GCSE Maths - Algebra

Collecting Like Terms

Notes

WORKSHEET

Collecting Like Terms

By manipulating algebraic expressions, we can simplify what initially may seem like a complicated expression into something that is much easier to deal with. The simplest form of manipulation is through the **collection of like terms**.

Collecting like terms

To simplify an algebraic expression, a good starting point is to **collect like terms.**

- A **term** is simply a collection of numbers, letters and brackets which are multiplied together. All terms in an equation are separated by a **+** sign or a **-** sign.

Consider the following:

$$8y + 4xy + 3a^2 - 7a + 54.$$

- Each term in the equation is an example of a different type of term.
- There are 5 terms in total: 'y' term, 'xy' term, 'a^2' term, 'a' term and a 'constant' term.
- Note all of the terms have a **+** or **-** sign in front of them. For the first term 8y, as it is the **first term** in the expression, there is an **invisible + sign** in front so it is technically + 8y. However, as it is the first term, we do not include it in the expression.

To collect like terms, **we collect terms with the same combination of letters**:

- We collect all the y terms together, all the x terms together, all the xy terms together, etc. and we also combine all the constant number terms. We also collect terms with the same power, such as terms with an x^2.
- Note, 'y' and 'xy' terms are **NOT** the same. Equally 'a' and 'a^2' terms are **NOT** the same and therefore cannot be collected together.

Since all the terms in the example above are different, we cannot simplify this expression any further.

Example: Simplify the expression $4x + 11 - 8x + 2 + x^2$

1. **Identify** the 'like terms' to make it clear which ones we can combine.

   $$4x + 11 - 8x + 2 + x^2$$

   *Here, we have **three types** of terms: the **'x'** term, the '**x^2**' term and the **constant** term.*

2. **Rearrange** the expression so the like terms can be placed together. **Remember** to include the invisible + sign that is front of the first term, i.e. the '4x' in this example.

   $$+4x - 8x + 11 + 2 + x^2$$

3. **Combine the like terms** by summing them together.

   $$+4x - 8x + 11 + 2 + x^2$$
   $$= -4x + 13 + x^2$$

   So, the final answer is $-4x + 13 + x^2$.

Example: Simplify the expression $3 + 4y + 7x^2 - 2y + 16$

1. **Identify** the 'like terms' to make it clear which terms we can combine.

$$3+4y + 7x^2 - 2y + 16$$

*Here, we have **three types** of terms, the **'y'** term, the '**x²**' term and the **constant** term.*

2. **Rearrange** the expression so the like terms can be placed together. **Remember** to include the invisible + sign that is front of the first term, i.e. the '3' in this example.

$$+3 + 16 + 7x^2 + 4y - 2y$$

3. **Combine the like terms** by summing them together.

$$+3 + 16 + 4y - 2y + 7x^2$$
$$= +19 + 2y + 7x^2$$

So, the final answer is $\mathbf{19 + 2y + 7x^2}$.

Example: Simplify the expression $6a - 12 + a - 5 + 8z$

1. **Identify** the 'like terms' to make it clear which ones we can combine.

$$6a - 12 + a - 5 + 8z$$

*Here, we have **three types** of terms, the **'a'** term, the '**z**' term and the **constant** term.*

2. **Rearrange** the expression so the like terms can be placed together. **Remember** to include the invisible + sign that is front of the first term, i.e. the '6a' in this example.

$$+6a + a - 12 - 5 + 8z$$

3. **Combine the like terms** by summing them together.

$$+6a + a - 12 - 5 + 8z$$
$$= +7a - 17 + 8z$$

So, the final answer is $\mathbf{7a - 17 + 8z}$.

Example: Simplify the expression $4x^2 + 7x - 2x - 3 + 2x^2 + 3$

1. **Identify** the 'like terms' to make it clear which ones we can combine.

$$4x^2 + 7x - 2x - 3 + 2x^2 + 3$$

*Here, we have **three types** of terms, the **'x'** term, the '**x²**' term and the **constant** term.*

2. **Rearrange** the expression so the like terms can be placed together. **Remember** to include the invisible + sign that is front of the first term, i.e. the '4x²' in this example.

$$+4x^2 + 2x^2 + 7x - 2x - 3 + 3$$

3. **Combine the like terms** by summing them together.

$$+4x^2 + 2x^2 + 7x - 2x - 3 + 3$$
$$= +6x^2 + 5x$$

So, the final answer is $\mathbf{6x^2 + 5}$.

Collecting Like Terms - Practice Questions

1. Simplify the following algebraic expressions:

a) $5p + 7q + 10 + 15p - 7q + 8t - 3$

b) $16 + 8d + 9e - 82 + 7de + 5 - d$

c) $92 + 7ab + 16 + 8abc + 9ab - bc$

d) $34ab + 17 + 52ab + 18ab^2 + 62 + 19a^2b -$

e) $62xy + 17xyz + 64 + xy - 18xyz + 9y + 21 + 92yz$

f) $x^2 - xy^2 + xy - y^2 + 1 - x^2 + yx$

g) $23 - a + b - ab + b^2 - a^2b^2 - 2a - (3ab)^2$

Worked solutions for the practice questions can be found amongst the worked solutions for the corresponding worksheet file.