

Simplifying Expressions and Collecting Like Terms

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

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.

1 (4 marks)

(a) Simplify fully $n + n + n + n + n$

Count the n 's: there are five of them.

Five lots of n is $5n$.

Answer: $5n$

Tip: Adding gives a number in front: $n + n + n + n + n = 5n$, not n^5 .

(b) Simplify fully $y \times y \times y$

y is multiplied by itself 3 times.

This is y cubed.

Answer: y^3

(c) Simplify fully $4 \times 3p$

Multiply the numbers: $4 \times 3 = 12$

Keep the letter: $12p$

Answer: $12p$

(d) Simplify fully $8m \div m$

Write it as a fraction: $\frac{8m}{m}$

The m on the top and the m on the bottom cancel.

This leaves 8.

Answer: 8

Tip: Any letter divided by itself is 1, so $8m \div m = 8 \times 1 = 8$, not $8m$.

2 (1 mark)

Simplify $3 \times a \times 2 \times b$

Circle your answer.

Options: $5ab$, $6ab$, $32ab$, $6a + b$

Multiply the numbers: $3 \times 2 = 6$

Write the letters next to each other, in alphabetical order: ab

Answer: $6ab$

Tip: The numbers are multiplied, not added. $3 \times 2 = 6$, so the answer is not $5ab$.

3 (1 mark)

Simplify fully $7x + 2x - 4x$

All the terms are x terms.

Work out the numbers: $7 + 2 - 4 = 5$

Answer: $5x$

4 (2 marks)

Simplify fully $6a + 5b + 2a - 3b$

Collect the a terms: $6a + 2a = 8a$

Collect the b terms: $5b - 3b = 2b$

Put them together: $8a + 2b$

Answer: $8a + 2b$

Tip: $8a + 2b$ is fully simplified. a and b are different letters, so do not combine them into $10ab$.

Marks: 2 marks for $8a + 2b$. 1 mark for $8a$ or $+2b$ in an expression.

5 (3 marks)

(a) Simplify fully $9m + 4 - 3m + 7$

Collect the m terms: $9m - 3m = 6m$

Collect the numbers: $+4 + 7 = 11$

Put them together: $6m + 11$

Answer: $6m + 11$

Tip: Each sign belongs to the term after it. The $-$ is only in front of $3m$, so the 7 is still added: $+4 + 7 = 11$, not $4 - 7$.

Marks: 2 marks for $6m + 11$. 1 mark for $6m$ or $+11$.

(b) Simplify fully $5c \times 3d$

Multiply the numbers: $5 \times 3 = 15$

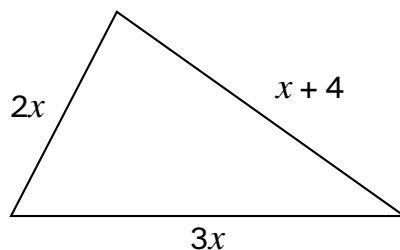
Multiply the letters: $c \times d = cd$

Answer: $15cd$

6 (2 marks)

Here is a triangle.

All lengths are in centimetres.



Not drawn accurately

Work out an expression for the perimeter of the triangle.

Give your answer in its simplest form.

The perimeter is the total of all three sides.

$$\text{Perimeter} = 2x + 3x + (x + 4)$$

$$\text{Collect the } x \text{ terms: } 2x + 3x + x = 6x$$

$$\text{So the perimeter is } 6x + 4$$

Answer: $6x + 4$ cm

Marks: 1 mark for adding all three sides, e.g. $2x + 3x + x + 4$. 1 mark for $6x + 4$.

7 (1 mark)

Tom simplifies $5x + 3y - 2x + y$

He writes $3x + 2y$

Is he correct? Tick a box.

Give a reason for your answer.

$$\text{Collect the } x \text{ terms: } 5x - 2x = 3x$$

$$\text{Collect the } y \text{ terms: } 3y + y = 4y$$

$$\text{So the answer should be } 3x + 4y.$$

Tom subtracted the last y instead of adding it.

Answer: No, because $+y$ means add y , so the y terms give $3y + y = 4y$, not $2y$.

8 (3 marks)

(a) Simplify fully $\frac{15h}{3}$

Divide the number by 3: $15 \div 3 = 5$

Keep the letter.

Answer: $5h$

(b) Simplify fully $\frac{10y}{15y}$

The y on the top and the y on the bottom cancel.

This leaves $\frac{10}{15}$

Divide the top and bottom by 5: $\frac{10}{15} = \frac{2}{3}$

Answer: $\frac{2}{3}$

Marks: 1 mark for $\frac{10}{15}$ or $\frac{2y}{3y}$. 1 mark for $\frac{2}{3}$.

9 (3 marks)

(a) Simplify fully $5p^2 - p^2$

p^2 means $1p^2$.

$$5p^2 - 1p^2 = 4p^2$$

Answer: $4p^2$

Tip: Only the number in front changes. The p^2 stays as it is, so the answer is $4p^2$, not 4 or $4p$.

(b) Simplify fully $4x^2 + 3x - 5 - x^2 - 7x + 2$

Collect the x^2 terms: $4x^2 - x^2 = 3x^2$

Collect the x terms: $3x - 7x = -4x$

Collect the numbers: $-5 + 2 = -3$

x^2 and x are *different* terms, so they cannot be collected together.

Answer: $3x^2 - 4x - 3$

Marks: 2 marks for $3x^2 - 4x - 3$. 1 mark for two of the three terms correct.

10 (1 mark)

Circle the expression which does **not** simplify to $6x$

Options: $2x + 4x$, $3 \times 2x$, $8x - 2x$, $2x \times 3x$

$$2x + 4x = 6x$$

$$3 \times 2x = 6x$$

$$8x - 2x = 6x$$

But $2x \times 3x = 6x^2$, because $x \times x = x^2$.

Answer: $2x \times 3x$

11 (3 marks)

(a) Simplify fully $2xy + 5x - 3xy + x$

Collect the xy terms: $2xy - 3xy = -1xy = -xy$

Collect the x terms: $5x + x = 6x$

xy and x are different terms, so stop here.

Answer: $6x - xy$ (or $-xy + 6x$)

Marks: 2 marks for the correct answer. 1 mark for $-xy$ or $6x$.

- (b) Simplify fully $3a \times 2a \times b$

Multiply the numbers: $3 \times 2 = 6$

Multiply the letters: $a \times a \times b = a^2b$

Answer: $6a^2b$

12 (6 marks)

p is 6 more than m .

q is 2 less than m .

- (a) Write an expression for p in terms of m .

'6 more than m ' means add 6 to m .

Answer: $m + 6$

- (b) Write an expression for q in terms of m .

'2 less than m ' means subtract 2 from m .

Answer: $m - 2$

Tip: '2 less than m ' is $m - 2$, not $2 - m$. Start with m , then take away 2.

- (c) Work out $p + q$
Simplify your answer.

$$p + q = (m + 6) + (m - 2)$$

Collect the m terms: $m + m = 2m$

Collect the numbers: $6 - 2 = 4$

Answer: $2m + 4$

Marks: 1 mark for $m + 6 + m - 2$ (using your answers to (a) and (b)). 1 mark for $2m + 4$.

(d) Show that $p - q$ is always equal to 8

$$p - q = (m + 6) - (m - 2)$$

The minus sign changes the sign of *both* terms in the second bracket:

$$(m + 6) - (m - 2) = m + 6 - m + 2$$

The m terms cancel: $m - m = 0$

This leaves $6 + 2 = 8$

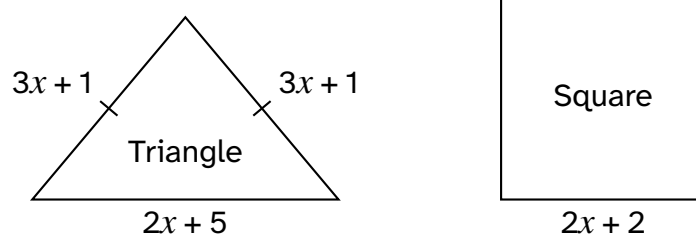
So $p - q = 8$ for every value of m .

Tip: Put the whole of q in a bracket before you subtract it. Subtracting -2 is the same as adding 2.

Marks: 1 mark for $m + 6 - (m - 2)$ or $m + 6 - m + 2$. 1 mark for fully correct working that leads to 8.

13 (3 marks)

Here are an isosceles triangle and a square.
All lengths are in centimetres.



Not drawn accurately

Show that the perimeter of the triangle is always 1 cm less than the perimeter of the square.

The triangle has two sides of $3x + 1$ and one side of $2x + 5$.

Triangle: $(3x + 1) + (3x + 1) + (2x + 5) = 8x + 7$

A square has four equal sides.

Square: $4 \times (2x + 2) = 8x + 8$

Difference: $(8x + 8) - (8x + 7) = 1$

So the triangle's perimeter is always 1 cm less than the square's.

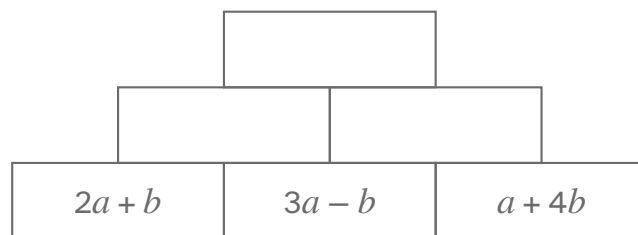
Answer: Triangle $8x + 7$, square $8x + 8$, and $8x + 8 - (8x + 7) = 1$

Tip: Multiply **every** term in the bracket by 4: $4(2x + 2) = 8x + 8$, not $8x + 2$.

Marks: 1 mark for a correct expression for either perimeter. 1 mark for both $8x + 7$ and $8x + 8$. 1 mark for showing the difference is 1.

14 (3 marks)

In this wall, the expression in each brick is the sum of the expressions in the two bricks directly below it.



Work out the expression for the top brick.

Give your answer in its simplest form.

Add pairs of bricks to fill the middle row.

Left middle brick: $(2a + b) + (3a - b) = 5a$

Right middle brick: $(3a - b) + (a + 4b) = 4a + 3b$

Top brick: $5a + (4a + 3b) = 9a + 3b$

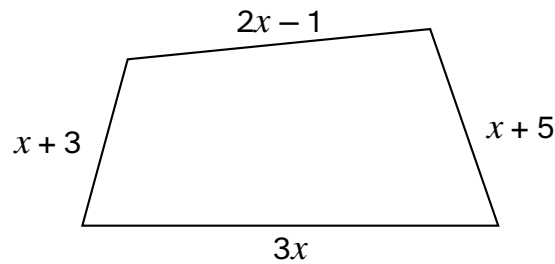
Answer: $9a + 3b$

Marks: 1 mark for one correct middle brick. 1 mark for both middle bricks correct. 1 mark for $9a + 3b$.

15 (3 marks)

Here is a quadrilateral.

All lengths are in centimetres.



Not drawn accurately

The perimeter of the quadrilateral is P cm.

Write a formula for P in terms of x .

Give your answer in its simplest form.

Add all four sides:

$$P = 3x + (x + 5) + (2x - 1) + (x + 3)$$

Collect the x terms: $3x + x + 2x + x = 7x$

Collect the numbers: $5 - 1 + 3 = 7$

A *formula* must start with ' $P =$ '.

Answer: $P = 7x + 7$

Tip: Do not combine $7x + 7$ into $14x$. A number and an x term are not like terms.

Marks: 1 mark for adding all four sides. 1 mark for $7x + 7$. 1 mark for a formula starting $P =$.