18. [Expansion]

Skill 18.1 Expanding brackets in expressions like 2(*a* + 1)

- Multiply the number outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

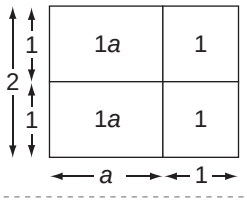
Hint: Once you multiply across the brackets the multiplication sign can be left out.
2(a) = 2 × a = 2a

Expand the brackets ① ② The × sign can be left out

$2\,(a + 1) = 2 \times a + 2 \times 1$

Keep the sign

$= 2a + 2$
① ②



Q. Expand $5(2 - b)$

A. $5(2 - b)$
$= 5 \times 2 - 5 \times b$
$= \mathbf{10 - 5b}$

a) Expand $3(4b - 5)$

Expand the brackets

Keep the sign

$= 3 \times 4b - 3 \times 5$ = 12*b* – 15

b) Expand $2(z + 4)$

$= 2 \times z + 2 \times 4$ =

c) Expand $3(5 + w)$

= ..... =

d) Expand $7(n - 2)$

= ..... =

e) Expand $9(4 - u)$

= ..... =

f) Expand $5(e - 8)$

= ..... =

g) Expand $8(1 + 2a)$

= ..... =

h) Expand $4(2g - 6)$

= ..... =

i) Expand $2(2k - 3)$

= ..... =

j) Expand $9(2h + 3)$

= ..... =

k) Expand $6(7 - 2c)$

= ..... =

l) Expand $8(4x - 5y + 3)$

= ..... =

m) Expand $3(4 - 6w + 4x)$

= ..... =

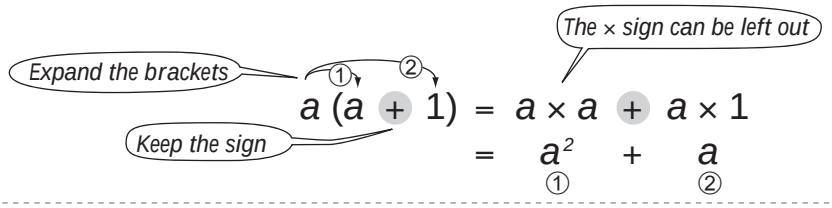
n) Expand $2(5 - 7d + 4e)$

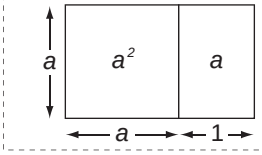
= ..... =

Skill 18.2 Expanding brackets in expressions like $a(a + 1)$

- Multiply the variable outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

Hint: Once you multiply across the brackets the multiplication sign can be left out.
$a(a) = a \times a = a^2$





Q. Expand $k(k - 6)$

A. $k(k - 6)$
$= k \times k - k \times 6$
$= \mathbf{k^2 - 6k}$

a) Expand $a(2 - 2a)$

$= a \times 2 - a \times 2a = \boxed{2a - 2a^2}$

Expand the brackets. Keep the sign.

b) Expand $e(e + 4)$

$= e \times e + e \times 4 =$ ____

c) Expand $r(9 + r)$

$=$ ____ $=$ ____

d) Expand $s(5 - s)$

$=$ ____ $=$ ____

e) Expand $d(d + 3)$

$=$ ____ $=$ ____

f) Expand $e(e - 7)$

$=$ ____ $=$ ____

g) Expand $a(1 + 2a)$

$=$ ____ $=$ ____

h) Expand $d(5d + 6)$

$=$ ____ $=$ ____

i) Expand $p(4 + 2p)$

$=$ ____ $=$ ____

j) Expand $z(6 - 6z)$

$=$ ____ $=$ ____

k) Expand $c(2c - 3)$

$=$ ____ $=$ ____

l) Expand $w(4 - 5w)$

$=$ ____ $=$ ____

m) Expand $x(3x - 2y + 7)$

$=$ ____ $=$ ____

n) Expand $t(u - 5 + 9t)$

$=$ ____ $=$ ____

o) Expand $s(7t - 4s - 8)$

$=$ ____ $=$ ____

p) Expand $e(f + 4 - 9e)$

$=$ ____ $=$ ____

Skill 18.3 Expanding brackets in expressions like $2a(b + 1)$

- Multiply the term outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

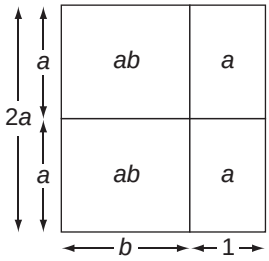
Hint: Once you multiply across the brackets the multiplication sign can be left out.
$2a(b) = 2 \times a \times b = 2ab$

Expand the brackets ① ② The × sign can be left out

$2a\,(b + 1) = 2a \times b + 2a \times 1$

Keep the sign

$= \underset{①}{2ab} + \underset{②}{2a}$



Q. Expand $2x(x - 7)$

A. $2x(x - 7)$
$= 2x \times x - 2x \times 7$
$= \mathbf{2x^2 - 14x}$

a) Expand $2d(3d + 6)$ (Expand the brackets; Keep the sign)

$= 2d \times 3d + 2d \times 6 =$ $6d^2 + 12d$

b) Expand $3a(a - 5)$

$= 3a \times a - 3a \times 5 =$ ____

c) Expand $5s(2 - 4s)$

$=$ ____ $=$ ____

d) Expand $3y(4y - 3)$

$=$ ____ $=$ ____

e) Expand $3k(5 + 2k)$

$=$ ____ $=$ ____

f) Expand $5g(2g - 4)$

$=$ ____ $=$ ____

g) Expand $4d(2d + 3)$

$=$ ____ $=$ ____

h) Expand $3a(7 + 2a)$

$=$ ____ $=$ ____

i) Expand $9c(4 + 2c)$

$=$ ____ $=$ ____

j) Expand $6h(5h - 2)$

$=$ ____ $=$ ____

k) Expand $3e(7e + 8)$

$=$ ____ $=$ ____

l) Expand $4z(8 - 2z)$

$=$ ____ $=$ ____

m) Expand $2q(6 - 2r)$

$=$ ____ $=$ ____

n) Expand $4i(6j + 4)$

$=$ ____ $=$ ____

o) Expand $7p(4p + q)$

$=$ ____ $=$ ____

p) Expand $5n(m - 5n)$

$=$ ____ $=$ ____

Skill 18.4 Expanding brackets in expressions like $-2a(b + 1)$

- Multiply the negative term outside the brackets by every term inside the brackets.
- Use the sign rules. (see skill 9.1, page 93)

Hint: Once you multiply across the brackets the multiplication sign can be left out.
$-a(b) = -a \times b = -ab$

Expand the brackets (①, ②) — The × sign can be left out — Use the sign rules

$$-2a\,(b\ +\ 1) = -2a \times b\ +\ -2a \times 1$$
$$= \underset{①}{-2ab}\ -\ \underset{②}{2a}$$

Q. Expand $-2(x - 4)$

A. $-2(x - 4)$
$= -2 \times x - -2 \times 4$
$= \mathbf{-2x + 8}$ (− − = +)

a) Expand $-5m(m + 4)$

Expand the brackets

$= -5m \times m + -5m \times 4 =$ $-5m^2 - 20m$ (+ − = +)

b) Expand $-4(f + 3)$

$= -4 \times f + -4 \times 3 =$

c) Expand $-(b + 9)$

$=$ ..... $=$

d) Expand $-3(r + 6)$

$=$ ..... $=$

e) Expand $-8a(a - 2)$

$=$ ..... $=$

f) Expand $-2w(3 + 4w)$

$=$ ..... $=$

g) Expand $-7q(q + 3)$

$=$ ..... $=$

h) Expand $-6b(4 - 5b)$

$=$ ..... $=$

i) Expand $-2cd(2 - 3d)$

$=$ ..... $=$

j) Expand $-tu(5t + 2u)$

$=$ ..... $=$

k) Expand $-5jk(8 - 4j)$

$=$ ..... $=$

l) Expand $-gh(7g - 3h)$

$=$ ..... $=$

m) Expand $-4i(6hi + 2h)$

$=$ ..... $=$

n) Expand $-9y(yz + 2z)$

$=$ ..... $=$

o) Expand $-2s(8st + 3t)$

$=$ ..... $=$

p) Expand $-3m(6mn - 4n)$

$=$ ..... $=$

Skill 18.5 Expanding and evaluating expressions.

- Multiply the term outside the brackets by every term inside the brackets.
- Group like terms. (see skills 16.3, page 169 and 16.4, page 170)
- Use the sign rules. (see skill 9.1, page 93)

Q. Expand and evaluate $2(ef - 5) + 4(ef + 3)$

A. $2(ef - 5) + 4(ef + 3)$ (Expand the brackets)
$= 2ef - 10 + 4ef + 12$ (Group like terms)
$= 2ef + 4ef - 10 + 12$
$= \mathbf{6ef + 2}$

a) Expand and evaluate $2(8c + 4) - 7c$

$= 16c + 8 - 7c$ (Expand the brackets)

$= 16c - 7c + 8$ (Group like terms) $=$ $9c + 8$

b) Expand and evaluate $3(2x + 1) + 4x$

$= 6x + 3 + 4x$

$=$ ..... $=$

c) Expand and evaluate $2(x + 1) - 4x$

$=$ .....

$=$ ..... $=$

d) Expand and evaluate $4s + s(2s - 5)$

$=$ .....

$=$ ..... $=$

e) Expand and evaluate $3p(q - 6) + 4p$

$=$ .....

$=$ ..... $=$

f) Expand and evaluate $5z(y + 3) - 8z$

$=$ .....

$=$ ..... $=$

g) Expand and evaluate $5(hi - 3) - 8(hi + 3)$

$=$ .....

$=$ ..... $=$

h) Expand and evaluate $n(n - 5) + 3(2n + 7)$

$=$ .....

$=$ ..... $=$

i) Expand and evaluate $6(de + 5) - 3(de - 2)$

$=$ .....

$=$ ..... $=$

j) Expand and evaluate $w(w + 4) - 2(4w - 7)$

$=$ .....

$=$ ..... $=$

k) Expand and evaluate $2b(b - 5) - 8(b - 5)$

$=$ .....

$=$ ..... $=$

l) Expand and evaluate $a(bc + 4) - 3(2a + 5)$

$=$ .....

$=$ ..... $=$

Skill 18.6 Expanding and evaluating more complex expressions.

- Multiply the term outside the brackets by every term inside the brackets.
- Group like terms. (see skills 16.3, page 169 and 16.4, page 170)
- Use the sign rules. (see skill 9.1, page 93)

Q. Expand and evaluate $-2(t^2 - u) + 5t(t - 3)$

A. $-2(t^2 - u) + 5t(t - 3)$ (Expand the brackets)

$= -2t^2 + 2u + 5t^2 - 15t$ (Group like terms)

$= -2t^2 + 5t^2 + 2u - 15t$

$= \mathbf{3t^2 + 2u - 15t}$

a) Expand and evaluate $-4a(a - 2) + 7(a^2 - b)$ (Expand the brackets)

$= -4a^2 + 8a + 7a^2 - 7b$

$= -4a^2 + 7a^2 + 8a - 7b = 3a^2 + 8a - 7b$ (Group like terms)

b) Expand and evaluate $x(2x + 3) - 3(x + 7)$

$= 2x^2 + 3x - 3x - 21$

$= \quad = \quad$

c) Expand and evaluate $3(2t - 4) + t(t - 2)$

$=$

$= \quad =$

d) Expand and evaluate $-2s(5s^2 + 3s) + (s - s^2)$

$=$

$= \quad =$

e) Expand and evaluate $tu(t - 1) + 8u(t^2 - t)$

$=$

$= \quad =$

f) Expand and evaluate $3e(f - e) + 8e(f^2 - e)$

$=$

$= \quad =$

g) Expand and evaluate $-6kl(k - 2) - 2l(2k^2 - 2k)$

$=$

$= \quad =$

h) Expand and evaluate $-5m(m - 1) + 6(m^2 - 1)$

$=$

$= \quad =$

i) Expand and evaluate $2pq(p - 6) - 3q(p^2 - 3p)$

$=$

$= \quad =$

j) Expand and evaluate $3(r^2 - 4) - 2r(r - 5)$

$=$

$= \quad =$

k) Expand and evaluate $-8y(xy - 1) + 4xy(x + 2y)$

$=$

$= \quad =$

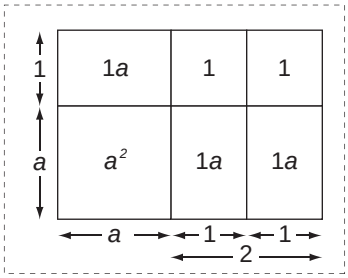
l) Expand and evaluate $-3(q^2 + q) + 4q(q + 1)$

$=$

$= \quad =$

Skill 18.7 Expanding brackets in expressions like $(a + 1)(a + 2)$

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skills 16.3, page 169 and 16.4, page 170)
- Use the sign rules. (see skill 9.1, page 93)



Expand the brackets: $(a + 1)(a + 2) = a \times a + a \times 2 + 1 \times a + 1 \times 2$

$= a^2 + 2a + a + 2$ — Simplify the products

$= a^2 + 3a + 2$ — Group like terms

Q. Expand and evaluate $(w - 3)(w - 2)$

A. $(w - 3)(w - 2)$ — Expand the brackets

$= w \times w + w \times -2 + -3 \times w + -3 \times -2$

$= w^2 - 2w - 3w + 6$ — Simplify the products; + − = −; Group like terms

$= \mathbf{w^2 - 5w + 6}$

a) Expand and evaluate $(h - 5)(h + 2)$

$= h \times h + h \times 2 + -5 \times h + -5 \times 2$ (+ − = −)

$= h^2 + 2h - 5h - 10 =$ $h^2 - 3h - 10$

b) Expand and evaluate $(x + 3)(x + 1)$

$= x \times x + x \times 1 + 3 \times x + 3 \times 1$

$=$ ..... $=$

c) Expand and evaluate $(w + 4)(w - 3)$

$=$ .....

$=$ ..... $=$

d) Expand and evaluate $(u + 4)(5 - u)$

$=$ .....

$=$ ..... $=$

e) Expand $(f - 2)(g + 8)$

$=$ .....

$=$ ..... $=$

f) Expand $(j - 5)(k - 3)$

$=$ .....

$=$ ..... $=$

g) Expand and evaluate $(2h - 4)(h + 5)$

$=$ .....

$=$ ..... $=$

h) Expand and evaluate $(r + 6)(3r - 7)$

$=$ .....

$=$ ..... $=$

i) Expand and evaluate $(3v + 4)(v - 9)$

$=$ .....

$=$ ..... $=$

j) Expand and evaluate $(y - 2)(5y - 6)$

$=$ .....

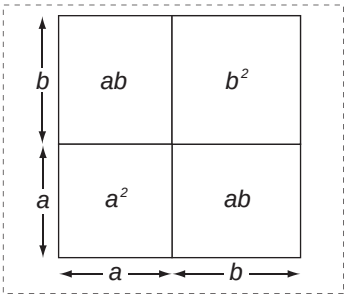
$=$ ..... $=$

Skill 18.8 Expanding brackets in binomial squares like $(a + b)^2$

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skills 16.3, page 169 and 16.4, page 170)

OR

- Substitute values into the binomial square formula
  $(a + b)^2 = a^2 + 2ab + b^2$ (see skill 17.9, page 181)



Expand the brackets

$(a + b)^2 = (a + b)(a + b) = a \times a + a \times b + b \times a + b \times b$

$= a^2 + ab + ba + b^2$ (Simplify the products)

$= a^2 + 2ab + b^2$ (Group like terms)

Q. Expand and evaluate $(n + 9)^2$

A. $(n + 9)^2$

$= (n + 9)(n + 9)$

$= n \times n + n \times 9 + 9 \times n + 9 \times 9$

$= n^2 + 9n + 9n + 81$

$= \mathbf{n^2 + 18n + 81}$

OR

$(n + 9)^2$

Using $a^2 + 2ab + b^2$ *where* $a = n$ *and* $b = 9$

$= n^2 + 2 \times n \times 9 + 9^2$

$= \mathbf{n^2 + 18n + 81}$

a) Expand and evaluate $(s + 4)^2$

$a^2 + 2ab + b^2$ *where* $a = s$ *and* $b = 4$

$= s^2 + 2 \times s \times 4 + 4^2 = s^2 + 8s + 16$

b) Expand and evaluate $(y + 1)^2$

= .....

= ..... = ...

c) Expand and evaluate $(h + 2)^2$

= .....

= ..... = ...

d) Expand and evaluate $(t + 6)^2$

= .....

= ..... = ...

e) Expand and evaluate $(p + 7)^2$

= .....

= ..... = ...

f) Expand and evaluate $(m + 5)^2$

= .....

= ..... = ...

g) Expand and evaluate $(a + 3)^2$

= .....

= ..... = ...

h) Expand and evaluate $(c + 10)^2 - 75$

= .....

= ..... = ...

i) Expand and evaluate $(r + 8)^2 + 4$

= .....

= ..... = ...

j) Expand and evaluate $(g + 3)^2 - 3g$

= .....

= ..... = ...

Skill 18.9 Expanding brackets in binomial squares like $(a - b)^2$

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skills 16.3, page 169 and 16.4, page 170)

OR

- Substitute values into the perfect square formula $(a - b)^2 = a^2 - 2ab + b^2$ (see skill 17.9, page 181)

Expand the brackets

$(a - b)^2 = (a - b)(a - b) = a \times a + a \times -b + -b \times a + -b \times -b$

$= a^2 - ab - ba + b^2$ (Simplify the products)

$= a^2 - 2ab + b^2$ (Group like terms)

Q. Expand and evaluate $(n - 3)^2$

A. $(n - 3)^2$

$= (n - 3)(n - 3)$

$= n \times n + n \times -3 + -3 \times n + -3 \times -3$

$= n^2 - 3n - 3n + 9$

$= \mathbf{n^2 - 6n + 9}$

OR

$(n - 3)^2$

Using $a^2 - 2ab + b^2$

where $a = n$ *and* $b = 3$

$= n^2 - 2 \times n \times 3 + 3^2$

$= \mathbf{n^2 - 6n + 9}$

a) Expand and evaluate $(s - 4)^2$

$a^2 - 2ab + b^2$ *where* $a = s$ *and* $b = 4$

$= s^2 - 2 \times s \times 4 + 4^2$ $= s^2 - 8s + 16$

b) Expand and evaluate $(k - 1)^2$

= .....

= ..... = ...

c) Expand and evaluate $(m - 2)^2$

= .....

= ..... = ...

d) Expand and evaluate $(q - 5)^2$

= .....

= ..... = ...

e) Expand and evaluate $(j - 7)^2$

= .....

= ..... = ...

f) Expand and evaluate $(e - 9)^2$

= .....

= ..... = ...

g) Expand and evaluate $(x - 8)^2$

= .....

= ..... = ...

h) Expand and evaluate $(x - 10)^2 + 15x$

= .....

= ..... = ...

i) Expand and evaluate $(z - 6)^2 + 8$

= .....

= ..... = ...

j) Expand and evaluate $(b - 4)^2 - 3b$

= .....

= ..... = ...