

QQQ – Pure Year 1 – Chapter 1 – Expanding & Factorising (Version 2)

Total Marks: 24

(24 = Platinum, 22 = Gold, 19 = Silver, 16 = Bronze)

1. Expand and simplify fully $(2x - 5)(3x - 4)(x + 2)$ **[3 marks]**

(Total 3 marks)

AQA November 2021 Paper 1 Q9

2. $(3x + a)(5x - 4) \equiv 15x^2 - 2x + b$

Work out the values of a and b .

[3 marks]

(Total 3 marks)

AQA June 2022 Paper 1 Q5

3. Factorise completely $x - 4x^3$

(3)

(Total 3 marks)

Edexcel C1 January 2013 Q1

4. Factorise fully $6x^2 + 26xy - 20y^2$

[3 marks]

(Total 3 marks)

AQA June 2019 Paper 1 Q10

5. Factorise fully $(x + 6)^4 + (x + 6)^3(3x + 4)$

Do **not** attempt to expand the brackets.

[3 marks]

(Total 3 marks)

AQA June 2017 Paper 1 Q6

6. Expand and simplify fully $(2x^3 - 9)(3x^2 + 4) + x(x - 4)^2$

[4 marks]

(Total 4 marks)

AQA June 2023 Paper 2 Q11

7. Show that $(x + 1)(x + 3)(x + 4) - x(x^2 + 7x + 11)$

can be written in the form $(x + a)(x + b)$ where a and b are positive integers. **[5 marks]**

(Total 5 marks)

AQA June 2019 Paper 2 Q17

Solutions

1.

Answer	Mark	Comments
Expanding second and third bracket $3x^2 + 6x - 4x - 8$ with at least three terms correct or $3x^2 + 2x + k$ where k is a non-zero constant	M1	oe expansion attempt of one pair of brackets eg1 first and second brackets $6x^2 - 8x - 15x + 20$ with at least three terms correct or $6x^2 - 23x + k$ where k is a non-zero constant eg2 first and third brackets $2x^2 + 4x - 5x - 10$ with at least three terms correct or $(2x^2 - x + k)$ where k is a non-zero constant
$6x^3 + 12x^2 - 8x^2 - 16x$ or $6x^3 + 4x^2 - 16x$ or $-15x^2 - 30x + 20x + 40$ or $-15x^2 - 10x + 40$	M1dep	attempt at a full expansion with correct multiplication of their 3 or 4 terms by one of the terms in the remaining bracket oe eg1 $6x^3 - 8x^2 - 15x^2 + 20x$ or $6x^3 - 23x^2 + 20x$ or $12x^2 - 16x - 30x + 40$ or $12x^2 - 46x + 40$ eg2 $6x^3 + 12x^2 - 15x^2 - 30x$ or $6x^3 - 3x^2 - 30x$ or $-8x^2 - 16x + 20x + 40$ or $-8x^2 + 4x + 40$
$6x^3 - 11x^2 - 26x + 40$	A1	fully correct simplified expansion allow terms written in a different order

Additional guidance

For the M marks terms may be seen in a grid

First M1 do not allow any omissions or extra terms

eg1 $3x^2 + 6x - 8$

M0

$$\text{eg } 2 \cdot 3x^2 + 6x - 4x - 8 + x^2$$

M0

2.

Answer	Mark	Comments
$15x^2 - 12x + 5ax - 4a$ or $5ax - 12x = -2x$ or $5a - 12 = -2$ or $b = -4a$	M1	oe
$(a =) 2$	A1	
$(b =) -4 \times \text{their } a$	Alft	-8 , but do not award -8 unless it comes from $a = 2$

Additional guidance

Candidates who use substitutions for x are likely to use $x = 0$ and gain M1. Award M1 for any number substituted in correctly to gain an equation in a and b

3.

Scheme	Marks
$x(1 - 4x^2)$ Accept $x(-4x^2 + 1)$ or $-x(4x^2 - 1)$ or $-x(-1 + 4x^2)$ or even $4x(\frac{1}{4} - x^2)$ or equivalent	B1
quadratic (or initial cubic) into two brackets	M1
$x(1 - 2x)(1 + 2x)$ or $-x(2x - 1)(2x + 1)$ or $x(2x - 1)(-2x - 1)$	A1
	(3 marks)

Notes

B1: Takes out a factor of x or $-x$ or even $4x$. This line may be implied by correct final answer, but if this stage is shown it **must be correct**. So **B0** for $x(1 + 4x^2)$

M1: Factorises the quadratic resulting from their first factorisation using usual rules (see note 1 in General Principles). e.g. $x(1 - 4x)(x - 1)$. Also allow attempts to factorise cubic such as $(x - 2x^2)(1 + 2x)$ etc
N.B. Should not be completing the square here.

A1: Accept either $x(1 - 2x)(1 + 2x)$ or $-x(2x - 1)(2x + 1)$ or $x(2x - 1)(-2x - 1)$. (No fractions for this final answer)

Specific situations

Note: $x(1 - 4x^2)$ followed by $x(1 - 2x)^2$ scores B1M1A0 as factors follow quadratic factorisation criteria

And $x(1 - 4x^2)$ followed by $x(1 - 4x)(1 + 4x)$ **B1M0A0**.

Answers with no working: Correct answer gets all three marks B1M1A1

$x(2x - 1)(2x + 1)$ gets B0M1A0 if **no working** as $x(4x^2 - 1)$ would earn B0

Poor bracketing: e.g. $(-1 + 4x^2) - x$ gets B0 unless subsequent work implies bracket round the $-x$ in which case candidate may recover the mark by the following correct work.

4.

Answer	Mark	Comments
Alternative method 1		
$(6x + ay)(x + by)$	M1	$ab = -20$ or $a + 6b = 26$
$(6x - 4y)(x + 5y)$	A1	
$2(3x - 2y)(x + 5y)$	A1	oe but must have 3 correct factors
Alternative method 2		
$(3x + ay)(2x + by)$	M1	$ab = -20$ or $2a + 3b = 26$
$(3x - 2y)(2x + 10y)$	A1	
$2(3x - 2y)(x + 5y)$	A1	oe but must have 3 correct factors
Alternative method 3		
$2(3x^2 + 13xy - 10y^2)$	M1	
$2(3x - 2y)(x + 5y)$	A2	oe but must have 3 correct factors A1 for correct answer with signs wrong way round ie $2(3x + 2y)(x - 5y)$

Alternative method 4 using $(3x^2 + 13xy - 10y^2)$		
$(3x + ay)(x + by)$	M1	$ab = -10$ or $a + 3b = 13$
$(3x - 2y)(x + 5y)$	A1	
$2(3x - 2y)(x + 5y)$	A1	oe but must have 3 correct factors

Additional guidance

Candidates who remove x or y , factorise correctly and then replace the letter to gain correct answer	M1A2
Candidates who remove x or y , factorise correctly and then don't replace the letter	MOA0
Condone further working in an attempt to solve an equation	

5.

Answer	Mark	Comments
$(x + 6)^3 [x + 6 + 3x + 4]$ or $(x + 6)^2 [(x + 6)^2 + (x + 6)(3x + 4)]$ or $(x + 6)[(x + 6)^3 + (x + 6)^2(3x + 4)]$	M1	for sight of $(x + 6)^3$, $(x + 6)^2$ or $(x + 6)$ taken out as a common factor
$(x + 6)^3 [4x + 10]$	A1	
$2(x + 6)^3 (2x + 5)$	A1	

Additional guidance

$(x + 6)^3 (x + 6)(3x + 4)$ implies M1

SC1 for all correct factors seen in working but never written as a product of terms

An attempt to expand brackets will be M0 unless the expansion leads to a correct solution worth 2 or 3 marks

$(x + 6)^3 [x + 6 + 4x + 3]$ scores M1 ... ignore the error in the 2nd bracket

6.

Answer	Mark	Comments
3 correct from $6x^5 + 8x^3 - 27x^2 - 36$	M1	expansion of $(2x^3 - 9)(3x^2 + 4)$ may be seen in a grid
$6x^5 + 8x^3 - 27x^2 - 36$	M1dep	may be seen in a grid
$x^3 - 4x^2 - 4x^2 + 16x$ or $x^3 - 8x^2 + 16x$	M1	expansion of $x(x - 4)^2$ may be seen in a grid
$6x^5 + 9x^3 - 35x^2 + 16x - 36$	A1	

Additional guidance

A correct term includes the sign (in a grid allow eg $8x^3$ for $+8x^3$)	
Terms may be in any order throughout	
Terms must be fully processed eg do not allow $2x^3 \times 3x^2$ for $6x^5$	
Allow eg $+ - 27x^2$ for $-27x^2$ for M marks	
$6x^5 + 8x^3 - 27x^2 - 36$ scores the 1st M1 and 2nd M1 even if incorrectly simplified (or differentiated) eg $6x^5 + 8x^3 - 27x^2 - 36 = 6x^5 - 19x^2 - 36$	M1M1
$x^3 - 4x^2 - 4x^2 + 16x$ (or $x^3 - 8x^2 + 16x$) scores the 3rd M1 even if incorrectly simplified (or differentiated) eg $x^3 - 4x^2 - 4x^2 + 16x = x^3 - 16x^2 + 16x$	3rd M1
Correct answer then incorrect further work eg differentiation	M3A0
$6x^5 + 9x^3 - 35x^2 + 16x - 36 = x(6x^4 + 9x^2 - 35x + 16) - 36$	M3A0

7.

Answer	Mark	Comments
$x^2 + 3x + x + 3$ with three terms correct or $x^2 + 4x + k$ where k is a non-zero constant	M1	oe expansion attempt of one pair of brackets eg1 $x^2 + 4x + 3x + 12$ with three terms correct or $x^2 + 7x + k$ where k is a non-zero constant eg2 $x^2 + 4x + x + 4$ with three terms correct

		or $x^2 + 5x + k$ where k is a non-zero constant
$x^3 + 3x^2 + x^2 + 3x$ or $x^3 + 4x^2 + 3x$ or $4x^2 + 12x + 4x + 12$ or $4x^2 + 16x + 12$	M1dep	attempt at a full expansion with correct multiplication of their 3 or 4 terms by one of the terms in the remaining bracket oe eg $x^3 + 4x^2 + 3x^2 + 12x$ or $x^3 + 7x^2 + 12x$ or $x^2 + 4x + 3x + 12$ or $x^2 + 7x + 12$ ($x^2 + 7x + 12$ must be from an attempt at a full expansion) or $x^3 + 4x^2 + x^2 + 4x$ or $x^3 + 5x^2 + 4x$ or $3x^2 + 12x + 3x + 12$ or $3x^2 + 15x + 12$
$x^3 + 8x^2 + 19x + 12$	A1	fully correct expansion allow if terms not collected eg $x^3 + 3x^2 + x^2 + 3x + 4x^2 + 12x + 4x + 12$ or $x^3 + 4x^2 + 3x + 4x^2 + 16x + 12$
$x^2 + 8x + 12$	A1ft	ft M2A0 full simplification of their $(x^3 + 8x^2 + 19x + 12) - x^3 - 7x^2 - 11x$ their $(x^3 + 8x^2 + 19x + 12)$ must be a cubic
$x^2 + 8x + 12$ and $(x + 6)(x + 2)$ or $(x + 2)(x + 6)$	A1	oe product of brackets

Additional guidance

1st M1 Do not allow omissions or extras

eg1 $x^2 + 3x + 3$

eg2 $x^2 + 3x + x + 3 + x^2$

M0

M0

For the first 2 marks terms may be seen in a grid

If 1st A1 has been awarded with terms not collected, A1ft can still be awarded using their simplified cubic eg $x^3 + 4x^2 + 3x + 4x^2 + 16x + 12$ $= x^3 + 8x^2 + 18x + 12$ $x^3 + 8x^2 + 18x + 12 - x^3 - 7x^2 - 11x$ $= x^2 + 7x + 12$	M1M1A1 A1ftA0
First A1 may be seen embedded eg $x^3 + 8x^2 + 19x + 12 - x^3 - 7x^2 - 11x$	M1M1A1
If an attempt at the expansion of all three brackets in one go is made it must be fully correct to gain M2A1, otherwise M0M0A0 eg $x^2 + 3x + x + 3 + x^2 + 4x$	M0M0A0
Allow recovery of missing brackets when subtracting $x^3 + 7x^2 + 11x$ from their cubic	
For final A1 allow $x^2 + 8x + 12$ and $a = 6 \ b = 2$ or $x^2 + 8x + 12$ and $a = 2 \ b = 6$	
Ignore equating to zero and/or any 'solving' of an equation	