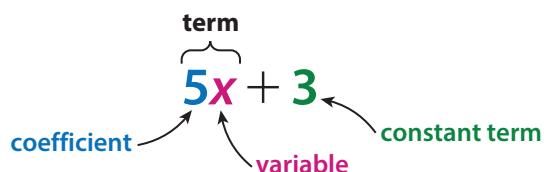


## Dear Family,

This week your student is learning to write and evaluate algebraic expressions.

An algebraic expression is like a numerical expression, except that it contains variables. A **variable** is a letter that represents an unknown quantity. Variables are useful for representing real-world situations such as the one below.

When you go bowling, each game costs \$5 and it costs \$3 to rent shoes. The total cost to play  $x$  games can be represented with the algebraic expression  $5x + 3$ .



Your student will be learning how to solve problems like the one below.

At a certain theater, movie tickets cost \$9 each. There is a \$4 fee to buy tickets online. The expression  $9x + 4$  represents the total cost, in dollars, to buy  $x$  tickets online. What is the total cost to buy 3 tickets online?

- **ONE WAY** to find the cost is to use a table.

1 ticket + fee	2 tickets + fee	3 tickets + fee
$\$9 + \$4 = \$13$	$\$9 + \$9 + \$4 = \$22$	$\$9 + \$9 + \$9 + \$4 = \$31$

- **ANOTHER WAY** is to evaluate the expression by substituting 3 for  $x$ .

$$\begin{aligned} 9x + 4 &= 9(3) + 4 \\ &= 27 + 4 \\ &= 31 \end{aligned}$$

Using either method, the total cost is \$31.



Use the next page to start a conversation about algebraic expressions.



## Activity Exploring Algebraic Expressions

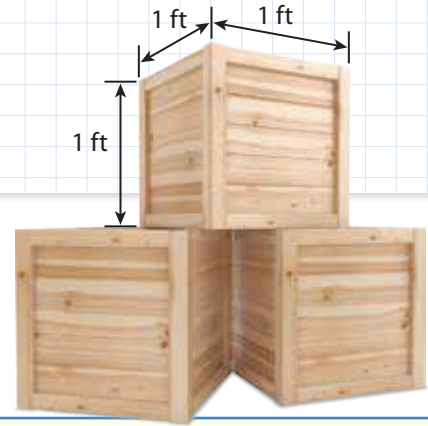
- **Do this activity together to explore how algebraic expressions can represent real-world situations.**

One use of algebraic expressions is to represent situations in which some quantities change and others do not. Then once you know the value of the quantity that is changing, you can quickly find the total amount. Look at the expressions below. What could each expression represent?

SITUATION	EXPRESSION	WHAT COULD IT REPRESENT?
How much it costs to buy a salad with additional toppings	$6 + 0.25x$	A salad costs \$6 and each additional topping costs \$0.25.
How much it costs to order pizzas with a coupon	$8p - 3$	Each pizza costs \$8 and ...
How much it costs for a school field trip to the museum with teachers and students	$10t + 5s$	
How much it costs to buy notebooks on sale	$(4 - 0.50) \cdot n$	

**?** Did it help to figure out what the variable represents first or the numbers?

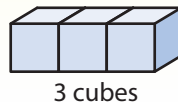
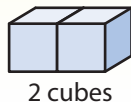
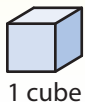
# Explore Algebraic Expressions



Previously, you learned about numerical expressions. In this lesson, you will learn about algebraic expressions.

► Use what you know to try to solve the problem below.

Kaley is making a long bench for a daycare center. She connects 1-foot wooden cubes in a row. She will use fabric to cover the bench on all sides, including the bottom. What is the surface area to be covered with fabric if Kaley uses 20 cubes?



## TRY IT



**Math Toolkit** centimeter cubes, connecting cubes, grid paper

## DISCUSS IT

**Ask:** How does your model or strategy show the number of cubes?

**Share:** My model or strategy shows . . .

### Learning Targets SMP 1, SMP 2, SMP 3, SMP 4, SMP 5, SMP 6

- Write expressions that record operations with numbers and with letters standing for numbers.
- Identify parts of an expression using mathematical terms; view a part of an expression as a single entity.
- Evaluate expressions at specific values of their variables.
- Understand that a variable can represent an unknown number, or any number in a specified set.

## CONNECT IT

- 1 **Look Back** What is the surface area Kaley will cover with fabric? What strategy or model can you use to find the answer?
- 2 **Look Ahead** Each time Kaley adds another cube to the row, the amount of fabric she needs changes. The algebraic expression  $4c + 2$  uses the **variable**  $c$  to represent any number of 1-foot cubes that Kaley can use in her bench.

The diagram shows the algebraic expression  $4c + 2$ . Arrows point from labels to parts of the expression: 'variable' points to the letter  $c$ , 'coefficient' points to the number 4, 'constant term' points to the number 2, and 'term' points to the entire  $4c$  part.

The expression  $4c + 2$  is a sum of two **terms**. The numerical factor 4 of the variable term is the term's **coefficient**.

- a. Which term of the expression  $4c + 2$  is a product? What part of the surface area of Kaley's bench does this product represent? How do you know?
- b. Look at the constant term, 2. What part of the surface area of Kaley's bench does it represent?
- 3 **Reflect** The formula for the area of a triangle includes the algebraic expression  $\frac{1}{2}bh$ . What is the coefficient in this expression? What are the variables? What do the variables represent?

## Prepare for Working with Algebraic Expressions

- 1 Think about what you know about parts of numerical expressions. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

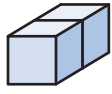
Word	In My Own Words	Example
sum		
difference		
product		
factor		
quotient		

- 2 a. Write a numerical expression for this word phrase.

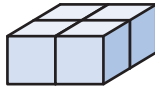
*the product of 4 and the difference of 9 and 2*

- b. Find the value of your expression.

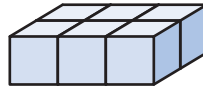
- 3 Jamal places 1-centimeter cubes in pairs. Then he uses the pairs of cubes to make rows of different lengths.



1 pair



2 pairs



3 pairs

- a. What is the surface area of a row made of 30 pairs of cubes? Show your work.

**SOLUTION** \_\_\_\_\_

- b. Check your answer to problem 3a. Show your work.

## Develop Writing and Interpreting Algebraic Expressions



► Read and try to solve the problem below.

The Ramirez family is making tamales. They wrap the tamales in corn husks for baking. They already have 8 corn husks. Isabel is bringing 3 bags of corn husks. Each bag has the same number of corn husks.

How can you use an algebraic expression to show the total number of corn husks the Ramirez family will have after Isabel arrives?

**TRY  
IT**



**Math Toolkit** algebra tiles, number lines, sticky notes

**DISCUSS IT**

**Ask:** How does your model show that each bag has the same number of corn husks?

**Share:** My model shows ...

► Explore different ways to write and interpret an algebraic expression.

The Ramirez family is making tamales. They wrap the tamales in corn husks for baking. They already have 8 corn husks. Isabel is bringing 3 bags of corn husks. Each bag has the same number of corn husks.

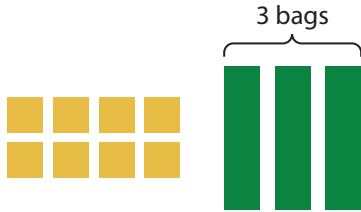
How can you use an algebraic expression to show the total number of corn husks the Ramirez family will have after Isabel arrives?

**Model It**

You can use algebra tiles to model the quantities in a problem.

Each small square algebra tile represents 1.

Each rectangular algebra tile represents the same unknown quantity.



**Model It**

You can use words to help you write an algebraic expression.

Describe how to find the total number of corn husks.

Add the number of corn husks the Ramirez family has to the number of husks in the 3 bags Isabel brings.

$$\begin{array}{ccccccc} \text{number they have} & \text{plus} & \text{3 times the number in 1 bag} & & & & \\ 8 & + & 3 \cdot \text{number in 1 bag} & & & & \end{array}$$

Use a variable for the unknown quantity.





## CONNECT IT

► Use the problem from the previous page to help you understand how to write and interpret an algebraic expression.

- 1 Look at the algebra tiles in the first **Model It**. What do the small square tiles represent? What unknown quantity does each large rectangular tile represent?
- 2 Use the variable  $x$  to represent each large rectangular tile. What algebraic expression can you write to represent the situation?
- 3 Gavin looks at the second **Model It** and uses the variable  $h$  to write the expression  $8 + 3h$ . How many terms does the expression have? Which term is a product? Identify the variable and the coefficient and explain what each represents.
- 4 Jade writes the expression for the total number of corn husks as  $3c + 8$ . Elias writes it as  $8 + c + c + c$ . Are both expressions correct? Explain.
- 5 How can you write an algebraic expression to represent a situation in which there is an unknown quantity?
- 6 **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to solve the **Try It** problem.

## Apply It

► Use what you learned to solve these problems.

- 7 Gaspar writes the algebraic expression  $5b + 3.79$ . It represents the total cost, in dollars, of buying 5 bagels and a container of cream cheese. Identify any variables, coefficients, and terms in the expression. Tell what each represents.



- 8 a. Write an algebraic expression for the word phrase below. Which factor of your expression is a sum of two terms?

*the product of 5.8 and the sum of 9 and a number  $n$*

- b. Write an algebraic expression for the word phrase below. Is your expression a *difference* or a *quotient*? Explain.

*subtract a number  $x$  from 15 and then divide by 2*

- 9 Laqueta has a \$50 gift card for an online music store. Each song costs  $s$  dollars. Write an algebraic expression that represents the amount left on the card after Laqueta buys 7 songs. Show your work.

## SOLUTION

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## Practice Writing and Interpreting Algebraic Expressions

- **Study the Example showing how to write an algebraic expression. Then solve problems 1–6.**

### Example

Noah reads a book and an article. The article is 12 pages long. He completes all the reading in 8 days, and he reads the same number of pages each day. Write an algebraic expression for the number of pages Noah reads each day.

Use the variable  $b$  to represent the unknown number of pages in the book.

Add to write an expression for the total number of pages Noah reads.

$$b + \text{the number of pages in the article} = b + 12$$

Divide by 8 to write an expression for the number of pages Noah reads each day.

$$(b + 12) \div 8$$

- 1 Julio says that the expression  $(b + 12) \div 8$  in the Example can be written as the fraction  $\frac{b + 12}{8}$ . Do you agree? Explain.
- 2 Write an algebraic expression for each word phrase.
  - a. 5 less than 3.1 times a number  $n$
  - b. four more than the quotient of 12 and a number  $x$
- 3 Ava has a part-time job at a store. She earns a weekly salary. She also earns a \$0.60 bonus for each gift card she sells. The expression  $165 + 0.60g$  shows Ava's total weekly earnings. Identify any variables, coefficients, and terms in the expression. Tell what each represents.

### Vocabulary

#### coefficient

a number that is multiplied by a variable.

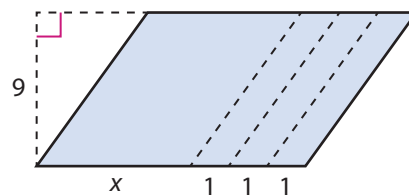
#### term

a number, a variable, or a product of numbers, variables, and/or expressions.

#### variable

a letter that represents an unknown number. In some cases, a variable may represent more than one number.

4 Dario looks at the parallelogram and writes the expression  $(x + 3)(9)$ .



- a. Is Dario's expression a *sum*, a *product*, a *difference*, or a *quotient*? Explain.
  
- b. What are the factors of the expression  $(x + 3)(9)$ ? What does each factor represent about the parallelogram?

c. What does the expression  $(x + 3)(9)$  represent? Why?

5 Three friends go to a restaurant. They share a meal. They decide to split the cost of the meal equally. Each friend also contributes \$2 for the tip. Write an algebraic expression for the amount each friend pays. Show your work.

**SOLUTION** \_\_\_\_\_

6 Leah runs  $m$  miles every day during the week except for Wednesday and Sunday.

- a. Write an algebraic expression that represents the total number of miles Leah runs each week.
  
- b. There are 52 weeks in a year. Write an algebraic expression that represents the total number of miles Leah runs in a year.

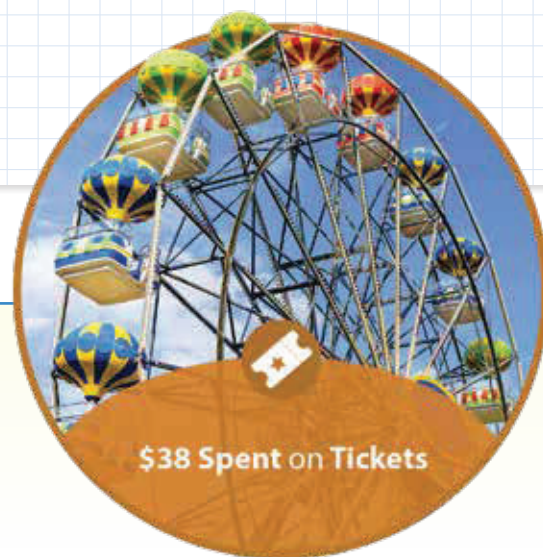


## Develop Evaluating Algebraic Expressions

► Read and try to solve the problem below.

A county fair has different ticket prices for adults and children. The expression  $6a + 5c$  represents the total cost in dollars of tickets for  $a$  adults and  $c$  children.

The Patel family spends \$38 on tickets. How many adult tickets and child tickets do they buy?



**TRY  
IT**



**Math Toolkit** counters, number lines, sticky notes

**DISCUSS IT**

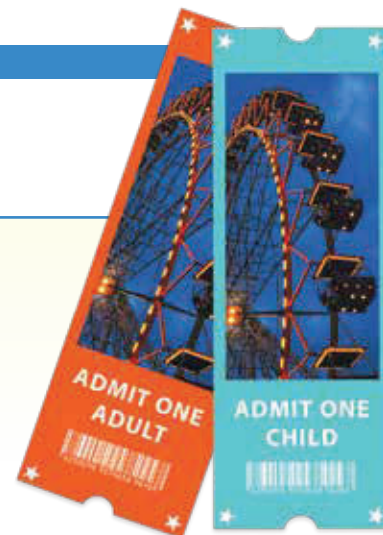
**Ask:** How did you use the expression  $6a + 5c$  in your solution?

**Share:** I knew . . .  
so I . . .

► Explore ways to interpret and evaluate algebraic expressions.

A county fair has different ticket prices for adults and children. The expression  $6a + 5c$  represents the total cost in dollars of tickets for  $a$  adults and  $c$  children.

The Patel family spends \$38 on tickets. How many adult tickets and how many child tickets do they buy?



## Analyze It

You can use the terms and coefficients of an expression to give you information about the situation.

The term  $6a$  represents the cost of tickets for  $a$  adults and the term  $5c$  represents the cost of tickets for  $c$  children. The coefficients of the terms tell you how much each type of ticket costs.

$$6a + 5c$$

An adult ticket costs \$6.

A child ticket costs \$5.

## Model It

You can evaluate an algebraic expression by substituting values for the variables.

You can guess and check different combinations of tickets. Try to find a combination that gives a total cost of \$38.

Evaluate the expression for  $a = 2$  and  $c = 3$ .

$$6a + 5c$$

$$6(2) + 5(3) = 12 + 15 \\ = 27$$

Because 27 is less than 38, try a greater value for one of the variables.

Evaluate the expression for  $a = 5$  and  $c = 3$ .

$$6a + 5c$$

$$6(5) + 5(3) = 30 + 15 \\ = 45$$

## CONNECT IT

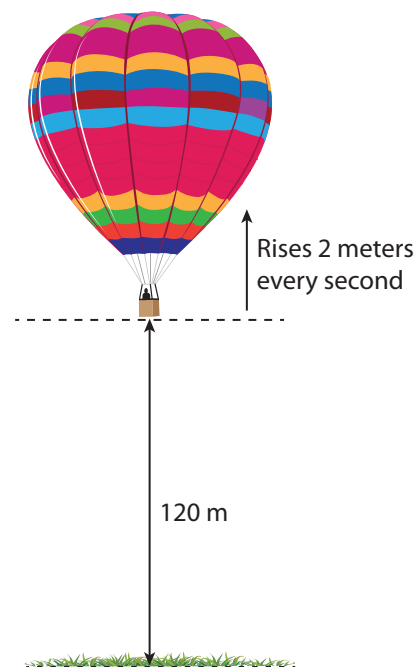
► Use the problem from the previous page to help you understand how to interpret and evaluate an algebraic expression.

- 1 Look at the algebraic expression in **Analyze It**. How do you know that the coefficient of the term  $6a$  represents the cost of an adult ticket?
- 2 How does the order of operations help you interpret the expression  $6a + 5c$  in **Model It**? Describe the order in which you perform the operations shown in the expression  $6(2) + 5(3)$ .
- 3 The choices for the variables in **Model It** do not give a total cost of \$38. Show that the value of  $6a + 5c$  is 38 when  $a = 3$  and  $c = 4$ . What does this mean about the number of adult tickets and child tickets the Patel family buys?
- 4 How is evaluating an algebraic expression similar to evaluating a numerical expression? How is it different?
- 5 **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to evaluate algebraic expressions.

## Apply It

► Use what you learned to solve these problems.

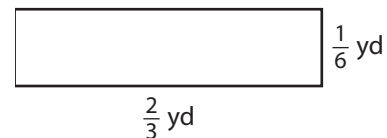
- 6 A hot air balloon is rising. The expression  $120 + 2t$  represents the height of the hot air balloon in meters after  $t$  seconds. Use the expression to find the height of the balloon after 15 s. Show your work.



### SOLUTION

---

- 7 What is the value of the expression  $4(x - y) + 2$  when  $x = 7$  and  $y = 1$ ?
- A 26
- B 29
- C 32
- D 48
- 8 You can use the expression  $2\ell + 2w$  to find the perimeter of a rectangle where  $\ell$  is the length and  $w$  is the width. Use the expression to find the perimeter of the rectangle. Show your work.



### SOLUTION

---



## Practice Evaluating Algebraic Expressions

- Study the Example showing how to evaluate an algebraic expression. Then solve problems 1–5.

### Example

The expression  $8s + 5m$  represents a student's score on a science test.

$s$  = the number of correct short answer items

$m$  = the number of correct multiple-choice items

Santo answers 4 short answer items correctly. He answers 10 multiple-choice items correctly. What is Santo's score?

Evaluate the expression  $8s + 5m$  for  $s = 4$  and  $m = 10$ .

$$\begin{aligned} 8s + 5m &= 8(4) + 5(10) \\ &= 32 + 50 \\ &= 82 \end{aligned}$$

Santo's score is 82.

- 1 The expression  $10s + 5m$  represents a student's score on a social studies test, where  $s$  = the number of correct short answer items and  $m$  = the number of correct multiple-choice items.

Noor answers 16 multiple-choice items correctly. She does not answer any short answer items correctly. What is Noor's score? Show your work.

**SOLUTION** \_\_\_\_\_

- 2 Evaluate the expression  $300m + 240,000$  when  $m = 21$ . Show your work.

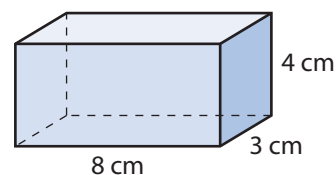
**SOLUTION** \_\_\_\_\_

### Vocabulary

#### evaluate

to find the value of an expression.

- 3 The surface area of a right rectangular prism is  $2f + 2t + 2r$ , where  $f$  is the area of the front face,  $t$  is the area of the top face, and  $r$  is the area of the right side face. Show how to use the expression to find the surface area of the right rectangular prism at the right. Show your work.



**SOLUTION** \_\_\_\_\_

- 4 Rafael has a sheet with 100 stickers. He gives  $n$  stickers to each of his 6 cousins. Write an expression that represents the number of stickers Rafael has left. Then evaluate the expression for  $n = 7$ . Show your work.

**SOLUTION** \_\_\_\_\_

- 5 Jessica saves quarters and dimes in a jar. She uses the expression  $0.25q + 0.1d$  to find the value of the coins. The variable  $q$  is the number of quarters and the  $d$  is the number of dimes. Find the value of the coins when Jessica has 18 quarters and 15 dimes. Show your work.



**SOLUTION** \_\_\_\_\_

# Refine Working with Algebraic Expressions

► Complete the Example below. Then solve problems 1–10.

## Example

Evaluate the algebraic expression  $5[2(c - 1) + d]$  when  $c = 8$  and  $d = 6$ .

Look at how you could show your work by substituting the given values for the variables and then following the order of operations.

$$\begin{aligned} &5[2(c - 1) + d] \\ &5[2(8 - 1) + 6] = 5[2(7) + 6] \\ &= 5[14 + 6] \\ &= 5[20] \end{aligned}$$

**SOLUTION** \_\_\_\_\_

## CONSIDER THIS . . .

This expression has two sets of grouping symbols, parentheses and brackets.

## PAIR/SHARE

Why is subtraction the first operation when you evaluate the expression?

## Apply It

- 1 You can use the expression  $\frac{5}{9}(F - 32)$  to find a temperature in degrees Celsius when you know the temperature  $F$  in degrees Fahrenheit. The temperature of a room is  $77^\circ$  Fahrenheit. What is the temperature of the room in degrees Celsius? Show your work.

## CONSIDER THIS . . .

Remember to substitute the value for the variable first. Then use the order to operations.

**SOLUTION** \_\_\_\_\_

## PAIR/SHARE

How can you use estimation to make sure your answer is reasonable?

- 2 Carmen has a bag of  $p$  peaches. She adds 10 peaches to the bag. Then she shares all the peaches equally among 5 friends. Write an expression that represents the number of peaches each friend receives. Show your work.

**CONSIDER THIS ...**

Is there a model that could help you see how the quantities are related?

**PAIR/SHARE**

How would your expression change if the peaches were shared equally among 3 friends?

**SOLUTION**

- 3 Which algebraic expression represents the statement below?

*four less than two times a number*

- A  $4 - 2x$   
 B  $2x - 4$   
 C  $2(x - 4)$   
 D  $(4 - 2)x$

Katrina chose A as the correct answer. How might she have gotten that answer?

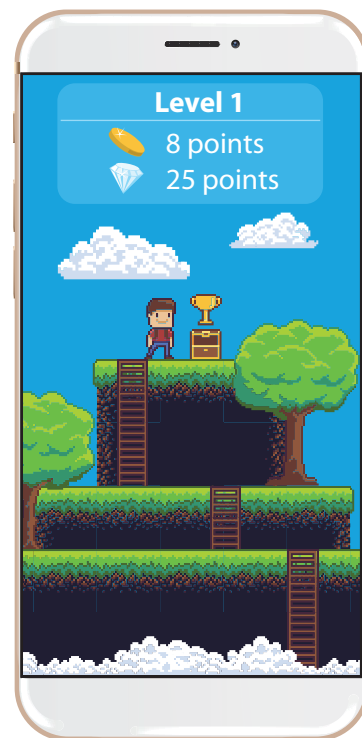
**CONSIDER THIS ...**

The expression  $9 - x$  can be read *nine minus x* or *x less than nine*. The first number in the algebraic expression is not always read first.

**PAIR/SHARE**

How can you decide whether or not the expression needs parentheses?

- 4 In a video game, players start with a score of 100 points. They earn 8 points for each gold coin and 25 points for each gem they find. Isaiah finds 3 gold coins and 2 gems. Write and evaluate an algebraic expression to find Isaiah's score. Use  $c$  for the number of gold coins found and  $g$  for the number of gems found. Show your work.



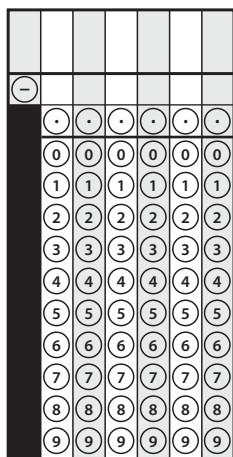
**SOLUTION** \_\_\_\_\_

- 5 Elon writes an algebraic expression to represent *the product of 10 and the difference of  $5y$  and 1*. The factors of his expression are \_\_\_\_\_ and \_\_\_\_\_.
- 6 Demi starts a gardening project with 80 sunflower seeds. She plants 12 of the seeds. Then she gives 5 seeds each to some friends. Which expression represents the number of sunflower seeds Demi has left after she gives seeds to  $f$  friends?
- A  $80 - 12 - \frac{f}{5}$                       B  $80 - 12 - \frac{5}{f}$
- C  $80 - 12 - 5 - f$                       D  $80 - 12 - 5f$
- 7 Use the expression  $11 + 9k + 6n$ . Tell whether each statement is *True* or *False*.

	True	False
a. The expression has three terms.	<input type="radio"/>	<input type="radio"/>
b. In the expression, 11 is a coefficient.	<input type="radio"/>	<input type="radio"/>
c. In one of the terms, 6 is a factor.	<input type="radio"/>	<input type="radio"/>
d. The expression has two variables.	<input type="radio"/>	<input type="radio"/>

- 8 Enrico is going to a department store. T-shirts are on sale for \$2 off the regular price,  $p$ . The expression  $5(p - 2)$  represents the total cost of the T-shirts he buys. What are the factors in the expression? What does each factor tell you? Explain.

- 9 Evaluate the expression  $3[a(4b - c)]$  for  $a = 2$ ,  $b = 3$ , and  $c = 2.8$ .



- 10 **Math Journal** Write a real-world situation that matches the expression  $10y - 3$ . Then evaluate the expression for  $y = 4$ . Explain the meaning of the result in terms of the real-world situation.

**✓ End of Lesson Checklist**

- INTERACTIVE GLOSSARY** Review the entry for *expression*. Find the entry for *term*. Give an example of an algebraic expression with two terms.
- SELF CHECK** Go back to the Unit 1 Opener and see what you can check off.