

Mark Scheme

AQA Level 2 Further Maths Mock Set D 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	121	103	86	69	60
This paper alone, rough guide (out of 80)	70	61	52	43	35	30

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)	(0, -4)	M1	$y - (-11) = \frac{7}{24}(x - (-24))$ or $-11 = \frac{7}{24} \times (-24) + c$ oe, or $c = -4$
		A1	(0, -4) <i>Additional guidance:</i> $y = \frac{7}{24}x - 4$ with no coordinates given scores M1A0. (-4, 0) scores M1A0. (0, -18) (from $-11 - 7$) scores M0A0.
1(b)	25 units	M1	$\sqrt{(0 - (-24))^2 + (-4 - (-11))^2}$ or $24^2 + 7^2$ or 625 oe ft their B
		A1ft	25 ft their B <i>Additional guidance:</i> ft only from a point B on the y -axis. $\sqrt{625}$ unsimplified scores M1A0.
Total for Question 1: 4 marks			
2	$8a^2b(3b^2 - 5a^2)$	B2	$8a^2b(3b^2 - 5a^2)$
		(B1)	a correct partial factorisation with at least two of 8, a^2 , b (or a factor of 8) outside the bracket, eg $4a^2b(6b^2 - 10a^2)$ or $8a^2(3b^3 - 5a^2b)$, or $8a^2b(\dots)$ with one error in the bracket <i>Additional guidance:</i> Accept $-8a^2b(5a^2 - 3b^2)$. Penalise further work on the answer line, eg going on to 'cancel'.
3	$a = -7, b = 42$	M1	at least two correct entries of $\mathbf{A}^2$ in terms of a , eg a^2 and $-6a$
		M1dep	$a = \pm 7$ or $b = -6a$ or $b = \pm 42$
		A1	$a = -7$ and $b = 42$ <i>Additional guidance:</i> $a = 7, b = -42$ scores M1M1A0. $a = \pm 7, b = \pm 42$ with no choice made scores M1M1A0. Top right entry as $-3a - 3$ or $-3a$ (wrong multiplication) scores M0 unless two other entries are correct.
4	12	M1	expands to a cubic with at least three of the four terms of $2x^3 + x^2 - 8x + 5$ correct
		M1	differentiates their cubic with at least two terms correct, eg $6x^2 + 2x - 8$
		A1	12 <i>Additional guidance:</i> Substituting $x = -2$ into y (giving 9) scores M1M0A0 at most. Differentiating each bracket separately, eg $2 \times 2(x - 1)$, scores M0M0A0.
5	$n = 27$	M1	any one of $7\sqrt{3}$, $2\sqrt{3}$ or $6\sqrt{3}$ (or $\frac{18\sqrt{3}}{3}$) seen

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Q	Answer	Marks	Guidance
		M1dep	$3\sqrt{3}$ or $7\sqrt{3} + 2\sqrt{3} - 6\sqrt{3}$ oe
		A1	27 <i>Additional guidance:</i> Answer $3\sqrt{3}$ or $\sqrt{27}$ (value of n not stated) scores M1M1A0. $\frac{18}{\sqrt{3}} = 6$ or $18\sqrt{3}$ scores M0 for that term. $3\sqrt{3}$ followed by $n = 9$ or $n = 81$ scores M1M1A0.
6	225° and 315°	B1	225
		B1	315 <i>Additional guidance:</i> If more than two answers are given, deduct 1 mark for each incorrect extra value (minimum 0). 135 and 45 (solving $\sin x = +\frac{\sqrt{2}}{2}$) score B0B0. -45 scores B0. $\sin 45 = \frac{\sqrt{2}}{2}$ (or 45) seen with no correct answers scores SC1.
7	$p = \frac{5q+2}{q-3}$	M1	$3p+2 = pq-5q$ or $3p+2 = q(p-5)$
		M1	collects the p terms on one side and factorises, eg $p(q-3) = 5q+2$ or $p(3-q) = -5q-2$ (ft their expansion)
		A1	$p = \frac{5q+2}{q-3}$ oe <i>Additional guidance:</i> Accept $p = \frac{-5q-2}{3-q}$ or $p = -\frac{5q+2}{3-q}$. $3p+2 = pq-5$ (only p multiplied by q) scores M0, but the second M1 may be awarded for collecting and factorising correctly from it, leading to $p = \frac{7}{q-3}$ (MOM1A0). $p = \frac{5q+2}{q-3}$ seen then spoiled by further work scores M1M1A0.
8	1st term 6, 2nd term 13	M1	one correct equation, eg $9a+3b+5=26$ or $(25a+5b+5)-(16a+4b+5)=25$ oe
		M1dep	both correct equations and a correct method to eliminate a or b
		A1	$a=3$ and $b=-2$
		A1ft	6 and 13 ft their a and b if M2 scored <i>Additional guidance:</i> $9a+b=25$ is the simplified second equation. $25a+5b+5=25$ (5th term taken as 25) scores M1 for the other equation only. $3n^2-2n+5$ seen with no terms worked out scores M1M1A1A0. 6 and 13 with no working scores 4 marks.
9(a)	$\frac{8}{x^3}$	B1	$\frac{8}{x^3}$

(continued)

Q	Answer	Marks	Guidance
9(b)	$5x^4y^2$	B3	$5x^4y^2$
		(B2)	two of 5, x^4 , y^2 correct in a single term
		(B1)	one of 5, x^4 , y^2 correct in a single term, or $30x^2y^3$ seen
		<i>Additional guidance:</i> $5x^0y^2$ (from $x^2 \div x^{-2}$ done as x^{2-2}) scores B2. Answers left as a fraction, eg $\frac{5x^4y^3}{y}$, are not fully simplified: maximum B2.	
Total for Question 9: 4 marks			
10	$63\sqrt{3} \text{ cm}^2$	M1	$\frac{1}{2} \times 14 \times 9 \times \sin 120$ or $14 \times 9 \times \sin 120$ or $14 \times 9 \times \sin 60$ oe
		M1dep	$\sin 120 = \frac{\sqrt{3}}{2}$ or $\sin 60 = \frac{\sqrt{3}}{2}$ used in a correct method for the whole area
		A1	$63\sqrt{3}$ <i>Additional guidance:</i> Alternative: perpendicular height $9 \sin 60 = \frac{9\sqrt{3}}{2}$ M1, $14 \times \frac{9\sqrt{3}}{2}$ M1dep, $63\sqrt{3}$ A1. $\frac{63\sqrt{3}}{2}$ (one triangle only) scores M1M0A0. $\sqrt{11907}$ scores M1M1A0.
11	$p = -2, q = 2, r = -3$	B1	$r = -3$
		M1	$r - 4q = -11$ or $p = q - 4$ oe, from a correct expansion
		A1	$p = -2$ and $q = 2$ <i>Additional guidance:</i> All three correct with no working scores 3 marks. $r = 3$ (sign error) scores B0, but M1 can still be scored for $r - 4q = -11$ with their r . Substituting $x = 4$ (a root of the left-hand side): $64 + 16p - 44 + 12 = 0$, so $p = -2$, is a correct method for p and scores M1.
12	$-2 \leq x \leq 4$	M1	$4x^2 - 8x - 32 (\leq 0)$ or $x^2 - 2x - 8 (\leq 0)$ oe (condone = or any inequality sign)
		M1dep	$(x - 4)(x + 2)$ or critical values -2 and 4
		A1	$-2 \leq x \leq 4$ <i>Additional guidance:</i> $x \leq -2$ or $x \geq 4$ scores M1M1A0. $-2 < x < 4$ scores M1M1A0. $x \geq -2$ and $x \leq 4$ is A1 (must see "and"). $4x^2 - 35 \leq 4x - 3$ (middle terms lost) scores M0M0A0.
13(a)	$a = 2, b = 3$	M1	$a + b = 5$ or $a(1)^2 + b = 4(1) + 1$ oe
		M1	$9a + b = 21$ or $a(-3)^2 + b = 21$ oe
		A1	$a = 2$ and $b = 3$

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> $a = 2$, $b = 3$ with no working scores 3 marks. Using $(0, 21)$ or $b = 21$ scores M0 for that equation.
13(b)	$x = -2$ and $x = 2\frac{1}{2}$	M1 A1	$2x^2 + 3 = 11$ or $4x + 1 = 11$ ft their a and b -2 and 2.5 oe and no other values <i>Additional guidance:</i> -2 , 2 and 2.5 scores M1A0. ± 2 only scores M1A0.
Total for Question 13: 5 marks			
14	$3x - 2y = -3$	B1 M1 M1dep A1	centre $(-2, 5)$ $\frac{3-5}{1-(-2)}$ or $-\frac{2}{3}$ oe ft their centre gradient $\frac{3}{2}$ (negative reciprocal of their radius gradient) and $y - 3 = \frac{3}{2}(x - 1)$ oe $3x - 2y = -3$ oe with integer coefficients, eg $2y - 3x = 3$ or $6x - 4y = -6$ <i>Additional guidance:</i> $y = \frac{3}{2}x + \frac{3}{2}$ not in the required form scores B1M1M1A0. The normal $2x + 3y = 11$ (using gradient $-\frac{2}{3}$) scores B1M1M0A0.
15	$(6 + 14\sqrt{3})$ cm	M1 M1dep A1	$AB = \frac{6}{\sin 60}$ or $AE = \frac{6}{\tan 60}$ oe, eg $\frac{12}{\sqrt{3}}$ or $\frac{6}{\sqrt{3}}$ or $AE = AB \cos 60$ $AB = 4\sqrt{3}$ and $AE = 2\sqrt{3}$ oe, eg $\frac{12}{\sqrt{3}}$ and $\frac{6}{\sqrt{3}}$, or $\sqrt{48}$ and $\sqrt{12}$ $6 + 14\sqrt{3}$ <i>Additional guidance:</i> Including AB in the perimeter $(6 + 18\sqrt{3})$ scores M1M1A0. Area or a perimeter of the square only scores at most M1M1A0. Using the $1:\sqrt{3}:2$ ratio of a 30° , 60° , 90° triangle is a correct method.
16	$\frac{3x}{5}$	M1 M1 A1	$(x - 5)(x + 3)$ $5(x + 3)$ and $2x(x - 5)$, and multiplying by the reciprocal of the second fraction $\frac{3x}{5}$ or $0.6x$ oe <i>Additional guidance:</i> $\frac{6x^2}{10x}$ not simplified scores M1M1A0. Multiplying without inverting can score the first M1 only.
17	$(5 + \sqrt{3})$ cm	M1 M1dep	$\frac{8+6\sqrt{3}}{1+\sqrt{3}} \times \frac{1-\sqrt{3}}{1-\sqrt{3}}$ oe (may use $\sqrt{3} - 1$) numerator $-10 - 2\sqrt{3}$ and denominator -2 (or $10 + 2\sqrt{3}$ and 2 using $\sqrt{3} - 1$), allow one error in the numerator

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Q	Answer	Marks	Guidance
		A1	$5 + \sqrt{3}$ <i>Additional guidance:</i> Alternative: $(1 + \sqrt{3})(p + q\sqrt{3}) = 8 + 6\sqrt{3}$, giving $p + 3q = 8$ and $p + q = 6$ M1M1, $p = 5$, $q = 1$ A1. Answer only $5 + \sqrt{3}$ with no working scores MOMOAO ("You must show your working").
18(a)	$(x - 3)^2(2x + 5)$	M1	$f(3) = 0$ or $f(-\frac{5}{2}) = 0$ shown, or $(x - 3)$ or $(2x + 5)$ stated as a factor
		M1dep	$(x - 3)(2x^2 - x - 15)$ or $(2x + 5)(x^2 - 6x + 9)$ (allow one error in the quadratic factor)
		A1	$(x - 3)^2(2x + 5)$ or $(x - 3)(x - 3)(2x + 5)$ <i>Additional guidance:</i> Correct answer with no working scores SC1 ("You must show your working"). Solutions $x = 3$, $x = -\frac{5}{2}$ given instead of factors score M1M1A0. $f(3) = 0$ followed by $(x + 3)$ as the factor scores M1MOA0. Algebraic division is not required, but a correct division is a correct method for the second mark.
18(b)	(3, 0)	B1ft	(3, 0) ft their repeated factor in (a) <i>Additional guidance:</i> Accept $x = 3$, $y = 0$. $x = 3$ alone or (0, 3) scores B0. $(-\frac{5}{2}, 0)$ scores B0.
Total for Question 18: 4 marks			
19(a)	$(x + 6)^2 - 18$	M1	$(x + 6)^2 \pm k$ or $p = 6$
		A1	$(x + 6)^2 - 18$ <i>Additional guidance:</i> $p = 6$, $q = -18$ seen but not written in the form scores M1A1. $(x + 6)^2 + 18$ or $(x + 6)^2 - 54$ scores M1A0.
19(b)	$x = -6 \pm 3\sqrt{2}$	B1ft	$-6 \pm 3\sqrt{2}$ (both) ft their $(x + p)^2 + q$ with $q < 0$, simplified <i>Additional guidance:</i> $-6 \pm \sqrt{18}$ (not simplified) scores B0. Only one solution scores B0.
Total for Question 19: 3 marks			
20	$p = 3$, $q = -2$, $r = \frac{1}{2}$	M1	a correct method to eliminate one letter from a pair of equations, eg $5p + 14r = 22$ or $5p + 8r = 19$ (allow one error)
		M1dep	eliminates the same letter from a different pair of equations
		M1dep	solves their two equations in two unknowns to find a value
		A1	one correct value

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Q	Answer	Marks	Guidance
		A1	$p = 3, q = -2$ and $r = \frac{1}{2}$ <i>Additional guidance:</i> Correct answers with no working, or by trial and improvement, score 0. Any order of elimination is acceptable, eg eliminating p : (1) $-2 \times (2)$ gives $5q - 16r = -18$, and (3) $-4 \times (2)$ gives $5q - 22r = -21$. Accept $r = 0.5$.
21	Angle $AOB = 2x$ and angles $OAT = OBT = 90^\circ$, so $3x + 180 = 360$ and $x = 60$. $TA = TB$, so angles $TAB = TBA = 60^\circ$: all angles are 60° , so ABT is equilateral.	M1	angle $AOB = 2 \times$ angle ACB and angle $OAT =$ angle $OBT = 90^\circ$ (may be on the diagram)
		M1dep	$x + 2x + 90 + 90 = 360$ oe or angle $ATB = 60^\circ$
		A1	angles TAB and TBA shown to be 60° (using $TA = TB$ or base angles) and a conclusion that ABT is equilateral
		B1	reasons stated and used correctly: angle at the centre is twice the angle at the circumference, tangent perpendicular to radius, angles in a quadrilateral sum to 360° (and tangents from a point are equal or base angles of an isosceles triangle) <i>Additional guidance:</i> Alternative method (alternate segment theorem): angle $TAB =$ angle ACB M1, angle $TBA =$ angle ACB so all three angles of ABT are equal M1dep, each is 60° (or “equiangular”) so ABT is equilateral A1, reasons: alternate segment theorem and angles in a triangle sum to 180° B1. Angles must be labelled clearly (eg “angle AOB ”, not “ O ”). Assuming the triangle is equilateral, or measuring, scores 0.
22	$\text{LHS} = \frac{\cos^2 x}{\cos x} + \frac{\sin^2 x}{\cos x} =$ $\frac{\cos^2 x + \sin^2 x}{\cos x} = \frac{1}{\cos x} =$ RHS	M1	$1 - \sin^2 x$ and $\cos^2 x$ (or the first term simplified to $\cos x$)
		M1	$\sin x \tan x = \frac{\sin^2 x}{\cos x}$
		A1	$\frac{\cos^2 x + \sin^2 x}{\cos x}$ (or $\frac{1 - \sin^2 x + \sin^2 x}{\cos x} = \frac{1}{\cos x}$, with no errors seen

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Q	Answer	Marks	Guidance
			<i>Additional guidance:</i> Alternative: write everything over $\cos x$: $\frac{1-\sin^2 x + \sin^2 x}{\cos x} = \frac{1}{\cos x}$ M1M1A1. Working on both sides at once, or starting from the identity as an equation and cross-multiplying, can score at most M1M1A0. Substituting a value of x scores 0.
23(a)	$\left(-\frac{1}{2}, \frac{15}{4}\right)$ and $(1, -3)$	M1 M1dep A1 A1	$12x^2 - 6x - 6$ (at least two terms correct) their $\frac{dy}{dx} = 0$ and a correct method to solve, eg $(2x + 1)(x - 1) = 0$ or $6(2x + 1)(x - 1) = 0$ $x = -\frac{1}{2}$ and $x = 1$ $\left(-\frac{1}{2}, \frac{15}{4}\right)$ and $(1, -3)$ (accept 3.75 or $3\frac{3}{4}$) <i>Additional guidance:</i> Correct coordinates with no working score 0 ("You must show your working"). Using the quadratic formula on $12x^2 - 6x - 6 = 0$ is a correct method. Pairing errors, eg $(1, \frac{15}{4})$, lose the final A1.
23(b)	Positive cubic shape with maximum $\left(-\frac{1}{2}, \frac{15}{4}\right)$, minimum $(1, -3)$ and y-intercept $(0, 2)$, all labelled	B1 B1ft	cubic shape with positive x^3 coefficient, maximum to the left of the y-axis above the x-axis and minimum to the right of the y-axis below the x-axis $\left(-\frac{1}{2}, \frac{15}{4}\right)$, $(1, -3)$ and $(0, 2)$ labelled on a cubic sketch ft their stationary points from (a) <i>Additional guidance:</i> Condone curves that do not extend far beyond the stationary points. A negative cubic shape scores B0 for the shape, but can score B1ft for the labels.
Total for Question 23: 6 marks			