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. $7.6 + 4.8 - 2.5 = 7.6 - 2.5 + 4.8$

3. $9a$ is equivalent to $11a - 2a$.

20.2 D's and J's

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

$$6j + 4d - 2j + 3d$$

- Jada thinks $8j + 1d$ is equivalent to the original expression.
- Diego thinks $4j + 7d$ is equivalent to the original expression.

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

$$6j + 4d - 2j + 3d$$

$$(j + j + j + j + j + j) + (d + d + d + d) - (j + j) + (d + d + d)$$

$$(j + j + j + j) + (j + j) + (d + d + d + d) - (j + j) + (d + d + d)$$

$$(j + j + j + j) + (d + d + d + d) + (j + j) - (j + j) + (d + d + d)$$

$$(j + j + j + j) + (d + d + d + d) + (d + d + d)$$

$$(j + j + j + j) + (d + d + d + d + d + d + d)$$

$$4j + 7d$$

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

$$6j + 4d - 2j + 3d$$

$$6j + 4d + (-2j) + 3d$$

$$6j + (-2j) + 4d + 3d$$

$$(6 + -2)j + (4 + 3)d$$

$$4j + 7d$$

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 a term or expression in parentheses that will make the expression on the left side of the equation equivalent to the expression on the right side. Check your results for Set A with your partner and work to reach an agreement before moving on to Set B.

Set A

1. $6x + ? = 10x$
2. $6x + ? = 2x$
3. $6x + ? = -10x$
4. $6x + ? = 0$
5. $6x + ? = 10$

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, and they may look very different from each other. One way to determine if two expressions are equivalent or not is to substitute the same number for the variable in both expressions.

For example, when x is 1, the expression $2(-3 + x) + 8$ equals 4 and the expression $2x + 5$ equals 7. This means $2(-3 + x) + 8$ and $2x + 5$ are not equivalent.

If two expressions are equal when many different values are substituted for the variable, then the expressions *may* be equivalent—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:

$$
\begin{aligned}
&2(-3 + x) + 8 && \\
&-6 + 2x + 8 && \text{by the distributive property} \\
&2x + -6 + 8 && \text{by the commutative property} \\
&2x + (-6 + 8) && \text{by the associative property} \\
&2x + 2 &&
\end{aligned}
$$