MPM1D: Principles of Mathematics

# Collecting Like Terms

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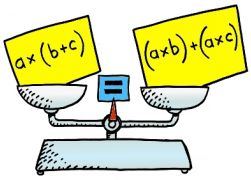







## Communicating with Algebra

**Recap**

Classify the polynomial $3x^3y^2 - 4x^5y$ according to its degree and its number of terms.

The degree of the first term is $3 + 2 = 5$, while the degree of the second term is $5 + 1 = 6$.

Therefore, the polynomial has a degree of 6.

Since there are two terms, the polynomial is a binomial.





## Identifying Like Terms

If two terms have the same variable component, then they are said to be *like terms*.

For example, the terms $3x^2$ and $-5x^2$ are like terms, because they both have the same variable component, $x^2$.

Note that the exponents must match *exactly*, although order does not matter.

Thus, the terms $2xy^2$ and $7y^2x$ are like terms, but $4x^5y^3$ and $2x^4y^7$ are not.

Constants, having no variable components, are always like terms.





## Identifying Like Terms

**Example**

Identify any like terms from $5x$, $-14x^3$, $5x^2$, $x^3$, and $-14$.

Only $-14x^3$ and $x^3$ are like terms, since they have the same variable components, $x^3$.

$5x$ is not a like term with $5x^2$ because the variable part is different – only the coefficient is the same.

The same is true for $-14x^3$ and $-14$. The latter has no variable component at all.





## Identifying Like Terms

**Example**

Identify any like terms from $6x^5y^2$, $3x^5$, $-2y^2x^5$ and $7y^2$.

Only $6x^5y^2$ and $-2y^2x^5$ are like terms, since they have the same variable component, $x^5y^2$ (order is unimportant).

The term $3x^5$ is missing one variable, $y$, while $7y^2$ is missing the other, $x$.





## Collecting Like Terms

Sometimes, a polynomial will contain two or more terms that are like terms.

If this is the case, it is possible to *collect* the like terms and express them as a single term, simplifying the polynomial.

This is done by adding or subtracting the coefficients, depending on their signs.

For example, the polynomial $3x^2 + 5x^2$ can be simplified as $(3 + 5)x^2 = 8x^2$.

Similarly, the polynomial $7xy^3 - 6y^3x$ can be simplified as $(7 - 6)xy^3 = xy^3$.

In the last example, we could have written $y^3x$ instead of $xy^3$, since variable order does not matter.

## Collecting Like Terms

**Example**

Simplify the polynomial $3x^2 - 5x + 7x - 8$.

The second and third terms, $-5x$ and $7x$, are like terms.

They can be simplified as $(-5 + 7)x = 2x$.

Therefore, $3x^2 - 5x + 7x - 8$ can be simplified as $3x^2 + 2x - 8$.





## Collecting Like Terms

**Example**

Simplify $6x + 5 - 9x + 8$.

There are two pairs of like terms: $6x$ and $-9x$, and the constants 5 and 8.

These simplify to $(6 - 9)x = -3x$ and $5 + 8 = 13$ respectively.

Therefore, the polynomial $6x + 5 - 9x + 8$ simplifies to $-3x + 13$.

You may find it easier to reorganize the terms in the polynomial before simplifying, but this is optional.

$$\begin{aligned} 6x + 5 - 9x + 8 &= 6x - 9x + 5 + 8 \\ &= (6 - 9)x + (5 + 8) \\ &= -3x + 13 \end{aligned}$$





## Collecting Like Terms

**Example**

Simplify the polynomial $5x^3y^2 - 2x^2y^3 + 8x^2y^2 - 7x^3y^2$.

The only two like terms in the polynomial are $5x^3y^2$ and $-7x^3y^2$, since the values of the exponents for $-2x^2y^3$ are reversed, and the $y$-variable in $8x^2y^2$ is squared, rather than cubed.

$$\begin{aligned} 5x^3y^2 - 2x^2y^3 + 8x^2y^2 - 7x^3y^2 &= 5x^3y^2 - 7x^3y^2 - 2x^2y^3 + 8x^2y^2 \\ &= (5 - 7)x^3y^2 - 2x^2y^3 + 8x^2y^2 \\ &= -2x^3y^2 - 2x^2y^3 + 8x^2y^2 \end{aligned}$$





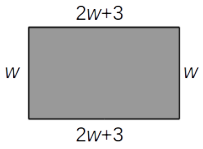
## Collecting Like Terms

**Example**

A rectangle has a length that is three centimetres longer than twice its width. Determine a simplified polynomial expression for its perimeter.

Recall that the perimeter of an object can be calculated by adding together the measures of all of its sides.

Let $w$ be the width of the rectangle. Then its length must have a value of $2w + 3$, as shown below.








## Collecting Like Terms

Add the four sides together for the perimeter.

$$\begin{aligned} w + (2w + 3) + w + (2w + 3) &= w + 2w + w + 2w + 3 + 3 \\ &= (1 + 2 + 1 + 2)w + (3 + 3) \\ &= 6w + 6 \end{aligned}$$

Therefore, a simplified polynomial expression for the perimeter of the rectangle is $6w + 6$.





## Questions?