Simplify Polynomials by Combining Like Terms

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9.3 Simplify Polynomials by Combining Like Terms

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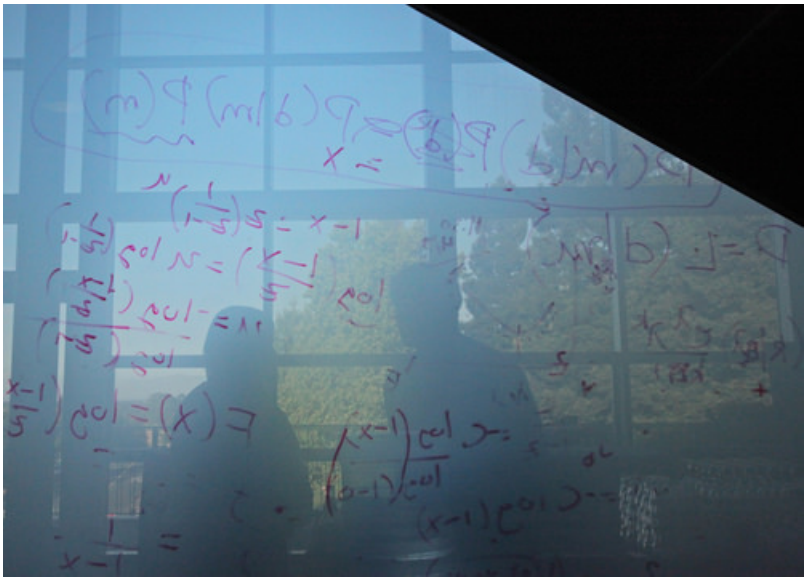

[Figure 1]

Jessie is stuck on her math homework. She is stuck on the problem $5x - 3y - 9x + 7y$. The directions are asking her to simplify, but she isn't sure how to do that. Do you know?

In this concept, you will learn to simplify polynomials by combining like terms.

Combining Like Terms

A **polynomial** is an algebraic expression that shows the sum of monomials. Since the prefix 'mono' means 'one', a monomial is a single piece or term. The prefix 'poly' means 'many'. So the word polynomial refers to multiple terms in an expression. The relationships between the terms may be sums or differences.

Polynomial expressions include: $x^2 + 5$ $3x - 8 + 4x^5$ $-7a^2 + 9b - 4b^3 + 6$

You can simplify polynomials by combining like terms. In mathematics, you are able to combine like terms but you cannot combine unlike terms.

Terms are considered **like terms** if they have exactly the same variables with exactly the same exponents.

A term can also be a single number like 7 or -5. These are called **constants**.

Any term with a variable has a numerical factor called the **coefficient**. The coefficient of $4x$ is 4. The coefficient of $-7a^2$ is -7. The coefficient of y is 1 (because its numerical factor is an unwritten number 1. You could write "$1y$" to show that the coefficient of y is 1 but it is not necessary because any number multiplied by 1 is unchanged).

Here are some examples of like and unlike terms:

$7n$ and $5n$ are like terms because they both have the variable n with an exponent of 1.

$4n^2$ and $-3n$ are not like terms because, although they both have the variable n, they do not have the same exponent.

$5x^3$ and $8y^3$ are not like terms because, although they both have the same exponent, they do not have the same variable.

Like terms can be combined by adding their coefficients.

$$\begin{aligned} 7n + 5n &= 12n \\ 3x^3 + 5x^3 &= 8x^3 \\ -2t^4 - 10t^4 &= -12t^4 \\ 2n^2 - 3n + 5n^2 + 11n &= 7n^2 + 8n \end{aligned}$$

Notice that the exponent does not change when you combine like terms. If you think of $7n$ as simply a shorter way of writing $n + n + n + n + n + n + n$ and $5n$ as a shorter way of writing $n + n + n + n + n,$ then combining those like terms would result in $(n + n + n + n + n + n + n) + (n + n + n + n + n),$ which is the same as $12n.$ So $7n + 5n = 12n.$

Examples

Example 1

Earlier, you were asked about helping Jessie with her simplification problem.

Here is the problem that Jessie is stuck on:

$$5x - 3y - 9x + 7y$$

First, consider the like terms and combine them:

$$\begin{aligned} 5x - 9x &= -4x \\ -3y + 7y &= 4y \end{aligned}$$

Then write the terms in a single expression again:

$$-4x + 4y$$

The answer is $-4x + 4y$.

Example 2

Simplify by combining like terms:

$$15x - 12x + 3y - 8x + 7y - 1 + 5$$

First, let's look at the like terms and combine them.

$$\begin{aligned} 15x - 12x - 8x &= -5x \\ 3y + 7y &= 10y \\ -1 + 5 &= 4 \end{aligned}$$

Then rewrite the combined terms in a single expression:

$$-5x + 10y + 4$$

The answer is $-5x + 10y + 4$.

Example 3

Simplify by combining like terms.

$$2x - 8y - 4x + 7y + 9$$

First, let's look at the like terms and combine them where possible.

$$\begin{aligned} 2x - 4x &= -2x \\ -8y + 7y &= -y \\ 9 &= 9 \end{aligned}$$

Then rewrite the terms in a single expression:

$$-2x - y + 9$$

The answer is $-2x - y + 9$.

Example 4

Simplify by combining like terms.

$$5a + 3b - 8b + a - 7$$

First, let's look at the like terms and combine them.

$$\begin{aligned} 5a + a &= 6a \\ 3b - 8b &= -5b \\ -7 &= -7 \end{aligned}$$

Then rewrite the terms in a single expression:

$$6a - 5b - 7$$

The answer is $6a - 5b - 7$.

Example 5

Simplify by combining like terms.

$$5a - 7b = 8b - 2a + 8a - 9 + 8$$

First, look at the like terms and combine them.

$$\begin{aligned} 5a - 2a + 8a &= 11a \\ -7b + 8b &= b \\ -9 + 8 &= -1 \end{aligned}$$

Then rewrite the combined terms in a single expression:

$$11a + b - 1$$

The answer is $11a + b - 1$.

Review

Simplify the following polynomials by combining like terms.

1. $6x + 7 - 18x + 4$
2. $5x - 7x + 5x + 4 - 9$
3. $3x + 8y - 5x + 3y$
4. $17x^2 - 7x^2 - 5x + 3x + 14$
5. $3xy - 9xy - 5x + 4x - 7 + 3$
6. $9x + 7y - 15x + 4x - 9y$
7. $3x + 7 - 5x - 8y + 4x - 2y + 7$
8. $3xy - xy - 15x + 4 - 11$
9. $-8x + 3x + 7y - 5x + 4y - 2$
10. $3x^2 + 6x - 3y + 2x - 7$
11. $14xy - 18xy + 7y + 8x - 2x + 9$
12. $3x + 7 - 5x + 4y - 18y$
13. $6y^2 - 4y^3 + y^2 - 8$
14. $-5q + q^2 + 7 - q - 7$
15. $n^2m - 3n^2m + 5n^2m^2 + 11n$

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

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