 46 legs in a zoo exhibit. Every animal has either two or four legs.
- List two possible choices for the number of each type of animal in the exhibit.
 - The number of two-legged animals is 2 more than the number of four-legged animals. How many of each are in the exhibit?
 - The number of legs in the exhibit increases by 4. What might account for this increase?

3.1 Puzzle Time

Why Were King Edward's Soldiers Too Tired To Fight?

Write the letter of each answer in the box containing the exercise number.

Write each expression using exponents.

1. $a \cdot a \cdot a \cdot a$ 2. $6 \cdot y \cdot y$
 3. $\frac{1}{4} \cdot c \cdot c \cdot d \cdot d$ 4. $9.8 \cdot m \cdot m \cdot m \cdot n \cdot n$

Evaluate the expression when $a = 4$, $b = 3$, and $c = 10$.

5. $5 + a$ 6. $c - 2.5$ 7. $2.8 \div a$
 8. $13\frac{3}{5} - b$ 9. $\frac{5a}{8}$ 10. $\frac{c}{5} - \frac{a}{2}$
 11. $a \cdot b \cdot c$ 12. $c^2 - ab$

Evaluate the expression when $a = 12$, $b = 5$, and $c = 2$.

13. $3a + 4$ 14. $5c - 6.7$ 15. $\frac{a}{5} + 4$
 16. $\frac{26}{b} + 8.8$ 17. $c^2 + \frac{2}{3}$ 18. $\frac{a^2}{12} - 2.4$
 19. $\frac{a}{6} + 7c$ 20. $bc + 11.2$ 21. $\frac{6a}{c} - 2$
 22. $\frac{ab}{6} - 3c$

Answers	
Y. $10\frac{3}{5}$	G. $9.8m^3n^2$
S. 14	S. $2\frac{1}{2}$
E. a^4	T. $6\frac{2}{5}$
H. 0	D. $4\frac{2}{3}$
N. 258	H. $6y^2$
L. 88	T. 120
S. 4	E. 34
S. $\frac{1}{4}c^2d^2$	I. 40
E. 21.2	A. 9
P. 3.3	E. 9.6
K. 7.5	L. 0.7
H. 16	

23. The expression $12a + 7s$ is the cost, in dollars, for a adults and s students to enter the local marching band competition. Find the total cost for 4 adults and 30 students.

11	2	21	8		10	5	17		22	12	18	1	14	7	20	16	3		6	23	13	4	19	15	9
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**Activity
3.2****Start Thinking!**

For use before Activity 3.2

Many common words have mathematical meanings. What operation do you think of when you hear these phrases?

Bigger than Older than Higher than

Think of some other everyday phrases that have mathematical meanings. Try to write a phrase for each operation: addition, subtraction, multiplication, and division.

**Activity
3.2****Warm Up**

For use before Activity 3.2

Evaluate the expression when $x = 2$ and $y = 6$.

1. $x + 8$

2. $12 - y$

3. $x \cdot y$

4. $x + y$

5. $\frac{y}{x}$

6. $y - x$

Explain what this sentence means:

“To get to school, Susie walks 5 blocks less than Bill.”

Can the sentence be written mathematically?

If you knew how many blocks Bill walked to school, how would you figure out how many blocks Susie walked?

Write the phrase as an expression.

1. the sum of 12 and a number t
2. a number h times 8
3. the difference of 7 and a number f
4. 11 decreased by a number w
5. a number n divided by 2
6. twice a number p

3.2 Practice A**Write the phrase as an expression.**

1. 6 more than 4
2. 7 less than 15
3. 3 times a number x
4. the quotient of a number m and 4
5. the product of 8 and a number p
6. twice a number x
7. a number y decreased by 10
8. 7 fewer than a number k
9. the total of a number c and 3
10. the difference of 11 and a number d
11. Describe and correct the error in writing the phrase as an expression.

\times	12 less than a number x $12 - x$
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Write two phrases for the expression.

12. $x + 8$
13. $20 - n$

Write the phrase as an expression. Then evaluate when $x = 2$ and $y = 10$.

14. twelve more than the product of 5 and a number x
15. the quotient of a number x and the sum of 3 and 7
16. 17 less than the quotient of 200 and a number y
17. 15 decreased by the product of a number x and 4
18. You eat five slices of bread. Your friend eats two slices fewer than you eat. Write an expression that describes the number of slices your friend eats.
19. Your uncle is 2 years older than 3 times your age.
 - a. You are x years old. Write an expression to describe your uncle's age.
 - b. You are 12 years old. How old is your uncle?

3.2 Practice B

Write the phrase as an expression.

1. 8 more than 5
2. 11 fewer than 24
3. 6 times a number y
4. the quotient of a number n and 7
5. the sum of 8 and a number e
6. twice a number n plus 6
7. a number x decreased by 13
8. 7 less than 3 times a number m
9. the total of a number f and 3
10. the difference of 25 and a number w
11. You have two cats. Each cat has a litter of 6 kittens. Write an expression that describes the total number of cats and kittens you have.
12. The total of your dinner bill plus tip is \$16.00. You left a \$3.20 tip. Write an expression to describe this situation.

Write the phrase as an expression. Then evaluate when $x = 8$ and $y = 20$.

13. fifteen more than the quotient of 24 and a number x
14. the sum of a number y and 30, all divided by 5
15. the product of 2 and the sum of a number x and 9
16. In the sequence, 2, 5, 8, 11, ..., which expression describes the number after x ? Explain your choice.
A. $x + 3$ B. $x - 3$ C. $3x$ D. $x \div 3$

17. You are baking cookies.
 - a. You make one and one-half batches of cookies. How many eggs have you used?
 - b. Each batch makes 24 cookies. You make x batches of cookies, but eat 5 cookies as you are baking. Write an expression for the number of cookies that you have.
 - c. You make 3 batches of cookies to make bags for a sale. You put 5 cookies in each bag. Given $14(5) + 2 = 3(24)$, what do the terms represent?

Recipe
2 cups sugar
$1\frac{1}{2}$ cups flour
2 eggs

3.2

Enrichment and Extension

Math Joke

Fill in the squares with the missing phrases.

1. Fifteen _____ the _____ 15 and 5 is 5.

First phrase

--	--	--	--	--	--	--	--	--	--

Second phrase

--	--	--	--	--	--	--	--	--	--

2. Thirty _____ the _____ 18 and 2 is 46.

First phrase

--	--	--	--	--	--	--	--

Second phrase

--	--	--	--	--	--	--	--	--	--

3. Six _____ the _____ 8 and 3 is 18.

First phrase

--	--	--	--	--	--	--	--

Second phrase

--	--	--	--	--	--	--	--

Rearrange the shaded letters to answer the following question.

What did the zero say to the eight?

--	--	--	--	--	--	--	--



Puzzle Time

What's A Mouse's Favorite Television Show?

Write the letter of each answer in the box containing the exercise number.

Write the phrase as an expression.

1. 4.2 less than 7.6
2. $27\frac{1}{5}$ divided by 9
3. the total of $7\frac{1}{6}$ and $13\frac{1}{8}$
4. 3 times a number x
5. $10\frac{1}{3}$ subtracted from a number x
6. the quotient of 17 and a number x
7. the difference of a number x and 6.4
8. a number x squared
9. 15.6 times a number x

Write the phrase as an expression. Then, evaluate the expression when $x = 4$ and $y = 24$.

10. the sum of a number x and $19\frac{3}{5}$
11. a number x multiplied by 14.2
12. 5 less than a quotient of a number y and 2
13. the sum of a number x and 8, all divided by 3
14. 8.6 more than the product of 3 and a number y
15. Your friend has read 6 more than twice as many pages as your sister has read. Let x be the number of pages your sister has read. Write an expression for the number of pages your friend has read.

Answers

- | | |
|-----------------------------------|------------------------|
| R. $7\frac{1}{6} + 13\frac{1}{8}$ | E. $15.6x$ |
| N. $3x$ | U. x^2 |
| F. $7.6 - 4.2$ | S. $x - 6.4$ |
| E. $17 \div x$ | A. $x - 10\frac{1}{3}$ |
| U. $27\frac{1}{5} \div 9$ | O. $23\frac{3}{5}$ |
| T. 4 | F. 80.6 |
| Q. $2x + 6$ | O. 56.8 |
| L. 7 | |

7	15	2	9	5	12		10	1		14	11	3	13	8	4	6
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Activity
3.3**Start Thinking!**

For use before Activity 3.3

How many different ways can you add the following numbers? Use your methods to add them.

$$13 + 24 + 27 + 6 + 19 + 11$$

Do you get the same answer each time? Why?

Activity
3.3**Warm Up**

For use before Activity 3.3

Find the sum.

1. $13 + 4 + 5$

2. $1 + 4 + 7$

3. $2 + 5 + 8$

4. $14 + 9 + 6$

5. $6 + (12 + 4)$

6. $(23 + 8) + 17$

**Lesson
3.3****Start Thinking!**

For use before Lesson 3.3

Describe a real-life situation that uses the Commutative Property.

You and two friends are at a movie theater. Describe a situation at the movie theater that demonstrates the Associative Property.

**Lesson
3.3****Warm Up**

For use before Lesson 3.3

Tell which property is illustrated by the statement.

1. $5 \times 12 = 12 \times 5$

2. $1 + (2 + 4) = (1 + 2) + 4$

3. $14 + q = q + 14$

4. $6 \cdot (9 \cdot 1) = (6 \cdot 9) \cdot 1$

5. $2 \cdot 6r = 6r \cdot 2$

6. $4 + (1 + 6) = (1 + 6) + 4$

3.3 Practice A

Tell which property the statement illustrates.

- $3 + 5 = 5 + 3$
- $12 + 0 = 12$
- $6 \cdot 7 = 7 \cdot 6$
- $8 \cdot (10 \cdot 7) = (8 \cdot 10) \cdot 7$
- $17 \cdot 1 = 17$
- $8 + (7 + 5) = (8 + 7) + 5$

Simplify the expression. Explain each step.

- $2 + (a + 8)$
- $7(4y)$
- $(8e) \cdot 1$
- $(2x) \cdot 5$
- $(0 + c) + 12$
- $7 \cdot x \cdot 5$

Copy and complete the statement using the specified property.

- Commutative Property of Addition: $a + 7 = \underline{\quad?}$
- Commutative Property of Multiplication: $12 \cdot 5 = \underline{\quad?}$
- Associative Property of Addition: $6 + (9 + 7) = \underline{\quad?}$
- Associative Property of Multiplication: $2 \cdot (5 \cdot 7) = \underline{\quad?}$
- Describe and correct the error made in simplifying the expression.

\times	$54 \cdot 1 = 1$ Multiplication Property of One
----------	--

- You and your friend are selling your old CDs. Your friend sells 14 the first day and x the next day. You sell y the first day and 6 the next day. Write an expression that shows that the total number of CDs sold both days. Rewrite your answer using the Commutative Property of Addition.

3.3 Practice B

Simplify the expression. Explain each step.

1. $16 + (f + 4)$
2. $(3y) \cdot 9$
3. $5(8y)$
4. $(0 + n) + 15$
5. $(21 \cdot y) \cdot 1$
6. $10 \cdot x \cdot 4$
7. $34 \cdot y \cdot 0$
8. $35 + (p + 5)$

Copy and complete the statement using the specified property.

9. Commutative Property of Addition: $h + 11 = \underline{\quad?}$
10. Commutative Property of Multiplication: $12 \cdot k = \underline{\quad?}$
11. Associative Property of Addition: $21 + (9 + 8) = \underline{\quad?}$
12. Associative Property of Multiplication: $12 \cdot (5 \cdot 4) = \underline{\quad?}$
13. Multiplication Property of One: $18 \cdot w \cdot 1 = \underline{\quad?}$
14. Addition Property of Zero: $26 + c + 0 = \underline{\quad?}$
15. Describe and correct the error made in identifying the property.

\times	$(2 \cdot x) \cdot 4 = 2 \cdot (x \cdot 4)$ Commutative Property of Multiplication
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16. On a bike trip, you traveled 21 miles on the first day, 19 miles on the second day, and n miles on the third day.
 - a. Write an expression for the number of miles traveled in three days.
 - b. Simplify the expression. Explain each step.
17. You practiced your guitar 37 minutes on Monday, t minutes on Wednesday, and 29 minutes on Friday. Write and simplify an expression for the number of minutes you practiced.

3.3 Enrichment and Extension

Finding Sums

Find the sum of the whole numbers from 1 to 100. You can use properties of addition to find the sum more quickly than adding the numbers one by one. Carl Friedrich Gauss, a famous mathematician from the late 1700s, is believed to have used a method similar to the one below as a child.

Step 1: Write the sum. Write the sum backwards below it.

$$1 + 2 + 3 + 4 + 5 + \cdots + 96 + 97 + 98 + 99 + 100$$

$$100 + 99 + 98 + 97 + 96 + \cdots + 5 + 4 + 3 + 2 + 1$$

Step 2: Circle the first numbers, second numbers, third numbers, and so on.

$$\begin{array}{cccccccccccc} (1) & + & (2) & + & (3) & + & (4) & + & (5) & + & \cdots & + & (96) & + & (97) & + & (98) & + & (99) & + & (100) \\ (100) & + & (99) & + & (98) & + & (97) & + & (96) & + & \cdots & + & (5) & + & (4) & + & (3) & + & (2) & + & (1) \end{array}$$

Step 3: Identify the number of pairs and the sum of each pair.

There are 100 pairs. The sum of each pair is 101.

Step 4: Find the sum.

The sum of both lines in step 2 is $100 \cdot 101 = 10,100$. Because the sum was written twice, divide by 2 to find the desired sum.

So, the sum of the whole numbers from 1 to 100 is $\frac{100 \cdot 101}{2} = 5050$.

Find the sum by using the method above to complete the table.

	Number of pairs	Sum of each pair	Sum
1. 1 through 9			
2. 1 through 20			
3. 1 through 50			
4. 1 through 199			
5. 1 through 1000			

6. Let n be a whole number. Write an expression that can be used to find the sum of the whole numbers from 1 through n .

3.3 Puzzle Time

Why Was A Book In The Frying Pan On The Stove?

Write the letter of each answer in the box containing the exercise number.

Tell which property is illustrated by the statement.

1. $\frac{1}{4} \cdot x = x \cdot \frac{1}{4}$
2. $3 + (11 + p) = (3 + 11) + p$
3. $6 \cdot (r \cdot 9) = (6 \cdot r) \cdot 9$
4. $c + 13.4 = 13.4 + c$
5. $\left(y + 7\frac{1}{8}\right) + 0 = y + 7\frac{1}{8}$
6. $b \cdot 1 = b$

Simplify the expression.

7. $5 + (4 + x)$
8. $7(3x)$
9. $(0 + x) + 6\frac{1}{2}$
10. $11.2 \cdot x \cdot 3$
11. $\left(6x + 5\frac{1}{3}\right) + 4\frac{1}{3}$
12. $(5x) \cdot 12$
13. $(17.3 \cdot x) \cdot 1$
14. $x \cdot 0 \cdot 16$

Answers for 1–6.

B. Addition Property of Zero
O. Commutative Property of Addition
A. Multiplication Property of One
K. Associative Property of Addition
T. Commutative Property of Multiplication
O. Associative Property of Multiplication

Answers for 7–14.

C. $60x$ **O.** $x + 6\frac{1}{2}$
K. $21x$ **I.** $33.6x$
S. $9 + x$ **A.** 0
O. $6x + 9\frac{2}{3}$ **W.** $17.3x$

10	1		13	6	7		14		12	3	11	8	5	4	9	2
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Activity
3.4**Start Thinking!**

For use before Activity 3.4

John says that 16×40 is the same as 8×80 .
Is he correct? How do you know?

Activity
3.4**Warm Up**

For use before Activity 3.4

Find the product.

1. 7×13

2. 9×23

3. 14×4

4. 5×41

5. 6×37

6. 18×7

How can you relate the Distributive Property to preparing for a birthday party?

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

1. 4×29

2. 3×42

3. 7×52

4. 6×19

5. $5(48)$

6. $8(67)$

3.4 Practice A

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

1. 5×23

2. 6×25

3. $9(54)$

4. $7(59)$

Use the Distributive Property to find the product.

5. $\frac{1}{3} \times 2\frac{3}{4}$

6. $\frac{2}{5} \times 3\frac{1}{2}$

7. $\frac{3}{8} \times 5\frac{2}{3}$

Use the Distributive Property to simplify the expression.

8. $4(x + 6)$

9. $8(c - 5)$

10. $7(2y + 8)$

11. $9(e - 4)$

12. $6(4 + n)$

13. $7(3 + x + 4)$

14. Describe and correct the error in rewriting the expression.

$\times \quad 5(x + 9) = x + 45$

15. Each day you do homework for m minutes and watch TV for 30 minutes. Which expression can you use to find how many minutes you do both activities in 5 days? Explain your reasoning.

A. $5m + 30$

B. $5(m + 6)$

C. $5(m + 30)$

D. $m(5 + 30)$

16. The school office uses r reams of white paper and 3 reams of blue paper every day. Use the Distributive Property to write and simplify an expression for how much paper the school office uses in five days.

Simplify the expression.

17. $9(w + 6) + 4$

18. $5(3 + m) - 7$

19. $2m + 7 + 9m$

20. $f + 4(f - 2)$

21. $\frac{1}{2}x + \frac{3}{8}x + x$

22. $3.1(p - 2.7)$

23. Write and simplify expressions for the area and the perimeter of a rectangle. The rectangle has a width of 5 and a length of $x + 2$.

3.4 Practice B

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

1. 6×24

2. 7×89

3. 4×99

Use the Distributive Property to find the product.

4. $\frac{3}{7} \times 5\frac{1}{2}$

5. $\frac{5}{12} \times 4\frac{3}{10}$

6. $\frac{3}{8} \times 3\frac{1}{6}$

Use the Distributive Property to simplify the expression.

7. $8(a + 6)$

8. $7(p - 5)$

9. $10(9 + 2x)$

10. $12(3f - k)$

11. $6(2 + a + 9)$

12. $9(x + y + 5)$

13. Describe and correct the error in rewriting the expression.

$\times \quad 6(x + 7) = 6x + 13$

14. A restaurant uses c cups of flour for baking rolls and 12 cups of flour for baking pies each day. Use the Distributive Property to write and simplify an expression for how much flour the restaurant uses in seven days.

15. You are y years old. Your sister is 3 years older than you. Your uncle is 4 times older than your sister. Write and simplify an expression that represents your uncle's age.

Simplify the expression.

16. $4 + 3(x + 5)$

17. $8(t + 5) + 15$

18. $4(y + 11) - 10$

19. $2w + 3 + 5w - 1$

20. $3.2(d + 1.7)$

21. $\frac{2}{3}\left(x - \frac{5}{6}\right) + 4x$

Find the value of x that makes the expressions equivalent.

22. $3(x - 7); 33 - 21$

23. $5(x + 4); 15 + 20$

24. Add one set of parentheses to the expression

$8 \bullet x + 10 + 2x + 4 \bullet x + 8 - 6$ so that it is equivalent to $2(7x + 18)$.

3.4

Enrichment and Extension

Using the Distributive Property

An electronics company sells two types of headphones. The in-ear model costs \$50. The over-the-ear model costs \$100.

The table shows how many units of each model Stores A, B, and C want to buy.

	Store A	Store B	Store C
In-ear	128	192	256
Over-the-ear	96	192	160

- How can the Distributive Property and mental math be used to find the total amount the company receives from the three stores for the in-ear headphone model?
- How can the Distributive Property and mental math be used to find the total amount the company receives from the three stores for the over-the-ear headphone model?
- What is the total amount the company receives from the three stores for both models?
- Suppose each store orders twice as many of the in-ear models as the over-the-ear models. Without doing any math, explain how you know that each store will pay the same amount for each type of model.
- The steps below show that the Distributive Property

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

can be written as $(b + c)a = ba + ca$. Fill in each blank with a property you know to justify the steps.

$(b + c)a = a(b + c)$		Property of	
$= ab + ac$		Property	
$= ba + ca$		Property of	

3.4 Puzzle Time

Why Was The Shoelace Told To Stay After School?

Write the letter of each answer in the box containing the exercise number.

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

- | | |
|---------------------------------------|--------------------------------------|
| 1. 4×22 | 2. $\frac{1}{3} \times 3\frac{1}{2}$ |
| 3. $6(89)$ | 4. 17×51 |
| 5. $\frac{1}{9} \times 18\frac{1}{4}$ | 6. $7(6.2)$ |

Use the Distributive Property to simplify the expression.

- | | |
|-----------------|-------------------------------------|
| 7. $2(x - 8)$ | 8. $4(x + 5)$ |
| 9. $9(x - 3.2)$ | 10. $7\left(x - \frac{4}{7}\right)$ |
| 11. $6(9 + x)$ | 12. $8\left(\frac{3}{4} + x\right)$ |

Simplify the expression.

- | | |
|------------------------|--|
| 13. $8x + 18 - x - 9$ | 14. $6x + 4x - 3x$ |
| 15. $10(2 + x + 3)$ | 16. $4(x + 6) - 9$ |
| 17. $11 + 5(x + 3)$ | 18. $\frac{3}{5}x + 6(x - 2)$ |
| 19. $1.8(x - 4.2) + x$ | 20. $\frac{1}{3}\left(x + \frac{1}{2}\right) + 3x$ |

Answers for 1–6.

T. 88	K. 534
C. 43.4	T. $2\frac{1}{36}$
A. 867	O. $1\frac{1}{6}$

Answers for 7–20.

N. $8x + 6$	Y. $4x + 20$
W. $4x + 15$	N. $7x$
N. $2x - 16$	S. $6x + 54$
C. $2.8x - 7.56$	I. $5x + 26$
O. $7x + 9$	A. $9x - 28.8$
U. $\frac{33}{5}x - 12$	O. $\frac{10}{3}x + \frac{1}{6}$
T. $7x - 4$	T. $10x + 50$

13	7		4	19	6	2	18	12	10		17	1		16	9	11		3	14	20	5	15	8
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**Extension
3.4****Start Thinking!**

For use before Extension 3.4

Your cousin simplified $10(x + 3) + x - 7$ to $10x + 23$. Is your cousin correct? Explain your reasoning.

**Extension
3.4****Warm Up**

For use before Extension 3.4

Use the order of operations to simplify the expression.

1. $3 + 4 \cdot 2$

2. $6 \div 3 - 2$

3. $20 - 8 \div 4$

4. $6 \cdot 4 \div 12$

5. $4(5 + 6)$

6. $7(12 - 5)$

Extension
3.4**Practice**

Factor the expression using the GCF.

1. $39 - 13$
 2. $5 + 10$
 3. $15 - 9$
 4. $45 + 30$
 5. $49 - 14$
 6. $96 - 30$
 7. $120 + 50$
 8. $3x + 9$
 9. $24x - 16$
 10. $6x - 45$
 11. $18x + 6$
 12. $17x + 51$
 13. $8x - 10y$
 14. $27x - 18y$
 15. $42x + 28y$
16. Which expression is not equivalent to $12x - 18$?
- A. $6(2x - 3)$ B. $2(6x - 9)$ C. $9(3x - 2)$ D. $3(4x - 6)$
17. Write five expressions that are equivalent to $20x + 100$.
18. The length of a rectangle is 6 centimeters and its area is $(6x + 18)$ square centimeters. Write an expression for the width.
19. You purchase 4 videos. The original price of each video is x dollars. You decide to purchase the Limited Edition versions of the videos for an additional cost. Your total cost is $(4x + 20)$ dollars. What can you conclude about the additional cost of the Limited Edition version of a video?

Chapter
3
Technology Connection

For use after Section 3.1

Using Algebraic Expressions in Spreadsheets

A spreadsheet consists of a grid of cells. You can fill in the cells with text, numbers, and formulas. Formulas are used to manipulate numerical data and can be built using references to other cells. These references to other cells are similar to variables in algebraic expressions. By using a spreadsheet and formulas, you can quickly evaluate algebraic expressions for many possible values of a variable.

EXAMPLE 1 Evaluate $6x$ for $x = 2, 8, 12, 15, 21, 26$.

SOLUTION

Step 1 Enter the label “value of x ” in cell A1 and the label “ $6x$ ” in cell B1. Then, enter the values of x in column A of the spreadsheet.

Step 2 Highlight cell B2 and enter the formula $=6*A2$. This instructs the computer to multiply the value in cell A2 by 6. When you leave the cell, you will see the generated value of the formula in the cell.

Step 3 Copy cell B2. Next, paste into cells B3 through B7. As you see in the table below, you have now found the value of the expression $6x$ for the values of x from cells A3 through A7.

	A	B	C	D
1	value of x	$6x$		
2	2	12		
3	8	48		
4	12	72		
5	15	90		
6	21	126		
7	26	156		
8				
9				

Refer to the spreadsheet in the example.

- Suppose you want to add the value $x = 35$ to the data set above. In which cell would you place 35? In which cell would the value of $6(35)$ appear?
- In column C you want to evaluate $6x - 9$ for the x -values in column A. What formula could you write in cell C2? Can you use either column A or column B as a starting point? Explain.