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## Unit 6, Lesson 20: Combining Like Terms (Part 1)

Let's see how we can tell that expressions are equivalent.

### 20.1: Why is it True?

Explain why each statement is true.

1.  $5 + 2 + 3 = 5 + (2 + 3)$

2.  $9a$  is equivalent to  $11a - 2a$ .

3.  $7a + 4 - 2a$  is equivalent to  $7a + -2a + 4$ .

4.  $8a - (8a - 8)$  is equivalent to 8.

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## 20.2: A's and B's

Diego and Jada are both trying to write an expression with fewer terms that is equivalent to

$$7a + 5b - 3a + 4b$$

- Jada thinks  $10a + 1b$  is equivalent to the original expression.
- Diego thinks  $4a + 9b$  is equivalent to the original expression.

1. We can show expressions are equivalent by writing out all the variables. Explain why the expression on each row (after the first row) is equivalent to the expression on the row before it.

$$7a + 5b - 3a + 4b$$

$$(a + a + a + a + a + a + a) + (b + b + b + b + b) - (a + a + a) + (b + b + b + b)$$

$$(a + a + a + a) + (a + a + a) + (b + b + b + b + b) - (a + a + a) + (b + b + b + b)$$

$$(a + a + a + a) + (b + b + b + b + b) + (a + a + a) - (a + a + a) + (b + b + b + b)$$

$$(a + a + a + a) + (b + b + b + b + b) + (b + b + b + b)$$

$$(a + a + a + a) + (b + b + b + b + b + b + b + b)$$

$$4a + 9b$$

2. Here is another way we can rewrite the expressions. Explain why the expression on each row (after the first row) is equivalent to the expression on the row before it.

$$7a + 5b - 3a + 4b$$

$$7a + 5b + (-3a) + 4b$$

$$7a + (-3a) + 5b + 4b$$

$$(7 + -3)a + (5 + 4)b$$

$$4a + 9b$$

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**Are you ready for more?**

Follow the instructions for a number puzzle:

- Take the number formed by the first 3 digits of your phone number and multiply it by 40
- Add 1 to the result
- Multiply by 500
- Add the number formed by the last 4 digits of your phone number, and then add it again
- Subtract 500
- Multiply by  $\frac{1}{2}$

1. What is the final number?

2. How does this number puzzle work?

3. Can you invent a new number puzzle that gives a surprising result?

**20.3: Making Sides Equal**

Replace each ? with an expression that will make the left side of the equation equivalent to the right side.

Set A

1.  $6x + ? = 10x$

2.  $6x + ? = 2x$

3.  $6x + ? = -10x$

4.  $6x + ? = 0$

5.  $6x + ? = 10$

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Check your results with your partner and resolve any disagreements. Then move on to Set B.

Set B

1.  $6x - ? = 2x$

2.  $6x - ? = 10x$

3.  $6x - ? = x$

4.  $6x - ? = 6$

5.  $6x - ? = 4x - 10$

## Lesson 20 Summary

There are many ways to write equivalent expressions that may look very different from each other. We have several tools to find out if two expressions are equivalent.

- Two expressions are definitely not equivalent if they have different values when we substitute the same number for the variable. For example,  $2(-3 + x) + 8$  and  $2x + 5$  are not equivalent because when  $x$  is 1, the first expression equals 4 and the second expression equals 7.
- If two expressions are equal for many different values we substitute for the variable, then the expressions *may* be equivalent, but we don't know for sure. It is impossible to compare the two expressions for all values. To know for sure, we use properties of operations. For example,  $2(-3 + x) + 8$  is equivalent to  $2x + 2$  because:

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

$$-6 + 2x + 8 \quad \text{by the distributive property}$$

$$2x + -6 + 8 \quad \text{by the commutative property}$$

$$2x + (-6 + 8) \quad \text{by the associative property}$$

$$2x + 2$$

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## Unit 6, Lesson 20: Combining Like Terms (Part 1)

1. Andre says that  $10x + 6$  and  $5x + 11$  are equivalent because they both equal 16 when  $x$  is 1. Do you agree with Andre? Explain your reasoning.

2. Select **all** expressions that can be subtracted from  $9x$  to result in the expression  $3x + 5$ .

- A.  $-5 + 6x$
- B.  $5 - 6x$
- C.  $6x + 5$
- D.  $6x - 5$
- E.  $-6x + 5$

3. Select **all** the statements that are true for any value of  $x$ .

- A.  $7x + (2x + 7) = 9x + 7$
- B.  $7x + (2x - 1) = 9x + 1$
- C.  $3x + (10 - 3x) = 10$
- D.  $5x - (8 - 6x) = -x - 8$
- E.  $4x - (2x + 8) = 2x - 8$
- F.  $6x - (2x - 4) = 4x + 4$

4. For each situation, would you describe it with  $x < 25$ ,  $x > 25$ ,  $x \leq 25$ , or  $x \geq 25$ ?

- a. The library is having a party for any student who read at least 25 books over the summer. Priya read  $x$  books and was invited to the party.
- b. Kiran read  $x$  books over the summer but was not invited to the party.
- c.

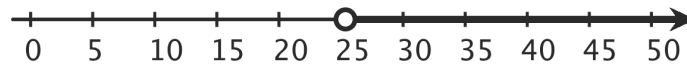


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d.



(from Unit 6, Lesson 13)

5. Consider the problem: A water bucket is being filled with water from a water faucet at a constant rate. When will the bucket be full? What information would you need to be able to solve the problem?

(from Unit 2, Lesson 9)