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Unit 6, Lesson 18: Subtraction in Equivalent Expressions

Let's find ways to work with subtraction in expressions.

18.1: Number Talk: Additive Inverses

Find each sum or difference mentally.

$-30 + -10$

$-10 + -30$

$-30 - 10$

$10 - -30$

18.2: A Helpful Observation

Lin and Kiran are trying to calculate $7\frac{3}{4} + 3\frac{5}{6} - 1\frac{3}{4}$. Here is their conversation:

Lin: "I plan to first add $7\frac{3}{4}$ and $3\frac{5}{6}$, so I will have to start by finding equivalent fractions with a common denominator."

Kiran: "It would be a lot easier if we could start by working with the $1\frac{3}{4}$ and $7\frac{3}{4}$. Can we rewrite it like $7\frac{3}{4} + 1\frac{3}{4} - 3\frac{5}{6}$?"

Lin: "You can't switch the order of numbers in a subtraction problem like you can with addition; $2 - 3$ is not equal to $3 - 2$."

Kiran: "That's true, but do you remember what we learned about rewriting subtraction expressions using addition? $2 - 3$ is equal to $2 + (-3)$."

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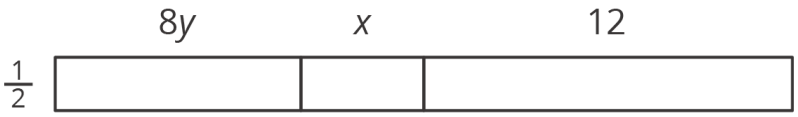
1. Write an expression that is equivalent to $7\frac{3}{4} + 3\frac{5}{6} - 1\frac{3}{4}$ that uses addition instead of subtraction.

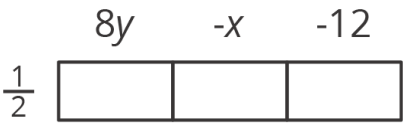
2. If you wrote the terms of your new expression in a different order, would it still be equivalent? Explain your reasoning.

18.3: Organizing Work

1. Write two expressions for the area of the big rectangle.



2. Use the distributive property to write an expression that is equivalent to $\frac{1}{2}(8y + -x + -12)$. The boxes can help you organize your work.



3. Use the distributive property to write an expression that is equivalent to $\frac{1}{2}(8y - x - 12)$.

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Are you ready for more?

Here is a calendar for April 2017.

April 2017						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Let's choose a date: the 10th. Look at the numbers above, below, and to either side of the 10th: 3, 17, 9, 11.

1. Average these four numbers. What do you notice?

2. Choose a different date that is in a location where it has a date above, below, and to either side. Average these four numbers. What do you notice?

3. Explain why the same thing will happen for any date in a location where it has a date above, below, and to either side.

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Lesson 18 Summary

Working with subtraction and signed numbers can sometimes get tricky. We can apply what we know about the relationship between addition and subtraction—that subtracting a number gives the same result as adding its opposite—to our work with expressions. Then, we can make use of the properties of addition that allow us to add and group in any order. This can make calculations simpler. For example:

$$\frac{5}{8} - \frac{2}{3} - \frac{1}{8}$$

$$\frac{5}{8} + -\frac{2}{3} + -\frac{1}{8}$$

$$\frac{5}{8} + -\frac{1}{8} + -\frac{2}{3}$$

$$\frac{4}{8} + -\frac{2}{3}$$

We can also organize the work of multiplying signed numbers in expressions. The product $\frac{3}{2}(6y - 2x - 8)$ can be found by drawing a rectangle with the first factor, $\frac{3}{2}$, on one side, and the three terms inside the parentheses on the other side:

	$6y$	$-2x$	-8
$\frac{3}{2}$			

Multiply $\frac{3}{2}$ by each term across the top and perform the multiplications:

	$6y$	$-2x$	-8
$\frac{3}{2}$	$\frac{3}{2} \cdot 6y$	$\frac{3}{2} \cdot -2x$	$\frac{3}{2} \cdot -8$

	$6y$	$-2x$	-8
$\frac{3}{2}$	$9y$	$-3x$	-12

Reassemble the parts to get the expanded version of the original expression:

$$\frac{3}{2}(6y - 2x - 8) = 9y - 3x - 12$$

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Unit 6, Lesson 18: Subtraction in Equivalent Expressions

1. For each expression, write an equivalent expression that uses only addition.

   a. $20 - 9 + 8 - 7$

   b. $4x - 7y - 5z + 6$

   c. $-3x - 8y - 4 - \frac{8}{7}z$

2. Use the distributive property to write an expression that is equivalent to each expression. If you get stuck, consider drawing boxes to help organize your work.

   a. $9(4x - 3y - \frac{2}{3})$

   b. $-2(-6x + 3y - 1)$

   c. $\frac{1}{5}(20y - 4x - 13)$

   d. $8(-x - \frac{1}{2})$

   e. $-8(-x - \frac{3}{4}y + \frac{7}{2})$

3. Kiran wrote the expression $x - 10$ for this number puzzle: "Pick a number, add -2, and multiply by 5."

   Lin thinks Kiran made a mistake.

   a. How can she convince Kiran he made a mistake?

   b. What would be a correct expression for this number puzzle?

4. The output from a coal power plant is shown in the table:

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energy in megawatts	number of days
1,200	2.4
1,800	3.6
4,000	8
10,000	20

Similarly, the output from a solar power plant is shown in the table:

energy in megawatts	number of days
100	1
650	4
1,200	7
1,750	10

Based on the tables, is the energy output in proportion to the number of days for either plant? If so, write an equation showing the relationship. If not, explain your reasoning.

(from Unit 2, Lesson 7)