

The Distributive Property

Example 1: Expand and Simplify.

a) $2(x + 3)$
 $= 2(x) + 2(3)$
 $= 2x + 6$

All terms in the bracket are multiplied by 2.
(You don't have to show this step.)

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

$x \cdot x = x^2$ (exponent laws)

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

Watch the signs! :)

d) $2(x + 3) - 2x(x + 3)$
 $= 2x + 6 - 2x^2 - 6x$
 $= -2x^2 - 4x + 6$

After expanding, collect like terms.

How would you expand something like $(x + 2)(x + 3)$? We know the distributive property means to multiply the "outer" part [in this case, $(x + 2)$] by everything inside the brackets. So our first step might look like:

$$(x + 2)(x + 3)$$
$$= (x + 2)(x) + (x + 2)(3)$$

Now we have something more familiar, and can continue distributing:

$$= x^2 + 2x + 3x + 6$$
$$= x^2 + 5x + 6$$

Collect like terms.

Notice that we ended up with 4 terms (before simplifying) – these correspond to 4 possible pairs of multiplications! We can distribute directly from the original brackets if we ensure *each term in the first bracket is multiplied to each term in the second bracket*.

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

Example 2: Expand and simplify.

$$\begin{aligned} \text{a) } (x + 2)(x - 3) \\ &= x^2 - 3x + 2x - 6 \\ &= x^2 - x - 6 \end{aligned}$$

$$\begin{aligned} \text{b) } (x - 2)(7x + 3) \\ &= 7x^2 + 3x - 14x - 6 \\ &= 7x^2 - 11x - 6 \end{aligned}$$

$$\begin{aligned} \text{c) } (x + 5)(x - 5) \\ &= x^2 - 5x + 5x - 25 \\ &= x^2 - 25 \end{aligned}$$

$$\begin{aligned} \text{d) } (x + 6)^2 \\ &= (x + 6)(x + 6) \\ &= x^2 + 6x + 6x + 36 \\ &= x^2 + 12x + 36 \end{aligned}$$

$$\begin{aligned} \text{e) } (x + 4)(x^2 + 3x + 2) \\ &= x^3 + 3x^2 + 2x + 4x^2 + 12x + 8 \\ &= x^3 + 3x^2 + 4x^2 + 2x + 12x + 8 \\ &= x^3 + 7x^2 + 14x + 8 \end{aligned}$$

$$\begin{aligned} \text{f) } (x + 1)(x + 2)(x + 3) \quad \text{Pick one pair at a time.} \\ &= (x + 1)(x + 2)(x + 3) \\ &= (x^2 + 2x + x + 2)(x + 3) \\ &= (x^2 + 3x + 2)(x + 3) \\ &= x^3 + 3x^2 + 3x^2 + 9x + 2x + 6 \\ &= x^3 + 6x^2 + 11x + 6 \end{aligned}$$

$$\begin{aligned} \text{g) } 2x(x - 1) - (x + 3)(x - 1) \\ &= 2x(x - 1) - (x + 3)(x - 1) \\ &= (2x^2 - x) - (x^2 - x + 3x - 3) \\ &= (2x^2 - x) - (x^2 + 2x - 3) \\ &= 2x^2 - x - x^2 - 2x + 3 \\ &= 2x^2 - x^2 - x - 2x + 3 \\ &= x^2 - 3x + 3 \end{aligned}$$

Practice: pg. 166 #4 - 11ac, 17ac