CHAPTER

7 Algebraic Expressions

Lesson 7.1   Writing Algebraic Expressions

Write an algebraic expression for each of the following.

1. The sum of k and 8

_____

2. The difference "y less than 10"

_____

3. The product of g and 7

_____

4. The quotient of h and 8

_____

5. Subtract 6 from $5w$.

_____

6. Add 10 to the product of z and 7.

_____

7. Subtract 10 from the product of 4 and h.

_____

8. Add 5 to the quotient of s and 9.

_____

9. Multiply y by 6, then divide the product by 7.

_____

10. Subtract the quotient of h and 3, from 4 multiplied by 4.

_____

11. Janet has p stickers.

   a)   Amy has 10 fewer stickers than Janet. How many stickers does Amy have in terms of p?

_____

   b)   Bernie has 3 times as many stickers as Janet. How many stickers does Bernie have in terms of p?

_____

   **c)**   Catherine has 6 more stickers than Janet. How many stickers does Catherine have in terms of p?

_____

   d)   Dina has $\frac{2}{5}$ as many stickers as Janet. How many stickers does Dina have in terms of p?

_____

Solve.

12. Mario collected 3*g* seashells. Jasmine collected 10 more seashells than Mario. Write the number of seashells they collected together in terms of *g*.

13. Mei bought a box of markers for *b* dollars, a shoulder bag that cost twice as much as the box of markers, and a pen that cost $6 less than the shoulder bag. Write the cost of the pen in terms of *b*.

14. In a bakery, a bag of bread rolls costs *x* dollars. A loaf of multi-grain bread costs $2 more than a bag of bread rolls. Mr. Lopez pays $50 for some multi-grain loaves of bread. Write the number of loaves of bread he buys in terms of *x*.

15. Audrey has some guppies in a fish tank. The ratio of the orange guppies to silver guppies is 3 : 5. She has 12*y* orange guppies. Write the number of silver guppies she has in terms of *y*.

16. Jacob is 4*p* years old. His niece is 5 years younger than $\frac{1}{3}$ of his age. Write his niece's age in terms of *p*.

17. The figure shown is made up of a square and a triangle. Express the area of the figure in terms of *y*.

y cm   4 cm
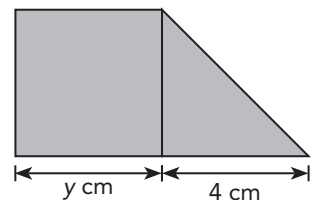
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Lesson 7.2 Evaluating Algebraic Expressions

Evaluate each expression for the given value of the variable.

1. $6x + 7$ when $x = 5$

= _____

2. $9y - 10$ when $y = 3$

= _____

3. $14g - 98 + 3g$ when $g = 7$

= _____

4. $6h + 25 - \dfrac{5h}{4}$ when $h = 8$

= _____

5. $50 - \dfrac{7w}{3} + 4w$ when $w = 6$

= _____

6. $10p - \dfrac{3p - 2}{4} + 5$ when $p = 10$

= _____

Evaluate each expression when $p = 4$.

7. $3(5p - 1) - 4(3p - 7)$

= _____

8. $3(5p - 6) + 4(20 - 3p)$

= _____

Evaluate each expression when $r = 9$.

9. $5(10r + 3) - 7r$

= _____

10. $4(5r - 3) - 2(6r - 7)$

= _____

Evaluate each expression for the given value of the variable.

11. $\dfrac{6p + 4}{7} + \dfrac{5p - 6}{2} - \dfrac{3p}{4}$ when $p = 4$

= _____

12. $\dfrac{3(y - 2)}{4} + \dfrac{4(2y - 3)}{5}$ when $y = 6$

= _____

Evaluate each of the following.

13. Subtract 60 from the sum of $8e$ and 20 when $e = 7$.

14. Find the product of $(2z + 1)$ and $(3z - 6)$ when $z = 4$.

15. $3(w^2 - 5w + 4)$ subtracted from $5(3w + 2)$ when $w = 6$

16. The sum of $2(3y + 8)$ and $5(40 - 4y)$ when $y = 9$

17. The sum of $\frac{3}{4}(m + 4)$ and $\frac{5}{6}(m - 6)$ when $m = 12$

18. The quotient of $(5x + 1)$ and $(2x - 5)$ when $x = 7$

19. The value of $\frac{x + 3}{x - 1} + \frac{4x - 5}{2x + 5} - \frac{6x - 25}{x}$ when $x = 5$

Lesson 7.3   Simplifying Algebraic Expressions

Simplify each expression. Then state the coefficient of the variable in each expression.

1. $x + x + 3 + 4$

= _____

2. $k - k + k - 3$

= _____

Simplify each expression.

3. $6g - 3g + 8g - g$

= _____

4. $10u + 4u - 8u - 3u$

= _____

5. $9m + 4m - 5m + 3m$

= _____

6. $12x - 4x + 3x + 5x$

= _____

State whether each pair of expressions are equivalent.

7. $8z + 2z$ and $3z + 4z + 3z$

_____

8. $9y$ and $9 + y$

_____

9. $7n - 2$ and $2 - 7n$

_____

10. $5g - 2g$ and $\dfrac{18g}{6}$

_____

Simplify each expression.

11. $12 - 8 + 5d + 4d - 6d$

= _____

12. $20 + 7k - 12 - 5k + 8k$

= _____

13. $9m + 11 - 8m - 6 + 5m$

= _____

14. $18 + 4n - 9 + 8n - 11n$

= _____

Simplify each expression.

15. $20 + 5u + 10u - 20 - 14u$

= _____

16. $20 + 12k - 7k - 8$

= _____

17. $6x + 15 + 9x - 10x - 8$

= _____

18. $r + 9 + 10r - 5 - 4r$

= _____

Solve.

19. Peggy bought 2 racing cars for $5x$ dollars each and 3 model motorcycles for $3x$ dollars each. Find the amount of money Peggy paid in terms of x.

20. Kevin works $3z$ hours each day from Monday to Friday. He works $(4z - 7)$ on Saturday. Kevin does not work on Sunday. Find the number of hours Kevin works in one week in terms of z.

21. The length of a square tile is $3w$ centimeters. Alice places 4 square tiles in a row to form a figure as shown below. Find the perimeter of the figure in terms of w.

22. Shanti baked $5p$ croissants. Jon baked twice as many croissants as Shanti. Ching baked 16 fewer croissants than Jon. Find the total number of croissants they baked in terms of p.

23. Bryan had $20x$ dollars. He spent $3x$ dollars for breakfast, $5 for maps, and $6x$ dollars for a guide book. Find the amount of money Bryan had left in terms of x.

24. Kelly leaves her home and cycles $4y$ miles south, then cycles $(3y + 9)$ miles east. Finally, she cycles $(5y + 7)$ miles south and reaches her school. How far does Kelly cycle?

25. A square has sides $\dfrac{5s + 2}{4}$ yards long. A rectangle is $(s + 9)$ yards long and $(3s - 5)$ yards wide.
  a) Find the perimeter of the square.

  b) Find the perimeter of the rectangle.

  c) Find the sum of the perimeters of the two figures if $s = 5$.

  d) The perimeter of the rectangle is greater than the perimeter of the square. Find the difference between the perimeters of the two figures if $s = 7$.

Lesson 7.4   Expanding and Factoring
Algebraic Expressions

Expand each expression.

1. $3(4w + 5)$

= _____

2. $5(6 - 3y)$

= _____

3. $7(2a - 7)$

= _____

4. $9(3p + 5)$

= _____

5. $10(3 - 4d)$

= _____

6. $8(5r + 3)$

= _____

Factor each expression.

7. $7y + 21$

= _____

8. $12 - 4k$

= _____

9. $18 - 12h$

= _____

10. $20w + 15$

= _____

11. $14 - 8x$

= _____

12. $24p - 15$

= _____

State whether each pair of expressions are equivalent.

13. $8(3 - 5m)$ and $24 - 5m$

_____

14. $9(2k + 3)$ and $18k + 27$

_____

15. $5(3 + 5b)$ and $25b + 15$

_____

16. $3(7z - 4)$ and $12 - 21z$

_____

Name: _____   Date: _____

Expand each expression. Then simplify the expression.

17. $3(3x + 7) + 4(5x - 2)$

= _____

18. $9(5k + 2) + 4(7 - 10k)$

= _____

19. $7(5 + 4w) + 6(8w - 3)$

= _____

20. $4(6 + 5g) + 7(3 - g)$

= _____

Simplify each expression. Then factor the expression.

21. $12p - 8 + 6p + 14$

= _____

22. $20 + 15x - 6 - 9x$

= _____

23. $9h + 30 + 12h - 2$

= _____

24. $20k + 7 - 2k + 8$

= _____

Solve.

25. Expand and simplify the expression
$3(y - 3) + 2(5 + 3y) + 24(2y - 5) + 6(5 - y)$.

26. Are the two expressions equivalent?
$2w + 3w + 2(w + 5) - 6w + 2(9w + 3) + (38 - 4w)$ and $3(5w + 18)$

27. A train is moving at an average speed of $(5x - 8)$ miles per hour.
a) Write an expression for the distance traveled by the train in 3 hours.

b) How far does the train travel in 3 hours if $x = 15$?

28. A pound of turkey costs $(3w + 8)$ dollars and a pound of cheese costs $(4w - 3)$ dollars. Mrs. Young bought 2 pounds of turkey and 3 pounds of cheese.
a) Write an expression for the amount Mrs. Young paid for the two items.

b) How much did Mrs. Young pay if $w = 4$?

29. The average height of 4 children is $(15h - 3)$ centimeters. Two more children with heights of $(10h + 46)$ centimeters and $(14h - 16)$ centimeters join the group. Find the average height of the 6 children if $h = 9$.

30. The figure below shows two identical squares joined together to form rectangle *WXYZ*.

$(2d - 3)$ cm

a) Write an expression for the perimeter of rectangle *WXYZ*.

b) Write an expression for the sum of the perimeters of the two identical squares.

c) Find the difference between your answers in **a)** and **b)** if $d = 8$.

Lesson 7.5   Real-World Problems: Algebraic Expressions

Solve. Show your work.

1. Daniel's house is located b miles from his school. The swimming pool is
   3 miles farther from his school. His doctor's office is 4 miles less than twice
   the distance from home to Daniel's school.
   a)   Write an expression that shows the distance from Daniel's house to the
   swimming pool.

   b)   Write an expression that shows the distance from Daniel's house to his
   doctor's office.

   c)   If $b = 3$, is the swimming pool or the doctor's office closer to Daniel's
   house? How much closer?

2. Casey can knit $6m$ doll dresses in 2 hours.
   a)   Write an expression that shows the number of doll dresses Casey can
   knit in 5 hours in terms of m.

   b)   If $m = 7$, how many doll dresses can Casey knit in 5 hours?

**3.** At a soccer tournament there are $(16x + 30)$ boys and $(5x - 12)$ more girls than boys.

   a) How many children are there at the tournament in terms of x?

   b) If $x = 5$, how many girls are at the tournament?

4. Adam sold $16p$ newspapers in the morning. He sold $\dfrac{3}{4}$ as many newspapers in the afternoon as he did in the morning. He sold 20 more newspapers in the evening than in the afternoon.

   a) How many newspapers did Adam sell altogether in terms of p?

   b) If $p = 3$, how many newspapers did Adam sell altogether?

5. Alicia, Jamar, and Tia collect dimes for charity. Alicia collects $(3k + 4)$ dimes. Jamar collects twice as many dimes as Alicia. Tia collects $4(5 + 6k)$ dimes. How many dimes do they collect altogether in terms of k?

6. The width of a rectangular field is $3h$ yards and its length is 3 yards longer than the width. The field has a fence around its perimeter with a gate 4 yards wide, as shown below.

(3h + 3) yd

3h yd

4 yd
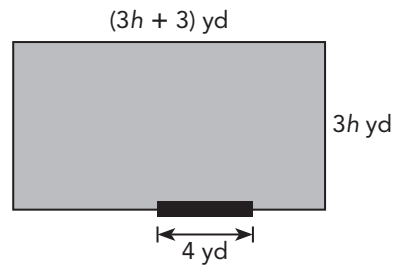
a) Write an expression for the perimeter of the rectangular field in terms of h, excluding the width of the gate.

b) It costs $28 per yard to fence the field, excluding the gate. Write an expression that represents the cost of fencing the field.

c) If $h = 5$, find the cost of the fencing, excluding the gate.

7. Moesha is $(3g + 1)$ years old and Shanti is twice Moesha's age.
a) Find the sum of the ages of Moesha and Shanti in 2 years' time.

b) How old will Shanti be when Moesha's age is twice her present age?

c) Find how old Moesha and Shanti were 4 years ago if $g = 5$.

CHAPTER

7 Brain @ Work

Solve. Show your work.

1. A swimming pool can be filled by a large water pump operating alone in
    w hours. If the pool is to be filled by a small water pump alone, it will take
    6 hours longer than the larger water pump filling it alone. Write an
    expression in terms of w for the part of the pool that:
    a)   the large water pump can fill in 1 hour.

    b)   the small water pump can fill in 1 hour.

    c)   both water pumps can fill together in 4 hours.

2. Teresa can paint a house in $(3y + 2)$ days. Teresa's brother takes 5 days
    longer to paint the same house. Write down an expression for the part
    of the house that:
    a)   Teresa can paint in 1 day.

    b)   Teresa's brother can paint in 2 days.

    c)   Teresa and her brother can paint in 3 days.