

Do Now

WALT expand algebraic expressions using the distributive law

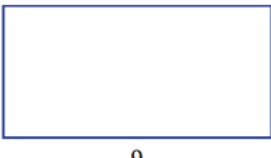
Success Criteria I know everything inside the bracket gets multiplied by the term outside the bracket.

Lets check your understanding “ This is a basic practice for people who missed out working on this in year 9’


Understanding

**1** What is the area of each of the following rectangles?


**a**



**b**



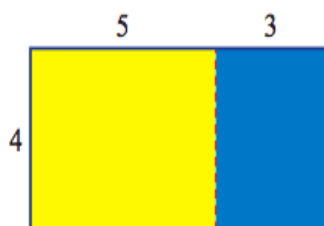
**c**



Expanding expressions explained

**2** The rectangle shown has height 4 and width  $5 + 3$ .

- a** What is the area of the yellow rectangle?  
**b** What is the area of the blue rectangle?  
**c** What is the total combined area?



### Example 12

 Expanding brackets by simplifying repeated terms

Write the expression  $3(2m + 5)$  in full without brackets and simplify the result.

**Solution**

$$\begin{aligned} 3(2m + 5) &= 2m + 5 + 2m + 5 + 2m + 5 \\ &= 6m + 15 \end{aligned}$$

**Explanation**

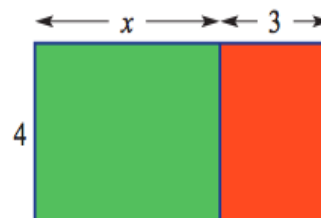
Three repeats of the expression  $2m + 5$ .  
Simplify by collecting the like terms.

**3** The expression  $3(a + 2)$  can be written as  $(a + 2) + (a + 2) + (a + 2)$ .

- a** Simplify this expression by collecting like terms.  
**b** Write  $2(x + y)$  out in full without brackets and simplify the result.  
**c** Write  $4(p + 1)$  out in full without brackets and simplify the result.  
**d** Write  $3(4a + 2b)$  out in full without brackets and simplify the result.

**4** The area of the rectangle shown can be written as  $4(x + 3)$ .

- a** What is the area of the green rectangle?  
**b** What is the area of the red rectangle?  
**c** Write the total area as an expression without using brackets.  
**d** Fill in the blank: The expressions  $4(x + 3)$  and  $4x + 12$  are \_\_\_\_\_ expressions.



**Example 14** Expanding using the distributive law

Expand the following expressions.

**a**  $5(x + 3)$

**b**  $3(a - 4)$

**c**  $2(3p - 7q)$

**Solution****Explanation**

**a**  $5(x + 3) = 5x + 5 \times 3$

$$= 5x + 15$$

Using the distributive law

$$5(x + 3) = 5x + 5 \times 3$$

Simplify the result.

**b**  $3(a - 4) = 3a - 3 \times 4$

$$= 3a - 12$$

Using the distributive law

$$3(a - 4) = 3a - 3 \times 4$$

Simplify the result.

**c**  $2(3p - 7q) = 2 \times 3p - 2 \times 7q$

$$= 6p - 14q$$

Using the distributive law

$$2(3p - 7q) = 2 \times 3p - 2 \times 7q$$

Simplify the result, remembering  $2 \times 3p = 6p$  and  $2 \times 7q = 14q$ .**6** Use the distributive law to expand the following.

**a**  $6(y + 8)$

**b**  $7(l + 4)$

**c**  $9(a + 7)$

**d**  $2(t + 6)$

**7** Use the distributive law to expand the following.

**a**  $2(m - 10)$

**b**  $8(y - 3)$

**c**  $3(e - 7)$

**d**  $7(e - 3)$

**8** Use the distributive law to expand the following.

**a**  $10(6g - 7)$

**b**  $5(3e - 8)$

**c**  $5(7w + 10)$

**d**  $5(2u + 5)$

**e**  $7(8x - 2)$

**f**  $3(9v - 4)$

**g**  $7(2q - 4)$

**h**  $4(5c - v)$

**i**  $4(2 + 5x)$

**j**  $3(7 + 2y)$

**k**  $8(9 - 3x)$

**l**  $11(2 - 4k)$

**9** Fill in the missing number in the following expansions.

**a**  $4(x + 5) = 4x + \square$

**b**  $3(x + 2) = 3x + \square$

**c**  $5(3a + 2) = 15a + \square$

**d**  $7(4x - 2) = 28x - \square$

**Challenge**

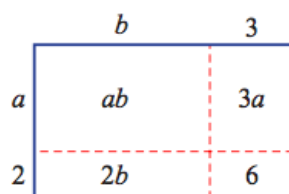
- 10** The perimeter of a rectangle is given by the expression  $2(l + w)$  where  $l$  is the length and  $w$  is the width. What is an equivalent expression for this?
- 11** Expand the brackets in the following and then simplify the result.
- $3(x + 2) + 4x$
  - $4(a + 3) - 2a$
  - $5(3b - 2) + 10$
  - $6(2c + 4) - 2c$
- 12** Write an expression for each of the following and then expand it.
- A number  $x$  has 3 added to it and the result is multiplied by 5.
  - A number  $b$  has 6 added to it and the result is doubled.
  - A number  $z$  has 4 subtracted from it and the result is multiplied by 3.
  - A number  $y$  is subtracted from 10 and the result is multiplied by 7.
- 13** When expanded,  $4(2a + 6b)$  gives  $8a + 24b$ . Find two other expressions that expand to  $8a + 24b$ .

You can combine like terms.



### ★ Bigger expansions

- 14** The diagram below helps to demonstrate that  $(a + 2)(b + 3) = ab + 2b + 3a + 6$ .



Use a diagram like the one above to expand the following expressions.

- $(a + 4)(b + 2)$
- $(x + 3)(y + 5)$
- $(2a + 5)(3c + 2)$
- $(4a + 1)(5b + 3)$

## More practice

### Exercise 11D

- 1** Complete the following to expand the expressions.

**a**  $5(d + 4) = \_ \times d + \_ \times 4$   
 $= \_ + \_$

**b**  $4(y - 3) = \_ \times y - \_ \times 3$   
 $= \_ - \_$

**c**  $3(6 - m) = \_ \times 6 - \_ \times m$   
 $= \_ - \_$

**d**  $2(q + 7) = 2 \times \_ + 2 \times \_$   
 $= \_ + \_$

**e**  $6(b - 2) = 6 \times \_ - 6 \times \_$   
 $= \_ - \_$



- 2** Expand the following expressions.

**a**  $4(b + 3)$

**b**  $12(k + 8)$

**c**  $7(c - 5)$

**d**  $6(d - 3)$

**e**  $2(y - 11)$

**f**  $9(a + 10)$

**g**  $10(j + 9)$

**h**  $8(m + 2)$

**i**  $7(q - 2)$

**j**  $5(l - 6)$

**k**  $4(2 - c)$

**l**  $3(r + 6)$

**m**  $9(7 - t)$

**n**  $4(v + 12)$

**o**  $6(8 - n)$

**p**  $6(x - 2)$

**3** Complete the following to expand.

**a**  $4(3z + 2) = \underline{\quad} \times 3z + \underline{\quad} \times 2$   
 $= \underline{\quad} + \underline{\quad}$

**b**  $5(2y - 3) = \underline{\quad} \times 2y - \underline{\quad} \times 3$   
 $= \underline{\quad} - \underline{\quad}$

**c**  $3(6 + 4k) = 3 \times \underline{\quad} + 3 \times \underline{\quad}$   
 $= \underline{\quad} + \underline{\quad}$

**4** Expand the following expressions.

**a**  $3(2m + 6)$

**b**  $5(4d + 5)$

**c**  $9(3p + 8)$

**d**  $7(5c - 4)$

**e**  $10(2p - 2)$

**f**  $12(4c - 3)$

**g**  $6(6k + 10)$

**h**  $2(13n + 5)$

**i**  $10(7a - 6)$

**j**  $8(7l - 3)$

**k**  $11(2h + 8)$

**l**  $4(15k - 5)$

**m**  $13(6x + 2)$

**n**  $7(10w - 9)$

**o**  $5(11j + 7)$

**p**  $3(9q - 4)$

**5** Explain the difference between each pair of expressions.

**a**  $2x + 1$  and  $2(x + 1)$

**b**  $5p - 8$  and  $5(p - 8)$

**6** Complete the following to expand.

**a**  $m(m + 3) = \underline{\quad} \times m + \underline{\quad} \times 3$   
 $= \underline{\quad} + \underline{\quad}$

**b**  $p(q - r) = \underline{\quad} \times q - \underline{\quad} \times r$   
 $= \underline{\quad} - \underline{\quad}$

**7** Expand the following expressions.

**a**  $x(x + 5)$

**b**  $q(q + 13)$

**c**  $a(a + 8)$

**d**  $z(z + 11)$

**e**  $t(t - 6)$

**f**  $m(m - 10)$

**g**  $d(3 - d)$

**h**  $r(r - 17)$

**i**  $a(c - 4)$

**j**  $b(d + a)$

**k**  $x(y - z)$

**l**  $m(n + c)$

**m**  $j(k - h)$

**n**  $d(f + g)$

**o**  $e(c - d)$

**p**  $r(x - y)$

**8** Complete the following to expand.

**a**  $4t(t - 3) = \underline{\quad} \times t - \underline{\quad} \times 3$   
 $= \underline{\quad} - \underline{\quad}$

**b**  $3x(2y + 5z) = \underline{\quad} \times 2y + \underline{\quad} \times 5z$   
 $= \underline{\quad} + \underline{\quad}$

**9** Expand the following expressions.

**a**  $8m(m + 3)$

**b**  $5c(c + 6)$

**c**  $3r(11 + r)$

**d**  $11q(q - 1)$

**e**  $4x(2 - x)$

**f**  $10a(7 - a)$

**g**  $4a(2a + 7)$

**h**  $9b(11b + 5)$

**i**  $5f(4 - 4f)$

**j**  $6d(d - f)$

**k**  $3k(8 - 4k)$

**l**  $12l(3 - 2l)$

**m**  $5p(2p - 3n)$

**n**  $7c(5c + 2d)$

**o**  $6n(6m - 5n)$

**p**  $4x(4x - 3z)$

**10** Complete the following to simplify.

**a**  $3(x + 5) + 2x - 7$   
 $= \underline{\quad} \times x + \underline{\quad} \times 5 + 2x - 7$   
 $= \underline{\quad}x + \underline{\quad} + 2x - 7$   
 $= \underline{\quad} + \underline{\quad}$

**b**  $2(p + 5) + 4(p - 3)$   
 $= \underline{\quad} \times p + \underline{\quad} \times 5 + \underline{\quad} \times p - \underline{\quad} \times 3$   
 $= \underline{\quad}p + \underline{\quad} + \underline{\quad}p - \underline{\quad}$   
 $= \underline{\quad} - \underline{\quad}$

**11** Expand and simplify by collecting like terms.

**a**  $7(a + 8) + 5a$

**b**  $9(p - 5) - 3$

**c**  $6(c + 8) + 4c$

**d**  $8(d - 7) - 4d$

**e**  $5(q + 4) + 10q$

**f**  $11(m - 7) + 15$

**g**  $4(n + 6) + 3n - 10$

**h**  $2(b - 7) + 3b + 12$

**i**  $3x - 19 + 3(5 - 2x)$

**j**  $7w - 8 + 5(w + 1)$

**k**  $9(f - 3) + 8 - 6f$

**l**  $6n - 10 + 2(n - 7)$

**m**  $10y + 22 + 2(y - 10) + 3y$

**n**  $7c + 3(6 - 4c) + 11 - 2c$

**o**  $4(y - 6) - 3 + 5y$

**12** Expand and simplify by collecting like terms.

**a**  $2(x + 7) + 4(x + 8)$

**b**  $4(d + 5) + 3(d - 2)$

**c**  $8(n - 3) + 7(n - 4)$

**d**  $3(q - 6) + 9(q - 7)$

**e**  $7(f - 8) + 2(f - 9)$

**f**  $10(c - 6) + 2(c - 2)$

**g**  $x(x + 5) + 2(x - 4)$

**h**  $y(y - 6) + 4(y + 2)$

**i**  $w(w - 8) + w(w - 9)$

**j**  $5(2m + 7) + 3(4m - 8)$

**k**  $4(3t + 6) + 3(2t + 4)$

**l**  $9(2a - 1) + 10(4a + 7)$

**m**  $10(4a - 2) + 2a(3a - 5)$

**n**  $6c(c - 7) + 2c(c + 8)$

**o**  $4d(3 - 2d) + 3d(2d + 1)$

**13** Complete the following to expand.

**a**  $-4(y + 3)$

$= (\quad) \times y + (\quad) \times 3$

$= -4y + (-12)$

$= \underline{\quad} - \underline{\quad}$

**b**  $-x(x - y)$

$= (\quad) \times x - (\quad) \times y$

$= \underline{\quad} - (\underline{\quad})$

$= \underline{\quad} + \underline{\quad}$

**c**  $-(4k + 3m)$

$= (\quad) \times 4k + (\quad) \times 3m$

$= \underline{\quad} + (\underline{\quad})$

$= \underline{\quad} - \underline{\quad}$

## Extension

**14** Expand the following.

**a**  $-6(a + 10)$

**b**  $-4(b + 8)$

**c**  $-9(k + 9)$

**d**  $-3(c - 3)$

**e**  $-5(f - 7)$

**f**  $-10(d - 6)$

**g**  $-7(m + 5)$

**h**  $-2(n + 10)$

**i**  $-11(h + 11)$

**j**  $-10(2p - 7)$

**k**  $-8(3m - 3)$

**l**  $-5(7q - 8)$

**15** Expand the following.

**a**  $-p(p + 7)$

**b**  $-w(w + 8)$

**c**  $-d(d + 11)$

**d**  $-s(s - 3)$

**e**  $-x(x - 6)$

**f**  $-f(f - 14)$

**g**  $-m(n + 5)$

**h**  $-a(y + 2)$

**i**  $-k(m + 10)$

**j**  $-3t(2t - p)$

**k**  $-4y(5y - c)$

**l**  $-8n(8n - 4m)$

**16** Expand the following.

**a**  $-(x + 2)$

**b**  $-(y + 3)$

**c**  $-(a + 7)$

**d**  $-(n - 11)$

**e**  $-(g - 5)$

**f**  $-(b - 4)$

**g**  $-(6 + g)$

**h**  $-(3 + k)$

**i**  $-(l + 13)$

**j**  $-(2p - 7)$

**k**  $-(5n - 8)$

**l**  $-(10d - 11)$

**17** Expand and collect like terms.

**a**  $5(p + 7) + 3p$

**c**  $4x + 7(x - 5) + 10$

**e**  $3(q - 4) + 2q + 9$

**g**  $10(n + 8) - (6n - 3)$

**i**  $16s - 17 - 5(s - 4) + 6$

**k**  $11(w + 2) - (w - 2)$

**m**  $2(d - 7) + 5(d - 8)$

**o**  $8(p - 6) - 3(p - 10)$

**q**  $n(n - 3) - 2(n - 6)$

**s**  $5c(2c - 6) - 3c(c - 7)$

**u**  $10d(d + 2) - 7d(2d - 4)$

**w**  $5c(c + 7) - 8(c - 9)$

**b**  $12(c - 8) + 29$

**d**  $6(d - 1) + 2d$

**f**  $15 + 2(m - 7) - 5m$

**h**  $9a + 14 + 2(a - 9)$

**j**  $9(x - 8) - (x + 12)$

**l**  $3(z + 12) - (z + 18)$

**n**  $4(k + 2) - 2(k + 3)$

**p**  $y(y + 8) - y(y - 9)$

**r**  $w(w + 4) - 5(w - 7)$

**t**  $8a(2a - 1) - 2a(3a + 4)$

**v**  $4f - 7(f + 6) - 3(f - 10)$

**x**  $12 + 3(n - 1) - 2(n - 6)$

**18** Expand and simplify each expression by collecting like terms.

**a**  $4(x + 7) - 3(x - 5) + 2(x - 9)$

**c**  $8(n - 6) + 12 - 5n - 4(n - 14)$

**e**  $-5(d - 11) - 8(d + 7) - 2(d - 5)$

**g**  $-7y(y - 4) - 6y(2y + 8) + 12y$

**i**  $-9k + 15 + 3k(4 - 2k) - 6k(7 + 2k)$

**b**  $2(c + 13) - 5(c + 4) + 9(c - 6)$

**d**  $12f + 30 + 4(f - 12) + 11 - 9f$

**f**  $-(p - 7) - 3(p + 5) + 17 - 10p$

**h**  $2a(a - 3) + 5a(a + 6) - 3a(9 - 2a)$

**j**  $4b(2c + 8b) - 2c(5b - 7c) + 2b(9c - 3b)$

### Check your answers

- 1 a** 36      **b** 20      **c** 35  
**2 a** 20      **b** 12      **c** 32  
**3 a**  $3a + 6$       **b**  $2x + 2y$       **c**  $4p + 4$       **d**  $12a + 6b$   
**4 a**  $4x$       **b** 12      **c**  $4x + 12$       **d** equivalent  
**5 a**  $4(x + 2) = 4x + 8$       **b**  $3(a + 1) = 3a + 3$   
**c**  $4(k + 7) = 4k + 28$       **d**  $3(b + 5) = 3b + 15$   
**6 a**  $6y + 48$       **b**  $7l + 28$       **c**  $9a + 63$       **d**  $2t + 12$   
**7 a**  $2m - 20$       **b**  $8y - 24$       **c**  $3e - 21$       **d**  $7e - 21$   
**8 a**  $60g - 70$       **b**  $15e - 40$       **c**  $35w + 50$       **d**  $10u + 25$   
**e**  $56x - 14$       **f**  $27v - 12$       **g**  $14q - 28$       **h**  $20c - 4v$   
**i**  $8 + 20x$       **j**  $21 + 6y$       **k**  $72 - 24x$       **l**  $22 - 44k$   
**9 a** 20      **b** 6      **c** 10      **d** 14  
**10**  $2l + 2w$   
**11 a**  $7x + 6$       **b**  $2a + 12$       **c**  $15b$       **d**  $10c + 24$   
**12 a**  $5(x + 3) = 5x + 15$       **b**  $2(b + 6) = 2b + 12$   
**c**  $3(z - 4) = 3z - 12$       **d**  $7(10 - y) = 70 - 7y$   
**13**  $2(4a + 12b)$  and  $8(a + 3b)$ . Others possible.  
**14 a**  $ab + 4b + 2a + 8$       **b**  $xy + 3y + 5x + 15$   
**c**  $6ac + 15c + 4a + 10$       **d**  $20ab + 5b + 12a + 3$

<p><b>1</b> a <math>5 \times d + 5 \times 4 = 5d + 20</math>  b <math>4 \times y - 4 \times 3 = 4y - 12</math>  c <math>3 \times 6 - 3 \times m = 18 - 3m</math>  d <math>2 \times q + 2 \times 7 = 2q + 14</math>  e <math>6 \times b - 6 \times 2 = 6b - 12</math></p> <p><b>2</b> a <math>4b + 12</math>      b <math>12k + 96</math>      c <math>7c - 35</math>  d <math>6d - 18</math>      e <math>2y - 22</math>      f <math>9a + 90</math>  g <math>10j + 90</math>      h <math>8m + 16</math>      i <math>7q - 14</math>  j <math>5l - 30</math>      k <math>8 - 4c</math>      l <math>3r + 18</math>  m <math>63 - 9t</math>      n <math>4v + 48</math>      o <math>48 - 6n</math>  p <math>6x - 12</math></p> <p><b>3</b> a <math>4 \times 3z + 4 \times 2 = 12z + 8</math>  b <math>5 \times 2y - 5 \times 3 = 10y - 15</math>  c <math>3 \times 6 + 3 \times 4k = 18 + 12k</math></p> <p><b>4</b> a <math>6m + 18</math>      b <math>20d + 25</math>  c <math>27p + 72</math>      d <math>35c - 28</math>  e <math>20p - 20</math>      f <math>48c - 36</math>  g <math>36k + 60</math>      h <math>26n + 10</math>  i <math>70a - 60</math>      j <math>56l - 24</math>  k <math>22h + 88</math>      l <math>60k - 20</math>  m <math>78x + 26</math>      n <math>70w - 63</math>  o <math>55j + 35</math>      p <math>27q - 12</math></p> <p><b>5</b> a <math>2(x + 1) = 2x + 2 \neq 2x + 1</math>  b <math>5(p - 8) = 5p - 40 \neq 5p - 8</math></p> <p><b>6</b> a <math>m \times m + m \times 3 = m^2 + 3m</math>  b <math>p \times q - p \times r = pq - pr</math></p>	<p><b>7</b> a <math>x^2 + 5x</math>      b <math>q^2 + 13q</math>  c <math>a^2 + 8a</math>      d <math>z^2 + 11z</math>  e <math>t^2 - 6t</math>      f <math>m^2 - 10m</math>  g <math>3d - d^2</math>      h <math>r^2 - 17r</math>  i <math>ac - 4a</math>      j <math>bd + ba</math>  k <math>xy - xz</math>      l <math>mn + mc</math>  m <math>jk - jh</math>      n <math>df + dg</math>  o <math>ec - ed</math>      p <math>rx - ry</math></p> <p><b>8</b> a <math>4t \times t - 4t \times 3 = 4t^2 - 12t</math>  b <math>3x \times 2y + 3x \times 5z = 6xy + 15xz</math></p> <p><b>9</b> a <math>8m^2 + 24m</math>      b <math>5c^2 + 30c</math>  c <math>33r + 3r^2</math>      d <math>11q^2 - 11q</math>  e <math>8x - 4x^2</math>      f <math>70a - 10a^2</math>  g <math>8a^2 + 28a</math>      h <math>99b^2 + 45b</math>  i <math>20f - 20f^2</math>      j <math>6d^2 - 6df</math>  k <math>24k - 12k^2</math>      l <math>36l - 24l^2</math>  m <math>10p^2 - 15pn</math>      n <math>35c^2 + 14cd</math>  o <math>36mn - 30n^2</math>      p <math>16x^2 - 12xz</math></p> <p><b>10</b> a <math>3 \times x + 3 \times 5 + 2x - 7</math>  <math>= 3x + 15 + 2x - 7 = 5x + 8</math>  b <math>2 \times p + 2 \times 5 + 4 \times p - 4 \times 3</math>  <math>= 2p + 10 + 4p - 12 = 6p - 2</math></p> <p><b>11</b> a <math>12a + 56</math>      b <math>9p - 48</math>  c <math>10c + 48</math>      d <math>4d - 56</math>  e <math>15q + 20</math>      f <math>11m - 62</math>  g <math>7n + 14</math>      h <math>5b - 2</math>  i <math>-3x - 4</math>      j <math>12w - 3</math>  k <math>3f - 19</math>      l <math>8n - 24</math>  m <math>15y + 2</math>      n <math>-7c + 29</math>  o <math>9y - 27</math></p>
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<p><b>13</b> a <math>(-4) \times y + (-4) \times 3</math>  <math>= -4y + (-12) = -4y - 12</math>  b <math>(-x) \times x - (-x) \times y</math>  <math>= -x^2 - (-xy) = -x^2 + xy</math>  c <math>(-1) \times 4k + (-1) \times 3m</math>  <math>= -4k + (-3m) = -4k - 3m</math></p> <p><b>14</b> a <math>-6a - 60</math>      b <math>-4b - 32</math>  c <math>-9k - 81</math>      d <math>-3c + 9</math>  e <math>-5f + 35</math>      f <math>-10d + 60</math>  g <math>-7m - 35</math>      h <math>-2n - 20</math>  i <math>-11h - 121</math>      j <math>-20p + 70</math>  k <math>-24m + 24</math>      l <math>-35q + 40</math></p> <p><b>15</b> a <math>-p^2 - 7p</math>      b <math>-w^2 - 8w</math>  c <math>-d^2 - 11d</math>      d <math>-s^2 + 3s</math>  e <math>-x^2 + 6x</math>      f <math>-f^2 + 14f</math>  g <math>-mn - 5m</math>      h <math>-ay - 2a</math>  i <math>-km - 10k</math>      j <math>-6t^2 + 3pt</math>  k <math>-20y^2 + 4cy</math>      l <math>-64n^2 + 32mn</math></p> <p><b>16</b> a <math>-x - 2</math>      b <math>-y - 3</math>  c <math>-a - 7</math>      d <math>-n + 11</math>  e <math>-g + 5</math>      f <math>-b + 4</math>  g <math>-6 - g</math>      h <math>-3 - k</math>  i <math>-l - 13</math>      j <math>-2p + 7</math>  k <math>-5n + 8</math>      l <math>-10d + 11</math></p>	<p><b>17</b> a <math>8p + 35</math>      b <math>12c - 67</math>  c <math>11x - 25</math>      d <math>8d - 6</math>  e <math>5q - 3</math>      f <math>-3m + 1</math>  g <math>4n + 83</math>      h <math>11a - 4</math>  i <math>11s + 9</math>      j <math>8x - 84</math>  k <math>10w + 24</math>      l <math>2z + 18</math>  m <math>7d - 54</math>      n <math>2k + 2</math>  o <math>5p - 18</math>      p <math>17y</math>  q <math>n^2 - 5n + 12</math>      r <math>w^2 - w + 35</math>  s <math>7c^2 - 9c</math>      t <math>10a^2 - 16a</math>  u <math>-4d^2 + 48d</math>      v <math>-6f - 12</math>  w <math>5c^2 + 27c + 72</math>      x <math>-n + 21</math></p> <p><b>18</b> a <math>3x + 25</math>      b <math>6c - 48</math>  c <math>n + 20</math>      d <math>7f - 7</math>  e <math>-15d + 9</math>      f <math>-14p + 9</math>  g <math>-19y^2 - 8y</math>      h <math>13a^2 - 3a</math>  i <math>-18k^2 - 39k + 15</math>      j <math>26b^2 + 14c^2 + 16bc</math></p>
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After completing your basic practice Discuss in Week 5

We can show what things are multiplied together

- using arrows

$$(a + b)(c + d) \quad \text{or}$$

- using the word **FOIL** where

**F** stands for **F**irsts

**O** stands for **O**uters

**I** stands for **I**nners

**L** stands for **L**asts.

$$(a + b)(c + d)$$

### Example 9

Expand and simplify:    **a**  $(x + 2)(x + 3)$     **b**  $(x + 7)(x + 11)$

$$\begin{aligned} \mathbf{a} \quad & (x + 2)(x + 3) \\ & = x \times x + x \times 3 + 2 \times x + 2 \times 3 \\ & = x^2 + 3x + 2x + 6 \\ & = x^2 + 5x + 6 \end{aligned}$$

$$\begin{aligned} \mathbf{b} \quad & (x + 7)(x + 11) \\ & = x \times x + x \times 11 + 7 \times x + 7 \times 11 \\ & = x^2 + 11x + 7x + 77 \\ & = x^2 + 18x + 77 \end{aligned}$$

### EXERCISE 11B

**1** Expand and simplify:

**a**  $(x + 2)(x + 4)$

**b**  $(x + 3)(x + 4)$

**c**  $(x + 2)(x + 1)$

**d**  $(x + 1)(x + 1)$

**e**  $(x + 4)(x + 5)$

**f**  $(x + 4)(x + 4)$

**g**  $(x + 3)(x + 5)$

**h**  $(x + 1)(x + 6)$

**i**  $(x + 7)(x + 2)$

1. [Expand brackets](#)
2. [Basic examples explained](#)



**Example 10**Expand and simplify:    **a**  $(x + 2)(x - 5)$     **b**  $(x - 3)(x - 4)$ 

$$\begin{aligned}
 \mathbf{a} \quad & (x + 2)(x - 5) \\
 & = (x + 2)(x +^{-}5) \\
 & = x \times x + x \times^{-}5 + 2 \times x + 2 \times^{-}5 \\
 & = x^2 - 5x + 2x - 10 \\
 & = x^2 - 3x - 10
 \end{aligned}$$

$$\begin{aligned}
 \mathbf{b} \quad & (x - 3)(x - 4) \\
 & = (x +^{-}3)(x +^{-}4) \\
 & = x \times x + x \times^{-}4 +^{-}3 \times x +^{-}3 \times^{-}4 \\
 & = x^2 - 4x - 3x + 12 \\
 & = x^2 - 7x + 12
 \end{aligned}$$

With practice lines two and three are usually left out.

**2** Expand and simplify:

**a**  $(x + 1)(x - 2)$

**b**  $(x + 2)(x - 10)$

**c**  $(x - 1)(x + 3)$

**d**  $(x - 2)(x + 5)$

**e**  $(x - 1)(x - 3)$

**f**  $(x - 4)(x - 4)$

**g**  $(x + 3)(x - 5)$

**h**  $(x - 3)(x + 5)$

**i**  $(x - 3)(x - 5)$

**3** Expand and simplify:

**a**  $(a + 3)(a + 6)$

**b**  $(a + 3)(a - 6)$

**c**  $(a - 3)(a + 6)$

**d**  $(a - 3)(a - 6)$

**e**  $(b + 4)(b + 7)$

**f**  $(b - 4)(b + 7)$

**g**  $(b + 4)(b - 7)$

**h**  $(b - 4)(b - 7)$

**i**  $(2c + 1)(c + 3)$

**4** Expand and simplify:

**a**  $(2x + 1)(3x + 2)$

**b**  $(5x - 1)(2x + 1)$

**c**  $(x - 4)(2x + 1)$

**d**  $(1 - x)(x + 1)$

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

**f**  $(3x - 2)(3x - 2)$

**Example 11**Expand and simplify:    **a**  $(x + 4)^2$     **b**  $(x - 4)^2$ 

$$\begin{aligned}
 \mathbf{a} \quad & (x + 4)^2 \\
 & = (x + 4)(x + 4) \\
 & = x^2 + 4x + 4x + 16 \quad \{\text{using FOIL}\} \\
 & = x^2 + 8x + 16
 \end{aligned}$$

$$\begin{aligned}
 \mathbf{b} \quad & (x - 4)^2 \\
 & = (x - 4)(x - 4) \\
 & = x^2 - 4x - 4x + 16 \quad \{\text{using FOIL}\} \\
 & = x^2 - 8x + 16
 \end{aligned}$$

**5** Expand and simplify:

- |          |            |          |            |          |            |          |            |
|----------|------------|----------|------------|----------|------------|----------|------------|
| <b>a</b> | $(x+1)^2$  | <b>b</b> | $(x+3)^2$  | <b>c</b> | $(x-2)^2$  | <b>d</b> | $(x-5)^2$  |
| <b>e</b> | $(2+x)^2$  | <b>f</b> | $(2-x)^2$  | <b>g</b> | $(2x+1)^2$ | <b>h</b> | $(2x-1)^2$ |
| <b>i</b> | $(3x+2)^2$ | <b>j</b> | $(3x-2)^2$ | <b>k</b> | $(x+y)^2$  | <b>l</b> | $(x-y)^2$  |

**Example 12**

Expand and simplify:  $(x-3)(x+3)$

$$\begin{aligned} & (x-3)(x+3) \\ &= x^2 + 3x - 3x - 9 \quad \{\text{using FOIL}\} \\ &= x^2 - 9 \end{aligned}$$

**6** Expand and simplify:

- |          |                |          |              |          |                |
|----------|----------------|----------|--------------|----------|----------------|
| <b>a</b> | $(x-1)(x+1)$   | <b>b</b> | $(x+4)(x-4)$ | <b>c</b> | $(x+5)(x-5)$   |
| <b>d</b> | $(2x+1)(2x-1)$ | <b>e</b> | $(4-x)(4+x)$ | <b>f</b> | $(3-2x)(3+2x)$ |

**7** Why did the  $x$ -terms disappear in the expansions of question **6**?

Answers

- 1** **a**  $x^2 + 6x + 8$  **b**  $x^2 + 7x + 12$   
**c**  $x^2 + 3x + 2$  **d**  $x^2 + 2x + 1$   
**e**  $x^2 + 9x + 20$  **f**  $x^2 + 8x + 16$   
**g**  $x^2 + 8x + 15$  **h**  $x^2 + 7x + 6$   
**i**  $x^2 + 9x + 14$
- 2** **a**  $x^2 - x - 2$  **b**  $x^2 - 8x - 20$  **c**  $x^2 + 2x - 3$   
**d**  $x^2 + 3x - 10$  **e**  $x^2 - 4x + 3$  **f**  $x^2 - 8x + 16$   
**g**  $x^2 - 2x - 15$  **h**  $x^2 + 2x - 15$  **i**  $x^2 - 8x + 15$
- 3** **a**  $a^2 + 9a + 18$  **b**  $a^2 - 3a - 18$   
**c**  $a^2 + 3a - 18$  **d**  $a^2 - 9a + 18$   
**e**  $b^2 + 11b + 28$  **f**  $b^2 + 3b - 28$   
**g**  $b^2 - 3b - 28$  **h**  $b^2 - 11b + 28$   
**i**  $2c^2 + 7c + 3$
- 4** **a**  $6x^2 + 7x + 2$  **b**  $10x^2 + 3x - 1$   
**c**  $2x^2 - 7x - 4$  **d**  $-x^2 + 1$  **e**  $-4x^2 - 4x + 3$   
**f**  $9x^2 - 12x + 4$
- 5** **a**  $x^2 + 2x + 1$  **b**  $x^2 + 6x + 9$  **c**  $x^2 - 4x + 4$   
**d**  $x^2 - 10x + 25$  **e**  $4 + 4x + x^2$  **f**  $4 - 4x + x^2$   
**g**  $4x^2 + 4x + 1$  **h**  $4x^2 - 4x + 1$  **i**  $9x^2 + 12x + 4$   
**j**  $9x^2 - 12x + 4$  **k**  $x^2 + 2xy + y^2$   
**l**  $x^2 - 2xy + y^2$
- 6** **a**  $x^2 - 1$  **b**  $x^2 - 16$  **c**  $x^2 - 25$   
**d**  $4x^2 - 1$  **e**  $16 - x^2$  **f**  $9 - 4x^2$
- 7** When expanded, the positive  $x$  term was matched by a negative  $x$  term.