

# Expanding brackets and simplifying expressions

## A LEVEL LINKS

**Scheme of work:** 1a. Algebraic expressions – basic algebraic manipulation, indices and surds

## Key points

- When you expand one set of brackets you must multiply everything inside the bracket by what is outside.
- When you expand two linear expressions, each with two terms of the form  $ax + b$ , where  $a \neq 0$  and  $b \neq 0$ , you create four terms. Two of these can usually be simplified by collecting like terms.

## Examples

**Example 1** Expand  $4(3x - 2)$

$4(3x - 2) = 12x - 8$	<p>Multiply everything inside the bracket by the 4 outside the bracket</p>
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**Example 2** Expand and simplify  $3(x + 5) - 4(2x + 3)$

$\begin{aligned} 3(x + 5) - 4(2x + 3) \\ = 3x + 15 - 8x - 12 \\ \\ = 3 - 5x \end{aligned}$	<p><b>1</b> Expand each set of brackets separately by multiplying <math>(x + 5)</math> by 3 and <math>(2x + 3)</math> by <math>-4</math></p> <p><b>2</b> Simplify by collecting like terms: <math>3x - 8x = -5x</math> and <math>15 - 12 = 3</math></p>
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**Example 3** Expand and simplify  $(x + 3)(x + 2)$

$\begin{aligned} (x + 3)(x + 2) \\ = x(x + 2) + 3(x + 2) \\ = x^2 + 2x + 3x + 6 \\ = x^2 + 5x + 6 \end{aligned}$	<p><b>1</b> Expand the brackets by multiplying <math>(x + 2)</math> by <math>x</math> and <math>(x + 2)</math> by 3</p> <p><b>2</b> Simplify by collecting like terms: <math>2x + 3x = 5x</math></p>
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**Example 4** Expand and simplify  $(x - 5)(2x + 3)$

$\begin{aligned} (x - 5)(2x + 3) \\ = x(2x + 3) - 5(2x + 3) \\ = 2x^2 + 3x - 10x - 15 \\ = 2x^2 - 7x - 15 \end{aligned}$	<p><b>1</b> Expand the brackets by multiplying <math>(2x + 3)</math> by <math>x</math> and <math>(2x + 3)</math> by <math>-5</math></p> <p><b>2</b> Simplify by collecting like terms: <math>3x - 10x = -7x</math></p>
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## Practice

1 Expand.

a  $3(2x - 1)$

c  $-(3xy - 2y^2)$

b  $-2(5pq + 4q^2)$

2 Expand and simplify.

a  $7(3x + 5) + 6(2x - 8)$

c  $9(3s + 1) - 5(6s - 10)$

b  $8(5p - 2) - 3(4p + 9)$

d  $2(4x - 3) - (3x + 5)$

3 Expand.

a  $3x(4x + 8)$

c  $-2h(6h^2 + 11h - 5)$

b  $4k(5k^2 - 12)$

d  $-3s(4s^2 - 7s + 2)$

4 Expand and simplify.

a  $3(y^2 - 8) - 4(y^2 - 5)$

c  $4p(2p - 1) - 3p(5p - 2)$

b  $2x(x + 5) + 3x(x - 7)$

d  $3b(4b - 3) - b(6b - 9)$

5 Expand  $\frac{1}{2}(2y - 8)$

6 Expand and simplify.

a  $13 - 2(m + 7)$

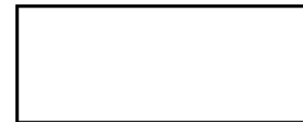
b  $5p(p^2 + 6p) - 9p(2p - 3)$

7 The diagram shows a rectangle.

Write down an expression, in terms of  $x$ , for the area of the rectangle.

Show that the area of the rectangle can be written as  $21x^2 - 35x$

$3x - 5$



$7x$

8 Expand and simplify.

a  $(x + 4)(x + 5)$

c  $(x + 7)(x - 2)$

e  $(2x + 3)(x - 1)$

g  $(5x - 3)(2x - 5)$

i  $(3x + 4y)(5y + 6x)$

k  $(2x - 7)^2$

b  $(x + 7)(x + 3)$

d  $(x + 5)(x - 5)$

f  $(3x - 2)(2x + 1)$

h  $(3x - 2)(7 + 4x)$

j  $(x + 5)^2$

l  $(4x - 3y)^2$

## Extend

9 Expand and simplify  $(x + 3)^2 + (x - 4)^2$

10 Expand and simplify.

a  $\left(x + \frac{1}{x}\right)\left(x - \frac{2}{x}\right)$

b  $\left(x + \frac{1}{x}\right)^2$

### Watch out!

When multiplying (or dividing) positive and negative numbers, if the signs are the same the answer is '+'; if the signs are different the answer is '-'.

**Answers**

- 1 a  $6x - 3$  b  $-10pq - 8q^2$   
c  $-3xy + 2y^2$
- 2 a  $21x + 35 + 12x - 48 = 33x - 13$   
b  $40p - 16 - 12p - 27 = 28p - 43$   
c  $27s + 9 - 30s + 50 = -3s + 59 = 59 - 3s$   
d  $8x - 6 - 3x - 5 = 5x - 11$
- 3 a  $12x^2 + 24x$  b  $20k^3 - 48k$   
c  $10h - 12h^3 - 22h^2$  d  $21s^2 - 21s^3 - 6s$
- 4 a  $-y^2 - 4$  b  $5x^2 - 11x$   
c  $2p - 7p^2$  d  $6b^2$
- 5  $y - 4$
- 6 a  $-1 - 2m$  b  $5p^3 + 12p^2 + 27p$
- 7  $7x(3x - 5) = 21x^2 - 35x$
- 8 a  $x^2 + 9x + 20$  b  $x^2 + 10x + 21$   
c  $x^2 + 5x - 14$  d  $x^2 - 25$   
e  $2x^2 + x - 3$  f  $6x^2 - x - 2$   
g  $10x^2 - 31x + 15$  h  $12x^2 + 13x - 14$   
i  $18x^2 + 39xy + 20y^2$  j  $x^2 + 10x + 25$   
k  $4x^2 - 28x + 49$  l  $16x^2 - 24xy + 9y^2$
- 9  $2x^2 - 2x + 25$
- 10 a  $x^2 - 1 - \frac{2}{x^2}$  b  $x^2 + 2 + \frac{1}{x^2}$