LESSON 2

Algebraic Expressions— Combining Like Terms

LEARNING OBJECTIVES

➤ Today I am: combining like terms.

➤ So that I can: simplify polynomial expressions.

➤ I'll know I have it when I can: solve a puzzle with algebraic expressions.

Exploratory Activity

In the last lesson, we were working with expressions like $x + x + 10 + x + 20 + x + 9 + x + 11$. We then combined the x terms together to get $5x$ and the numbers together to get 50. Our expression became $5x + 50$. In this lesson, we'll look at expressions where there are more complicated terms, such as $-4x^2$. Our first task will be to determine which of these terms are "like" another.

1. Take a look at the following expression:

   $$-2x + 3 - 4x + 5 - 4x^2 + 11 - 15x + 2x^2 - 15$$

   A. Using a pen or pencil, divide the expression above into smaller units. We'll call these smaller units "terms" of an expression or equation. *9-term polynomial*

   B. Describe the meaning of the word "term".

   an algebraic expression consists of: a number (constant), variable, or a product of number & variable

   C. Check with your team to see if everyone divided the expression the same way. Be sure to explain how you determined your division marks.

2. Joey says that a lot of these terms are "like terms". What do you think Joey means by this?

These are all terms of the expression, $-2x + 3 - 4x + 5 - 4x^2 + 11 - 15x + 2x^2 - 15$.

Coefficient

-15 $-15x$ $+3$ $-4x$ $+11$ $-4x^2$ $+5$ $+2x^2$ $-2x$
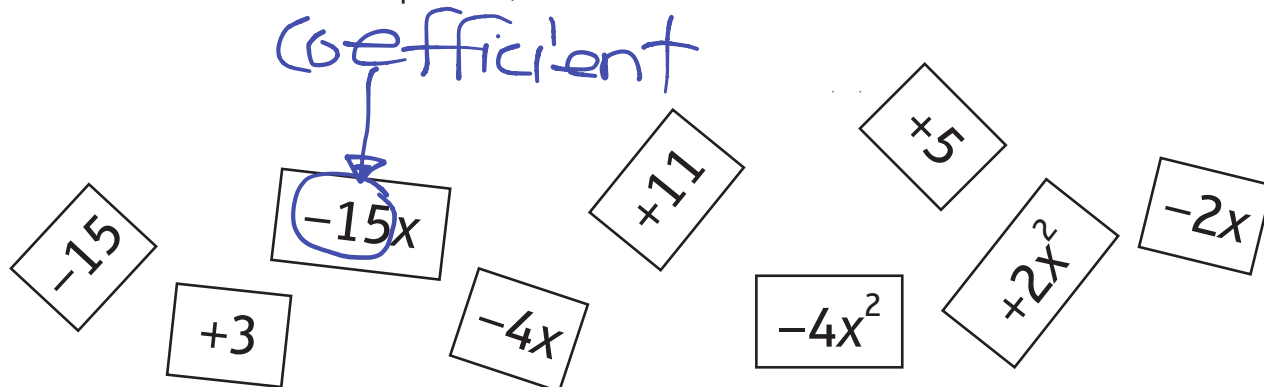
Same variable (s)
↓　exponents

3. Use the table provided below to sort the terms into **like terms**. You do not need to use all of the space provided, but make sure you justify your grouping by explaining why they belong together.

Group 1	Group 2	Group 3	Group 4	Group 5
-15 3 11 5	$-4x^2$ $2x^2$	$-15x$ $-4x$ $-2x$		
Reason: constants	**Reason:** same variable & exponent	**Reason:** same variable & exponent	**Reason:**	**Reason:**

4. Should everyone in class have grouped the terms together in the same way? Explain why.

Yes

5. Now that we have our like terms grouped, it is time to simplify. Add together the terms in each group separately and then write them as one expression. Don't forget to write in the sign of each term.

$-2x + 3 - 4x + 5 - 4x^2 + 11 - 15x + 2x^2 - 15 =$ $4 - 21x - 2x^2$

$-2x^2 - 21x + 4$ ← standard form

6. For each expression below, simplify by combining like terms.

A. $3x^4 - 8x^2 + 12x^4 - 5x^3 + 2x - 7x^2 + 3 - 4x$ B. $10b^2 + 3b^4 - 2b^2 + 17b - 22 + 3b - b^4$

$15x^4 - 5x^3 - 15x^2 - 2x + 3$

C. $11y - 4y^2 + 6y^3 + 9y^2 - 1 + y - 3y + 8$ D. $24z - 32 + 8z - 6 + 5 - z$

$6y^3 + 5y^2 + 9y + 7$

7. Fill in the blank so that the expressions on the right side of the table are equivalent to the expressions on the left side of the table. The first one has been done for you.

A.	$3z^2 - 6z + 9z + 2z^2$	$4z^2 + \underline{z^2} - 7z + \underline{10z}$
B.	$\underline{4}ab + \underline{9}ab - \underline{6}ab - \underline{2}ab$ **5ab**	$5ab + \textbf{ab} - ab + 2ab^2 \textbf{≠ 2ab}^2$ **5ab**
C.	$-2xy - 3xy + 7xyz$	$6xyz + \underline{\quad} - 4xy + \underline{\quad}$
D.	$-m + 9n - 7m - 2n + 3mn - 5n$ **− 8m + 2n + 3mn**	$2mn + \textbf{mn} + 4n \cancel{+}\, \underline{\textbf{-2n}} - 10m + \textbf{2m}$

8. Below are three common mistakes students make when combining like terms. Circle the mistake, complete their work correctly and then explain what they did.

Student A	Student B	Student C
$a^2 - 4a + 5a =$	$3y + 4x^2 - 3y + 5y =$	$3h + 14g - 5h + 5g =$
$2a^2$	$3y - y + 5y + 4x^2 =$	$3h + 5h + 14g - 5g =$
	$7y + 4x^2$	$8h + 9g$
Correct answer: _____	Correct answer: _____	Correct answer: _____
Explain error:	Explain error:	Explain error:

Lesson Summary

Like terms have the same _____ with the same _____.

Examples:

Like Terms	Unlike Terms
$3, -7, 8$	3 apples, -7 dollars, 8 dogs
$-2y, 5y, 88y$	$-2x, 5y, 88xy$
$16a^2, -3a^2, \frac{1}{2}a^2$	$16z^2, -3mn^2, \frac{1}{2}x^2$

NAME: _____ PERIOD: _____ DATE: _____

Homework Problem Set

Simplify each expression by combining like terms.

1. $-6b + 4a + 8b - 3a$

2. $5m - 4n - 7mn + 8n - m + 10n$

3. $7x^2y + 14x^2 - 3y + 2y - 8x^2 - 9xy + 3x^2y$

4. $8k - 13k^2 + 4k^3 + 2k - 6k^2 - 9$

5. $12r + 5 + 3r - 5$

6. $n + 4 - 9 - 5n$

7. $10x + 36 - 38x - 47$

8. $w^3 + 7q + 3w^3 - 5w^2 - 14q + 10$

9. $6v - 12 + 2v + 12 + 2v^2$

10. $2p^2q + 18p^2 - 4q + 3q - 7p^2 - 3pq + 4p^2q$

11. **Open Ended** Using the terms a^2, b and c^3, write an expression where once it is simplified will give the result of $3a^2 - b + 10c^3$.

12. Below are several common errors students make when combining like terms. Find a value for x that makes the statement false.

Statement	Counterexample (value of x that make the statement false)	Work
Example: $3x + 4x = 7x^2$	2	$3 \cdot 2 + 4 \cdot 2 \neq 7 \cdot 2^2$ $6 + 8 \neq 7 \cdot 4$ $14 \neq 28$
A. $2x + 4x = 8x$		
B. $3x - 4x = x$		
C. $3x - 4x = -x^2$		
D. $3x + x = 3x^2$		

13. **Counterexample** Sam says that $2x^3 - 6x^2 + 4x - 7$ is always a negative number for any value of x. Prove Sam is wrong by finding a value of x that will make the expression positive or equal to zero.

14. Each statement below is correct. Use two different values to show that both sides of the equation are equivalent. Use negative values as well as positive ones.

Statement	First x-value	Work for first x-value	Second x-value	Work for second x-value
Example: $3x + 4x = 7x$	2	$3 \cdot 2 + 4 \cdot 2 = 7 \cdot 2$ $6 + 8 = 14$ $14 = 14$	-2	$3 \cdot (-2) + 4 \cdot (-2) = 7 \cdot (-2)$ $-6 + -8 = 7 \cdot (-2)$ $-14 = -14$
A. $2x + 4x = 6x$				
B. $3x - 4x = -x$				

Spiral REVIEW—Evaluating Expressions

For each expression below, $a = 3$, $b = 5$, $c = -1$ and $d = 0$. Substitute the value for each variable and then evaluate the expression.

15. $4a - 2b$

16. $-7c + 14d$

17. $5c - 3b$

18. $a - b$

19. $a + b + c + d$

20. $a - b - c - d$

21. $b - a$

22. ab

23. cd

24. $abcd$

25. $-a + b$

26. $2b - 4a$

27. Which of the expressions above gave the same value?