**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** 