



## Formulae and expressions

- Simplifying more complex algebraic expressions involving brackets
- Forming algebraic expressions
- Multiplying a single term over a bracket
- Taking out a single term common factor

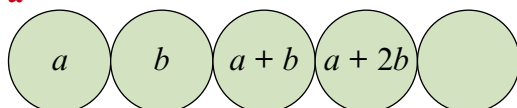
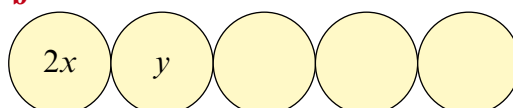
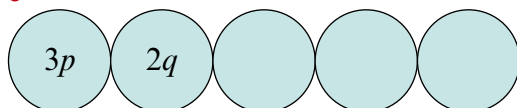
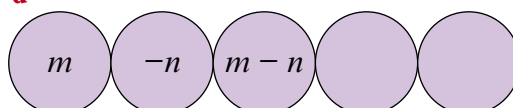
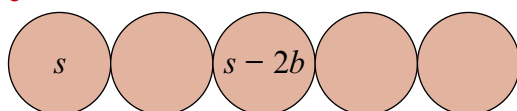
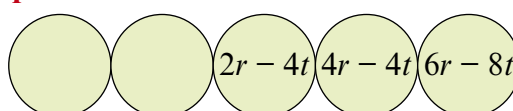
Keywords

You should know

### explanation 1

- 1** In each algebra caterpillar, the expression in each section is the sum of the expressions in the previous two sections.

What are the missing expressions? Give each answer in its simplest form.

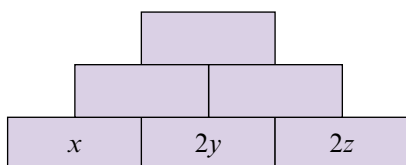
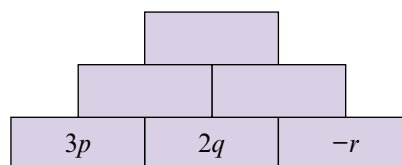
**a****b****c****d****e****f**

### explanation 2a

### explanation 2b

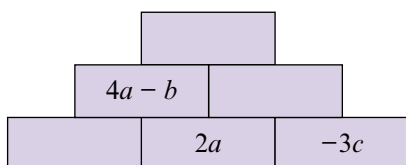
- 2** In an addition pyramid, the expression in each brick is the sum of the expressions in the two bricks beneath it.

Copy and complete each pyramid. Give each expression in its simplest form.

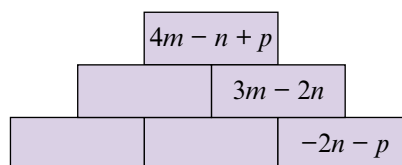
**a****b**

**3** Copy and complete these addition pyramids. Simplify each expression.

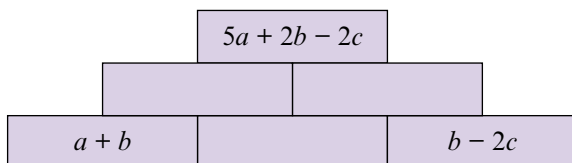
**a**



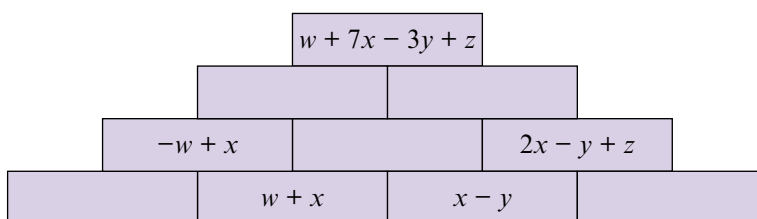
**b**



**c**



**d**



### explanation 3

**4** For each function machine, what is the output for each input?  
Copy and complete each table. Write each answer in its simplest form.

**a** Input  $\rightarrow$   $\boxed{\times 2}$   $\rightarrow$  Output

	Input	Output
<b>i</b>	$3x + 2$	
<b>ii</b>	$\frac{x}{3}$	
<b>iii</b>	$a - 6$	
<b>iv</b>	$\frac{p - 4}{5}$	

**b** Input  $\rightarrow$   $\boxed{+ 1}$   $\rightarrow$   $\boxed{\times 3}$   $\rightarrow$  Output

	Input	Output
<b>i</b>	$k - 1$	
<b>ii</b>	$\frac{m}{3}$	
<b>iii</b>	$-\frac{1}{3}(y + 3)$	
<b>iv</b>	$\frac{1 - u}{6}$	

**5** Copy and complete each table. Give each answer in its simplest form.

**a** Input  $\rightarrow$   $\boxed{\div 2}$   $\rightarrow$   $\boxed{+ a}$   $\rightarrow$  Output

	Input	Output
<b>i</b>	$4a + 2b$	
<b>ii</b>	$6 - a$	
<b>iii</b>	$4(x - a)$	
<b>iv</b>	$\frac{-4a + 8}{2}$	

**b** Input  $\rightarrow$   $\boxed{\times 3}$   $\rightarrow$   $\boxed{- b}$   $\rightarrow$  Output

	Input	Output
<b>i</b>	$a + b$	
<b>ii</b>	$\frac{b}{3}$	
<b>iii</b>	$-b + 2$	
<b>iv</b>	$\frac{b}{6}$	

**c** Input  $\rightarrow$   $\boxed{+ 6}$   $\rightarrow$   $\boxed{\times q}$   $\rightarrow$  Output

	Input	Output
<b>i</b>	$2(q - 3)$	
<b>ii</b>	$\frac{1}{q}$	
<b>iii</b>	$\frac{p - 5q}{q}$	
<b>iv</b>	$c - 3(b + 2)$	

**d** Input  $\rightarrow$   $\boxed{- 2}$   $\rightarrow$   $\boxed{\div z}$   $\rightarrow$  Output

	Input	Output
<b>i</b>	$\frac{z + 4}{2}$	
<b>ii</b>	$\frac{z}{2} + 4$	
<b>iii</b>	$1 + \frac{az^3 + z}{z}$	
<b>iv</b>	$\frac{x^2 - x(x - a)}{0.5ax}$	

explanation 4a

explanation 4b

**6** Multiply out these brackets.

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

**b**  $5(a - 1)$

**c**  $3(2b - d)$

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

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

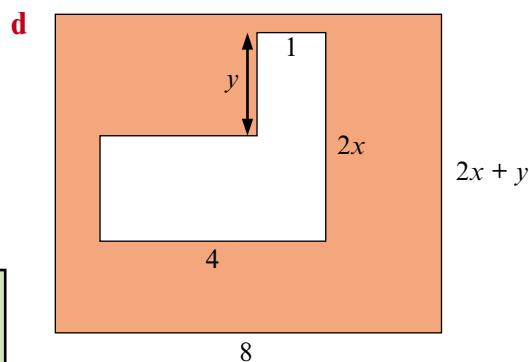
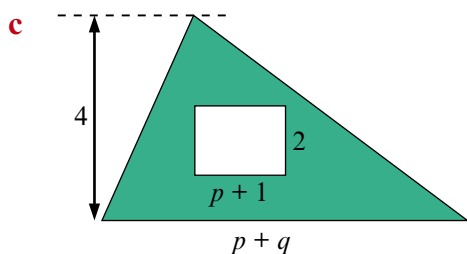
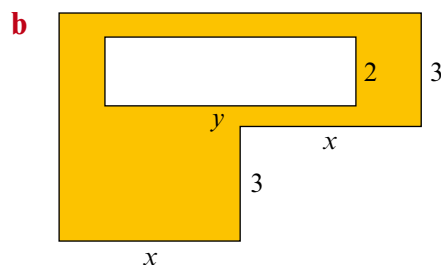
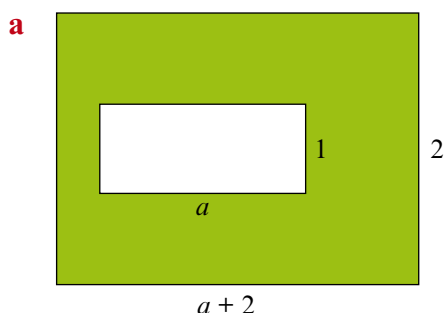
**f**  $3r(2 + 4r)$

**g**  $5x(x - y + 2z)$

**h**  $m(m^2 - 2n)$

**i**  $x^2(3 - x)$

**7** Write an algebraic expression for the shaded area of each diagram.  
Give your answers in simplified form.



**Remember**

Area of a rectangle = length  $\times$  width

Area of a triangle =  $\frac{1}{2} \times \text{base} \times \text{height}$

**8** Factorise these expressions as far as you can.

**a**  $3x + 6$

**b**  $12x - 6$

**c**  $15p + 10q$

**d**  $m^2 - 2m$

**e**  $4x - x^2$

**f**  $2p^2 - 4p$

**g**  $x^2 - ax^2$

**h**  $2m^3 + 3m^2$

**i**  $2a^3 + a^2b^2 - 3a^2$

**9** Factorise  $3xy^2 + 4x^3y^2 - x^2y^3$  as far as possible.

Use your answer to simplify  $\frac{3xy^2 + 4x^3y^2 - x^2y^3}{3 + 4x^2 - xy}$ .