

Mark Scheme

AQA Level 2 Further Maths Mock Set B 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(a)	$-4 < f(x) \leq 17$	B1	$-4 < f(x) \leq 17$ oe <i>Additional guidance:</i> oe eg $17 \geq f(x) > -4$ or $-4 < f(x)$ and $f(x) \leq 17$. Condone y or f for $f(x)$. $-4 \leq f(x) < 17$ (signs not swapped) B0. $-4 < x \leq 17$ B0. $(-4, 17]$ B1.
1(b)	$-7 \leq g(x) < 9$	B2	$-7 \leq g(x) < 9$ oe <i>Additional guidance:</i> B1 for $k \leq g(x) < 9$ where $k < 9$, or $-7 \leq g(x) < m$ where $m > -7$, or -7 and 9 seen from correct working. Condone y or g for $g(x)$. $-7 \leq x < 9$ B1 (both values correct). $2 < g(x) < 9$ B1. $-7 < g(x) \leq 9$ B1 (-7 and 9 seen).
Total for Question 1: 3 marks			
2	$a = -4, b = 6$	M1 A1 A1ft	$4b - 15 = 9$ or $2b + 5a = -8$ oe $b = 6$ $a = -4$ ft their b in $2b + 5a = -8$ <i>Additional guidance:</i> Correct answers with no working M1A1A1. Embedded answers in a correct matrix calculation with nothing on the answer line M1A1A1. Multiplying in the wrong order, eg $4b + 10 = 9$ (column times matrix) M0.
3(a)	$2x + 3y = 9$	M1 M1 A1	$\frac{5 - (-1)}{-3 - 6}$ oe or $-\frac{2}{3}$ $y - 5 = -\frac{2}{3}(x + 3)$ or $y + 1 = -\frac{2}{3}(x - 6)$ or $y = -\frac{2}{3}x + 3$ oe ft their gradient $2x + 3y = 9$ oe with integers <i>Additional guidance:</i> Accept eg $-2x - 3y = -9$ or $4x + 6y = 18$ or $3y + 2x = 9$ for A1. $y = -\frac{2}{3}x + 3$ as the final answer M1M1A0. Gradient $-\frac{3}{2}$ or $\frac{2}{3}$ M0, but the second M1 can be scored for a correct method with their gradient through A or B.
3(b)	$C = (0, 3),$ $AC = \sqrt{6^2 + 4^2} = \sqrt{52} =$ $\sqrt{4} \times \sqrt{13} = 2\sqrt{13}$	M1 A1	$C = (0, 3)$ and $(6 - 0)^2 + (-1 - 3)^2$ oe or 52 or $\sqrt{52}$ $\sqrt{52} = \sqrt{4} \times \sqrt{13}$ or $\sqrt{4 \times 13}$ and $2\sqrt{13}$ <i>Additional guidance:</i> A1 needs a correct intermediate step between $\sqrt{52}$ and $2\sqrt{13}$. Using C from an incorrect line in part (a) MOA0.

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Q	Answer	Marks	Guidance
Total for Question 3: 5 marks			
4	45th term (position 45)	M1 M1dep A1	$-0.8n$ seen eg $5.4 - 0.8n$ $5.4 - 0.8n < -30$ oe eg $0.8n > 35.4$ 45 <i>Additional guidance:</i> Condone $=$, $\leq$ or $>$ in place of $<$ for M1dep. 44.25 seen implies M2. -30.6 on the answer line with 45 seen M2A0. SC1 44 on the answer line if no other marks scored. Listing terms to the correct answer M2A1. Listing terms with an incorrect answer M0A0.
5	$-6x^3 + 5x^2 + 83x - 28$	M1 M1dep A1	two brackets expanded with at least 3 of 4 terms correct eg $6x^2 - 2x + 21x - 7$ or $8x + 28 - 2x^2 - 7x$ or $12x - 4 - 3x^2 + x$ their quadratic $\times$ third bracket with at least 4 of 6 terms correct (ft) $-6x^3 + 5x^2 + 83x - 28$ <i>Additional guidance:</i> Terms may be in any order. Condone a grid method. $6x^3 - 5x^2 - 83x + 28$ (sign of every term wrong) M1M1A0.
6	$x = \frac{7}{3}$ and $x = -1$	M1 M1dep A1	$3x^2 - 4x - 5$ (at least two terms correct) $3x^2 - 4x - 7 = 0$ and $(3x - 7)(x + 1)$ or correct substitution into the formula for their 3-term quadratic $\frac{7}{3}$ and -1 <i>Additional guidance:</i> oe eg $2\frac{1}{3}$ or $2.3\dot{3}$ for $\frac{7}{3}$. Both values correct with no working M1M1A1. Setting $y = 2$ MOM0A0. $3x^2 - 4x - 5 = 0$ solved (gradient taken as 0) M1M0A0.
7(a)	$-\frac{\sqrt{3}}{2}$	B1	$-\frac{\sqrt{3}}{2}$
7(b)	Three increasing branches: through (0, 0) up towards $x = 90$; from below near $x = 90$ through (180, 0) up towards $x = 270$; from below near $x = 270$ to (360, 0). Asymptotes at $x = 90$ and $x = 270$	B1	curve through (0, 0), (180, 0) and (360, 0), increasing in each section

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Q	Answer	Marks	Guidance
		B1	correct asymptotic behaviour at $x = 90$ and $x = 270$ (three separate branches, none crossing $x = 90$ or $x = 270$) <i>Additional guidance:</i> Mark intention. Asymptotes need not be drawn, but no branch may cross $x = 90$ or $x = 270$. A curve joined across $x = 90$ or $x = 270$ B1B0 at most. A sketch of $y = \sin x$ or $y = \cos x$ B0B0. Ignore any curve drawn beyond 0° or 360° .
Total for Question 7: 3 marks			
8	$-6 - \sqrt{35}$ ($m = -6$, $n = -1$)	M1	$\frac{\sqrt{5} + \sqrt{7}}{\sqrt{5} - \sqrt{7}} \times \frac{\sqrt{5} + \sqrt{7}}{\sqrt{5} + \sqrt{7}}$ oe
		M1dep	denominator $5 - 7$ or -2
		M1dep	numerator $5 + \sqrt{35} + \sqrt{35} + 7$ oe with at least three terms correct
		A1	$-6 - \sqrt{35}$ <i>Additional guidance:</i> oe eg multiplying by $\frac{-\sqrt{5} - \sqrt{7}}{-\sqrt{5} - \sqrt{7}}$. Numerator may be seen simplified, eg $12 + 2\sqrt{35}$. Accept $m = -6$, $n = -1$. $\frac{12 + 2\sqrt{35}}{-2}$ as the final answer M3A0. Both M1dep marks depend on the first M1 only. $6 + \sqrt{35}$ (from a denominator of 2) M1MOM1A0. Multiplying by $\frac{\sqrt{5} - \sqrt{7}}{\sqrt{5} - \sqrt{7}}$ MOMOMOA0.
9(a)	$b = -6$, $c = -16$	M1	8 seen as the other root or $(x + 2)(x - 8)$ or $-\frac{b}{2} = 3$ or $b = -6$
		M1dep	$x^2 - 8x + 2x - 16$ or $0 = (-2)^2 + (-6)(-2) + c$ oe
		A1	$b = -6$ and $c = -16$ <i>Additional guidance:</i> Both values correct with no working M1M1A1. Only $b = -6$ correct with no working M1MOA0. Only $c = -16$ correct with no working MOMOA0. Other root taken as 5 or 4 (not using the symmetry correctly) MO. $b = 6$, $c = -16$ M1M1A0.
9(b)	$(3, -25)$	B1ft	$(3, -25)$ ft their b and c <i>Additional guidance:</i> ft $(3, 9 + 3b + c)$ for their b and c .
Total for Question 9: 4 marks			

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Q	Answer	Marks	Guidance
10	$x = 0, x = \frac{3}{2}, x = -\frac{5}{2}$	M1	$x(4x^2 + 4x - 15)$ or $x = 0$ and $4x^2 + 4x - 15$ seen
		M1	$(2x - 3)(2x + 5)$ or correct substitution into the formula
		A1	$0, \frac{3}{2}$ and $-\frac{5}{2}$ <i>Additional guidance:</i> oe eg 1.5 and -2.5 . Second M1 can be scored after dividing by x . Two non-zero values only (from dividing by x) MOM1A0. SC1 for all three correct solutions with no factorising seen.
11	104	M1	7×8 or 56 or 6×8 or 48
		M1dep	$7 \times 8 + 6 \times 8$ oe
		A1	104 <i>Additional guidance:</i> $7 \times 8 \times 2 = 112$ M1MOA0. $7 \times 10 \times 2 = 140$ (repeated digits allowed) MOMOA0. Listing outcomes with the correct answer M2A1. Listing with an incorrect answer MOA0 (unless 56 or 48 is seen).
12	$16 - 96x + 216x^2 - 216x^3 + 81x^4$	M1	1, 4, 6, 4, 1 seen and used or a full expansion of four brackets attempted
		M1dep	$2^4 + 4(2^3)(-3x) + 6(2^2)(-3x)^2 + 4(2)(-3x)^3 + (-3x)^4$ oe all correct
		A1	$16 - 96x + 216x^2 - 216x^3 + 81x^4$ <i>Additional guidance:</i> Terms in any order. Missing brackets must be recovered. $16 + 96x + 216x^2 + 216x^3 + 81x^4$ (all signs +) M1MOA0. Correct answer with no working M1M1A1.
13(a)	$x^{\frac{4}{3}}$	B1	$x^{\frac{4}{3}}$
13(b)	$x = \frac{1}{25}$	M1	$x^{-\frac{3}{2}} = 125$ or $x^{\frac{3}{2}} = \frac{1}{125}$ oe
		M1dep	$x^{\frac{1}{2}} = \frac{1}{5}$ or $x^{-\frac{1}{2}} = 5$ or $x^{-3} = 125^2$ oe
		A1	$\frac{1}{25}$ oe <i>Additional guidance:</i> Correct answer with no working M1M1A1. Accept 0.04. 25 (reciprocal not taken) M1MOA0. $x^{-\frac{3}{2}} = 248$ or $x^{-\frac{3}{2}} = 500$ MOMOA0.

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Q	Answer	Marks	Guidance
Total for Question 13: 4 marks			
14	$\frac{x^2 + 14}{(x - 2)(x + 4)}$ (or $\frac{x^2 + 14}{x^2 + 2x - 8}$)	M1	denominator $(x - 2)(x + 4)$ with two of $3(x + 4)$, $-5(x - 2)$, $(x - 2)(x + 4)$ correct in the numerator
		M1dep	$\frac{3(x + 4) - 5(x - 2) + (x - 2)(x + 4)}{(x - 2)(x + 4)}$ oe
		A1	$\frac{x^2 + 14}{(x - 2)(x + 4)}$ or $\frac{x^2 + 14}{x^2 + 2x - 8}$ <i>Additional guidance:</i> Ignore an attempt to 'cancel' after a correct answer is seen. $\frac{x^2 - 6}{(x - 2)(x + 4)}$ (from $-5x - 10$) M1M0A0. $\frac{-2x + 22}{(x - 2)(x + 4)} + 1$ or the 1 added to the numerator only, eg $\frac{-2x + 23}{(x - 2)(x + 4)}$ M1M0A0.
15	78°	M1	angle $ADC = 7x + 11$ or angle $ACB = 3x - 1$ (alternate segment theorem) may be on the diagram
		M1dep	$7x + 11 = 9x - 15$ or $(3x - 1) + (4x + 12) + 180 - (9x - 15) = 180$ oe
		A1	$x = 13$
		A1	78 <i>Additional guidance:</i> Alternative for the second mark: angle $ABC = 180 - (9x - 15)$ with $(3x - 1) + (4x + 12) + (195 - 9x) = 180$. 102 on the answer line (angle ADC) M1M1A1A0. Angle ACB taken as $4x + 12$ or angle $ADC = 3x - 1$ M0. Correct answer with no working MOM0A0A0 ("You must show your working").
16	9 cm	M1	$8^2 + 8^2$ or 128 or $AC = 8\sqrt{2}$ or $4^2 + 4^2$ or $AM = 4\sqrt{2}$ or $AM^2 = 32$ oe
		M1dep	$32 + 7^2$ or $(4\sqrt{2})^2 + 7^2$ or 81 oe
		A1	9 <i>Additional guidance:</i> $\sqrt{4^2 + 7^2} = \sqrt{65}$ (half the side used for AM) MOM0A0. $\sqrt{128 + 49} = \sqrt{177}$ (AC not halved) M1M0A0. Correct answer with no working M1M1A1.

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Q	Answer	Marks	Guidance
17	$P(-1, 3)$, gradient of tangent 7, gradient of normal $-\frac{1}{7}$: $y - 3 = -\frac{1}{7}(x + 1)$, so $7y - 21 = -x - 1$ and $x + 7y - 20 = 0$	B1	$y = 3$ (at $x = -1$)
		M1	$3x^2 - 6x - 2$ (at least two terms correct)
		M1dep	gradient of normal = $-\frac{1}{\text{their } 7}$ and $y - 3 = -\frac{1}{7}(x + 1)$ oe
		A1	$x + 7y - 20 = 0$ with all working correct <i>Additional guidance:</i> Accept $y = -\frac{1}{7}x + c$ with $c = \frac{20}{7}$ found for the M1dep. A1 needs a correct step between the line and the given equation, eg $7y - 21 = -x - 1$. Using the tangent gradient 7 B1M1MOAO. Substituting $x = -1$ to show the given line passes through P only B1 at most.
18	$x = 45$	M1	$\frac{\sin x}{6\sqrt{2}} = \frac{\sin 120}{6\sqrt{3}}$ oe
		B1	$\sin 120 = \frac{\sqrt{3}}{2}$ (may be implied)
		A1	45 with $\sin x = \frac{\sqrt{2}}{2}$ or $\frac{1}{\sqrt{2}}$ oe seen <i>Additional guidance:</i> 45 and 135 both given as answers M1B1AO. Sides and angles mismatched, eg $\frac{\sin x}{6\sqrt{3}} = \frac{\sin 120}{6\sqrt{2}}$ MOB1AO. $\sin 120$ taken as $-\frac{\sqrt{3}}{2}$ or $\frac{1}{2}$ M1BOAO. 45 with no working MOBOAO.
19	$\frac{2}{3} < x < 2$	M1	$\frac{1}{2}(3x - 2)(x + 4) < 12$ oe (condone = or $\leq$)
		M1dep	$3x^2 + 10x - 32 < 0$ oe (condone = or $\leq$)
		M1dep	$(3x + 16)(x - 2)$ or $-\frac{16}{3}$ and 2 as critical values
		B1	$x > \frac{2}{3}$ or $3x - 2 > 0$
		A1	$\frac{2}{3} < x < 2$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> B1 is independent. $-\frac{16}{3} < x < 2$ on the answer line M3BOA0. $0 < x < 2$ M3BOA0. Accept 0.67 or better for $\frac{2}{3}$ only if $\frac{2}{3}$ is seen. Trial and improvement scores 0. Using $(3x - 2)(x + 4) < 12$ (no $\frac{1}{2}$), giving $3x^2 + 10x - 20 < 0$ MOMOMO, B1 still available.
20(a)	$\frac{dy}{dx} = 3x^2 + 24x + 63 =$ $3(x + 4)^2 + 15;$ $(x + 4)^2 \geq 0$, so $\frac{dy}{dx} \geq 15 > 0$ for all x , so y is increasing	M1	$3x^2 + 24x + 63$ oe (3 terms with at least two correct)
		M1	$3(x + 4)^2 \dots$ or $(x + 4)^2 \dots$ (ft their quadratic derivative)
		M1dep	$3(x + 4)^2 + 15$ or $3[(x + 4)^2 + 5]$ or $(x + 4)^2 + 5$ from a correct $\frac{dy}{dx}$
		A1	$(x + 4)^2 \geq 0$ and $\frac{dy}{dx} > 0$ (or ≥ 15), so increasing <i>Additional guidance:</i> M1dep is dependent on both previous M marks. Condone $(x + 4)^2 > 0$ for the A1. The A1 needs a statement that the gradient (or $\frac{dy}{dx}$) is always positive. Alternative (discriminant): M1 for $\frac{dy}{dx}$; M1 for $24^2 - 4 \times 3 \times 63$ (or $8^2 - 4 \times 21$); M1dep for -180 (or -20) or 'no real roots'; A1 for the gradient is never 0 and, eg, the gradient is $63 > 0$ at $x = 0$, so always positive, so increasing. Substituting a few values of x only M1MOMOA0.
20(b)	15	B1	15 <i>Additional guidance:</i> Do not accept $x = -4$ as the answer. 5 (from $(x + 4)^2 + 5$ without the factor 3) BO.
Total for Question 20: 5 marks			
21	$(4, -4)$ and $\left(-\frac{1}{5}, -\frac{13}{5}\right)$	M1	$(-8 - 3y - 3)^2 + y^2 = 17$ or $(x - 3)^2 + \left(\frac{-8 - x}{3}\right)^2 = 17$ oe
		M1dep	$121 + 66y + 9y^2$ or $x^2 - 6x + 9$ and $\frac{x^2 + 16x + 64}{9}$ correctly expanded

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Q	Answer	Marks	Guidance
		A1	$5y^2 + 33y + 52 = 0$ or $5x^2 - 19x - 4 = 0$ oe
		M1	$(5y + 13)(y + 4)$ or $(5x + 1)(x - 4)$ or correct method to solve their 3-term quadratic
		A1	$y = -4$ and $y = -\frac{13}{5}$ or $x = 4$ and $x = -\frac{1}{5}$
		A1	$(4, -4)$ and $\left(-\frac{1}{5}, -\frac{13}{5}\right)$ <i>Additional guidance:</i> oe eg $(-0.2, -2.6)$. Using a wrong circle equation, eg $(x + 3)^2 + y^2 = 17$ or $(x - 3)^2 + y^2 = \sqrt{17}$ MOMOAO, but the fourth mark (M1) is available for correctly solving their 3-term quadratic. Correct points with no working, or from a graph or trial and improvement 0 marks. Coordinates not paired, or paired wrongly, eg $(4, -\frac{13}{5})$ M1M1A1M1A1AO.
22	$x = 30^\circ, 150^\circ, 210^\circ, 330^\circ$	M1	$\cos x = \pm \frac{\sqrt{3}}{2}$ or $\cos^2 x = \frac{3}{4}$ and 30 seen
		A1	two correct angles
		A1	30, 150, 210 and 330 and no others in the range <i>Additional guidance:</i> Only 30 and 330 (positive root only) M1A1AO. Extra values outside the range are ignored; extra incorrect values in the range AO for the final mark. Condone missing degree signs.