

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?

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

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

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

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

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.

189

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

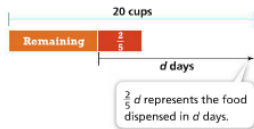
EXAMPLE 1 Write Expressions to Represent Situations

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?

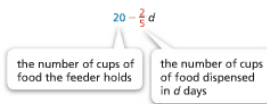
Model with Math How can a bar diagram represent the situation?



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: $9.99(1\frac{1}{2}) + 12.99(2\frac{1}{2})$
 $= 9.99(1\frac{1}{2}) + 12.99(2\frac{1}{2})$
 $= 14.985 + 32.475$
 $= 47.46$

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

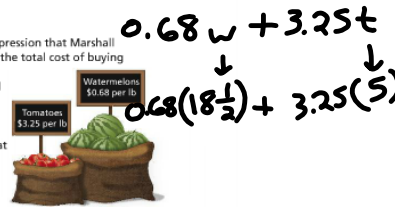
Algebraic expressions can be used to represent problems with unknown or variable values.
Values can be substituted for variables to evaluate the expression.

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 in 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 $\frac{1}{3}$ 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 $p = 4$?



Practice & Problem Solving

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

- Evaluate $10.2x + 9.4y$ when $x = 2$ and $y = 3$.
 $10.2(\quad) + 9.4(\quad)$
 $= \quad + 28.2$
 $= \quad$
- Evaluate $\frac{1}{2}t + \frac{3}{8}$ when $t = \frac{1}{4}$.
 $\frac{1}{2}(\frac{1}{4}) + \frac{3}{8}$
 $= \quad + \frac{3}{8}$
 $= \quad$
- 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.
 $\square + \square y$

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

- $3d - 4$
 $d = 1.2$
- $0.5f - 2.3g$
 $f = 12, g = 2$
- $\frac{2}{3}p + 3$
 $p = \frac{3}{5}$
- $34 + \frac{1}{3}w$
 $w = -\frac{1}{2}$

Handwritten work for problem 11:
 $3(1.2) + 3.6 + 4$
 $+ -4 \rightarrow -0.4$

Vertical text on the left: $\frac{2}{3}p + 3$

Handwritten work for problem 12:
 $\frac{1}{2}(\frac{1}{4}) + \frac{3}{8}$
 $= \frac{1}{8} + \frac{3}{8}$
 $= \frac{4}{8} = \frac{1}{2}$

Handwritten work for problem 14:
 $34 + \frac{1}{3}(-\frac{1}{2})$
 $34 - \frac{2}{9}$
 $33 \frac{7}{9}$

Vertical text on the right: $\frac{2}{3}p + 3$

- Model with Math** What expression can be used to determine the total cost of buying g pounds of granola for \$3.25 per pound and f pounds of flour for \$0.74 per pound?

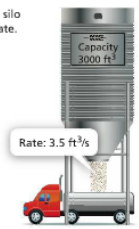
- Model with Math** Which expression can be used to determine the total weight of a box that by itself weighs 0.2 kilogram and contains p plaques that weigh 1.3 kilograms each?

- 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?

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.



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

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 decreases at a rate of 1.5°F each hour. What expression can be used to determine the temperature h hours after 1 P.M.?

