

## Algebraic Expressions

Name: \_\_\_\_\_

**Prerequisite: Write Numerical Expressions**

**Study the example showing how to write numerical expressions. Then solve problems 1–6.**

**Example**

Write a numerical expression for this phrase: 12 minus the product of 3 and 2.

Think about what the words mean.

12 minus	the product of 3 and 2
↑	↑
Minus means to subtract.	A product is the result of multiplication.

Before you can subtract the product from 12, you need to multiply 3 by 2 to find the product. Use parentheses to show that first you need to multiply.

The numerical expression is  $12 - (3 \times 2)$ .

- 1** Jennifer says that you can also write  $(12 - 3) \times 2$  for the phrase in the example. Is Jennifer correct? Explain why or why not.

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- 2** Write a numerical expression for the phrase “16 times the difference of 9 and 3.” What operation should you perform first? Explain.

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**Vocabulary**

**parentheses** the symbols ( ) that can be used to group numbers and operations in an expression.

$$24 - (3 \times 5)$$

$$(5 + 7) \times 3$$

## Solve.

- 3** To evaluate the expression “10 minus the sum of 2 and 3,” should you subtract or add first? Explain how you know.

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- 4** Write a numerical expression for each word phrase. Then evaluate the expression.

**a.** 5 times the sum of 3 and 4

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**b.** 24 divided by the sum of 6 and 2

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**c.** Divide the difference of 18 and 3 by the sum of 1 and 2.

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**d.** the sum of 4 and 3 multiplied by the quotient of 4 and 2

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- 5** Write a word phrase for the expression  $12 \div (7 - 3)$ .

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- 6** Marisa made a fruit salad. She used 1 cup of green grapes and 3 cups of red grapes. She used twice as many cups of blueberries as cups of grapes.

Write an expression for the number of cups of blueberries that Marisa used. Then evaluate the expression. Explain your reasoning.

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## Write Expressions with Variables

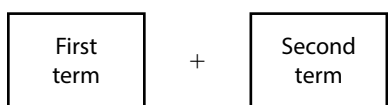
**Study the example showing how to write an expression from words. Then solve problems 1–10.**

### Example

Write an expression with the same meaning as “add a number times 2 to 5.”

Find operation words to help you write the expression.

Add a number times 2 to 5. This expression will be an addition of two terms.



The first term is 5. The second term is  $2x$ . So the expression is  $5 + 2x$ .

**1** What does the variable  $x$  in the example represent?

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**2** The number 2 in the expression  $5 + 2x$  is called the coefficient of  $x$ . How does changing the coefficient to 6 change the meaning of the expression?

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**3** In the expression,  $5 + 2x$ , how is the first term different from the second term?

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**4** Write an expression for each word phrase.

**a.** Multiply 4 by a number and then subtract 5.

\_\_\_\_\_

**b.** 15 more than half a number

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### Vocabulary

**variable** a letter that stands for an unknown number.

**constant** a term that is a known number without variables.

**coefficient** a factor of a variable term that is a known number. The coefficient of the term  $4x$  is 4.

## Solve.

- 5 Connie says an expression for the phrase “10 more than the square of a number” is  $x^2 + 10$ . Sharon says it is  $10x^2$ . Who is correct? Explain.

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- 6 Write an expression for each word phrase.

a. 5 less than the quotient of a number and 2

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b. 5 minus the quotient of a number and 2

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- 7 How are the expressions that you wrote in problem 6 similar? How are they different?

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- 8 Write a word phrase for the expression  $16 \div (x + 4)$ .

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- 9 Write an expression with two terms. One term should have a coefficient with a variable and the other term should be a constant. Name the coefficient, the variable, and the constant in the expression. Then write a word phrase for your expression.

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- 10 Mario says that the expression  $4 + 3n^2$  has four terms: 4, 3,  $n$ , and 2. Is he correct? Explain.

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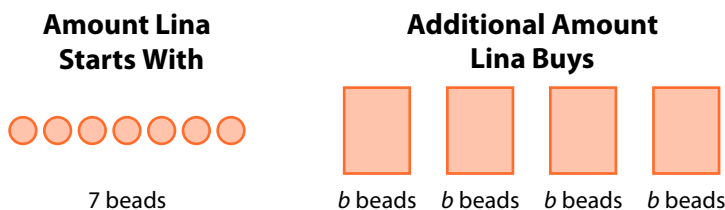
## Write and Evaluate Expressions

**Study the example showing how to write and evaluate expressions. Then solve problems 1–7.**

### Example

Lina is making jewelry. She has 7 beads and buys 4 additional packets of beads that each have the same number of beads. Write an expression to show the total number of beads that Lina uses.

Draw the beads she starts with and the packets she buys, and label the number of beads in each. You don't know how many beads are in each packet, so use a variable like  $b$  to label the number of beads in each packet.



**1** Write an expression for each word or phrase.

a. the number of beads Lina starts with

\_\_\_\_\_

b. the total number of beads in the four packets

\_\_\_\_\_

c. the total number of beads Lina has

\_\_\_\_\_

**2** Laura wrote and solved the following expression to find the total number of beads Lina has if there are 6 beads in each packet. Find and correct Laura's mistake.

$$\begin{aligned}
 7 + 4b &= 11b \\
 &= 11(6) \\
 &= 66
 \end{aligned}$$

\_\_\_\_\_

\_\_\_\_\_



## Solve.

- 3 Blake and three friends meet for lunch. His friends all get the same thing, but Blake gets a different lunch that costs \$6. Write an expression to show the total amount that Blake and his friends spend. Then find the total amount that Blake and his friends spend if each friend spends \$8.
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- 4 Ana's age is 8 years less than 4 times her sister's age. Write an expression for Ana's age. How old is Ana if her sister is 5 years old?
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- 5 Belle put the muffins she baked on six plates, four of which are red and two of which are yellow. The four red plates each have 5 muffins. The two yellow plates each have the same number of muffins. Write an expression for the total number of muffins Belle baked. If each yellow plate has 8 muffins, find how many muffins Belle baked in all. Explain.
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- 6 Adam says that the expression  $52 - 3y$  is equal to 20 when  $y = 2$ . Explain why Adam's answer is incorrect.
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- 7 A blue suitcase weighs 10 pounds less than three-fourths the weight of a green suitcase. Write an expression that you can use to find the weight of the blue suitcase. Then explain how you can find the total weight of both suitcases if the green suitcase weighs 36 pounds.
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## Write and Evaluate More Expressions

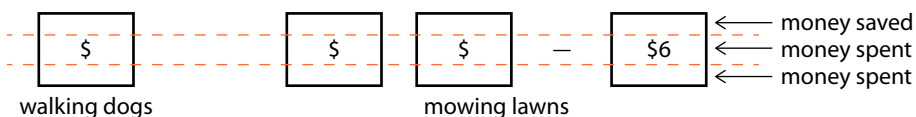
**Study the example showing how to write and evaluate more expressions. Then solve problems 1–5.**

### Example

Last week Juan mowed lawns and walked his neighbor's dog to earn money. For mowing lawns, he earned \$6 less than twice as much as he did for walking dogs. Juan saves one-third of the money he earns and spends the rest.

Write an expression to show how much money Juan earned last week.

Draw a picture to help you understand the problem.



Let  $w$  be the amount Juan earned walking dogs. Then  $(2w - 6)$  is the amount Juan earned mowing lawns. The total amount Juan earned is  $w + (2w - 6)$ , or  $3w - 6$ .

- 1** Emma wrote the expression  $2(3w - 6)$  to represent the amount of money that Juan spent. Is she correct? Explain.

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- 2** Explain how you can find the amount of money Juan saved if he earned \$12 walking dogs.

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## Solve.

- 3 The price  $p$  of a gallon of gas goes up \$0.05 cents on Friday. On Saturday the price goes down \$0.03. Write an expression with three terms to show the price of a gallon of gas on Saturday.
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- 4 Look at problem 3. If the price of a gallon of gas was \$2.59 on Friday morning before the change in price, what was the price of a gallon of gas on Saturday? Explain how you know.
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- 5 Katie gives Maggie half of her pencils. Maggie keeps 5 pencils and gives the rest to Jamil.

- a. Write an expression for the number of pencils Maggie gives to Jamil.
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- b. If Katie had 16 pencils, how many pencils does Maggie give to Jamil?

**Show your work.**

*Solution:* \_\_\_\_\_

- c. How many pencils did Katie have if Maggie gave Jamil 1 pencil? Explain how you can use the expression to help you answer the question.

**Show your work.**

*Solution:* \_\_\_\_\_

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## Write and Solve Expressions with Two Variables

**Study the example showing how to write and solve an expression with two variables. Then solve problems 1–6.**

### Example

Brooke sells paintings at art fairs. She charges \$10 for a small painting and \$20 for a large painting. Write an expression to represent the amount Brooke charges for any number of paintings of both sizes. Be sure to define your variables. How much money does Brooke charge for 3 small paintings and 2 large paintings?

**You can draw a picture to help you understand the problem.**

$$\begin{aligned} 10(s) + 20(\ell) \\ 10(3) + 20(2) \\ 30 + 40 = 70 \end{aligned}$$

Large ( $\ell$ ) \$20	Small ( $s$ ) \$10
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$$10(s) + 20(\ell)$$

Brooke charges \$70 for 3 small and 2 large paintings.

- 1** Define the variables  $s$  and  $\ell$  in the example.

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- 2** A buyer returns 2 small paintings and buys 2 large paintings. How much does the buyer owe Brooke?

**Show your work.**

*Solution:* \_\_\_\_\_



### Solve.

- 3 The students at Jackson Middle School sell pizzas for a fundraiser during volleyball games. A pepperoni pizza is \$12 and a cheese pizza is \$9. Write an expression to show the cost to buy any number of pepperoni and cheese pizzas.

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- 4 During the first hour of selling pizzas, the students sell 13 pepperoni pizzas and 16 cheese pizzas. Evaluate the expression to determine how much money the students earn in the first hour.

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- 5 Toby charges \$5 a visit and \$3 per walk to watch his neighbor's dog when the neighbor goes out of town. Write an expression to show the cost to the neighbor for any number of visits and walks.

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- 6 Toby watches the neighbor's dog for a week. He visits the dog 21 times. Toby gives his neighbor a bill for \$120. How many times did Toby walk the dog?

**Show your work.**

*Solution:* \_\_\_\_\_



## Algebraic Expressions

Solve the problems.

- 1 Lewa's hiking backpack weighs 5 pounds less than  $\frac{1}{2}$  the weight of Alani's hiking backpack. Write an expression to describe the weight of Lewa's backpack. How many pounds does Lewa's backpack weigh if Alani's backpack weighs 36 pounds?

**Show your work.**

Finding  $\frac{1}{2}$  of an amount is the same as dividing that amount by 2.



Solution: \_\_\_\_\_

- 2 A bookcase has two shelves. The top shelf has 10 more than  $\frac{1}{3}$  the number of books on the bottom shelf. There are 12 books on the bottom shelf. How many books are on the top shelf?

- A 4                                      C 40  
B 14                                      D 46

Cohen chose **D** as the correct answer. How did he get that answer?

Which operations will you use to solve this problem?



- 3 Which expression equals 6 when  $a = 5$  and  $b = \frac{1}{3}$ ? Circle all that apply.

- A  $9b^2 + 3a - 10$   
B  $a^2 - 20 - 3b$   
C  $3(a - 2) - a + 6b$   
D  $9b + ab$

Remember to use the order of operations when evaluating expressions.



## Solve.

- 4** Martin used some apples to make muffins. Omar used some apples to make applesauce. Omar used 5 fewer than half as many apples as Martin used.

- a.** Write an expression to show the number of apples that Martin and Omar used in all. What does your variable represent?

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- b.** Could Martin have used 10 apples? Why or why not? Use the expression to help you decide.

**Show your work.**

Solution: \_\_\_\_\_

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After you find the solution, read the problem again and check to be sure that your solution makes sense.



- 5** Lilla read  $\frac{1}{5}$  of her book last week. This week she read 3 times as much as she read last week.

- a.** Write an expression to show how much of her book Lilla has left to read. Then simplify the expression.

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- b.** There are 75 pages in Lilla's book. How many pages does she have left to read?

**Show your work.**

Solution: \_\_\_\_\_

What should the variable in your expression represent?

