JUNIOR CYCLE MATHS · FREE REVISION SHEET

Expanding & simplifying

↗ Léim

Learning outcomes (2018 specification): AF.3a, AF.3b. Play the game: **leim.ie/bracket-blaster.html**

1. Multiplying terms

Numbers × numbers, letters × letters: $3x \times 4x =$ **$12x^2$** · $2a \times 5b =$ **$10ab$** · $x^2 \times x =$ **x^3** (add the powers). Same signs give +, different signs give −.

2. One bracket

Multiply **every** term inside:

$3(x - 4)$	**$3x - 12$** (not $3x - 4$)
$-2(x - 5)$	**$-2x + 10$** ($- \times - = +$)
$x(x + 3)$	**$x^2 + 3x$**
$-(x - 6)$	**$-x + 6$** (every sign changes)

3. Expand, then simplify

$3(x + 2) - 2(x - 4)$
$= 3x + 6 - 2x + 8$
$=$ **$x + 14$** (collect like terms last)

4. Squares

$(x + 4)^2 = (x + 4)(x + 4) =$ **$x^2 + 8x + 16$**
$(x - 3)^2 = x^2 - 6x + 9$ (not $x^2 - 9$ or $x^2 + 9$)
$(2x + 5)^2 =$ **$4x^2 + 20x + 25$**

5. Double brackets: the area model

Every term × every term. One bracket along the top, one down the side; each box = row × column; add the boxes.

	x	**−5**
x	**x^2**	**$-5x$**
+3	**$3x$**	**-15**

$(x + 3)(x - 5)$
$= x^2 - 5x + 3x - 15$
$=$ **$x^2 - 2x - 15$**

Spot the pattern: $(x + a)(x + b) = x^2 + (a + b)x + ab$. The middle number is the two numbers added, the last is the two multiplied: $(x + 6)(x - 2) = x^2 + 4x - 12$.

$(2x + 1)(x - 4) = 2x^2 - 8x + x - 4 =$ **$2x^2 - 7x - 4$**

$(a + 2)(b - 3) =$ **$ab - 3a + 2b - 6$** (no like terms)

6. Difference of two squares

$(x + 7)(x - 7) = x^2 - 7x + 7x - 49 =$ **$x^2 - 49$**: the middle terms cancel.

7. Higher Level: three terms

$(x + 2)(x^2 - x + 3) = x^3 - x^2 + 3x + 2x^2 - 2x + 6$
$=$ **$x^3 + x^2 + x + 6$**

Exam tip: write all four terms of a double bracket before you collect, and write $(x + 3)^2$ as $(x + 3)(x + 3)$ first. **Check with a number:** put $x = 1$ into the question and your answer: they must give the same value.

PRACTICE · 34 QUESTIONS

Have a go

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A. Expand (multiply out)

1. $3(x + 5)$ _____
2. $-4(x - 2)$ _____
3. $x(x + 7)$ _____
4. $2a(3a - 5)$ _____
5. $5x \times 3x$ _____
6. $-2y \times 4$ _____
7. $-(3x - 8)$ _____
8. $4ab \times 3a$ _____

B. Expand and simplify

9. $3(x + 4) + 2(x - 1)$ _____
10. $5(2x - 3) - 3(x - 4)$ _____
11. $7x - (2x - 5)$ _____
12. $4(a + 3) - (a - 6)$ _____
13. $2x(x + 3) + 5x$ _____
14. $3(2y - 1) - 2(y + 4)$ _____
15. $x(x - 2) - 3(x - 2)$ _____
16. $6 - 2(3 - x)$ _____

C. Double brackets

17. $(x + 3)(x + 5)$ _____
18. $(x + 2)(x - 7)$ _____
19. $(x - 4)(x - 6)$ _____
20. $(2x + 1)(x + 3)$ _____
21. $(3x - 2)(x + 4)$ _____
22. $(a + 3)(b - 2)$ _____
23. $(x + 5)(x - 5)$ _____
24. $(2x - 3)(3x - 1)$ _____

Questions 31–34 are on the next page.

D. Squares and special products

25. $(x + 6)^2$ _____
26. $(x - 5)^2$ _____
27. $(2x + 3)^2$ _____
28. $(3x - 1)(3x + 1)$ _____
29. Ciara says $(x + 4)^2 = x^2 + 16$. Put in $x = 1$ to show she is wrong. _____
30. $(x + 7)(x - 2) = x^2 + \square x - 14$. What number goes in the box? _____

EXAM-STYLE · THEN CHECK

Exam corner + answers

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E. Exam-style questions (show your work)

31. Expand and simplify $(x + 5)(x - 3) - x(x + 1)$.

32. A rectangle is $x + 7$ cm long and $x + 2$ cm wide. A square has sides of $x + 4$ cm. (a) Write each area without brackets. (b) Show that the square's area minus the rectangle's area is $2 - x$. (c) Which shape is bigger when $x = 5$?

33. (a) Show that $(n + 3)^2 - (n + 1)^2 = 4n + 8$. (b) Use this to work out $23^2 - 21^2$ without a calculator.

34. *Higher Level.* Expand and simplify $(x + 3)(x^2 - 2x + 4)$.

Answers

A	1. $3x + 15$ · 2. $-4x + 8$ · 3. $x^2 + 7x$ · 4. $6a^2 - 10a$ · 5. $15x^2$ · 6. $-8y$ · 7. $-3x + 8$ · 8. $12a^2b$
B	9. $5x + 10$ · 10. $7x - 3$ · 11. $5x + 5$ · 12. $3a + 18$ · 13. $2x^2 + 11x$ · 14. $4y - 11$ · 15. $x^2 - 5x + 6$ · 16. $2x$
C	17. $x^2 + 8x + 15$ · 18. $x^2 - 5x - 14$ · 19. $x^2 - 10x + 24$ · 20. $2x^2 + 7x + 3$ · 21. $3x^2 + 10x - 8$ · 22. $ab - 2a + 3b - 6$ · 23. $x^2 - 25$ · 24. $6x^2 - 11x + 3$
D	25. $x^2 + 12x + 36$ · 26. $x^2 - 10x + 25$ · 27. $4x^2 + 12x + 9$ · 28. $9x^2 - 1$ · 29. $(1 + 4)^2 = 25$ but $1 + 16 = 17$, so she is wrong: $(x + 4)^2 = x^2 + 8x + 16$ · 30. 5
E	31. $x^2 + 2x - 15 - x^2 - x =$ **$x - 15$** · 32. (a) rectangle **$x^2 + 9x + 14$**, square **$x^2 + 8x + 16$** (b) $x^2 + 8x + 16 - x^2 + 9x + 14 =$ **$2 - x$** (c) $2 - 5 = -3$, so the **rectangle** is bigger by 3 cm² (84 v 81) · 33. (a) $n^2 + 6n + 9 - (n^2 + 2n + 1) =$ **$4n + 8$** (b) $n = 20$: $4(20) + 8 =$ **88** · 34. $x^3 - 2x^2 + 4x + 3x^2 - 6x + 12 =$ **$x^3 + x^2 - 2x + 12$**

Got one wrong? Check: did you multiply **every** term in the bracket? Did a minus in front of a bracket change every sign inside? Did your double bracket have four terms before you collected? Did you keep the middle term in a square? Then play **Bracket Blaster** at leim.ie/bracket-blaster.html: the "Go back over these" list at the end shows the rule for each mistake.

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