Subtracting Linear Expressions

Essential Question

Why are algebraic rules useful?

CCSS Common Core State Standards

Content Standards
7.EE.1

Mathematical Practices
1, 3, 4, 7

What You'll Learn

• Subtract linear expressions.
• Solve real-world problems by subtracting linear expressions.

Real-World Link

Lacrosse Middle school girls play a modified version of women's lacrosse to help them acquire good ball-handling skills as they are learning the sport. Some of the statistics that are tracked in lacrosse include number of goals and number of assists.
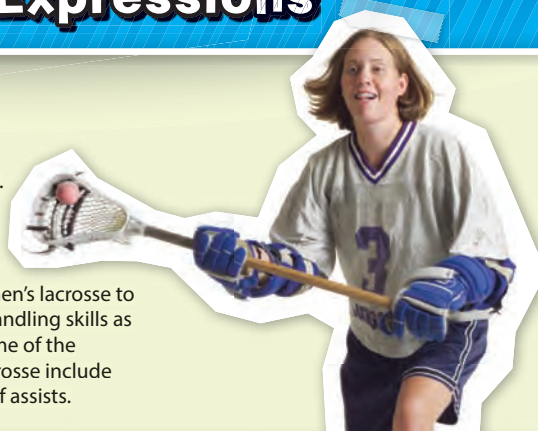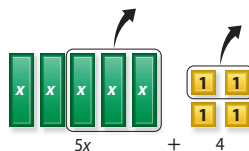
Subtract Linear Expressions

When subtracting linear expressions, subtract like terms. As with adding linear expressions, you can use models and zero pairs if needed.

Tools   **Tutor**

Example 1

Subtract. Use models if needed.

a. $(5x + 4) - (3x + 2)$

Model the linear expression $5x + 4$.

To subtract $3x + 2$, remove three x-tiles and two 1-tiles.

Then write the linear expression for the remaining tiles.

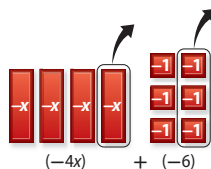$5x$ $+$ 4

So, $(5x + 4) - (3x + 2) = 2x + 2$.

b. $-4x - 6 - (-x - 3)$

Arrange like terms in columns.
Each term is subtracted.

$$\begin{array}{r} -4x - 6 \\ -\quad -x - 3 \\ \hline \end{array} \quad \Rightarrow \quad \begin{array}{r} -4x - 6 \\ +\quad x + 3 \\ \hline -3x - 3 \end{array}$$

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

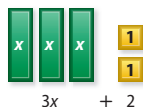$(-4x)$ $+$ (-6)

Got It? Do these problems to find out.

1a. $(7x - 5) - (2x - 1)$ **5x − 4**   **1b.** $(6x - 4) - (2x - 4)$ **4x**

Alan Bailey/Rubberball/Getty Images
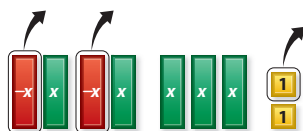
Example 2

Find $(3x + 2) - (-2x + 1)$.

Model the linear expression $3x + 2$.

$3x$ $+$ 2

Since there are no negative x-tiles to remove, add 2 zero pairs of x-tiles.

2 zero pairs

Remove 2 negative x-tiles and one 1-tile.

So, $(3x + 2) - (-2x + 1) = 5x + 1$.

Got It? Do these problems to find out.

2a. Find $(x - 5) - (2x - 1)$. **$-x - 4$**   **2b.** Find $(6m + 3) - (-4m - 1)$. **$10m + 4$**

Solve Problems with Linear Expressions

You can solve real-world problems by subtracting linear expressions.

Real World   Example 3

Tutor

The expression $8x + 48.75$ represents the total amount of money the soccer team earned from selling x T-shirts.

a. If the team had to pay $(2x + 24)$ dollars in expenses, write an expression to represent their profit.

Total – Expenses = $(8x + 48.75) - (2x + 24)$	Subtract.
$= 8x + 48.75 - 2x - 24$	Distributive Property
$= 6x + 24.75$	Simplify.

⚠️ **Watch Out!**

When subtracting $(2x + 24)$, subtract both $2x$ and 24, which is written as $-2x - 24$.

b. If the soccer team sold 54 T-shirts, what was their profit?

| $6x + 24.75 = 6(54) + 24.75$ | Replace x with 54. |
| $= 324 + 24.75$ or 348.75 | Simplify. |

So, the soccer team made $348.75 profit.

Got It? Do this problem to find out.

3. After working x hours on Monday, Kay earns $9x$ dollars. On Tuesday, she earns $(7x + 3)$ dollars.

a. Write an expression to represent how much more she earned on Monday. **$2x - 3$**

b. If she worked for 5 hours each day, how much more did she earn on Monday? **$7**

Guided Practice

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

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

2. $(-4x + 2) - (-2x + 1)$ **$-2x + 1$**

3. $(9x - 4) - (-2x + 1)$ **$11x - 5$**

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

5. The cost of shipping an item that weighs x pounds from Charlotte to Chicago is shown in the table. (Example 3)

Shipping Company	Cost ($)
Atlas Service	$4x + 2.80$
Mid-Atlantic Service	$3x + 1.25$

a. Write an expression to represent how much more Atlas charges than Mid-Atlantic for shipping an item. **$x + 1.55$**

b. If an item weighs 2 pounds, how much more does Atlas charge for shipping it? **$3.55**

Independent Practice

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

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

7. $(-4x + 3) - (-x - 4)$ **$-3x + 7$**

8. $(8x - 9) - (3x - 1)$ **$5x - 8$**

9 $(3x + 7) - (x - 2)$ **$2x + 9$**

10. $(5x + 6) - (2x + 5)$ **$3x + 1$**

11. $(x + 5) - (2x + 3)$ **$-x + 2$**

12. **CCSS** **Model with Mathematics** The expression $5.5x + 2$ represents the number of miles Celeste rode her bike, and $10x$ represents the number of miles that Kimiko rode her bike, in x hours. (Example 3)

a. Write an expression to show how many more miles Kimiko rode than Celeste. **$4.5x - 2$**

b. If they each rode for 2 hours, how many more miles did Kimiko ride? **7 mi**

B **13** Evan plans to download x songs from a music site on the Internet. The expression $1.29x$ represents the cost at Web site A, and $0.25x + 25$ represents the cost at Web site B. How much more will Evan pay at Web site A than Web site B if he downloads an average of 30 songs per month? **$6.20**

14. The expression $5\frac{1}{2}x + 6$ represents the perimeter of the rectangle shown. Write an expression that represents the length of the rectangle. **$2\frac{1}{2}x + 1$**

$\frac{1}{4}x + 2$

H.O.T. Problems Higher Order Thinking

C **15.** **CCSS** **Identify Structure** Write two linear expressions that have a difference of $4x + 1$. **Sample answer: $5x + 4$ and $x + 3$**

16. **CCSS** **Persevere with Problems** Suppose A and B represent linear expressions. If $A + B = 2x - 2$ and $A - B = 4x - 8$, find A and B. **$A = 3x - 5$; $B = -x + 3$**

17. **Building on the Essential Question** Explain how you can use a rule for subtracting integers to help subtract linear expressions.

17. Sample answer: The rule to add the inverse when subtracting integers is applied to each term in the linear expression that is being subtracted.