

Exercise walk-through

C2.2

Algebraic manipulation

IGCSE Mathematics

You must be able to

- Collect like terms and expand brackets
- Expand products of two linear expressions
- Factorise a common factor and check equivalence

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The method

Method — Key knowledge: Algebraic manipulation

Like terms have the same letter part and powers. Add their coefficients only. Expand one bracket by multiplying every term; expand two brackets by making all four products and then collecting. Factorising reverses expansion: take out the greatest factor shared by every term, including letters. Check by expanding your answer.

Exercises 2.1·2.3

2.1 Simplify $8p + 3q - 5p + q$. [2]

2.2 Expand $4y(3y - 2)$. [2]

2.3 Expand $(x + 4)(x + 2)$. [2]

Exercises 2.1·2.3

2.1 Simplify $8p + 3q - 5p + q$. [2]

2.1

- Collect each letter: $3p + 4q$.

2.2 Expand $4y(3y - 2)$. [2]

2.2

- Multiply both terms: $12y^2 - 8y$.

2.3 Expand $(x + 4)(x + 2)$. [2]

2.3

- Four products give $x^2 + 2x + 4x + 8 = x^2 + 6x + 8$.

Exercise 2.4

2.4 Factorise fully $15a^2 - 10ab$.

[2]

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[2]

2.4

- Take out $5a$: $5a(3a - 2b)$; expanding returns the original.

Exercise 3.1 (a)

3.1 Apply the algebraic manipulation methods below. Show working and include units where appropriate.

(a) A rectangle has sides $(x + 5)$ cm and $(x + 1)$ cm. Write and expand its area. [2]

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(a)

- $A = (x + 5)(x + 1) = \mathbf{x^2 + 6x + 5}$ cm².

Exercise 3.1 (b)

3.1 Apply the algebraic manipulation methods below. Show working and include units where appropriate.

(b) Find its area when $x = 3$.

[2]

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3.1 Apply the algebraic manipulation methods below. Show working and include units where appropriate.

(b) Find its area when $x = 3$.

[2]

(b)

- $A = 3^2 + 6(3) + 5 = \mathbf{32} \text{ cm}^2$; also $8 \times 4 = 32$.

Exercise 3.1 (c)

3.1 Apply the algebraic manipulation methods below. Show working and include units where appropriate.

(c) Factorise $6x^2 + 24x$ fully and check by expanding.

[2]

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(c) Factorise $6x^2 + 24x$ fully and check by expanding. [2]

(c)

- Common factor $6x$ gives $6x(x + 4)$; expansion is $6x^2 + 24x$.

Exercise 3.2 (a)

3.2 A rectangle has length $(2x + 3)$ cm and width $(x + 2)$ cm.

(a) Write and expand its area expression. Find the area when $x = 2$.

[3]

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[3]

(a)

- Use $A = lw = (2x + 3)(x + 2)$.
- Expand $A = \mathbf{2x^2 + 7x + 6}$.
- At $x = 2$, $A = 8 + 14 + 6 = \mathbf{28}$ cm².

Exercise 3.2 (b)

3.2 A rectangle has length $(2x + 3)$ cm and width $(x + 2)$ cm.

(b) A student says $6x^2 + 9x = 3x(2x + 9)$. Correct the factorisation and explain how expanding checks it. [3]

Exercise 3.2 (b)

3.2 A rectangle has length $(2x + 3)$ cm and width $(x + 2)$ cm.

(b) A student says $6x^2 + 9x = 3x(2x + 9)$. Correct the factorisation and explain how expanding checks it. [3]

(b)

- Divide both terms by the common factor $3x$: $6x^2 + 9x = \mathbf{3x(2x + 3)}$.
- Expanding gives $6x^2 + 9x$; the proposed expression instead gives $6x^2 + 27x$.