



Simplifying, expanding, factorising and rearranging

Grades 4–9 About 80 minutes No calculator 92 marks

Name _____

Class _____

Date _____

A Before you start

Grades 4–5

You will need these in every question below.

A1 Work out the value of $3a - 2b$ when $a = 4$ and $b = -5$.

[2 marks]

Answer

A2 Simplify $5p + 3q - 2p + 4q$.

[1 mark]

Answer

A3 Expand $4(2x - 3)$.

[1 mark]

Answer

A4 Factorise $6y + 15$.

[1 mark]

Answer

A5 Expand and simplify $(x + 8)(x + 7)$.

[2 marks]

Answer

Your teacher works through each example with you. Then try the one beside it on your own.

EXAMPLE 1

Factorise fully $12x^2y - 18xy^2$.

Hint Take out the highest common factor of the numbers, then the lowest power of each letter that is in every term.

B1 Factorise fully $15a^3b + 20a^2b^2$. [2 marks]

Answer

EXAMPLE 2

Expand and simplify $(2x + 5)(x - 3)$.

Hint Multiply each term in the first bracket by each term in the second. There are four products, then collect the two x terms.

B2 Expand and simplify $(3x - 2)(2x + 5)$. [2 marks]

Answer

EXAMPLE 3

Factorise $2x^2 + 7x + 3$.

Hint Look for two numbers that multiply to $2 \times 3 = 6$ and add to 7. Split the middle term with them.

B3 Factorise $3x^2 + 11x - 4$. [2 marks]

Answer

EXAMPLE 4

Make w the subject of $P = 2(l + w)$.

Hint Undo the operations in the reverse order: divide by 2 first, then subtract l .

B4 Make x the subject of $y = \frac{3x-5}{2}$. [2 marks]

Answer

C Practice

Grades 5–7

Each question asks for something different. Show your working.

C1 Work out the value of $\frac{a^2-3b}{2c}$ when $a = -4$, $b = -2$ and $c = 5$. [2 marks]

Answer

C2 Simplify each expression.

(a) $3x^2y \times 4xy^3$ [1 mark]

Answer

(b) $\frac{20a^5b^2}{4a^2b}$ [2 marks]

Answer

Total for C2: 3 marks

C3 Expand and simplify $3(2x - 5) - 2(x - 4)$. [2 marks]

Answer

C4 Expand and simplify $(x - 6)^2$. [2 marks]

Answer

C5 Expand and simplify $(x + 2)(x - 3)(x + 4)$.

[3 marks]

Answer

C6 Factorise each expression.

(a) $x^2 + x - 42$

[2 marks]

Answer

(b) $x^2 - 169$

[1 mark]

Answer

(c) $4x^2 - 25y^2$

[2 marks]

Answer

Total for C6: 5 marks

C7 Factorise $6x^2 - 7x - 5$.

[3 marks]

Answer

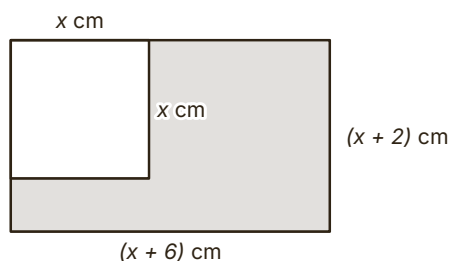
C8 Make r the subject of $A = \pi r^2 + 5$.

[3 marks]

Answer

- C9** A square of side x cm is cut from the corner of a rectangle that measures $(x + 6)$ cm by $(x + 2)$ cm. The shaded part is left. [3 marks]

Write an expression for the shaded area. Simplify your answer.



Not drawn accurately

Answer

D Exam-style questions

Grades 6–9

Answer every question in the space given. Show your working: most of the marks are for method.

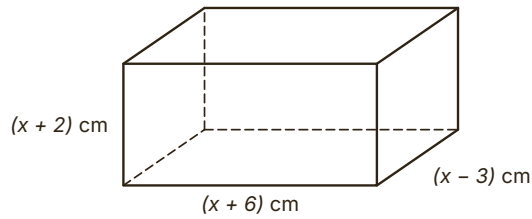
- D1** Show that $(n + 3)^2 - (n - 3)^2$ is a multiple of 12 for every whole number n . [3 marks]

- D2** Ella factorises $3x^2 - 27$. She writes $3(x^2 - 9)$ and says, "That is factorised fully." [3 marks]

Explain why Ella is wrong. Then factorise $3x^2 - 27$ fully.

Answer

D3 A cuboid has edges $(x + 6)$ cm, $(x + 2)$ cm and $(x - 3)$ cm.



Not drawn accurately

(a) Show that the volume of the cuboid is $x^3 + 5x^2 - 12x - 36$ cm³.

[3 marks]

(b) Work out the total surface area of the cuboid. Give your answer in the form $ax^2 + bx + c$.

[3 marks]

Answer

Total for D3: 6 marks

D4 Make a the subject of $\frac{a+2}{a-3} = b$.

[4 marks]

Answer

D5 Factorise fully $3x^2 - 12x - 63$.

[3 marks]

Answer

D6 Expand and simplify $(2x - 3)^2 - (x + 1)(x - 5)$.

[3 marks]

Answer

D7 a and b are integers. $(2x + a)(x + b) = 2x^2 + 3x - 20$.

[3 marks]

Find the values of a and b .

Answer $a = \dots\dots$, $b = \dots\dots$

D8 The energy, E joules, of a ball is given by $E = \frac{1}{2}mv^2 + mgh$.

(a) Work out the value of E when $m = 4$, $v = 3$, $g = 10$ and $h = 2$.

[2 marks]

Answer

(b) Make h the subject of the formula.

[3 marks]

Answer

Total for D8: 5 marks

D9 The area of the rectangle is $x^2 + 7x - 30 \text{ cm}^2$. One side is $(x - 3) \text{ cm}$. [4 marks]

Work out an expression for the perimeter of the rectangle. Simplify your answer.



Not drawn accurately

Answer

D10 Make x the subject of $y = \sqrt{\frac{x+4}{3}}$. [3 marks]

Answer

E Extension

Grade 9 and beyond

No route is given. Spend five minutes on a problem before you look at a hint. The hints are on the last page of the worksheet, and you can use one at a time.

E1 Prove that the sum of the squares of three consecutive whole numbers is never a multiple of 3. [4 marks]

E2 Factorise fully $x^4 - 81$.

[3 marks]

Answer

E3 Show that $(x + 1)(x + 2)(x + 3)(x + 4) + 1$ is a perfect square. Write it in the form $(x^2 + bx + c)^2$.

[4 marks]

Answer

E4 $ax^2 + 17x + 12 = (2x + 3)(cx + 4)$ for every value of x .

[3 marks]

Find the value of a .

Answer $a = \dots\dots$

F How did it go?

Colour one circle on each line.

	Not yet	Nearly	Yes
I can substitute numbers into an expression, collect like terms and take out a common factor.	☐	☐	☐
I can expand two brackets, a squared bracket and three brackets.	☐	☐	☐
I can factorise a quadratic, including one where the x^2 term is not 1 and a difference of two squares.	☐	☐	☐
I can change the subject of a formula, including when the subject appears twice.	☐	☐	☐

Extension hints

Use one hint at a time. Cover the ones below it with a sheet of paper.

- E1** **Hint 1** Call the numbers $n - 1$, n and $n + 1$.
 Hint 2 $(n - 1)^2 + n^2 + (n + 1)^2 = 3n^2 + 2$.
 Hint 3 $3n^2$ is a multiple of 3, so $3n^2 + 2$ is 2 more than a multiple of 3.
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- E2** **Hint 1** Write x^4 as $(x^2)^2$ and 81 as 9^2 .
 Hint 2 $x^4 - 81 = (x^2 + 9)(x^2 - 9)$.
 Hint 3 One of those two brackets is itself a difference of two squares.
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- E3** **Hint 1** Pair the outer brackets and the inner brackets.
 Hint 2 $(x + 1)(x + 4) = x^2 + 5x + 4$ and $(x + 2)(x + 3) = x^2 + 5x + 6$.
 Hint 3 Write $y = x^2 + 5x$. Then the expression is $(y + 4)(y + 6) + 1 = y^2 + 10y + 25$.
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- E4** **Hint 1** Expand $(2x + 3)(cx + 4)$.
 Hint 2 $(2x + 3)(cx + 4) = 2cx^2 + (8 + 3c)x + 12$.
 Hint 3 Compare the x terms: $8 + 3c = 17$.