

Mark Scheme

AQA Level 2 Further Maths Mock Set C Paper 1

For AQA Level 2 Certificate in Further Mathematics (8365)

Paper 1 (Non-Calculator)

Total 80 marks

Key to the marks

M	Method mark: for a correct method that could lead to the correct answer.
A	Accuracy mark: for a correct value or answer that follows from a correct method. The method may be implied.
B	Independent mark: for a correct answer or statement; no method needs to be seen.
Q	Quality mark: for a clear, complete and correct explanation or conclusion.
ft	Follow through: credit correct work that uses a wrong value from an earlier step.
dep	Dependent: can only be given if the mark before it has been given.
SC	Special case: credit for a common misreading that still has some mathematical worth.
oe	Or equivalent: accept any equal value or form, e.g. 0.5 for $\frac{1}{2}$.
cao	Correct answer only.
$[a, b]$	Accept any value from a to b inclusive.
3.14 ...	Accept any answer that begins 3.14, e.g. 3.14, 3.142, 3.1416.
$()$	Working in brackets does not need to be seen.

Give credit for any correct method, including ones not listed here. A correct answer with no working scores full marks unless the question asks for working (for example “show that” or “you must show your working”). If a correct answer is followed by further work that does not change it, ignore the further work. Exact answers (fractions, surds, multiples of π) must be given where the question asks for them.

Indicative grade boundaries

Grade	9	8	7	6	5	4
Whole set: Papers 1 and 2 (out of 160)	139	122	105	88	72	63
This paper alone, rough guide (out of 80)	70	61	53	44	36	32

Indicative only. Based on the real AQA 8365 boundaries for June 2023 to June 2026 (median), adjusted for how this set compares in difficulty with the real papers. Grades are awarded on the total for both papers; the single-paper guide is about half of the set boundaries.

These are estimates to help you judge performance on a practice paper; real boundaries change every year.

Marking guidance

Q	Answer	Marks	Guidance
1	30	M1	9×10^2 or 900 or $250\,000 \times 0.0036$ oe
		A1	30 (accept ± 30) <i>Additional guidance:</i> Condone 3×10 or 3×10^1 for A1. $10^5 \times 10^{-3} = 10^8$ ($pq = 9 \times 10^8$, answer 30 000) scores MOA0. $\sqrt{2.5 \times 10^5} \times \sqrt{3.6 \times 10^{-3}}$ with no further progress scores M0.
2(a)	$fg(x) = 13 - 3x^2$	M1	$7 - 3(x^2 - 2)$ or $7 - 3x^2 + 6$
		A1	$13 - 3x^2$ oe, e.g. $-3x^2 + 13$ <i>Additional guidance:</i> $7 - 3x^2 - 2$ ($= 5 - 3x^2$) scores MOA0. $gf(x) = (7 - 3x)^2 - 2$ ($= 9x^2 - 42x + 47$) scores MOA0. Penalise incorrect further working (e.g. dividing by a common factor) with A0.
2(b)	$h^{-1}(x) = \frac{5}{x} + 2$	M1	$y(x - 2) = 5$ or $x - 2 = \frac{5}{y}$ or $x(y - 2) = 5$ or $y - 2 = \frac{5}{x}$ oe
		A1	$\frac{5}{x} + 2$ oe, e.g. $\frac{5 + 2x}{x}$ <i>Additional guidance:</i> Answer in terms of y scores M1A0. $\frac{x - 2}{5}$ (the reciprocal of h) scores MOA0. $\frac{5}{x + 2}$ or $\frac{5}{x} - 2$ scores MOA0 unless a correct first step is seen. Ignore any domain given.
Total for Question 2: 4 marks			
3	Gradient of $L = -2$ and gradient of $M = \frac{-6}{3} = -2$: the gradients are equal, so the lines are parallel.	M1	$y = -2x + 5$ oe or gradient of $L = -2$ or $\frac{-3 - 3}{2 - (-1)}$ oe
		A1	both gradients -2 (oe) with a statement, e.g. same gradient so parallel <i>Additional guidance:</i> Condone $-2x$ given as the gradient of L . A statement about gradients that does not say the lines are parallel scores A0. Gradient of M as $\frac{3}{-6} = -\frac{1}{2}$ (change in x over change in y) scores M0 for that gradient. Alternative: equation of M found as $y = -2x + 1$ and compared with $y = -2x + 5$, with statement, scores M1A1.

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Q	Answer	Marks	Guidance
4	$2y(3x + 1)(2x - 3)$	M1	$2y(6x^2 - 7x - 3)$ or $y(12x^2 - 14x - 6)$ or $2(6x^2y - 7xy - 3y)$ or $(6x + 2)(2x - 3)y$ or $(3x + 1)(4x - 6)y$ or two of the three factors $2y$, $(3x + 1)$, $(2x - 3)$ correct
		A1	$2y(3x + 1)(2x - 3)$ (factors in any order) <i>Additional guidance:</i> $y(6x + 2)(2x - 3)$ or $2y(6x^2 - 7x - 3)$ scores M1A0 (not fully factorised). Penalise further working, e.g. solving for x , with A0.
5(a)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	B1	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$
5(b)	$P = (2, 1)$	M1	$(1, -2)$ or $2x + 3y = -4$ and $x - 2y = 5$ solved for one value or $\begin{pmatrix} 2 & 3 \\ 1 & -2 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ with at least two entries of $\begin{pmatrix} -3 & 2 \\ 2 & 1 \end{pmatrix}$ correct
		M1dep	their $(1, -2)$ rotated 90° anticlockwise (e.g. $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ -2 \end{pmatrix}$) or $-3x + 2y = -4$ and $2x + y = 5$ solved for one value
		A1	$(2, 1)$ <i>Additional guidance:</i> $x = 2, y = 1$ or $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$ is A1. $(1, -2)$ given as the answer scores M1M0A0. $(1, -2)$ rotated 270° anticlockwise again, giving $(-2, -1)$, scores M1M0A0. Combined matrix in the wrong order, $\begin{pmatrix} 1 & -2 \\ -2 & -3 \end{pmatrix}$, scores M0M0A0. Answer $(2, 1)$ with no working scores 3.
Total for Question 5: 4 marks			
6	$-3n^2 + 20n + 1$	M1	$-3n^2$ or second differences of -6 with an^2 , $a = -3$
		M1dep	$21, 41, 61, \dots$ or $20n + 1$ or $3a + b = 11$ and $a + b + c = 18$ with $a = -3$ oe
		A1	$-3n^2 + 20n + 1$ oe <i>Additional guidance:</i> $3n^2 + \dots$ scores M0 but M1dep cannot then be awarded. $-6n^2 \dots$ scores M0M0A0. Answer of $an^2 + bn + c$ with $a = -3$, $b = 20$, $c = 1$ stated but not combined scores M1M1A0.

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Q	Answer	Marks	Guidance
7	$19 - 12\sqrt{7}$	M1	$9 - 6\sqrt{7} - 6\sqrt{7} + 28$ (four terms, at least three correct) or $37 - 12\sqrt{7}$
		M1	$25 - 5\sqrt{7} + 5\sqrt{7} - 7$ or $25 - 7$ or 18
		A1	$19 - 12\sqrt{7}$
		<i>Additional guidance:</i> $37 - 12\sqrt{7} + 18 = 55 - 12\sqrt{7}$ (sign error when subtracting) scores M1M1A0. $9 - 12\sqrt{7} + 14$ scores M0 for the first M1. Accept $a = 19, b = -12$.	
8	$x = -2$	M1	$3x^3 + 5$ (at least one term correct)
		M1dep	their $\frac{dy}{dx} = -19$ or $3x^3 = -24$ or $x^3 = -8$
		A1	-2
		<i>Additional guidance:</i> $\frac{3}{4}x^4 + 5x = -19$ (not differentiated) scores M0M0A0. $x = 2$ or ± 2 scores M1M1A0.	
9	145° and 215°	M1	145 or 215
		A1	145 and 215
<i>Additional guidance:</i> Condone missing degree signs. 325 (the other solution of $\cos x = k$) with one correct value scores M1A0. Correct values with extra incorrect values in the range on the answer line score M1A0.			
10(a)	$x^2 + y^2 = 37$	B1	$x^2 + y^2 = 37$ oe
<i>Additional guidance:</i> $x^2 + y^2 = \sqrt{37}$ scores B0.			
10(b)	$6x - y = 37$	M1	gradient of $OP = -\frac{1}{6}$ oe
		M1dep	gradient of tangent = 6
		A1	$6x - y = 37$ or any integer multiple, e.g. $-6x + y = -37$
		<i>Additional guidance:</i> $y = 6x - 37$ (not in the required form) scores M1M1A0. Gradient $-\frac{1}{6}$ used for the tangent ($x + 6y = 0$) scores M1M0A0. A correct answer with no working scores 3.	
Total for Question 10: 4 marks			
11	$\frac{3}{3x+2}$	M1	$(3x+2)(x-5)$
		M1dep	$\frac{2(3x+2) - (3x+19)}{(3x+2)(x-5)}$ oe or $\frac{3x-15}{(3x+2)(x-5)}$ oe
		A1	$\frac{3}{3x+2}$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> $\frac{3x-15}{3x^2-13x-10}$ as the final answer scores M1M1A0. $6x + 4 - 3x + 19$ (sign error, numerator $3x + 23$) scores M1M0A0. Alternative: common denominator $(x - 5)(3x^2 - 13x - 10)$ with a correct numerator scores M1M1, and A1 only for $\frac{3}{3x+2} \cdot \frac{3}{3x+2}$ followed by incorrect further working (e.g. $\frac{1}{x+2}$) scores M1M1A0.
12	$a = 3$ or $a = -3$	M1 M1 A1	$3 \times 2 \times (ax)^2$ or $6a^2$ (may be in a full expansion) $6 \times 3^2 \times (-x)^2$ or 54 (may be in a full expansion) 3 and -3 (or ± 3) <i>Additional guidance:</i> $a = 3$ only scores M1M1A0. $3 \times 2 \times ax^2 (= 6a, \text{ giving } a = 9)$ scores M0M1A0. -54 (sign error from $(-x)^2$) scores M1M0A0. Full expansions with the correct x^2 terms identified score the M marks.
13	$x \approx 0.3$ and $x \approx 3.2$	M1 M1 A1 A1	$x^2 - 4x + 2 = 1 - 0.5x$ oe or $y = 1 - 0.5x$ stated ruled straight line through (0, 1) and (2, 0) (within half a small square) drawn at least from $x = 0$ to $x = 4$ one solution in $[0.2, 0.4]$ or $[3.1, 3.3]$ both solutions in range <i>Additional guidance:</i> Solutions must come from intersections with a drawn line. Correct answers from the quadratic formula (0.31... and 3.18...) with no line drawn score SC1. A line from a wrong rearrangement, e.g. $y = 0.5x - 1$, scores M0M0A0A0.
14	$-4 \leq x \leq -\frac{3}{2}$	M1 M1dep A1 A1	$2x^2 + 11x + 12$ oe (all terms multiplied by x ; condone = or any inequality sign) $(2x + 3)(x + 4)$ or correct use of the formula for $2x^2 + 11x + 12 = 0$ critical values -4 and -1.5 $-4 \leq x \leq -1.5$ oe <i>Additional guidance:</i> $x \leq -4$ or $x \geq -1.5$ (sign not reversed) scores M1M1A1A0. $-4 < x < -1.5$ scores M1M1A1A0. $x \geq -4$ and $x \leq -1.5$ is A1 (must see "and"). Trial and improvement scores 0. Answer with no working scores 0.
15	$x = -\frac{1}{2}$	M1	at least two of 16, 8, 64 written correctly as powers of 2 in the equation, e.g. $2^{4(x-1)}$ or $(2^3)^{2x+1}$ or 2^6

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Q	Answer	Marks	Guidance
		M1dep	$4(x - 1) = 3(2x + 1) - 6$ oe linear equation
		A1	$-\frac{1}{2}$ oe <i>Additional guidance:</i> Working must be seen: $-\frac{1}{2}$ with no working scores 0. $4x - 1 = 6x + 1 - 6$ (brackets not expanded correctly) scores M1MOAO. Alternative using powers of 4 and 8 (e.g. 4^{2x-2} , $64 = 8^2$) leading to a correct linear equation in one base scores the same.
16	$m = 16, c = 20$ (tangent $y = 16x + 20$)	M1	$10x^4$ or $+6x^{-2}$ oe
		A1	$10x^4 + 6x^{-2}$ oe
		M1	substitutes $x = -1$ into their $\frac{dy}{dx}$ and uses $y - 4 = m(x + 1)$ or $4 = -m + c$ with their gradient (the point $(-1, 4)$ must be correct)
		A1	$m = 16$ and $c = 20$ (or $y = 16x + 20$) <i>Additional guidance:</i> $10x^4 - 6x^{-2}$ gives gradient 4 and $y = 4x + 8$: M1A0M1A0. Using the normal gradient $-\frac{1}{16}$ scores M1A1M0A0. $y - 4 = 16(x + 1)$ not rearranged scores M1A1M1A0. Using $y = -8$ at $x = -1$ (from $+\frac{6}{x}$) scores at most M1A1M0A0.
17	$4\sqrt{6}$ cm	M1	$6^2 + 10^2 - 2 \times 6 \times 10 \times \frac{1}{3}$ oe
		M1dep	96 or $\sqrt{96}$
		A1	$4\sqrt{6}$ <i>Additional guidance:</i> $\sqrt{96}$ or $2\sqrt{24}$ as the final answer scores M1M1A0. $\pm 4\sqrt{6}$ scores A0. $(36 + 100 - 120) \times \frac{1}{3}$ scores M0.
18	$x = 3, y = -\frac{1}{2}, z = 2$	M1	correct method to eliminate z from (1) and (2), e.g. $7x + 6y = 18$ (allow one arithmetic error)
		M1dep	correct method to eliminate x or y from their equation and $4x - 2y = 13$, e.g. $19x = 57$
		A1	$x = 3$ or $y = -\frac{1}{2}$
		M1	substitutes their values to find the other unknowns
		A1	$x = 3, y = -\frac{1}{2}$ and $z = 2$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Accept $y = -0.5$. Answers with no working, or from trial and improvement, score 0. Alternative: $y = \frac{4x-13}{2}$ substituted into (1) and (2) is a correct method for the first two M marks.
19(a)	<i>ADB:</i> angle in a semicircle is 90° . <i>TAB:</i> the tangent is perpendicular to the radius <i>OA</i> .	B1	(angle <i>ADB</i>) angle in a semicircle (is 90°) oe
		B1	(angle <i>TAB</i>) a tangent is perpendicular to the radius oe, e.g. angle between tangent and radius is 90° <i>Additional guidance:</i> Accept “angle subtended by a diameter at the circumference is 90° ”. Do not accept “angle in a semicircle” for <i>TAB</i> , or “tangent and diameter” with no mention of 90° or perpendicular. “Alternate segment theorem” scores B0 for either angle.
19(b)	$x = 10, y = 5$	M1	$4x + 3y + 3x + y = 90$ or $3x + y + 5x + y + 90 = 180$ or $4x + 3y = 5x + y$ oe
		M1dep	two correct equations and a correct method to eliminate x or y
		A1	$x = 10$ and $y = 5$ <i>Additional guidance:</i> Equations may be in any equivalent form, e.g. $7x + 4y = 90$, $4x + y = 45$, $x = 2y$. Answers with no working score 0. One correct value with working scores M1M1A0.
Total for Question 19: 5 marks			
20	$12n^2 + 18n + 24 = 6(2n^2 + 3n + 4)$, which is a multiple of 6 because $2n^2 + 3n + 4$ is an integer.	M1	$16n^2 + 16n + 4$ or $4n^2 - 2n - 20$ (may be seen in a subtraction)
		M1dep	$12n^2 + 18n + 24$ or $16n^2 + 16n + 4 - 4n^2 + 2n + 20$
		A1	$6(2n^2 + 3n + 4)$ and a statement, e.g. $2n^2 + 3n + 4$ is an integer so it is a multiple of 6 <i>Additional guidance:</i> $12n^2 + 14n - 16$ (bracket error) scores M1MOA0. $12n^2 + 18n + 24$ with “all the terms are multiples of 6, so it is a multiple of 6” scores M1M1A1. Testing values of n only scores 0.

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Q	Answer	Marks	Guidance
21	$v = 60$ and $\frac{d^2C}{dv^2} = \frac{1440}{v^3} > 0$, so a minimum; minimum cost 24 pence per mile.	M1	$\frac{1}{5} - 720v^{-2}$ (at least one term correct)
		M1dep	their $\frac{dC}{dv} = 0$ and $v^2 = 3600$ oe
		A1	$v = 60$
		B1	$\frac{d^2C}{dv^2} = 1440v^{-3}$ oe and positive (when $v = 60$) so minimum
		A1	24 <i>Additional guidance:</i> Alternative for B1: $\frac{dC}{dv}$ evaluated either side of $v = 60$ with correct signs, e.g. $v = 50$: -0.088 and $v = 70$: $0.053 \dots$ (or negative then positive), and minimum stated. Allow $\frac{1}{150} > 0$ for the second derivative at $v = 60$. £0.24 is acceptable for the final A1. 24 with no minimum test scores M1M1A1BOA1. $v = 60$ and 24 from trial of values (no calculus) score 0.
22	$(3, -8)$ and $\left(-\frac{3}{2}, 10\right)$	M1	$y = 4 - 4x$ oe or $x = \frac{4 - y}{4}$ oe
		M1	$2x^2 - 7x - 5 = 4 - 4x$ oe (their linear expression for y substituted into the curve)
		A1	$2x^2 - 3x - 9 (= 0)$
		M1dep	$(2x + 3)(x - 3)$ or correct method to solve their 3-term quadratic (dep on the second M1)
		A1	$x = 3$ and $x = -\frac{3}{2}$
		A1	$(3, -8)$ and $\left(-\frac{3}{2}, 10\right)$ <i>Additional guidance:</i> Correctly paired values, e.g. $x = 3, y = -8$ and $x = -1.5, y = 10$, are A1. Accept -1.5 . Substituting $y = 4 + 4x$ (sign error) gives $2x^2 - 11x - 9 = 0$ and scores at most M0M1A0M1A0A0. Answers with no working, or from trial and improvement, score 0.
23	$\frac{6 \sin^2 x}{-3 \cos^2 x} = -2 \tan^2 x$, so $k = -2$	M1	$6 \sin^2 x$ oe for the numerator, e.g. $6 \sin^2 x (\sin^2 x + \cos^2 x)$ with $\sin^2 x + \cos^2 x = 1$
		M1	$-3 \cos^2 x$ oe for the denominator, e.g. $2 \cos^2 x + 5(1 - \cos^2 x) - 5$ or $2 \cos^2 x - 5 \cos^2 x$

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Q	Answer	Marks	Guidance
		A1	$-2 \tan^2 x$ with full working <i>Additional guidance:</i> Correct notation is needed for A1 ($\tan^2 x$, not $\tan x^2$). $2 \tan^2 x$ (sign error in the denominator) scores at most M1M0A0. Stop marking once the candidate treats it as an equation (e.g. cross-multiplying by $k \tan^2 x$).