

TOPIC  
**4**

### GET READY!

## Review What You Know!

**Vocabulary**  
Choose the best term from the box to complete each definition.

1. When you \_\_\_\_\_ an expression, you replace each variable with a given value.

2. To evaluate  $a + 3$  when  $a = 7$ , you can \_\_\_\_\_ 7 for  $a$  in the expression.

3. The set of rules used to determine the order in which operations are performed is called the \_\_\_\_\_.

4. Each part of an expression that is separated by a plus or minus sign is a(n) \_\_\_\_\_.

5. A(n) \_\_\_\_\_ is a mathematical phrase that can contain numbers, variables, and operation symbols.

6. When two numbers are multiplied to get a product, each number is called a(n) \_\_\_\_\_.

evaluate  
expression  
factor  
order of operations  
substitute  
term

### Order of Operations

Evaluate each expression using the order of operations.

7.  $3(18 - 7) + 2$       8.  $(13 + 2) \div (9 - 4)$       9.  $24 \div 4 \cdot 2 - 2$

### Equivalent Expressions

Evaluate each expression when  $a = -4$  and  $b = 3$ .

10.  $ab$       11.  $2a + 3b$       12.  $2(a - b)$

13. Explain the difference between evaluating  $3 \cdot 7 - 4 \div 2$  and evaluating  $3(7 - 4) \div 2$ .

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Topic 4 Generate Equivalent Expressions 187

### Solve & Discuss It!

Mr. Ramirez's class was playing a game in which students need to match sticky notes that have equivalent expressions. How can you sort the expressions into groups?

$8p + 2p - 8$ 
 $10p - 8$ 
 $5p + 8 + 3p$

$10p + 4 + 2p + 2$ 
 $2(5p - 4)$

$8(p + 1)$ 
 $4(2p + 2)$

$3p + 4p + 6 + 5p$ 
 $3(4p + 2)$

**Lesson 4-1**  
**Write and Evaluate Algebraic Expressions**

**I can...**  
write and evaluate algebraic expressions.

**Focus on math practices**

**Reasoning** Is there more than one way to group the expressions? Give an example.

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**Essential Question** How can algebraic expressions be used to represent and solve problems?

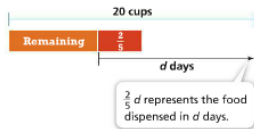
**EXAMPLE 1** Write Expressions to Represent Situations

An automatic dog feeder dispenses  $\frac{2}{5}$  cup of dog food each day. What expression can the dog owner use to determine the amount of food left in the feeder after  $d$  days?

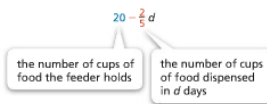
**Model with Math** How can a bar diagram represent the situation?



Draw a bar diagram to represent the amount of food remaining in the feeder after  $d$  days.



Use the bar diagram to write an expression to represent the amount of food remaining in the feeder after  $d$  days.



The dog owner can use the expression  $20 - \frac{2}{5}d$  to determine the amount of food left in the feeder after  $d$  days.

**Try It!**

Misumi started with \$217 in her bank account. She deposits \$25.50 each week and never withdraws any money. What expression can Misumi use to determine her account balance after  $w$  weeks?

+   $w$



**Convince Me!** How did you determine which value to use for the constant and which value to use for the coefficient?

**EXAMPLE 2** Evaluate Expressions

The expression  $9.99d + 12.99c$  can be used to find the total cost of  $d$  pounds of almonds and  $c$  pounds of cashews. How much does it cost to buy  $1\frac{1}{2}$  pounds of almonds and  $2\frac{1}{2}$  pounds of cashews?

Evaluate the expression for the given values.

Total cost of almonds:  $9.99d + 12.99c$   
 Total cost of cashews:  
 $9.99d + 12.99c$   
 $= 9.99(1\frac{1}{2}) + 12.99(2\frac{1}{2})$   
 $= 14.985 + 32.475$   
 $= 47.46$

It costs \$47.46 to buy  $1\frac{1}{2}$  pounds of almonds and  $2\frac{1}{2}$  pounds of cashews.



**Try It!**

The cost to rent a scooter is \$15.50 per hour and the cost to rent a watercraft is \$22.80 per hour. Use the expression  $15.5s + 22.8w$  to determine how much it would cost to rent a scooter for  $3\frac{1}{2}$  hours and a watercraft for  $1\frac{1}{2}$  hours.

**EXAMPLE 3** Write and Evaluate Expressions

Malik and two friends earn  $m$  dollars in one week doing odd jobs. They split the earnings so that each friend gets  $\frac{1}{3}$  of the total earnings. Malik uses \$32.50 of his earnings on lunch each week. Last week, the three friends earned \$963. How much money did Malik have left after paying for lunch?

Write an expression to represent how much Malik has left. Then evaluate the expression for the given value.

$\frac{1}{3}m - 32.5$   
 $= \frac{1}{3}(963) - 32.5$   
 $= 288.5$

Malik had \$288.50 left after paying for lunch.

**Try It!**

Emelia earns \$8.74 per hour plus a gas allowance of \$3.50 per day at her job. How much does Emelia's job pay in a day when she works  $5\frac{1}{2}$  hours? Write an expression and evaluate for  $5\frac{1}{2}$  hours.


**KEY CONCEPT**

Algebraic expressions can be used to represent problems with unknown or variable values.  
Values can be substituted for variables to evaluate the expression.

**Do You Understand?**

- Essential Question** How are algebraic expressions used to represent and solve problems?
- Use Structure** How is a constant term different than a variable term for an expression that represents a real-world situation?
- Look for Relationships** Explain why you can have different values when evaluating an algebraic expression.

**Do You Know How?**

- A tank containing 35 gallons of water is leaking at a rate of  $\frac{1}{4}$  gallon per minute. Write an expression to determine the number of gallons left in the tank after  $m$  minutes.
- Write an algebraic expression that Marshall can use to determine the total cost of buying a watermelon that weighs  $w$  pounds and some tomatoes that weigh  $t$  pounds. How much will it cost to buy a watermelon that weighs  $18\frac{1}{2}$  pounds and 5 pounds of tomatoes?
 
- What is the value of  $\frac{3}{8}x - 4.5$  when  $x = 0.4$ ?
- What is the value of  $8.4n - 3.2p$  when  $n = 2$  and  $p = 4$ ?

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

**Practice & Problem Solving**

**Leveled Practice** For 8–10, fill in the boxes to complete the problems.

8. Evaluate  $10.2x + 9.4y$  when  $x = 2$  and  $y = 3$ .  
 $10.2(2) + 9.4(3)$   
 $20.4 + 28.2$   
 $= 48.6$

9. Evaluate  $\frac{1}{2}t + \frac{3}{8}$  when  $t = \frac{1}{4}$ .  
 $\frac{1}{2}(\frac{1}{4}) + \frac{3}{8}$   
 $\frac{1}{8} + \frac{3}{8}$   
 $\frac{4}{8} \rightarrow \frac{1}{2}$

10. Write an expression that represents the height of a tree that began at 6 feet and increases by 2 feet per year. Let  $y$  represent the number of years.  
 +   $y$

For 11–14, evaluate each expression for the given value of the variable(s).

11.  $3d - 4$  when  $d = 1.2$ .  
 $3 \cdot (1.2) - 4$   
 $+ 3.6 - 4$   
 $- 0.4$

12.  $0.5f - 2.3g$  when  $f = 12, g = 2$ .  
 $0.5(12) - 2.3(2)$   
 $6 - 4.6$   
 $1.4$

13.  $\frac{2}{3}p + 3$  when  $p = \frac{3}{5}$ .  
 $\frac{2}{3}(\frac{3}{5}) + 3$   
 $\frac{2}{5} + 3 \rightarrow 3\frac{2}{5}$

14.  $3d + \frac{1}{3}w$  when  $d = 1, w = 1$ .  
 $3(1) + \frac{1}{3}(1)$   
 $3 + \frac{1}{3}$   
 $3\frac{1}{3}$

**Model with Math** Which expression can be used to determine the total weight of a box that by itself weighs 0.2 kilogram and contains  $p$  plaques that weigh 1.3 kilograms each?

- A  $1.3p + 0.2$
- B  $0.2p + 1.3$
- C  $0.2 - 1.3p$
- D  $1.2p$



17. The expression  $-120 + 13m$  represents a submarine that began at a depth of 120 feet below sea level and ascended at a rate of 13 feet per minute. What was the depth of the submarine after 6 minutes?

ex)  $5 + 5(2)$   
 $5 + -10$   
 $\checkmark$   $(-5)$

ex)  $5 + 5(1)$   
 $5 + -5$   
 $\odot$

18. **Be Precise** A full grain silo empties at a constant rate. Write an expression to determine the amount of grain left after  $s$  seconds.



ex)  $5 + 5(-20)$   
 $+5 + +100$   
 $(+105)$

P  
 D  
 M  
 P  
 A  
 V  
 S  
 S

19. **Higher Order Thinking** For the expression  $5 - 5x$  to have a negative value, what must be true about the value of  $x$ ?

ex)  $5 + 5(-2)$   
 $+5 + +10$   
 $(+15)$

ex)  $5 + 5(7)$   
 $+5 + -35$   
 $(-30) \checkmark$

**Assessment Practice**

20. Joe bought  $g$  gallons of gasoline for \$2.85 per gallon and  $c$  cans of oil for \$3.15 per can.

**PART A**  
 What expression can be used to determine the total amount Joe spent on gasoline and oil?

**PART B**  
 If he bought 8.4 gallons of gasoline and 6 cans of oil, how much will he have spent in all?

21. The outside temperature was 73°F at 1 p.m., and **decrease** at a rate of 1.5°F each hour. What expression can be used to determine the temperature  $h$  hours after 1 p.m.?

The expression  $73 - 1.5h$   
 can be used to determine the temperature

194 4-1 Write and Evaluate Algebraic Expressions **h hours after 1 p.m.**

$73 - 1.5h$

