

Do Now

WALT expand algebraic expressions using the distributive law

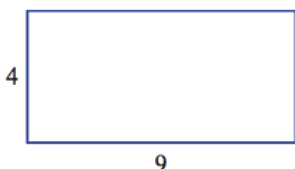
Success Criteria I know everything inside the bracket gets multiplied by the term outside the bracket.

Let's check your understanding


Understanding

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

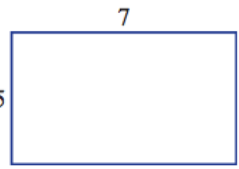
**a**



**b**



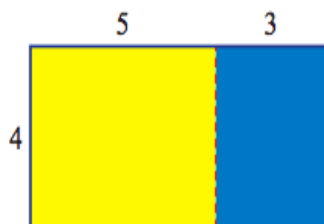
**c**



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**

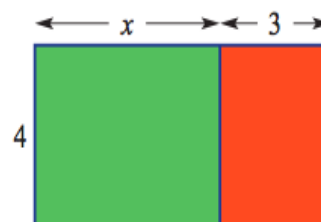
Three repeats of the expression  $2m + 5$ .  
Simplify by collecting the like terms.

**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**

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

$$= 5x + 15$$

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

$$= 3a - 12$$

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

$$= 6p - 14q$$

**Explanation**

Using the distributive law

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

Simplify the result.

Using the distributive law

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

Simplify the result.

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**

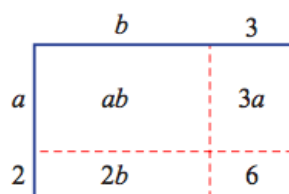
- 10** The perimeter of a rectangle is given by the expression  $2(l + w)$  where  $l$  is the length and  $w$  is the width. What is an equivalent expression for this?
- 11** Expand the brackets in the following and then simplify the result.
- $3(x + 2) + 4x$
  - $4(a + 3) - 2a$
  - $5(3b - 2) + 10$
  - $6(2c + 4) - 2c$
- 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**  $20ab + 5b + 12a + 3$

- 1 a  $5 \times d + 5 \times 4 = 5d + 20$   
 b  $4 \times y - 4 \times 3 = 4y - 12$   
 c  $3 \times 6 - 3 \times m = 18 - 3m$   
 d  $2 \times q + 2 \times 7 = 2q + 14$   
 e  $6 \times b - 6 \times 2 = 6b - 12$
- 2 a  $4b + 12$       b  $12k + 96$       c  $7c - 35$   
 d  $6d - 18$       e  $2y - 22$       f  $9a + 90$   
 g  $10j + 90$       h  $8m + 16$       i  $7q - 14$   
 j  $5l - 30$       k  $8 - 4c$       l  $3r + 18$   
 m  $63 - 9t$       n  $4v + 48$       o  $48 - 6n$   
 p  $6x - 12$
- 3 a  $4 \times 3z + 4 \times 2 = 12z + 8$   
 b  $5 \times 2y - 5 \times 3 = 10y - 15$   
 c  $3 \times 6 + 3 \times 4k = 18 + 12k$
- 4 a  $6m + 18$       b  $20d + 25$   
 c  $27p + 72$       d  $35c - 28$   
 e  $20p - 20$       f  $48c - 36$   
 g  $36k + 60$       h  $26n + 10$   
 i  $70a - 60$       j  $56l - 24$   
 k  $22h + 88$       l  $60k - 20$   
 m  $78x + 26$       n  $70w - 63$   
 o  $55j + 35$       p  $27q - 12$
- 5 a  $2(x + 1) = 2x + 2 \neq 2x + 1$   
 b  $5(p - 8) = 5p - 40 \neq 5p - 8$
- 6 a  $m \times m + m \times 3 = m^2 + 3m$   
 b  $p \times q - p \times r = pq - pr$

- 7 a  $x^2 + 5x$       b  $q^2 + 13q$   
 c  $a^2 + 8a$       d  $z^2 + 11z$   
 e  $t^2 - 6t$       f  $m^2 - 10m$   
 g  $3d - d^2$       h  $r^2 - 17r$   
 i  $ac - 4a$       j  $bd + ba$   
 k  $xy - xz$       l  $mn + mc$   
 m  $jk - jh$       n  $df + dg$   
 o  $ec - ed$       p  $rx - ry$
- 8 a  $4t \times t - 4t \times 3 = 4t^2 - 12t$   
 b  $3x \times 2y + 3x \times 5z = 6xy + 15xz$
- 9 a  $8m^2 + 24m$       b  $5c^2 + 30c$   
 c  $33r + 3r^2$       d  $11q^2 - 11q$   
 e  $8x - 4x^2$       f  $70a - 10a^2$   
 g  $8a^2 + 28a$       h  $99b^2 + 45b$   
 i  $20f - 20f^2$       j  $6d^2 - 6df$   
 k  $24k - 12k^2$       l  $36l - 24l^2$   
 m  $10p^2 - 15pn$       n  $35c^2 + 14cd$   
 o  $36mn - 30n^2$       p  $16x^2 - 12xz$
- 10 a  $3 \times x + 3 \times 5 + 2x - 7$   
 $= 3x + 15 + 2x - 7 = 5x + 8$   
 b  $2 \times p + 2 \times 5 + 4 \times p - 4 \times 3$   
 $= 2p + 10 + 4p - 12 = 6p - 2$
- 11 a  $12a + 56$       b  $9p - 48$   
 c  $10c + 48$       d  $4d - 56$   
 e  $15q + 20$       f  $11m - 62$   
 g  $7n + 14$       h  $5b - 2$   
 i  $-3x - 4$       j  $12w - 3$   
 k  $3f - 19$       l  $8n - 24$   
 m  $15y + 2$       n  $-7c + 29$   
 o  $9y - 27$

- 13 a  $(-4) \times y + (-4) \times 3$   
 $= -4y + (-12) = -4y - 12$   
 b  $(-x) \times x - (-x) \times y$   
 $= -x^2 - (-xy) = -x^2 + xy$   
 c  $(-1) \times 4k + (-1) \times 3m$   
 $= -4k + (-3m) = -4k - 3m$
- 14 a  $-6a - 60$       b  $-4b - 32$   
 c  $-9k - 81$       d  $-3c + 9$   
 e  $-5f + 35$       f  $-10d + 60$   
 g  $-7m - 35$       h  $-2n - 20$   
 i  $-11h - 121$       j  $-20p + 70$   
 k  $-24m + 24$       l  $-35q + 40$
- 15 a  $-p^2 - 7p$       b  $-w^2 - 8w$   
 c  $-d^2 - 11d$       d  $-s^2 + 3s$   
 e  $-x^2 + 6x$       f  $-f^2 + 14f$   
 g  $-mn - 5m$       h  $-ay - 2a$   
 i  $-km - 10k$       j  $-6t^2 + 3pt$   
 k  $-20y^2 + 4cy$       l  $-64n^2 + 32mn$
- 16 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 a  $8p + 35$       b  $12c - 67$   
 c  $11x - 25$       d  $8d - 6$   
 e  $5q - 3$       f  $-3m + 1$   
 g  $4n + 83$       h  $11a - 4$   
 i  $11s + 9$       j  $8x - 84$   
 k  $10w + 24$       l  $2z + 18$   
 m  $7d - 54$       n  $2k + 2$   
 o  $5p - 18$       p  $17y$   
 q  $n^2 - 5n + 12$       r  $w^2 - w + 35$   
 s  $7c^2 - 9c$       t  $10a^2 - 16a$   
 u  $-4d^2 + 48d$       v  $-6f - 12$   
 w  $5c^2 + 27c + 72$       x  $-n + 21$
- 18 a  $3x + 25$       b  $6c - 48$   
 c  $n + 20$       d  $7f - 7$   
 e  $-15d + 9$       f  $-14p + 9$   
 g  $-19y^2 - 8y$       h  $13a^2 - 3a$   
 i  $-18k^2 - 39k + 15$       j  $26b^2 + 14c^2 + 16bc$