**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*≠ 0 and *b*≠ 0, you create four terms. Two of these can usually be simplified by collecting like terms.

Examples

**Example 1** Expand 4(3*x* − 2)

|  |  |
| --- | --- |
| 4(3*x* − 2) = 12*x* − 8 | Multiply everything inside the bracket by the 4 outside the bracket |

**Example 2** Expand and simplify 3(*x* + 5) − 4(2*x* + 3)

|  |  |
| --- | --- |
| 3(*x* + 5) − 4(2*x* + 3) = 3*x* + 15 − 8*x* – 12 = 3 − 5*x* | **1** Expand each set of brackets separately by multiplying (*x* + 5) by 3 and (2*x* + 3) by −4**2** Simplify by collecting like terms: 3*x*− 8*x*= −5*x* and 15 − 12 = 3 |

**Example 3** Expand and simplify (*x* + 3)(*x* + 2)

|  |  |
| --- | --- |
| (*x* + 3)(*x* + 2) = *x*(*x* + 2) + 3(*x* + 2) = *x*2 + 2*x* + 3*x* + 6 = *x*2 + 5*x* + 6 | **1** Expand the brackets by multiplying (*x* + 2) by *x* and (*x* + 2) by 3**2** Simplify by collecting like terms: 2*x*+ 3*x* = 5*x* |

**Example 4** Expand and simplify (*x* − 5)(2*x* + 3)

|  |  |
| --- | --- |
| (*x* − 5)(2*x* + 3) = *x*(2*x* + 3) − 5(2*x* + 3) = 2*x*2 + 3*x* − 10*x* − 15 = 2*x*2 − 7*x* − 15 | **1** Expand the brackets by multiplying (2*x* + 3) by *x* and (2*x* + 3) by −5**2** Simplify by collecting like terms: 3*x*− 10*x* = −7*x* |

Practice

**1** Expand.

**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 ‘–’.

 **a** 3(2*x* − 1) **b** −2(5*pq* + 4*q*2)

 **c** −(3*xy* − 2*y*2)

**2** Expand and simplify.

 **a** 7(3*x* + 5) + 6(2*x* – 8) **b** 8(5*p* – 2) – 3(4*p* + 9)

 **c** 9(3*s* + 1) –5(6*s* – 10) **d** 2(4*x* – 3) – (3*x* + 5)

**3** Expand.

 **a** 3*x*(4*x* + 8) **b** 4*k*(5*k*2 – 12)

 **c** –2*h*(6*h*2 + 11*h* – 5) **d** –3*s*(4*s*2 – 7*s* + 2)

**4** Expand and simplify.

 **a** 3(*y*2 – 8) – 4(*y*2 – 5) **b** 2*x*(*x* + 5) + 3*x*(*x* – 7)

 **c** 4*p*(2*p* – 1) – 3*p*(5*p* – 2) **d** 3*b*(4*b* – 3) – *b*(6*b* – 9)

**5** Expand (2*y* – 8)

**6** Expand and simplify.

 **a** 13 – 2(*m* + 7) **b** 5*p*(*p*2 + 6*p*) – 9*p*(2*p* – 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 21*x*2– 35*x*

**8** Expand and simplify.

 **a** (*x* + 4)(*x* + 5) **b** (*x* + 7)(*x* + 3)

 **c** (*x* + 7)(*x* – 2) **d** (*x* + 5)(*x* – 5)

 **e** (2*x* + 3)(*x* – 1) **f** (3*x* – 2)(2*x* + 1)

 **g** (5*x* – 3)(2*x* – 5) **h** (3*x* – 2)(7 + 4*x*)

 **i** (3*x* + 4*y*)(5*y* + 6*x*) **j** (*x* + 5)2

 **k** (2*x* − 7)2 **l** (4*x* − 3*y*)2

Extend

**9** Expand and simplify (*x* + 3)² + (*x* − 4)²

**10** Expand and simplify.

 **a**  **b** 

Answers

**1 a** 6*x* – 3 **b** –10*pq* – 8*q*2

**c** –3*xy* + 2*y*2

**2 a** 21*x* + 35 + 12*x* – 48 = 33*x* – 13

 **b** 40*p* – 16 – 12*p* – 27 = 28*p* – 43

 **c** 27*s* + 9 – 30*s* + 50 = –3*s* + 59 = 59 – 3*s*

**d** 8*x* – 6 – 3*x* – 5 = 5*x* – 11

**3 a** 12*x*2 + 24*x* **b** 20*k*3 – 48*k*

 **c** 10*h* – 12*h*3 – 22*h*2 **d** 21*s*2 – 21*s*3 – 6*s*

**4 a** –*y*2 – 4 **b** 5*x*2 – 11*x*

 **c** 2*p* – 7*p*2 **d** 6*b*2

**5** *y* – 4

**6 a** –1 – 2*m* **b** 5*p*3 + 12*p*2 + 27*p*

**7** 7*x*(3*x* – 5) = 21*x*2 – 35*x*

**8 a** *x*2 + 9*x* + 20 **b** *x*2 + 10*x* + 21

 **c** *x*2 + 5*x* – 14 **d** *x*2 – 25

 **e** 2*x*2 + *x* – 3 **f** 6*x*2 – *x* – 2

 **g** 10*x*2 – 31*x* + 15 **h** 12*x*2 + 13*x* – 14

 **i** 18*x*2 + 39*xy* + 20*y*2 **j** *x*2 + 10*x* + 25

 **k** 4*x*2 − 28*x* + 49 **l** 16*x*2 − 24*xy* + 9*y*2

**9** 2*x*2 − 2*x* + 25

**10 a**  **b** 