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GCSE MATHEMATICS • ALGEBRA

Factorising

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free Factorising worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Factorising worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

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A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $HCF = 5ab$ $15ab^2 \div 5ab = 3b$ and $10a^2b \div 5ab = 2a$ $5ab(3b - 2a)$

A2 Multiply to 28, add to 11: 4 and 7 $(x+4)(x+7)$

A3 $5^2 - y^2$ $(5+y)(5-y)$

HIGHER

A4 $3 \times 6 = 18$: multiply to 18, add to -11 : -9 and -2
 $3x^2 - 9x - 2x + 6 = 3x(x-3) - 2(x-3)$ $(3x-2)(x-3)$

A5 $2x(x^2 - 4)$, then the difference of two squares: $2x(x+2)(x-2)$

A6 $(x-2)^2 - 5^2 = ((x-2)+5)((x-2)-5)$ $(x+3)(x-7)$

A7 $(2x+3)(x+4)$ Perimeter $= 2(2x+3) + 2(x+4) = (6x+14)$ cm

B**Fluency solutions**

One mark for each correct part. The notes in *italics* explain why each sequence was chosen.

FOUNDATION

B1 (a) $4(x+3)$ (b) $2(2x+3)$ (c) $x(x+5)$ (d) $3x(2x+3)$

B2 (a) $5b(2a-3)$ (b) $4pq(2p+3q)$ (c) $3x^2(x-2)$ (d) $7a(1-2a+3a^2)$

Fully means nothing common is left inside the bracket.

B3 (a) $(x+2)(x+6)$ (b) $(x-2)(x-6)$ (c) $(x+6)(x-2)$ (d) $(x-6)(x+2)$

A positive constant means the two numbers have the same sign; a negative constant means different signs.



B4 (a) $(x+5)^2$ (b) $(x-6)^2$ (c) $(x-5)(x+4)$ (d) $(x+4)(x+9)$

B5 (a) $(x+6)(x-6)$ (b) $(x+1)(x-1)$ (c) $(7+y)(7-y)$

B6 (a) $x(x-9)$ (b) $(x+3)(x-3)$ (c) $(x-3)(x-6)$ (d) **cannot be factorised**

A sum of two squares does not factorise.

HIGHER

B7 (a) $(2x+3)(x+1)$ (b) $(2x-3)(x-1)$ (c) $(2x+3)(x-1)$ (d) $(3x-2)(2x+3)$

B8 (a) $2(x+5)(x-5)$ (b) $3(x+2)(x+3)$ (c) $x(x-5)(x+1)$ (d) $3(2x+3)(2x-3)$

B9 (a) $(2x+1)(2x-1)$ (b) $(5a+3b)(5a-3b)$ (c) $(x^2 + 4)(x^2 - 4) = (x^2 + 4)(x+2)(x-2)$
 (d) $(x+4)(x-2)$

B10 (a) $(x+3)((x+3)+5) = (x+3)(x+8)$ (b) $(x-2)(x+3)$ (c) $(x^2+2)(x^2+3)$
 (d) With $u = x+1$: $2u^2 - u - 3 = (2u-3)(u+1) = (2x-1)(x+2)$

C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 $4x - 6$ still has a common factor of 2. The HCF of $8x^2$ and $12x$ is $4x$ $4x(2x-3)$

C2 $(x-4)(x-4) = x^2 - 8x + 16$, not $x^2 - 16$ $(x+4)(x-4)$

C3 $(x+2)(x+3)$ and $(x+6)(x-1)$

$x^2 + 6$ is not a difference of two squares, and no two whole numbers multiply to 6 and add to 0

C4 $x^2 + 6x + 9 = (x+3)^2$ A square is never negative, so $x^2 + 6x + 9 \geq 0$ for every x



HIGHER

C5 $(2x+2)(x+3) = 2x^2 + 8x + 6$, not $2x^2 + 7x + 6$ Correct: $(2x+3)(x+2)$

C6 $x^2 - 4$ is a difference of two squares, $(x+2)(x-2)$. $x^2 + 4$ is a sum, which does not factorise.

$$x^4 - 81 = (x^2 + 9)(x^2 - 9) = (x^2 + 9)(x+3)(x-3)$$

C7 $n^2 + 3n + 2 = (n+1)(n+2)$, the product of two consecutive whole numbers. One of them is even, so the product is even.

C8 $(a+b)(a-b) = 60$. $a+b$ and $a-b$ are both even or both odd (they differ by $2b$), and $a+b > a-b$

Factor pairs of 60 with the same parity: 2×30 and 6×10

$$a+b = 30, a-b = 2: a = 16, b = 14 \quad a+b = 10, a-b = 6: a = 8, b = 2$$

The pairs 1×60 , 3×20 , 4×15 , 5×12 mix odd and even, so they give no whole-number answers.

D

Problem solving solutions

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 Total = $12p + 18q = 6(2p + 3q)$. $2p + 3q$ is a whole number, so the total is a multiple of 6

D2 Pairs that multiply to 12: 1×12 , 2×6 , 3×4 , and the same pairs both negative

$$b = m + n: 13, 8, 7, -13, -8, -7$$

D3 $17(23 + 77) = 17 \times 100 = 1700$

D4 (a) $(n+2)(n+3)$ (b) $12 \times 13 = 156$

HIGHER

D5 (a) $2x^3 + 10x^2 + 12x = 2x(x^2 + 5x + 6) = 2x(x+2)(x+3)$ $(x+2)$ cm and $(x+3)$ cm

(b) $x = 3: 54 + 90 + 36 = 180 \quad 6 \times 5 \times 6 = 180$



D6 (a) $\text{Area} = (x+5)^2 - 3^2 = ((x+5)+3)((x+5)-3) = (x+8)(x+2)$ as required

(b) $(x+2)(x+8) = 91 = 7 \times 13$, and the brackets differ by 6, so $x+2 = 7$ $x = 5$

D7 $(x+y)(x-y) = 40$, so $10(x-y) = 40$ and $x-y = 4$ Add: $2x = 14$ $x = 7$, $y = 3$

D8 (a) $(n^2+2)^2 - (2n)^2 = n^4 + 4n^2 + 4 - 4n^2 = n^4 + 4$, and this is a difference of two squares:

$n^4 + 4 = (n^2 + 2 + 2n)(n^2 + 2 - 2n)$ as required

(b) For $n > 1$, both brackets are greater than 1, since $n^2 - 2n + 2 = (n-1)^2 + 1 > 1$. So $n^4 + 4$ has two factors greater than 1

(c) $n = 5$: $(25 + 10 + 2)(25 - 10 + 2) = \boxed{37 \times 17} = 629$

E

Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION Foundation and Higher crossover

E1 (a) $3(2x+5)$ B1

(b) $4y(2y-3)$ B2

B1 for a partly factorised answer such as $2y(4y-6)$

E2 $(x+3)(x+4)$ B2

E3 $(x-5)(x+2)$ B2

E4 $(x+7)(x-7)$ B2

E5 (a) $x^2 + 9x + 20 = (x+4)(x+5)$ M1

$x+5$ A1

(b) $2(x+4) + 2(x+5) = \boxed{4x+18}$ B1

E6 (a) $(57+43)(57-43)$ M1

$100 \times 14 = \boxed{1400}$ A1

(b) One factor is $57+43 = 100$, so the answer is 100×14 C1



HIGHER

E7	(a) $((x+3)+4)((x+3)-4)$	M1
	$(x+7)(x-1)$	A1
	(b) $(2x+3y)(2x-3y)$	B1
E8	(a) $5(x^2-9)$	M1
	$5(x+3)(x-3)$	A1
	(b) Multiply to -12 , add to -1 : -4 and 3	M1
	$(2x+1)(3x-2)$	A1
E9	$6x^2+7x-3 = (3x-1)(2x+3)$	M1
	Perimeter $= 2(3x-1) + 2(2x+3)$	M1
	$10x+4$	A1
E10	(a) $n(n^2-1)$	M1
	$n(n-1)(n+1)$	A1
	(b) $(n-1)n(n+1)$ is the product of three consecutive whole numbers	M1
	One of them is even and one is a multiple of 3, so the product is a multiple of $2 \times 3 = 6$	C1
	(c) $101^3 - 101 = 100 \times 101 \times 102$, three consecutive numbers, so it is a multiple of 6	B1

