

Factorising

GCSE Maths Foundation · Revision Booklet

Topic 1 Factorising expressions (single brackets)

Topic 2 Factorising quadratics

3 sets per topic · Bronze → Silver → Gold · 15 minutes per set · answers and marking notes at the back

Name: _____ Date: _____

How to use this booklet

1. Read the Key Ideas page before you start each topic.
2. Set a timer for 15 minutes for each set. Work without a calculator.
3. Always check your answer by expanding the brackets – you should get back to the question.
4. Mark your work using the answers at the back. Read the “Watch out” notes for anything you got wrong.
5. Record your score and confidence below. Only move up a level when you score at least 80%.

My progress

Set	Level	Focus	Score	Time	Confidence
1A	Bronze	Number common factors	/ 12	min	☐ Not yet ☐ Nearly ☐ Secure
1B	Silver	Letters as common factors	/ 10	min	☐ Not yet ☐ Nearly ☐ Secure
1C	Gold	Fully factorise and reason	/ 17	min	☐ Not yet ☐ Nearly ☐ Secure
2A	Bronze	All positive terms	/ 20	min	☐ Not yet ☐ Nearly ☐ Secure
2B	Silver	Negative terms	/ 20	min	☐ Not yet ☐ Nearly ☐ Secure
2C	Gold	Choose the method and apply it	/ 18	min	☐ Not yet ☐ Nearly ☐ Secure

Topic 1 · Factorising expressions

Key ideas

Factorising is the reverse of expanding.

Expanding: $3(x + 4) \rightarrow 3x + 12$

Factorising: $3x + 12 \rightarrow 3(x + 4)$

Method

- Find the HCF (highest common factor) of every term – the biggest number AND any letters that are in every term.
- Write the HCF outside the bracket.
- Divide each term by the HCF and write the results inside the bracket.
- Check: expand your answer. You must get back to the original expression.

Worked example 1

Factorise $12k - 18$

HCF of 12 and 18: 6

$12k \div 6 = 2k$, $18 \div 6 = 3$

Answer: $6(2k - 3)$

Worked example 2

Factorise fully $10x^2 + 15x$

HCF: 5 (numbers) and x (letters) $\rightarrow 5x$

$10x^2 \div 5x = 2x$, $15x \div 5x = 3$

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

Watch out

- “Factorise fully” means take out the HIGHEST common factor. $2(6k - 9)$ is not fully factorised because $6k$ and 9 still share a 3.
- If a term is exactly the HCF, leave 1 in the bracket: $5x + 5 = 5(x + 1)$.
- Letters count too: $x^2 = x \times x$, so x is a factor of x^2 .

Set 1A · BRONZE

Topic 1: Number common factors**Aim:** Take out a number common factor.**Target time: 15 minutes** · Total: 12 marks · No calculator

Start time: _____ Finish time: _____

Factorise each expression.

Q	Question	Working and answer
1	Fill in the box: $3x + 12 = 3(x + \square)$ [1]	
2	Fill in the box: $5a - 20 = 5(a - \square)$ [1]	
3	$2x + 8$ [1]	
4	$4y + 6$ [1]	
5	$6x + 9$ [1]	
6	$7m - 21$ [1]	
7	$10p - 15$ [1]	
8	$8 + 12n$ [1]	
9	$5x + 5$ [1]	
10	$12k - 18$ [1]	
11	$16t + 24$ [1]	
12	$20 - 8w$ [1]	

Score: _____ / 12 **Time taken:** _____ min**Confidence:** ☐ Not yet ☐ Nearly ☐ Secure 80%+ ? Move up a level!

Set 1B · SILVER

Topic 1: Letters as common factors**Aim:** Take out a letter (and a number) common factor.**Target time: 15 minutes** · Total: 10 marks · No calculator

Start time: _____ Finish time: _____

Factorise fully.

Q	Question	Working and answer
1	$x^2 + 5x$ [1]	
2	$y^2 - 7y$ [1]	
3	$3x^2 + 6x$ [1]	
4	$4a^2 - 10a$ [1]	
5	$6p^2 + 9p$ [1]	
6	$xy + 4x$ [1]	
7	$2ab - 6b$ [1]	
8	$10m^2 + 15m$ [1]	
9	$5x + 10y + 15$ [1]	
10	$9x^2 - 3x$ [1]	

Score: _____ / 10 **Time taken:** _____ min**Confidence:** ☐ Not yet ☐ Nearly ☐ Secure 80%+ ? Move up a level!

Set 1C · GOLD

Topic 1: Fully factorise and reason**Aim:** Fully factorise harder expressions and explain your thinking.**Target time: 15 minutes** · Total: 17 marks · No calculator

Start time: _____ Finish time: _____

Answer every question. Show your working.

Q	Question	Working and answer
1	Factorise fully:	
(a)	$12x^2y + 18xy$ [2]	
(b)	$15a^2b - 10ab^2$ [2]	
(c)	$6x^2 + 9x - 3$ [1]	
2	$x^3 + 4x^2$ [2]	
3	Tom says $8x^2 + 12x = 4(2x^2 + 3x)$. Explain why Tom has not factorised fully, then write the correct answer. [2]	
4	Fill in the boxes: $18y^2 - 24y = 6y(\square - \square)$ [1]	
5	A rectangle has area $5x^2 + 15x$. Its width is $5x$. Find an expression for its length. [2]	
6	Expand and simplify $4(x + 5) + 2(3x + 5)$. Then factorise your answer fully. [3]	
7	n , $n + 1$ and $n + 2$ are three consecutive whole numbers. Show that their sum is always a multiple of 3. [2]	

Score: _____ / 17 **Time taken:** _____ min**Confidence:** ☐ Not yet ☐ Nearly ☐ Secure

Topic 2 · Factorising quadratics

Key ideas

$$x^2 + bx + c = (x + p)(x + q)$$

Find two numbers p and q that MULTIPLY to give c and ADD to give b.

Worked example

Factorise $x^2 + 7x + 12$

Factor pairs of 12: 1×12 , 2×6 , 3×4

Which pair adds to 7? $3 + 4 = 7$ ✓

Answer: $(x + 3)(x + 4)$

Check: $(x + 3)(x + 4) = x^2 + 4x + 3x + 12 = x^2 + 7x + 12$ ✓

Signs

Example	Look at	Signs in brackets	Answer
$x^2 + 7x + 12$	c positive, b positive	both +	$(x + 3)(x + 4)$
$x^2 - 7x + 12$	c positive, b negative	both -	$(x - 3)(x - 4)$
$x^2 + x - 12$	c negative	one +, one - (bigger number takes the sign of b)	$(x + 4)(x - 3)$
$x^2 - x - 12$	c negative	one +, one - (bigger number takes the sign of b)	$(x - 4)(x + 3)$

Difference of two squares

$$x^2 - a^2 = (x + a)(x - a)$$

e.g. $x^2 - 25 = (x + 5)(x - 5)$. There is no x term, because +5x and -5x cancel.

Watch out

- No number term? Use a single bracket: $x^2 + 7x = x(x + 7)$.
- Terms in a strange order? Rearrange into $x^2 + bx + c$ first.
- Solving $x^2 + bx + c = 0$: each solution has the OPPOSITE sign to the number in its bracket.

Set 2A · BRONZE

Topic 2: All positive terms

Aim: Factorise $x^2 + bx + c$ when b and c are positive.

Target time: 15 minutes · Total: 20 marks · No calculator

Start time: _____ Finish time: _____

Factorise each expression.

Q	Question	Working and answer
1	Find two numbers that:	
(a)	multiply to 6 and add to 5 [1]	
(b)	multiply to 12 and add to 8 [1]	
(c)	multiply to 20 and add to 9 [1]	
2	Fill in the box: $x^2 + 6x + 8 = (x + 2)(x + \square)$ [1]	
3	$x^2 + 5x + 6$ [2]	
4	$x^2 + 7x + 12$ [2]	
5	$x^2 + 6x + 5$ [2]	
6	$x^2 + 8x + 15$ [2]	
7	$x^2 + 9x + 20$ [2]	
8	$x^2 + 10x + 16$ [2]	
9	$x^2 + 4x + 4$ [2]	
10	$x^2 + 13x + 12$ [2]	

Score: _____ / 20 Time taken: _____ min

Confidence: ☐ Not yet ☐ Nearly ☐ Secure 80%+ ? Move up a level!

Set 2B · SILVER

Topic 2: Negative terms**Aim:** Factorise $x^2 + bx + c$ when b and/or c are negative.**Target time: 15 minutes** · Total: 20 marks · No calculator

Start time: _____ Finish time: _____

Factorise each expression.

Q	Question	Working and answer
1	$x^2 - 5x + 6$ [2]	
2	$x^2 - 8x + 12$ [2]	
3	$x^2 + 2x - 8$ [2]	
4	$x^2 - 2x - 15$ [2]	
5	$x^2 - x - 12$ [2]	
6	$x^2 + x - 20$ [2]	
7	$x^2 - 9x + 14$ [2]	
8	$x^2 + 3x - 18$ [2]	
9	$x^2 - 6x + 9$ [2]	
10	$x^2 - 4x - 21$ [2]	

Score: _____ / 20 **Time taken:** _____ min**Confidence:** ☐ Not yet ☐ Nearly ☐ Secure 80%+ ? Move up a level!

Set 2C · GOLD

Topic 2: Choose the method and apply it**Aim:** Difference of two squares, choosing a method, solving and reasoning.**Target time: 15 minutes** · Total: 18 marks · No calculator

Start time: _____ Finish time: _____

Answer every question. Show your working.

Q	Question	Working and answer
1	Factorise (difference of two squares):	
(a)	$x^2 - 16$ [1]	
(b)	$x^2 - 1$ [1]	
2	Choose the right method and factorise:	
(a)	$x^2 + 7x$ [1]	
(b)	$x^2 - 49$ [1]	
(c)	$x^2 + 6x - 7$ [2]	
3	Factorise $12 - 7x + x^2$ [2]	
4	Sam writes $x^2 - 2x - 8 = (x + 4)(x - 2)$. Show that Sam is wrong and write the correct answer. [2]	
5	$x^2 + kx + 18 = (x + 3)(x + m)$. Find the value of m and the value of k. [2]	
6	Solve by factorising: $x^2 - 3x - 10 = 0$ [3]	
7	Challenge: Factorise fully $2x^2 + 10x + 12$ [3]	

Score: _____ / 18 **Time taken:** _____ min**Confidence:** ☐ Not yet ☐ Nearly ☐ Secure

Answers and marking notes

Award the marks shown. For factorising questions, an answer that is correct but not fully factorised usually scores 1 mark less. Accept answers with the brackets in either order.

Set 1A · Bronze · Number common factors (12 marks)

Q	Answer	Mark	Watch out for
1	4	1	
2	4	1	
3	$2(x + 4)$	1	
4	$2(2y + 3)$	1	
5	$3(2x + 3)$	1	
6	$7(m - 3)$	1	
7	$5(2p - 3)$	1	
8	$4(2 + 3n)$	1	
9	$5(x + 1)$	1	Don't forget the 1: $5 \div 5 = 1$, not 0.
10	$6(2k - 3)$	1	$2(6k - 9)$ or $3(4k - 6)$ are not fully factorised – the HCF is 6.
11	$8(2t + 3)$	1	
12	$4(5 - 2w)$	1	

Set 1B · Silver · Letters as common factors (10 marks)

Q	Answer	Mark	Watch out for
1	$x(x + 5)$	1	
2	$y(y - 7)$	1	
3	$3x(x + 2)$	1	$3(x^2 + 2x)$ scores only partial credit – x is also a common factor.
4	$2a(2a - 5)$	1	
5	$3p(2p + 3)$	1	
6	$x(y + 4)$	1	
7	$2b(a - 3)$	1	
8	$5m(2m + 3)$	1	
9	$5(x + 2y + 3)$	1	Three terms – divide every term by 5.
10	$3x(3x - 1)$	1	$3x \div 3x = 1$. Leaving it out gives $3x(3x)$, which is wrong.

Set 1C · Gold · Fully factorise and reason (17 marks)

Q	Answer	Mark	Watch out for
1(a)	$6xy(2x + 3)$	2	
1(b)	$5ab(3a - 2b)$	2	
1(c)	$3(2x^2 + 3x - 1)$	1	x is not in every term, so only 3 comes out.

Q	Answer	Mark	Watch out for
2	$x^2(x + 4)$	2	Take out x^2 , not just x .
3	x is still a common factor inside the bracket. Correct: $4x(2x + 3)$	2	
4	$6y(3y - 4)$	1	
5	$x + 3$	2	Area = width $\times$ length, so factorise: $5x(x + 3)$.
6	$10x + 30 = 10(x + 3)$	3	
7	$n + (n + 1) + (n + 2) = 3n + 3 = 3(n + 1)$, which is $3 \times$ a whole number, so always a multiple of 3.	2	

Set 2A · Bronze · All positive terms (20 marks)

Q	Answer	Mark	Watch out for
1(a)	2 and 3	1	
1(b)	2 and 6	1	
1(c)	4 and 5	1	
2	4	1	
3	$(x + 2)(x + 3)$	2	
4	$(x + 3)(x + 4)$	2	1×12 and 2×6 multiply to 12 but don't add to 7.
5	$(x + 1)(x + 5)$	2	
6	$(x + 3)(x + 5)$	2	
7	$(x + 4)(x + 5)$	2	
8	$(x + 2)(x + 8)$	2	
9	$(x + 2)^2$	2	Also accept $(x + 2)(x + 2)$.
10	$(x + 1)(x + 12)$	2	

Set 2B · Silver · Negative terms (20 marks)

Q	Answer	Mark	Watch out for
1	$(x - 2)(x - 3)$	2	c positive, b negative $\rightarrow$ both signs negative.
2	$(x - 2)(x - 6)$	2	
3	$(x + 4)(x - 2)$	2	c negative $\rightarrow$ one $+$ and one $-$. The bigger number takes the sign of b .
4	$(x - 5)(x + 3)$	2	
5	$(x - 4)(x + 3)$	2	$-x$ means $b = -1$.
6	$(x + 5)(x - 4)$	2	
7	$(x - 2)(x - 7)$	2	
8	$(x + 6)(x - 3)$	2	
9	$(x - 3)^2$	2	Also accept $(x - 3)(x - 3)$.
10	$(x - 7)(x + 3)$	2	

Set 2C · Gold · Choose the method and apply it (18 marks)

Q	Answer	Mark	Watch out for
1(a)	$(x + 4)(x - 4)$	1	
1(b)	$(x + 1)(x - 1)$	1	$1 = 1^2$, so this is a difference of two squares.
2(a)	$x(x + 7)$	1	No number term → single bracket.
2(b)	$(x + 7)(x - 7)$	1	
2(c)	$(x + 7)(x - 1)$	2	
3	$(x - 3)(x - 4)$	2	Rearrange to $x^2 - 7x + 12$ first.
4	$(x + 4)(x - 2) = x^2 + 2x - 8$, not $x^2 - 2x - 8$. Correct: $(x - 4)(x + 2)$	2	
5	$m = 6, k = 9$	2	$3 \times m = 18$, so $m = 6$. $k = 3 + 6$.
6	$(x - 5)(x + 2) = 0$, so $x = 5$ or $x = -2$	3	Common error: $x = -5$ or $x = 2$ – each solution has the opposite sign to the number in its bracket.
7	$2(x + 2)(x + 3)$	3	Take out the common factor 2 first, then factorise $x^2 + 5x + 6$.