Unit 6, Lesson 21: Combining Like Terms (Part 2)

Let's see how to use properties correctly to write equivalent expressions.

21.1: True or False?

Select **all** the statements that are true. Be prepared to explain your reasoning.

1. $4 - 2(3 + 7) = 4 - 2 \cdot 3 - 2 \cdot 7$
2. $4 - 2(3 + 7) = 4 + \text{-}2 \cdot 3 + \text{-}2 \cdot 7$
3. $4 - 2(3 + 7) = 4 - 2 \cdot 3 + 2 \cdot 7$
4. $4 - 2(3 + 7) = 4 - (2 \cdot 3 + 2 \cdot 7)$

21.2: Seeing it Differently

Some students are trying to write an expression with fewer terms that is equivalent to
$8 - 3(4 - 9x)$.

Noah says, "I worked the problem from left to right and ended up with $20 - 45x$."

$$8 - 3(4 - 9x)$$

$$5(4 - 9x)$$

$$20 - 45x$$

Lin says, "I started inside the parentheses and ended up with $23x$."

$$8 - 3(4 - 9x)$$

$$8 - 3(\text{-}5x)$$

$$8 + 15x$$

$$23x$$

Jada says, "I used the distributive property and ended up with $27x - 4$."

$$8 - 3(4 - 9x)$$

$$8 - (12 - 27x)$$

$$8 - 12 - (\text{-}27x)$$

$$27x - 4$$

Andre says, "I also used the distributive property, but I ended up with $\text{-}4 - 27x$."

$$8 - 3(4 - 9x)$$

$$8 - 12 - 27x$$

$$\text{-}4 - 27x$$

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1. Do you agree with any of them? Explain your reasoning.

2. For each strategy that you disagree with, find and describe the errors.

Are you ready for more?

1. Jada's neighbor said, "My age is the difference between twice my age in 4 years and twice my age 4 years ago." How old is Jada's neighbor?

2. Another neighbor said, "My age is the difference between twice my age in 5 years and and twice my age 5 years ago." How old is this neighbor?

3. A third neighbor had the same claim for 17 years from now and 17 years ago, and a fourth for 21 years. Determine those neighbors' ages.

21.3: Grouping Differently

Diego was taking a math quiz. There was a question on the quiz that had the expression $8x - 9 - 12x + 5$. Diego's teacher told the class there was a typo and the expression was supposed to have one set of parentheses in it.

1. Where could you put parentheses in $8x - 9 - 12x + 5$ to make a new expression that is still equivalent to the original expression? How do you know that your new expression is equivalent?

2. Where could you put parentheses in $8x - 9 - 12x + 5$ to make a new expression that is not equivalent to the original expression? List as many different answers as you can.

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Lesson 21 Summary

Combining like terms allows us to write expressions more simply with fewer terms. But it can sometimes be tricky with long expressions, parentheses, and negatives. It is helpful to think about some common errors that we can be aware of and try to avoid:

- $6x - x$ is not equivalent to 6. While it might be tempting to think that subtracting x makes the x disappear, the expression is really saying take 1 x away from 6 x's, and the distributive property tells us that $6x - x$ is equivalent to $(6 - 1)x$.

- $7 - 2x$ is not equivalent to $5x$. The expression $7 - 2x$ tells us to double an unknown amount and subtract it from 7. This is not always the same as taking 5 copies of the unknown.

- $7 - 4(x + 2)$ is not equivalent to $3(x + 2)$. The expression tells us to subtract 4 copies of an amount from 7, not to take $(7 - 4)$ copies of the amount.

If we think about the meaning and properties of operations when we take steps to rewrite expressions, we can be sure we are getting equivalent expressions and are not changing their value in the process.

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1. ○ Noah says that $9x - 2x + 4x$ is equivalent to $3x$, because the subtraction sign tells us to subtract everything that comes after $9x$.

   ○ Elena says that $9x - 2x + 4x$ is equivalent to $11x$, because the subtraction only applies to $2x$.

   Do you agree with either of them? Explain your reasoning.

2. Identify the error in generating an expression equivalent to $4 + 2x - \frac{1}{2}(10 - 4x)$. Then correct the error.

   $4 + 2x + \frac{-1}{2}(10 + \text{-}4x)$
   $4 + 2x + \text{-}5 + 2x$
   $4 + 2x - 5 + 2x$
   -1

3. Select **all** expressions that are equivalent to $5x - 15 - 20x + 10$.

   A. $5x - (15 + 20x) + 10$
   B. $5x + \text{-}15 + \text{-}20x + 10$
   C. $5(x - 3 - 4x + 2)$
   D. $\text{-}5(\text{-}x + 3 + 4x + \text{-}2)$
   E. $\text{-}15x - 5$
   F. $\text{-}5(3x + 1)$

4. The school marching band has a budget of up to $750 to cover 15 new uniforms and competition fees that total $300. How much can they spend for one uniform?

   a. Write an inequality to represent this situation.

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b. Solve the inequality and describe what it means in the situation.

(from Unit 6, Lesson 14)

5. Solve the inequality that represents each story. Then interpret what the solution means in the story.

a. For every $9 that Elena earns, she gives x dollars to charity. This happens 7 times this month. Elena wants to be sure she keeps at least $42 from this month's earnings. $7(9 - x) \geq 42$

b. Lin buys a candle that is 9 inches tall and burns down x inches per minute. She wants to let the candle burn for 7 minutes until it is less than 6 inches tall. $9 - 7x < 6$

(from Unit 6, Lesson 16)

6. A certain shade of blue paint is made by mixing $1\frac{1}{2}$ quarts of blue paint with 5 quarts of white paint. If you need a total of 16.25 gallons of this shade of blue paint, how much of each color should you mix?

(from Unit 4, Lesson 3)