GCSE Maths – Algebra

Notation and Vocabulary

Worksheet

WORKED SOLUTIONS

This worksheet will show you how to work out different types of notation and vocabulary questions. Each section contains a worked example, a question with hints and then questions for you to work through on your own.

Section A

Worked Example

Simplify $a + 2a + a + b$

Step 1: Recall how to simplify algebraic operations.

- *Addition is written simply as* $a\ +\ b$
- *Subtraction is written as* $a\ -\ b$
- *Multiplication is shown by putting the numbers or letters together. For example,* $3 \times a = 3a$*. When multiplying two algebraic letters, we put them together too, e.g.* $a \times b\ =\ ab$*.*
- *Division is shown by writing a fraction. If we were to divide a by b, we write this as* $\frac{a}{b}$*.*

Step 2: Write the simplified expression.

We collect like terms (terms that are the same). In this case, we can add the all the 'a's together.

$$a + 2a + a + b = \mathbf{4a + b}$$

Guided Example

Simplify $a \times b \times c$

Step 1: Recall how to simplify algebraic operations.

Multiplication is shown by putting the numbers or letters together.

Step 2: Write the simplified expression.

The algebraic letters can be put together:

$$a \times b \times c = abc$$

Now it's your turn!
If you get stuck, look back at the worked and guided examples.

1. Simplify the following operations:

a) $b + b + 2c$

$= b + b + 2c$ → the b can be added together as they are like terms

$= 2b + 2c$

b) $x \div 3y$

$= x \div 3y$ → change to fraction

$= \frac{x}{3y}$ → this term can't be simplified further

c) $4a - a + 4b - 2b$

$= \underline{4a - a} + \underline{4b - 2b}$ → only substract the terms with the same unknown (ie. a with a and b with b)

$= 3a + 2b$

$4a - 1a = 3a$

$4b - 2b = 2b$

d) $a - (b \div c)$

$= a - (b \div c)$ → change this to fraction

$= a - \frac{b}{c}$ → this term cannot be simplified further

Section B

Worked Example

Write $1.25a$ **so that the coefficient is a fraction.**

Step 1: Identify the coefficient of the algebraic term.

The coefficient is the number in front of the letter. Here, it is 1.25.

Step 2: Convert the coefficient into a fraction.

To do this, we need to identify the number of columns in the decimal. There is a digit in the tens and hundreds column, so we write this decimal as a whole number as the numerator, and have a factor of 10 as the denominator, like this:

$$\frac{125}{100}$$

Then look to simplify this fraction by finding the highest common factor of the numerator and denominator.

$$\frac{125}{100} = \frac{5}{4}$$

Step 3: Write the new term.

The answer is $\frac{5}{4}a$.

Guided Example

Write $0.7b - 2.3a$ **so that the coefficients are fractions.**

Step 1: Identify the coefficients of the algebraic terms.

The coefficient for b is 0.7.
The coefficient for a is −2.3.

The coefficient is the number in front of the letter.

Step 2: Convert the coefficients into fractions.

coefficient for b : $0.7 = \frac{7}{10}$

coefficient for a $= -2.3 = -\frac{23}{10}$

these fractions cannot be simplified further

Step 3: Write the new term form.

$\frac{7}{10}b - \frac{23}{10}a$

Now it's your turn!
If you get stuck, look back at the worked and guided examples.

2. Write the following terms so that any algebraic coefficients are in fractional form:

a) $0.5c$

The coefficient is 0.5.

Change 0.5 to fraction $= \frac{5}{10} = \frac{1}{2}$ → simplify the fraction

Answer: $\frac{1}{2}c$ (alternatively, you can also write as $\frac{c}{2}$)

b) $5.6b - 1.4a$

The coefficient for $b = 5.6$

$5.6 = \frac{56}{10} = \frac{56 \div 2}{10 \div 2} = \frac{28}{5}$

$$\begin{array}{r} 28 \\ 2\overline{)56} \\ 4 \\ \hline 16 \\ 16 \\ \hline \end{array}$$

The coefficient for $a = -1.4$

$-1.4 = -\frac{14}{10} = -\frac{14 \div 2}{10 \div 2} = -\frac{7}{5}$

Answer: $\frac{28}{5}b - \frac{7}{5}a$

c) $1.8a + 0.25b$

The coefficient for a is 1.8.

$1.8 = \frac{18}{10} = \frac{18 \div 2}{10 \div 2} = \frac{9}{5}$

The coefficient for b is 0.25

$0.25 = \frac{25}{100} = \frac{25 \div 25}{100 \div 25} = \frac{1}{4}$

Answer: $\frac{9}{5}a + \frac{1}{4}b$

d) $0.85(a - c) + 4.5 - 5.2a^2$

Expand the bracket $= 0.85(a-c) + 4.5 - 5.2a^2$

$= 0.85a - 0.85c + 4.5 - 5.2a^2$

collect like terms $= \frac{17}{20}a - \frac{26}{5}a^2 - \frac{17}{20}c + \frac{9}{2}$

change decimals to fraction:

$0.85 = \frac{85}{100} = \frac{85 \div 5}{100 \div 5} = \frac{17}{20}$

$4.5 = \frac{45}{10} = \frac{45 \div 5}{10 \div 5} = \frac{9}{2}$

$5.2 = \frac{52}{10} = \frac{52 \div 2}{10 \div 2} = \frac{26}{5}$

Section C

Worked Example

Work out the value of $2a^2$ when $a = 3$.

Step 1: Substitute in any given values.

We have been told that $a = 3$.

We can substitute this number in for 'a' but remember to perform the operations in the right order (BIDMAS).

$$2a^2 = 2 \times (3^2) = 2 \times 9 = \mathbf{18}$$

Guided Example

Calculate the value of $3a + 4b$ when $a = 5$ and $b = 2$.

Step 1: Substitute in any given values.

$= 3a + 4b$

$= 3(5) + 4(2)$

$= 15 + 8$

$= 23$

Now it's your turn!
If you get stuck, look back at the worked and guided examples.

3. Calculate:

a) The value of $a^2 + b^2$ when $a = 6$ and $b = 1$.

$= a^2 + b^2$
$= (6)^2 + (1)^2$
$= 36 + 1$
$= \boxed{37}$

b) The value of $10x^2y$ when $x = 3$ and $y = 2$.

$= 10x^2y$
$= 10 \times x^2 \times y$
$= 10 \times (3)^2 \times (2)$
$= 10 \times 9 \times 2$
$= 90 \times 2$
$= \boxed{180}$

c) The value of $2(p+q) - r^2$ when $p = 5$, $q = 3$ and $r = 4$.

expand
$= 2(p+q) - r^2$
$= 2p + 2q - r^2$
$= 2(5) + 2(3) - (4)^2$
$= 10 + 6 - 16$
$= 16 - 16$
$= \boxed{0}$

d) The value of $2ab^3 - \frac{2(a-b)}{c}$ when $a = 4$, $b = 3$ and $c = 0.5$

$= 2ab^3 - \frac{2(a-b)}{c}$ expand

$= 2 \times a \times b^3 - \frac{2(a-b)}{c} = 2 \times a \times b^3 - \frac{(2a - 2b)}{c}$ solve in the bracket first before dividing

$= 2 \times 4 \times (3)^3 - \frac{(2(4) - 2(3))}{0.5} = 8 \times 27 - \frac{(8-6)}{0.5} = 216 - \frac{2}{0.5}$

$= 216 - 4 = \boxed{212}$

Section D

Worked Example

In a shop, the price of an egg is a and the price of a loaf of bread is b. Sally wants to buy 12 eggs and 2 loaves of bread. Write an expression for the price of the eggs and loaves of bread.

Step 1: Work out each term of the expression.

We need to multiply the number of eggs Sally buys by the price per egg, and similarly the number of loaves of bread by the price per loaf.

$$Total\ price\ of\ eggs = 12 \times a$$
$$Total\ price\ of\ bread = 2 \times b$$

Step 2: Write the terms in algebraic form, then write the whole expression.

When multiplying together numbers and letters, we put them next to each other to represent multiplication:

$$Total\ price\ of\ eggs = 12a$$
$$Total\ price\ of\ bread = 2b$$

Then we need to write out the expression of the cost of eggs and bread together:

$$Total\ cost = 12a + 2b$$

Guided Example

At a factory, there are 3 machines making calculators. Each machine makes x number of calculators per hour. Write an expression for the total number of calculators made by the factory in 15 hours.

Step 1: Work out each term of the expression.

number of calculators made per 1 machine per hour = x

number of calculators made by 3 machines per hour = $3x$

Step 2: Write the terms in algebraic form, then write the whole expression.

1 hour = $3x$

15 hours = $3x \times 15$

= $45x$

Total number of calculators made by factory in 15 hours = $45x$

Now it's your turn!
If you get stuck, look back at the worked and guided examples.

4. 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.

number of party guests : x
number of pizzas = 10
Pizza each guest receives : $\frac{10}{x}$

5. A café makes £x per hour. On a particular day, they are open for 8 hours. 4 people work at the café for 10 hours, each earning £y per hour, which comes out of the café's takings. Write an expression for the total profit of the café, after paying the 4 workers.

8 hours
Total sales by the cafe : $x \times 8 = 8x$
Salary for 1 worker : $y \times 10 = 10y$ → 10 hours worked
Salary for 4 workers : $10y \times 4 = 40y$ → there are 4 workers
Total profit of the cafe : £ $(8x - 40y)$
sales deducted by the salary of workers

6. 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.

number of sweets Tom has : x
number of sweets given to his sister : y
number of sweets given to his brother = z
Sweets Tom has left = $x - y - z$
substract with number of sweets given to others

7. Richard is collecting stones on the beach. He collects a number of stones and gives half of his stones to his friend Courtney. Richard then finds 10 more stones, and keeps them. Write an expression for the number of stones Richard has now.

Initial number of stones Richard collected = a
Number of stones given to Courtney = $\frac{a}{2}$
Additional stones collected later = 10
this can be substracted
Number of stones Richard has now $= \left[a - \frac{a}{2}\right] + 10$
$= \frac{a}{2} + 10$