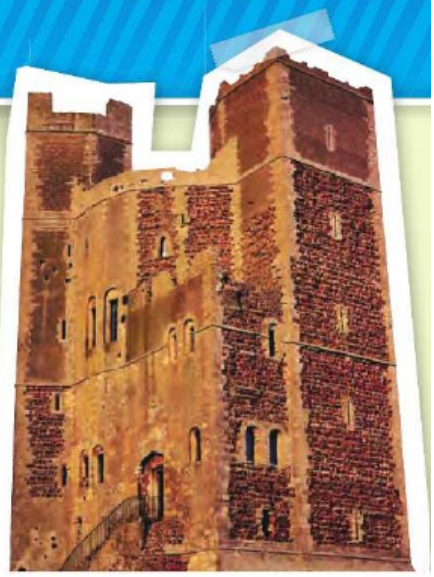
Lesson 7-3

Adding Linear Expressions



Interactive Study Guide

See pages 153–154 for:
- Getting Started
- Real-World Link
- Notes

Essential Question

Why are algebraic rules useful?

Common Core State Standards

Content Standards
7.EE.1

Mathematical Practices
1, 2, 3, 4, 7

Vocabulary

linear expression

What You'll Learn

- Add linear expressions.
- Find perimeter by adding linear expressions.

Real-World Link

Engineering A *trebuchet* is a medieval catapult that was used to hurl large stones and other projectiles at castle walls. Building a model trebuchet requires knowledge of science, math, and engineering. If done successfully, a model can launch a clay ball thirty feet or farther!

Add Linear Expressions

A **linear expression** is an algebraic expression in which the variable is raised to the first power. You can use models to add linear expressions.

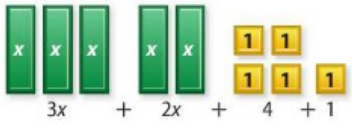
Example 1

Tools Tutor

Add. Use models if needed.

a. $(3x + 4) + (2x + 1)$

Model each linear expression.



Combine the tiles that have the same shape.

$(3x + 4) + (2x + 1) = 5x + 5$

b. $(-4x + 2) + (-2x + 2)$

$$\begin{array}{r} -4x + 2 \\ +\ -2x + 2 \\ \hline -6x + 4 \end{array}$$

Arrange like terms in columns.

Add.

So, $(-4x + 2) + (-2x + 2) = -6x + 4$.

Got It? Do these problems to find out.

1a. $(x - 3) + (x - 4)$

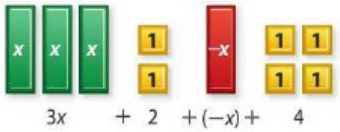
1b. $(-x + 1) + (-3x)$

Example 2

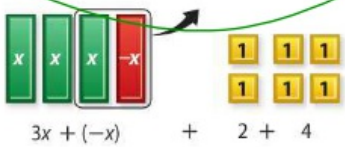
Tools Tutor

Add $(3x + 2) + (-x + 4)$.

Model the linear expressions.



Group tiles with the same shape. Then remove any zero pairs.

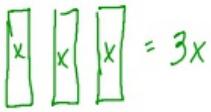


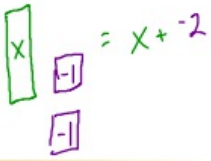
So, $(3x + 2) + (-x + 4) = 2x + 6$.

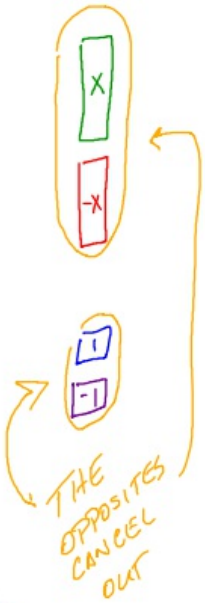
Zero Pairs

Remember that a zero pair is one positive and one negative tile of the same unit. Since $1 + (-1) = 0$, you can remove zero pairs without affecting the value of the expression.

29.







Got It? Do these problems to find out.

Add. Use models if needed.

2a. $(-2x + 4) + (8x - 4)$

2b. $(-4x - 1) + (5x - 3)$

Find Perimeter

Linear expressions can be used to find perimeter.

Example 3

Tutor

The lengths of the sides of golden rectangles are in the ratio 1:1.62. So, the length of a golden rectangle is approximately 1.62 times greater than its width.

a. Write and simplify a linear expression for the perimeter of a golden rectangle.

$P = 2\ell + 2w$ Formula for the perimeter of a rectangle

$P = 2(1.62x) + 2x$ Replace ℓ with $1.62x$ and w with x.

$P = 3.24x + 2x$ or $5.24x$ Simplify.

The formula is $P = 5.24x$, where x is the measure of the width.

b. Find the perimeter of a golden rectangle if its width is 8.3 centimeters.

$P = 5.24x$ Perimeter of a golden rectangle

$= 5.24(8.3)$ or 43.492 Replace x with 8.3 and simplify.

The perimeter of the golden rectangle is 43.492 centimeters.

Got It? Do these problems to find out.

3. A rectangle has side lengths of $(5x - 1)$ units and $(2x + 1)$ units.

a. Write and simplify a linear expression for the perimeter of the rectangle.

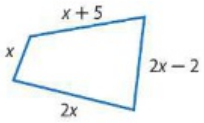
b. Find the perimeter of the rectangle if the value of x is 5.4 units.

Guided Practice

Add. Use models if needed. (Examples 1 and 2)

1. $(x + 5) + (2x + 3)$
2. $(-4x + 3) + (-5x + 2)$
3. $(x + 6) + (-2x - 4)$
4. $(-7x + 2) + (x + 4)$

5. Use the figure at the right. (Example 3)



   a. Write and simplify a linear expression for the perimeter of the figure.

   b. Find the perimeter of the figure if $x = 4$.

Independent Practice

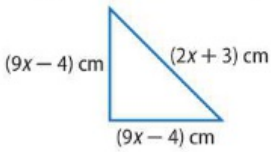
Go online for Step-by-Step Solutions

Add. Use models if needed. (Examples 1 and 2)

6. $(7x + 5) + (x + 2)$
7. $(-x + 3) + (-5x + 6)$
8. $(-7x + 1) + (-x + 2)$
9. $(5x + 4) + (-9x + 5)$
10. $(-2x + 1) + (2x + 10)$
11. $(x - 1) + (x + 1)$

For each of the figures, write and simplify a linear expression for the perimeter of the figure. Then find the perimeter of each figure if $x = 0.8$. (Example 3)

12.



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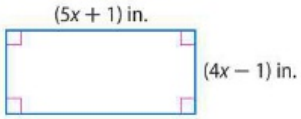


14. The angle measures of a triangle are $(x + 15)°$, $(2x - 20)°$, and $2x°$. What are the actual angle measures of the triangle?

15. **Reason Abstractly** Anna and Cole each earn x cents per newspaper that they deliver, plus tips. Anna delivered 55 newspapers and earned \$12 in tips. Cole delivered 68 newspapers and earned \$15 in tips.

   a. Write a linear expression to represent Anna's total earnings.

   b. Write a linear expression to represent Cole's total earnings.

   c. Write a linear expression to represent their total earnings.

Add.

16. $\left(3\frac{1}{2}x - \frac{2}{3}\right) + \left(-\frac{1}{4}x + 1\frac{1}{2}\right) + \left(-1\frac{3}{4}x + \frac{5}{6}\right) + (4x)$
17. $(2a - b + 4) + (-a + 3b - 6)$

H.O.T. Problems Higher Order Thinking

18. **Identify Structure** Write two linear expressions that have a sum of $3x - 8$.
19. **Persevere with Problems** What linear expression would you add to $-4y + 2$ to have a sum of y?
20. **Justify Conclusions** Explain how algebra tiles represent like terms and zero pairs.
21. **Building on the Essential Question** Explain how to add linear expressions without using numbers in your explanation.

Standardized Test Practice

22. Add.

$(-2x - 3) + (-3x + 8)$

A $-x + 5$ **C** $-5x + 5$

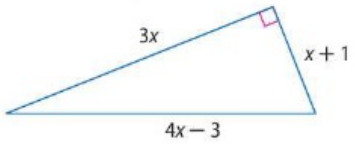
B $-x + 11$ **D** $-5x + 11$

23. Keisha makes and sells x baskets at her shop. The expression $9x - 2$ represents the profit she made on Monday, and the expression $6x + 5$ represents the profit she made on Tuesday. Which expression represents the total profit Keisha made on Monday and Tuesday?

F $15x + 3$ **H** $3x + 3$

G $15x - 3$ **J** $3x - 3$

24. Short Response Write and simplify a linear expression for the perimeter of the triangle.



25. Jin and Henry earn x dollars plus tips for each lawn they mow. The expression $4x + 15$ represents Jin's earnings, and $3x + 10$ represents Henry's earnings. How much did they earn in all if $x = \$20$?

A \$140 **C** \$155

B \$150 **D** \$165

Common Core Review

Express each ratio as a fraction in simplest form. 7.RP.1

26. 12 cheetahs to 18 lions

27. 15 apples to 30 oranges

28. 14 out of 30 whales

29. 5 lilies to 25 daffodils

30. 9 sheep to 15 goats

31. 4 boats to 16 cars

Find each square root or cube root. 8.EE.2

32. $\sqrt{121}$

33. $\pm\sqrt{49}$

34. $\sqrt[3]{216}$

35. $\sqrt[3]{64}$

36. $-\sqrt{225}$

37. $\sqrt[3]{-512}$

38. Tara is making salt dough for a craft project. She uses 3 cups of salt to 4 cups of flour to make the dough. If she uses 9 cups of flour, how many cups of salt should she use? 7.RP.3

39. Joaquin bought a \$120 jacket for a discount of 15%. If tax is 7%, what is the total cost of the jacket? 7.RP.3

Simplify each expression. 7.EE.1

40. $-3a + 4b + 9a - 6b$

41. $2x + 5(3 - x)$

42. $2.3y + 8 - 3y - 10$

43. $\frac{2}{3}z - 12\left(\frac{1}{2}\right) - \frac{4}{9}z$

44. $2 + 0.7z - 2(-5) + 0.3z$

45. $\frac{3}{16}m + 1\frac{1}{2} - \frac{1}{4}m - \frac{3}{4}$

46. $4y + 5(5 - y) - 20 + 2y$

47. $5(3 - x) - (6x + 11)$

ISG Interactive Study Guide
See page 155 for:
• Mid-Chapter Check