

Factorising into Single Brackets

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 (2 marks)

(a) Factorise $5a + 10$

The highest common factor (HCF) of $5a$ and 10 is 5 .

Divide each term by 5 :

$$5a \div 5 = a$$

$$10 \div 5 = 2$$

Answer: $5(a + 2)$

(b) Factorise $21x + 28$

The HCF of 21 and 28 is 7 .

$$21x \div 7 = 3x$$

$$28 \div 7 = 4$$

Answer: $7(3x + 4)$

2 (1 mark)

Factorise $12a + 15b$

The HCF of 12 and 15 is 3 .

There is no letter in both terms, so only 3 goes outside the bracket.

$$12a \div 3 = 4a$$

$$15b \div 3 = 5b$$

Answer: $3(4a + 5b)$

Tip: Factorising does not mean adding the terms. $12a$ and $15b$ are not like terms, so $12a + 15b$ can never be $27ab$.

3 (1 mark)

Which is the correct factorisation of $6x - 9$?

Circle your answer.

Options: $3(2x - 9)$, $6(x - 3)$, $3(2x - 3)$, $2(3x - 9)$

The HCF of 6 and 9 is 3.

$$\text{So } 6x - 9 = 3(2x - 3)$$

Check by expanding:

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

$$3 \times (-3) = -9 \quad \checkmark$$

Answer: $3(2x - 3)$

Tip: You can check any factorisation by expanding the bracket. You should get back to the expression you started with.

4 (3 marks)

(a) Factorise $x^2 + 7x$

Both terms have a common factor of x .

$$x^2 \div x = x$$

$$7x \div x = 7$$

Answer: $x(x + 7)$

(b) Factorise fully $3x^2 + 12x$

Number part: the HCF of 3 and 12 is 3.

Letter part: both terms contain x .

So the HCF is $3x$.

$$3x^2 \div 3x = x$$

$$12x \div 3x = 4$$

Answer: $3x(x + 4)$

Tip: "Factorise fully" means take out the **highest** common factor, including any letters.

Marks: 2 marks for the correct answer. 1 mark if it is only partly factorised, e.g. $3(x^2 + 4x)$ or $x(3x + 12)$.

5 (2 marks)

Factorise fully $40y + 80$

The HCF of 40 and 80 is 40 (not 10 or 20).

$$40y \div 40 = y$$

$$80 \div 40 = 2$$

Answer: $40(y + 2)$

Tip: After factorising, look inside the bracket. If the terms still have a common factor, you have not finished.

Marks: 2 marks for the correct answer. 1 mark for a partly factorised answer, e.g. $10(4y + 8)$ or $20(2y + 4)$.

6 (2 marks)

Mia factorises $8x + 12$

She writes $2(4x + 6)$

Her teacher says her answer is correct but it is not fully factorised.

(a) Explain why $2(4x + 6)$ is not fully factorised.

Look at the terms inside the bracket: $4x$ and 6.

They still have a common factor of 2.

Answer: $4x$ and 6 still have a common factor (2), so more can be taken outside the bracket.

(b) Factorise $8x + 12$ fully.

The HCF of 8 and 12 is 4.

$$8x \div 4 = 2x$$

$$12 \div 4 = 3$$

Answer: $4(2x + 3)$

7 (2 marks)

Tick **one** box for each statement.

	True	False
$4x + 20 = 4(x + 5)$	✓	
$3y - 12 = 3(y - 12)$		✓
$x^2 + x = x(x + 1)$	✓	
$10a + 5 = 5(2a + 5)$		✓

Check each one by expanding the bracket.

$$4(x + 5) = 4x + 20 \quad \checkmark$$

$$3(y - 12) = 3y - 36, \text{ not } 3y - 12$$

$$x(x + 1) = x^2 + x \quad \checkmark$$

$$5(2a + 5) = 10a + 25, \text{ not } 10a + 5$$

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

8 (2 marks)

(a) Write the missing terms in the boxes.

$$6a + 18 = 6(\square + \square)$$

$$6a \div 6 = a$$

$$18 \div 6 = 3$$

Answer: $6(a + 3)$

(b) Write the missing number in the box.

$$14b - 21 = \square (2b - 3)$$

The box times $2b$ must make $14b$.

$$14b \div 2b = 7$$

$$\text{Check: } 7 \times 3 = 21 \quad \checkmark$$

Answer: $7(2b - 3)$

9 (2 marks)

Factorise fully $18y^2 - 12y$

Number part: the HCF of 18 and 12 is 6.

Letter part: both terms contain y .

So the HCF is $6y$.

$$18y^2 \div 6y = 3y$$

$$12y \div 6y = 2$$

Answer: $6y(3y - 2)$

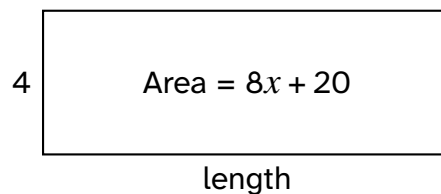
Tip: Keep the minus sign: the second term inside the bracket is -2 .

Marks: 2 marks for the correct answer. 1 mark for a partly factorised answer, e.g. $6(3y^2 - 2y)$ or $3y(6y - 4)$.

10 (2 marks)

The area of this rectangle is $(8x + 20) \text{ cm}^2$

The width of the rectangle is 4 cm.



Not drawn accurately

Work out an expression for the length of the rectangle.

Area = width $\times$ length

So $8x + 20 = 4 \times \text{length}$

Factorise the area: $8x + 20 = 4(2x + 5)$

So the length is $2x + 5$.

Answer: $2x + 5 \text{ cm}$

Marks: 1 mark for $(8x + 20) \div 4$ or $4(2x + 5)$. 1 mark for $2x + 5$.

11 (2 marks)

Factorise fully $4p^2q + 10pq^2$

Number part: the HCF of 4 and 10 is 2.

Letter part: both terms contain p and q .

So the HCF is $2pq$.

$$4p^2q \div 2pq = 2p$$

$$10pq^2 \div 2pq = 5q$$

Answer: $2pq(2p + 5q)$

Marks: 2 marks for the correct answer. 1 mark for a partly factorised answer, e.g. $2p(2pq + 5q^2)$.

12 (1 mark)

Circle the expression that **cannot** be factorised.

Options: $4x + 6$, $x^2 + 3x$, $5x + 7$, $9 - 3x$

$$4x + 6 = 2(2x + 3)$$

$$x^2 + 3x = x(x + 3)$$

$$9 - 3x = 3(3 - x)$$

5 and 7 have no common factor (other than 1), and only one term contains x .

Answer: $5x + 7$

13 (4 marks)

n is a positive whole number.

(a) Show that $6n + 15$ is always a multiple of 3

$$\text{Factorise: } 6n + 15 = 3(2n + 5)$$

$2n + 5$ is a whole number.

So $3(2n + 5)$ is 3 times a whole number.

This means it is always a multiple of 3.

Tip: In “show that” questions, finish with a sentence that says what you have shown.

Marks: 1 mark for $3(2n + 5)$. 1 mark for explaining why this is a multiple of 3.

- (b) Is $5n + 20$ always a multiple of 10?

Tick a box.

Give a reason for your answer.

$5n + 20 = 5(n + 4)$, so it is always a multiple of 5.

But it is not always a multiple of 10.

For example, when $n = 1$: $5 \times 1 + 20 = 25$

25 is not a multiple of 10.

Answer: No. For example, $n = 1$ gives 25, which is not a multiple of 10.

Tip: One example that does not work (a counter-example) is enough to show a statement is not always true.

Marks: 1 mark for No. 1 mark for a correct example or explanation.

14 (3 marks)

- (a) Expand and simplify $3(2x + 4) + 2(x - 2)$

$$3(2x + 4) = 6x + 12$$

$$2(x - 2) = 2x - 4$$

$$\text{Add: } 6x + 12 + 2x - 4 = 8x + 8$$

Answer: $8x + 8$

Marks: 1 mark for $6x + 12$ or $2x - 4$. 1 mark for $8x + 8$.

- (b) Factorise your answer to part (a) fully.

The HCF of $8x$ and 8 is 8.

$$8x \div 8 = x$$

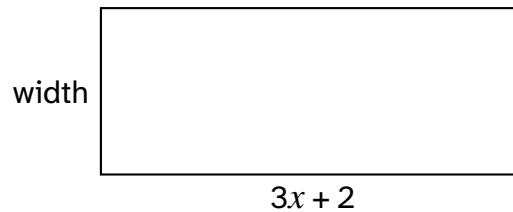
$$8 \div 8 = 1$$

Answer: $8(x + 1)$

Tip: When a term divides exactly by the HCF, it leaves 1, not 0.

15 (3 marks)

Here is a rectangle.



Not drawn accurately

The perimeter of the rectangle is $(10x + 6)$ cm
Work out an expression for the width of the rectangle.
Give your answer in its simplest form.

$$\text{Perimeter} = 2(\text{length} + \text{width})$$

$$10x + 6 = 2(5x + 3)$$

$$\text{So length} + \text{width} = 5x + 3$$

$$\text{Width} = (5x + 3) - (3x + 2)$$

$$\text{Width} = 2x + 1$$

Answer: $2x + 1$ cm

Tip: Put brackets round $(3x + 2)$ when you subtract it, so that you subtract both terms.

Marks: 1 mark for $(10x + 6) \div 2$ or $5x + 3$. 1 mark for $5x + 3 - (3x + 2)$. 1 mark for $2x + 1$.

16 (2 marks)

Factorise fully $9m^3 - 6m$

Number part: the HCF of 9 and 6 is 3.

Letter part: both terms contain m .

So the HCF is $3m$.

$$9m^3 \div 3m = 3m^2$$

$$6m \div 3m = 2$$

Answer: $3m(3m^2 - 2)$

Marks: 2 marks for the correct answer. 1 mark for $3(3m^3 - 2m)$ or $m(9m^2 - 6)$.
