

Factorising into Single Brackets

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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 $3n + 12$

The highest common factor (HCF) of 3 and 12 is 3.

Divide each term by 3:

$$3n \div 3 = n$$

$$12 \div 3 = 4$$

Answer: $3(n + 4)$

Tip: Divide *both* terms by 3. $3(n + 12)$ is wrong: check by expanding, $3(n + 12) = 3n + 36$.

(b) Factorise $15y - 10$

The HCF of 15 and 10 is 5.

$$15y \div 5 = 3y$$

$$-10 \div 5 = -2$$

Answer: $5(3y - 2)$

2 (2 marks)

(a) Factorise $6a + 15$

The HCF of 6 and 15 is 3.

$$6a \div 3 = 2a$$

$$15 \div 3 = 5$$

Answer: $3(2a + 5)$

Tip: Always check by expanding. $3(a + 5) = 3a + 15$, which is not $6a + 15$.

(b) Factorise $5 - 10m$

The HCF of 5 and 10 is 5.

$$5 \div 5 = 1$$

$$-10m \div 5 = -2m$$

Don't forget the 1.

Answer: $5(1 - 2m)$

3 (2 marks)

(a) Factorise $y^2 + 9y$

Both terms contain y , so take y outside the bracket.

$$y^2 \div y = y$$

$$9y \div y = 9$$

Answer: $y(y + 9)$

Tip: Factorising means writing it with a bracket. Do not add the terms: $y^2 + 9y$ is not $10y^2$.

(b) Factorise $m^2 - 5m$

Both terms contain m , so take m outside the bracket.

$$m^2 \div m = m$$

$$-5m \div m = -5$$

Answer: $m(m - 5)$

4 (2 marks)

Factorise fully $10x^2 + 15x$

Number part: the HCF of 10 and 15 is 5.

Letter part: both terms contain x .

So the HCF is $5x$.

$$10x^2 \div 5x = 2x$$

$$15x \div 5x = 3$$

Answer: $5x(2x + 3)$

Tip: "Factorise fully" means take out the highest common factor, including the letter.
 $5(2x^2 + 3x)$ only gets 1 mark.

Marks: 2 marks for $5x(2x + 3)$. 1 mark for $5(2x^2 + 3x)$ or $x(10x + 15)$.

5 (2 marks)

Factorise fully $12w^2 - 4w$

Number part: the HCF of 12 and 4 is 4.

Letter part: both terms contain w .

So the HCF is $4w$.

$$12w^2 \div 4w = 3w$$

$$-4w \div 4w = -1$$

Answer: $4w(3w - 1)$

Tip: When a whole term is taken out, it leaves 1 behind, not 0. So the bracket is $(3w - 1)$, not $(3w)$.

Marks: 2 marks for $4w(3w - 1)$. 1 mark for a partial factorisation, e.g. $4(3w^2 - w)$ or $2w(6w - 2)$.

6 (2 marks)

Amir says,

' $12x + 18$ factorised fully is $3(4x + 6)$ '

Amir is wrong.

- (a) Explain why Amir is wrong.

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

They still have a common factor of 2.

So the expression is not fully factorised.

Answer: The terms in the bracket ($4x$ and 6) still have a common factor of 2.

- (b) Factorise fully $12x + 18$

The HCF of 12 and 18 is 6.

$$12x \div 6 = 2x$$

$$18 \div 6 = 3$$

Answer: $6(2x + 3)$

7 (2 marks)

Factorise fully $3a^2b + 12ab^2$

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

Letter part: both terms contain a and b .

So the HCF is $3ab$.

$$3a^2b \div 3ab = a$$

$$12ab^2 \div 3ab = 4b$$

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

Marks: 2 marks for $3ab(a + 4b)$. 1 mark for a partial factorisation, e.g. $3a(ab + 4b^2)$.

8 (2 marks)

- (a) Write down the highest common factor of $12x^2$ and $18x$

The HCF of 12 and 18 is 6.

$x^2 = x \times x$, so x^2 and x have one x in common.

So the HCF is $6x$.

Answer: $6x$

- (b) Hence, factorise fully $12x^2 + 18x$

Use the HCF, $6x$, from part (a).

$$12x^2 \div 6x = 2x$$

$$18x \div 6x = 3$$

Answer: $6x(2x + 3)$

9 (2 marks)

Factorise fully $14c - 7c^2$

Number part: the HCF of 14 and 7 is 7.

Letter part: both terms contain c .

So the HCF is $7c$.

$$14c \div 7c = 2$$

$$-7c^2 \div 7c = -c$$

Answer: $7c(2 - c)$

Marks: 2 marks for $7c(2 - c)$. 1 mark for $7(2c - c^2)$ or $c(14 - 7c)$.

10 (2 marks)

The area of this rectangle is $(6x^2 + 9x) \text{ cm}^2$

The width of the rectangle is $3x \text{ cm}$.

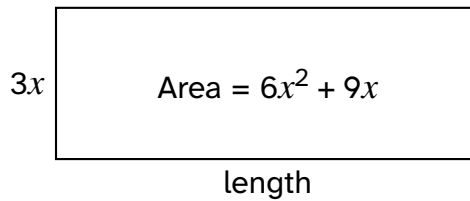


Diagram **NOT** accurately drawn

Find an expression, in terms of x , for the length of the rectangle.

Area = width $\times$ length

So $6x^2 + 9x = 3x \times \text{length}$

Factorise the area, taking out the width $3x$:

$$6x^2 + 9x = 3x(2x + 3)$$

So the length is $2x + 3$.

Answer: $2x + 3 \text{ cm}$

Marks: 1 mark for $3x(\dots)$ or $(6x^2 + 9x) \div 3x$. 1 mark for $2x + 3$.

11 (3 marks)

(a) Expand and simplify $2(3x + 5) + 4(x - 1)$

Expand each bracket:

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

$$4(x - 1) = 4x - 4$$

$$\text{Collect like terms: } 6x + 10 + 4x - 4 = 10x + 6$$

Answer: $10x + 6$

Marks: 1 mark for $6x + 10$ or $4x - 4$. 1 mark for $10x + 6$.

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

The HCF of 10 and 6 is 2.

$$10x \div 2 = 5x$$

$$6 \div 2 = 3$$

Answer: $2(5x + 3)$

12 (2 marks)

The perimeter of this square is $(12x + 20)$ cm



Diagram **NOT** accurately drawn

Find an expression, in terms of x , for the length of one side of the square.

A square has 4 equal sides.

So one side = perimeter $\div 4$.

$$12x + 20 = 4(3x + 5)$$

So one side is $3x + 5$.

Answer: $3x + 5$ cm

Marks: 1 mark for $(12x + 20) \div 4$ or $4(3x + 5)$. 1 mark for $3x + 5$.

13 (2 marks)

n is an integer.

Show that $10n + 25$ is always a multiple of 5

Factorise: $10n + 25 = 5(2n + 5)$

n is an integer, so $2n + 5$ is an integer.

So $10n + 25$ is 5 times an integer.

This means it is always a multiple of 5.

Tip: Finish with a sentence that says what you have shown.

Marks: 1 mark for $5(2n + 5)$. 1 mark for a conclusion, e.g. '5 × an integer, so a multiple of 5'.

14 (2 marks)

Factorise fully $6x^3y + 9xy^2$

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

Letter part: both terms contain x (the lowest power is x) and y (the lowest power is y).

So the HCF is $3xy$.

$$6x^3y \div 3xy = 2x^2$$

$$9xy^2 \div 3xy = 3y$$

Answer: $3xy(2x^2 + 3y)$

Tip: Check the number *and* each letter. Taking out only $3x$ or only $3y$ does not factorise fully.

Marks: 2 marks for $3xy(2x^2 + 3y)$. 1 mark for a partial factorisation, e.g. $3x(2x^2y + 3y^2)$.

15 (3 marks)

Kasia thinks of a whole number.

She multiplies her number by 4 and then adds 9

Next she adds on 2 times the number she first thought of.

Finally she subtracts 3

Show that Kasia's final answer is always a multiple of 6

Let Kasia's number be n .

Multiply by 4 and add 9: $4n + 9$

Add 2 times the number: $4n + 9 + 2n$

Subtract 3: $4n + 9 + 2n - 3 = 6n + 6$

Factorise: $6n + 6 = 6(n + 1)$

$n + 1$ is a whole number, so the answer is 6 times a whole number.

So the final answer is always a multiple of 6.

Tip: Trying a few numbers does not show it is *always* true. Use a letter for the number, then factorise to show the 6 outside the bracket.

Marks: 1 mark for an expression such as $4n + 9 + 2n - 3$. 1 mark for $6n + 6$. 1 mark for $6(n + 1)$ with a conclusion.

16 (2 marks)

Factorise fully $8x^2y - 12xy$

Number part: the HCF of 8 and 12 is 4.

Letter part: both terms contain x and y .

So the HCF is $4xy$.

$$8x^2y \div 4xy = 2x$$

$$-12xy \div 4xy = -3$$

Answer: $4xy(2x - 3)$

Marks: 2 marks for $4xy(2x - 3)$. 1 mark for a partial factorisation, e.g. $4x(2xy - 3y)$.
