Name & Surname: _____ Class: _____ Date: _____

MULTIPLYING BINOMIALS

Expand double brackets, then triple brackets

About 60 minutes Level ★★★☆☆

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EXPANDING TWO BINOMIALS

To **expand** (x + a)(x + b), multiply every term in the first bracket by every term in the second, then collect **like terms**.

- Multiply First, Outside, Inside, Last: x*x, x*b, a*x, a*b
- Take care with **signs**: minus times minus gives plus
- Add the middle terms to simplify, for example 3x + 2x = 5x

⚖ TASK A /6

Explain in one sentence how you know the difference in each pair.

(x + 3)^2 VS **x^2 + 9**

The difference is…

(x + 4)(x - 4) VS **(x + 4)(x + 4)**

The difference is…

expanding (x + 2)(x + 5) VS **simplifying x + 2 + x + 5**

The difference is…

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DOUBLE BRACKETS PRACTICE

Fluent practice with two binomials.

KEY WORDS

expand: multiply out brackets to remove them

like terms: terms with the same letters and powers

square: a bracket multiplied by itself, like (x + 2)^2

binomial: an expression with two terms, like x + 3

collect: add or subtract like terms to simplify

TASK B

/12

Expand each pair and collect like terms to simplify.

WARM UP

1 Expand (x + 2)(x + 3)

Answer: _____

2 Expand (x + 4)(x + 5)

Answer: _____

3 Expand (x + 1)(x + 7)

Answer: _____

4 Expand (x + 2)(x + 6)

Answer: _____

PRACTISE

5 Expand (x - 3)(x + 5)

Answer: _____

6 Expand (x - 4)(x - 6)

Answer: _____

7 Expand (2x + 1)(x + 3)

Answer: _____

8 Expand (3x - 2)(x + 4)

Answer: _____

PROBLEM SOLVING

9 A rectangle is (x + 3) cm by (x + 2) cm. Write its **area** in expanded form.

Answer: _____

10 A square garden is (x + 5) m by (x + 5) m. Write its **area** in expanded form.

Answer: _____

11 A student says (x + 5)(x + 2) = x^2 + 10. Explain how you know they are wrong.

Answer: _____

12 Two identical rectangles are (x + 4) cm by (x + 1) cm. The total area is 2(x + 4)(x + 1). First expand (x + 4)(x + 1), then double it.

Answer: _____

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SQUARES AND TRIPLES

Special cases and products of three binomials.

TASK C

/12

Look for patterns and expand two brackets at a time.

WARM UP

1 Expand (x + 6)(x - 6)

Answer: _____

2 Expand (x + 2)(x - 2)

Answer: _____

3 Expand (x + 5)^2, which means (x + 5)(x + 5)

Answer: _____

4 Expand (x - 4)^2, which means (x - 4)(x - 4)

Answer: _____

PRACTISE

5 Expand (2x + 5)(2x - 5)

Answer: _____

6 Expand (2x - 3)^2

Answer: _____

7 Expand (x + 1)(x + 2)(x + 3). First expand the first two brackets.

Answer: _____

8 Expand (x + 2)(x - 2)(x + 1). Hint: start with the **difference** of two squares.

Answer: _____

PROBLEM SOLVING

9 A rectangle is (2x + 1) cm by (x + 3) cm. Write its **area** in expanded form.

Answer: _____

10 A cube has edges (x + 2) cm, (x + 2) cm and (x + 2) cm. Write its **volume** in expanded form.

Answer: _____

11 Explain how you know (x + 4)^2 is not x^2 + 16.

Answer: _____

12 A student says (x - 3)(x + 3)(x + 2) = x^3 + 2x^2 - 9x - 18. Explain how you know they are correct.

Answer: _____

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FACTS YOU NEED

Quick multiplication facts and key vocabulary.

TASK D

/7

Fill the grid to practise multiplication facts for expanding.

×	2	5	8	9
3	6			27
4		20		
6		30	48	
7	14	35	56	63

TASK E

/4

Complete the map to show what expand means.

Definition (in my own words)

Characteristics

expand

Examples

3(x + 2) = 3x + 6

Non-examples

x + 2 + x + 3 = 2x + 5

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MULTIPLYING BINOMIALS

TASK F

/3

Use the FOIL steps to expand each pair of brackets, then try the matching question.

WORKED EXAMPLE

Expand $(x + 3)(x + 4)$

1. Multiply First: x squared
2. Multiply Outside: 4x and Inside: 3x
3. Multiply Last: 12
4. Add middle terms: $4x + 3x = 7x$, so $x^2 + 7x + 12$

Answer: $x^2 + 7x + 12$

YOUR TURN

Expand $(x + 5)(x + 2)$

Answer: _____

WORKED EXAMPLE

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

1. Multiply First: x squared
2. Multiply Outside: 5x and Inside: -2x
3. Multiply Last: -10
4. Add middle terms: $5x + (-2x) = 3x$, so $x^2 + 3x - 10$

Answer: $x^2 + 3x - 10$

YOUR TURN

Expand $(x - 3)(x - 4)$

Answer: _____

WORKED EXAMPLE

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

1. Expand first two brackets: $(x + 1)(x + 2) = x^2 + 3x + 2$
2. Multiply by third bracket: $(x^2 + 3x + 2)(x + 3)$
3. Multiply every term: $x^3 + 3x^2 + 3x^2 + 9x + 2x + 6$
4. Collect like terms: $x^3 + 6x^2 + 11x + 6$

Answer: $x^3 + 6x^2 + 11x + 6$

YOUR TURN

Expand $(x + 1)(x + 3)(x + 4)$

Answer: _____

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MULTIPLYING BINOMIALS

TASK G

/3

Find the mistake in each statement and write the correct expansion.



Student A

$(x + 3)(x + 4) = x^2 + 12$. I multiplied the **first** and **last** terms only.

What mistake did Student A make? Write the correct fact.



Student B

$(x - 3)(x - 4) = x^2 - 7x - 12$ because minus times **minus** gives **minus**.

What mistake did Student B make? Write the correct fact.



Student C

$(x + 1)(x + 2)(x + 3) = x^3 + 6$. I multiplied the **x** terms and the **numbers**.

What mistake did Student C make? Write the correct fact.

HOW DID I DO?

Circle a face for each line.

I can expand a product of two binomials	☹ 😐 ☺
I can expand squares and spot the difference of two squares	☹ 😐 ☺
I can expand three binomials by doing two at a time	☹ 😐 ☺

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Answer sheet: Multiplying Binomials

Task A

1. They are different because (x + 3)^2 means (x + 3)(x + 3) = x^2 + 6x + 9, the middle term 6x is missing from x^2 + 9.
2. The first gives x^2 - 16 because -4x + 4x cancel, the second gives x^2 + 8x + 16.
3. Expanding multiplies: x^2 + 7x + 10, simplifying only adds: 2x + 7.

Task B

1. x^2 + 5x + 6
2. x^2 + 9x + 20
3. x^2 + 8x + 7
4. x^2 + 8x + 12
5. x^2 + 2x - 15
6. x^2 - 10x + 24
7. 2x^2 + 7x + 3
8. 3x^2 + 10x - 8
9. x^2 + 5x + 6 cm^2
10. x^2 + 10x + 25 m^2
11. They only multiplied First and Last. The full expansion is x^2 + 7x + 10, the middle terms 5x + 2x are missing.
12. 2x^2 + 10x + 8 cm^2

Task C

1. x^2 - 36
2. x^2 - 4
3. x^2 + 10x + 25
4. x^2 - 8x + 16
5. 4x^2 - 25
6. 4x^2 - 12x + 9
7. x^3 + 6x^2 + 11x + 6
8. x^3 + x^2 - 4x - 4
9. 2x^2 + 7x + 3 cm^2
10. x^3 + 6x^2 + 12x + 8 cm^3
11. You must multiply (x + 4)(x + 4), which gives x^2 + 8x + 16. Squaring each term misses the two middle terms.
12. First (x - 3)(x + 3) = x^2 - 9, then (x^2 - 9)(x + 2) = x^3 + 2x^2 - 9x - 18, so it matches.

Task D

3 × 2, 5, 8, 9: 6, 15, 24, 27

4 × 2, 5, 8, 9: 8, 20, 32, 36

6 × 2, 5, 8, 9: 12, 30, 48, 54

7 × 2, 5, 8, 9: 14, 35, 56, 63

Task E

Definition: to multiply out brackets so each term multiplies to give an equal expression without brackets

Characteristics: every term in one bracket multiplies every term in the other, then collect like terms to simplify, the value stays the same, only the form changes

Examples: 3(x + 2) = 3x + 6, (x + 2)(x + 3) = x^2 + 5x + 6, (x - 2)(x + 2) = x^2 - 4

Non-examples: x + 2 + x + 3 = 2x + 5, (x + 3)^2 = x^2 + 9, leaving the brackets in the answer

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Task F

1. $x^2 + 7x + 10$
2. $x^2 - 7x + 12$
3. $x^3 + 8x^2 + 19x + 12$

Task G

1. Student A: Missed the outside and inside terms; $4x + 3x = 7x$, so the correct expansion is $x^2 + 7x + 12$.
2. Student B: Sign error: minus times minus gives plus, $(-3) \times (-4) = 12$, so the correct expansion is $x^2 - 7x + 12$.
3. Student C: Only multiplying First and Last misses all the middle terms; expand in two stages to get $x^3 + 6x^2 + 11x + 6$.

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