

C2.2 Algebraic manipulation

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS term 项 • expand 展开 • area 面积 • like terms 同类项 • brackets 括号

Objective

Use algebraic manipulation to solve Core IGCSE Mathematics problems.

You must be able to:

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

1 Key knowledge and worked examples

■ 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.

■ Worked example: Algebraic manipulation

	x	5
x	x^2	$5x$
1	x	5

Expand $(x + 3)(x - 2)$: the four products are $x^2, -2x, 3x, -6$, so $Q = x^2 + x - 6$.

- Collect: $4a + 2b - a + 5b = 3a + 7b$.
- Expand one bracket: $3x(2x - 5) = 6x^2 - 15x$.
- Factorise: $12x^2 + 18x = 6x(2x + 3)$; 6 and x are common to both terms.
- An area is the product of side lengths: for $(x + 2)$ cm and $(x + 3)$ cm, $A = (x + 2)(x + 3) = x^2 + 5x + 6$. At $x = 4$, $A = 16 + 20 + 6 = 42 \text{ cm}^2$.

■ Method check

An area multiplies whole side expressions. The distributive law produces every cross-product; a factorisation should expand back to the original.

2 Practice

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

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

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

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

3 Exam-style questions

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]

(b) Find its area when $x = 3$. [2]

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

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]

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