

Algebraic Expressions

Information Sheet

Algebraic Terms

$2a$ means $2 \times a$

a^2 means $a \times a$

$\frac{a}{b}$ means $a \div b$

ab means $a \times b$

a^3 means $a \times a \times a$

$\frac{a^2b}{c}$ means $a \times a \times b \div c$

Adding and subtracting terms

You can only add or subtract terms if they are the same type of terms.

It may help to think of a thermometer when combining positive and negative terms.

Examples

$$5x - 4y + 2x + 6y = 7x + 2y$$

$$a^2 + 3ab - 4b^2 + 2a^2 - 5ab - 7b^2 = 3a^2 - 2ab - 11b^2$$

$a^2 + 2a^2$ $3ab - 5ab$ $-4b^2 - 7b^2$

Expanding a bracket

When there is a number (or letter) in front of a bracket, it means everything inside the bracket must be multiplied by that number (or letter).

Remember the rules for signs when **multiplying** or **dividing** positive and negative quantities:

When signs are the same	$+$ \times $+$ or $-$ \times $-$ $+$ \div $+$ or $-$ \div $-$	the answer is +
When signs are different	$+$ \times $-$ or $-$ \times $+$ $+$ \div $-$ or $-$ \div $+$	the answer is -

Examples

$$3(2x + 1) = 6x + 3$$

$3 \times 2x$ 3×1

$$a(a - b) = a^2 - ab$$

$a \times a$ $a \times -b$

Expanding 2 brackets

When two brackets are multiplied, each term in the first is multiplied by each term in the second.

Examples

$$(2x - 3)(4x + 5) = 8x^2 + 10x - 12x - 15 = 8x^2 - 2x - 15$$

$2x \times 4x$ $2x \times 5$ $-3 \times 4x$ -3×5

Here are more examples of expanding brackets and simplifying.

Examples

$$5(x - 2y) - 2(2x - 3y) = 5x - 10y - 4x + 6y = x - 4y$$

$$4x(x + y) + 3x(x - y) = 4x^2 + 4xy + 3x^2 - 3xy = 7x^2 + xy$$

$$(5a - b)(2a - 3b) = 10a^2 - 15ab - 2ab + 3b^2 = 10a^2 - 17ab + 3b^2$$



Try these:

1. Work out the value of these terms if $x = 4$, $y = 5$ and $z = 2$

a) $3y$

b) x^2

c) x^3

d) xy

e) y^3

f) $3z^2$

g) $2x + y$

h) $4z - y$

i) $\frac{x}{z}$

j) $\frac{yz}{x}$

k) $\frac{2x+z}{y}$

l) $\frac{y^2}{x-z}$

2. Collect the terms in these:

a) $7a + 5b + 2a - 6b$

b) $3x - 4y - 2x + 6y$

c) $p - 5q + 3p - q$

d) $2x^2 + x - 3x - 4$

e) $a^2 - 5ab + 4ab + b^2$

f) $4p^2 - 5p + 1 - p^2 - 2p - 7$

g) $5ab - 3bc + ab + 6bc$

h) $7p^2 - 4pq - 2q^2 + 6pq$

i) $x^2 - 2xy - y^2 - x^2 + 6xy - 2y^2$

3. Expand the brackets:

a) $3(x - y)$

b) $4(5x + 2y)$

c) $2(6a - 5b)$

d) $x(x + y)$

e) $a(3a - b)$

f) $3x(2x - 7y)$

g) $5(2x + 4y - 3z)$

h) $2p(3p - q + 4)$

i) $ab(a + 2b)$

4. Expand the brackets and collect the terms:

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

b) $(5x + 1)(2x - 3)$

c) $(a - 1)(a - 3)$

d) $(3a - 4)(2a + 5)$

e) $(p + q)(p - q)$

f) $(a + b)(a - 5b)$

g) $(2x - y)(x + 7y)$

h) $(3p - 2q)(5p - 7q)$

i) $(a + b + c)(a - b - c)$

5. Expand the brackets and simplify:

a) $5(x + 3) - 2(x + 4)$

b) $2(a - b) + 3(a + b)$

c) $4(2x - 3y) - 3(x - y)$

d) $5(p + 2q) + 7(2p - q)$

e) $x(x - 2y) + 3x(5x - y)$

f) $3a(a - b) - b(a - b)$

g) $(x - 2y)(5x - y)$

h) $(5a - b)(2a + 4b)$

i) $(4p + 3q)(2p - 7q)$

j) $(5x + 3)(4x - 3) - x(3x - 1)$



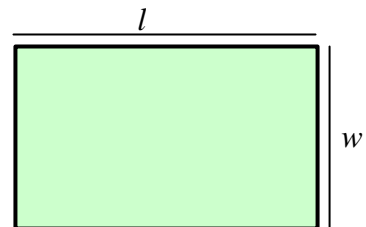
Algebraic Expressions

Perimeter

The **perimeter** of a shape is the **total length of its sides**.

Perimeter of this rectangle $P = l + w + l + w$

This can also be written as $P = 2l + 2w$ or $P = 2(l + w)$



Area

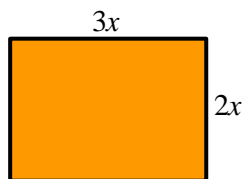
Area measures the **surface** of something.

Area of a rectangle = length \times width

For the rectangle shown, the area $A = lw$

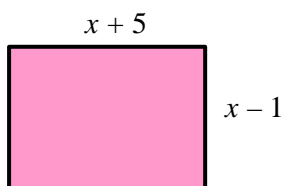
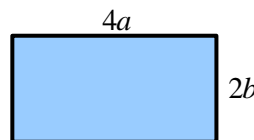
Sometimes you may need to find other algebraic expressions for perimeters and areas.

Examples



$$\begin{aligned} \text{Perimeter} &= 3x + 2x + 3x + 2x = 10x \\ \text{Area} &= 3x \times 2x = 6x^2 \end{aligned}$$

$$\begin{aligned} \text{Perimeter} &= 4a + 2b + 4a + 2b = 8a + 4b \\ \text{Area} &= 4a \times 2b = 8ab \end{aligned}$$



$$\text{Perimeter} = x + 5 + x - 1 + x + 5 + x - 1 = 4x + 8$$

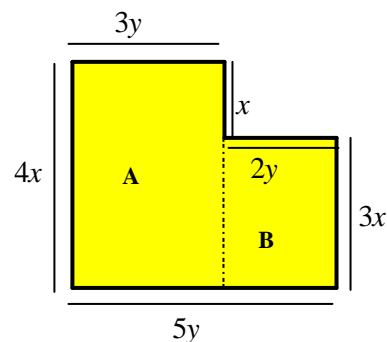
$$\text{Area} = (x + 5)(x - 1) = x^2 - x + 5x - 5 = x^2 + 4x - 5$$

$$\begin{aligned} \text{Perimeter} &= 4x + 3y + x + 2y + 3x + 5y \\ &= 8x + 10y \end{aligned}$$

$$\text{Area of A} = 4x \times 3y = 12xy$$

$$\text{Area of B} = 3x \times 2y = 6xy$$

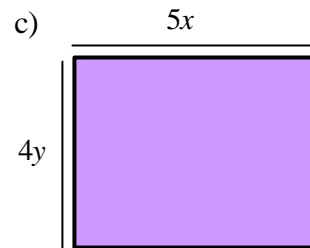
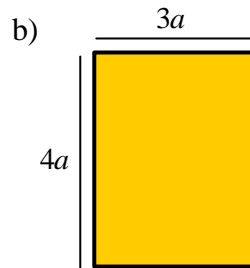
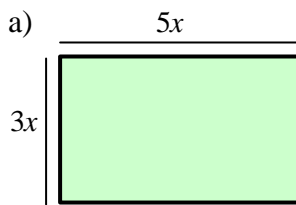
$$\text{Total area} = 12xy + 6xy = 18xy$$



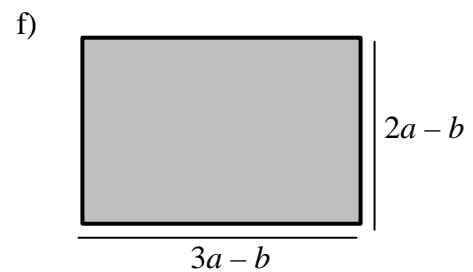
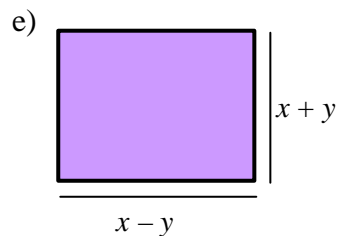
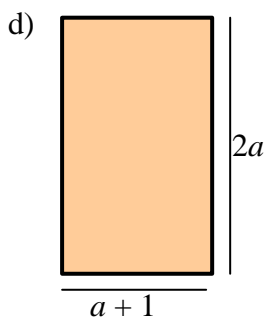
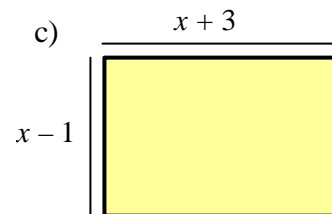
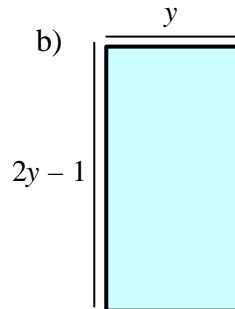
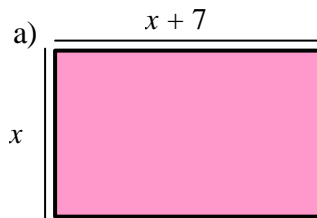
Perimeter and Area

Worksheet

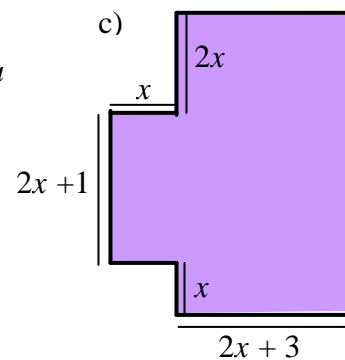
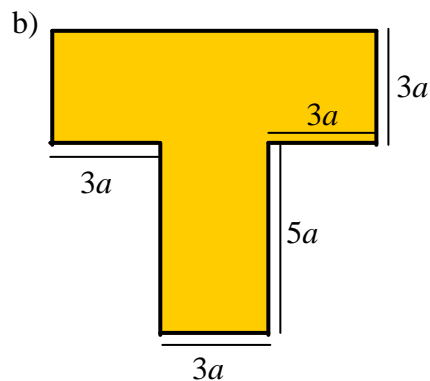
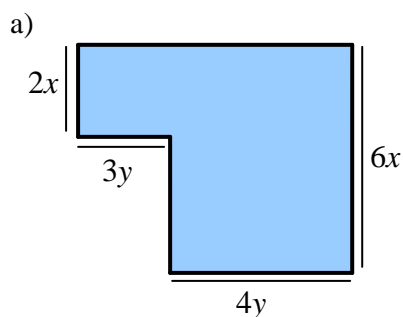
1. Find algebraic expressions for the perimeter and area of each rectangle.



2. Find algebraic expressions for the perimeter and area of these rectangles.



3 Find algebraic expressions for the perimeter and area of these shapes.



Teacher Notes

Unit Intermediate Level, *Using algebra, functions and graphs*

Skills used in this activity:

- Evaluating algebraic terms
- Adding, subtracting and multiplying algebraic terms
- Expanding brackets
- Finding algebraic expressions to represent perimeters and areas

Notes

It is intended that the information sheet (Page 1) should be used alongside the practice questions on pages 2 and 4.

Answers

Page 2

- 1) a) 12 b) 16 c) 64 d) 20 e) 125 f) 12
 g) 13 h) 3 i) 2 j) 2.5 k) 4 l) 12.5

- 2) a) $9a - b$ b) $x + 2y$ c) $4p - 6q$ d) $2x^2 - 2x - 4$
 e) $a^2 - ab + b^2$ f) $3p^2 - 7p - 6$ g) $6ab - 3bc$ h) $7p^2 + 2pq - 2q^2$
 i) $x^2 - 4xy - 3y^2$

- 3) a) $3x - 3y$ b) $20x + 8y$ c) $12a - 10b$ d) $x^2 + xy$
 e) $3a^2 - ab$ f) $6x^2 - 21xy$ g) $10x + 20y - 15z$ h) $6p^2 - 2pq + 8p$
 i) $a^2b + 2ab^2$

- 4) a) $x^2 + 7x + 12$ b) $10x^2 - 13x - 3$ c) $a^2 - 4a + 3$ d) $6a^2 + 7a - 20$
 e) $p^2 - q^2$ f) $a^2 - 4ab - 5b^2$ g) $2x^2 + 13xy - 7y^2$ h) $15p^2 - 31pq + 14q^2$
 i) $a^2 - b^2 + c^2 - 2bc$

- 5) a) $3x + 7y$ b) $5a + b$ c) $5x - 9xy$ d) $19p + 3q$
 e) $16x^2 - 4xy$ f) $3a^2 - 4ab + b^2$ g) $5x^2 - 11xy + 2y^2$ h) $10a^2 + 18ab - 4b^2$
 i) $8p^2 - 22pq - 21q^2$ j) $17x^2 - 2x - 9$

Page 4

- 1) a) Perimeter = $16x$, Area = $15x^2$ b) Perimeter = $14a$, Area = $12a^2$
 c) Perimeter = $10x + 8y$, Area = $20xy$

- 2) a) Perimeter = $4x + 14$, Area = $x(x + 7) = x^2 + 7x$
 b) Perimeter = $6y - 2$, Area = $y(2y - 1) = 2y^2 - y$
 c) Perimeter = $4x + 4$, Area = $(x - 1)(x + 3) = x^2 + 2x - 3$
 d) Perimeter = $6a + 2$, Area = $2a(a + 1) = 2a^2 + 2a$
 e) Perimeter = $4x$, Area = $(x - y)(x + y) = x^2 - y^2$
 f) Perimeter = $10a - 4b$, Area = $(3a - b)(2a - b) = 6a^2 - 5ab + b^2$

- 3) a) Perimeter = $12x + 14y$, Area = $30xy$
 b) Perimeter = $34a$, Area = $42a^2$
 c) Perimeter = $16x + 8$, Area = $12x^2 + 18x + 3$

