GCSE Maths – Algebra

Notation and Vocabulary

Notes

WORKSHEET

Algebraic Notation

In algebra, we use different notation to show the **terms** we are using and the **operations** we are performing.

Letters

Letters, frequently a, b, x and y, are used to represent either a **constant**, which is fixed, or a **variable**, which can change.

Operations

When we perform an operation using two or more algebraic letters, we show them in a specific way:

- ***Addition*** is written as $\boldsymbol{a + b}$
- ***Subtraction*** is written as $\boldsymbol{a - b}$
- ***Multiplication*** is shown by putting the numbers or letters together.

  For example,

  $3 \times a$ is written as $3a$,
  $a \times b$ is written as ab.

  Multiplication can also be written with brackets, e.g. $a(b) = a \times b = ab$.

  When ***squaring*** an algebraic letter, like a, we simplify $a \times a$ to a^2.

- ***Division*** is shown by writing a fraction. If we were to divide a by b, we write this as $\frac{a}{b}$.

Example: Simplify $a + a + a + a$.

a represents either an unknown number or a variable.
We don't need to know what a is to simplify this.

*We collect the **like terms** (terms that contain the same variable) and count them. This gives:*

$$a + a + a + a = \boldsymbol{4a}$$

Coefficients

A coefficient is the **number in front** of an algebraic letter. They tell us the multiple of that particular term. For example, $2a$ means $2 \times a$, or 2 lots of a, where 2 is the coefficient.

Coefficients are generally whole numbers (integers) or fractions. We usually avoid using decimals as coefficients.

Example: Write $0.4a$ so that the coefficient is a fraction.

The coefficient is the 0.4 seen in front of the a.
We need to convert the decimal 0.4 to a fraction. There is a 4 in the tenths column only, so we can write it as $\frac{4}{10}$.

By dividing the numerator and denominator by 2, $\frac{4}{10}$ can be simplified to $\frac{2}{5}$:

$$0.4a = \frac{2}{5}\boldsymbol{a}.$$

Brackets
Brackets are used to **group terms** together. For example, $(x + 2)$ *or* $(a - b)$.

Substitution

As we know, the algebraic letter represents an unknown value or variable. Substitution means **replacing the letter** with a number and calculating the result.

Take the algebraic expression $5ab$. This means $5 \times a \times b$:

If we know the values that a and b represent, we can calculate the value of the whole expression. For example, if $a = 3$ and $b = 4$, then

$$5 \times 3 \times 4 \ = \ \mathbf{60}.$$

Example: If $x = 1$ and $y = 3$, calculate the value of $6xy^2$.

If we substitute the numbers in, we are calculating $6 \times 1 \times 3^2$:

$$6xy^2 = 6 \times 1 \times 3^2 = 6 \times 1 \times 9 = 6 \times 9 = \mathbf{54}$$

Substitution is especially useful when using scientific formulae, as the letters represent variables.

Example: Using the equation $V = IR$, where V is voltage, I is current and R is resistance, what is the voltage if the current is 3 amps and the resistance is 6 ohms?

We simply substitute the numbers we are given into the equation:

Remember that $V = IR$ means $V = I \times R$.

$$V = 3 \times 6 = 18$$

*The voltage is **18 volts**.*

Vocabulary

When using algebra, we must be careful to use the correct words to describe different things.

Expressions

An algebraic expression involves **a letter and an operation** $(+, -, \times, \div)$, but no equals sign. Examples of expressions include $7a + 4b$ or $x^2 - 4$.

Terms

A term is simply a **number**, a **letter**, or a **number and letter together**. Terms are the **individual parts of an expression**. For example, $7a$ is a term, as is 3.

Equations

An equation contains an **equal sign** and shows that one side is equal in value to the other. $9y = 3$ is an equation, as is $x^2 - 5x + 6 = 0$.

Formulae

A formula is an equation that contains several algebraic letters that represent **variables**. For example, Newton's second law, $Force = Mass \times Acceleration$ $(F = ma)$ is a formula. The force, mass and acceleration can be any number, provided that the product of the mass and acceleration is **equal** to force.

Identities

An identity is an equation that is **always true**, no matter the numbers that the letters represent. For example, $6a^2 \times 3a \equiv 18a^3$ will always be true for any value of *a*. We use a three-lined equals sign to indicate identities.

Notation and Vocabulary – Practice Questions

1. Simplify $b + b + 2c$.

2. Simplify $4a - a + 4b - 2b$.

3. Write $0.5c$ so that the coefficient is a fraction.

4. Write the following expression with fraction coefficients: $1.8a + 0.25b$

5. Calculate the value of $a^2 + b^2$ if $a = 6$ and $b = 1$.

6. Calculate the value of $(2p + q) - r^2$ if $p = 5$, $q = 3$ and $r = 4$.

7. At a party, there are 10 pizzas. The pizzas must be divided evenly between x number of party guests. Write an expression for the pizza each guest receives.

8. Tom has x number of sweets. He gives y number of sweets to his sister and z number of sweets to his brother. Write an expression for the sweets Tom has left.

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