Lesson 7.3   Simplifying Algebraic Expressions

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

*Example*

$s + s + s =$ ___5___ $\cdot s$

$=$ ___5s___

In the term ___5s___, the coefficient of s is ___5___.

$6 + 6 + 6 = 3 \cdot 6$
$s + s + s = 3 \cdot s$
$3 \cdot s$ is the same as $3s$.

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1. $p + p + p + p + p + p =$ _____ $\cdot p$

   $=$ _____

   In the term _____, the coefficient of p is _____.

2. $n + n + n + 13 + 8 =$ _____ $\cdot n + 13 + 8$

   $=$ _____ $+ 21$

   In the term _____, the coefficient of n is _____.

3. $d + d + d + d + d + 5 - 2 =$ _____ $\cdot d + 5 - 2$

   $=$ _____ $+ 3$

   In the term _____, the coefficient of d is _____.

4. $m + m + m + m + 3 + 8 =$ _____ $+ 11$

   In the term _____, the coefficient of m is _____.

5. $r + r + r + r + r + 15 - 5 =$ _____ $+ 10$

   In the term _____, the coefficient of r is _____.

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Solve.

┌─── *Example* ──┐

A square has a length of *g* yards.
Find the perimeter of the square in terms of *g*.

?

g yd

_____ yd _____ yd _____ yd

$g + g + g + g = \underline{\quad 4 \quad} \cdot g$

$= \underline{\quad 4g \quad}$
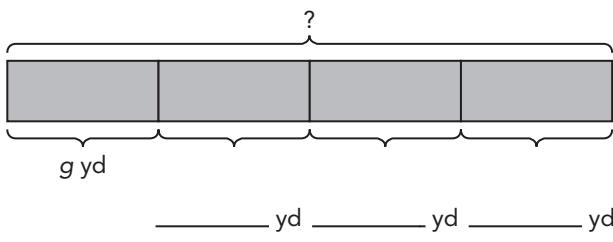
The perimeter of the square is $\underline{\quad 4g \quad}$ yards.

g yd
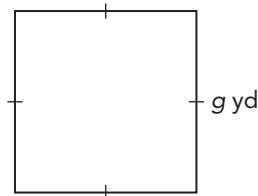
$2 + 2 + 2 + 2 = 4 \cdot 2$
$g + g + g + g = 4 \cdot g$
$4 \cdot g$ is the same as $4g$.

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6. An equilateral triangle has sides measuring *d* inches long.
Find the perimeter of the equilateral triangle in terms of *d*.
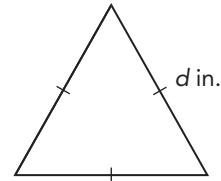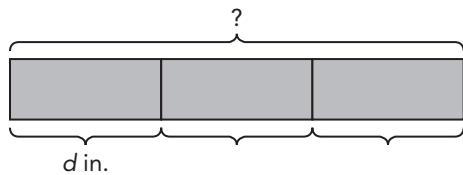
?

d in.

_____ in. _____ in.

_____ + _____ + _____ = _____ · _____

= _____

The perimeter of the triangle is _____ inches.

d in.

7. A rectangle has a width of 2 feet and a length of *m* feet.
Find the perimeter of the rectangle in terms of *m*.

_____ ft   _____ ft

_____ + _____ + _____ + _____ = _____ · _____ + _____

= _____
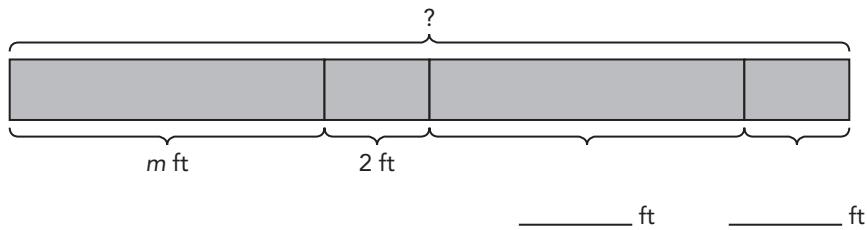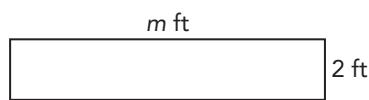
The perimeter of the rectangle is _____ feet.

8. A piece of wire is bent in the shape a regular octagon.
Each side of the octagon is *h* centimeters long.
What is the total length of the wire in terms of *h*?
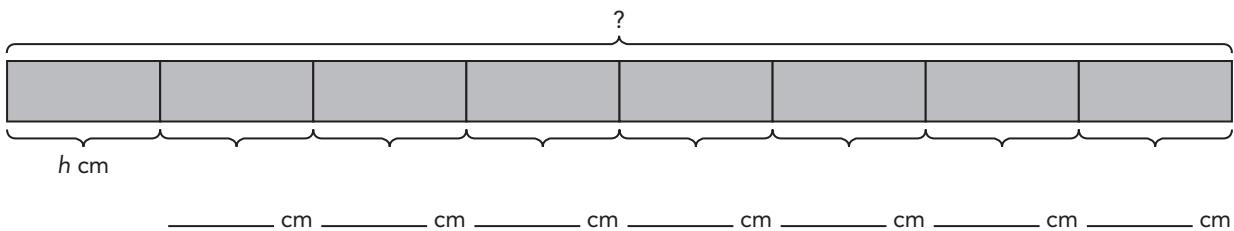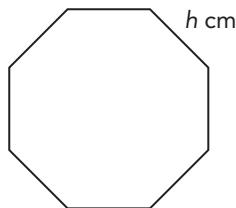
_____ cm _____ cm _____ cm _____ cm _____ cm _____ cm _____ cm

Simplify each expression.

Example

Simplify $2c + 3c$.
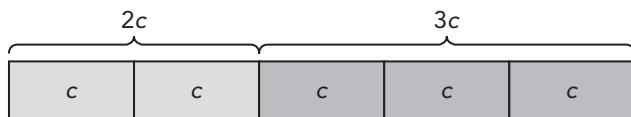
2c		3c		
c	c	c	c	c

$2c + 3c = c + c + c + c + c$

$= \underline{\ \ 5c\ \ }$

> $2c + 3c$ and $5c$ are **equivalent expressions** because they are equal for all values of c.
> If $c = 1$, $2c + 3c = 5$ and $5c = 5$.
> If $c = 2$, $2c + 3c = 10$ and $5c = 10$.

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9. $3g + 4g =$ _____

?

g	g	g	g	g	g	g

  3g   4g
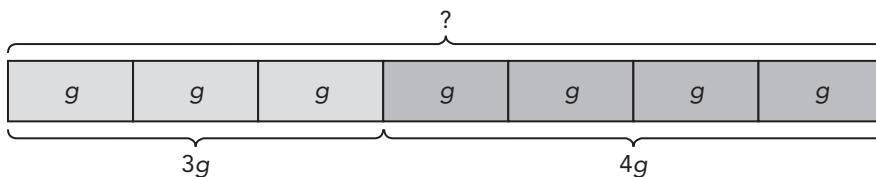
10. $8p + 3p =$ _____   **11.** $6m + 10m =$ _____

12. $16y + 4y =$ _____   **13.** $42d + d =$ _____

State whether each pair of expressions is equivalent.

14. $7p + 2p$ and $3p + 6p$ **15.** $9r + 3r$ and $5r + 3r$

_____   _____

16. $6m + m$ and $8m$ **17.** $8y + 4y$ and $12y$

_____   _____

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Simplify each expression.
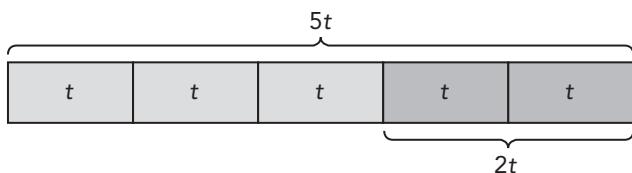
> **Example**
>
> $5t - 2t$
>
> $5t$
>
> | t | t | t | t | t |
>
> $2t$
>
> $5t - 2t =$ ___$3t$___
>
> $5t - 2t$ and $3t$ are **equivalent expressions** because they are equal for all values of t.
> If $t = 3$, $5t - 2t = 9$ and $3t = 9$.
> If $t = 4$, $5t - 2t = 12$ and $3t = 12$.

18. $7x - 4x =$ _____

$7x$

| x | x | x | x | x | x | x |

$4x$
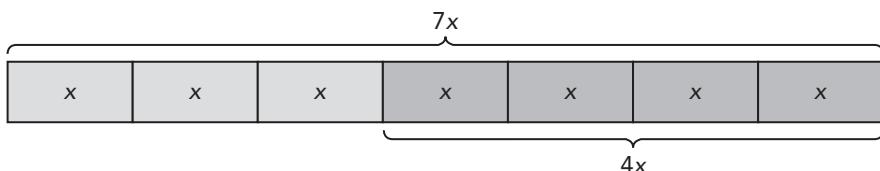
19. $18n - 2n =$ _____   **20.** $6g - 6g =$ _____

21. $44z - 15z =$ _____   **22.** $15b - b =$ _____

State whether each pair of expressions is equivalent.

23. $5n - n$ and $6n$

_____

24. $4e - 4e$ and $10w - 10w$

_____

25. $7a - 2a$ and $9a - 4a$

_____

26. $9u$ and $12u - 2u$

_____

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Simplify each expression.

Example

$7v - 3v + 2v =$ ___4v___ $+ 2v$

$=$ ___6v___

When adding and subtracting algebraic expressions with no parentheses, always work from left to right.

27. $12c - 3c - 3c$

$=$ _____ $- 3c$

$=$ _____

28. $5j + 2j + 9j$

$=$ _____ $+ 9j$

$=$ _____
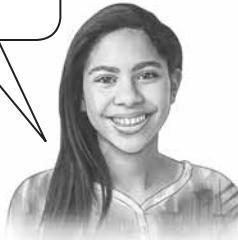
29. $9k + 3k - 2k$

30. $8y - 5y + 2y$

Simplify each expression.

Example

$8 + 5g - 2 + 6g$

$=$ ___5g + 6g___ $+$ ___8 − 2___

$=$ ___11g + 6___

First, identify like terms. Then change the order of terms to collect like terms. Lastly, simplify.

31. $5t + 4 + 2t$

= _____ + _____

= _____
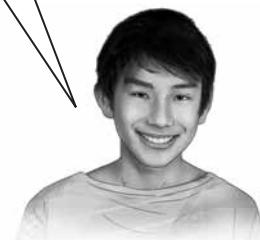
32. $6m - 10 - 2m - m$

= _____ + _____

= _____

33. $7r + 5r - 12$

34. $8 + 3j - 5 - 2j + 8j$

Solve.

Example

The figure shows an isosceles triangle. Find the perimeter of the triangle.

= ___$5w + 1$___ + ___$5w + 1$___ + ___$4w$___

= $5w + 5w + 4w$ + ___$1 + 1$___

= ___$14w + 2$___

The perimeter of the triangle is ___$(14w + 2)$___ yards.

(5w + 1) yd
4w yd

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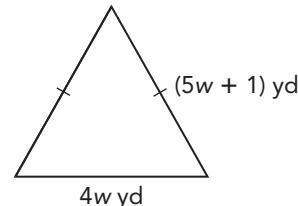
35. The figure shows a rectangle. Find the perimeter of the rectangle.

_____ + _____ + _____ + _____

= _____ + _____

= _____

5y cm
(2y + 2) cm
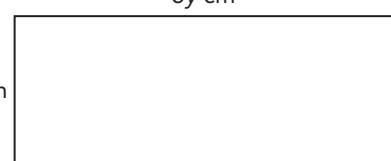
The perimeter of the triangle is _____ centimeters.

36. The figure shows a trapezoid. Find the perimeter of the trapezoid.

(17 − d) in.
(d + 8) in.
5d in.
11 in.
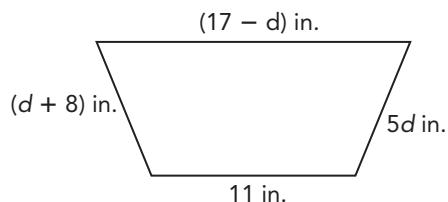
Lesson 7.3

1. $p + p + p + p + p + p = \underline{6} \cdot p$
$\qquad\qquad\qquad\qquad\quad = \underline{6p}$
In the term $\underline{6p}$, the coefficient of p is $\underline{6}$.

**2.** $n + n + n + 13 + 8 = \underline{3} \cdot n + 13 + 8$
$\qquad\qquad\qquad\qquad\quad = \underline{3n} + 21$
In the term $\underline{3n}$, the coefficient of n is $\underline{3}$.

3. $d + d + d + d + d + 5 - 2$
$\quad = \underline{5} \cdot d + 3$
In the term $\underline{5d}$, the coefficient of d is $\underline{5}$.

4. $4m$, $4m$, 4 **5.** $5r$, $5r$, 5

6. Figure label: d, d;
$\underline{d} + \underline{d} + \underline{d} = \underline{3} \cdot \underline{d}$
$\qquad\qquad\quad = \underline{3d}$
The perimeter of the triangle is $\underline{3d}$ inches.

7. Figure label: m, 2;
$\underline{m} + \underline{2} + \underline{m} + \underline{2} = \underline{2} \cdot \underline{m} + \underline{4}$
$\qquad\qquad\qquad\quad = \underline{2m + 4}$
The perimeter of the rectangle is $\underline{(2m + 4)}$ feet.

8. Figure label: h, h, h, h, h, h, h;
8h centimeters

9. $7g$ **10.** $11p$

11. $16m$ **12.** $20y$

13. $43d$ **14.** Equivalent

15. Not equivalent   **16.** Not equivalent

17. Equivalent   **18.** $3x$

19. $16n$ **20.** 0

21. $29z$ **22.** $14b$

23. Not equivalent   **24.** Equivalent

25. Equivalent   **26.** Not equivalent

27. $12c - 3c - 3c = \underline{9c} - 3c$
$\qquad\qquad\qquad\quad = \underline{6c}$

28. $5j + 2j + 9j = \underline{7j} + 9j$
$\qquad\qquad\qquad = \underline{16j}$

29. $10k$ **30.** $5y$

31. $5t + 4 + 2t = \underline{5t + 2t} + \underline{4}$
$\qquad\qquad\qquad = \underline{7t + 4}$

32. $6m - 10 - 2m - m$
$\quad = \underline{6m - 2m - m} - \underline{10}$
$\quad = \underline{3m - 10}$

33. $12r - 12$ **34.** $9j + 3$

35. $\underline{2y + 2} + \underline{2y + 2} + \underline{5y + 5y}$
$\quad = \underline{2y + 2y + 5y + 5y} + \underline{2 + 2}$
$\quad = \underline{(14y + 4)}$
The perimeter of the triangle is
$\underline{(14y + 4)}$ centimeters.

36. $(5d + 36)$ inches

Lesson 7.4

1. Figure label $\underline{4} \cdot \underline{g}$, $\underline{4} \cdot \underline{4}$;
$4(g + 4) = 4 \cdot (g + 4)$
$\qquad\qquad = \underline{4 \cdot g} + \underline{4 \cdot 4}$
$\qquad\qquad = \underline{4g + 16}$

2. $2h + 14$ **3.** $9k - 36$

4. $42s + 54$ **5.** $27c - 18$

6. Not equivalent   **7.** Equivalent

8. Equivalent   **9.** Not equivalent

10. The factors of $3d$ are:
$1 \cdot 3d$
$3 \cdot \underline{1}d$
The factors of 9 are:
$1 \cdot 9$
$3 \cdot \underline{3}$
$9 \cdot \underline{1}$
The common factor of $3d$ and 9 is $\underline{3}$.
$3d = \underline{3} \cdot \underline{d}$
$9 = \underline{3} \cdot \underline{3}$
$3d + 9 = \underline{3} \cdot \underline{d} + \underline{3} \cdot \underline{3}$
$\qquad\quad = \underline{3(d + 3)}$

11. $8(3g + 1)$ **12.** $7(3b - 1)$

13. $5(9h + 1)$ **14.** $6(9z - 1)$

15. Equivalent   **16.** Not equivalent

17. Not equivalent   **18.** Not equivalent

19. $6p + 2 + 4p + 13p$
$\quad = \underline{6p} + \underline{4p} + \underline{2} + \underline{13}$
$\quad = \underline{10p} + \underline{15}$
$\quad = \underline{5(2p + 3)}$

20. $7(v + 2)$

21. $3(17a + 19)$

22. $2(8s + 25)$

Lesson 7.5

1. a) $2k + 8$
b) $\underline{6k} + \underline{8} + \underline{2k} + \underline{8}$
$\quad = \underline{6k + 2k} + \underline{8 + 8}$
$\quad = \underline{8k + 16}$
The perimeter of the rectangle is
$\underline{(8k + 16)}$ inches.
c) When $k = 3$
$8k + 16 = 8 \cdot 3 + 16$
$\qquad\qquad = 24 + 16$
$\qquad\qquad = 40$
The perimeter of the rectangle is $\underline{40}$ inches.

2. a) $(9n + 10)$ years
b) $(15n + 10)$ years
c) $(6n - 9)$ years
d) $(21n + 1)$ years
e) 85 years