

# Algebraic Notation and Vocabulary

## Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

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Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

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**1** (4 marks)

Write each of these using correct algebraic notation.

(a)  $a \times b$

Letters multiplied together are written next to each other.

Leave out the  $\times$  sign.

**Answer:**  $ab$

(b)  $y \div 4$

In algebra, division is written as a fraction.

$y \div 4$  is  $y$  over 4.

**Answer:**  $\frac{y}{4}$

(c)  $p \times p$

A letter multiplied by itself is written as a square.

$$p \times p = p^2$$

**Answer:**  $p^2$

**Tip:**  $p \times p$  is  $p^2$ , not  $2p$ .  $2p$  means  $p + p$ . Write the small 2 clearly raised, so  $p^2$  does not look like  $p2$ .

(d)  $3 \times (x + 2)$

The number goes in front of the bracket.

Leave out the  $\times$  sign.

**Answer:**  $3(x + 2)$

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**2** (1 mark)

Circle the expression that is equal to  $y + y + y + y$

Options:  $y^4$ ,  $4y$ ,  $y + 4$ ,  $4 + y$

$y + y + y + y$  is four lots of  $y$ .

Four lots of  $y$  is  $4y$ .

**Answer:**  $4y$

**Tip:** Adding the same letter gives a number in front:  $y + y + y + y = 4y$ . Multiplying gives a power:  $y \times y \times y \times y = y^4$ .

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**3** (1 mark)

$$3x + 5 = 11$$

Circle the word that describes this.

Options: expression, equation, formula, identity

It has an equals sign.

It is only true for one value of  $x$  (here  $x = 2$ ).

So it is an equation.

**Answer:** equation

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**4** (3 marks)

Tick **one** box for each row.

|                          | Expression | Equation | Formula | Identity |
|--------------------------|------------|----------|---------|----------|
| $5a + 2b$                | ✓          |          |         |          |
| $A = lw$                 |            |          | ✓       |          |
| $4x - 1 = 11$            |            | ✓        |         |          |
| $2(x + 3) \equiv 2x + 6$ |            |          |         | ✓        |

$5a + 2b$  has no equals sign, so it is an **expression**.

$A = lw$  connects different quantities (area, length and width), so it is a **formula**.

$4x - 1 = 11$  is only true for one value ( $x = 3$ ), so it is an **equation**.

$2(x + 3) \equiv 2x + 6$  is true for every value of  $x$ , so it is an **identity**.

The  $\equiv$  sign tells you it is an identity.

**Tip:** Learn the four words. **Expression:** no = sign. **Equation:** you can solve it. **Formula:** a rule linking letters that stand for real quantities. **Identity:** true for all values ( $\equiv$ ).

*Marks:* 3 marks for all four correct. 2 marks for three correct. 1 mark for two correct.

**5** (3 marks)

Here is an expression.  $7x - 3y + 5$

(a) How many terms does the expression have?

The terms are  $7x$ ,  $-3y$  and  $5$ .

That is 3 terms.

**Answer: 3**

(b) Write down the coefficient of  $y$ .

The coefficient is the number in front of the letter.

Include its sign: the term is  $-3y$ .

**Answer:**  $-3$

**Tip:** A term includes the sign in front of it. The  $y$  term here is  $-3y$ , not  $3y$ .

(c) Write down the constant term.

The constant term is the term with no letter.

Here that is 5.

**Answer:** 5

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**6** (1 mark)

$T$  is 5 less than  $s$ .

Circle the correct formula.

Options:  $T = 5 - s$ ,  $T = s - 5$ ,  $T = 5s$ ,  $T = \frac{s}{5}$

'5 less than  $s$ ' means start with  $s$ .

Then subtract 5.

So  $T = s - 5$

**Answer:**  $T = s - 5$

**Tip:** Test it with a number. If  $s = 12$ , then 5 less is 7.  $12 - 5 = 7$  ✓ but  $5 - 12 = -7$ , which is wrong.

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**7** (3 marks)

$c$  and  $d$  are positive whole numbers.

$c$  is even.

$d$  is odd.

Tick a box for each expression.

|               | Even | Odd | Cannot tell |
|---------------|------|-----|-------------|
| $c + d$       |      | ✓   |             |
| $3c$          | ✓    |     |             |
| $cd$          | ✓    |     |             |
| $\frac{c}{2}$ |      |     | ✓           |

Try  $c = 4$  and  $d = 3$ :

$$c + d = 7 \text{ (odd)} \quad 3c = 12 \text{ (even)} \quad cd = 12 \text{ (even)} \quad \frac{c}{2} = 2 \text{ (even)}$$

Now try  $c = 6$ :  $\frac{c}{2} = 3$ , which is odd.

So for  $\frac{c}{2}$  we cannot tell.

The other three are always the same:

Even + odd is always odd, so  $c + d$  is odd.

Even  $\times$  any whole number is always even, so  $3c$  and  $cd$  are even.

**Tip:** Try more than one set of numbers. One example can hide a 'Cannot tell' answer.

*Marks:* 3 marks for all four correct. 2 marks for three correct. 1 mark for two correct.

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**8** (2 marks)

(a) Circle the expression that means 'multiply  $n$  by 4, then subtract 3'.

Options:  $4n - 3$ ,  $4(n - 3)$ ,  $3 - 4n$ ,  $n - 12$

Multiply first:  $4n$

Then subtract 3:  $4n - 3$

**Answer:**  $4n - 3$

- (b) Circle the expression that means 'subtract 3 from  $n$ , then multiply by 4'.

Options:  $4n - 3$ ,  $4(n - 3)$ ,  $3 - 4n$ ,  $n - 12$

Subtract first:  $n - 3$

The whole of  $n - 3$  is then multiplied by 4.

So  $n - 3$  goes in a bracket:  $4(n - 3)$

**Answer:**  $4(n - 3)$

**Tip:** When the adding or subtracting happens first, you need a bracket.

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**9** (2 marks)

Tom says,

' $y^2$  and  $2y$  always have the same value.'

Show that Tom is wrong.

$y^2$  means  $y \times y$ .

$2y$  means  $2 \times y$ .

Try  $y = 3$ :

$$y^2 = 3 \times 3 = 9$$

$$2y = 2 \times 3 = 6$$

$9 \neq 6$ , so  $y^2$  and  $2y$  do not always have the same value. Tom is wrong.

**Tip:** Do not use  $y = 2$  or  $y = 0$ : they give the same value for both, so they do not show Tom is wrong.

**Marks:** 1 mark for putting a value (not 0 or 2) into both. 1 mark for two correct values and saying Tom is wrong.

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**10** (1 mark)

Sam says,

' $3(x + 4) \equiv 3x + 4$  is an identity.'

Is he correct? Tick a box.

Give a reason for your answer.

Multiply both terms in the bracket by 3:

$$3(x + 4) = 3x + 12, \text{ not } 3x + 4.$$

For example, when  $x = 1$ :  $3(1 + 4) = 15$

$$\text{but } 3 \times 1 + 4 = 7$$

So Sam is not correct.

**Answer:** No, because  $3(x + 4) = 3x + 12$

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**11** (2 marks)

Here are some terms.

$$3x \quad 5y \quad x^2 \quad -2x \quad 4 \quad 7y^2$$

(a) Write down the term that is a like term of  $3x$

Like terms have exactly the same letters and powers.

$-2x$  is the only other term in  $x$ .

**Answer:**  $-2x$

(b) Write down the term that is a like term of  $3x^2$

We need the same letter with the same power.

$x^2$  matches  $3x^2$ .

**Answer:**  $x^2$

**Tip:**  $3x$  and  $3x^2$  are not like terms. The power must match as well as the letter.

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**12** (2 marks)

$n$  is a positive whole number.

- (a) Circle the expression that is **always** even.

Options:  $n + 1$ ,  $2n + 1$ ,  $2n$ ,  $n^2$

$2n$  is 2 times a whole number, so it is always even.

$n + 1$  and  $n^2$  can be odd or even, depending on  $n$ .

$2n + 1$  is always odd.

**Answer:**  $2n$

- (b) Circle the expression that is **always** odd.

Options:  $3n$ ,  $2n + 3$ ,  $n + 2$ ,  $4n$

$$2n + 3 = 2n + 2 + 1$$

$2n + 2$  is even.

Even + 1 is odd, so  $2n + 3$  is always odd.

**Answer:**  $2n + 3$

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**13** (2 marks)

Write = or  $\equiv$  in each box to make a correct statement.

(a)  $2(x + 5)$    $2x + 10$

$$2(x + 5) = 2x + 10 \text{ for every value of } x.$$

So this is an identity: use  $\equiv$ .

**Answer:**  $\equiv$

(b)  $2x + 5$   11

This is only true when  $x = 3$ .

So it is an equation: use =.

**Answer:** =

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**14** (2 marks)

Is each statement true for all values of  $x$ , some values of  $x$  or no values of  $x$ ?  
Tick **one** box in each row.

|                  | All values | Some values | No values |
|------------------|------------|-------------|-----------|
| $x + 3 = x + 5$  |            |             | ✓         |
| $4x + 8 = 20$    |            | ✓           |           |
| $x + x + x = 3x$ | ✓          |             |           |

$x + 3 = x + 5$ : take  $x$  from both sides to get  $3 = 5$ , which is never true. So: **no values**.

$4x + 8 = 20$ : this is an equation.  $4x = 12$ , so it is only true when  $x = 3$ . So: **some values**.

$x + x + x = 3x$ : three lots of  $x$  is always  $3x$ , whatever  $x$  is. So: **all values** (it is an identity).

**Answer:** no values; some values; all values

**Tip:** Not every statement with an = sign has a solution. If the  $x$  terms cancel and leave something false, such as  $3 = 5$ , it is true for no values.

*Marks:* 2 marks for all three rows correct. 1 mark for two rows correct.

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**15** (3 marks)

$k$  is a positive whole number.

- (a) Write down, in terms of  $k$ , the whole number that is 1 less than  $k$

1 less than  $k$  means take 1 away from  $k$ .

**Answer:**  $k - 1$

**Tip:** Write  $k - 1$ , not  $1 - k$ . “1 less than  $k$ ” starts with  $k$ .

- (b) Show that the total of  $k$  and the whole number that is 1 less than  $k$  is always odd.

Add the two numbers:  $k + (k - 1) = 2k - 1$

$2k$  is 2 times a whole number, so it is even.

$2k - 1$  is one less than an even number.

So  $2k - 1$  is always odd.

**Tip:** Trying a few numbers is not enough to show something is *always* true. Use algebra and explain in words.

*Marks:* 1 mark for  $k + k - 1$  or  $2k - 1$ . 1 mark for  $2k - 1$  with an explanation, e.g. ‘ $2k$  is even, so  $2k - 1$  is odd’.

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