Expanding Brackets

Year 9 · Friday ATL

Warm-up to challenge. Work down the page and stop where it stops being easy — then push one level further.

Name: _____ Date: _____ Got to level: _____

Every term in the first bracket multiplies every term in the second. Check yourself: in $(x+a)(x+b)$ the constant is ab and the x-coefficient is $a+b$. Watch the signs.

Level 1 · Single brackets — Warm-up

1. $3(x+4)$
2. $5(2y-3)$
3. $-4(a-6)$
4. $x(x+7)$
5. $2p(3p-5q)$
6. $3(x+2)+4(x-1)$
7. $5(2m+1)-3(m-4)$
8. $4x(x-3)-x(2x+5)$

Level 2 · Double brackets — Core

1. $(x+3)(x+5)$
2. $(y-4)(y+7)$
3. $(a-6)(a-2)$
4. $(x+5)^2$
5. $(2x+1)(x+4)$
6. $(3x-2)(2x+5)$
7. $(x+6)(x-6)$
8. $(2a-3b)^2$

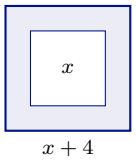
Level 3 · Stretch — Harder

1. $(x+1)(x+2)(x+3)$
2. $(x+3)^2-(x-3)^2$
3. $(x^2+2x-1)(x+3)$
4. $(2x-1)^3$
5. $(x+2)(x-5)-(x-3)^2$

Level 4 · Problems in context — Apply it

1. A rectangle is $(x + 5)$ cm long and $(x - 2)$ cm wide. Write expressions for its perimeter and its area. Simplify both.

2. A square photo of side x cm sits in a square frame of side $(x + 4)$ cm. Show that the area of the frame itself is $8x + 16$ cm^2.



3. A box has length $(x + 2)$, width x and height 3. Write its volume without brackets.

4. Show that the difference between the squares of two consecutive whole numbers is always odd. *(Hint: call them n and $n + 1$.)*

5. Ali picks a number, adds 3 and squares the result. Ben picks the same number, subtracts 3 and squares. Prove that the difference between their answers is always a multiple of 12.

Level 5 · Puzzles: work backwards — Think

1. $(x + a)(x + b) = x^2 + 9x + 20$. Find a and b.

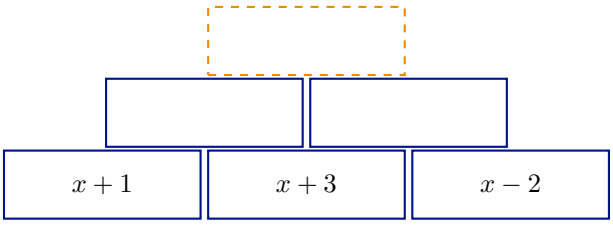
2. $(x + a)(x - b) = x^2 + 2x - 15$, where a and b are positive whole numbers. Find a and b.

3. $(x + p)^2 = x^2 + 14x + q$. Find p and q.

4. $(ax + 3)(3x + b) = 6x^2 + 19x + 15$. Find a and b.

5. Sam writes $(x + 4)^2 = x^2 + 16$. Test it with $x = 1$. Explain the mistake and correct it.

6. In this pyramid each middle brick is the *product* of the two bricks below it, and the top brick is the *sum* of the two middle bricks. Fill it in.



7. Use $(a + b)(a - b) = a^2 - b^2$ or $(a + b)^2$ to work these out *without a calculator*:
   103×97 $\qquad$ 51^2 $\qquad$ 99^2

8. **Open.** $x^2 + kx + 12$ can be written as $(x + a)(x + b)$ with whole numbers a and b. Find *every* possible value of k. How do you know you have them all?