

Mark Scheme

AQA Level 2 Further Maths Mock Set A 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)	138	122	106	89	71	62
This paper alone, rough guide (out of 80)	69	61	53	45	36	31

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)	19	M1 A1	$g(-2) = -2$ or $11 - 4((-2)^2 - 6)$ oe 19 <i>Additional guidance:</i> $gf(-2) = 19^2 - 6 = 355$ scores M0A0. $(-2)^2$ taken as -4 giving $g(-2) = -10$ and answer 51 scores M0A0. $11 - 4 \times (-2) = 3$ (sign error) scores M1A0.
1(b)	$f^{-1}(x) = \frac{11-x}{4}$	M1 A1	$y = 11 - 4x$ rearranged to $4x = 11 - y$ or $x = 11 - 4y$ or $-4x = y - 11$ oe $\frac{11-x}{4}$ oe <i>Additional guidance:</i> Accept $\frac{11}{4} - \frac{x}{4}$, $-\frac{x-11}{4}$, $\frac{x-11}{-4}$, $2.75 - 0.25x$. Answer in terms of y scores M1A0. $\frac{x-11}{4}$ scores M1A0 if a correct first step is seen, otherwise M0A0. $\frac{1}{11-4x}$ scores M0A0.
Total for Question 1: 4 marks			
2	$2xy(5x - 2y)(5x + 2y)$	B2 (B1)	$2xy(5x - 2y)(5x + 2y)$ (factors in any order) $2xy(25x^2 - 4y^2)$ or $x(5x - 2y)(10xy + 4y^2)$ oe or $(5x - 2y)(5x + 2y)$ multiplied by an incomplete common factor (e.g. xy or $2x$) <i>Additional guidance:</i> Accept $2 \times x \times y \times (5x - 2y)(5x + 2y)$ for B2. $2xy(25x^2 - 4y^2)$ followed by an incorrect factorisation, e.g. $2xy(5x - 2y)^2$, scores B1. $2xy(5x - 2y)^2$ with $2xy(25x^2 - 4y^2)$ not seen scores B0. $xy(50x^2 - 8y^2)$ scores B0.
3	(7, 13)	M1 M1dep A1	9 and 6 (the changes from A to P) or 3 and 2 (one part) or $\frac{2}{3}$ or $\frac{5}{3}$ oe $1 + 2 \times 3$ or $9 + 2 \times 2$ or $-8 + 5 \times 3$ or $3 + 5 \times 2$ or $1 + \frac{2}{3} \times 9$ oe (7, 13) <i>Additional guidance:</i> (10, 15) (as if P were the midpoint) scores M1M0A0. (14.5, 18) (from $PB = \frac{3}{2}AP$) scores M1M0A0. One correct coordinate with the other wrong scores M1M1A0.
4	$a = 2, b = -6$	M1 M1dep A1	at least two correct entries of AB , e.g. $16 + 3a$, $-4 + 2a$, $4b + 24$, $-b + 16$ an entry equated to the matching entry of 22 I , e.g. $-4 + 2a = 0$ or $16 + 3a = 22$ or $4b + 24 = 0$ or $-b + 16 = 22$ $a = 2$ and $b = -6$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Working with BA gives the same equations here and can score full marks. $a = 2$ and $b = -6$ with no working scores M1M1A1. One correct value with no working scores M0M0A0.
5(a)	$\frac{5}{4}$	B1	$\frac{5}{4}$ oe <i>Additional guidance:</i> Accept 1.25 or $1\frac{1}{4}$.
5(b)	$\frac{5}{4} - \frac{5n-2}{4n+3} = \frac{23}{4(4n+3)} > 0$ because $4n+3 > 0$, so every term is less than $\frac{5}{4}$	M1 A1	$\frac{5(4n+3) - 4(5n-2)}{4(4n+3)}$ or $\frac{23}{4(4n+3)}$ oe or $4(5n-2) < 5(4n+3)$ oe or $20n-8 < 20n+15$ $\frac{23}{4(4n+3)} > 0$ (or $-8 < 15$, which is true for all n) with $4n+3 > 0$ (or n positive) stated and a conclusion <i>Additional guidance:</i> ft their limiting value from (a) for M1 only. Substituting values of n only scores M0A0. Multiplying both sides of $\frac{5n-2}{4n+3} < \frac{5}{4}$ by $4(4n+3)$ is acceptable only if $4n+3 > 0$ is stated for the A1. Condone $\frac{23}{16n+12}$. Arguing only that the terms increase towards $\frac{5}{4}$ scores M0A0.
Total for Question 5: 3 marks			
6	$\frac{dy}{dx} = 18x^5 - 30x + 6$	M1 M1 A1	$3x^6 - 15x^2 + 6x$ with at least two terms correct at least two terms of their expansion differentiated correctly $18x^5 - 30x + 6$ <i>Additional guidance:</i> Differentiating each factor and multiplying, e.g. $6x\left(4x^3 - \frac{2}{x^2}\right)$, scores M0M0A0. $3x^6 - 15x^2 + 6$ (from $3x^2 \times \frac{2}{x} = 6$) then $18x^5 - 30x$ scores M1M1A0. Ignore “+ c”.
7(a)	15	M1 A1	$6\sqrt{5} - 3\sqrt{5}$ or $3\sqrt{5}$ or $\sqrt{900} - \sqrt{225}$ or $30 - 15$ or $\sqrt{5} \times 3\sqrt{5}$ 15 <i>Additional guidance:</i> $\sqrt{675}$ or $\sqrt{5} \times \sqrt{135}$ (from $\sqrt{180 - 45}$) scores M0A0.
7(b)	$11 + 4\sqrt{7}$	M1	$\frac{5 + \sqrt{7}}{3 - \sqrt{7}} \times \frac{3 + \sqrt{7}}{3 + \sqrt{7}}$ oe

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Q	Answer	Marks	Guidance
		M1dep	denominator 2 and numerator $15 + 5\sqrt{7} + 3\sqrt{7} + 7$ with at least three terms correct or $22 + 8\sqrt{7}$
		A1	$11 + 4\sqrt{7}$ <i>Additional guidance:</i> Multiplying by $\frac{3-\sqrt{7}}{3-\sqrt{7}}$ scores M0. $\frac{22+8\sqrt{7}}{2}$ with no further work scores M1M1A0. $11 + 8\sqrt{7}$ scores M1M1A0. $p = 11, q = 4$ with $11 + 4\sqrt{7}$ not seen: condone for A1.
Total for Question 7: 5 marks			
8	218° and 322°	B1	218
		B1	322 <i>Additional guidance:</i> Ignore the degree sign. Any extra values in the range (e.g. 142) with both correct scores B1B0. -38 or -142 score B0.
9	$a = 3, b = 5, c = 37$	B1	$a = 3$
		B1ft	$b = 5$ ft 4x their $a - 7$
		B1ft	$c = 37$ ft 4x their $a + 5$ x their b <i>Additional guidance:</i> $a(x^2 + 4x + 4) - bx + 5b$ seen with no correct values scores SC1. $c = -13$ (from $-b(x - 5) = -bx - 5b$) scores B1B1B0. Values in the wrong positions on the answer line score B0 for those values.
10	$5x^6y + 2xy^7$	B1	coefficients 5 and 2
		B1	x^6 and x in the correct terms
		B1	y and y^7 in the correct terms <i>Additional guidance:</i> $5x^6y + 2xy^7$ or $xy(5x^5 + 2y^6)$ scores B3. Penalise incorrect further working (e.g. adding the terms). If no B marks are scored, $\frac{2x^{-2}y^{-1}(5x^5+2y^6)}{2x^{-3}y^{-2}}$ seen scores SC1.
11(a)	$(x + 3)^2 + (y - 2)^2 = 41$	M1	$(x + 3)^2 + (y - 2)^2$ or $5^2 + 4^2$ or $r^2 = 41$ or $r = \sqrt{41}$
		A1	$(x + 3)^2 + (y - 2)^2 = 41$ oe <i>Additional guidance:</i> Accept $x^2 + 6x + y^2 - 4y = 28$ oe. $(x + 3)^2 + (y - 2)^2 = \sqrt{41}^2$ scores M1A1. $(x - 3)^2 + (y + 2)^2 = 41$ scores M1A0.
11(b)	$2 + 4\sqrt{2}$ and $2 - 4\sqrt{2}$	M1	$3^2 + (y - 2)^2 = 41$ or $(y - 2)^2 = 32$ or $y^2 - 4y - 28 = 0$ oe (ft their equation from (a))
		A1	$2 + 4\sqrt{2}$ and $2 - 4\sqrt{2}$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> $2 \pm 4\sqrt{2}$ scores M1A1. $2 \pm \sqrt{32}$ scores M1A0. Only one value scores M1A0. Decimal answers score M1A0.
			Total for Question 11: 4 marks
12	Line from (0, 0) to (2, 4); smooth curve through (2, 4), (3, 1), (4, 0), (5, 1); line from (5, 1) to (8, 1)	B1 M1 A1 B1	straight line from (0, 0) to (2, 4) at least three of (2, 4), (3, 1), (4, 0), (5, 1) plotted or the curve passing through them smooth curve through (2, 4), (3, 1), (4, 0) and (5, 1) only horizontal line from (5, 1) to (8, 1) <i>Additional guidance:</i> All points within half a small square. The quadratic piece drawn with a ruler (or with a clear vertex at (4, 0)) scores at most B1M1A0B1. A straight piece drawn freehand: condone if reasonably straight. Any piece extended more than half a square beyond its domain: deduct 1 mark (from the B or A mark for that piece).
13	$-5 \leq x \leq \frac{2}{3}$	M1 A1 A1	$3x^2 + 13x - 10$ (inequality or $= 0$) and $(3x - 2)(x + 5)$ or a correct substitution into the quadratic formula critical values $\frac{2}{3}$ and -5 $-5 \leq x \leq \frac{2}{3}$ oe <i>Additional guidance:</i> Condone 0.67 for the first A1 only. $-5 < x < \frac{2}{3}$ scores M1A1A0. $x \leq -5$ or $x \geq \frac{2}{3}$ scores M1A1A0. $x \geq -5$ and $x \leq \frac{2}{3}$ (two separate inequalities joined by “and”) scores M1A1A1. $(2x + 3)^2$ expanded as $4x^2 + 9$ gives $3x^2 + x - 10 \leq 0$ and $-2 \leq x \leq \frac{5}{3}$: M0A0A0. Answer only: $-5 \leq x \leq \frac{2}{3}$ scores 3 marks.
14	$5\sqrt{3} - 5$ cm	M1 M1dep A1	$BD = AD$ (or h) and $DC = AD\sqrt{3}$ or $\frac{AD}{\tan 30}$ oe $h + h\sqrt{3} = 10$ or $h = \frac{10}{1+\sqrt{3}}$ oe $5\sqrt{3} - 5$ oe in the required form

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Accept $-5 + 5\sqrt{3}$, $p = 5$, $q = -5$. $\frac{10}{1+\sqrt{3}}$ or $5(\sqrt{3} - 1)$ as the final answer scores M1M1A0. $DC = \frac{h}{\sqrt{3}}$ (from $h \tan 30$) giving $h = \frac{10\sqrt{3}}{\sqrt{3}+1} = 15 - 5\sqrt{3}$ scores MOM0A0. Decimal 3.66 scores M1M1A0 only if $\frac{10}{1+\sqrt{3}}$ is seen.
15	$x = \pm \sqrt{\frac{3y+4w}{4-y}}$	M1	$3y + x^2y = 4x^2 - 4w$ oe
		M1	$3y + 4w = 4x^2 - x^2y$ or $x^2y - 4x^2 = -3y - 4w$ oe (all x^2 terms on one side, all other terms on the other; ft their expansion with two x^2 terms)
		M1	$x^2(4-y) = 3y + 4w$ or $x^2 = \frac{3y+4w}{4-y}$ oe (ft their collected terms)
		A1	$x = \sqrt{\frac{3y+4w}{4-y}}$ oe <i>Additional guidance:</i> Accept with or without $\pm$. Accept $\sqrt{\frac{-3y-4w}{y-4}}$ oe. The root must clearly cover the whole fraction. $4(x^2 - w)$ expanded as $4x^2 - w$ can score at most MOM1M1A0 (ft).
16(a)	$f\left(\frac{1}{2}\right) = \frac{1}{4} - \frac{3}{4} - \frac{23}{2} + 12 = 0$, so $(2x - 1)$ is a factor.	M1	$2\left(\frac{1}{2}\right)^3 - 3\left(\frac{1}{2}\right)^2 - 23\left(\frac{1}{2}\right) + 12$ oe
		A1	$\frac{1}{4} - \frac{3}{4} - \frac{23}{2} + 12 = 0$ (or $0.25 - 0.75 - 11.5 + 12 = 0$) and a statement that $(2x - 1)$ is a factor <i>Additional guidance:</i> Algebraic division scores M0A0 (the question says use the factor theorem). $= 0$ with no evaluated terms shown scores M1A0. Missing conclusion scores M1A0.
16(b)	$x = \frac{1}{2}$, $x = -3$, $x = 4$	M1	$x^2 - x - 12$ seen as the quadratic factor (by inspection, comparing coefficients or division) or $f(-3) = 0$ or $f(4) = 0$ shown
		M1dep	$(x+3)(x-4)$ or $(2x-1)(x+3)(x-4)$
		A1	$\frac{1}{2}$, -3 and 4 <i>Additional guidance:</i> Answer only (three correct values) with no working scores M0M0A0. $(2x-1)(x+3)(x-4)$ as the answer scores M1M1A0. $\frac{1}{2}$ missing scores M1M1A0. Values $-\frac{1}{2}$, 3 , -4 (signs reversed) score M1M1A0.
			Total for Question 16: 5 marks

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Q	Answer	Marks	Guidance
17	$ADB = x$, $DAB = DBA = \frac{180-x}{2}$, $y = DAB$, so $x + 2y = 180$, with reasons	M1	angle $ADB = x$ or angle $ACB = x$
		M1dep	angle $DAB = \frac{180-x}{2}$ or angle $DBA = \frac{180-x}{2}$ or $x + 2 \times$ angle $DAB = 180$ oe
		A1	angle $DCB =$ angle DAB (or $y = \frac{180-x}{2}$) leading to $x + 2y = 180$
		B1	all reasons given: alternate segment theorem, base angles of an isosceles triangle (are equal), angles in a triangle (add up to 180), angles in the same segment (are equal) <i>Additional guidance:</i> Other valid routes score equivalent marks, with reasons that match the route, e.g. angle $ACB = x$ (alternate segment), angle $ACD = 180 -$ angle $ABD = 90 + \frac{x}{2}$ (opposite angles of cyclic quadrilateral $ABDC$), so $y =$ angle $ACD -$ angle $ACB = 90 - \frac{x}{2}$. Angles may be marked on the diagram. The B1 can only be awarded if M1M1 have been scored. "Angles at the circumference" for angles in the same segment: BO. $y = 90 - \frac{x}{2}$ as the final line, with all previous marks, scores full marks.
18	$3\left(x - \frac{3}{2}\right)^2 - \frac{19}{4}$	M1	$3(x^2 - 3x \dots)$ or $3\left(x - \frac{3}{2}\right)^2 \dots$ or $a = 3$ and $2ap = -9$
		M1dep	$3\left[\left(x - \frac{3}{2}\right)^2 - \frac{9}{4}\right] + 2$ or $3\left(x - \frac{3}{2}\right)^2 - \frac{27}{4} + 2$ or $ap^2 + q = 2$ with $a = 3, p = -\frac{3}{2}$ oe
		A1	$3\left(x - \frac{3}{2}\right)^2 - \frac{19}{4}$ oe
			<i>Additional guidance:</i> Accept $3(x - 1.5)^2 - 4.75$. $a = 3, p = -\frac{3}{2}, q = -\frac{19}{4}$ with the expression not written scores M1M1A0. $3\left(x - \frac{3}{2}\right)^2 - \frac{1}{4}$ (from $-\frac{9}{4} + 2$) scores M1MOA0.
19	$x = 7$	M1	$13^2 = x^2 + 8^2 - 2 \times x \times 8 \times \cos 120$ oe
		A1	$x^2 + 8x - 105 (= 0)$ oe
		M1	$(x + 15)(x - 7) (= 0)$ or correct use of the quadratic formula (ft their three-term quadratic)
		A1	7 cao

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> If -15 is also given as an answer then do not award the final A1. Using $\cos 120 = \frac{1}{2}$ gives $x^2 - 8x - 105 = 0$, $x = 15$: scores M1A0M1A0. $x = 7$ with no working scores 0 (working is required).
20	(0, 0) maximum; (-1, -3) minimum; (4, -128) minimum	M1	$4x^3 - 12x^2 - 16x$ with at least two terms correct
		M1dep	their $\frac{dy}{dx} = 0$ and $4x(x^2 - 3x - 4)$ or $4x(x+1)(x-4)$ or $x(x+1)(x-4)$ oe
		A1	$x = 0$, $x = -1$ and $x = 4$
		A1	(0, 0), (-1, -3) and (4, -128)
		M1	$12x^2 - 24x - 16$ (ft their $\frac{dy}{dx}$) and substitutes at least one of their x -values
		A1	(0, 0) maximum, (-1, -3) minimum, (4, -128) minimum, with -16, 20 and 80 (or their signs) correctly stated
			<i>Additional guidance:</i> Alternative for the last M1A1: the sign of $\frac{dy}{dx}$ either side of each point, correctly evaluated. Nature stated with no valid test (or from a sketch) scores M0A0 for the last two marks. Dividing by x (so $x = 0$ is lost) can score M1M1A0A0M1A0. Setting $\frac{d^2y}{dx^2} = 0$ to find the stationary points scores M0.
21	$x = \frac{16}{5}$, $y = \frac{9}{5}$ and $x = -2$, $y = -6$	M1	$3x - 2y = 6$ or $y = \frac{3x-6}{2}$ or $x = \frac{2y+6}{3}$ oe
		M1	their rearranged linear equation substituted into $x^2 + xy = 16$, e.g. $x^2 + x\left(\frac{3x-6}{2}\right) = 16$ or $\left(\frac{2y+6}{3}\right)^2 + \left(\frac{2y+6}{3}\right)y = 16$
		A1	$5x^2 - 6x - 32 (= 0)$ or $5y^2 + 21y - 54 (= 0)$ oe
		M1	$(5x - 16)(x + 2)$ or $(5y - 9)(y + 6)$ or correct use of the quadratic formula (ft their three-term quadratic)
		A1	$x = \frac{16}{5}$ and $x = -2$ or $y = \frac{9}{5}$ and $y = -6$
		A1	$x = \frac{16}{5}$, $y = \frac{9}{5}$ and $x = -2$, $y = -6$ correctly paired

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Accept 3.2 and 1.8. Correct answers with no working, or from trial and improvement, score 0. -2, -6 found by inspection only, with no algebraic method, scores 0. $3x - 2y = 1$ (only the fractions multiplied by 6) scores M0 but can score M1 for the substitution (ft) and M1 for solving their quadratic. Pairs not matched scores at most M1M1A1M1A1A0.
22	$\sin^2 x + 4 \cos^2 x - \sin x =$ $\sin^2 x + 4(1 - \sin^2 x) -$ $\sin x =$ $4 - \sin x - 3 \sin^2 x =$ $(4 + 3 \sin x)(1 - \sin x)$	M1	$\sin^2 x - 4 \sin x \cos x + 4 \cos^2 x$
		M1	$4 \sin x \cos x - \sin x$ or $\frac{\sin x}{\cos x} \times 4 \cos^2 x - \frac{\sin x}{\cos x} \times \cos x$ oe
		A1	$\sin^2 x + 4 \cos^2 x - \sin x$, $\cos^2 x = 1 - \sin^2 x$ used correctly to reach $4 - \sin x - 3 \sin^2 x$, and factorised to $(4 + 3 \sin x)(1 - \sin x)$, with no errors <i>Additional guidance:</i> Treating the identity as an equation (moving terms across the $\equiv$ sign, e.g. to reach $0 = 0$) scores at most M1M1A0. Substituting a value of x scores 0. Alternative for the A1: the left-hand side manipulated correctly to $4 - \sin x - 3 \sin^2 x$ and the right-hand side expanded correctly to the same expression, with a statement that therefore LHS $\equiv$ RHS. Stopping at $4 - \sin x - 3 \sin^2 x$ with no link to the right-hand side scores M1M1A0. Condone missing x in a single line.