



eClassroom

GCSE MATHEMATICS • ALGEBRA

Simplifying & Expanding

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Free Simplifying and Expanding worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: collect like terms • expand single brackets and simplify • expand two brackets, including squares like $(x - 4)^2$ • use expanding in area problems and “show that” questions • *Higher*: three brackets, larger coefficients, and finding constants in identities.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER Higher only: expanding three brackets, plus brackets with larger coefficients, identities and expansion arguments. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	23	10	13	16
Higher marks	16	14	17	14
My score				

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A**Worked examples & Your turn**

Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION*Everyone starts here***Worked example A1**

Simplify $3x^2 + 5x - x^2 + 2x - 4$

Like terms have exactly the same letters and powers.

x^2 and x are different.

$$3x^2 - x^2 = 2x^2 \quad 5x + 2x = 7x$$

$$2x^2 + 7x - 4$$

Your turn A1

Simplify $4ab - 2a + ba + 5a$

Worked example A2

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

The -3 multiplies both terms: $-3 \times -4 = +12$

$$5x + 10 - 3x + 12$$

$$2x + 22$$

Your turn A2

Expand and simplify $6(y - 1) - 2(y + 3)$

Worked example A3

Expand and simplify $(x + 4)(x - 7)$

Four products: $x \times x$, $x \times -7$, $4 \times x$, 4×-7

$$x^2 - 7x + 4x - 28$$

$$x^2 - 3x - 28$$

Your turn A3

Expand and simplify $(x - 5)(x - 2)$



HIGHER*Higher only: three brackets, larger coefficients and identities***Worked example A4: larger coefficients**Expand and simplify $(3x - 2)(2x + 5)$

$$3x \times 2x = 6x^2 \quad \text{and} \quad 3x \times 5 = 15x$$

$$-2 \times 2x = -4x \quad \text{and} \quad -2 \times 5 = -10$$

$$6x^2 + 11x - 10$$

Your turn A4Expand and simplify $(4x + 1)(x - 3)$ **Worked example A5: squaring a bracket**Expand and simplify $(2x - 5)^2$ *Write it as $(2x - 5)(2x - 5)$. There are two middle terms.*

$$4x^2 - 10x - 10x + 25$$

$$4x^2 - 20x + 25$$

Your turn A5Expand and simplify $(3x + 2)^2$ **Worked example A6: three brackets**Expand and simplify $(x + 1)(x - 2)(x + 4)$ *Expand two brackets first, then multiply by the third.*

$$(x^2 - x - 2)(x + 4) = x^3 + 4x^2 - x^2 - 4x - 2x - 8$$

$$x^3 + 3x^2 - 6x - 8$$

Your turn A6Expand and simplify $(x - 3)(x + 2)(x + 5)$ **Worked example A7: finding constants** $(x + a)(x - 3) \equiv x^2 + bx - 12$. Find a and b .*Expand: $x^2 + (a - 3)x - 3a$. Match the numbers, then the x terms.*

$$-3a = -12, \text{ so } a = 4 \quad b = a - 3$$

$$a = 4, b = 1$$

Your turn A7 $(2x + a)^2 \equiv 4x^2 + bx + 9$, where $a > 0$. Find a and b .

B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

FOUNDATION*Everyone starts here*

B1 Simplify, if possible. If it cannot be simplified, say so.

(a) $3a + 5a$

(b) $3a + 5b$

(c) $3a^2 + 5a$

(d) $3ab + 5ba$

[4 marks]

B2 Simplify

(a) $7x - 2y - 3x + 5y$

(b) $x^2 - 4x + 3x^2 + x$

(c) $6 - 2p - 9 + 5p$

(d) $2xy - x^2 + 3yx + 2x^2$

[4 marks]

B3 Expand

(a) $4(x + 3)$

(b) $-4(x + 3)$

(c) $-4(x - 3)$

(d) $x(x - 3)$

[4 marks]

B4 Expand and simplify

(a) $2(x + 5) + 3(x + 1)$

(b) $2(x + 5) - 3(x + 1)$

(c) $2(x + 5) - 3(x - 1)$

(d) $x(x + 5) - 3(x + 1)$

[4 marks]

B5 Expand and simplify

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

(b) $(x + 2)(x - 5)$

(c) $(x - 2)(x - 5)$

(d) $(x - 2)(x + 5)$

[4 marks]

B6 Expand and simplify

(a) $(x + 6)^2$

(b) $(x - 6)^2$

(c) $(x + 6)(x - 6)$

[3 marks]



HIGHER*Higher tier only***B7** Expand and simplify

(a) $(2x+1)(x+3)$

(b) $(2x+1)(3x+1)$

(c) $(2x-1)(3x+4)$

(d) $(5-2x)(3+x)$

[4 marks]**B8** Expand and simplify

(a) $(3x-1)^2$

(b) $\left(x + \frac{1}{2}\right)^2$

(c) $(2x+3y)^2$

(d) $(4x-5)(4x+5)$

[4 marks]**B9** Expand and simplify

(a) $(x+1)(x+2)(x+3)$

(b) $(x+1)(x-1)(x+2)$

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

(d) $(2x-1)(x+1)(x-3)$

[4 marks]**B10** Find the value of each letter.

(a) $(x+a)(x+2) \equiv x^2 + 7x + 10$

(b) $(x+a)^2 \equiv x^2 + 10x + b$

(c) $(ax+1)(x-3) \equiv 2x^2 + bx - 3$

(d) $(x+a)(x-a) \equiv x^2 - 49$, where $a > 0$

[4 marks]

C**Reasoning**

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** Jay writes $(x+3)^2 = x^2 + 9$
Explain Jay's mistake, and write the correct expansion. [2 marks]
- C2** Mia writes $-2(x-4) = -2x - 8$
Explain Mia's mistake, and write the correct expansion. [2 marks]
- C3** (a) Kim simplifies $3x+2y$ and gets $5xy$. Explain why Kim is wrong.
(b) Simplify $3x \times 2y$ [3 marks]
- C4** Show that $(x+5)(x-1) - (x+2)^2$ has the value -9 for every value of x . [3 marks]



HIGHER*Higher tier only*

- C5** Explain when $(a + b)^2$ is equal to $a^2 + b^2$, and when it is not. [3 marks]
- C6** Without a calculator, use expanding to work out
(a) 103×97 (b) $101^2 - 99^2$ [3 marks]
- C7** Leo says, " $(x + 2)^3 = x^3 + 8$ "
Use a value of x to show that Leo is wrong, and expand $(x + 2)^3$ correctly. [3 marks]
- C8** n is a whole number, so $2n - 1$ and $2n + 1$ are consecutive odd numbers.
(a) Show that the difference between their squares is $8n$
(b) Hence explain why the difference between the squares of any two consecutive odd numbers is a multiple of 8, and check your answer with 15 and 17 [5 marks]



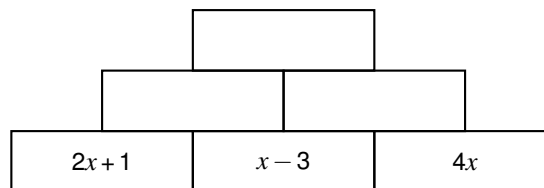
D**Problem solving**

You decide the method. Read the whole question first, and show every step.

FOUNDATION*Everyone starts here*

- D1** A rectangular floor is $(x + 4)$ m long and $(x + 1)$ m wide. A rectangular rug 2 m by x m is placed on the floor. Write an expression, in its simplest form, for the area of floor that is not covered by the rug. [3 marks]

- D2** In this wall, each brick is the sum of the two bricks directly below it.



- (a) Write an expression, in its simplest form, for the top brick.
- (b) The top brick is 27. Find x . [4 marks]
- D3** Kai thinks of a number n . He adds 3, multiplies by 4, subtracts $2n$ and then halves the result. Show that his answer is always 6 more than the number he thought of. [3 marks]
- D4** Fill in the missing numbers. $(x + \square)(x - 2) = x^2 + 3x - \square$ [3 marks]



HIGHER*Higher tier only*

- D5** A cuboid measures $(x+1)$ cm by $(x+2)$ cm by $(x-1)$ cm.
(a) Show that its volume is $(x^3 + 2x^2 - x - 2)$ cm³
(b) Check your expression by working out the volume in two ways when $x = 4$ [4 marks]
- D6** A square has side $(2x+3)$ cm. A rectangle measures $(x+1)$ cm by $(4x+5)$ cm.
The area of the square is 19 cm^2 more than the area of the rectangle. Find x . [4 marks]
- D7** n is a whole number.
(a) Show that $n(n+1)$ is always 2 more than $(n-1)(n+2)$
(b) Check this with $n = 7$ [4 marks]
- D8** a , b and c are positive whole numbers, and $(ax+b)^2 - (x+c)^2 \equiv 8x^2 + 2x - 3$
Find a , b and c . [5 marks]



E**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION*Foundation and Higher crossover***E1** Simplify

(a) $5a + 3b - 2a + b$

.....
(1)

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

.....
(1)

(c) $2ab + 3ba$

.....
(1)

(Total for Question E1 is 3 marks)

E2 (a) Expand $3(2y - 5)$

.....
(1)

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

.....
(2)

(Total for Question E2 is 3 marks)

E3 Expand and simplify $(x + 5)(x - 3)$

.....
(Total for Question E3 is 2 marks)



E4 Expand and simplify $(x - 4)^2$

.....

(Total for Question E4 is 2 marks)

E5 A rectangle measures $(x + 7)$ cm by $(x + 2)$ cm. A square of side x cm is cut out of it.

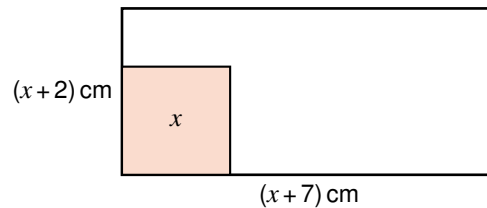


Diagram NOT accurately drawn

Show that the area that is left is $(9x + 14) \text{ cm}^2$

(Total for Question E5 is 3 marks)

E6 (a) Simplify $2x \times 5y$

.....
(1)

(b) Expand $x(x - 6)$

.....
(1)

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

.....
(1)

(Total for Question E6 is 3 marks)



HIGHER*Higher tier only*

E7 Expand and simplify $(x+2)(x-1)(x+3)$

.....
(Total for Question E7 is 3 marks)

E8 Show that $(2x-3)^2 - (x-3)^2 \equiv 3x(x-2)$

(Total for Question E8 is 3 marks)

E9 $(3x+a)(x-2) \equiv 3x^2 + bx - 8$

Find the value of a and the value of b .

$a = \dots\dots\dots b = \dots\dots\dots$

(Total for Question E9 is 3 marks)



E10 n is a whole number.

(a) Show that $n(n+1)(n+2)(n+3)+1 \equiv (n^2+3n+1)^2$

(4)

(b) Hence write $7 \times 8 \times 9 \times 10 + 1$ as the square of a whole number.

.....
(1)

(Total for Question E10 is 5 marks)

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